

[54] **TRANSFER TYPE ELECTRONIC
PHOTOGRAPH DUPLICATOR**[75] Inventors: **Susumu Tanaka; Masayoshi Inoue**, both of Sakai; **Yuji Enoguchi**, Higashiosaka; **Kenichi Wada**, Toyokawa; **Takao Fujiwara**, Sakai, all of Japan[73] Assignee: **Minolta Camera Kabushiki Kaisha**, Osaka-shi, Osaka-fu, Japan[22] Filed: **May 17, 1972**[21] Appl. No.: **254,082**[52] U.S. Cl. **355/10, 355/8, 355/16, 96/1 LY, 117/37 LE, 118/637, 118/DIG. 28**[51] Int. Cl. **G03g 15/10, G03g 15/00**[58] Field of Search..... **355/10, 8, 3, 11, 355/12, 16, 78; 96/1 LY, 1 R; 117/37 LE; 118/637, DIG. 28**[56] **References Cited****UNITED STATES PATENTS**

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Primary Examiner—Robert P. Greiner*Attorney*—Watson, Cole, Grindle & Watson[57] **ABSTRACT**

In an electronically controlled electrostatic latent image transfer type photographic duplicator, an original document receiver having a transparent plate for supporting an original document thereon is movable along the top surface of the duplicator case. An optical exposure projection system is mounted within the case and includes exposure and image slit openings. The original document receiver is reciprocated along the top surface of the duplicator case to completely expose the original document as it moves in one direction traversing the slit opening. A photosensitive plate reciprocates along a path parallel to and spaced from the original document receiver and is reciprocated at the same speed and in the same direction as the document receiver so that an image of the original document is projected onto the photosensitive plate as it moves in the same direction as the document receiver to completely traverse the image slit opening.

The electrostatic latent image formed on the photosensitive plate is transferred to a transfer paper having a conductive base and an image transfer surface by contacting the transfer surface with the electrostatic latent image on the photosensitive plate as both the contacting portions of the transfer surface and the photosensitive plate move at the same speed and in the same direction.

The transfer paper is deposited on the photosensitive plate so that its leading edge overlaps the leading edge of the photosensitive plate and is separated therefrom by a separating mechanism which includes a guide plate having a surface extending into the plane of the path of the photosensitive plate and including thereon comb-like projections. A member rotatable to a first and second position also includes comb-like projections and is biased into a first position wherein the comb-like projections are upstanding in the path of the transfer paper and the member is rotated to a second position by contact with the leading edge of the photosensitive plate having comb-like projections on the leading edge thereof; with the rotating member in the second position, its comb-like projections, as well as the comb-like projections on the photosensitive guide plates, are in interleaving relationship to form a continuous surface for guiding the transfer paper to a developing means.

The image on the transfer paper is developed by contacting the transfer surface thereof with a developer. In one embodiment, the transfer paper is transported across a developing tank in close proximity to an electrode plate by an endless belt. In another embodiment, the developing tank is divided into two compartments separated by a weir and developer is pumped into one compartment and flows to the other compartment whereupon it flows over an electrode plate having wires on the surface thereof which have a height slightly less than the flow of developer. The transfer surface is carried across the electrode plate at a greater speed than the flow of the developer stream.

The developed image is fixed by removing excess developer from the transfer paper by squeezing it between one or more squeeze rollers, respective ones of which may be in contact with a hygroscopic roller and a cleaning roller. The transfer paper is then dried by guiding it in close proximity to a heater and a blower. In a modification of the fixing mechanism, the squeeze rollers are caused to be separated in the absence of transfer paper therebetween. Additional developer may also be removed from the transfer paper by a rotating wiper roller the surface speed of which is greater than the speed of the transfer paper passing from the electrode plate, or a doctor blade which scrapes the transfer surface.

11 Claims, 20 Drawing Figures

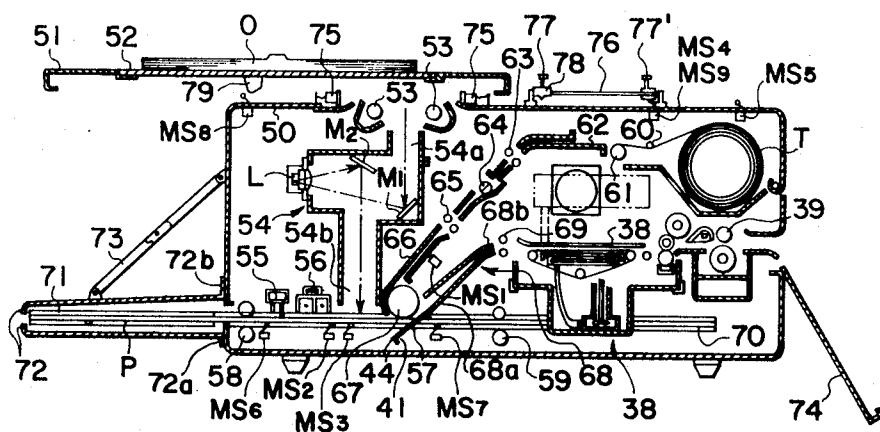


FIG. 1A

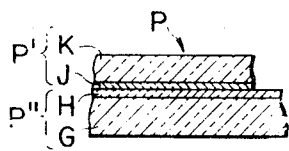


FIG. 1B

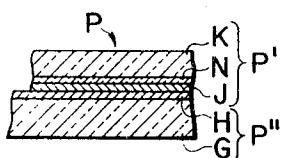


FIG. 1C

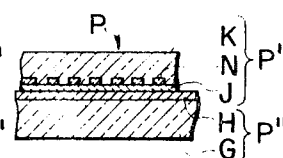


FIG. 1D

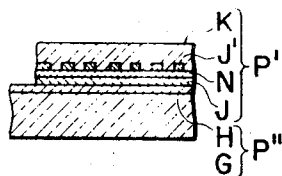


FIG. 1E

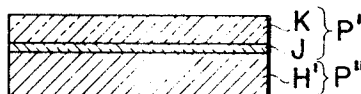


FIG. 1F

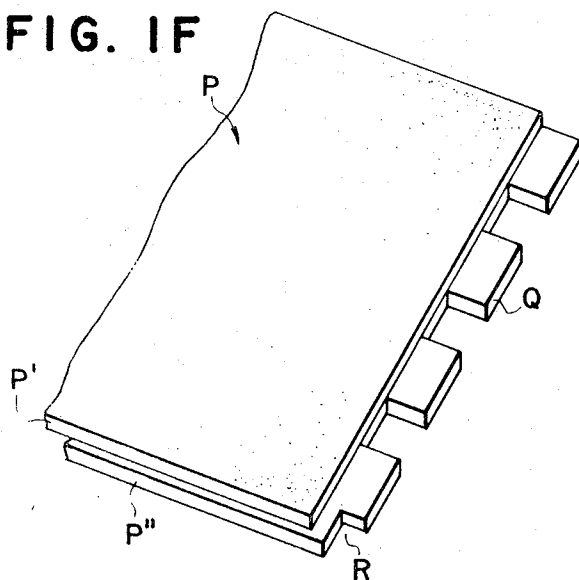


FIG. 2

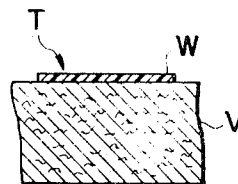


FIG. 3

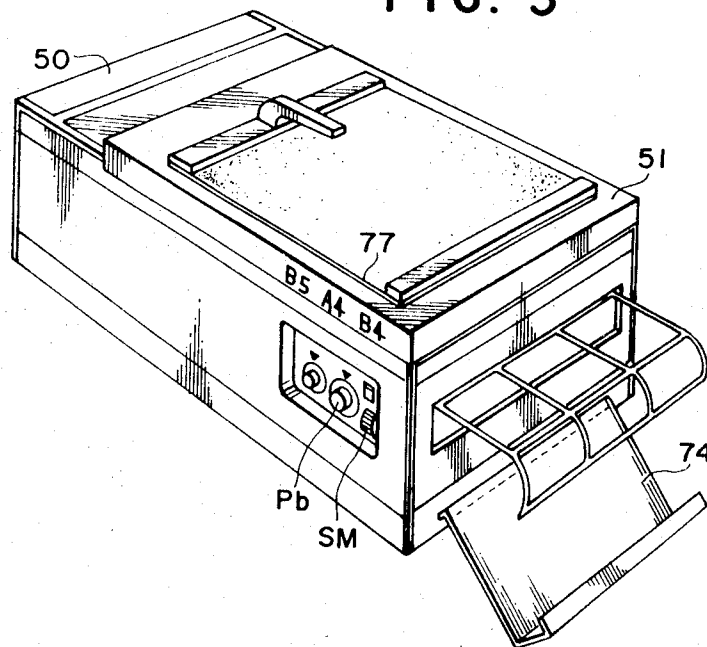
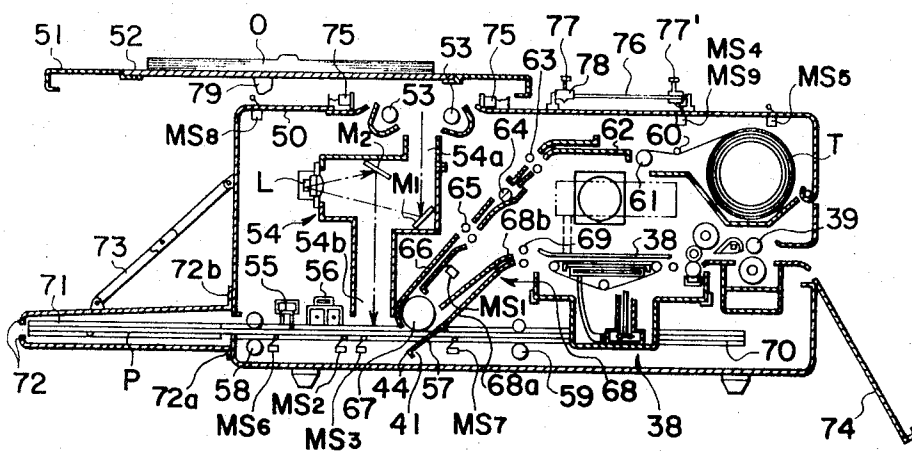


FIG. 4



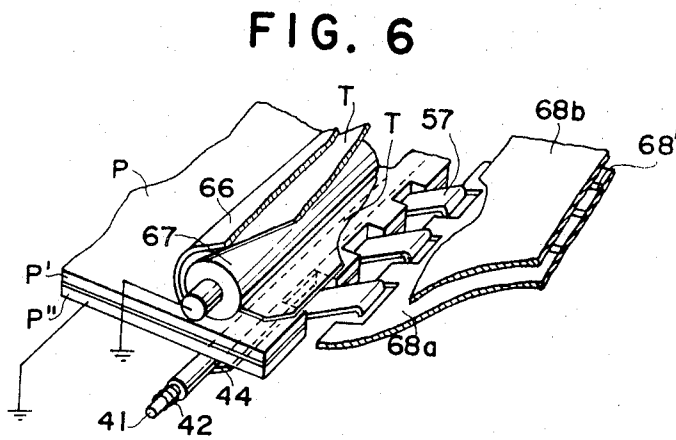
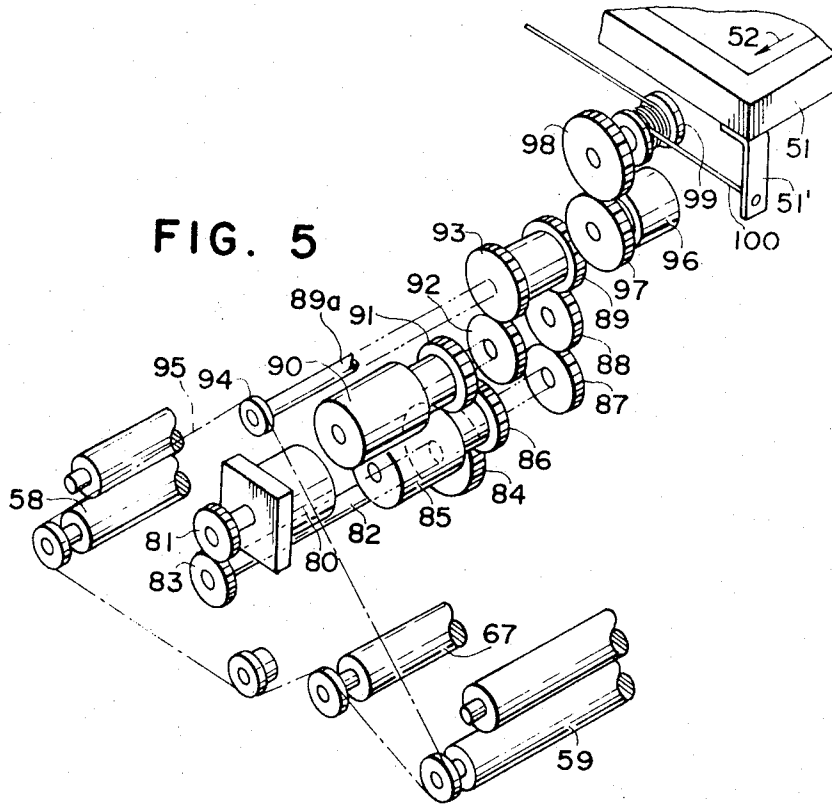


FIG. 7

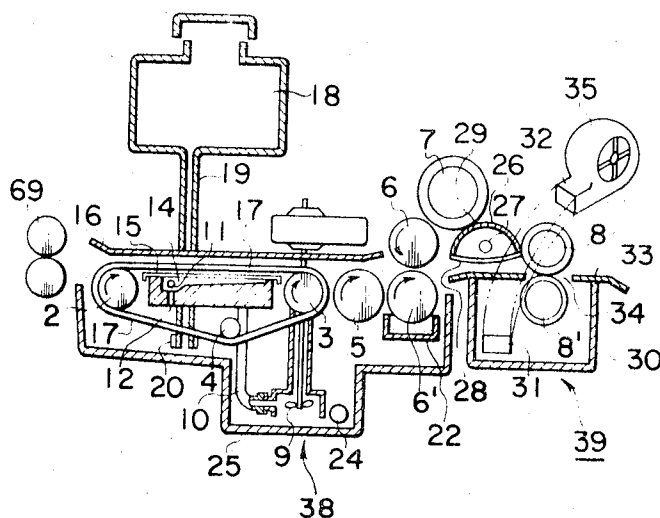


FIG. 8

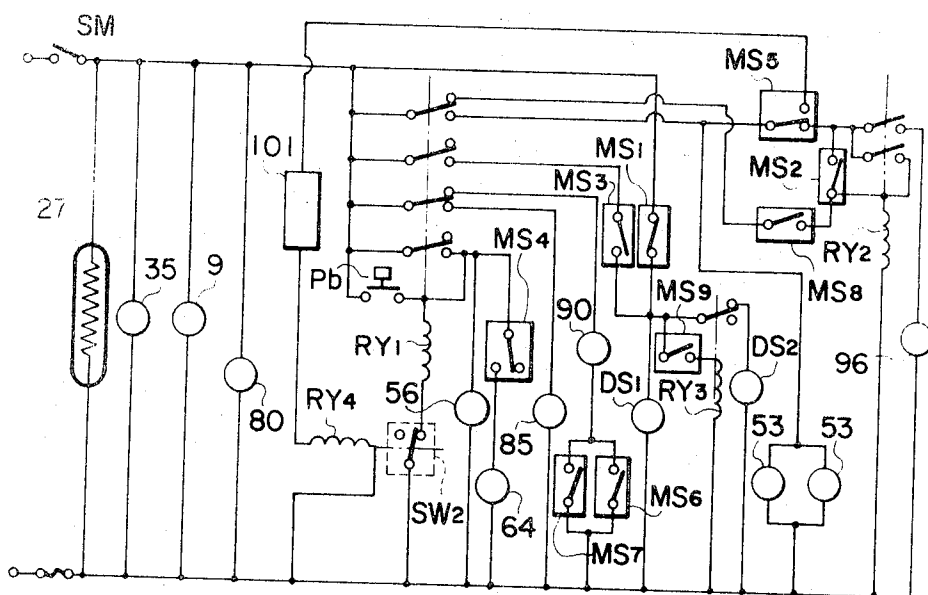


FIG. 9

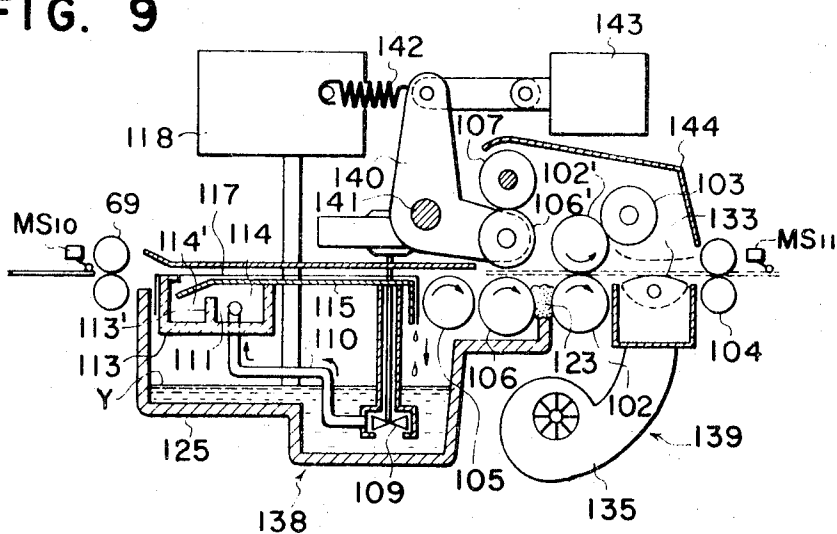


FIG. 10

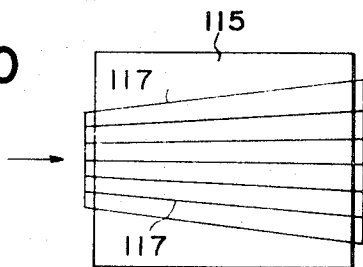
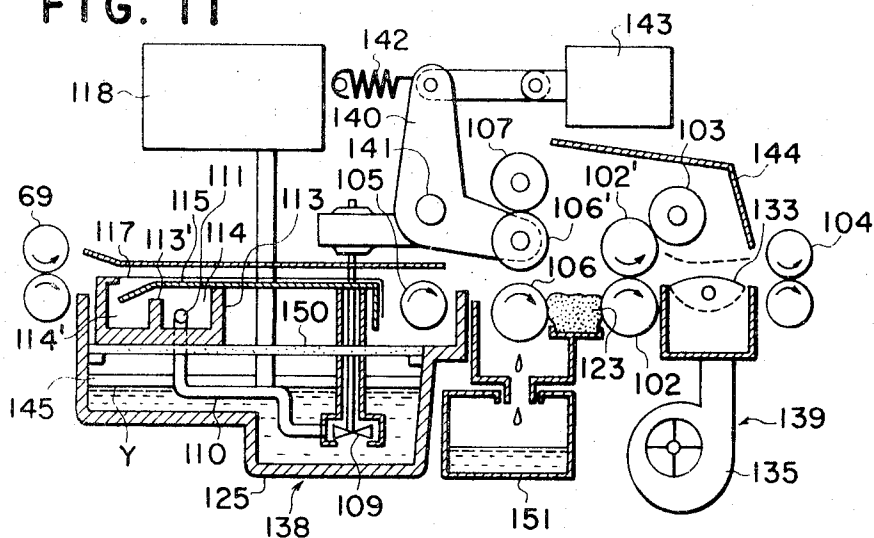


FIG. 11



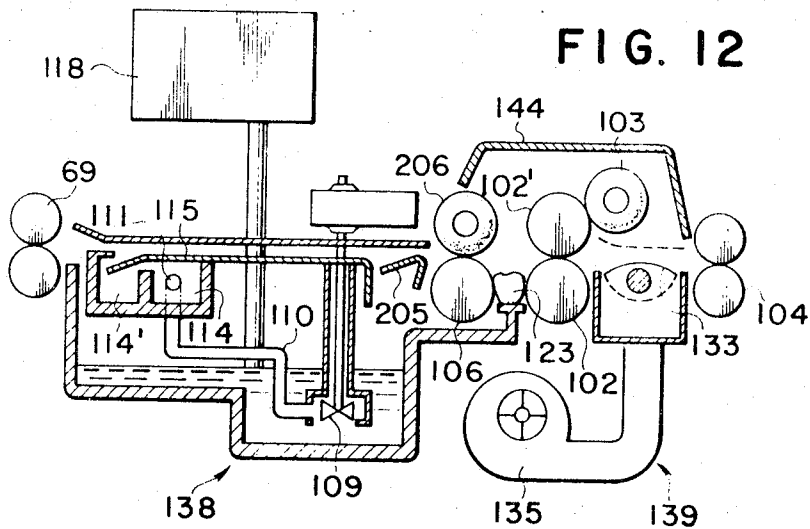


FIG. 13

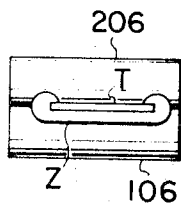
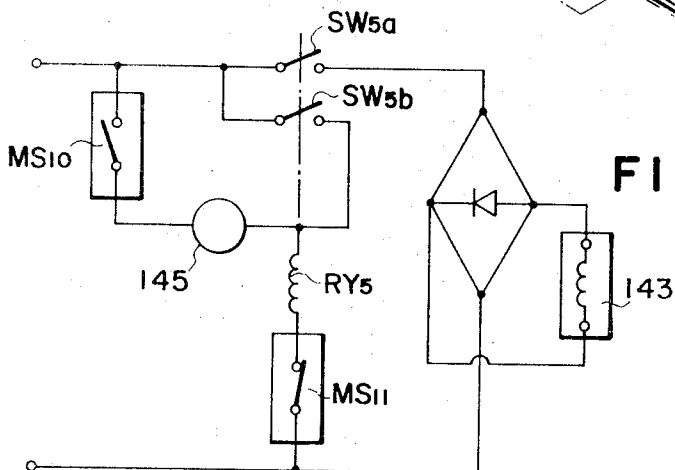
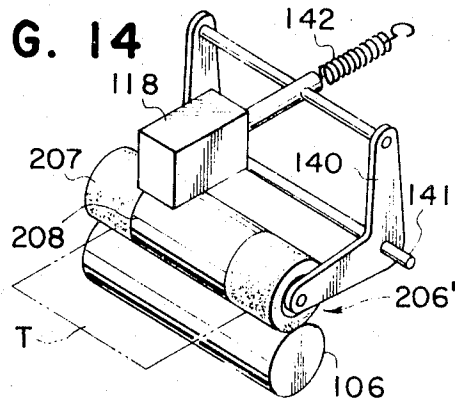


FIG. 14



TRANSFER TYPE ELECTRONIC PHOTOGRAPH DUPLICATOR

BACKGROUND OF THE INVENTION

The present invention relates to an electrostatic transfer type electronic controlled photographic duplicator in which an electrostatic latent image is formed on the photosensitive plane of a charged photosensitive plate by optically projecting a document image onto the photosensitive plane. The electrostatic latent image is then transferred onto transfer paper by contact of the photosensitive plane and the transfer paper, and then the transferred image is developed and fixed. The invention more particularly relates to a duplicator of the aforementioned type wherein the document image is projected onto the photosensitive plate as it is moved in the same direction as the original document relative to a projection optical system. The transfer plane of the transfer paper is rotated against the electrostatic latent image to transfer an erect image of the original image.

Included in electronic photographic duplicators known to the prior art are xerographic and electrofax type duplicators. The former type transfers "dusted" electrostatic images formed on the photosensitive plane onto conventional paper and has the advantages that a number of copies can be quickly obtained, and the copy is light because of the use of conventional paper; however, the photosensitive body is usually wrapped around the surface of the drum and is integral therewith, so that when the photosensitive body decays it is troublesome and expensive to replace. Additionally, when the picture image is exposed, in order to project the picture image of a flat original document onto the arcuate plane of the drum the length of the light path from the central portion to the peripheral portion of the document varies. No adjustment of the exposure slit and synchronization of the circumferential speed of the drum with the scanning speed of the projection optical system will produce a copy of clear picture quality covering the whole picture plane of the original document. Besides, damage and decay of the photosensitive plane from cleaning, or dust image transfer, are apt to take place directly on the photosensitive body and thereby cause additional deterioration of the picture quality of the copy. Further, because of making use of a drum shaped photosensitive body the size of the duplicator becomes large.

The latter type duplicator has the advantages that the image forming process is simplified, and flexible photosensitive sheet-like paper is used and therefore the duplicator is small-sized, and for one copy the copying speed is faster than that of the former type duplicator, and it is possible to obtain a clearer copy than in the former type duplicator. However, the copy obtained is on a photosensitive type paper, so that it is thick and heavy and therefore more unwieldy than conventional paper. In addition, when obtaining a number of copies the duplicating operations must be repeated.

For the reasons described above, the known commercially used duplicators are not completely satisfactory.

An image forming process in which the electrostatic latent image formed on a photosensitive body is transferred to a dielectric coated paper and then the dielectric coated paper is developed to obtain a copy is well known as the TESI process. The most simple means is that the transfer surface of a dielectric coated paper is

placed in close contact with the photosensitive surface on which an electrostatic latent image is formed and then both surfaces are grounded. Separation of the two surfaces causes the electrostatic latent image to be transferred to the transfer paper. According to that process for developing the electrostatic latent image, the photosensitive body is not physically acted on so that damage or deterioration of the photosensitive surface as described above does not result and a copy can be obtained even on the dielectric coated paper.

However, the following drawbacks of the TESI process explain why it has not been completely satisfactory in a practical application. The density of the copy is too low when known photosensitive bodies are used. It is hard to obtain a clear copy because of the effect of a previous exposure when the photosensitive body is repeatedly used. It is impossible to make fast duplications.

The Assignee of the present application has filed a U.S. application, Ser. No. 213,377, filed Dec. 29, 1971, the inventor of which is Tanaka et al. for an apparatus for effecting a process to transfer an electrostatic latent image formed electrostatically on a photosensitive body to a transfer paper. The transfer paper is formed by coating a high insulating layer on a paper base which has been made conductive. In the transfer type electronic photograph duplicator based on that invention the original document and the photosensitive body move in the opposite direction with respect to each other and both the document and the photosensitive body move relative to the projection optical system which is stationary. The original document carrier, the transfer means, the developing means for developing the transferred image on the transfer paper, the fixing and drying means, and the carrier for carrying the transfer paper to the latter means are mounted to one side in the duplicator case so that it was limited in designing the duplicator small-sized.

THE OBJECT OF THE INVENTION

One object of the present invention is to provide an electrostatic transfer type photographic duplicator in which an electrostatic latent image is formed on a sheet-like photosensitive plate having high performance capabilities and the electrostatic latent image is electrostatically transferred onto a transfer paper. The electrostatic latent image is formed while an original document and the photosensitive plate are moving parallel with respect to each other and in the same direction relative to a stationary optical image projection system.

Another object of the present invention is to provide a duplicator of the type specified herein in which an electrostatic latent image is formed while an original document and a sheet-like photosensitive plate are transported parallel with respect to each other and in the same direction relative to a stationary optical image projection system, and whereby a member for carrying the original document in reciprocal motion, a driving means therefor, a carrier for reciprocating the photosensitive body, transfer paper storage, a transfer means, developing means, fixing and drying means, and a transfer paper carrier are dispersively mounted in the case of the duplicator so that the duplicator is small-sized.

Further another object of the present invention is to provide a separating means in an improved duplicator

of the type specified herein that is suitable for separating a transfer paper from the photosensitive body.

Still further another object of the present invention is to provide a wet developing means in an improved duplicator of the type specified herein that is suitable for increasing the speed of the drying and fixing processes.

Other objects and advantages of the present invention will be apparent from the following description of the invention.

SUMMARY OF THE INVENTION

In order to attain the above-mentioned objects the apparatus of the present invention has the following advantageous features. An original document receiver is driven by a driving means for effecting motion of an original document along the top surface of the duplicator case to expose the document, repetitively, if so desired, and the return motion of the original document and its receiver to its starting position after exposure.

A photosensitive plate carrier is movable to reciprocate in the same direction and in parallel with respect to the original document receiver along the lower portion of the duplicator case and for forming an electrostatic latent image composed of a mirror image of the original document on the photosensitive plate when the photosensitive plate and the receiver are driven in a direction toward the optical projection system.

A charging means disposed between the original document receiver and the photosensitive plate carrier and facing the photosensitive surface of the photosensitive plate. The charging means is mounted to the duplicator case along the direction of travel of the photosensitive plate carrier at a position ahead of the mirror image projection optical system.

An image transfer means, and including a transfer paper storage mounted in the upper portion of the duplicator case and a separating mechanism operating in association with the photosensitive plate carrier for separating the transfer paper and the photosensitive plate.

A means for developing and fixing the transferred image on the transfer paper after the transfer means has rotated the transfer surface of the transfer paper into contact with the photosensitive surface during movement of the photosensitive plate. Apparatus is also provided for drying the developed and partially fixed image that has been transferred to the transfer paper so as to "fix" it.

The apparatus of the present invention is characterized in that while the original document receiver and the photosensitive plate are driven in the same direction, the light image of the original document is projected onto the photosensitive plate. In this manner, it is possible to uniformly disperse in the duplicator case the original document receiver, the photosensitive plate carrier, the transfer means, the developing means, the fixing means, and the transfer paper carrier, and accordingly accommodate them in a small duplicator case.

In addition, the present invention is characterized in that, by disposing the original document receiver on the top surface of the duplicator case and reciprocating the photosensitive plate by carrier along the lower portion of the duplicator case with the photosensitive surface facing the top of the duplicator case, it is possible to mount the charging means, the optical mirror image

projection system, and the transfer means between the original document receiver and the photosensitive plate carrier. Additionally, the transfer paper storage, the developing means, the drying means for fixing the developed image, and the transfer paper carrier are mounted in the duplicator case above the path along which the photosensitive plate moves.

The structure for inserting the photosensitive plate into its carrier enables the photosensitive plate to be easily replaced.

Further, after the transfer paper is separated from the photosensitive plate it is carried with its transfer surface facing the bottom of the duplicator case, so that only the high insulating coated surface constituting the transfer surface is required to be soaked in the wet developer, therefore, the subsequent fixing and drying processes can be done quickly.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A-1E show various types of photosensitive plates used in the present invention, and FIG. 1F is a perspective view showing the front end portion of a photosensitive plate;

FIG. 2 is a sectional side view of the transfer paper used in the present invention;

FIG. 3 is a perspective view of the housing of the duplicating machine;

FIG. 4 is a longitudinal sectional view showing the internal structure of the duplicating machine;

FIG. 5 is a perspective view showing the essential portion of the driving mechanism for the duplicating machine;

FIG. 6 is a perspective view showing the transfer means and the separating means of the duplicating machine;

FIG. 7 is a partially cut-away side view of a first embodiment of a developing means and fixing means of the duplicating machine;

FIG. 8 is a diagram of a control circuit for controlling the various components of the duplicating machine;

FIG. 9 is a partially cut-away side view of the second embodiment of a developing means and fixing means in accordance with the present invention;

FIG. 10 is a plan view of an electrode plate roller portion used in the embodiment shown in FIG. 9;

FIG. 11 is a partially cut-away side view of the third embodiment of a developing means and fixing means in accordance with the present invention;

FIG. 12 is a partially cut-away side view of the fourth embodiment of a developing means and fixing means in accordance with the present invention;

FIG. 13 illustrates the developer being squeezed from the transfer paper;

FIG. 14 is a perspective view showing a modification of the absorbent roller in the developing means of the fourth embodiment in accordance with the present invention; and

FIG. 15 is a wiring diagram showing the control circuit for the squeeze rollers in the second, the third, and the fourth embodiments in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1A-1E show the types of photosensitive plates suitable for the electrostatic transfer type photographic duplicator in accordance with the present invention,

wherein FIG. 1A shows the formation of photosensitive plate P comprising flexible film base G made of a polyester film 75 μ thick on which is evaporated a thin film electrode H of aluminum. On top of electrode H a very thin non-crystalline selenium evaporated thin film J is laid, and organic semi-conductor coated film K is coated over film J. Film K is made of polyvinylcarbazole (PVK) added to a plasticizer, diphenyl trichloride, and a solvent, monochlorobenzene. In this case, thin layer J can contain tellurium in an amount less than 7 percent by weight ratio to the non-crystalline selenium. Also, the polyvinylcarbazole can contain a very little silicon in an amount having no effect on electrostatic photographic image forming characteristics, and is not required to contain diphenyl trichloride in this case.

PVK layer K of the uppermost layer of photosensitive plate P formed as described above effects good retention of electric charges and serves as a passage for positive holes. Selenium thin film layer J absorbs light rays to generate electric charge carriers, and functions to form a high commutating barrier on the interface between aluminum thin film layer H and selenium thin film layer J to completely prevent positive holes from pouring into selenium thin film J and provides negative electric charges onto the surface of photosensitive plate P. Therefore, upon exposure of the photosensitive plate, positive holes generated on selenium thin film layer J flow into PVK layer K and move onto the surface of PVK layer K to neutralize electric charges on the surface thereof, and, thereby, form an electrostatic latent image. The density of the picture image obtained is high enough to provide a usable photosensitive plate with good contrast.

It is also possible to interpose an evaporated thin film N, such as selenium-tellurium alloy, between PVK layer K and selenium layer J as shown in FIG. 1B. With such a structure, selenium layer J does not absorb light rays and functions only to form a strong commutating barrier on the interface between aluminum layer H and selenium layer J to prevent passage of positive holes. Selenium-tellurium alloy layer N can be made so that the quantity of tellurium mixed into the selenium is about 10 to 60 percent by weight and it is possible to improve the sensitivity of the photosensitive plate remarkably.

Additionally, in the photosensitive plate, selenium-tellurium alloy film N can be formed into a mesh screen shape or a grid screen shape, for example, a wire netting of 200 to 400 mesh, as shown in FIG. 1C. Further, in the photosensitive plate shown in FIG. 1B, it is also possible to interpose layer J' formed into a grid screen shape or a mesh screen shape as described above which is a selenium thin layer between selenium-tellurium alloy layer N and PVK layer K as shown in FIG. 1D. With that construction, because of the difference of the optical decay property effected by the difference in the sensitivity between selenium layer J or J' and selenium-tellurium alloy N, a net resolving action takes place and it is possible to obtain a photosensitive plate P having high resolving power and useful for reproducing halftones.

In the photosensitive plates described above, selenium layer J and selenium-tellurium alloy layer N are thin films each less than 1 μ in thickness and PVK layer K is made of a macromolecule substance, so that the photosensitive plate is flexible. The aluminum layer

and the selenium layer between film P'', composed of base plate G and aluminum conductive layer H, and the other film P' are oxidized by ion bombardment by the glow discharging of the aluminum layer. Subsequently, by evaporating the selenium layer in a vacuum, both layers are closely bonded with each other, and the other layers are also closely bonded with one another, so that it is possible to form a strong photosensitive plate, the layers of which are not separated from each other even though the photosensitive plate is bent.

For example, photosensitive plate P was formed into a belt shape and put over two rollers of approximately 30 mm diameter and rotated at speed of 1 m/Sec for 1,000 hours continuously and none of the layers separated from one another. Such a test indicates that such a laminated photosensitive plate is strong enough to be used in a practical application.

FIG. 1E shows conductive base P' in which, in the photosensitive plate shown in FIG. 1A, instead of polyester film base G, aluminum metal plate H' is used. In this way, a similar substitution of the base can be made for the photosensitive plates P shown in FIGS. 1B, C, and D. However, such a substitution reduces the flexibility of photosensitive plate P', but such a construction has the advantage that the plate can be easily grounded.

A more complete description of the types of photosensitive plates, as well as the processes for making such photosensitive plates, that can be used with the apparatus of this invention is disclosed in the following U.S. patent applications, all of which have been assigned to the same Assignee as this application: Tanaka et al, Ser. No. 151,713, filed June 10, 1971, for Electronic Photograph Photosensitive Plate; Tanaka et al, Ser. No. 152,161, filed June 11, 1971, for Manufacturing Process for Flexible Electronic Photograph Photosensitive Plate; Tanaka et al, Ser. No. 152,569, filed June 14, 1971, for Electronic Photograph Photosensitive Plate; and Tanaka et al, Ser. No. 155,794, filed June 23, 1971, for Half Tone Reproducing Electronic Photograph Photosensitive Plate.

When a photosensitive plate P as described above is put to use in accordance with the present invention, the front edge of conductive base P'' is extended relative to the front edge of the other layer P', and has projections Q, much like that of the teeth of a comb as illustrated in FIG. 1F. The comb-like projection is useful for separating paper transferred from photosensitive plate P as described more fully hereinafter. And, by means of the projections Q, or cut-away portion R formed on the side end of one of the projections, it is possible to observe the photosensitivity of the photosensitive plate and thereby to adjust electrically or mechanically the exposure slit of the mirror image projection optical system described later.

FIG. 2 shows a section through transfer paper T, wherein layer W, made of a high dielectric substance, is coated on paper V in a thickness of 25 to 150 μ and made conductive by a well-known technique. Examples of dielectric substances that may be used are polyethylene, wax, alkyd resin, cellulose acetate, epoxide, or a resin such as an interpolymer of vinyl chloride and vinyl acetate, which is formed into layer W by coating on paper V to a thickness of about 2 to 10 μ .

FIG. 3 and FIG. 4 show the components of the assembled electronic transfer type photographic duplicator in accordance with the present invention, wherein, on

the top surface of duplicator case 50, original document carrying base 51 is movably mounted and includes original document receiver 52 composed of a transparent glass plate. Original document O is placed on document receiver 52 with the surface to be duplicated face down and is irradiated by lamp 53 fixed to case 50 as document receiver 52 is moved.

Reference numeral 54 denotes an optical mirror projection system which is provided with first reflector M₁ for reflecting light rays from slit-shaped opening 54a, roof mirror lens L, second reflector M₂, and exposure slit 54b. The aforesaid optical projection system is fixed to the duplicator case and projects the picture image of an original document irradiated by lamp 53 which is lighted when carrying base 51 is moved from the left to the right in FIG. 4.

Along the bottom face of case 50 and in parallel with original document receiver 52, a photosensitive plate P of the type shown in FIGS. 1A-1E, is carried by rollers 58 and 59 and grounded guide rail 70 at the same speed as carrying base 51 is driven.

Facing the carrying path of photosensitive plate P, cleaner 55, having a soft felt for removing dust on photosensitive plate P, and corona discharge means 56 are mounted, and to the left side of which is exposure slit 54b. Transfer roller 67 of the transfer means is adjacent the right side of exposure slit 54b.

Continuing with the description of FIG. 4, transfer paper T, on which the final copy is made, is a roll and mounted on the right upper portion in case 50, and in order to carry the tip of transfer paper T there are also mounted tension roller 60, carrying control roller 61, guide plate 62, paper feed roller 63, cutter 64, paper feed roller 65, and guide plate 66.

In the transfer means shown in FIG. 6, guide plate 66 surrounds a portion of transfer roller 67 for guiding dielectric layer W of transfer paper T onto photosensitive plate P and to ground transfer roller 67. Separating means 57 is a plate for separating transfer paper T passing through transfer roller 67 from photosensitive plate P. Separating plate 57 is rotatably supported on shaft 41 and stands up in the carrying path of the photosensitive plate by rotating counter-clockwise from the force of coil spring 42 into contact with stop shaft 44 shown in FIG. 4. Separating plate 57 is cut into a shape like the teeth of a comb so as to mesh with the teeth-like projections Q (FIG. 1F) formed on the tip of conductive base plate P' of the photosensitive plate.

Guide 68 for guiding the transfer paper T, which is separated from photosensitive plate P by separating plate 57, to developing means 38 is composed of two guide plates 68a and 68b to form a clearance therebetween for transfer paper T. On one end of lower guide plate 68a there is formed the comb-like projections which, when separating plate 57 is located in a position to come into contact with stop shaft 44, lie in the same plane as separating plate 57 and mesh with the bent outer portions of separating plate 57. On the top surface of lower guide plate 68a there is formed rib 68' for facilitating the floating of the tip of transfer paper T, which is separated from the photosensitive plate, to engage carrying roller 69.

As shown in FIG. 4, in order to insert photosensitive plate P into the case of the duplicator, and to aid in exchanging photosensitive plates in the front of case 50 (on the left side in FIG. 4) photosensitive plate holder 72 having guide member 71 is firmly positioned on the

left extension of guide rail 70 and held by extension 73 to enable plate holder 72 to be folded along case 50. In the position illustrated in FIG. 4, photosensitive plate holder 72 is supported by extension 73 and braced against the side of duplicator case 50 by angled members 72a, 72b.

On the top surface of the case, guide rod 76 is disposed parallel to the direction along which original document carrying base 51 moves. Size setting member 78 is guided slidably by guide rod 76 and is adjustably set on one side edge of carrying base 51 by means of knob 77. And, by means of size setting member 78, the reciprocating stroke of carrying base 51 (described more fully hereinafter), the reciprocating stroke of photosensitive plate P equal thereto in length, and the cut size of transfer paper T are arranged to correspond to the length of original document O.

Stopper 75 neutralizes the shock of concussion of the front and rear edges of original document carrying base 51 caused by its reciprocating movement, and element 74 is an outlet base for transfer paper T.

Additionally, the driving mechanism allowing photosensitive plate P and original document carrying base 51 to reciprocate will be described with reference to FIG. 5. Gear 81 for driving motor 80 is meshed with gear 83 fixed to shaft 82, and also fixed to shaft 82 are gears 86 and 91 which are disconnected from meshing with gear 84 by electromagnetic clutches 85 and 90. The rotation of gear 86 is transmitted to gear 89 through gears 87 and 88. The rotation of gear 91 is transmitted to gear 93, fixed to the same shaft 89a as is gear 89, through gear 92. The rotation of gears 89 and 93 is transmitted to chain sprocket 94 fixed to shaft 89a. The rotation of chain sprocket 94 is transmitted through chain 95 to the sprockets of rollers 58 and 59 for driving photosensitive plate P and the sprocket of transfer roller 67.

Further, gear 97, supported on shaft 89a and operated by electromagnetic clutch 96, is detachable from gear 98, and pulley 99 is fixed on gear 98. Wire 100, the respective ends of which are connected to metal fittings 51' (at both ends of original document carrying base 51), is wound around pulley 99 to move carrying base 51 by the rotation of pulley 99.

Microswitches MS1, MS2, MS3, MS4, MS5, MS6, MS7, MS8 and MS9 connected in the electric circuit as shown in FIG. 8 are disposed, respectively, at the positions shown in FIG. 4 in case 50, so as to start and stop the operation of various components of the duplicator.

One embodiment of developing means 38 and drying means 39 for fixing the transferred image is shown in FIG. 7. It is understood that developing means 38 and drying means 39 are operated in conjunction with carrying roller 69. Pump 9 circulates the developer in developing tank 25 into developing tray 14 via pipe 10 and opening 11. The developer flows from hole 12 back into tank 25. Replenishment of the developer to developing tank 25 is performed by connecting storage tank 18 to valve 20 by means of pipe 19, and in the developing tank 25 outlet 24 is provided for obsolete developer.

On the upper opening of developing tray 14 electrode plate 15 is mounted. Electrode plate 15 has a number of small holes or slits not shown in the drawings so as to supply the developer in tray 14 onto electrode plate 15. Net-like developing belt 17, in the form of an endless belt, is carried over electrode plate 15 with a

very small clearance between it and the electrode plate and moves in the direction shown by the arrow indicated on rollers 2,3 and 4 as in FIG. 7. The transfer paper which is carried to the right in FIG. 7 by means of carrying roller 69 is deposited on developing belt 17 with its transfer surface down, and carried to squeeze rollers 6 and 6' while being developed by contact with the developer on developing belt 17. The transfer paper is guided onto and along belt 17 by guide plate 16.

Developed transfer paper T is carried to guide roller 5 by belt 17 and then to squeeze rollers 6 and 6' to remove excess developer. By differentiating the rotating speed of guide roller 5 a little from the carrying speed of belt 17 guide roller 5 can squeeze excess developer from the picture image forming plane. And, on the lower roller 6' there is disposed cleaner 22 with a cleaning element such as a sponge, for cleaning the picture image to be transferred. Upper roller 6 is in contact with roller 7 wound with a hygroscopic material, and reflector 26 of heater 27 has slits 29 and faces hygroscopic roller 7 for drying transfer paper T.

Drying means 39 for fixing the transferred image is provided in series with the aforescribed developing means, and guide plate 33 is provided on drying housing 30 for guiding transfer paper T carried by said squeeze rollers 6 and 6', and dry air is blown from opening 31 through duct 32 by means of warm air fan 35 into drying housing 30. Transparent cover 28 of heater 27 faces guide plate 33 to dry the passing transfer paper as a preliminary step. In opening 34 of guide plate 33 two hygroscopic rollers 8 and 8' are provided, and by virtue of heated dry air blown up from rollers 8 and 8' and drying housing 30 the transfer paper is completely dried and carried to exit tray 74 (FIG. 4).

In the transfer type duplicator formed as described above in accordance with the present invention, upon turning on power switch SM shown in FIG. 3 and FIG. 8, rollers 63 and 65 for feeding the transfer paper are rotated by the operation of electromagnetic clutches DS1 and DS2 (see FIG. 8) and the tip of transfer paper T is carried from the storage roll through paper feed roller 63, cutter 64, and paper feed roller 65 to microswitch MS1 to open it, so that electromagnetic clutches DS1 and DS2 are cut off, paper feed rollers 63 and 65 are stopped, and the movement of the severed transfer paper T is stopped as long as microswitch MS1 is opened.

Further, upon inserting photosensitive plate P into guide 71 from the inlet of photosensitive plate holder 72 (FIG. 4) the forward edge of the plate P is in a position adjacent to microswitch MS6. If photosensitive plate P is inserted manually too far, microswitch MS6 is operated to close electromagnetic clutch 90, and as seen in FIG. 5 driving rollers 58 and 59 are reversed, and photosensitive plate P is automatically pushed back to a position where switch MS6 is opened.

With photosensitive plate P in position and switch MS6 opened, original document O is put on document receiver 52. In the case wherein the length of original document O is equal to that of document receiver 52 knob 77 is adjusted to the left end of guide 76 as shown in FIG. 4. If the length of an original document O is shorter than that of document receiver 52 knob 77 is moved along guide 76 and set in accordance with the length of the original document.

Then, upon depressing print button Pb relay RY1 shown in FIG. 8 is operated, the relay contact is switched, light source 53 is lit, and charging means 56 is energized. Simultaneously therewith, electromagnetic clutch 85 is operated to rotate driving rollers 58 and 59 in the normal direction whereby photosensitive plate P is carried to the right (FIG. 4). At this time, dust is removed from photosensitive plate P by cleaner 55 and plate P is uniformly charged by charging means 56.

Next, when photosensitive plate P operates microswitch MS2 relay RY2 is operated and held through microswitch MS5 to close the relay switch to operate electromagnetic clutch 96, and the rotation of clutch 96 is transmitted to pulley 99 together with driving rollers 58 and 59, and original document carrying base 51 starts to move past mirror image projection optical system 54. Original document O is irradiated by light from source 53 through opening 54a and the reflected document image is, in turn, projected from exposure slit 54b onto photosensitive plate P which is carried in the same direction and at the same speed as original document O. The movement of original document carrying base 51 to the right causes the left end thereof to contact microswitch MS8 and close it.

When photosensitive plate P operates microswitch MS3, electromagnetic clutches DS1 and DS2 are again operated to actuate paper feed rollers 63 and 65 and transfer paper T again starts to be carried. Because of the position of microswitch MS3 along the path of the photosensitive plate, the tip of transfer paper T is first carried right under transfer roller 67 and after a short time interval photosensitive plate P is carried right under transfer roller 67, and when transfer paper T and photosensitive plate P pass over transfer roller 67 with transfer paper T on top of photosensitive plate P, the electrostatic latent image on photosensitive plate P is transferred onto the transfer surface of transfer paper T.

As described above, separating plate 57, provided with the comb-like projections which mesh with comb-like projections Q formed on the tip of the photosensitive plate, is turned counterclockwise to be upright by spring 42 and the tip of transfer paper T, having passed over transfer roller 67, is guided onto lower guide plate 68a. Then, when the tip of photosensitive plate P contacts separating plate 57, separating plate 57 by the weight of photosensitive plate P is depressed against the force of spring 42 (FIG. 6), and the tip of plate P continues to move onward to close microswitch MS7.

In the meantime, with the movement of original document carrying base 51 to the right, size setting member 78 is pushed to the right by the engagement of knob 77 with the right-hand portion of base 51 (FIG. 4), so as to operate simultaneously microswitches MS4 and MS9 connected in parallel with each other (FIG. 8). When switch MS4 is closed, cutter 64 is operated to cut transfer paper T at the document size set in accordance with the length of the original document, and when switch MS9 is closed, relay RY3 is operated and the relay contact is opened, electromagnetic clutch DS2 is cut off and paper feed roller 63 is stopped. And then, projection 79 on original document carrying base 51 opens microswitch MS5 and the self-maintenance of relay RY2 is broken, electromagnetic clutch 96 is cut off and the movement of carrying base 51 to the right is stopped. Simultaneously therewith, because of the opening of switch MS5, timer 101 which is set for an

optional predetermined time starts to operate, and after the predetermined time elapses relay RY4 is operated after the trailing end of photosensitive plate P passes over transfer roller 67, and switch SW2 operated by timer 101 is opened. Thereby, relay RY1 and its contact are disconnected, charging means 56 is stopped, light source 53 is extinguished, electromagnetic clutch 85 is stopped, and electromagnetic clutch 90 operates, so that driving rollers 58 and 59 and transfer roller 67 start to rotate in the reverse direction. Simultaneously therewith, relay RY2 operates through closed microswitch MS8 to actuate electromagnetic clutch 96 and original document carrying base 51 is driven by gear 98 to start to return to its initial position as shown in FIG. 4.

In addition, as seen in FIG. 5, the gear train used for the returning motion is different from that used in the forward motion and the number of gears is less by one, so that the shaft and gears 93 and 89 are reversely rotated and because of the ratio of gear 93 to gear 92 the return speed is higher than that of the forward motion.

With reference to FIGS. 4 and 8, when original copy carrying base 51 is completely returned to its initial starting position, projection 79 opens microswitch MS8, stopping electromagnetic clutch 96, and photosensitive plate P immediately stops when the tip thereof opens switch MS6 and photosensitive plate P returns to its initial starting position. Meanwhile, transfer paper T is carried to developing means 38 from separating plate 57 and passes through the clearance between guide plates 68a and 68b, as described hereinbefore.

In FIG. 7, transfer paper T is fed to developing belt 17 from roller 69 with its transfer surface W facing belt 17 so that only transfer surface W contacts the developer on belt 17 without soaking base paper V. Developer belt 17 picks up developer which is forced past electrode 15 from tank 14 by the operation of pump 9. The drying of the transfer paper to fix the transferred image is considerably facilitated by the fact that the transfer paper itself is not wet with the developing fluid. Also, the developer is not unnecessarily wasted. In addition, between electrode 15 and transfer plane W of transfer paper T only developing belt 17 is interposed and thereby both the electrode and the transfer surface are close to each other, so that developing can be quickly performed.

The developed transfer paper is fixed and dried completely by guide roller 5, squeeze rollers 6 and 6', and drying means 39, as described above, and sent to tray 74 via rollers 8, 8'.

FIG. 9 and FIG. 10 show the second embodiment of the developing and drying means for fixing, wherein transfer paper T carried from separating means 68 by roller 69 is carried to developing means 138 and then passed over drying means 139. Into developing means 138 the developer is poured to a liquid level Y in developing tank 125 as indicated in FIG. 9 and pumped to commutation chamber 114 by pump 109. The developer also enters chamber 114' over weir 113' so that the developer is settled and non-turbulent in commutation chamber 114' and runs in a certain shallow depth over electrode plate 115 from the left to the right and at last drops from the right end of the electrode plate to developing tank 125 to be recirculated. And, when the liquid level in developing tank 125 gets lower than level Y the developer is automatically replenished from

developer reservoir 118 by means well known to those skilled in the art.

On electrode plate 115 there are spread out slender wires 117 which diverge as shown in FIG. 10. The developer level running over electrode plate 115 slightly exceeds the height of wires 117. Wires 117 support transfer paper T as it emerges from roller 69 and the transfer paper is pushed to the right along electrode 115 in contact with the developer by the rotation of roller 69. The developed transfer paper is then carried by roller 105 as it emerges from the right end of plate 115. The carrying speed of the transfer paper along wires 117 is set to be faster than the flow of the developer running over electrode plate 115 so that the level of the developer running over both sides of electrode plate 115 is lower than the level of developer in contact with the transfer surface, thereby preventing the developer from running onto the back or upper surface of transfer paper T and wetting it. While slender wires 117 are not indispensable to the operation of the embodiment shown in FIG. 9, they are provided for preventing the tip of the transfer paper carried from roller 69 from thrusting into the developer on electrode plate 115 and from wetting the back of the transfer paper. Additionally, the divergence of slender wires 117 prevents the picture image on transfer paper T from being smudged or damaged and prevents the transfer paper T from having longitudinal creases thereon.

The developed transfer paper is removed of excess developer by roller 105 in the same manner as in the first embodiment, and additional excess developer is squeezed away by squeeze rollers 106 and 106'. On the lower squeeze roller 106, which is in contact with the developed transfer surface, cleaner 123 is provided for removing any picture image transferred to roller 106.

The surface of squeeze roller 106 is wet with the developer squeezed from the transfer paper. Therefore, that surface is in continuous contact with the upper squeeze roller 106', and the developer on lower roller 106 will be transferred to the upper roller 106' when the transfer paper is not passing therebetween. Therefore, upper roller 106' is separated from lower roller 106 when transfer paper is not between rollers 106, 106'. Upper roller 106 is supported rotatably by L-shaped lever 140 pivotally mounted by shaft 141. Lever 140 is cocked counter-clockwise by spring 142 about shaft 141 to be in contact with hygroscopic roller 107. Electromagnet 143 is energized to rotate L-shaped lever 140 clockwise to press squeeze rollers 106 and 106' into contact with each other through transfer paper T. With additional reference to FIG. 15, electromagnet 143 is energized by the tip of transfer paper T closing normally open microswitch MS10 to actuate timer 145. Timer 145 can be electrical or mechanical as is well known to the art, and is set for a time interval equal to the time it takes the tip of the transfer paper to pass from microswitch MS10 to the lower roller 106 of the squeeze rollers. At the end of that time interval timer 145 operates relay RY5 connected in series thereto through normally closed microswitch MS11. The operation of relay RY5 closes relay switch contacts SW5a and SW5b, and when switch SW5b is closed relay RY5 is self-maintained and when switch SW5a is closed electromagnet 143 is excited to press upper roller 106' against lower roller 106 through transfer paper T to squeeze out the developer adhering to transfer paper T.

The passage of the trailing edge of transfer paper T opens microswitch MS10, but as described above relay RY5 is self-maintained. The tip of transfer paper T opens microswitch MS11, so that the self-maintenance of relay RY5 is broken and switch contacts SW5a, SW5b are opened; therefore, electromagnet 143 is demagnetized and the shaft of upper roller 106' is turned counter-clockwise by spring 142 to separate from lower roller 106. Additional developer remaining on transfer paper T after passing between squeeze rollers 106, 106', is removed by squeeze rollers 102 and 102' which are mounted to be in contact with each other, and hygroscopic roller 103 contacts roller 102'. Lower roller 102 is cleaned in the same way as described above with respect to roller 106.

After passing through squeeze rollers 102 and 102' transfer paper T passes through drying means 133 of fixing means 139 and after being completely dried, it is ejected by roller 104 to tray 74 (FIGS. 3 and 4). In addition to drying the transfer paper, the hot blast from fan 135 is deflected by cover 144 for drying hygroscopic rollers 107 and 103.

The third embodiment of developing means 138 and drying means 139 for fixing the transferred image in accordance with the present invention as shown in FIG. 11 is a modification of the second embodiment and the same numeral designations are used for the same components. In this embodiment the developer is made of toner dispersed in an electrical insulating solvent, so that the toner is adsorbed onto the transfer paper and the density of toner drops as the developing operation progresses, but the soluble dispersion agent remains in the developer, so that the stability of dispersion and the quantity of toner are changed and the developing power of the developer is lowered. Therefore, it is required that the toner be replenished and the variation of the dispersion agent, polarity control agent, and the like be adjusted.

And, when the developer is repeatedly used for developing, a portion of fiber from the transfer paper, as well as other foreign matter, is intermixed into the developer, so that such impurities are required to be filtered.

In order to perform such operations automatically while developing, in the present invention the developer running over the electrode plate and the developer that is adhered to the transfer paper and wiped off by roller 105 are filtered by filter 150 before being returned to developing tank 125. However, the developer squeezed by squeeze rollers 106 and 106', having developed the transfer surface of the transfer paper, is abandoned and drips into waste developer reservoir 151, instead of running back into developing tank 125. In this manner, the deterioration of the developer is prevented. As a matter of course, the developer in developing tank 125 is maintained at level Y and is replenished from developer reservoir 118 in the same manner as in the second embodiment. Plate 145 is floated on the developer in developer tank 125 and prevents the developer from evaporating.

The control means for letting the upper roller of the squeeze rollers in the embodiment of FIG. 11 to come into contact with and separate from the lower roller by means of a swinging lever depending upon the presence or absence of a transfer paper is not illustrated, but it is the same as that in the second embodiment described above.

FIG. 12 shows the fourth embodiment of developing means 138 and fixing means 139, and the same numeral designations are used for the same components as those in the second embodiment. The distinction between the fourth embodiment and the second embodiment is that in order to scrape off the developer adhering to the transfer surface of a transfer paper used in the second embodiment, instead of roller 105 being rotated at a different circumferential speed than the speed at which the transfer paper is carried, doctor blade 205 is used in the fourth embodiment.

In addition, in the second embodiment hygroscopic roller 107 contacts the upper roller 106 of squeeze rollers 106 and 106', while in the fourth embodiment the upper roller 206 itself is covered with a good hygroscopic material to form a hygroscopic roller. That is, during developing, the back of the transfer paper has relatively little developer adhering thereto, but when the developer is squeezed by squeeze rollers 106 and 206, as shown in FIG. 13, the developer Z adhering to the transfer surface of transfer paper T runs out from both side edges thereof and onto the top surface of the transfer paper to stain the back of the transfer paper. Upper squeeze roller 206 absorbs the developer running onto the back (the top side) of the transfer paper. Therefore, the upper squeeze roller 206 is required to have sufficient hardness to effect the squeezing operation in cooperation with the lower roller 106 as well as the property to absorb the liquid. Thus roller 206 may comprise a metal roller around which a blotting-paper is wound.

The hot blast from fan 135 in the drying means is led by cover 144 onto squeeze roller 206 to dry the moisture absorbed thereby.

In the fourth embodiment as in the first embodiment, when transfer paper T does not pass through, it is not required that roller 206 be separated from the lower squeeze roller 106 and both squeeze rollers can be mounted to be constantly pressed in contact with each other.

Moreover, as described hereinbefore, a wetted portion on the back of the transfer paper only exists near both side edges thereof and the central portion is not wetted, so that the upper squeeze roller can be, as shown in FIG. 14, formed into squeeze roller 206' in which only the outer side portions of both ends of metal roller 208 are wound with hygroscopic material 207. The central section of metal roller 208 is exposed. In this case, however, when the upper and lower squeeze rollers 106 and 206' are continuously in contact with each other, the base metal on the central portion of roller 208 is wetted whenever the transfer paper is not interposed between the rollers. Therefore, in the same way as in the second embodiment upper roller 206' is supported on lever 140 so as to enable lever 140 to swing to a position in which roller 206' is pressed against lower roller 106 by means of an electromagnet, and a position in which the two rollers are separated by spring 142, depending upon the presence or absence of the transfer paper, respectively.

Additionally, in the fourth embodiment, the transfer paper is carried by roller 69 and floats on the developer running over electrode plate 115 without the use of wires 117 as in the second embodiment.

Electrode plate 15 in FIG. 7, and electrode plates 115 in FIGS. 9, 11 and 12 are grounded by their contact with the respective developing tank structures

shown in the aforementioned Figures. It is also understood that the voltage applied to corona discharge means 56 is not critical to the operation of the duplicating apparatus disclosed herein. Additionally, the same considerations apply to the necessary voltages for exciting the pumps, blowers, heaters, etc. which are necessary to the operation of the apparatus. It is considered that one having skill in the art to which this invention relates has the requisite knowledge of such voltages as, for example, are necessary with respect to the control diagrams illustrated in FIGS. 8 and 15.

What is claimed is:

1. An electronically controlled electrostatic latent image transfer type photographic duplicator, comprising:

- a duplicator case having a top surface;
- an optical mirror image exposure projection system mounted in said case and including an exposure slit opening and an image slit opening;
- a driving means;
- an original document carrying member movable along said top surface and including an original document receiver having a transparent plate for supporting an original document thereon, said original document carrying member being reciprocated along said top surface by said driving means to completely expose said original document as said transparent plate moves in one direction to traverse said slit opening;
- a photosensitive plate having a photosensitive surface thereon and mounted in said case to reciprocate along a path parallel to and spaced from said original document carrying member and reciprocated by said driving means at the same speed and in the same direction as said original document carrying member whereby the image of said original document is projected onto said photosensitive surface from said projection system as said photosensitive surface moves in said one direction to completely traverse said image slit opening;
- charging means mounted along said path for uniformly charging said photosensitive surface before said photosensitive plate traverses said image slit opening;
- transfer paper having a conductive base and an image transfer surface thereon;
- means for storing said transfer paper;
- means for transferring the electrostatic latent image from said photosensitive surface to said transfer paper by contacting said transfer surface with said photosensitive surface, said means for transferring being driven by said driving means whereby the contacting portions of said transfer surface and said photosensitive surface move at the same speed and in the same direction;
- means for conveying said transfer paper from said means for storing to said means for transferring, said means for conveying including means for cutting said transfer paper in accordance with the length of said original document;
- means for separating said transfer paper from said photosensitive surface;
- means for developing the image on said separated transfer paper and including means for storing developer, said means for developing further including an electrode plate, means for wetting said electrode plate with developer, means for carrying said

separated transfer paper across said electrode plate whereby said transfer surface contacts said developer;

means for guiding said transfer paper from said means for separating to said means for developing; means for carrying said transfer paper from said electrode plate; and

means for fixing said transfer surface carried from said electrode plate and including means for removing developer adhering to said transfer surface and means for drying said transfer paper.

2. A photographic duplicator as in claim 1 wherein said means for carrying said separated transfer paper across said electrode plate comprises an endless mesh-like belt, said means for storing developer includes a developing tank, said electrode plate is mounted over said developing tank, said endless belt is mounted within said means for developing so that a portion thereof for carrying said transfer paper extends parallel to and closely adjacent said electrode plate, said endless belt is driven by said driving means at the same speed as the speed of said photosensitive plate traversing said image slit opening in said one direction;

said means for carrying said transfer paper is a rotatable roller having a surface contacting said transfer surface, said roller rotates at a speed whereby the tangential speed of the portion of the roller surface contacting said transfer surface is greater or less than the speed at which said transfer paper is carried across said electrode plate; and

said means for removing developer includes a pair of spaced squeeze rollers and a hygroscopic roller contacting at least one of said squeeze rollers, said means for carrying said transfer paper from said electrode plate transfers said transfer paper between said squeeze rollers.

3. A photographic duplicator as in claim 2 wherein said means for drying includes means for generating heat and means for blowing air from said means for generating heat, means for guiding said transfer paper in close proximity to said means for generating heat, and means for deflecting said air on said transfer paper and said hygroscopic roller.

4. A photographic duplicator as in claim 1 wherein said means for storing developer includes a developing tank having first and second compartments, said compartments being separated by a weir, said electrode plate is mounted over said first and second compartments, means for supplying developer to said first compartment whereby said developer flows over said weir into said second compartment, said means for wetting said electrode plate comprises a portion of said electrode plate contacting the developer in said second compartment, and said electrode plate is mounted so that the developer forms a shallow stream on the surface thereof;

said driving means includes means for transporting said transfer paper from said means for separating and across the surface of said electrode plate at a greater speed than the flow of said stream of developer;

said means for carrying includes a wiper roller receiving the transfer paper from said electrode plate for removing excess developer from said transfer surface, said roller rotates at a speed so that the portion of its surface in contact with said transfer surface moves at a greater or less speed than the speed

of said transfer paper cross said electrode plate; and

said means for fixing includes first and second squeeze rollers mounted to receive between the respective surfaces thereof said transfer paper carried by said wiper roller, support means pivotally mounted to said duplicator case of rotatably supporting said first squeeze roller in a first position wherein said first and second squeeze rollers squeeze said transfer paper between their respective surfaces and a second position wherein said first and second squeeze rollers are separated, a hygroscopic roller contacting said first squeeze roller, means for biasing said first squeeze roller into said first position, means for pivoting said support means to rotate said first squeeze roller into said second position, and means for actuating said means for pivoting with said transfer paper in contact with said second squeeze roller.

5. A photographic duplicator as in claim 4 wherein said electrode plate includes a number of wires extending along the surface thereof in substantially the direction of travel of said transfer paper, said number of wires diverging from the end of the electrode plate adjacent said means for transporting to the end of the electrode plate adjacent said wiper roller, said number of wires each having a height above the surface of said electrode plate less than the height of the flow of said developer across said electrode plate.

6. A photographic duplicator as in claim 4 wherein said means for fixing further includes third and fourth squeeze rollers for receiving between their respective surfaces the transfer paper passing through said first and second squeeze rollers, a second hygroscopic roller continuously in contact with said third squeeze roller; said means for drying includes means for generating heat, means for blowing hot air from said means for generating heat onto said transfer paper, and said means for blowing including means for deflecting hot air onto said first and second hygroscopic rollers.

7. A photographic duplicator as in claim 4 wherein said first and second squeeze rollers are mounted outside of said developing tank, said duplicator further comprising means for collecting waste developer removed by said first and second squeeze rollers.

8. A photographic duplicator as in claim 4 wherein said means for supplying developer includes a reservoir for maintaining the level of developer in said developing tank and said developing tank further includes means for filtering said developer from said reservoir, and wherein said electrode plate and said wiper roller are mounted within said developing tank.

9. A photographic duplicator as in claim 1 wherein said means for carrying said transfer paper from said electrode plate is a doctor blade mounted within said developing tank for removing excess developer from said transfer surface; and

said means for fixing said transfer surface includes first and second squeeze rollers mounted within said developing tank to squeeze said transfer paper

moving from said doctor blade, a roller having hygroscopic material around its surface in contact with said first squeeze roller, a cleaner mounted adjacent to and in contact with said second squeeze roller, third and fourth squeeze rollers mounted outside said developing tank for squeezing the transfer paper from said first and second squeeze rollers, a hygroscopic roller mounted in contact with said third squeeze roller, said fourth squeeze roller mounted in contact with said means for cleaning; said means for drying includes means for generating heat, means for blowing hot air from said means for generating heat, and means for deflecting the hot air from said means for blowing to said first squeeze roller and said hygroscopic roller.

10. A photographic duplicator as in claim 1 wherein said means for fixing includes first and second squeeze rollers mounted to receive between the respective surfaces thereof said transfer paper carried by said doctor blade, support means pivotally mounted to said duplicator case for rotatably supporting said first squeeze roller in a first position wherein said first and second squeeze rollers squeeze said transfer paper between their respective surfaces and a second position wherein said first and second squeeze rollers are separated, means for biasing said first squeeze roller into said first position, means for pivoting said support means to rotate said first squeeze roller into said second position, and means for actuating said means for pivoting with said transfer paper in contact with said second squeeze roller; and

wherein said first squeeze roller includes hygroscopic material wound around the surfaces of both end portions thereof and exposing the surface portion of said roller between said end portions.

11. A photographic duplicator as in claim 1 wherein the edge of said photosensitive plate first moving along said path in said one direction includes first comb-like projections;

said separating means further including a guide plate having a surface extending into the plane of said path of said photosensitive plate and including thereon third comb-like projections;

said means for transferring depositing said transfer surface on said photosensitive plate in overlapping relationship with said edge thereof;

said means for separating includes a member rotatable to a first and second position and including second comb-like projections, means for biasing said member into said first position wherein said second comb-like projections are upstanding in the path of said transfer paper as it is separated from said photosensitive surface, said member is rotated to said second position by contact with said edge of said photosensitive plate and said first, second and third comb-like projections are in interleaving relationship to form a surface for guiding the transfer paper to said developing means.

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