

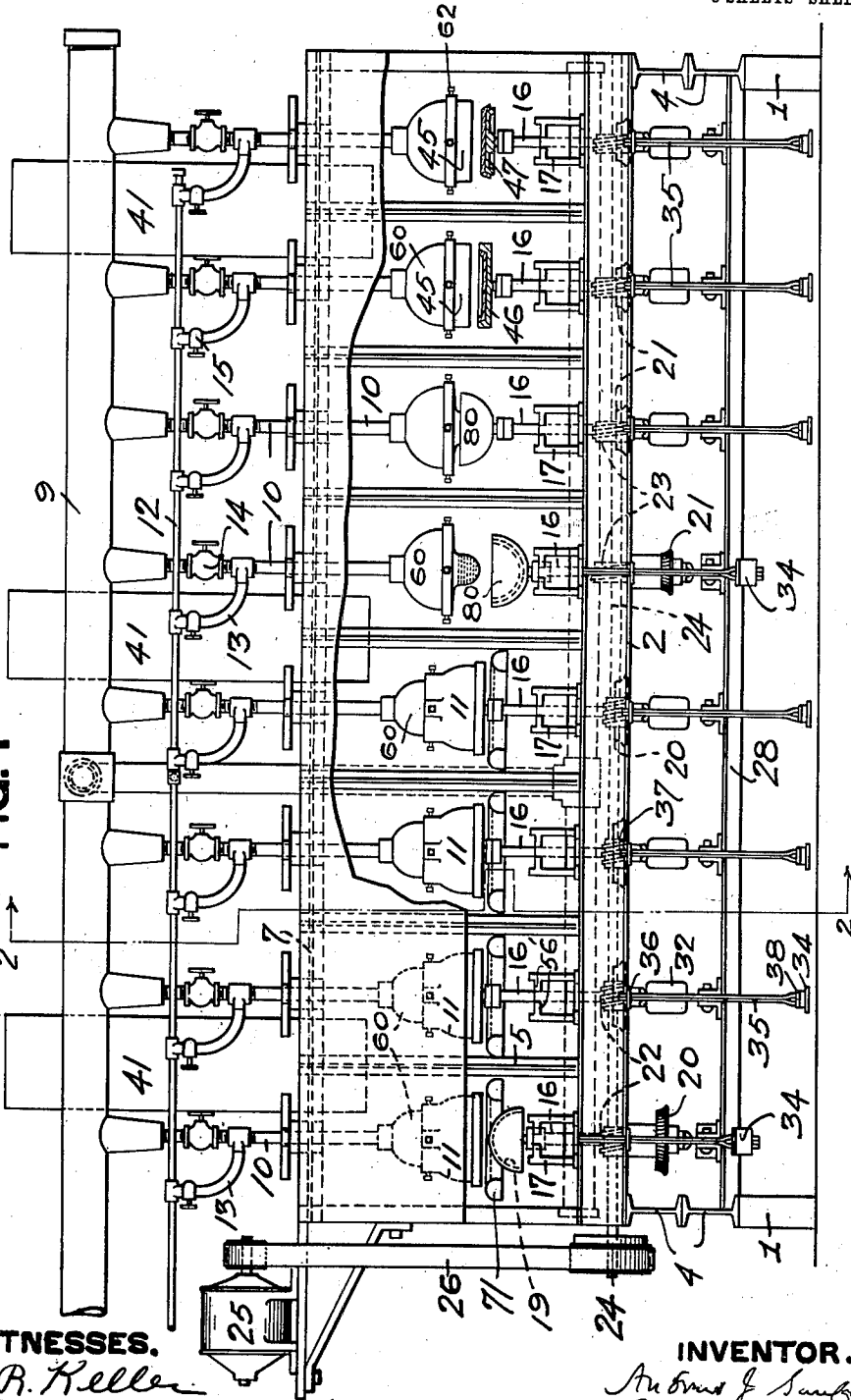
A. J. SANFORD.
METHOD OF FIRE POLISHING GLASSWARE.
APPLICATION FILED JUNE 26, 1909.

960,587.

Patented June 7, 1910.

3 SHEETS—SHEET 1.

FIG. 1



WITNESSES.

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FIG. 3

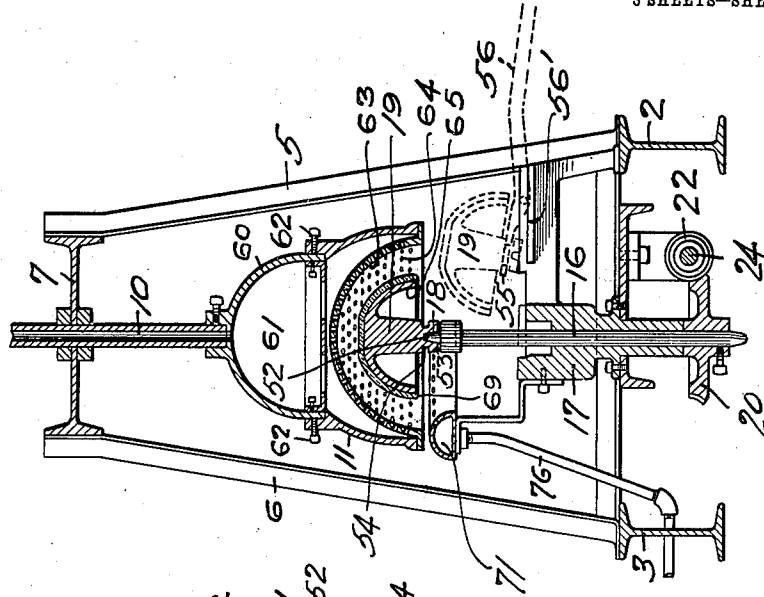


FIG. 4

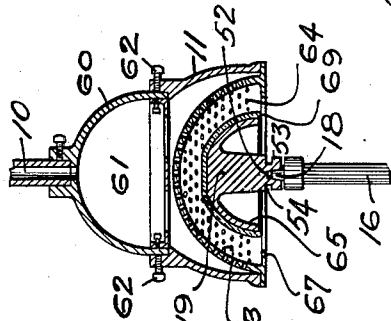
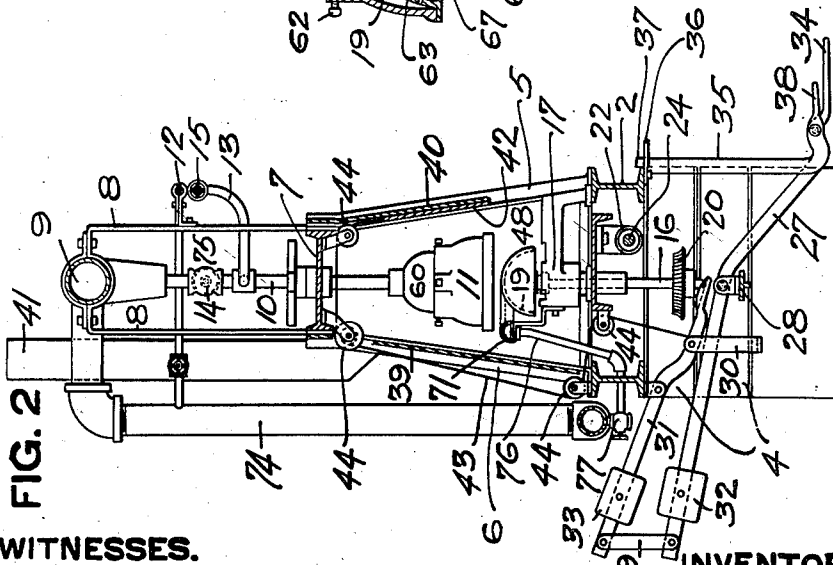


FIG. 2



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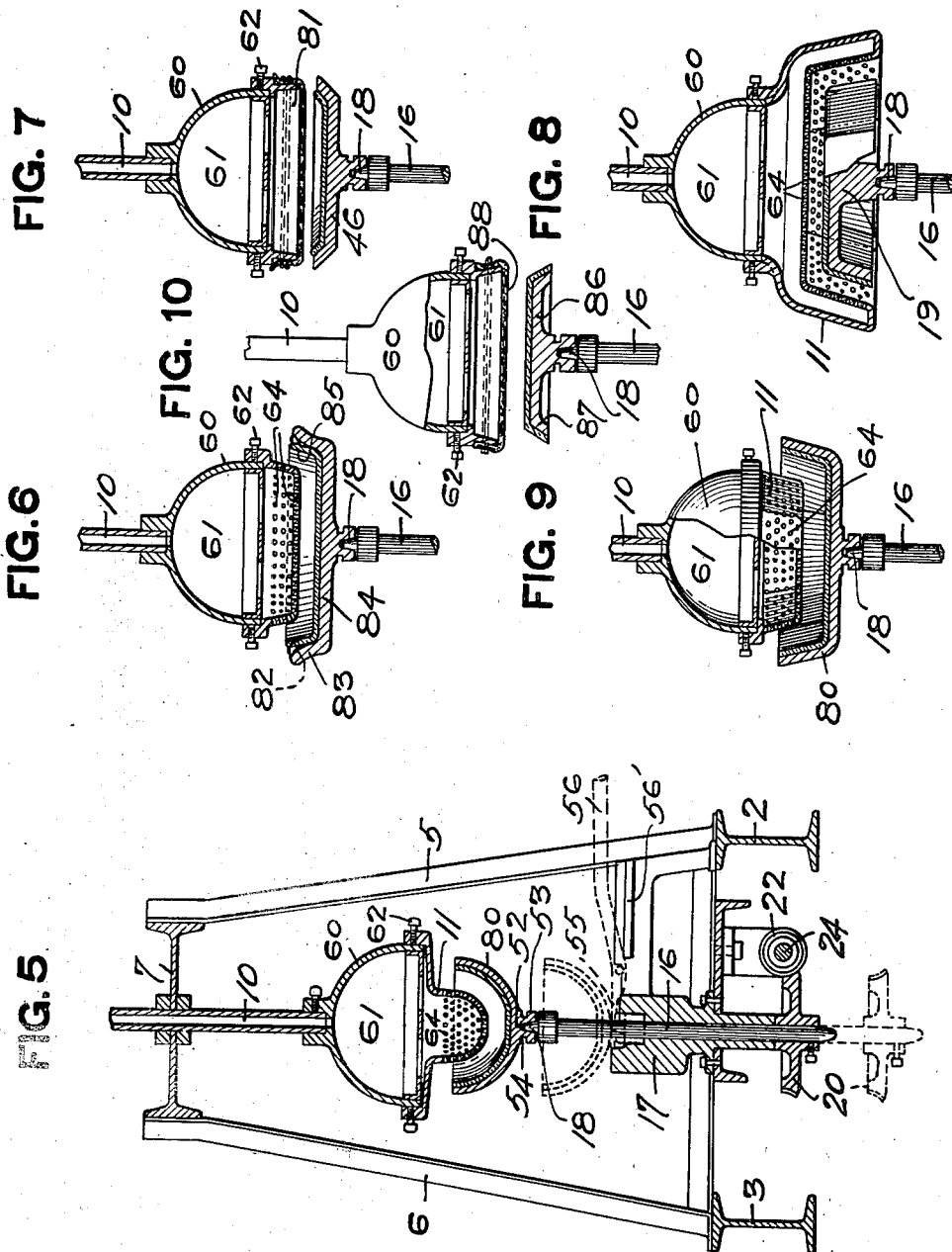
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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METHOD OF FIRE-POLISHING GLASSWARE.

960,587.

Specification of Letters Patent.

Patented June 7, 1910.

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To all whom it may concern:

Be it known that I, ANDREW J. SANFORD, a resident of Newark, in the county of Licking and State of Ohio, have invented a new and useful Improvement in Methods of Fire-Polishing Glassware; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the fire polishing of glassware, its object being to provide for the proper fire polishing of both the interior and the exterior surfaces of articles of glassware, such as hollow bowls and the like, also including flat dishes with upwardly extending rim portions.

It consists, generally stated, in supporting the article within a hollow burner and projecting from the hollow burner multitudinous flame jets distributed substantially evenly over the outer surface of the article to be fire polished.

It also includes the finishing of bowl shaped articles by first projecting the flame jets upon the outer face of the same, while supported upon a suitable former conforming in shape to the interior of the article and then projecting the flame jets against the interior thereof while supporting the article in a former conforming to the desired outer shape of the finished article.

It also comprises the slow rotation of the article in fire polishing the exterior thereof so as to hold the same to the former on which it is supported, and the rapid rotation of the article when fire polishing the interior thereof so as to cause it to conform in shape to the hollow former in which it is held.

It also comprises certain other improvements hereinafter set forth.

In the accompanying drawings Figure 1 is a side view of apparatus suitable for the practice of the invention; Fig. 2 is a cross section on the line 2—2 illustrating such apparatus; Fig. 3 illustrates the fire polishing of the exterior of a bowl shaped blank; Fig. 4 shows another form of burner suitable for such purposes; Fig. 5 illustrates the fire polishing of the interior of such blank; and Figs. 6, 7, 8, 9 and 10 are like views illustrating the fire polishing of other shapes.

While the invention may be employed with different forms of apparatus I have found that illustrated in the drawings to be the most desirable for the purpose and will describe the invention in connection there-

with, it being understood that in the practice of the invention different burners embodying the principle above set forth can be employed and different formers or supports for the glassware can be substituted according to the shape and character of the same.

The apparatus illustrated has the machine base 1, which supports the longitudinal beams 2, 3, forming the main portion of the frame of the machine, these longitudinal beams being carried on the cross beams 4, 4, resting on the base 1. Between each different stand I provide uprights 5, 6, illustrated as formed of T-iron and supporting at the top the horizontal beam 7, these parts forming the main frame of the machine. Carried on suitable uprights 8 leading up from said top beam 7 are the means for supplying gas and air to support combustion. For this purpose I employ the longitudinal air supply pipe 9 carrying air under pressure and having extending down for each burner a down-take pipe 10 which passes through the top beam 7 when supported therein and carrying the burner 11, and the gas supply pipe 12 extends along the front of the machine and has branch pipes 13 extending therefrom to the pipe 10, the supply of air and gas being regulated by valves 14 and 15. Directly under the burners 11 is the blank supporting shaft 16 which passes up through the feeding casting 17 and carries at its upper end a center pin or nipple 18 upon which the blank support or former 19 rests. This shaft 16 as illustrated in the different figures, carries at its lower end a worm wheel 20 or 21 engaging with a worm 22 or 23, these worms and worm wheels differing only in relative size to each other to provide for rotating the blanks at different speeds as illustrated in Figs. 2 and 3. The shafts 16 are vertically movable, and means are provided for raising the same to bring their worm wheels into engagement with their respective worms, the worms being carried upon the worm shaft 24 driven by a suitable motor such as the electric motor 25 which connects by belt 26 with the worm shaft.

Suitable means for raising and lowering the shaft 16 are provided, that illustrated being suitable lever mechanism operated by foot treadles, the main lever 27 being mounted on brackets supported on the longitudinal bar 28 which is connected by links 29, 30, with the lever 31, the inner end of which

supports the shaft 16 in a suitable seat, the levers 27 and 31 carrying the weights 32, 33, which act when the levers are free to raise the shaft 16 into operative position, raising the worm wheels into contact with their respective worms so as to cause the rotation of the blanks carried on the shafts 16 as hereafter described, the worms in this way forming stops for the upward movement of the shafts as the worm wheels have flaring faces as illustrated. The lever 27 has the foot treadle 34 through the operation of which the shaft 16 is lowered, and pivoted on said lever 27 is the tripping arm 35 which passes through a guide-way 36 secured to the front longitudinal beam 2, said tripping lever having the notched upper end 37 which catches under the beam when the main treadle 34 is depressed so as to lower the work out of the burner and hold it in that position. The tripping lever is so pivoted that it drops of its own weight under the beam 2, and it has the treadle 38 by which it may be withdrawn and permit the weights 32 and 33 on the levers 27 and 31 to lift the shaft 16 and raise the blank into fire polishing position. The burner is preferably located within a suitable inclosed chamber during the fire polishing operation, and for this purpose the back wall 39 is formed of sheet metal fitting between the uprights 6 and a like front wall 40 extends downwardly from the top beam 7 part-way toward the feeding stand 17, a suitable chimney or hot air shaft 41 leading from the chamber so formed.

In front of each burner I provide the sliding door or shield 42 which slides between the uprights 5 so as to inclose the work during the fire polishing operation and protect the workman and prevent the apparatus being affected by currents of air within the plant. This shield is raised by means of a rope 43 passing around suitable sheaves 44, and connected to the lever 31 so that when the inner end of that lever is raised to lift the blank up into fire polishing position, the shield 42 will be dropped into lowered position inclosing the work support 17 and closing the fire polishing chamber 48. Upon the depression of the lever 31 and the dropping of the blank supporting shaft 16, the shield is raised to provide space for withdrawing and feeding in the blanks.

Any suitable form of blank support may be employed according to the character of the article to be fire polished. For the practical purpose of fire polishing bowls I employ for each bowl two blank holders, one conforming substantially to the inner shape of the article, as shown more particularly in Fig. 3, and one conforming substantially to the outer shape thereof, as shown in Fig. 5. These blank holders can be of any desired shape conforming to the blanks and

for that purpose I have illustrated in Fig. 1 in connection with some of the separate sets of fire polishing apparatus, flat burners 45 for fire polishing and blank holders 46 and 47 for the support of that class of articles.

The blank holders can be handled in any suitable way, the preferred form of blank holder being more particularly illustrated in Fig. 2, each blank holder having a center recess or seat 52 to fit over the centering pin 18 on the blank holding shaft 16 and having in its center stem 53 an annular depression 54 into which the forked end 55 of the carrier bar 56 fits, and by which the workman carries the blank holder and inserts it in the machine and withdraws it therefrom. For that purpose the carrier bar slides along the guide way 56' of the feeding casting and brings the blank holder directly over the centering pin 18 and drops it onto the pin 18.

Any suitable burner may be employed according to the character of work to be polished. The burners all involve the principle of fire polishing by the use of multitudinous flame jets projected against the surface of the article to be polished at approximately right angles to such surface, the burners conforming substantially to the article to obtain an even fire polishing action over such surface. For example, the burner of Fig. 4 is suitable for fire polishing the outer face of a bowl. The pipe 10 leads down into the mixing chamber 60 which is illustrated is of an inverted dome shape, giving free space 61 for the mixing of the gas and air, and receives the desired form of burner, the burner proper 11 being secured thereto by means of set screws 62. The mixing chamber 60 has a circular lower edge against which the burner fits and the burner has a jet face 63 corresponding substantially to the shape of the article to be polished. It is illustrated as a hollow concave burner having a multitude of jet orifices 64 formed in its face and extending down close to the lower edge thereof, the orifices being illustrated as circular holes extending through the jet face so as to project the jets of gas on lines substantially transverse to the face of the burner, practically innumerable flame jets being thus projected against the blank on lines about transverse to the face thereof, and so giving a uniform distribution of flame over the entire surface of the article to be polished.

In polishing the outer face of the bowl the bowl is raised so as to be entirely inclosed within the concave burner and is held in such position that the jet flames strike directly upon it all over its surface, so giving an even fire polishing action over the entire outer surface of the bowl.

The blank holder 19 fits within the blank

and corresponds substantially to the inner face thereof, and when the blank is raised the blank holder supports it at a short distance from the jet face of the burner, usually at a distance of about two inches, so that the flame jets strike directly on the blank and so give uniform fire polishing action. In polishing such bowls it is desirable to obtain as great heat as possible around the edge of the bowl and for that purpose, as illustrated in Fig. 4, the blank projects below the lower edge 65 of the blank holder so exposing such lower edge to the action of the flame. As, however, the flame naturally rises as it escapes from the hollow burner and it is important that the lower edge 66 of the bowl shall be raised to specially high heat to melt therefrom the square edges or fin marks on the edge of the bowl, I prefer to employ a separate burner 71 made as illustrated in Figs. 1, 2 and 3, as of about a half a ring, said burner being supported around the back edge of the main burner 11 and having jet orifices on its inner face so as to project the flame against the exposed edge 69 of the blank and melt such edge sufficiently to at least remove the fin, and if necessary melt off the square edge thereof. For this purpose I carry from the air main 9 the branch pipe 74 leading down to the lower part of the apparatus and carry from the gas main 12 the pipe 75 communicating with said air pipe which forms a mixing chamber, from the lower end of which the pipe 76 leads upwardly to the edge finishing burner 71, the supply of gas and air through said pipe 76 being controlled by the valve 77.

In the practice of the invention where it is employed in connection with the fire polishing of bowls, as the bowl is pressed in a suitable mold the glass is liable to show any imperfections present on the surface of the mold, and the edges of the bowl are necessarily pressed practically square or at least at an angle, while fins are formed at the meeting points of the mold. The pressed article while still sufficiently hot is placed upon a suitable former such as the former 19, the former in the preferred practice being slightly shallower than the blank so that the edge portion thereof projects somewhat below the former. The former is carried on a suitable carrier bar and is fed to the polishing machine, the former being centered upon the lifting shaft 16 and raised by the same into the burner 11.

As above stated gas and air under pressure are mixed in the mixing chamber of the burner and projected through the multitudinous perforations or slits formed therein and is ignited on the exterior surface of the jet face of the burner. In this way a continuous series of small jet flames play over the surface of the blank, which as shown is

raised so as to be entirely covered or inclosed within a hollow burner which projects below the edge of the blank. These jet flames project downwardly and inwardly directly against the curved body of the bowl and play over the surface thereof in a practically continuous flame, evenly distributed over the entire surface so that the surface is evenly re-melted or fire polished and all imperfections on the outer surface of the bowl are thus re-melted or smoothed down, producing a uniformly polished surface thereon. In so doing the ornamentation of the bowl is maintained, the flame being so distributed over the surface that while the surface is thus re-melted, such an even re-heating is obtained as will not melt away and destroy such ornamentation unless the same is over-exposed. In this step in the fire polishing, as the edge of the blank projects below its supporting former such edge is exposed to the heat and flame more fully than the body of the blank and the flame can be projected by any suitable means against such edge, such for example as shown in Fig. 4, where the lower portion of the former has an inwardly projecting edge portion 67 below the jet face thereof, which throws the flame against such edge portion. As, however, the flame from such hollow burner naturally rises and escapes therefrom, in order to insure the re-melting of the edge portion so as to melt off the actual angular edge thereof and give it a rounded effect and remove all fins, I prefer to employ the supplemental burner 71 which, as illustrated, extends around for a good portion of the edge of the blank and projects the flame directly upon such edge portion, which as it is exposed as above described will by such extra heating be melted off so as to produce a slightly rounded and properly finished edge. In this operation it is preferred to rotate the blank slowly such as by the use of a relatively small worm and large worm wheel, as above described. As soon as the outer face of the article is thus properly fire polished it is lowered out of the burner and withdrawn by the carrier bar and inverted into the blank support 80, which is of hollow bowl form corresponding exactly to the curve desired in the finished article, and by means of the carrier bar is placed below another fire polishing burner to polish the interior thereof as shown in Fig. 5. The burner in this case is made of smaller size than the bowl and otherwise corresponds substantially in shape to it, and as the bowl is raised up to the burner the burner enters within the same and the air and gas mixed within the burner are projected through like multitudinous jet orifices in the jet face of the burner and ignite on the exterior surface of said jet face and the multitudinous flame jets are projected against the interior of the bowl, when

it is held usually at a distance of about two inches from the jet face, and in so doing the interior of the bowl is re-heated and fire polished as above described. In this operation as the flame escapes from between the burner and the blank support it naturally plays over the inner edge portion of the blank a large body of flame and heat being projected against such edge portion and melting the surface, removing the fin and giving a slightly rounded edge to the same, so finishing the interior edge thereof. The supporting blank holder or former is in this case made to conform to the curve or contour desired in the finished blank; for example if it is desired to widen the mouth of the bowl in this operation the support therefor may be slightly larger than the portion of the blank where it is desired to widen the same and during such fire polishing of the interior the blank is rotated at a higher speed than in fire polishing the exterior thereof, being rotated at a sufficient speed to spread the body of the blank by centrifugal action against the hollow support and so bring it to the desired finished shape. When such fire polishing action is completed the bowl is lowered and withdrawn with its support and the finished article removed therefrom.

The operation in connection with the finishing of substantially flat articles having upwardly projecting rims, is substantially the same as above described. In this case the burner may either conform in shape to the blank, this being desirable where the rim of the blank extends up to some height as illustrated in Fig. 6. Where, however, the rim portion is not of any great height I may employ a flat burner 81 as illustrated in Fig. 7, and for such purpose I have found, for example, that a very efficient burner is formed by the use of an asbestos cloth stretched over the base of the burner, such cloth providing the multitudinous small orifices for the escape of the mixed gas and air and giving very evenly distributed flame jets to operate upon the blank. In the fire polishing of such articles I find it advantageous to fire polish first the interior of the blank and if it is desired to flare the rim portion, to rotate the blank at a sufficient speed to throw out the edge thereof by centrifugal force, this action bringing the edge in contact with the outer lip portion of the holder as illustrated in Fig. 6 at 82. As, however, such outer lip portion 83 of the support 84 may flare outwardly and the rim portion 85 of the article may not be pressed firmly against the same, I provide the interior support or former 86 of exact shape corresponding to the desired interior of the finished article, and in this case I place the article upon the support with a partially flaring rim support 87 and expose the exterior of the same to the heat of the jet flame

burner as at 88, the continuous surface of flame feeding downwardly upon the same, and I rotate the article only at slow speed, so that as it is raised to the necessary heat in fire polishing it becomes plastic enough to drop of its own weight down onto and conform itself to the shape of the supporting former. In either use of the invention I am thus enabled to bring the article to the desired finished shape and to properly fire polish both the interior and the exterior thereof and melt off any mold marks or fins around the edge faces of the same, so producing a practically perfectly fire polished article. The invention can also be employed with square or oblong, or other angular shaped articles, in which case where the articles are of considerable depth the burners are made to conform to the angular shape of the same and extend down over the sides thereof for exterior polishing and enter within the same for interior polishing as shown in Figs. 8 and 9, the burners having the multitudinous flame jet perforations or slots so as to give an even distribution of the flame over the surface thereof and provide for the even heating of the surface of the blanks in practically the way above described, though in this case the articles are not rotated.

What I claim is:

1. The method of polishing the outer surface of bowls or like glass articles; consisting in supporting the article within a hollow burner and projecting from the hollow burner multitudinous flame jets distributed substantially evenly over the surface of the article to be fire polished.

2. The method of polishing the outer surface of bowls or like glass articles, consisting in supporting the article within a hollow burner which extends below the edge of the article and projecting from the hollow burner multitudinous flame jets distributed substantially evenly over the surface of the article to be fire polished.

3. The method of fire polishing glass articles, consisting in supporting the article upon a former conforming substantially to the shape thereof but with the edge of the article projecting beyond the former, subjecting the surface of the article to be polished to the action of multitudinous flame jets distributed over the surface thereof while supporting the article close to the surface of the burner and projecting the escaping flame against the exposed edge of the article.

4. The method of fire polishing glass articles, consisting in supporting the article upon a former conforming substantially to the shape thereof but with the edge of the article projecting beyond the former, subjecting the surface of the article to be polished to the action of multitudinous flame jets distributed over the surface thereof

while supporting the article close to the surface of the burner, and projecting a flame jet from another burner directly against such exposed edge of the article.

- 5 5. The method of polishing glass articles, consisting in supporting the article upon a former conforming to the shape of one surface thereof, fire polishing that surface and then supporting the article upon a former
10 conforming substantially to the opposite face thereof, fire polishing that surface, and rotating the article at different speeds for the first fire polishing operation and the second fire polishing operation respectively.
15 6. The method of fire polishing glass bowls and the like, consisting in supporting the article upon a former conforming substantially to the interior thereof, fire polishing the exterior while rotating the article at
20 a relatively slow speed and then supporting the article within a former conforming to the desired outline of the finished article and fire polishing the interior thereof while rotating the article at a relatively high
25 speed.

7. The method herein described of fire polishing glass articles, consisting in supporting the blank upon a former conforming substantially to the shape of one face

thereof and close to a burner conforming 30 substantially to the article and providing multitudinous flame jets distributed over the surface thereof, and then supporting the article upon a support conforming to the
35 opposite face of the finished article and subjecting the unpolished surface to the action of multitudinous small flame jets projected a short distance against the surface thereof.

8. The method of fire polishing glass bowls and the like, consisting in supporting 40 the article upon a former conforming substantially to the interior thereof and inclosing it within a hollow burner and subjecting it to the action of multitudinous jet flames projected a short distance against the
45 surface thereof and distributed over said surface, and then supporting the article upon a former conforming to the exterior thereof and entering the burner within the article and projecting therefrom multitu- 50
dinous small jet flames against the interior surface of the same.

In testimony whereof, I the said ANDREW J. SANFORD have hereunto set my hand.

ANDREW J. SANFORD.

Witnesses:

E. J. MORATH,
J. E. SNELLING.