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LITHOGRAPHER'S GLASS

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The invention relates in general to an improvement in the art of lithography and specifically relates to a substitute for the lithographic stones and plates now in general use and to a method of preparing and using such a substitute, hereinafter referred to as a lithographic glass plate.

In making transfers from lithographic stones as practiced at present, it is the usual practice to place markings on the stone to locate the successively positioned transfer papers and by means of such papers replaced one after the other on the stone to take off duplicate impressions for use in forming the final color printing plates. The method is not conducive to accuracy in the locating of the reproductions on the printing plates due among other reasons to the fact that the transfer paper frequently sticks to the stones as it is peeled off the same, and in removing the paper it stretches thus distorting the transfers. It is vitally necessary in lithographic work that the transfers on the printing plates be exact duplicates of each other to insure the edge to edge contacting of the different colored areas on the final prints.

The primary object of the invention is to provide a form of lithographic stone, or rather a substitute for such a stone, by means of which the transfers on the several printing plates can be made as exact duplicates of each other and thus capable of having their colored reproductions superposed on each other line for line.

Broadly, this object is attained by using a transparent or rather a translucent plate prepared to receive the image in place of the usual opaque stone forming the original design thereon by any of the methods now known in preparing such stones, by directing strong light through the glass plate on to different sensitized surfaces or different parts of the same sensitized surface. Differently expressed, the invention features the elimination of the usual paper transferring steps in lithographic work and the substitution of reproduction made by photo-printing in preparing the several color plates.

Another object of the invention is to provide an improved form of lithographic stone substitute which will function efficiently in practicing high grade lithographic and photolithographic work which will avoid certain defects at present known in the use of lithographic stones and their metallic substitutes, and which will possess certain economic advantages in both the original cost of preparing the same and in storage and other subsequent cost in practicing the art of reproducing from such opaque stones.

Basically, these objects are attained by fusing glass colors or enamel in the form of minute articles to a sheet of glass to produce the requisite grain, stipple or roughness of surface, hereinafter referred to as grain in a refinement of texture necessary to produce fine tones and character in the resulting reproductions. Attempts have been made heretofore to prepare such articles by grinding or etching or painting glass to provide the requisite grain, but attempts along these lines have not been able to produce a stone capable of use in high grade work such as the producing of half tones and the like and such stones when etched have only a limited use in producing cheap cardboards or bill board sheets and are entirely unfited for use in photolithographic work and other work requiring an artistic finish.

In lithographic work there is a demand for lithographic stones which can be formed of any desirable size; which will give a variety of grain, some fine almost to the point of being smooth and others which will give a coarse or rough surface effect with different shades of coarseness between these two extremes and to provide a stone substitute which will possess all of the advantages of the present form of high grade stone.

Accordingly another object of the invention is to provide for a refinement in roughness of surface or working face produced on the stone substitutes herein featured and to provide for a uniformity of surface and with any desired degree of roughness and which selection of degree and uniformity of surface has not been capable of production by any known method of finishing the stone substitutes or metallic plates now in general use.

Still another object of the invention is to

provide a lithographic stone substitute or glass plate which can be produced economically in a variety of colors and which can be produced in sheets, both flat and curved and which sheets can be readily cut to size after they are finished to assure identity in the several composite parts.

Various other objects and advantages of the invention will be in part obvious from a consideration of the method features of the disclosure, from the description of one physical embodiment of the invention and in part will be more fully set forth in the following particular description of one method of practicing the invention, and the invention also consists in certain new and novel modifications of the preferred method and other features of construction and combinations of parts hereinafter set forth and claimed.

In practicing the method of forming the plate herein featured, a surface of a sheet of glass, preferably clear window or plate glass is cleaned conventionally and to this cleaned surface is applied a layer of previously prepared glass colors, usually a mixture of different colors and capable of producing minute and spaced apart particles when fused to the glass. After drying, the coated glass is subjected to one or more firing operations in an oven or lehr and at a temperature previously ascertained for this particular work which will fuse the color to the glass without causing the applied color particles to lose or rather entirely lose their rough appearance, or differently expressed to become smooth.

In preparing the mixture of glass colors there is selected first an ingredient which will give the requisite grain to the surface. Zinc oxide is usually selected especially as it fuses at a high temperature but bone ash can also be used and gives an excellent matted surface. Zinc oxide tends to give a grey cast to the finished glass surface but is the most satisfactory reagent now known despite objections to the greyness.

It is suggested that the roughness of the zinc oxide or equivalent reagent be toned down or rendered somewhat smoother by the use of a reagent capable of rendering the rough zinc oxide paticles less noticeable or prominent on the surface and therefore smoother. Stannous oxide is suggested especially for this purpose as it fuses at a relatively low temperature and thus assists in bringing the mixture to the requisite fusing point. Incidentally, the stannous oxide has the effect of bleaching the grey effect of the zinc oxide. Red lead oxide has been used in place of the stannous oxide with satisfactary results.

As one specific illustration, a mixture containing forty percent by weight of zinc oxide, and fifty percent of stannous oxide has been used with a suitable glass flux. In this particular case, ten percent by weight of a soft lead containing flux was used. Different colors may be added to give the desired coloration. For instance, in forming the reds, oranges and yellows, a selenium base is used; for forming the blues a cobalt is used; all in the proportions necessary to give the required intensity and tone of color shade.

In compounding these ingredients, extreme care must be exercised to obtain the proper fusing point. As the composition of glass varies from time to time and even different batches of glass purchased from the same concern and sold as identically the same glass differ in their fusing points, it is necessary to test each batch of glass and each mixture of the glass colors above described experimentally before proceeding with the preparation of the lithographer's glass herein featured. It is suggested that a sample of the glass under test be first subjected to ascertain its fusing point; then the rough and smooth surface producing reagents in the coating mixture above referred to should be apportioned both to obtain the desired resulting finish, or rather roughness of finish, and if necessary the grain producing reagents should be combined with the requisite amount of flux to bring the fusing point of the mixture below the fusing point of the particular glass on which it is to be used. The mixture of reagents so prepared and combined is placed on a small sample of the glass and subjected to a heat treatment. The temperature is raised experimentally to that point where the mixture fuses into the surface of the glass with a resulting smooth finish. This finish is of course unsuited for lithographic work.

In the instant case recited above this complete smooth finish fusing point was found to be eleven hundred and eighty (1180° F.) degrees Fahrenheit.

With this preliminary work finished it is possible to proceed to form the lithographic glass. A sheet of plain window glass, plate glass or even a colored glass sheet is first cleaned on one face following conventional practices in cleaning glass to receive glass colors. The prepared mixture preferably in liquid form is sprayed, brushed or otherwise applied to the cleaned surface and in such way that the surface receives a thin but uniform coat. One way in which this is attained is to spray the sheet from one side to the other by directing the spray up and down and along vertically extending parallel bands, after which the coating so applied is permitted to dry by exposure to atmospheric air; this usually takes about one minute. Then a second coat is applied, this time directing the spray from top to bottom and along parallel horizontal bands, after which this second coat is permitted to dry. Finally one or more additional coats are applied criss-cross preferably directing the spray diagonally of the plate and along parallel bands

at forty-five degrees to both the vertical and horizontal bands forming the first two coats. After each application the coats are permitted to dry and after the last coat the glass plate is laid down flat with its coated surface facing upwardly and is subjected to an atmospheric drying for a long period of time preferably for at least one hour. It is also suggested that the glass colors be applied to the glass surface by means of a decalcomania or any of the other methods now used in applying coating to glass surfaces.

When thoroughly dried the coated sheet is placed in an oven or lehr and subjected to a heat or firing treatment until the colors have fused into the glass. At this time particular care is exercised to insure a temperature less than the ascertained temperature at which the colors became smooth. If the colors are underfired the surface is too rough and the particles do not lie flat on the glass, and if overfired the surface becomes smooth. In most cases a temperature about forty degrees less than the temperature at which the colors fuse to a smooth finish is about right, but here again some experimental tests are necessary in order to obtain the exact temperature at which the best results are obtained. In the specific case above mentioned where zinc and stannous oxides were used a temperature of eleven hundred and forty (1140° F.) degrees Fahrenheit gave satisfactory results.

When thus fused the resulting glass is permitted to cool conventionally and may be then used for the purpose herein intended. A better character of surface is provided however by subjecting the surface so formed to a rubbing operation with a suitable abrasive and until the desired smoothness or rather the desired degree of roughness is attained. Ground flint and pumice stone are the usual abrasives used for this purpose and the practice followed is that used in polishing smooth glass surfaces. As these plates are usually ordered by sample, the rubbing proceeds until the finish on each plate matches that of the sample.

By following the technic herein outlined there is finally produced an all-glass substitute for a lithographic stone comprising a sheet of glass of any desired thickness having a design, image or pattern receiving surface defined by fused, spaced apart glass or enamel particles integral with the glass sheet and forming a grained appearance to the surface.

When viewed at a distance as at arm's length the plate produced by following this method seems smooth but with a grained or non-reflecting surface. When viewed at close range under a low powered reading glass there is disclosed a uniformally roughened surface.

As the roughened surface so produced is an integral part of the glass base it is impossible for the surface to peel off, and it is not affected by submersion in water. After the design is photographed or otherwise imposed on the glass plate, the artist can work on the same conventionally while under water to bring up the high lights and other necessary retouching for the glass so surfaced is visible under water. With the glass plate so formed the design may be transferred directly to the usual zinc and aluminum plates from which the design is printed, incidentally saving the expense of effecting the transfer by means of transfer paper now necessary with known forms of lithographic stones.

After once ascertaining the proper fusing point for any one particular grade or bath of glass, it is obvious that any amount or number of plates may be practiced simply by coating the plates with the determined glass color mixture and subjecting the same to the ascertained fusing temperature. In producing lithographic plates by this method and as a factory production the cost is very much lower than the nearest corresponding grade of lithographic stone. As the glass plates prepared as herein disclosed are thin compared to the stones, there is effected a material saving in storage space.

When so prepared the frosted grained surface is in condition to receive the design impressed thereon by drawing, by photolithography and by any other process now used in forming designs on the conventional forms of lithographic stones. As the prepared surface shows up white while under water the artist can work on the plate as hereinbefore indicated. Reproductions can be made from the plate simply by interposing the same between a source of strong light and a sensitized surface. In commercial practice and where it is desired to form one or more large color plates each containing a plurality of the designs, the plate is used as the negative in a photocomposing machine which permits of a definite resetting of the plate in case reproductions are to be made at some future time. The machine is advanced along the large color plates in parallel lines conventionally until the desired number of reproductions are formed on the plate of one color and the method repeated for each other color plate desired. As the glass plate with its original design is used over and over again without removing any of its design forming coatings, it is obvious that there is no deterioration of the design. It is simply subjected to the effect of light passed through it at each exposure. As the reproductions are made following the usual practices in forming blueprints and like photoprinting each reproduction is an exact duplicate of every other reproduction and there is no possibility of sectional distortions as is the case with paper transfers and no necessity of exercising care to ascertain that the reproductions

were taken repeatedly from the same parts of the stone.

I claim:

1. In the art of preparing a grained glass sheet for use in place of a lithographer's stone, the method which includes the steps of applying a glass color to a sheet of glass covering the surface in parallel bands, permitting this first coating to dry, applying a second coat of said color covering the dried surface with parallel bands disposed at right angles to the first applied bands, permitting this second coating to dry, similarly applying a third coating in diagonal parallel bands at an angle to both the first two mentioned bands, subjecting the glass so coated to an atmosphere drying for about an hour, subjecting the glass to a heat treatment at a temperature sufficiently high to fuse the colors to the glass but at a temperature less than that at which the colors would fuse to a smooth finish to produce a rough grained surface; permitting the glass so treated to cool and rubbing the rough surface with an abrasive until a desired fineness of grain surface is attained.

2. In the art of preparing a grained glass sheet for use in place of a lithographer's stone, the method which consists in applying to a surface of glass a coating of a mixture comprising zinc oxide, approximately forty percent by weight, stannous oxide, approximately fifty percent by weight and a flux approximately ten percent by weight, and subjecting the glass so coated to a firing treatment at a temperature of about eleven hundred and forty degrees Fahrenheit.

3. In the art of preparing a grained glass sheet for use in place of a lithographer's stone, the method which consists in applying to one face of a sheet of clear glass a coating comprising a mixture of zinc oxide, stannous oxide and a flux, and subjecting the glass so coated to a firing treatment at a temperature of about forty degrees Fahrenheit, lower than the temperature at which said coating would fuse to a smooth finish when applied to this particular glass.

4. In the art of forming a grained glass sheet for use in place of a lithographer's stone, the method which consists in applying to one face of a main sheet of clear glass a uniform and thin coating of a glass color permitting the same to dry in the presence of atmospheric air, subjecting a sample piece of the same glass and similarly coated and dried to a firing treatment to determine the temperature at which there is a fusion of the glass colors into this particular glass and at which ascertained temperature there will be formed a smooth finish to the coated face of the sample glass, subjecting said main coated sheet to a firing treatment at a temperature approximately that of said determined temperature but slightly less than the same, thereby to fuse the colors into the glass and to provide a ground effect or rather grained surface effect in distinction from the smooth finish of the sample.

5. In the art of preparing a grained glass sheet for use in place of a lithographer's stone, the method which consists in providing a mixture of glass colors including a color which when fused to glass will give a rough grain effect and a color which when fused to glass will give a less rough or a substantially smooth effect, together with a flux added to regulate the desired fusing point of the mixture, coating a sheet of glass with said mixture, and subjecting the glass so coated to a firing operation and at a temperature sufficiently high to cause the colors to fuse to the glass and to cause the smooth effect producing color to become smooth or substantially smooth, and at a temperature not so high as would cause the rough grain producing color to lose entirely its grain producing effect or to become smooth.

6. In the art of forming a lithographic glass plate, the method of applying a coating containing zinc oxide uniformally over a surface of a glass plate and subjecting the plate so coated to a firing treatment at a temperature sufficiently high to fuse the zinc oxide into the glass and cause the zinc oxide particles to be somewhat flat on the glass but not so high as would cause the zinc oxide to become smooth across the face of the resulting glass plate.

7. In the art of forming a lithographic glass plate, the method hereto consists in applying to a glass surface a coating containing a mixture of a fine grain producing reagent and coarse grain producing reagent and subjecting the glass so coated to a firing treatment to fuse the reagents into the glass and thus produce a grained surface having a texture depending upon the relative proportions of the reagents in the mixture.

8. In the art of providing a grain effect on the surface of a lithographer's glass, the method which consists in applying to the surface of a plate of glass, a coating of a mixture comprising zinc oxide, stannous oxide and a flux and subjecting the glass so coated to a firing treatment at a temperature of about forty degrees Fahrenheit lower than the temperature at which said coating would fuse to a smooth finish on this particular glass and rubbing the resulting surface with an abrasive until the desired grain effect is attained.

9. In the art of forming a grained glass sheet for use in place of a lithographer's stone, the method which consists in applying to one face of a sheet of clear glass a uniform coating of a glass color, permitting the same to dry, subjecting a sample piece of the same glass and similarly coated and dried to a firing treatment to determine the temperature at which there is a fusion of the glass colors

into this particular glass and at which temperature there will be formed a smooth finish to the coated face of the sample glass, subjecting said coated sheet to a firing treatment at a temperature approximately that of said determined temperature but slightly less than the same, thereby to fuse the colors into the glass and to provide a ground or rather grained surface effect in distinction from the smooth finish of the sample, permitting the glass sheet so treated to cool and rubbing the grained surface with an abrasive until the desired fineness of grained effect is attained.

10. A substitute for lithographic stone, comprising a sheet of glass having a design, image or pattern receiving surface defined by fused, spaced apart glass color particles integral with the glass sheet lying flat thereon and forming a somewhat smooth grained and non-reflecting surface when reviewed at arm's length and which discloses a uniformly roughened appearance when closely examined.

Signed at New York city, in the county of New York and State of New York, this 3rd day of January A. D. 1929.

EDWARD A. ZEH.