Sept. 22, 1964 C. E. NOLAN 3,149,445

SURFACE FINISHING AND TREATING METHOD

Original Filed Sept. 25, 1959 2 Sheets-Sheet 1

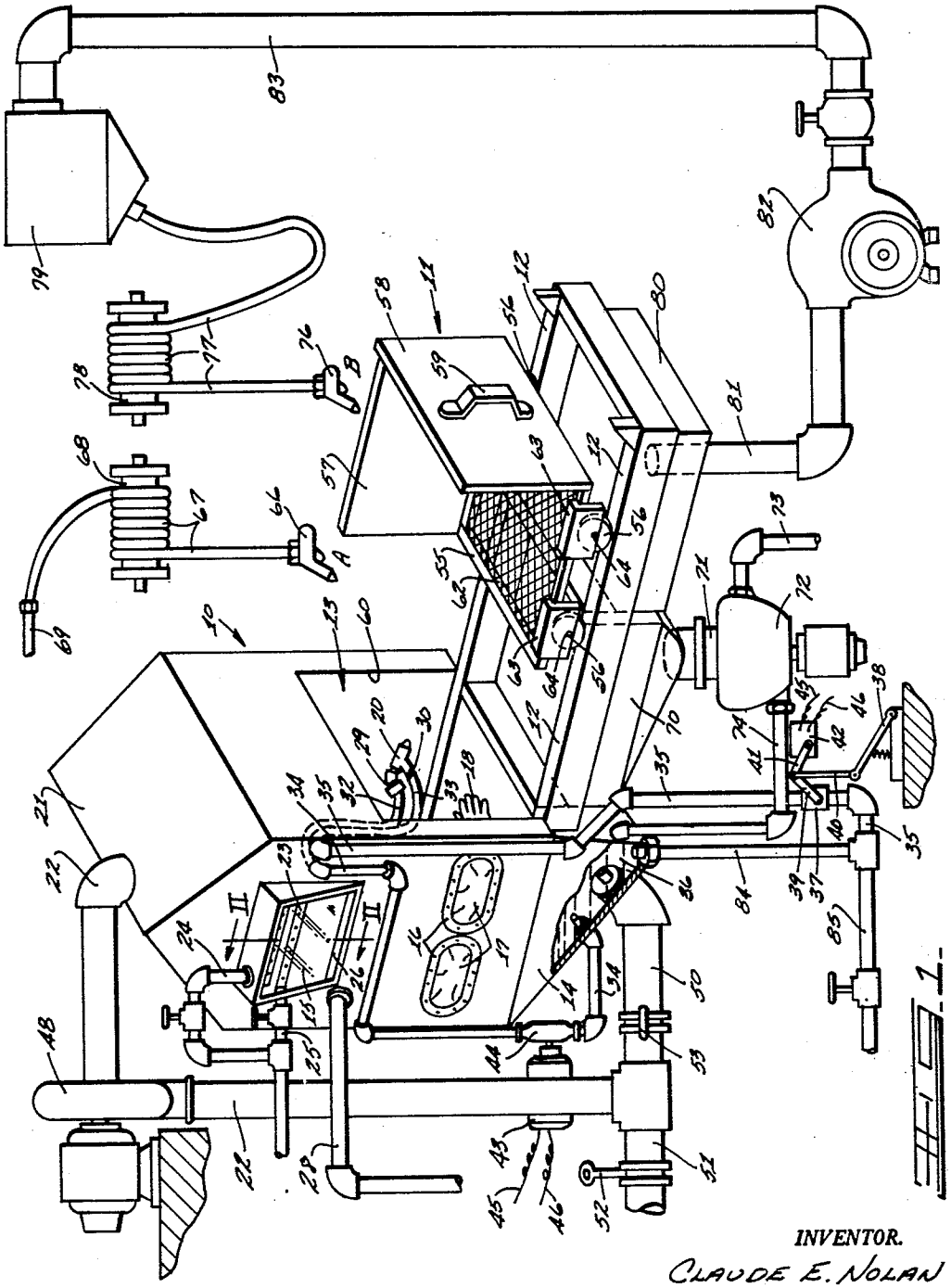


FIG. 1

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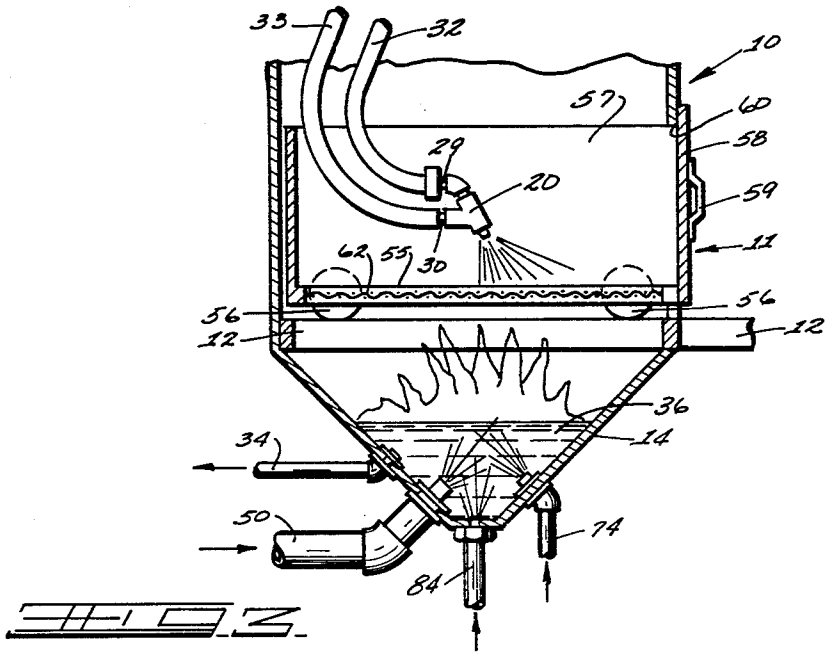


FIG. 3

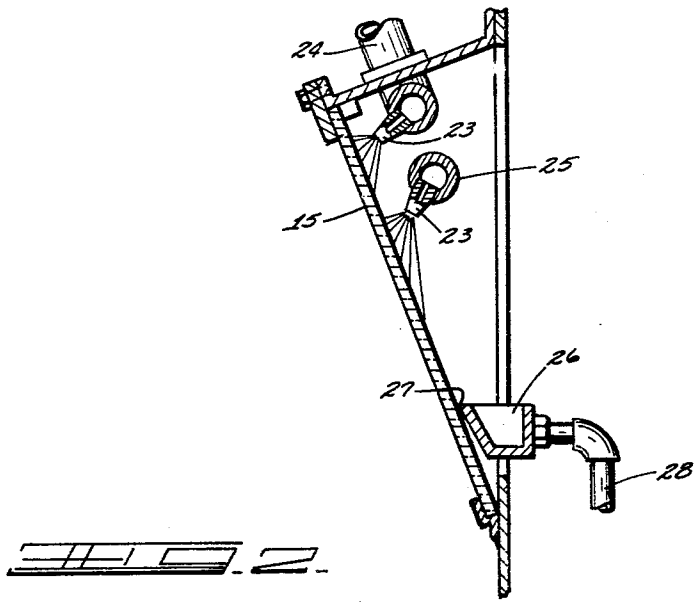


FIG. 2

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SURFACE FINISHING AND TREATING METHOD

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Original application Sept. 25, 1959, Ser. No. 842,264, now Patent No. 3,103,765, dated Sept. 17, 1963. Divided and this application Dec. 7, 1962, Ser. No. 243,067
6 Claims. (Cl. 51—319)

This application is a division of applicant's copending application Serial No. 842,264, filed September 25, 1959, now Patent No. 3,103,765, dated September 17, 1963.

The present invention relates to an improved slurry surface finishing and treating method, and more particularly to an improved method wherein the surface finishing is accomplished by utilizing a powerful stream of fluid borne abrasive material in slurry form.

Among other important objects, it is a principal object of the present invention to provide an improved method employing an abrasive slurry of the aforementioned type for producing a surface finish of extreme smoothness on articles subjected to such slurry.

Another object of this invention is to provide a method capable of accomplishing the surfacing operation and the subsequent cleaning and corrosion inhibiting operations in an economical manner and in such a manner as to substantially reduce the waste and loss of abrasive slurry and treating mediums utilized.

A further object of the present invention is to provide a method for accomplishing such slurry blasting and surface cleaning and treating at one convenient location whereby the entire surface finishing operation can be effected rapidly and with a minimum of movement of the articles being resurfaced and finished.

A still further object of this invention is to provide a method for maintaining the fluid borne abrasive in thoroughly agitated and homogeneously suspended condition with its fluid carrier during the surfacing operation.

A still further objective is to provide an improved method for removing and reusing the residual slurrious abrasive remaining on the slurry-blasted article or workpiece subsequent to the slurry blasting operation.

A still further objective is to provide a method for treating the slurry-blasted surfaces of the workpiece with a corrosion inhibiting medium immediately following the slurry blasting and washing operations and to recapture the medium for reuse.

Another particular object of the present invention is to exhaust the slurry blasting chamber during the slurry blasting operation to remove the vapors and fine air-borne abrasive material from within the chamber and return same to the main slurry supply.

A more specific object of this invention is to provide a method for easy movement of the workpieces into the blasting chamber through an access opening therein and in such manner that such movement will also close the access opening when the workpieces are positioned within the blasting chamber.

Other objects and advantages will become apparent from the following detailed description taken in conjunction with the accompanying drawings upon which a preferred embodiment of the apparatus selected for performing the present invention is illustrated, and wherein:

FIG. 1 is a schematic front perspective view of apparatus embodying the present invention; and including a cabinet enclosure for the slurry blasting operation and adjacent washing and surface treating stations; and

FIG. 2 is a vertical sectional view along the plane II—II in FIG. 1 and taken through the viewing window in the cabinet enclosure; and

FIG. 3 is a fragmentary vertical sectional view of the

bottom portion of the cabinet enclosure with the workpiece carrier in position within the slurry blasting chamber.

Generally, the invention is shown embodied in apparatus commonly referred to as wet blasting or slurry blasting apparatus in cooperative association with washing and surface treating apparatus, the latter effecting a washing and treating of the workpiece after it has been subjected to the blasting operation. Referring particularly to FIG. 1, the blasting operation is carried out within a cabinet enclosure **10**. Thereafter, the workpiece is transferred to a washing station designated as A and which is located adjacent to the cabinet enclosure **10**. Following the washing operation the workpiece is removed to a treating station designated as B and situated adjacent to washing station A. The movement of the workpiece or group of workpieces between the stations A and B and the cabinet enclosure **10** is conveniently accomplished by means of a wheeled dolly **11** which rides on tracks **12** running between stations A and B and into the interior of the cabinet enclosure **10** through an access opening in the side wall thereof adjacent to station A. Hence, the workpiece or group of workpieces may be placed on the bed of the dolly **11** and wheeled thereon into the cabinet enclosure **10** wherein the blasting operation is performed to remove scale, rust, dirt, etc. from the surfaces of the workpiece. Thereafter, the dolly **11** may be withdrawn from the cabinet enclosure **10** and wheeled along tracks **12** to station A where the workpiece is thoroughly washed and rinsed to remove foreign material adhering to the polished surfaces thereof including residual slurry and abrasive material remaining thereon from the wet blast operation. Following a thorough washing, the dolly **11** is wheeled to station B where the washed workpieces are preferably treated with a corrosion inhibiting medium in order to protect the newly polished and exposed surfaces thereof.

A preferred form of construction of the cabinet enclosure **10** is illustrated in FIG. 1, the illustrated enclosure being of a type well-known in the art and comprising a hollow interior blasting chamber **13** emptying into a hopper **14** at the base of the enclosure; a viewing window **15** formed in the front wall of the cabinet enclosure which permits the operator to view the blasting operation; and arm openings **16** formed in the front wall of the enclosure which provide access into flexible waterproof sleeves **17** extending into the blasting chamber and having gloves **18** on the inner extremities thereof which permit the operator of the apparatus to grasp and manipulate the workpieces and the blasting gun **20** which is suspended within the interior of the blasting chamber **13**. The roof **21** of the blasting chamber **13** is provided with an outlet opening around which is connected an exhaust line **22** which withdraws vapors and dust from the interior of the blasting chamber which occur while the blasting operation is in progress.

As best illustrated in FIG. 2, the aforementioned viewing window **15** is preferably inclined downwardly and inwardly and receives a constant spray of wash water on the interior surface thereof to remove dirt and slurry deposits from the window and to better enable the operator to view the blasting operation. The spray of wash water is received on the viewing window **15** from spray nozzles **23** which are positioned at several closely spaced locations across the breadth of the window and disposed toward a window. Valved water lines **24** and **25** are connected to the spray nozzles **23** and pipe the wash water thereto from a suitable water supply line, not illustrated. As the wash water runs down the inclined viewing window **15**, it is trapped in a horizontal trough **26** disposed lengthwise along the lower margin of the viewing window. A receiving lip **27** on the edge of the trough **26**

in contact with the window directs the wash water into the trough. The trough **26** feeds to a drain pipe **28** which in turn disposes of the wash water in a suitably located drain, not illustrated.

The blast gun **20** from which is emitted a pressurized jet of abrasive slurry may be of conventional construction well known in the art and has inlet ports **29** and **30** leading to the barrel of the gun. Ports **29** and **30** are respectively connected with flexible hoses **32** and **33** which deliver compressed air and slurry to the gun **20** to form the liquid blasting jet. Also, the hoses **32** and **33** are connected at their opposite ends to pipes **34** and **35**, respectively. Pipe **34**, which supplies slurry to the gun **20**, passes through the wall of the cabinet enclosure **10** and leads down to and through the wall of the slurry hopper **14** where it emerges into the interior of the hopper at location disposed well beneath the surface level of the slurry **36** contained therein, for example, as shown in FIG. 3. The pipe **35** supplying compressed air to the blast gun **20**, likewise, preferably runs through the wall of the cabinet and the passage of compressed air therethrough is controlled by a suitable foot valve **37** conveniently located near the foot of the operator. Although normally closed, the foot valve is constructed to open when the operator presses his foot down upon the spring loaded foot lever **38** which is operatively connected to a lever arm **39** on the valve **37** (FIG. 1) by linkage **40**. The foot lever **38** is likewise linked to a lever arm **41** on a switch box **42** which provides an on-off electrical switch for the motor **43** operating the slurry sump pump **44** which pumps slurry from the hopper **14** through pipe **34** to blast gun **20**. When the foot lever **38** is depressed the lever arm **41** closes the electrical circuit in the switch box **42**. Thus, electrical wires **45** and **46** leading from the switch box **42** to the motor **43** actuate the later when the foot lever **38** is depressed thereby causing slurry to be pumped to the blast gun **20** concurrently with the admission of compressed air to the gun.

The slurrious abrasive utilized in the blasting operation may be of the conventional types and depends in large measure upon the degree of smoothness desired to be produced on the workpiece. For example, a fine mesh silica of about 300 mesh screen size mixed in a water carrier and having a consistency ranging from an extremely fluid or watery slurry to a fluid mud may be employed with varying degrees of success depending upon the quality and texture of finish desired. Commercially available abrasives such as "Hydrosil Arkansas Abrasive" sold by the Hydrapone Equipment Company or "K5XX240 Aluminum Oxide" sold by the Carborundum Company are suitable in most instances where an extremely fine finish is desired. Obviously, many types of fine abrasives may be employed and the invention herein is not intended to be limited to those types of abrasives disclosed.

The exhaust system which draws vapors through the exhaust line **22** from the cabinet enclosure and thereby ventilates and effectively reduces fog in the cabinet enclosure will now be described in detail. During the blasting operation moisture and moist vapors in large part composed of the fine abrasive material and dust are generated in the blasting chamber **13**. The exhaust system comprises a motor driven centrifugal air displacement pump **48** or other suitable vacuum pump connected in the exhaust line **22**. An exit pipe **50** at the outlet end of the exhaust line **22** discharges the exhausted vapors into the hopper **14** at a location substantially beneath the surface level of the slurry supply **36**. A vent line **51** extending from exit pipe **50** between the pump **48** and hopper **14** to the atmosphere or suitable disposal apparatus, not illustrated, is provided with a damper **52** which together with another similar damper **53** located in the exit pipe **50** near the hopper **14** serves to control the amount of exhausted vapors returned to the slurry **36**. By manual or other adjustment of the dampers **52** and **53** the exhaust vapors may be in part discharged into the slurry **36** and in part vented or may be entirely vented or discharged into the slurry **36**.

The wheeled dolly **11** upon which the workpieces are placed prior to being moved into the cabinet enclosure **10** comprises a horizontal rectangular bed **55** carried upon rotatable wheels **56** disposed at spaced locations along opposite sides of the bed and riding on the tracks **12**; a vertical side splash wall **57**; and a vertical back plate **58**. The back plate **58** is constructed and arranged to form a door for the access opening at **60** in the side of the cabinet enclosure **10** when the dolly is wheeled into the blasting chamber **13** and is provided with a suitable handle **59** for easy manual manipulation of the dolly along the tracks **12**. As shown in FIG. 3, when the dolly is wheeled into the cabinet enclosure **10** the back plate **58** contacts and forms a snug fit with the wall of the cabinet enclosure immediately around the acess opening **60**. Where desired, a gasket or other suitable sealing material may be employed between the mating surfaces of the back plate **58** and wall area around the access opening **60**. The bed **55** of the dolly **11** is preferably of an open-work or lattice structure and may be constructed of wire mesh **62**. Wheel blocks **63** securely mounted on the edge of the bed **55** have rotatable stub shafts **64** journalled therein on bearings which carry the wheels **56**.

After the workpieces or material have been blasted with abrasive emitted slurry from the blast gun **20** until the desired surface finish has been obtained, the dolly **11** with the workpieces thereon is wheeled from the cabinet enclosure **10** along the tracks **12** to station A where the workpieces are thoroughly washed or rinsed to remove residual slurry and such other foreign matter as may remain on the surfaces of the workpieces. The washing operation preferably utilizes tap water or other suitable washing medium which is sprayed from an overhead spray gun **66** or other suitable means for directing a stream or spray onto the workpiece. The spray gun **66** is operatively attached to a flexible hose **67** coiled around a retractable roller **68** and connected to a conduit **69** leading to a supply source (not shown) of wash water or other washing medium. Beneath the tracks **12** and disposed under the spray gun **66** is a catch basin **70** having a drain pipe **71** leading to a separator which is shown as a motor driven centrifuge **72**. The centrifuge **72** empties into a drain line **73** and a slurry return line **74**. The drain line **73** leads to a suitably disposed drain or waste receptacle and the return line **74** feeds to the hopper **14** beneath the surface level of the slurry **36**. The centrifuge **72** functions as a separator and dispels excess wash water which would otherwise dilute the residual slurry washed down from the workpieces. The slurry, on the other hand, drains from the centrifuge and is pumped back to the main slurry supply contained in the hopper **14**.

After the workpieces have been thoroughly washed at station A, the dolly **11** is transferred along tracks **12** to station B where a corrosion inhibiter is applied to the washed and finished surfaces of the workpieces. The corrosion inhibiter, which may be any conventional anti-rust solution or the like is sprayed from an overhead spray gun **76** which receives a suitable corrosion inhibiting medium through a flexible hose **77**. The hose **77** is coiled around a retractable roller **78** suitably mounted overhead and extends therefrom to a storage tank **79** supported at an elevation substantially above the spraying position and storing a supply of the corrosion inhibiting medium. Beneath the spray gun **76** and the track **12** there is a catch basin **80**, similar to the catch basin beneath station A, which traps the excess corrosion inhibiting medium draining from the workpieces and passing through the openings in the dolly bed **55**. Communicating with the catch basin **80** is a valved drain line **81** in which there is a suitable fluid pump, such as

a centrifugal pump **82**, which returns the excess corrosion inhibiting medium through the return line **83** to the overhead storage tank **79**.

During periods of idleness in the use of the slurry blasting apparatus it is quite common for the abrasive constituents of the slurry to precipitate to the bottom of the hopper **14**. Accordingly, a compressed air line **84**, leading into the lowermost portion of the hopper **14** from a valved feed line **85**, affords means for alleviating the sedimentation problem arising from such precipitation. As illustrated, the valved feed line **85** may also be utilized to supply compressed air to the air line **35** leading to the blast gun **20**. Hence, by admitting compressed air into the lowermost portion of the hopper **14** from air line **84** prior to pumping the slurry **36** to operating the blast gun **20**, the sediment collected therein will be violently agitated and resuspended within its water carrier.

From the foregoing it will be readily apparent that the exhaust system avoids loss and waste of the slurry by enabling the exhausted vapors and air borne abrasive particles to be returned to the slurry hopper for reuse. Additionally, the arrangement of the exhaust system is such that the exhausted vapors and abrasive particles are discharged under positive pressure into the slurry **36** through an outlet opening or discharge opening in the hopper **14** at a location well beneath the surface level of the slurry **36**. Consequently, the slurry **36** may be maintained in a well agitated and homogeneously mixed condition during the use of the slurry blasting apparatus.

It will also be apparent that the workpieces may be transferred quickly and conveniently into and out of the blasting chamber **13** by the dolly **11**. Also, the entire slurry blasting or surface finishing, washing and corrosion inhibiting operations may be performed with little effort by a single operator within a very small working area and with only limited movement of workpieces. The dolly, upon which the workpieces are transferred, in addition to increasing the efficiency of the operation and reducing the time expended to completely finish, wash and treat the workpieces is constructed to cooperate with the cabinet enclosure **10** and function to close the access opening **60** in the side of the cabinet enclosure. Thus, the necessity of closing a door to confine the slurry within the blasting chamber **13** during the slurry blasting operation is obviated and the physical movements and operations performed by the operator are reduced. Thus, more time is available for productive efforts on the part of the operator of the apparatus.

Although the present invention has been described in substantial detail in the foregoing description, it is not intended that the invention be limited to such details, or otherwise, than is necessitated by the scope of the appended claims. Having now described the invention in full detail, I claim:

1. In the method of slurry blasting a workpiece to produce a smooth finish thereon and including the steps of blasting the workpiece with a jet of abrasive slurry in an enclosed chamber, trapping the spent jet of slurry in a slurry storage chamber, and withdrawing said slurry from said storage chamber to repeat said blasting step, the improvement comprising the steps of exhausting said enclosed chamber during said blasting step, and discharging the exhaust into the trapped slurry in said storage chamber under sufficient force to substantially agitate said slurry.

2. In the method of slurry blasting a workpiece to produce a smooth finish thereon and including the steps of blasting the workpiece with a jet of abrasive slurry in an enclosed chamber, trapping the spent jet of slurry in a slurry storage chamber, and withdrawing said slurry from said storage chamber to repeat said blasting step, the improvement comprising the steps of exhausting said enclosed chamber during said blasting step, discharging the exhaust into the trapped slurry in said storage chamber under sufficient force to substantially agitate said slurry, and selectively controlling the discharging force of said exhaust into said storage chamber to control the extent of agitation of the slurry therein.

3. In the method of slurry blasting a workpiece to produce a smooth finish thereon and including the steps of blasting the workpiece with a jet of abrasive slurry in an enclosed chamber, trapping the spent jet of slurry in a slurry storage chamber, and withdrawing said slurry from said storage chamber to repeat said blasting step, the improvement comprising the steps of exhausting said enclosed chamber during said blasting step, discharging the exhaust into the trapped slurry in said storage chamber under sufficient force to substantially agitate said slurry, and selectively venting a portion of said exhaust during said exhausting step to control the discharging force of said exhaust into said storage chamber.

4. In the method of surface finishing a workpiece to produce a smooth finish thereon, the steps of blasting the workpiece with a jet of abrasive slurry, trapping the spent jet of slurry in a slurry storage chamber, and withdrawing said slurry from said slurry storage chamber to repeat said blasting step, the improvement comprising the steps of washing the workpiece with a washing medium to remove abrasive slurry adhering thereto, trapping the washings, separating the removed abrasives from said washing medium, and returning the abrasives to said slurry storage chamber.

5. In the method of surface finishing a workpiece to produce a smooth finish thereon, the steps of blasting the workpiece at a slurry blasting station with a jet of abrasive slurry, trapping the spent jet of slurry in a slurry storage chamber, and withdrawing said slurry from said slurry storage chamber to repeat said blasting step, the improvement comprising the steps of transferring the slurry-blasted workpiece to a washing station adjacent to said slurry blasting station, washing the workpiece at said washing station with a washing medium to remove abrasive slurry adhering thereto, trapping the washings, separating the removed abrasives from said washing medium, and returning the abrasives to said slurry storage chamber.

6. In the method of surface finishing a workpiece to produce a smooth finish thereon, the steps of blasting the workpiece at a slurry blasting station with a jet of abrasive slurry, trapping the spent jet of slurry in a slurry storage chamber, and withdrawing said slurry from said slurry storage chamber to repeat said blasting step, the improvement comprising the steps of transferring the slurry-blasted workpiece to a washing station adjacent to said slurry blasting station, washing the workpiece at said washing station with a washing medium to remove abrasive slurry adhering thereto, trapping the washings, separating the removed abrasives from said washing medium, and returning the abrasives to said slurry storage chamber, transferring said workpiece to a corrosion inhibiting station adjacent to said washing station, emitting a corrosion inhibiting medium onto said workpiece, and thereafter trapping said corrosion inhibiting medium and recirculating the same for reuse.

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