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DUPLEX XEROGRAPHIC REPRODUCTION

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2 Sheets—Sheet 1

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This application is a continuation-in-part of application Ser. No. 334,249, filed Dec. 30, 1963, now abandoned.

This invention relates to xerography and more particularly, it relates to novel method and apparatus for forming xerographic reproductions on both sides of a support sheet.

In the process of xerography, for example, as disclosed in Carlson Patent No. 2,297,681, issued Oct. 6, 1942, a xerographic plate comprising a layer of photoconductive insulating material on a conductive backing is given an initial electric charge over its surface and is then exposed to the subject matter to be reproduced, usually by conventional projection techniques. This exposure discharges the plate areas in accordance with the radiation intensity that reaches them, and thereby creates an electrostatic latent image on or in the photoconductive layer. Development of the latent image is effected with electrostatically charged, finely-divided material such as an electrophotographic powder that is brought into surface contact with the photoconductive layer and is held thereon electrostatically in a pattern corresponding to the electrostatic latent image. Thereafter, the developed xerographic image is usually transferred to a support surface with which it may be fixed by any suitable means.

In recent years there has been a growing use of xerography in automatic drum-type machines for producing full size copies from microfilm intermediates or from full-size originals, as shown, for example, in Johnson U.S. 3,049,968 and Ceransiti et al. U.S. 3,076,392.

Xerography has become a valuable new tool, not only for producing copies of documents and engineering drawings, but also for reproducing entire books. Many out-of-print books have thus again been made available. It has also been possible for libraries and individuals to replace badly deteriorated books with bound xerographic copies on good paper. Xerography has also made possible the publication of limited editions of theses, legal briefs, and other papers, where the size of the edition is so small that its publication by conventional printing methods would be prohibitive, or at least unduly burdensome.

In the xerographic reproduction of books as practiced at the present time, it is customary to first produce a microfilm copy with the pages copies preferably side by side in sequence on a continuous strip or reel of film. The film is then fed through an automatic xerographic drum-type machine where the pages are enlarged to full size and the resulting xerographic powder images are applied in sequence to one side of a web of paper upon which they are then affixed by heat fusing. After removal of a length of the paper web carrying a series of images on one side representing a sequence of pages, the web is fanfolded, bound along one edge and a cover applied to produce a book is finished. Various methods can be used to bind the book, for example, rubber or plastic rings, paper binding, or saddle stitching. It would be if both sides of the paper could be used. Therefore, despite the success of the xerographic process, it has heretofore been in a manner in which a reproduction is formed on only one side of a support sheet. Irrespective of whether the original or originals being reproduced contain reproducible information on both sides, as is the case with many opaque originals, or otherwise lend themselves to a feasible xerographic reproduction, it has heretofore been the practice to reproduce each copy face essentially on a separate single reproduction sheet. It should be readily apparent therefore, that current practice, particularly with multiple page documents, produces twice the bulk and consequently twice the paper consumption as compared to what can be realized by duplex reproduction.

The need for duplex copying from both a practical and economic point of view has, therefore, been long recognized. Despite the long felt need, it has heretofore encountered handicaps which were unable to be resolved. First, the fusing step as conventionally performed utilizing heat or a solvent vapor causes the powder image to become soft and tacky which in the past has caused the always present problem of offsetting and smudging particularly where both sides of the sheet were subjected to heat or vapor simultaneously. Second, where sequential transfer was attempted to opposite sides of a sheet, long time delays were required to assure complete fusing of the first side before attempting transfer to the second side. Alternatively, complicated scheduling was required for subsequent interposing of the various pages. Thirdly, as known, heat fusing causes cracking as well as drying of the paper support sheet, such that it is difficult to get uniform contact for a subsequent electrostatic transfer step while at the same time imposing a fire hazard by subjecting the already dried paper to a subsequent heat fusing step. Thus, all previous handicaps have prevented the emergence thereof on a commercial scale.

Now in accordance with the instant invention, there is provided novel method and apparatus by which duplex xerographic copying can be readily and simply achieved. Accordingly, it is an object of the invention to provide a novel method and apparatus for effecting duplex xerographic reproduction.

This and other objects as well as the various features, advantages and limitations of the invention will become apparent from the following description and drawings in which:

FIG. 1 is a schematic sectional elevation of an apparatus for performing the method in accordance with an embodiment of the invention;

FIG. 2 is an isometric of a vapor control unit comprising part of the apparatus of FIG. 1;

FIG. 3 illustrates a modification of the image transfer station in the embodiment of FIG. 1;

FIG. 4 illustrates a modification of the copy sheet exposure station in the embodiment of FIG. 1; and

FIG. 5 is a schematic of a program timer comprising part of the apparatus of FIG. 1.

Referring to FIG. 1, an automatic drum-type xerographic machine is shown, according to a first aspect of the invention, for producing two-sided xerographic copies. The images are produced in sequence for the two sides of any two-sided original or from the single side of two separate originals and arranged so that page 2 is produced and transferred to side 2 of a copy sheet substantially simultaneously as page 1 is applied to the first side. This is accomplished without danger of smudging or undesired offsetting, with no substantial time delays, and no thermal deterioration of the copy paper. Moreover, since the images are transferred simultaneously, no complicated scheduling is required.

The machine is shown arranged to produce full-size copies enlarged from the frames of a reel of microfilm 16 on which have previously been recorded a sequence of images in side by side relation, such as microcopies of the
succeeding pages of a book. It is contemplated, however, that other exposure sources can be substituted. For example, an optical system can be used for copying from full-size original sheets, in the manner illustrated, for example, in Eichler et al. U.S. Patent 2,945,434. In this event it will be necessary for an operator to place the originals, one at a time, in a feeder-like device. The window of the exposure board is adapted in operation in a manner whereby the left margin of the original will be reproduced as the top of the copy sheet as will be understood. Timing is important, as will be understood, such that for opaque originals an automatic feed may be preferred to assure proper orientation and spacing essentially critical to the apparatus hereof. It is also contemplated that the exposure position can be occupied by the phosphor screen of a cathode ray tube upon which are displayed facsimile images or characters received over a transmission channel from a distant source, from a computer, or the like.

The original images contained on reel microfilm 10 also contain reference indicia in the form of a punch, magnetic or optically detectable mark or the like (not shown) associated with a particular edge or other reference point of each image as is well known in the art. Operation may be continuous and a detector means 21 (FIG. 5) in detected response to the indicia is adapted to operate a mirror system, designated 150, by which images may be projected onto rotating drum 11. For reasons as will be understood, reflection of the image from the mirror system is achieved alternately from mirror 151 or from a reversing mirror 152 which may be of a type described in U.S. Patent No. 2,940,358. Each mirror is connected to a rotatable shaft 153 that is rotated 180° clockwise after each successive exposure by means of an operable rotary solenoid 154 connected thereto and energized in detected response to the indicia on the film 10.

The xerographic drum 11 in this embodiment and its associated charging, exposure development, cleaning and discharging devices may be of types known in the art, and is shown, by way of illustration, as an adaptation of the machine disclosed in Eichler et al. U.S. Patent 2,945,434.

Instead of providing for direct transfer of the powder images from the xerographic drum to copy sheets, however, two transfer drums are provided, to which powder images are transferred, and upon which they are softened or tackifed by application of solvent vapor, after which pressure transfer is effected to the final copy sheets. The first transfer drum 12 is shown of the same diameter as the xerographic drum, and it may be either larger or smaller than the xerographic drum, provided the drive mechanism is arranged to drive them both at the same peripheral speed and that the copy sheet feeding mechanism is synchronized to feed copy paper to the transfer drum at the appropriate point in the operating cycle to place the transferred images in the desired positions on the copy sheets.

In the machine of FIG. 1, the operative components are mounted in a light-tight cabinet 13 which includes means for shielding the xerographic drum from room light and in which all the operative components are contained. Microfilm 10 to be copied is fed from a supply reel 14 to a take up reel 15, in an optical slit projection system, generally similar to that shown, for example, in Johnson U.S. Patent 3,046,968. Images projected through the microfilm passes through a shielded light passage 20 and mirror system 150 to the xerographic drum 11. The microfilm is advanced intermittently as by an instant start and stop synchronous motor (not shown) controlled by a program timer 24 (FIG. 5). The timer also controls the paper feeding mechanism designated 86 for the copy paper 171, which is to receive the final xerographic images. The drive rollers are adapted in this embodiment to move a microfilm frame at a constant rate across the projection zone and then stop for a brief period before advancing the next succeeding frame. As stated above, indexing marks, holes or the like are provided in the microfilm and sensing means is arranged to cooperate therewith in a well-known manner to ensure accurate registration of the individual frames.

Xerographic drum 11 includes an accurately machined metal cylindrical member coated uniformly on its periphery with a uniform layer of photoconductive insulating material, such as vitreous selenium, or other such material useful in xerography, and is mounted on shaft 29 in suitable bearing in the frame of the machine. The drum is driven in a counterclockwise direction by a motor 30 at a constant rate that is proportional to the projection rate of the copy, whereby the peripheral rate of the drum surface is identical to the projection rate of the reflected light image. The drum surface comprising the layer of photoconductive material on a conductive backing is sensitized prior to exposure by means of a corona generating device 31, which may be an adaptation of the type disclosed in Vyverberg Patent No. 2,965,756 and which is energized from a suitable high potential source.

The exposure of the drum to the light image discharges the photoconductive layer in the areas struck by light, whereby there remains on the drum a latent electrostatic image in image configuration corresponding to the light image projected from the copy. As the drum surface continues its movement, the electrostatic latent image passes through a developing station 40 in which a two-component developing material 41, which may be of the type disclosed in Walkup Patent No. 2,638,416, is cascaded over the drum surface by means of a developing apparatus 42.

In the developing apparatus, developing material 41 is carried up by conveyor 43 driven by suitable drive means from motor 30 and released onto chute 44 wherefrom it cascades down over the drum surface effecting development of the latent image thereon. Toner component 45 of the developer that is consumed in developing the image is stored in dispenser 46 and is released in amounts as controlled by the dispenser mechanism. Other types of developing material could be employed including well-known forms of powder cloud, brush, liquid, magnetic, etc.

After development, the powder image passes through the first image transfer station or position 50 at which point transfer drum 12 is lightly in contact with the image to effect transfer under the influence of an electric field.

After transfer, the xerographic drum surface passes through a cleaning station 56 at which the surface is brushed with a cleaning brush assembly 57 rotated by motor 30, whereby residual developing material remaining on the drum surface is removed. The powder removed from the drum surface is exhausted through port 58 by means of suction provided from fan 59 where it becomes lodged in a removable filter bag 67. Thereafter, the drum surface passes through a discharge station 68 at which it is illuminated by a fluorescent lamp 69 whereby the drum surface in this region is completely flooded with light to remove any electrostatic charge that may remain thereon. Suitable light traps are provided in the system to prevent any light rays from reaching the drum surface other than the projected image, during the period of drum travel immediately prior to sensitization by corona generating device 31 until after the drum surface is completely passed through developing station 40.

Transfer drum 12 may be comprised of an accurately machined metal drum 51 which is covered or coated with a non-conducting adhesive material 52. Material 52 is characterized in that it does not readily or effectively form a mechanical bond to sticky materials, and more particularly to the powder developing material when supported thereon after transfer, either in a dry or tackified state, as will be understood, but readily permits the
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powder material to be temporarily held thereon electrostatically. Shaft 53 of transfer drum 12 is journaled in bearings 54 which are mounted in insulating blocks 55 attached to the frame of the machine. Alternatively, a powder coat may comprise a tetrafluoroethylene polymer resin or a fluorinated copolymer of ethylene and propylene, such materials being available commercially as Teflon resin finishes and sheets. The layer may be applied as a finish to the cleaned and primed steel drum by spray, dip or brush coating, followed by drying and heat fusing. Teflon sheet material may alternatively be cemented to the drum surface. Since such films are available with one surface which is cementable.

In order to further enhance the abrasing character of the layer it is preferred that the Teflon surface be coated with a silicone oil, which is also an abrasing type material. One such suitable oil is Dow Corning 200 silicone fluid, 100 cps, viscosity at 25°C. The Teflon surface may be applied by wiping the surface with a porous cloth or paper saturated with the fluid, and the coating can be maintained in operation by using a cleaning web of porous paper or cloth which has been pre-treated with silicone. Preferably, layer 52, particularly where intended for recycling use, should also be substantially non-absorbent of solvent vapors as will be understood. Other materials that have relatively little affinity for developing material, such as silicone coated bated, bonded glass layers or closely woven glass fiber cloth may also be employed, if desired. Also, although materials having a low bond strength for tacked and/or hardened powder images are considered more practicable for use with the apparatus of the invention, it should be noted that materials having a higher bond strength for powder image material such as paper may also be employed in the form of an expendable web.

The xerographic and transfer drums are accurately spaced in relation to each other to provide light pressure contact between the adhesive surface of the transfer drum and the powder image on the xerographic drum at the line of transfer without producing such heavy pressures that the powder layer will be compressed or mechanically bonded to either drum surface. The two drums are synchronously driven at the same peripheral speed.

The developed image on xerographic drum 11 is transferred onto transfer drum 12 by means of a biased transfer roll 174. The potential applied to roll 174 is adapted to maintain the drum at the opposite polarity to the charge on the powder image. If the powder carries a negative charge the drum is biased positively, and vice versa. The powder is thereby transferred electrostatically, in mirror-reverse image configuration, to the abrasing surface of transfer drum 12 as it rotates in a clockwise direction.

A vapor fusing chamber 160 is mounted below the transfer drum and comprises a shallow tank 155 with side walls 156 and 157. The walls are arranged to extend up into closely-spaced relation to the curved drum surface and to extend along parallel to the drum for a short distance, so that the drum substantially closes the top of the vapor chamber, with just sufficient space provided for clearance of the powder image by the side walls of the tank. A bath of liquid solvent 166 for the resin of the powder image, is maintained in the bottom of the tank below the drum surface. Wicks 165 of porous material extend up the side walls to aid in generation of solvent vapor in the chamber. Any volatile solvent for the resin of the powder image may be used. Typically this includes such materials as trichloroethylene, certain Freons, or hydrocarbon solvents.

Forming part of the vapor chamber is a closure gate 161 (FIG. 2) comprising a pair of parallel gate members 162 and 163, each having a plurality of elongated parallel slots 164 formed therein. As shown, the upper gate member 162 is secured stationary to the chamber walls above the wick 165 and the solvent supply 166 to completely occupy the upper area of the chamber. The lower gate member 163 is adapted for reciprocal sliding movement under control of a solenoid 167 that is programmed in timed relation to the operation of mirror system 150. By withdrawing the lower gate member, the slots 164 are caused to misalign to isolate the chamber from the image passing above. Likewise alignment of the slots permits emission of vapor to the image on the drum surface as will be understood. Where vapor density impedes rapid emission from the chamber, a blower may be provided.

As the first transferred image (of two to be applied to different sides of copy) arrives above the fusing chamber 169, solenoid 167 is energized closing off the gate so that the powder image passes without receiving a significant amount of vapor. Instead, the image proceeds on the surface of drum 12 past the chamber to a transfer station designated 168 where the image is electrostatically transferred to the surface of a second transfer drum 169 in rolling contact with drum 12 by means of a pair of biased transfer rolls 175 and 176 programmed as to remove only every other image being conveyed on drum 12. Roll 175 is always biased of opposite polarity to the bias applied on roll 174 as indicated by the (+) and (−) signs in the drawing. This serves to repel the powder image from the surface of drum 12 such that during transfer, roll 176 is biased oppositely to roll 175 via a timer 177 in order to electrostatically attract the image from drum 12 to drum 169.

Drum 169 rotates in conjunction with the rotation of drum 12 and is of a diameter selected ideally to form a circumferential length of predetermined length greater than the copy sheet on which the image is ultimately to be transferred and not necessarily in the proportion shown. By this means and appropriate programming, the image transferred thereto will approach tangential contact with drum 12 coincident and in registration with the leading edge of a second image transferred to the latter drum. Drum 169 likewise contains an abrasing surface and is similar to drum 12. Below the drum 169 is supported a vapor chamber here designated 61, being similar to vapor chamber 161 but with an absence of the gate control.

As each transfer drum rotates and gate 161 opens they carry their powder images through their respective vapor tank in which the image rapidly becomes tackified or liquified during the time of passage through the chamber. Due to the close spacing of the sides walls there is very little solvent vapor emitted from the image. The images emerge from their chambers in tacky or semi-liquid condition. With gate 161 closed the first formed image passes vapor chamber 160 without any perceptible tackification therefrom and is subsequently transferred onto the transfer drum 169 for tackification thereon. The second image formed on drum 12 on traversing above the vapor chamber is exposed to solvent vapor by operation of solenoid 167 to permit emission of vapor from wick 165. The two images thus contained on their respective transfer rolls arrive tackified in registration to their point of mutual tangency.

In timed program relation to movement of the two tackified images, a sheet of copy paper 171 supported on a tray 172 is mechanically fed as by means of a feed mechanism 86 to advance in conveyor-like fashion through conveyor mechanism 173 into the bite between the transfer rolls. Concomitantly therewith timer 177 switches the polarity on roll 176 to effectively repel the image material from drum 169 toward the copy sheet. As the copy sheet advances therebetween, tackified copy on each of the rolls is pressed onto opposite sides of the copy sheet. On emerging, a puffer 180 disengages the sheet from drum 12 causing continued advance of the sheet with drum 169 until being disengaged therefrom by puffer 181. At this point the sheet is caused to be engaged by conveyor 182, which conveys the copy sheet to a suitable collecting tray 183.

After an image has been transferred to a copy sheet, a
very small amount of dried resin toner may remain loosely bonded to the surface of each of the transfer drums. This is removed by a wiper consisting of a web of soft paper or cloth-like material 107, which is fed from a supply roll 108 to a take-up roll 109 around a soft pressure roll 110 of felt, foam rubber, or other soft material, pressing against the drum above the paper transfer position. In some instances, the web may be pre-treated with silicone liquid in order to maintain the silicone coating on the transfer drum.

In order to control cleaning of drum 169 selectively only following image transfer therewith, web 107 associated with drum 169 passes over idle roll 110 that is supported at 111 and in a pivotal arm 186 pivoted about pin 196 and being acted upon at its right end by means of a tension spring 187 and at its opposite end by means of a solenoid 188. When the solenoid 188 is deenergized, spring 187 causes the web to withdraw completely clear of an image on the surface of drum 169 while when energized, arm 186 is pivoted counterclockwise causing idle roll 110 to place web 107 in wiping relation to the surface of drum 169.

Since the abhesive coating on transfer drum 12 is an insulating material, it has a tendency to pick up electrostatic charges during the transfer and cleaning operations which may interfere with subsequent transfer steps. In order to free the surface to a reference potential the drum surface passes, after cleaning, and before contact with the xerographic drum, under a conductive wiper, such as a cellulose sponge 115 kept moist with pure water. The sponge is supported in a metal channel 116, which is insulated from the frame, but is connected to a conductive part of the transfer drum or grounded as shown.

Since the abhesive coating is not removable with water, the surface does not carry away a film of moisture and hence there is substantially no loss of moisture from the sponge. Neutralization of drum 169 has been found unnecessary by virtue of the effects of the reverse polarity on roll 176.

It should be apparent that in order to effect operation hereof, it is necessary that solenoids 154, 167, and 188, as well as transfer roll 176 and feed mechanism 84 be suitably programmed in timed relation to each other on detection of indicia corresponding to successive images on microfilm 10. Programming within the knowledge of the art necessarily includes appropriate time delays to effect sequential operation of the different mechanisms in order that simultaneous transfer can be imposed onto both sides of a copy sheet 171 arriving between the transfer drums.

A program timer 24 for controlling the sequence of operations is schematically illustrated in FIG. 5. It comprises the indicia detector means 21 operating mirror solenoid 154 and a magnetic clutch 22 which may be mounted directly on the xerographic drum shaft 29, or on a shaft geared to the drum. Cam 80 on shaft 29 is adapted to open and close an electric switch which controls the microfilm advance mechanism previously described. The remaining cams operative under control of the clutch include cam 81 which controls a switch operating gate solenoid 167. The third and fourth cams, 92, 93 respectively actuate switches for controlling timer 177 and solenoid 188 while cam 94 controls a lever arranged in a well-known manner for operating paper feed mechanism 86. It will be appreciated that there may also be provided manual controls to vary the operation of the microfilm advance, and in order to take the control away from the control program timer during start-up, shut-down, or unusual operating conditions.

FIGURE 3 shows schematically another embodiment of the invention in which the second xerographic image is tackified directly on the xerographic drum and one transfer is made to the copy paper directly from this drum in a manner similar to that described in connection with FIGS. 1 and 2. In this embodiment, the photoconductive insulating material is provided with an abhesive surface treatment or coating. Vitreous selenium, upon which there has been spread a thin film of silicone oil, such as Dow Corning 200 silicone fluid, provides such a surface. In the case of other photosconductors, a very thin selenium finish may be applied and then silicone coated. Operation is otherwise similar to that described for FIG. 1.

A modification of FIG. 1 adapted to simultaneously expose two faces of opaque, original copy is illustrated in FIG. 4. In this embodiment, an opaque original, designated 191 and having copy on both faces thereof, is supported on a transparent platen 192. Each face of the copy when supported in this position is adapted to be optically scanned by means of scanning mechanisms, designated 193 and 194, which may be of a type described in U.S. Patent 2,945,434. Image exposures to drum 11 from the respective faces is incidentally displaced to different segments about drum 11 as shown so that the trailing edge scan of the top face will lead the leading edge of the bottom face by a predetermined distance. Corona generator 195 charges the drum preceding exposure as the drum rotates. The top copy face is therefore reflected by means of a mirror 197 through exposure aperture 198 while the bottom face is reflected from a mirror 199 to a mirror 190 and then through exposure slit 190 to selectively discharge the drum surface. In order to maintain the optical paths during scan through the respective exposure slits, each of the mirrors described in this embodiment are intended to be pivoted and disengaged in conjunction with movement of the scanning mechanism. The balance of apparatus of this embodiment necessary to effect transfer to a copy sheet and not shown is intended to be similar to FIGS. 1 or 3 described above.

By the description above, there has been disclosed a novel and unique method as well as apparatus for achieving duplex xerographic reproduction. Operation is extremely rapid since the vapor softened toner images set out very rapidly after transfer from the transfer rolls to the copy paper, being on the order of a fraction of a second. The method was found to have extremely low solubility consumption since the copy paper is not exposed to vapor and the only absorption of solvent is in the powder image. This also contributes to the high speed of operation since only minor amounts of vapor are required to be absorbed by the powder image being more than less than would be needed for fusing the image on the copy paper, since the image need only be brought to a tacky state rather than be completely liquefied. The process accords many advantages among which are the substantial reduction in bulk of printed publications or the like which previously were prepared with a reproduction on only one side of a page. In addition, the process makes it possible to place images on surfaces to which electrostatic transfers cannot conveniently be made such as heavy card stock, metal sheets, etc. At the same time, it has been found that the smooth surface of the abhesive material accords improved electrostatic transfer from the xerographic drum due to more uniform conditions at the point of separation between the smooth surface and that of the drum.

Since many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the drawings and specification shall be interpreted as illustrative and not in a limiting sense.

What is claimed:

1. Apparatus for forming xerographic reproductions on two sides of a copy sheet comprising:
   (a) first support means on which to support a first tackifiable xerographic powder image of copy containing a solvent soluble component;
   (b) second support means arranged opposite said first support means and adapted to support a second tacki-
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fiable xerographic powder image of copy containing a solvent soluble component;
(c) solvent generator means to generate a vapor atmosphere of a solvent of said solvent soluble component of the powder images;
(d) drive means connected to said supports to pass powder images on their respective supports through said atmosphere of solvent vapor to render the powder images tackified and to bring the tackified images to an opposed superposed registered relation;
(e) copy advance means operative in timed relation with said drive means to advance a copy sheet into a sandwich relation intermediate the superposed relation of said tackified images on their supports; and,
(f) separating means to effect removal of a copy sheet from said last recited relation.

2. Apparatus according to claim 1 in which said image supports comprise cylindrical members in substantially rolling surface contact.

3. Apparatus according to claim 1 including transfer means adapted to transfer a first formed xerographic image from one support to the other prior to vapor tackification thereof.

4. Apparatus for forming xerographic reproductions on two sides of a copy sheet comprising:
(a) a xerographic drum supported for rotation;
(b) means to sequentially form at least two consecutive tackifiable xerographic powder images containing a solvent soluble component on said drum;
(c) a first endless abhesive material supported to be advanced into moving contact with said drum;
(d) a second endless abhesive material supported to be advanced into moving contact with portions of said first endless abhesive following contact thereof with said drum;
(e) first transfer means adapted to transfer power images from the drum to the surface of said first abhesive material;
(f) second transfer means adapted to transfer a first formed powder image from said first abhesive to said second abhesive;
(g) solvent generator means to generate a vapor atmosphere of a solvent of said solvent soluble component of the powder images;
(h) drive means connected to the abhesive material supports to advance said abhesive materials containing the powder images through said atmosphere of solvent vapor to render the powder images tackified and to advance the tackified images toward contiguous face-to-face relation;
(i) means to support a copy sheet on which the reproductions are to be formed;
(j) feed means operative in timed relation to said drive means to advance a sheet from its support means intermediate between the tackified images in the relation effected by said drive means; and,
(k) separating means to effect removal of the sheet from said last recited relation.

5. Apparatus according to claim 4 including optical reversal means operative to optically reverse every other image formed on said xerographic drum.

6. Apparatus for forming xerographic reproductions on two sides of a copy sheet comprising:
(a) a xerographic drum supported for rotation, said drum comprising a photoconductive insulating material on a conductive substrate and overcoated with a transparent abhesive material;
(b) a second endless abhesive material supported to be advanced into moving contact with the periphery of said drum;
(c) means to sequentially form at least two consecutive tackifiable xerographic powder images containing a solvent soluble component on the drum surface;
(d) transfer means adapted to transfer a first formed powder image from said drum surface to the surface of said second abhesive;
(e) solvent generator means to generate a vapor of a solvent of said soluble component of the powder images;
(f) drive means adapted to pass the powder images on their supports through said atmosphere of solvent vapor to render the powder images tackified and to advance the tackified images toward contiguous face-to-face relation;
(g) means to support a sheet on which the reproductions are to be formed;
(h) feed means operative in timed relation to said drive means to feed a sheet from its support intermediate between the tackified images in the relation effected by said drive means; and,
(i) separating means to effect removal of the sheet from said last recited relation.

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