

July 7, 1964

H. HISTED
SANDBLAST MACHINE WITH PRECISION SANDFEED, REMOTELY
STARTED AND STOPPED

3,139,705

Filed Dec. 10, 1962

3 Sheets-Sheet 1

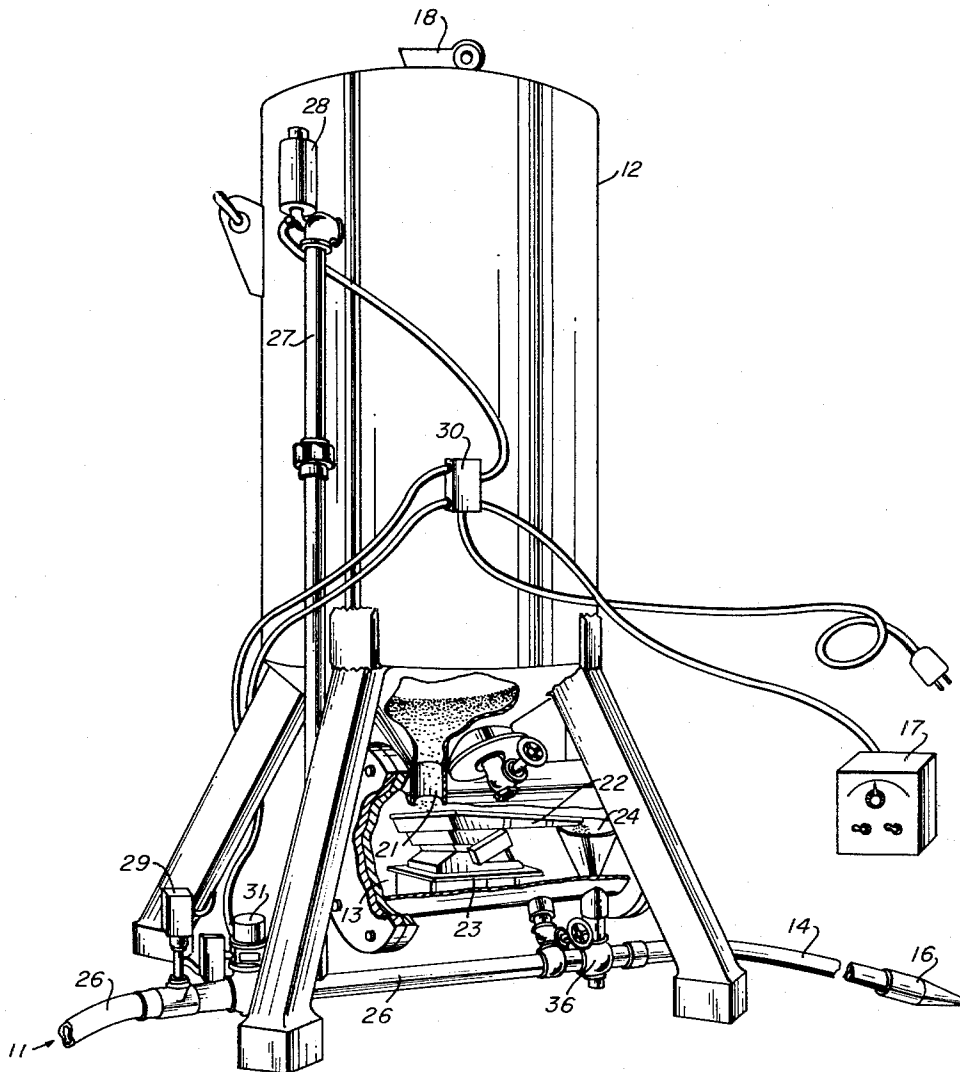


FIG. 1

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3 Sheets-Sheet 2

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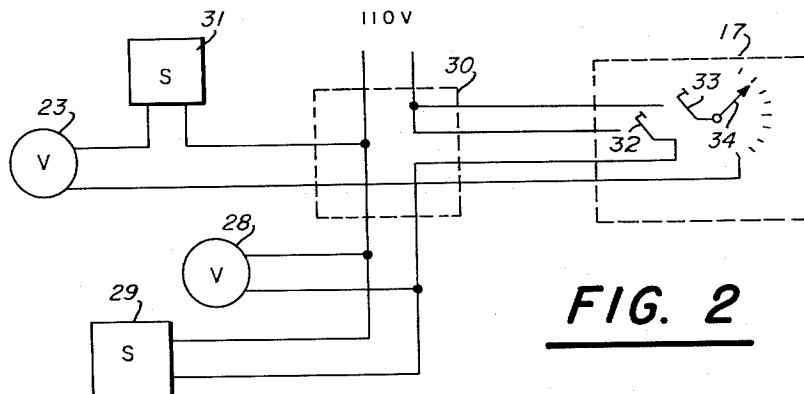


FIG. 2

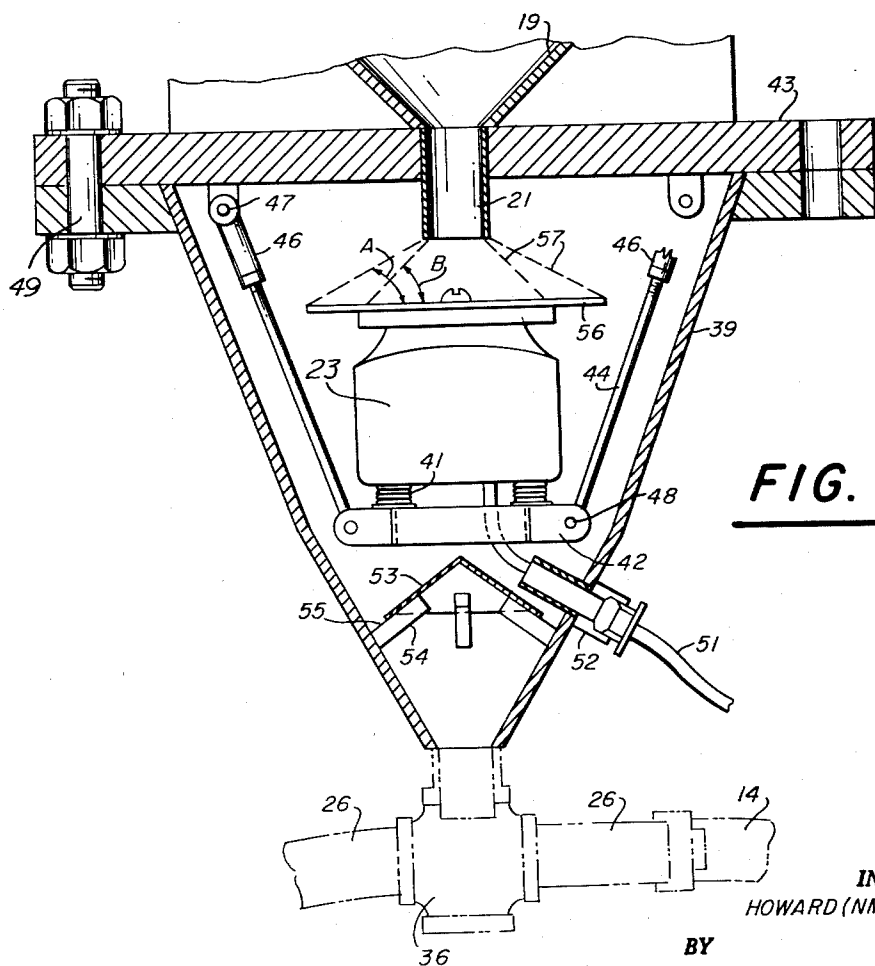


FIG. 5

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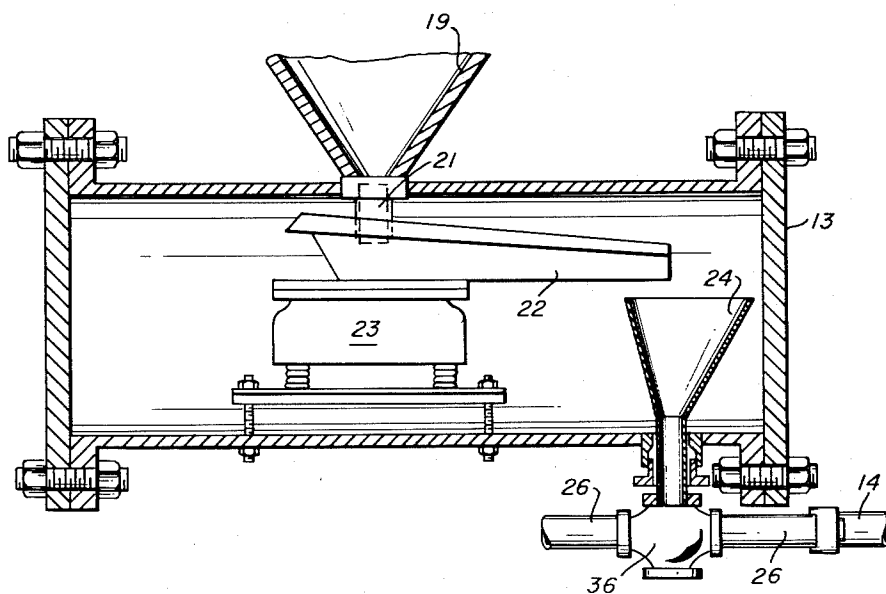
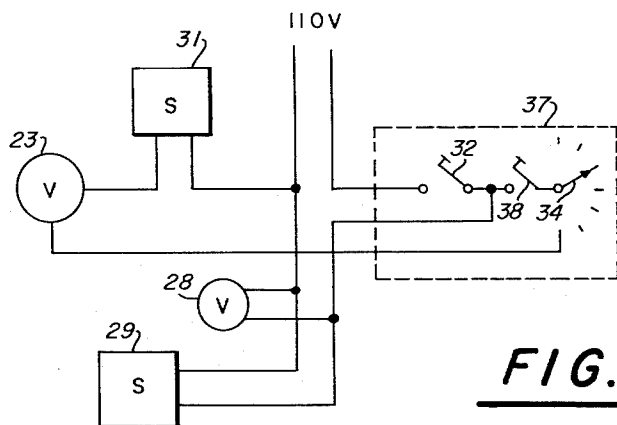
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3 Sheets-Sheet 3



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SANDBLAST MACHINE WITH PRECISION SAND-FEED, REMOTELY STARTED AND STOPPED

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Filed Dec. 10, 1962, Ser. No. 243,690

17 Claims. (Cl. 51—8)

(Granted under Title 35, U.S. Code (1952), sec. 266)

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.

This invention relates to new and useful improvements in the art of sand blasting and particularly as applied to ships in repair yards and dry docks. More specifically it covers improvements in the means and methods of remotely controlling the operation of a sandblasting system by the operator at the nozzle.

In the present apparatus employed for sand blasting the hull or compartments of a ship, the nozzle is connected by feed hose to the machine and controls located at some remote point in the shipyard. The usual procedure for starting and stopping the machine, and varying the rate of sand feed is for the blaster to signal to an operator at the machine the nozzleman's desires. This intelligence is conveyed by phone or some improvised signaling system and the results are generally unsatisfactory depending upon the degree of accuracy and the delay in execution of the signal.

The general object of this invention is to overcome the aforesaid disadvantages and provide novel means for automatically controlling and thus improving the efficiency of any sand blasting system in response to the action of the nozzle operator remotely located from the machine itself.

Another object is to provide operable means at the sandblast nozzle whereby the operator can start or stop the machine directly and independent of assistants or helpers.

Another object is to provide means for adjusting the sand feed rate by shifting the control directly to the sandblaster at the nozzle.

Another object is to provide a novel structure for feeding the sand including a vibrator, means for supporting said vibrator and means for protecting the vibrator against malfunction as a result of blow-back or excess moisture in the sand.

In the improved version of the sandblast machine proposed herein a pair of switches and a variable rheostat at the nozzle are connected by a control circuit to a solenoid air pressure inlet valve for starting or stopping the air flowing, second to energize the vibrator and start the sand supply and third to adjust the rheostat and vary the amplitude of the vibrator and in turn the rate of the sand feed. Foolproof automatic controls have been installed to automatically stop the sand supply in case the compressed air supply shuts off. Means are provided in the sand storage tank for rapidly venting the air pressure therein and bring the system to atmospheric pressure and in balance so the sand in process will not be shifted about unduly after stopping feeds.

Additional objects reside in the combinations of elements, arrangements of parts, and features of construction, all as will be more fully pointed out hereinafter and disclosed in the accompanying drawings, wherein there is shown a preferred embodiment of this inventive concept.

With these and other objects in view, as will hereinafter more fully appear, and which will be more particularly pointed out in the appended claims, reference is now made to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of a sand blasting machine showing the sand feed chamber partially in phantom;

2

FIG. 2 is the control circuit diagram for the sand blasting machine;

FIG. 3 is a modification of the circuit shown in FIG. 2; FIG. 4 is an enlarged view in section showing a sand feed chamber having the vibrating pan type feeder installed therein; and

FIG. 5 is an enlarged view in section of an improved type of sand feed chamber and vibrating plate type feeder installed therein.

In general a sand blasting machine consists of a source of pressure fluid 11 such as compressed air, connected by a feed line or hose 14 to a nozzle 16, and a sand storage tank 12 for supplying sand into said feed line where the rush of compressed air picks up the sand and discharges it out the nozzle against a work piece to be cleaned or blasted.

In the past, the sand blaster at the nozzle determines when the operation is to start or stop by signaling to the machine operator when to turn on the air compressor and sand feed, and also to increase or decrease the rate of sand feed.

In the proposed device the control is direct by the nozzleman, thus providing not only instant response but more accurate results.

The control panel 17 accompanies the blaster wherever he is using the nozzle 16. The control circuit is shown schematically in FIG. 2 wherein a 110 volt power supply is connected through control panel 17 and junction box 30 to a compressed air supply valve 29 and a vibrator or sand feed valve 23. By closing switch 32 of the control panel 17, the solenoid valve 29, which is normally closed, is energized and thereby opened remotely by the blaster at the nozzle. By closing switch 33 the blaster energizes the vibrator circuit and starts the sand feed vibrator 23.

Safety devices have been incorporated to automatically prevent malfunctioning. For example, if the compressed air supply failed and the sand feed continued the system could become clogged with excess sand.

In case the 110 volt power circuit opens or is not energized, the aforesaid air supply valve 29 will remain in its normally closed position. In case the air supply valve 29 remains closed or if the source of compressed air fails, then the safety pressure switch 31 in series with the sand feed vibrator 23 will remain in its normally open position so that vibrator 23 is not energized and sand will not be fed into the blasting line 26 where it would pile up and stop up the line due to the lack of air blast.

In FIG. 3 a modification of the circuit of FIG. 2 is shown. The safety feature of the modified circuit provides that the vibrator line through switch 38 is not closed to the power supply until switch 32 is also closed. In other words the compressed air supply circuit must be closed before the sand feed vibrator circuit can be energized to prevent clogging the blasting line 26 at the mixing point.

The main operating factors in the system are the compressed air and sand supply. The air volume and air pressure are normally fixed by an original setting and remain constant except in cases of malfunction or pressure failure, in which case the sand feed is stopped automatically as described above. Therefore, the sand feeder which measures the rate of sand entering the blasting line 26 and hose 14 must be varied according to the blaster's requirements. Therefore, besides the operator controlling starting and stopping of the air and sand supplies direct, he must also be able to directly control the rate of sand fed to the nozzle.

FIG. 4 is an enlarged view of sand feeder shown in phantom in FIG. 1. The base 19 of the sand storage tank 12 is funnel shaped terminating in a nipple orifice 21 for discharging sand from tank 12 onto pan 22. The

pan 22 is supported on a resilient vibrator 23 within the air tight feed chamber 13. By closing switch 33 (or the combination of 32 and 38 FIG. 3) the vibrator will become energized and cause the sand to move to the right in pan 22 and be dropped by gravity into funnel 24 and continue to fall into the blasting line 26 at point 36.

By FIG. 1 it is evident that the compressed air line 26 is connected to the top of the sand storage tank 12 by riser 27 and the base of the tank 12 is connected through the sand feed chamber 13 to the air line at 36 making the tank 12, chamber 13 and feed lines 26 into an air tight system, wherein the gravity sand flow is not influenced by internal air currents between components. In fact the sand feed mechanism comprising the pan 22 mounted on the vibrator 23 are contained within the pressurized sand feed chamber 13 and therefore are not influenced by the regular flow of blasting air. However, some difficulty was experienced in the chamber 13 during the short period of producing a pressure equilibrium immediately after turning on or off the air pressure. To correct this difficulty an air vent valve 28, normally open and solenoid operated, is located near the top of the sand storage tank 12 for rapidly venting the air pressure therein and bringing the system to atmospheric pressure and in balance so that the sand in process will not be shifted about unduly after stopping the feeds. With the system at atmospheric, turning on the compressed air supply would force air up through connection 36, funnel 24 into chamber 13 by the shortest path until such time as the air pressure in tank 12 and connection 36 are in balance. This reversal of direction would carry sand back with it and occasionally will foul up the vibrator 23 and clog the chamber 13 and require its special cleaning. To overcome this disadvantage, the improved sand feeder combination shown in FIG. 5, was provided.

The sand feed chamber 39 of FIG. 5 with sloping sides fastened to the base plate 43 by bolts 49 is submitted as an improvement over the species of chamber 13 and contents as illustrated in FIG. 4. In detail, a horizontal feeder plate 56 is mounted on the vibrator 23 FIG. 5 centrally located below the circular nipple orifice 21. The base plate 43 fixed to the sand tank base 19 is leveled as a horizontal reference plane, and the vibrator 23 and in turn the feed plate 56 is suspended from base plate 43 by means of platform 42, pins 48 and rods 44 having an adjustable threaded connection 46 fastened to plate 43 by pins 47.

The horizontal position of sand feed plate 56 is adjusted by means of the screw connection 46 on rods 44. At the same time the vertical distance or clearance between the upper surface of sand plate 56 and the opening of orifice 21 is also adjusted by screw connection 46 on rods 44.

Since the angle of repose of the sloping sides 57 of abrasives or sand employed for blasting, runs from 30 to 45 degrees as shown at A and B in FIG. 5, therefore the vertical adjustment described above must be made to provide a 30 or 45 degree angle and still maintain the base of the sand cone within the circumference of the feed plate 56 when stationary, and preferably the edge of the sand cone must be closely adjacent the circumference. In this position when vibrator 23 is energized, the sides of the angle of slope 57 will be reduced and sand will be vibrated over the sides of the plate 56 so that it may fall freely by gravity along the sloping sides of chamber 39, by baffle 53 and into the connection 36 and blasting line 26. By varying the amplitude of the vibrator through adjusting control 34 FIGS. 2 and 3 the rate of sand fed by the vibrator can be varied by the operator at the nozzle.

The purpose of the baffle 53 is to prevent sand from impinging on the vibrator 23 as a result of blow-back through connection 36 when air pressure in the system is not in balance such as at the start of operations. The baffle 53 is conical in shape and mounted on four blocks

54 in spaced relation to the side of the chamber 39, leaving clearance between the base of the baffle 53, chamber wall 39 and the spaced blocks 54 for sand to pass freely by gravity into the lower section and connection 36. Any blow back would normally drive the sand carried thereby against the baffle and away from the vibrator platform 42 whereby there would be no accumulation of sand to interfere with the vibrator operation.

The stuffing box 52 is extended internally beyond the clearance space 55 of the baffle 53 so that the electric cable 51 to vibrator 23 will not be subjected to direct sand impingement as a result of blow back or gravity.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purpose of the disclosure, which do not constitute departures from the spirit and scope of the invention.

What is claimed is:

1. A sand blasting machine employing free flowing granular material comprising the elements designated as (a) to (n) inclusive and defined as follows:

- (a) a supply source of air under pressure,
 - (b) a sand storage tank provided with a lower portion having sloping sides converging into a circular sand feed orifice,
 - (c) a sand feed chamber connected to said orifice so that sand will be fed by gravity from (b) to (c),
 - (d) a sand blast nozzle connected to supply source (a) by a main feed line,
 - (e) an air pressure line connecting the source (a) to the top of tank (b),
 - (f) a sand discharge orifice in the base of chamber (c) connected to said main feed line so that an abrasive mixture can be supplied to nozzle (d),
 - (g) a horizontal feed plate mounted in chamber (c) adjacent the outlet of the sand feed orifice of tank (b) and spaced therefrom so that sand, falling on said plate when motionless, will form into a conical pile,
 - (h) said feed plate (g) being spaced from said sand feed orifice a predetermined distance so that the angle of repose of the sides of said conical pile will form a base within the perimeter of said plate (g) and the height of the conical pile of sand will build up until it blocks the outlet of said circular sand feed orifice,
 - (i) an electric vibrator located in chamber (c) and linked to said plate (g) for keeping it in motion and reducing the angle of repose so that sand will be vibrated over the perimeter and fall by gravity into the discharge
 - (j) a hollow conical baffle located in chamber (c) between the sand discharge orifice (f) and the vibrator (i) so that blowback sand from orifice (f) will not clog or interfere with the vibrator operation,
 - (k) electrical control means at the nozzle (d) for energizing vibrator (i) and regulating its amplitude so that the sand blast operator can directly control the rate of sand feed,
 - (l) electromechanical means controlled at the nozzle for starting or stopping the supply of air from (a),
 - (m) mechanical-electrical means for automatically venting said sand blasting machine in case of electrical power failure, and
 - (n) electromechanical means for automatically shorting said vibrator circuit and sand feed in case of pressure failure.
2. A sand blasting machine comprising,
- (a) a source of fluid pressure,
 - (b) a sand storage tank connected to and maintained under pressure from (a), and provided with a sand feed orifice at its lower end,
 - (c) a sand blasting nozzle connected to (b) for di-

recting sand under fluid pressure to a surface to be blasted,

(d) a rigid sand feed chamber located between (b) and (c) for receiving sand by gravity from (b), and maintained under pressure from (a),

(e) a horizontal feed plate mounted on a vibrating device in chamber (d) adjacent the outlet of said sand feed orifice of tank (b) and spaced therefrom so that sand falling on said plate when motionless will form into a conical pile and block said orifice, (f) and means for energizing said vibrating device controlled at nozzle (c) for operating (e) and starting or stopping the sand feed.

3. A sand blasting machine as set forth in claim 2 wherein;

(g) the energizing means recited in (f) includes a regulator controlled at (c) for varying the amplitude of (e) and the rate of sand feed.

4. A sand blasting machine as set forth in claim 2 wherein;

(h) an air pressure shut-off valve normally closed is located in the connection between (a) and (b), and (i) remote control means located at nozzle (c) for opening (h) by the sand blaster.

5. A sand blasting machine as set forth in claim 4 wherein;

(j) a rapid air venting valve on tank (b) is automatically opened when the energizing means (f) or control means (i) are deenergized.

6. A sand blasting machine as set forth in claim 2 wherein;

(l) a low-pressure control automatically shuts off vibrator (e) so that the sand feed will stop when the fluid pressure (a) drops below normal.

7. A sand blasting machine as set forth in claim 2 wherein;

(m) a gravity feed sand orifice is provided in the base of said tank (b) and chamber (d) is attached to orifice (m) for receiving sand therefrom,

(n) an adjustable supporting bracket for suspending vibrator (e) from the ceiling of chamber (d) directly below orifice (m).

8. A sand blasting machine as set forth in claim 7 wherein;

(o) a horizontal feed plate attached to the top of the vibrator (e) adjacent said orifice and spaced therefrom so that sand falling on said plate when motionless will form into a conical pile so that the angle of repose of the sides of the conical pile will form a base within the perimeter of said plate and the height of the conical pile will build up until it blocks the outlet of orifice (m).

9. A sand blasting machine as set forth in claim 8 wherein feed plate (o) is circular and horizontally concentric with sand orifice (m) and vertically spaced therefrom to form a sand angle of repose on a motionless plate (o) of a minimum of thirty degrees with the horizontal so that sand will rest on the plate (o) within its circumference until vibrator (e) is energized.

10. A sand blasting machine as set forth in claim 7 wherein;

(p) the sides of sand feed chamber (d) converge downward toward an outlet connecting to the nozzle (c) and

(q) a hollow conical baffle located in chamber (d) between said outlet and vibrator (e) and fixed at its base in spaced relationship to said converging sides so that sand will normally fall, by gravity between the baffle and sides toward said outlet but blow back sand from the outlet connection will normally be directed at the baffle and be prevented from reaching the vibrator (e) during pressure differentials of starting and stopping the machine.

11. A sand blasting machine comprising:

(a) a source of fluid pressure,

(b) a sand storage tank connected to (a) and provided with a gravity sand feed orifice in its base,

(c) a sand blasting nozzle connected to (b) for directing sand under fluid pressure to a surface to be blasted,

(d) a rigid sand feed chamber located between (b) and (c) for receiving sand by gravity from (b) and maintained under pressure from (a),

(e) mechanical-electrical means located in said chamber (d) for controlling the sand feed rate through said orifice,

(f) said means (e) for controlling the sand feed rate includes a horizontal feed plate supported adjacent said sand feed orifice and spaced therefrom so that sand falling on said plate when motionless will build up into a conical pile until it blocks the outlet of said orifice, and

(g) means for vibrating said horizontal feed plate (f) so that said conical sand pile will be reduced in height to permit sand to flow through said orifice, over the feed plate (f) and into the nozzle connection (c).

12. A sand blasting machine as set forth in claim 11 wherein;

(h) said sand feed chamber (d) is an inverted cone fastened to the base of the tank (b) and adapted to receive sand therefrom through said sand feed orifice and discharge said sand at its apex into said nozzle connection (c).

13. A sand blasting machine as set forth in claim 12 wherein;

(i) a conical shaped baffle is supported in said chamber (d) opposite the discharge in the apex of said tank so that blow back through said discharge will not foul the sand feed mechanism (e).

14. A sand blasting machine as set forth in claim 11 wherein;

(j) said plate (f) is fixed to said vibrator (g) and suspended by adjustable means from the tank base (b) so that said plate (f) may be maintained in a horizontal position below the feed orifice.

15. A sand blasting machine as set forth in claim 11 wherein;

(k) the mechanical-electrical means (e) for regulating the sand feed rate is controlled by the operator at the nozzle.

16. A sand blasting machine as set forth in claim 15 wherein;

(l) said means (e) for controlling the sand feed rate includes a pressure actuated normally open vibrator switch so that air pressure failure will automatically open said pressure switch and stop said sand feed.

17. A sand blasting machine as set forth in claim 11 wherein;

(m) an electrically actuated rapid venting valve is fixed to the top of said tank (b) so that the sand in process will not be shifted about unduly in case of electrical power failure.

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