United States Patent

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[72] Inventors **Ronald I. Morley**
Minneapolis;
Raymond W. Biernat, Minneapolis; Arnold J. Smidt-Hayer, St. Paul, all of Minn.

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[73] Assignee **Dymo Industries, Inc.**
Berkeley, Calif.

[54] **ADDRESSING METHODS**
9 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **156/238,** 40/326, 101/470, 117/13, 117/155, 156/272, 156/277, 156/380, 161/413, 260/99.5
[51] **Int. Cl.** **B41m 5/00,** B41m 7/00
[50] **Field of Search** 156/238, 272, 277

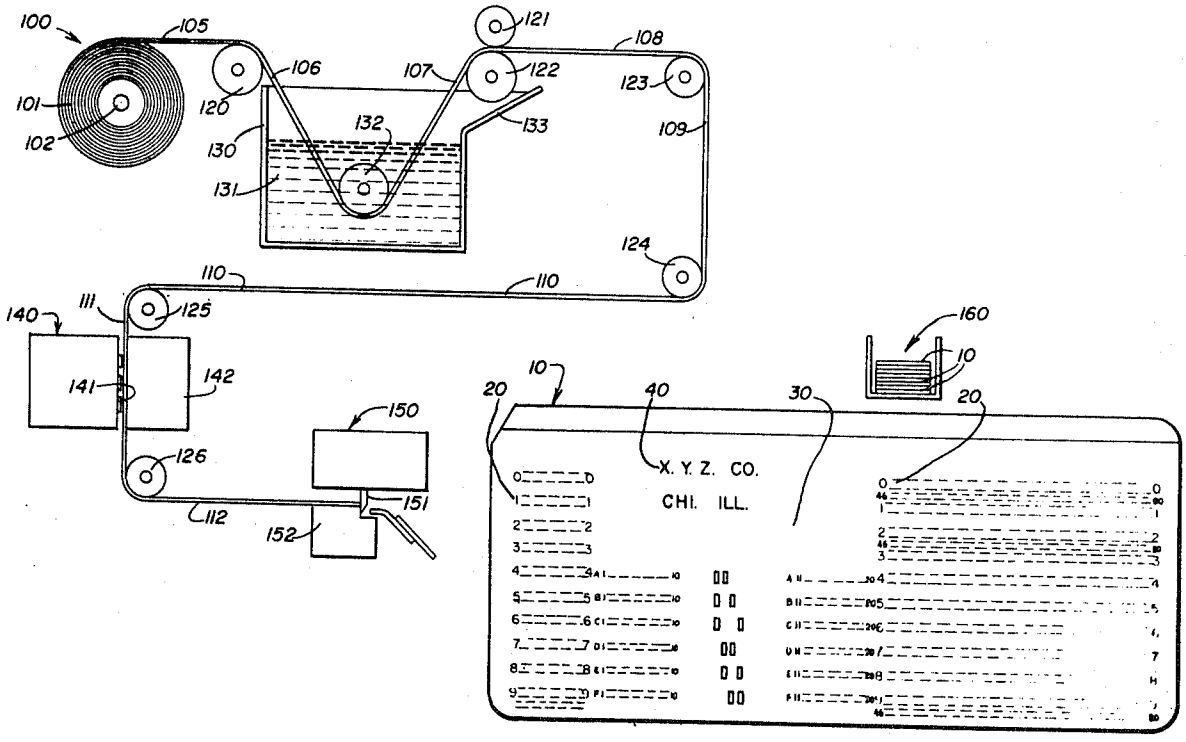
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Primary Examiner—Leland A. Sebastian
Attorney—Prangley, Clayton, Mullin, Dittman & Vogel

ABSTRACT: There is disclosed an addressing system including an addressing apparatus and addressing methods and materials used therein. A set of master cards is provided formed of porous tab card stock impregnated with a sensitizer vaporizable at 100° C. to 160° C. and having a selected area on one face thereof for the address in infrared absorbing ink; as disclosed, the master card is made by passing the porous tab card stock through a bath containing the sensitizer and a solvent therefor, after which the solvent is evaporated. The set of master cards is then employed to provide a master tape that is a strip of nonporous release material that is oleophobic and transparent to infrared radiation, and carrying thereon reverse reading copies of the addresses in the form of bodies of partially fused novel toner applied to one side of the master tape; the addresses are transferred from the master cards to the master tape utilizing a novel apparatus and method wherein a printing station is provided having a first source of infrared radiation thereat, first feed mechanism for feeding the master cards sequentially to the printing station and a second feed mechanism for feeding the master tape to the printing station to position a predetermined portion of the master tape immediately adjacent to the address on a master card positioned at the printing station, thereafter operating the first source of infrared radiation to vaporize from the master card sensitizer in areas corresponding to the address thereon onto the one surface of the master tape, applying a toner to the master tape to adhere toner to the sensitizer in areas corresponding to the address, and thereafter exposing the master tape carrying the powdered toner to a second source of infrared radiation for at least partially fusing the toner to provide a reverse reading copy of the address on the master tape. The novel toner comprises a vehicle body of wood rosin and polymerized resin, modifiers of polyamide resin and a hydrocarbon resin and pigment of carbon black. The master tape with the addresses thereon in partially fused toner is then fed to an addressing station where an envelope or other article to be addressed is placed with the surface thereof against the partially fused toner on a section of the master tape after which heat and pressure are applied thereto to transfer the bodies of toner to the envelope and fully to fuse the toner to provide on the envelope bodies of fully fused toner in areas corresponding to the address on a master card.



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SHEET 1 OF 2

FIG. 1

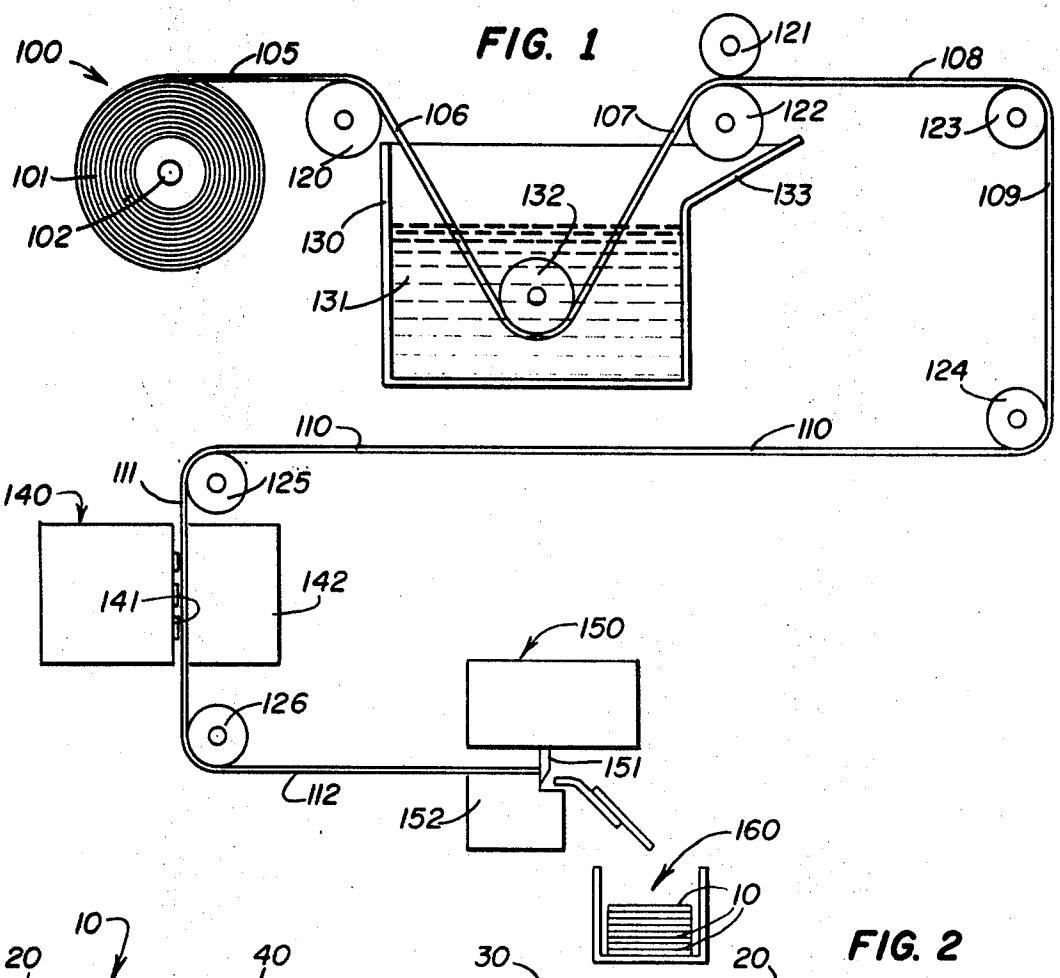
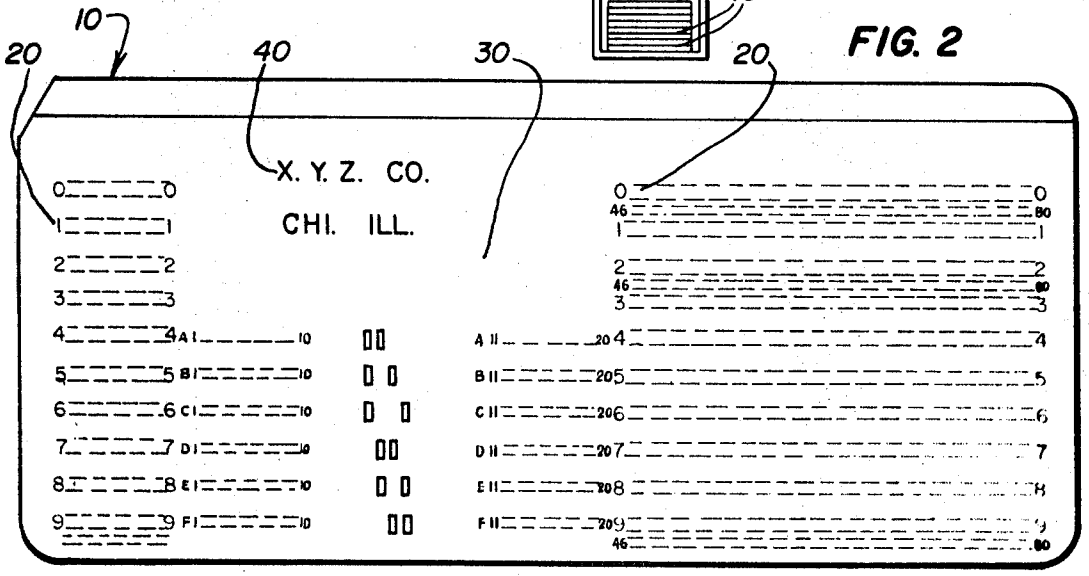


FIG. 2



Inventors
RONALD I. MORLEY
RAYMOND W. BIERNAT
BY ARNOLD J. SMIDT-HAYER.
Brangley, Baird, Clayton, Miller & Vogel.
ATTYS.

FIG. 3

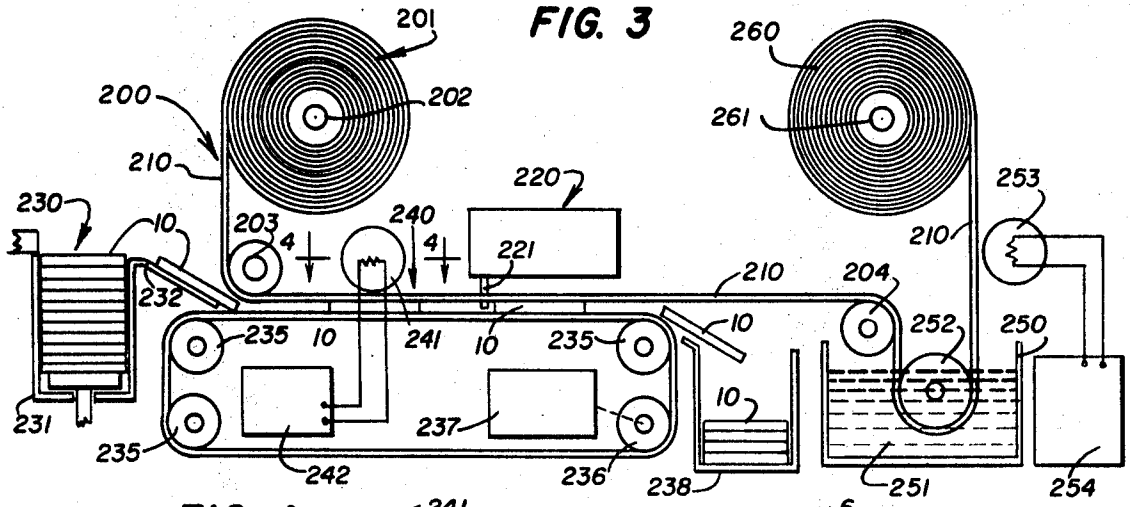


FIG. 4

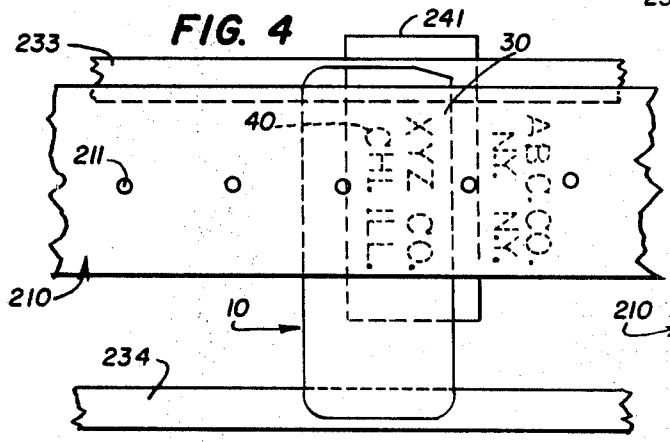


FIG. 5

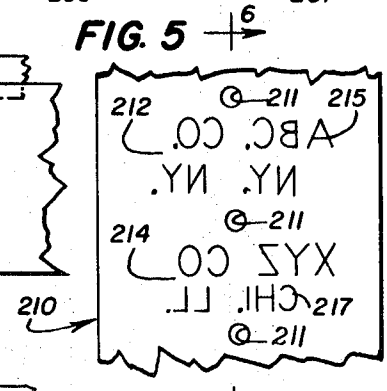


FIG. 6

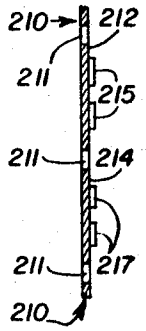
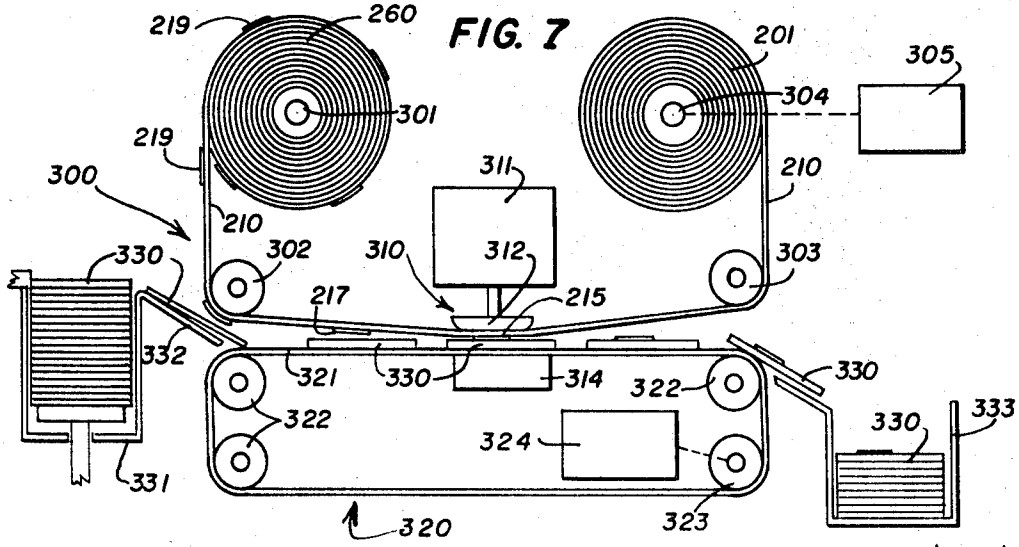


FIG. 7



Inventors
RONALD I. MORLEY
RAYMOND W. BIERNAT
BY ARNOLD J. SMIDT-HAYER.

Prangley, Baird, Clayton, Miller & Vogel ATTYS

ADDRESSING METHODS

The present invention relates to an addressing system, and more specifically to improved addressing methods

A further object of the invention is to provide an improved method of transferring addresses from a group of master cards onto a master tape comprising the steps of providing a printing station having a source of infrared radiation thereat, providing a group of master cards having thereon an address in infrared-absorbing material and vaporizable sensitizer in the area of the address, feeding the master cards sequentially to the feeding station, providing a master tape that has a nonporous oleophobic surface possessing release characteristics and that is transparent to infrared radiation, feeding the master tape to the printing station to position a predetermined portion of the master tape immediately adjacent to the address on a master card, operating the source of infrared radiation to vaporize sensitizer from the master card onto the adjacent surface of the master tape to provide on the master tape a film of sensitizer arranged in areas corresponding to the address on the master card, applying a toner to the master tape thereby to adhere toner to the sensitizer thereon in areas corresponding to the address, and irradiating with infrared radiation the master tape to at least partially fuse the toner thereon, thereby to provide a continuous master tape having on predetermined portions thereof bodies of partially fused toner areas corresponding to the addresses on the group of the master cards.

A still further object of the invention is to provide an improved method of transferring the addresses from the master tape onto a receptor sheet such as an envelope, the method comprising the steps of feeding receptor sheets sequentially to position a receptor sheet against the bodies of partially fused toner on the master tape corresponding to the address on a master card, and applying heat and pressure to the master tape and the receptor sheet to transfer the bodies of partially fused toner to the receptor sheet and fully to fuse the toner thereby to provide on the receptor sheet bodies of fully fused toner in an area corresponding to the address on a master card.

Further features of the invention pertain to the particular arrangement of the steps of the methods, whereby the outlined and additional features thereof are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings, in which:

FIG. 1 is a schematic drawing of the apparatus and method for producing master cards useful in the method of the present invention;

FIG. 2 is a plan view of the front face of a master card made for use with the present invention;

FIG. 3 is a schematic drawing of the apparatus and method for applying to a master tape addresses from a group of master cards, all in accordance with the present invention;

FIG. 4 is a fragmentary enlarged plan view of the portion of the apparatus of FIG. 3 as seen in the direction of the arrows along the line 4—4 of FIG. 3;

FIG. 5 is a plan view of the front surface of a portion of a master tape made in accordance with the present invention;

FIG. 6 is a view in vertical section through the master tape of FIG. 5 along the line 6—6 thereof; and

FIG. 7 is a schematic drawing illustrating an apparatus and method of transferring addresses from a master tape onto envelopes, all in accordance with the present invention.

The addressing system of the present invention utilizes therein a master card **10** as illustrated in FIG. 2, the master card **10** being generally rectangular in shape and having standard dimensions, such as for example a length of 7⅜ inches, a width of 3¼ inches and a thickness of 7 mils. More specifically, the master card **10** is formed from a piece of porous tab card stock having capillary passages extending therethrough throughout substantially the entire body thereof. Absorbed in the capillary passages of the master card **10** is a quantity of vaporizable sensitizer, the master card **10** containing about 1 mg. of sensitizer. As illustrated, the master card **10** is further

provided with a standard punched card grid on the front face thereof, the grid being generally designated by the numeral **20** and comprising a series of rows of numbers, 80 columns of such numbers being illustrated in FIG. 2. The grid **20** defines an address area **30** on the card **10** to receive therein an address **40** printed in infrared or heat absorbing material, for example, in ink containing a high content of carbon black.

The sensitizer absorbed in the master card **10** must have certain specific properties to be useful in the method of the present invention. A preferred sensitizer for use in the master card **10** is sold under the designation "Magie Oil 590", and is a mixture of branched aliphatic hydrocarbons each containing at least **10** carbon atoms with branches thereon containing up to as many as four carbon atoms. The oil further has an A.P.I. gravity of 36, a specific gravity of 0.845, a density of 6.9 pounds per gallon, a flash point of 335° F., a fire point of 360° F., a viscosity at 100° F. of 47, a K. B. number of 22.5, a straw color, an aniline point of 187, an initial boiling point of 590° F. and an end boiling point of 635° F. A master card **10** having the dimensions set forth above may contain as little as 0.1 mg. of oil and up to as much as 4 grams of oil, care being taken that not too much oil be present so that the master card **10** will not feel oily to the touch.

Another preferred sensitizer for use in the master card **10** are certain alkyl esters such as dimethyl sebacate and diethyl sebacate. Yet other preferred sensitizers for use in the master card **10** are aromatic esters including dimethyl phthalate and diethyl phthalate. A master card **10** having the dimensions set forth above may contain as little as 0.1 mg. of the ester and up to as many as 4 grams of the ester.

The master card **10** has many important advantages due to the character of the tab card stock of which it is made and due to the character and quantity of sensitizer impregnated therein. More specifically, the master card **10** can have the address **40** printed thereon, or typed thereon, or written thereon, or applied thereto in any other known manner, all without interference from the sensitizer content thereof. Furthermore, the address **40** will not bleed, smudge or block, (i.e., transfer from the face of one card to the rear of another in a stack of the cards) due to the presence of sensitizer therein. Furthermore, the sensitizer does not increase the friction between cards or the adhesiveness between cards, whereby the master cards **10** may be handled manually and in machines in the usual manner required. Furthermore, the sensitizer is nontoxic, odorless, and otherwise not obnoxious in use. Furthermore, the sensitizer does not cause the card stock to become soft and mushy. Finally, the sensitizer has low volatility at ambient conditions but has a substantially partial pressure in the temperature range from about 100° C. to about 160° C., whereby heating thereof will cause a vapor transfer from the master card **10** to an adjacent surface. Up to 500 such vapor transfers or impressions can be made from a single master card **10** without replenishing the sensitizer therein, and as many as eight vapor transfers or impressions may be made in a single working day due to the fact that the sensitizer lost in transfer is replaced due to the movement of sensitizer through the capillary passages in the master card **10** from areas adjacent to those from which the sensitizer is lost by vaporization.

There is illustrated in FIG. 1 of the drawings a schematic representation of the apparatus and method of forming the master card **10**, the apparatus being generally designated by the numeral **100**. The apparatus **100** includes a source of porous tab card stock in the form of a roll **101** thereof which may be, for example, 24 inches in diameter and is supported on an axle **102**. A first length **105** of the tab card stock from the roll **101** passes over a guide pulley **120** and into a tank **130** in which is disposed an impregnating solution **131** that will be described more fully hereinafter. Another guide roller **132** is provided in the tank **130** so that another section **106** of the tab card stock is disposed between the pulleys **120** an **132**, a portion of the section **106** being disposed in the impregnating composition **131**. From the guide roller **132** another section **107** of the tab card stock extends upwardly to a pair of

cooperating pinch or nip rolls 121 and 122 which tend to squeeze excess impregnating composition from the tab card stock, the excess composition falling downwardly onto an inclined surface 133 that drains back into the tank 130. After leaving the pinch rolls 121–122, the tab card stock passes in a length 108 to a guide roller 123 and along a length 109 to a guide roller 124 and along a length 110 to a guide roller 125 from which a length 111 extends to a guide roller 126. The several lengths 108, 109 and 110 of the impregnated tab card stock are exposed to ambient pressure and temperature conditions, whereby the solvent forming a part of the solution 131 will be evaporated therefrom leaving in the tab card stock only the sensitizer, all as explained above. The length 111 of the tab card stock with the sensitizer impregnated therein has the grid 20 printed thereon by a printing mechanism 140 that includes movable type 141 and a backup plate or bed 142, whereby there is printed on the tab card stock the grid 20.

After passing the printing mechanism 140, the tab card stock passes to a section 112 where a cutting mechanism 150 is provided that served to cut the essentially continuous tab card stock strip into individual master cards 10, the cutting mechanism 150 including the usual die 151 and a backup plate or bed 152. The cut and finished master cards 10 are fed to a stack thereof generally designated 160.

The impregnating solution 131 is preferably a mixture of the sensitizer that is to be impregnated into the master card 10 and a suitable volatile solvent therefor, the preferred solvent being hexane when the sensitizer is "Magie Oil 590". The hexane not only is a solvent for the sensitizer but also serves as a penetrating agent carrying the sensitizer into the tab card stock and also lowering the viscosity of the sensitizer to aid in the impregnation. In a preferred example, the sensitizer is "Magie Oil 590" and comprises 20 percent by weight of the impregnating solution 131 and the hexane comprises 80 percent by weight of the impregnating solution 131. It has been found that the impregnating solution may contain as little as 5 percent by weight of the sensitizer and up to as much as 50 percent by weight of the sensitizer, the remainder being hexane. In general it is impractical to use less than 5 percent by weight of sensitizer in the impregnating solution 131, and on the other hand, if more than about 50 percent by weight of the impregnating solution is sensitizer, then the resultant master card 10 is objectionably oily to the touch. Other suitable solvents may be utilized in place of the hexane, examples being acetone, pentane, heptane and chlorinated solvents such as dichloroethane and trichloroethane.

In the impregnating method of FIG. 1, it is preferred that the speed of the web of tab card stock be about 10 feet per second, and that about 6 inches of the tab card stock be immersed at any time in the impregnating solution 131, thereby to give a residence time of one-twentieth second in the impregnating solution 131. Such a residence time is adequate to provide saturation of the tab card stock. It will be appreciated that other methods of applying the impregnating solution 131 such as by spraying and the like may be substituted in place of the dip bath of FIG. 1. The vapor pressure of the solvent in the impregnating solution 131 must have a sufficiently high vapor pressure so that all of the solvent is evaporated in approximately 1 second, whereby the printing mechanism 140 may be disposed as short a distance as 10 feet from the tank 130, and still permit all of the solvent to be evaporated from the tab card stock before reaching the printing mechanism 140.

There is then applied to the master card 10 in the address area 30 the address 40 in an infrared absorbing material. The address 40 may be applied by typing, by printing, by addressograph methods, by handwriting, or by any other suitable method, so long as the address 40 is in a heat or infrared absorbing material.

In accordance with the addressing system of the present invention, the address on a master card 10 is reproduced on a master tape by distilling a portion of the sensitizer from the master card 10 in areas corresponding to the infrared absorbing indicia in the address 40 thereon onto one surface of the master tape. Thereafter the latent image in the form of a sensitizer film on the master tape is developed by passing the master tape through a toner box where toner is picked up by the sensitizer film to reproduce the address in the toner on the master tape. The apparatus and method of transferring addresses from a group of master cards onto a master tape are illustrated in FIGS. 3 to 6, the apparatus being generally designated in FIG. 3 by the numeral 200. A roll 201 of master tape 210 is mounted on a support axle 202 in a position to feed a length of the master tape 210 around a first guide roller 203 and a second guide roller 204, a reciprocating type feed mechanism 220 being provided having a finger 221 engageable in one of a series of openings 211 provided in the master tape 210 intermediate the longitudinal edges thereof and spaced the entire length thereof, the feed mechanism 221 serving to feed the master tape 210 stepwise in fixed increments from left to right as viewed in FIG. 3 between the guide rollers 203 and 204. There also is provided as a part of the apparatus 200, a feed mechanism 230 for a stack of master cards including a magazine 231 to hold a stack of the master cards, a chute 232 leading from the magazine 231 onto a pair of spaced apart conveyor belts 233 and 234 that are supported by a plurality of guide rollers 235 and a drive roller 236 connected to a source 237 of motive power for the conveyor belts 233 and 234. As illustrated in FIG. 4, the conveyor belts 233 and 234 are spaced apart and support a master card 10 adjacent to the ends thereof thereby to leave unobstructed the address area 30 carrying the address 40 thereon, the master tape 210 overlying the address area 30 and being disposed thereagainst, the side of the master card 10 carrying the address 40 therein being disposed upwardly.

The apparatus 200 also includes a printing station 240 at which is disposed a source of infrared radiation in the form of a powerful lamp 241 having its power supply 242 associated therewith. The infrared lamp 241 will preferentially heat the heat absorbing ink forming address 40 in the area 30 and cause a portion of the sensitizer in the master card 10 to be vaporized in the area of the address 40 from the upper surface of the master card 10 onto the adjacent undersurface of the master tape 210 where the oil is condensed in a film having areas shaped corresponding to the address 40 in the area 30 on the master card 10.

After exposure to the lamp 241 at the printing station 240, the master card 10 eventually is deposited in a receptacle 238 therefor and the master tape 210 with the latent image of the address in the form of a sensitizer film thereon is fed to a toner box 250 containing a suitable toner 251. More specifically, the master tape 210 is fed from the printing station 240 to and over the guide roller 204 and around a guide roller 252 in the toner box 250, thereby to expose the sensitizer film on the underside of the mater tape 210 to the toner 251 in the toner box 250. The master tape 210 with the granular toner thereon in the areas corresponding of the address on a master card 10 is then fed past a second source of infrared radiation in the form of a lamp 253 having a power supply 254, the lamp 253 providing intense infrared radiation at least partially to fuse the toner on the master tape 210, thereby to provide a continuous master tape 210 having on predetermined portions thereof bodies of partially fused toner in the areas corresponding to the indicia on a group of master cards 10, two such predetermined portions 212 and 214 of the master tape 210 having been illustrated in FIG. 5 of the drawings carrying two addresses from two of the master cards 10 thereon. More specifically, the predetermined portion of 212 carries bodies 215 of toner and predetermined portion 214 carries bodies 217 of partially fused toner, the bodies 215 and 217 of toner defining addresses corresponding to the addresses on two of the master cards 10.

In order properly to operate the apparatus 200, the master tape 210 must have certain predetermined characteristics. In one preferred form of the invention, the master tape 210 is a glassine base paper strip (i.e., a strip of high density paper fibers treated with concentrated sodium hydroxide to render

the strip transparent) coated on at least one side thereof with a Werner-type chromium complex such as that sold under the trademark "Quilon," , such a paper strip being offered by the Rhinelander Paper Co. under the trademark "Q_2S" (coated on both sides with the Werner-type chromium complex). A master tape formed of these materials is nonporous and oleophobic, is transparent to infrared radiation, is nonsticky to the touch, possesses good resin release characteristics, is dry to the toner, and is nonsticky to an envelope or other mailing piece to which the addresses thereon are to be transferred in a subsequent operation to be described hereinafter.

In place of the glassine base strip described above, there may be utilized in the present invention a parchment paper such as that sold by Patterson Parchment Company under the trademark "TS—35" carrying on each side thereof a coating of a Werner-type chromium complex such as that sold under the trademark "Quilon."

The toner **251** of the present invention preferably comprises a vehicle body, modifiers and pigments, the following being an example of a preferred formulation thereof:

Ingredients	Parts by Weight
Wood rosin	60
Polymerized rosin	20
Polyamide resin	4
Hydrocarbon resin	2
Furnace carbon black	10
Channel carbon black	4
Dispersant, lecithin	0.5
	100.5

The above ingredients were thoroughly mixed and thereafter placed in a jacketed mixture having sigma mixture blades therein and heated to a temperature in the range from about 250° F. to about 275° F. by passing steam through the jacket of the mixture, the steam entering at a temperature of about 280° F. and exiting at a temperature of about 270° F. The fused and molten mixture was stirred until the consistency was that of molasses, a 5 gallon batch requiring about 35 minutes of mixing. The molten mixture was then poured onto a ceramic slab and cooled to a solid. The cooled solid was ground and pulverized in a hammer mill until the toner particles had sizes in the range from about 5 microns to about 50 microns. Thereafter the particles wee screened to be sure that the particles utilized in the toner were in the range from about 5 microns to about 50 microns. Particles smaller than about 5 microns are too small and cause dusting, whereas particles larger than about 50 microns provide poor toning or imaging.

The wood **50** in the composition is that sold under the designation "WW Wood Rosin" by the Hercules Powder Company and contains about 60 percent by weight abietic acid, the compound having a higher acid number so as to provide better wetting when dispersing the pigment carbon and also to provide compatibility with the resins in the composition. The wood rosin utilized has a softening point (ASTM ring and ball method) of 163° F., an acid number of 164, a saponifaction number of 168, contains 6.5 percent unsaponifiable material, contains substantially no material insoluble in gasoline, has a specific rotation for plane polarized light (sodium line) of +11°, a refractive index at 20° C. of 1.5453, a density at 20° C. of 1.067 grams per milliliter, and a flash point (Cleveland open cup) of 420° F.

The polymerized rosin in the toner formulation is that sold under the trademark "Poly-Pale" by the Hercules Powder Company. It has an acid number of 145, a softening point (Hercules drop method) of 216, and a bulking value (pounds per gallon at 25° C.) of 8.9. The polymerized rosin increases the viscosity of the formulation and checks the plasticity of the wood rosin.

The amount of wood rosin in the toner composition may be as little as 50 parts by weight or as much as 70 parts by weight, whereas the polymerized rosin may comprise as few as about 10 parts by weight and up to as many as 30 parts by weight. However, the ratio between the wood rosin and the polymerized rosin is maintained in a preferred range of from about 2.7 to about 3.3, the preferred ratio being that given in the table above, namely, about 3. If the wood rosin content is too low, there is poor wetting and poor compatibility among the ingredients, whereby a broken image results after toning. On the other hand, if the wood rosin content is too high, the image is too soft and too tacky and tends to spread out, thus providing a blotchy toned image. If the amount of polymerized rosin is too low, there is a low viscosity of the toner and too much plasticity, whereas if the amount of polymerized rosin is too high, the toner is very brittle and friable.

The polyamide resin in the toner composition is that sold under the trademark "Versamid 930" and is more particularly a resin prepared by the condensation of polymerized unsaturated fatty acids, i.e., dilinoleic acid, with aliphatic amines, i.e., ethylene diamine. The "Versamid 930" resin has a softening point of 110° C., a Brookfield viscosity at 150° C. of 35 poises, a specific gravity of 0.98, a density of 8.2 pounds per gallon at 25° C., and a value of 3 in a modified penetration test at 25° C. following ASTM D5–52. Also useful is the polyamide resin sold under the trademark "Versamid 940," this resin having a softening point of 110° C., a Brookfield viscosity at 150° C. of 22 poises, a specific gravity of 0.98, a density of 8.2 pounds per gallon at 25° C., and a penetration value of 4 at 25° C. using the modified procedure of ASTM D5–52.

The hydrocarbon resin in the toner formulation is preferably that sold under the trademark "Amoco Resin 18–210," this being a linear alpha methyl styrene polymer. This product has a softening point (ring and ball) of 210° F., a Gardner-Holdt viscosity (60 percent in toluene) of G-H, a specific gravity of 1.08 and a molecular weight of about 720.

As little as 3 parts of the polyamide resin may be utilized in the toner formulation and up to as many as 5 parts, whereas from about 1 parts to about 2 parts of the hydrocarbon resin are useful. It is also necessary to maintain a predetermined ratio between the polyamide resin and the hydrocarbon resin, the ratio being in the range from about 1.5 to about 5, the preferred value being about 2 as illustrated in the table set forth above. If the amount of polyamide resin in the toner composition is too high, the toner is too sticky, is hard to fuse and is too viscous; on the other hand, if the content of polyamide resin is too low, there is blocking of the toner and the adhesion to an underlying support is not good. If the hydrocarbon resin content of the toner composition is too high, the toner exhibits poor adhesion and is too friable; on the other hand, if the hydrocarbon resin content is too low, the toner exhibits a high viscosity and is too sticky.

It further is necessary that there is a predetermined ratio between the ingredients forming the vehicle body, i.e., the wood rosin and the polymerized rosin, and the modifiers, i.e., the polyamide resin and the hydrocarbon resin. The ratio between the vehicle body ingredients and the modifiers is preferably in the range from about 12 to about 16, the preferred value being about 14.

The furnace carbon black utilized in the formulation is preferably that sold under the trademark "Statex F–12" and is characterized as a medium density black with low oil absorption and a large particle size. The channel carbon black in the toner formulation is preferably that sold under the trademark "Carbolac 2" which is a high density black carbon of small particle size and high oil absorption. As few as one part by weight of the furnace carbon black can be utilized and up to as many as 14 parts by weight, whereas up to as many as 10 parts by weight of the channel carbon black may be utilized in the formulation. At the higher concentrations of furnace carbon black, the color of the toner becomes grayish and the toner has a low viscosity, whereas at the lower concentrations of furnace carbon black the toner tends to become too heavy in viscosity and also tends to become dusty and friable. The ratio between all of the other ingredients in the toner, namely, the

vehicle body and modifiers on the one hand, and the pigments on the other hand, is preferably in the range from about 4.5 to about 9, the preferred ratio being about 6.

The dispersant used in the toner formulation set forth above is preferably that sold under the trademark "Despergan," , it being essentially a lecithin formulation. The amount of dispersant can be as many as two parts by weight. If the amount of dispersant is too low, the dispersion is poor in the finished toner, whereas if the amount of dispersant in the formulation is too high, the toner tends to become tacky.

The toner described above gives very sharp heat transfer on the herein described apparatus. The combination of the rosins and resins noted forms a dry, fluid powder which in use produces a sharp image and a sharp, dense heat transfer which releases easily from the master tape **210**.

The toner as described has a melting point of about 225° F., the toner preferably having a melting point in the range from about 225° F. to about 230° F. If it is desired to raise the melting point of the toner, the proportions of polymerized rosin and polyamide resin are increased, but if these proportions are increased too much, broken lines will result in the toned image. To lower the melting point of the toner, the proportions of polymerized rosin and polyamide resin are lowered, but if these proportions are too low, blocking of the toned image will result and the lines in the toned image will tend to spread.

It also is desirable to provide in the toner box **200** a plurality of glass beads (for example having diameters of approximately 200 microns) to prevent packing of the toner **251** and to improve the fluidity thereof. Alternatively, the toner box **250** may be vibrated or an auger may be placed therein to prevent agglomeration of the toner.

Considering now further the method of utilizing the apparatus **200** illustrated in FIGS. **3** and **4** of the drawings, the master cards **10** are successively fed on by one from the magazine **231** onto the chute **232** and from there onto the conveying belts **233, 234**. At the same time, the master tape **210** is being fed from the roll **201** thereof downwardly and around the guide roller **203**. Then the lower face thereof is pressed against the master cards **10**, movement of the master tape **210** being under the control of the tape feed mechanism **220** and the finger **221** engaging in the openings **211** in the master tape **210**. The feed mechanism **220** and the drive **237** for conveyor belts **233, 234** operate stepwise to stop the master tape **210** with the predetermined portion thereof disposed against and covering the address **40** on a master card **10** disposed therebeneath at the printing station **240** and in alignment with the infrared lamp **241**. More specifically, the portion of the master tape **210** disposed between two adjacent openings **211** is in registry with the address **40** on the master card **10** disposed below the infrared lamp **241** as illustrated in FIG. **4**. Energization of the lamp **241** vaporized a portion of the sensitizer in the master card **10** onto the adjacent surface of the master tape **240**. The infrared radiation from the lamp **241** is preferentially absorbed by the pigments in the address **40**, whereby the sensitizer is vaporized from those areas of the card **10** covered by the address **40**. The sensitizer as it is vaporized from the card **10** is immediately condensed and cooled on the adjacent surface of the master tape **210** to provide thereon sensitizer film that reproduces the address **40** to form in effect a latent image of the address thereon.

The above described process is repeated rapidly at the printing station **240**, after which the master tape **210**, with the latent image of an address in sensitizer disposed between each pair of adjacent openings **211** therein, is fed to the toner box **250** where the loose toner is picked up by the sensitizer films on the master tape **210**, thus to provide developed images in particles of toner of the addresses on the master tape **210**. In order to render the thus developed toner images more permanent, they are exposed to the radiation from the lamp **253** which heats the toner to a temperature above the fusion point thereof, i.e., above about 225° F., thus to provide bodies of partially fused toner defining the addresses on the series of master cards **10** to which the master tape **210** was exposed.

At the same time the exposed master cards **10** are delivered by the conveyor belts **233, 234** to the receptacle **238** therefor. The sensitizer in the master cards **10** adjacent to the address areas **40** therein quickly migrates by capillary and osmotic action into the address areas **40** to replenish the sensitizer therein, thereby to render it possible shortly thereafter again to print a latent image in sensitizer of the address **40** on another master tape **210**. It has been found that as many as eight or more impressions can be taken from a master card **10** in a normal working day, and up to a total of 500 or more may be made from a single master card **10** before it is necessary to replenish the sensitizer therein.

There are illustrated in FIGS. **5** and **6** of the drawings the details of the structure of the master tape **210** carrying the addresses thereon in bodies of partially fused toner. Referring first to FIG. **5**, there is shown a section of the master tape **210** with the longitudinal axis thereof arranged vertically with three of the openings **211** therein illustrated defining therebetween two predetermined address carrying portions **212** and **214**, respectively. Arranged in the predetermined portion **212** is an address **215** and arranged in the predetermined portion **214** is an address **217**, the addresses **215** and **217** being backward reading i.e., reading from right to left. As is illustrated in FIG. **6**, the addresses **215** and **217** comprise bodies of fused toner adhered to the underlying surface of the master tape **210**. The partially fused toner bodies forming the addresses **215** and **217** have a certain amount of elasticity and resilience whereby the master tape **210** may be rewound into roll form as at **260** in FIG. **3**, the roll **260** being supported upon an axle **261**. The roll **260** of the master tape **210** with the several addresses **215, 217, 219**, etc. thereon can be stored substantially indefinitely and further can be transferred as an article of commerce at such time as the addresses thereon are required for mailing or the like.

There is illustrated in FIG. **7** of the drawings a diagrammatic representation of an apparatus **300** and a method for transferring the addresses **215, 217, 219**, etc. from the master tape **210** onto a suitable receptor sheet such as a plurality of envelopes **330**. In the apparatus **300**, the roll **260** of master tape **210** is supported upon an axle **301** so that the master tape **210** can be readily fed therefrom and around a guide roller **302** to an addressing station **310** where the addresses on the master tape **210** are transferred onto the envelope **330**. From the addressing station **310**, the master tape **210** is fed around a guide roller **303** and up to a takeup roll **201** of the master tape **210** mounted on an axle **304**.

The envelopes **330** are contained in a magazine **331** and are fed therefrom onto and down a chute **332** onto an envelope feed mechanism **320** including a feed belt **321** supported by a plurality of rollers **322** and a drive roller **323** connected to a suitable stepwise drive mechanism **324**. The envelope feed mechanism **320** serves to feed the envelope **330** sequentially to the addressing station **310** at which is positioned a mechanism **311** for pressing a heated member **312** against the rear surface of the master tape **210** positioned above an envelope **330**, the enveloped **330** and the belt **321** being supported by a backup bed or platen **314**. After leaving the addressing station **310**, the tape **210** is wound upon the roll **201**, the axle **304** being suitably driven by a drive mechanism **305** and the addressed envelopes **330** are delivered to a receptacle **333** therefor.

Considering now more specifically the method of operation of the address transferring apparatus **300**, the addresses such as the addresses **215, 217** and **219** on the outer surface of the master tape **210** are carried by the master tape **210** to the addressing station **310**, the addresses such as the address **215** being disposed downwardly. The envelope feed mechanism **320** operates sequentially to feed envelopes **330** received from the magazine **331** sequentially one by one to the addressing station **310** to place the envelope below a predetermined one of the addresses, such as the address **215**, on the master tape **210**. The master tape **210** and the envelope **330** are both stopped at the addressing station **310** after which the mechanism **311** is operated to press the heated member **312**

against the rear of the master tape **210** to heat the partially fused bodies of toner forming the address **215** to a temperature in the range of about 225° F. to about 250° F., and to press the bodies of toner forming the address **215** against the adjacent surface of the envelope **330**. In this operation, the bodies of partially fused toner forming the address **215** are substantially completely transferred from the surface of the master tape **210** onto the adjacent surface of the envelope **330**, and also the bodies of toner forming the address **215** are fully fused to provide on the envelope **330** bodies of fully fused toner arranged to provide the address **40** on the master card **10** that was utilized to provide the address **215** on the master tape **210**.

The transfer of the toner from the master tape **210** and the envelope **330** to provide an address on the envelope **330** is facilitated by the fact that there is substantially no adherence between the toner bodies and the surface of the master tape **210**, it being pointed out that the surface of the master tape **210** is nonporous, oleophobic, and possesses good release characteristics. The surface of the envelope **330** on the other hand has a good affinity for the bodies of toner forming the address, thereby materially to facilitate the transfer of the toner bodies thereto. As a result, there is provided on the envelope **330** a forward reading, i.e., left to right reading, reproduction in toner of the address **40** on the original corresponding master card **10**. As the addresses on the master tape **210** are transferred onto the envelopes **330** sequentially, a group of envelopes is provided having addresses thereon corresponding to the addresses on the group of master cards **10** that were in the magazine **231**.

It will be appreciated that other suitable apparatus may be utilized in place of the apparatus **300** illustrated in FIG. **7** to transfer the addresses on the master tape **210** onto the envelope **330**. For example, a machine sold under the trademark "Cheshire Model 514" is particularly useful for this purpose. In fact any suitable machine that will supply a heated member or platen that will heat the bodies of toner to a temperature in the range of about 225° F., to 250° F. and apply a pressure thereto will be suitable for this purpose.

The master tape **210** is also preferably transparent, whereby the right to left reading addresses in the partially fused toner bodies on the one face thereof can be seen therethrough from the other face thereof to present left to right reading addresses in the partially fused toner bodies. In accordance with another preferred form of the present invention, the master tape **210** may be cut into individual addressing labels with a single address thereon, and thereafter secured to an envelope or the like, with the side of the master tape **210** carrying the tone thereon disposed toward the envelope; any suitable securing means such as glue, or the like, may be used to secure the addressing label to the envelope. The address will be seen through the addressing label and will be readable from left to right in the usual manner.

From the above it will be seen that there has been provided an improved addressing system incorporating therein improved methods which fulfill all of the objects and advantages set forth above. It will be understood that the information on the master cards **10** need not be addresses but may be any other form of information arranged in indicia formed of infrared absorption material, wherein it is desired to duplicate those indicia in a sequential manner on receptor sheets such as the envelopes **330** described above.

While there have been described what are at present considered to be the preferred embodiments of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A method for transferring indicia from a group of master cards onto a master tape, said method comprising providing a printing station having a source of infrared radiation thereat, providing a group of master cards having thereon indicia of infrared absorbing material and vaporizable material in the area of the indicia, feeding the master cards sequentially to said printing station to position a master card with the indicia thereon in position to be exposed to the source of infrared radiation, providing a master tape that has a nonporous oleophobic surface having resin release characteristics and that is transparent to infrared radiation, feeding the master tape to said printing station to position a predetermined portion of the master tape with one surface thereof disposed immediately adjacent to the indicia on a master card positioned at said printing station, energizing said source of infrared radiation after feeding of a master card and a predetermined portion of the master tape to said printing station to vaporize from the master card a portion of the vaporizable material from areas corresponding to the indicia thereon onto the one surface of the predetermined portion of the master tape to provide on the master tape vaporizable material arranged in areas corresponding to the indicia, and applying a toner to the one surface of the master tape to adhere toner to the vaporizable material thereon in areas corresponding to the indicia, thereby to provide a continuous master tape having on the predetermined portions thereof bodies of toner in areas corresponding to the indicia on the group of master cards.

2. The method set forth in claim **1**, and further comprising the steps of feeding receptor sheets sequentially to position a receptor sheet against the bodies of toner corresponding to the address on a master card, and applying heat and pressure to the master tape and the receptor sheet to transfer the bodies of toner to the receptor sheet and fully to fuse the toner thereby to provide on said receptor sheet bodies of fully fused toner in an area corresponding to the address on a master card.

3. The method set forth in claim **2**, wherein a pressure is applied at a temperature above about 225° F.

4. A method for transferring indicia from a group of master cards onto a master tape, said method comprising providing a printing station having a source of infrared radiation thereat, providing a group of master cards having thereon indicia of infrared-absorbing material and vaporizable material in the area of the indicia, feeding the master cards sequentially to said printing station to position a master card with the indicia thereon in position to be exposed to form source of infrared radiation, providing a master tape that has a nonporous oleophobic surface having resin release characteristics and that is transparent to infrared radiation, feeding the master tape to said printing station to position a predetermined portion of the master tape with one surface thereof disposed immediately adjacent to the indicia on a master card positioned at said printing station, energizing said source of infrared radiation after feeding of a master card and a predetermined portion of the master tape to said printing station to vaporize from the master card a portion of the vaporizable material from areas corresponding to the indicia thereon onto the one surface of the predetermined portion of the master tape to provide on the master tape vaporizable material arranged in areas corresponding to the indicia, applying a toner to the one surface of the master tape to adhere toner to the vaporizable material thereon in areas corresponding to the indicia, and irradiating the master tape with the toner thereon at least partially to fuse the toner on the master tape, thereby to provide a continuous master tape having on the predetermined portions thereof bodies of partially fused toner in areas corresponding to the indicia on the group of master cards.

5. The method set forth in claim **4**, wherein the master card is stopped at said printing station and the master tape is stopped at said printing station, the master card and the master tape being stationary during the operating of the source of infrared radiation at the printing station.

6. The method set forth in claim **4**, wherein the side of the master card carrying the indicia is placed in contact with the adjacent one surface of the master tape during the operating of the source of infrared radiation at the printing station.

7. The method set forth in claim 4, and further comprising the steps of feeding receptor sheets sequentially to position a receptor sheet against the bodies of partially fused toner on the master tape corresponding to the indicia on a master card, and applying heat and pressure to the master tape and the receptor sheet to transfer the bodies of partially fused toner to said receptor sheet and fully to fuse the toner thereby to provide on said receptor sheet bodies of fully fused toner in an area corresponding to the indicia on a master card.

8. A method for transferring addresses from a group of master cards onto a master tape, said method comprising the steps of providing a printing station having a source of infrared radiation thereat, providing a group of master cards having thereon an address in infrared-absorbing material and vaporizable sensitizer in the area of the address, feeding the master cards sequentially to said printing station to position a master card with the address thereon in position to be exposed to said source of infrared radiation, providing a master tape that has a nonporous oleophobic surface possessing resin release characteristics and that is transparent to infrared radiation, feeding the master tape to said printing station to position a predetermined portion of the master tape with one surface thereof disposed immediately adjacent to the address on a master card positioned at said printing station, operating said source of infrared radiation to vaporize from the master card a portion of the vaporizable sensitizer from areas corresponding to the address thereon onto the one surface of the predetermined portion of the master tape to provide on the master tape a film of sensitizer arranged in areas corresponding to the address, applying a toner to the one surface of the master tape to adhere toner to the sensitizer thereon in areas corresponding to the address, and irradiating with infrared radiation the predetermined portion of the master tape at least partially to fuse the toner thereon, thereby to provide a continuous master tape having on predetermined portions thereof bodies of partially fused toner in areas corresponding to the addresses on the group of master cards.

9. The method set forth in claim 8, and further comprising the steps of feeding receptor sheets sequentially to position a receptor sheet against the bodies of partially fused toner on the master tape corresponding to the address on a master card, and applying heat and pressure to the master tape and the receptor sheet to transfer the bodies of partially fused toner to the receptor sheet and fully to fuse the toner thereby to provide on the receptor sheet bodies of fully fused toner in an area corresponding to the address on a master card.