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L. E. WALKUP

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PRODUCTION OF DUPLICATING MASTERS

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FIG. 1

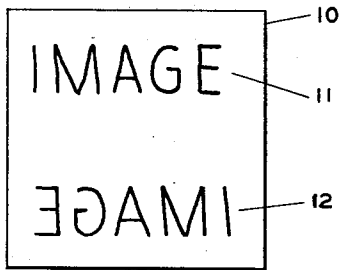


FIG. 2

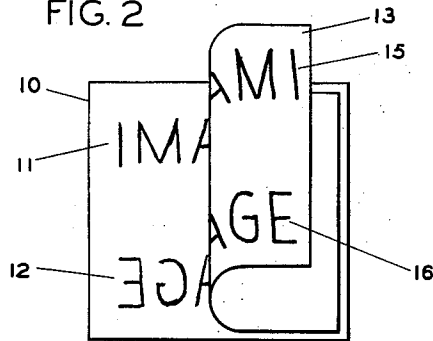


FIG. 3

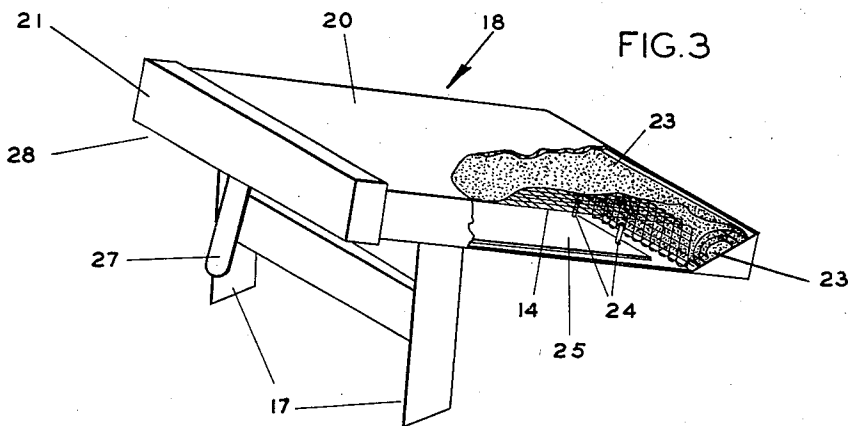
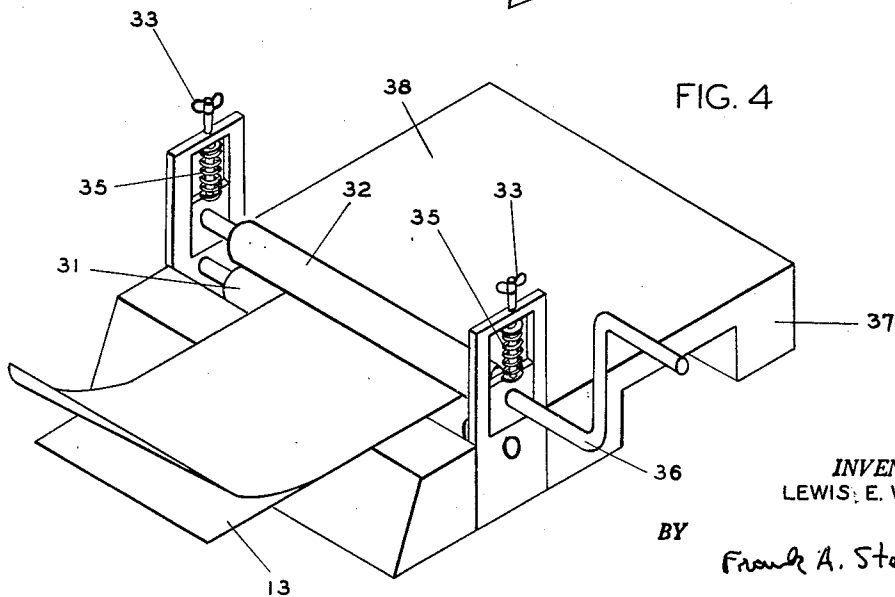


FIG. 4



INVENTOR.
LEWIS, E. WALKUP

BY

Frank A. Stemmler

ATTORNEY

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3,143,066

PRODUCTION OF DUPLICATING MASTERS

Lewis E. Walkup, Columbus, Ohio, assignor, by mesne assignments, to Xerox Corporation, Rochester, N.Y., a corporation of New York

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21 Claims. (Cl. 101-149.4)

This invention relates to the art of duplicating and is more particularly concerned with the production of masters to be used in duplicating processes.

In the art of duplicating such as hectograph, spirit duplicating and the like, a large volume of low cost work is produced using masters having highly concentrated dye deposits in image areas. To produce multiple copies from these masters small amounts of the dye are released from the master image and transferred to copy paper. The processes are fast and economical.

At present, the master copy is prepared by typing, printing, writing, or drawing the desired material onto a sheet of master paper using special ribbons, carbon papers, inks, or pencils. This method of producing the master is both tedious and time-consuming, especially when it is found necessary to copy an existing image onto the master, such as charts, tables, drawings or the like. A skilled technician or artist is in such a case essential so that valuable copies may subsequently be obtained, and this factor of course increases the cost element substantially.

Another consideration involved in present methods of preparing a master for duplicating processes is that the element of human error is present at all times.

It has been known for some time that a photographic means for producing masters would substantially improve the art by reducing cost, saving time, substantially doing away with the human element of error and generally increasing efficiency. These improvements are accomplished by this invention.

It is pointed out that in carrying out the steps of this invention, the art of xerography or electrophotography is specifically referred to as that part of the art of photography of value to produce the masters used in duplicating processes. Although the art of xerography or electrophotography is specifically referred to, other methods of attaining those results obtained through the use of xerography in this invention are intended to be encompassed by this application. For example, as a first step in the process of producing a master it is necessary, according to this invention, to produce a powder image of the copy being reproduced. In the art of xerography, a latent image is first produced using electrostatic charges. This latent electrostatic image may then be developed by depositing on areas of electrostatic charge powder particles whereby the original image is reproduced in powder form. Any other art capable of producing a copy of the original image in powder form would allow one to progress to the next step in this invention; however, to date xerography has been found to be the most valuable aid in carrying out the steps of this invention due to its adaptability and due to the high resolution obtained.

Other objects and advantages of this invention will become more apparent as the following detailed description progresses, reference being had to the accompanying drawings, in which:

FIG. 1 is a flow step showing a formed powder image;
FIG. 2 is a flow step showing transfer of a formed powder image;

FIG. 3 is an isometric view of a tackifier partially in section; and,

FIG. 4 is an isometric view of a pressure transfer assembly.

Referring more particularly to the drawings, and as

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shown in FIG. 1, a right reading powder image 11 or a mirror reverse reading powder image 12 is formed on a surface 10 through xerography or some other means. Using conventional xerography the image may be formed either right reading or mirror reverse, depending completely on what is desired for the master itself, as will appear more clearly from what follows. Surface 10 is any surface on which the xerographic image has been placed through conventional xerography. For example, a photosensitive xerographic member comprising a photoconductive insulating layer overlying a conductive backing may be charged, exposed and developed in a conventional manner to form the powder image.

The powder image 11 or 12 on surface 10 is then transferred, as is shown in FIG. 2, to a surface designated 13, again using conventional xerographic methods of electrostatic transfer, or other means, and opposite reading images are produced, that is, mirror reverse reading powder transferred image 15 from right reading image 11, or right reading powder transferred image 16 from mirror reverse reading image 12. Surface 13 may be any one of a number of surfaces depending on the approach taken in carrying out this invention as will appear more fully below. After the transfer of powder image 11 or 12 has been completed to surface 13 from surface 10, surface 13 is removed out of contact with surface 10.

Master sets or master units as conventionally used in spirit duplicating are composed of the master sheet which generally is a firmly coherent coated paper sheet, the carbon sheet having a detachable coherent dye layer, and a cushion sheet placed between the two which is mainly for the purpose of preventing the carbon from getting on the master sheet prematurely. The carbon may be coated with a wax like material or it may be uncoated. Coated carbons have the additional advantages of cleanliness and preventing smudging of carbon dye on the master during the master making process. One such unit sold commercially is called the "Carbon Master Unit" by the Standard Duplicating Machine Corporation of Everett, Massachusetts. The various different units and kinds of units sold commercially have been found to work well with this invention; yet it is preferred in carrying out this invention to use master sets with coated carbons.

In the preferred embodiment of this invention, sheet 13 is the carbon member of a commercial type of master set. It may be used as a separate element; however, it is preferred that it remain attached to the master sheet of the master set or master unit. At this point then, a substantial part of the original powder image 11 or 12 has now been electrostatically transferred to the carbon 13 and rests on its surface in reading form reverse from the direction it appeared on surface 10. As pointed out above this reverse form will make the powder image either direct reading or mirror reverse reading depending on the direction of reading of the image placed on surface 10.

FIG. 3 shows a tackifier generally designated as 18 which is composed of support 17 and fusing tank 20 into which drawer 21 slides. The drawer 21 is shown in a closed position. Wick member 23 is supported by screen 14 and is positioned to cover the entire upper area of fusing tank 20. Wick member 23 terminates in a coil of wick material at the base of fusing tank 20. Drawer 21 is composed of bottom 25, handle 27, and lid 28. Handle 27 is used for grasping while opening or closing drawer 21. Lid 28 is positioned and disposed so that the opening of fusing tank 20 through which the drawer moves is completely covered when drawer 21 is in a closed position thereby making the enclosure of fusing tank 20 complete. Stop pegs 24 found at the end of bottom 25 opposite the end to which lid 28 is connected are positioned so that when drawer 21 is in a closed position

as shown, pegs 24 fall short of support screen 14 thereby avoiding contact and entanglement between the two.

The tackifier 18 is used to cause an image body, such as powder image 15 or 16 to be made tacky. Tackiness in this invention is accomplished when the powder image becomes a more liquified adhesive unit. Although it is not desired to limit this invention to a particular mode of operation, it is now thought that tackifier 18 causes an image to become tacky due to the effect of vapors in fusing tank 20 on the viscosities and surface tensions of the materials making up the image. It is believed that exposing the image to proper vapors causes the surface tensions of the materials to decrease thereby making the particles more adhesive. This will cause the particles to stick to one another and at the same time cause the image itself to become adhesive. It is thought in general that solvents for the image materials or, more particularly, vapors soluble in the image materials cause the lowering of surface tensions. Exposure to vapors also causes the viscosity of the materials making up the image to fall thereby allowing the particles to flow more readily. The tackifier causes an image to reach this tacky state by decreasing the viscosities and surface tensions of the materials composing the image thereby producing a more liquified adhesive single image body. The image should be composed of materials which can be reacted on as indicated by proper vapors. It is pointed out that although this invention is described in terms of tackifier 18, any other device capable of accomplishing the same results is intended to be encompassed within this invention.

To prepare tackifier 18 for use drawer 21 is removed and a liquid which will vaporize and properly tackify the image is poured into fusing tank 20. The entire wick 23 should be saturated with the liquid and sufficient liquid should be allowed to remain as a pool at the end of the fusing tank 20 so that a portion of the wick coil soaks in it. The pool of liquid should not be allowed to reach the bottom 25 of the drawer when drawer 21 is in a closed position. The proper liquid to use will depend on many factors; however, it may be stated in a general sense that the liquid should be such that its vapors will act quickly to tackify the image and at the same time will have little or no effect on the carbon member being used. For example, if a resin is being used for the image, then a liquid, the vapors of which will be absorbed to tackify the resin material and at the same time will have substantially no effect on the carbon member, would be a proper liquid to use. When such a liquid has been poured into fusing tank 20 drawer 21 is replaced to its closed position. The liquid will saturate all areas of the wick causing vapors to escape from wick member 23 thereby saturating the air in fusing tank 20 with vapors of the liquid.

The particular tackifying liquid will depend on the nature of both the particular image material or powder and the particular carbon member. It generally would not dissolve or impair the carbon member. It is believed that it should be a volatile solvent for the image material. Trichloroethylene is hereinafter named as a solvent for one particular image material and it is to be realized that other solvents or tackifiers may be used. For example, suitable solvents for various combinations of carbon member and image materials include chloroform, carbon tetrachloride, trichloroethylene and other chlorinated solvents; the various Freons (believed to be fluorinated lower alkanes); aromatic and aliphatic hydrocarbons such as benzene, toluene, gasoline and gasoline fractions; oxygenated solvents such as ethanol, acetone, ethyl acetate and other alcohols, ketones, esters and the like. In all cases, the particular solvent will be appropriately selected to operate empirically with the particular combination of materials and compositions employed.

Tackifier 18 is shown with the area through which drawer 21 moves in a raised position in that as a general rule the vapors of the liquids which can be used are

heavier than air. In carrying out the steps of this invention it will be necessary to remove and replace drawer 21 from time to time and with the front end of fusing tank 20 being raised to a higher level than the rear end, the escape of vapors from within fusing tank 20 will be prevented to a great extent. It is also noted that wick 23 is supported at the top of fusing tank 20 so that the vapors which are generally heavier than air will escape downward to the effective area of fusing tank 20 of tackifier 18. It is also pointed out that provisions may be made for heat control of the entire fusing tank 20 where such control is deemed desirable. To date no such control has been found necessary, and such controls are therefore omitted from tackifier 18.

Wick 23 should be composed of such a material as will saturate quickly with the liquid being used in fusing tank 20 and which will allow vapors to escape from it readily. Generally, it may be said that any material which normally may be used as a wick will work successfully and this will also include such materials as cotton batting, blotter paper, woven cloth and the like. In the preferred construction of tackifier 18 it has been found that cotton toweling material produces a very satisfactory wick.

Tackifier 18 is ready to be used when the air within fusing tank 20 is substantially saturated with the vapors of the liquid which has been poured into the fusing tank 20. Generally, once tackifier 18 is readied for use it will remain in such a condition until just about all the liquid which has been poured into fusing tank 20 is fully evaporated or has been used in saturating wick 23. At this point the air in fusing tank 20 is no longer sufficiently saturated with vapors for the vapors to act on the image body. However, provisions may be made to keep the liquid content constant by arranging an automatic feed system.

When tackifier 18 is ready to be used, sheet 13, which is in this embodiment the carbon on which the powder image 15 or 16 rests, is placed against pegs 24 and on bottom 25 of the drawer. The drawer is then replaced to its closed position. In that the vapors used in this invention have little or no effect on carbon member 13, and in that it is desirable that carbon 13 be affected as little as possible, carbon 13 should be placed in this embodiment of the invention in the drawer so that the side opposite the side carrying the powder image is against or in the direction of bottom 25 of drawer 21.

In this embodiment of this invention, the carbon member may be inserted in drawer 21 in a number of ways. It may be placed in the drawer as a separate element, for example, the carbon carrying the powder image. It may also be placed in the drawer as a part of a master unit, for example, the carbon carrying the powder image while attached to the master sheet. In such an instance it may be placed in the drawer with the master sheet folded behind the carbon member so that the master sheet is against the side of the carbon opposite to the side of the carbon carrying the powder image, or, it may be placed in drawer 21 in what will be termed a closed sandwich position wherein the master sheet attached to the carbon is folded over so that it overlies the powder image which overlies or rests on the carbon member. Another possibility is to use carbon 13 with other sheets which will make valuable masters such as for example Kromekote, Litho, label 70-pound paper or the like, which may be used as a substitute in any of the positions suggested for the commercial master sheet.

The carbon 13 carrying the powder image 15 or 16 either as a separate element or as part of a master unit being used in an open or in a sandwich position is allowed to remain in the tackifier 18 until the powder image 15 or 16 becomes tacky. The time necessary to make the powder image tacky, is dependent upon a number of factors, such as, for example, the material the powder is composed of, the vapors being used in fusing tank 20,

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whether placed in drawer 21 in a position so that the vapors contact directly powder image 15 or 16, indirectly through the master sheet which is overlying powder image 15 or 16 (the sandwich position), and in some instances to some extent the humidity content and the temperature of the area where tackifier 18 is being used. It has been found, for example, that when a carbon member alone or as a part of the master set in an open position is placed in tackifier 18, and using trichloroethylene as the liquid whose vapors are to tackify the powder image 15 or 16 that a range of from 10 to 50 seconds with a preferred timing of about 15 seconds produces a properly tackified image. When the carbon is placed in fusing tank 20 in a closed sandwiched position, a range of from 10 to 90 seconds, with a preferred timing of about 45 seconds, will produce a properly tackified image in a tackifier 18 where all areas of air contacting the carbon or master set are substantially 100% saturated with trichloroethylene vapors and times up to about 2½ minutes at high but unsaturated vapor concentration. In the above examples, xerography was used to place the image on the carbon member and therefore the images were composed of normal xerographic developers such as for example that disclosed in Copley 2,659,670, and the like.

An examination of the powder image after it has been tackified shows that the particles have flowed together and generally the image appears glossier than it appeared in the powder form.

The next step in carrying out this invention, a step that should be carried out as soon as possible after the image has been tackified, generally within 20 seconds and preferably within about 5 seconds after the carbon carrying the tackified image is removed from tackifier 18, is the pressing of the tackified image to the master sheet. Where a delay of about 30 seconds has intervened between the removal of the tackified image on the carbon member from the tackifier 18 and the carrying out of the pressing step legible images of a poorer quality than are obtainable using the preferred time are obtained. It is pointed out that this time delay varies somewhat depending on how the carbon 13 was placed in the tackifier 18. If a sandwich formation was used, then on removal the tackifying process continues in a sense in that the master sheet itself carries with it absorbed vapors and continues the tackifying process. If on the other hand the carbon sheet had been placed in the tackifier in an open position or as a separate element, then on removal from the tackifier 18 the air strikes the tackified image allowing the absorbed vapors to evaporate and allowing the tackified image to start to solidify and a shorter delay is desirable. It may therefore be said that where 15 seconds will have considerable effect on the tackified image which has been removed from the tackifier 18 in an open position, 15 seconds will not have much effect upon the image removed in a sandwiched position due to the effect of the entrapped vapors in both the area between the carbon and the master sheet and those absorbed within the master sheet itself.

In carrying out the pressure step, a master sheet is placed over the tackified image overlying or resting on carbon 13. Where carbon 13 has been placed in tackifier 18 in a closed sandwich formation nothing must be done to prepare the carbon and master for the pressure step. However, where carbon 13 has been placed in tackifier 18 in an open position or as a separate element, it is necessary to place the master sheet over the tackified image resting on the active side of carbon 13. No matter whether the carbon had been used in an open or sandwich formation previously in this step the carbon and master are used in a sandwich formation, as described previously, that is, a carbon on which rests an image and on which rests the master sheet. To this sandwich is applied even pressure as for example as is shown in FIG. 4 where the sandwich is being rolled between pressure rollers 31 and 32. The pressure applied may be

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adjusted by pressure adjustment knobs 33, which bring additional compression to springs 35 causing upper pressure roller 32 which is turned by crank 36 to be forced into closer relationship with the lower pressure roller 31. The pressure apparatus shown in FIG. 4 is constructed with pressure roller 31 fitted within support 37 so that the sandwich rides smoothly along a flat surface 38. Any other means for applying a uniform pressure to the master set sandwich may be used such as, for example, placing the sandwich between two flat surfaces which when squeezed together bring uniform pressure on all areas of the master sandwich, or, the use of electrostatics to tack the elements of the sandwich together, and the like; and it is intended that such means of bringing uniform regulated pressures on the sandwich are to be encompassed within the scope of this invention.

The amount of pressure necessary to accomplish a valuable transfer will vary depending upon the many factors involved such as, for example, the particular carbon set or carbon and master sheet being used, the condition of the tackified image, the particular resin image employed, the delay before placing the sandwich into a pressure unit, the humidity and temperature of the area in which the transfer step is being carried out, and the like. It has been found using xerography as an aid to carrying out the steps of this invention and the xerographic developer previously disclosed and having allowed the master and carbon as a sandwich to remain in the tackifier 18 for the preferred amount of time and then placing the sandwich into the pressure rollers as shown in FIG. 4 within 5 seconds after removal from the tackifier 18, that the pressures are in the order of 5 to 20 pounds and preferably between 10 to 15 pounds per linear inch of roller where roller 32 was a rubber roller having a durometer hardness 85, Rex gauge, and roller 31 was a steel roller in a room of normal temperature and humidity.

Although the speed at which the rollers of FIG. 4 are turned is not now known to be critical, it is necessary to move the sandwich between the rollers so that the last part of the tackified image coming through the rollers is not substantially in a different condition from the first part that went through and a speed of approximately 1.5 inches per second and faster has been found to produce good results.

After the sandwich has been removed from the pressure apparatus the sandwich should be allowed to stand for at least 5 seconds if in open form or, if in sandwich form at least about 30 seconds and preferably for about 60 seconds or more before the master sheet is separated from the carbon 13. During this time delay the image solidifies and adheres to the surfaces in contact with it. The sandwich may be allowed to stand apparently for many hours and even many days before separation is accomplished without any detrimental effect to the quality of the master produced. Separation is accomplished by simply pulling the master sheet apart from the carbon member 13.

When the master and carbon are separated the master will carry the image with a coating of carbon dyes thereon. One possible explanation of how this occurs follows; however, it is not intended to limit the scope of this invention, nor is it intended to be the only possible explanation of what has occurred. The powder image when tacky will readily adhere to a surface presented to it and the tacky image is presented to the two surfaces in which it is sandwiched, that is the master sheet and carbon member 13. It is felt that the image is transferred to the master sheet and carries with it dye in that the carbon dye will more readily adhere to the tacky image, when it solidifies, than to the backing of the carbon member, and the tacky image will more readily adhere to the master sheet than to the carbon backing member. In this sense the image is transferred to the master sheet and the image carries with it

a layer or coating of carbon dye and a master according to the preferred embodiment of this invention is produced. It is thought that the image is fused between and to the master sheet and the duplicating dye.

In another embodiment of this invention, sheet 13 which was the carbon member described above is replaced by the master sheet and the powder image is transferred to the master sheet from the surface on which it rests after being formed instead of being initially transferred to the carbon member. The master sheet is then carried through the many steps that the carbon member was carried through, which includes placing the master sheet in the tackifier and causing the powder image to be made tacky either in an open or in a sandwich position and preferably in the sandwich position. In this embodiment, as in the others, a sandwich of the master sheet carrying the tackified image on which rests the carbon member is subjected to even pressures. This again is the transfer step, causing the carbon dye to be drawn on top of the image body which will solidify on the master sheet and includes the time delay and then the separation of the master sheet and the carbon member, at which time a master has been produced for duplicating processes.

In another embodiment of this invention the powder image is transferred to either the carbon or the master sheet acting as a separate element or as a part of the master unit. The image is then sandwiched between the carbon member and the master sheet, and the sandwich is subjected to an even spray of corona discharge thereby tacking the outer elements, the carbon member and the master sheet, together, due to electrostatic forces. This sandwich is then placed in fusing tank 20 of tackifier 18 and the powder image is allowed to tackify for the preferred amount of time. On removal from the tackifier the sandwich may be subjected to even pressures as in other embodiments of this invention and then may be allowed to stand for the proper delay time before the separation is accomplished. In this case, however, if the electrostatic forces holding the sandwich together are strong enough, they may include the function of the pressure step and the pressure step may be omitted and the sandwich removed from the tackifier may be allowed to stand for the proper delay time and then separated.

In another embodiment of this invention a xerographic image is transferred using conventional steps of xerography to the master sheet which in this instance is a separate element not connected to a carbon. The master sheet carrying the powder image is then exposed to vapors in the tackifier causing the image to become tacky. Immediately following the tackifying stage a dye of value in duplicating processes is dusted over the surface of the master sheet carrying the tacky image and the dye will adhere and form as a part of the image body. When the image body solidifies, it will carry a layer of dye on its surface which may then be used for producing multiple copies.

Another method of forming a master for duplicating processes is to develop the xerographic latent image with developer material composed of a mixture of conventional xerographic developers and dyes of value in the duplicating process. This developed image is then transferred to the master sheet and the master sheet is heat fused or is inserted in the tackifier and then removed and allowed to stand until the tacky image solidifies forming an image body of which a portion thereof is composed of dyes which will produce multiple copies.

As an example for the need of a right reading image 11 or a mirror reverse reading image 12 in the first instance as is shown in FIG. 1, it is pointed out that in producing a gelatin or like hectograph master a right reading image body carrying carbon dye is placed on a gelatin surface, the gelatin surface carrying dye to act as the master for reproduction, while for spirit duplication a mirror reverse image carrying dye acts as the master itself. In these examples it is necessary to determine first what type of a

master is being made and if it is desired to form a mirror reverse image carrying dye, this may be accomplished by forming the original image in mirror reverse reading form transferring this image to the carbon member and then transferring the image from the carbon member to the master sheet carrying with it carbon dye, or in some of the other ways described. If it is desired to form a right reading image carrying dye this may be accomplished by carrying out the steps just described except that the original image formed should be a right reading rather than a mirror reverse reading image. A direct reading image may be formed by optical systems such as prisms, or the like, and may be also accomplished by transferring an original mirror reverse reading image to the master sheet rather than to the carbon member and then carrying out the steps of this invention or through some of the other methods described.

It is to be noted that in many of the modern processes of duplication, the master sheet produces multiple copies through the removal from the master of small portions of the reservoir of dye residing in image areas. When all the dye is removed using conventional processes, the master sheet must be discarded. Using the processes of this invention the master sheet may be reused. When all the dye has been removed from image areas using a master made according to the processes of this invention a solid image body remains. This image body may be retackified and when sandwiched against another carbon member and subjected to pressure the image body will draw a new coating of carbon dye onto itself. This step of rejuvenating a used master sheet may be accomplished a number of times. This rejuvenation process allows for the use of a master for many times the number of copies which are possible using duplicating processes before the advent of this invention.

It has also been found that when a master for duplicating processes is produced with undesirable background, the background may be removed by contacting the areas of undesirable background of the master sheet with solvent for the carbon dye. This may be done by rubbing the back of the master with cotton saturated with a solvent for the carbon dye or through any other means such as for example exposure of the master to vapors of the solvent in an apparatus similar to tackifier 18 or the like whereby all areas are contacted with the solvent. Carrying out such a step the background particles dissolve into the master and do not reproduce on the copies produced. The image areas remain unaffected in that they are generally separated from the master somewhat by the powder image resting on the master surface; however, a beneficial effect has been noticed in that small amounts of dye have been removed from the periphery of the image areas thereby causing sharper images to result. Where removal of background is carried out during the making of a hectograph master, this step is carried out before the dye is transferred to the gelatin surface.

A surprising and beneficial result of the invention is a readily apparent superiority in quality of reproduction as contrasted to conventional methods of forming duplicating masters. It is common experience in the art that fine lines and letters become blurred or smeared, particularly when these lines or letters are formed by typing or drawing on the master with the use of a duplicating carbon member. In the case of the present invention substantially finer resolution and evenness of image is achieved.

It is pointed out that in describing this invention a sheet which will eventually carry an image on which rests a layer of carbon dye has been referred to generally as the master sheet. This sheet is the master for some process such as spirit duplicating, and the like. In the description of other processes such as for example in the production of a hectograph gelatin master, and the like, this sheet is used during intermediate stages, and yet in this application it has been spoken of as the master sheet.

While this invention has been described in terms of manually performed steps, and in terms of certain embodiments which have been shown and described, it is to be understood that automatic and semiautomatic devices as well as other modifications, which will be easily recognized by those skilled in the art, are intended to be encompassed without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. In a process for the production of a master for duplicating processes the steps comprising forming a tackifiable powder image on a member bearing a film of duplicating dye, said powder image being formed on said film, tackifying said image, pressing said tackified image to a master sheet while said image is in contact with said member, solidifying the image in contact with the master sheet and said member to form an adhesive bond therebetween, and separating said member from said master sheet forming on said master sheet a fused solid image bearing a film in image formation of duplicating dye.

2. The process for the production of a master for duplicating processes comprising forming a tackifiable powder image on a master sheet, exposing said image on said master sheet to vapors of a liquid in which said image is soluble to make said image tacky, transferring duplicating dye to said image by pressing said image on said master sheet while tacky against a member bearing a film of duplicating dye with said tacky image between said film and said master sheet, allowing said image to become adhesively bonded therebetween, and separating said member from said master sheet forming on said master sheet a fused solid image bearing a film in image formation of duplicating dye.

3. The method for producing a duplicating master comprising forming a tackifiable powder image on a surface, transferring said image to the dye-bearing member of a master set, said dye-bearing member having a film of duplicating dye, exposing said image on said dye-bearing member to a vapor of a tackifier for said image to make said image tacky, pressing said dye-bearing member against the master sheet of said master set with said tacky image therebetween, allowing said image to become adhesively bonded therebetween, and removing said dye-bearing member from said master sheet forming on said master sheet a fused image bearing in image configuration a film of duplicating dye.

4. The method for producing a master to be used for making multiple copies comprising placing a xerographic developed tackifiable powder image on a dye-bearing member of a spirit duplicating master unit comprising a dye-bearing member and a master sheet, said dye-bearing member having a film of duplicating dye, placing the master unit in a sandwich formation by closing the master sheet over the image on said dye-bearing member and then positioning said master unit in said sandwich formation in a concentrated atmosphere of solvent for said image thereby causing the xerographic developed image to tackify, subjecting the sandwich to uniform pressure within about 5 seconds after removal from said concentrated atmosphere of solvent for said image, adhesively bonding said image therebetween by allowing said solvent for said image, which has been absorbed by said image, to evaporate, and separating the master sheet of said master unit from said dye-bearing member forming on said master sheet a fused image bearing in image configuration a film of duplicating dye.

5. A method for the production of duplicating masters comprising xerographically forming a latent image of copy to be reproduced, developing said latent image with vapor fusible particles, transferring said particles in image form to a member having a film of duplicating dye, exposing said particles on said member to a concentrated atmosphere of solvent for said particles thereby tackifying said particles in image form on said member, subjecting

a sandwich comprising said member carrying said tackified image over which is positioned and disposed a master sheet to uniform pressure, adhesively bonding said tackified image in contact with said member and said master sheet, and separating said member from said sandwich forming on said master sheet a fused image conforming to said latent image and bearing on its outer surface a film of duplicating dye in image configuration.

6. The method for producing a duplicating master comprising forming a tackifiable resin powder image on a surface, transferring said image to the dye-bearing member of a master set, said dye-bearing member bearing a film of duplicating dye, forming a sandwich of said master set, said sandwich comprising positioning and disposing the master sheet of said master set against said resin image on said dye-bearing member, subjecting said master set in said sandwich formation to an electrostatic charge, exposing said electrostatically charged sandwich to vapors of a tackifier for said resin image, allowing said resin image to become adhesively bonded in said sandwich and then separating said dye-bearing member from said master set forming on said master sheet a solid fused resin image bearing on its outer surface a film of duplicating dye in image configuration.

7. The process for the production of a spirit duplicating master comprising placing a developed xerographic resin image on the dye-bearing member of a master set, said resin image being tackifiable by exposure to trichloroethylene vapors, said dye-bearing member having a film of spirit duplicating dye, exposing said master set in a sandwich formation having said image sandwiched between said dye-bearing member and the master sheet of a master set to trichloroethylene vapors for from about 10 seconds to about 2½ minutes, forming an adhesive bond between the tackified image and each of said dye-bearing member and said master sheet by subjecting said sandwich to substantially linear forces of from about 5 to about 20 pounds per linear inch within about 5 to about 20 seconds after removal from exposure to said vapors, and separating said dye-bearing member from said master sheet after a minimum standing time of about 30 seconds after said master set has been subjected to said forces thereby forming a master for duplicating processes on said master sheet of said image carrying film portions of spirit duplicating dye.

8. The process for the production of a spirit duplicating master comprising transferring electrostatically a developed xerographic resin image to the dye-bearing member of a master set comprising a master sheet and a dye-bearing member having a film of spirit duplicating dye, said resin image being characterized by its ability to become tackified when exposed to trichloroethylene vapors, exposing said master set in a sandwich formation comprising positioning and disposing the master sheet of said master set against said transferred image on said dye-bearing member to trichloroethylene vapors for about 45 seconds, forming an adhesive bond between the tackified image and each of said dye-bearing member and said master sheet by subjecting said sandwich to substantially linear forces of about 10 to about 15 pounds per linear inch within about 5 seconds after said sandwich has been removed from exposure to said vapors, and separating said dye-bearing member from said sandwich about 45 seconds after said master set has been subjected to said forces, thereby forming a master for duplicating process on said master sheet of said image carrying film portions of spirit duplicating dye.

9. The method for producing a duplicating master comprising forming a fused tackifiable xerographic image on a master sheet, subjecting said master sheet carrying said fused xerographic image to vapors of a tackifier for said image to render said image tacky, pressing a member carrying a film of duplicating dye against said master sheet carrying said tacky image, and after said image becomes adhesively bonded to said film removing said mem-

ber from said image on said master sheet to form on said master sheet a fused xerographic image bearing a portion of said dye film in image configuration.

10. In a process of producing a duplicating master, the steps comprising tackifying a resin image by contacting said tackifiable image with vaporized solvent for said image, pressing said image while tacky between a master sheet and a member having a film of duplicating dye, allowing the tackified image to adhesively bond between said member and said master sheet, and then removing said member from the bonded image forming on said master sheet a solid image bearing on its outer surface a portion of said dye film in image configuration.

11. The method of adding a film of material to a developed xerographic image of powdered tackifiable material comprising tackifying the tackifiable powder image on a support base, pressing said tacky image between said support base and a releasable continuous film of material on a film transfer member, allowing the tackified image to solidify while between said support base and said film to form an adhesive bond therebetween, and then removing said film transfer member away from said support base and said solidified image forming on said solidified image on said support base a film of material in image configuration.

12. A method of producing an imaged hectograph master on a flexible master sheet by use of a transfer sheet coated with a transferable layer of copy-producing material including the steps of:

- (a) producing on a plate a latent electrostatic image of the copy to be reproduced;
- (b) developing said latent image with an electroscopic powder tackifiable by solvent to form a powder image of said copy;
- (c) transferring said powder image from said plate to one of said sheets;
- (d) superposing said sheets so that the powder image is in intimate contact with the master sheet and the transferable layer of the transfer sheet and subjecting the powder image to vapor of a solvent therefor to render it tacky;
- (e) permitting the tackified powder image to solidify and bond to the master sheet and to the transferable layer of the transfer sheet; and
- (f) stripping the sheets apart; whereby those portions of the transferable layer which have been bonded to the solidified image on the master sheet are separated from the transfer sheet to produce an imaged hectograph master.

13. A method of producing a spirit duplicating master sheet by use of a transfer sheet coated with a transferable layer of copy producing material comprising:

- (a) forming a tackifiable powder image on one of said sheets;
- (b) tackifying the powder image;
- (c) while the image is in its tackified state causing said sheets to be superposed so that the powder image is in intimate contact with the master sheet and the transferable layer of the transfer sheet;
- (d) permitting the tackified powder image to solidify and bond to the master sheet and to the transferable layer of the transfer sheet; and,
- (e) stripping the sheets apart whereby those portions of the transferable layer which have been bonded to the solidified image on the master sheet are separated from the transfer sheet to produce a spirit duplicating master.

14. A method of producing a spirit duplicating master sheet by use of a transfer sheet coated with a transferable layer of copy producing material comprising:

- (a) tackifying a previously untackified image of copy supported sandwiched in intimate contact between a master sheet and the transferable layer of a transfer sheet;
- (b) permitting the tackified image to adhesively bond

to the master sheet and to the transferable layer of the transfer sheet; and,

- (c) stripping the sheets apart whereby those portions of the transferable layer which have been bonded to the image on the master sheet are separated from the transfer sheet to produce a spirit duplicating master.

15. A method of producing an image duplicating master sheet for the reproduction of copy comprising:

- (a) tackifying a previously untackified image of copy supported sandwiched in intimate contact between a first support material and a second support material, one of which is formed of a material that is selectively adhesively detachable from the remainder of material comprising said support;
- (b) permitting the tackified image to adhesively bond to each of said support materials; and,
- (c) stripping the sheets apart whereby those portions of the detachable support material which have been bonded to the image are transferred with the image to said other support material.

16. A method of producing an image duplicating master sheet for the reproduction of copy comprising:

- (a) superposing in contacting non-tacky relation a transfer sheet coated with a transferable layer of copy producing material and a sheet base for a duplicating master sheet;
- (b) causing tackification between said sheets in image configuration of copy to be duplicated;
- (c) permitting the tackified image to solidify and become adhesively bonded to the master sheet and to the transferable layer of the transfer sheet; and,
- (d) stripping the sheets apart whereby those portions of the transferable layer which have been bonded to the solidified image on the master sheet are separated from the transfer sheet to produce a spirit duplicating master.

17. The method of affixing a predetermined pattern of pattern forming material to a supporting material comprising the steps of:

- (a) forming a powder particle coated reproduction of the predetermined pattern on one of a pair of superposable sheets, said powder particle coating including a material capable of being tackified and subsequently hardened, said pair of superposable sheets including a first sheet having a uniform coating of detachable coherent pattern forming material and a second sheet of firmly coherent supporting material;
- (b) superposing said pair of sheets, tackifying said powder particles to a degree to adhere to the material of both of said superposed sheets;
- (c) permitting said tackified powder particles to harden to form a bond between the materials of said superposed sheets; and,
- (d) separating said superposed sheets, whereby an area of pattern forming material corresponding to the area of the predetermined pattern is separated from the sheet of pattern forming material and is affixed to the sheet of supporting material.

18. The method of affixing a predetermined pattern of pattern forming material to a supporting material comprising the steps of:

- (a) forming such predetermined pattern on a first surface;
- (b) coating said pattern with a powdered material capable of being tackified and subsequently hardened;
- (c) transferring the thus-formed pattern of powdered material to one of a pair of superposable sheets, said pair including a first sheet having a uniform coating of detachable coherent pattern forming material and a second sheet of firmly coherent supporting material;
- (d) superposing said pair of sheets;
- (e) tackifying said powdered material to a degree to adhere to the material of both said superposed sheets;

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- (f) permitting said tackified powdered material to harden to form a bond between the materials of said superposed sheets; and,
- (g) separating said superposed sheets, whereby an area of pattern forming material corresponding to the area of the predetermined pattern is separated from the sheet of pattern forming material and is affixed to the sheet of supporting material. 5
19. The method of affixing a predetermined pattern of pattern forming material to a supporting material comprising the steps of: 10
- (a) forming an electrostatic image of such predetermined pattern on a xerographic plate;
- (b) coating said pattern image with a powdered material capable of being tackified and subsequently hardened; 15
- (c) transferring the thus-formed pattern of powdered material to one of a pair of superposable sheets, said pair including a first sheet having a uniform coating of detachable coherent pattern forming material and a second sheet of firmly coherent supporting material; 20
- (d) superposing said pair of sheets;
- (e) tackifying said powdered material to a degree to adhere to the material of both said sheets; 25
- (f) permitting said tackified powdered material to harden to form a bond between the materials of said sheets; and,
- (g) separating said sheets, whereby an area of pattern forming material corresponding to the area of the predetermined pattern is separated from the sheet of pattern forming material and is affixed to the sheet of supporting material. 30
20. The method of forming a predetermined dye pattern on a spirit duplicating master sheet comprising the steps of: 35
- (a) forming an electrostatic image of such predetermined pattern on a xerographic plate;
- (b) coating said pattern image with a powdered resinous material capable of being tackified and subsequently hardened; 40
- (c) transferring the thus-formed pattern of powdered material to the dye layer of the carbon sheet of a duplicating set;
- (d) superposing a master sheet on the dye layer of said carbon sheet; 45

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- (e) tackifying said powdered material to a degree to adhere to the material of both said sheets;
- (f) permitting said tackified powdered material harden to form a bond between the materials of said sheets; and,
- (g) separating said sheets, whereby an area of the dye layer corresponding to the area of the predetermined pattern is separated from the carbon sheets and is affixed to the master sheet.
21. A method for the reproduction of copy comprising
- (a) superposing in contacting non-tacky relation a transfer sheet coated with a transferable dye containing layer and a sheet base on which copy is to be reproduced;
- (b) causing tackification between said sheets in copy image configuration;
- (c) permitting the tackified image to solidify and become adhesively bonded to the copy sheet and to the transferable dye layer of the transfer sheet; and,
- (d) stripping the sheets apart whereby those portions of the transferable dye layer which have been bonded to the copy sheet are separated from the transfer sheet to the copy sheet.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,143,066

August 4, 1964

Lewis E. Walkup

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 2, before "indirectly" insert -- or --;
line 32, for "preefrably" read -- preferably --; column 14,
line 3, after "material" insert -- to --; line 8, for "sheets"
read -- sheet --.

Signed and sealed this 30th day of March 1965.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents