May 18, 1954 M. H. JEWETT 2,678,520

ABRASIVE BLAST CABINET AND APPURTENANT APPARATUS

Filed Aug. 5, 1952 2 Sheets-Sheet 1

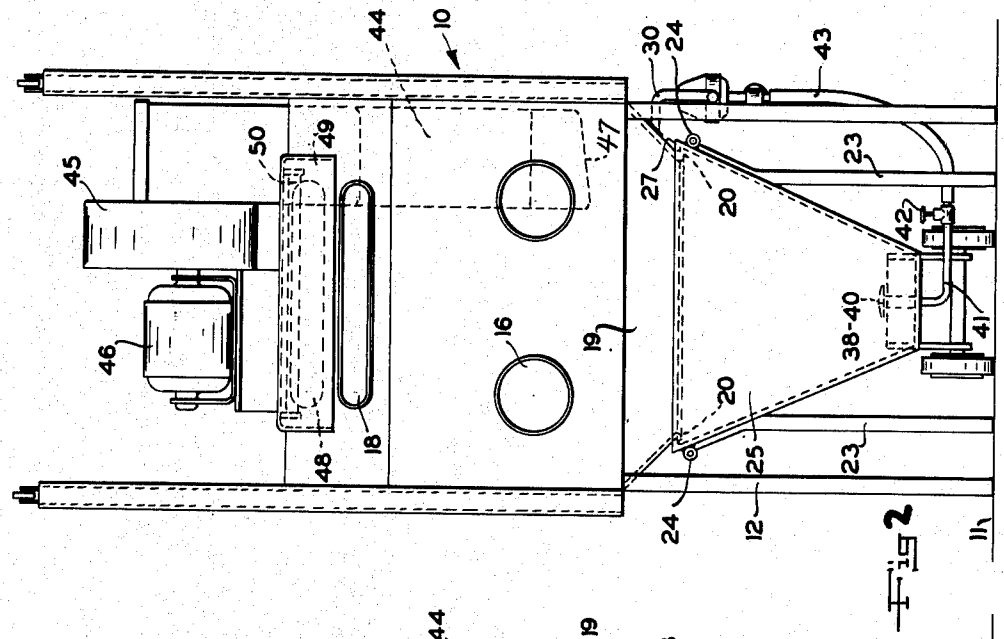


Fig. 2

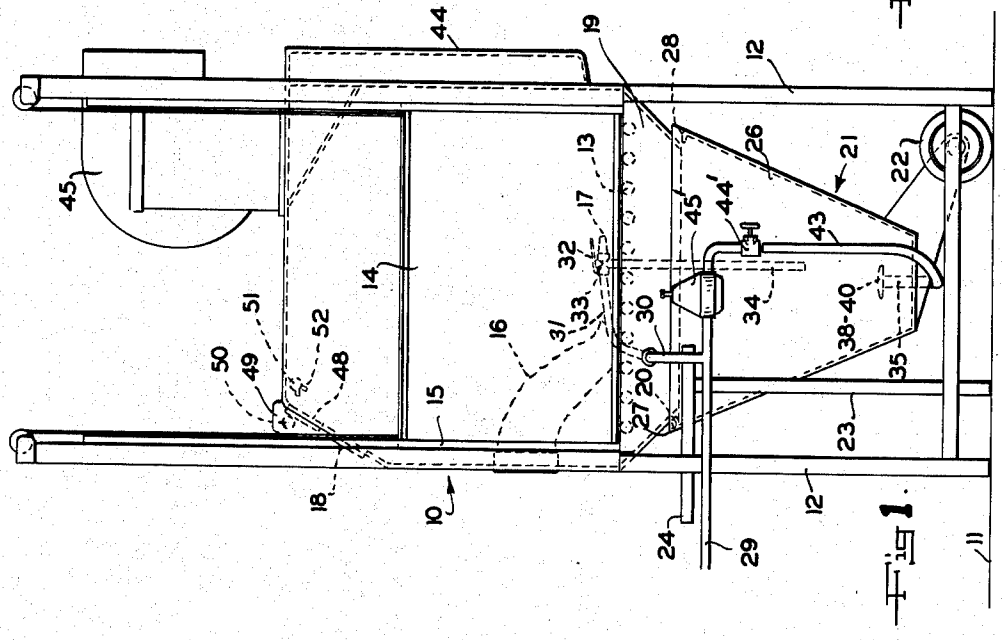


Fig. 1

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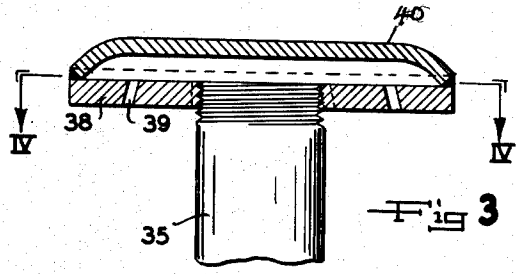


Fig 3

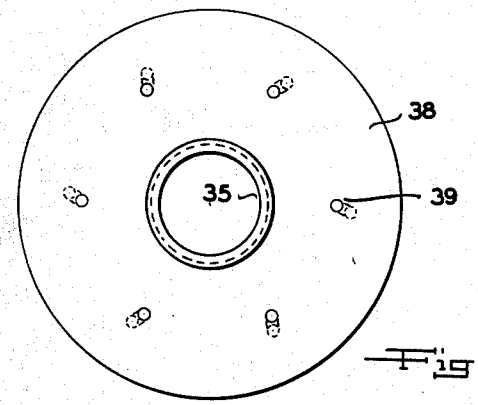


Fig 4

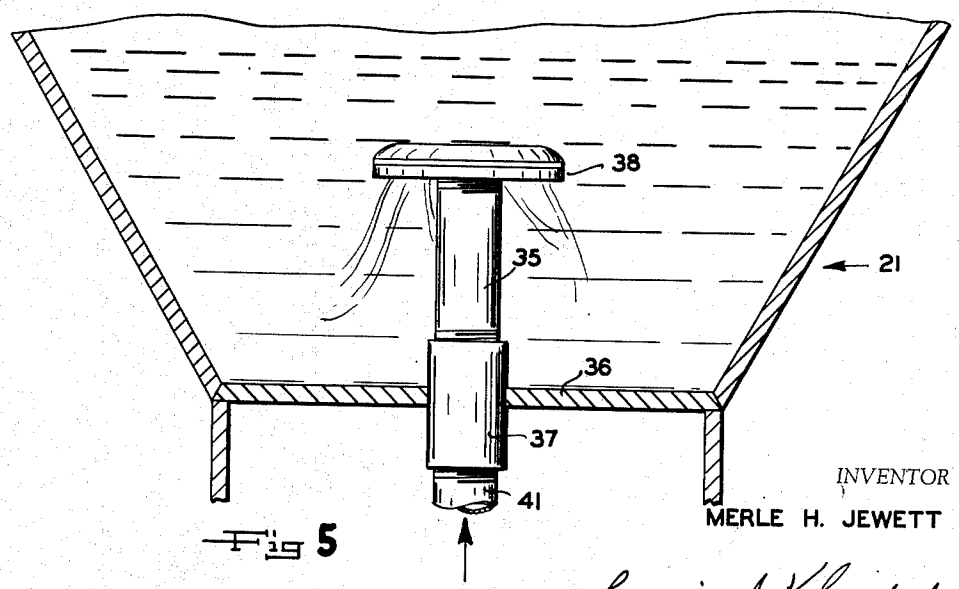


Fig 5

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ABRASIVE BLAST CABINET AND APPURTENANT APPARATUS

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8 Claims. (Cl. 51—8)

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The present invention relates to the art of cleaning articles by means of an abrasive stream or blast, and has particular reference to improvements in the construction and use of apparatus for this purpose. The invention disclosed herein is concerned particularly with abrasive cleaning apparatus of the type utilizing a high pressure liquid stream having abrasive particles suspended therein. But as will be apparent, certain of the concepts of the invention are applicable to sand blasting and like abrasive cleaning processes.

In cleaning by "wet blast" or liquid stream processes it is common practice to provide a blasting cabinet structure having a suitable reservoir or hopper for a bath of liquid which has suspended therein small abrasive particles such as aluminum oxide, for example. Generally the abrasive-laden liquid is drawn from the bath and forcibly impinged upon the surface of an article to be cleaned; the cleaning operation taking place above the reservoir so that the spent stream may flow back into the reservoir for subsequent reuse.

Often it is desirable to change the abrasive solution or bath from time to time so that, for example, a solution containing coarse grit may be exchanged for a solution containing finer abrasive particles; the nature of the solution depending upon such factors as the surface finish desired and/or the time requirements of a job. Heretofore this has been a relatively difficult job, and it has been found to be more economical to merely open the reservoir into a drain whereby the first solution is carried away to ready the reservoir for subsequent filling with another solution. This arrangement is both wasteful and expensive since the valuable grit of the first solution is lost. But to trap and save the solution for subsequent reuse has been found to be still more expensive and therefore the better of the two undesirable courses has been followed.

Accordingly, it is the ultimate object of the present invention to provide a "wet blast" abrasive cleaning cabinet of improved construction whereby abrasive solutions may be quickly and easily substituted, one for the other, and whereby solutions taken from the cabinet may be economically saved for reuse at a subsequent time.

More specifically, it is an object of this invention to provide an abrasive cleaning cabinet of the type described wherein is provided a reservoir or hopper for an abrasive solution which reservoir is bodily removable from the cabinet and exchangeable with other reservoirs containing different abrasive solutions. By the present arrangement a plurality of reservoirs or hoppers may be conveniently positioned in the vicinity of the cleaning cabinet whereby when it becomes desirable to change solutions the reservoir currently in use may be removed from the apparatus and a selected one of the plurality of other reservoirs may be operatively positioned in the cabinet. In this manner a variety of solutions may be kept constantly at hand and the abrasive solution may be quickly changed to suit particular job requirements—all in a most economical and practical manner, and without the loss of valuable abrasive grit.

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In furtherance of the above object the present invention also seeks to provide abrasive cleaning cabinet having removable and replaceable solution reservoirs wherein the reservoirs may be mounted on wheels or skids to facilitate movement thereof, and wherein the reservoirs are so constructed that an operator may merely wheel or skid the same into operative relation with the principal cabinet structure. The present construction also contemplates certain provisions whereby upon wheeling or skidding a reservoir into operative position the same will be so connected to the principal cabinet structure as to substantially prevent leakage of the liquid solution or of a mist of such solution resulting from the impingement of the solution onto the surface of an article being cleaned.

As will be readily understood, abrasive particles of the type presently contemplated are more dense than the water solution in which they are suspended for the wet blast cleaning operation, and for this reason the particles tend to settle to the bottom of the reservoir or hopper unless means are provided for constantly agitating the solution. Such means are usually located at or near the bottom of the reservoir for most effective dispersion of the abrasive particles.

To render the use of a plurality of interchangeable solution reservoirs economical and practical it is an important object of the present invention to provide a simple and inexpensive, yet effective, agitating device to be permanently mounted on and carried by each of the plurality of reservoirs whereby upon a reservoir being positioned in the cleaning cabinet the agitating device may be quickly connected to an operating source and activated to cause the settled grit particles to be thoroughly dispersed throughout the solution. It is important that the agitating device may be inexpensively produced and installed since it is contemplated that several reser-

voirs may be utilized for a single cleaning installation. And it is also important that the agitating device be adapted for rapid connection and disconnection to and from the operating source therefor so that the fundamental concept of the invention, i. e., rapid interchangeability of abrasive solutions, may be effectively carried out.

In accordance with the above stated objects, this invention further seeks to provide a novel and extremely simple device or arrangement for agitating an abrasive cleaning solution which may be activated from a source of compressed air; it being understood that the preferred apparatus for wet blast abrasive cleaning utilizes a source of compressed air for directing a stream of abrasive liquid onto an article to be cleaned. The air supply being thus required for one phase of the cleaning operation is advantageously utilized in accordance with the teachings of the present invention for agitating the abrasive solution.

Other objects and advantages of my invention include certain improvements relating to economy, safety and facility of operation of the cleaning apparatus, and these as well as the objects and advantages specifically set forth above will become apparent upon full consideration of the following detailed specification and accompanying drawing wherein is disclosed a certain preferred embodiment of the invention.

In the drawing:

Figure 1 is a side elevation of a wet blast cleaning cabinet and appurtenant apparatus constructed in accordance with the teachings of my invention;

Figure 2 is a front elevation of the apparatus of Figure 1;

Figure 3 is an enlarged fragmentary section view of a device constructed in accordance with my invention for agitating an abrasive solution to disperse the grit particles therein;

Figure 4 is a section view taken along line IV—IV of Figure 3; and

Figure 5 is a fragmentary section view of a solution reservoir for the apparatus of Figure 1, illustrating the manner in which the agitating device of Figure 3 is arranged and assembled therein.

Referring now to the drawings, and initially to Figures 1 and 2 thereof, the numeral 10 designates a generally rectangular hollow cleaning cabinet which is supported in elevated relation to a floor or base 11 by spaced legs 12. The cabinet 10, in accordance with conventional design for wet blast cleaning apparatus, is enclosed on the sides and top, but is provided with a grate 13 at the bottom whereby an article to be cleaned, not shown, may be supported while openings are provided for the abrasive solution to flow freely from the cabinet interior to a reservoir located below. Also in accordance with usual construction, the cabinet 10 is provided with a removable side panel 14, which in the present illustration is vertically slidable in guides 15, whereby articles to be cleaned may be loaded into and removed from the cabinet.

In the usual manner of operation, the cabinet 10 is loaded and closed, and the cleaning operation is carried out by an operator standing adjacent the front side of the apparatus and having his arms inserted in a pair of rubber sleeves 16 whereby he may manipulate the article and/or a nozzle 17 communicating with the abrasive solution and adapted to eject a controlled stream thereof. The cleaning operation may be viewed from the outside through a window 18 which is positioned appropriately on the front side of the cabinet.

In accordance with the teachings of the invention the cabinet 10 is provided adjacent its bottom and below the grate 13 with a converging funnel-like portion 19 having a rectangular opening at its lower end. The front and side walls of the funnel-like portion 19 are provided with outwardly flaring lips 20 or flanges, and, if desired, the rear wall may be provided with a similar flange, not shown.

Positioned directly below the opening of the funnel portion 19 is a reservoir or hopper 21 which is preferably in the general form of an inverted pyramid having wall panels extending up to or slightly above the lower end of the funnel portion 19. In the preferred form of the invention the hopper 21 is mounted on a pair of wheels 22 and is provided at its forward side with depending legs 23 so that the hopper 21 may normally rest on the wheels 22 and the legs 23. Rigidly secured to and extending forwardly of the hopper 21 is a pair of spaced handles 24 which may be grasped by an operator to raise the supporting legs 23 from the floor or base 11 and permit the hopper 21 to be easily moved about on the wheels 22. The arrangement is not unlike a conventional wheel barrow as will be apparent.

In the preferred embodiment of the invention the front and side wall panels 25 and 26 respectively of the reservoir 21 are provided along their upper edge portions with inwardly turned lips 27 adapted in the assembled apparatus to overlie the outwardly extending flanges 20 of the funnel 19. The rear wall panel of the reservoir is provided with an inwardly turned lip 28 which lies below the funnel portion 19 to provide clearance for moving the reservoir into an operative position as illustrated; the arrangement being such that the reservoir or hopper 21 is wheeled forwardly from an inoperative to an operative position, or from left to right as viewed in Figure 1. The lips 27 and 28 provide for a certain amount of interengagement between the hopper 21 and the funnel portion 19, as will be apparent, and thereby prevent direct splashing of the abrasive solution from the hopper and materially inhibit escape from the hopper of spray and mist formed during a cleaning operation.

To draw the abrasive solution from the reservoir 21 for performing a cleaning operation I provide a more or less conventional arrangement including a conduit 29 mounted on the cabinet structure externally thereof and communicating with a source, not shown, of compressed air. The conduit 29 communicates, through a conduit 30, with a flexible hose or conduit 31 positioned within the blasting cabinet 10. The hose 31 is provided at its free end with a nozzle assembly 17 which includes a control valve and operator 32 therefor and a restricted or Venturi portion 33. Communicating with the nozzle 17 at the Venturi portion 33 thereof is a second flexible conduit 34 which depends downwardly into the solution reservoir 21 below the liquid level thereof. Thus, when the valve 17 is opened, the stream of high velocity air flowing through the venturi 33 draws the abrasive solution from the reservoir 21 into the nozzle wherein it is accelerated to high velocity and caused to forcibly impinge on the surface of an article to be cleaned.

To maintain the solution in the hopper 21 in a

state of constant agitation to thoroughly disperse the heavy abrasive particles throughout the body of the liquid, I have provided a device of the type illustrated in Figures 3–5 which is positioned near the bottom of the hopper and arranged to impart a swirling motion to the liquid solution.

The agitating device illustrated in Figures 3–5 comprises a vertically extending conduit member 35 which is mounted on the lower wall 36 of the hopper 21 by means of a conventional pipe coupling 37. Threadedly engaging the upper end of the conduit member 35 is a disc-like member 38 having a plurality of circumferentially spaced bores 39 therein extending generally axially, but inclined outwardly from top to bottom and also inclined in a clockwise direction from top to bottom. Secured to the upper surface of the disc-like member 38 about the outer edge thereof is a cap 40 having a downwardly extending edge portion whereby to provide a clearance space between the upper surface of the disc 38 and lower surface of the cap 40.

Threadedly engaging the coupling 37 externally of the hopper 21 is an L-shaped conduit member 41 which extends laterally of the hopper and which carries a valve 42 at its outer end in exposed and readily accessible position. Communicating with the valve 42 is a flexible hose or conduit 43 which connects at its upper end with a valve 44', and through the valve 44' and a pressure reducer and regulator 45' with the supply conduit 29 leading to the source of compressed air. In accordance with the teachings of my invention the flexible conduit 43 is readily disconnectible at either its upper or lower end—preferably the latter—and for such purpose I may provide any of various conventional quick-disconnect air conduit fittings, not shown, at one or both ends of the conduit 43.

When a hopper or reservoir 21 is operatively positioned in the cleaning apparatus, with conduit 43 connected as shown, and valves 42 and 43 open, compressed air at reduced pressure will be caused to flow into the reservoir 21 through the bores 39 in the disc-like member 38. As illustrated in Figure 5, the air streams issuing from the bores 39 are directed downwardly but at an angle with respect to the axis of the conduit 35 whereby a swirling motion is imparted to the solution to keep the body thereof in motion and to keep the lower portion of the bath in a constant state of turbulence. This arrangement prevents settling of the abrasive particles and tends to keep them evenly dispersed throughout the solution while the cleaning apparatus is being operated.

It is contemplated that each of a plurality of hoppers 21 will be provided with an agitating device of the type above described whereby by merely connecting and disconnecting the flexible conduit 43 proper agitation may be provided in each of the hoppers in a most practical and economical manner. The valve 42, carried by the hopper 21, is, of course, closed before conduit 43 is disconnected from the hopper. And after this simple operation the hopper may be wheeled out from under the cabinet structure and replaced by another hopper, not shown, having, for example, an abrasive of different quality. The entire operation may be accomplished in an absolute minimum of time as will be readily apparent.

During the course of a normal wet blast cleaning operation the confined area within the

cabinet 10 often becomes saturated with a heavy mist of solution and abrasive particles, making it very difficult for an operator stationed outside the cabinet and viewing the operation through the window 18 to follow the progress of the cleaning to insure a complete and acceptable job. Hence, it has been common practice in the past to provide means for ventilating the cabinet 10 to exhaust the same of the mist-laden air. Heretofore, however, where such ventilating means have been provided, the outlet opening from the cabinet has been conventionally located in the top wall of the cabinet where the upwardly swirling mist currents passed quickly out of the cabinet while still traveling at a relatively high velocity. As a result of this condition large quantities of abrasive dust were also exhausted from the cabinet and lost. By the teachings of the present invention I avoid such unnecessary loss of the abrasive by locating the ventilator opening near a lower corner of the cabinet where the air and mist carried thereby are less turbulent, and further by causing the mist-laden air to pass through one or more tortuous bends before being exhausted.

Thus, in the presently illustrated embodiment of my invention I have provided an exhaust duct 44 having an opening 47 communicating with the lower right-hand rear corner of the cabinet and bending first inwardly toward the center of the cabinet and then upwardly to an exhaust blower 45 powered by an electric motor 46. The opening is located so as to be normally aside of the direct path of the nozzle 17 and to be adjacent normally relatively stagnant air currents so that a substantial portion of the heavy mist and abrasive particles have settled out before the air enters the exhaust duct. Then, as the air enters the duct it is first directed sharply upward, then inward toward the center of the cabinet, and then upward toward the blower 45. At each of these bends in the duct 44 more of the heavy mist and abrasive particles are caused to precipitate out of the air mass and drain back into the cabinet, and ultimately into the reservoir 21. The overall result is a substantial saving in the abrasive dust, which is a desired end of this invention.

A further novel and highly meritorious feature of my apparatus resides in my improvements in viewing facilities for the cleaning cabinet whereby an operator may more efficiently carry out his duties and whereby operation of the cleaning apparatus is rendered less hazardous. As shown in Figures 1 and 2, I have provided in addition to the conventional viewing window 18 a second window 48 located above the window 18 and enclosed exteriorly of the cabinet 10 by a protruding cover 49. Housed within the cover 49, but exteriorly of the cabinet wall, is a conventional lighting fixture 50 which is preferably of the elongated tubular fluorescent type. The lighting fixture 50 is positioned adjacent the window 48 so that the light therefrom is directed into the interior of the cabinet in the manner desired. This arrangement is particularly desirable since the necessary electrical facilities may be located wholly externally of the continually damp cabinet interior and are thus substantially less subject to dangerous short circuits and the like as has been heretofore experienced where lighting has been provided interiorly of the cabinet.

To prevent the windows 18 and 48 from becoming fogged with abrasive-laden mist and other-

wise clouded over to inhibit the operator's view of the cleaning operation I have provided a water conduit 51 communicating with a source of fresh water, not shown, and having a plurality of openings or nozzles 52 directed toward the inner surfaces of the windows 18 and 48 whereby the windows may be periodically rinsed with fresh water to remove the mist and other foreign matter therefrom. The water applied to the windows in this manner is then caused to drain into the reservoir 24 to replace water unavoidably carried out through the exhaust duct 44. Or if desired, suitable means, not shown, may be provided to trap and remove this water if the volume thereof required is greater than that carried out with the exhausted air.

It should thus be apparent that I have fulfilled the objects of the invention hereinbefore set forth. The apparatus disclosed represents a substantial advancement in the art of wet blast abrasive cleaning as tangibly characterized by very material savings in abrasive costs and overall improvement in speed of operation, and as more or less intangibly characterized by ease and safety of operation.

My removable and interchangeable abrasive reservoirs or hoppers provide for maximum flexibility in the use of cleaning apparatus of the type concerned, and thereby provide for substantially improved speed and overall economy of operation.

Combined with the concept of the replaceable abrasive hopper, my novel arrangement for providing agitation of the abrasive solution is highly advantageous in that it becomes economically feasible to provide each of a plurality of portable hoppers with permanently mounted agitating device. This arrangement readily lends itself to the use of quickly connectible and disconnectible attachments between the agitating devices and activating means therefor. The present invention also makes advantageous use of an otherwise required compressed air supply for activating the agitating devices.

Additional economies in the operation of my apparatus are afforded by my arrangement for exhausting mist-laden air from the interior of the cleaning cabinet. The arrangement provides first, that the air is removed from the cabinet at a point where air currents are most inactive, and second, that the air is caused to move tortuously through the exhaust duct; the two named provisions acting to precipitate out and recover a large percentage of the abrasive dust normally carried in the mist and heretofore representing a substantial loss.

While my invention has been described with reference to a single preferred embodiment thereof, it will be understood that the teachings disclosed herein may be more broadly applied by skilled artisans and others familiar with the art. Reference should therefore be had to the appended claims in determining the true scope of the invention.

I claim:

1. In wet blast abrasive cleaning apparatus the combination of a base, a cleaning cabinet having enclosed top and side walls and an open bottom wall, grate means at the bottom of said cabinet arranged to support an object to be cleaned, means supporting said cleaning cabinet in spaced relation to said base, a hopper movable on said base and adapted to be positioned below said grate means in communication with the interior of said cabinet, said hopper being adapted to retain a liquid solution containing abrasive particles, means including a source of compressed air and a nozzle communicating with the interior of said hopper and adapted to draw said solution therefrom for forcible impingement on an article to be cleaned.

2. Apparatus according to claim 1 further characterized by funnel-like means depending from the lower end portion of said cabinet and defining a generally rectangular opening from said cabinet, said funnel-like means having outwardly directed flanges about said opening, said hopper having an upper end opening complementary with said first mentioned opening and having inwardly directed lips arranged when said hopper is positioned beneath said opening to act cooperatively with said flanges to substantially prevent the passage of liquid and mist-laden air between said funnel-like portion and said hopper.

3. Apparatus according to claim 1 further characterized by means carried by said hopper and adapted to be connected to and activated by said source of compressed air for agitating solution retained in said hopper.

4. In wet blast abrasive cleaning apparatus the combination of a base, a cleaning cabinet having enclosed top and side walls and an open bottom wall, means supporting said cabinet in spaced relation to said base, means in said cabinet for supporting an article to be cleaned, a hopper movable on said base and adapted to be positioned beneath said cabinet to form a bottom wall therefor, said hopper being adapted to retain a solution containing abrasive particles, and means carried by said cabinet and communicating with the interior of said hopper when said hopper is positioned beneath said cabinet for drawing solution from said hopper for forcible impingement on an article to be cleaned.

5. In wet blast abrasive cleaning apparatus of the type comprising a cleaning cabinet having an open bottom wall, a hopper movably positioned beneath said cabinet in communication therewith and forming a bottom wall therefor, and means including a source of compressed air for drawing abrasive solution from said hopper during a cleaning operation; the improvement characterized by said hopper having an upper open end adapted when said hopper is positioned beneath said cabinet to closely register with the bottom wall opening of said cabinet, said hopper having downwardly converging side walls and a bottom wall, means carried by said hopper and positioned adjacent said bottom wall for agitating solution carried by said hopper, said means comprising conduit means communicating with said source of compressed air and means to direct streams of air from said source at and about said bottom wall.

6. Apparatus according to claim 5 further characterized by said means for agitating comprising a conduit member carried by the bottom wall of said hopper, a disc-like member carried by said conduit member in spaced relation to said bottom wall, a cap secured to said disc-like member and defining a space between said cap and disc-like member, said conduit member being in communication with said space, said disc-like member having a plurality of spaced bores communicating with said space and directed downwardly therefrom toward said bottom wall, and conduit means for connecting said conduit member to said source of compressed air.

7. Apparatus according to claim 5 further char-

acterized by said means to agitate comprising a conduit member carried by said bottom wall, means at the upper end of said conduit member defining a plurality of bores directed toward said bottom wall, said bores being in communication with said conduit member, means for connecting said conduit member with a source of compressed air, said last mentioned means including a valve carried by said hopper.

8. In a wet blast abrasive cleaning apparatus the combination of a base, a cleaning cabinet having enclosed top and side walls and an open bottom wall, means in said cabinet for supporting an object to be cleaned, means supporting said cleaning cabinet in spaced relation to said base, a hopper movable on said base and adapted to be positioned below said cabinet to enclose said bottom wall, a source of compressed air, conduit means in said cabinet including an outlet nozzle and a venturi adjacent said nozzle, said

conduit means communicating with said source of compressed air, and flexible conduit means communicating with said venturi and depending loosely into said removable hopper whereby upon passage of air through said venturi abrasive solution in said hopper will be drawn through said flexible conduit means and ejected from said nozzle.

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