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CENTRIFUGAL BLASTING WHEEL

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Fig. 1

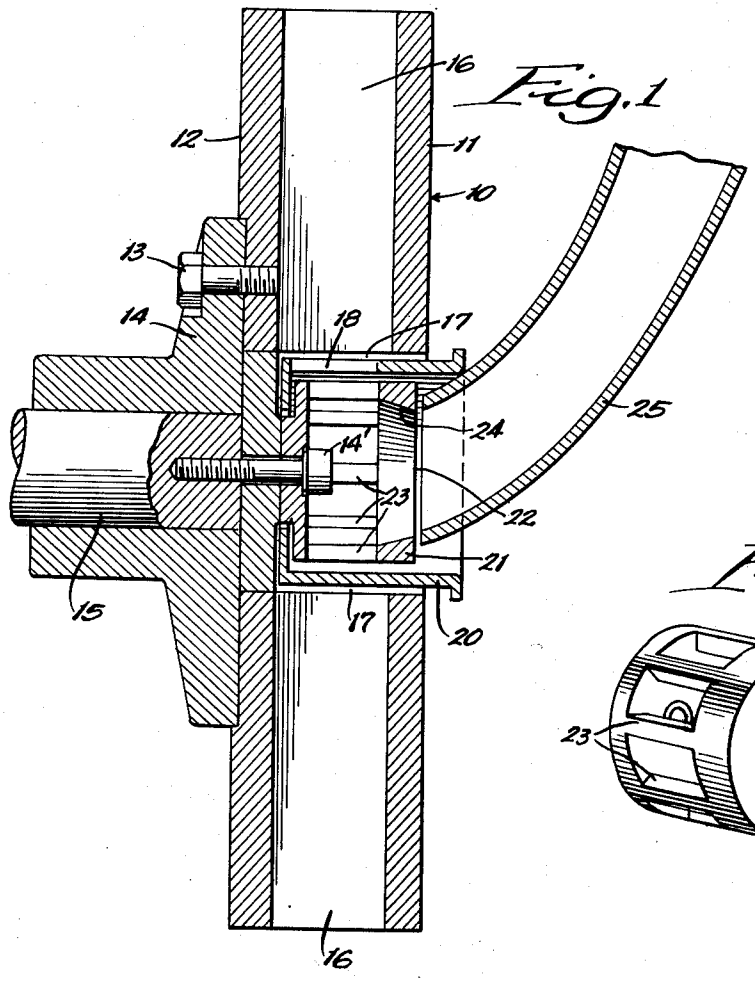


Fig. 2

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CENTRIFUGAL BLASTING WHEEL

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4 Claims. (Cl. 51—9)

This invention relates to a centrifugal blasting machine and more particularly to a device for accelerating the movement of particulate substances, such as metallic shot or grit, sand and similar non-metallic abrasives, crushed nut shells and the like, to impact surfaces for the purpose of cleaning, peening, eroding, deburring, deflashing and the like.

More specifically, this invention relates to an improvement in blasting wheels of the type described wherein particulate substances are accelerated in radial movement as they travel outwardly along the blades of a wheel and are thrown with high centrifugal force from the periphery thereof against the object to be worked, cleaned or abraded. Obviously in structures of the type described, it is desirable to embody means for limiting the direction of flow of the material thrown by the wheel in order to concentrate the substances onto the surface to be treated. Similarly, it is desirable to increase the capacity of the device as much as possible in order to make most efficient use of the device for the purpose for which it was intended.

As will appear hereinafter, directional control has been achieved by the use of a control cage which delivers the particulate substance to the inner ends of the blades at a determinable location calculated to throw the particulate substance in a predetermined direction by centrifugal force from the periphery of the wheel. While effective directional control has been achieved, it has been found that the characteristics of such control systems which have heretofore been used undesirably limit the amount of particulate substance which can be effectively thrown from the wheel and thereby limits the capacity thereof.

It is an object of this invention to produce a blasting wheel of the type described in which the capacity of the device is markedly increased over equivalent wheels of present construction.

Another object is to produce an improved blasting wheel of the type described having increased capacity thereby to increase the utility thereof without undesirably increasing the wear or break-down of parts.

A further object is to produce a bladed centrifugal blasting wheel of the type described capable of delivering considerably greater volumes of particulate material without loss of directional control and without loss of force thereby to increase the capacity of the machine for accomplishing the work for which it was intended.

A still further object is to produce a blasting wheel of the type described embodying a new and improved feed system to increase the flow rate of particulate substance through the wheel.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, and not of limitation, an embodiment of the invention is shown in the accompanying drawing in which—

Figure 1 is a sectional elevational view of a part of a blasting wheel embodying features of this invention, and

Figure 2 is a perspective view of the impeller device shown in the blasting wheel of Figure 1.

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. 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 into the interior of the cage is passed 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, 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 secured to the end of the shaft **15** by bolt **14'** for rotational movement with the rotor. 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 the conventional impeller, this opening, corresponding to opening **22** in the drawing, is in the form of a hollow cylinder rather than having the conical shape opening **22**, shown in Figures 1 and 2. The particulate substance is actuated by the impeller vanes in the direction of rotation of the wheel and is caused to pass through the discharge opening or port **18** in the control cage onto the inner ends of the blades.

To the present, description has been made of a conventional bladed wheel of the type generally used in the art for blasting with abrasive particles to clean metal castings and the like. For more detailed description, reference may be had to the Minich Patents No. 2,049,466 or No. 2,077,638, or the Unger Patent No. 2,162,139, or the Guendling Patent No. 2,204,587, or the Keefer Patent No. 2,582,702.

It is well known that wear of the impeller, the control cage and the inner ends of the wheel throwing blades is somewhat proportional to the velocity of the particulate substance as it moves across the impeller vanes and through the control cage opening, Since the velocity of particulate substance leaving the impeller vanes is proportional to the outside diameter of the impeller, it has been the practice to keep the control cage and the impeller as small in diameter as practical. However, the amount of particulate substance capable of being fed into the wheel is thereby handicapped.

It is also recognized that each wheel is somewhat limited

in the volume of particulate substance that can be delivered and therefore the amount of work capable of being performed by each machine is limited. The capacity of a wheel may vary from one design to another or between a wheel of one size as compared to another but all wheels of a given type and size have been found to have a common limiting flow rate. When an attempt is made to increase the rate of flow of particulate substance through a wheel, a fairly uniform point is reached at which the wheel becomes choked and is incapable of handling more. When this point is reached, any attempt to increase the feed rate causes a noticeable decrease in the volumetric capacity of the wheel. In order to return the wheel to maximum efficiency, it is necessary first to drain the particulate substance from the feed device.

Thus it is an important object of this invention to increase the flexibility of a blasting wheel of the type described whereby the unit may be caused to maintain a high rate of flow of particulate substance over and beyond that of which it has heretofore been capable without increased proportional wear of parts relative to the amount of particulate substance thrown by the wheel and yet remain capable of efficient operation with normal flow. Under such circumstances the amount of work which could be made available from a wheel might be increased to eliminate the necessity for multiple wheels in certain operations and to increase the work available from a single wheel thereby to achieve the effect of two or more wheels without increased expense or wear on parts.

It has been found that the desired flexibility in operation of the blasting wheel markedly to increase the capacity thereof may be achieved by modification of the impeller assembly to provide a feed section in advance of the bladed section in the form of a conical surface or other surface of revolution **24** gradually increasing in diameter toward the bladed portion whereby responsive to rotational movement of the impeller, particulate substance introduced into the inlet feed section of the impeller is caused to flow smoothly along the conical wall to the vaned portion of the impeller unit. During inward movement of the particulate substance along the conical wall of the feed section, rotational movement is also imparted to the particulate substance whereby the degree of relative movement between the particles and the vanes of the impeller is greatly minimized. As a result, wear on the impeller vanes is markedly reduced and, more important, the elimination of high impact between the particles and the vanes so minimizes turbulence within the impeller section that the possibility of choking is substantially eliminated even when the feed rate is markedly increased to almost twice or more than the amount capable of being fed directly into the vaned impeller, as in practices heretofore employed.

To achieve the desired improvement it is important that the feed section of the impeller be substantially free of vanes or other obstructing surfaces which might impact the particles upon introduction and cause turbulence. It is also important that the wall in the feed section increase in diameter from the feed end to the vaned section so as to cause the particulate substance to flow smoothly inwardly to the vaned section responsive to centrifugal force. This increasing diameter in the wall of the feed section may be in the form of an arcuate section of spherical or elliptical contour or it may be a taper such as is formed of a conical section whereby the inner wall of the feed section will define a frusto-conical shape having the end of smallest diameter extending forwardly to provide a concentric opening through which the particulate substance may be introduced.

In operation, abrasive particles or other particulate substance is deposited from a feed spout **25** onto the inner surface **24** of the conical section forming the feed end of the impeller **21**. As the particles engage the conical surface of the rapidly rotating impeller, frictional forces become effective to impart rotational movement to the particulate substance. Responsive to the centrifugal action of the particles on the curvilinear or tapered surface, the particulate substances are caused to shift in the direction to the left in the device shown in Figure 1 and enter the vaned section while rotating almost at the speed of the vane members **23**. As a result, relative velocities between the particles and the vane members are minimized whereby an impacting relation of the type which has heretofore caused turbulence is markedly reduced or substantially eliminated. Whatever the reason, it has been found that the amount of particulate substance capable of being handled by the assembly without choking is about twice or more than the amount capable of being handled by an equivalent unit in the absence of the improved feed section on the impeller.

Because of the favorable conditions existing in the feed section of the impeller for advancing the particulate substance smoothly and with turning movement into the vaned section, it is possible to avoid many of the critical requirements heretofore believed necessary for maintaining a desirable feeding relation. For example, the angle of inclination of the feed spout **25** can be greatly increased and can be placed in a more desirable position thereby to increase the flow of particulate substance without interfering with the control cage or other parts of the device. As a result, more rapid and controlled feed can be maintained with less space requirements and with smoother and more flexible operation.

By way of comparison, test runs were made in conventional centrifugal blasting wheels with and without the conical feed section positioned in connection with the vaned impeller. All tests were run with ferrous abrasive particles fed from a static supply immediately adjacent the top of the feed spout **25**, thereby taking no advantage of velocity of abrasive entering the feed spout. In practically every instance, the flow rate was capable of being increased as much as two-fold or more by the use of the conical feed section. Without the conical section, the maximum flow rate obtainable in a conventional 19½ inch by 2½ inch wheel operating at a speed of 2250 R. P. M. and with no velocity head of abrasive as defined above was 750 pounds abrasive particles per minute. With the conical feed section, the flow rate of the same machine could be increased to 1350 pounds per minute. Without the conical feed section, the maximum flow rate obtainable with a 19½ inch by 5 inch wheel operating at 2250 R. P. M. and with no velocity head of abrasive as described above was about 1000 pounds per minute, while the capacity of the same wheel could be increased to 2100 pounds per minute with the conical feed section on the impeller.

The increase in rate of flow of particulate substance from a machine has been found proportionally to increase the amount of work performed. This indicates that there is no loss of action by reason of any interference between the particles thrown in higher concentration from the periphery of the wheel or from rebound of particles off of the surface upon which the work is being performed. It has also been found that there is no loss experienced in directional control of the particles thrown from the periphery of the wheel by reason of the increase in flow rate. The percentage of particulate substance thrown from various locations about the periphery of the wheel corresponds to the ratio in standard units of the type heretofore employed.

In view of the full utilization of the increased volume of abrasive particles capable of being thrown from a wheel embodying features of this invention, it will be evident that a wheel may now be used to accomplish the amount of work formerly requiring a wheel of larger size or formerly requiring the use of a plurality of wheels. It will also be apparent that a wheel capable of twice the capacity of present wheels of equivalent size may be operated at different flow rates with proportional ef-

fectiveness thereby to embody greater flexibility in use in machines of the type described.

While description has been made of the application of this invention to a preferred form of wheel, it will be understood that the inventive concepts may be adopted for use with other types of centrifugal wheels such as those having circular side plates on one side only, as at **12** in Figure 1, with the blades being fastened on one side only to the side plate.

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

I claim:

1. In a centrifugal blasting wheel, the combination of a rotor having a plurality of substantially equally spaced apart radially extending blades mounted for rotational movement at high speed about an axis and terminating short of the axis to provide a central opening, a control cage of cylindrical shape axially aligned with the rotor and stationarily mounted within the central opening between the rotor blades and having an opening extending through the wall thereof, and an impeller mounted within the stationary control cage for rotational movement at high speed about the axis, said impeller being formed with an inner section concentrically aligned with the control cage having a plurality of vanes with openings therebetween and an integral feed section in advance thereof having its interior walls free of vanes and smoothly decreasing in dimension from the inner vaned portion to the outer inlet portion, and means for introducing the particulate substance onto the outer inlet end portion of the feed section so as to cause the substance to flow smoothly toward the vaned section while acquiring rotational movement so that the substance flows smoothly into the vaned section.

2. A centrifugal blasting wheel as claimed in claim 1

in which the outer section of the impeller is formed with an interior wall of frusto-conical shape with the base adjacent the vaned section of the impeller.

3. In a centrifugal blasting wheel, the combination of a rotor having a plurality of substantially equally spaced apart radially extending blades mounted for rotational movement at high speed about an axis and terminating short of the axis to provide a central opening, a control cage of cylindrical shape axially aligned with the rotor and stationarily mounted within the central opening between the rotor blades and having an opening extending through the wall thereof, and an impeller mounted within the stationary control cage for rotational movement at high speed about the axis, said impeller being formed with an inner section dimensioned to correspond in length with the control cage opening and having radial vanes with openings therebetween and an outer feed section in the form of a hollow surface of revolution having an internal wall smoothly increasing in diameter from the outer inlet end portion inwardly toward the vaned section of the impeller, and a feed spout having its outlet end portion aligned with the feed section and terminating adjacent the inlet end to deposit the particulate substance onto the inlet end portion of the feed section so as to cause the substance to flow smoothly toward the vaned section while acquiring rotational movement so that the substance flows smoothly into the vaned section.

4. A centrifugal blasting wheel as claimed in claim 3 in which the interior wall of increasing dimension of the impeller defines a curvilinear section.

References Cited in the file of this patent

UNITED STATES PATENTS

2,204,632	Turnbull	June 18, 1940
2,275,434	Hobson	Mar. 10, 1942
2,352,588	Rosenberger et al.	June 27, 1944