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[54] CENTRIFUGAL BLASTING WHEEL AND BLADE THEREFOR

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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**

UNITED STATES PATENTS

2,708,814	5/1955	Straub	51/9
2,204,632	6/1940	Turnbull	51/9
2,108,211	2/1938	Rosenberger et al.	51/9
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FOREIGN PATENTS OR APPLICATIONS

1,003,441	9/1965	Great Britain	51/9

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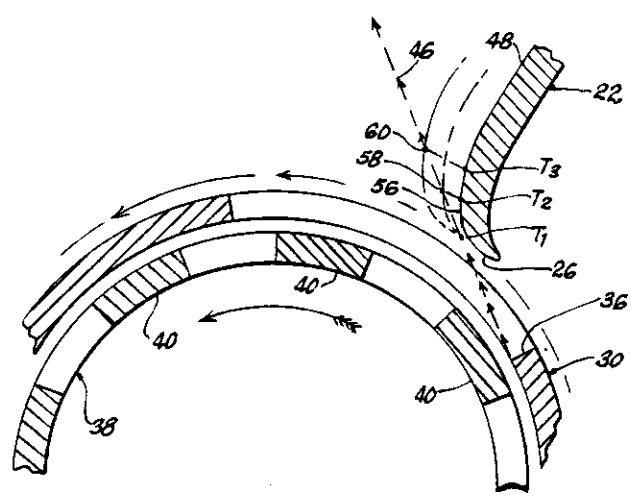
[57] **ABSTRACT**

A centrifugal blasting wheel is provided with throwing blades which have throwing surfaces curved at their inner ends to provide a surface for initial contact with particulate material being thrown. The surfaces are thus traveling in a plane substantially corresponding to the plane to which the particulate material is being propelled onto the blades in order to effect a smoother and more efficient transfer of material to the surface of the blades.

7 Claims, 3 Drawing Figures



CENTRIFUGAL BLASTING WHEEL AND BLADE THEREFOR

BACKGROUND OF THE INVENTION

This invention relates to centrifugal blasting wheels. More specifically, it relates to improvements in the blade structure of such wheels.

Centrifugal throwing or blasting wheels used for the cleaning or other treatment of the surface of workpieces such as castings have a rotor carrying a plurality of throwing blades. At the center of the rotor there are provided elements for receiving particulate material, imparting velocity to it and thus controlling its direction of discharge onto the surfaces of circumferentially spaced throwing wheels. The throwing blades increase the resultant velocity of material to direct it against the surface of a workpiece.

It has long been known the efficiency of a cleaning or treating operation can be increased by increasing the velocity of the media as it leaves the surfaces of the blades. Efforts to accomplish this by increasing the drive horsepower and/or the rotational velocity of the wheel have been used. However, there are practical limitations on these kinds of approaches — limitations imposed in large part by the economics of the matter and practical engineering problems.

Therefore, it is an object of this invention to provide a novel centrifugal blasting wheel which is capable of producing a higher velocity of material being thrown without requiring greater drive horsepower and/or rotational velocity.

It is another object of this invention to provide a novel centrifugal blasting wheel which may be operated with greater overall efficiency and economy than heretofore possible with such wheels.

As a part of the problem of economy in the operation of centrifugal blasting wheels, it is desired to provide for the greatest possible life of the components of such wheels. Of all the components the one subject to the most rapid wear and need for periodic replacement is the blade. Blade wear is most rapid in large part because of the manner in which the particles being propelled are picked up by the throwing surface of the blade, travel radially along its length and are accelerated.

In the operation of these wheels the particulate material supplied to the center of the wheel is subjected to centrifugal force which is attempting to force it outwardly. However, it is confined by the wall of the control cage except for an opening in the wall of that cage which is circumferentially adjustable to determine the direction of discharge. The material leaves this opening to encounter the throwing surface of a blade and travel along that surface to the end. Because this surface has a greater angular speed than that of the material the pick-up of the particles by the surfaces of the blades in the wheel is not smooth. In a certain sense, the blade "bats" the particles and in this manner interrupts their direction of movement. Many particles as the result of this will bounce along the surface of the blade and cause uneven wear spots. In addition, available energy is lost as the result of the significant change of direction of movement so that the final velocity is less than that theoretically available.

Accordingly, it is another object of this invention to provide a novel centrifugal blasting wheel which is not subject to rapid wear as the result of the impact of particles of particulate material on its surface.

SUMMARY OF THE INVENTION

In order to achieve the foregoing and other objects, an embodiment of the invention is constituted by a blasting wheel having a plurality of radially extending throwing blades which are provided with throwing surfaces shaped to effect a smooth and efficient translation of particles of particulate material being propelled onto those surfaces.

BRIEF DESCRIPTION OF THE DRAWING

The invention is set forth in the claims while the structure and operation of an embodiment thereof may be understood by reference to the detailed description and the drawing in which:

FIG. 1 is an elevational view, partially in section, of an embodiment of the invention;

FIG. 2 is a sectional view along the line 2—2 of FIG. 1 of a throwing wheel in accordance with the invention; and

FIG. 3 is a partial sectional view of a blasting wheel and blade in accordance with the invention illustrating its operation in use.

DETAILED DESCRIPTION

Referring now to the drawings, a throwing wheel embodying the features of this invention comprises a rear side wall-forming disc member **10** and a front side wall-forming disc member **12** which are secured one to the other in a predetermined spaced-apart relation by spacers (not shown). The rear side wall-forming member **10** is secured by bolts **16** to a hub **18** for rotational movement therewith. The hub **18** is secured on a shaft **20** for rotational movement.

Reference numeral **22** indicates an improved throwing blade embodying the features of this invention. A plurality of blades are mounted to extend crosswise between the front and rear side wall-forming disc members **10** and **12** generally in the radial direction with the outer edges **24** of the blades. In the embodiment illustrated, the outer edges may reach beyond the periphery of the wheel while the inner edges **26** terminate short of the axis about which the wheel rotates to define a central opening **28** therebetween. The wheel may be partially enclosed in a stationary housing (not shown), opened on one side so that particulate cleaning or treating material may be thrown by the wheel onto the work.

Fitting into the opening **28** is a control cage in the form of a tubular member **30** having an annular flange **32** extending inwardly from the rearward end thereof while its forward end portion **34** extends beyond the front wall-forming disc member **12** for engagement with means, such as the wall of the housing (not shown) so that the control cage may be supported stationarily within the central opening. The control cage is provided with a discharge opening **36** in the periphery thereof through which particulate material fed into the control cage is projected onto the blades. The location of the discharge opening is adapted to be adjusted by turning movement of the control cage relative to the housing thereby to provide directional control to the particulate material thrown from the wheel.

Mounted within the control cage is an impeller **38** which may be of the type described in the patent to Straub U.S. Pat. No. 2,708,814 issued May 24, 1955. The impeller is formed with a plurality of vanes **40** extending forwardly to a conically shaped lead-in section **42** which tapers outwardly from the feed end to the bladed section of the impeller. The impeller is secured by means of a bolt **44** to the end of the shaft **20** for rotational movement with the shaft.

Means (not shown) are provided which communicate with a source of particulate material for the delivery of material onto the conical surface **42** of the vaned impeller **38**. In operation, material deposited upon the lead-in portion of the vaned impeller has a rotational movement imparted to it as it advances rearwardly over the conical surface to the vanes **40** so that the material will flow smoothly onto the vaned section where the vanes operate to propel the material outwardly with considerable force through the discharge opening **36** of the control cage **30** and onto the leading side of the inner edges of the blades or into the paths thereof.

The particulate material thrown by the impeller vanes tends to be urged outwardly by the centrifugal force imparted by the rotating impeller but is constrained by the inner wall of the control cage **30**. Due to the velocity imparted by impeller vanes it tends to travel around that inner wall until it reaches the discharge opening **36** where it exits from that opening in an interrupted stream or slugs along the line of arrows **46** substantially tangent to the inside wall to be picked up by the

leading edge of a blade. At this point it is contacted or picked up by throwing surfaces of the blades and moves radially outwardly over the faces of the blades to be thrown from the ends thereof with considerable force and velocity onto the surface to be treated. By rotational movement of the control cage the direction of the pattern formed by the particulate material thrown from the wheel may be regulated and controlled.

The throwing blades 22 embodying this invention comprise elongated hardened members of generally rectangular shape having a relatively smooth top face or throwing surface 48 over which the particles of particulate material travel from the inner end 26 outwardly to be discharged centrifugally from the wheel.

Each blade when mounted in a wheel is inserted between guides 50 formed on the inside of the discs 10 and 12. The guides are equally spaced circumferentially so that a balanced wheel is achieved. When inserted in the guides, the blades may be held in the wheel by any suitable means. In the embodiment illustrated, this means may take the form of a conical screw 52 passing through the wall-forming member 12 and engaging in a conical opening 54 in the side of each blade.

It should be noted that the particular wheel, blade guides and blade retaining means are illustrated for purposes of exemplification only. Other wheel designs, for instance those having only one side wall or side walls extending out to the top of the blades, and different blade retaining means may be used.

As the particles are propelled through the discharge opening 36, as may be seen by the line of arrows 46, their velocity has radial and tangential components. The radial component is a function of the wheel RPM and the radius of the inner wall of control cage 30. Inasmuch as the inner end 26 of a blade has a radius from the center of the wheel greater than that of the inner wall of the control cage, its radial velocity is greater than that of the inner wall and therefore greater than that of the particles. Consequently, in prior art blades which present a straight oncoming surface to the stream of particles not only do the particles encounter a surface moving at an angle to their path of travel but also one which has a significantly higher velocity. The result is that particles experience an abrupt change of direction and some of their kinetic energy is dissipated in shock deforming either the particles or the blades. In addition, there is a tendency to "bat" some of the particles so that they move ahead of the blades but a short time later impact on a portion of the throwing surface further out and cause wear spots.

In accordance with the invention in order to eliminate the above problems, a blade 22 is provided with a surface 56 which is curved at its inner end in a direction away from the throwing surface 48 and the direction of the rotation of the wheel, as seen in FIGS. 2 and 3. Such curvature may be termed a negative or reverse curve and continues from the inner end 26 to the blade to a point radially outwardly where it blends smoothly with the rest of the throwing surface which is straight in cross section or angles back as shown in FIG. 3.

In order to appreciate the effect of the curved surface 56, reference may be had to FIG. 3. In this figure, the line of arrows 46 represents the path of a slug of particles being propelled through the discharge opening 36, which path is substantially tangent to the inner wall of the control cage 30. As may be seen in this figure, the impeller and blades are assumed to be rotating counterclockwise so that the curvature of the blade 22 is to the right as shown in that drawing.

As may be seen in FIG. 3, the first contact of the bottom of the blade with a particle occurs at a time T_1. At a time T_2 the blade has advanced to a first dotted line position and points further up or radially outwardly on the curved surface 56 are in contact with particles that have traveled further along the line 46 after discharge from the opening 36 than the first particles encountered by the bottom of the blade at the time T_1. Thus, the particles contacted at the time T_2 will contact the blade at the point 58. At a still later moment in time, T_3, the blade has advanced to the second dotted line position and particles still further along the line 46 will contact the surface of the blade at the point 60. The points and times indicated illustrate what occurs along the entire surface 56 while the blade is picking up particles from the stream exiting from the discharge opening. After initial engagement with the surface 56, the particles travel outwardly along the rest of the surface 48 to be thrown from its outer end.

The curvature of the surface 56 is such that at a moment of contact with a particle a point on that surface is traveling along a line which is substantially parallel to the line 46. Thus, there is no abrupt change of direction of those particles, dissipated energy in shock or causing them to be "batted." Consequently, the efficiency of the mechanism of transfer to the throwing surfaces 48 is increased and it is possible to obtain high particle velocity and force at the point of discharge from the wheel without increasing wheel RPM or drive horsepower.

The precise curvature of the surface 56 will be determined by the wheel parameters such as RPM, control cage radius, etc. with the objective being to have points thereon lie in a plane as near to parallel to the path of the stream of particles as possible. Thus, the surface may be the arc of a circle or it may be more complex, as for instance a portion of an ellipse or the combination of the arcs of a number of circles of different radii.

It will be understood that changes in the type of blasting wheel, blade guides and locking means, details of blade design and other details of construction without departing from the spirit of the invention may be made, 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 and provided with a central opening, means mounted within said central opening for propelling particulate material supplied thereto radially and tangentially outwardly, and a stationary control cage having an inner peripheral surface and a discharge port mounted within said central opening whereby the particulate material is propelled substantially tangentially to the inner peripheral surface of said control cage for controlling the direction of discharge of the particulate material; the improvement comprising a plurality of spaced radially extending blades having discharge ends extending from said central opening for propelling the particulate material from said discharge ends; each blade being provided with a propelling surface for engaging the particulate material, said propelling surface having a curved portion at its inner end curved away from the remainder of the propelling surface and the direction of rotation of the wheel.

2. In the centrifugal blasting wheel of claim 1 wherein the propelling surface of each blade outwardly from said curved portion lies in a plane parallel to the axis of rotation of the wheel.

3. In the centrifugal blasting wheel of claim 1 wherein the radius of curvature of said curved portion is such as to present a surface portion traveling in substantially the same plane as a particle of particulate material at the point of contact with such material by a blade.

4. A blade for use with a centrifugal blasting wheel having an intended direction of rotation about an axis, said blade having inner and outer ends with a flat throwing surface extending therebetween for engagement with particulate material to be thrown by the wheel which surface is curved at the inner end in a direction away from its throwing surface and its intended direction of rotation.

5. The blade of claim 4 wherein said throwing surface lies in a plane parallel to the axis of rotation of the wheel above said curved surface.

6. The blade of claim 4 wherein the curvature of said curved surface is such as to provide a surface having points traveling substantially in the same plane as a particle of particulate material at the point of contact with such particle by the blade.

7. The blade of claim 4 wherein the curved surface of the blade starts at the inner end in a direction away from its intended direction of rotation and curves back at its outer end.

* * * * *

FIG. 1

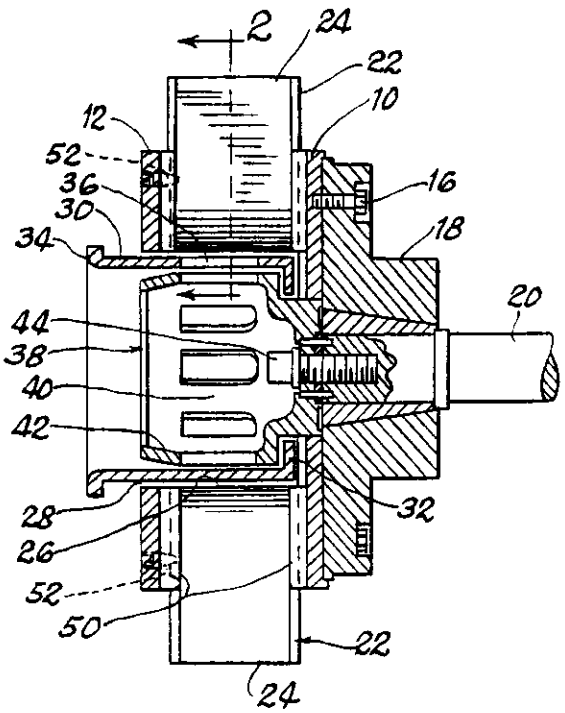


FIG. 2

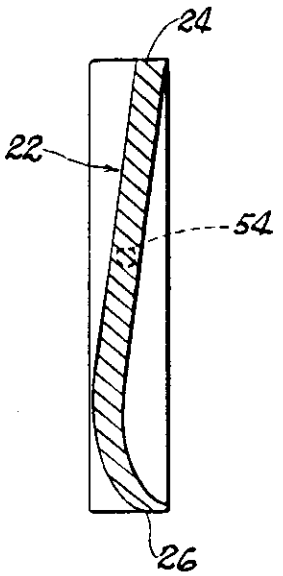
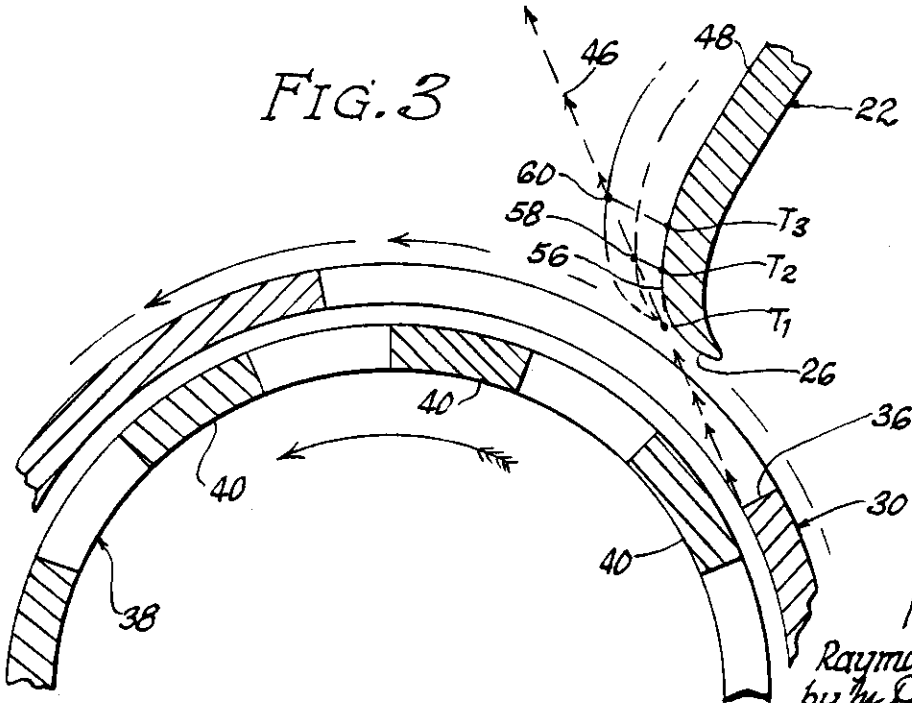


FIG. 3



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