May 9, 1950 C. A. BORCHERT ET AL 2,507,433

METHOD OF FIRE POLISHING GLASSWARE

Filed July 14, 1943

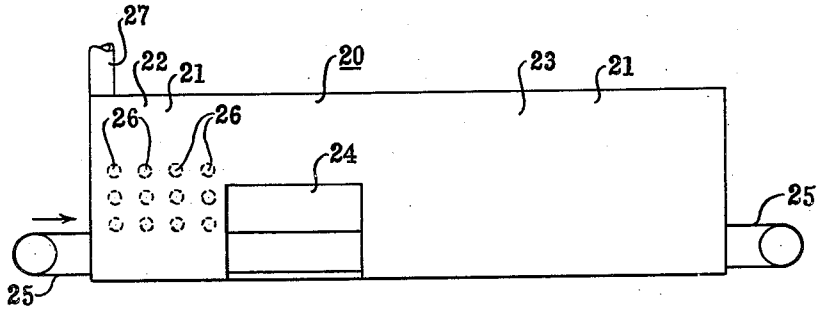

FIG 1

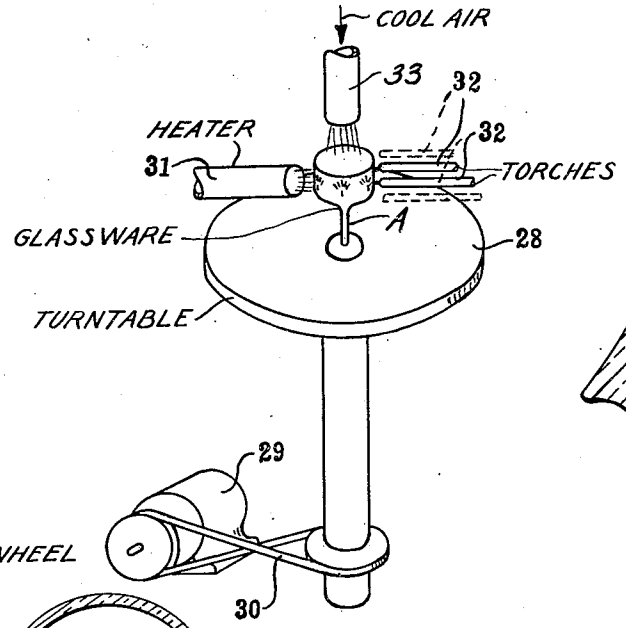

FIG 2

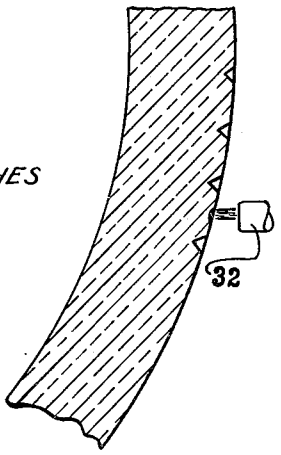

FIG 3

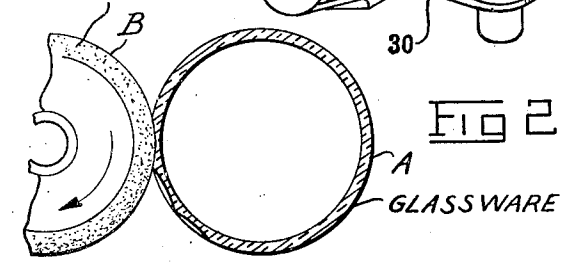

FIG 4

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Patented May 9, 1950 2,507,433

UNITED STATES PATENT OFFICE

2,507,433

METHOD OF FIRE POLISHING GLASSWARE

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Application July 14, 1943, Serial No. 494,670

7 Claims. (Cl. 49—77)

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This invention relates generally to the glass industry and is particularly directed to improvements in the manufacture and ornamentation of cut glass tableware.

An object of this invention resides in the provision of a method of finishing glassware by which mass production of fine, plain or richly ornamented ware are attained at relatively low cost.

A further object is the provision of a method by which fine cut glassware can be fire polished quickly and easily while maintaining the definition of the design.

A still further object is to produce polished cut glassware having a finer finish whether composed of low or high grade of glass.

Another object is the provision of a method of fire polishing vitreous material in which the material is preheated to a uniform temperature throughout and then subjected to special heat treatments to produce temperature differentials between opposite surfaces of the material in the same region, the higher temperature being sufficient to fuse the material but being applied for such a short time period as to fuse the material at the surface only whereby the article will retain its stability, the treatments being repeated as many times as necessary to produce the desired finish.

Another object also resides in the provision of a method of finishing glassware in which the articles are preheated, then placed on a turntable and revolved while a concentrated source of heat is applied to a wall thereof to fuse the material at the immediate surface, the rotation of the turntable and the application of lower temperature fluid to the opposite side of the wall, serving to prevent the major part of the material behind the fused portion from reaching a temperature wherein its stability will be lessened.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of embodiment of the invention is clearly shown.

In the drawings:

Fig. 1 is a diagrammatic view of a combined heating and cooling lehr or kiln having an endless conveyor extending therethrough, the lehr or kiln being used in carrying out the method forming the subject matter of this invention;

Fig. 2 is a perspective view of a turntable employed in performing one of the steps in the method;

Fig. 3 is a fragmentary horizontal sectional

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view taken through an article during the polishing operation and,

Fig. 4 is a detailed view partly in section, showing the operation of cutting a design in a glass article, the thickness of the wall of the latter being exaggerated to facilitate illustration.

The glassware A to be ornamented by the process set forth herein is usually of the thin walled type which cannot be exposed to high heat for sustained periods without destruction. It is first treated to produce the desired design in intaglio in the usual manner by exposing the selected area to the action of a cutting wheel B as illustrated in Fig. 4. This step in the method can be performed by hand by a skilled workman or in any other suitable manner. After the articles have had the design cut therein, they are then fire polished in accordance with the present invention.

In carrying out the present invention, use is made of a tunnel lehr or kiln 20 of the type illustrated in Fig. 1 and which comprises an elongated enclosure 21 having a heating section 22 and a cooling section 23. Between these sections, the side wall of the enclosure is provided with an opening 24 through which access may be had to the interior thereof. It will be noticed from Fig. 1 that the heating section is of short length when compared to the cooling section, since less time will be consumed in raising the temperature of ware introduced into the kiln than will be required to cool the same after treatment. Each end of the enclosure is open to permit an endless conveyor 25 to extend completely through the enclosure, that is, from one end to the other. Any suitable means may be provided to impart longitudinal movement to the conveyor, the upper strand thereof moving through the enclosure in the direction indicated by the arrow.

The section 22 of the kiln has a plurality of burners 26 directed thereinto to raise the temperature within this section. Gas is preferably used as a fuel because of its clean burning characteristic and the convenience in operation and control. The front or inlet end of the enclosure is provided with a stack 27 through which the waste gas may be exhausted, these gases traveling counter-current to the movement of the ware, being treated, through the enclosure.

The speed of the conveyor is adjusted and the heat is applied so as to gradually raise the temperature of the ware during its travel through the heating section to approximately 1,000° F. When this ware reaches the opening 24, it is

removed and fire polished by applying an extraneous source or sources of heat to the ware by rotating the ware and directing the source or sources of heat thereagainst by hand or in any other suitable manner. In the present embodiment, the ware, after being removed from the lehr, is placed on a turntable 28 with an axis of the ware in alignment with the axis of rotation of the turntable. The turntable is disposed adjacent the opening 24. The turntable is then revolved at a predetermined rate of speed through any suitable means such as an electric motor 29 and a belt arrangement shown at 30, while the polishing operation is performed. The rate of rotation of the ware will depend upon the size thereof, larger articles being rotated at a lower rate than the smaller articles due to the fact that as the surface being operated upon is farther from the axis of rotation, its linear speed will be greater than the linear speed of the surface of a smaller article turning at the same rate.

While the ware is undergoing the rotation, its temperature is maintained at approximately 1,000° F. by directing a secondary flame thereagainst, this flame issuing from a burner 31 provided for this purpose. In the event the articles being polished are of unusual size, it is within the concept of the invention to employ as many burners as are necessary to keep the articles at the desired temperature. These secondary burners are so positioned with respect to the ware that the desired temperature will be maintained and yet the ware will not be permitted to overheat.

In addition to the secondary burner or burners, a source or sources of high temperature heat is directed against the surface of the ware to be polished. In the present embodiment, a small diameter burner, burners or a torch or torches 32 are utilized. Highly satisfactory results have been obtained through the use of a burner with a number nine tip, the outlet of which is approximately one thirty-secondth of an inch in diameter. It will be understood that the tip employed will depend on the thickness of the ware; a larger diameter tip will be used when thick ware is to be polished and another diameter tip when thin ware is to be polished. In performing the polishing operation, the torch or torches 32 are held in closely adjacent relationship to the surface of the article being operated on, in order to confine the flame or flames to a small area. Due to the high temperature of the flame and the speed of rotation of the article, the flame will be applied to the surface for a length of time sufficient to fuse only the material at the surface in the area contacted by the flame. As soon as the surface leaves the flame, due to the rotation of the ware, the temperature of the surface will fall and the fused portion will solidify substantially immediately. It has been found that the fusing takes place to a depth less than .001 of an inch and even though the surface has been cut to produce sharp designs, these will not be obliterated or changed in any way. In the polishing operation, the flame from the torch 32 is usually repeatedly applied to any one area until the desired result is obtained. When the entire outer surface of an article, such as the goblet illustrated, is to be polished, the torch 32 is held in closely adjacent relation to the article and preferably stationary and as the latter revolves, the repeated surface fusing will gradually effect a polishing of the surface. The torch is moved substantially

parallel to the axis of rotation, as indicated by the dotted lines in Fig. 2, until the entire exterior surface has been repeatedly contacted by the hot flame. This operation may be performed in any suitable manner, such as by hand. When this treatment has been completed, the article is removed from the turntable and again placed on the conveyor as it passes the opening 24. This ware gradually cools as it moves through the section 23 of the lehr, until it reaches a sufficiently low temperature at which time it will have arrived at the discharge end of the conveyor. The ware can then be removed and stored or disposed of according to the desires of the manufacturer. When certain hollow articles are being treated, it may be desirable to direct a stream of air into the interior of the ware through a tube 33. This air is relatively cool with respect to the heat of the torch and prevents the overheating of the ware. It should also be understood that if the interior of the article is to be polished, the air may be applied to the exterior of the article while the secondary heat would be applied to the surface being treated. This air, by holding the temperature at a predetermined point, prevents the walls of the article from losing their stability when subjected to the higher temperature flame employed in polishing the ware. By reason of the introduction of the cooling air, the temperature of the wall will be considerably below the fusing temperature of the material and the stability of the wall will be maintained even though the outer surface contacted by the high flame is being fused.

It should be obvious that the ware may be polished on any surface, either inside or out and that any suitable source of heat may be employed as long as it will quickly raise a localized portion of the surface to fusing temperature.

From the foregoing, it will be apparent that a new and improved method of polishing vitreous material has been provided which permits the use of relatively inexpensive materials and such a rapid production of ware that the latter can be sold at a relatively low cost.

Due to the rapid rate at which the temperature of the ware is raised in the actual polishing operation, only a small amount of material will be fused and the wall which is being polished will maintain its stability. It has been found through actual operation that the finest patterns can be polished without sacrificing any of the features thereof. One of the desirable features of the method is that the sharp corners which contribute to the beauty of cut glassware will remain after being polished.

While the form of embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

We claim:

1. In a method of ornamenting thin walled glassware, the steps which comprise retaining the ware in a heated enclosure until it has been elevated to a predetermined temperature, transferring the ware to a rotatable support, rotating the support at a predetermined rate of speed, directing heated gases against said ware to maintain the same at said predetermined temperature, applying a concentrated stream of heated gases to a surface of said ware during rotation thereof, the gases of said stream being of sufficient intensity to fuse the glass at the surface of a localized portion, and moving the concentrated

source of heat over the surface of the ware in a direction parallel to the axis of rotation of the ware.

2. In a method of ornamenting glassware, the steps which comprise retaining the ware in a heated enclosure until it reaches a temperature of approximately 1000° F., transferring the ware to a rotatable support, rotating the support at a predetermined rate of speed, applying heated gases to said ware to maintain the same at the temperature of 1000° F., directing a minute stream of heated gases against a surface of said ware during rotation thereof, the temperature of said gases being sufficiently high to fuse the glass, moving the minute stream over the surface of the ware in a direction parallel to the axis of rotation of the ware, and gradually cooling the ware.

3. Those steps in a method of ornamenting glassware which comprise, retaining the ware in a heated enclosure until it has been elevated to a predetermined temperature, rotating said ware about an axis at a predetermined rate of speed, directing a heating medium toward said ware to maintain said predetermined temperature, directing a cooling medium over said ware to prevent excessive heating thereof, directing a minute jet of high temperature gas against said ware during rotation thereof, the temperature of said gas being sufficiently high to fuse said glass, and moving said jet of gas over said ware in a direction parallel to the axis of rotation thereof.

4. Those steps in a method of ornamenting hollow cut glassware which comprise, retaining the ware in a heated enclosure until it has been elevated to a predetermined temperature, rotating said ware about an axis at a predetermined rate of speed, directing a heating medium against said ware to maintain said predetermined temperature, directing a cooling medium into the interior of said ware to preclude overheating thereof, applying a minute jet of high temperature gas against the exterior of said ware during rotation thereof, the temperature of said gas being sufficiently high to fuse glass and moving said jet over said ware in a direction parallel to the axis of rotation thereof.

5. The method of fire polishing thin walled cut glassware comprising the steps of rotating the ware about an axis, holding a torch from which a small jet of high temperature flame is issuing in close proximity to the ware during rotation thereof, and moving the torch in a plane parallel to the axis of rotation of the ware while maintaining the original spacing between the torch and the ware.

6. A method of fire polishing vitreous ware which comprises rapidly rotating said ware, simultaneously applying a concentrated source of heat at a relatively high temperature at substantially a single point and moving the source of said heat during said rotation constantly along a line substantially parallel to the axis of rotation.

7. The method of fire polishing thin wall glassware comprising the steps of rotating the ware about an axis, simultaneously applying a relatively broad flame to heat the ware on one side to a temperature below the fusion point, simultaneously applying a small jet of a concentrated flame of a relatively high temperature well above the temperature of the broad flame and of a sufficiently high temperature to fuse the glass at the surface of a localized portion substantially at a single point on the opposite side of said ware, and simultaneously cooling said ware by directing a stream of cooling air into the interior of the ware.

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