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(54) Resists.

(57) The stencils (resists) currently employed in sand-blasting engraving techniques, for example of glass, are relatively flimsy, and thus it is easy to over-engrave and so to spoil the article being worked upon. In addition, the paper backing onto which the resist layer is applied is invariably uncoloured, and this makes it too easy to mistake the paper for engraved glass or vice versa, adding to the difficulties of performing the engraving process correctly.

The present invention provides a resist the backing sheet of which is of a strong colour that contrasts with the colour of the surface to be engraved when thus engraved. The backing sheet preferably also contrasts with the colour of the resist layer itself, and is advantageously of a heavy-weight pre-gummed paper wherein the adhesive gum is provided in spaced particulate form.

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RESISTS

This invention concerns resists, and relates in particular to the paper-backed "plastics" resists used in the engraving of glass by a sand-blasting technique.

For many centuries glass has been engraved by a variety of techniques. Hand-engraving, using a hand-held engraving tool to "scrape" off glass, has been, and still is, the way the best results are obtained. but it is naturally very expensive. Modern technology has provided two alternative ways that are much faster, and need less of a craftsman's time (and so are cheaper), namely acid etching and, more recently, sand blasting. Each of these techniques requires the use of a stencil-like device, known as a "resist", through the apertures of which the acid or sand can cut, but which protects the glass from attack elsewhere; the present invention relates to the resists used with the sand blasting method.

The resists commonly employed in the engraving of glass by sand blasting (the "sand" employed is particulate aluminium oxide of whatever size is deemed appropriate; it is commonly referred to as "grit") comprises a stencil-like pattern of grit-resistant material on a paper backing. The grit-resistant material is usually a very thin "plastics" layer derived from certain varieties of printing ink, whilst the paper backing is commonly a very light weight paper (tissue paper, say, of around 17g/m^2 weight). The whole is, rather confusingly, known as "the resist", and in this Specification the whole - the resist layer/paper backing combination - will be referred to as "the resist", whilst the resist layer itself, which is also often called "the resist", will be referred to as "the resist layer".

In use the resist is first coated on its reverse side (that side of the paper backing not carrying the resist layer) with a suitable adhesive usually by brushing or spraying, and is then positioned on, and placed in contact with, the glass surface to be engraved, glue to glass, and firmly pressed into attachment with the surface. This forms a resist layer stencil mounted via the paper backing on the glass. The next stage is the sand (or grit) blasting stage, when fine grit (of, say, around 200 mesh in size ... that is, of such a size that it passes through a mesh having 200 mesh threads per inch) is air-blasted (at a pressure around 20 lbs/in^2; about 3 kPa) at the glass through the resist. The resist's tissue paper backing is eroded away almost immediately, leaving the relevant areas of glass unprotected, and accordingly those areas are themselves eroded by the air-borne grit, the depth of erosion, or "cut", depending upon the air pressure (the higher the deeper), the grit size (the coarser the deeper) and the time taken (the longer the deeper). Conversely, where the glass is protected by the resist layer no erosion occurs, and the glass stays in its original pristine condition.

Of course, the resist layer is only partially resistant to the eroding effect of the grit, and in time it too will be eroded away, together with its paper backing, leaving the glass unprotected. Indeed, the higher the pressure and the coarser the grit, the shorter time the resist layer can hold out. Accordingly, in actual use it is necessary to apply skill and judgment to the blasting process, in order to achieve the desired cut where required but no cut at all where the glass should be protected. The present invention relates to ways of improving the quality of the resist so as to make this easier, and so make the engraving process more reliable.

The paper commonly used in the Art as the backing sheet is invariably white - or, rather uncoloured in any way - and this has a serious disadvantage during the actual blasting/engraving stage, for the result of engraving water-white (i.e, colourless) glass by this, or any other, technique is to leave a "white" area which is practically indistinguishable from the untouched paper. As a consequence it is all too easy to mistake paper for engraved surface, and to end up either completely failing to blast one part of the design or only partially blasting one part, leaving it "under cut" (that is, not eroded uniformly or deeply enough).

Moreover, the paper backing sheets employed in the Art are generally of a very light paper - tissue paper - and this makes the resist difficult to use because the backing sheet is so flimsy that it is easily torn, especially when wet (as it will be when coated with adhesive prior to application to the glass). The paper's flimsiness also makes it very difficult to position and then re-position, without tearing, the resist on the glass surface (repositioning will very often be necessary so as correctly to align the resist - and this particular problem of re-positioning is made worse by the use of an adhesive which, applied by a brushing or spraying technique, extends over the whole of the sheet's reverse surface.

To help reduce at least some of these difficulties the invention proposes that the resist's backing sheet be made of a strongly coloured paper that will contrast well with the colour (usually white) of the engraved glass surface (and, indeed, preferably with the colour of the resist layer as explained further hereinafter).

In one aspect, therefore, the invention provides a sand-blasting engraving resist comprising a backing sheet and a resist layer supported thereon,

characterised in that the backing sheet is of a strong (non-white) colour that contrasts well with the colour of the surface to be engraved when thus engraved.

The invention provides a resist with a backing sheet that is strongly coloured in contrast to the colour of the expected sand blasted engraved surface. When the material to be engraved is clear glass the colour of that surface when engraved will be white - a fairly bright, opaque white when the engraving is accomplished using a coarse grit, a less bright, more transparent white when a finer grit is employed. Suitable colours are the darker primary colours - blue, green, and (especially) red - as well as shades thereof (a preferred paper is that shade of red referred to by the Manufacturers Samuel Jones as FLATSAM RED).

The colour of the paper backing sheet is chosen to be a contrast to the expected colour of the surface when blasted/engraved. In addition, however, the colour is very preferably chosen to be a good contrast to the resist layer. As described further hereinafter a preferred resist layer is made by screen printing a chosen printer's ink (or mixture thereof) that is itself blue in colour; a paper colour that is a good contrast to this blue is red (specifically the red shade mentioned above).

Apart from being strongly coloured, as described hereinbefore, the backing sheet may incorporate any of those features, and be of any material, commonly used in the Art. Thus, it is in some respects to be preferred to employ a relatively lightweight paper which will more easily be "mouldable" (by carefully folding in situ) to the shape of a curved surface to be engraved than to employ a heavyweight paper. There are tough, lightweight papers available - those commonly used as airmail paper, or "onion skin", are good examples - so that a light paper need not be flimsy. However, for general use - and especially on flat surfaces - the paper may conveniently be quite a lot heavier (and thus thicker and stronger). Papers of 70 and 80 g/m^2, for example, are robust enough to stand up to the harsh treatment they will receive yet flexible enough for most purposes.

It is also advantageous if possible to avoid the awkward and messy stage of applying an adhesive to the reverse of the resist's backing sheet. Such avoidance may be achieved by employing a pre-gummed backing sheet. The gum used may be one of the contact adhesives (usually a vinyl glue), such as is used on peel-off sticky labels, or it may be a more conventional water-based glue that needs wetting before the paper is applied to the surface to be etched. In this latter case there are particular benefits if the glue is provided on the reverse side of the sheet as a myriad of individual, spaced, particles (so that comparatively large areas - those between the adhesive particles -have no gum at all), as this enables the sheet to adhere to the surface to be engraved sufficiently yet not so much that it cannot easily be slid around thereon into the desired position. Moreover, one perhaps surprising advantage is that, unlike a conventional gummed paper (having a complete layer of glue), a particulate-gummed paper does not suffer nearly so seriously from differential expansion/contraction effects when dried in an oven (as is required for curing the subsequently-applied resist layer; see below).

Pre-gummed paper having its adhesive layer in the required particulate form is fairly readily available (the technology is used extensively for "ready-pasted" wallpaper), and the exact nature of the adhesive, and the precise size and description of the particles thereof, is not especially critical. One such paper, available at 70 and 80 g/m^2, is made and sold by Samuel Jones under the name FLATSAM and supplied by Wiggins Teape.

As might be expected, an excellent resist of the invention is obtained using paper that is of a strong surface-contrasting colour and has a particulate adhesive coating on its reverse side. Such a sheet is a considerable improvement on those sheets presently in use. However, the resist can be improved even further by prudent choice of the characteristics of the resist layer itself.

The materials presently employed to make engraving resists are a special type of printer's ink formulated so as to be, in theory, particularly good for this purpose. They may be applied onto the backing sheet in a number of ways, depending upon whether they are applied in the desired pattern or whether they are applied all over to form a blank into which the desired pattern is cut thereafter. In the former case they may conveniently be applied by a screen printing technique, whilst in the latter they may be applied by any printing technique (the pattern may later be cut therein by some form of cutting and removing operation; the cutting stage is often computer-controlled).

Unfortunately, the inks used do not always provide a resist layer that is really tough enough for use in a sand blasting engraving process. It is all too common for the blasting stage to be so inexpertly carried out that the resist layer itself (and the backing sheet thereunder) is in parts completely eroded as the blasting proceeds, so that the underlying surface is engraved where it should not be as well as where it should be. Where this danger exists then it may be overcome, or at least mitigated, by selecting a rather different, and potentially tougher, material for the resist layer. One such is a mixture of heat-fixable printer's inks of the type more commonly employed to print slogans and pictures onto textile fabric (especially,

onto T-shirts). These inks are generally of the kind wherein a pigment is dispersed within a suitable liquid carrier together with a plastic-like curable material such as a vinyl or "rubber" polymer or pre-polymer of some sort, and often including a silicone. Such inks are available from Sericol and from Marler, and two particular examples of such an ink are Marler Special Blue SP 3182 and Texical T.X. One of these is a vinyl ink, the other is a rubberised one; one is blue, the other black.

Mixtures of these inks can give better properties (such as strength and/or colour). Typically, two inks will be mixed - 70 to 80 wt parts of one (SP 3182, say) with 30 to 20 wt parts of the second (T.X., say).

As might be expected, the thickness of the resist's resist layer is also an important factor determining the durability of the resist, and by and large the thicker the layer the better, though in practice really thick layers - layers more than, say, 0.05 in (1 mm) thick - are too thick to be used easily especially on curved surfaces). A preferred resist layer thickness is around 0.005 in (0.1 mm), which is the sort of thickness that can readily be achieved by a screen printing method using a screen with a mesh size of from 70 to 90 mesh (that is, from 70 to 90 apertures per inch: the smaller the number the larger the apertures, and the more ink is squeezed through to make a thicker layer). Such a layer is about four times the thickness of those layers presently used in the Art, which, when screen printed, are applied using screens with mesh sizes of from 110 (relatively coarse) to 320 (very fine).

However, in the special case where the resist layer is made using a printer's ink of the preferred "T-shirt" variety (or a mixture thereof), the screen used to print it on may be rather finer - just, indeed, as presently conventionally used - for the ink material itself provides a tough resist layer despite its relative thinness.

The types of ink commonly employed in the Art for making resist layers are usually heat-fixable, or heat "curable" - that is, they are passed at a carefully controlled rate through a hot oven in which their volatile components are evaporated off and their plastics components are combined - perhaps by polymerisation and/or evaporation - to render them permanently affixed onto the substrate. With some of them, and especially the "T-shirt" sort, a particularly tough and durable resist layer is formed if this heat curing stage is effected at a lower temperature, and for a longer time, than normally recommended for the particular inks. Thus, while SP 3182 is normally cured at 180°C for 50 seconds, a better resist product is obtained if the cure is affected at a lower temperature 175°C, say - and for a significantly longer time -for instance, for 70 to 80 seconds. It is not entirely clear why this should provide an improved coating. It seems likely, however, that part of the fixing process involves the ink penetrating the surface layers of the paper, and that the longer curing time enables this to happen to a greater extent, thus improving the bond to the paper and hence the durability.

It will be appreciated that a resist having a resist layer with excellent properties is achievable by using one (or more) ink as described above to create a layer around 0.005 in (0.1 mm) thick and then curing it more slowly and at a lower temperature than normally recommended.

The sand blasting engraving resists of the invention, especially those using thicker resist layers, are of considerable value in improving the ease and reliability of the engraving process. Not only does a preferred resist have the specific advantages mentioned hereinbefore, but in addition it may, because of its increased durability, be employed with blasting grits of a much coarser nature; instead of fine particles of perhaps 180 to 220 mesh, that erode away the surface at a slow rate, leaving a relatively smooth finish, there may be employed coarse particles of 90 to 110 mesh, that erode the surface very much faster, leaving a relatively rough finish. Moreover, the blasting process may be effected at a higher pressure -say, 100 to 110 lbs/in^2 (around 15 kPa) rather than the previously-used 20 to 25 lbs/in^2 (around 3 kPa). In this way quite different engraving effects can be achieved in a much shorter time; part of a job can be done using coarse grit at low pressure, to produce a rough, "opaque", surface, whilst some other part of the job can be done using finer grit at higher pressure, to produce a smoother, more "transparent", surface. Furthermore, it is now easier to "over-engrave" - that is to say, to carry out a second stage of engraving over an area that has already been engraved and specifically to blast-engrave, with a single resist, first one area and then, after removing some of that resist, the thus-revealed area, without any significant risk that the resist will fail to stand up to the additional engraving stage.

The resist of the invention, and the sand-blasting engraving method using the resist, may be employed in the engraving of almost any sort of material - stone (granite, for example), metal, plastic, wood, or, and especially, glass. Moreover, the material may take almost any shape and form, from a wine glass or beer mug to a plate glass window, from a tombstone or a commemorative plaque to a pub mirror. Naturally, the invention extends to an object whenever engraved by the inventive method.

The following Example is now given, though by

way of illustration only, to show details of a preferred embodiment of the invention.

Example The Sand-Blasting Engraving of a Small Window

Stage 1 Preparation of the Resist

Using a normal commercial source there is prepared for use in a screen printing process a screen bearing the desion to be printed. This screen is a 90 mesh polyester screen, and carries the image in the form of ink-impenetrable areas where the window is to be engraved.

A printing ink mixture is prepared by blending together 75 wt parts of Marler Special Blue SPO 3182 and 25 wt parts of Texical T.X. There is also readied the paper to become the backing sheet for the resist. This paper is Flatsam Red, from Samuel Jones. It is a bright red in colour, is of 70 g/m^2 weight, and has a particulate adhesive coating on the reverse.

In the normal way, the prepared ink mixture is screen printed onto the backing sheet using the prepared screen. The resultant printed sheet is then "cured" by heating for 80 seconds in an oven at 160° C, to give a resist wherein the resist layer (the "cured" ink) is about 0.025 in (0.5 mm) thick.

The blue resist and the red paper make an excellent contrast.

Stage2 Engraving by the Sand-Blasting Technique

The formed resist is moistened on the reverse side, and then stuck to the water-white (clear) window glass. Before the glue dries the resist may be moved -slid - about to obtain the desired registration.

After being placed in a suitable closed cabinet, the glass is engraved, through the resist, using the sand-blasting technique. In this technique a source of fine grit - in this case, aluminium oxide particles of a 50:50 180/220 mesh mixture - is entrained in air and blasted at the resist at a pressure of 100 lbs/in^2 (15 kPa). As the blasting proceeds the sand erodes through the paper backing sheet until the glass surface therebelow is revealed, and then erodes through that as well. As the smooth glass surface is eroded so it turns milky white (the normal "colour" of roughened clear glass), and this is in strong contrast to those areas of the resist where the red paper backing sheet has not yet been eroded away. Meanwhile the sand-blasting continues, the resist layer protecting those areas where erosion is not required.

Eventually, by blasting back and forth over the whole surface, the complete design is engraved into the glass surface to the required depth, and the blasting is stopped. The remains of the resist - comprising the slightly "weakened" parts of the resist layer - are then removed to reveal the finished engraving.

Claims

1. A sand-blasting engraving resist comprising a backing sheet and a resist layer supported thereon, characterised in that the backing sheet is of a strongly non-white colour that contrasts well with the colour of the surface to be engraved when thus engraved.

2. A resist as claimed in Claim 1, wherein the backing sheet is red.

3. A resist as claimed in either of the preceding Claims, wherein the backing sheet is paper having a weight of 70 to 80 g/m^2.

4. A resist as claimed in any of the preceding Claims, wherein the backing sheet is made of a ready-gummed paper.

5. A resist as claimed in Claim 4, wherein the adhesive gum is a water-based glue present in a spaced particulate form.

6. A resist as claimed in any of the preceding Claims, wherein the resist layer is of a colour that contrasts with the colour of the backing sheet.

7. A resist as claimed in any of the preceding Claims, wherein the resist layer is made from one or more printer's ink of a heat-fixable kind.

8. A resist as claimed in any of the preceding Claims, wherein the thickness of the resist layer is 0.005 in (0.1mm).

9. A method of sand-blasting engraving characterised in that there is employed a resist as claimed in any of the preceding Claims.

10. A method is claimed in Claim 9, in which there is employed a blasting grit of 90 to 110 mesh, and the blasting is effected at 100 to 110 lbs/m^2 (15 kPa).