Sept. 22, 1953 F. NEWELL 2,652,662

BLAST CLEANING

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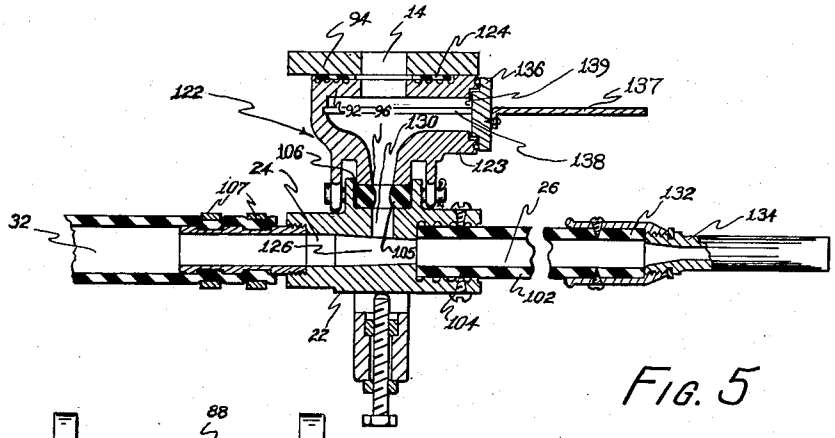


FIG. 5

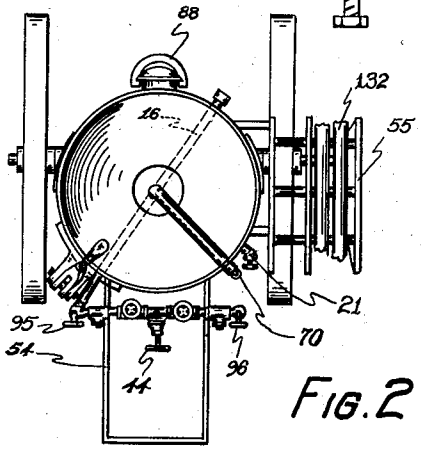


FIG. 2

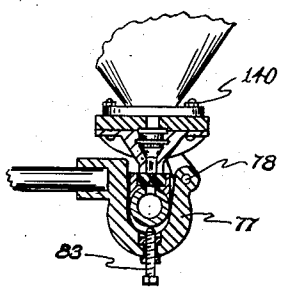


FIG. 3

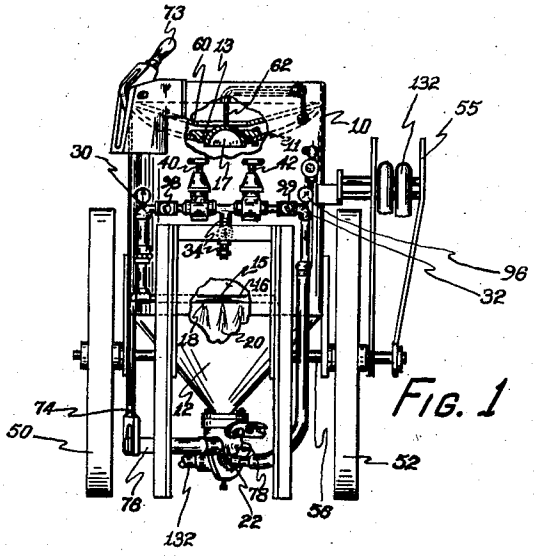


FIG. 1

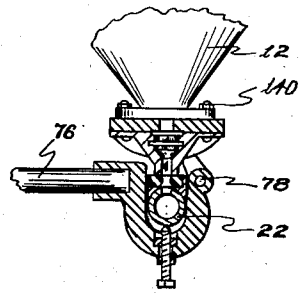


FIG. 4

INVENTOR.
FRANK NEWELL
BY
Arthur G. Connolly
HIS ATTORNEY.

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BLAST CLEANING

Frank Newell, Chicago, Ill., assignor to Pangborn Corporation, Hagerstown, Md., a corporation of Maryland

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3 Claims. (Cl. 51—12)

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This invention relates to the cleaning of materials and more particularly to a pressure blasting machine and method for projecting a stream of soft abrasive particles or grit against a surface to remove superfluous materials such as greases, carbon and dirt therefrom.

Soft grit blasting of fragile electrical and motor parts, etc., as a means of removing heavy, hard coating of grease, carbon, dirt, etc., is of great interest to industry. The widespread trend toward greater industrial plant safety has given impetus to the use of soft grits due to the toxic hazards of previously used solvent type chemicals. Typical soft grits are cellulosic materials such as ground corn cobs, wood particles (saw dust), rice hulls, ground walnut or pecan shells or ground pits of fruits like peach, apricot, etc., and are usually particles of about 10 to 40 mesh or smaller.

The use of prior art blasting equipment to blast these soft grits has not been satisfactory, particularly with the smaller sized particles which are more desirable by reason of the better and more economical cleaning they effect. These particles do not feed themselves properly to the blasting mechanism whether pressure, suction, gravity or combinations of these forces are used to carry them to the mechanism. Instead of moving smoothly the particles have a tendency to bridge or pack (jam) in the passageway they move through. As a result the flow of particles is cut off and, where the feeding force is large enough, the jammed particles suddenly break loose in excessive amounts. This feast-or-famine operation continues in short cycles and necessitates careful attention to assure thorough cleaning.

It is among the objects of this invention to provide an improved blasting machine and method for projecting a stream of soft abrasives without the above difficulties.

Another object of the invention is to provide a machine that will allow a small flow of soft grit at high pressure, or a heavy solid flow of soft grit at low pressure for cleaning heavy grease or light oil films efficiently from various machine surfaces.

Further objects of the invention will become apparent from the description and claims that follow.

This invention will be more readily understood with reference to the appended drawings wherein:

Fig. 1 is a front view of a pressure blasting machine of the present invention, portions of the machine being broken away to show details,

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Fig. 2 is a plan view of the machine shown in Fig. 1,

Figs. 3 and 4 are vertical cross-section views of a mixing chamber portion of the machine of Figs. 1 and 2, the chamber being shown in different operating positions, and

Fig. 5 is a vertical cross-section view at right angles to those of Figs. 3 and 4 of the mixing and projecting portions of the apparatus of Figs. 1 and 2.

The machine of the figures comprises a tank 10 for receiving and storing a quantity of abrasive particles. The bottom portion of the tank 10 is in the form of a hopper 12 having an opening 14 (see Fig. 5) for discharging the abrasive. Agitating means 15, consisting preferably of a conduit 16 having a plurality of downwardly directed holes 18, extends within and across the tank 10 for discharging a plurality of fluid streams 20 into the abrasive holding hopper 12 in order to assure that the abrasive particles are uniformly discharged and do not jam the hopper 12 or the opening 14. This opening is connected through an abrasive control valve mechanism 122 to a mixing chamber 22 where the particles discharged from the hopper are mixed with the propellant fluid, in this case air. Mixing chamber 22 has an opening 24 for receiving a stream of air under pressure for imparting a projecting force upon said abrasive particles discharged from hopper 12, and a discharge opening 26 for directing the impelled stream of abrasive particles and air (see Fig. 5).

The machine shown in Figs. 1 and 2 includes a first conduit 30 for delivering fluid to agitating means 15, a second conduit 32 for delivering fluid to mixing chamber 22, and a third conduit 34 connected to conduits 30, 32 for carrying fluid to the first and second conduits from a common supply of fluid under pressure (not shown). The conduits may be rigid or non-rigid as desired and may consist of ordinary flexible hose or metal pipe or partly of each. Regulating valves 40, 42 and 44, are provided to permit regulation of the fluid flow to agitating means 15, to mixing chamber 22, and from the fluid supply (not shown) respectively. A nozzle 134 is connected by an additional conduit 102, shown as a flexible hose, to the outflow opening 26 of chamber 22. The flexible conduits are attached in place by any suitable arrangement such as the wood screws 104, or the clamps 107. To prevent the carrying back of the blasting particles to the valves 40, 42, a set of check valves 98, 99 are desirably inserted in conduits 30, 32.

The pressure blasting machine of Figs. 1 and

2 is of the portable type supported on wheels 50, 52 mounted on axle 56 suitably secured to the tank 10. Framework 54 also secured to the tank forms a stand to support the machine when it is rolled to the desired position. This or an additional framework 55 can also be used to carry a coiled up length of hose 132 or a source of compressed fluid.

A funnel 60 is provided in the top of tank 10 for guiding the abrasive supply into a loading opening 13 in a concave top portion 11 forming the upper wall of the sealed-in tank storage space. A valve 17 seats in opening 13 for the purpose of opening and closing tank 10 to the flow of abrasive from funnel 60. Handle means 70 is connected as by flexible cable 62 or chain to operate valve 17.

An abrasive control valve lever 73 is also provided at the top of tank 10 and connected through vertically extending rod 74 to arm 76 pivoted at 78 to the upper portion 123 of the abrasive control valve mechanism 122. This portion is hollow and has an upper flange 92 clamped to a plate 94 at the bottom of the hopper, as by bolts 140, and a gasket 124 seals this joint. Member 123 tapers down at its lower end to a small tube 96 seated against a deformable rubber valve ring 105 held in a socket 106 in the upper portion of the mixing chamber 22. An upward movement of arm 76 moves a U-shaped clamp 77 about hinge 78 and compresses the valve ring forcing it from the open position shown in Fig. 4 to the closed position shown in Fig. 3. For regulating the required movement of U clamp 77 a compression adjustment screw 83 is also provided. Modifications of this valve control mechanism can be made as indicated in U. S. patents numbered 2,025,247 granted December 24, 1935, and 2,146,917 granted February 14, 1939.

A clean out plate 136 fastened over an external opening 139 in hollow member 123 is made readily removable and carries a valve slider 137 (partly broken away in Fig. 1) which can be received in grooves 138 of enlarged portion 123 to shut off the supply of abrasive. The mixing chamber 22 can be removed from the tube portion 96, and when this is done it is advisable to first remove the plate 136, and then reverse and replace it so that slider 137 is in cut-off position. To improve the cut-off operation, the grooves 138 can be located against the upper wall of member 136 so that abrasive cannot flow out over the top of slider 137 and through opening 139 when the plate 136 is not fully seated. Such a construction is shown in the above-mentioned U. S. Patent No. 2,146,917. Plate 136 can also be removed to permit convenient inspection and cleaning of this member. An exhaust valve 21 for selectably opening tank 10 to the atmosphere facilitates its cleaning and opening when required. A capped handhole 88 (Fig. 2) at about mid-tank height, enables the insertion of a hand or suitable cleaning or exploring tool into substantially all portions of the tank interior.

Mixing chamber 22 has a converging passageway 126 through which it carries the stream of fluid under pressure and in which is mixed the abrasive particles. This convergence which may be about 5 to 10 degrees assures that there is no blocking offset in the abrasive-carrying bore where the mixing chamber 22 meets the conduit 102.

A feature of the above machine is the maintenance of above-atmospheric pressure in the tank 10 during the blasting. This is provided by the fluid under pressure that is admitted through conduit 30. To assist in controlling the pressures, meters 95, 96 are conveniently connected to the conduits 30, 32.

With a blast hose 132 having a one-inch diameter, a nozzle 134 having a $\frac{5}{16}$ inch diameter, and an air source of at least 60 pounds per square inch, the following operational instructions have been found highly effective.

Setting of air control valves: Before loading abrasive into the tank,

(1) place lever 73 in "closed" position.
(2) Pull handle 70 to "out" position, hold while turning on valve 44. The slightest build up of pressure will hold the filling valve 17 in closed position, at which time the hand may be released from handle 70.
(3) Adjust valve 40 to 60 lbs. per square inch.
(4) Hold the nozzle end of the hose 102 while adjusting valve 42 to 35 lbs. per square inch.
(5) Close valve 44.
(6) Open valve 21 which will exhaust the air from the tank, and permit opening of valve 17. After the pressure in the tank has come down to atmospheric, valve 21 is closed.

This completes preliminary setting of control valves, before abrasive is placed in the tank.

To fill the machine with abrasive:

(7) Check the interior of the tank for any foreign material by removing the bail and cap of handhole 88 and inserting a hand and arm into the tank and probing to determine if there is any refuse at the bottom of the cone. A flash light may also be used to see the interior. Replace all parts carefully.
(8) Handle 70 is pushed in so that the filling valve drops to its lowest position.
(9) Pour about 5 cu. ft. of abrasive into the top of the tank. The abrasive should not contain any coarse particles such as paper, match stems, lint from cloth bags, etc.
(10) The blast hose 102 should be held by the operator for blasting, before the next operation.
(11) Pull handle 70 to close the filling valve, hold until valve 44 is turned "on."
(12) Turn valve 44 "on" which admits air to the tank and hose line. (Valves were set at preliminary setting.)
(13) When tank pressure is up to 60 lbs. per square inch, the control lever 73 may be pulled down to "open" position.

Abrasive should now be flowing from the nozzle.

The gauges will show a differential pressure of approximately 5 lbs. per square inch, while blasting. The gauge on the tank pressure will be 45–50 lbs., and the gauge on the blast line pressure will be approximately 40–45 lbs. For soft abrasives it is necessary that the tank pressure be higher than the blast line pressure.

For pressures other than 60 lbs. per square inch, the differential pressure will be in approximately the same proportion.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope hereof, it is to be understood that this invention is not limited to the specific embodiments hereof, except as defined in the appended claims. Thus, the conduit 16 can be positioned in the hopper 12, and as far down as the lowest portion of the tank.

The height of the conduit is only limited by the ability of the available fluid pressure to effect agitation of the soft grits adjacent the tank bottom, and about two feet is the practical maximum. The directing holes 18 of the conduit need not be pointed straight down, but can be tilted about 80 degrees up in any direction, although the agitation produced with such a construction is not quite as efficient.

What is claimed is:

1. A pressure blast machine for projecting a stream of soft abrasive particles, said machine comprising a tank for receiving and storing a quantity of said particles, the bottom portion of said tank forming a hopper in free communication with the upper portion of the tank for discharging said particles, a mixing chamber secured to said hopper for receiving said discharged particles, said mixing chamber having an opening therein for receiving a stream of fluid, under pressure, for imparting a projecting force upon said discharged particles, and a blasting opening for receiving and directing said particles and said stream of fluid, tank pressurizing structure connected for introducing fluid under pressure into said tank, said structure including agitating means within said tank for discharging at least one stream of fluid, under pressure, into said hopper to agitate said particles, and fluid pressure regulating elements connected to said mixing chamber and controlling the fluid operating pressure under which the projecting fluid is received, and maintaining this pressure below that at which fluid is introduced into said tank to assure that the particles are uniformly discharged and do not jam in the bottom of the hopper, said tank including a first conduit for carrying fluid to said agitating means, a second conduit for carrying fluid to said mixing chamber, a third conduit common to both said first and said second conduit for carrying fluid to each from a common supply of fluid under pressure, the fluid pressure regulating elements are connected at least in said second conduit, and the second conduit also has a check valve to resist the movement of particles from the mixing chamber to the pressure regulating elements under the influence of the high tank pressure.

2. In a method of blasting articles with finely divided soft abrasive particles, the steps of maintaining the particles in a container, injecting into the container a fluid under pressure to agitate the particles, supplying a stream of blastant fluid under a lower super-atmospheric pressure, mixing the agitated particles in the tank with the blastant stream at their respective pressures to cause the particles to be carried along with the stream, and directing said stream at the articles to be blasted.

3. A pressure blast machine for projecting a stream of soft abrasive particles, said machine comprising a tank for receiving and storing a quantity of said particles, the bottom portion of said tank forming a hopper in free communication with the upper portion of the tank and terminating in an outlet through which it moves said particles, a mixing chamber secured to said outlet for receiving said moved particles, said mixing chamber having a supply line opening therein for receiving a stream of fluid, under pressure, to impart a projecting force upon the particles received by the chamber, and a discharge opening for directing said particles and said stream of fluid, tank pressurizing structure connected for introducing fluid under pressure into said tank, said structure including agitating means within said tank for discharging at least one stream of fluid under pressure into said hopper to agitate the particles therein, and a pressure regulating valve connected in said line to hold substantially fixed the projection-imparting pressure and maintain it below the pressure at which fluid is introduced into the tank, to assure that the particles are uniformly discharged and do not jam in the bottom of the hopper.

FRANK NEWELL.

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