United States Patent

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[54] **CENTRIFUGAL BLASTING WHEEL**

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[52] **U.S. Cl.** **51/9**

[51] **Int. Cl.** **B24c 3/00**

[58] **Field of Search** 51/9

[56] **References Cited**

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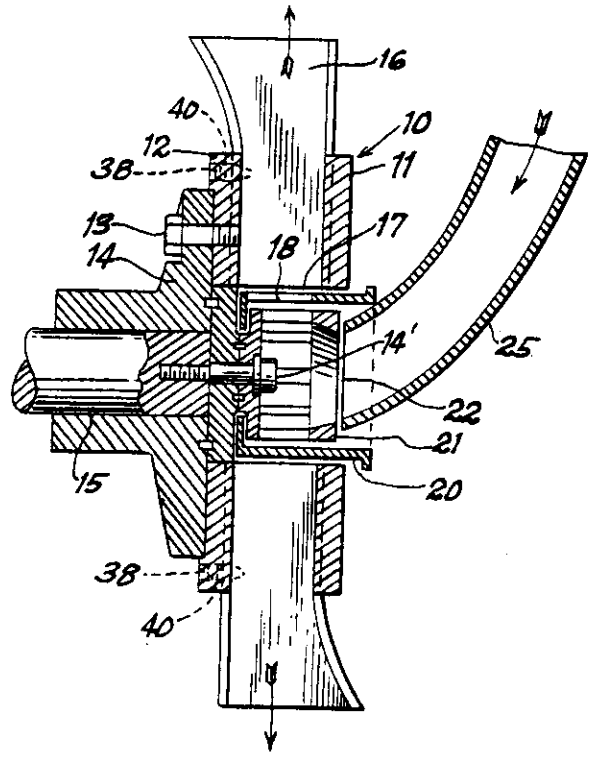
[57] **ABSTRACT**

A centrifugal blasting wheel provided with throwing blades whose throwing surfaces are flat and parallel to the axis of rotation of the wheel at their inner ends and slope gradually so that their outer ends lie in a plane at an angle to the axis of rotation.

14 Claims, 9 Drawing Figures



CENTRIFUGAL BLASTING WHEEL

BACKGROUND OF THE INVENTION

This invention relates to improvement in apparatus for the cleaning or treating of surfaces. More specifically, it relates to improvements in centrifugal blasting wheels and blades for use in such wheels.

Briefly, a centrifugal blasting wheel makes use of a plurality of throwing blades radially mounted to propel an abrasive or some other type of particulate matter against the surfaces of object, which surfaces are to be cleaned or treated by the impact of the particulate matter. Very frequently, it is desired to provide a blast pattern which is very wide to cover the widest possible surface on the object being treated.

Therefore, it is an object of this invention to provide a novel centrifugal blasting wheel which is capable of providing a wide blast pattern.

In the use of a blasting efficiency and economy of operation are objectives which can be measured in a number of ways. Assuming a given workpiece to be cleaned or otherwise treated, the efficiency and economy of a particular wheel can be evaluated by determining the amount of material consumed, the power needed to drive the wheel, and the cleaning time. All of these parameters can be increased as the result of "interference." Interference is the collision of particles thrown by a wheel with particles that have previously impacted on the surface of the workpiece and have rebounded into the path of oncoming particles. The effect of interference is to lessen the effectiveness of the projected oncoming particles so as to compel the use of a smaller amount of particulate material in those areas where the rebound path is the same or close to the projection path. Consequently more time may be required to do the job desired. It has been proposed to reduce interference by the use of a throwing blade which has an angled face so that particles propelled by it will impact on the surface of the workpiece at an angle and rebound away from the oncoming particles. However, the angle blades used have themselves introduced inefficiencies for they introduce surface discontinuities where the particulate material is transferred from the impeller vane and control cage opening to their surfaces. Thus the particles being thus transferred generally are deposited out of phase with the surface of the blade and may bounce along the surface of the blade causing wear and short life.

Accordingly, it is another object of this invention to provide a centrifugal blasting wheel and throwing blade which are effective to reduce interference and therefore increase the efficiency of the wheel in operation.

In some situations, arising as a consequence of the position of the blasting wheel with respect to the workpiece or because the workpiece is a complex surface, it is desired to provide a blast pattern in which the particulate matter leaves the wheel at an angle other than one which is substantially parallel to the axis of rotation. Thus, in the case of a workpiece having one portion overhanging or in some way shielding another, it may be desired to direct the blast at the shielded portion of the workpiece.

Therefore, it is another object of this invention to provide a novel centrifugal blasting wheel and blades therefor which may be arranged to direct the blast at an angle to a direction parallel to the axis of rotation at the option of an operator.

It is still another object of this invention to provide a novel centrifugal blasting wheel and blades therefor which may at the object of an operator be arranged to provide wide or angularly directed blast patterns.

SUMMARY OF THE INVENTION

In one embodiment of the invention, the above and other objects are achieved by providing a centrifugal blasting wheel in which the blades are constructed to have flat surfaces which blend into a sloped surface to direct the blast away from a direction normal to the axis of rotation of the wheel. Means are provided whereby an operator may select the blast pattern desired.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the invention will hereinafter appear, and, for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawings in which:

FIG. 1 is a sectional elevational view of a blasting wheel in accordance with the invention;

FIG. 2 is a perspective view of a throwing blade shown in the blasting wheel of FIG. 1;

FIG. 3 is a top plan view of the throwing blade of FIG. 2;

FIG. 4 is a view along the line 4—4 of FIG. 2;

FIG. 5 is a view along the line 5—5 of FIG. 2;

FIG. 6 is a view along the line 6—6 of FIG. 3;

FIG. 7 is a view along the line 7—7 of FIG. 3;

FIG. 8 is a perspective view of an alternative embodiment of a throwing blade shown in FIG. 1;

FIG. 9 is a sectional view of a control cage forming a part of a throwing wheel; and

FIG. 10 is a perspective illustration of still another embodiment of the invention.

Briefly described, a blasting wheel of the type embodying features of this invention comprises a rotor **10** formed of a pair of spaced circular plates **11** and **12** fixed to each other by means of several spacer bolts or rivets (not shown) and fixed as by bolts **13** onto the end of a hub **14**. The hub is mounted onto a shaft **15** adapted to be turned at high speed by a power source (not shown). Fixed between the plates **11** and **12** are a plurality of radially extending blades or vanes **16** substantially equidistantly spaced to provide a balanced wheel. The blades are usually constructed of wear-resistant materials and designed in such manner that they can easily be replaced when worn out through normal usage.

The blades **16** extend inwardly short of the axis of the rotor to provide a concentric opening **17** in which a device for feeding and controlling the direction of discharge of the particulate substance is positioned. The control device includes a control cage in the form of a hollow cylinder **20** positioned to occupy the opening defined by the inner ends of the blades and having an outside diameter slightly less than the diameter of the concentric opening defined by the blades to provide operating clearances. The control cage is provided with a discharge opening or port **18** in the peripheral wall of the cylinder through which the particulate substance introduced by the impeller into the interior of the cage is passed through the discharge opening onto the inner ends of the blades **16** at a definite controlled location as they rotate past the discharge opening. The

control cage is stationarily mounted in the machine but in a manner to permit circumferential adjustment to position the discharge opening for causing the particulate substance to be thrown from the periphery of the bladed wheel in a predetermined direction. The control cage thus prevents the particulate substance from being sprayed indiscriminately from the periphery of the rotor and, instead, locates and concentrates the delivery thereof to make most effective use in a limited area.

Particulate substance fed to the interior of the control cage is projected through the discharge opening by means of an impeller **21** preferably in the form of a small vaned wheel adjustably secured to the end of the shaft **15** by bolt **14'** for rotational movement with the rotor. The vanes of the impeller lead the throwing surfaces of the blades by a predetermined angle which may be adjusted by the means securing it to the shaft **15**. The impeller used in a conventional centrifugal wheel is provided with a concentric opening **22** at its center through which the particulate substance is fed from one end into the wheel.

In further accordance with the invention a blade **16** is shown in FIGS. **2** through **7**. As seen in FIG. **2**, the blade is provided with a pair of spaced flanges **26** and **28** which extend longitudinally. A propelling or particulate material engaging surface **30** is provided between the two flanges. At its inner end **32**, that is, the surface adjacent the discharge port **18** in the control cage **20**, the surface **30** lies in a plane which is parallel to the axis of rotation of the wheel. By virtue of this arrangement, the blade at this portion of its surface is aligned with the leading edge **19** of the discharge opening so as to receive material from that opening. Further along its length as it extends radially when mounted in a throwing wheel the surface slopes gradually from the flange **26** toward the flange **28** so as to present a sloping surface. The slope is such that at its outer end **34** of the blade the surface **30** is at an angle to a plane parallel to the axis of rotation of the wheel. This gradual slope may be appreciated from an examination of FIGS. **4** through **7**. In order to accommodate the angular translation of the particles, the blade is provided with a portion **35** flared in the direction of the slope. By providing such a flared portion, the blade surface is provided over which the particles may travel without encountering interference from angularly translated particles rebounding from the flange **28**.

By virtue of the construction illustrated, a quantity of particulate material picked up by a blade **16** as it rotates past the discharge opening **18** in addition to being accelerated along the surface will be translated angularly. Thus, that quantity of material as it leaves the end of a blade will generally leave with its main axis of travel in a plane which is at an angle to a plane parallel to the axis of wheel rotation. The angle for the surface of the outer end **34** may range upwardly to 12° to the plane parallel to the axis of wheel while its width may range up to eight inches rotation. When so thrown, the particles will impact at an angle to the surface of the workpiece with an angle of rebound not in the plane of impact and will generally rebound away from the oncoming particles. Interference is the word used to describe the effect when particles of particulate material rebound from the surface of a workpiece and collide with oncoming particles from the wheel. These collisions deflect and/or dissipate the energy of the oncoming particles reducing their effectiveness. By providing a blade in accordance with the invention which is propelled at an angle, the particles will have an angle of impact on the surface of the workpiece which will cause them to rebound away from the oncoming particles rather than toward them, thus reducing the possibility of interference considerably. This is desired because such interference is inefficient as more particulate material and driving energy will be required to overcome it.

An alternative embodiment of a blade in accordance with the invention is shown in FIG. **8**. In the blade of FIG. **8** the slope or twist is from the flange **28** toward the flange **26**. In this embodiment the direction of throw will be opposite to that of the embodiment of FIG. **2**. As with the embodiment of FIG. **2**, the angle of the outer end **34'** of this embodiment is preferably at 5° to a plane normal to the axis of rotation of a wheel when the blade is mounted in the wheel.

It is contemplated that the blade **16** may be held in a wheel by any suitable means which will permit their insertion and removal without great difficulty. As illustrated, the means for retaining a blade in the wheel may be constituted by a conical opening **36** in the flange **28** which, when the blade is mounted between the side plates **11** and **12** and positioned by guide elements provided on those side plates, receives a conical set screw **38** threaded in bushing **40** in the side plate **11**. By rotation of the set screw, the blade may be removed or held in position on the wheel.

In one form of the invention the blades of FIGS. **2** and **8** may be alternated in the wheel and a wide blast pattern obtained. Alternatively, either the blades of FIG. **2** or those of FIG. **8** may be used exclusively and the blast pattern will be directed to the right or to the left. This form may be used when it is desired to provide a direct blast to treat the surface of a workpiece which may be shielded in part by another portion of the workpiece.

In the embodiment illustrated in FIG. **10**, a blade **16'** in accordance with the invention includes a pair of spaced flanges **26'** and **28'**. A propelling or particulate material engaging surface **30'** is provided between the two flanges. At its inner end **32'**, that is, the surface adjacent the discharge opening **18'** in the control cage **20**, the surface **30'** is parallel to the axis of rotation of the wheel but curves away from the direction of rotation of the wheel in order to permit a more efficient transfer of material from the opening onto the surface of the blade. This feature alone in general blade construction and its advantages are disclosed and claimed in my copending application entitled "Centrifugal Blasting Wheel and Blade Therefor," Ser. No. 21,160, filed Mar. 19, 1970. This embodiment therefore provides a blade which has the capability of reducing interference while at the same time increasing the efficiency of a wheel in which it is incorporated.

It will be understood that various changes may be made in the details of construction without departing from the spirit of the invention, especially as defined in the following claims.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a centrifugal blasting wheel having a rotor for rotation about an axis in a given direction, means for mounting said rotor for holding a plurality of radially extending blades having inner and outer ends with their inner ends terminating at points spaced from the center of said rotor to provide a concentric opening, and control means having a discharge port having a leading edge positioned in said concentric opening for feeding and controlling the direction of radial discharge of particulate material to be propelled by the wheel, the improvement comprising radially extending blades mounted on the rotor having surfaces engageable with the particulate material said surfaces at their inner ends aligned with the leading edge of the discharge port of said control means, said surfaces sloping gradually at their outer ends to an angle to a plane parallel to the axis of rotation of the wheel.

2. The centrifugal blasting wheel of claim 1 wherein said blades are equally spaced around the circumference of the rotor and each blade slopes in a direction opposite to the direction of slope on the blade of either side of it.

3. The centrifugal blasting wheel of claim 1 wherein said blades have a surface at their inner ends which is curved away from the direction of rotation of the wheel.

4. The centrifugal blasting wheel of claim 1 wherein said blades are equally spaced around the circumference of the rotor and slope in the same direction away from the plane parallel to the axis of rotation of the wheel.

5. The centrifugal blasting wheel of claim 1 wherein said blades have a flat surface lying in a plane normal to the axis of rotation at their inner ends and twist gradually so that their outer ends lie in a plane ranging up to approximately 12° to a plane parallel to the axis of rotation of the wheel.

6. In a centrifugal blasting wheel having a pair of spaced side walls forming disc members interconnected for rotational movement together about an axis and having pairs of facing guide means extending radially for receiving blades having inner and outer ends extending crosswise between the side walls, one of said members having a central opening formed therein, a control cage of cylindrical shape axially aligned with the axis stationarily mounted within said central opening and having an opening extending through the wall thereof, an impeller rotatably mounted within said control cage concentric with said control cage and having a plurality of vanes with openings therebetween whereby particulate material supplied to said impeller is propelled radially by said vanes through said opening in said control cage; the improvement comprising a plurality of radially extending blades mounted in the guide means between said members, each blade having a surface for engaging and propelling the particulate material tangentially, twisting from a plane parallel to the axis of rotation of the wheel at their inner ends to lie in a plane at an angle to the plane parallel to the axis of rotation of the wheel at their outer ends.

7. In the centrifugal blasting wheel of claim 6 wherein each blade twists in a direction opposite to the direction of twist of the blade on either side of it.

8. The centrifugal blasting wheel of claim 6 wherein each blade twists in the same direction away from the plane parallel to the axis of rotation of the wheel.

9. The centrifugal blasting wheel of claim 6 wherein each blade is twisted gradually so that its outer end is at approximately a 5° angle to the plane parallel to the axis of rotation of the wheel.

10. In the centrifugal blasting wheel of claim 6 wherein each blade has an inner surface curved away from the direction of rotation of the wheel.

11. A blade for use with a centrifugal blasting wheel mounted for rotation about an axis in a given direction, said blade having a surface with inner and outer ends for engaging particulate material and propelling it substantially tangentially from the wheel as the wheel rotates, said surface being twisted so that when it is mounted in the wheel the inner end thereof first engaging the particulate material lies in a first plane parallel to the axis of rotation of the wheel and its outer end lies in a second plane at an angle to the first plane and parallel to the axis of rotation of the wheel.

12. The blade of claim 11 wherein its inner end is flat to lie in said first plane parallel to the axis of rotation of the wheel while its outer end lies in said second plane approximately 5° to said first plane parallel to the axis of rotation of the wheel when the blade is mounted in a wheel.

13. The blade of claim 11 having a pair of spaced flanges on either side of said propelling surface for engagement by means for holding the blade in the wheel.

14. The blade of claim 13 wherein its inner end is flat to lie in said first plane parallel to the axis of rotation of the wheel while its outer end lies in said second plane approximately 5° to said first plane parallel to the axis of rotation of the wheel when the blade is mounted in a wheel.

* * * * *

FIG. 1

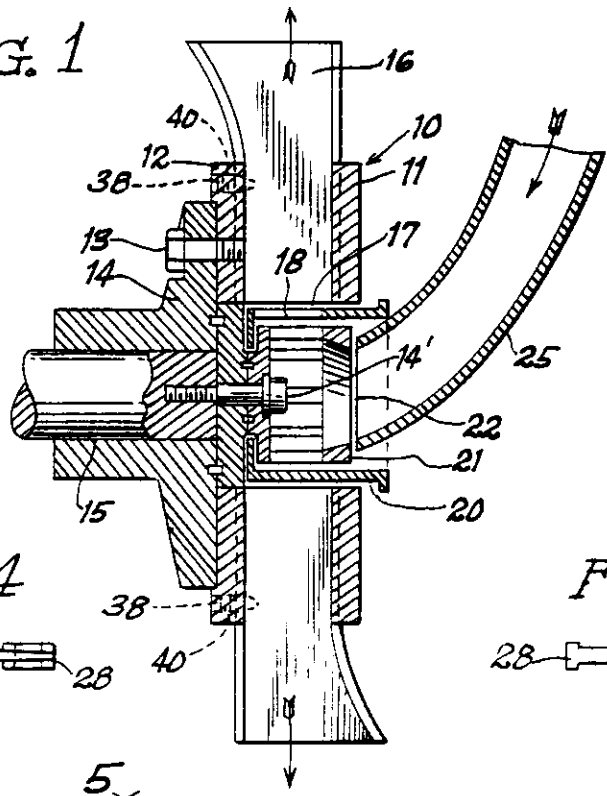


FIG. 9

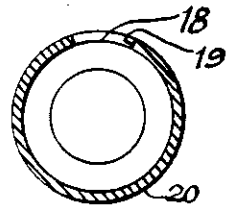


FIG. 4

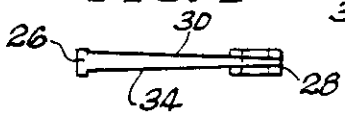


FIG. 5

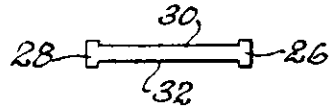


FIG. 2

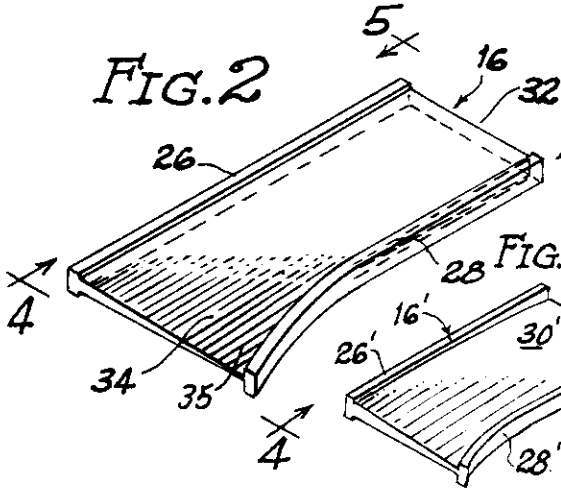


FIG. 10

FIG. 3

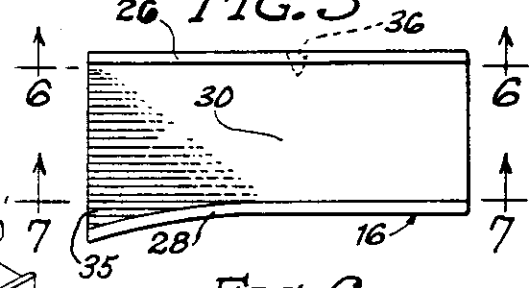


FIG. 6

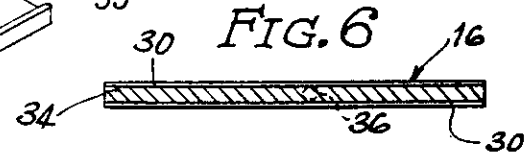


FIG. 8

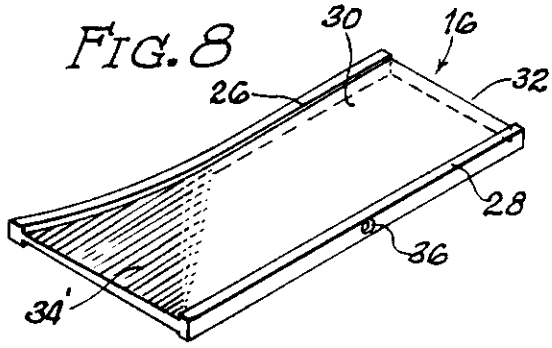
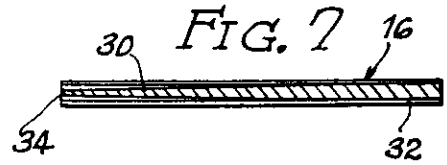


FIG. 7



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