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3,256,642

UNDERWATER SANDBLASTING GUN

Filed Nov. 7, 1963

2 Sheets-Sheet 1

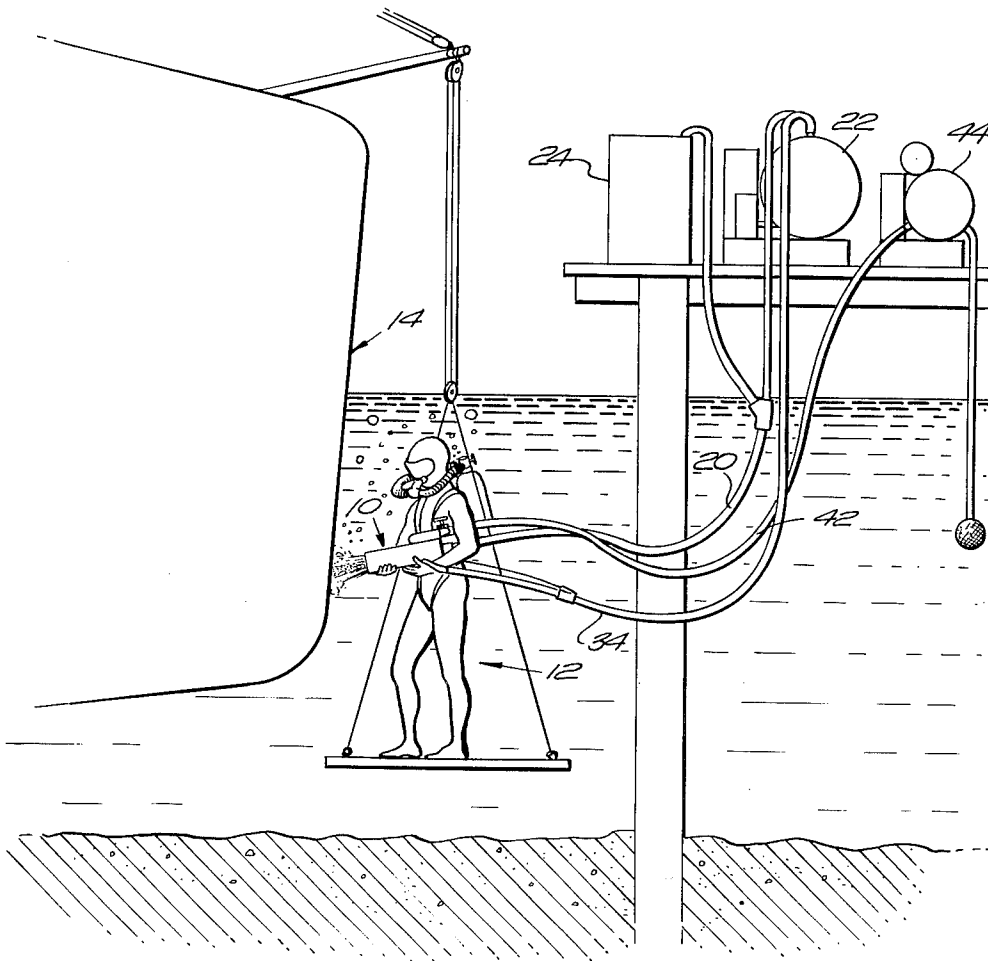


FIG. 1

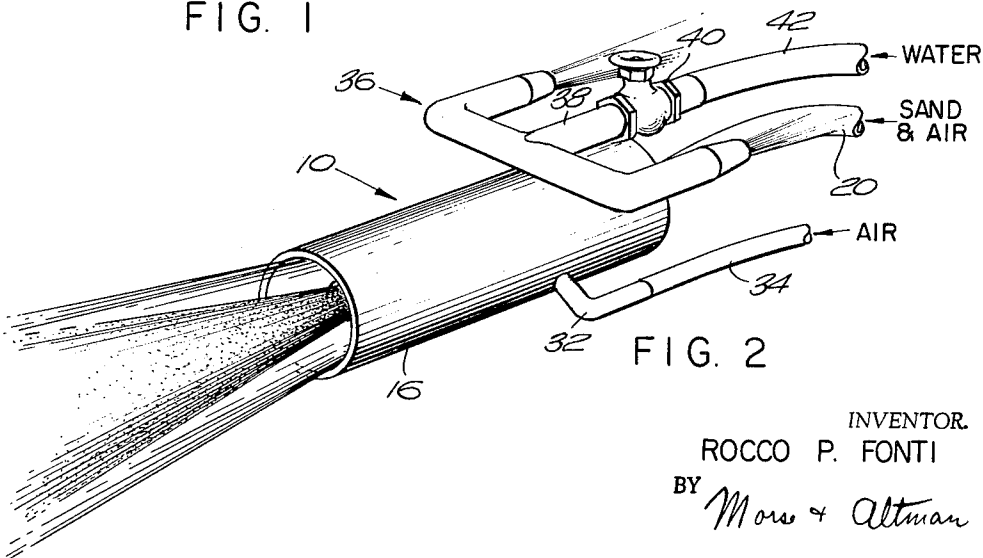


FIG. 2

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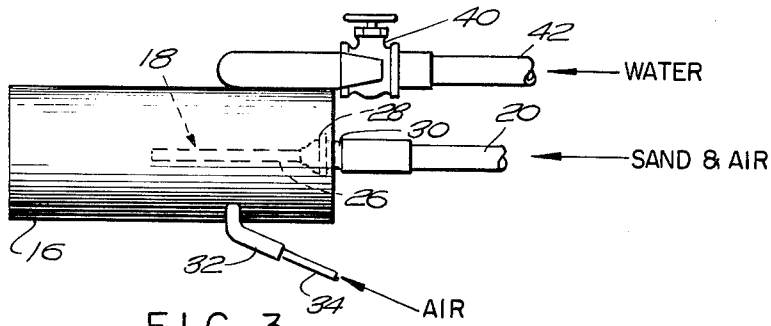


FIG. 3

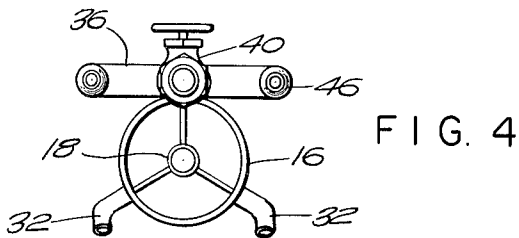


FIG. 4

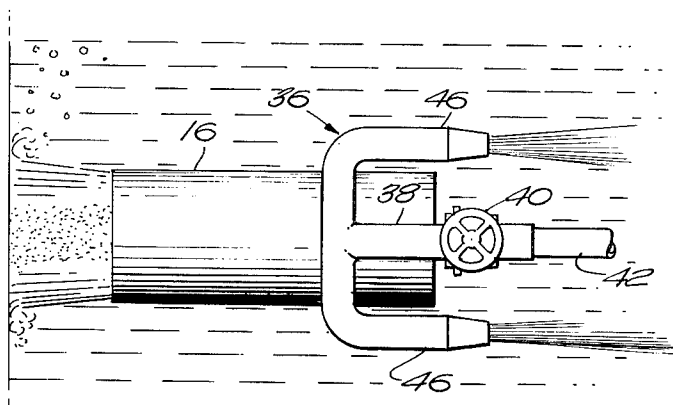


FIG. 5

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UNDERWATER SANDBLASTING GUN
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This invention relates generally to sandblasting devices and more particularly is directed towards a new and improved underwater gun adapted to deliver a flow of dry abrasive particles under pressure against a working surface which is substantially clear of water. The invention is also directed towards a novel thrust balancing system adapted to control or eliminate, as desired, reaction forces produced by operation of the gun underwater.

Underwater cleaning of ship hulls, piers and the like is very rarely carried on for the reason that heretofore there has been no means available to perform the cleaning operations quickly and efficiently. For example, conventional sandblasting guns are unable to operate efficiently underwater since the abrasive material loses its velocity when it passes from the nozzle into the water. Also, the thrust reaction produced by the discharge from a conventional sandblasting gun renders it almost impossible to be held by one man underwater. For this reason, ships are usually drydocked for hull cleaning by conventional techniques.

Accordingly, it is a general object of the present invention to provide improvements in sandblasting guns.

Another object of this invention is to provide a sandblasting gun which will operate efficiently underwater.

Yet another object of this invention is to provide an underwater sandblasting gun which is dynamically balanced against thrust reaction so that the gun may be held easily by a single diver.

A further object of this invention is to provide a self-cleaning sandblasting gun adapted to deliver a flow of high velocity dry abrasive particles against an underwater surface.

More particularly, this invention is directed towards an underwater sandblasting gun in which a main nozzle is mounted within a tubular outer housing, open at one end only, with the discharge end of the main nozzle being directed towards and recessed from the open end of the housing. A conduit is connected to the main nozzle and is adapted to deliver a mixture of compressed air and sand for discharge through the nozzle. Auxiliary conduits, connected to the housing are adapted to deliver a flow of compressed air only into the housing 10 for the purpose of clearing the housing of water and other foreign matter and to maintain a pressure head within the housing while at the same time being operative to produce an air pocket between the discharge end of the main nozzle and the surface which is to be cleaned. This invention also features one or more reversely directed nozzles mounted to the housing and connected to a source of pressurized water. These reversely directed jets of water will counteract the thrust from the main nozzle and from the compressed air discharged from the housing, thereby dynamically balancing the gun for easy handling during underwater operations.

But these and other features of the invention, along with further objects and advantages thereof, will become more fully apparent from the following detailed description of a preferred embodiment of the invention, with reference being made to the accompanying drawings in which;

FIG. 1 is a view in perspective showing a typical use of an underwater sandblasting gun made according to the invention together with auxiliary equipment,

FIG. 2 is a view in perspective of the gun,

FIG. 3 is a view in side elevation of the gun,

FIG. 4 is a view in end elevation, and,

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FIG. 5 is a top plan view of the gun as it appears in operation.

Referring now to the drawings, the reference character 10 generally indicates a sandblasting gun adapted to be hand held by a diver 12 for cleaning an underwater surface such as the hull of a ship 14, for example. The gun comprises a tubular housing 16 open at one end only and typically fabricated from a non-corrosive metal such as brass, bronze or the like.

Mounted to and extending through the rear wall of the housing and coaxially therewith is a nozzle 18 connected by a conduit 20 to a source of pressurized sand and air typically furnished by an air compressor 22 and a sand hopper 24 located above the surface of the water. It will be noted in FIGS. 2 and 3 that the discharge end of the nozzle 18 is directed towards the open end of the housing 16 but set back therefrom. The nozzle 18, in practice, comprises a pipe nipple 26 of selected length threaded to a collar 28 which in turn is threaded onto a nipple 30 mounted to the rear wall of the housing 16. Typically, the nipple 26 is of 1/2 inch diameter while the nipple 30 is of 1 1/4" stock. With this arrangement nozzles of different lengths and diameters may be readily installed.

Fastened to the side walls of the housing 16 and towards the rear thereof are a pair of spaced elbow pipe connections 32 each coupled by a conduit 34 to the air compressor 22. The auxiliary air supply which is delivered to the housing through the pipe connections 32 serves a number of distinct functions. First, assuming that the gun is connected up in the fashion shown in FIG. 1, when air is emitted to the housing through the auxiliary conduits 34, all water and any foreign material present within the housing will be discharged out through the open end of the housing. With the discharge end of the housing 16 held in proximity to the surface which is to be cleaned as suggested in FIGS. 1 and 5, the compressed air emitted by the auxiliary conduits 34 passes through the housing and out through its open end and will form an air pocket between the surface that is to be cleaned and the gun. This air pocket thus provides a clear, dry path for the abrasive material which is discharged from the nozzle 18. Thus, the gun 10 may be moved back and forth freely across the surface that is being cleaned without impairment of the cleaning action since the auxiliary air flow will maintain a constant and unobstructed path for the dry abrasive particles.

In addition to keeping the interior of the housing clear of foreign material and maintaining an air pocket in front of the gun, the auxiliary air flow also helps to maintain the velocity of the cleaning agent discharged from the nozzle 18 by maintaining a relatively high air pressure within the housing. Normally the air discharged from the nozzle 18 would experience a pressure drop as it enters the housing 16. By the use of the auxiliary air connections, the pressure of the air and sand mixture is maintained at a high level even after it has been discharged from the nozzle. Since the discharge end of the nozzle 18 is recessed from the open end of the housing 16, a clear space will always be available for the flow of the air and sand mixture even though the front of the gun 10 is brought up close to the surface which is to be cleaned.

Securely mounted by welding or the like to the top of the housing 16 and towards the rear end thereof, is a reaction balancing unit 36. This unit comprises a T-pipe connection in which the center section 38 thereof is provided with a valve 40 and connected by a conduit 42 to a pump 44 which may take suction directly from the local body of water. The unit 36 is provided with a pair of rearwardly extending nozzles 46 in communication with the center section 38 whereby water admitted under pressure through the section 36 will be discharged to the rear

of the gun 10. This will have the effect of balancing the reaction from the thrust of the air and sand which is discharged through the open end of the gun. By manipulating the valve 40 the counter reaction from the balancing nozzles 46 may be adjusted to precisely offset the reaction from the opposite end of the gun produced by the air and sand discharge. The volume and pressure of the water passing through the balancing unit will depend upon the depth at which the gun is being operated and the volume and pressure of air and sand discharge. Thus, a diver may handle the gun easily and will not be required to exert effort to hold the gun against the thrust of the air and sand discharge. By balancing one reaction with another, the gun thus becomes easy to use, aim and move about since the diver is supporting only the weight of the gun, which is, of course, effectively lower when under water.

The gun disclosed herein has been found to be extremely efficient in cleaning underwater surfaces by reason of the fact that a flow of dry, high-pressure, high velocity sand and air mixture can be directed in an unobstructed path against the surface which is to be cleaned. The auxiliary air connections provide a self-cleaning feature for the gun in addition to maintaining a high pressure head and an air pocket between the nozzle discharge and the surface which is to be cleaned.

The reaction balancing system completely eliminates any problem of reaction from the nozzle discharge and makes it possible for one diver to operate the gun over extended periods.

While the invention has been described with particular reference to the illustrated embodiment, it will be understood that numerous modifications thereto will appear to those skilled in the art. Also, it will be understood that the above description and the accompanying drawings should be taken as illustrative of the invention and not in a limiting sense.

Having thus described my invention, what I claim and desire to obtain by Letters Patent of the United States is:

1. An underwater sandblasting gun comprising a tubular housing formed with a relatively large discharge opening at one end and closed at the other end, a nozzle mounted centrally within said housing and formed with a relatively small discharge opening recessed from and directed towards the open discharge end of said housing, first conduit means connected to said nozzle for delivering a mixture of sand and compressed air through said nozzle and second conduit means connected to said housing for delivering a flow of compressed air into said housing.

2. An underwater sandblasting gun comprising a tubular housing open at one end and closed at the other end, a first nozzle mounted centrally within said housing and

having its discharge end recessed from and directed towards the open end of said housing, first conduit means connected to said first nozzle for delivering a mixture of sand and compressed air through said nozzle, second conduit means connected to the closed end of said housing for delivering a flow of compressed air only into said housing, a second nozzle fixed to said housing and having its discharge end directed oppositely said first nozzle and third conduit means connected to said second nozzle for delivering a flow of pressurized water through said second nozzle.

3. An underwater sandblasting gun, comprising a tubular housing open at one end and closed at the other end, a first nozzle mounted centrally within said housing and having its discharge end recessed from and directed towards the open end of said housing, first conduit means connected to said first nozzle for delivering a mixture of sand and compressed air through said nozzle, second conduit means connected to the closed end of said housing for delivering a flow of compressed air only into said housing, a second nozzle fixed to said housing and having its discharge end directed oppositely said first nozzle, third conduit means connected to said second nozzle for delivering a flow of pressurized water through said second nozzle and means for controlling the flow of said water.

4. An underwater sandblasting gun comprising a first nozzle having a discharge end, first conduit means connected to said first nozzle for delivering a mixture of sand and compressed air through said first nozzle, a second nozzle fixed to said first nozzle and having its discharge end directed oppositely said first nozzle, and second conduit means connected to said second nozzle for delivering a flow of pressurized water through said second nozzle.

5. An underwater sandblasting gun according to claim 4 including means for controlling the flow of water through said second nozzle.

6. An underwater sandblasting gun according to claim 4 including means defining an annular chamber enclosing said first nozzle and open about the discharge end of said first nozzle and conduit means communicating with said chamber for delivering a flow of air only to said chamber.

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