

1

2,945,333

METHOD AND APPARATUS FOR POLISHING

Robert Touvay and Philippe Tommy Martin, Paris, France, assignors to Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey, Paris, France

No Drawing. Filed June 2, 1950, Ser. No. 165,858

9 Claims. (Cl. 51—283)

This invention relates to the polishing of glass and particularly to the polishing of flat glass. The invention includes a process, an apparatus and a material which are cooperative. The invention is particularly applicable to the polishing of sheets of plate glass, but it may be applied to the polishing of other materials which require the use of such tools to attain a high luster.

The finishing of the surface of materials such as glass and stone has involved a number of stages of which the first is usually called grinding, which is frequently carried out by iron runners and coarse abrasive, and the last, that which brings the material to its smoothest condition and highest polish, is called polishing, and is carried out by tools having felt faces. The polishing of flat glass has been accomplished heretofore by means of tools having a rigid body covered by felt, which is still the standard polishing material despite all attempts to use substitutes. In employing felt it is necessary to divide the polishing operation into two phases, one at the beginning during which the tools are fed by a liquid containing a polishing composition and a second during which the supply of polishing composition is reduced and finally ended, whereupon the felt dries and acquires sufficient rigidity to complete the polishing. The material most frequently used as a polishing composition is a water sludge of iron oxide called rouge. The tools move across the surface being polished, under pressure.

The previous practice involves working at the beginning with abundant polishing composition in order to keep the felts loaded with polish, and this portion of the work is called the wet stage. After this stage has been completed the supply of polish is reduced little by little and finally terminated completely, leading to the dry stage of the operation, during the course of which the felt becomes much more rigid, and finishes the polishing. Heretofore, no wholly satisfactory substitute for felt has been found and the two-stage process has been necessary.

It is an object of this invention to keep the polishing in the wet stage, eliminating the dry stage of polishing, which heats the flat glass and renders it very sensitive to local cooling caused by air draughts.

Another object is to shorten the time required for polishing.

A further object is to reduce the cost of iron oxide polish, by replacing said polish by a less expensive material.

The objects of the invention are accomplished, generally speaking, by a combination, including a polishing tool having a polishing face composed of rubber or a rubbery synthetic resin, and by supplying the tool continuously throughout the polishing with a suspension of polish in liquid. The cost of polish is reduced by this invention because the invention makes it possible to use the detritus from previous polishing operations as the polish in subsequent operations. Thus, if an initial polishing of glass has been accomplished by an aqueous suspension of iron oxide, the by-product of the polishing is a paste or sludge containing water, iron oxide and

2

glass grindings. That mixture could not be used heretofore but can be used in the practice of our invention, thereby reducing the purchases of polish and saving the cost thereof. The tool employed, except for its polishing surface, may be identical with the tools now in use, most of which are either circular or annular, used singly or in groups. The tool employed in this invention has a hard base attached to a spindle. The hard base is flat and is usually circular or annular. The spindle rotates the base. The working face of the hard base, which may be of wood or metal, is covered wholly or partly with the rubbery resin in a thin sheet.

This invention is based upon the principle of carrying out the polishing throughout with an abundant supply of polish suspended in liquid, but employing a tool having a working face which possesses at all times a rigidity of the same order as that of felt during the dry stage of standard practice. The materials employed as the working face of the tool are rubber and rubbery artificial resins, examples of which are natural rubber, polymerized vinyl chloride, plasticized or not, preferably mixed with fillers such as saw-dust which offers in particular the advantage of being practically inert and resistant to chemical agents, and the silicones having physical properties similar to natural rubber.

It has been demonstrated, whereas in former practice the speed and pressure of the tools had to be relaxed during the dry stage in order to avoid breakages caused by the accidental changes of temperature which have been above mentioned, that with this invention the speed and pressure can be maintained without risk of cracking the glass, the speed and pressure being at least equal to that which is permissible during the wet stage of the earlier practice and frequently higher. This has permitted a reduction in the time required for polishing, while attaining results of equal excellence. It is particularly advantageous to maintain a single speed and pressure of tools throughout the operation.

The thickness of the working face of the tool, the rubbery polishing face which is attached to the rigid foundation of the tool, can be varied at will to suit the nature of the material employed and to give some variation in rigidity. The new polishing material may be applied to the tool by a special adhesive called Durofilm primer in a very thin layer, or by means of heat and pitch of a hardness on the order of 6-20 Shell.

The tools may be supplied with liquid, containing the polishing composition in abundance, throughout the polishing operation and this permits one, as explained hereinabove, to maintain on the glass, throughout the operation, the high pressure favorable to good polishing, and to reduce the time required to complete the work. A particularly useful tool has a hollow central shaft through which the abrasive sludge is fed, and an annular polishing face containing radial channels, extending all or part of the way to its outer rim, which serve to conduct the sludge evenly to the face of the polisher.

In a valuable modification of the invention, the rubbery working material may have incorporated in it, dispersed through it, during its manufacture, mineral or organic fibers, natural or synthetic, such for example as hair or cellulose fibers, and particularly glass fibers, preferably well dispersed and acting as modifiers of the surface. Saw dust from soft wood gives a clotty (rugged) structure which increases the efficiency of the working of the polishing agent.

An advantage of the incorporation is that it produces a surface less smooth, reduces elasticity, and produces a granular but not a harsh working surface. With poplar saw dust one may employ a variable mixture, the percentage of saw dust ranging between 10 and 50 parts by

volume of dry wood. Below 10% efficiency decreases and above 50% the material tends to become friable.

The hardness of the material is best measured against felt, because that is a material known to the glassmaker and a standard he understands, but it is also possible to measure it against a laboratory standard such as Shore, being somewhere near 84-92 on that scale.

The polishing abrasive used in the polishing composition may be any oxide the melting temperature of which exceeds 800° C., such as silica, alumina, titanium oxide, etc.

Sometimes, to increase the adherence of the grains of polish, the working face of the tool may be supplied with a thin coating of material capable of retaining the polish while operating at the best working temperature and in contact with the liquid. Examples of such materials are wax and pitch, which may be applied to the surface of the tools in any convenient way. The hardness of wax and pitch is a function of their temperature and the efficiency of a polisher is related to its hardness. Polishing with a continuous and abundant supply of fluid polishing composition according to the invention, makes it possible to control the temperature of working and consequently the hardness of the polisher, which can be maintained at the optimum value for the particular polishing agent; for instance, the apparatus may be enclosed and the enclosure kept at the selected temperature by external or internal heat exchange, or the temperature of the polishing fluid can be regulated while the fluid is supplied in quantities sufficient to maintain the selected temperature.

Certain abrasives may be included in the body of the polisher, for instance rouge or other glass polishes, but are not generally considered to form an equivalent polisher. The filler should be thoroughly and uniformly dispersed in the material during its manufacture. For example, in making polyvinyl chloride in bulk, a mixture of one part by weight of polyvinyl chloride with one part of tricresylphosphate and one part by weight of poplar saw dust may be prepared and maintained in uniformly dispersed condition by the regular agitation which accompanies the polymerization of the vinyl chloride, becoming embedded in the polymer. Or the filler may be added to the prepared rubbery resin on the calendar.

The following example illustrates the process and the making of the new products.

One part in weight of poplar saw dust passing through a 6-10 mesh screen and retained by a 30-60 mesh screen is added to a mixture of one part in weight of polyvinyl chloride and of one part in weight of tricresylphosphate maintained at a temperature of about 130° C. These constituents are kneaded together and formed into a sheet of rugged structure which is stuck to an ordinary polisher by means of molten pitch having a hardness comprised between 6 and 20 of the Shell test scale. The polishing composition used is a suspension of from 100 to 300 grams of iron oxide per liter of water, fed at a uniform rate of 5-6 cubic centimeters per square decimeter of polishing surface per second. With a speed of the tools of 2-3 meters per second the working time is 20% less than with the known process.

Generally, it is advisable to supply a minimum of 5-6 cubic centimeters per second, per square decimeter of surface, of the polishing sludge. The concentration of the sludge may be on the order of 100-300 grams of polish solids to each liter, corresponding to a density on the order of 1.05 to 1.2. These figures are illustrative, not limitations.

The new materials can be made of extreme thinness, on the order of $\frac{1}{32}$ of an inch or less or of material thickness. A satisfactory method of producing such materials is to make thin sheets or the calendar, during which the filler can be incorporated, for instance at 130° C., if a filler is desired, the resulting sheets being laminated by processes which employ their thermoplasticity, for in-

stance by heating them to a plastic condition at an appropriate temperature such as 130° C.

The polishing sludge may be used at a higher rate than previously, because the total polishing can be carried out at about 20° C., while with the felts during the wet stage the glass attained 50° C. and the rate of supply was held to 4 cc./sec. for a surface of 90 square decimeters, the speed of the tools being alike in both cases, that is to say, 2-3 m./sec. In contrast, this invention entertains a rate of supply of 5-6 cc./sec./sq. decimeter without disadvantage in quality and with improved speed of work. The detritus from grinding is used again, which was not the case with prior practice.

An advantage of the invention is that during the greater part of the polishing operation it is not necessary to use new polish but that the sludge or detritus from other polishings of similar material can be used for polishing. Thus, in the polishing of glass, the detritus from an earlier polishing, including iron oxide and glass dust, can be satisfactorily used, and in like manner the polishing of marble may be carried forward by the use of a watery suspension of the detritus from previous polishings with sand, emery, carborundum or the like. The detritus employed may be the by-product of the initial dressing of the same or of different material, of the second or grinding stage, or of the third or polishing stage. The use of such compositions reduces the cost of polishing while maintaining the quality. Such compositions could not be employed previously with satisfactory results.

The invention has among its objects:

(1) A process for polishing glass, marble and similar material that comprises combining throughout the polishing operation an abundant flow of liquid containing the polishing agent with the use of a tool having a working face composed of resinous material which possesses and retains, in the presence of the polishing fluid, a rigidity of the same order as that of felt during the dry stage of polishing in the prior art processes.

(2) In the process according to 1, the working face of the tool is composed of rubber, polyvinyl chloride, plasticized or not, and certain silicones.

(3) A polishing tool as described above having the following characteristics, singularly or combined;

A. The material of the polisher contains mineral or organic fibers, artificial or synthetic material, such as saw dust, acting as modifiers of the polisher surface.

B. The polisher surface is covered with a layer of a material capable of retaining the polishing composition, for instance wax or pitch.

C. The hardness of the material capable of retaining the polishing composition is regulated by controlling the surrounding temperature or by controlling the temperature of the polishing fluid.

(4) In cooperation with polishing tools of the kind described, the use, as polishing composition, of abrasives of kinds that could not previously be used, in particular the detritus resulting from the dressing, grinding down, and polishing operations on similar material.

As many apparently widely different embodiments of the present invention may be made without departing from the spirit and scope thereon, it is to be understood that the invention is not limited to the specific embodiments.

What is claimed is:

1. The method of polishing the surface of an object such as glass and stone that comprises flowing a polishing sludge containing a polishing abrasive continuously into engagement with the said surface, and rubbing the said surface with said sludge by means of a polishing tool throughout the duration of the polishing operation, the abrasive being iron oxide in water at a density of about 1.05 to 1.2 in a concentration of 100-300 grams per liter and fed at a rate of 5 cc./sec./sq. decimeter, the polishing tool having a face, a major and essential constituent of which consists of a resin from the class of rubber,

5

and rubbery synthetic resins, having a hardness circa Shore 84-92, and containing sawdust.

2. A polishing material in sheet form adapted to the polishing of glass consisting of substantially equal parts by weight of poplar sawdust between 6-10 and 30-60 mesh per linear inch, polyvinyl chloride, and tricresyl-phosphate, and having a hardness circa Shore 84-92.

3. The method of polishing the surface of an object such as glass and stone that comprises flowing a polishing sludge containing a polishing abrasive continuously into engagement with the said surface throughout the duration of the polishing operation, and rubbing the said surface with said sludge by means of a polishing tool having a face a major and essential constituent of which consists of a resin from the class of rubber, and rubbery synthetic resins, having a hardness circa Shore 84-92, and containing sawdust.

4. The method of polishing the surface of an object from the class of vitreous and stony objects that includes the steps of continuously supplying abrasive sludge to the said surface at a concentration of about 100-300 grams of abrasive per liter of water at a rate circa 5 cc./sec./sq. decimeter and rubbing the surface with the sludge by a rubbery resin polisher having a hardness circa Shore 84-92.

5. The method of polishing the surface of an object from the class of vitreous and stony objects that includes the steps of continuously supplying abrasive sludge to the said surface at a concentration of about 100-300 grams of abrasive per liter of water at a rate circa 5 cc./sec./sq. decimeter and rubbing the surface with the sludge by a rubbery resin polisher having a hardness circa Shore 84-92, and containing sawdust.

6. The method of polishing the surface of an object such as glass and stone that comprises flowing a polishing sludge containing a polishing abrasive continuously into engagement with the said surface throughout the duration of the polishing operation, and rubbing the said surface with said sludge by means of a polishing tool having a face a major and essential constituent of which consists of a resin from the class of rubber, and rubbery synthetic resins, having a hardness circa Shore 84-92, said face being coated with an adhesive for the polish of the class of wax and pitch, and maintaining the hardness thereof by heat exchange.

7. In the manufacture of sheet glass objects and the like in which the surface of the object has undergone grinding and has been brought to a level state containing a multitude of tiny pits or striations, the method of polishing the object that comprises flowing a polishing sludge containing a polishing abrasive continuously into

6

engagement with the object being polished and with the polishing tool, progressively diminishing the pits and striae, existing in the object as a result of said previous grinding operations, until the surface is substantially free of such pits and striations by rubbing the object to be polished with the polishing tool and said sludge, the polishing tool having a face a major and essential constituent of which consists of a resin from the class of rubber and rubbery synthetic resins having a hardness circa Shore 84-92.

8. In the finishing of the surface of sheet glass objects and the like in which a surface of the object has undergone grinding and has been brought to a level state containing a multitude of tiny pits or striations, the method of polishing the said surface that comprises flowing a polishing sludge containing a polishing abrasive continuously into engagement with the object being polished and with the polishing tool, progressively diminishing the pits and striae, existing in the object as a result of said previous grinding operations, until the surface is substantially free of such pits and striations by rubbing the said surface with the polishing tool and said sludge, the polishing tool having a face a major and essential constituent of which consists of a resin from the class of rubber and rubbery synthetic resins containing sawdust and having a hardness circa Shore 84-92.

9. The method of claim 8 in which the polishing abrasive contained in the polishing liquid is an oxide the melting temperature of which is above 800° C.

References Cited in the file of this patent

UNITED STATES PATENTS

1,966,856	Groff	July 17, 1934
2,027,962	Currie	Jan. 14, 1936
2,057,882	Crowley	Oct. 20, 1936
2,188,396	Semon	Jan. 30, 1940
2,235,507	Strauch	Mar. 18, 1941
2,279,450	Diehl	Apr. 14, 1942
2,309,819	Benner	Feb. 2, 1943
2,309,831	Devol	Feb. 2, 1943
2,434,207	Gapen	Jan. 6, 1948
2,434,614	Hicks	Jan. 13, 1948
2,450,433	Leeman	Oct. 5, 1948
2,460,367	Sharpe	Feb. 1, 1949
2,597,182	Rickner	May 20, 1952

FOREIGN PATENTS

263,858	Great Britain	Oct. 6, 1927
150,924	Austria	Oct. 11, 1937
1,005,922	France	Jan. 9, 1952