Sept. 25, 1945. P. J. POTTER 2,385,728

ABRADING APPARATUS

Filed Dec. 11, 1943 3 Sheets-Sheet 1

Fig. 1.

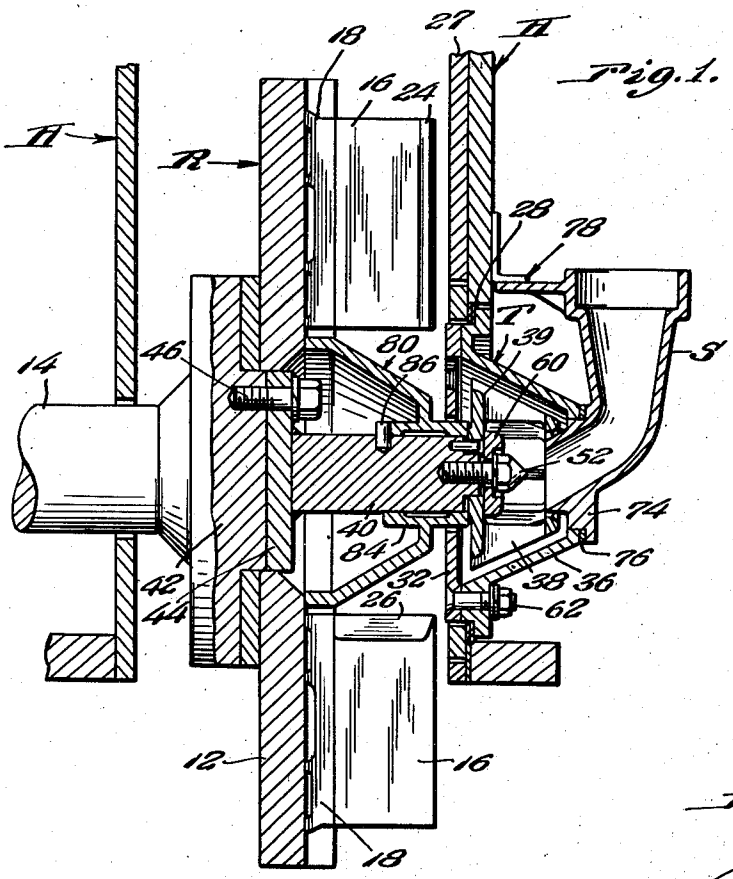


Fig. 9.

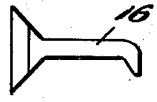


Fig. 8.

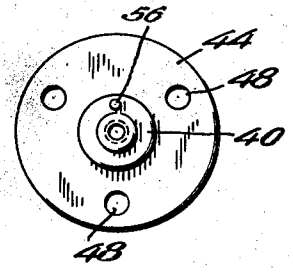
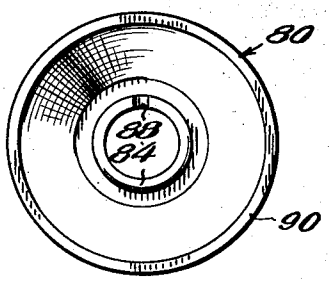


Fig. 7.



Inventor

Percy J. Potter

By William D. Hall

Attorney

Sept. 25, 1945. P. J. POTTER 2,385,728

ABRADING APPARATUS

Filed Dec. 11, 1943 3 Sheets-Sheet 2

Fig. 2.

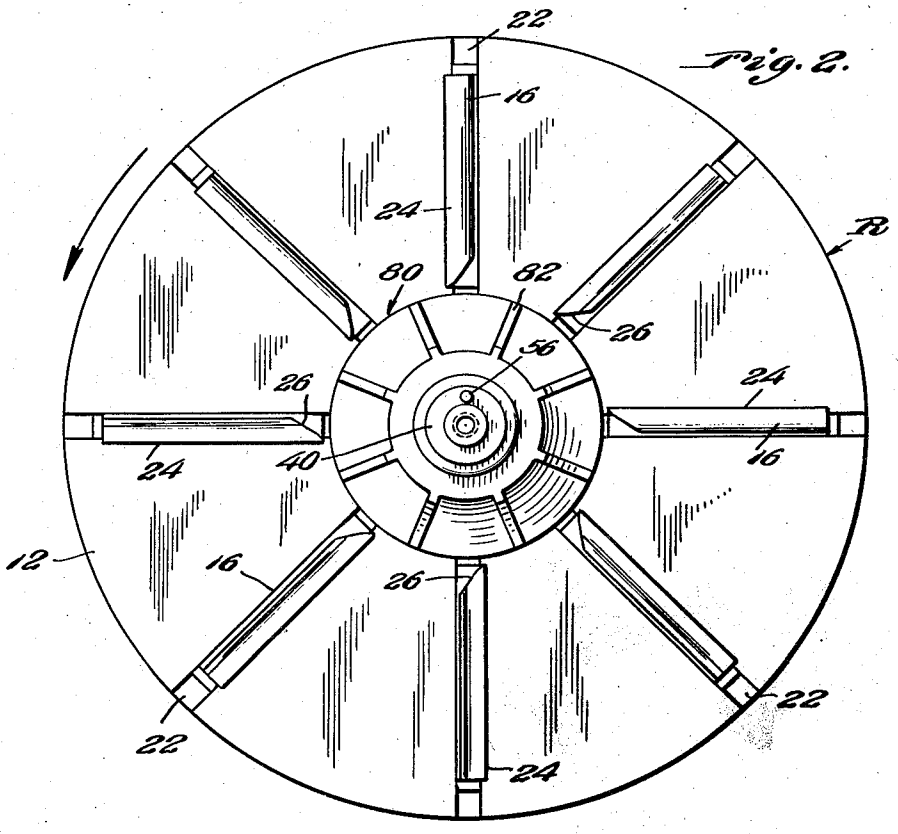


Fig. 10.

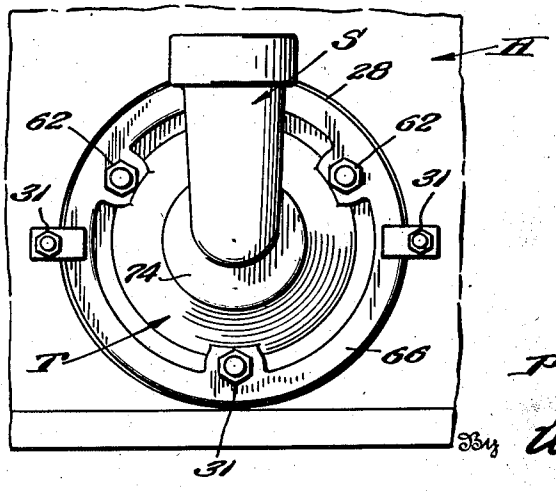
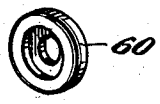


Fig. 11.



Inventor

Percy J. Potter

By William P. Hall

Attorney

Sept. 25, 1945. P. J. POTTER 2,385,728

ABRADING APPARATUS

Filed Dec. 11, 1943 3 Sheets-Sheet 3

Fig. 3.

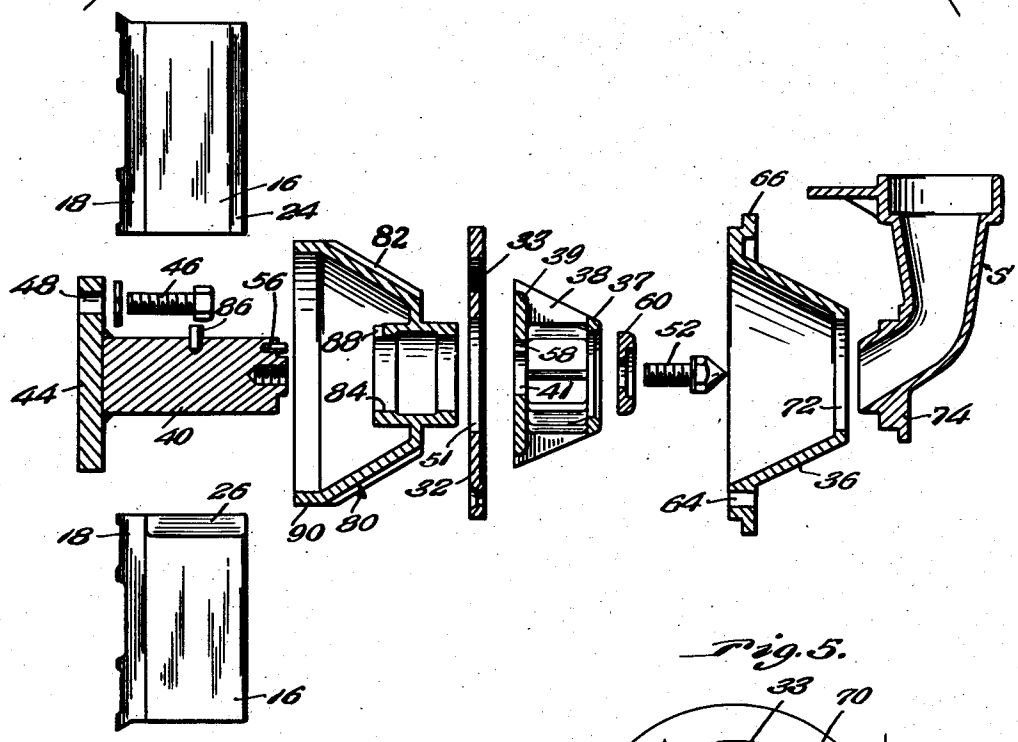


Fig. 4.

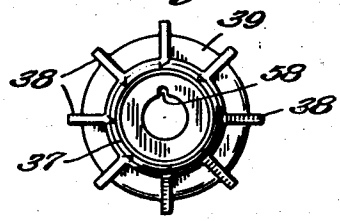


Fig. 5.

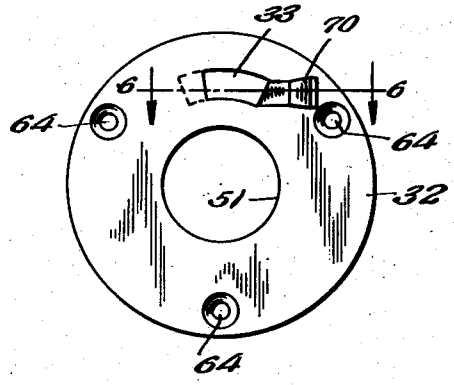
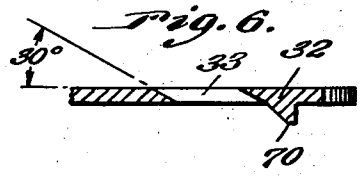


Fig. 6.



Inventor

Percy J. Potter

By William D. Hall

Attorney

Patented Sept. 25, 1945 2,385,728

UNITED STATES PATENT OFFICE

2,385,728

ABRADING APPARATUS

Percy J. Potter, Hagerstown, Md., assignor to Pangborn Corporation, Hagerstown, Md., a corporation of Maryland

Application December 11, 1943, Serial No. 513,941

14 Claims. (Cl. 51—9)

The present invention relates to abrading apparatus of the type for centrifugally propelling or throwing relatively small particles at abrading or blasing velocities. The invention more specifically pertains to means for transferring abrasive particles from a supply source to a predetermined position or zone within the path described by the propeller blades of a rapidly rotating rotor so as to obtain a blast stream limited in arcuate extent at the periphery of the rotor.

An object of the invention pertains to the provision of means having a minimum of relatively movable parts for efficiently transferring the abrasive particles from a supply source to the propeller blades of the rotor wherein the means for transferring the abrasive to the propeller blades of the rotor is mounted in such a manner as to be readily accessible for maintenance and adjustment.

A more specific object of the invention resides in providing a transfer mechanism including a normally stationary control cage so mounted as to be positioned entirely outside a protective housing for the wheel for transferring the abrasive to the inner ends of the propeller blades wherein the mounting of the control cage is simplified and the adjustment thereof circumferentially of the axis of the wheel is facilitated to provide an assembly which may be conveniently dismantled for replacement of parts of the transfer mechanism.

A further and more detailed object of the invention pertains to the provision of a frustoconical shaped normally stationary control cage provided with an end wall having an outlet opening therein removably attached to the frustoconical cage so that the end wall member may be readily replaced when worn without the necessity of furnishing a complete control cage.

Other objects and features of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawings and the following detailed description wherein an exemplary embodiment of the invention is disclosed.

In the drawings:

Fig. 1 is an axial sectional view of a centrifugal blasting wheel embodying the invention.

Fig. 2 is an elevational view of the front face of the rotor with the transfer mechanism and the feed spout removed.

Fig. 3 is an exploded sectional view more clearly showing details of the transfer mechanism and illustrating the manner in which the parts may be assembled.

Fig. 4 is an end elevational view of the impeller.

Fig. 5 is an elevational view of a plate forming an end wall for the control cage.

Fig. 6 is a fragmentary sectional view of the end wall taken on the line 6—6 of Fig. 5 and showing details of the opening therein.

Fig. 7 is an end view of a shield adapted to be arranged at the axis of the wheel.

Fig. 8 is an elevational view showing the end of a stub shaft which is adapted to provide an extension of the main driving shaft.

Fig. 9 is an end view of one of the propeller blades.

Fig. 10 is an elevational view of the feed spout and the frusto conical control cage and showing a portion of the protective housing.

Fig. 11 is a prospective view of a washer member for facilitating the attachment of the impeller to the stub shaft member.

Referring to the drawings and particularly to Figs. 1 and 2 there is shown at R a rotor which includes a disc or runner head 12 suitably secured to and rotatable with a driving shaft 14 and a plurality of propeller blades 16 removably secured to the disc or runner head 12 in any conventional manner. The propeller blades may be mounted on the disc 12 by means of dovetailed edges 18 provided on the propeller blades 16 which are arranged in substantially radially extending dovetailed grooves 22 in or on the disc or runner head. The propeller blades 16 may be securely maintained in operative positions on the runner head or disc 12 against radial outward movement by any suitable conventional means (not shown). Each of the propeller blades is provided with a flange 24 along the free lateral edge thereof and on the forward face of each propeller blade 16 for the purpose of preventing the abrasive particles from spilling over the free lateral edges during radial outward movement of the abrasive particles on the blades. The propeller blades 16 extend inwardly short of the axis of the rotor as shown in Figs. 1 and 2. The inner ends of the propeller blades are preferably bevelled or sharpened as indicated at 26 so as to more efficiently intercept the abrasive discharged by the transfer mechanism.

The rotor hereinabove described and shown in the annexed drawings pertains to the type wherein the propeller blades are supported at one edge by a single disc forming the runner head. It is apparent that changes may be made in the rotor structure without departing from the scope of the invention which relates primar-

ily to the transfer mechanism associated with any type rotor assembly for transferring the abrasive to the inner ends of the propeller blades at a given point or zone in the rotation thereof. Thus other conventional types of rotor structures may be employed in combination with the transfer mechanism hereinafter described.

The rotor is preferably encased so as to prevent spattering or unobstructed movement of erratically moving abrasive particles which may improperly engage the propeller blades 16. The closure means may take the form of a housing partly illustrated at H in Fig. 1 provided with replaceable wear plates one of which is shown at 27. The housing H and the wear plate or plates are provided with an opening 28 which is preferably circular and arranged substantially concentric with the axis of the rotor. In apparatus embodying the invention the transfer mechanism is so mounted as to be positioned substantially entirely outside the housing H and at the same time closing the opening 28 to provide an unapertured shield over a substantial portion of the front face of the rotor.

A centrifugal blasting wheel exhibiting the invention includes a transfer mechanism indicated generally at T in Fig. 1 for supplying the abrasive to the inner ends of the propeller blades 16 of the rotor at a given clock dial position or zone in the rotation thereof. The transfer mechanism T is mounted on the housing H adjacent the opening 28 and is adapted to be secured thereto by means of clamps shown at 31 in Fig. 10. The transfer mechanism may be adjusted circumferentially of the wheel and secured in any adjusted position by manipulation of the clamps 31. Another characteristic feature of the invention relates to a removable end plate or end wall 32 for the normally stationary control cage 36 of the transfer mechanism. This end wall is provided with an opening 33 through which the abrasive is supplied to the propeller blades and the end plate is detachably secured to the control cage so that this end member may be replaced when worn without replacing the entire cage. The end portion of the transfer mechanism assembly also serves to close the opening 28 in the housing H without the use of an auxiliary member for this purpose.

The transfer mechanism includes an impeller mounted for rotation within the normally stationary cage 36. The impeller is provided with a plurality of radially arranged impeller vanes 38 which taper at their outer ends to outline a frusto conical shaped impeller. The impeller is of the hollow center type and the vanes 38 terminate inwardly short of the axis to provide a central space within the impeller. The impeller vanes 38 are maintained in circumferentially spaced relationship by means of end rings 37 and 39 as clearly shown in Fig. 3. These end rings may be formed integral with the vanes 38. The end ring 39 is preferably provided with an aperture 41 for facilitating the mounting of the impeller. The impeller is supported for rotation within the normally stationary cage 36 by any suitable means such as a shaft 40 projecting from the hub portion 42 of the wheel. The stub shaft 40 may be provided with a flange 44 appropriately secured to the hub of the wheel as by means of a plurality of cap screws 46 extending through openings 48 in the flange. The stub shaft 40 may be formed integral with or welded to the flange 44 and extends laterally therefrom as shown in Figs. 1 and 3. The axis of the shaft 40 is aligned with the axis of the driving shaft 14. The stub shaft preferably projects beyond a plane defined by the free lateral edges of the propeller blades 16 and through an opening 51 provided in the end wall or plate 32 of the control cage assembly. The impeller may be secured to the end of the stub shaft 40 in any appropriate manner and in the embodiment illustrated a cap screw 52 extends through the opening 41 in the end ring member 39 of the impeller and is threaded into the stub shaft 40 so as to provide a rigid support for the impeller. In order that the driving connection between the stub shaft 40 and the impeller may be more positive a pin 56 is firmly seated in the stub shaft and extends into a recess 58 provided in the inner ring member 39 of the impeller. The impeller is thus rotated with the rotor. A washer 60 such as shown in Figs. 1 and 11 may be employed with a cap screw 52 to maintain the impeller in operative association with the shaft 40.

The control cage 36 is completed to provide an enclosure by means of the removable end plate or end wall 32 as shown particularly in Fig. 1. The end plate may be of any shape and in the embodiment illustrated takes the form of a disc of approximately the same diameter as the opening 28 in the protective housing H. The end wall member 32 is provided with a central opening 51 through which the stub shaft 40 projects into the control cage for supporting the impeller therein as hereinabove described. The end wall member 32 is detachably secured to the cage 36 by means of a plurality of bolt and nut assemblies as shown at 62 in Figs. 1 and 10. These bolts extend through openings 64 in the end plate 32. Thus the end wall of the cage may be removed and replaced when worn without furnishing the tubular portion of the control cage. The end wall member and the adjacent portions of the cage 36 serve to close the opening 28 in the housing and the control cage thus completes the shield of the front face of the wheel without the addition of an auxiliary member for this purpose. The larger end portion of the cage is provided with a flange 66 which is adapted to seat on the shoulder formed in the opening 28. A plurality of shims may be arranged between the flange 66 and this shoulder so as to adjust the axial position of the control cage. The flange 66 is also engaged by the clamps 31 to maintain the control cage portion of the transfer mechanism in the adjusted position relative to the housing.

In the embodiment illustrated the cage 36 is of frusto conical design and the peripheral wall is so tapered as to be approximately parallel to the outer ends or tips of the impeller vanes 38. In one embodiment of the invention the peripheral wall of the cage 36 slopes with respect to the horizontal at approximately thirty degrees. The control cage 36 is somewhat larger in diameter than the circumference of the impeller so as to provide an annular space between the inner wall of the cage 36 and the path described by the outer ends of the impeller vanes.

The outlet opening 33 is arranged adjacent the tubular wall of the cage 36 at its larger end thereof through which the abrasive is discharged to a position for being picked up by the propeller blades 16. The opening 33 preferably extends angularly through the end wall member 32 forwardly and outwardly with respect to the direction of rotation of the wheel. In the structure illustrated in the drawings the walls of the opening slope at an angle of approximately thirty de-

gress with regard to the face of the end member 32. The end wall 32 may also be provided with a lip or projection 70 for deflecting the abrasive discharged outwardly therethrough in a direction more axially of the wheel.

A centrifugal abrading wheel embodying the invention includes means for supplying the abrasive into the normally stationary control cage. Such means may take the form of a feed spout indicated generally at S in the drawings. The feed spout extends downwardly and the lower end portion thereof is adapted to project into the smaller end portion of the control cage through an opening 72 therein. The feed spout may be provided with a shouldered flange 74 for closing the outer end of the control cage. A yieldable washer 76 may be interposed between the shouldered flange 74 and the outer end of the control cage as shown in Fig. 1. The upper end of the feed spout S may be supported in any conventional manner such as by means of a bracket arrangement indicated generally at 78.

In assembling the transfer mechanism and mounting these parts on the wheel proper the impeller is first arranged within the control cage 36. The end plate 32 may then be secured to the tubular portion of the cage by means of the bolts 62. In this connection it is to be noted that the end plate fits against the inner end portion of the control cage so as to provide a tight joint therebetween to prevent escape of the abrasive particles. Thereafter the control cage with the impeller therein is arranged in the opening 28 of the housing H. Then the impeller may be secured to the end portion of the stub shaft 40 and in this connection the recess 58 is aligned with the pin 56 and thereafter the cap screw 52 may be threaded home to rigidly secure the impeller to the stub shaft 40. The control cage may be secured in the opening 28 by tightening the clamps 31 against the flange 66.

In the operation of the wheel the shaft 14 is rotated at a speed of approximately 2,400 revolutions per minute to drive the rotor R in a counterclockwise direction as indicated by the arrow in Fig. 2. The abrasive is then supplied into the feed spout. The abrasive enters the control cage through the opening 72 and passes axially into the hollow center impeller. It is to be noted that the inner edges of the impeller vanes 38 are sharpened or bevelled as shown in Fig. 4 to efficiently intercept the abrasive supplied by the feed spout S. The abrasive is then engaged by the rotating impeller vanes 38 and moved circumferentially within the cage 36. The point or zone at which the abrasive leaves the transfer mechanism and is supplied to the inner ends of the propeller blades is determined by the position of the opening 33 in the end wall member 32. The abrasive is moved circumferentially within the cage 36 by means of the impeller vanes and engages the inner surface of the frusto conical cage 36 and is discharged through the opening 33 generally in a tangential direction with respect to the transfer mechanism and diagonally across the path described by the inner ends of the propeller blades 16. The circumferential movement of the particles within the frusto conical cage 36 attain a pronounced velocity and upon engaging the inner conical surface move somewhat axially through the opening 33 with considerable velocity so as to move within the orbit of the rotating propeller blades. The wheel has been found to function in a proper manner simply by providing an opening such as the outlet opening 33 in the end plate 32. In order to improve the operating characteristics of the wheel, and to direct the abrasive in a direction more axially of the wheel, the opening 33 slopes outwardly and forwardly from the interior of the cage with respect to the direction of rotation. The trailing outer edge of the opening 33 with respect to the direction of rotation may also be provided with the projection or lip 70 for further directing the abrasive in a direction axially of the wheel.

The point or zone at which the abrasive leaves the periphery of the wheel after being accelerated by centrifugal force may be controlled by adjusting the position of the control cage and the outlet opening 33. The adjustment of the firing position may therefore be controlled and determined by loosening the clamps 31 and rotating the cage 36 with the end member 32 secured thereto until the opening 33 is in the desired clock dial position after which the clamps 31 may be tightened to maintain the control cage in the readjusted position.

When the end wall member 32 becomes worn so that the discharge opening therein is no longer capable of sufficiently limiting the circumferential extent of the stream of abrasive supplied to the inner ends of the propeller blades, this part of the transfer mechanism may be replaced without furnishing additional parts for the wheel. The removal of the end plate 32 is accomplished by removing the feed spout S after which the clamps 31 may be removed. Thus the cap screw 52 is uncovered and may be removed to detach the impeller from the stub shaft 40. Then the cage 36 with the end plate 32 still attached thereto may be withdrawn from the opening 28 after which the end plate 32 may be replaced and the parts reassembled.

A shield member may be mounted within the central opening of the rotor to prevent unobstructed free movement of erratically moving particles. The shield may take the form of a conical shaped deflector 80 mounted within the central opening and arranged to rotate with the wheel. The conical deflector may be hollow to reduce the weight thereof and the frusto conical outer surface is preferably provided with a plurality of ribs 82 for engaging any stray particles and deflecting these particles to a position for being engaged by the propeller blades 16. The deflector member 80 in the embodiment illustrated is supported for rotation by means of the stub shaft 40. The outer end portion of the hollow conical deflector may therefore be provided with a ferrule 84 for fitting snugly over the stub shaft 40. A positive driving connection may be provided between the deflector member 80 and the shaft by means of pin 86 projecting from the periphery of the shaft 40 and engaging a recess 88 in an end of the ferrule 84. In assembling the parts the deflector member 80 is first arranged over the stub shaft 40 and before the transfer mechanism is associated therewith. When the impeller is attached to the outer end of the stub shaft 40 the end ring 39 of the impeller engages the end of the ferrule 84 to maintain the skirt portion 90 of the deflector member in engagement with the hub portion of the rotor and to maintain the recess 88 of the ferrule in operative association with the pin 86.

As hereinabove indicated the wheel has been found to function correctly without the use of the shield or deflector member 80 and the principal purpose thereof is to deflect any stray parti-

cles to positions for being engaged by the propeller blades. In the embodiment illustrated the ribs 82 are located at positions between the inner end of the propeller blades, but the relationship of the ribs 82 with respect to the propeller blades 16 may be varied without altering the function of the deflector member.

While the invention has been described with reference to specific structural details various modifications may be made in the different parts of the wheel. The structure of the rotor may be modified without altering the characteristic features of the invention and changes may be made in the specific details of the transfer mechanism. Such modifications may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. In centrifugal abrading apparatus, a rotor including a plurality of substantially radially arranged propeller blades terminating inwardly short of the axis of the rotor, a housing including a portion arranged over the face of said rotor, said housing having an opening therein adjacent the axis of the rotor, a normally stationary frusto conical shaped control cage, a removable end member secured to the larger diameter end of said cage, means supporting the control cage with the end member closing the opening in the housing and with the cage portion extending outwardly from the housing, a feed spout guiding abrasive into the smaller end of the frusto conical cage, said end member having a discharge opening therein of limited cross sectional area radially displaced from the axis of the rotor, and means for moving abrasive from said cage through said discharge opening into the path described by the inner ends of said propeller blades.

2. In centrifugal abrading apparatus, a rotor including a plurality of substantially radially arranged propeller blades terminating inwardly short of the axis of the rotor, a normally stationary frusto conical shaped control cage including an end wall, means supporting said cage adjacent the axis of the rotor, a feed spout guiding abrasive into the smaller end portion of the control cage, said end wall having an opening therein sloping forwardly and outwardly from the interior of the cage with respect to the direction of rotation of the rotor and radially displaced from the axis of the rotor, and means for moving abrasive from said cage through said discharge opening into the path described by the inner ends of said propeller blades.

3. In centrifugal abrading apparatus, a rotor including a plurality of substantially radially arranged propeller blades terminating inwardly short of the axis of the rotor, a normally stationary frusto-conical shaped control cage including an end wall, means supporting the cage wholly outside a plane defined by the lateral edges of said propeller blades with the larger diameter end of the frusto-conical cage adjacent the inner ends of said blades, a frusto-conical shaped impeller within said control cage, a feed spout guiding abrasive into the smaller end portion of the control cage, said end wall having an opening therein sloping forwardly and outwardly from the interior of the control cage with regard to the direction of rotation of the rotor, means carried by the rotor supporting and driving said impeller for discharging abrasive through said opening, and a lip on the end wall adjacent said opening for deflecting the abrasive axially of the rotor.

4. In centrifugal abrading apparatus, a rotor including a plurality of substantially radially arranged propeller blades terminating inwardly short of the axis of the rotor, a normally stationary frusto-conical shaped control cage including an end wall, means supporting the cage wholly outside a plane defined by the lateral edges of said propeller blades with the larger diameter end of the frusto-conical cage adjacent the inner ends of said blades, a frusto-conical shaped impeller within said control cage, a feed spout guiding abrasive into the smaller end portion of the control cage, said end wall having an opening therein sloping forwardly and outwardly from the interior of the control cage with regard to the direction of rotation of the rotor, a stub shaft extending laterally from the rotor between the inner ends of said propeller blades through an opening in said end wall, means securing the impeller to said stub shaft whereby the impeller is supported and driven by the stub shaft to discharge abrasive through said opening.

5. A mechanism for transferring abrasive onto the inner ends of propeller blades of centrifugal abrading apparatus comprising, a normally stationary frusto-conical control cage including a detachable end member, an impeller rotatable within said control cage including a plurality of substantially radial vanes tapering at the outer ends thereof to outline a frusto-conical impeller, means for supplying abrasive into said control cage, and said end member having an opening therein of limited circumferential extent radially displaced from the axis of the impeller through which the abrasive is discharged onto the inner ends of the propeller blades.

6. A mechanism for transferring abrasive particles to a position to be engaged by the inner ends of propeller blades of centrifugal blasting apparatus comprising, a normally stationary frusto-conical control cage including an end wall at the larger diameter portion thereof, an impeller rotatable within said control cage including a plurality of substantially radially arranged vanes tapering at the peripheral ends thereof to outline a frusto-conical shaped impeller, said vanes terminating inwardly short of the axis of the impeller to provide a hollow center therefor, a fed spout guiding abrasive into the control cage and within the hollow center of the impeller, and said end wall having an opening therein of limited cross sectional area radially displaced from the axis of the impeller.

7. A mechanism for transferring abrasive particles to a position to be engaged by the inner end of propeller blades of centrifugal blasting apparatus comprising, a normally stationary frusto-conical control cage including an end wall at the larger diameter portion thereof, an impeller rotatable within said control cage including a plurality of circumferentially spaced substantially radially arranged vanes tapering at the peripheral ends thereof to outline a frusto-conical shaped impeller and terminating inwardly short of the axis of the impeller to provide a hollow center therefor, a feed spout guiding abrasive into the control cage and within the hollow center of the impeller, and said end wall having an opening extending therethrough with the bounding walls of the opening sloping forwardly and outwardly with respect to the direction of rotation of said impeller.

8. A mechanism for transferring abrasive particles to a position to be engaged by the in-

ner ends of propeller blades of centrifugal blasting apparatus comprising, a normally stationary frusto-conical control cage including an end member at the larger diameter portion thereof, an impeller rotatable within said control cage including a plurality of circumferentially spaced substantially radially arranged vanes tapering at the peripheral ends thereof to outline a frusto-conical shaped impeller, and terminating inwardly short of the axis of the impeller to provide a hollow center therefor, a feed spout guiding abrasive into the control cage and within the hollow center of the impeller, said end member having an opening therethrough sloping outwardly and forwardly with respect to the direction of rotation of the impeller, and a lip projecting from the surface of said end member adjacent the forward end of said opening with regard to the direction of rotation of the impeller.

9. In centrifugal abrading apparatus, a rotor including a plurality of substantially radial propeller blades terminating inwardly short of the axis of the rotor, a normally stationary control cage including an end wall, means supporting said control cage substantially concentrically with the axis of the rotor with the end wall adjacent the inner ends of said propeller blades and with the entire control cage positioned outside a plane defined by the lateral edges of said propeller blades, means guiding abrasive into said control cage, said end wall having an opening therein radially displaced from the axis of the rotor, an impeller rotatable within said control cage, means positioned between the inner ends of the propeller blades supporting and driving said impeller, and an annular deflector mounted between the inner ends of the propeller blades rotating with the impeller.

10. In a centrifugal abrading apparatus, a rotor including a plurality of substantially radial propeller blades extending inwardly short of the axis of the rotor, a normally stationary control cage including an end wall, means supporting said control cage substantially concentric with the axis of the rotor and positioned wholly outside a plane defined by the lateral edges of said propeller blades, an impeller rotatable within the control cage including an end ring, a stub shaft carried by said rotor substantially aligned with the axis of the rotor extending into said control cage, means for supplying abrasive particles into the control cage, said end wall of the control cage having an opening therein radially displaced from the axis of the rotor through which the abrasive is discharged by the impeller onto the inner ends of the propeller blades at one zone in the rotation thereof, a frusto conical shaped deflector member mounted between the inner ends of the propeller blades, a ferrule carried by said frusto conical deflector member embracing said stub shaft, a cap screw for urging the end ring of the impeller against the end of said ferrule to support the impeller on the stub shaft and to maintain a base portion of the frusto conical deflector member against said rotor, and means providing a positive driving connection between the deflector member and the stub shaft.

11. A control assembly for centrifugal blasting apparatus comprising, a frusto-conical shaped cage, an annular flange adjacent the larger diameter end of said cage, a removal end plate secured to said flange substantially closing the larger diameter end of the cage, and said end plate having an opening therein of limited cross sectional area displaced from the axis of the cage.

12. An end wall for the control cage of centrifugal blasting apparatus comprising, a disc shaped plate having a discharge opening therethrough at a point displaced from the axis thereof, and the bounding walls of said opening being arranged at an acute angle to the face of the disc.

13. An end wall for the control cage of centrifugal blasting apparatus comprising, a disc shaped plate having an abrasive discharge opening extending therethrough at a point displaced from the axis of the disc, and a lip projecting from the outside face of the disc adjacent one boundary of the discharge opening.

14. A control cage for a centrifugal blasting wheel comprising, a frusto-conical shaped cage, an end member substantially closing the larger diameter end of said cage, said end member having an opening therein radially displaced from the axis of the cage and of limited dimensions measured circumferentially of the cage, and means projecting from the outer face of the end member adjacent the forward end of said opening with regard to the direction of rotation of the wheel.

PERCY J. POTTER.