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NOZZLE APPLICATOR FOR DRY PROCESS ENAMELS

Filed June 23, 1966

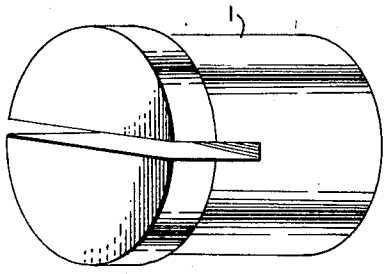


FIG. 1

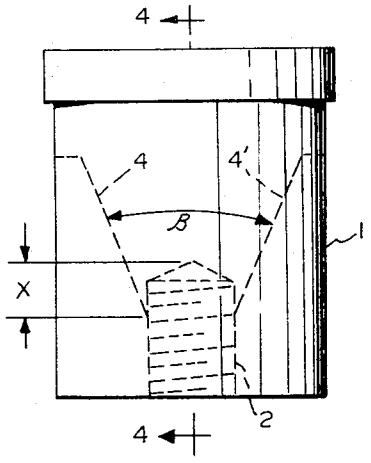


FIG. 2

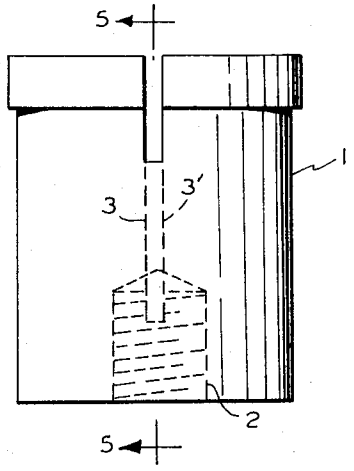


FIG. 3

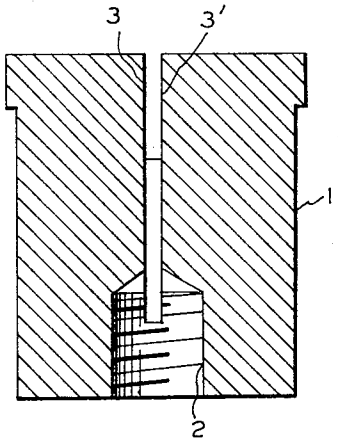


FIG. 4

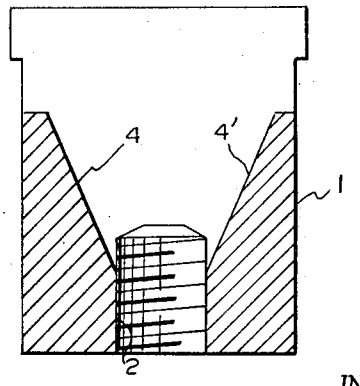


FIG. 5

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NOZZLE APPLICATOR FOR DRY PROCESS ENAMELS

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4 Claims. (Cl. 239—597)

ABSTRACT OF THE DISCLOSURE

A nozzle for the pneumatic application of discrete particulate material to a predetermined surface area, and more particularly for the deposition of powdered, dry process porcelain enamel to a heated cast metal substrate.

For as long as cast iron sanitary ware such as bathtubs, lavatories and sinks have been coated with vitreous porcelain enamel, the process has usually been carried out by heating the casting to be coated to a temperature of from approximately 1400 to 1700° F., withdrawing the casting from the heating furnace, placing same in a cradle adapted to be tilted through a 90° arc and rotatable 360°, with an operator standing over the hot casting manually sifting powdered porcelain enamel onto the heated article the while it is manipulated in its cradle to present various surfaces to the cascading material.

The heat of the base metal caused the porcelain enamel coming in contact therewith to fuse and adhere thereto, and the process was repeated, with reheating of the casting, two or three times until a sufficiently thick coating of vitreous enamel had been built up on the surface of the article, to thereby provide a protective coating having a pleasing smooth appearance, and high degree of chemical resistance.

The casting, following the above procedure, was then allowed to cool during which the vitreous coating became quite hard and glassy and the article was ready for distribution and installation.

However, one of the drawbacks to the conventional method of manually sifting powdered porcelain enamel onto a hot casting is that rising costs have rendered the manual operation prohibitively expensive.

Too, manual sifting of powdered enamel onto a hot casting to secure proper and even distribution thereof is a highly skilled art, thus resulting in an extremely high wage scale for the skilled operator, as well as necessitating a rather lengthy training period for him. This, plus the fact that the absence of an operator for several days through sickness or otherwise severely hampers production, militates toward substitution of mechanized means for the traditional hand method of coating.

Finally, the hand sifting method, which relies on gravity to transport the powdered particulate material to the substrate to be coated is limited in its rate of application thus resulting in an excessively long period of time being required for adequately covering a predetermined area.

Numerous methods have been tried for getting the particulate material to the substrate, included among them being electrostatic deposition and various nozzle means for blowing powdered porcelain enamel directly onto the ware to be coated.

However, the electrostatic means requires rather expensive and intricate equipment, the use of which presents problems in coating the rather complex contours of a bathtub or lavatory, particularly in view of the rather strong air currents created in the vicinity of an extremely hot mass such as a bathtub at 1600° F.

The use of compressed air for directly blowing powdered enamel onto a hot workpiece, on the other hand, has, until my invention, met with very little success because the volume of high pressure air impinging directly onto the red hot casting has a tendency to cause localized cold spots which interfere with the proper, even fusion of the enamel.

Accordingly, it is an object of this invention to provide an apparatus for the directional deposition of particulate material onto a predetermined area.

It is further an object of this invention to provide an improved apparatus for the directional deposition of particulate, powdered porcelain enamel to a cast metal substrate.

It is a further object of this invention to provide a new and improved apparatus for the directional deposition of powdered porcelain enamel to a heated, cast iron piece of sanitary ware.

The invention is demonstrated by the attached drawings wherein:

FIG. 1 is a perspective view of the nozzle of this invention;

FIG. 2 is a plan view of said nozzle;

FIG. 3 is a side elevation view of said nozzle;

FIG. 4 is a section taken along the line 4—4 of FIG. 2; and

FIG. 5 is a section taken along line 5—5 of FIG. 3.

Referring now specifically to the attached drawings, the reference numeral 1 indicates the nozzle of this invention generally.

In this particular embodiment of my invention, the reference numeral 2 indicates a tapped, internally threaded female opening adapted to receive a male, threaded pressure hose linkage for delivering to said nozzle, via opening means 2, air entrained, discrete particulate material, particularly dry process powdered enamel, which has been milled to at least 50% through a 200 mesh screen.

Any suitable, conventional means for delivering air entrained particles to the nozzle may be employed, and such means form no part of this invention. For example, it is contemplated that the delivery means disclosed in my copending application, Ser. No. 547,618, filed May 4, 1966, would be suitable for air delivery of powder to the nozzle of this invention.

And, while the opening means disclosed herein is a circular tapped and threaded opening, it of course could be oval or square in cross section, tapered or flawed, so long as it has some "maximum" cross-sectional dimension. Of course if the opening is circular, then its maximum cross-sectional dimension is constant. On the other hand, if opening means 2 of the nozzle were flared, tapered or oval, then at some point in the opening there would be a "maximum" diameter, which is critical to this invention as will hereinafter be described.

While the illustrated embodiment of nozzle 1 is generally cylindrical in exterior shape, it is to be understood that the exterior configuration of this nozzle is not particularly critical, with the interior design being of primary importance.

The nozzle embodiment disclosed herein is essentially a prototype, which, when fed by a flexible hose, could be held in the hand and manually manipulated to apply particulate material to a hot casting. It is contemplated that future, automated and commercial versions would be so designed that they could be clamped into a suitable and conventional mechanical device for programmed manipulation to direct air entrained particles according to a predetermined pattern.

Proceeding now to a detailed description of the structure claimed, the crux of my invention is a V-shaped slot bounded by generally parallel surfaces 3 and 3' best seen in FIGS. 3 and 4, and by generally convergent edges 4 and 4', lines coincident with such edges, if subtended in

the direction of convergence, forming angle β which must be within the range of 35° to 85°. Edges 4 and 4' are best seen in FIGS. 2 and 5.

Surfaces 3 and 3' are preferred in parallel relationship, but either or both may be varied from 0 to 15°, divergent from opening 2, with respect to the longitudinal axis of nozzle 1.

Referring to FIG. 2, X represents the distance measured from the internal extremity of opening 2 to the point where convergent edges 4 and 4' terminate at, and communicate with, opening 2. It is critical to this invention that the distance X be at least half the maximum cross-sectional dimension, or diameter, of opening 2. The reason for this being that if edges 4 and 4' were to terminate and communicate with opening 2 at a point too close to the internal extremity of opening 2, the previous fault encountered with air entrained deposition onto hot cast iron ware would occur. That is, the air pressure emanating from nozzle 2 is far too high, and the volume per unit time far too low for effective distribution without undue cooling. However, if edges 4 and 4' communicate with opening 2 at least the critical distance from the internal extremity of opening 2, the volume and pressure of air, and the volume and distribution pattern of the particulate material, are dramatically and unexpectedly improved, whereby this invention for the first time makes available a practical and workable air nozzle for application of particulate dry process material to a hot casting in the dry process method of enameling.

Thus, in operation, a suitable and conventional means, such as a flexible pressure hose, for delivering air entrained particulate material to my nozzle 1 is connected by any conventional means into an opening means 2, the source of supply of said particulate material activated, and there emanates from the slot opening, downstream of opening means 2, a relatively flat, fan-shaped volume of powdered dry process enamel suitable for coating a hot casting as hereinabove described, having just the right combination of pressure and volume of both dry process enamel and air to permit effective enameling.

Because the proper combination of air and particulate material volume is a matter requiring the skilled judgment of an individual operator, it is not possible to set precise limits on the air pressure to be utilized in this invention for delivering particulate material to my nozzle, nor to describe dimensional limitations for the diameter of the hose delivery means.

However, as is well known, the delivery means, as to both particulate material and air, would be subject to instantaneous metering and adjustment by well known valve means, permitting a skilled operator, in the case of an automated device having a battery of my nozzles affixed thereto, to quickly make the necessary adjustments as to each nozzle until each was producing, in his estimation, a suitable, fan-shaped test pattern having the proper volume and pressure requirements for the size and design of a particular casting, whether it would be a kitchen sink, lavatory or bathtub to be enameled.

For very small items, and for "touching up," one or more of my nozzles could be clamped together in a manually operable cluster permitting an individual to apply powder under special circumstances by hand.

Wherefore, having described my apparatus in detail as required by the governing patent statutes and case law, I claim:

1. In a nozzle for air dispersion of particulate discrete particles, at least 50% of which pass a 200 mesh screen, opening means for introducing air entrained particles into said nozzle, said nozzle having a discharge end and an outer surface, a longitudinal axis generally parallel with the path of discrete particle introduction thereinto, the improvement comprising a slot opening in said nozzle defined by generally parallel upper and lower surfaces, said slot bounded generally by convergent edges when viewed generally normal to said upper and lower surfaces, the angle formed by lines coincident with said edges subtended to their point of juncture being from about 35° to 85°, said edges communicating with the outer surface of said nozzle at a point anterior said discharge end and communicating with said means for introducing air entrained particles into said nozzle, and terminating thereat.

2. The nozzle of claim 1 wherein said edges terminate at said opening means at a point a distance from the internal extremity of said opening means equal to at least half the maximum diameter of said opening means.

3. The nozzle of claim 1 wherein said edges terminate at said opening means at a point a distance from the internal extremity of said opening means, and the upper and lower surfaces of said slot are divergent, respectively, away from said opening means, at angles of from 0° to 15° with the longitudinal axis of said nozzle.

4. The nozzle of claim 1 wherein said edges terminate at said opening means at a point a distance from the internal extremity of said opening means, and the upper and lower surfaces of said slot are divergent, respectively, away from said opening means, at angles of from 0° to 15° with the longitudinal axis of said nozzle, said nozzle being of unitary construction.

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