July 1, 1958 H. HASTRUP ET AL 2,840,955

PORTABLE BLAST CLEANING MACHINE

Filed July 13, 1955 3 Sheets-Sheet 1

FIG. 1

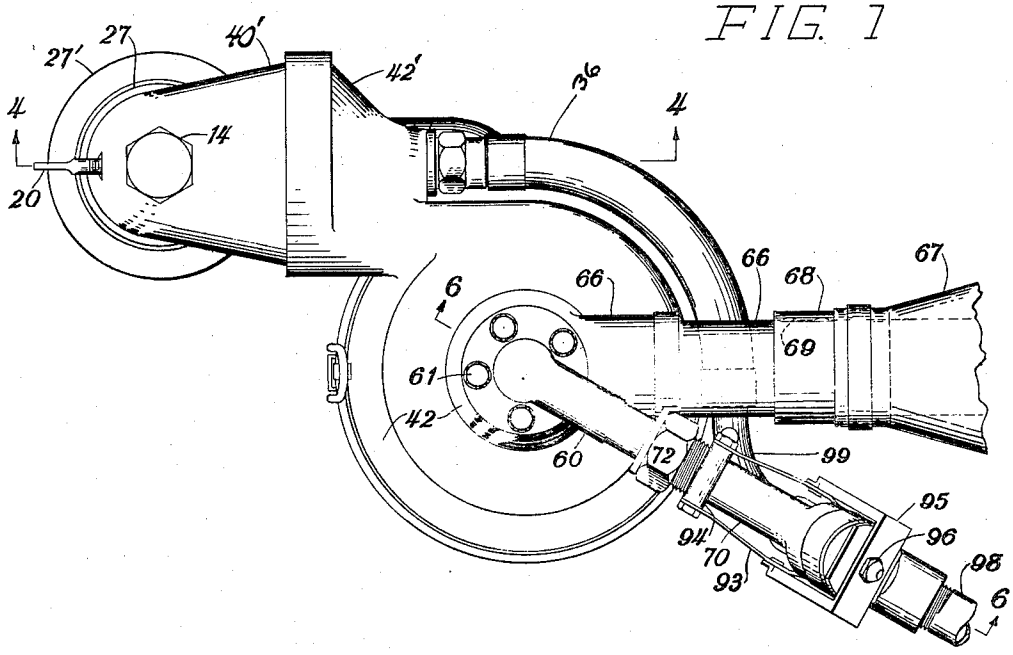
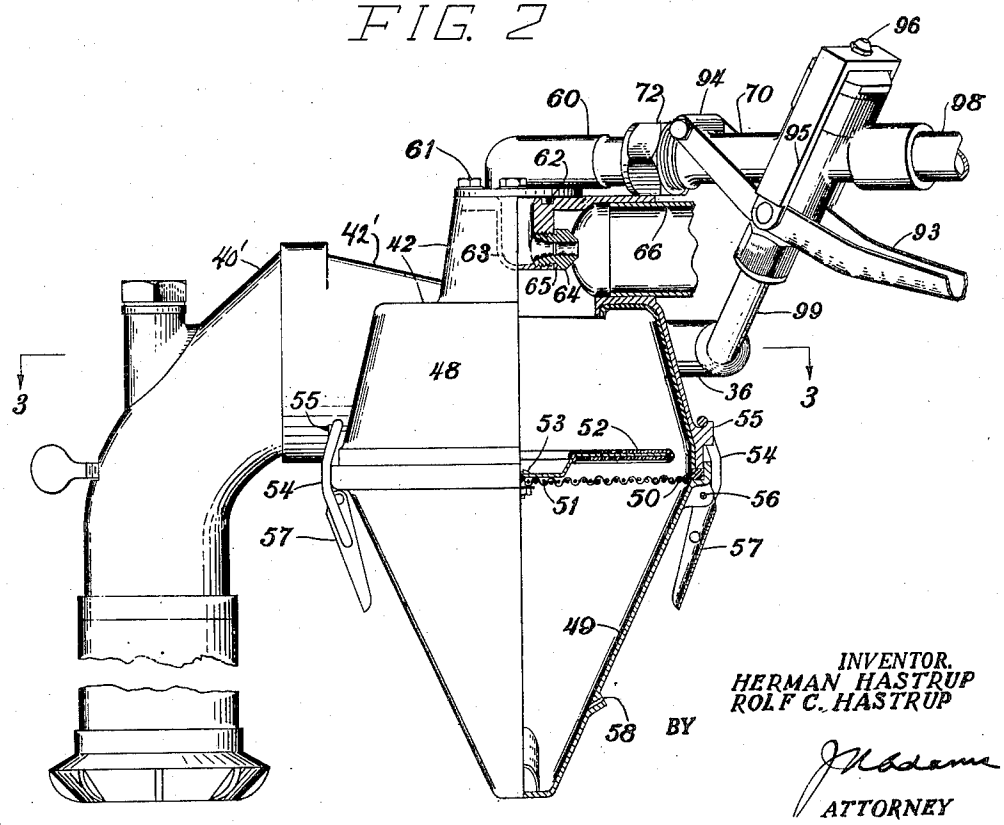


FIG. 2



INVENTOR.
HERMAN HASTRUP
ROLF C. HASTRUP

BY

ATTORNEY

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PORTABLE BLAST CLEANING MACHINE

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FIG. 3

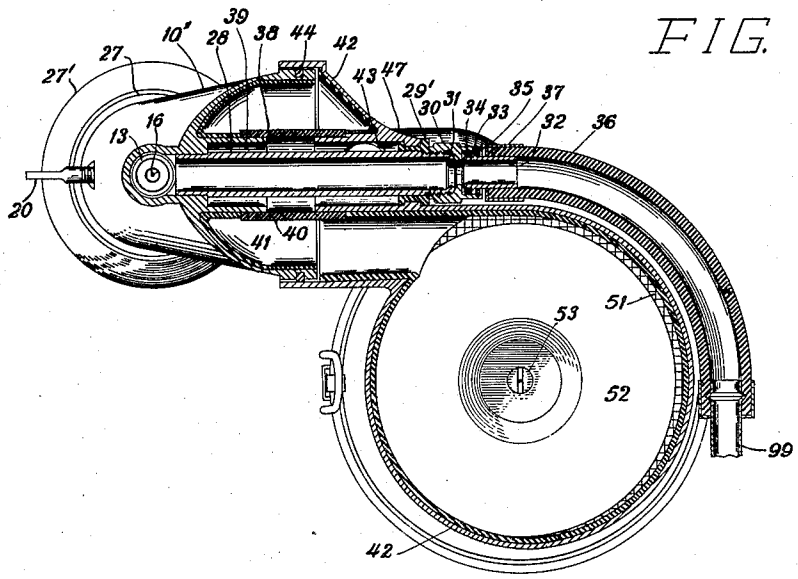


FIG. 4

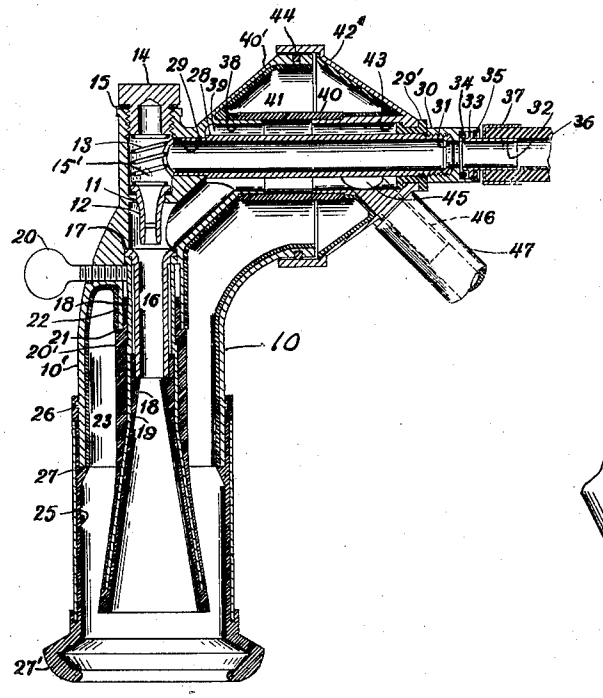
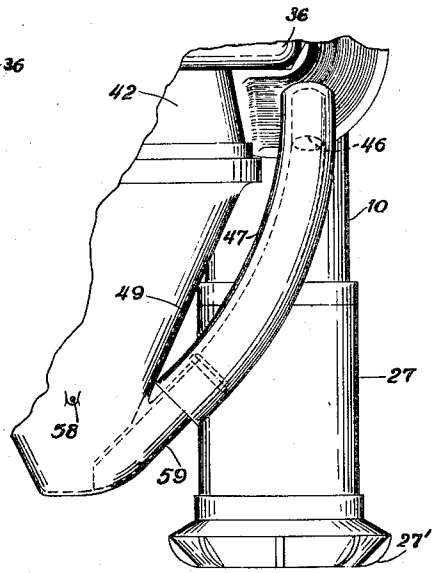


FIG. 5



INVENTOR.
HERMAN HASTRUP
ROLF C. HASTRUP

BY J. H. Adams

ATTORNEY

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PORTABLE BLAST CLEANING MACHINE

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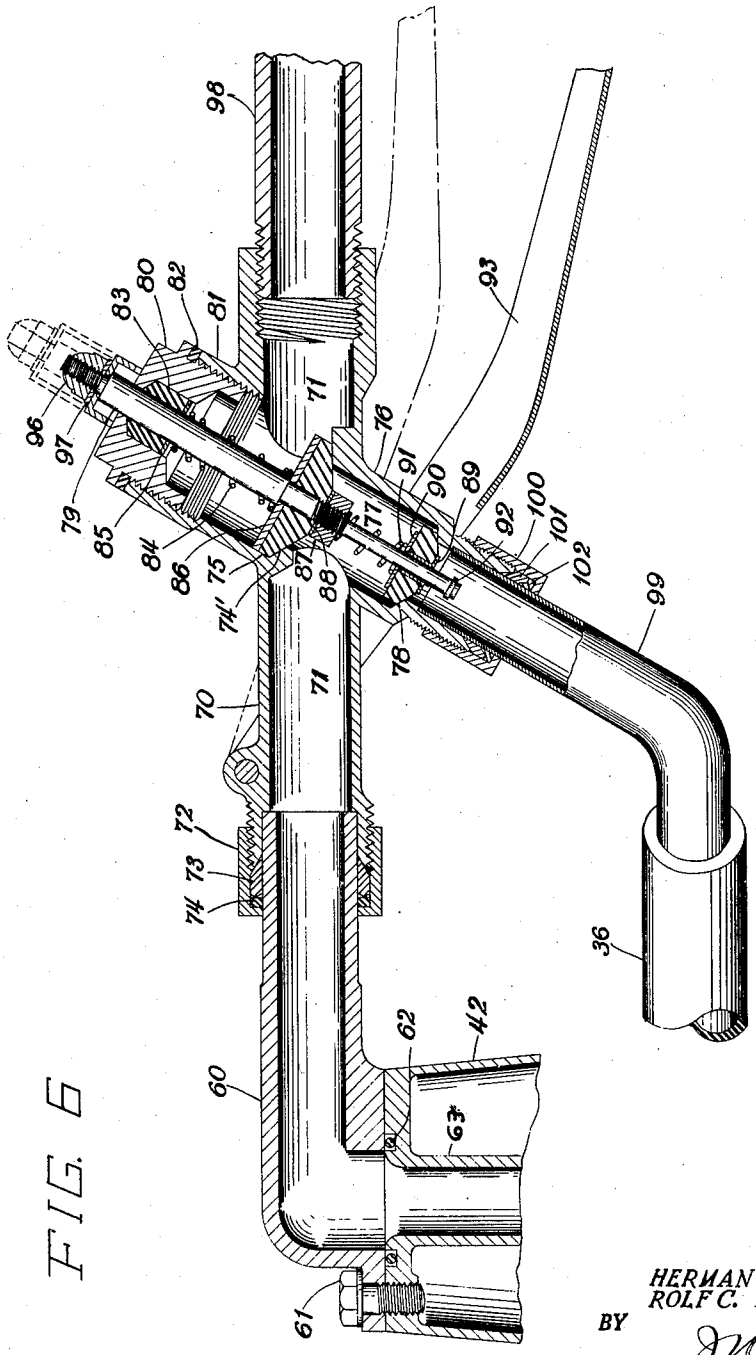


FIG. 6

INVENTOR.
HERMAN HASTRUP
ROLF C. HASTRUP

BY

ATTORNEY

United States Patent Office

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PORTABLE BLAST CLEANING MACHINE

Herman Hastrup, Kaneohe, Oahu, Territory of Hawaii, and Rolf C. Hastrup, Torrance, Calif.

Application July 13, 1955, Serial No. 521,719

20 Claims. (Cl. 51—8)

This invention relates to abrasive blasting machines for removing paint, rust or other coatings from surfaces by applying thereto a blast stream of abrasive particles. More particularly it relates to an abrasive blast cleaning machine of the portable type, and one wherein the spent abrasive and removed debris are kept within the machine so as to give an operation that does not contaminate the surrounding area with dust and debris, and wherein the spent abrasive is separated from debris for continuous reuse. By a portable machine is meant one that is fully complete in itself, all elements thereof being contained therein, including abrasive container and abrasive supply, blast head, nozzles, separator chamber, interconnecting passageways and dust bag, and said complete machine being carried about by a single operator while said machine is in operation as distinguished from machines in which certain component elements necessary for the operation must remain stationary.

In U. S. Patent 2,723,498 issued November 15, 1955, to Hastrup et al., there is described a portable blast cleaning machine which goes far in solving the problems encountered in obtaining a device of this type.

It is an object of this invention to provide a portable blast cleaning machine of the above type in which the constituent parts are not only light and compact but have such connection and continuity with each other that the complete unit may be looked upon as constituting a tool used for blast cleaning rather than a piece of equipment or machinery for that purpose—a complete unit the total weight of which, including the abrasive recirculated therein, is less than eight or nine pounds.

Another object is to provide an improved control for the blast stream in which the abrasive becomes entrained and for the exhaust stream which pulls the spent abrasive and debris away from the surface being cleaned.

Another object is to provide a control which permits the automatic shutting off of the blast stream in advance of the stopping of the said exhaust stream, thereby guaranteeing that the suction which exhausts the debris and spent abrasive from the surface being cleaned continues momentarily after the end of each blast stream period, with the consequent assurance of a surface free from grit and debris when the machine is lifted from the surface being cleaned.

Another object is to provide control means by which the said exhaust stream can be operated at the will of the operator without operation of the blast stream, thereby permitting the operator to load the machine with abrasive by drawing the abrasive into the machine by suction, reducing the loading procedure of the machine to a simple and quick operation without the necessity of opening the abrasive container of the machine.

Another object is to provide an improved swivel joint connection to allow the blast stream to be directed in any direction while the remainder of the machine is kept in the proper operating position.

These and other objects accomplished by our invention

will become obvious from the ensuing description and the appended claims.

The invention is exemplified in the following description and illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a top plan view of our portable blast cleaning machine.

Fig. 2 is a side elevational view of the machine shown in Fig. 1.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1.

Fig. 5 shows in end elevational view a portion of the machine shown in plan and side elevations in Figs. 1 and 2.

Fig. 6 is a sectional view of the valve mechanism.

Referring now to the drawings and more particularly to Fig. 4:

A blast head, generally represented by **10**, having a blast head housing **10'**, the lower part of which is generally cylindrical in shape, is provided with an inner shoulder **11** on which is seated a downwardly extending blast nozzle **12** held in place against said shoulder by spring **13** which presses against screw plug **14**, which screws into the top of the said housing and which by its removal permits removal and replacement of said nozzle. A gasket washer **15** seals the said screw plug in the blast head housing. By the seating of said nozzle **12** on said shoulder **11** the vertical space in which said spring **13** is positioned and which leads into said nozzle **12** is closed off from the interior of said blast head housing except for the channel through said nozzle, said closed-off space constituting a nozzle chamber **15'** for the receipt of blast air as later explained. Eductor sleeve **16** is positioned in axial alignment below the outlet of blast nozzle **12** with its upper end seated against inner shoulder **17** formed in said blast head housing, the lower end of said eductor sleeve being seated in the inner rubber coating **18** of hollow blast cone **19**, the latter member being cylindrical in shape at its upper end and held in place by thumb screw **20** which is threadedly fitted in blast head housing **10'**. This permits the removal of eductor sleeve **16** for replacement if need arises from wear. The outer surface of blast cone **19** is covered with rubber coating **20'** provided with a shoulder **21** which seats against the lower end of sleeve **22** extending downwardly from that part of blast head housing **10'** which surrounds and is spaced apart from blast nozzle **12** and the upper part of eductor sleeve **16**. The said sleeve **22** together with rubber coated blast cone **19**, form with the outer wall of blast head housing **10'** an annular passageway **23**, sometimes referred to hereinafter as the outer channel in said blast head **10**. Similarly the passageway through the eductor sleeve **16** and blast cone **19** is sometimes hereinafter referred to as the inner channel in said blast head **10**. A rubber coating on the inner surface of said housing supplements rubber coating **20'** to provide rubber surface for said annular passageway. Cylindrical rubber member **25**, secured to the lower end of housing **10'** by means of a groove and lip thereon adapted to snap over a mating shoulder **26** on said housing, extends downwardly a short distance beyond the end of blast cone **19** and is formed into a surface contacting boot adapted to contact the surface to be blasted. Said member **25** is preferably reinforced with sleeve **27** made of aluminum or other suitable material and the lower end of said boot is preferably made of abrasion resistant rubber formed into a suitable mouth-piece **27'** adapted to contact the surface to be blasted. The said mouth piece may be modified to contact surfaces of objects of different shapes.

A blast air tube **28** has one end thereof mounted, by

threaded, or press, or other suitable fit, in a horizontal bore 29 in the blast head housing, which said bore communicates with the said nozzle chamber 15'. The outer end of said blast air tube is fitted with rubber bushing 29', later referred to again, and is threaded to receive special nut 30 provided with an inner circumferential shoulder 31 beveled on one side to fit against a corresponding bevel on the end of said blast air tube. Barbed hose insert 32, provided with an outer circumferential shoulder 33, has one end inserted within nut 30. An O-ring 34 positioned between shoulders 31 and 33 provides a seal. A retaining washer 35 fitted around hose insert 32 and against shoulder 33 is held in place by the crimped over end of nut 30. Thus, since the hose insert 32 is restrained only against being pulled axially out of the nut 30, the said nut 30 carried by blast air tube 28 will swivel with respect to hose insert 32, or vice versa. In other words, since the blast air tube 20 is rigidly fitted to the blast head housing 10' at the bore 29 as aforesaid, when said blast head is rotated, as later explained, the said blast air tube 28 will rotate with said blast head and simultaneously will swivel within said nut 30, said nut being held rigid as later explained. Compressed air hose 36 is slipped over barbed hose insert 32 and is held thereon by clamping ferrule 37.

The blast head housing 10' is formed with an inner laterally extending casing or sleeve 38 positioned about and apart from the inner end portion of blast air tube 28, so as to provide an annular passageway 39 about said blast air tube, said passageway 39 being in open communication with the space or chamber surrounding the lower end of blast nozzle 12 leading into the mouth of blast eductor sleeve 16 into which said blast nozzle discharges. An abrasive hose 40, further referred to later, fits, preferably swivelable, over the end of sleeve 38 and thereby lengthens the annular space 39 about blast air tube 28. The blast head housing 10' is further formed into an outer, laterally-extending casing 40' spaced outwardly of and apart from said inner casing or sleeve 38, terminating circumferentially and forming with said inner sleeve 38 and said abrasive hose 40 a second and outer annular space 41 with respect to said blast air pipe 28, said outer space 41 being in communication with the aforesaid annular passageway 23, i. e., the said outer channel in said blast head 10.

Separator housing 42 (see Figs. 1 and 2), enclosing a separator chamber 48 (Fig. 2) is formed with an outer, laterally-extending, circumferentially terminating casing 42' which is adapted to mate with the aforesaid laterally extending casing 40' of the said blast head housing and is rotatably connected therewith and sealed with O-ring 44 (Fig. 4). An inner sleeve casing 43 (Fig. 4) adapted to serve as the complement to the aforesaid inner sleeve casing 38 of blast head housing 10', projects from separator housing 42 forming an annular space with the said laterally extending casing 42', said annular space being in communication with the said separator chamber 48 generally enclosed by said separator housing 42. The end of said inner sleeve casing 43 is swivelably fitted in the aforesaid abrasive hose 40. While the abrasive tube 40 fits snugly over both inner sleeve casing 43 and inner sleeve casing 38, it may be fitted to rotate with respect to either or both of these casings. If desired, the sleeve casings 38 and 43 may be sufficiently long to be directly rotatably connected together at their end portions without the use of connecting abrasive tube 40. The aforesaid mated and rotatably connected casings 40' and 42' are held firmly together by means of a suitable shoulder extending radially outward on the rubber bushing 29' which as hereinabove explained fits over blast air tube 28 and against which the threaded nut 30 fits. It will be observed that annular space 39 "dead ends" against bushing 29'. A side port 45 in sleeve casing 43 and a similar port in alignment therewith in outer casing 42' are each fitted with a single or common hose adapter 46 to which hose 47 is removably attached. This puts annular space 39 in communication with an abrasive container later referred to.

It will thus be seen that there is provided a swivelable joint connection between the separator chamber housing 42 and blast head housing 10' whereby the blast head can be rotated through 360° with respect to the abrasive chamber, and that there are three concentric passageways through this swivel joint connection: an innermost passageway through blast air tube 28 which communicates with the blast nozzle chamber 15', an outermost passageway 41 through which the separator chamber 48 is in communication with the outer passageway 23 (i. e., the aforesaid outer channel) in blast head 10, and an intermediate passageway 39 through which hose 47 is in communication with eductor sleeve 16 and blast cone 19 (i. e., the aforesaid inner channel) in blast head 10.

Abrasive container 49 (Fig. 2) fits against that part of the separator housing 42 which forms the main body of the separator chamber 48, with a gasket 5 providing a seal between them. A screen 51 is positioned between the separator chamber and the abrasive container and is held in place by having its edge secured underneath gasket 50. A circular baffle plate 52 is positioned a short distance above said screen and is secured thereto by screw bolt 53. The said baffle plate is of such diameter as to leave a circumferential space between it and the housing of separator chamber 48. The abrasive container 49 is held in place by snap-over latches 54, similar to suit-case latches, which hook over lugs 55 protruding from housing 42, which turn on pins 56 and are operated by levers 57. A small bleed hole 58, which may be about 1/16 inch in diameter, is provided through the wall of abrasive container 49 near the bottom of the container. Abrasive hose 47 (Fig. 5) which, as aforesaid, connects with the annular passageway 39 in the aforesaid swivel joint connection between separator chamber 48 and blast head 10 fits tightly over a spout 59 leading from near the bottom of abrasive container 49. It will thus be seen that a continuous passageway is provided from abrasive container 49 through hose 47 and annular passageway 39 to the space surrounding the exit path from blast nozzle 12 and thence through the aforesaid inner channel of blast head 10.

As seen from Figs. 1 and 3 the main body of separator chamber 48 enclosed by separator housing 42 is scroll shaped. As seen from Fig. 2 the separator housing 42 is formed into an upwardly extending part which encloses a recess in the upper part of the separator chamber 48, the upper part of this recess being shown in the sectional view of Fig. 6. A tubular flanged elbow 60 (Figs. 1 and 2) is secured by bolts 61 to that part of the housing 42 which forms the said recess and is sealed thereto by O-ring 62 positioned in an appropriate groove in the housing 42. A passageway means 63 (Figs. 6 and 2) extends inwardly from the housing adjoining the area of attachment of said flanged tubular elbow 60, an opening being formed in said housing whereby said tubular elbow is in communication with said means. Suction nozzle 64 is threadedly engaged to the end of said means, a gasket 65 providing a seal. Suction tube 66 is pressed or otherwise secured in an opening through the separator chamber housing in line with said suction nozzle 64 whereby said nozzle discharges into said tube. The tube 66 in turn discharges into a dust bag 67 (partially shown in Fig. 1) secured to a sleeve 68, preferably of rubber, which in turn is suitably secured to tube 66 as by snapping it over beads 69 rolled into tube 66. Any appropriate fastening or clamping means may be used to secure the dust bag whereby tube 66 may discharge thereinto. The dust bag is preferably of a type similar to that used on some vacuum cleaners and may be provided with appropriate means for emptying it. It will thus be seen that leading to the dust bag 67 there is a continuous passageway which leads from the annular passageway 23,

surrounding and beginning at the exit end of blast cone 19, through the outermost annular passageway 41 thence through the scroll-shaped portion of separator chamber 48 to the entrance area of tube 66 surrounding the exit end of exhaust nozzle 64 and thence through tube 66 into dust bag 67.

Next will be described our improved valve mechanism which is another important feature of novelty in the operation of the foregoing apparatus.

A valve body 70 (Figs. 1, 2 and 6) having a longitudinal passageway 71 therethrough, is secured to elbow 60 in any suitable manner, a standard flareless tube type fitting being illustrated comprising union nut 72 in threaded engagement with said valve body and provided with a radially extending shoulder on its outer end which in coaction with the end of said body, said end being desirably beveled, compresses ferrules 73 and 74 to form a seal. If desired, valve body 70 and flanged elbow 60 may be made of one continuous piece, without the necessity for any joint structure therebetween. An annular shoulder 74' extending inwardly from the wall of said valve body in a plane oblique to the longitudinal axis of the valve body is adapted to seat primary valve 75 whereby said passageway 71 can be completely closed. A tubular branch 76 extending from said valve body provides a branch passageway 77 forwardly of and coaxially with said valve seat and valve 75. A secondary valve 78 is adapted to seat upon an annular shoulder formed on the inside of tubular branch 76 to completely close branch passageway 77, said secondary valve 78 being preferably coaxial with primary valve 75. Valve stem 79, fits through bushing 80 which threadedly engages a hollow cylindrical branch 81 formed on valve body 70 in axial alignment with the branch 76, said bushing being sealed by gasket washer 82 and said valve stem being sealed by packing 83 held in place by spring 84 which pushes against washer 85 contacting said packing and against washer 86 which backs up primary valve 75, said spring 84 also tending to push said primary valve against its seat in the valve body. Said primary valve 75 is secured to the said valve stem by nut 87 and washer 88. The secondary valve 78 is secured to a small bushing 89 which slides on the said valve stem. This valve is backed up by washer 90 and is held against its seat by compression spring 91. At the lower end of the said valve stem, and spaced a short distance from the sliding bushing 89, a small snap ring 92 on the valve stem acts as a shoulder adapted to contact said sliding bushing when said valve stem is moved a sufficient distance in an upwardly axial direction. It will thus be seen that in an axial upward movement of the valve stem a distance less than the distance between ring 92 and bushing 89 primary valve 75 will be lifted from its seat while the secondary valve 78 will remain seated, thereby opening up a continuous passageway through the longitudinal portion 71 of the valve body, the passageway through the branch 76' remaining closed; also that upon continuing the upward movement of the valve stem the secondary valve 78 will then in turn be lifted from its seat so that an open passageway is then provided outwardly through passageway 77 from passageway 71. It will also be seen that upon a sufficient downward movement of the valve stem 79 secondary valve 78 will be seated a short interval of time before primary valve 75 is seated, and that thus the passageway 77 is closed a short interval of time prior to the closing of the continuous passageway 71.

The said valve stem 79 is moved upwardly by a valve handle lever 93 which pivots on hinge 94 (Figs. 1 and 2) appropriately positioned and secured to the valve body 60, the valve handle being pivotally connected to yoke 95 which is secured to the upper end of the valve stem 79 by lock nut 96 and washer 97 (Fig. 6). An upward movement of lever 93 transmits an axial upward movement to the valve stem 79 lifting valves 75 and 78 successively in the manner hereinabove explained. The valve stem 79 will be moved downwardly automatically by the action of spring 84 upon the release of valve lever 93 so that the successive closing of valves 75 and 78 as above explained will be automatic.

A pipe nipple 98 screwed into the outer end of valve body 60 and threaded to receive a compressed air hose (not shown) serves to convey compressed air from any convenient source into the passageway 71 of the valve body 70. The said pipe nipple, with the valve handle lever 93 in proximity thereto, also serves as a hand grip for actuating said valve handle lever.

At the outer end of branch 76 of the said valve body, forwardly from the secondary valve 78, a compressed air conduit 99 is connected thereto by a flareless tube nut 100 and ferrules 101 and 102 in a manner similar to the connection of valve body 70 to flanged pipe 60 hereinbefore described. This conduit 99 is connected to the compressed air hose 36 which latter leads around the aforesaid scroll-shaped portion of separator chamber 48 into the aforesaid blast air tube 28.

It will be seen from the foregoing description that with pipe nipple 98 connected to a source of compressed air, when primary valve 75 is first opened, secondary valve 78 then remaining closed, compressed air will flow through the longitudinal passageway 71 of the valve body, thence through flanged elbow 60 and thence through suction nozzle 64 and be discharged into tube 66 leading to dust bag 67. The suction effect created by the eductor action of exhaust nozzle 64 extends back through the scroll shaped portion of separator chamber 48, thence back through the outer annular passageway 41 in the swivel connection of separator chamber 48 to blast head housing 10, and thence back to the aforesaid inner channel in blast head 10. It will also be seen that when the secondary valve 78 opens compressed air will flow from passageway 71 through the branch passageway 76, through conduit 99 and compressed air hose 36 through blast air tube 28 into nozzle chamber 15 and thence through blast nozzle 12, discharging into eductor sleeve 16 and blast cone 19 onto any surface against which the mouth piece 27 of blast head 10 is placed. The suction created by the eductor action of blast nozzle 12 will carry back through the inner annular space 39 surrounding blast air tube 28, thence back through conduit 47 to the bottom of abrasive container 49, whereby abrasive material will be drawn from abrasive container 49 and be caused to entrain with the blast air stream discharged through the eductor sleeve 16 in the blast head. It will also be seen that in any cessation of operation of the blast cleaning machine the blast air supply to blast nozzle 12 is automatically cut off before that to exhaust nozzle 64 so that suction effect to remove spent abrasive and debris from the surface being cleaned automatically continues for a brief period, thus avoiding any spattering of spent abrasive and debris and assuring freedom therefrom on the said surface when the machine is removed. Likewise, upon beginning to clean a given surface the suction effect of exhaust nozzle 64 starts prior to the blast action of nozzle 12. It will be further observed that when the operator has moved the valve handle 93 to a position where valve 75 is open while valve 78 remains closed, the said handle may be held in that position at the will of the operator during which time the suction effect and exhaust operation created by exhaust nozzle 64 is maintained in the absence of any blast from blast nozzle 12. Advantage is taken of this to quickly load the machine with abrasive material by simply placing a desired supply of abrasive material on a surface and bringing the mouthpiece 27' of blast head 10 in contact with said supply while such suction is in operation. Thus the machine can be loaded without the necessity of opening the abrasive container of the machine.

It may be questioned whether by reason of the open communication between separator chamber 48 and abrasive container 49 (through screen 51) and the fact that

exhaust nozzle 64 is positioned "down stream" from the separator chamber, the suction effect of the said exhaust nozzle may work against the suction effect of blast nozzle 12 and thereby adversely affect the flow of abrasive from the abrasive container. The equipment is designed so that the intensity of vacuum provided by the eductor action of the blast nozzle is much greater than the vacuum created by the eductor action of the exhaust nozzle and experiments with our device have shown that there is little or no difference in the effectiveness of the blast over that obtained in machines where the exhaust nozzle is "up-stream" with reference to the separator chamber.

The baffle plate 52 (Fig. 2) positioned as foresaid between the separator chamber and the abrasive container, serves to control and direct the exhaust stream so as to carry the dust and light flaky particles of debris away toward the tube 66 and into the dust bag, large flakes of debris being held on screen 51 to prevent clogging of the machine while the abrasive material passes through the annular space about the periphery of the baffle plate downwardly into abrasive container 49.

By the incorporation of the features explained in the foregoing description, we have obtained a portable blast cleaning machine that is compact, light in weight, easily carried about and operated by a single person. It is operated by gripping one hand on the valve handle lever 93 and pipe nipple 98 which connects the machine with a single source of compressed air and holding the blast head with the other hand. The design affords a well balanced machine that is easy to hold. It is operated with air pressure at from 80 to 120 p. s. i. The free swi velability of the blast head through a complete circle affords easy access to the many variously located surfaces encountered in blast cleaning work. The O-ring used in the swivel joint connection is sufficiently compressed in position to offer the required resistance to turning so that once the blast head is turned to the correct position it will remain in that relative position for as long as desired. During the operation the abrasive that is separated out from the suction stream by centrifugal action falls outside the baffle plate, through the screen into the abrasive container. The baffle plate prevents the abrasive in the container from being drawn out of the container into the exhaust stream.

The lugs on the surface contacting boot act against any tendency for the rubber boot to collapse against the surface when the machine is used with suction only—whenever primary valve 75 is lifted from its seat while secondary valve 78 still remains seated. Such lugs may be provided on the boot by other means than molding out of rubber, such as by using projecting rivet heads or special pins in the boot. The metal parts which are exposed to abrasion may be treated in any desirable manner for abrasion resistance or they may be coated with rubber or other suitable material such as various coatings prepared from plastics or plastic like substances. If desired, certain metal parts may be entirely substituted by molded rubber parts and the like; or molded rubber construction may be used to form into one piece certain parts shown in the illustrated embodiment as comprised of separate pieces. For example in the blast head 10 molded rubber construction may be employed while still preserving the inner and the outer channels therethrough.

While we have illustrated and described our invention in detail, it is understood that various modifications may be made therein by those skilled in the art without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. In a portable abrasive blast cleaning machine to be carried and operated by a single operator for removing debris from a coated surface, said machine including an abrasive container, a blast head having a surface contactor boot adapted to contact an area of surface to be blast cleaned, an inner and an outer casing spaced apart to form an inner channel for the passage of abrasive toward said surface and an outer channel for the passage of spent abrasive and debris from said surface, a blast nozzle adapted to discharge a blast stream of air into said inner channel and against said area, a separator chamber wherein spent abrasive is separated from debris and dust, an exhaust nozzle adapted to create suction in said outer channel of said blast head, passageway connecting means to provide, when said contactor boot is in contact with said surface, a short, endless and always open recirculatory path for abrasive material from said abrasive container to said blast head and against said surface, thence to said separator chamber and back to said container, the combination therewith of a swivel joint means connecting said blast head to said separator chamber to permit rotation of said head with respect to said separator chamber wherein the longitudinal axis of said head may move through 360° in a plane perpendicular to the axis of rotation, said swivel joint means comprising an inner and an outer casing spaced apart and extending laterally from said blast head rotatably connected, respectively, to an inner and an outer casing spaced apart and extending laterally from said separator chamber, the space enclosed between said inner and outer connected casings constituting a passageway communicating between said outer channel of said blast head and the said separator chamber, passageway means, positioned within the space enclosed by said inner connected casings but out of communication with said space, adapted to convey compressed air to said blast nozzle; the remaining portion of said space enclosed by said inner connected casings constituting a passageway through which abrasive material passes enroute from said abrasive container to said blast head.

2. A portable blast cleaning machine in accordance with claim 1 wherein said exhaust nozzle is so positioned that its zone of eduction is in communication with said separator chamber whereby dust separated from spent abrasive in said separator chamber is entrained with the exit air from said exhaust nozzle, and a dust bag adapted to receive the discharge from said exhaust nozzle.

3. A portable blast cleaning machine in accordance with claim 2, wherein said separator chamber presents a scroll-shaped path leading from the space in said swivel joint connecting means between said inner and outer connected casings, but otherwise being circular in cross-section; said abrasive container being downwardly directed from said separator chamber and fitted circumferentially to the lower end thereof; and a circular baffle plate positioned between said separator chamber and said abrasive container having a diameter less than that of said separator chamber to provide a circumferential, ring-like space between said baffle plate and the wall of said separator chamber.

4. In a portable blast cleaning machine in accordance with claim 1, the combination therewith of a valve mechanism to control the air flow from a single source of compressed air supply to both said blast nozzle and said exhaust nozzle, comprising a valve body, a primary passageway therethrough adapted to lead from said single source of compressed air to supply air to said exhaust nozzle, a secondary passageway branching from said primary passageway to supply air to said blast nozzle, a primary valve positioned upstream from said branch passageway, adapted to close said primary passageway, a secondary valve adapted to close said branch passageway, a single and manually operated actuating means associated with both said valves adapted to open said primary valve in advance of said secondary valve, and separate spring actuating means adapted automatically to close said secondary valve in advance of said primary valve upon release of said manually operated actuating means.

5. A portable blast cleaning machine in accordance with claim 4, wherein said exhaust nozzle is so positioned

that its zone of eduction is in communication with said separator chamber whereby dust separated from spent abrasive in said separator chamber is entrained with the exit air from said exhaust nozzle, and a dust bag adapted to receive the discharge from said exhaust nozzle.

6. A portable blast cleaning machine in accordance with claim 4, wherein said separator chamber presents a scroll-shaped path leading from the space in said swivel joint connecting means between said inner and outer connected casings, but otherwise being circular in cross-section; said abrasive container being downwardly directed from said separator chamber and fitted circumferentially to the lower end thereof; and a circular baffle plate positioned between said separator chamber and said abrasive container having a diameter less than that of said separator chamber to provide a circumferential, ring-like space between said baffle plate and the wall of said separator chamber.

7. In a portable abrasive blast cleaning machine to be carried and operated by a single operator for removing debris from a coated surface, said machine including an abrasive container, a blast head having a surface contactor boot adapted to contact an area of surface to be blast cleaned, an inner and an outer casing spaced apart to form an inner channel for the passage of abrasive toward said surface and an outer channel for the passage of spent abrasive and debris from said surface, a blast nozzle adapted to discharge a blast stream of air into said inner channel and against said area, a separator chamber wherein spent abrasive is separated from debris and dust, an exhaust nozzle adapted to create suction in said outer channel of said blast head, passageway connecting means to provide, when said contactor boot is in contact with said surface, a short, endless and always open recirculatory path for abrasive material from said abrasive container to said blast head and against said surface, thence to said separator chamber and back to said container, the improvement consisting of swivel joint connecting means between said blast head and said separator chamber comprising an outer and an inner casing spaced apart and projecting from said blast head laterally with respect to its longitudinal axis and having coaxial circumferential end portions to form an inner and an outer concentric space which spaces communicate respectively with said inner and said outer channels of said blast head; an outer and an inner casing spaced apart and projecting from said separator chamber laterally with respect to the longitudinal axis of said separator chamber, said casings ending circumferentially to constitute complemental mating members, respectively, of said circumferential end portions of said laterally extending casings of said blast head, the outer concentric space formed by said casings of said separator chamber being in communication with the interior of said separator chamber and the inner of said concentric spaces being "dead ended" in the direction of said separator chamber, means by which said complemental mating members are sealably and constrainedly rotatably connected with their respective counterpart circumferential end portions of said externally extending casings of said blast head whereby said two outer and said two inner concentric spaces are formed into one outer and one inner concentric space, a side port in the inner, and a side port in the outer of said two laterally extending casings of said separator chamber, a conduit means having one end sealably fitted in the said side port of said inner casing and passing through and sealably fitted in said side port of said outer casing and the other end of said conduit means communicating with said abrasive container to constitute a passageway from said abrasive container into said inner concentric space, a first axial port positioned axially and inwardly with respect to said inner casing of said separator chamber and extending through its housing structure to the exterior thereof, a second axial port positioned axially and inwardly with respect to said inner circumferentially ended casing of said blast head and extending through the housing structure thereof to the entrance to said blast nozzle, a pipe having one end fitted in said second axial port extending through and fitted in said first axial port, at least one of said fittings being also rotatably fitted, to constitute a part of said swivelable joint connection and to form with said rotatably connected inner casings a third concentric passageway through said swivel joint.

8. In a portable blast cleaning machine in accordance with claim 7, the combination therewith of a valve mechanism to control the air flow from a single source of compressed air supply to both said blast nozzle and said exhaust nozzle, comprising a valve body, a primary passageway therethrough adapted to lead from said single source of compressed air to supply air to said exhaust nozzle, a secondary passageway branching from said primary passageway to supply air to said blast nozzle, a primary valve positioned upstream from said branch passageway adapted to close said primary passageway, a secondary valve adapted to close said branch passageway, a single and manually operated actuating means associated with both said valves adapted to open said primary valve in advance of said secondary valve, and separate spring actuating means adapted automatically to close said secondary valve in advance of said primary valve upon release of said manually operated actuating means.

9. A portable blast cleaning machine in accordance with claim 8, wherein said exhaust nozzle is so positioned that its zone of eduction is in communication with said separator chamber whereby dust separated from spent abrasive in said separator chamber is entrained with the exit air from said exhaust nozzle, and a dust bag adapted to receive the discharge from said exhaust nozzle.

10. In a portable abrasive blast cleaning machine of the type referred to in claim 1, the improvement consisting of a swivel joint connecting means between said blast head and said separator chamber comprising an inner and an outer casing spaced apart and extending laterally from said blast head and adapted to be rotatably connected to an inner and an outer casing spaced apart and extending laterally from said separator chamber, means to rotatably connect said two inner and said two outer casings, respectively, to constitute thereof a swivel joint and to form therein two concentric passageways, the outer of said passageways communicating with said outer channel of said blast head and said separator chamber and the inner of said passageways communicating in one direction with said inner channel of said blast head, a pipe axially and inwardly positioned with respect to said inner connected casings to form with reference thereto a third concentric passageway, a port in the housing structure of said blast head leading to the entrance to said blast nozzle and in which port one end of said pipe is sealably fitted, a port in the housing structure of said separator chamber leading to the exterior of said separator chamber and through which port said pipe extends and is sealably and rotatably fitted therein, a side port in each of said two laterally extending casings of said separator chamber, and a single conduit means which leads from said abrasive container fitted in both said side ports to bring said abrasive container into communication with the intermediate of said three concentric passageways.

11. In a portable blast cleaning machine in accordance with claim 10, the combination therewith of a valve mechanism to control the air flow from a single source of compressed air supply to both said blast nozzle and said exhaust nozzle, comprising a valve body, a primary passageway therethrough adapted to lead from said single source of compressed air to supply air to said exhaust nozzle, a secondary passageway branching from said primary passageway to supply air to said blast nozzle, a primary valve positioned upstream from said branch passageway adapted to close said primary passageway, a secondary valve adapted to close said branch passage-

way, a single and manually operated actuating means associated with both said valves adapted to open said primary valve in advance of said secondary valve, and separate spring actuating means adapted automatically to close said secondary valve in advance of said primary valve upon release of said manually operated actuating means.

12. A portable blast cleaning machine in accordance with claim 11 wherein said exhaust nozzle is so positioned that its zone of eduction is in communication with said separator chamber whereby dust separated from spent abrasive in said separator chamber is entrained with the exit air from said exhaust nozzle, and a dust bag adapted to receive the discharge from said exhaust nozzle.

13. A portable blast cleaning machine in accordance with claim 11 wherein said separator chamber presents a scroll-shaped path leading from the space in said swivel joint connecting means between said inner and outer connected casings, but otherwise being circular in cross-section; said abrasive container being downwardly directed from said separator chamber and fitted circumferentially to the lower end thereof; and a circular baffle plate positioned between said separator chamber and said abrasive container having a diameter less than that of said separator chamber to provide a circumferential, ring-like space between said baffle plate and the wall of said separator chamber.

14. In a portable abrasive blast cleaning machine to be carried and operated by a single operator for removing debris from a coated surface, said machine including an abrasive container, a blast head having a surface contactor boot adapted to contact an area of surface to be blast cleaned, an inner and an outer casing spaced apart to form an inner channel for the passage of abrasive toward said surface and an outer channel for the passage of spent abrasive and debris from said surface, a blast nozzle adapted to discharge a blast stream of air into said inner channel and against said area, a separator chamber wherein spent abrasive is separated from debris and dust, an exhaust nozzle adapted to create suction in said outer channel of said blast head, passageway connecting means to provide, when said contactor boot is in contact with said surface, a short, endless and always open recirculatory path for abrasive material from said abrasive container to said blast head and against said surface, thence to said separator chamber and back to said container, the improvement comprising a swivel joint means connecting said blast head to said separator chamber to permit rotation of said blast head with respect to said separator chamber, and means providing separate passageways through said swivel joint means for the passage of compressed air to said blast nozzle, abrasive material to said inner channel of said blast head, and spent abrasive and debris from said outer channel of said blast head to said separator chamber.

15. In a portable blast cleaning machine in accordance with claim 14, the combination therewith of a valve mechanism to control the air flow from a single source of compressed air supply to both said blast nozzle and said exhaust nozzle, comprising a valve body, a primary passageway therethrough adapted to lead from said single source of compressed air to supply air to said exhaust nozzle, a secondary passageway branching from said primary passageway to supply air to said blast nozzle, a primary valve positioned upstream from said branch passageway adapted to close said primary passageway, a secondary valve adapted to close said branch passageway, a single and manually operated actuating means associated with both said valves adapted to open said primary valve in advance of said secondary valve, and separate spring actuating means adapted automatically to close said secondary valve in advance of said primary valve upon release of said manually operated actuating means.

16. In a portable abrasive blast cleaning machine to be carried and operated by a single operator, said machine including an abrasive container, a blast head having an inner channel for the passage of abrasive toward a surface to be cleaned and an outer channel for the passage of spent abrasive and debris from said surface, a surface contactor boot on said blast head adapted to contact a surface to be blast cleaned, a blast nozzle to discharge a blast stream into and against said surface, a separator chamber wherein spent abrasive is separated from debris and dust, an exhaust nozzle adapted to create suction in said outer channel of said blast head, and passageway connecting means to provide, when said contactor boot is in contact with said surface and the machine is connected with a single source of compressed air, a short, endless and always open recirculatory path for abrasive material from said abrasive container to said blast head and against said surface, thence to said separator chamber and back to said container, the improvement comprising a swivel joint means connecting said blast head to said separator chamber adapted to rotate through 360° and having three concentric passageways therethrough, the outermost of said passageways communicating between said outer channel of said blast head and said separator chamber, the intermediate of said passageways communicating between a conduit which leads from said abrasive container and said inner channel of said blast head, and the innermost of said passageways communicating between a source of compressed air and the entrance to said blast nozzle, said swivel joint means comprising an inner and an outer casing spaced apart, extending laterally from said blast head and terminating circumferentially and concentrically and adapted to mate respectively with an inner and an outer circumferentially concentrically terminating casing projecting laterally from said separator chamber, means for rotatably and sealably connecting said mating casings at their circumferential terminal ends, the outer concentric space thereby formed constituting the outermost of said three concentric passageways, a first axial port through the housing of said separator chamber and a second axial port through the housing of said blast head, both said ports being axially positioned with reference to said mated and connected casings, and communicating with the space enclosed by the said inner mated casings, the said first axial port communicating also with the space outside of said separator chamber and the said second axial port communicating also with the entrance to said blast nozzle in said blast head, a pipe having one end sealably fitted in said second axial port and extending through and fitted in said first axial port, thereby dividing the space enclosed by said inner mated casings into the intermediate and the innermost of said three concentric passageways, said pipe being also rotatably fitted in at least one of said axial ports, means for connecting the end of said pipe extending outwardly through said first axial port with a source of compressed air, whereby compressed air may pass through the innermost of said three concentric passageways to said blast nozzle, a side port in the inner, and a side port in the outer of said two laterally extending casings of said separator chamber, a conduit means having one end sealably fitted in the said side port of said inner casing and passing through and sealably fitted in said side port of said outer casing and the other end of said conduit means communicating with said abrasive container to form a passageway from said abrasive container into said intermediate of said three concentric passageways.

17. In an abrasive blast cleaning machine having a blast head adapted to contact an area of surface to be cleaned, a first channel in said blast head for the passage of abrasive toward said surface and a second channel in said blast head for the passage of spent abrasive and debris from said surface, an abrasive container, a separator chamber wherein spent abrasive is separated from debris

and dust, a blast nozzle to discharge a blast stream of air into said first channel against said surface and adapted to create suction on said abrasive container and to effect entrainment of abrasive from said abrasive container into said blast stream, and an exhaust nozzle adapted to create suction in said second channel and effect entrainment of material from said second channel into its discharging air stream, the improvement comprising a swivel joint means connecting said blast head to said separator chamber to permit rotation of said blast head with respect to said separator chamber, a compressed air conduit axially positioned in said swivel joint means and communicating with said blast nozzle, and means constituting two separate passageways through said joint means positioned concentric to said compressed air conduit, the first for the passage of abrasive material enroute from said abrasive container to said first channel in said blast head and the second for the passage of spent abrasive and debris enroute from said second channel of said blast head to said separator chamber.

18. A portable blast cleaning machine in accordance with claim 17 wherein said exhaust nozzle is so positioned that its zone of entrainment is in communication with said separator chamber to pull suction thereon and separate dust from spent abrasive for entrainment of said dust into the discharging air stream from said suction nozzle, said separator chamber having a scroll-shaped path leading from the said second concentric passageway of said swivel joint means but otherwise being circular in cross-section, said abrasive container being downwardly directed from said separator chamber and fitted circumferentially to the lower end thereof, and a circular baffle plate positioned between said separator chamber and said abrasive container having a diameter less than that of said separator chamber to provide a circular, ring-like space between said baffle plate and the wall of said separator chamber.

19. In an abrasive blast cleaning machine having a blast head provided with a first channel through which a blast air stream carrying abrasive material is directed toward a work surface and a second channel through which a suction air stream draws spent abrasive and debris away from said surface, the combination therewith of a valve mechanism to control the airflow from a single source of compressed air supply to both said blast air channel and said suction air channel, comprising a valve body, a primary passageway therethrough adapted to lead from said single source of compressed air to supply air to one of said air channels, a secondary passageway branching from said primary passageway to supply air to the other of said air channels, a primary valve adapted to close said primary passageway, a secondary valve adapted to close said branch passageway, a first actuating means associated with both said valves adapted to open said primary valve in advance of said secondary valve, and a second actuating means adapted automatically to close said secondary valve in advance of said primary valve upon release of said first actuating means.

20. In an abrasive blast cleaning machine having a blast head adapted to contact an area of surface to be cleaned, a blast nozzle in said blast head to direct a stream of air and abrasive against said area, a first passageway into said blast head to convey compressed air thereinto for said blast nozzle, a second passageway into said blast head to convey thereinto abrasive for the abrasive component of said stream of air and abrasive, a separator chamber wherein spent abrasive is separated from debris and dust, and a third passageway, leading from said blast head, to convey spent abrasive and debris from said area to said separator chamber, the improvement comprising a swivel joint means connecting said blast head to said separator chamber to permit rotation of said blast head with respect to said separator chamber, and means providing separate passageways through said swivel joint means for the passage of compressed air to said first passageway, abrasive material to said second passageway, and spent abrasive and debris from said third passageway.

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