

Oct. 8, 1957

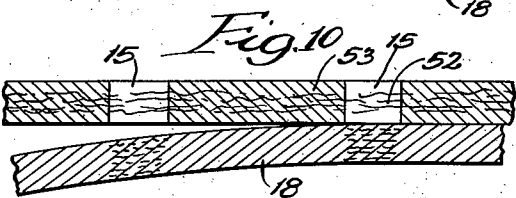
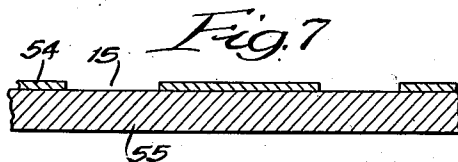
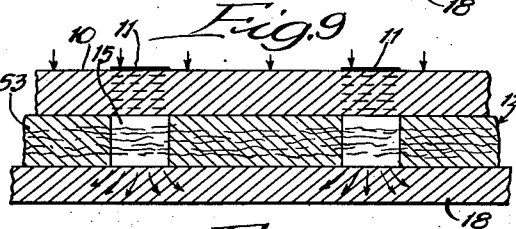
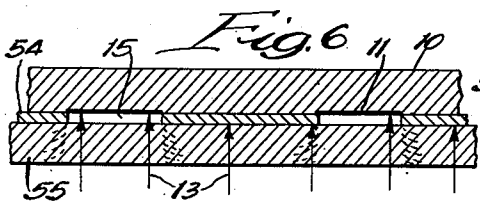
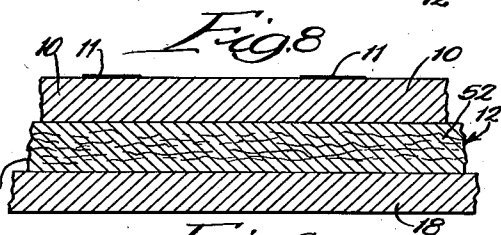
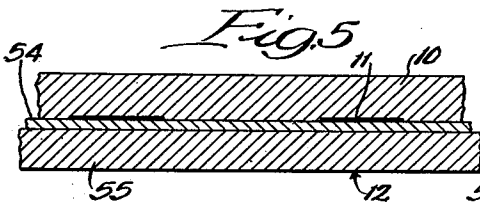
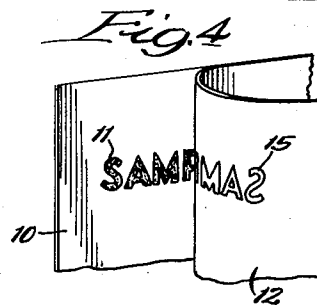
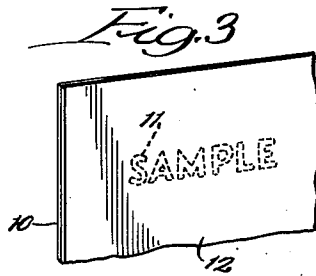
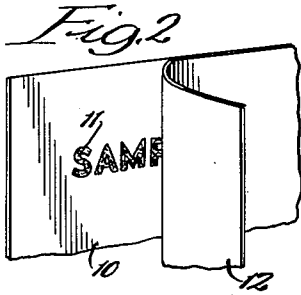
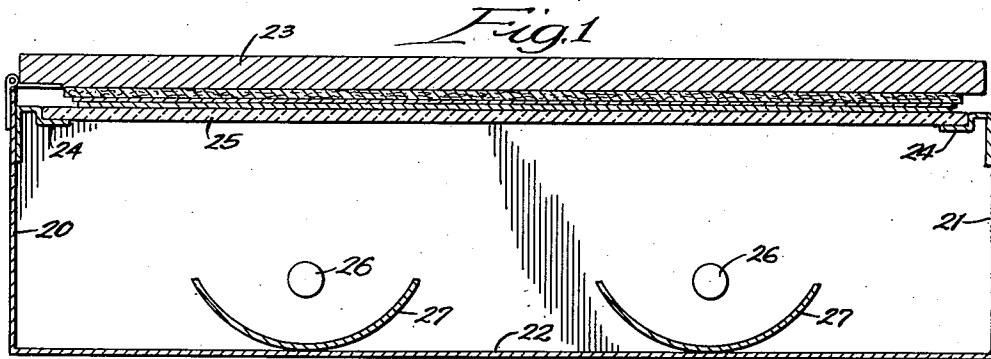
A. I. ROSHKIND

2,808,777

METHOD FOR MANUFACTURING DUPLICATING MASTERS

Filed Feb. 26, 1952

4 Sheets-Sheet 1



INVENTOR:
Atlan I. Roskind,
BY
Dawson & Orms,
ATTORNEYS.

Oct. 8, 1957

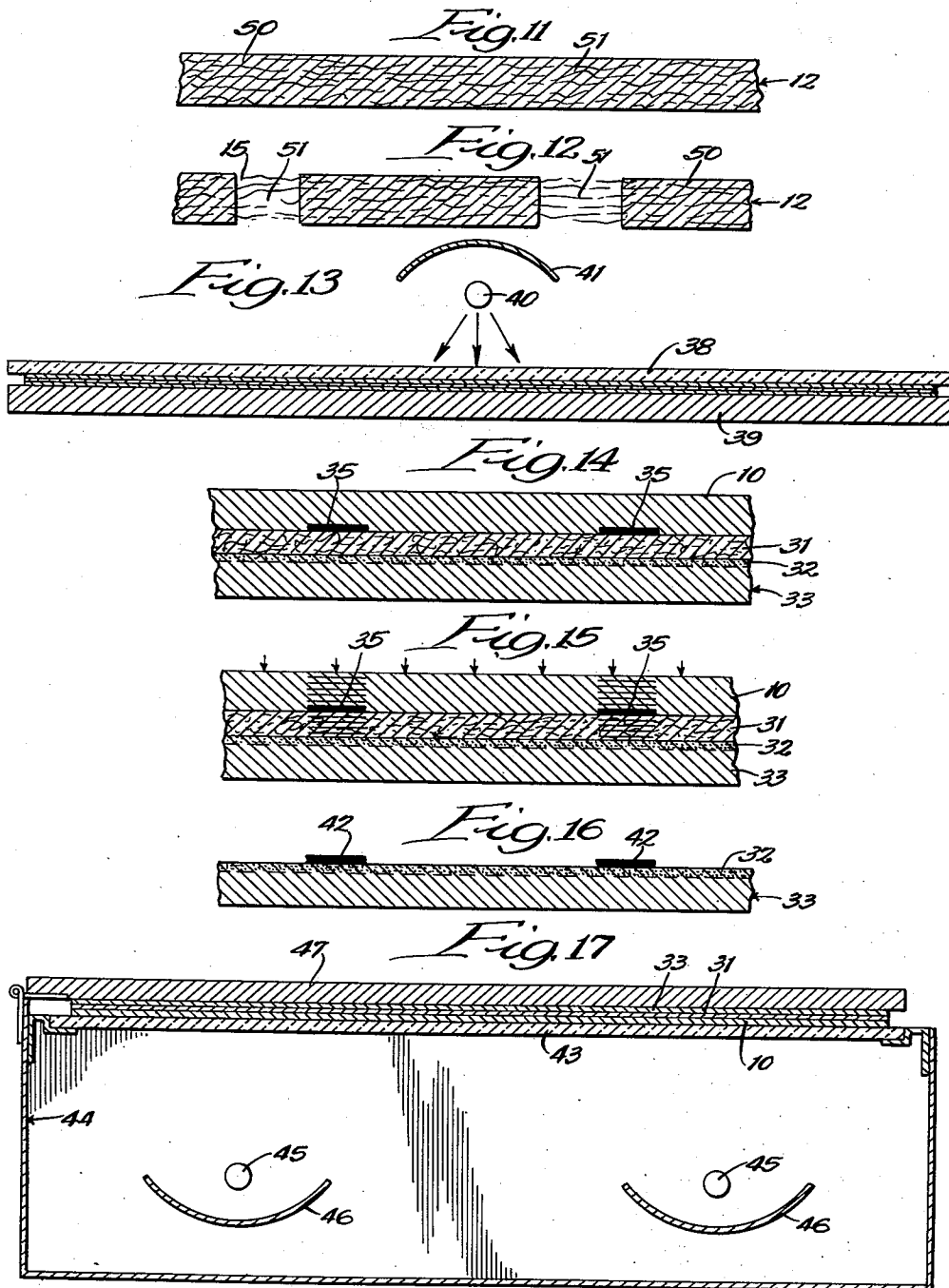
A. I. ROSHKIND

2,808,777

METHOD FOR MANUFACTURING DUPLICATING MASTERS

Filed Feb. 26, 1952

4 Sheets-Sheet 2



INVENTOR:

Atlan I. Roskind,

BY

Dawson & Oome,

ATTORNEYS.

Oct. 8, 1957

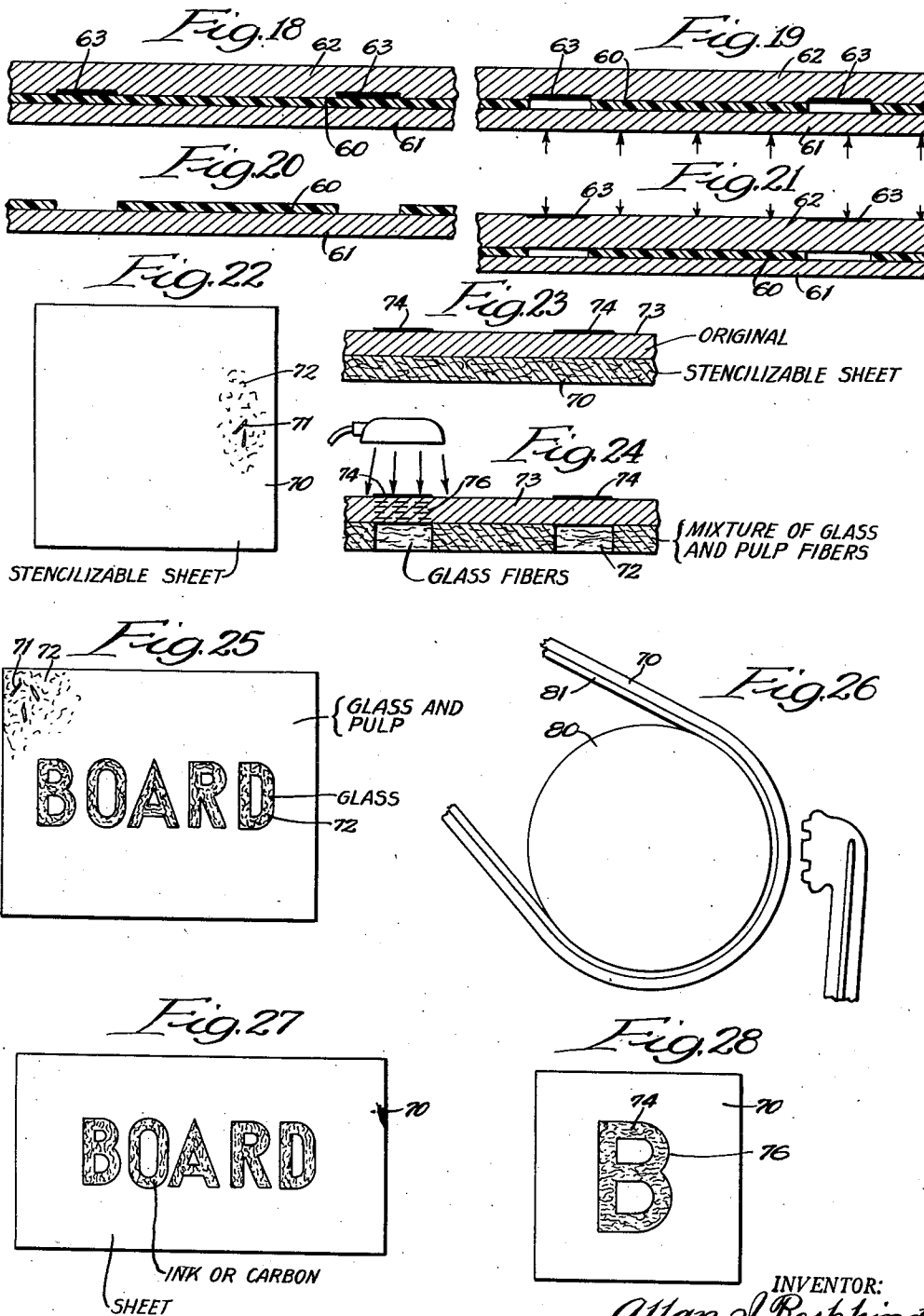
A. I. ROSHKIND

2,808,777

METHOD FOR MANUFACTURING DUPLICATING MASTERS

Filed Feb. 26, 1952

4 Sheets-Sheet 3



INVENTOR:
Atlan I. Roskind
BY
Dawson & Ooms
ATTORNEYS.

Oct. 8, 1957

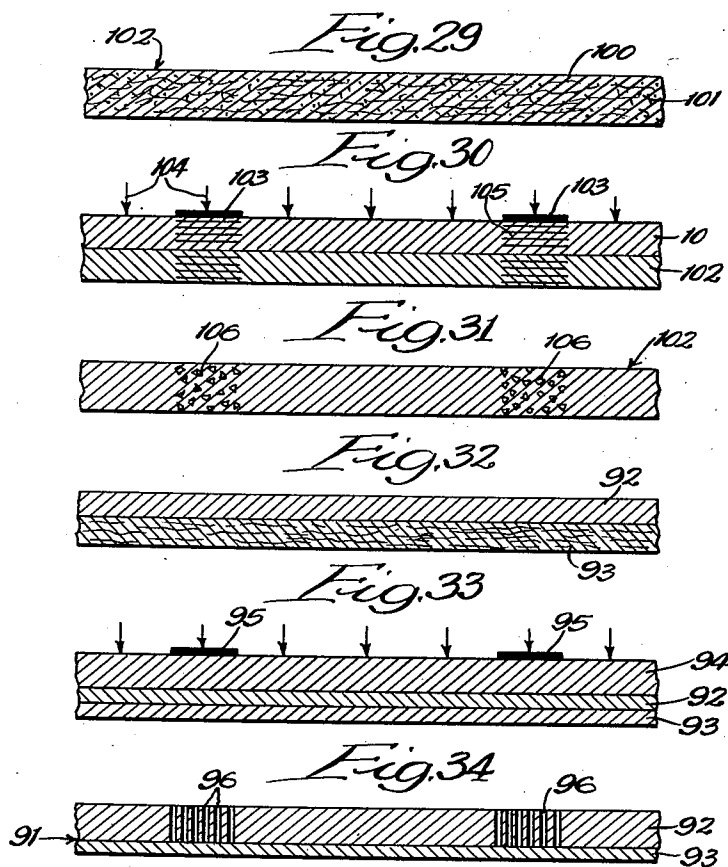
A. I. ROSHKIND

2,808,777

METHOD FOR MANUFACTURING DUPLICATING MASTERS

Filed Feb. 26, 1952

4 Sheets-Sheet 4



INVENTOR:
Atlan I. Roskind,
BY
Dawson & Coine,
ATTORNEYS.

1

2,808,777

METHOD FOR MANUFACTURING DUPLICATING MASTERS

Allan I. Roshkind, Glenview, Ill., assignor to A. B. Dick Company, Niles, Ill., a corporation of Illinois

Application February 26, 1952, Serial No. 273,530

3 Claims. (Cl. 101—128.2)

This invention is in a new method for producing duplicating masters and to structures for use in manufacturing same. More particularly it relates to structures and methods for manufacturing stencil duplicating masters, lithograph duplicating masters, hectograph duplicating masters and the like.

Duplicating masters of the type described are generally manufactured of a base sheet which, in the case of a stencil, is coated with an ink impervious composition capable of being displaced by the application of force to form stencil openings through which ink may pass, and in the case of a lithograph or hectograph master, is provided with an image on the surface for the reproduction of inked copies. Common with duplicating masters of the type described is the necessity for inscribing upon the masters by stylus, pen, typewriter keys, die impression or the like to form the stencil openings or the reproducible image thereon. Reproduction of copy directly from an original is not readily adapted for the preparation of stencil duplicating masters and photographic techniques or other similar indirect methods are required in forming an image on lithograph or hectograph masters.

It is an object of this invention to provide a method for preparing duplicating masters of the type described directly from an original and it is a related object to provide new articles of manufacture for use in same.

Another object of this invention is to provide a method for producing a stencil duplicating master directly from an original and it is a related object to produce structures for use in the manufacture of same.

A further object is to provide a new method for producing an imaged lithograph master directly from an original and it is a related object to produce structures for use in producing same.

A still further object is to provide a method for producing an imaged hectograph master directly from an original and it is a related object to produce articles of manufacture for use in producing same.

More specifically, it is an object of this invention to produce and to provide a method for producing a duplicating master directly from an original for the reproduction of exact copies without the necessity for having extensive equipment, without the use of chemicals or the like for developing the image thereon, and with immediate visibility for determining the character of the image and the quality and exactness of the reproduction capable of being produced therewith.

An important object of this invention is to provide a method and structures for use in the preparation of a duplicating master directly from an original with equipment that can be packaged in a small container for ready transportation from place to place and for use in immediate preparation of the duplicating master without the necessity of removing the original from its normal location and with power that can be made available practically anywhere.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustra-

2

tion, but not of limitation, embodiments of the invention are shown in the accompanying drawings in which—

Figure 1 is a sectional elevational view of a device which may be used in the preparation of a duplicating master in accordance with this invention;

Figure 2 is a fragmentary perspective view showing the arrangements of parts used in the practice of this invention;

Figure 3 is a perspective fragmentary view illustrating the preparation of a stencil with the assembly shown in Figure 2;

Figure 4 is a fragmentary perspective view similar to that of Figures 2 and 3 illustrating the removal of a stencil prepared in accordance with the practice of this invention;

Figures 5-10 are sectional elevational views illustrating the concepts of this invention with the different arrangements of elements to form the stencil sheet;

Figure 11 is an enlarged sectional view of a base sheet which may be used in accordance with the practice of this invention;

Figure 12 is a sectional elevational view of the base sheet shown in Figure 11 after stenciling operations in accordance with the practice of this invention;

Figure 13 is a schematic sectional elevational view showing the arrangement of elements for the production of an imaged lithograph or hectograph master in accordance with the technique of this invention;

Figure 14 is an enlarged sectional elevational view of the elements shown in Figure 1 from which the imaged lithograph or hectograph master is produced;

Figure 15 is an enlarged sectional elevational view corresponding to that of Figure 2 illustrating a step in the manufacture of a lithograph or hectograph master;

Figure 16 is an enlarged sectional elevational view of the imaged lithograph or hectograph master formed in accordance with the practice of this invention;

Figure 17 is a sectional elevational view diagrammatically illustrating a modification in the arrangement of elements for the preparation of a lithograph or hectograph master in accordance with the concepts of this invention;

Figure 18 is an enlarged sectional elevational view of a fragment of an assembly for forming a stencil sheet in accordance with the practice of this invention;

Figure 19 is an enlarged sectional elevational view corresponding to that of Figure 18 illustrating the method of forming the duplicating stencil;

Figure 20 is a sectional elevational view corresponding to that of Figure 19 showing the stencil which is formed separate and apart from its assembly;

Figure 21 is a sectional elevational view showing a modification in the arrangement of parts for manufacturing a stencil in accordance with the practice of this invention;

Figure 22 is a top plan view showing a modification in a stencilizable sheet embodying features of this invention;

Figure 23 is a sectional elevational view illustrating the use of the stencilizable sheet shown in Figure 22 in the preparation of a stencil directly from an original;

Figure 24 is a sectional elevational view corresponding to that of Figure 23 illustrating reactions which occur during stencil manufacture;

Figure 25 is a top plan view of a stencil sheet formed in response to the steps shown in Figures 22-24;

Figure 26 is a schematic elevational view showing the stencilizable sheet of Figure 22 in position for receiving the letter outlines applied directly thereto;

Figure 27 is a top plan view of the stencilizable sheet processed in accordance with the arrangement shown in Figure 26;

Figure 28 is a top plan view of the stencilized sheet of Figure 27;

Figure 29 is an enlarged sectional elevational view of

a modification in a sheet capable of stencil preparation in accordance with the practice of this invention;

Figure 30 is a sectional elevational view schematically illustrating the preparation of a stencil from the sheet shown in Figure 29;

Figure 31 is an enlarged sectional elevational view similar to that of Figure 29 illustrating stencil openings formed therein by the process illustrated in Figure 30;

Figure 32 is an enlarged sectional elevational view of a still further modification in a stencilizable sheet which may be processed in accordance with the practice of this invention;

Figure 33 is a sectional elevational view illustrating the preparation of a stencil from the sheet shown in Figure 32; and

Figure 34 is an enlarged sectional elevational view of the stencilizable sheet shown in Figure 32 with the stencil openings formed therein by the process illustrated in Figure 33.

Briefly described, invention resides in the manufacture of a duplicating master by positioning an original of which copies are desired in surface contact with a base sheet comprising a substantially continuous layer formed of material displaceable at elevated temperatures and then directing a sufficient quantity of radiations rich in infra red onto the original to generate a heat pattern and cause displacement of the heat displaceable material directly to the base sheet to form the corresponding printing areas in the duplicating master.

As used herein, the term "displaceable" or "displacement" relates to materials in which some movement is evidenced responsive to heating at elevated temperatures, such for example as by reduction of the material from solid state to fluid consistency enabling flow of heated portions to adjacent areas of the same sheet or to surfaces in contact therewith to form a stencil, a lithograph master, or a hectograph master; or by contraction or molecular rearrangement in a substantially continuous film of resinous or plastic material when heated to plastic stage to form a network of apparently connected resinous islands with openings therebetween through which ink may pass; or by substantially complete removal of material, as by elimination of heat disposable fibers or by volatilization of ingredients in whole or in part of a substantially continuous layer; or to change the physical character of the heated portions of a substantially continuous layer in a manner to permit transmission of ink or other material therethrough; or by physical change to shift a substantially non-crystalline, continuous film forming material into crystalline or particle form and introduce porosity to permit transmission of ink composition therethrough; or by similar action which by physical or chemical change causes movement of material from one form to another or elimination thereof, in whole or in part.

For use in the manufacture of a stencil or for use in the preparation of an imaged lithograph or hectograph master, the base sheet is formed with a substantially continuous layer of a fluid impervious material or composition reducible to flowable condition at elevated temperature. It is preferred, however, especially in the preparation of a stencil, that the substantially continuous layer 50 which is reducible to flowable condition at elevated temperature be reinforced with fibers 51 distributed in haphazard arrangement throughout the layer (Figures 11 and 12). Instead, the fibers may be provided in the form of a highly porous web or tissue 52, such as a porous stencil base tissue which is substantially completely impregnated with the composition 53 which is solid at room temperature but reducible to flowable condition at elevated temperatures (Figures 8-10), or the substantially continuous layer may comprise a coating 54 applied to one surface of a fibrous base sheet 55 substantially completely to fill the interstices (Figures 5-7).

In the manufacture of a sheet for preparation of a

stencil, material for use as a base of the composition forming the substantially continuous layer of heat displaceable material may be selected of bituminous substances and preferably waxy components thereof such as natural waxes of the type beeswax, ceresin wax, carnauba wax, Japan wax, ozokerite, esparte wax and the like, or petroleum waxes of the type paraffin wax, petrolatum, or the like. In order to secure a relatively sharp melting point adapted to give better definition to the formation of the printing image by displacement of the material for the production of copy of good quality, it is desirable to select the waxy component or fractions thereof to provide for a rather sharp melting point at a temperature within the range capable of being developed in the heat pattern.

Instead of basing the selection of materials entirely upon melting point, improvement in the operating characteristics of the waxy base and adjustment for desirable melting range may be achieved by a combination of the bituminous or waxy substance and modifying agents such as plasticizers, fluidizing agents, or lubricating agents or combinations thereof including fatty acids such as stearic acid, palmitic acid, oleic acid, tallow acids and hydrogenated derivatives thereof and the like; or oils such as mineral oil, petroleum oil, and vegetable oils including palm oil, peanut oil, cottonseed oil, olive oil and hydrogenated oils and other fatty acid glycerides and the like; or fatty acid esters and amides such as amyl stearate, stearamide, pentaerythritol stearate and the like. Since the temperatures capable of being developed by radiation of the original in accordance with the practice of this invention may range from about 200° F. to 1000° F. or more, depending upon the absorbency of the material in the original, the intensity of the infra red radiations and the time of exposure, it is preferred to formulate the base for a composition having a melting point above room temperature and preferably above 200° F. but below about 1000° F.

Instead of bituminous materials, natural resins such as rosin, hydrogenated rosin, rosin esters, copal, coumarone indene resins, dammar, polyterpenes and Vinsol, which is the residue left from the extraction of pinewood pitch, may also be used with or without plasticizer or other modifying agents to give the desired operating characteristics for application in fabrication of the base sheet and melting characteristics in use thereof. Combinations of bituminous and natural resins with or without modifiers may also be used. Use may also be made of synthetic polymeric materials capable of fluid flow at elevated temperatures such as the polyamides (nylon), acrylic acid ester derivative polymers such as polyethylacrylate, butyl methacrylate and the like, polystyrene of relatively low molecular weight (20,000 to 75,000) and the like, with or without plasticizers or other softening agent.

In fabrication, the fibrous reinforcement may be introduced directly into the composition with which the substantially continuous layer is to be formed and the mixture cast into a film and set either by solidification upon cooling, when applied as a hot melt, or by the elimination of diluent preferably at elevated temperature, if applied from solution or dispersion. It will be apparent that various methods well known in the art may be employed in the production of the base sheet. When applied to an already formed web of fibrous material, application may be made by way of a hot melt, aquasol, plastisol solution or dispersion to secure substantially complete impregnation. More than one application may be necessary when applied from solution or dispersion in concentrations as low as 10-30 percent by weight solids in order to secure continuity sufficient to resist passage of ink.

In practice, base sheets having a thickness ranging from 0.5-5 mils thickness have been found to be sufficient. In the event that the ink impervious material forming the substantially continuous layer merely con-

stitutes a coating applied onto a fibrous web, film thicknesses ranging from 2-5 mills will be sufficient.

Fibers suitable for dispersion with the heat displaceable material in forming the base sheet may be selected of the common cellulose fibers such as ethyl cellulose, wood pulp, cotton, wool, hemp, abaca and the like but it is preferred to make use of inorganic fibers insensitive to heat such as glass fibers, mineral wool fibers, asbestos fibers or the like, or combinations of such fibers. Ordinarily from 5-20 percent by weight fibers based upon the amount of sheet stock may be sufficient. When a stencil base tissue is used, the amount of fiber may increase and the base sheet may be formed of one or more of the fibrous systems described or of Kozu fiber which is often used in the manufacture of stencils.

The following are given by way of illustration of treating compositions which may be used in the preparation of a stencil base sheet assembly embodying features of this invention:

Example 1

Paraffin wax, melting point 115° F.

Example 2

	Percent by weight
Ethyl cellulose -----	3.5
Ceresin wax -----	25.8
Stearic acid -----	51.4
Amyl stearate -----	9.7
Hydrogenated cottonseed oil -----	9.7

In forming the base sheet with one or the other of the above compositions by impregnation of the base tissue, treatment may be effected by application of the coating compositions in the form of a hot melt in a conventional dip squeeze process. Substantially complete impregnation and filling of interstices between the fibers is achieved to provide a substantially continuous layer of the waxy composition. Instead of a dip squeeze process or the like, the composition may be applied as a hot melt by roller coating technique or by knife coating with a resultant heavier concentration or film formed on one face of the sheet with lesser amount of impregnation. When cooled to room temperature, a flexible sheet is secured which has been found suitable for stenciling operations in accordance with the concepts of this invention.

In a further example embodying a preferred concept in the manufacture of a base sheet for use in the manufacture of stencils, lithograph masters or hectograph masters, a composition is formed with 45 percent by weight paraffin wax melting point 125° F., 22 percent by weight paraffin wax melting point 132° F., 23 percent by weight ceresin wax, and 10 percent by weight hydrogenated castor oil. The materials are heated to a fluid state and blended one with the other and then about 10-20 percent by weight cellulose fibers or glass fibers or mixtures of cellulose and glass fibers having lengths ranging from 1/8-1/2 inch are mixed into the hot melt which is then cast into substantially continuous layers having a thickness of about 3 mills. Upon cooling the cast layers solidifies into a substantially continuous sheet having the waxy material as the continuous phase 50 with fibers 51 substantially uniformly distributed throughout. In carrying out the invention, the original 10 having the infra red absorbing material formed therein as printed characters 11 is placed in surface contact with a base sheet 12 of the type previously described. The structure is radiated with a line of light, arrows 13, preferably rich in infra red directed through the base sheet 12 onto the printing 11, as illustrated in Figure 6, or else directed onto the original 10 from the opposite direction, as shown in Figure 9. In either event, the non-printed areas of the original generally reflect or otherwise dissipate the great proportion of radiations directed thereon while the areas containing infra red absorbing material, absorb the radiations directed

thereon and transform the radiations into heat to form a heat pattern corresponding in area to the letter outline. The heat pattern transfers to the adjacent layer of heat displaceable material to reduce the composition to fluid consistency whereby displacement thereof can be effected in sufficient quantities to provide stencil openings 15 through which ink may pass or to form the image on a suitable hectograph or lithograph master.

Variations with respect to the arrangement of elements in the assembly for manufacturing the stencilizable sheet in accordance with the practice of this invention are manifold. Other possible arrangements are illustrated in the accompanying drawings while still others will be readily apparent and are incorporated in this invention by reference without departing from the spirit of the invention.

Figure 1 of the drawings illustrates a device used in the preparation of duplicating masters in accordance with the practice of this invention. The device includes a container having side walls 20 and 21, a bottom wall 22 and a hinged cover 23. Brackets 24 extending inwardly from the upper edge portions of the side walls support a transparent plate 25 and disposed within the container are a number of infra red ray generating lamps 26 preferably arranged with reflectors 27 for directing radiations in higher concentration upwardly towards the transparent plate 25. The assembly from which the stencil is to be prepared generally is placed on top of the transparent plate and it is anchored thereon by the hinged cover plate 23.

In Figures 2-7 inclusive, illustration is made of an arrangement wherein an assembly for preparing stencil masters in accordance with the practice of this invention comprises a base sheet 12 illustrated as having a substantially continuous film 54 located on the surface of a base tissue 55 but it will be understood that the material forming the substantially continuous layer may substantially completely impregnate the base tissue, as illustrated in Figures 8-12 inclusive. Radiations passing through the base sheet are absorbed by the printed areas and converted into heat and the heat pattern generated causes the material forming the substantially continuous layer to melt and become dissipated onto adjacent areas of the base sheet, if not completely impregnated, or onto an absorbent sheet 18 intentionally provided therefor. Dissipation is sufficient to form openings 15 in the base sheet corresponding closely to the letter outlines of the original which when the stencilizable sheet is separated from the original permits the passage of ink therethrough.

Figures 8-10 inclusive specifically illustrate the use of a similar base tissue in combination with the absorbent sheet 18 previously described in surface contact with the base sheet for removal of composition reduced to flowable condition by the generated heat pattern.

For use in the preparation of a lithograph master, the composition forming the substantially continuous layer of the base sheet may similarly be formulated upon an oily, waxy or greasy substance which is ink receptive and water repellent in character, such as natural waxes of the type carnauba wax, ceresin wax, Japan wax, ozokerite, esparte wax, or other similar bituminous materials; hydrocarbon waxes such as paraffin and microcrystalline waxes or petrolatum, alone or in combination with the natural waxes; fatty acids such as stearic acid, palmitic acid, oleic acid, oleostearic acid, tallow acids and corresponding hydrogenated fatty acids and derivatives thereof and the like; fatty acid amides and esters such as stearamide, dicetyl carbonate, diglycol stearate, pentaerythritol stearate; oils such as linseed oil, castor oil, cottonseed oil, peanut oil, olive oil and the like and hydrogenated oils; fatty acid alcohols such as stearyl alcohol, cetyl alcohol and chlorinated hydrocarbons such as chlorinated naphthalenes of the type marketed under the trade name "Hallowax." Various mixtures of such waxes, oils, fatty acids and derivatives thereof and the

like specified above may be combined in a single formulation to achieve the desired physical characteristics.

When used in the manufacture of an imaged lithograph plate of the type described, it will be apparent that displacement of the molten material in areas corresponding to the heat pattern need not be complete, it being sufficient if only some of the material in areas corresponding to the letter outlines is displaced onto the lithographic surface to provide an ink receptive, water repellent image. As a result, a base sheet having the characteristics and composition previously described for use in stencil duplication may be used or, in the alternative, a thin fibrous web may be coated with a relatively thin continuous layer of the ink receptive hydrophobic material reducible to flowable condition at elevated temperature, such for example as may be obtained by coating a stencil base tissue or other thin sheet of paper, plastic film, metal foil or the like with about 2-8 pounds of the coating composition containing from 10-50 percent solids per 3,000 square feet of surface area.

In the event that the composition has sufficient strength in itself, the base sheet may merely comprise the substantially continuous layer of ink receptive, hydrophobic substance but the base sheet is preferably fabricated with a small amount of fiber incorporated therein by way of entrainment or by way of a fibrous web to reinforce the base sheet and hold the loop letters in place.

Reference is made to my copending application Serial No. 252,745 for a more specific description of the concepts described herein. As shown in the drawings, the base sheet 31 is positioned in surface contact with the lithograph surface 32 of a planographic plate 33. The original 10 of which it is desired to make copies is positioned with the infra red absorbent printed portions 35 in surface contact with the opposite side of the base sheet 31 and very often a jig or a holder is provided, such as the transparent plate 38, to urge the sheets into substantial contacting relation so as to bring the surfaces together. Although a support, such as an underplate 39, may be provided upon which the described elements rest, such support is not always necessary in the practice of this invention.

Infra red rays (arrows) generated by a tungsten filament lamp 40 are directed downwardly upon the surface of the original 10 with the aid of reflectors 41. The rays are absorbed substantially completely and converted into heat by the letter outlines 35 formed with infra red ray absorbing material while the lighter background areas of the original substantially reflect or otherwise dissipate rays directed thereon. The infra red rays are of sufficient intensity or else are directed thereon for a sufficient time to develop a heat pattern conforming to the letter outline of the original and of a temperature sufficient to reduce corresponding areas of the substantially continuous layer of ink receptive hydrophobic material to flowable condition whereby portions thereof in corresponding areas transfer to the surface 32 of the lithograph plate 33 to form an ink receptive and water repellent image 42 thereon. The image on the lithographic surface will correspond substantially identically to the printed portion in the original. Upon separation of the original lithograph master and base sheet, the imaged lithograph plate 33 may be mounted in a suitable lithographic printing machine for wetting out with etching solution, repellent and application of ink in the usual manner in the reproduction of copies.

Instead of positioning the original 10 adjacent the base sheet, the original may be positioned adjacent the underside of the lithograph plate if not too thick to form a barrier to the transfer of heat whereby the heat pattern developed in the original transfers without loss of definition through the plate to effect reduction of the hydrophobic ink receptive material forming the continuous layer in the transfer sheet to flowable condition for displacement onto the lithograph surface.

By way of still further modification, the original, transfer sheet and lithographic plate may be positioned upon a glass plate 43 which forms the cover of a container 44 having a number of infra red ray generating lamps 45 mounted therein with reflectors 46 for concentrating the infra red rays in the upper direction through plate 43 onto the original. The device described is preferably provided with a hinged cover plate 47 adapted to be positioned over the sheet assembly for urging the elements into more intimate contact during exposure.

Example 4

A base sheet suitable for use in the practice of this invention may be fabricated of a layer of paraffin wax having a melting point of about 400-500° F. with a plurality of fibers embedded therein in haphazard arrangement.

Example 5

By way of further example, a suitable base sheet may be prepared by coating a thin tissue of absorbent fibers with a hot melt of carnauba wax suitably plasticized with oils or tricresyl phosphate or the like to a melting point temperature within the range of 300-550° F. The amount of hot melt applied as a coating onto the surface of the fibrous base tissue may range from 2-8 pounds per 3,000 square feet.

Example 6

A porous base tissue of fibers such as cellulose fibers, glass fibers, synthetic resinous fibers or the like or combinations thereof may be impregnated with an aqueous dispersion of paraffin or other wax having a melting point within the range of 200-600° F. and in concentrations to form a substantially continuous layer having a thickness of about 2 mils such as may be formed by the application of 2-8 pounds of the waxy composition per 3,000 square feet of surface area. Instead of carnauba wax, paraffin or the like other waxy substances, fatty acids, fatty acid amides, fatty acid alcohols or chlorinated hydrocarbons of the type previously described may be substituted in the coating or in the impregnating composition.

The characteristics of the base sheet for use in the fabrication of an imaged hectograph plate by the methods described and claimed herein are substantially similar to that for the production of a lithograph plate except that the heat meltable imaging material displaced by the heat pattern from the base sheet to the hectographic surface in contact therewith need not be ink receptive but should be capable of solution in a spirit system, such as in alcohol or alcohol and water mixtures and should embody a high concentration of non-infra red absorbing coloring material for displacement to form the image on a hectograph plate from which copies are produced in the normal manner for hectograph spirit duplication. Reference may be had to my copending application Serial No. 256,250, now U. S. Patent 2,769,391 for a more specific description of the concepts embodying elements of this phase of the invention.

As the composition forming the substantially continuous layer of displaceable material in the base sheet used to image a hectograph master preferably with fibrous reinforcement, use may be made of waxes of the type paraffin wax, petrolatum, Montan wax, carnauba wax, ceresin wax, Japan wax and the like, alone or in combination with each other. Use may also be made of fats and oils if of sufficient hardness at ordinary temperature to militate against inadvertent transfer upon contact with the hectographic surface of the master. In order to prevent transfer merely upon contact with the hectograph surface, it is desirable to select waxes and combinations thereof, compounded with or without plasticizers or softeners, such as mineral oil, castor oil, petroleum oils, polyethylene glycol, triethylene glycol and the like to formulate for a melting point which is above 150° F. and preferably within the range of

200–1200° F. It is also preferable to formulate the composition for as sharp a melting point as possible in order to secure copy of good quality as will hereinafter be pointed out.

Modification to the desired melting point range may also be effected by the addition of fatty acids, fatty acid amides and fatty acid alcohols as previously described in the formulation for the manufacture of the base sheet for producing the lithograph image.

It will be apparent that the coloring agent used in high concentration in the displaceable material should not only be a spirit soluble dye as has heretofore been necessary, but it should also be characterized by being non-infra red absorbing, otherwise radiations will be absorbed thereby to develop an overall competing heat pattern. Suitable non-infra red absorbing dyes may be selected of rhodamine dyes, safranin dyes, Victoria green or the like. Where the original is so constructed to militate against substantial penetration of the infra red rays as when the letter outlines are located on the outer surface of the original, too thick for light penetration, the water and alcohol soluble dye is not so limited to non-infra red ray absorbing materials and pigments may also be used.

The following examples illustrate the compositions of base sheets for carrying out this phase of the invention:

Example 7

A base sheet for the preparation of an imaged hectograph master may be fabricated of a porous fibrous tissue coated with a composition containing 40 percent paraffin wax, 50 percent Victoria green dye and 10 percent plasticizer of the type petroleum oil. The coating is applied in amounts ranging from 2–20 pounds per 3,000 square feet and preferably in amounts of about 15 pounds per 3000 square feet.

In operation the coated side of the base sheet is positioned in surface contact with the hectographic surface of a master. The original is then placed on top of the master with the infra red absorbing letter outlines uppermost. Infra red rays, generated from a tungsten filament lamp or the like, are directed downwardly upon the surface of the original, preferably with the aid of a reflector. Rays are absorbed substantially completely and converted into heat by the letter outlines of the original while the remainder substantially reflects or otherwise dissipates rays directed thereon. By concentrating the rays generated by the tungsten filament lamp, rays of sufficient density are directed onto the original to form a heat pattern conforming to the letter outlines of the original and reduce the corresponding areas of the substantially continuous coating on the base sheet to flowable condition whereby wax based hectographic material is displaced onto the surface of the hectograph master to form the image thereon. Upon separation of the sheets, the imaged master may be mounted in a commercial hectograph spirit duplicating machine for the reproduction of a number of copies each of which will conform almost exactly with the letter outlines in the original.

Example 8

A suitable base sheet may be prepared of a thin film of plastic material, such as a film of polyvinyl chloride or polyvinylidene chloride having a wax coating applied thereon in thicknesses ranging from 2–5 mils and containing substantially equal proportions of a hectograph dye. The wax composition may be selected of carnauba wax, beeswax, petrolatum, paraffin wax and combinations thereof, with or without plasticizer to provide a surface which is substantially solid at room conditions and at temperatures up to about 125° F. but which is reduced to flowable condition at temperatures in excess of 150° or 200° F. Application of this composition may be made from a hot melt at the rate of about 5–25 pounds per 3,000 square feet.

Example 9

Instead of coating the composition of Example 7 onto a porous fibrous tissue, fibers such as cellulose fibers, glass fibers and the like may be introduced and dispersed in the hot melt in amounts ranging up to about 5–20 percent by weight thereof and the mixture then cast into sheets for use as transfer sheets in the preparation of hectograph masters in the manner described.

As previously pointed out, displacement of the material forming the substantially continuous layer in the base sheet responsive to temperature developed in the heat pattern may occur in a number of other ways to produce the desired duplicating master. As more specifically described in my copending application Serial No. 176,384, now abandoned, displacement may occur in a continuous film of plastic or other resinous film forming material to provide a network of openings through which ink may pass in normal stencil duplicating operations.

Although the desired displacement of the resinous material when raised to the elevated temperature of the heat pattern has been found to occur even in ordinary resinous films or coatings because of the influence of surface tensions while in flowable condition, it has been found more desirable to employ a stretched or oriented film of resinous or plastic material. Characteristic of such an oriented or stretched film of plastic material is its ability to retain substantially permanent dimension at normal temperatures but to enhance molecular readjustment when raised to plastic condition at elevated temperatures whereby the molecules tend to return to their normal relaxed state. When the oriented film is sufficiently thin and especially when the resinous material has a relatively sharp softening or melting point, the continuity of the film in the heated area is disrupted and the resinous material tends to shrink into globules covering smaller area but interconnected to form a network having a plurality of small openings therebetween through which ink may pass. Films which are not stretched or oriented usually require somewhat more intense heat to produce the desired rupturing in the heated areas.

Films of plastic material impervious to ink compositions and having the characteristics of the type described may be fabricated of resinous material such as polyvinylidene chloride and copolymers thereof with vinyl chloride and vinyl acetate, polystyrene, polyamides, polytetrafluoroethylene, polychlorotrifluoroethylene, polyethylene, rubber hydrochloride, styrene-isobutyl copolymer, styrene-acrylonitrile copolymer and resinous films based upon polyvinyl chloride resin, vinyl chloride-vinyl acetate copolymer, polyvinyl butyral, and cellulose derivatives of the type cellulose ethers and esters, such as ethyl cellulose and cellulose propionate-butyrate.

Film thicknesses in the range of 0.1–3 mils have been found to be desirable but films of lesser thickness can be used if they are able to resist the passage of ink and films of greater thickness may be used especially if the plastic becomes relatively fluid at the temperatures developed by the heat pattern.

To the present it has been difficult accurately to measure the temperature developed substantially instantaneously by radiation of the original but it is believed that temperatures in excess of 200° F. and possibly up to 1200° F. may be developed depending upon the intensity of the radiations and the time of exposure as well as the characteristics of the infra red ray absorbing material. Thus it is desirable to formulate the film of the resinous composition for rupturing when heated locally to a temperature within the range of 200° to about 600° F. However, where the conditions are such as will enable the development of higher temperatures, the range of suitable plastic material may correspondingly be broadened.

In the event that the resinous substance forming the base in the substantially continuous film is incapable of the desired characteristics within the temperature range developed, the resinous material can be modified to pro-

vide such characteristics by compounding with other resins or with plasticizers or softeners. These serve not only to lower the temperature range for rupture of the plastic film but they also tend to render the plastic more fluid under elevated temperature whereby separation or rupture to provide the desired stencil openings is easier to achieve.

Suitable plasticizers, softeners and the like for specific resinous materials or cellulosic materials may be selected by those skilled in the art from the numerous data available in the plastics, coating and resinous fields. For example, polystyrene may be suitable plasticized with aryl phosphates such as tricresyl phosphate, chlorinated biphenyl, dibutyl phthalate and the like, usually in amounts up to 35 percent by weight. Polyvinyl chloride and other polyvinyl derivatives may be plasticized with dibutyl phthalate, diamyl phthalate, tricresyl phosphate, triglycol di-(2 ethyl hexanoate) and with glycerol esters, camphor, triacetin and the like. Amounts up to about 40 percent by weight thereof may be substantially introduced with the vinyl resins to impart the desired characteristics.

Polyvinylidene chloride, which may be oriented while in the plastic stage or while in the super-cooled stage, may be plasticized to the desired degree with such materials as polychloro derivatives of aromatic hydrocarbons and ethers, such as polychloro biphenyl, dibenzyl ether, tricresyl phosphate and the like. Acrylic acid ester polymers such as the various polyalkyl acrylates including methyl methacrylate, ethyl acrylate and the like may be plasticized in amounts up to about 40 percent by weight whenever necessary with dibutyl phthalate, dibutoxy ethyl phthalate, chlorinated biphenyl, tricresyl phosphate and the like.

The polyamides can selectively be formulated to provide the desired softening range but the heat sensitive point may be lowered by plasticizing with sulfonamides, such as paratoluene sulfonamide.

Plastic films of the type described may be used by themselves when of sufficient mass integrity or they may be laminated or calendered onto a porous fibrous tissue by heated rolls or by adhesive or other related means.

Example 10

A suitable stencil sheet assembly may be prepared by laminating a 0.5 mil film 60 of polyvinylidene chloride having a relatively sharp softening point in the range of about 250-350° F. onto a porous tissue 61 formed of Yoshino fiber or the like having a thickness of about 1-2 mils.

In practice, the base sheet assembly is positioned in surface contact with the side of the original 62 having the infra red ray absorbing letter outlines 63 thereon. Radiations (arrows) from a tungsten filament lamp or the like are directed through the base sheet assembly on to the original and absorbed in the dark letter outlines 63 for the generation of a corresponding heat pattern. The heat pattern developed is sufficient to cause displacement of the resinous material in the heated areas to form the interconnected resinous islands with openings therebetween through which ink may pass.

As shown in Figure 21, the base sheet assembly may, in the alternative, be arranged in surface contact with the original having the letter outlines uppermost. Radiations are then directed onto the printed side of the original whereby the heat pattern developed transmits through the original to the corresponding areas of the substantially continuous plastic film to form the desired stencil openings in the described manner.

Example 11

Instead of a polyvinylidene chloride film, the substantially continuous layer may be compounded of rubber hydrochloride (Pliofilm) preferably oriented and having a softening point of 200-250° F. or it may be compounded of styrene-isobutene copolymer having a softening

ing point of about 220-250° F. In the event that the substantially continuous layer is based upon a polystyrene resin, it is preferred to make use of a polymer having a molecular weight average between 25,000 and 65,000 and preferably with a plasticizer of the type chlorinated biphenyl present in amounts up to 30 percent by weight. Polyvinyl chloride having a softening point of about 200-250° F. may be used with or without plasticizer. Vinyl chloride-vinyl acetate copolymers may be selected for a melting point between 250-300° F. for use as the substantially continuous resinous layer.

Displacement of material forming the substantially continuous layer of the base sheet may also be achieved by elimination of all or portions thereof in the heated areas, as more specifically described in my copending application Serial No. 204,608, now U. S. Patent 2,684,628. As described therein, the base sheet may be fabricated of a relatively high concentration of heat disposable fibers, such as cellulosic or organic fibers in combination with a small amount of heat insensitive inorganic fibers of the type glass fibers, asbestos fibers or the like, or less sensitive organic fibers such as the higher melting point synthetic resinous fibers which remain when subjected to elevated temperatures sufficiently to cause displacement of the heat destructible or disposable fibers whereby openings are formed with the less sensitive fibers remaining as a network to tie in the loop letters and provide a filtering web through which ink may pass.

In the practice of this phase of the invention, it is preferred to fabricate the base sheet with kraft or a sulphite type cellulosic pulp fiber as the displaceable or destructible component and with mineral fibers such as glass, asbestos, rock wool and the like as the heat insensitive fibers. In the event that the heat insensitive fibers are selected of such inorganic mineral fibers, other natural fibers such as wool, cotton, silk, hemp or the like or synthetic resinous fibers such as those formed of the polyamides, vinyl acetate-vinyl chloride, cellulose acetate, polyvinylidene chloride, regenerated cellulose and the like may be used alone or in combination with the cellulosic type pulp fibers. In the event that the heat destructible fibers are of the cellulosic type which are displaced at relatively low temperatures, the heat insensitive fibers may be formed of materials having a higher softening point and greater inertness including synthetic fibers such as Saran, rayon, nylon and the like.

It is preferred to use base sheets formed of fibers in the ratio of 20 parts by weight of the insensitive fibers to about 80 parts by weight of the displaceable and heat destructible fibers. In any event, it is best if the fiber ratio is maintained in excess of 60 percent by weight destructible fibers and more than 3 percent but less than 40 percent by weight of the less sensitive fibers. When higher concentrations of the heat insensitive fibers are used, the amount of fiber which remains in the heated areas of the base sheet tend to obstruct the desired flow of ink compositions and retard successful duplication at high speeds.

The base sheet may be compounded with the desired ratio of fibrous materials in combination with fillers, such as finely divided silica, diatomaceous earth, titanium oxide, chalk and the like to bulk up the sheet stock and to improve the imperviousness of the base sheet to passage of ink composition. It is preferred to calender or otherwise compound the fibers to form the displaceable fibers in combination with the insensitive fibers into a substantially continuous layer capable of resisting passage of ink. When the cellulosic type fibers are sufficiently bulked and calendered they tend to form the desired substantially continuous layer and provide characteristics similar to that of glassine paper which is highly resistant to the passage of ink. Highly calendered base sheets having a thickness of about 2 mils have been successfully used in the practice of this invention with glass fibers present in amounts ranging up to 10 percent by

weight and cut to lengths ranging from $\frac{1}{16}$ – $\frac{1}{2}$ inch or more.

An important modification for use in the practice of this phase of the invention resides in the use of activators and the like for catalyzing the displacement and destruction of the cellulosic type fibers at lower temperature though substantially ineffective for destroying the fibers at room temperature. Such degradating or catalytic agents, particularly adapted for use with cellulosic pulp fibers, may be selected of inorganic acids and acid salts, such as hydrochloric acid, sulfuric acid, aluminum chloride, bismuth chloride, ferric chloride, stannic chloride and corresponding sulphates, bisulphates and persulphates, peroxides, perchlorates and nitrates. They may also be selected of organic acids such as citric acid, aniline hydrochloride, aniline nitrate, aniline hydrobromide, or organic sulfonic acids such as 1-naphthalene, 4-sulfonic acid or other organic acids of the type indophenol, ammonium thiocyanide, coupled with ferric chloride and the like. These catalytic agents may be incorporated directly into the base sheet as a component thereof during sheet formation or they may be incorporated into the base sheet by coating or impregnation. Instead they may be incorporated as a component of an ink composition applied directly to the base sheet for forming the desired openings therein upon radiation with infra red, as will hereinafter be described. The concentration of the catalytic agent is unimportant so long as it is able to lower the temperature at which the fibers are displaced and accelerate their destruction so that substantially complete elimination may be effected in minimum time. Usually concentrations ranging from 0.1–10 percent by weight based upon the fibers to be destroyed is sufficient.

Example 12

A base sheet 70 may be formed of 10 percent by weight glass fibers, 71, having a length of about $\frac{1}{8}$ inch and about 90 percent by weight kraft pulp fibers 72 followed by calendering to work the pulp fibers into a substantially continuous layer which is ink impervious.

In use, the base sheet 70 is positioned in surface contact with an original 73 having the infra red absorbing letter outlines 74 uppermost. Upon radiation by means of a photographer's flash lamp 75 or the like, as illustrated in Figure 24, the radiations are absorbed substantially completely by the material in the letter outlines 74 and converted into a heat pattern. The generated heat, indicated by broken lines 76, transfers directly to the base sheet and functions to displace the pulp fibers by elimination to leave the glass fibers 72 in their original position as a highly porous network arranged across openings 77 formed through the base sheet.

Example 13

Instead of employing a stencilizable sheet formed of cellulosic and glass fibers, the base sheet may be formed of about 10 percent by weight polyvinylidene chloride fibers felted in uniform distribution with cellulosic fibers having about 0.5 percent zinc chloride incorporated therewith. The zinc chloride catalyzes the destruction of the pulp fibers so that displacement thereof can be effected at temperatures starting at 250° F. whereby reaction to the heat pattern causes sufficient elimination of the cellulosic fibers to provide porous areas in the base sheet through which ink may pass.

Example 14

In the modification shown in Figures 26–28, a base sheet 70 formed of about 20 percent by weight glass fibers and 80 percent by weight pulp fibers is impregnated with a 10 percent solution of ferric chloride and highly calendered to form the pulp fibers into a substantially continuous layer which is ink impervious. The base sheet is sufficiently flexible to wind about a typewriter platen 80 with a carbon 81 disposed therebetween. The carbon

paper may be impregnated with a composition containing a relatively high concentration of carbon black or the like for transfer to the surface of the base sheet upon impact. In the event that the base sheet is not impregnated with the ferric chloride solution, catalytic material such as ferric sulphate may be incorporated as part of the carbon coating for transfer to the base sheet.

Upon radiation of the typed base sheet, the radiations are reflected or otherwise substantially dissipated by the unprinted surface and absorbed in the letter outlines which have been typed onto the surface thereof and converted into heat. The heat pattern thus developed becomes effective to displace the pulp fibers in substantial amounts leaving the glass fibers 74 as a web across the formed openings 76 through which ink may pass.

Somewhat related to the concept previously described but differing therefrom with respect to the construction of the base sheet is a new and novel structure which embodies a proportion of heat insensitive fibers, such as glass fibers, in combination with a substantially continuous layer of pulp fibers formed into what appears to be a substantially gelatinous layer which is highly impervious to the passage of ink but which at the elevated temperatures developed in the heat pattern, is substantially displaced by destruction or the like in the heated areas to provide areas through which ink may pass in normal stencil duplicating operations.

Apparent gelatinization of the type described is preferably secured by the use of very highly beaten pulp fibers deposited to form a substantially continuous layer on a web of heat insensitive fibers which remain to integrate the structure after stencilization to hold the loop letters in place. Instead, gelatinization of the cellulosic fibers may result by treatment with chemicals to convert at least a portion of the fibers to a more gelatinous state bordering on resinous characteristics.

By one method, the cellulosic pulp fibers either prior to or after they have been fabricated into the base sheet, may be wet with chemicals by which the cellulose fibers are partially dissolved or gelatinized as for Rayon manufacture. For example, the fibers may be wet with a solution of zinc chloride for complete or partial gelatinization. Copper sulphate and ammonium hydroxide solution may be used to secure a reaction of the type described. Carbon disulphide and sodium sulphate may be applied in solution similar to the manner for reducing cellulose fibers to form Viscose in Rayon manufacture. When the desired degree of gelatinization has taken place, reaction may be stopped by removal of the chemical reactants with water or by introducing a coagulating substance such as dilute sulphuric acid, sodium sulphate, zinc sulphate solution or the like. The cellulose and heat insensitive fibers may be deposited together from a single slurry to form the desired fibrous base sheet followed by chemical treatment for proper gelatinization of the cellulosic components.

By way of further modification, chemical reactants, such as cupri ethylene diamine, or the copper ammonium complex, or the zinc chloride solution may be introduced into the slurry of pulp fibers alone or in combination with the glass fibers. When gelatinization of the pulp fibers has progressed to the desired degree, deposition to form the base sheet may be carried out in the normal manner. It is preferred to stop the reaction before the pulp fibers have entirely lost their fibrous characteristics but not before sufficient gelatinization has taken place to bind the deposited fibers into an integral and substantially continuous ink impervious layer.

The cellulose fibers, with or without gelatinization, can be displaced from the layer by thermal reaction in a manner previously described, and for this purpose accelerators and catalytic agents may also be incorporated as before. While strengths developed impart sufficient mass integrity to permit elimination of the glass fibers as a component in the base sheet, presence thereof as a separate

15

web or intermixed with the cellulose fibers is preferred to hold the loop letters together and to provide a network through which the ink may pass. Preparation of the base sheet follows procedures previously described.

Example 15

A slurry is formed of about 22 parts by weight pulp fibers in 100 parts by weight of water and a sheet formed thereof by filtration through a foraminous member to separate out the fibers on the surface thereof. The formed layer of fibers is then soaked for one hour in a solution formulated of 300 parts by weight ammonia (28% NH_3) and 100 parts by weight copper sulphate in 300 parts by weight water. After soaking to gelatinize the cellulose fibers, the chemical reactants are washed off by flushing with water and the solvation mixture is further inactivated by application of a solution containing 400 parts by weight concentrated sulphuric acid, 240 parts by weight sodium sulphate and 32 parts by weight zinc sulphate in 4000 parts by weight water. After washing the coagulating substances from the fabric the structure may be calendered to form the gelatinized fibers into a substantially continuous layer 91 which is ink impervious.

Example 16

A slurry formed of 100 parts by weight of cellulosic pulp fibers is combined with a solution containing about 1000 parts by weight zinc chloride in very dilute solution. After standing together for about three hours, the slurry is run onto a foraminous belt having a glass fiber web 93 on the surface thereof. The gelatinized cellulose fibers separate out to form a layer 92 on the surface of the glass fiber web 93 and thereafter the formed sheet is soaked freely in water to remove the remaining zinc salts. Upon drying a fibrous structure having a high degree of mass integrity is produced and the partially gelatinized cellulose fibers may be worked into a substantially ink impervious layer by subsequent calendering.

In use, the base sheet 91 is positioned adjacent the underside of an original 94 having the infra red absorbing outlines 95 uppermost. Infra red rays (arrows) directed downwardly upon the original are converted into heat in the letter outlines to form a pattern which transfers through the original to the base sheet to cause displacement of the partially gelatinized cellulose fibers whereby openings 96 are formed through the substantially continuous layer for passage of ink in normal stencil duplicating operations.

Displacement of material to provide openings in a base sheet for passage of ink in the manufacture of a stencil may also be achieved in accordance with the practice of this invention by the use of a substantially continuous, ink-impervious layer formed with material which, responsive to heat generated in the heat pattern, eliminates substances volatile at the elevated temperature or by reason of thermal decomposition or physical change converts the substantially continuous layer in the heated areas to a porous body through which ink may pass.

Example 17

By way of illustration of the concepts described above, description will be made to a base sheet formed with a substantially ink impervious layer 109 of a composition based upon the following formula, with fibrous reinforcement which may be in the form of fibers 101 dispersed in the continuous layer or arranged as a porous base tissue impregnated or coated by the composition forming the continuous layer:

	Parts
Gelatin	100
Acetic acid	6
Glycerine	50
Sulfonated olive oil	20

16

	Parts
Urea	10
Water	650
Ethyl alcohol	100
Citric acid	3

The ingredients in the above composition may be varied by amounts ranging up to 20 percent by weight but it is desirable to maintain the ratio of alcohol to water within the limitations described in order to maintain better stability in the treating composition.

In preparing the composition, the gelatin is soaked in about 100 parts of water for four hours at room temperature. The additional water, glycerine, citric acid stabilizer and sulfonated olive oil or other sulfonated mineral or vegetable oil are added to dissolve the gelatin. The urea is dissolved in water and alcohol and added to the gelatin solution.

In application, the composition is heated to above 60° C. and applied as a coating or as an impregnating composition with conventional equipment to a porous tissue such as a 6-pound stencil tissue formed of Yoshino fiber.

In use, the stencil base sheet 102 is positioned substantially in surface contact with an original 10 having the letter outlines 103 formed of infra red ray absorbing-heat generating material. Radiations 104 are directed onto the original 10 and are absorbed by the material in the letter outlines 103 and converted into a corresponding heat pattern 105. The heat pattern which transfers to the base sheet 102 thermally decomposes the gelatin composition to form the material into a porous medium 106 through which ink may pass.

Although infra red radiations exist in substantial quantity in daylight, they do not exist in sufficient concentration to develop a heat pattern having a temperature high enough to reduce the material to flowable condition unless the rays are concentrated by suitable lenses or reflectors. Radiations capable of providing infra red of suitable intensity may be generated by various well known and readily available means. They have been developed in the matter of a fraction of a second by photo-flash lamps whereby the printing image in exact duplication of the original may be formed in the base sheet or displaced to the lithographic or hectographic surface almost instantaneously. In the alternative, use may be made of radiations generated by a carbon arc lamp, tungsten filament lamp or standard infra red ray lamp.

It has been found that the definition of the image formed in the master is markedly improved when sufficient heat for displacing the composition forming the substantially continuous layer is developed by absorbed radiations in the letter outlines of the original in minimum time. If exposure is prolonged in order to develop adequate heat to accomplish the desired displacement, there is a tendency for the heat to dissipate laterally and consequently produce ragged and indistinct images in the master. In order to accomplish the desired instantaneous or concentrated exposure, devices of the type heretofore described, such as photographers' flash lamps or other means for developing a high concentration of infra red rays are preferred. Instead, use may be made of devices in which the source of infra red ray-bearing light is energized at high wattage by a capacitor device similar to that used for industrial spot welding. Use may also be made of a relatively long but thin source of infra red ray radiation, such as a tungsten filament lamp from which the radiations are focused onto the original through the use of suitable lenses and reflectors and which may be concentrated to line or pin-point dimension and traversed over the original at constant speed so that the exposure of each line element in the original is of substantially equal intensity. A still further device for accomplishing the desired results may consist of a high source of infra red radiation, such as an incandescent lamp, in which

17

the radiations are focused to a relatively fine dimension through a reflector system and are guided over the surface of the original in the development of the desired heat pattern.

It will be apparent from the description that a duplicating master prepared in accordance with this invention is capable of immediate use for the reproduction of copies corresponding exactly to that of the original. In view of the simplicity of the method coupled with the low cost of materials and the failure to impair or otherwise injure the original, the prepared master may be discarded if desired since others may as easily be prepared from the original.

It will be further apparent that a device adapted to form masters directly from an original in the manner described and claimed herein may be embodied in a simple and low cost structure capable of such small dimension as to permit ready transportation from place to place for immediate use in the preparation of duplicating masters of the stencil, hectograph, lithograph types and the like.

It will be apparent from the description that this invention provides a new method for preparing duplicating masters directly from an original and which becomes immediately visible to determine the conformance with the original and the quality of the copy which may be produced therefrom.

It will be understood that numerous changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. In the method of producing a duplicating master for use in a multiple copy process directly from an original having the reproducible imaged portion formed of a material which is infra red ray absorbing-heat generating, the steps of positioning the original, the master sheet and a transfer sheet having a continuous layer of a non-infra red absorbing composition which is solid at room temperature and which is reducible to flowable condition at a temperature in excess of 200° F. in surface contact with each other with the transfer sheet adjacent the master sheet and with the sheets at about ambient temperature, directing a sufficient quantity of radiations rich in infra red onto the original substantially instantaneously to generate a temperature rise from ambient temperature to a temperature in excess of 200° F. in the imaged portion of the original which reduces the composition in the corresponding areas of the transfer sheet to flowable condition whereby the flowable material transfers in the corresponding areas from the transfer sheet to the master sheet to provide an image thereon corresponding to the original.

2. In the method of producing a stencilled master sheet for use in a multiple copy process directly from an original having the reproducible imaged portion formed in the original of a material which is infra red ray absorbing-heat generating, the steps of positioning the original, a master sheet and a stencil sheet having a continuous layer of a non-infra red ray absorbing ink impervious com-

18

position which is solid at room temperature and which is reducible to flowable condition at a temperature in excess of 200° F. in surface contact with each other with the stencil sheet adjacent the master sheet and with the sheets at about ambient temperature, directing a sufficient quantity of radiations rich in infra red onto the original substantially instantaneously to generate a temperature rise from ambient temperature to a temperature in excess of 200° F. in the imaged portion of the original which reduces the composition in the corresponding areas of the stencil sheet to flowable condition whereby the flowable material transfers from the stencil sheet to the master sheet to provide openings in the stencil sheet through which ink may flow.

3. In the method of producing an imaged lithographic master for use in a multiple copy process directly from an original having the reproducible imaged portion formed of a material which is infra red ray absorbing-heat generating, the steps of positioning the original, the master sheet and a transfer sheet having a continuous layer of a non-infra red ray absorbing, ink receptive, water repellent, hydrophobic composition which is solid at room temperature and which is reducible to flowable condition at a temperature in excess of 200° F. in surface contact with each other with the transfer sheet adjacent the lithographic surface of the master sheet and with the sheets at about ambient temperature, directing a sufficient quantity of radiations rich in infra red onto the original substantially instantaneously to generate a temperature rise from ambient temperature to a temperature in excess of 200° F. in the imaged portions of the original which reduces the composition in the corresponding areas of the transfer sheet to flowable condition whereby the flowable material transfers from the transfer sheet to the master sheet in the corresponding areas to provide an ink receptive, water repellent image thereon corresponding to the original.

References Cited in the file of this patent

UNITED STATES PATENTS

505,698	Brodrick	Sept. 26, 1893
525,675	Brodrick	Sept. 4, 1894
789,153	Horn et al.	May 9, 1905
1,656,338	Ranger	Jan. 17, 1928
1,819,264	Ranger et al.	Aug. 18, 1931
1,973,151	Murphy	Sept. 11, 1934
2,057,696	Sherman	Oct. 20, 1936
2,243,078	Bjorksten et al.	May 27, 1941
2,337,012	Bjerg et al.	Dec. 14, 1943
2,501,495	Carrol et al.	Nov. 21, 1950
2,503,758	Murray	Apr. 11, 1950
2,554,909	Holik	May 29, 1951
2,616,961	Groak	Nov. 4, 1952
2,668,126	Taylor et al.	Feb. 2, 1954
2,684,628	Roshkind et al.	July 27, 1954
2,699,113	Hoover	Jan. 11, 1955
2,713,822	Newman	July 26, 1955