May 22, 1945. S. J. OECHSLE ET AL 2,376,616

SAND-BLASTING APPARATUS

Filed Jan. 18, 1944 2 Sheets-Sheet 1

Fig. 1

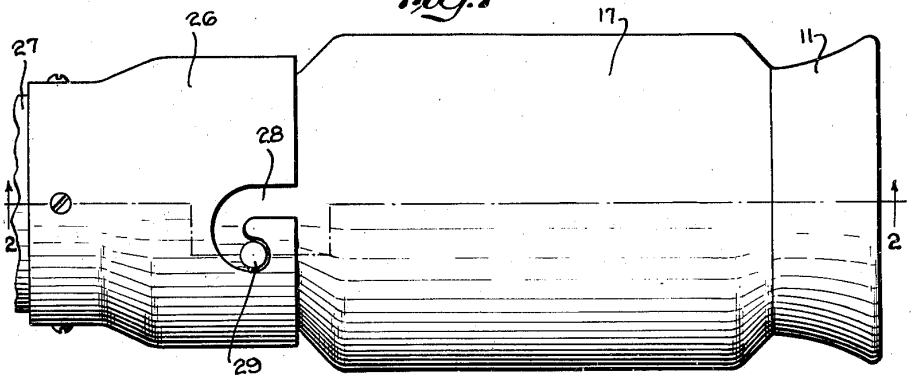


Fig. 2.

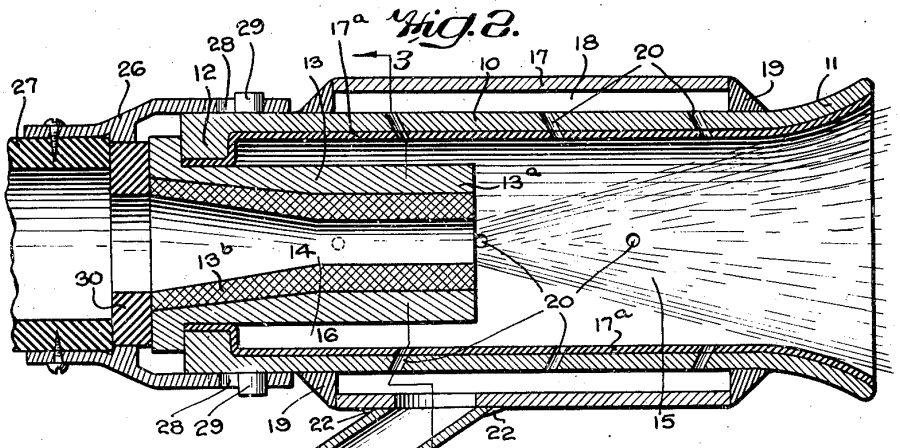
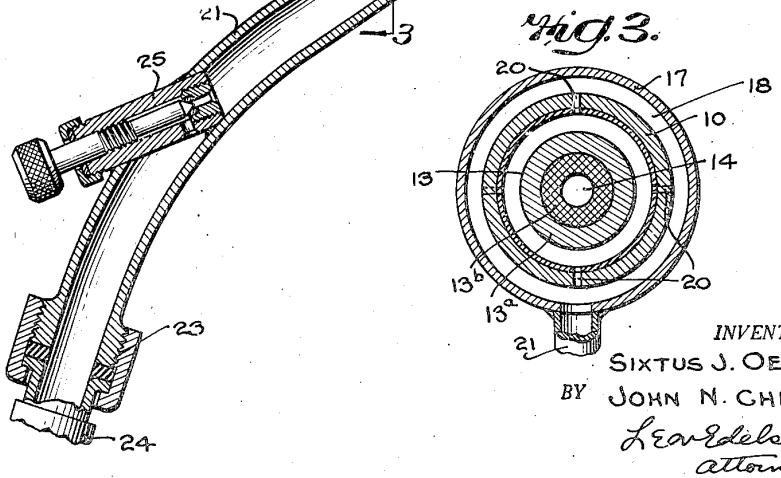


Fig. 3.



INVENTOR.
SIXTUS J. OECHSLE
BY JOHN N. CHILDS
Lear Edelson,
Attorney

May 22, 1945. S. J. OECHSLE ET AL 2,376,616

SAND-BLASTING APPARATUS

Filed Jan. 18, 1944 2 Sheets-Sheet 2

Fig. 4.

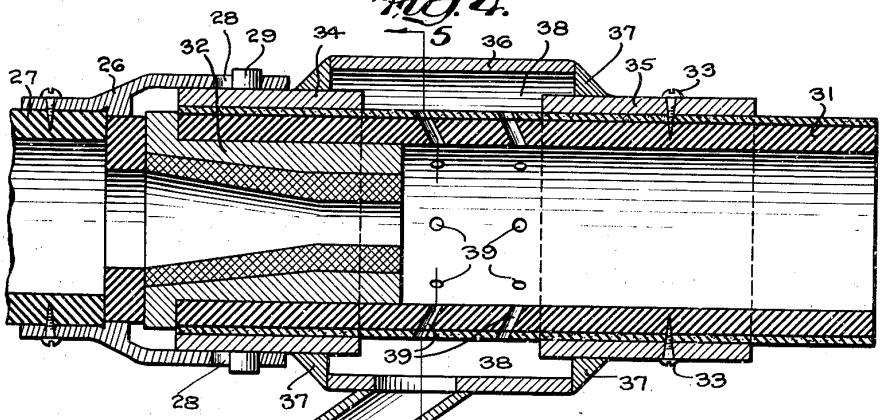


Fig. 5

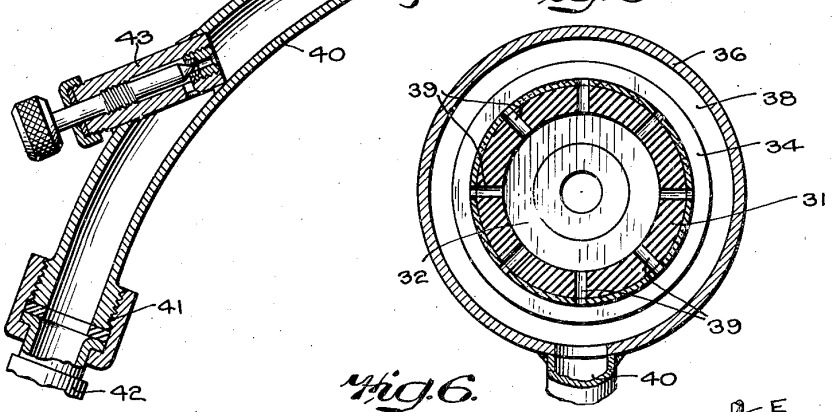
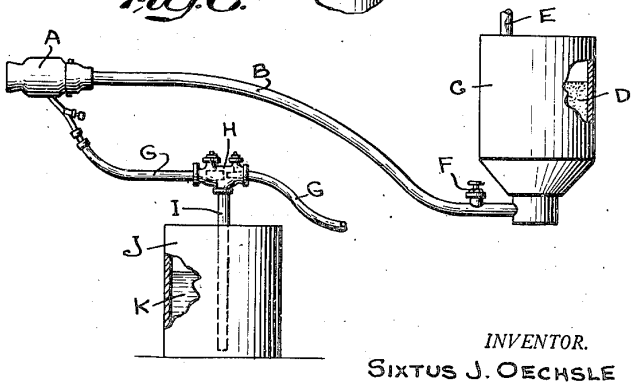


Fig. 6.



INVENTOR.
SIXTUS J. OECHSLE
BY JOHN N. CHILDS
Earl Edelson
Attorney

Patented May 22, 1945 2,376,616

UNITED STATES PATENT OFFICE

2,376,616

SANDBLASTING APPARATUS

Sixtus J. Oechsle, Philadelphia, and John N. Childs, Meadowbrook, Pa., assignors to Metalweld, Inc., Philadelphia, Pa., a corporation of Pennsylvania

Application January 18, 1944, Serial No. 518,688

7 Claims. (Cl. 51—11)

This invention relates to the art of sand-blasting and more particularly to improvements in the method of and apparatus for sand-blasting in which water is employed to wet the sand as it is projected against the surface to be treated.

Heretofore and prior to the present invention, the operation of sand-blasting as ordinarily performed involved the projection by air pressure of dry sand against the surface to be treated. This method of dry sand-blasting necessarily produced a great deal of dust which was not only annoying and often hazardous to the operator of the sand-blasting gun and to those in the immediate vicinity of the sand-blasting operation, requiring their use of protective masks, but also rendered the operation impracticable in many cases, as where it was desired to sand-blast surfaces in more or less closed interiors which might contain valuable and delicate apparatus and instruments which would be adversely affected by sand dust. An example of this would be a ship which might require sand-blasting treatment of surfaces, both exterior and interior. In such case, dry sand-blasting would be quite objectionable because the dust attending the operation would have very deleterious effects not only upon the machinery and equipment of the ship undergoing the dry sand-blasting treatment, but also on that of any other ship that might be docked near it.

It is accordingly among the principal objects of the present invention to provide a method of and apparatus for wet sand-blasting in which the creation of sand-dust is effectively reduced, if not entirely eliminated.

A further and important object of the present invention is to provide an improved construction of sand-blasting apparatus which is so designed and operated as to draw into the stream of the pressure-projected sand, for intimate mixture therewith by suction induced by said stream, water in sufficient amount to wet the sand and to be carried by it to the surface to be sand-blasted, thus holding the sand-dust in suspension in the wetted sand stream, all without impairing in any respect the abrasive qualities of the sand.

Still another and important object is to provide a method of and apparatus for wet sand-blasting wherein water is entrained into a stream of sand to be projected therewith at high velocity against the surface to be treated, the water being continuously introduced into the sand stream at any desired rate constantly proportional to the rate of flow of the sand stream, and wherein a rust-inhibiting or other liquid agent may be introduced into the water stream also at a pre-determined rate for admixture with the sand stream and conveyance by it to the surface to be treated, the said surface-treating agent being continuously drawn into the water stream through a suction action induced by the latter preliminarily to its introduction into the high-pressure sand jet.

A still further object of the present invention is to so improve the construction of the sand-blasting apparatus as to measurably prolong its operating life, this objective being accomplished primarily by providing the sand-blasting nozzle with a lining of rubber which extends throughout the whole length of that portion of the nozzle which immediately embraces and receives the full impact of the high pressure sand jet.

Still other objects relating to economies of operation and construction of the sand-blasting device of the present invention will appear more fully hereinafter, such as the provision of a wet-sand-blast nozzle which is simple and compact in design, efficient and durable in operation and capable of manufacture at low cost.

It will be understood that the present invention consists substantially in the combination, construction, location and relative arrangements of parts, as well as in the method of continuously projecting a wetted stream of sand against a surface to be treated, all as hereinafter described in detail, as shown in the accompanying drawings, and as finally pointed out in the appended claims.

In the said accompanying drawings, which show for purposes of illustration certain preferred constructions and arrangements embodying the principles of the present invention,

Figure 1 is a top elevational view of the sand-blasting device;

Figure 2 is a longitudinal cross-sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a transverse sectional view taken on the line 3—3 of Figure 2;

Figure 4 is a view similar to Figure 2 but showing a somewhat modified construction of the sand-blasting device;

Figure 5 is a view taken on the line 5—5 of Figure 4; and

Figure 6 is a schematic view showing in side elevation and in operative relation all of the essential parts employed in practicing the method of the present invention.

Referring now to the drawings and more particularly to Figures 1 to 3 thereof which show one of the preferred forms of sand-blast nozzle constructed in accordance with and embodying the principles of the present invention, it will be observed that such nozzle generally comprises a

main tubular body portion 10 having an outwardly flared discharge end 11 and an internally flanged rear end 12 within which is adapted to be fitted an inner nozzle tube 13. This inner nozzle tube 13 is longitudinally bored to provide a passage 14 for the projection therethrough of a stream of dry sand supplied from any suitable source under sufficient air pressure to cause said sand to be discharged from the tube 13 in the form of an outwardly flaring high velocity jet, such as is indicated by the reference numeral 15 in Figure 2. To this end, the rear portion of the passage 14 through the tube 13 is of gradually decreasing diameter toward the point 16 from whence it continues forwardly in the form of a restricted passage of uniform diameter, the outer end of which terminates at a point spaced a substantial distance rearwardly of the discharge end of the outer tube 10. The relative dimensions and arrangement of the outer and inner tubes 10 and 11 are such that as the high velocity jet of air and sand issues from the inner nozzle 13, a region of suction is created between the envelope of the jet and the surrounding wall of the outer tube 10, this suction being such as is characteristically produced by suction jet pumps and other such jet devices.

As most clearly appears in Figures 2 and 3, the inner wall of the outer tube 10 is provided with a protective lining or coating 17a of rubber or other such material having the capability of resisting the abrasive action of the sand. Also, the inner nozzle 13a is preferably constructed of an outer shell within which is suitably fitted an inner shell 13b formed of any suitable material suitable for withstanding the abrasive action of sand for reasonably long periods of use.

Suitably secured to the outer tubular shell 10 of the sand-blasting nozzle is a concentric shell 17 providing an annular space 18 between it and the outer surface of its supporting tube 10. Preferably, the shell 18 is integrally secured to the tube 10, as is most clearly shown in Figure 2, by annular welds 19—19 which respectively join the opposite ends of the shell 17 to the body of the main tube 10. The length and arrangement of the tube 17 relative to that of its supporting tube 10 are such that the annular space 18 extends from a point well to the rear of the transverse plane of the discharge end of the inner tube 13 to a point well in advance of said plane, or, in other words, so that the said annular space 18 is substantially coextensive with and circumferentially embraces the annular zone of suction created internally of the main tube 10 by the high velocity jet of air and sand issuing from the inner nozzle 13. Communication between the annular space 18 and the said suction zone is effected by way of a plurality of openings 20 formed in that portion of the tube 10 which is embraced by the outermost shell 17, these openings 20 being preferably arranged in longitudinally and circumferentially spaced relation with respect to the longitudinal axis of the nozzle and being each preferably so inclined with respect to said axis that the water is freely drawn from the annular space 18 into the suction region for intimate mixing with the sand and air jet 15.

The water jacket which surrounds the tube 10 is connected to a suitable supply of water by way of a rigid conduit 21 secured to the shell 17 as an integral part thereof, preferably by welding as at 22, the rear end of this conduit 21 being provided with suitable fitting 23 for attachment to a flexible hose 24 connected to the water supply. The rigid conduit 21 is preferably curved as is most clearly shown in Figure 2 to constitute it a supporting handle or grip for the sand-blasting nozzle, and it is provided intermediate its length with a suitable valve 25 for regulating the supply of water through the conduit 21 into the water jacket 18 of the sand-blasting nozzle.

As also clearly appears in Figure 2, the inner nozzle 13, which is removably fitted within the rear end of the main water-jacketed tube 10, is retained in operative position during operation of the sand-blasting nozzle, preferably by means of the fitting 26 fixedly secured to and carried by the flexible conduit 27 which is connected to the supply of sand under suitable air pressure. This fitting 26 is provided with a pair of diametrically opposed slots 28 which are respectively adapted to interlock with a pair of elements 29 which project radially from diametrically opposite sides of the main tube 10, these slots and projections 28—29 coacting to provide for a quick-detachable bayonet-and-slot type of connection between the fitting 26 and the rear end of the tube 10. A compressible gasket 30 of rubber or other such resilient material is interposed between the corresponding ends of the conduit 27 and the inner nozzle 13 so that when the parts are interlocked as shown in Figure 2, the inner nozzle 13 is maintained in its operative position within the outer tube 10 and the sand-blasting nozzle is then in operative condition for use. It will be understood, of course, that any other suitable means may be provided for effectively interlocking the several parts together and accordingly, it will be understood that it is not intended to limit the present invention to the use of the bayonet-and-slot type of connection shown for interlocking the sand conduit 27 to the main tube 10 of the sand-blasting nozzle.

Figures 4 and 5 show a somewhat modified construction of sand-blasting nozzle. In this modified construction, the main outer tube of the sand-blasting nozzle generally comprises a suitable length of rubber-lined hose 31 within the rear end of which is adapted to be fitted the inner sand jet nozzle 32, which latter is similar in all material respects to the nozzle 13 of Figure 2. Secured to the rubber-lined main discharge tube 31, as by the securing elements 33, is a rigid tubular unit of metal formed of a pair of axially spaced tubular elements 34 and 35 of equal diameter secured together by an intermediate tubular shell 36 of somewhat larger diameter, the shell 36 being concentrically arranged with respect to the axially spaced elements 34 and 35 and being integrally secured to the latter by the annular welds 37—37 to provide an annular chamber 38 immediately surrounding that portion of the main tube 31 extending between the axially spaced elements 34 and 35. Suitable openings 39 are provided in this intermediate portion of the tubular discharge hose 31 to effect communication between the annular water chamber 38 and the suction zone located interiorly of the tube 31.

As in the form of sand-blasting nozzle previously described, this water chamber 38 is connected to a suitably shaped rigid conduit 40 having a fitting 41 at its outer extremity for facilitating coupling it to a flexible hose 42 leading to a suitable supply of water, the rigid conduit 40 being also supplied, as in the case of the conduit 21 of the previously described construction of sand-blasting nozzle, with a regulating valve 43 for controlling the flow of water into the nozzle. In all other material respects the sand-blasting

nozzle of Figures 4 and 5 is the same as that previously described, the advantage of its construction residing in the fact that the main discharge tube 31 thereof is formed of a length of rubber-lined hose which is cut to suitable length and then provided with the apertures 39, following which it is adapted to be slipped into and secured within the tubular assembly consisting essentially of the several elements 34, 35 and 36. Obviously, maintenance, repair and servicing of the sand-blasting nozzle of the form shown in Figures 4 and 5 is easily effected due to the fact that the tubular section of the hose 31, which constitutes the main discharge tube of the nozzle, is subject to easy removal and replacement on the job, should that be necessary.

Figure 6 diagrammatically illustrates the method of use of the sand-blasting nozzle of the present invention in order to provide for continuous wetting of the sand preliminarily to its discharge from the nozzle. In this Figure 6, the sand-blasting nozzle of the present invention is designated generally by the reference character A, it being understood that this nozzle may be of either of the forms of construction hereinbefore described. The rear end of the nozzle is connected by way of the conduit B to a receptacle C in which is contained a suitable supply of dry sand D. Compressed air of suitable pressure is delivered by way of the conduit E into the top of the receptacle C to force the sand out of the latter and through the conduit B to the nozzle A, the supply of this sand under such pressure being controlled by a suitable valve F included in the line B.

The water chamber surrounding the main tube of the nozzle A (18 of Figure 2, or 38 of Figure 4) is connected to a suitable supply of water (not shown) by way of the conduit G, this water being normally supplied at a pressure less than the air pressure behind the supply of the dry sand. As the compressed air and sand is discharged from the interior tube of the sand-blasting nozzle in the form of an outwardly flaring high velocity jet, there is created within the main tube of the sand-blasting nozzle within the region immediately embraced by the annular water space a region of suction by virtue of which the water delivered by way of the conduit G is drawn into and intimately mixes with the jet of sand and air whereby to wet the sand preliminarily to its final discharge from the sand-blasting nozzle. The result is that the dust, which is a normal product of dry sand-blasting, is eliminated without impairing in any respect the abrasive action of the sand upon the surface against which it is directed.

In those cases where it is desired to specially treat the surface undergoing sand-blasting, as where it may be desired to coat said surface with a rust inhibiting agent, such agent may be introduced into the water stream preliminarily to its entrainment and mixture with the sand and air jet. This is readily accomplished by including in the water line G a water jet eductor H of any suitable type and construction well known in the art having a tube I which is extended into a suitable receptacle J containing a supply K of a liquid rust inhibitor or other such surface treating agent. As an example of such an agent is a solution consisting of emulsified oil and a suitable detergent, or a solution of dichromate and/or phosphoric acid. The pressure of the water as it passes through the jet eductor H induces a suction therein which acts to draw the liquid out of the container J into the water stream, thereby insuring a continuous supply of the rust inhibiting agent or the like to the sand-blasting nozzle. By use of a jet eductor of proper design, the proportion of the surface treating agent derived from container J to the total volume of the solution delivered to the sand-blasting nozzle may be maintained substantially constant, e. g. a water solution containing 5 percent by volume of a liquid rust inhibiting agent. Also, by virtue of the fact that the water delivered by the conduit G to the sand-blasting nozzle is introduced into the dry sand by the suction action induced by the high velocity sand and air jet, it will be apparent that the proportion of water to the dry sand will be maintained constant so long as the rates of supply of these materials to the nozzle remain unchanged. Should it be desired to vary the proportion of water to sand, the water regulating valve immediately associated with the sand-blasting nozzle (valve 25 of Figure 2, or valve 43 of Figure 4) may be adjusted to increase or decrease, as desired, the amount of water delivered to the nozzle. Or, this valve may be operated to entirely shut off the supply of water should it be desired to resort to the use of dry sand.

It will be understood, of course, that the present invention is susceptible of various changes and modifications which may be made from time to time without departing from the general principles or real spirit thereof, and it is accordingly intended to claim the same broadly, as well as specifically, as indicated by the appended claims.

What is claimed as new and useful is:

1. In an apparatus for effecting wet sand-blasting, a combining nozzle for intimately mixing dry sand and water comprising a main discharge tube for the wetted sand, a sand-jet-producing nozzle fitted in one end of said tube and having a bore therethrough coaxial with the tube, an annular water jacket surrounding said tube adapted for connection to a continuous supply of water, said tube constituting the inner wall of said annular water jacket and having a plurality of openings therethrough affording communication between the water jacket and the interior of said tube, and means for continuously delivering a supply of sand under pressure to said nozzle for mixture with the water drawn from said water jacket.

2. In a combining nozzle for intimately mixing dry sand and water, a main tubular member, a sand-jet nozzle fitted in one end of said member and having a restricted bore terminating short of the opposite discharge end of the tubular member, said nozzle being adapted to project a high velocity outwardly flaring jet of sand axially toward and through said discharge end of the tubular member, and an outer shell disposed in spaced relation about said tubular member to form an annular water jacket thereabout, the inner wall of said jacket having openings communicating with the interior of said tubular member whereby water delivered to said jacket may be drawn therefrom interiorly of the tubular member for mixing with the sand jet preliminarily to its final discharge from the combining nozzle.

3. In a combining nozzle of the character defined in claim 2 wherein said tubular member is internally lined throughout with a rubber lining.

4. In a combining nozzle of the character defined in claim 2 wherein the outer shell of the water jacket is integrally secured to the main tu-

bular member constituting the inner wall of said jacket by annular welds respectively joining opposite ends of the outer shell to said tubular member.

5. In a combining nozzle of the character defined in claim 2 wherein said annular water jacket is provided with a rigid water inlet conduit shaped to provide a convenient handle for the nozzle.

6. In a combining nozzle for intimately mixing dry sand and water, a main tubular member formed of a replaceable length of rubber-lined conduit, a water-jacket assembly externally fitted on said conduit intermediate the opposite ends thereof, said assembly including a pair of axially spaced tubular members of equal diameters snugly fitting said conduit and a third tubular member of greater diameter bridging the space between said first pair of members and integrally secured thereto to provide the outer shell of an annular water chamber, the said conduit forming the inner wall of the water chamber and being provided with openings affording communication between the water chamber and the interior of the conduit, and a sand-jet nozzle fitted in one end of said conduit and having a restricted bore terminating within the zone encompassed by said annular water chamber whereby water delivered into the chamber may be drawn therefrom by the suction action induced by the sand jet for mixing with the sand preliminarily to its final discharge from the combining nozzle, and means for projecting a high velocity jet of sand from said inner sand-jet nozzle.

7. In a combining nozzle for intimately mixing dry sand and water for sand-blasting purposes, a main tubular member formed of a replaceable length of rubber-lined conduit, a water-jacket assembly externally fitted on said conduit intermediate the opposite ends thereof, means affording communication between the interiors of the water-jacket and the conduit, a sand-jet nozzle fitted in one end of the conduit and having a restricted bore terminating within the zone encompassed by said water jacket, and means for delivering continuous supplies of water and sand to said jacket and jet nozzle, respectively, and for causing the water to be introduced into the sand jet by the suction induced by the latter within said conduit.

SIXTUS J. OECHSLE.
JOHN N. CHILDS.