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Fuma et al.

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[54] **PORTABLE BLASTING DEVICE**

[75] Inventors: **Toyozi Fuma; Hideo Takeuchi; Susumu Ikeda,** all of Toyokawa, Japan

[73] Assignee: **Sintokogio, Ltd.,** Nakamura-ku, Nagoya, Aichi-ken, Japan

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Mar. 2, 1973	Japan	48-26544[U]

[52] **U.S. Cl.** **51/9,** 114/224

[51] **Int. Cl.** **B24c 3/06**

[58] **Field of Search** ..... 51/9, 12, 180, 170 R; 118/72, 305, 307, 207, 108; 114/222, 224

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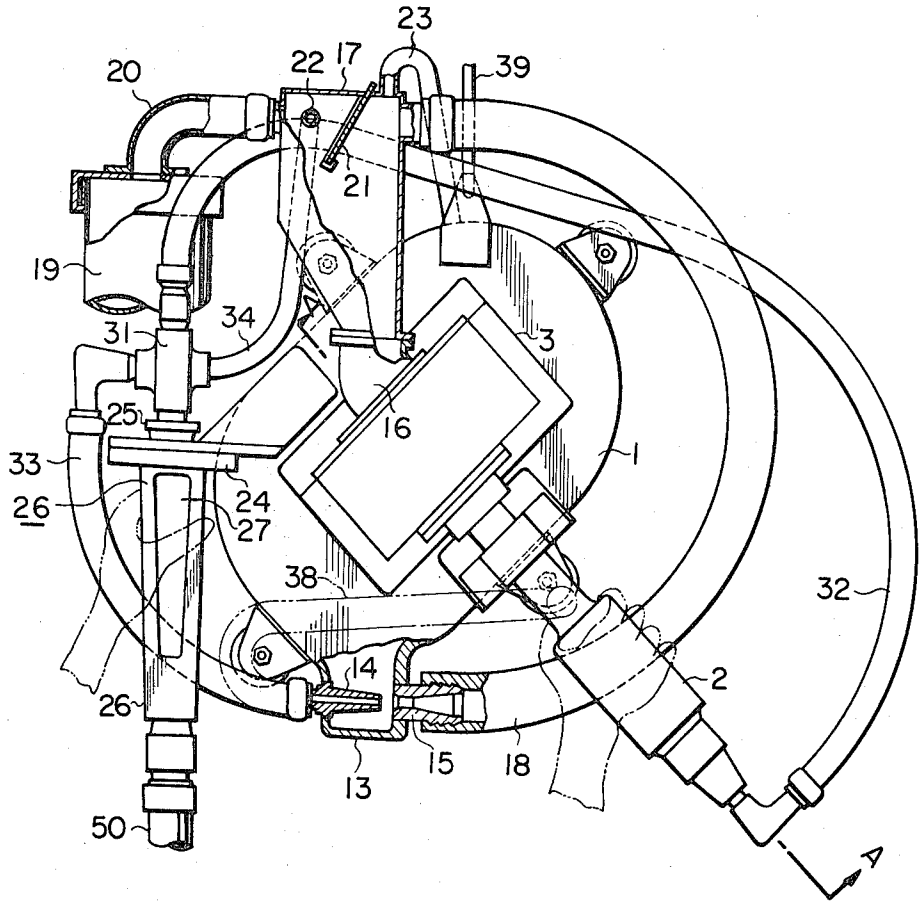
Primary Examiner—Donald G. Kelly

Attorney, Agent, or Firm—Armstrong, Nikaido & Wegner

[57] **ABSTRACT**

A small-sized, light-weight and portable blasting device for centrifugally blasting abrasive materials such as shot or grit for grinding and cleaning the surface of large-sized workpieces such as pre-fabricated structures to be assembled into the hull of a ship.

6 Claims, 9 Drawing Figures



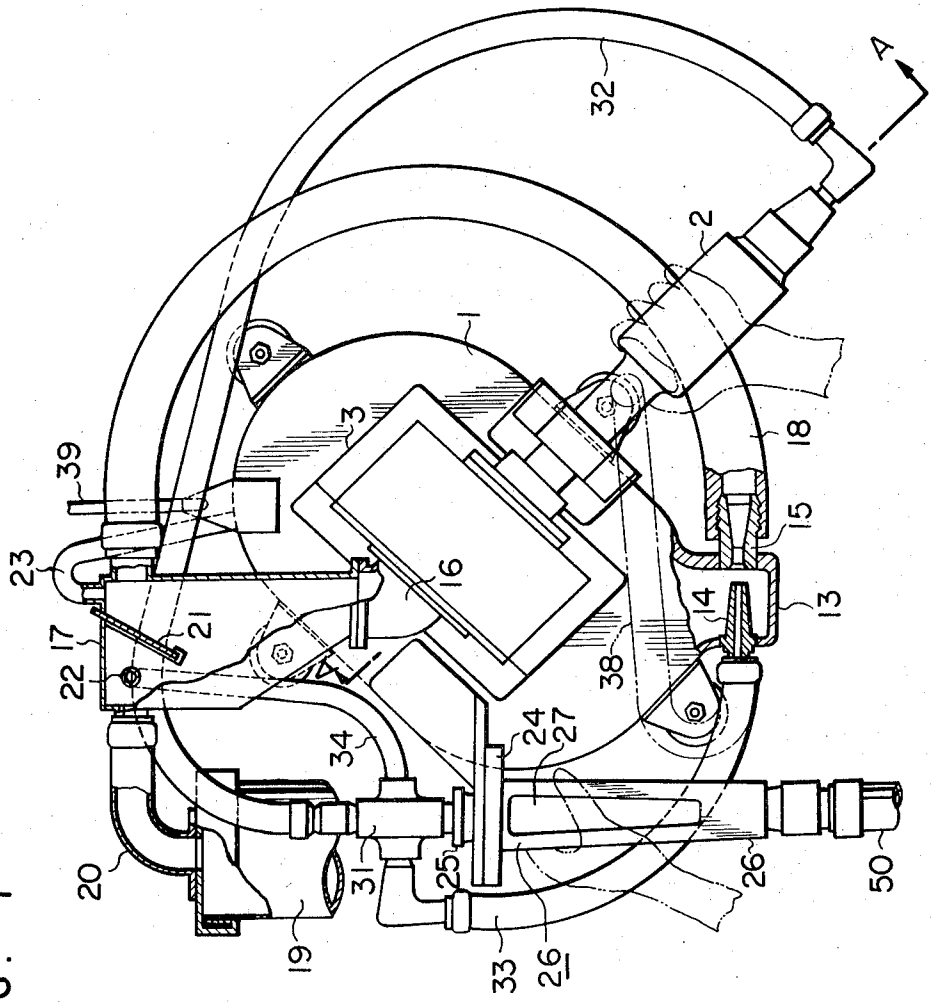

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FIG. 1

FIG. 2

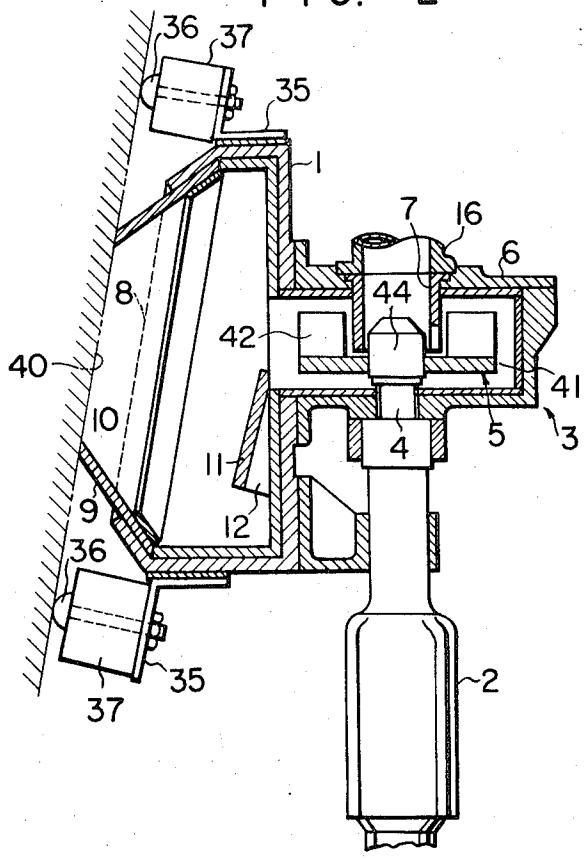


FIG. 3

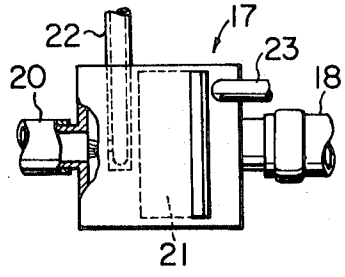


FIG. 4

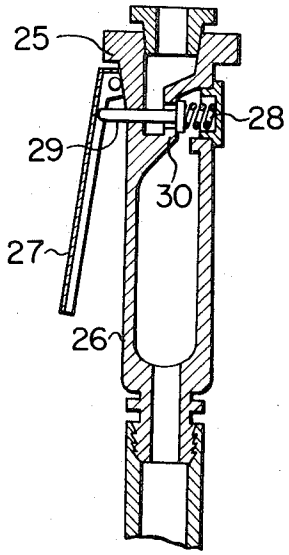


FIG. 5

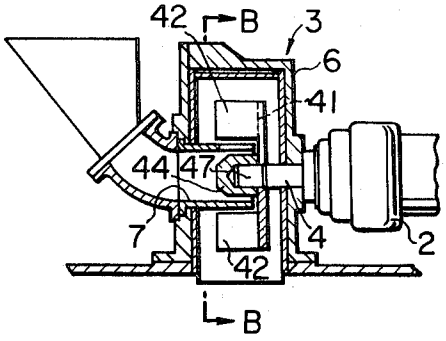


FIG. 6

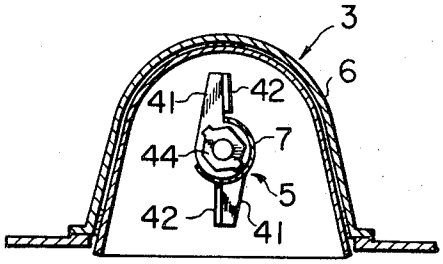


FIG. 7

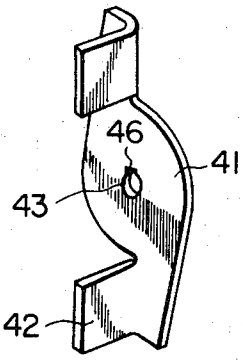


FIG. 8

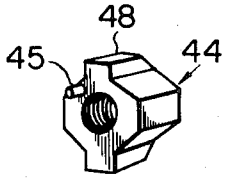
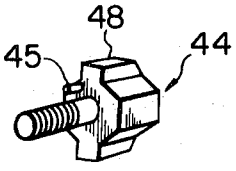


FIG. 9



PORTABLE BLASTING DEVICE

This invention relates to a portable blasting device suitable for cleaning the surface of large-sized workpieces such as pre-fabricated structures to be assembled into the hull of a ship.

An air blasting device which blast abrasive materials such as shot or grit together with compressed air has been commonly conventionally used for cleaning the surface of large-sized workpieces such as prefabricated structures to be assembled into the hull of a ship. However, this conventional air blast device has been defective in that the working efficiency thereof is quite low due to the inherent limitation of the treatable area and the finished surface is far from being uniform due to the difficultly of uniformly blasting abrasive materials toward the workpiece surface.

A blasting device of the centrifugal blasting type commonly conventionally employed in the art is capable of cleaning the surface of such a workpiece over a wide area in one operation. However, due to the fact that complex and bulky mechanisms are required in such a device for the supply and recovery of the abrasive materials, it has been impossible to reduce the overall size of the device to such an extent that the operator can carry out the surface cleaning operation while supporting the device by his hand in so far as these mechanisms are incorporated in the device. Therefore, the blasting device of the centrifugal blasting type has been defective in that it is unsuitable for such a cleaning operation in which the device is moved along the surface of a large-sized workpiece.

With a view to obviate these and other drawbacks of the prior art devices, the present invention contemplates the provision of a novel and improved blasting device which is light in weight and small in size such that it can be easily carried by the hand of the operator and in which compressed air is used to actuate all the means including means for driving a centrifugal blasting means which blast abrasive materials toward the surface of a workpiece by the centrifugal action, means for conveying the abrasive materials contained within a container toward a dust separator, and means therein for separating dust from the abrasive materials.

Further, the present invention contemplates the provision of a portable blasting device of the kind above described in which a guide means is disposed within a cabinet for directing the materials rebounded from the workpiece surface toward such surface again so that the abrasive materials can repeatedly impinge against the workpiece surface for effectively cleaning the workpiece surface over a wide area.

Furthermore, the present invention contemplates the provision of a portable blasting device of the kind above described in which a communication conduit is provided to connect the interior of the cabinet to the interior of the dust separator so that fine dust particles floating in the cabinet can be drawn into the dust separator.

Moreover, the present invention contemplates the provision of a portable blasting device of the kind above described in which a deflector means is disposed within the dust separator for deflecting the abrasive materials supplied into the dust separator thereby effectively separating the dust from abrasive materials.

Further, the present invention contemplates the provision of a portable blasting device of the kind above described which is remarkably light in weight and which can be simply handled and manufactured at low costs due to the fact that the impeller for blasting the abrasive materials is composed of a rotary plate, a plurality of blades formed integrally with the plate, and a distributor serving the dual purpose of securing the rotary plate to the shaft of an air motor and changing the direction of flow of the abrasive materials.

It is an object of the present invention to provide a portable blasting device which is light in weight and small in size and can be easily carried by the hand of the operator.

Another object of the present invention is to provide a portable blasting device which can operate with improved surface cleaning efficiency due to the fact that the abrasive materials can be caused to repeatedly impinge against the surface of a workpiece.

Still another object of the present invention is to provide a portable blasting device in which fine dust particles floating within a cabinet can be drawn into a dust separator to be separated from the abrasive materials by utilizing a negative pressure established within the dust separator.

Yet another object of the present invention is to provide a portable blasting device in which the mixture of abrasive materials and dust conveyed by being entrained on the stream of compressed air can be effectively separated from each other.

A further object of the present invention is to provide a portable blasting device having an impeller which is remarkably light in weight and which can be simply handled and manufactured at low costs.

These and other objects, features and advantages of the present invention will be apparent from the following detailed description of a preferred embodiment thereof taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a partly sectional back view showing the general arrangement of components of a portable blasting device embodying the present invention;

FIG. 2 is a sectional view taken on the line A — A in FIG. 1;

FIG. 3 is a partly cut-away plan view of a dust separator;

FIG. 4 is a longitudinal section of a grip handle;

FIG. 5 is a section of a centrifugal blasting means;

FIG. 6 is a sectional view taken on the line B — B in FIG. 5;

FIG. 7 is an enlarged perspective view showing the relation between a rotary plate and blades of an impeller;

FIG. 8 is an enlarged perspective view of one form of a distributor; and

FIG. 9 is an enlarged perspective view of another form of the distributor.

Referring now to the drawings showing a portable blasting device embodying the present invention, a centrifugal blasting means 3 driven by an air motor 2 is mounted on the back face of a cabinet 1. The centrifugal blasting means 3 comprises an impeller 5 fixed to the drive shaft 4 of the air motor 2 for unitary rotation therewith and a cage 7 secured to a cover member 6 for the blasting means 3 so as to terminate at one end thereof in the vicinity of the central portion of the impeller 5. The cabinet 1 is formed on the front face thereof with an opening 8 through which abrasive materials such as shot or grit can be directed toward the

surface of a workpiece **40.** This opening **8** is disposed in a plane which makes an angle slightly less or more than 90° with respect to the blasting direction of the abrasive materials by the centrifugal blasting means **3.** Thus, the back face and front face of the cabinet **1** are not in parallel with each other as best shown in FIG. **2.** A sealing member **9** of material such as rubber or synthetic resin is fixed to the periphery of the opening **8** by a mounting member **10** so as to confine the abrasive materials blasted from the blasting means **3** within the cabinet.

A guide means **11** is fixed by a mounting member **12** to a lower portion of the back face of the cabinet **1** in substantially parallel relation with the plane including the opening **8.**

A container **13** for temporarily containing the abrasive materials is connected to the lower end of the cabinet **1** so that the interior of the former communicates with the interior of the latter. A compressed air injection nozzle **14** extends into the container **13,** and a throat member **15** is connected to the side wall of the container **13** at a position opposite to the nozzle **14.** A tubular member **16** is connected at one end thereof to the other end of the cage **7** in the centrifugal blasting means **3** for supplying the abrasive materials into the cage **7,** and this tubular member **16** is connected at the other end thereof to the lower end of a dust separator **17.**

The throat member **15** which is connected at one end thereof to the side wall of the container **13** is connected at the other end thereof to an upper side portion of the dust separator **17** by a conduit **18.** A conduit **20** communicating at one end thereof with a dust collector **19** is connected at the other end thereof to another upper side portion of the dust separator **17** at a position opposite to the joint between the dust separator **17** and the conduit **18.** The dust collector **19** is of simple construction such that a bag filter is merely disposed within a casing.

A deflector means **21** is disposed at an upper central position within the dust separator **17** in an inclined relationship with respect to the vertical so as to deflect the abrasive materials impinging thereagainst. Thus, the upper space within the dust separator **17** is partitioned by the deflector means **21** into a left-hand and a right-hand space portion which communicate with each other in the lower space. A compressed air injection conduit **22** extends into the dust separator **17** for directing compressed air toward the joint between the conduit **20** and the dust separator **17.** A suction conduit **23** is connected at one end thereof to an upper portion of the dust separator **17** and at the other end thereof to a suitable portion of the cabinet **1.**

A hollow grip handle **26** having a hand operated valve **25** therein is secured by a mounting means **24** to a suitable portion of the cabinet **1.** A lever **27** is pivoted at one end thereof to the grip handle **26** so that, in response to the manipulation or depression of the lever **27,** a valve rod **29** can be urged in the corresponding direction against the force of a spring **28** thereby opening a valve opening **30** as seen in FIG. **4.** The lower end of the grip handle **26** is connected to a source of compressed air (not shown) by a rubber hose **50.** A cross joint **31** is connected to the upper portion of the grip handle **26** above the valve **25,** and the three branch connections of the cross joint **31** are connected to the air motor **2,** nozzle **14** in the container **13** and injection conduit **22** in the dust separator **17** by respective supply conduits **32, 33** and **34** which may be a hose of rubber or synthetic resin.

A plurality of stoppers **36** of non-magnetic material are supported on the outer periphery of the cabinet **1** by brackets **35** and extend toward the surface of the workpiece **40** to terminate at their front end at a position slightly retracted from the front end of the sealing member **9.** A permanent magnet **37** is carried by each of the stoppers **36** as seen in FIG. **2.** A supply conduit **38** may be connected between the air motor **2** and the nozzle **14** so that the exhaust from the air motor **2** may be also utilized for the conveyance of the abrasive materials. Further, a suitable hand **39** may be fixed to the cabinet **1** so that the portable blasting device can be conveniently suspended from the shoulder of the operator.

The structure of the impeller **5** will be described in more detail with reference to FIGS. **5** to **9.** A plurality of blades **42** are formed integrally with a flat metal plate **41** by bending end edge portions of the flat metal plate **41** at substantially right angles with respect to the plane of the metal plate **41** as best shown in FIG. **7.** The metal plate **41** is provided with a central axial bore **43,** and a cutout **46** is formed in the bore **43** so that a pin **45** provided on a distributor **44** described later can be received in the cutout **46.** The rotary shaft **4** of the air motor **2** extends through the cover member **6** of the blasting means **3** into the internal space of the blasting means **3,** and the front end portion **47** of the rotary shaft **4** is externally threaded. The distributor **44** is provided with a plurality of radial projections **48** thereon and a threaded axial bore extends therethrough like a nut as shown in FIG. **8.** The externally threaded front end portion **47** of the rotary shaft **4** extends through the axial central bore **43** of the metal plate **41** having the blades **42** formed integrally therewith, and the nut-like distributor **44** having the projections **48** thereon is brought into threaded engagement with the externally threaded front end portion **47** of the rotary shaft **4** to constitute the impeller **5.** The metal plate **41** may be fixed to the rotary shaft **4** by forming a threaded axial bore in the rotary shaft **4** and bringing a bolt-shaped distributor **44** as shown in FIG. **9** into threaded engagement with the axial bore of the rotary shaft **4.**

The portable blasting device according to the present invention operates in a manner as described below. Referring to FIG. **1,** a suitable amount of abrasive materials such as shot or grit is contained within the container **13.** The operator grips the grip handle **26** and air motor **2** with his hands and moves the entire device to press the front end of the stoppers **36** against the surface of a workpiece **40.** In this case, the front end portion of the sealing member **9** is brought into sealing engagement with the surface of the workpiece **40** in slightly inwardly bent relation thereby acting to confine the abrasive materials within the cabinet. Further, due to the fact that the device is bodily attracted to the workpiece **40** by the action of the permanent magnets **37,** the effort of the operator to force the device against the workpiece **40** is substantially unnecessary. The operator then depresses the lever **27** on the grip handle **26.** In response to the depression of the lever **27,** compressed air is supplied to the air motor **2,** to the nozzle **14** in the container **13** and to the injection conduit **22** in the dust separator **17** by way of the respective conduits **32, 33** and **34.** Compressed air supplied from the

nozzle 14 into the container 13 forces the abrasive materials out of the container 13 into the throat means 15 where the abrasive materials are accelerated to be conveyed into the dust separator 17 by way of the conduit 18.

The abrasive material fed into the dust separator 17 impinges against the deflector means 21 to be decelerated thereby and falls downward by gravity to be supplied into the cage 7 through the tubular member 16. In the meantime, compressed air supplied to the air motor 2 causes high-speed rotation of the impeller 5 fixedly mounted on the rotary shaft 4 of the air motor 2. Thus, the abrasive materials being supplied into the cage 7 in the manner above described are now directed toward the blades 42 by the action of the projections 48 on the distributor 44 and are blasted toward the surface of the workpiece 40 from the opening of the cage 7 by the centrifugal force imparted by the blades 42. After impinging against the surface of the workpiece 40, the blasted abrasive materials are rebounded to impinge against the guide means 11 to be rebounded again thereby toward the portions of the workpiece surface which are not yet cleaned. This manner of impingement of the abrasive materials against the surface of the workpiece 40 are repeated to clean effectively a wide area of the workpiece surface, and then the abrasive materials fall down into the container 13 by gravity to be stored therein.

Considerable amount of dust is produced as a result of the surface cleaning operation and the greater part of the dust is stored in the container 13 together with the abrasive materials. The fine dust particles which are very light and floating in the cabinet 1 are directly guided into the dust separator 17 by the suction applied from the suction conduit 23 as will be described later.

On the other hand, the abrasive materials stored in the container 13 are supplied together with the dust into the dust separator 17 and fall down in the manner above described. The pressure within the dust separator 17 is slightly negative due to the fact that compressed air is directed toward the communication conduit 20 which communicates with the dust collector 19. Thus, the dust of light weight supplied into the dust separator 17 together with the abrasive materials is separated from the abrasive materials without falling down as it is drawn toward the dust collector 19 by the suction applied from the communication conduit 20. Further, the fine dust particles floating in the cabinet 1 are drawn into the dust separator 17 by way of the conduit 23 due to the fact that the slightly negative pressure is always maintained within the dust separator 17. While the above manner of operation is continuously carried out, the operator gripping the grip handle 26 and air motor 2 may move the device from one position to another in the state in which the device is kept pressed against the surface of the workpiece 40 so as to continuously clean the surface of the workpiece 40.

It will be understood from the foregoing description that the present invention provides a portable blasting device which is very small in size and light in weight and can be easily carried by the operator by virtue of the fact that compressed air is merely required for actuating the working components thereof. Further, the provision of the guide means 11 in the cabinet 1 is advantageous in that the abrasive materials impinges repeatedly against the surface of the workpiece 40 thereby effectively cleaning the workpiece surface over a wide area. Furthermore, the provision of the communication conduit 23 between the dust separator 17 and the cabinet 1 is advantageous in that fine dust particles floating in the cabinet 1 can be effectively collected. Moreover, the provision of the deflector means 21 in the dust separator 17 is advantageous in that the dust can be effectively separated from the abrasive materials. An additional advantage resides in the fact that the impeller 5 is light in weight and inexpensive and can be easily replaced or repaired since the impeller 5 is in the form of the integral unit consisting of the metal plate 41 and blades 42.

What is claimed is:

1. A portable blasting device comprising in combination a cabinet having an opening and a sealing member made of rubber or synthetic resin like, said sealing member being disposed around said opening so that surface grinding and abrasive materials blasted toward the surface of a workpiece through said opening can be confined within the cabinet; a centrifugal blasting means mounted on said cabinet and provided with an impeller adapted to be driven by an air motor for imparting the centrifugal action to said materials supplied thereto and blasting said materials toward said surface to clean it; a container for said materials communicating with the interior of said cabinet so that the materials having completed the surface grinding and cleaning operation by being blasted onto the said workpiece surface can fall down to be received in said container together with the dust produced as a result of said operation; a dust separator having an aperture for discharging the separated dust therethrough and an air injection means for directing compressed air toward said aperture thereby establishing a negative pressure within said dust separator so that the materials and said dust pneumatically conveyed into said dust separator can be separated from each other and said separated dust can be discharged through said aperture; a dust collector connected to said dust separator for collecting said dust supplied through said aperture of said dust separator; and means for supplying said materials including a throat means connected to said container for supplying the materials and said dust into the dust separator therethrough, and a nozzle means extending into said container for directing compressed air toward said throat means, said nozzle means being operative to impart air pressure to said materials and dust contained within said container for causing them to pass through said throat means at a high speed thereby pneumatically conveying them into said dust separator.

2. A portable blasting device as claimed in claim 1, further comprising a guide means disposed within said cabinet for causing said materials blasted onto and rebounded from said surface to be directed toward it again so that said materials having completed the cleaning operation on a portion of said surface can be utilized again for the cleaning of another portion thereof.

3. A portable blasting device as claimed in claim 1, further comprising a communication conduit means connecting the cabinet to the dust separator for applying the negative pressure established in said dust separator to the interior of said cabinet so that a portion of said dust floating within said cabinet can be drawn into said dust separator.

4. A portable blasting device as claimed in claim 1, further comprising a deflector means disposed within said dust separator for deflecting said materials pneumatically conveyed from said container into said dust separator and directing same toward said centrifugal blasting means so as to prevent said materials from being discharged into said dust collector through said aperture of said dust separator.

5. A portable blasting device as claimed in claim 1, wherein said impeller comprises a rotary plate disposed within the casing of said centrifugal blasting means for making coaxial rotation with said air motor; a plurality of blades provided on the opposite end edges of said plate and formed by bending portions of said plate at substantially the right angles with respect to the plane of said plate for imparting the centrifugal force to said materials supplied thereto so as to direct said materials toward said surface at a high speed; and a distributor securing said plate to the shaft of said air motor and making rotation with said plate for changing the direction of flow of said materials supplied into said centrifugal blasting means so that said materials can be directed toward said blades.

6. A portable blasting device as claimed in claim 1, further comprising a grip handle secured to said cabinet and adapted to be gripped by a operator so that said device can be supported by the operator during the surface grinding and cleaning operation, said grip handle being provided with a valve connected to a source of compressed air for supplying compressed air therethrough, and lever for biasing said valve to the open position when said grip handle is gripped by the operator; a three-way branching means communicating with said valve for branching the stream of the compressed air into three directions when said valve is biased to the open position; a first communication conduit connecting the first branch connection of said branching means to said air motor for supplying the compressed air for driving said air motor; a second communication conduit connecting the second branch connection of said branching means to said nozzle means for supplying the compressed air to said nozzle means; and a third communication conduit connecting the third branch connection of said branching means to said air injection means for supplying the compressed air to said air injection means.

* * * * *