

United States Patent

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[54] **SILK SCREEN MAKING**
4 Claims, 3 Drawing Figs.

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96/36.4, 96/67

[51] Int. Cl. **B41h 1/24,**
G03c 5/00

[50] Field of Search..... **96/67, 36.4,**
83; 101/128.3

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ABSTRACT: A silk screen stencil is prepared by engaging the screen cloth with a dry layer of photosensitizable colloid carried on a backing member and applying a liquid photosensitized emulsion to the screen cloth to fill the meshes in the screen cloth and, simultaneously, sensitize the colloid layer and join it to the screen cloth. After drying, the backing member is removed.

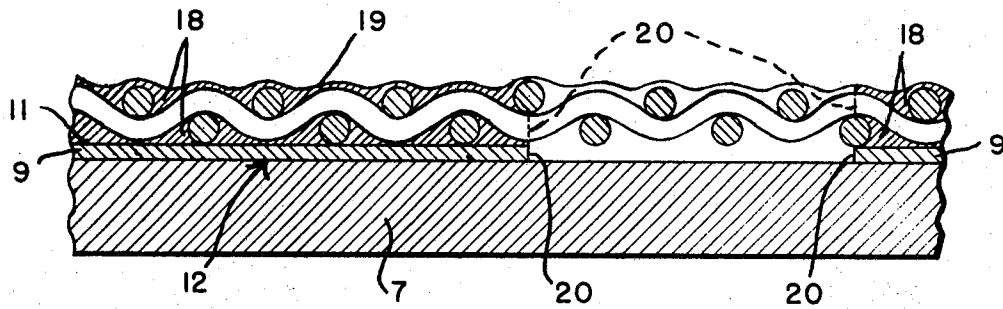


FIG. 1

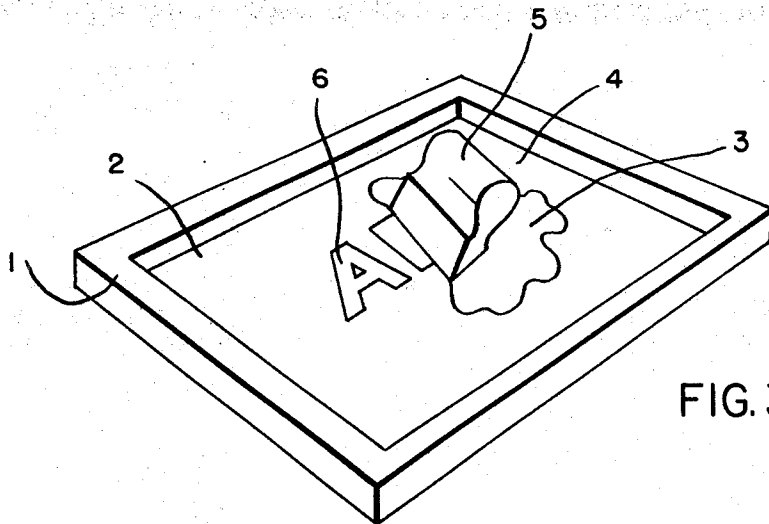


FIG. 3

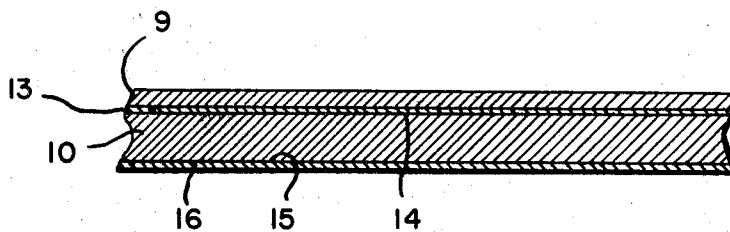


FIG. 2

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SILK SCREEN MAKING

This invention relates to the silk screen printing process and has special reference to improvements in the method and means for making the screens used in this process.

At the present time there are three common methods, with accompanying means, for making so-called silk screens. There is the cut film process, the photosensitive film process, and the liquid emulsion process.

There are many difficulties involved in the making of silk screens by these three methods, and highly skilled personnel are required in order to make screens which result in good quality printing. For example, it is necessary that the colloid on the silk screen be of as uniform a layer as possible on the so-called contact side of the screen, otherwise the printing resulting from the screen will have thick edges and/or saw-toothed edges and will not have top quality appearance.

In the photosensitive film method and in the cut film method of making silk screens, a colloid is carried on a backing member or support of any suitable material during the photographic exposure and washout or the hand cutting procedure, respectively, when the artwork is formed in the colloid. The colloid is transferred to the silk screen after the exposure washout or the cutting out procedures. The backing member or support is all that holds the colloid stable during these processes and serves to maintain the stencil or artwork in its desired form while the colloid is transferred to the silk screen material. This transfer is made while the colloid is in a softened or moist condition so that the threads of the silk screen material may be displaced into the colloid to a sufficient depth to insure that the colloid will stay in place on the screen material.

To accomplish this, the colloid and its backing are placed on a suitable flat surface, and the silk screen material is positioned over the colloid to its proper position and then lowered on the wet or moist colloid. The screen maker must then carefully press the silk screen material into the colloid layer to a sufficient depth to insure that the colloid will adhere to the screen completely, in all areas thereof, being careful to imbed the silk threads to a uniform depth in all areas so that a contact surface of uniform thickness is obtained with no thick edges which might cause paint or ink to run on the finished product, and so that the threads do not go through or nearly through the colloid causing too thin edges which result in saw-toothed edges on the finished product.

The average thickness of a layer of colloid used on these two processes is about four-thousandths of an inch, thus it can be seen that great skill and dexterity are required to properly and uniformly mount a colloid on a silk screen.

Even at best, the wet colloid does not and cannot surround the silk threads, and the adhesion of the colloid to the screen silk leaves something to be desired. The silk screen material is exposed on the top side of the screen and leaves the colloid vulnerable to the pressure of the squeegee during the printing process, and also vulnerable to some hydrostatic effect from the ink or paint being used in the printing process. Normally, a silk screen made from these two processes has too thick a colloid on the contact side because the colloid, to start with, is necessarily relatively thick to allow for a margin of error in the imbedding process.

It is apparent that the mere act of imbedding, or pushing, the silk into the colloid will cause distortion of the emulsion so that the image or art work is not necessarily the same shape as it was originally made. It is also apparent that the problem of placing and adhering of parts of the image or art work to the screen; such as a small period, a dot, a thin line, a small letter or shape standing by itself presents very serious difficulties. There is very little chance of application of uniform pressure on the silk in these very small areas and fine lines, since any pressure at all quite logically would displace the colloid so that the end results would be no adhesion at all or just a smear of colloid from too much pressure.

The screen and colloid are dried before the backing member or support is removed.

Silk material is used almost exclusively in the photo sensitive film and in the cut film processes. Because of the fibrous nature of natural silk, the colloid will adhere better to silk than to monofilaments. Monofilaments such as nylon, dacron, or stainless steel material are almost never used in these two processes because it is difficult to make the colloid adhere to monofilaments.

The best life that can be expected from screens in these two systems is about 800 impressions before the colloid starts to tear away from the silk.

In the so-called liquid emulsion system of silk screen making, liquid emulsion is initially squeegeed on to the top side of the screen material or cloth; that is, the side of the material opposite the contact side; to create an initial barrier or plugging of the mesh. This layer of emulsion is dried, or at least partially dried, then liquid emulsion is applied to the contact side of the screen material to, in effect, fill the mesh with emulsion level with the silk fibers. After this emulsion has been dried or set up, a second and sometimes a third layer of emulsion is added to the contact side to build up the necessary layer or thickness of emulsion required to make the colloid for the printing process.

This building up of a uniform layer or thickness of emulsion on the contact side of the screen to make the desired colloid is very difficult to do as will be apparent. The operation must be done under a subdued light because the liquid emulsion is photosensitive. Also the screen material cannot be supported against a flat surface during this operation, and the screen is a flexible, somewhat elastic material and only a hand operated squeegee is used to apply the layer. Even a great degree of skill gives no assurance of a uniform coating or layer. The layer usually is quite heavy and relatively irregular in thickness.

Either silk or monofilaments may be used for screen cloth in the liquid emulsion system.

In the liquid colloid system, the exposure of the emulsion to the positive art is done after the colloid is dry, then the nonexposed colloid is washed from the screen in a conventional manner. The resultant screen is likely to have objectionable thick and thin areas of colloid on the contact side as in the photosensitive film process and the cut film process.

Liquid emulsion screens, as compared to the other two screens described, are very rugged and are capable of as many as 100,000 impressions.

In the above processes or methods, if the contact side colloid layer is too thick or too thin, the quality of printing suffers, and the degree of fineness of printing is quite limited, as the thick edges may fill in fine lettering in such a manner as to make it unreadable. It is essential to have a uniform layer or thickness of colloid on the contact side of the screen to get best printing results.

Very little fine work is done with the liquid emulsion system, because of the difficulty of obtaining uniformity in the hand made contact colloid layer.

It is therefore one of the principal objects of this invention to provide an improved method and means for making better screens for printing or reproduction purposes.

Another object is to provide screens which will have a positively uniform colloid layer on the contact surface thereof to insure optimum results in the reproduction of all details in the artwork to be printed.

Another object is to provide a method and means for making these screens which require relatively little skill, and which provide for ease in obtaining positive register control for multicolor printing.

Other objects are to provide a simple method and means for making screens wherein adhesion of the colloid to the material is positive, wherein monofilament materials may be used for screens, wherein the mesh of the screen is protected from buildup of paint which makes for easier and more perfect washout or clean up, and wherein screen losses due to improper preparation are almost eliminated.

Another object is to provide a method and means for making screens wherein the screen material is so protected and

handled that it may be reused many times, for greater savings in material and costs.

Another object is to provide a method and means for making screens which does not require special equipment other than that already in service in a screen making operation.

A more specific object of this invention is to provide a method and means for making screens for printing purposes which includes a preprepared film or colloid layer of the desired thickness to form the contact layer for a screen, this layer being applied to a removable backing member for easy removal when required, and a liquid emulsion for securing this layer to a contact side of a screen, the liquid emulsion being applied to the screen from the top side thereof through and substantially filling the mesh of the screen and the liquid emulsion having the characteristic of joining and becoming homogenous with the preprepared contact layer of emulsion and thereby form a complete colloid which has a uniform contact layer and a firm mounting on the screen material.

Another specific object is to provide such a preprepared contact layer which may be dry when initially placed on the screen, and which may be non photo-sensitive, and to provide a liquid emulsion which has characteristics which permit it to suitably bond the contact layer to the screen and photosensitize the contact layer.

Another object is to provide a screen wherein the colloid is tough and stable so that a maximum number of first class impressions may be obtained from the screen and wear and tear on the screen from use is reduced to a minimum.

These and other objects and advantages of the present invention will become more apparent as the description proceeds.

In the drawing;

FIG. 1 is a segmented sectional view through a screen made in accordance with my invention, greatly enlarged.

FIG. 2 is a similar view showing the backing or support member with a uniform colloid layer mounted thereon.

FIG. 3 is a perspective view illustrating a screen in use.

In the drawing, the reference numeral 1 indicates a screen frame, which may be made of any suitable material such as wood or metal. The screen cloth 2 is mounted on the frame 1 in a tight stretched condition, by any suitable means, for use in the screen printing art.

As shown in FIG. 3, a quantity of paint or ink 3 is laid on the top surface 4 of the screen cloth 2 and a squeegee 5 is used to draw the ink or paint 3 across the screen cloth 2 so that the ink or paint will pass through open areas or art work 6 of the screen leaving a print or impression on the workpiece 7. This arrangement of frame, screen cloth, ink or paint, and squeegee is conventional in the art.

My invention has to do with the preparation of the screen cloth 2, after it is in position on the frame 1, for use as a printing screen.

In my invention I employ a prepared contact colloid layer 9 comprising a backing or support member 10 to carry the contact layer 9 of a uniform predetermined thickness coated thereon. This colloid layer 9 ultimately forms the contact surface 12 of the screens made in accordance with my invention.

The support member 10 is preferably a suitable heavy paper or the like and does not have to be clear or transparent as is required in the cut film or photosensitive film process, because the backing member is removed before the colloid is exposed to the artwork. Obviously the paper backing or support 10 is less expensive than the transparent backings.

The backing or support 10 has a release coating 13 on the colloid side 14 thereof, of a suitable material to permit the application and adhesion of the contact colloid layer 9 thereto, yet permitting the easy removal of the backing 10 from the colloid after the emulsion is installed and dried on to the screen cloth 2 to form the contact surface for the screen. The contact layer 9, the backing member 10, and the release coating 13 can be called the contact layer piece.

The opposite side 15 of the backing 10 preferably has a release coating 16 thereon which is different than coating 13

in that it will not permit the colloid layer 9 to adhere thereto, and thus, the prepared contact layer 9 may be manufactured, shipped, stored and used in roll form, for convenience, rather than in sheets requiring special handling and losses from sheet cutting etc.

The emulsion layer 9 is coated on to the side 14 of the backing or support 10 by any suitable means to obtain a uniform layer or thickness. I have found that it is desirable to employ a thickness of colloid of from .5 to 1.5 mils for consistent results under most conditions of silk screen printing. I have found that a thickness of about .8 mils of the contact layer will suit most silk screen printing applications, variations from thinner to thicker layers being employed for fine or coarse printing respectively. The emulsion is coated on to the backing member 10 while in liquid form and is thoroughly dried before rerolling is done.

I prefer to use a light colored backing 10, such as white, and I employ a nonopaque coloring or dye in the liquid colloid to be coated on the backing. In this manner, the uniformity of the layer 9 of colloid can be checked visually as the prepared contact layer 9 is being manufactured. Differences of the colloid layer's thickness will be indicated by changing shades of the color of the colloid on the backing. If the colloid gets thinner in areas, its shade will be lighter, if the colloid gets thicker, its shade will be darker. Thus, a person operating the equipment for coating the colloid to the backing member will be aware of variations in thickness of the colloid layer immediately and may make adjustments to keep the layer uniform at all times. Quality control of the prepared contact colloid 9 is therefore easy to obtain and to maintain. If defective areas do occur, they are immediately discovered by anyone using the prepared contact colloid layer piece 9—10—13 and these defective areas can be discarded to avoid the preparation of a screen from such defective areas. Quality screens are thus insured.

The material used to form the colloid contact layer 9 is preferably a liquid type having characteristics which make it tough and somewhat elastic so that it can be coated on to the backing 10 and so that screens will be durable and not easy to damage in use.

The colloid is applied to the backing while in a liquid, non-photosensitive condition, but must have characteristics to permit it to be photosensitized later in the process, as will become apparent. By using a non-photosensitive emulsion for the prepared contact layer 9, it can be handled and stored in any suitable place without regard to spoilage due to light.

As is stated earlier in the specification, two of the major problems in making good screens are first, to obtain a uniform thickness of the contact layer or surface of colloid on the contact side 12 of a screen, and second, to obtain good adhesion of the colloid to the screen cloth.

It is deemed apparent that the first problem of obtaining a uniform contact layer on a screen will be overcome by using my prepared contact colloid layer piece 9—10—13 in the manner which will be described.

The second problem of proper adhesion of the colloid is taken care of in the following manner:

The prepared contact colloid 9 is mounted or applied to the screen cloth by laying the prepared contact colloid layer piece 9—10—13 on a flat clean surface, not shown, such as glass, with the emulsion facing upward and with the colloid layer 9 dry. The screen frame 1 is then lowered in place on the prepared colloid layer 9 with the screen cloth on the down side so that the contact side 12 of the screen cloth engages the colloid layer 9. Because the colloid is flat, and the screen cloth is stretched tight and in a flat plane, there will be contact of the screen cloth contact side 12 over the entire area of the colloid layer 9, as is deemed apparent.

A quantity of photo-sensitive liquid emulsion 18 is then deposited on the upper surface 4 of the screen cloth 2 and is squeegeed across the upper surface thereof to force it through the mesh of the cloth and into contact with the prepared contact colloid layer 9 to bond the contact emulsion to the screen. The liquid emulsion 18 fills the mesh completely, when

properly squeegeed as indicated in FIG. 1 of the drawing. This operation is also performed under suitable subdued or non-photosensitive light.

The liquid emulsion 18, as it is applied to the upper surface of the screen, has contained therein a suitable wetting agent the dry prepared contact layer 9 sufficiently to bond the colloid in one homogenous layer and also to make the prepared contact layer photosensitive. The wetting agent is not present in sufficient quantity in the liquid layer 18 to permit the contact emulsion 9 to be wetted sufficiently to be distorted in any way by the screen cloth threads. It can be seen that because the contact colloid layer 9 is dry when the liquid emulsion is squeegeed on to the screen cloth, no penetration of the screen cloth or distortion of thickness can occur. The wetting agent and the photosensitizer work into the contact colloid 9 after the squeegee has laid the liquid emulsion in place.

As should be apparent, no great skill is required to lay a screen on to the prepared contact colloid and to squeegee the photosensitive liquid emulsion over the top surface of the screen cloth to form a tight bond of the contact colloid to the cloth. The liquid emulsion 18 is merely squeegeed off, level with the top surface of the screen cloth 2, and this operation automatically fills the mesh with emulsion for maximum protection of the screen cloth against wear and abrasion as well as against paint or ink building up in the mesh during the ultimate printing process. It also automatically bonds the prepared contact colloid 9 in its proper place on the screen cloth, assuring proper thickness of the contact layer, and simultaneously photo-sensitizes the formerly nonphotosensitive prepared contact layer.

Because this operation may be done on a hard flat surface, such as glass, there is no opportunity to in any way distort the contact layer of colloid, it will remain in its firm contact with the contact side 12 of the screen in all areas during screen preparation.

After the liquid emulsion is applied to the upper surface 4 of the screen, the excess liquid emulsion is removed from the screen, and put back in a container for reuse, and the screen frame, with cloth, liquid colloid, prepared contact emulsion and backing member 10 are dried. Drying may be done in a dryer or by air drying as desired. The drying of the liquid emulsion causes some shrinkage in the upper surface 19 of the liquid emulsion so that it dries to a somewhat irregular surface similar to the texture of the screen cloth, as shown in FIG. 1, however this does not affect the quality of the printing because it occurs on the upper surface only of the screen.

After drying, the backing member 10 may be easily removed from the complete colloid 9-18 because of the release coating 13. After the backing member is removed, the screen is ready for exposure to the artwork desired. This is done in a conventional manner, that is, the positive artwork is placed on a flat transparent surface and the screen frame placed over it with the prepared contact colloid against the artwork, suitable means being employed to hold the screen cloth and emulsion in total contact with all areas of the artwork being used to prevent distortions during exposure.

Exposure is done with suitable lights through the flat transparent surface. The timing of the exposure is determined by the usual considerations in making screens.

The thickness of the prepared contact colloid 9 is predetermined and controlled to provide an optimum thickness that is as thin as possible to minimize paint or ink edge thickness and thick enough so that paint or ink can still completely fill the image being made and creep around and under all open filaments of the screen. This depth or thickness has been determined to be about .8 mils thick, as pointed out above, using presently known materials in the art.

The inside colloid 18 which is applied as a liquid is also of a controlled and uniform thickness, just the depth of the material used as screen cloth. This inside colloid 18 is preferably of this minimum obtainable thickness, merely enough to cover and fill the mesh of the screen cloth. This arrangement provides a minimum total thickness of complete colloid 9-18 on

the screen consistent with obtaining optimum results in exposure and paint depth.

The minimum total thickness of complete colloid 9-18 is necessary in the preparation of screens so that when exposures are made the light will have to penetrate a minimum depth or thickness of colloid and exposure time is therefore less, and a minimum amount of colloid will have to be washed out of the screen cloth after exposure, and the open area edges 20 will have sharp edges and straight sides as shown in FIG. 1 for good printing results.

Another reason for the desirability of minimum total colloid thickness is that the exposure of the colloid to light during the exposure of the artwork, as above pointed out, causes the colloid to harden. If the colloid is thick, it must be exposed a longer time and the colloid will harden more, making it more difficult to wash out the colloid from the screen for reuse.

The exposure is done after the complete colloid 9-18 is dried into place on the screen cloth in my invention and therefore there is no possible distortion of the image once the screen is exposed, as compared to the processed film and cut film processes, as pointed out above.

Another beneficial effect of my invention is that as the liquid emulsion 18 dries on the inside or top surface of the screen, any and all shrinkage during the drying period occurs on this surface, as the contact colloid layer 9 is not wetted enough by the liquid emulsion 18 to cause shrinkage. The liquid colloid layer 18 does not pull the contact emulsion 9 from the support paper as it dries and consequently the contact surface of the contact colloid layer remains smooth and uniform. Comparing this to the liquid emulsion system above described, the liquid emulsion applied to both the contact side and the inside of the screen shrinks, because of the water present in the liquid emulsion and the contact surface in the liquid emulsion system shrinks to somewhat the texture of the mesh of the screen cloth, leaving an irregular surface, as well as a nonuniform thickness, in the contact surface of the liquid emulsion system.

In my invention as well as in the liquid emulsion system, the mesh of the screen cloth is completely locked into the colloid minimizing any possible distortion during operations of making and using the screen.

From the above, it is deemed apparent that my invention has overcome the drawbacks of present screens used in silk screen printing and has combined the advantages present in the present screen making systems into a new and much improved screen and method of making them.

Accurate register for multicolor printing can be obtained by using the screen frame as a reference point because exposure is made after the colloid is dried on the screen and distortions or misalignments are precluded.

I claim:

1. The method of making screens for the silk screen printing process comprising the steps of engaging a preprepared layer of photo-sensitizable contact colloid against the contact surface of a screen cloth, said layer of colloid being carried on a removable backing member, said layer of colloid being of a substantially uniform thickness in the range of from .5 to 1.5 mils and being substantially dry whereby said screen cloth will not penetrate said layer, and applying a layer of photosensitized but not yet exposed liquid emulsion through the opposite surface of the screen cloth to fill the mesh of the cloth and to contact and join with the preprepared layer of colloid to cause said colloid layer to be photosensitized and to form a homogenous photosensitized colloid with said layer of colloid and to secure the colloid layer to the screen in its predetermined thickness, and subsequently drying said liquid emulsion.

2. The method of making screens for silk screen printing comprising the steps of engaging a photo-sensitizable colloid layer of a thickness range between .5 and 1.5 mils and carried on a release backing member against the contact surface of a screen cloth while said colloid layer is substantially dry to prevent displacement of the screen into said colloid layer, ap-

plying photosensitized but not yet exposed liquid emulsion to and through the screen cloth from the surface thereof opposite said colloid layer to fill the mesh of the cloth and to contact and join with the colloid layer to photosensitize said colloid layer and to form a homogenous photosensitized colloid therewith and secure the colloid layer in place on the screen, drying said colloid, and removing said backing member.

3. The method as set forth in claim 2 and exposing said colloid with the work piece engaged directly against said colloid layer.

5 4. The method as set forth in claim 3 and subsequently washing out the unexposed portions of said colloid with warm water to form the open areas for screen printing.

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