

1

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METHOD OF STAIN MARKING ARTICLES HAVING VITREOUS SURFACES

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This invention relates to a method of marking articles 15
having vitreous surfaces.

By way of example the invention will be described
herein with respect to the marking of glass articles and
more particularly, glass medical instruments. However,
it is to be understood that this form of the invention only 20
is to be considered as illustrative and the invention is
not to be deemed as limited thereby except to the extent
to which features of such embodiment are pointed out
below and are incorporated in the appended claims.

Two methods of permanently marking glass medical 25
instruments are in general use presently. In one of them,
hereinafter referred to as "staining," a composition is
arranged on the instrument in the pattern of a desired
mark and the instrument heated in an oven. The com-
position contains a heat-decomposable metallic compound, 30
the metallic constituent of which upon release in nascent
state migrates into the surface of the glass instrument and
stains the same. The decomposition temperature to which
the instrument is heated in the oven must be below the
melting point of the glass which forms the instrument. 35

The other method consists in etching the desired mark,
as with hydrofluoric acid. The etching step usually en-
tails covering the surface to be marked with a layer of
inert material, e. g. wax, removing this material in the
shape to be marked, and applying an etching substance 40
which eats into the glass where the inert material has
been removed.

The staining method usually is preferred to the etching
method due to its lower cost and lesser number of steps.
However, it cannot be employed where the heat necessary 45
to decompose the marking composition is so great that it
will destroy the article to be marked.

For example, fever thermometers cannot be marked by
the staining method because such thermometers must be
marked after filling and the decomposing temperature
is of the order of 1000° F.—just below the melting point
of the glass—so that the filled thermometer would ex-
plode. Moreover, the staining method is subject to the
disadvantage that the entire article being marked is sub-
jected to a high temperature which tends to affect dimen-
sional stability. Also, the heating step may give rise to
internal stresses if the article is not properly cooled after
heating. In addition, the heating step involves the pro-
vision of much unnecessary heat and the handling of very
hot objects.

It is an object of my invention to provide a method
of printing articles of the character described which is
subject to the drawbacks of neither of the foregoing
processes but has all the advantages of the staining pro-
cess. 65

More specifically it is an object of the present invention
to provide a method of the character described in which
articles are stain-marked but are not heated in their en-
tirety to the high temperatures characteristic of the staining
process.

It is another object of my invention to mark by staining
articles such as fever thermometers which if bodily heated

2

to the high temperatures of the present-day staining
method, would explode.

It is another object of my invention to provide a mark-
ing method of the character described which does not
require the handling of hot articles, the expenditure of
considerable energy for heat and the careful cooling of
heated glass.

It is another object of my invention to provide a method
of the character described which is rapid, simple and
economical to practice. 10

Other objects of my invention in part will be obvious
and in part will be pointed out hereinafter.

My invention accordingly consists in the series of steps
which will be exemplified in the methods hereinafter de-
scribed and of which the scope of application will be indi-
cated in the appended claims.

Basically, pursuant to my invention, I place on an article
having a vitreous surface to be marked a composition
which is arranged in the pattern of a desired mark. This
composition contains a heat-decomposable metallic com-
pound whose metallic constituent upon release in nascent
state migrates into the surface of the article and stains
the same. My invention differs from the previous stain-
ing method hereinbefore described in that, instead of
heating the article in its entirety, e. g. in an oven, so as to
decompose the compound, I locally heat only the com-
position, i. e. heat the composition directly by an external
source of energy, the article incidentally being heated by
conduction in the immediate vicinity only of the composi-
tion. 20

More particularly, the composition is heated electri-
cally by placing it in a high-frequency field of electric
energy, e. g. an electrostatic field or an electromagnetic
fields, depending, as soon will be explained, upon the
nature of the composition. 25

An example of a heat-decomposable metallic com-
pound which is useful in carrying out my invention is
a metallic halide, for instance, silver chloride. When a
composition including this compound is heated in the
vicinity of glass, upon decomposition of said compound
the silver is liberated in a nascent state which is char-
acterized by its ability to penetrate an adjacent vitreous
surface in its immediate vicinity and to form a stain
therein duplicating in pattern the pattern in which the
composition was arranged. If the composition should
consist entirely of silver chloride, the same is heated in
accordance with my invention by placing the article on
which the composition is disposed between the electrodes
of a conventional electrostatic heating machine. As is
well known, the frequency of the machine is adjusted
to approximately the critical (resonant) frequency for
silver chloride. Thereupon the application of a high fre-
quency electrostatic field with extreme rapidity will elevate
the temperature of the silver halide until the same de-
composes and liberates nascent silver. 30

Inasmuch as the critical frequency for the glass article
on which the composition is disposed is quite different
from that of silver chloride, the article will not be heated
noticeably by the electrostatic field, although the article
will be heated locally by conduction of heat from the hot
silver chloride. However, this heating of the article
is comparatively minor—a matter of a few degrees—and
therefore will not affect the dimensional stability of the
article nor raise the overall temperature of the article
to any substantial extent. For instance, if the article
being marked is a fever thermometer and the markings
are placed on by electrostatic heating of silver chloride,
the temperature of the fever thermometer will be raised
less than 8° F. so that there will be no danger of the
indicating liquid over-heating enough to explode the
thermometer. 35

It now will be appreciated that, pursuant to my inven-

tion, I can stain mark objects such as fever thermometers which heretofore could not be thus marked. Likewise articles which would have had their dimensional stability affected by subjection to the temperature required for stain marking now can be stain marked pursuant to my invention. In this latter connection, some objects, e. g. glass hypodermic syringes, are known to be slightly affected by the previous method of stain marking. These articles are finished to very close tolerances so that even the slight warping caused by their overall heating for stain marking lessened their usefulness. By employing my new method of stain marking this is avoided.

The composition can be placed on an article in any desired pattern by a suitable method, for example, by printing, as through a silk screen or stencil. The composition can be printed through the stencil simply as a powder. However, it is desirable to have the powdered composition incorporated in a suitable carrier, such for instance as a synthetic plastic and solvent for the same. The solvent will evaporate after the mark is printed through the screen and before the heat-printing step has taken place which decomposes the metallic compound. A typical synthetic plastic is cellulose acetate, and typical solvents are ethyl acetate and acetone.

When the printed mark upon evaporation of the solvent solidifies in the pattern of a mark to be applied, the article is placed in an electrostatic field which is tuned to the frequency required to rapidly heat the heat-decomposable metallic compound. Alternatively, the electrostatic field can be tuned to the critical frequency of the synthetic plastic and as the same is heated it will heat the metallic compound which is intimately admixed therewith to the point of decomposition.

In either case the synthetic plastic will decompose while the metallic compound is decomposing.

It may be mentioned that the electrostatic field may not be, and desirably is not, applied over the entire article but can be localized at the region where the stain marking is to be effected. For example, if a large article is to have a small mark applied thereto, pursuant to my invention, the electrostatic field can be quite limited. However, if, as in the case of a fever thermometer, the stain marking is to cover substantially an entire side of an article, the electrostatic field will be coextensive with the article.

Another manner of placing the marking on an article consists in having the metallic compound incorporated as a powder in a carrier, such for instance as an oil paste and printing the combined oil paste and metallic compound on a plastic pellicle. This plastic pellicle in turn can be carried by a sheet, being adhered to the sheet by a water-soluble cement so as to form a decalcomania. When it is desired to remove the pellicle from the sheet the decalcomania is immersed in water whereupon the freed pellicle can be transferred to the article to be marked and there heated by placing the article and marking in an electrostatic field of the proper frequency.

Desirably, in order to obtain good dispersion of particles of the metallic compound and a high concentration of said particles, the compound is carried by a matrix, a satisfactory and typical matrix being particles of ferrous oxide (Fe_2O_3). The metallic compound is incorporated in the matrix in any suitable manner. For instance, a water-soluble salt of the metal involved, such as silver nitrate, is dissolved in water. Then the matrix, ferrous oxide, is added to the solution in powder form. The solution is mechanically agitated to uniformly disperse the ferrous oxide particles and then silver chloride is precipitated on said particles by adding hydrochloric acid to the solution. The composite matrix and metallic compound can be incorporated in a carrier such as a pasty oil base or a synthetic plastic and solvent and printed either directly on the article to be marked, as by a stencil, or printed on a decalcomania pellicle. After the marking is applied to an article to be stain marked the metallic

compound and matrix are heated electrostatically, the frequency of the electrostatic field being tuned to heat either the heat-decomposable metallic compound directly or the matrix or carrier.

Furthermore, the matrix may constitute powders of a magnetic material, e. g. powders of iron, steel, cobalt, nickel or alloys thereof, on which the metallic compound is deposited in powder form or the composition may include magnetic powder with which the compound is admixed. A magnetic composition of this type is printed in any of the foregoing manners (as a powder, by incorporation with a synthetic plastic base, by incorporation with a pasty oil base, or as a decalcomania) on an article and the article or that portion thereof on which the printing is present is disposed in a high frequency electromagnetic field where the magnetic powders will be heated by induction so as to reach the temperature at which the metallic compound will decompose and release nascent metal which will enter the surface of the article to be stain marked.

It thus will be seen that there is provided a method which achieves all the objects of the invention and is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiments above set forth, it is to be understood that all steps herein described are to be interpreted as illustrative and not in a limiting sense.

Having thus described the invention, I claim as new and desire to secure by Letters Patent:

1. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including a heat-decomposable metallic compound, and locally heating only the composition in a high frequency field of electric energy.

2. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including a heat-decomposable metallic compound, and locally heating only the composition in a high frequency electrostatic field.

3. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including a heat-decomposable metallic compound and a magnetic powder, and locally heating only the composition in a high frequency electromagnetic field.

4. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including a heat-decomposable metallic compound, and locally heating only the composition in a high frequency electrostatic field whose frequency is approximately the critical frequency for the metallic compound.

5. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including a heat-decomposable metallic compound incorporated in a synthetic plastic, and locally heating only the composition in a high frequency electrostatic field whose frequency is approximately the critical frequency for the plastic.

6. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including a heat-decomposable metallic compound in a non-magnetic matrix and locally heating only the composition in a high frequency electrostatic field whose frequency is approximately the critical frequency for the matrix.

7. A method of stain marking an article with a vitreous surface, said method comprising applying to said

5

surface a composition in the shape of the mark to be effected, said composition including a heat-decomposable metallic compound in a magnetic matrix, and locally heating only the composition in a high frequency electro-magnetic field.

8. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including a silver halide, and locally heating only the silver halide in a high frequency field of electric energy.

9. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including a silver halide, and locally heating only the silver halide in a high frequency electrostatic field.

10. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including silver chloride, and locally heating only the silver chloride in a high frequency electrostatic field.

11. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including silver chloride, and locally heating only the silver chloride in a high frequency field of electric energy.

12. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including silver chloride in a ferrous oxide matrix, and locally heating only the composition in a high frequency field of electric energy.

13. A method of stain marking an article with a vitreous surface, said method comprising applying to said surface a composition in the shape of the mark to be effected, said composition including silver chloride in a matrix of ferrous oxide, and locally heating only the composition in a high frequency electrostatic field.

14. A method of stain marking a filled glass fever thermometer, said method comprising applying to the

6

thermometer a composition in the shape of marks to be formed on the thermometer, said composition including a heat-decomposable metallic compound, and locally heating only the composition in a high frequency field of electric energy.

15. A method of stain marking a filled glass fever thermometer, said method comprising applying to the thermometer a composition in the shape of marks to be formed on the thermometer, said composition including a heat-decomposable metallic compound, and locally heating only the composition in a high frequency field of electric energy.

16. A method of stain marking a filled glass fever thermometer, said method comprising applying to the thermometer a composition in the shape of marks to be formed on the thermometer, said composition including a silver halide, and locally heating only the silver halide in a high frequency electrostatic field.

17. A method of stain marking a filled glass fever thermometer, said method comprising applying to the thermometer a composition in the shape of marks to be formed on the thermometer, said composition including silver chloride in a ferrous oxide matrix, and locally heating only the composition in a high frequency field of electric energy.

18. A method of stain marking a filled glass fever thermometer, said method comprising applying to the thermometer a composition in the shape of marks to be formed on the thermometer, said composition including silver chloride in a matrix of ferrous oxide, and locally heating only the composition in a high frequency electrostatic field.

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