May 9, 1967 D. RUBIN 3,318,212

DUPLEX XEROGRAPHIC REPRODUCTION

Filed Sept. 20, 1965 2 Sheets-Sheet 1

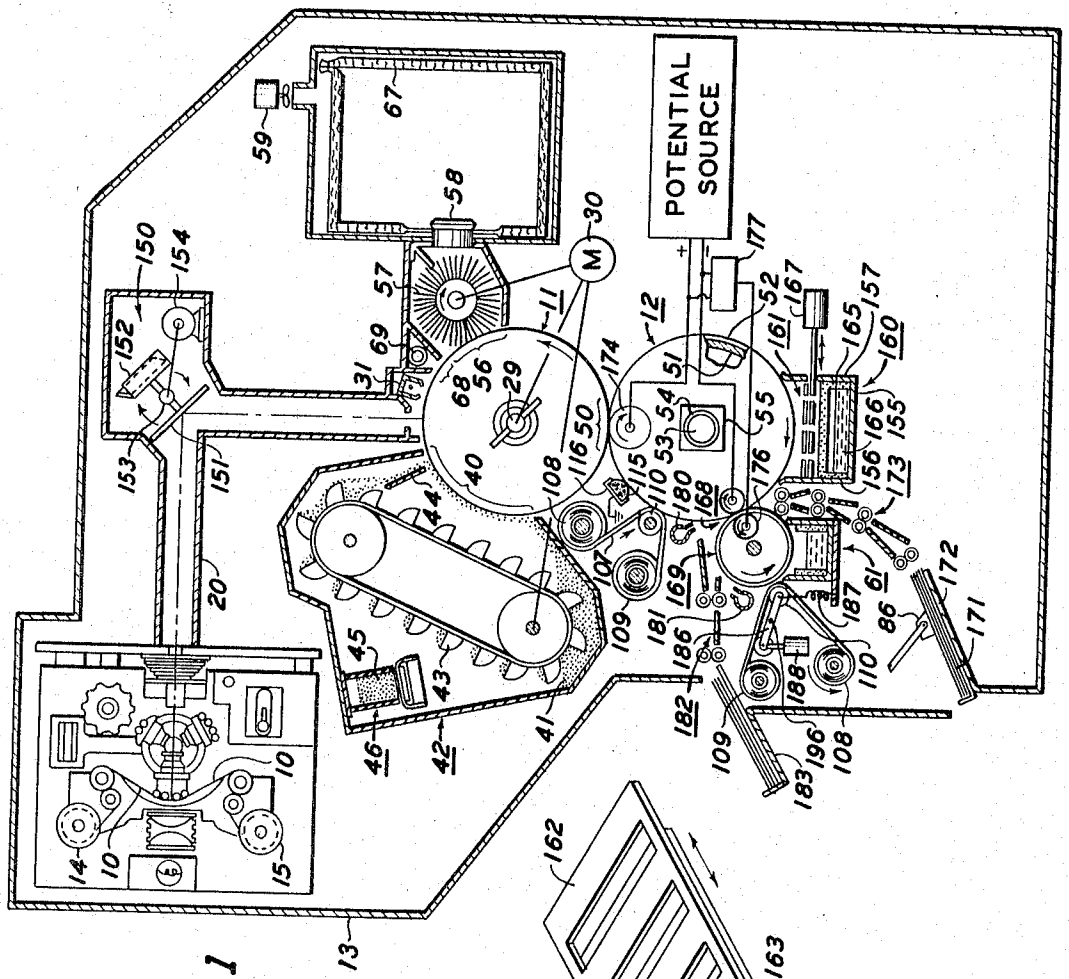


FIG. 1

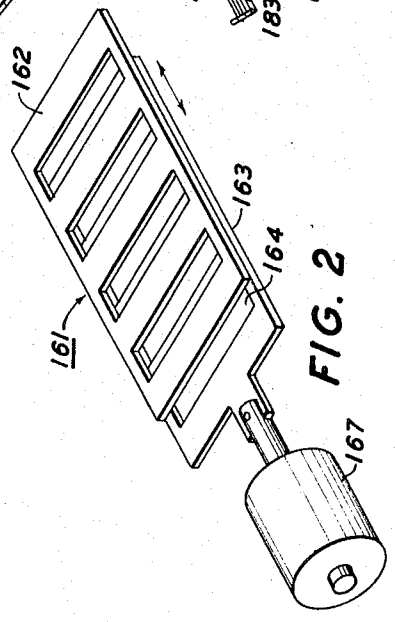


FIG. 2

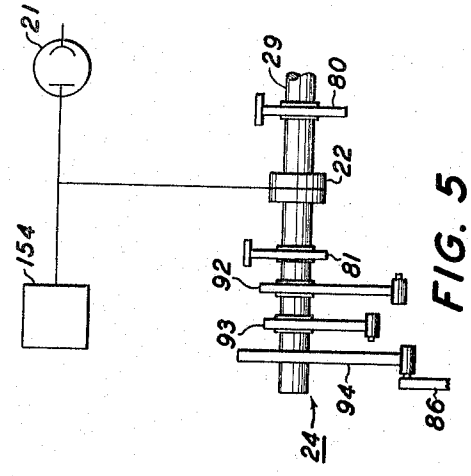


FIG. 5

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DUPLEX XEROGRAPHIC REPRODUCTION

Filed Sept. 20, 1965 2 Sheets-Sheet 2

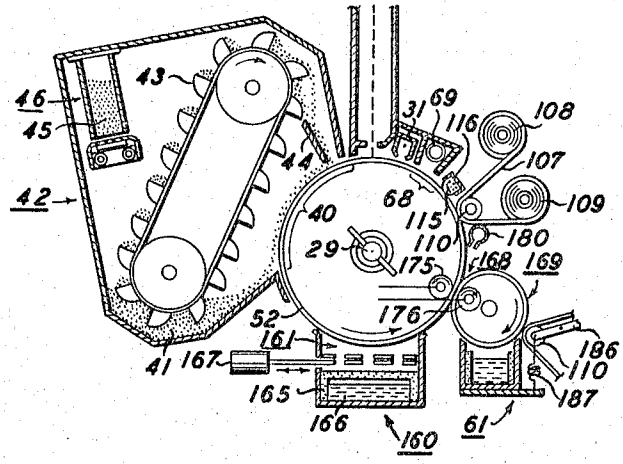


FIG. 3

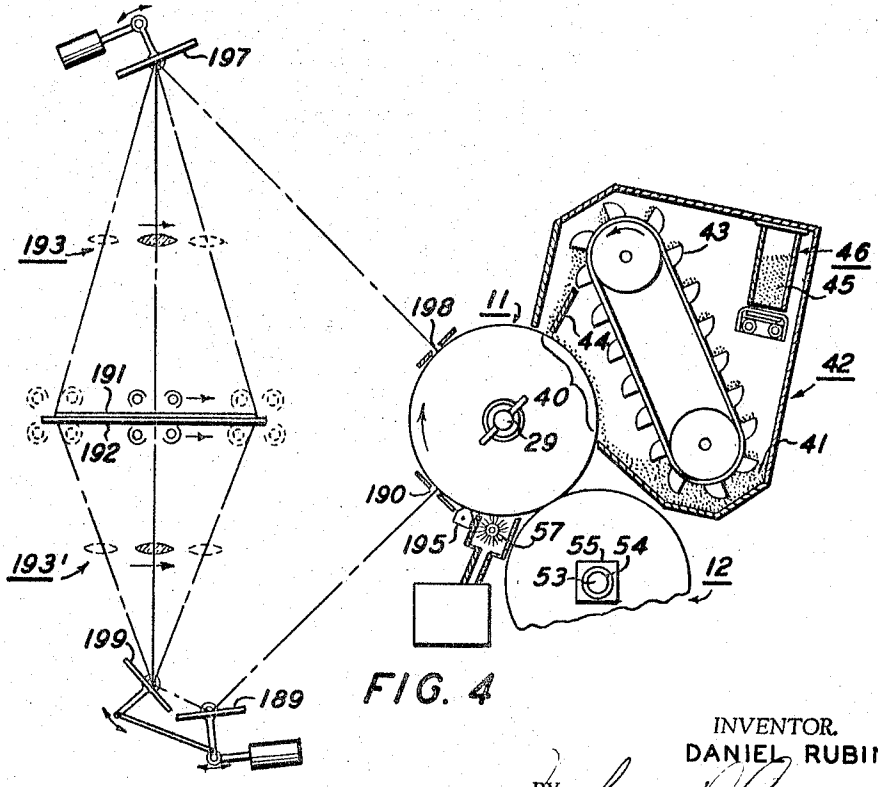


FIG. 4

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3,318,212

DUPLEX XEROGRAPHIC REPRODUCTION

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Filed Sept. 20, 1965, Ser. No. 492,980
6 Claims. (Cl. 95—1.7)

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 a uniform 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 materal such as an electroscopic 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 to 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 Cerasani 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 papers, the web is fan-folded, bound along one edge and a cover applied to produce a completed book. Each leaf of the book, therefore, has two thicknesses of paper joined by a fold at the free edge and bound at the back so that the reader, in turning a page, finds text printed on both exposed sides. The unprinted side of the paper is enclosed within the fold and is hidden from view, but nonetheless the physical bulk of the book is twice greater than it would be if both sides of the paper could be used. Therefore, despite the success of the xerographic process, it has heretofore been used 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 duplex 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 tackified 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 interspersing of the various pages. Thirdly, as is known, heat fusing causes crinkling as well as drying of the paper suport 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, these prior 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 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 one 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 10 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 after another, on the exposure copyboard during 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 reeled mircrofilm **10** also contain reference indicium 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 indicium 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 indicium 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 tackified 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 Johanson U.S. Patent 3,049,968.

Light 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 uesful in xerography, and is mounted on shaft **29** in suitable bearings in the frame of the machine. The drum is driven in a counter-clockwise 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 is stored in dispenser **46** and is released in amounts as controlled by the dispenser mechanism. Other types of development 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** rolls 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 by 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 abhesive 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

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.

The abhesive material layer **52** 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 abhesive character of the layer it is preferred that the Teflon surface be coated with a silicone oil, which is also an abhesive type material. One such suitable oil is Dow Corning 200 silicone fluid, 100 cps. viscosity at 25° C. The silicone can 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 baked enamel, bonded glass layers or closely woven glass fiber cloth may also be employed, if desired. Also, although materials having a low bond strength for tackified 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 abhesive 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 **160**, 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** whereat 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 abhesive 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 side walls there is very little solvent vapor drag-out from the chamber. 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 arriving 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 therefrom, web **107** associated with drum **169** passes over idler roll **110** that is supported at one end 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 counter-clockwise causing idler 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 bring 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 wettable 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 paper feed to take the control away from the 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 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 photoconductors, a very thin Teflon finish may be applied and then silicone treated. 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 **193'**, which may be of a type described in U.S. Patent 2,945,434. Image exposures to the drum **11** from the respective faces is circumferentially 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 slit **198** while the bottom face is reflected from a mirror **199** to a mirror **189** 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 slightly as shown 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 solvent 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 much 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 is:

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-

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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