United States Patent

[11] 3,596,093

[72] Inventors **William D. Bostman**
Fridley;
Jerome M. Short, Burnsville, Minn.; Elden L. Johnson, Jr., Denver, Colo.

[21] Appl. No. **759,533**
[22] Filed **Sept. 12, 1968**
[45] Patented **July 27, 1971**
[73] Assignee **Dymo Industries, Inc.**
Emeryville, Calif.

[54] **SELECTIVE ADDRESSING MACHINE FOR PREPARING A LIST OF SELECTED ADDRESSES FROM A GROUP OF MASTER CARDS**
38 Claims, 26 Drawing Figs.

[52] U.S. Cl. 250/65, 101/47, 209/110, 250/219
[51] Int. Cl. B30b 15/30
[50] Field of Search ..... 250/65.1, 219 L; 101/47, 50, 65; 209/110

[56] **References Cited**

UNITED STATES PATENTS

2,838,175	6/1958	Lake et al.	209/110
2,995,240	8/1961	Cunningham et al.	209/110
3,044,395	7/1962	Ackell et al.	101/65
3,259,330	7/1966	Baybick et al.	250/219 L
3,400,895	9/1968	Cole et al.	250/219 L

FOREIGN PATENTS

691,304	7/1964	Canada	250/65.1

Primary Examiner—Archie R. Borchelt
Attorneys—Samuelson and Jacob and Kenneth E. Forman

ABSTRACT: A machine for preparing a list of selected addresses on an elongate master tape from a group of master cards each carrying a visible address and machine information pertaining to the address, the machine having an imaging station, a mechanism for sequentially advancing each of the group of master cards to the imaging station, a mechanism for advancing the master tape in sequential fixed increments to the imaging station, imaging means at the imaging station, a device for sensing machine information on each advanced master card for selecting at least some of the master cards from the advancing master cards and operating the imaging means only when a selected master card is at the imaging station to establish upon the master tape an image of the address carried by the selected master card. Each selected master card is momentarily halted at the imaging station with the address carried thereby juxtaposed with a stationary increment of the master tape and the master tape is advanced from the imaging station after each operation of the imaging means. Also disclosed is a novel arrangement for the advancement of tape through the machine and a novel arrangement for the advancement and sorting of the cards passing through the machine.

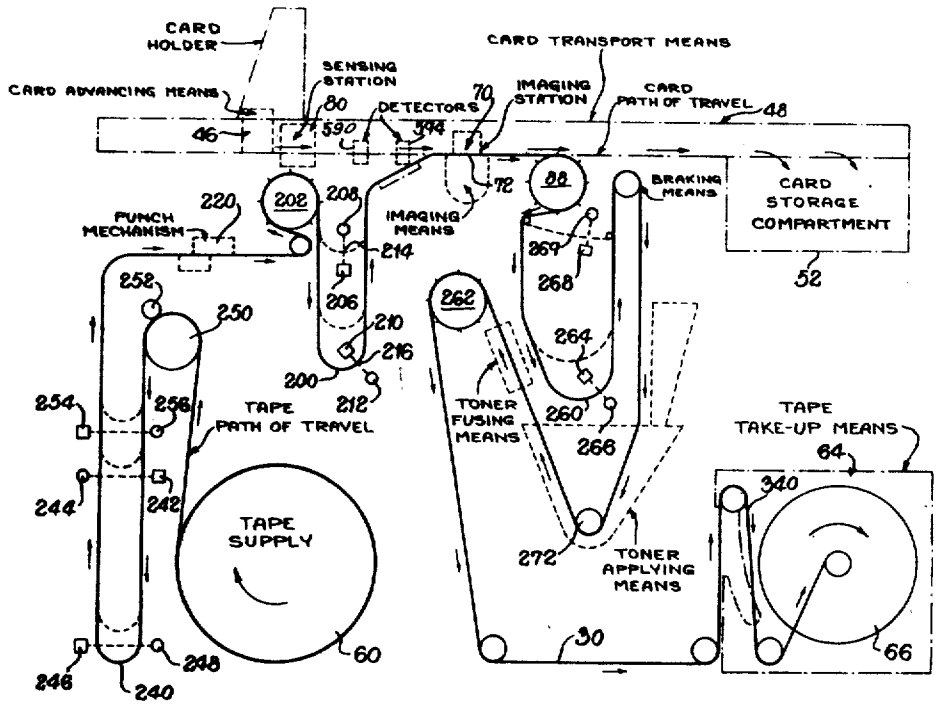
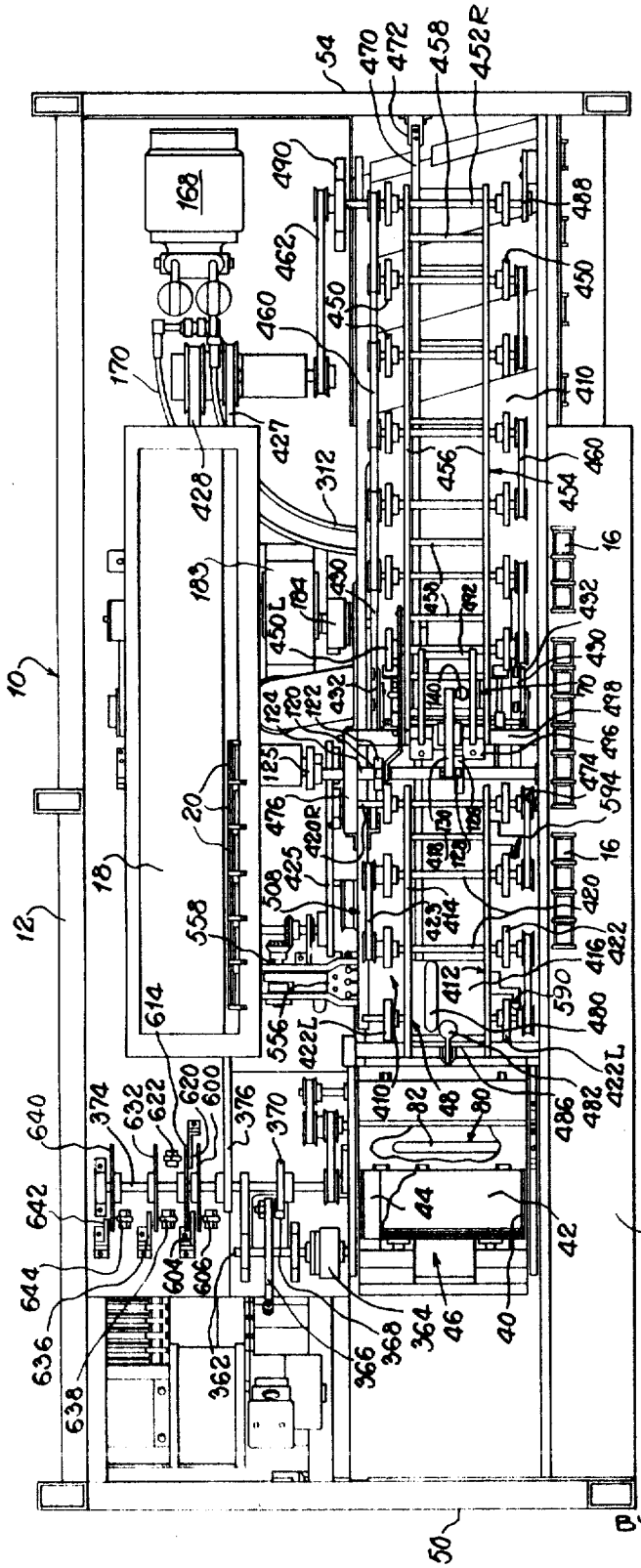


FIG. 1.



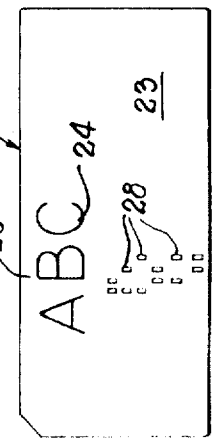


FIG. 4

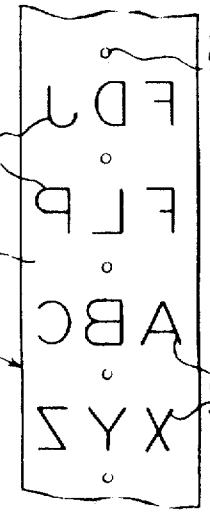
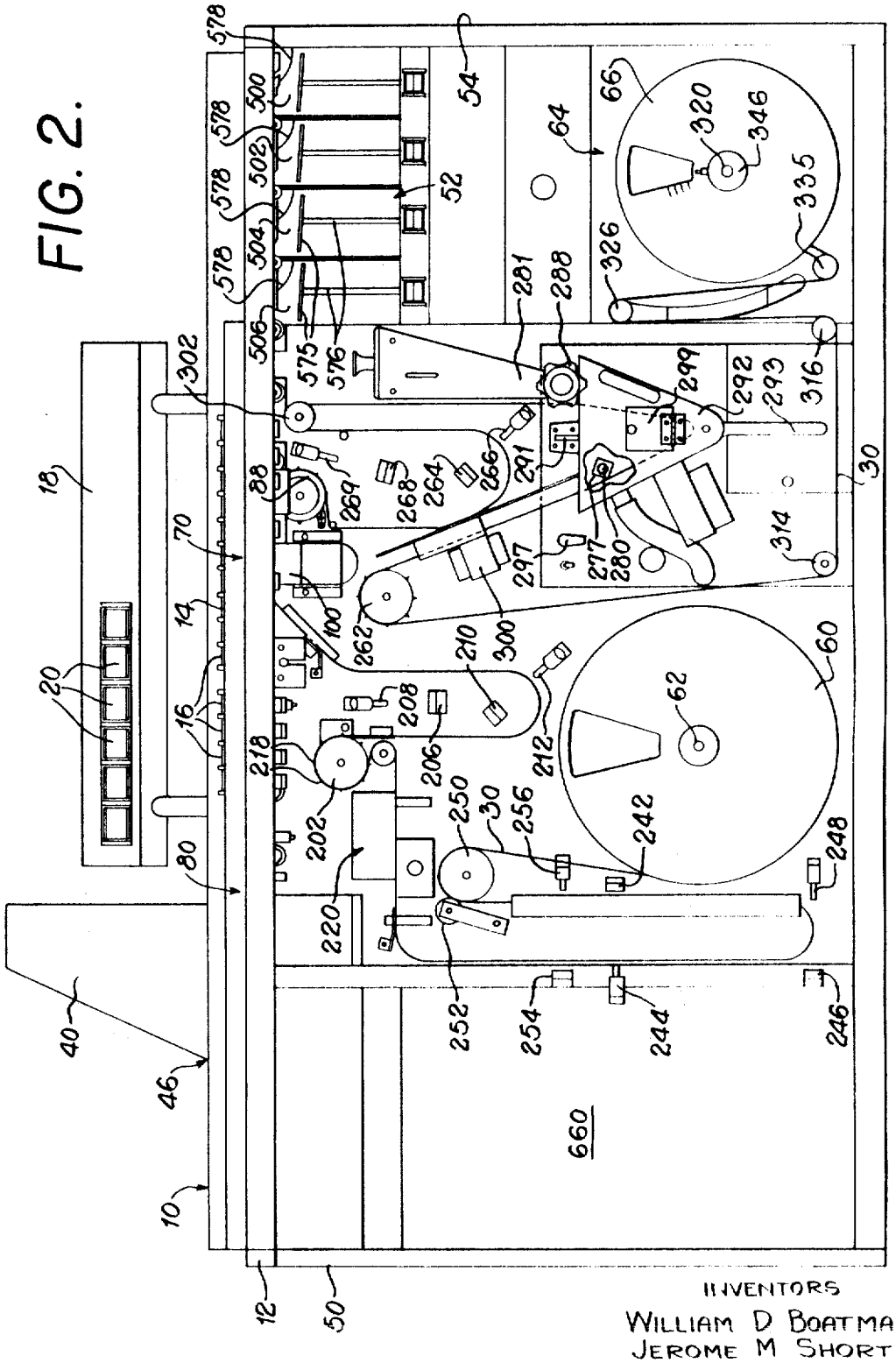


FIG. 5.

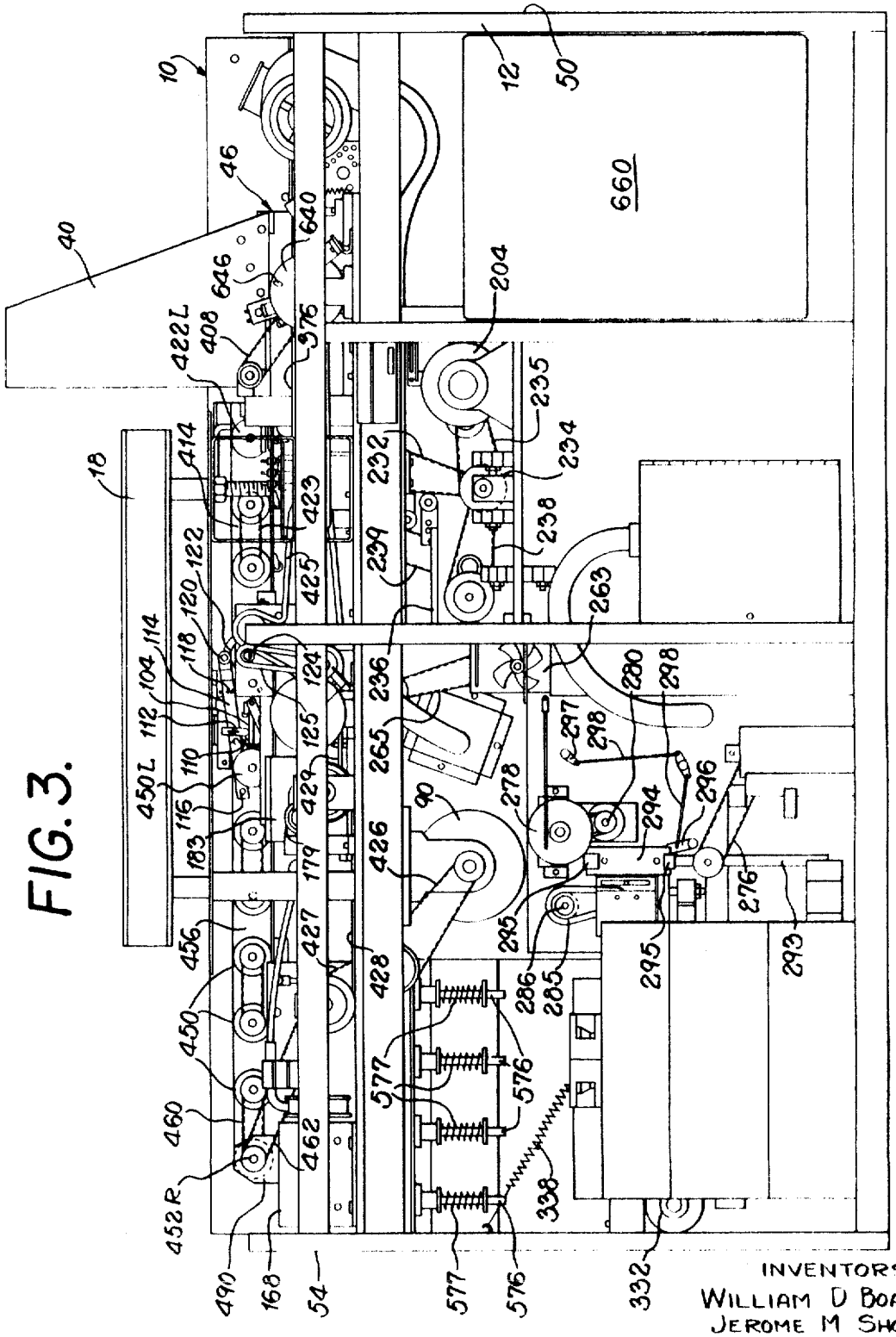
INVENTORS
WILLIAM D BOATMAN
JEROME M. SHORT
ELDEN L. JOHNSON, JR.
BY
Samuelson & Jacob
ATTORNEYS

FIG. 2.



INVENTORS
WILLIAM D BOATMAN
JEROME M SHORT
ELDEN L JOHNSON, JR
BY
Samuelson & Jacob
ATTORNEYS

FIG. 3.



INVENTORS
WILLIAM D BOATMAN
JEROME M SHORT
ELDEN L JOHNSON, JR.
BY Samuelson & Jacob
ATTORNEYS

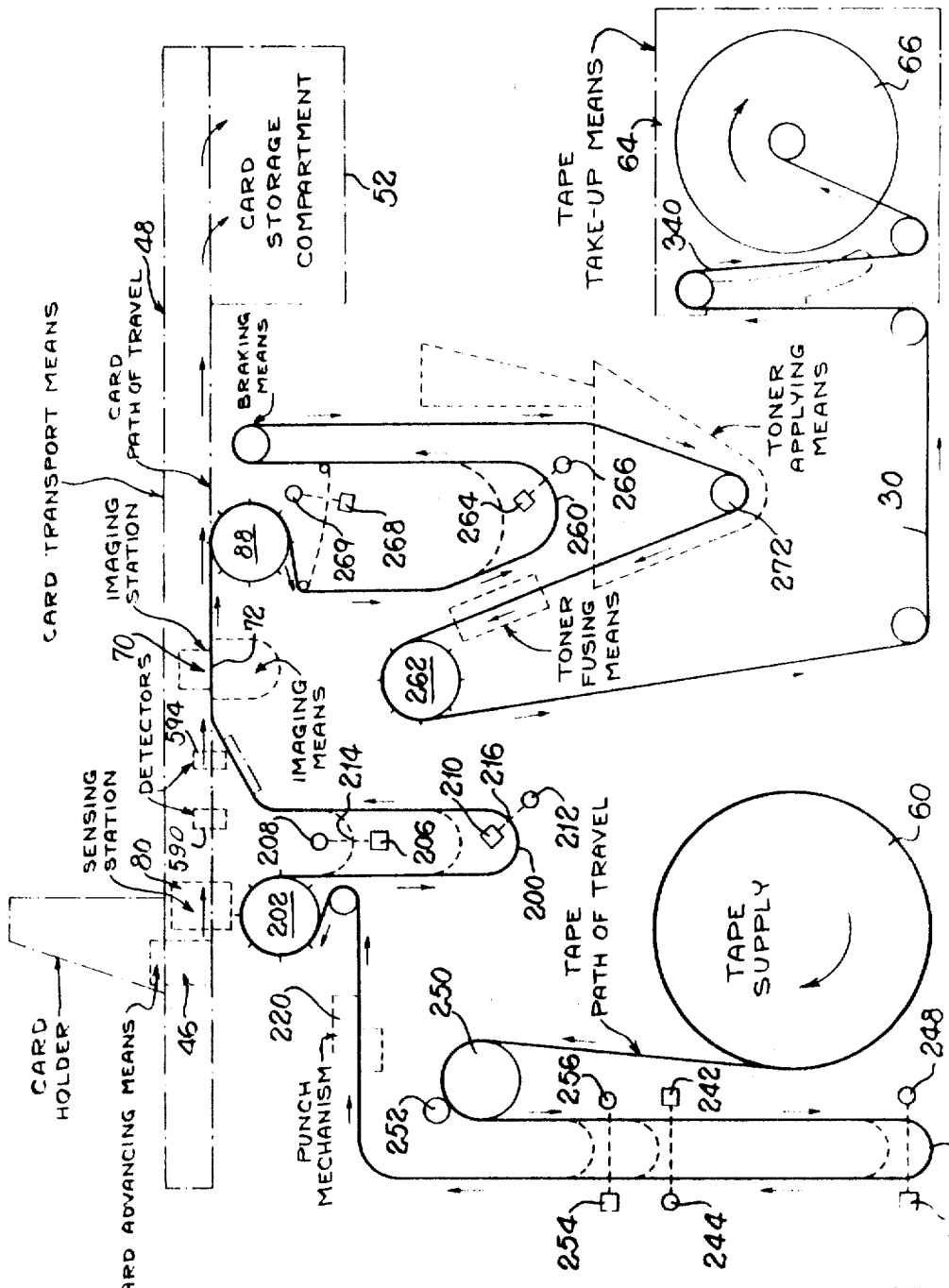
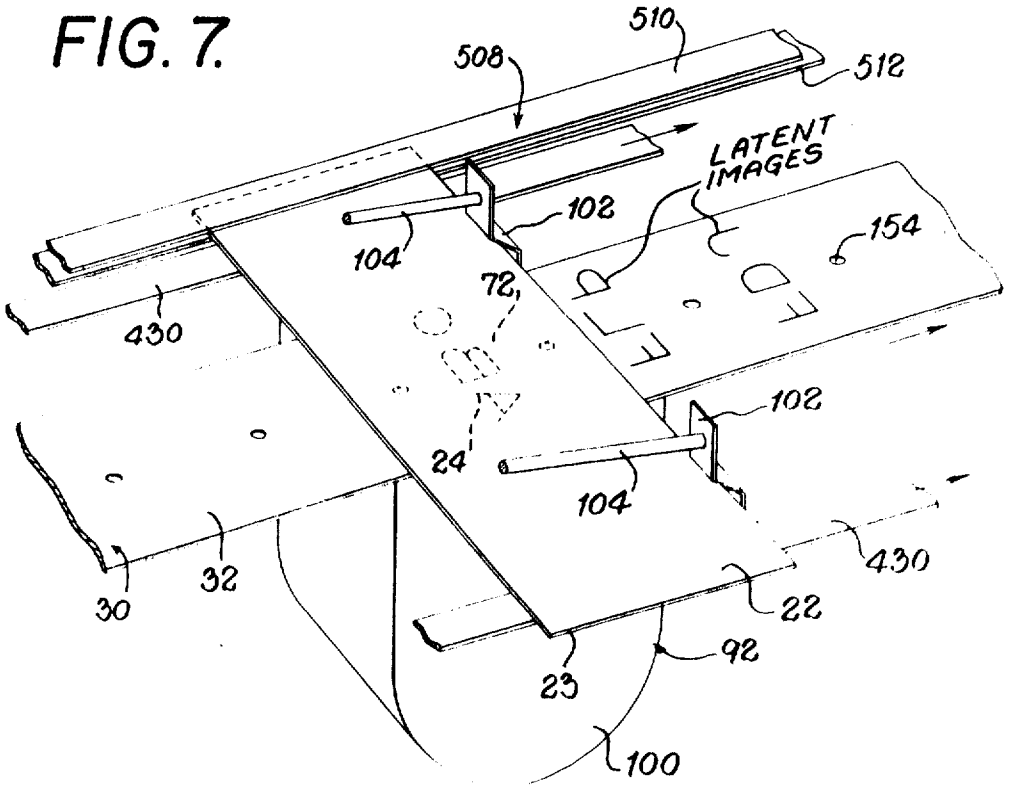


FIG. 6.

INVENTORS
WILLIAM D BOATMAN
JEROME M. SHORT
ELDEN L. JOHNSON, JR
BY
Samuelson & Jacob
ATTORNEYS

FIG. 7.



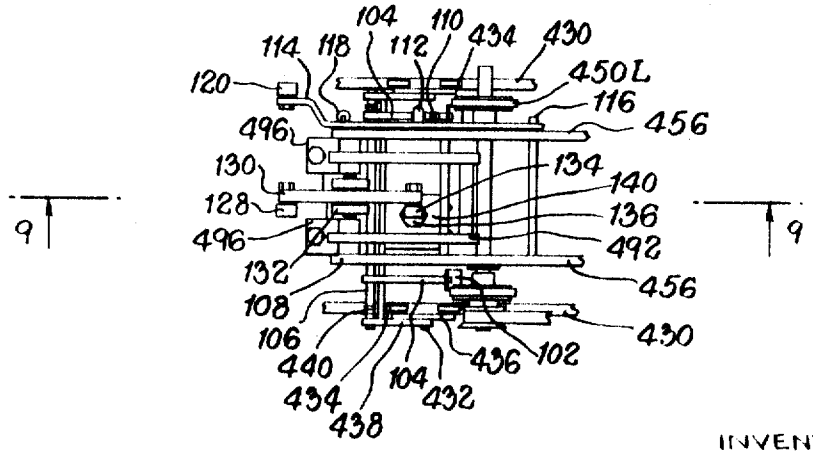


FIG. 8.

INVENTORS
WILLIAM D BOATMAN
JEROME M SHORT
ELDEN L JOHNSON, JR
BY
Samuelson & Jacob
ATTORNEYS

FIG. 9.

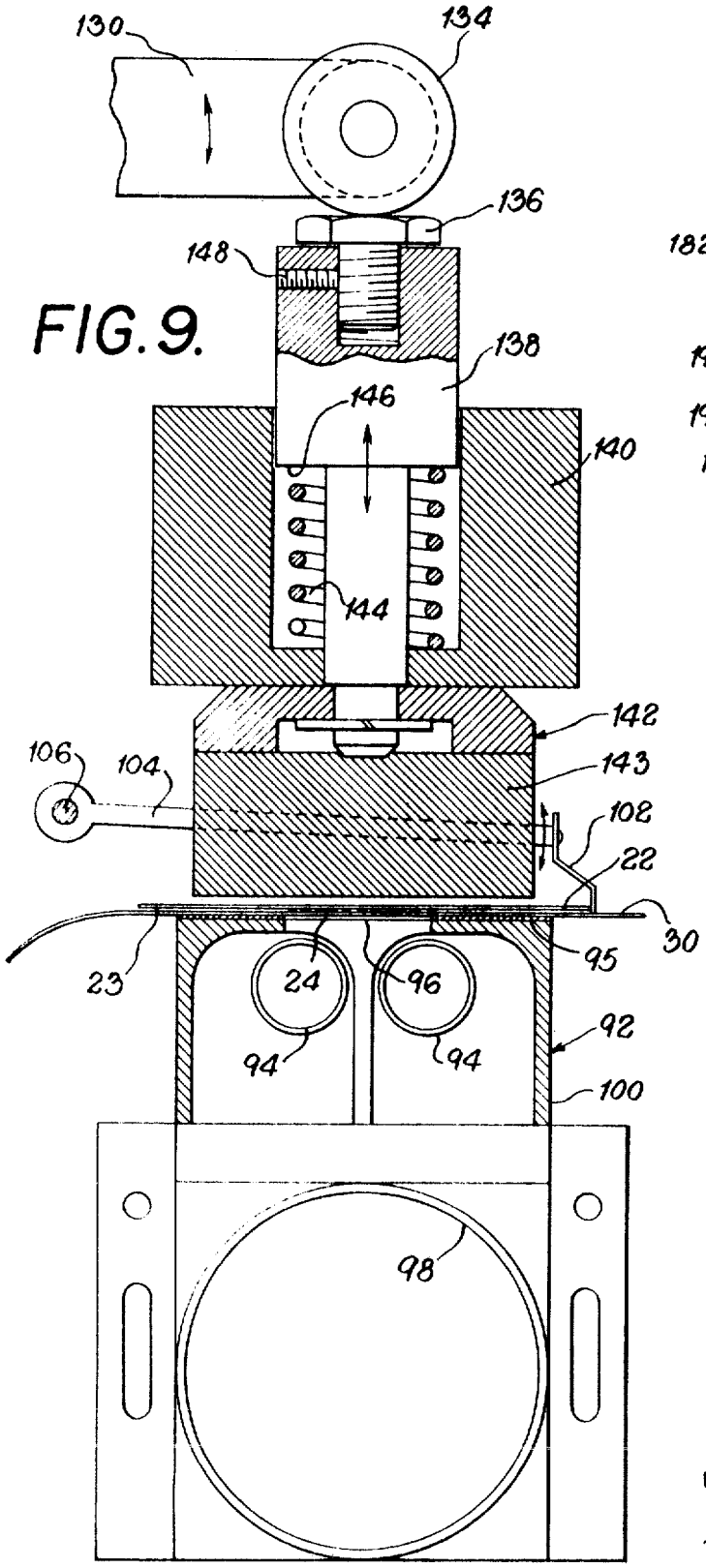
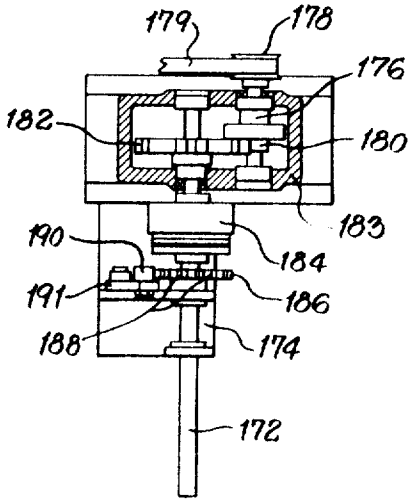


FIG. 10.



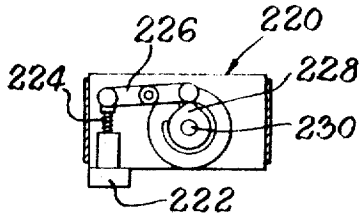


FIG. 13.

INVENTORS
WILLIAM D BOATMAN
JEROME M SHORT
ELDEN L. JOHNSON, JR.
BY
Samuelson & Jacob
ATTORNEYS

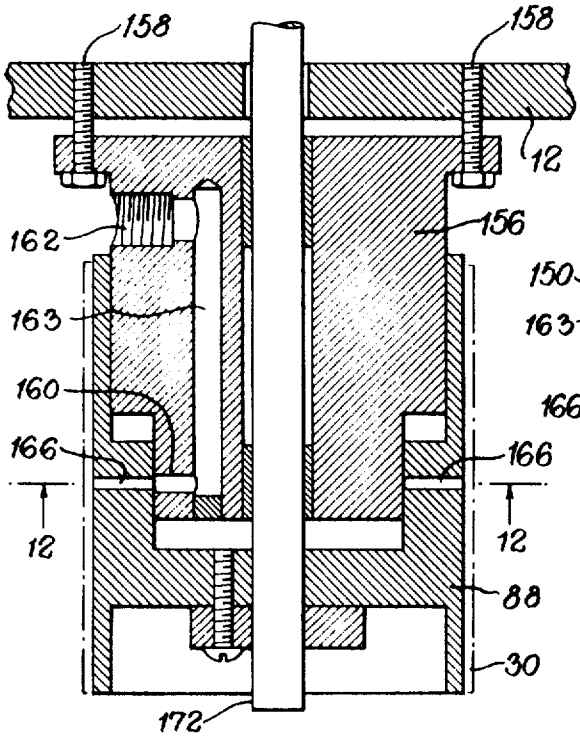


FIG. 11.

FIG. 12.

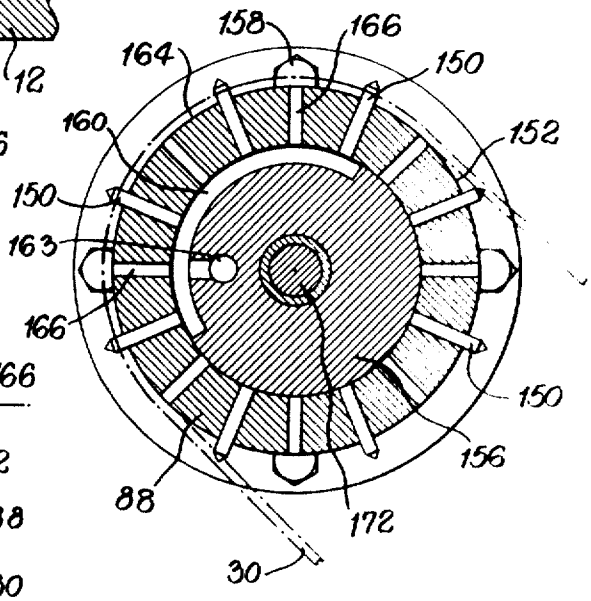
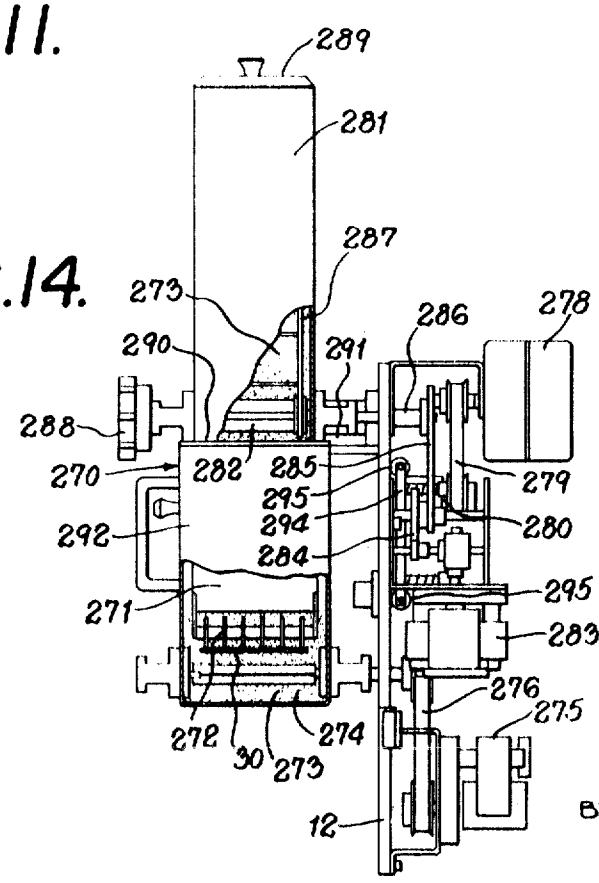


FIG. 14.



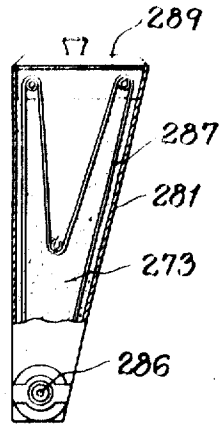


FIG. 15.

INVENTORS
WILLIAM D. BOATMAN
JEROME M. SHORT
ELDEN L. JOHNSON, JR
BY
Samuelson & Jacob
ATTORNEYS

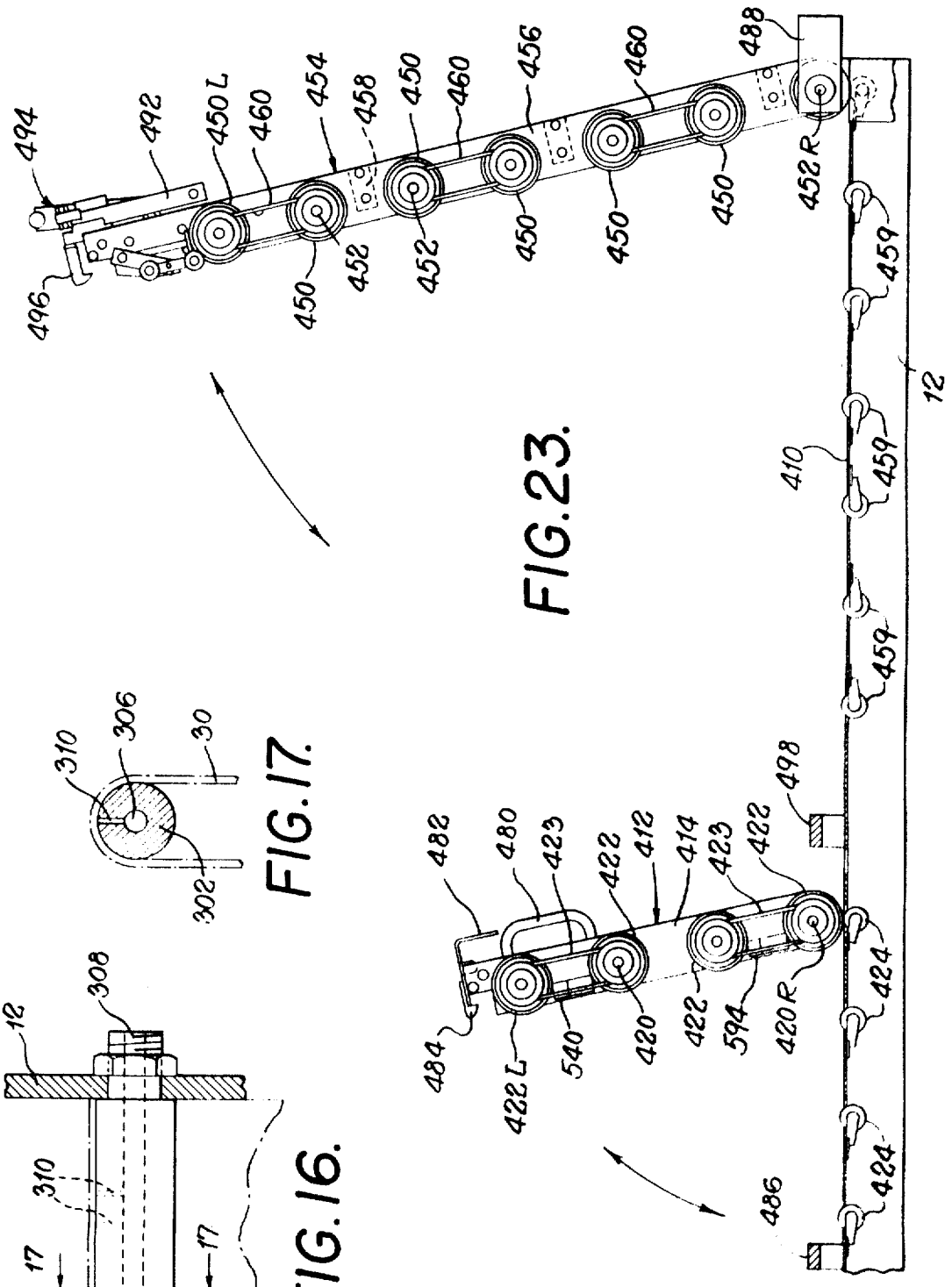


FIG. 23.

FIG. 17.

FIG. 16.

INVENTORS
WILLIAM D. BOATMAN
JEROME M. SHORT
ELDEN L. JOHNSON, JR
BY
Samuelson & Jacob
ATTORNEYS

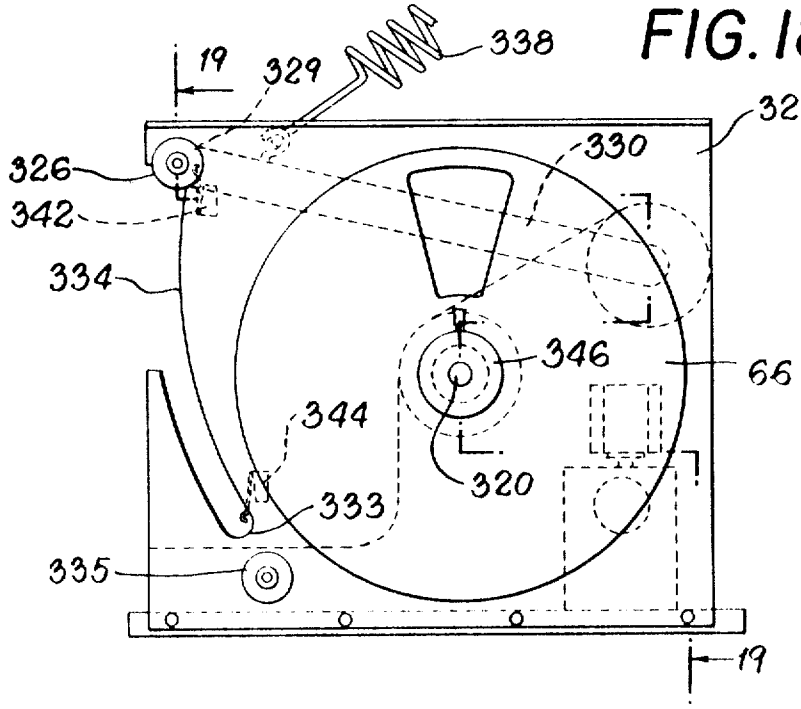


FIG. 18.

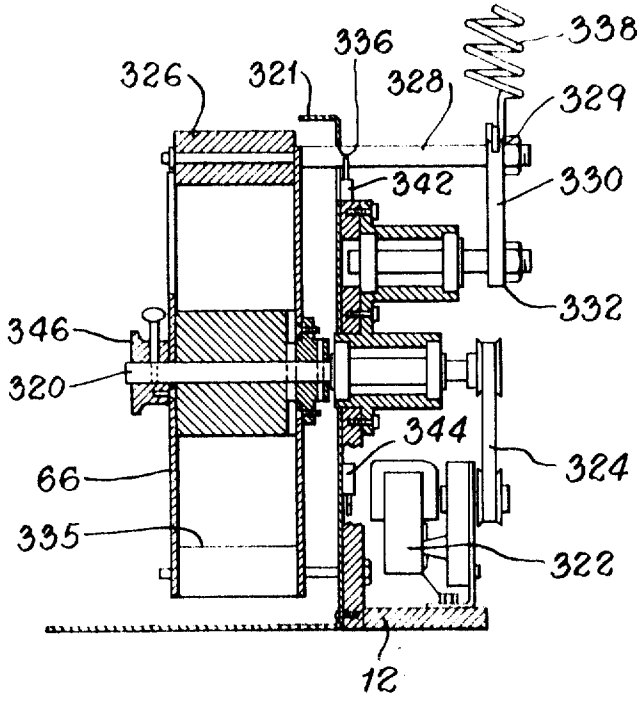


FIG. 19.

INVENTORS
WILLIAM D BOATMAN
JEROME M. SHORT
ELDEN L. JOHNSON, JR
BY
Samuelson & Jacob
ATTORNEYS

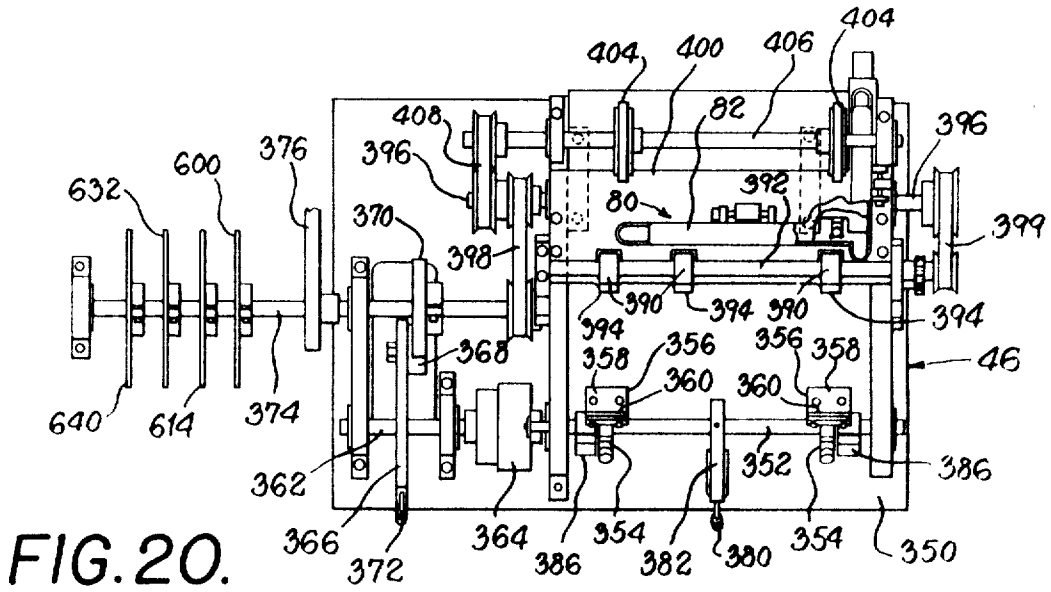


FIG. 20.

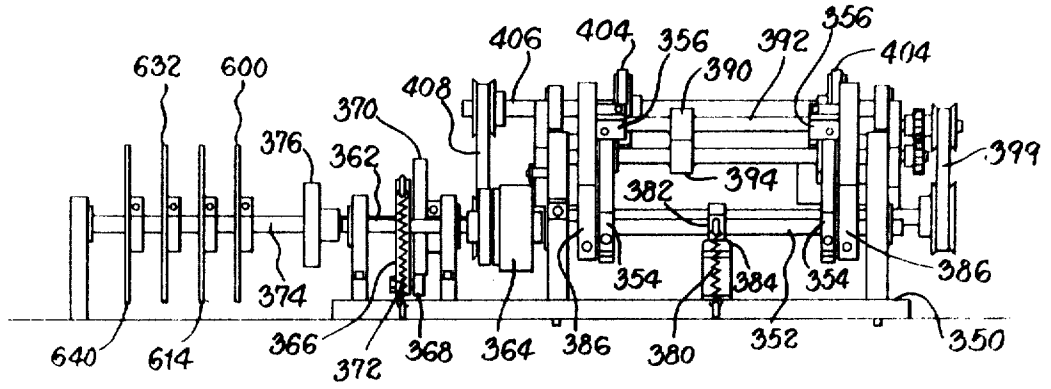


FIG. 21.

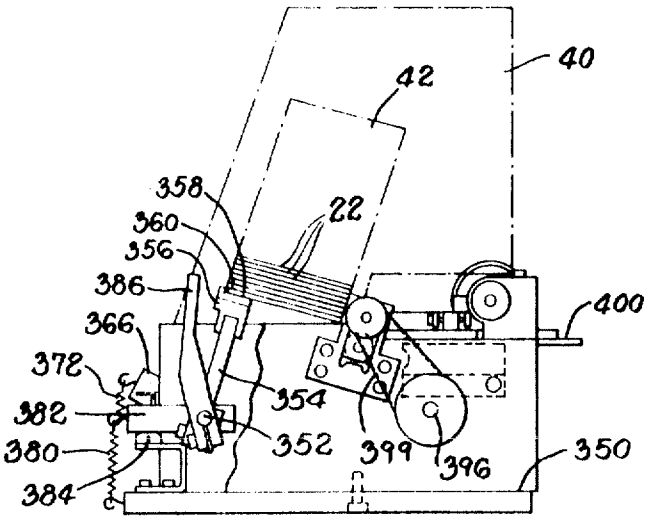


FIG. 22.

INVENTORS
WILLIAM D BOATMAN
JEROME M SHORT
ELDEN L JOHNSON, JR
BY
Samuelson & Jacob
ATTORNEYS

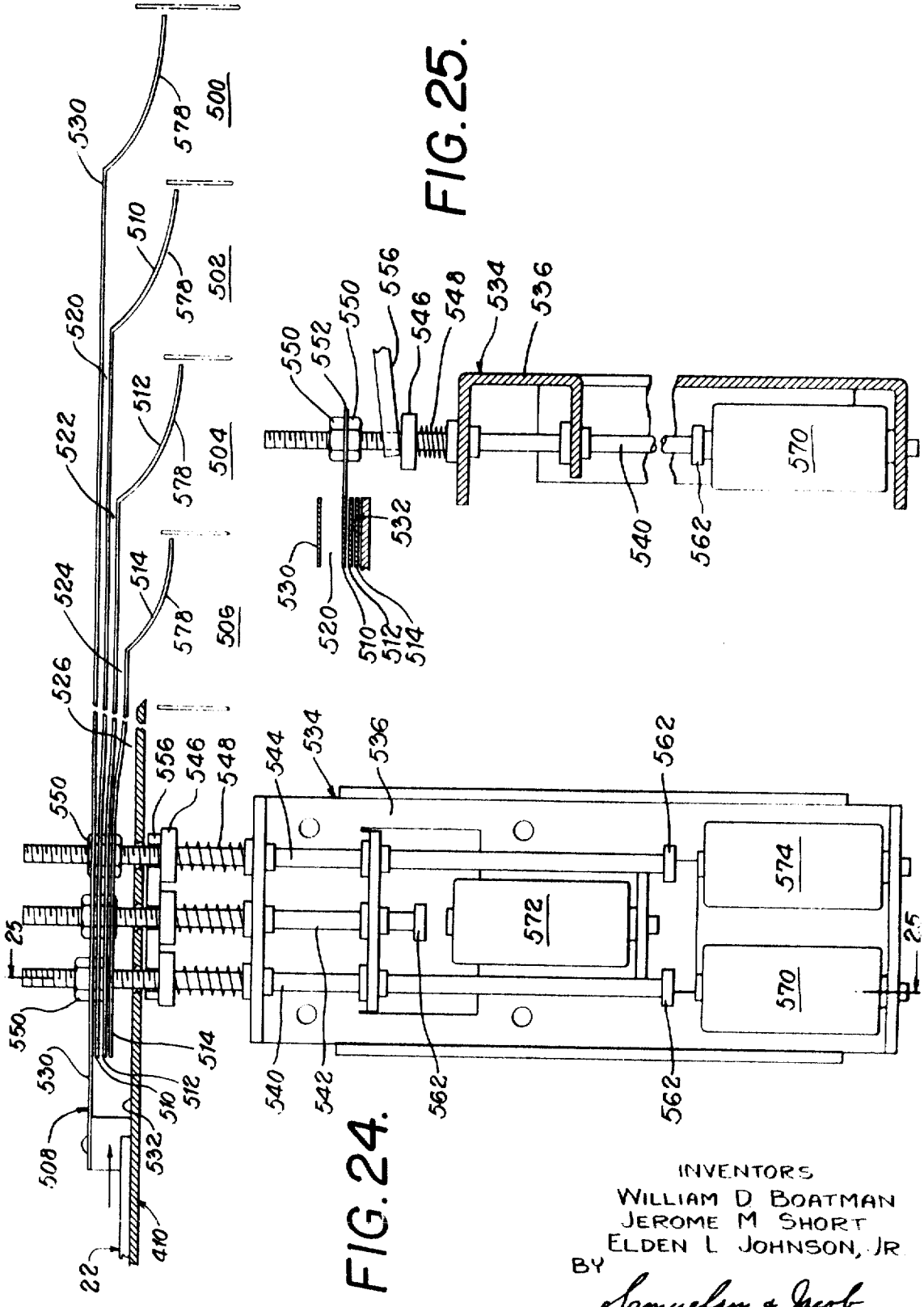


FIG. 24.

FIG. 25.

INVENTORS
WILLIAM D. BOATMAN
JEROME M. SHORT
ELDEN L. JOHNSON, JR.
BY
Samuelson & Jacob
ATTORNEYS

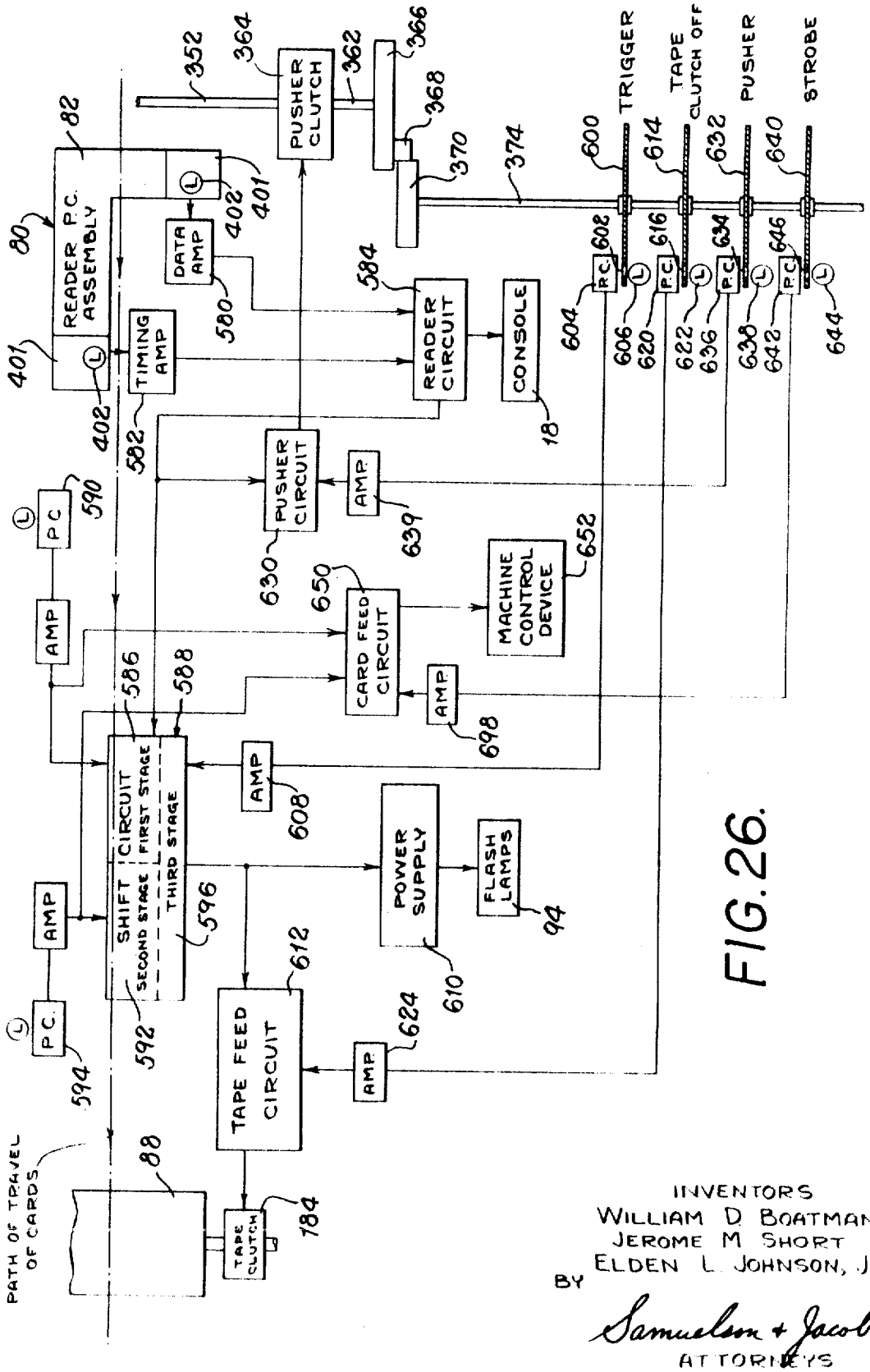


FIG. 26.

INVENTORS
WILLIAM D. BOATMAN
JEROME M. SHORT
ELDEN L. JOHNSON, JR.
BY
Samuelson & Jacob
ATTORNEYS

SELECTIVE ADDRESSING MACHINE FOR PREPARING A LIST OF SELECTED ADDRESSES FROM A GROUP OF MASTER CARDS

The present invention relates generally to addressing machines and pertains, more specifically, to an addressing machine in which a list of selected addresses is prepared on an elongate master tape from a group of master cards carrying machine information and visible addresses, the machine being capable of sensing the machine information on each card to determine whether or not the address carried by that card should appear on the tape.

The current increase in the number of mailings performed by various large scale mailing organizations such as publishers, mail order concerns and other large volume users of the mails, and the need for the development of lengthy, well-organized mailing lists from which specified addresses may be selected in accordance with any of a variety of common characteristics of such addresses has led to the requirement for more effective machines for composing lists of such specified addresses as well as printing such lists on items to be mailed. Thus, it would be advantageous to have available a machine which could prepare a list of addresses chosen from a larger group of addresses in accordance with common characteristics such as those pertaining to the names of addressees, occupations of addressees, geographical locations, and like data.

Addressing machines are currently available which accept lists of addresses printed on an elongate tape and which transfer such addresses onto envelopes or other mailing pieces, or onto mailing labels. Among that type of addressing machine are machines which accept a heat transfer tape having addresses printed thereon of heat transferable material and which employ heat to transfer the addresses.

It is an important object of the invention to provide a machine which employs master cards carrying addresses and machine information pertaining to the addresses and utilizes the machine information to select a plurality of cards from those cards supplied to the machine and to create an image of the addresses carried by the selected cards on a master tape to establish a list of selected addresses on the tape. The master cards are preferably tab cards which are punched to establish machine information relating to the particular address carried by the card, and the address is in the form of a visible address appearing on a portion of the card.

Another object of the invention is to provide an exceptionally high speed machine for preparing a printed list of selected addresses for subsequent use in an addressing machine from a group of master address cards, each such card carrying a visible address and machine information pertaining to the address.

Still another object of the invention is to provide a machine for creating a list of selected addresses from a larger group of addresses, the list being provided on a heat transfer tape. Preferably, the address is printed on the tape in reverse image and is of a material capable of being directly imprinted onto envelopes or other mailing pieces or transferred to address labels.

A further object of the invention is to provide a machine of the type described above wherein the visible address of each master card is in the form of characters of infrared absorbing material and the card carries vaporizable material in the area of the characters, and wherein the master tape is transparent to infrared radiation so that a latent image of the address carried on a selected card may be created upon the tape by exposing juxtaposed areas of the card and the tape to infrared radiation and vaporizing some of the vaporizable material to deposit such vaporized material upon the tape surface and wherein a toner is subsequently applied to the material in the latent image to establish a visible image on the tape.

A still further object of the invention is to provide a machine of the type described above and which utilizes master cards of the type compatible with current electronic data processing equipment employing punched tab cards of known configuration.

Another object of the invention is to provide tape handling systems for incrementally advancing the master tape through the machine, accurately locating the increments of advanced tape with respect to various stations in the machine and collecting the completed tape, and for accomplishing such handling without excessive stresses placed on the tape, in deference to the relatively delicate nature of the master tape.

Still another object of the invention is to provide a machine of the type described above in which the maximum speed of processing every card of the entire group of master cards, from which are selected only a plurality of cards whose addresses are to be printed on the master tape, is not limited by the speed at which each selected card can be processed. Thus, although the rate of advance of the cards passing through the machine must be slowed each time an address is extracted from a selected card, the rate of advance is not slowed when no address is extracted, thereby increasing the overall speed of processing the entire group of cards.

A further object of the invention is to provide a mechanism for sorting the cards as the cards are advanced through the machine.

A still further object of the invention is to provide a card transport mechanism which allows easy, selective access to the path of travel of the cards as they pass through the machine, ease in removing any cards which may become jammed within the card transport mechanism and for ease of maintenance.

The above objects, as well as further objects and advantages, are attained by the invention which may be described briefly as a machine for preparing a list of selected addresses on an elongate master tape from a group of master cards, each carrying a visible address and machine information pertaining to the address, a selected plurality of which master cards carry the selected addresses, the machine comprising a frame, means for holding the group of master cards, means for holding a supply of master tape, an imaging station on the frame, means on the frame for sequentially advancing each of the group of master cards along a path of travel from the master card holding means to the imaging station, means on the frame for advancing the master tape from the master tape supply to the imaging station, the master tape advancing means including intermittent tape feed means for sequentially providing stationary fixed increments of the master tape at the imaging station, imaging means at the imaging station, sensing means on the frame at a sensing station for sensing the machine information carried by each advanced master card, selector means on the frame and responsive to the sensing means for determining when each one of the plurality of selected master cards is at the sensing station, means on the frame and operated in timed relationship with the travel of the master cards for momentarily halting at least each selected master card in a prescribed position at the imaging station with the address carried thereby juxtaposed with a stationary increment of the master tape at the imaging station, means responsive to the travel of the one selected master card along the path of travel and operated in timed relationship with the master card halting means for operating the imaging means and the intermittent tape feed means only when the one selected master card is in the prescribed position to establish upon the juxtaposed increment of master tape an image of the address carried by the selected master card and for operating the intermittent feed means to advance the master tape relative to the imaging station through one complete fixed increment for each such operation of the imaging means. The image established upon the master tape by the imaging means is a latent image and the machine includes means for subsequently converting the latent images so established into a visible list of selected addresses upon the master tape. the address carried by each master card is comprised of characters of infrared absorbing material and the master card carries vaporizable material in the area of the characters, the master tape is transparent to infrared radiation, the imaging means includes a source of infrared radiation, each halted master card is juxtaposed with the increment of master tape at the imaging

station such that the increment of master tape lies between at least the portion of the master card carrying the address and the source of infrared radiation with the characters of the address facing the master tape, the means for operating the imaging means operates the source of infrared radiation to vaporize from the master card a portion of the vaporizable material from areas corresponding to the characters of the address and to deposit the vaporized material onto the surface of the juxtaposed increment of master tape to establish the latent image, and the means for converting the latent images to a visible list of selected addresses includes means on the frame for applying a toner to the surface of the master tape so as to adhere toner to the vaporizable material deposited thereon in areas corresponding to the characters of the addresses, and means for advancing the master tape through the toner applying means. The machine further includes means for fusing the toner while in place upon the master tape.

The invention will be more fully understood, and still further objects and advantages will be related in the following detailed description of an embodiment of the invention illustrated in the accompanying drawing, in which:

FIG. 1 is a plan view of a machine constructed in accordance with the invention;

FIG. 2 is a front elevational view of the machine;

FIG. 3 is a rear elevational view of the machine;

FIG. 4 is a plan view of a master card employed in the machine;

FIG. 5 is a plan view of a portion of the master tape employed in the machine;

FIG. 6 is a diagrammatic view illustrating the path of travel of master cards and master tape through the machine;

FIG. 7 is a diagrammatic pictorial view of a master card juxtaposed with a portion of the master tape at the imaging station of the machine;

FIG 8 is an enlarged plan view of a portion of the machine at the imaging station;

FIG. 9 is an enlarged sectional view taken along line 9–9 of FIG. 8;

FIG. 10 is an enlarged plan view of a portion of the master tape advancing mechanism of the machine;

FIG. 11 is a further enlarged cross-sectional view of a portion of the master tape advancing mechanism;

FIG. 12 is a cross-sectional view taken along line 12–12 of FIG. 11;

FIG. 13 is an enlarged elevational view of the tape punching mechanism of the machine;

FIG. 14 is an enlarged end view, partially sectioned, illustrating the toner applying mechanism of the machine;

FIG. 15 is a front elevational view, partially sectioned, of the toner supply;

FIG. 16 is an end elevational view of a brake mechanism for the master tape;

FIG. 17 is a cross-sectional view taken along line 17–17 of FIG. 16;

FIG. 18 is an enlarged elevational view, partially sectioned, of a takeup mechanism for the master tape;

FIG. 19 is a cross-sectional view taken along line 19–19 of FIG. 18;

FIG. 20 is an enlarged plan view of the master card feed mechanism of the machine;

FIG. 21 is an end elevational vie of the card feed mechanism;

FIG. 22 is a front elevational view of the card feed mechanism;

FIG. 23 is an enlarged front elevational view of a portion of the transport mechanism for the master card;

FIG. 24 is an enlarged front elevational view, partially diagrammatic, of a sorting mechanism for the master cards;

FIG. 25 is a fragmentary cross-sectional view taken along line 25–25 of FIG. 24; and

FIG. 26 is a schematic diagram illustrating the timing of the machine.

Referring now to the drawing, and especially to FIGS. 1 through 5, a machine constructed in accordance with the invention is shown at 10 and has a frame 12. An operating panel 14 having a plurality of pushbutton operating controls 16 is mounted upon the frame at the front of the machine and a data display console 18 having a plurality of counting display devices 20 is mounted above and toward the rear of the frame.

It is the principal function of machine 10 to accept a group of master cards each of which carries an address and machine information pertaining to various characteristics of the address. One such card is illustrated in FIG. 4 and is shown in the form of a tab card 22 which carries on the face 23 thereof a visible address 24 which, in this instance, has been printed upon a portion 26 of the card and machine information in the form of punched holes 28, the punched holes 28 being located upon the card at predetermined positions in coded arrangement so as to supply information pertaining to the address in a now well-known manner. The machine information could pertain to the name of the addressee, the principal occupation of the addressee, the various elements of the geographical address or any other information which would serve to classify the visible address in one category or another. The group of master cards is advanced sequentially through the machine so that the machine may select a plurality of individual cards and print the address appearing on each of the selected cards upon a master tape, such as tape 30 illustrated in FIG. 5. Thus, the machine 10 will compose a list of selected addresses and the addresses will be placed in sequential arrangement upon a surface 32 of the tape as illustrated by addresses 34.

The selection of a particular card and the corresponding address appearing thereon is done on the basis of the particular machine information carried by the card. For example, the machine may be set up or programmed to choose cards carrying addresses in only one particular geographical area, in which case the machine will select, from a group of master cards carrying addresses in a multitude of geographical areas, only the pertinent cards and the list of addresses established upon the tape will be only those addresses from the chosen geographical area. Likewise, the machine may be set up to choose cards based upon any of the other characteristics of the addressee or the geographical address which appear in the machine information carried by the card.

At the left end of the machine, as seen in FIGS. 1 and 2, there is provided means for holding the group of master cards and these means are shown in the form of a hopper 40 which will support a stack of cards 42 upon the platform 44 of a card feed mechanism 46. The cards are then sequentially advanced from the stack by card advancing means which include the card feed mechanism 46 and a card transport mechanism 48 which extends along the length of the path of travel of the cards through the machine, the path of travel of the cards extending from the hopper 40 adjacent the left end 50 of the machine to collecting means including a storage compartment 52 adjacent the right end 54 of the machine where the cards are collected and stored pending their removal from the machine.

As best seen in FIG. 2, a supply of master tape is held within the machine by means including a supply reel 60 mounted for rotation upon a spindle 62 which is affixed to the frame 12 of the machine. The tape 30 follows a path of travel through the machine and is eventually brought to a takeup mechanism 64 at the tape storage means where the tape is wound onto a takeup reel 66 mounted for rotation upon the frame 12 adjacent the right end 54 of the machine where the tape 30 will await removal from the machine.

As best seen in FIG. 6, as well as in FIGS. 1 through 3, the path of travel of the cards 22 overlaps the path of travel of the tape 30 at an imaging station 70 located between the ends of the machine so that at least the portion 26 of each card upon which the address 24 appears is juxtaposed with a portion or increment 72 of the tape at imaging means located at the imaging station 70 as the cards and the tape are advanced through the machine. Each of the cards 22 is momentarily

halted in a prescribed position at the imaging station **70** with the address carried thereon juxtaposed with a stationary increment **72** of the tape in a manner which will be explained hereinafter.

Sensing means are provided along the path of travel of the cards at a sensing station **80** located between the card feed mechanism **46** and the imaging station **70** for sensing the machine information on each advanced master card, the sensing means being shown in the form of a photocell card reader assembly **82** which detects the presence or absence of a punched hole or punched holes at a particular location or locations in the card. Selector means are provided which are responsive to the sensing means as will be explained in greater detail below for selecting only those cards from which an address will be extracted and for operating the imaging means only when such a selected card is in the prescribed position at the imaging station to establish upon each juxtaposed stationary increment **72** of master tape an image of the address carried by each selected card.

The tape **30** is advanced by means on the frame which include an intermittent feed means shown in the form of a feed drum **88** which is operated each time the imaging means is operated to advance the tape relative to the imaging station **70** through one complete fixed increment for each such operation of the imaging means. The card advancing means and the intermittent tape feed means are engageable with a drive means which includes a main drive motor **90** mounted upon the frame **12** (see FIG. 3). The means which achieve the card selection, the operation of the imaging means, and the operation of the intermittent feed means will be more fully described below.

The imaging station **70**, shown in FIGS. **1** through **3** and **6**, is illustrated in greater detail in FIGS. **7**, **8** and **9** wherein it is seen that the imaging means comprises a source of infrared radiation shown in the form of a flash lamp assembly **92** in which flash lamps **94** are mounted below a platen **95** having a transparent window **96** and above a cooling duct **98** in the flash lamp assembly housing **100** over which the tape **30** and the cards **22** are made to travel. Each card **22** is halted momentarily in the prescribed position at the imaging station **70** by a pair of stop fingers **102** carried by arms **104** which are mounted for rocking movement in an up and down direction so that the stop fingers **102** may alternately be brought into and out of the path of travel of the cards **22**.

As best seen in FIGS. **8** and **9**, each arm **104** is affixed to a pin **106** which is mounted for rocking motion with respect to a frame portion **108** and a helical spring **110** (also see FIG. 3) couples one of the arms **104** with a drive pin **112** carried by a drive arm **114** such that both arms **104** are driven in an upward and downward direction out of and into the path of travel of the cards. The arrangement of the drive pin **112** and the helical spring **110** in coupling the drive arm **114** to an arm **104** allows adjustment of the location of the arms **104** relative to the drive arm **114** by adjustment of the drive pin **112** and thereby permits accurate location of the stop fingers **102** with respect to the path of the oncoming cards **22**. The arms are driven upwardly and downwardly in timed relationship with the travel of the cards by the drive pin **112** which is mounted upon the drive arm **114**, the drive arm **114** being carried by a rod **116** mounted for pivotal movement upon the same frame portion **108** and being normally resiliently biased in a downward direction by a further helical spring **118** connected thereto at one end thereof. The drive arm **114** carries at the other end thereof a cam follower **120** which follows a cam **122** mounted for rotation with a transverse drive shaft **124** which is coupled with the main drive means by a timing chain **125** (see FIG. 1) so as to rotate in timed relationship with the advance of the cards. Thus it will be seen that upon rotation of the transverse drive shaft **124** the drive arm **114** will be periodically lowered enabling the drive pin **112** to push against the corresponding arm **104** and urge the arms **104** and the corresponding stop fingers **102** downwardly to momentarily halt each card as the card arrives at the imaging station **70**.

At the same time, another cam **126**, which is also mounted upon the transverse drive shaft **124**, raises a follower **128** carried by a rocker arm **130** at one end thereof which is also mounted on the frame portion **108** at **132** for pivotal movement relative thereto to lower a roller **134** mounted at the other end of the rocker arm **130**, the roller **134** engaging an axially adjustable cap **136** fixed to a plunger **138** at one end thereof to lower the plunger **138** which is slideably received in a plunger housing **140** also affixed to frame portion **108** and to lower a pressure pad assembly **142** affixed to the other end of the plunger **138** so that a pressure pad **143** of the assembly **142** will press the address-carrying portion **26** of the card **22** downwardly against the tape **30** and will press both the card and the tape against the platen **95** and window **96** of housing **100**. The plunger **138** is resiliently biased upwardly by a helical spring **144** extending between a shoulder **146** on the plunger and a part of the plunger housing **140** so that when the roller **134** carried by the rocker arm **130** is rocked upwardly, the plunger **138** will move upwardly and release the pressure of the pressure pad **143** on the card. Since the cards **22** are halted for only a very short duration, fine adjustments in the axial distance which must be traversed by the plunger and in the pressure exerted by the pressure pad upon the card may be made by moving the cap **136** axially with respect to the plunger **138** and the cap may be locked in place by a setscrew **148**. The pressure pad **143** is preferably fabricated of a resiliently deformable material such as an elastomer so that intimate contact between the card and the tape is assured.

In the illustrated embodiment of the invention, the cards **22** are formed of porous tab card stock impregnated with a sensitizer which is vaporizable at approximately 100° C. to 160° C. and the address which appears on the one face **23** thereof is printed in infrared absorbing ink, although the address may be handwritten, stenciled or formed in any other way which will produce the necessary contrast between the address characters and the background. The tape has a nonporous oleophobic surface having resin release characteristics and is transparent to infrared radiation so that when the card is pressed against the tape at the platen **95** with the address-carrying face of the card contiguous with the tape and the source of infrared radiation is activated by flashing the flash lamps **94**, infrared radiation passes through the window **96** and the tape **30** and heats the areas of the card corresponding to the characters of the address to vaporize from the master card a portion of the vaporizable material which lies in the areas corresponding to the characters of the address. The material which is thus vaporized from the card is deposited onto the surface **32** of the juxtaposed increment **72** of master tape to establish a latent image.

Returning now to FIG. **6**, it will be seen that the latent images thus established upon the tape are converted to visible images constituting a visible list of selected addresses by applying a toner to the surface **32** of the tape which carries the latent image of vaporizable material which has been deposited on that surface in areas corresponding to the characters of the addresses. The tape is passed through a toner applicator means in a manner which will be described in greater detail hereinafter and the toner is made to adhere to the vaporizable material deposited on the surface of the tape in areas corresponding to the characters of the addresses. The method by which the latent image is formed, the construction of the cards and the tape, and the composition and application of the toner are all described more fully in an application of Ronald I. Morley et al. filed in the U.S. Patent Office on June 5, 1967, and bearing Ser. No. 643,718.

It is important that the master tape be advanced past the imaging station in precisely delineated fixed increments of advancement so that these fixed increments will be accurately registered with respect to the imaging means and the address carried by each card which is at the prescribed position in the imaging station. Thus, an intermittent feed mechanism must be provided which will accurately feed the tape across the imaging means. In addition, the tape is relatively delicate and

must be handled without the placement of undue stress upon the tape which might cause tearing of the tape resulting in either complete severance of the tape or mutilation of the tape which could impede accurate advancement. The machine of the invention therefore provides a tape handling system which will accomplish the advancement of the tape through the various portions or stations of the machine in an accurate yet delicate fashion. Referring now to FIGS. **6**, **10**, **11**, and **12**, as well as to FIGS. **1** through **3**, the feed drum **88** of the intermittent feed means is seen to carry a plurality of teeth **150** spaced equidistant from one another around the periphery of the surface **152** of the drum **88**. These teeth **150** are arranged to engage corresponding apertures **154** in the tape **30** (see FIGS. **5** and **7**) so that as the drum **88** rotates through an increment corresponding to an increment of advancement of the tape, the tape is positively engaged and advanced without slippage between the drum surface and the tape. In order to preclude any tearing of the tape by the teeth **150** in the vicinity of the apertures **154** which might occur if there were a tendency for the tape to slip relative to the surface of the feed drum, and in order to assure intimate contact between the tape and the feed drum surface and thereby attain accurately fixed increments of advancement of the tape, the feed drum **88** is mounted for rotation upon an arbor **156** which is affixed to the frame **12** of the machine **10** by machine screws **158** as seen in FIG. **11**. The arbor **156** is provided with a manifold **160** having an external connection point **162** through conduit **163** and extending over a circumferential portion **164** of the arbor corresponding approximately to the circumferential portion of the drum surface **152** against which the tape **30** must be intimately held. A plurality of passage **166** are circumferentially located between the teeth **150** of the drum **88** and pass radially through the drum so as to communicate with the manifold **160** as the portion of the drum carrying such passages passes over the manifold. A pressure below atmospheric pressure is maintained within the manifold **160** by means of a vacuum pump **168** (see FIG. **1**) connected to the connection point **162** by a vacuum line **170** so that atmospheric pressure will press the tape against the surface of the feed drum in the vicinity of those passages which communicate with the manifold.

The feed drum **88** is affixed to a drive spindle **172** which, in turn, is mounted for rotation within a bracket **174** affixed to the frame **12** of the machine. Means are provided for intermittently rotating the drive spindle **172** and the drum **88** and are shown to be in the form of a drive shaft **176** driven by a drive pulley **178** which, in turn, is engaged by a drive belt **179** that is driven by the main drive mechanism of the machine. An intermittent tape drive mechanism includes the drive shaft **176** which carries a crank **180** which engages a Geneva wheel **182** mounted for rotation within a housing **183** such that the Geneva wheel **182** is rotated intermittently by the continuous rotation of the drive shaft **176**. An electrically operated clutch **184** releaseably engages the tape drive mechanism by engaging the Geneva wheel **182** with the drive spindle **172** and the drive spindle carries a grooved detent wheel **186** having a number of grooves **188** corresponding to the number of slots (not shown) in the Geneva wheel **182** and with the number of increments of intermittent rotation into which one revolution of the feed drum **88** is divided (in this instance the number being eight). A detent **190** is carried by an arm **191** pivoted on the bracket **172** and is resiliently urged into the grooves **188** in the detent wheel **186** so that the drive spindle **172** is positively retained stationary during each dwell in the rotation of the Geneva wheel. Thus, operation of the clutch **184** to engage the Geneva wheel with the drive spindle will rotate the feed drum to feed fixed increments of tape across the imaging station.

In order to preclude any deleterious resistence to advancement of the tape **30** by the feed drum **88**, the path of travel of the tape is made to follow a loop prior to the imaging station **70** so that all tape fed by the intermittent feed means is supplied to the intermittent feed means from a supply loop **200** (see FIGS. **2** and **6**). The supply loop **200** is, in turn, supplied with tape by another portion of the tape advancing means which is shown in the form of a tape feed wheel **202** mounted for rotation upon the frame **12** and driven by an electric drive motor **204** (see FIG. **3**) which may be operated completely independently of the operation of the main drive motor **90** which drives the feed drum **88** of the intermittent feed means. The length of tape **30** within the supply loop **200** is regulated by sensing means shown in the form of a first photocell **206** and a corresponding lamp **208**, and a second photocell **210** and a corresponding lamp **212**, each mounted upon the frame **12** such that the beam of light passing from each lamp to each corresponding photocell is aimed at an angle to the plane of the paper so that the photocells will not be contacted by the tape **30**. As the feed drum **88** draws tape from the storage loop **200** the loop will become shortened until the beam of light between the first photocell **206** and its corresponding lamp **208** is interrupted by the tape **30** (which will not transmit the beam of light) as seen at **214** in FIG. **6**. Such an interruption of the light beam at **214** will actuate the drive motor **204** and rotate the feed wheel **202** until a sufficient length of tape is fed into the storage loop **200** to return the loop to its maximum length wherein the tape will interrupt the beam of light between the second photocell **210** and its corresponding lamp **212** as seen at **216**, whereby the drive motor **204** will be stopped. Thus, each time the supply loop **200** is depleted by the feed drum **88**, the loop **200** will be replenished by rotation of the feed wheel **202**.

The feed wheel **202** is also provided with eight teeth **218** engaging the corresponding apertures **154** in the tape **30**. These apertures **154** are formed by a punch mechanism **220** which is actuated by the same drive motor **204** as the feed wheel **202** so that as the feed wheel **202** advances tape into the supply loop **200** the tape will also be drawn across the punch mechanism **220** and the apertures **154** will be punched at accurately spaced intervals in the tape.

As best seen in FIG. **13**, the punch mechanism **220** includes a die **222** over which the tape **30** is drawn and a reciprocating punch **224** driven by a crank arm **226** which is rocked by a cam **228** affixed to a shaft **230** which is rotated by a drive belt **232** (see FIG. **3**) that is in driving connection with a belt drive assembly **234** driven by the drive motor **204** through drive belt **235**. The feed wheel **202** must advance the tape intermittently in order to allow the punch mechanism to punch the tape when the tape is stationary and also advance the tape in accurately defined increments in order to assure that the punch mechanism accurately spaces the punched apertures. Thus, the feed wheel **202** is driven by an eight-point Geneva drive **236** (similar to that which drives feed drum **88**) and which is driven by a drive belt **238** and drives the feed wheel **202** through a drive belt **239**. Hence, the tape is made to follow a path which includes another loop, the loop being located between the punch mechanism **220** and the tape supply reel **60** so that the tape being drawn across the punch mechanism by the feed wheel **202** will be advanced from a tape supply loop **240** and will not meet with deleterious resistance. The length of the tape supply loop **240** is regulated by sensing means shown in the form of a first photocell **242** and a corresponding lamp **244** and a second photocell **246** and a corresponding lamp **248**. As the tape is drawn from the supply loop **240** the loop will become shorter until, eventually, the loop will pass beyond the beam of light projected by the lamp **244** and the photocell **242** will actuate a feed roll **250** against which the tape **30** is urged by an idler roll **252** so that tape will be drawn from the tape supply reel **60** and fed to the supply loop **240** until the length of the loop once again allows the tape to interrupt the beam of light between the photocell **246** and the corresponding lamp **248** and rotation of the feed roll **250** will be stopped. Thus, when a prescribed length of tape is exhausted from the supply loop **240** the depleted supply loop will be replenished by the feed roll **250**. A further photocell **254** and corresponding lamp **256** are provided above the first photocell **242** and lamp **244** and are located far enough above the photocell **242** and lamp **244** so that the beam of light

between the photocell **254** and lamp **256** would ordinarily always be interrupted by the tape; however, should the tape supply reel **60** be depleted so that the tape feed roll **250** can no longer replenish the supply loop **240**, the loop will be shortened to a point above the light beam projected between lamp **256** and photocell **254**. The photocell **254** will then sense that there is insufficient tape to continue the operation of the machine and the machine will be stopped.

Referring now to FIGS. **6**, **14**, **15**, **16** and **17**, as well as to FIGS. **1** through **3**, the tape **30** is passed from the feed drum **88** of the intermittent feed means into a tape storage loop **260** which lies above the toner applying means and which serves to collect a predetermined length of tape prior to the tape being processed in the toner applying means. The path of travel of the tape thus follows a further loop so that the feed drum **88** of the intermittent feed means is actually isolated between two free tape loops **200** and **260** and the tape which is being advanced by the tape feed drum **88** is not subjected to harmful stresses in portions of the path of travel lying at either side of the tape feed drum which might affect the accurate registration of the tape with respect to the feed drum and the imaging station. The tape is drawn from the storage loop **260** through the toner applying means by another tape feed wheel **262** which is driven by an independent motor **263** and a belt **265** and is intermittently actuated in response to the length of tape in the tape storage loop **260**. Thus, a first photocell **264** and corresponding lamp **266** are provided adjacent the lower end of the loop **260** while a second photocell **268** and corresponding lamp **269** are located adjacent the uppermost limit of the loop. When the loop **260** attains the prescribed maximum length, the beam of light between the first photocell **264** and its corresponding lamp **266** is interrupted thereby turning on motor **263** and causing actuation of the tape feed wheel **262** to draw the tape from the loop **260** and through the toner applying means. Upon reaching the upper limit of the loop **260**, the tape **30** will interrupt the beam of light between the second photocell **268** and its corresponding lamp **269** to turn off motor **263** and the tape feed wheel **262** will be stopped. The first and second photocells and their corresponding lamps are located such that the beams of light make an angle with the plane of the paper to enable the tape to pass the photocells without contacting the photocells.

Turning now to FIGS. **14** and **15**, the toner applying means is seen to include a toner box **270** mounted upon the frame **12** of the machine and providing a chamber **271** having therein a tape guide **272** about which the tape **30** is passed. A volume of toner **273**, which is in the form of powdered or particulate material, is maintained in the chamber **271** such that the level of toner **273** will always be above the tape **30** as it passes around the tape guide **272**. Located below the tape guide is an agitator **274** which is rotated by a motor **275** and a drive belt **276** in order to keep the toner **273** in proper position and condition to assure that the tape is always immersed in the toner for a length of time sufficient to allow the toner to adhere to the material which makes up the latent image carried by the tape. It is noted that the surface **32** of the tape which carries the latent image faces downwardly as it passes over the tape guide **272**. As the tape emerges from the toner, but before the tape leaves the toner chamber **271**, a small beater **277** (see FIG. **2**), which is rotated by a beater motor **278** (see FIG. **14**) through a drive belt **279** and a drive shaft **280**, gently beats the opposite surface of the tape to shake excess toner from the tape.

In order to maintain the proper supply of toner in the toner chamber **271**, a toner supply hopper **281** is located above the toner box **270** and communicates with the toner chamber through a gate **282** which is mounted for rotation at the bottom of the hopper **281** and which is normally rotated during advancement of the tape **30** through chamber **271** by a metering motor **283** through a gear assembly **284**, a drive chain **285** and a drive shaft **286** which enters the hopper **281** at the bottom thereof. Such rotation of the gate **282** will also advance an endless conveyorlike belt **287** which is immersed in the toner held in the hopper **281** and which serves to agitate and facilitate the feeding of accurately metered amounts of toner through the gate **282** to the chamber **271**. The gate **282** may also selectively be rotated manually by means of a knob **288**. The supply of toner within the hopper **281** is replenished by merely removing a lid **289** at the top of the hopper and pouring in a fresh supply of toner.

The toner box **270** has a top **290** which is affixed to the frame **12** by a bracket **291** and which also supports the hopper **281**, and a housing **292** which is mounted for vertical sliding movement within a vertical slot **293** by means of a holder assembly **294** which includes rollers **295**. The housing **292** is held in place by a latch **296** (see FIG. **3**) which may be released by actuating a lever assembly **297** (see FIGS. **2** and **3**) to move connecting rods **298** to displace the latch **296** out of engagement with the holder assembly **294** and allow the housing **292** to be lowered or even completely removed from frame **12** for inspection of maintenance. An access door **299** is provided in the front face of the housing **292** and may be opened for periodic service and observation of the operation of the toner box **270** while the housing is in place against the top **290**.

The tape **30** with the powdered toner adhered to the material of the latent image then leaves the toner chamber **271** and enters another housing **300** wherein the tape is exposed to another source of infrared radiation in the form of a lamp (not shown) which is activated to heat the powdered toner carried by the material of the latent image and fuse the toner while in place upon the tape to establish integral bodies of toner, rather than particulate conglomerates, in the form of characters adhered to the master tape, the characters corresponding to the characters of the visible addresses carried by the selected master cards, but in reverse image.

It will be seen that by the intermittent operation of the toner applying means attained through the employment of the storage loop **260** and sensing means responsive to the condition of the storage loop to operate the feed wheel **262**, the tape is processed through the toner applying means only as required and the second source of infrared radiation within housing **300** need only operate intermittently so that any excessive buildup of heat within the machine which might arise from continuous operation of the second source of infrared radiation is precluded.

Because there is a certain amount of inertia in the tape as the tape is advanced from the supply loop **260** to the toner applying means, it has been found advantageous to provide a firm but gentle braking means between the supply loop and the means which advances the tape through the toner applying means. Such braking means are found between the supply loop **260** and the toner applying means in FIGS. **2** and **6** and are shown in greater detail in FIGS. **16** and **17**. The braking means comprise an arbor **302** affixed to the frame **12** of the machine **10** and having an outer surface **304** over which the tape **30** is passed. The arbor **302** is provided with an internal chamber **306** having an external connection point **308** and a plurality of passages **310** extending radially between the portion of the surface **304** contacted by the tape and the internal chamber **306**. The vacuum pump **168** (see FIG. **1**) is connected to the external connection point **308** by a length of tubing **312** so that the pressure within the chamber **306** is maintained below atmospheric pressure and the tape will be gently pressed against the arbor surface **304**. Such a gentle pressure will establish a small amount of frictional drag upon the tape to assure that the desired length of tape will be fed from the feed drum **88** into the storage loop **260** rather than spilling over the arbor **302** toward the toner applying means which might otherwise occur by virtue of the weight of the length of tape between the arbor and the toner applying means. In addition, the frictional drag will establish a small amount of tension within the tape lying beyond the arbor **304**, which tension is of some advantage as the tape is passed through the toner applying means.

Referring now to FIGS. 2, 6, 18, and 19, the tape 30 with the list of visible addresses now established on the surface thereof in the form of characters of toner material which has been fused, continues along a path of travel over further roller guides 314 and 316 affixed to the frame 12 of the machine 10 to arrive at the tape storage means. As the tape follows this segment of the path of travel, the fused toner material cools so as to establish integral characters of toner material adhered to the surface 32 of the tape 30. The tape storage means maintains a gentle tension in the tape so that the tape will not deviate from its prescribed path of travel and will be properly rolled up onto the tape takeup reel 66, but does so without placing excessive tension upon the tape. Thus, the takeup reel 66 is affixed to a spindle 320 which is mounted for rotation upon a subframe 321 affixed to the frame 12 of the machine 10 by a separate electric takeup motor assembly 322 which engages the spindle 320 through a drive belt 324. A takeup roll 326 is mounted for rotation upon a takeup spindle 328 which, in turn, is carried at one end 329 of a takeup arm 330 which is mounted upon the subframe 321 for swinging movement at the other end 332 thereof between a first position wherein the takeup spindle 328 is located at the lower end 333 of a slot 334 in the subframe and the takeup roll 326 is located between roller guide 316 and a further roller guide 335 mounted upon the subframe 321, and a second position wherein the takeup spindle 328 is located adjacent the upper end 336 of the slot 334. The takeup arm 330 is resiliently biased toward the second position by means of a helical spring 338 extending between the takeup arm 330 and the frame 12 of the machine 10 (see FIG. 3). Thus, as the tape 30 traverses the path of travel from the feed wheel 262, the takeup roll 326 will draw the tape upwardly from between the roller guides 316 and 335 to form an upwardly extending loop 340. When a sufficient length of tape has been accumulated in the loop 340 to allow the takeup spindle 328 to actuate an electric switch 342 located adjacent the uppermost end 336 of the slot 334, the electric switch 342 will turn on the electric takeup motor assembly 322 thereby rotating the takeup reel 66 and drawing the tape 30 from the accumulated loop 340 against the bias of the helical spring 338 to simultaneously deplete the loop 340 and draw the takeup arm 330 downwardly toward the lowermost end 333 of the slot 334. Upon arrival of the takeup spindle 328 adjacent the lowermost end 333 of the slot 334 the takeup spindle 328 will actuate a second electric switch 344 which will then turn off the takeup motor assembly 322 and allow the takeup arm 330 to again start its upward travel. Thus, the tension within the tape may be regulated by the bias of the helical spring 338 and may be held to a minimum concomitant with proper storage of the tape 30 on the takeup reel 66. When all of the cards have been processed and all of the tape rolled up onto the takeup reel, the takeup reel may be removed from the machine by removal of retainer 346 from spindle 320 with the desired list of selected addresses now appearing in reverse image upon a surface of the tape in the form of characters of fusible material which may be subsequently heated for transfer from the tape to an envelope or some other mailing piece, or to a mailing label.

Turning now to FIGS. 20, 21 and 22, as well as FIGS. 1, 2, and 3, the card feed mechanism 46 is shown in greater detail and is seen to include a subframe 350 upon which is mounted a transverse shaft 352. A pair of pusher fingers 354 is carried by the transverse shaft 352, each finger 354 being affixed adjacent to one end thereof to the transverse shaft for movement therewith and carrying at the other end thereof a picker member 356 which includes a flat platform 358 and a raised shoulder 360 rising from the platform 358 adjacent the rear end of the platform. A card drive means is shown in the form of a drive shaft 362 mounted for rocking motion upon the subframe 350 and selectively coupled to the transverse shaft 352 by means of an electrically operated pusher clutch 364. The drive shaft 362 is continuously rocked to and fro or oscillated by a drive arm 366 affixed thereto and carrying a cam follower 368 at one end thereof which is urged into driving engagement with a cam 370 by means of a helical spring 372 affixed between the other end of the drive arm 366 and the subframe 350. The cam 370 is affixed to a timing shaft 374 which is continuously rotated by the main drive motor 90 of the machine 10 through a drive chain 376 (see FIG. 1). Thus, when the machine 10 is operating and when there is a supply of master cards 22 stacked within the hopper 40 with the trailing edge of the lowermost card in the stack 42 resting upon the platforms 358 of the picker members 356, the clutch 364 can engage the transverse shaft 352 with the drive shaft 362 such that the drive shaft will rock the transverse shaft in a clockwise direction as seen in FIG. 22 against the bias of a spring 380 which extends between an arm 382 carried by the transverse shaft and the subframe 350 and which is urged into engagement with a stop 384 mounted upon the subframe and thereby move the fingers 354 forward such that the shoulders 360 of the picker members 356 will engage the trailing edge of the lowermost card in the stack and push the card forward. At the same time, a pair of tamping fingers 386 which are also fixed to the transverse shaft 352 for movement therewith will engage the trailing edges of some of the cards lying above the lowermost card and will align these cards within the stack so that the next card will be in position to be advanced by the picker members 356. It is noted that each shoulder 360 is raised from the corresponding platform 358 a distance equal to no more than the thickness of a single card to assure that only the lowermost card is advanced for each cycle of operation of the card feed mechanism.

As the lowermost card is advanced the leading edge thereof will be brought into a plurality of nips established between feed rolls 390 carried by a feed shaft 392 and idler rolls 394 cooperating with the feed rolls 390. The feed shaft 392 is also mounted for rotation upon the subframe 350 and is continuously rotated by rotation of the timing shaft 374 through an intermediate shaft 396 which is coupled at one end thereof to the timing shaft by means of a drive belt 398 and which is coupled at the other end thereof to the feed shaft 392 by means of a drive belt 399.

The feed rolls 390 advance the card across a platform 400 and through the sensing station 80 wherein is located the means which include the photocell reader assembly 82 which has photocells 401 located therein adjacent one face of the card and corresponding lamps 402 located therein adjacent the opposite face of the card (the photocells and lamps are shown schematically in FIG. 26). The leading edge of the card then passes into the nips established between a pair of feed rolls 404 mounted for rotation about an axis lying above the platform 400 and a corresponding pair of idler rolls (not shown) mounted for rotation about an axis lying below the platform 400, each idler roll engaging a respective feed roll. The feed rolls 404 are carried by a feed shaft 406 mounted for rotation upon the subframe 350 and driven by a drive belt 408 which is in driving engagement with the intermediate shaft 396.

Each advanced card is passed by the feed rolls 404 from the platform 400 to the card transport mechanism 46 which includes a table 410 (see FIGS. 1 and 23) which extends along the length of the path of travel of the cards as they pass through the machine. Mounted above the table 410 is a first bridge 412 having a pair of side rails 414 affixed to one another by means of a plate 416 extending between the rails 414 and a stiffener bar 418. A plurality of feed shafts 420 are mounted for rotation upon the rails 414 and carry adjacent each of their ends a feed roll 422 fixed for rotation with the feed shafts 420 about axes located above the table 410. Corresponding idler rolls 424 (see FIGS. 3 and 23) are mounted for rotation about axes lying below the table 410, each idler roll 424 being resiliently urged upwardly into engagement with a corresponding feed roll 422 to establish a nip there between so that the cards will first engage feed rolls 422L, which are furthest to the left, and then may be sequentially passed from nip to nip to be transported along the prescribed path of travel through the machine. Each feed shaft 420 is in

driving engagement with a neighboring feed shaft 420 through drive belts 423 and, among those feed shafts 420 which are mounted for rotation upon the bridge 412, the feed shaft 420R which is furthest to the right in FIG. 1 is driven by a timing chain 425 which, in turn, is driven by the main drive motor 90 through a series of drive belts 426, 427, and 428 and drive chain 429 (see FIGS. 1 and 3). As each card emerges from below the first bridge, the card is brought into the imaging station 70 where the card is juxtaposed with the master tape and is momentarily halted as explained above in connection with the description of the imaging station and imaging means.

When a card is momentarily stopped at the imaging station, as seen in FIG. 7, it is no longer engaged with any of the feed rolls 422, but does lie over a pair of feed belts 430 and is urged into engagement with the feed belts 430 by a pair of idler roller assemblies 432 (see FIG. 8), each assembly 432 including two idler rollers 434 rotatably mounted upon a carriage 436 which, in turn, is pivotally mounted upon a carriage arm 438, the carriage arm 438 being mounted upon the pin 106 for swinging movement relative thereto and being resiliently biased in a downward direction by virtue of a helical spring 440 such that the idler rollers 434 are biased against the card which is at the imaging station and the card is pressed against each of the feed belts 430 underlying the idler rollers 434 and the card. The feed belts 430 are moving continuously to the right as seen in FIGS. 1 and 7 and, by virtue of a frictional engagement with the card at the imaging station, tend to move the card in that direction. This tendency is defeated when the stop fingers 102 are lowered to stop a card; however, when the stop fingers 102 are raised, the card will be frictionally gripped by the feed belts 430 and advanced into a pair of nips established by the first-encountered pair of feed rolls 450L of a plurality of feed rolls 450 mounted for rotation about axes located above the table 410 upon feed shafts 452 which are in turn rotatably mounted upon a second bridge 454 having side rails 456 affixed to one another by means of bars 458. Corresponding idler rolls 459 are mounted for rotation about axes lying below the table 410 and are each resiliently urged upwardly into engagement with a corresponding feed roll 450. Each of the feed shafts 452 is driveably connected to a neighboring feed shaft 452 through a drive belt 460 so that all of the feed shafts rotate concurrently. The last of the feed shafts 452R which is located at the right end of the bridge 454 as seen in FIG. 1 is driven by a drive belt 462 which in turn is driven by the drive belt 427 driveably engaged with the main drive motor 90.

As the cards traverse the path of travel through the machine 10, it is possible that a card may become jammed somewhere along the path of travel, for one reason or another, resulting in the disruption of the operation of the machine. Means are provided in the machine for detecting such a card jam and for stopping the machine as a result of detecting such a jam. As best seen in FIG. 1, an elongate member 470 extends along the path of travel of the cards and is located above the table 410 and above the cards traveling thereon such that the cards pass between the table 410 and the elongate member 470. Should any card stop somewhere along the table 410 at a position where it is not intended that a card should stop, subsequent cards will bunch up with the stopped card until a sufficient thickness of cards is developed to deflect the elongate member 470 upwardly. The upward deflection of the elongate member 470 is sensed by an electric switch 472 which is coupled to the elongate member 470 and which is actuated by the deflection of the elongate member to cause the machine to be stopped.

In order to provide for the removal of any jammed cards, as well as to provide access to the table and to other components of the machine for inspection and maintenance, each of the bridges 412 and 454 may be raised in the following manner. The first bridge 412 is mounted to the frame 12 of the machine for pivotal movement about the feed shaft 420R, which itself is mounted for rotation upon the frame 12 at 474 and 476. As best seen in FIG. 23, the first bridge 412 may be raised by gripping handle 480 affixed to the plate 416 and depressing a lever 482 which will pivot a latch 484 out of engagement with a bar 486 which is affixed to the frame 12 of the machine so that the bridge 412 may be raised by swinging the bridge around the pivot provided by the feed shaft 420R. In a similar manner, the second bridge 454 may be raised by swinging the bridge 454 about the feed shaft 452R which is itself mounted for rotation upon the frame 12 of the machine 10 by brackets 488 and 490. The second bridge 454 carries a handle 494 which operates an overcenter clamp 494 to release the clamp jaws 496 from a bar 498 affixed to the frame 12 of the machine and to allow the bridge 454 to be raised into the position shown in FIG. 23. It is noted that such a raising of the second bridge 454 completely exposes the imaging station 70 since all of the mechanism for stopping and pressing the cards against the tape at the imaging station is carried by the bridge 454.

The machine 10 provides means for the sorting of the cards 22 as they pass along the path of travel from the hopper 40 to the storage compartment 52 so that as the cards arrive at the storage compartment 52 they are channeled into one of four bins 500, 502, 504 and 506 provided within the storage compartment (see FIG. 2). Referring now to FIGS. 24 and 25, as well as to FIGS. 1 through 3, a guideway 508 is provided adjacent one edge of the table 410 and is located so that a portion of each card will enter the guideway 508 and traverse the guideway as the card passes along its prescribed path of travel (also see FIG. 7). A plurality of thin, flexible bands 510, 512 and 514 are placed within the guideway 508 and overlap one another to divide the guideway into a plurality of channels 520, 522, 524 and 526. As best seen in FIG. 24, the upper wall of the guideway 508 is established by a flexible band 530 while the lower wall of the guideway 508 is defined by the top 532 of the table 410 itself. Between the tabletop and the uppermost band are the three elongate flexible bands 510, 512 and 514 which divide the guideway into the four channels, channel 520 lying between the uppermost band 530 and the first band 510, channel 522 lying between the first band 510 and the second band 512, channel 524 lying between the second band 512 and the third band 514, and channel 526 lying between the third band 514 and the tabletop 532.

A sorter mechanism 534 is mounted upon the frame 12 adjacent to the forward ends of the bands and includes a bracket 536 carrying three pull rods 540, 542 and 544 mounted in the bracket 536 for vertical sliding movement. Each pull rod includes a collar 546 affixed thereto and a helical spring 548 between the collar and the bracket which biases each rod in an upward direction. Each pull rod is affixed to a particular band by means of a pair of threaded fasteners 550 which captivate a tab 552 extending laterally from each band (see FIG. 25) such that rod 540 is attached to band 510, rod 542 is attached to band 512 and rod 544 is attached to band 514 so that normally the pull rods push all the corresponding bands upwardly and close off all but the lowermost channel 526 to an oncoming card which would approach from the left in FIG. 24. A pusher plate 556 engages all three of the collars 546 and is mounted for pivotal movement upon the frame 12 of the machine 10. As best seen in FIG. 1, the pusher plate 556 is rocked by a cam shaft 558 which is driven through drive chain 425 by the main drive system which includes drive motor 90 and drive belts 426, 427 and 428 and drive chain 429. The pusher plate 556 rocks once for each cycle of operation of the card feed mechanism 46 and depresses all of the pull rods until a pad 562 located at the lower end of each rod comes into contact with a corresponding electromagnet 570, 572 or 574 (see FIG. 25), each electromagnet being affixed to the bracket 536. Such downward movement of all of the pull rods will pull all three bands 510, 512 and 514 downwardly against the top 532 of the table to close off all but the uppermost channel 520 to the oncoming card.

As the card passes the photocell reader assembly 82, the reader assembly will read the machine information carried by the card and the data thus obtained will be transmitted to the

sorting mechanism in the form of an electric current or electric currents which will activate either one or a combination of the three electromagnets **570**, **572** and **574** dictated by the sensed machine data. Thus, should the data on the card indicate that the card must proceed to bin **506**, none of the electromagnets are activated and all of the pull rods will return to their original upward positions upon the upward movement of the pusher plate **556** thereby closing channels **520**, **522** and **524** and opening channel **526** for the reception of the card. By activating only electromagnet **574**, channel **526** will be closed and channel **524** will be opened, while channels **522** and **520** will remain closed. By activating electromagnet **572** channels **526** and **524** will be closed and channel **522** will be opened while channel **520** remains closed. By activating electromagnet **570**, pull rod **540** will remain down thereby closing channels **526**, **524** and **522** and opening channel **520**. It will be seen that when electromagnet **570** is activated electromagnets **572** and **574** may also be activated or need not be activated since band **510** overlies the remaining bands **512** and **514** and will hod those bands in the downward position. Likewise where electromagnet **572** is activated, electromagnet **574** may be activated but need not be activated since band **512** will be held down and will, in turn, hold down band number **514**. The bands traverse the entire length of the path of travel of the cards and each band terminates in a respective bin to divert the card within the channel defined by the band into the proper bin. As best seen in FIGS. **2** and **3**, the cards come to rest within each bin upon a platform **575** within the bin, each platform **575** being supported upon a vertical rod **576** mounted on the frame **12** for vertical sliding movement and biased upwardly by a helical spring **577**. As the individual cards are deflected into each bin by the downwardly directed ends **578** of the bands, the cards will come to rest without dropping a great distance so that deleterious tumbling of the cards is precluded to preserve the proper orientation of the cards. As the weight of each stack of cards in each bin builds up, the platforms **575** will descend against the bias of the springs **577** to allow more cards to be received on each stack. Thus, the group of master cards may be sorted to separate the cards according to categories chosen by the operator of the machine, the categories pertaining to characteristics of the name of the addressee or of the geographical address, and the cards will be collected in neat stacks of properly oriented cards.

The selection of the particular plurality of master cards from which addresses will be printed, from the group of master cards placed in the machine is best described in connection with FIG. **26**. The timing shaft **374**, which is shown only schematically in FIG. **26** but which is shown in more detail in FIGS. **1** and **21**, is rotated continuously by the main drive motor **90** of the machine **10** through drive chains **376** and **425** and drive belts **426**, **427** and **428** and drive chain **429** and rotates through one full revolution for each cycle of operation. Thus, the drive shaft **362** of the card feed mechanism **46** which is oscillated continuously by the cam **370**, the follower **368**, and the drive arm **366**, may be engaged with the transverse shaft **352** of the card feed mechanism **46** as described above by actuation of the pusher clutch **364** to rock the pusher fingers **354** through one complete cycle of operation for each revolution of the timing shaft **374** to advance one card to the reader assembly **82** at the sensing station **80** for each cycle of operation of the card feed mechanism **46**. As the advanced card passes through the reader assembly the presence or absence of punched holes in particular locations on the card is sensed by the passage of light from lamps **402** (designated schematically as "L" in FIG. **26**) to corresponding photocells **401** within the reader assembly so that the reader assembly reads the data provided by the machine information carried by the card and supplies that information via a data amplifier **580** and a timing amplifier **582** to selector means which include a reader logic and memory circuit **584**. The reader logic and memory circuit **584** has been programmed by the operator of the machine **10** prior to operation of the machine to select only certain cards based upon the machine information carried by the cards so that only a plurality of cards are chosen from the entire group of cards for subsequent printing of the addresses carried by the plurality of cards. Thus, the reader circuit **584** determines whether or not a particular card which is at the sensing station **80** will be selected for subsequent printing. If the reader circuit **584** determines that the address on the particular card located at the sensing station **80** must be printed at the imaging station **70**, a "print command signal" is developed in the reader circuit. The advancement of the card from the reader assembly at the sensing station to the table will be detected by the timing photocell of the reader assembly as the trailing edge of the card leaves the reader assembly and that information will enter the reader circuit through the timing amplifier **582** and cause the print command signal to be transferred to a first stage **586** of a shift logic and memory circuit **588**. Located downstream from the reader photocell assembly **82** is an intermediate photocell detector device **590** (see FIG. **1**) which detects the arrival of the card which has just left the reader assembly, and upon the departure of that card from the position where the photocell detector device **590** is located, such departure will again shift the print command signal to a second stage **592** of the shift circuit **588**. Still further downstream from the reader assembly there is located another or final photocell detector device **594** (see FIG. **1**) which again detects the arrival and departure of the same card, and as that card departs the position where the photocell detector device **594** is located, the print command signal will again be transferred to a third stage **596** of the shift circuit **588**. The card has now arrived at the imaging station **70** and the print command signal has arrived at the third stage **596** of the shift circuit **588**. The intermediate and final photocell detectors **590** and **594** are located along the path of travel of the master cards in predetermined spaced relationship with one another and with the sensing station, the spaced relationship being a function of the speed of travel of each card and the duration of the cycle of operation of the card feed mechanism so that the photocell detectors **590** and **594** actually keep track of a selected card as that card travels from the sensing station to the imaging station.

Returning now to the timing shaft **374**, an opaque trigger disc **600** is affixed to the timing shaft **374** for rotation therewith and has an aperture **602** placed at a particular angular location on the disc **600**. A photocell **604** is located at one side of the disc **600** and a corresponding lamp **606** is located at the other side of the disc **600** so that when the aperture **602** is aligned with the beam of light passing from the lamp **606** to the photocell **604** a "trigger signal" will be supplied through a trigger amplifier **608** to the shift circuit **588**. If, at the time the trigger signal is supplied to the shift circuit **588** there is also a print command signal at the third stage **596** of the shift circuit, a signal will be transmitted from the shift circuit **588** to the power supply **610** of the imaging means and the flash lamps **94** will be fired. Since the timing shaft **374** rotates in fixed mechanical relationship with the movement of the stop fingers **102** and the pressure pad **143** located at the imaging station **70** (timing chain **125** is coupled with drive belts **426**, **427**, and **428** and drive chain **429**) it will be seen that the aperture **602** in the trigger disc **600** may be so located as to assure that the flash lamps **94** will fire only when a properly selected card is in the prescribed position at the imaging station **70**.

The same signal which causes the flash lamps **94** to fire is also transmitted to a tape logic and memory circuit **612** which, in response to receiving the signal, will actuate the clutch **184** to engage the intermittent tape drive mechanism with the tape feed drum **88**. The intermittent tape drive mechanism is mechanically interrelated with the timing shaft **374** (drive belt **179** is coupled with drive belts **426**, **427** and **428**) such that the tape feed drum **88** will rotate through only one angular increment for each revolution of the timing shaft. An opaque tape clutch disc **614** is affixed to the timing shaft **374** and carries an aperture **616** at a particular angular location therein. A

photocell 620 and a corresponding lamp 622 are located at opposite sides of the tape clutch disc 614 so that at a particular angular location of the tape clutch disc 614 the aperture 616 therein will be aligned with the light emanating from the lamp 622 to the photocell 620 and the photocell will provide a signal via a tape clutch amplifier 624 to the tape circuit 612 so that the tape circuit will cause the clutch 184 to disengage upon the completion of the one angular increment of rotation of the feed drum 88. It is noted that the tape feed drum 88 is positively retained against rotation when the clutch 184 is disengaged by virtue of the detent 190 being engaged with the detent wheel 186 as described above so that an exceptionally accurate increment of advancement of the tape is attained and that increment is accurately located with respect to the imaging station.

Thus, the shift circuit 588 with its related photocell detector devices 590 and 594 and the trigger disc 600 provide means for operating the imaging means and the intermittent tape feed means in response to the travel of a selected master card along the path of travel from the sensing station to the imaging station. The photocell detecting devices 590 and 594 provide means for detecting the travel of a selected card and transmitting the information necessary to accomplish the operation of the imaging means and the intermittent tape feed means when the selected card is in the prescribed position at the imaging station in connection with the timing means which includes the trigger disc 600 and its related photocell and lamp.

As explained above, the imaging means include the flash lamps 94 and a power supply 610 for operating the lamps. These components require that a specific period of time transpire between consecutive operations of the components. Thus, the rapidity of repeated operation of the imaging means is limited by the duration of each full cycle of operation of the imaging means, which full cycle includes the recovery of the components of the imaging means subsequent to firing of the flash lamps 94 as well as the firing of the flash lamps. The duration of the cycle of operation of the imaging means of machine 10 is greater than the duration of the cycle of operation of the card feed mechanism 46 so that it is possible to feed cards more rapidly than it is possible to establish consecutive addresses on the master tape with the imaging means. Therefore, machine 10 provides a system which causes the card feed mechanism to skip the advancement of a card from the group of cards provided in the stack 42 in hopper 40 immediately after the advancement of a card carrying a selected address so that extra time will be provided subsequent to the operation of the imaging means prior to the arrival of the next subsequent selected card at the imaging station. The extra time is provided by means which will disengage the pusher clutch 364 in response to a signal from the sensing means provided at the sensing station. Thus, when the reader circuit 584 develops the print command signal and when that print command signal is transmitted to the first stage of the shift circuit 588, a corresponding signal is supplied to a pusher logic and memory circuit 630. An opaque pusher disc 632 is affixed to the timing shaft 374 for rotation therewith and carries an aperture 634 at a particular angular location on the pusher disc, and a photocell 636 and a corresponding lamp 638 are located on opposite sides of the pusher disc 632 so that when the aperture 634 is aligned with the light projected from the lamp 638 to the photocell 636 a signal is transmitted to the pusher circuit 630 via the pusher amplifier 639. If, when the signal generated by the photocell 636 arrives at the pusher circuit 630 there is also present in the pusher circuit a signal corresponding to the print command signal, the pusher clutch 364 will be disengaged by the pusher circuit 630 thereby disengaging the transverse shaft 352 from the drive shaft 362 and causing the card feed mechanism 46 to skip the feed of a card for one complete cycle of operation during which the pusher disc 632 will complete one revolution. Upon completion of that revolution of the pusher disc, the selected card will already have departed from the intermediate photocell detector device 590 thereby shifting the print command signal to the second stage 592 of the shift circuit 588 and clearing the pusher circuit 630 so that the signal received from the photocell 636 and the pusher amplifier 639 prior to the next subsequent cycle of operation of the card feed drive means will cause the pusher circuit to actuate the pusher clutch and engage the drive shaft with the transverse shaft and the card feed mechanism will advance another card.

When a card which is not one of the plurality of cards which is to be selected for subsequent printing reaches the reader assembly 82, the reader circuit 584 will determine that that card is not to be printed and a print command signal will not be developed. Since there is then no print command signal to be shifted through the various stages of the shift circuit 588 there will be no signal available in the third stage 596 of the shift circuit when the trigger signal is transmitted to the shift circuit and neither the imaging means nor the intermittent tape feed means will be operated when that particular card reaches the imaging station. Likewise, there will be no signal corresponding to the print command signal transmitted to the pusher circuit and the signal received from the pusher photocell 636 will cause the pusher circuit to actuate the pusher clutch so that the card feed mechanism will operate to advance a card from the stack without skipping the advancement of a card.

Thus, it will be seen that the processing of all of the entire group of cards may be slowed by the time required for the imaging means to operate through a complete cycle, but will not be limited to the advancement of only one card during a period of time equivalent to the duration of the cycle of operation of the imaging means. The above described system illustrates how the speed of processing a given group of cards containing a mixture of selected and nonselected cards may be increased beyond the speed at which only selected cards may be processed. In practice, machine 10 has been made to feed cards at the rate of 36,000 cards per hour. It can thus be determined that if no card is selected for printing at the imaging station, the machine 10 will process cards at the rate of 36,000 cards per hour, or if every card were selected for printing at the imaging station, the machine 10 would then process cards at the rate of only 18,000 cards per hour. In actual practice, where the group of cards presented to the machine is comprised of a mixture of selected and nonselected cards, the machine will process cards at a rate of somewhere between 18,000 and 36,000 cards per hour.

The intermediate photocell detector device 590 and the final photocell detector device 594 also serve to detect unwanted deviations from the prescribed traverse of the cards traveling from the card feed mechanism to the imaging station. The photocell detector devices 590 and 594 are spaced from one another such that either one detector device or the other or both photocell detecting devices must detect the presence of a card at the corresponding position or positions of the photocell detecting devices at a particular point in time in order to determine that the cards are being transported in correct sequence. To this end, an opaque strobe disc 640 is affixed to the timing shaft 374 for rotation therewith. A strobe photocell 642 is mounted on one side of the strobe disc and a corresponding lamp 644 is mounted at the other side of the disc and the strobe disc carries an aperture 646 at a particular angular location thereon so that at the particular point of time in question the aperture 646 will be aligned with the light projected from the lamp 644 and passing to the photocell 642 and the strobe photocell will generate a signal which will be transmitted through the strobe amplifier 648 to a card feed logic circuit 650. If at the time the strobe photocell signal reaches the card feed logic circuit 650 the information received from the photocell detector devices 590 and 594 indicates that no card is in position to be detected by either of the photocell devices, the card feed logic circuit will transmit a signal to a machine control device 652 which will stop the operation of the machine 10.

The reader circuit 584 will also serve to transmit information requested by its program to the counting devices 20 to display the information at the data display console 18.

In the machine **10**, each of the circuits described above are electronic circuits and are housed within the machine at **660** (see FIGS. **2** and **3**).

It will be apparent that a machine constructed in accordance with the invention is capable of very rapidly processing a group of tab cards to extract from the cards a plurality of selected addresses which may be selected on the basis of any one or more of a plurality of characteristics pertaining to the addressee or the geographical address itself.

It is to be understood that the above detailed description of an embodiment of the invention is provided by way of example only. Various details of design and construction may be modified without departing from the true spirit and scope of the invention which is set forth in the appended claims.

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

1. A machine for preparing a list of selected addresses on an elongate master tape from a group of master cards each carrying a visible address and machine information pertaining to the address, a selected plurality of which master cards carry the selected addresses, said machine comprising:

a frame;

means for holding the group of master cards;

means for holding a supply of master tape;

an imaging station on the frame;

means on the frame for sequentially advancing each of the group of master cards along a path of travel from the master card holding means to the imaging station;

means on the frame for advancing the master tape from the master tape supply to the imaging station, the master tape advancing means including intermittent tape feed means for sequentially providing stationary fixed increments of the master tape at the imaging station;

imaging means at the imaging station;

a sensing station on the frame along said path of travel and located between the master card holding means and the imaging station;

sensing means at the sensing station for sensing the machine information carried by each advanced master card;

selector means responsive to the sensing means for determining when each one of the plurality of selected master cards is present at the sensing station;

means on the frame and operated in timed relationship with the travel of the advanced master cards for momentarily halting at least each selected master card in a prescribed position at the imaging station with the address carried thereby juxtaposed with a stationary increment of the master tape at the imaging station; and

means responsive to the travel of said one selected master card along said path of travel and operated in timed relationship with the master card halting means for operating the imaging means and the intermittent tape feed means only when said one selected master card is in said prescribed position to establish upon the juxtaposed increment of master tape an image of the address carried by the selected master card and for operating the intermittent tape feed means to advance the master tape relative to the imaging station through one complete fixed increment for each such operation of the imaging means.

2. The machine of claim **1** wherein said means for operating the imaging means and the intermittent tape feed means include

detector means located along the path of travel of the master cards between the sensing station and the imaging station in predetermined spaced relationship with the sensing station and the imaging station for detecting the travel of each master card past the detector means location;

timing means operated in timed relationship with the travel of the master cards; and

means responsive to the selector means, the detector means and the timing means for operating the imaging means and the intermittent tape feed means only when said one selected master card has passed through the detector means location and is in said prescribed position.

3. The machine of claim **2** wherein:

drive means are provided on the frame;

the master card advancing means is engageable with the drive means for operation in timed relationship with the drive means;

the intermittent tape feed means is engageable with the drive means for operation in timed relationship with the drive means; and

the timing means is coupled with the drive means for operation in timed relationship with the drive means.

4. A machine for preparing a list of selected addresses on an elongate master tape from a group of master tab cards, each card carrying a visible address on a portion thereof and machine information pertaining to the address, the machine information being in the form of holes located at predetermined positions on the card, a selected plurality of which master cards carry the selected addresses, said machine comprising:

a frame;

drive means on the frame;

means on the frame for holding the group of master cards;

means on the frame for holding a supply of master tape;

an imaging station on the frame;

means on the frame and engageable with the drive means for sequentially advancing each of the group of master cards along a path of travel from the master card holding means to the imaging station;

means on the frame for advancing the master tape from the master tape supply to the imaging station, the master tape advancing means including intermittent tape feed means engageable with the drive means for sequentially providing stationary fixed increments of the master tape at the imaging station;

imaging means at the imaging station;

a card reader assembly on the frame at a reader station located between the card advancing means and the imaging station for sensing the presence or absence of holes at predetermined locations on each advanced master card;

selector means on the frame and responsive to the card reader assembly for determining when each one of the plurality of selected master cards is present at the reader station;

stop fingers mounted on the frame for movement in timed relationship with the drive means for momentarily halting each master tab card in a prescribed position at the imaging station with the address carried thereby juxtaposed with a stationary increment of the master tape at the imaging station;

a pressure pad mounted on the frame for movement in timed relationship with the drive means for pressing at least the address-carrying portion of the halted master card against the stationary increment of master tape at the imaging station;

card detectors at predetermined locations along the path of travel of the master cards between the reader station and the imaging station in predetermined spaced relationship with the reader station and the imaging station for detecting the travel of each master card past the predetermined locations;

timing means coupled with the drive means for operation in timed relationship with the movement of the stop fingers and the pressure pad; and

means responsive to the selector means, the card detectors and the timing means for operating the imaging means and the intermittent tape feed means only when said one selected master card has passed through the predetermined card detector locations and the address-carrying portion thereof is pressed against the stationary increment of master tape at the imaging station to establish upon the juxtaposed increment of master tape an image of the address carried by the selected master card and for

operating the intermittent tape feed means to advance the master tape through one complete fixed increment subsequent to each such operation of the imaging means.

5. The machine of claim 1 wherein the image established upon the master tape by the imaging means is a latent image and wherein the machine includes means for subsequently converting the latent images so established into a visible list of selected addresses on the master tape.

6. The machine of claim 5 wherein:

the address carried by each master card is comprised of characters of infrared absorbing material and the master card carries vaporizable material in the area of the characters;

the master tape is transparent to infrared radiation;

the imaging means includes a source of infrared radiation;

each halted master card is juxtaposed with the increment of master tape at the imaging station such that the increment of master tape lies between at least the portion of the master card carrying the address and the source of infrared radiation, with the characters of the address facing the master tape;

the means for operating the imaging means operates the source of infrared radiation to vaporize from the master card a portion of the vaporizable material from areas corresponding to the characters of the address and to deposit the vaporizable material onto the surface of the juxtaposed increment of master tape to establish said latent image; and

the means for converting the latent images to a visible list of selected addresses includes means on the frame for applying a toner to said surface of the master tape to adhere toner to the vaporizable material deposited thereon in areas corresponding to the characters of the addresses and means for advancing the master tape through the toner applying means.

7. The machine of claim 6 wherein the toner is a fusible particulate material and the means for applying the toner to the surface of the master tape includes means for fusing the toner while in place on the master tape to establish integral characters adhered to the master tape such that the master tape is provided with a list of selected addresses having characters of fusible material carried upon said surface in reverse image with respect to the corresponding characters of the visible addresses carried by the selected master cards.

8. The machine of claim 4 wherein the image established upon the master tape by the imaging means is a latent image and wherein the machine includes means for subsequently converting the latent images so established into a visible list of selected addresses on the master tape.

9. The machine of claim 8 wherein:

the address carried by each master card is comprised of characters of infrared absorbing material and the master card carries vaporizable material in the area of the characters;

the master tape is transparent to infrared radiation;

the imaging means includes a source of infrared radiation;

each halted master card is juxtaposed with the increment of master tape at the imaging station such that the increment of master tape lies between at least the portion of the master card carrying the address and the source of infrared radiation, with the characters of the address facing the master tape;

the means for operating the imaging means operates the source of infrared radiation to vaporize from the master card a portion of the vaporizable material from areas corresponding to the characters of the address and to deposit the vaporizable material onto the surface of the juxtaposed increment of master tape to establish said latent image; and

the means for converting the latent images to a visible list of selected addresses includes means on the frame for applying a toner to said surface of the master tape to adhere toner to the vaporizable material deposited thereon in areas corresponding to the characters of the addresses and means for advancing the master tape through the toner applying means.

10. The machine of claim 9 wherein the toner is a fusible particulate material and the means for and the toner to the surface of the master tape includes means for fusing the toner while in place on the master tape to establish integral characters adhered to the master tape such that the master tape is provided with a list of selected addresses having characters of fusible material carried upon said surface in reverse image with respect to the corresponding characters of the visible addresses carried by the selected master cards.

11. The machine of claim 9 wherein:

the master tape follows a prescribed path of travel extending from the master tape supply to the imaging station and they beyond the imaging station to the means for applying toner to the master tape, said path of travel including a storage loop of prescribed length lying between the imaging means and the toner applying means such that the storage loop is fed by said intermittent feed means and said prescribed length is comprised of a plurality of said fixed increments of the master tape; and

the means for advancing the master tape through the toner applying means lies along said path of travel beyond the storage loop and includes means responsive to the attainment of said prescribed length in the storage loop for advancing the master tape from said storage loop and through the toner applying means until the storage loop is depleted.

12. The machine of claim 11 wherein the means for advancing the master tape through the toner applying means lies along said prescribed path beyond the toner applying means such that the master tape is drawn through the toner applying means by said advancing means.

13. The machine of claim 12 including means located along said path of travel between the storage loop and the means for advancing the master tape through the toner applying means for braking the tape as the tape passes from the storage loop through the toner applying means.

14. The machine of claim 13 wherein said braking means includes an arbor affixed to said frame and having a surface over which the tape passes with a portion of the surface of the tape opposite to that surface which carries the latent image contacting an area of the surface of the arbor, said arbor including at least one passage communicating with the area of the arbor surface contacted by the tape, and means for maintaining a pressure below atmospheric pressure within said passage to press the tape against the arbor surface at the area of contact therewith and thereby establish a frictional drag upon the tape without marring the latent image.

15. The machine of claim 1 wherein:

the master tape follows a prescribed path of travel extending from the master tape supply to the imaging station and then beyond the imaging station, the path including a first storage loop located between the master tape supply and the imaging station;

the intermittent tape feed means lies along said path beyond the first storage loop such that operation of the intermittent feed means will freely draw the master tape from said first storage loop and pass the tape across said imaging station in accurately fixed increments; and

the master tape advancing means includes means for advancing tape from said master tape supply to said first storage loop in response to the depletion of said first storage loop by the intermittent feed means to replenish said first storage loop.

16. The machine of claim 15 wherein the intermittent feed means lies along said path beyond the imaging station.

17. The machine of claim 15 wherein:

the master tape advancing means includes means located along said path of travel between the master tape supply tape said first storage loop for punching longitudinally spaced apertures in said mister tape in response to opera-

tion of the master tape advancing means to replenish said first storage loop so that said first storage loop is supplied with apertured tape;

the intermittent feed means includes a feed mechanism having spaced projections for engaging the spaced apertures to accurately advance said increments of master tape;

the path of travel includes a second storage loop lying between the punching means and the master tape supply such that operation of the tape advancing means and punching means will freely draw the master tape from the second storage loop and pass the tape through the punching means to attain accurate uniform spacing between said apertures; and

the master tape advancing means includes further means for advancing tape from said master tape supply to said second storage loop in response to the depletion of the second storage loop by the tape advancing means and punching means to replenish said second storage loop.

18. The machine of claim **16** wherein the intermittent feed means includes:

a feed drum mounted for intermittent rotation and having an external surface, a portion of which surface will engage the surface of the master tape opposite to that surface which carries the latent image to advance the tape in said fixed increments;

a plurality of passages within the feed drum, each communicating with a portion of the periphery of the external surface of the drum; and

means for maintaining a pressure below atmospheric pressure within each said passage when the portion of the periphery of the external surface communicating with said passage engages the surface of the tape.

19. The machine of claim **6** wherein the master tape follows a prescribed path of travel extending from the master tape supply to the imaging station, then beyond the imaging station to the means for applying toner to the master tape, and then beyond the toner applying means, the machine including takeup means for collecting the master tape with the list of addresses thereon, said takeup means comprising:

a takeup reel mounted for rotation upon the frame and receiving the master tape;

an arm mounted on the frame for movement between a first position and a second position;

means carried by said arm for intercepting the path of travel of the tape adjacent the first position of the arm and ahead of the takeup reel;

means resiliently biasing the arm toward the second position so that, with the takeup reel stationary, the tape advanced beyond the toner applying means will be drawn toward the second position by the resilient bias of the arm to establish a loop in said path of travel between said first and second positions;

means operating in response to the arrival of the arm at the second position for rotating the takeup reel and drawing the tape in said loop and the arm toward the first position against the bias of the arm to deplete said loop by winding the tape therefrom onto said takeup reel; and

means operating in response to the depletion of said loop and the arrival of the arm at the first position to stop the rotation of the takeup reel.

20. In a machine in which a relatively delicate elongate tape is advanced from a tape supply along a path of travel passing through the machine to a tape storage means, a takeup mechanism comprising:

a frame;

a takeup reel mounted for rotation upon the frame and for receiving the tape;

an arm mounted on the frame for movement between a first position and a second position;

means carried by said arm for intercepting the path of travel of the tape adjacent the first position of the arm and ahead of the takeup reel;

means resiliently biasing the arm toward the second position so that, with the takeup reel stationary, the tape advanced to the takeup mechanism will be drawn toward the second position by the resilient bias of the arm to establish a loop in said path of travel between said first and second positions;

means operating in response to the arrival of the arm at the second position for rotating the takeup reel and drawing the tape in said loop and the arm toward the first position against the bias of the arm to deplete said loop by winding the tape therefrom onto said takeup reel; and

means operating in response to the depletion of said loop and the arrival of the arm at the first position to stop the rotation of the takeup reel.

21. The machine of claim **1** wherein the imaging means operates through a cycle of predetermined duration and the master card advancing means includes:

card drive means operating continuously through repeating cycles of operation, the duration of each cycle of operation of the card drive means being less than the predetermined duration of the cycle of operation of the imaging means;

card feed means engageable with the card drive means for advancing one card from the card holding means during each cycle of operation of the card drive means; and

means for engaging the card feed means with the card drive means to advance each card and for disengaging the card feed means from the card drive means in response to the selector means for one complete cycle of operation of the card drive means immediately following the advancement of one of said selected cards such that no card is advanced during said one complete cycle and the duration of the cycle of operation of the card drive means during which no card is advanced will allow the imaging means to complete said cycle of predetermined duration prior to the delivery of the next consecutive selected master card to the prescribed position at the imaging station.

22. The machine of claim **21** wherein:

the card holding means hold said group of cards in a generally vertical stack;

the card drive means include a drive shaft mounted on the frame for oscillating movement;

the card feed means include a transverse shaft mounted on the frame for oscillating movement and fingers mounted for rocking movement below the stack, each finger having a member for engaging the lowermost card in the stack and advancing the engaged card from the stack during said rocking movement; and

the engaging and disengaging means include a clutch between said drive shaft and said transverse shaft and means for selectively operating the clutch in timed relationship with the oscillation of the drive shaft.

23. The machine of claim **4** wherein the imaging means operates through a cycle of predetermined duration and the master card advancing means includes:

card drive means coupled with the drive means for operating continuously through repeating cycles of operation, the duration of each cycle of operation of the card drive means being less than the predetermined duration of the cycle of operation of the imaging means;

card feed means engageable with the card drive means for advancing one card from the card holding means during each cycle of operation of the card drive means; and

means for engaging the card feed means with the card drive means to advance each card and for disengaging the card feed means from the card drive means in response to the selector means for one complete cycle of operation of the card drive means immediately following the advancement of one of said selected cards such that no card is advanced during said one complete cycle and the duration of the cycle of operation of the card drive means during which no card is advanced will allow the imaging means to complete said cycle of predetermined duration prior to

the delivery of the next consecutive selected master card to the prescribed position at the imaging station.

24. The machine of claim 23 wherein:

the card holding means hold said group of cards in a generally vertical stack;

the card drive means include a drive shaft mounted on the frame for oscillating movement;

the card feed means include a transverse shaft mounted on the frame for oscillating movement and fingers mounted for rocking movement below the stack each finger having a member for engaging the lowermost card in the stack and advancing the engaged card from the stack during said rocking movement; and

the engaging and disengaging means include a clutch between said drive shaft and said transverse shaft and means for selectively operating the clutch in timed relationship with the oscillation of the drive shaft.

25. The machine of claim 6 wherein the imaging means operates through a cycle of predetermined duration and the master card advancing means includes:

card drive means operating continuously through repeating cycles of operation, the duration of each cycle of operation of the card drive means being less than the predetermined duration of the cycle of operation of the imaging means;

card feed means for advancing one card from the card holding means during each cycle of operation of the card drive means; and

means for engaging the card feed means with the card drive means to advance each card and for disengaging the card feed means from the card drive means in response to the selector means for one complete cycle of operation of the drive means immediately following the advancement of one of said selected cards such that no card is advanced during said one complete cycle and the duration of the cycle of operation of the card drive means during which no card is advanced will allow the imaging means to complete said cycle of predetermined duration prior to the delivery of the next consecutive selected master card to the prescribed position at the imaging station.

26. The machine of claim 25 wherein:

the card holding means hold drive group of cards in a generally vertical stack; operation,

the card drive means include a drive shaft mounted on the frame for oscillating movement;

the card feed means include a transverse shaft mounted on the frame for oscillating movement and fingers mounted for rocking movement below the stack, each finger having a member for engaging the lowermost card in the stack and advancing the engaged card from the stack during said rocking movement; and

the engaging and disengaging means include a clutch between said drive shaft and said transverse shaft and means for selectively operating the clutch in timed relationship with the oscillation of the drive shaft.

27. The machine of claim 9 wherein the imaging means operates through a cycle of predetermined duration and the master card advancing means includes:

card drive means coupled with the drive means for operating continuously through repeating cycles of operation the duration of each cycle of operation of the card drive means being less than the predetermined duration of the cycle of operation of the imaging means;

card feed means engageable with the card drive means for advancing one card from the card holding means during each cycle of operation of the card drive means: and

means for engaging the card feed means with the card drive means to advance each card and for disengaging the card feed means from the card drive means in response to the selector means for one complete cycle of operation of the card drive means immediately following the advancement of one of said selected cards such that no card is advanced during said one complete cycle and the duration of the cycle of operation of the card drive means during which no card is advanced will allow the imaging means to complete said cycle of predetermined duration prior to the delivery of the next consecutive selected master card to the prescribed position at the imaging station.

28. The machine of claim 27 wherein:

the card holding means hold said group of cards in a generally vertical stack;

the card drive means include a drive shaft mounted on the frame for oscillating movement;

the card feed means include a transverse shaft mounted on the frame for oscillating movement and fingers mounted for rocking movement below the stack, each finger having a member for engaging the lowermost card in the stack and advancing the engaged card from the stack during said rocking movement; and

the engaging and disengaging means include a clutch between said drive shaft and said transverse shaft and means for selectively operating the clutch in timed relationship with the oscillation of the drive shaft.

29. The machine of claim 1 wherein:

the advanced master cards follow a prescribed path from the master card holding means to a sensing station, then to the imaging station and then beyond the imaging station to a collecting means, the collecting means including a plurality of longitudinally spaced bins, the machine including means operating in response to the sensing means for sorting said advanced master cards for advancement into one or another of said bins, said sorting means comprising:

a guideway extending along the path of travel of the cards from a leading end adjacent to the card holding means to a trailing end terminating adjacent the collecting means;

a plurality of overlapping elongate thin flexible bands, each extending along the guideway from a leading end adjacent to the card holding means to a trailing end terminating adjacent a prescribed bin and dividing the guideway into a pluraLity of channels between adjacent bands and between the bands and the guideway, all but one of said channels being normally closed to an oncoming card and each channel communicating with a corresponding bin;

means mounted adjacent to the path of travel of the cards and engaging said bands for flexing the leading ends of all of said bands relative to the guideway to close all but another of said channels as each card is advanced from the card holding means through the sensing station toward the leading end of the guideway; and

means operating in response to the sensing means for either releasing the flexed leading ends of all of said bands or retaining flexed only the end of a selected band or bands to hold open only one particular selected channel into which the card at the sensing station will be passed, said releasing or retaining means operating to release said retained band or bands after movement of said card from the sensing station and into the selected channel.

30. The machine of claim 29 wherein said flexing means include mechanical means for drawing said bands into the flexed position and said releasing or retaining means include selectively operated electromagnetic means for retaining said band or bands.

31. In a machine wherein each of a group of cards carrying machine information is sequentially advanced from a card holding means along a path of travel to a sensing means and then to a collecting means, the collecting means including a plurality of longitudinally spaced bins, the machine including means operating in response to the sensing means for sorting said advanced cards for advancement into one or another of said bins, said sorting means comprising:

a guideway extending along the path of travel of the cards from a leading end adjacent to the card holding means to a trailing end terminating adjacent the collecting means;

a plurality of overlapping elongate thin flexible bands, each extending along the guideway from a leading end adjacent to the sensing means to a trailing end terminating adjacent a prescribed bin and dividing the guideway into a plurality of channels between adjacent bands and between the bands and the guideway, all but one of said channels being normally closed to an oncoming card and each channel communicating with a corresponding bin;

means mounted adjacent to the path of travel of the cards and engaging said bands for flexing the leading ends of all of said bands relative to the guideway to close all but another of said channels as each card is advanced from the card holding means through the sensing station toward the leading end of the guideway; and

means operating in response to the sensing means for either releasing the flexed leading ends of all of said bands or retaining flexed only the end of a selected band or bands to hold open only one particular selected channel into which the card at the sensing station will be passed, said releasing or retaining means operating to release said retained band or bands after movement of said card from the sensing means and into the selected channel.

32. The machine of claim **31** wherein said flexing means include mechanical means for drawing said bands into the flexed position and said releasing or retaining means include selectively operated electromagnetic means for retaining said band or bands in said flexed position.

33. The machine of claim **1** wherein the advanced master cards travel in a plane and follow a prescribed path of travel from the master card holding means to the imaging station and then beyond the imaging station and the master card advancing means include:

a pluraLity of cooperating pairs of drive and idler rolls mounted along the path of travel of the cards for rotation in planes perpendicular to the plane in which the cards travel and parallel to the direction of travel, the axis of rotation of one of the rolls in each pair being located on one side of said plane of travel and the axis of rotation of the other of said rolls in each pair being located on the other side of said rolls in each pair being located on the other side of said plane of travel;

means on said frame and engaged with said drive rolls for driving said drive rolls; and

means on said frame for allowing selective displacement of at least some of the axes of rotation located on one side of the plane of travel away from the corresponding axes of rotation located on the other side of the plane of travel to selectively gain open access to the path of travel without requiring disengagement of the driving means from the drive rolls.

34. The machine of claim **33** including:

a table lying in the plane of travel of the cards;

the idler rolls being mounted for rotation about axes of rotation lying below the table;

a bridge extending over the table and being mounted for swinging movement relative to the table;

the drive rolls being mounted for rotation on the bridge;

means for holding the bridge in place relative to the table to engage corresponding drive and idler rolls at the plane of travel of the cards; and

means for selectively releasing said holding means to selectively swing the bridge away from the table and thereby gain open access to said table.

35. The machine of claim **34** wherein the bridge is mounted on said frame adjacent one end of the bridge for pivotal movement about an axis coinciding with the axis of rotation of at least one of said drive rolls and the means for driving said drive rolls are engaged with that one of said drive rolls such that displacement of the bridge relative to the table will not require disengagement of the drive roll drive means.

36. In a machine which cards are advanced sequentially from a group of cards held in card holding means and the cards travel in a plane and follow a prescribed path of travel from the card holding means through the machine, card advancing means including:

a plurality of cooperating pairs of drive and idler rolls mounted along the path of travel of the cards for rotation in planes perpendicular to the plane in which the cards travel and parallel to the direction of travel, the axis of rotation of one of the rolls in each pair located on one side of said plane of travel and the axis of rotation of the other of said rolls in each pair located on the other side of the plane of travel;

means on the frame and engaged with said drive rolls for driving said drive rolls; and

means on said frame for allowing selective displacement of at least some of the axes of rotation located on one side of the plane of travel away from the corresponding axis of rotation located on the other side of the plane of travel to selectively gain open access to the path of travel without requiring disengagement of the driving means from the drive rolls.

37. The machine of claim **36** including:

a table lying in the plane of travel of the cards;

the idler rolls being mounted for rotation about axes lying below the table;

a bridge extending over the table and being mounted for swinging movement relative to the table;

the drive rolls being mounted for rotation upon the bridge;

means for holding the bridge in place relative to the table to engage corresponding drive and idler rolls at the plane of travel of the cards; and

means for selectively releasing said holding means to selectively swing the bridge away from the table and thereby gain open access to said table.

38. The machine of claim **37** wherein the bridge is mounted upon said frame adjacent one end of the bridge for pivotal movement about an axis coinciding with the axis of rotation of at least one of said drive rolls and the means for driving said drive rolls are engaged with that one of said drive rolls such that displacement of the bridge relative to the table will not require disengagement of the drive roll drive means.