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METHOD OF SANDBLASTING AND APPARATUS THEREFOR

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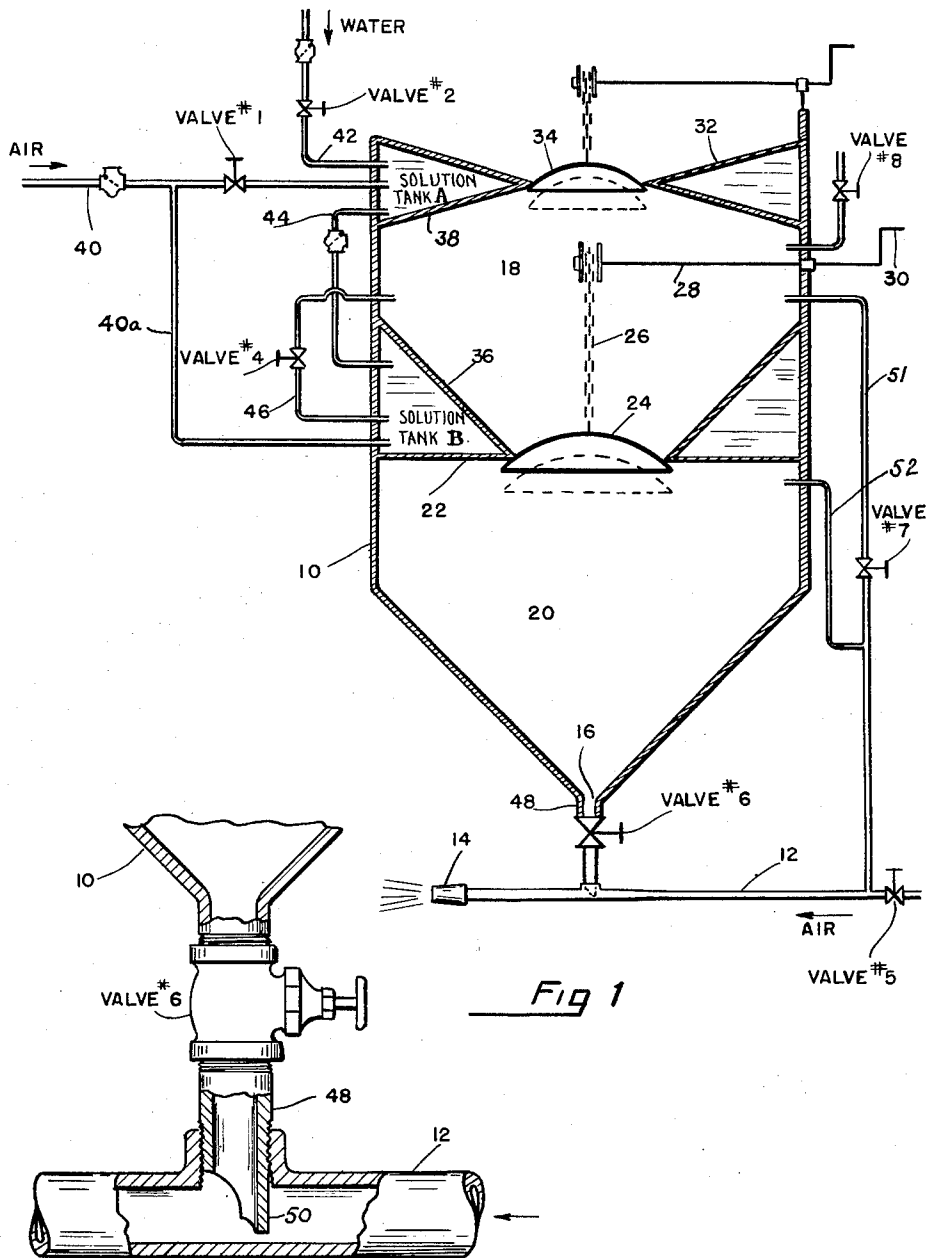


Fig 2

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METHOD OF SANDBLASTING AND
APPARATUS THEREFOR

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This invention relates to methods for controlling flow and apparatus for use in connection therewith and, more specifically, to methods of sandblasting and apparatus therefor.

In general, it is an object of the invention to provide a method that is extremely simple and apparatus which is not complicated, which can be quickly and readily manufactured of inexpensive materials by relatively untrained workmen and can be repaired by them at the place of operation and which may be used with ease, safety and economy.

Another object of the invention is to provide sandblasting equipment for ships' hulls which lowers the present requirements of pumps and motors, which lowers the present requirement of conduits to the sandblasting nozzle, which makes use of the oxidation-inhibiting liquid to lessen the amount of apparatus rather than to increase it, which does away with substantially all moving parts and eliminates all moving parts which come in contact with the sand, which permits the use of moist sand, which gives continuous operation, which cuts down the time to clean a ship's hull to a small fraction of that hitherto necessary and which similarly reduces the weight of the manually operated sandblast nozzle.

Another object of the invention is to provide a method of sandblasting which gives substantially no dust to float away from the operating site, and in which the sand settles immediately after having been delivered in the blast; and to provide such a method which may be used in large compartments.

Other objects of this invention will, in part, be obvious, and will, in part, appear hereinafter.

The invention accordingly comprises methods and apparatus possessing the features, properties and relation of elements that will be exemplified in the methods and apparatus hereinafter described, the scope of the application of which will be indicated in the claims.

For a better understanding of the invention, reference should be had to the following description taken in connection with the drawing, in which

Fig. 1 is a somewhat diagrammatic view of an apparatus embodying one form of the invention; and

Fig. 2 is a view with a portion cut away of a detail of the apparatus indicated in Fig. 1.

Before a ship is repainted in dry dock, it should be sandblasted to remove rust and old paint. At the time of sandblasting it is sprayed with a so-

lution of a rust inhibitor substance in order that it not rust during the time elapsing until the paint can be applied.

It has been customary to bring dry sand to containers positioned along the hull and from therein the sand was forced under pressure into tubes in which it was transported to the nozzles in the hands of the workmen. Separately, the inhibiting solution was placed in other containers and pumped through other tubes to the nozzles. Each workman carried a ten- to twelve-pound nozzle and, as he climbed up and moved about on the rigging, had to drag the two unwieldy tubes with every motion that he made.

Furthermore, the sand had to be completely dry. If it had been exposed to the slightest shower or to dew, it had to be carried back to drying ovens and dried. The enormous time and labor involved in this can be appreciated when it is realized that even a normal submarine takes about one hundred fifty barrels of sand for cleaning and each barrel weighs more than eighty pounds.

Not only does the present invention permit the use of moist sand, but it actually makes it wet. Hence, there is never any need to take sand back to drying kilns when it has accidentally become moist. Further, it permits the re-use of sand collected wet in the dry dock so that the sand never has to be redried.

The present invention does away entirely with the inhibiting solution tube and the motor and pump for forcing the solution through the tube. The weight of the tubing is thereby cut in half and the ever present entanglement of the tubes is wholly eliminated. Now, too, the nozzle does not have to be a mixing chamber and the weight of the nozzle in the hands of the workman is cut down to about a pound.

The inhibiting solution is mixed with the sand in the hopper and the entire mixing apparatus is made so small that it can be wheeled about. Its operation is made to be continuous. The time in dry dock and the labor being considered, the overall cost is reduced by the present invention to a small fraction of what it has been. Moreover, with a given period for dry dock and a limited manpower supply, vessels which formerly could not be repainted now are being given a fresh coat.

Heretofore, certain surfaces could not be sandblasted because a cloud of sand dust floated off and entered places and objects where the sand could not be tolerated. When the outer surface of the hull of a submarine was sandblasted it

was impossible to prevent the floating sand from going topside and getting into the intricate machinery. Sandblasting of submarines was abandoned; the old paint was brushed off by hand with steel brushes. In enclosed spaces the cloud of sand and sand dust was so thick as to not permit the use of sandblast. The method of the present invention thoroughly wets the sand before it reaches the sandblast nozzle and after the wet particles have been delivered against the object to be blasted; they settle out of the atmosphere and there is no dust cloud floating off to adjacent objects. The present method has been used on submarine hulls and in enclosed spaces.

In the drawing, 10 denotes a containing means from which sand and solution are delivered into the air supply line or conduit 12, and thence to the sandblasting nozzle 14. The container 10, which may be cylindrical, has a bottom which slopes down to an aperture 16 and is divided conveniently by a partition 22 into an upper hopper 18 and a lower hopper 20. A central circular opening in the partition provides an interhopper passageway which may be closed by ball valve 24. The latter is operated in any suitable fashion, that indicated being by chain 26 windable on rod 28 which leads out to a handle 30. A rotary motion of the handle raises or lowers the valve.

Container 10 is closed at the top by an inverted, truncated, conical wall 32, having an opening at the center. There may be any desired closure such as ball valve 34 with means of operation similar to those for ball valve 24.

A partition 36, shaped like the surface of an inverted truncated cone, is joined to the side wall of the container 10 and to partition 22 to form a solution tank B. Partition 36 forms, with the side wall of the container 10 and wall 32, a solution tank A.

A bifurcated air line 40 leads to each solution tank and water or solution inlet line 42 leads into the upper solution tank A. Conduit 44 extends between the tanks and allows liquid to pass only from the upper to the lower tank. The solution delivery line 46 conducts solution from tank B to one, preferably the upper, of the hoppers. An air pressure line 51 extends from air line 12 to the upper hopper 18 and a branch line 52 extends into the lower hopper 20. Suitable valves are positioned as shown.

A tube 48 connects orifice 16 with air line 12 (see Fig. 2) and has a portion extending as a guard 50 into the air line and on the upstream side and providing an opening out of said tube into the downstream side. Suitable check valves are preferably provided in conduits 40, 42, and 44, as indicated in the drawing.

The operation of the apparatus is as follows:

Valves 2, 4, 5, 6, 7, and 24 are closed. These, respectively, shut off the solution supply line to tank A, the solution line from tank B to the upper hopper, the main air line to the nozzle, the sand delivery tube from the lower hopper into the main air line, the air pressure to the upper hopper, and the passage between the hoppers. Air pressure from line 40 is at all times on tank B through the branch line 40a. (a) A load of sand is dropped past the open ball valve 34. This may be about twenty-five gallons weighing, if screened through a quarter-inch mesh screen, about forty pounds. (b) Valve 1 is closed and valve 2 in line 42 is held open, permitting solution to flow into the upper tank A, until a gauge, not indicated on the drawing, shows tank A to contain five or six gallons of the water solution. The latter may

contain about a gill of a rust inhibitor, e. g., a mixture of one part of potassium dichromate and one to five parts of trisodium phosphate, the drier the day, the more of the latter. There may be a vent from tank A, also not indicated, held open only while the solution is being introduced into tank A. (c) Valve 2 is then closed and valve 1 is opened, equalizing the pressure in tanks A and B, and permitting the solution to fall to tank B. (d) Ball valve 34 is closed, valve 7 is opened and valve 4 is opened while the solution is forced by air pressure from line 40, out of tank B into the upper hopper. Since line 40 enters the bottom of tank B, the entering air stirs the solution in that tank. (e) Valve 24 is opened. This drops the sand and solution from the upper to the lower hopper. (f) Valves 5 and 6 are opened. This starts the sandblast. (g) Valves 24 and 7 are closed and valve 34 is opened. Steps (a), (b), (c), (d), (e), and (g) are repeated as long as desired. This gives continuous sandblasting. The tanks A and B may be at a distance from container 10.

The five or six gallons of solution mentioned above for twenty-five gallons of sand are sufficient to fill all or substantially all the interstices between the sand particles and sufficient to wet the sand so that it drops continuously through the aperture in the bottom of the hopper, and sufficient to leave the sand so wet that, after the operation, it settles and does not float away. At least two or three times as much solution may be used, but this increases the cost of the extra anti-oxidant solute.

The pressure in line 12 in operation, has been about 90 pounds. The amount of this pressure may be greatly increased or somewhat decreased.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What I claim as new and desire to secure by Letters Patent is:

1. Apparatus for continuously delivering granular material into a container which is under pressure, said apparatus comprising means for containing a mass of said material, means providing an orifice through said containing means, means for connecting said orifice-providing means and the container, and means for supplying liquid to said material before it is delivered through said orifice, said containing means and said orifice being so positioned that said material and said liquid may pass together through said orifice under gravity, said containing means comprising means providing a plurality of chambers, said orifice opening into one of said chambers, means providing a passage between said chambers, valve means in said passage, and means for supplying one of said chambers with pressure about equal to the pressures in the container.

2. Apparatus for continuously delivering granular material into a container which is under pressure, said apparatus comprising means for containing a mass of said material, means providing an orifice through said containing means, means for connecting said orifice-providing means and the container, and means for supplying liquid to said material before it is delivered through said orifice, said containing means and said orifice being so positioned that said material and said liquid may pass together through said orifice under gravity, said containing means

comprising means providing a plurality of chambers, said orifice opening into one of said chambers, means providing a passage between said chambers, valve means in said passage and means for supplying one of said chambers with pressures about equal to the pressures in the container, and means providing an entrance into the second of said chambers for said material.

3. Apparatus for continuously delivering granular material into a container which is under pressure, said apparatus comprising means for containing a mass of said material, means providing an orifice through said containing means, means for connecting said orifice-providing means and the container, and means for supplying liquid to said material before it is delivered through said orifice, said containing means and said orifice being so positioned that said material and said liquid may pass together through said orifice under gravity, said containing means comprising means providing a plurality of chambers, said orifice opening into one of said chambers, means providing a passage between said chambers, valve means in said passage, and means for supplying one of said chambers with pressure about equal to the pressures in the container, said liquid-supplying means being adapted continuously to deliver liquid under pressure to one of said chambers.

4. Apparatus for continuously delivering granular material into a container which is under pressure, said apparatus comprising means for containing a mass of said material, means providing an orifice through said containing means, means for connecting said orifice-providing means and the container, and means for supplying liquid to said material before it is delivered through said orifice, said containing means and said orifice being so positioned that said material and said liquid may pass together through said orifice under gravity, said containing means comprising means providing a plurality of chambers, said orifice opening into one of said chambers, means providing a passage between said chambers, said passage being positioned to allow said material to pass therethrough under gravity, valve means in said passage and means for supplying one of said chambers with pressures about equal to the pressures in the container.

5. Apparatus for continuously delivering granular material, said apparatus comprising a container, means for maintaining superatmospheric fluid pressure therethroughout, means for containing a mass of said material, means providing an orifice through said containing means, means for connecting said orifice-providing means and the container, and means for supplying liquid to said material before it is delivered through said orifice, said containing means and said orifice being so positioned that said material and said liquid may pass together by gravity through said orifice and into said container.

6. Apparatus for continuously delivering granular material, said apparatus comprising a container adapted for maintaining a fluid pressure therein, means for supplying thereto a fluid under pressure, means providing an exit aperture therethrough, means connecting said aperture to the atmosphere, means for containing a mass of said material, means providing an orifice through said containing means, means for connecting said orifice-providing means and the container, and means for supplying liquid to said material before it is delivered through said orifice, said containing means and said orifice being so positioned that

said material and said liquid may pass together by gravity through said orifice and into said container, said fluid pressure being sufficient to deliver said material and said liquid through said aperture.

7. Apparatus for continuously delivering granular material into a container which is under pressure, said apparatus comprising means for containing a mass of said material, means providing an orifice through said containing means, means for connecting said orifice-providing means and the container, and means for supplying liquid to said material before it is delivered through said orifice, said containing means and said orifice being so positioned that said material and said liquid may pass together by gravity through said orifice and into said container and means providing superatmospheric pressure in said containing means during the passage of said material and said liquid through said orifice.

8. Apparatus for continuously delivering granular material into a container which is under pressure, said apparatus comprising means for containing a mass of said material, means providing an orifice through said containing means, means for connecting said orifice-providing means and the container, and means for supplying liquid to said material before it is delivered through said orifice, said containing means and said orifice being so positioned that said material and said liquid may pass together by gravity through said orifice and into said container and means providing a pressure upon said material and said liquid in said orifice, in the direction of flow of said material and said liquid, the last-mentioned pressure being at least substantially equal to the first-mentioned pressure.

9. Apparatus for continuously delivering granular material into a container which is under pressure, said apparatus comprising means for containing a mass of said material, means providing an orifice through said containing means, means for connecting said orifice-providing means and the container, and means for supplying liquid to said material before it is delivered through said orifice, said containing means and said orifice being so positioned that said material and said liquid may pass together through said orifice under gravity, said containing means comprising means providing a plurality of chambers, said orifice opening into one of said chambers, means providing a passage between said chambers, valve means in said passage, and means for supplying one of said chambers with pressure about equal to the pressure in the container, said liquid-supplying means being adapted continuously to deliver liquid under pressure to one of said chambers and to said material therein, and comprising an upper tank with liquid inlet means, a lower tank connected to receive liquid by gravity from said upper tank, means supplying pressure to said lower tank to transfer liquid therefrom to said material in said chamber, and means supplying pressure to said upper tank to effect the transfer of said liquid to said lower tank under the action of gravity.

10. Apparatus for continuously delivering granular material into a container which is under pressure, said apparatus comprising means for containing a mass of said material, means providing an orifice through said containing means, means for connecting said orifice-providing means and the container, and means for supplying liquid to said material before it is delivered through said orifice, said containing means and

said orifice being so positioned that said material and said liquid may pass together through said orifice under gravity, said containing means comprising means providing a plurality of chambers, said orifice opening into one of said chambers, means providing a passage between said chambers, valve means in said passage, and means for supplying one of said chambers with pressure about equal to the pressure in the container, said liquid-supplying means being adapted continuously to deliver liquid under pressure to one of

5 said chambers and to said material therein, and comprising an upper tank with liquid inlet means, a lower tank connected to receive liquid by gravity from said upper tank, means continuously supplying pressure to said lower tank to transfer liquid therefrom to said material in said chamber, and means supplying pressure to said upper tank to effect transfer of said liquid to said lower tank under the action of gravity, said supplied pressures being equal and from a common source.

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