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Goto et al.

[11] **3,906,673**

[45] **Sept. 23, 1975**

[54] **ABRASIVE CLEANING MACHINE**

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[52] **U.S. Cl.** ..... **51/9 M;** 51/12
[51] **Int. Cl.²** **B24C 3/06;** B24C 7/00
[58] **Field of Search** ..... 51/9, 8 R, 12, 9 M; 114/222, 224

[56] **References Cited**

UNITED STATES PATENTS

3,262,228	7/1966	Schenck	51/9
3,380,196	4/1968	Mabille	51/9
3,566,543	3/1971	Fogle	51/9
3,691,689	9/1972	Goff	51/9

Primary Examiner—Donald G. Kelly
Attorney, Agent, or Firm—Farley, Forster and Farley

[57] **ABSTRACT**

A portable abrasive cleaning machine has a hood covering a surface area to be cleaned, means such as motor driven impeller for discharging an abrasive agent against the surface, the abrasive agent being fed to the impeller from a container on the machine and being returned to the container together with any foreign particles cleaned from the surface through a tube communicating with the hood. Air currents obtained from a pressurized air source to which the machine is connected are employed to power the motor, to feed abrasive agent to the impeller, to convey the abrasive agent and particles back to the container and to separate the abrasive agent from the particles which are discharged into a bag filter. An embodiment of the machine for cleaning an area at the intersection of perpendicular surfaces is provided with wheels engageable with both surfaces and adjustable to obtain proper contact between the surfaces and the hood of the machine.

15 Claims, 8 Drawing Figures

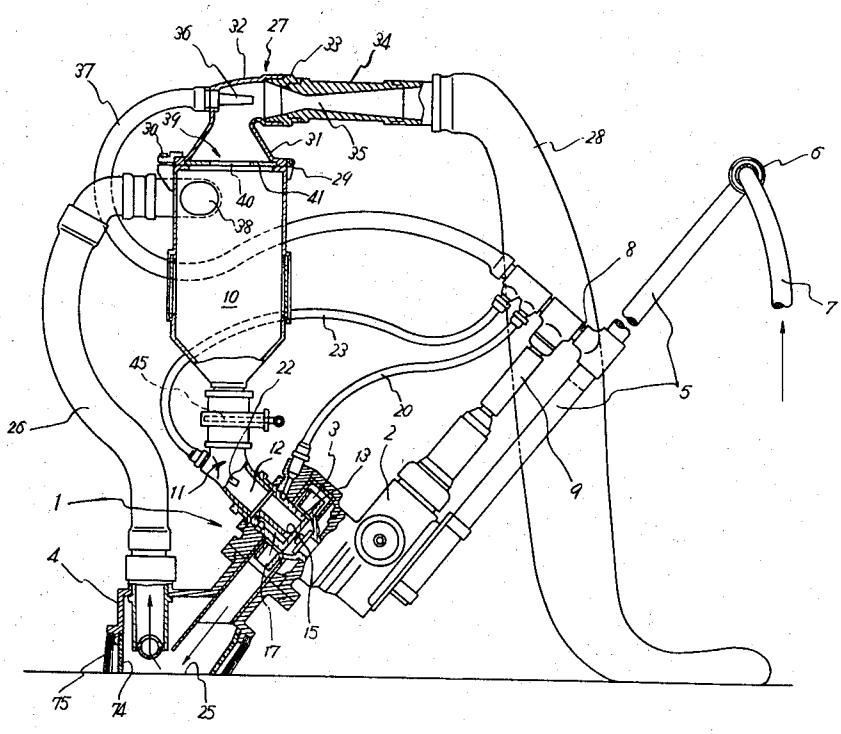


FIG. 1

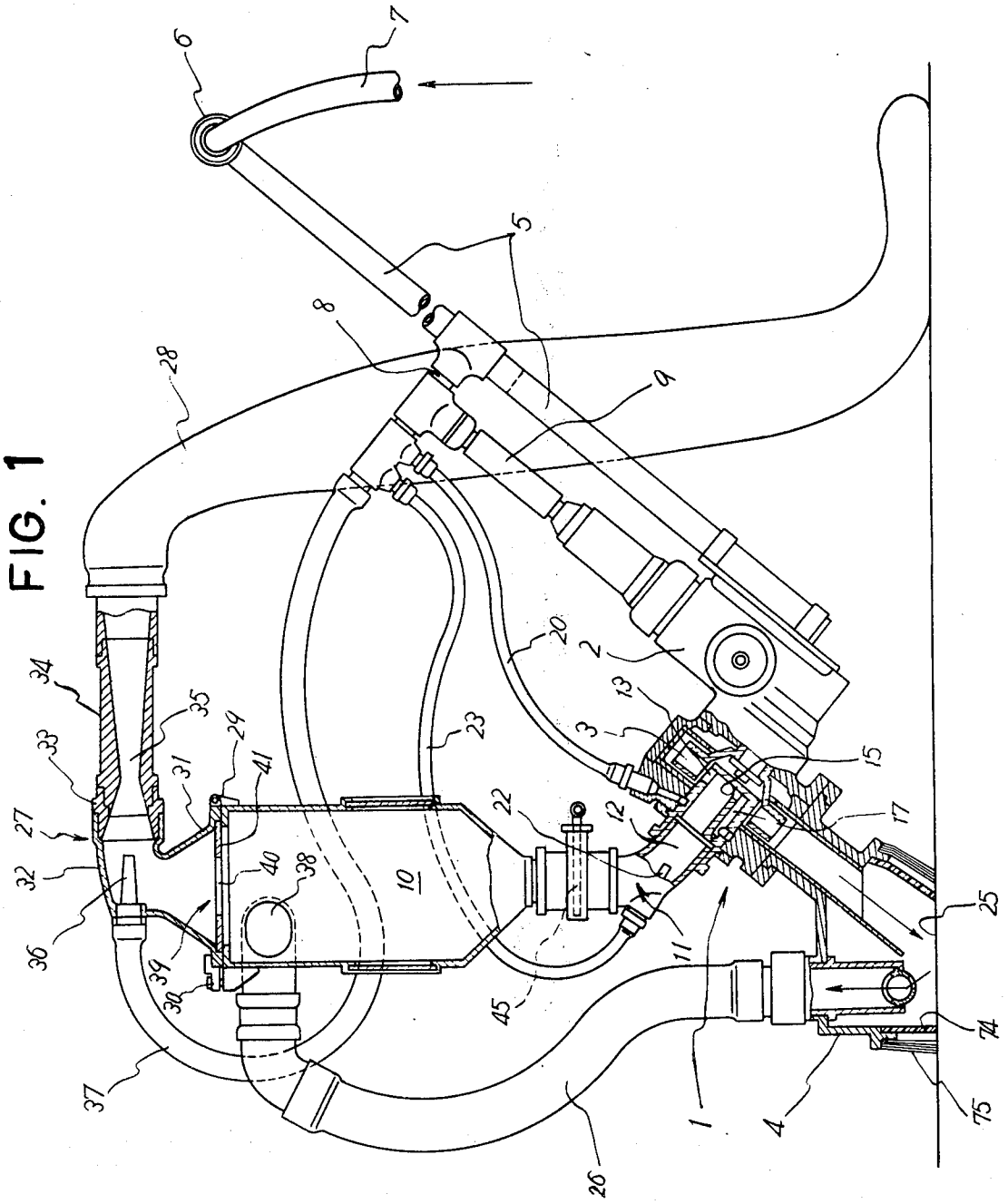

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FIG. 2

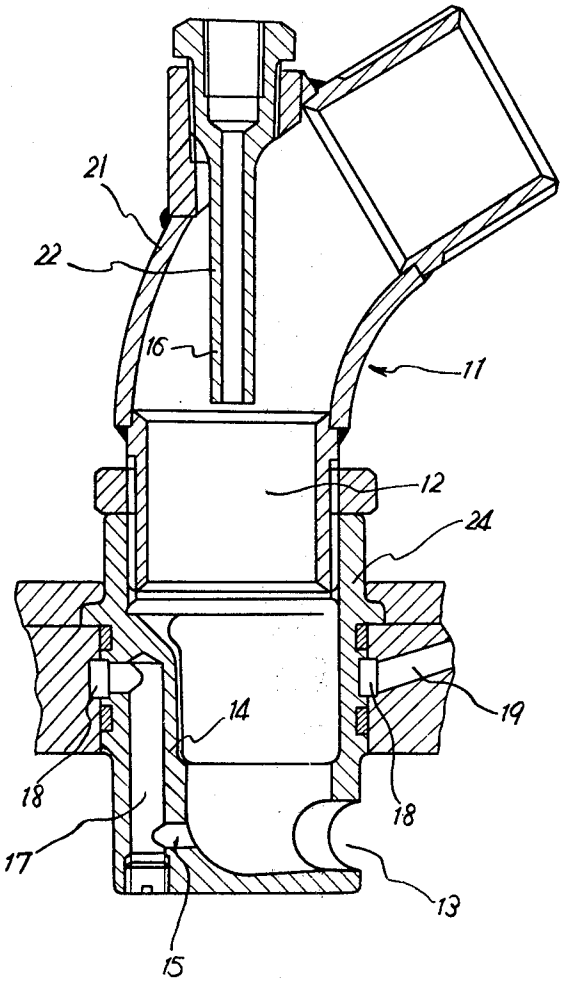


FIG. 3

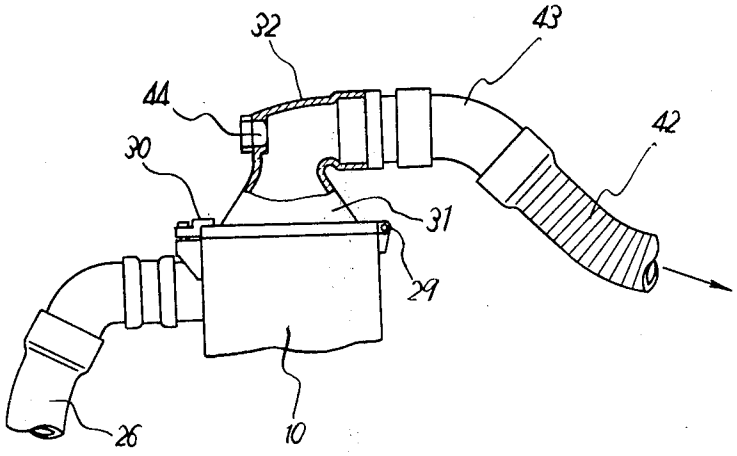

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FIG. 4

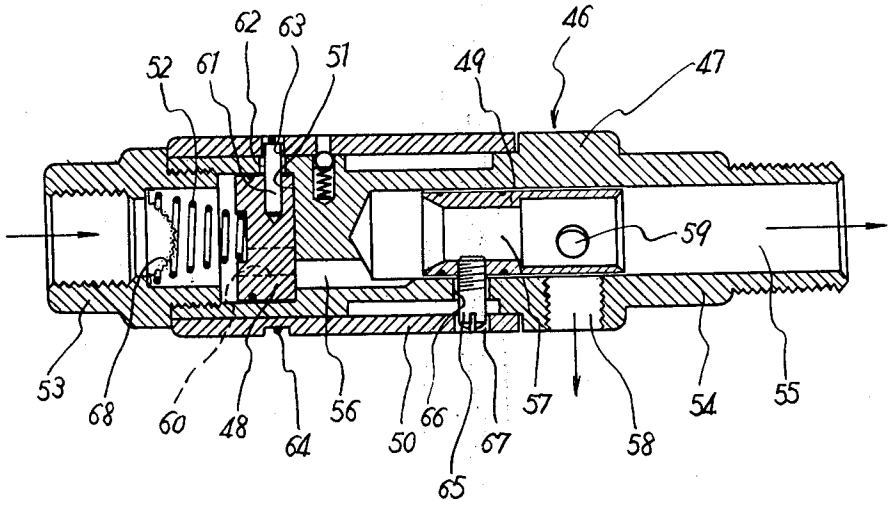

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FIG. 5

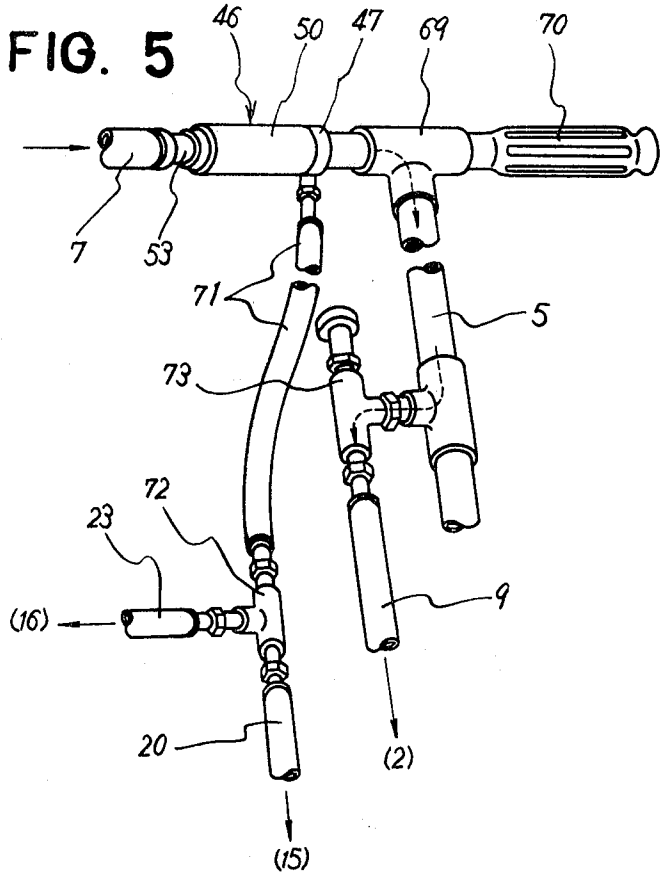

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(16)
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(2)
(15)

FIG. 6

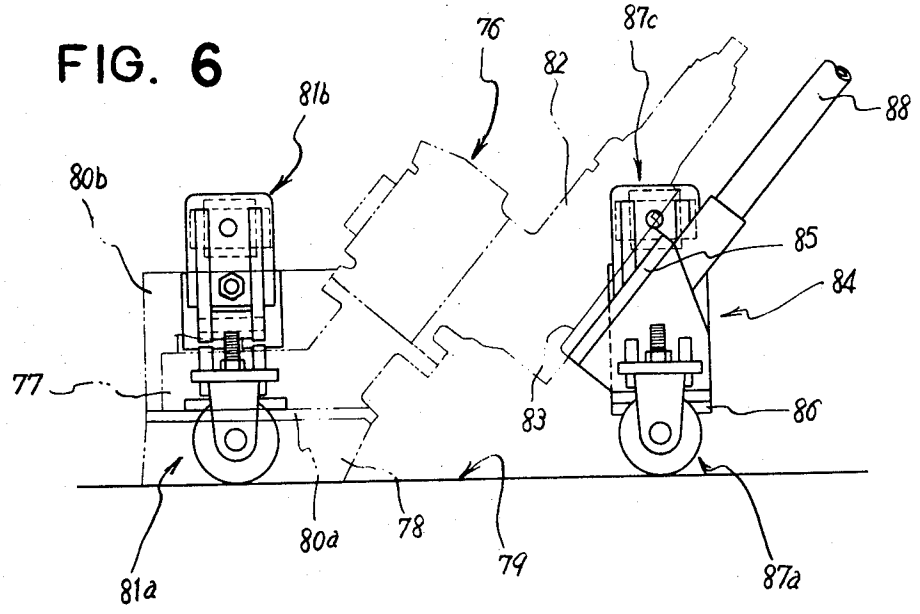

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87c
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88
81b
80b
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83
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80a
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87a
81a

FIG. 7

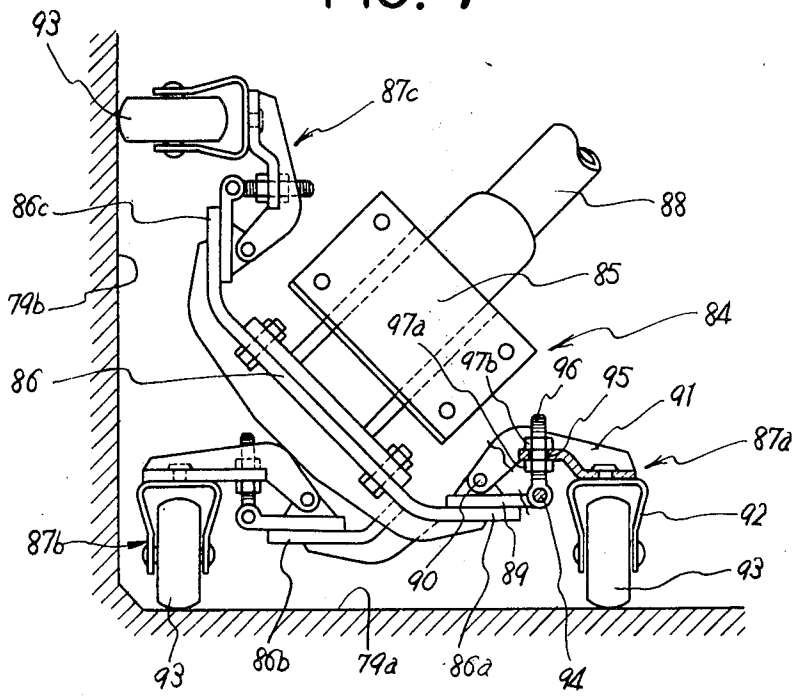
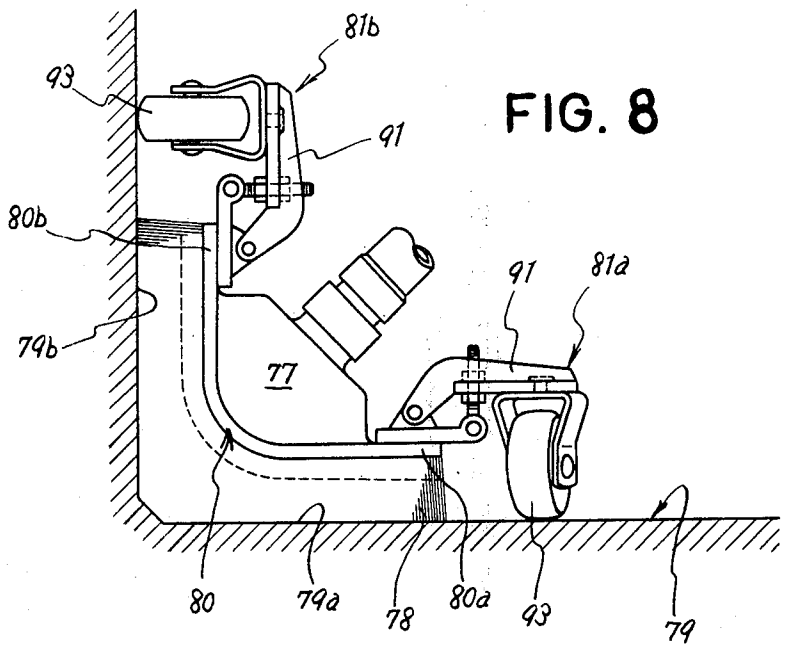

93
87c
88
86c
85
79b
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97a
97b
96
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87a
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87b
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93
86b
79a
86a
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FIG. 8


81b
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91
80b
91
81a
79b
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80
79a
78
80a
93
79

ABRASIVE CLEANING MACHINE

The present invention relates to an abrasive cleaning apparatus adapted to be transported to a shipbuilding dock and conveniently used for removal of rust from hull blocks before the latter are joined together.

For this kind of abrasive cleaning operation, use has hitherto been made principally of the power-operated method using a portable pneumatic grinder and the sand blast method using manual air blast, but in each method, the operation must be conducted in an unsanitary environment where there is a cloud of rust and dust. As a result, it is necessary for the operator to heavily armor himself, making it impossible to achieve high efficiency of abrasive cleaning. The method using sand blast has higher efficiency of abrasive cleaning than the method using an air grinder, but the former method makes it necessary to later recover the abrasive agent used, which requires much more time and labor than required in the actual abrasive cleaning operation. In order to reuse the recovered abrasive agent, it is necessary to separate the rust particles therefrom, so that high economic effect has not been attained.

Further, in connection with the abrasive cleaning of flat surfaces and corners, there has not been provided a compact closed type (automatic abrasive agent circulation type) abrasive cleaning machine which has basically solved the problems. This kind of conventional closed type impeller blaster is excessively large in size, weighing several hundred kilograms, so that it cannot be utilized for the abrasive cleaning of hull blocks described above.

The present invention is intended to solve all these problems and provides an abrasive cleaning machine which is small in size and highly portable.

An abrasive cleaning machine according to the invention comprises an abrasive agent slinging device including a hood for covering a surface of given area to be abrasive cleaned and a drive motor for a sling impeller, an abrasive agent accommodating sealed container supported by said abrasive agent slinging device and communicating with the sling impeller chamber of said device through an abrasive agent feed path, a communication tube for establishing communication between the interior of the upper portion of said container and the interior of said hood, a bleed channel which opens to the interior of said container at the upper end thereof, means for producing air currents which flow from the interior of said hood via said communication tube and the interior of the container to said bleed channel, the arrangement being such that only those abrasive agent particles which are slung against the surface to be abrasive cleaned within said hood by the impeller of the abrasive agent slinging device are returned to said container by said air currents for circulation for reuse.

With such abrasive cleaning machine of the invention, since the slung abrasive agent can be automatically recovered and circulated for reuse at the same time as the abrasive cleaning of a predetermined surface by slinging an abrasive agent thereagainst, it is possible to carry out the abrasive cleaning operation continuously as much as required by simply preparing a relatively small amount of abrasive agent. This means that the entire apparatus is compact and easy to handle since the abrasive agent accommodating container may be small in size. Further, the abrasive agent slung region is enclosed with the hood and the dust including

removed rust as well as the abrasive agent slung from the space within the hood is sucked and collected in the abrasive agent accommodating container. Therefore, by simply connecting a bag filter or other suitable dust separating means to the bleed channel extending from said container, the working environment can be maintained sanitary and satisfactory. Moreover, it is no longer necessary to provide for a dust seal.

To sum up, according to the present invention, there is provided an abrasive cleaning machine which is small in size, light in weight (about 20kg), highly portable and particularly suitable for the abrasive cleaning of hull blocks.

Other numerous features and merits of the present invention will be readily understood from the following description of a preferred embodiment of the invention with reference to the accompanying drawings.

FIG. 1 is a side elevation, partly in section, of an abrasive cleaning machine according to the present invention;

FIG. 2 is an enlarged longitudinal section of the abrasive feeding portion thereof;

FIG. 3 is a side elevation, partly in section, of the abrasive return portion in the case where an ordinary vacuum cleaner is used instead of a bag filter;

FIG. 4 is a longitudinal section of an on-off valve suitable for the present inventive abrasive cleaning machine;

FIG. 5 is a perspective view showing a handle part and air feed passageways in the case where said on-off valve serves also as one of the grip bars of the handle lever;

FIG. 6 is a side elevation showing how a wheel device is attached to an abrasive cleaning machine of the present invention which is designed for cleaning of corners;

FIG. 7 is a transverse elevation showing a rear wheel assembly; and,

FIG. 8 is a transverse elevation showing a front wheel construction and a hood.

An embodiment of the present invention will now be described with reference to FIGS. 1 and 2.

This machine includes abrasive discharging means in the form of a slinging device 1 having an impeller 3 driven by an air motor 2, and a hood 4 adapted to enclose a region where an abrasive agent is slung by said impeller 3. The slinging device 1 is attached to the lower region of a handle lever 5 through the air motor 2. The upper end of the handle lever contains an on-off valve and there is provided a grip bar 6 which serves as an operative member for said on-off valve. High pressure air from an air compressor (not shown) flows through a flexible tube 7 and then through the on-off valve into the handle lever 5, wherefrom it is fed to the air motor 2 via a branch tube 8 and a hose 9.

A container 10 stores an abrasive agent and is attached to the slinging device 1 through a piping 11 which defines an abrasive agent feed path 12 for introducing the abrasive agent into the slinging device 1. Forming the end portion of the feed path 12 is a bottomed cylinder 24 located centrally of the impeller 3 and provided with an abrasive agent outlet port 13 which opens transversely at right angles to the impeller axis, and with an air nozzle 15 which opens toward said abrasive agent outlet port 13 in a lateral wall opposite said port. This cylinder 24 is attached to the slinging device 1 so that it may be rotated around the impeller

axis to change the direction of the abrasive agent outlet port 13.

Further, in said abrasive agent feed path 12, there is provided an air nozzle 16 which opens toward the end of said feed path. The air nozzle 15 communicates with a hose 20 through a vertical path 17 in the lateral wall 14, an annular path 18 surrounding the feed path 12 and a communication path 19, said hose 20 communicating with said branch tube 8. The air nozzle 16 is constituted by a narrow tube 22 extending through the curved outer wall 21 of the piping 11 and communicates with the branch tube 8 through the hose 23.

The abrasive agent in the container, upon opening of a valve 45, flows down the feed path 12, is accelerated by high pressure air currents discharged from the air nozzle 16 and reaches the feed path end, from which it is forced into the rotating impeller 3 through the abrasive agent outlet port 13 by high pressure air currents discharged from the air nozzle 15. The abrasive agent is then slung against a surface 25 within the hood 4 to abrasively clean said surface 25.

A tube 26 establishes communication between the interior of the container 10 at the upper region thereof and the space within the hood 4, and a piping 27 which opens at one end thereof to the upper central region of said container 10 has a filter bag 28 connected to the other end thereof. The piping 27 comprises a tubular portion 32 fixed to a lid 31 adapted to be opened and closed with respect to the container 10 by a hinge 29 and a lock mechanism 30, and comprises a constricted tube portion 34 connected to said portion 32 through a joint nut 33, said portion 32 being provided with an air nozzle 36 which opens to the constricted channel 35 of said constricted tube portion 34 from the upstream side of said constricted channel. The air nozzle 36 is connected to the branch tube 8 through a hose 37. The opening 38 in the container 10 for the tube 26 extends tangentially to the container wall. The opening 39 in the lid 31 for the container 10 is provided with an orifice plate 41 having a small opening 40 at the center thereof.

When high pressure air is blown from said air nozzle 36, the presence of the constricted channel 35 results in a negative pressure being produced in the container 10, while, on the other hand, high pressure air from the air nozzles 15 and 16 is flowing into the hood. Therefore, there is defined a path of flow extending from the hood 4 through the tube 26 to the container 10 and then through the piping 27 to the bag filter 28. Therefore, the abrasive agent slung into the hood 4 hits the surface 25 and then, together with foreign matter including rust removed from the surface 25, is sucked into the tube 26 and guided into the container 10. Because of the presence of the orifice plate 41 and the tangential opening 28, the heavier abrasive agent falls down into the container for recovery or storage therein, while the less heavy foreign matter including the rust is sucked up into the piping 27 and then into the bag filter 28, with the air alone permitted to be discharged into the atmosphere through the bag filter.

FIG. 3 shows an example in which a vacuum cleaner is used as suction means. In this case, the tubular portion 32 may be connected to a vacuum suction cleaner hose 42 through a suitable connection tube 43. The hole left after removal of the air nozzle 36 must be closed by inserting a plug 44.

With the abrasive cleaning machine of the construction shown in FIG. 1, when the valve 45 is closed and the grip bar 6 containing said on-off valve therein is manipulated to cut off the air supply from the flexible tube 7 in order to stop the abrasive cleaning operation, the impeller 3 and the rotor of the air motor 2 will continue to rotate for some time by momentum. As a result, the pressure in the feed path to the air motor 2 becomes negative. Since said air feed path is in constant communication with the abrasive agent feed path 12 through the hoses 20, 23 and air nozzles 15, 16, when the pressure in said air feed path to the air motor becomes negative, there is produced a reverse air current flowing from the hood 4 through the abrasive agent feed path 12, air nozzles 15, 16 and hoses 20, 23 to the air motor 2. If sufficient time is taken between the closure of the valve 45 and the subsequent closure of the air feed path to ensure that the abrasive agent which exists in the route between the abrasive agent feed path 12 and the impeller 3 is completely slung, there will be no problem; without such precaution, however, there would be the danger of the remaining abrasive agent being borne on said reverse air current and sucked into the air motor to damage the latter. When there is fear that such danger will occur, it is desirable to use an on-off valve designed to cut off both the supply of air to the two channels and the communication between said two channels at the same time in one operation.

An example of such on-off valve is shown in FIG. 4. An on-off valve 46 shown therein comprises a cylindrical body 47, an air feed valve 48, a shut-off valve 49, said valves being rotatable in sliding contact with the inner surface of said body 47; a grip portion 50 rotatable in sliding contact with the outer surface of said body and adapted to operate said air feed valve 48 and shut-off valve 49 at the same time; an air feed inlet tube 53 threadedly connected to one end of said body 47 and containing therein an air feed valve spring 52 for urging said air feed valve 48 against the step surface 51 of the body 47; and an outlet tube portion 54 formed at the other end of said body. An opening 55 in said outlet tube portion 54 communicates with an air inlet path 56 which is opened and closed by the air feed valve 48, through a path in the shut-off valve 49. A second opening 58 formed in the peripheral wall of the body 47 communicates with said air inlet path 56 only when a valve port 59 formed in the peripheral wall of the shut-off valve 49 communicates with said second opening 58. The air inlet path 56 communicates with the inlet tube 53 only when said air inlet path communicates with a valve port 60 formed eccentrically in the air feed valve 48. Designated at 61 is a pin having its inner end fitted in an opening in the peripheral wall of the air feed valve 48, the outer end of the pin extending through a circumferential elongated opening 62 in the body 47 and being fitted in an opening 62 in the grip portion 50. The pin 61 is prevented from slipping out by an O-ring 64. A screw 65 threadedly engaged in the peripheral wall of the shut-off valve 49 has its outer end extending through a circumferential elongated opening 66 in the body and fitted in an opening 67 in the grip portion 50. Therefore, by rotating the grip portion 50, the air feed valve 48 and shut-off valve 49 in the body 47 are simultaneously rotated through the pin 61 and screw 65. The numeral 68 designates a strainer installed in the inlet tube 53.

With the on-off valve **46**, the air feed valve **48** is rotated by the grip portion **50** to close the air inlet path **56**, whereby the supply of air to the opening **55** and also the second opening **58** can be cut off. At the same time, the shut-off valve **49** is rotated in operative connection with the air feed valve **48** to move the valve port **59** away from the second opening **58** so that communication between the openings **55** and **58** is cut off. Further, when the air feed valve **48** is rotated in the reverse direction until its valve port **60** communicates with the air inlet path **56**, the shut-off valve **49** is simultaneously rotated in the reverse direction until its valve port **59** communicates with the second opening **58** so that is is possible to feed both openings **55** and **58** with air from the inlet tube **53**.

Therefore, by using said on-off valve **46** with its inlet tube **53** receiving the air feed flexible tube **7** shown in FIG. **1**, with the opening **55** in the outlet tube portion **54** connected to the air feed path to the air motor **2** and with the second opening **58** connected to the air feed path to the air nozzles **15** and **16**, it is ensured that there will be produced no reverse air current described above when the supply of air is cut off. Therefore, the situation in which the remaining abrasive agent is sucked into the air motor is avoided.

Preferably, the on-off valve **46** may be used in the manner shown in FIG. **5**. Thus, a T-tube **69** is connected to the upper end of the handle lever **5** shown in FIG. **1**, one end opening in said T-tube being connected to the outlet tube portion **55** of said on-off valve **46**, the other end opening receiving a usual grip **70** which closes said opening and cooperates with the grip portion **50** of the on-off valve to form a pair. Thus, communication is established between the opening **55** in the outlet tube portion of the on-off valve **46** and the inner passageway of the handle lever **5**. Connected to the inlet tube **53** is said air feed flexible tube **7**. A piping **71** is connected to the second opening **58** and to said hoses **20** and **23** through a T fitting **72**. In addition, the inner passageway of the handle lever **5** communicates with the air motor **2** through a flow control valve **73** and hose **9**.

The peripheral edge of the hood **4**, as shown in FIG. **1**, has mounted thereon a skirt **74** of rubber or the like surrounding a region where an abrasive agent is to be slung, and a brush **75** surrounding said skirt **74**. An abrasive cleaning operation is carried out by advancing the abrasive cleaning device in such a condition that said skirt and brush are in contact with the surface **25** to be cleaned. In order to readily maintain said condition, it is desirable to provide the abrasive cleaning machine with a plurality of wheels for maintaining the level of the hood with respect to said surface **25**. In that case, if each wheel is arranged so that its level may be adjusted, it is possible to set the level and attitude of said hood to the optimum condition.

As for an abrasive cleaning machine to be used on a flat horizontal surface to be cleaned, there is no need to elaborate a plan for attachment of a wheel device such as the one described above. However, as for an abrasive cleaning machine for cleaning a corner of a surface to be cleaned which is bent at a right angle, a corresponding specially designed wheel device is required.

Description will be made with reference to FIGS. **6–8** illustrating an example of an abrasive cleaning machine adapted for the abrasive cleaning of corners. This machine **76** is inclined at an angle of about 45°. As shown in FIG. **8**, a hood **77** for this machine corresponding to the hood **4** shown in FIG. **1** has its peripheral opening edge bent in a V-shape with the axis extending in the direction of travel of the machine. A skirt and a brush **78** are mounted around said peripheral edge and are adapted to contact a substantially right angled surface **79** to be cleaned from its horizontal portion **79***a* to vertical portion **79***b*. Front wheel units **81***a* and **81***b* are mounted on the horizontal and vertical outer ends **80***a* and **80***b* of the substantially right-angled flange **80** of the hood **77**.

A rear wheel assembly **84** is mounted on an attachment seat plate **83** inclined at an angle of about **45** degrees for an air motor **82** (see FIGS. **6** and **7**) corresponding to the air motor **2** shown in FIG. **1**. The rear wheel assembly **84** comprises a base **86** having an attachment plate **85** attached to said attachment seat plate **83**, a horizontal plane engaging outer wheel unit **87***a* mounted on the outer end **86***a* of said base **86**, a horizontal plane engaging inner wheel unit **87***b* mounted on a horizontal projection **86***b* of the base **86**, and a vertical plane engaging wheel unit **87***c* mounted on the vertical outer end **86***c* of the base **86**. A handle lever **88**, corresponding to the handle lever **5** shown in FIG. **1**, projects from the base **86**.

Each of the wheel units **81***a*, **81***b*, **87***a* – **87***c* comprises an attachment plate **89** (FIG. **7**) an arm **91** pivotally mounted on a shaft **90** extending parallel to the direction of travel of the abrasive cleaning machine, a wheel support frame **92** attached to the outer end of the arm **91**, a wheel **93** journaled on said support frame, a screw shaft **96** pivotally mounted at one end on said attachment plate **89** and extending through an opening **95** formed in said arm **91**, and a pair of nuts **97***a* and **97***b* threadedly engaged on said screw shaft **96** to clamp said arm **91** for fixing the attitude of the latter at any desired angle. Thus, the level of the wheel **93** of each wheel unit with respect to its attachment plate **89** can be optionally adjusted by loosening or tightening the nuts **97***a* and **97***b*.

The front wheel unit **81***a* and horizontal plane engaging rear wheel units **87***a* and **87***b* contact the horizontal region **79***a* of the surface to be abrasively cleaned so as to be rollable in the direction of travel of the machine, while the front wheel unit **81***b* and vertical plane engaging rear wheel unit **87***c* contact the vertical region of said surface to be rollable in the direction of travel of the machine. Thus, by moving the abrasive cleaning machine along a corner of said surface with the wheels **93** of the wheel units maintained in contact with the surface **79** as shown in FIGS. **7** and **8**, the surface corner surrounded with the brush **78** can be continuously abrasively cleaned. In this case, the level of the wheel **93** of each wheel unit is adjusted so that the brush **78** may be in uniform contact with the surface to be cleaned.

In the above abrasive cleaning operation, it is necessary for an operator who is pushing the machine to manipulate the handle in such a manner as to urge the machine toward the vertical region **79***b* of the surface to be cleaned so that the wheels **93** of the wheel units **81***b* and **87***c* may not be disengaged from said vertical region **79***b*. In order to decrease the labor required in such operation, it is desirable that the wheel **93** of the front wheel unit **81***a* which is in contact with the horizontal region **79***a* of said surface be fixed at some angle

biased toward the vertical region 79*b* of said surface, as shown in FIG. 8.

In addition, an abrasive cleaning machine according to the present invention may be provided with a power-driven wheel device.

We claim:

1. An abrasive cleaning machine comprising:
abrasive discharging means including a hood adapted to cover a given area of a surface to be cleaned;
an enclosed container for an abrasive agent, and a feed path for said agent extending from said container to said abrasive discharging means;
a return tube establishing communication between the interior of the upper portion of said container and the interior of said hood, and a bleed channel which opens to the interior of said container at the upper end thereof; and,
means for producing air currents which flow from the interior of said hood to said container via said return tube and from the interior of the container to said bleed channel whereby abrasive agent particles which are discharged against the surface to be cleaned are recirculated to said container by said air currents for re-use, said means comprising a constructed passage provided in said bleed channel, and an air nozzle for discharging pressurized air toward the downstream side of said constructed passage.

2. An abrasive cleaning machine as set forth in claim 1, including a bag filter connected to the terminal end of said bleed channel.

3. An abrasive cleaning machine as set forth in claim 1, wherein an opening in said container for said return tube is directed tangentially to the peripheral wall of the container, and an opening in said container for said bleed channel is sufficiently smaller than the cross sectional area of the container and is located centrally of the container.

4. An abrasive cleaning machine connectable to a source of working air comprising:
abrasive discharging means including a hood adapted to cover a given area of a surface to be cleaned, an air driven drive motor and an abrasive slinging impeller driven thereby, and means for feeding working air to said air motor;
an enclosed container for an abrasive agent, a feed path for said agent extending from said container to said abrasive discharging means, and nozzle means supplied by working air for producing air currents to forcibly feed the abrasive agent to said impeller from said feed path;
a return tube establishing communication between the interior of the upper portion of said container and the interior of said hood, and a bleed channel which opens to the interior of said container at the upper end thereof; and,
means supplied by working air for producing air currents which flow from the interior of said hood to said container via said return tube and from the interior of said container to said bleed channel whereby abrasive agent particles which are discharged against the surface to be cleaned are recirculated to said container by said air currents for re-use.

5. An abrasive cleaning machine as set forth in claim 4, wherein the means for producing air currents comprises a constricted passage provided in said bleed channel, and an air nozzle for discharging pressurized air toward the downstream side of said constricted passage.

6. An abrasive cleaning machine as set forth in claim 4 wherein said abrasive agent feed path is provided at the terminal end thereof with an oulet port opening radially to said impeller, and said air nozzle means comprises a first air nozzle and a second air nozzle, said first air nozzle being located between the ends of said feed path and being directed toward said terminal end thereof, and said second air nozzle being directed toward said outlet port.

7. An abrasive cleaning machine as set forth in claim 4, wherein said hood is shaped to cover a corner portion of a surface to be cleaned from the horizontal region to the vertical region thereof and said machine is provided with horizontal plane engaging wheel units adapted to roll on the horizontal region of said surface and vertical plane engaging wheel units adapted to abut against and roll on the vertical region of said surface.

8. An abrasive cleaning machine as set forth in claim 7 wherein said horizontal plane and vertical plane engaging wheel units are spaced longitudinally in the direction of travel of the machine, and the horizontal plane engaging wheel units include a pair of such units disposed transversely of the direction of travel of the machine.

9. An abrasive cleaning machine as set forth in claim 7 wherein each of said wheel units is arranged so that the level of its wheel is adjustable.

10. An abrasive cleaning machine as set forth in claim 7 wherein one of the horizontal plane engaging wheel units is disposed so that its rolling direction is inclined toward the vertical region of the surface to be cleaned.

11. An abrasive cleaning machine as set forth in claim 4 wherein said machine further includes a manual push handle having a grip bar, a connection on said grip bar for working air, a working air passage extending through at least a portion of said handle, and an on-off valve which also serves as a portion of said grip bar.

12. An abrasive cleaning machine as set forth in claim 4, wherein working air is supplied to said air motor and to said nozzle means through separate feed paths, an on-off valve communicating with each of said feed paths and with the working air connection, said valve including closure means capable of cutting off the supply of working air to each of said feed paths and simultaneously isolating said feed paths from each other.

13. An abrasive cleaning machine as set forth in claim 4, including a bag filter connected to the terminal end of said bleed channel.

14. An abrasive cleaning machine as set forth in claim 4, wherein the means for producing air currents comprises a constricted passage provided in said bleed channel, and an air nozzle for discharging pressurized air toward the downstream side of said constructed passage.

15. An abrasive cleaning machine as set forth in claim 4, wherein an opening in said container for said return tube is directed tangentially to the peripheral wall of the container, and an opening in said container for said bleed channel is sufficiently smaller than the cross sectional area of the container and is located centrally of the container.

* * * * *