

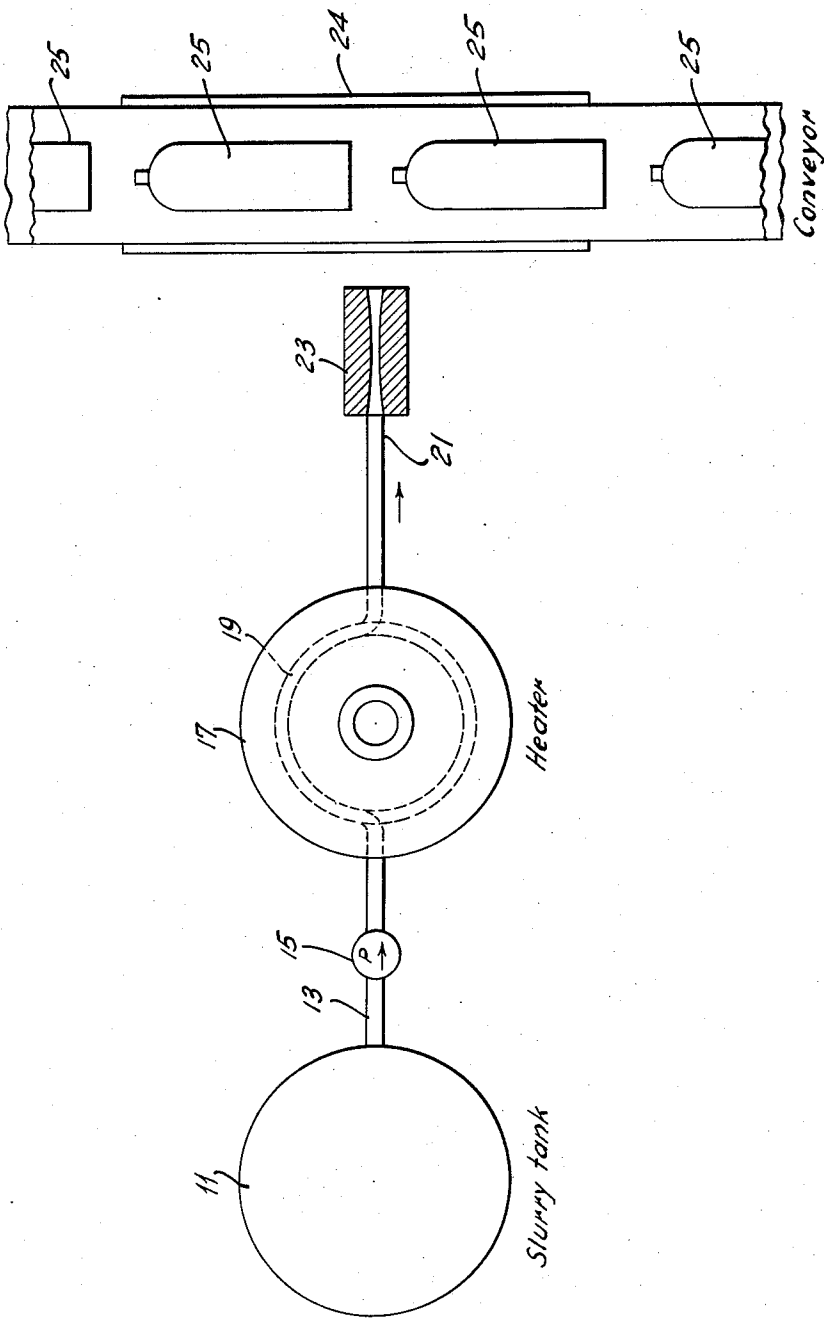
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ABRADING OBJECTS

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ABRADING OBJECTS

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5 Claims. (Cl. 51—282)

The present invention relates to a novel improvement in the method for abrading objects, commonly known as sand blasting or shot blasting, wherein particles of an abrasive material are suspended in a stream of gas and blown against the object to be abraded, such as a metal object being cleaned or a stone object being shaped.

In the past sand blasting and shot blasting have been performed by picking up particles of abrasive material in a stream of air and blowing them against the object to be cleaned or eroded. In such a procedure only a relatively low proportion of solids can be picked up, the weight ratios of air to solids generally running between 5:1 and 20:1. Furthermore, it is difficult to introduce granular material uniformly into a flowing gas stream. Another disadvantage of previous procedures is the requirement for expensive air compressors, receivers, high pressure lock hoppers, and auxiliary equipment.

The disadvantages of the prior art are overcome by the present invention wherein the particles of abrasive solid material are first mixed with a body of vaporizable liquid such as water to form a flowable mixture, such as a slurry. This flowable mixture is then passed through a tubular zone as a confined flowing stream and is heated during its passage through said zone to a temperature above the boiling point of the liquid, which thus is vaporized to form a high velocity flowing dispersion of the solid particles suspended in gas. The dispersion is then discharged at high velocity from the tubular zone into free space as an unconfined shaped stream, and is directed so as to impinge against the object to be abraded.

The principles of the invention will be described more in detail below with reference to the single figure of the drawing, which is a schematic plan view of apparatus for abrading objects in accordance with the invention.

Referring to the drawing, solid granules of abrasive material are mixed at atmospheric pressure with the vaporizable liquid in tank 11, and from there flow through a conduit 13 to a pump 15 which forces the flowable mixture under high pressure into a tube 19 coiled within a heater 17 which may be fired in any suitable manner, as by a gas or oil flame.

During its passage through tube 19 the liquid content of the mixture is heated to its boiling point and vaporized to form a flowing dispersion of the solid particles in the gaseous vaporized liquid. Continued flow through the tube 19 superheats the gas and increases its volume substantially. Then the dispersion is delivered through a conduit 21 to a convergent-divergent nozzle 23 from which the dispersion is discharged as a well defined compact stream flowing at extremely high velocity, such as supersonic. Upon impingement of the solid particles against the object to be abraded, which is illustrated only by way of example as a steel gas cylinder 25 passing on a conveyor in front of the nozzle, the solid particles rapidly remove all paint or scale and convert the metal to a bright condition.

The pump 15 generally forces the flowable mixture into tube 19 at a velocity between ½ and 10 feet per

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second and a pressure which may be from about 200 to 1200 or more pounds per square inch, but other conditions may be employed successfully. High velocities are assured by maintaining a pressure drop through the heater ranging between 200 and 800 pounds per square inch, although smaller and larger pressure drops may be employed.

While water is generally the most readily available and economical liquid to use in making up the flowable mixture, it is evident that the principles of the invention apply equally well when other vaporizable liquids are used, such as liquid petroleum hydrocarbons, coal tar distillates, alcohols, glycols, carbon tetrachloride and the like.

The abrasive solid material may be sand, steel or cast iron shot, silicon carbide grains, alumina grains, or others. Size of the particles depends to some extent upon the character of the finish desired on the abraded object, since the finer the particles the smoother is the finish. The process is operable, however, even with the coarsest particles that can be suspended in the liquid and passed through the system successfully. In general, it may be said that the particle size advantageously may range between those particles which just pass through an 8 mesh U. S. Standard sieve and those which are just large enough to be retained upon a 100 mesh sieve.

Economy of operation is assured by suspending as much solids as possible in a given quantity of the liquid. Generally the ratio of liquid to solid will run between 2:1 and 1:2 weight, with a 1:1 ratio being advantageous.

While the temperature to which the flowable mixture is heated as it passes through the tube 19 is not critical to the operation as long as it exceeds the boiling point, suitably high velocity is assured by superheating the liquid. For example, with water a temperature between 500 and 1000° F. is advantageous.

Nozzle 23 has been shown as a convergent-divergent nozzle, which is designed to discharge streams of the dispersion at a velocity greater than the velocity of sound at the temperature of the stream. However, successful operation can be achieved by discharging the stream directly from the end of conduit 21, or by passing it through a conventional convergent nozzle. Velocities of the order of 1000 to 3000 feet per second are ordinarily employed, but lower or higher velocities are operable.

The size of the heater tube 19, the conduit 21, and the nozzle 23 are ordinarily dependent upon the requirements of the operation involved since the abrading of very large objects with great rapidity requires much larger volumes of dispersion than would a smaller operation. Successful operation can be achieved with a heater tube 19 formed of ½ inch steel pipe, and a nozzle 23 having a ¼ inch throat diameter and a ½ inch outlet.

Heater tube 19 may take any suitable form such as a helical coil, or a series of straight pipe lengths connected together by return bends.

Obviously, many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. A method for abrading an object comprising mixing a vaporizable liquid with particles of an abrasive solid material to form a flowable mixture; passing said flowable mixture through a tubular zone as a confined stream; heating said mixture during passage through said tubular zone to a temperature above the boiling point of said liquid and forming therein a high velocity flowing dispersion of said particles in vapor; and discharging said

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dispersion at high velocity from said tubular zone into free space, and then against said object.

2. A method in accordance with claim 1, wherein said flowable mixture is pumped into said tubular zone at super-atmospheric pressure.

3. A method in accordance with claim 1 wherein said flowable mixture is a slurry in which the ratio of liquid to solid is between 2:1 and 1:2 by weight.

4. A method in accordance with claim 1 wherein said liquid is water.

5. A method in accordance with claim 1 wherein said flowing dispersion is passed as a confined stream of

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decreasing cross-section, and then as a confined stream of increasing cross-section, just prior to discharge against said object, whereby the velocity of said dispersion as it enters free space is of the order of supersonic velocity.

References Cited in the file of this patent

UNITED STATES PATENTS

2,114,573	Rhodes	Apr. 19, 1938
2,532,655	Backer	Dec. 5, 1950
2,666,279	Chalom	Jan. 19, 1954