June 18, 1940. E. R. HUGHES 2,204,596

ABRASIVE BLAST MACHINE

Filed April 26, 1938 2 Sheets-Sheet 1

Fig. 1

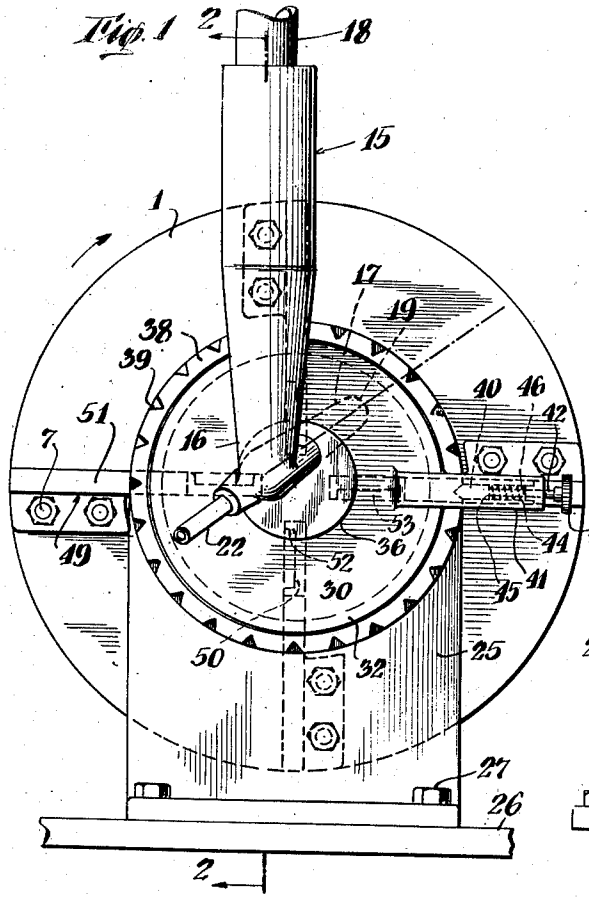


Fig. 2

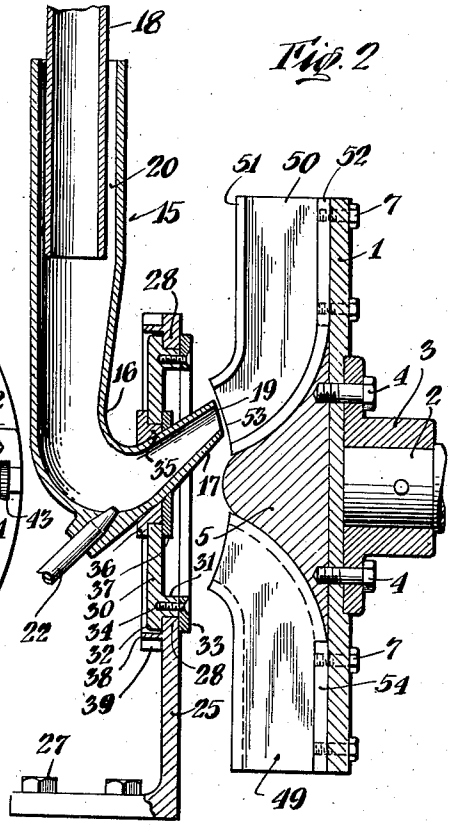


Fig. 3

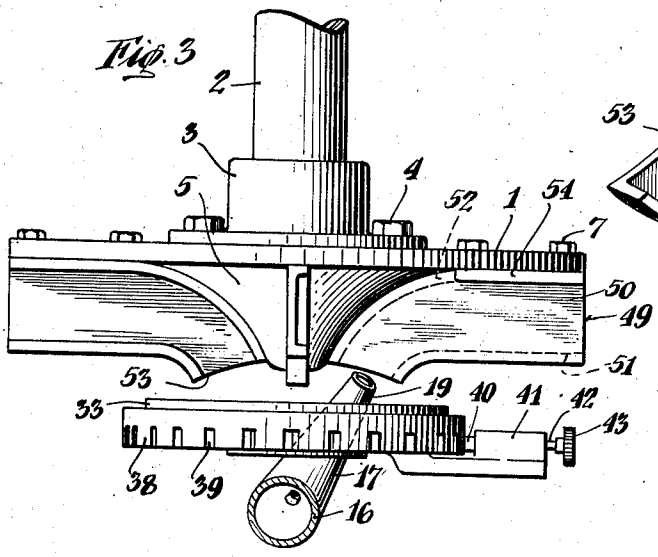
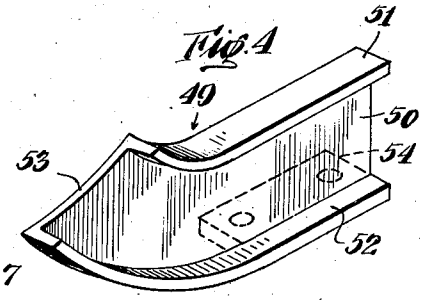


Fig. 4



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Fig. 5

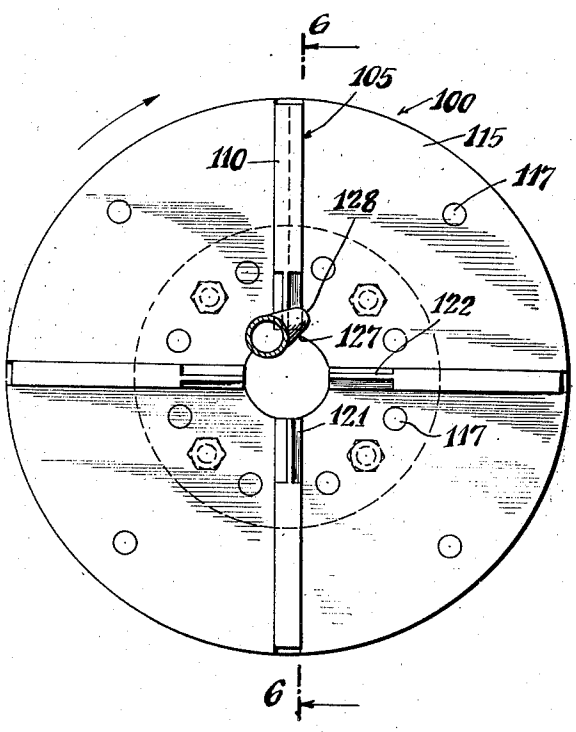


Fig. 6

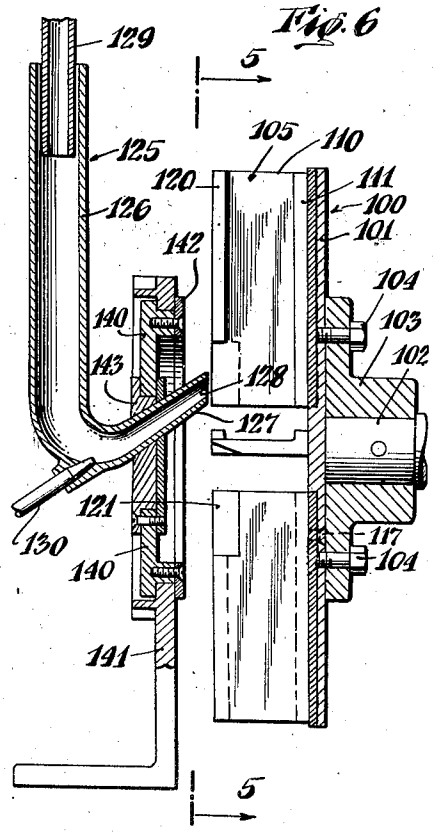
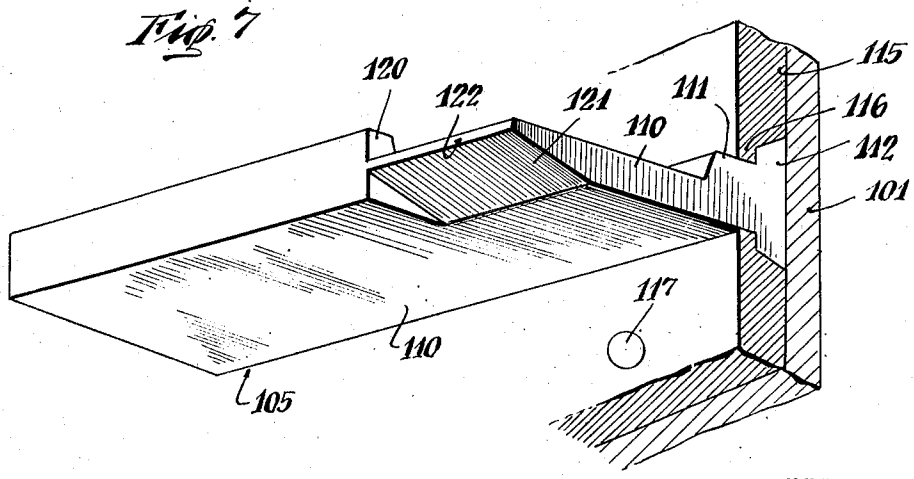


Fig. 7



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Patented June 18, 1940

2,204,596

UNITED STATES PATENT OFFICE

2,204,596

ABRASIVE BLAST MACHINE

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Application April 26, 1938, Serial No. 204,268

8 Claims. (Cl. 51—9)

This invention relates to abrasive blast machines and more particularly to centrifugal means for throwing abrasive at blasting velocities so as to clean and treat metallic castings, forgings, bars, sheets and like material.

In accordance with this invention, the metallic shot, grit, sand or similar cleaning agent, is projected against the article to be cleaned by means of a rapidly rotating throwing wheel having blades or throwing elements radially mounted thereon. The blades and other wearing parts may be made removable and replaceable. The abrasive is fed into the path of the rotating blades near the axis of rotation of the wheel where the peripheral velocity is relatively low.

In order to bring the abrasive under directional control so that substantially all, if not all, the abrasive is thrown in the desired direction, it is necessary that the abrasive be deposited upon the advancing face of the throwing blades during the rotation of the blades through a predetermined limited arc. A serious defect of abrasive throwing wheels, such as illustrated in the Beeg United States Patent No. 554,473, Young & Conley United States Patent No. 859,863, and Weber & Grocholl German Patent No. 539,056, is lack of substantial directional control of the thrown abrasive due to the fact that the blades have a tendency to spatter the abrasive in all directions and the abrasive is not deposited suitably upon the advancing face of the blades when rotating through a limited arc. As a result the abrasive is thrown in all directions resulting in serious damage and destruction to the surrounding shroud or guard and to other parts of the equipment.

In accordance with this invention the abrasive is conducted onto the blades at the inner portions thereof at a substantial initial velocity which approaches the peripheral speed of rotation of the blades at the point where the abrasive passes onto the face of the blades. The abrasive may be given this initial velocity in any desired and convenient manner, but preferably by subjecting the abrasive to pressure so as to cause a rapid, controlled, flow of the abrasive. Propulsion of the abrasive onto the face of the blades may be effected by providing a gravity flow supplemented and aided by pressure devices, such as airblast pressure. The blade edge over which the abrasive flows is also reduced to a relatively thin edge so that the blade itself offers the least possible obstruction to the entry of the abrasive onto the face of the blade. Means are also provided for adjusting the position of the feed device in various clock-dial positions to effect the desired direction of discharge of abrasive from the wheel.

An object of this invention is to provide a centrifugal abrasive blasting machine wherein a high degree of directional control of the thrown abrasive is accomplished.

Another object of this invention is to provide an improved centrifugal wheel and abrasive feed assembly whereby the abrasive can be deposited onto the advancing face of the throwing blades over a limited predetermined arc with a minimum amount of diffusion or scattering of the abrasive.

Other objects of this invention will become apparent as the disclosure proceeds.

Various other features and advantages of the invention will be apparent from the following particular description and from an inspection of the accompanying drawings.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which

Fig. 1 is a side elevational view of my improved centrifugal blasting machine showing more particularly an abrasive throwing wheel and abrasive feeding device associated therewith;

Fig. 2 is a transverse cross-sectional view of my improved centrifugal blasting machine showing more particularly certain structural details thereof, this view being taken on line 2—2 of Fig. 1;

Fig. 3 is a top plan view of my centrifugal blasting machine;

Fig. 4 is an enlarged perspective view of a throwing blade;

Fig. 5 is a longitudinal cross-sectional view through a centrifugal blasting machine of somewhat modified construction, this view being taken on line 5—5 of Fig. 6;

Fig. 6 is a transverse cross-sectional view of the modified centrifugal blast machine illustrated in Fig. 5, this view being taken on line 6—6 of Fig. 5; and

Fig. 7 is an enlarged perspective view of an abrasive throwing blade and mounting therefor used in the wheel illustrated in Figs. 5 and 6.

In the following description and in the claims, various details will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit.

Like reference characters denote like parts in the several figures of the drawings.

The centrifugal blast machine as illustrated in Figs. 1 to 4, inclusive, comprises more particularly a rotor including a rotatable disc or side wall member 1, fixed to a rotatably mounted drive shaft 2 by means of a hub 3 secured to the side wall 1 as by bolts 4. The hub 3 is suitably secured against rotation on the shaft 2, as by a spline (not shown).

A plurality of blades 49, illustrated as four in number, are mounted upon the disc 1, preferably in such a manner as to permit removal and replacement thereof. It is understood that two or more blades can be used in the rotor here disclosed. To permit satisfactory feeding, it is preferable to limit the rotor to not more than eight blades.

The throwing blades 49 may be shaped as illustrated more particularly in Figs. 2, 3 and 4, each blade comprising more particularly a blade wall 50, an outer flange portion 51, and an inner flange portion 52. The inner end of the blade 49 may be formed with a curvature, as illustrated in the drawings, to facilitate the reception of abrasive on the advancing face of the blade wall 50 and further to facilitate the movement of the abrasive across the face of the blade smoothly and continuously, and substantially without abrupt change of direction.

The inner end of the blade 49 terminates in a tapered or thinned inner end portion or lip 53. The inner end or lip portion 53 of the blade receives relatively little wear since the velocity of the abrasive at this point is comparatively low, and for this reason this edge may be reduced in thickness as compared with the outer portion of the blade wall 50. The smoothly curved flanges 51 and 52 facilitate the smooth and uniform flow of the abrasive in its passage over the face of the blades.

The throwing blades 49 may be removably held in fixed position on the side wall 1 in a suitable manner, as for example, by screws 7. Preferably, each blade 49 is provided with a lug extending from the inner side flange 52 at the portion of the blade which lies against the side wall 1. A center block 5 of generally peaked shape is disposed centrally of the rotor and secured to the side plate 1 as by screws 4. Preferably, the center block 5 is adapted to provide a support for the curved tapered inner end portions of the throwing blades and also may serve to guide abrasive onto the rotating throwing blades 49.

The abrasive is fed into the path of the throwing blades 49 through a feed conduit 15 which extends in a suitable direction. The feed conduit 15 comprises a reduced throat 16 and a feed nozzle 17, the end of which extends to closely adjacent the path of rotation of the reduced end portions 53 of the blades 49. The abrasive is supplied to the conduit 15 through a suitable feed pipe 18, which extends into the conduit 15 a substantial distance, and preferably is spaced therefrom to provide an air space 20 therebetween.

Centrifugal abrasive throwing wheels to effectively clean hard metallic castings, should develop a peripheral tip blade velocity of 10,000 to 15,000 lineal feet per minute. If a rotor having a diameter of 18 inches is used, for example, the rotor must be rotated from 2200 to 2800 R. P. M. to develop this peripheral velocity. When the rotor is rotating at this high speed, it will be appreciated that the abrasive must be projected onto the face of the blade at a velocity which approaches the speed of travel of the blade at that point if substantial spattering and scattering of the abrasive are to be avoided. This is accomplished by subjecting the abrasive flowing through the nozzle portion 17 of the feed conduit 15 to an acceleration sufficient to cause the abrasive to be ejected from the feed opening 17 at a velocity which approaches the peripheral velocity of the reduced edge portion 53 of the blade where the abrasive passes onto the leading face of the blade, or which may be slightly greater.

In the form shown in Fig. 2, for example, an accelerating force may be applied to the abrasive by providing an air jet nozzle or inlet 22 positioned with its outlet at approximately the junction of the throat 16 and feed nozzle 17 of the feed conduit and positioned to eject air in the general direction of the length of the nozzle 17 and in a sense toward the discharge outlet 19.

Air under pressure is introduced into the jet nozzle 22 and flows through the nozzle 17 in the general direction of travel of abrasive flowing through the feed pipe 15. This not only accelerates the abrasive and hurls it through the discharge opening 19 with the desired velocity, but also serves to prevent any clogging or arcing of abrasive in the feed conduit 15 particularly at the juncture of the throat 16 and feed nozzle 17.

It will be noted that the discharge outlet 19 of the fed conduit is positioned relatively close to the axis of rotation of the rotor. It will be appreciated that it is desirable to position the discharge outlet 19 of the feed conduit relatively close to the axis of rotation of the rotor where the velocity of the blade surface is relatively low, and yet offset radially and entirely on one side of the axis, so as to confine the abrasive feed to a limited arc of the path of rotation of the inner portions of the blades.

The discharge outlet 19 is not only offset radially from the axis of rotation of the rotor but the direction of discharge of abrasive from the discharge outlet is inclined to the radii of the rotor in a sense in the direction of rotation of the rotor. Thus, the abrasive is delivered into the path of the blades in a generally outward direction with a velocity which has a component radially of the rotor and also a component in the direction of rotation of the blades, whereby the abrasive is deposited on the leading faces of the blades with a minimum of shock. Thus turbulence and bounding of abrasive is minimized and a more smooth and even flow of abrasive along the faces of the blades is insured.

The throat 16 of the feed conduit is preferably mounted so that it may be adjusted to various clock-dial positions whereby direction of abrasive discharged from the rotor can be adjusted. Thus, by a proper adjustment of the discharge opening 17 of the feed device, other factors being constant, the abrasive stream may be thrown either downward, or upward, or to either side of the rotor.

The nozzle may be adjustably mounted by a rotatably mounted plate 30 supported upon a suitable bracket 25 fixed to a stationary support 26 as by means of bolts 27. A collar portion 31 provided on the rear of the circular plate 30 is received in a circular opening cut in the bracket 25, and a shoulder portion 32 on the circular plate 30 abuts the outside face of the inner circular rim portion 28 of the bracket. The circular plate 30 is held in rotatable position by the provision of a suitable rim member 33 which

overlaps the inside face of the rim portion 28 of the bracket 25 and is secured in position by screws 34 extending through the shoulder portion 31 of the rotatable plate 30. The throat portion 16 preferably extends through a bushing member 35 which seats within a circular opening provided in the rotatable plate 30. The bushing 35 may be provided with shoulders 36 and 37 which surround the circular edge of the opening in the circular plate 30.

It will be noted that the bushing 35 is positioned so as to support the discharge opening 17 of the feeding device in an off-center position and closely adjacent to the path of the thinned edge portions 53 of the blades. It will thus be appreciated that when the circular plate 30 is rotated, the discharge opening 17 of the feed device may be brought into and positively held in any desired clock-dial position with respect to the axis of rotation of the rotor. Where the feed conduit is to be adjusted to certain positions, a suitably shaped feed conduit is substituted for the feed conduit shown in order to eliminate the necessity for feeding upwardly into the throat portion.

As illustrated more particularly in Figs. 1 to 3 the bracket 25 may be provided with a laterally projecting rim portion 38 which surrounds the peripheral edge of the circular disc 30. Suitably spaced notches 39 may be cut in the rim portion 38 to receive a spring-pressed plunger bolt 40 which is slidably supported in a suitable sleeve 41 fixed to or formed integral with the rotatable plate 30. The plunger bolt 40 sliding within the sleeve 41 is provided with a reduced shaft portion 42 which terminates in a head 43 by which the plunger bolt 40 may be manipulated. A compression spring 44 surrounding the stem 42 and abutting against the shoulder 45 provided on the draw-bolt 40 and a shoulder 46 provided on the interior of the sleeve 41 automatically retains the draw-bolt 40 in cooperative seating engagement with a selected notch 39 in the rim portion 38.

By exerting an outward pull on the head portion 43 the bolt 40 may be withdrawn from the notch in which it is seated, permitting rotation of the circular plate 30 so as to bring the discharge opening 17 of the feeding device into the desired clock-dial position. It will be appreciated that other means may be provided for permitting rotatable adjustment of the discharge opening 17 of the feeding device within the purview of this invention.

The inventive concept represented by the present invention is capable of various embodiments, and a second embodiment of the invention is illustrated in Figs. 5 to 7. This apparatus includes a rotor 100 comprising a balanced side wall 101 mounted on a shaft 102 for rotation, by a hub 103, the side wall being suitably secured to the hub as by bolts 104. The hub 103 is secured against rotation on the shaft in a suitable manner, as by a spline (not shown).

Carried on the side wall member 101 is a plurality of spaced throwing blades 105 which extend in a general direction inwardly from adjacent the periphery of the rotor 100 toward the axis of rotation thereof. Each blade comprises a relatively straight member having a body portion or wall 110, a base 111 and a base flange 112. The base flange 112 preferably is of dovetail construction adapted to engage with correspondingly shaped edge portions 116 of wear plates 115 which are generally segmental in shape. A suitable number of wear plates 115 are provided in accordance with the number of blades and are secured to the side wall member 101 in a suitable manner, as by bolts 117.

The side edge of each blade 105 preferably is provided with a flange 120 on the leading face of the blade, which flange extends from the outer end of the blade to a point short of the inner end. The edge portion of the blade 105, extending from the inner end of the flange 120 to the inner end of the blade is provided with a taper or bevel as indicated at 121, whereby this side edge portion of the blade is of reduced thickness, for a purpose which will hereinafter appear.

For the purpose of feeding abrasive into the path of rotation of the blades 105, a feed conduit 125 is provided. The feed pipe 125 includes a throat or pipe portion 126 which preferably extends downwardly and a nozzle 127 which extends toward the rotor 101 and in a direction generally outwardly of the rotor. The nozzle 127 has a discharge outlet 128 located adjacent the path of rotation of the inner side edge portions of the blades, as illustrated particularly in Fig. 6. Abrasive is delivered to the feed conduit 125 in any suitable manner by a pipe or conduit 129. Preferably the conduit 129 is readily removable from the feed pipe 125 or is readily movable therewith in order to permit adjustment of the feed pipe 125 as hereinafter described.

For the purpose of accelerating abrasive flowing in the feed conduit 125 and discharging it from the discharge outlet 128 with the desired velocity, an air jet nozzle or inlet 130 is provided in the feed conduit 125. The air jet nozzle or inlet 130 is so located and directed that the air jet is pointed in the direction of the discharge outlet 128 and imparts a velocity to the abrasive in this direction. The air jet nozzle 130 is located at the juncture of the throat 126 and the nozzle 127 and thus serves not only to impart a velocity to the abrasive in the desired direction, but also prevents clogging or choking of the feed conduit.

The feed pipe 125 is suitably mounted relative to the rotor 100 in a firm and rigid manner so that it is retained in suitable operating position. Furthermore, the feed conduit 125 is mounted so that the clock-dial position of the discharge outlet 128 can be adjusted relatively to the axis of the rotor.

The mounting means may be constructed in a manner generally similar to the mounting means illustrated in Figs. 1 to 3, inclusive, and described in detail above. It is also advisable in this embodiment to provide one or more additional feed conduits of different suitable shapes to be substituted accordingly where the same is to be adjusted to certain positions.

A circular plate 140 is mounted in a bracket 141 for turning movement about the axis of the rotor 100. The plate 140 may be secured in the bracket 141 by a rim member 142 and may be locked in the desired position by a locking mechanism (not shown) generally similar to that illustrated in Figs. 1 to 3 and described in the accompanying description. The nozzle preferably is positioned in the plate 140 by a bushing 143 which maintains the nozzle in the desired position with the discharge outlet 128 offset from the axis of rotation of the rotor and adjacent the path of rotation of the inner portions of the side edges of the blades.

The feed conduit 125 is positioned so that the discharge outlet 128 is radially offset from the

axis of rotation of the rotor and is located closely adjacent the path of rotation of the reduced edge portions 122 of the blades. The nozzle 127 is so positioned that it directs a stream of abrasive into the path of rotation of the blades in a direction inclined to the radii of the rotor in the sense of rotation of the rotor. Thus, abrasive is thrown into the path of the throwing blades with a velocity having a component radially of the rotor and a component in the direction of rotation of the blades.

Since the abrasive is given an initial velocity in the direction of rotation of the blades, it is deposited on the leading faces of the blades with a minimum of shock and thus is forced outwardly by the rotating throwing blades with a minimum of bounding and turbulence. This not only results in a more desirable action of the throwing wheel, but also minimizes wear of the throwing blades and deterioration of the abrasive particles.

Since the edge portion 122 of each throwing blade across which the abrasive is delivered by the feed pipe 125 is reduced in thickness, there is a minimum obstruction to and interference with the passage of abrasive onto the leading faces of the throwing blades with the result that the spread and direction of the abrasive hurled by the throwing blades can be more accurately controlled. Furthermore, since there is a minimum of interference with the passage of abrasive onto the throwing blades, only a very small portion of the abrasive is diverted and thrown out of the path of the throwing blades.

While certain novel features of the invention have been disclosed herein, and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. An abrasive throwing machine comprising a rotor including a plurality of spaced throwing blades, means mounting said blades for rotation, and means for feeding abrasive into the path of rotation of said blades, said feeding means including a conduit having a portion extending downwardly and a nozzle portion extending in a direction generally toward and outwardly of said rotor, said nozzle portion having a discharge outlet disposed adjacent the inner portions of the blades at a location offset radially from the axis of rotation of said rotor and positioned to deliver abrasive in a direction crossing the radii of the rotor in the direction of rotation of the rotor, and means in said conduit for accelerating abrasive whereby abrasive is discharged into the path of rotation of said blades with a velocity outwardly of said rotor and in the direction of rotation of said blades.

2. An abrasive throwing machine comprising a rotor including a plurality of spaced throwing blades extending inwardly from adjacent the periphery of said rotor toward the axis of rotation and having thinned edges at their inner portions and means mounting said blades for rotation, and means for feeding abrasive into the path of rotation of said blades, said feeding means including a conduit having a portion extending downwardly and a nozzle portion extending in a direction generally toward and outwardly of said rotor, said nozzle having a discharge outlet disposed adjacent the path of the thinned edge portions of the blades and at a location offset radially from the axis of rotation of said rotor and positioned to deliver abrasive in a stream crossing the radii of the rotor in the general direction of rotation of the rotor, and means in said conduit for accelerating abrasive whereby abrasive is discharged into the path of rotation of said blades with a velocity outwardly of said rotor and in the direction of rotation of said blades.

3. A machine for throwing abrasive at blasting velocities comprising a rotor including a side wall member, a plurality of spaced throwing blades carried by said side wall member and extending inwardly from adjacent the periphery of the rotor, and means for feeding abrasive into the path of rotation of said blades, said feeding means comprising a conduit having a discharge outlet adjacent the path of rotation of the inner portions of said blades and offset radially from the axis of rotation of the rotor, said conduit being positioned to direct abrasive outwardly of the rotor and in the general direction of rotation of said rotor, and means comprising an air jet for accelerating abrasive in said conduit.

4. A machine for throwing abrasive at blasting velocities comprising a rotor including a side wall member, a plurality of spaced throwing blades carried by said side wall member and extending inwardly from adjacent the periphery of the rotor toward the axis of rotation, and means for feeding abrasive into the path of rotation of said blades, said feeding means comprising a conduit having a discharge outlet adjacent the path of rotation of the side edges of said blades and offset radially from the axis of rotation of the rotor, said conduit being positioned to direct abrasive in a direction outwardly of the rotor and crossing the radii of the rotor in the general direction of rotation of said rotor, and means comprising an air jet for accelerating abrasive in said conduit.

5. An abrasive throwing machine comprising a rotor including a plurality of spaced throwing blades and means mounting said blades for rotation, and means for feeding abrasive into the path of rotation of said blades, said feeding means including a conduit having a portion extending downwardly and a nozzle portion extending in a direction generally toward and outwardly of said rotor, said nozzle portion having a discharge outlet disposed adjacent the inner portions of the blades at a location offset radially from the axis of rotation of said rotor and positioned to discharge abrasive in a stream crossing the radii of the rotor and in the general direction of the rotation of the rotor, and means including an air inlet in said conduit adjacent the juncture of said downwardly extending portion and said nozzle portion for discharging abrasive from said discharge outlet whereby abrasive is discharged into the path of rotation of said blades with a velocity outwardly of said rotor and in the direction of rotation of said blades.

6. An abrasive throwing machine comprising a rotor including a plurality of spaced throwing blades, means mounting said blades for rotation, and means for feeding abrasive into the path of rotation of said blades, said feeding means including a conduit having a portion extending downwardly and a nozzle portion extending in a direction generally toward and outwardly of said rotor, said nozzle portion having a discharge outlet disposed adjacent the inner portions of the blades at a location offset radially from the axis of rotation of said rotor and positioned to deliver abrasive in a direction crossing the radii of the rotor in the general direction of rotation of the rotor, means in said conduit for accelerating abrasive whereby abrasive is discharged into the

path of rotation of said blades with a velocity outwardly of said rotor and in the direction of rotation of said blades, and means rigidly mounting said conduit adjacent said rotor for angular adjustment of said conduit whereby the clockdial position of said discharge outlet can be adjusted relatively to the axis of rotation of said rotor.

7. An abrasive throwing machine comprising a rotor including a plurality of spaced throwing blades extending inwardly from adjacent the periphery of said rotor toward the axis of rotation and having their inner edge portions of reduced thickness and means mounting said blades for rotation, and means for feeding abrasive into the path of rotation of said blades, said feeding means including a conduit having an abrasive supply portion and a nozzle portion extending in a direction generally toward and outwardly of said rotor, said nozzle portion having a discharge outlet disposed adjacent the path of rotation of the inner edge portions of the blades and at a location offset radially from the axis of rotation of said rotor, said feeding means being positioned to deliver abrasive in a stream crossing the radii of the rotor in the general direction of rotation of the rotor, and means for discharging abrasive from said discharge outlet into the path of rotation of said blades with a velocity in the direction of rotation of said blades.

8. A machine for throwing abrasive at blasting velocities comprising a rotor including a side wall member, a plurality of spaced throwing blades carried by said side wall member and extending inwardly from adjacent the periphery of the rotor toward the axis of rotation, and means for feeding abrasive into the path of rotation of said blades, said feeding means comprising a conduit having a discharge outlet adjacent the path of rotation of the side edges of said blades, each of said blades having a side edge portion of reduced thickness across which abrasive is fed by said feeding means and a side flange portion extending from said side edge portion to the outer end of said blade, each of said flange portions being offset radially from the axis of rotation of the rotor, said conduit being positioned to direct abrasive in a direction outwardly of the rotor and crossing the radii of the rotor in the general direction of rotation of said rotor, and means for accelerating abrasive in said conduit.

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