March 25, 1952 W. A. ROSENBERGER ET AL 2,590,576

ABRADING APPARATUS

Filed May 17, 1934 3 Sheets-Sheet 1

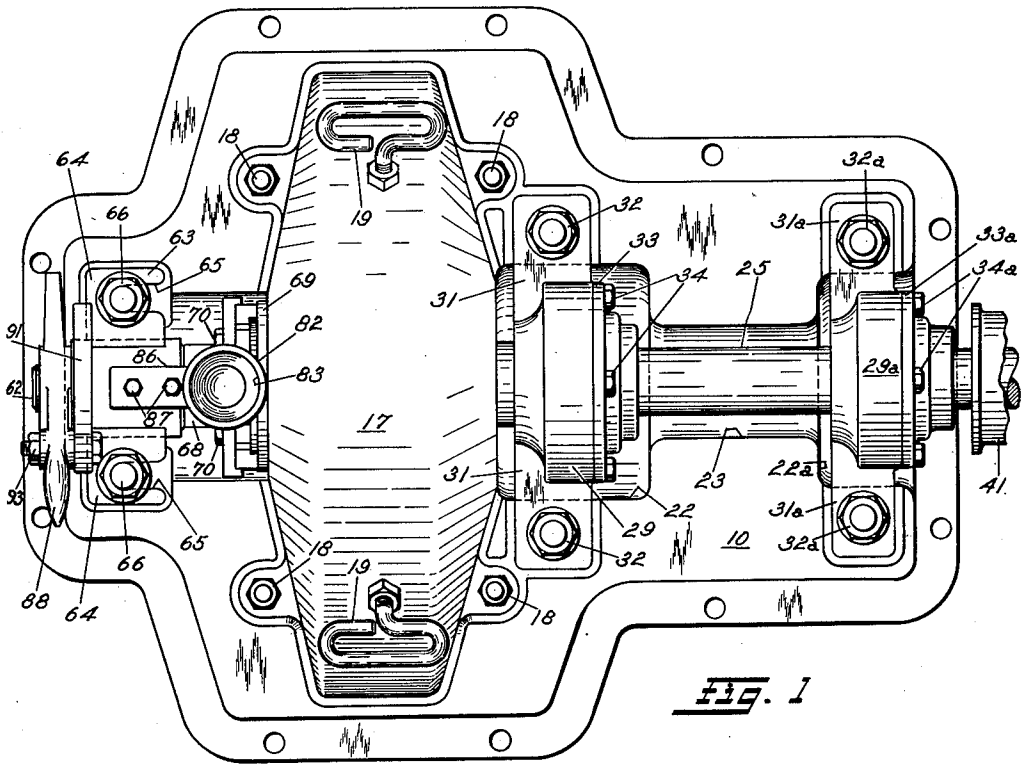

Fig. 1

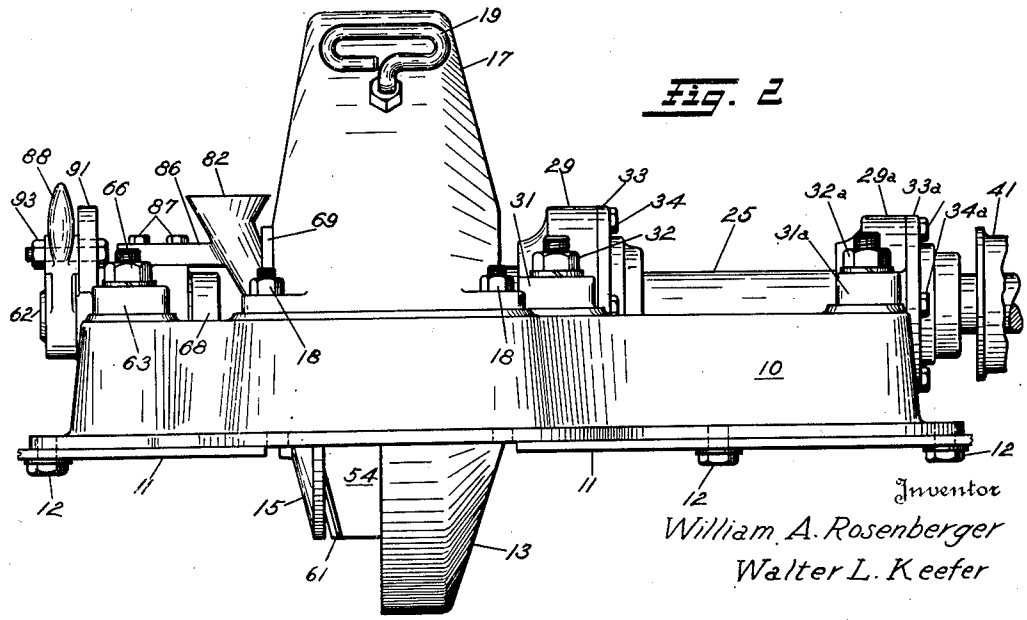

Fig. 2

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ABRADING APPARATUS

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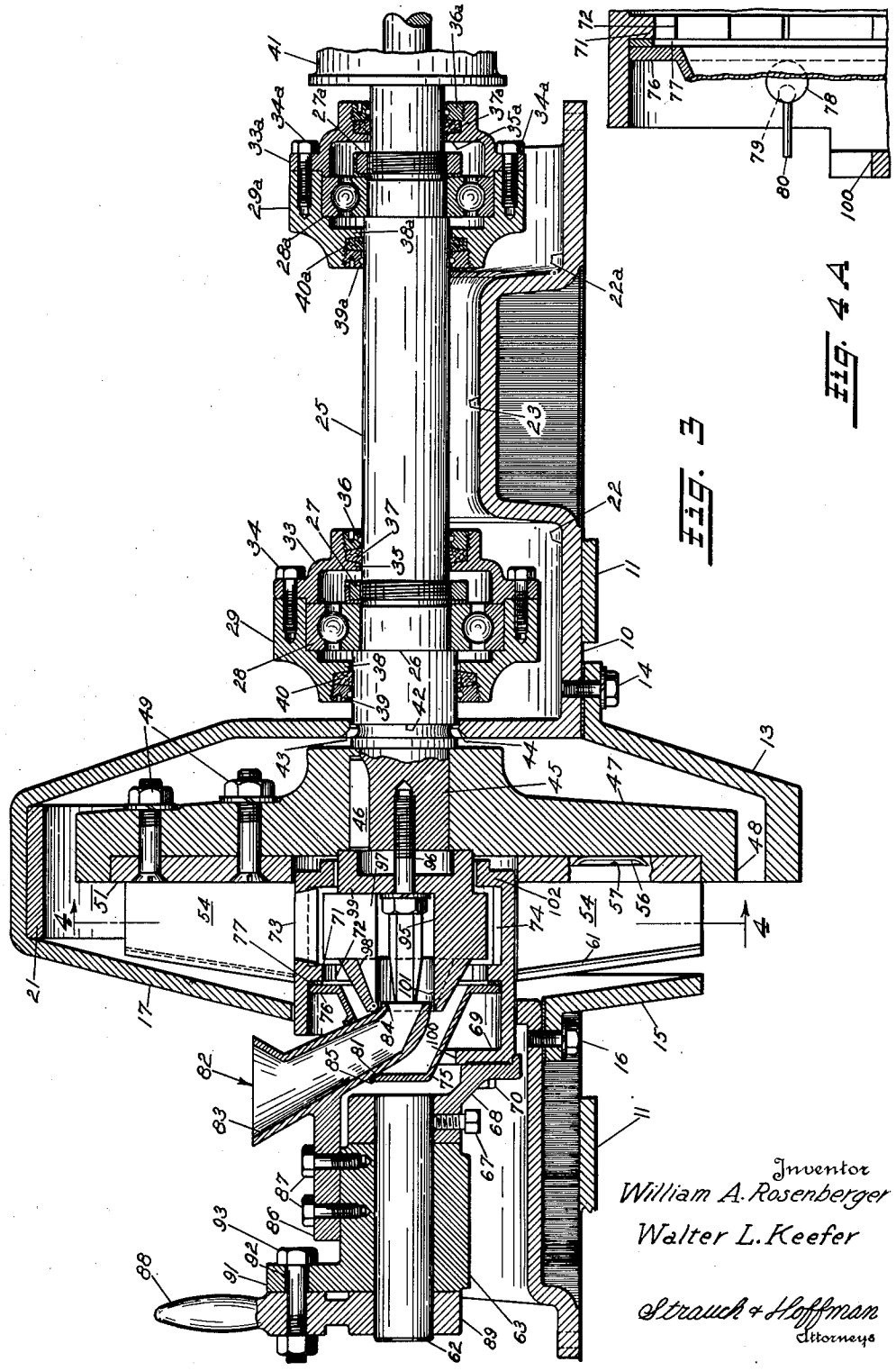

Fig. 3

Fig. 4A

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ABRADING APPARATUS

Filed May 17, 1934 3 Sheets-Sheet 3

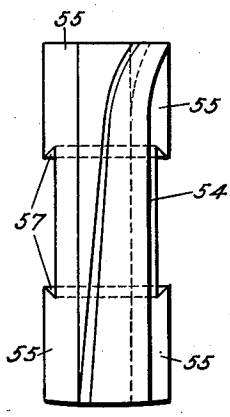

Fig. 5

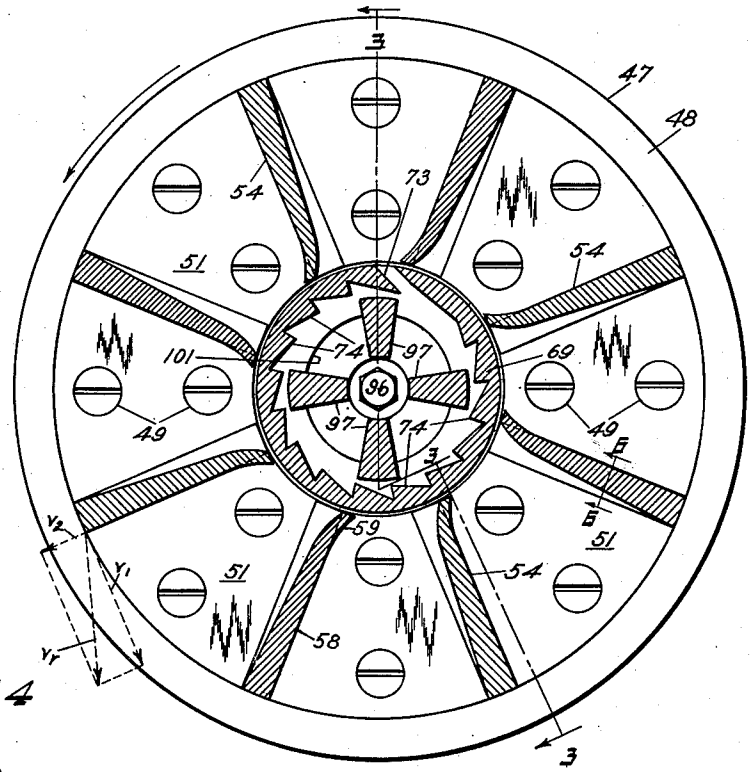

Fig. 4

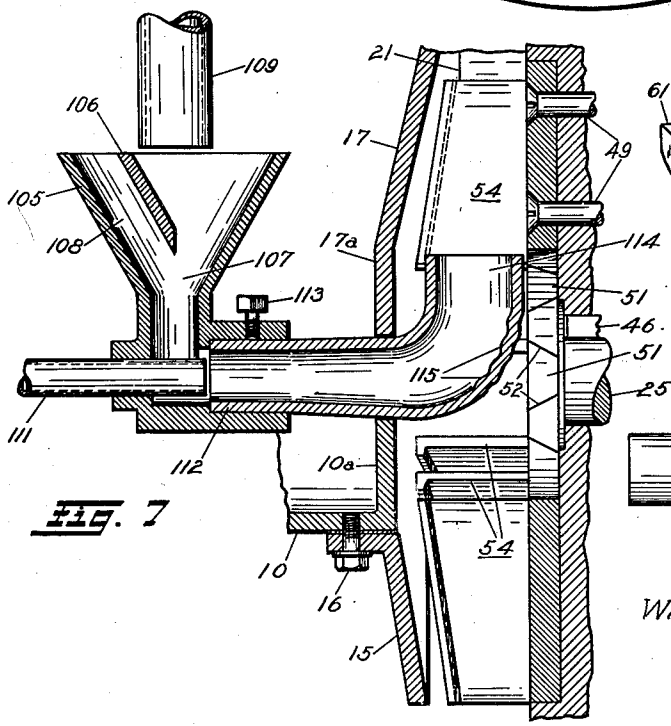

Fig. 7

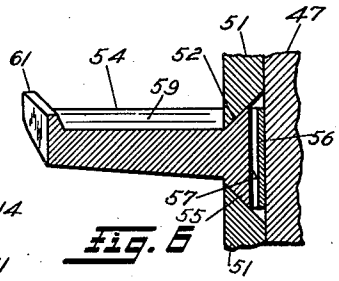

Fig. 6

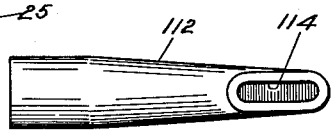

Fig. 8

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UNITED STATES PATENT OFFICE

2,590,576

ABRADING APPARATUS

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Application May 17, 1934, Serial No. 726,188

8 Claims. (Cl. 51—9)

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The present invention relates to abrading apparatus, more particularly the present invention is concerned with abrading machines of the character wherein an abrasive is picked up and directed against the work operated upon, by centrifugal action.

Machines of this general character have been heretofore proposed, but they have not been commercially successful for the reason that they have failed not only to efficiently perform the functions required of such machines, but also to stand up in use, due to parts thereof rapidly wearing away under the influence of the abrasive handled thereby. Such prior machines discharge abrasive throughout 360 degrees of the impeller, and since the article operated upon by the machine must be held to one side of the impeller only a small proportion of the abrasive handled by the machine is utilized for useful work, with the result that the greater part of the abrasive is directed against the casing or housing that may enclose the machine, causing it to wear away rapidly in use. It has been found that the impeller elements in such prior proposed machines also wear away rapidly, particularly near their inner ends, where they initially contact the abrasive.

It is accordingly a primary object of our invention to devise a novel centrifugal abrading machine that will efficiently utilize the abrasive supplied thereto, and which will have a long life.

It is another major object of our invention to devise a novel centrifugal blasting machine that will efficiently direct substantially all of the abrasive supplied it against the work that is being handled thereby.

It is another important object of the present invention to devise a centrifugal blasting machine having means for supplying abrasive to a limited angular portion of the inside of the impeller, so as to limit the centrifugal discharge thereof to a limited angular region.

It is a further object of this invention to provide a centrifugal abrading machine of the character having a plurality of outwardly extending blades which terminate short of the center of rotation to define a central space, with means for selectively supplying abrasive to predetermined limited portions of the central space.

It is another object of our invention to provide the abrasive impelling mechanism of a centrifugal blasting machine with an abrasive impelling blade assembly that will not impede air or abrasive flow therefrom, and also with means for supplying abrasive to a limited angular region of the inner ends of the blades.

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A further object of our invention is to so construct a centrifugal blasting machine of the character having rotary abrasive impelling surfaces, that an initial velocity of considerable magnitude is imparted to the abrasive prior to its being picked up by the abrasive impelling surfaces.

It is another object of the present invention to equip a blasting machine of the character having a plurality of radially outwardly extending blades which terminate short of the center of rotation, to define a central space with means for supplying abrasive to a limited portion of the central space to thereby predetermine the angular discharge of the machine.

It is a further object of our invention to provide a blasting machine of the character having a plurality of outwardly extending blades, which terminate short of the center of rotation to define an abrasive supply space, with novel means for introducing abrasive to the abrasive supply space.

A further object of this invention resides in the provision of a centrifugal blasting machine with novel means for securing the abrasive impelling elements in place in such manner that it is possible to readily remove them when they are worn out, and yet which will securely hold them in place when the machine is in operation.

It is another object of our invention to so construct a centrifugal blasting machine that wear of the parts thereof will not result in substantial dynamic or static unbalance of the machine.

Further objects of the present invention will become apparent as the detailed description thereof proceeds in connection with the annexed drawings, and from the appended claims.

In the drawings:

Figure 1 is a plan view of a blasting machine embodying our invention.

Figure 2 is an elevational view of the machine illustrated in Figure 1.

Figure 3 is a longitudinal sectional view on an enlarged scale of the machine shown in Figure 1, and illustrates the handle disposed in its vertical position in order to more clearly show the structure involved, and the sectional part of the runner-head is taken substantially in line 3—3 of Figure 4.

Figure 4 is a sectional view taken substantially on the line 4—4 of Figure 3.

Figure 4A is a fragmental sectional view illustrating the device employed for holding the cone in place in the machine shown in Figure 3.

Figure 5 is a side elevational view of one of the

main impeller blades employed in the device shown in Figure 1.

Figure 6 is a detailed sectional view taken substantially on the line 6—6 of Figure 4.

Figure 7 is a longitudinal sectional view of a modified form of blasting machine also forming part of our invention when viewed apart from the machine, and

Figure 8 is a top plan view illustrating the abrasive supply conduit of the machine shown in Figure 7 as it appears when viewed apart from the machine.

With continued reference to the drawings wherein like reference characters have been employed to designate like parts throughout the several views thereof, the machine is supported upon a base designated generally at 10, and although the base may be supported in any desired manner, we have in the present instance shown it as being secured to the upper side 11 of a sand blasting cabinet (not shown) by means of cap screws 12 or the like.

Cabinet top 11 is provided with a comparatively large opening through which an impeller housing 13 projects. Housing 13 is secured to the lower side of base 10 by means of cap screws 14, and a complemental housing member 15 is secured to base 10 in spaced relation to housing 13 by means of cap screws 16. Housings 13 and 15 house the lower part of the impeller of the machine that will be hereinafter described.

An upper housing member 17 is secured to the upper side of base 10 by means of nut and bolt assemblies 18 and is provided with a pair of handles 19 by which it may be lifted when it is detached from the base. Housing 17 encloses the upper portion of the centrifugal impeller and is preferably provided with a removable wear element which takes the form of a semi-cylindrical ring 21, which may be detachably secured thereto in any suitable manner.

As seen in Figures 1 and 3, base 10 is of hollow construction and is provided with a pair of bearing recesses 22 and 22*a* which are interconnected by a trough-like portion 23. A shaft 25 is disposed in trough portion 23 and extends longitudinally of the base. Shaft 25 constitutes the impeller driving shaft, and it is journaled in bearings which in the present instance preferably take the form of anti-friction ball bearings of conventional design.

Clamped between a shoulder 26 provided on shaft 25, and a nut 27 is the inner race of a bearing 28. The outer race of bearing 28 is supported in a bearing support 29, which is provided with a pair of laterally extending arms 31. Arms 31 bridge bearing recess 22 and are secured to the top side of base 10 by means of bolt and nut assemblies 32.

Bearing 28 is secured within support 29 by means of a cap member 33, which is secured to support 29 by means of cap screws 34. Frictionally clamped between a flange 35 formed on cap member 33, and a nut 36 threaded into the cap, is a sealing member 37, which in the present instance takes the form of a hard felt ring-member. Also frictionally clamped between a flange 38 provided on bearing support 29 and a nut 39 threadedly connected thereto, is a similar sealing member 40.

The chamber defined by bearing support 29 and cap 33 is preferably filled with lubricant prior to assembly to provide lubrication for bearing 28, and the seal rings 37 and 40 operate to prevent lubricant from escaping from the reservoir and also prevent any abrasive that may be present in the air from entering and causing wear of the bearings. The right hand end of shaft 25 is supported in a bearing and sealing assembly that is identical (except for size) with that just described, and corresponding reference characters with the subscript "*a*" have accordingly been applied to designate like parts.

Shaft 25 is accordingly mounted for rotation upon base 10, and power may be applied to it in any suitable manner, as for instance by means of a pulley 41 secured thereto. Shaft 25 is provided with an annular groove 42 and extends through semi-circular recesses 43 and 44 located respectively in housing 17 and base 10. Secured to a reduced portion 45 of shaft 25 by means of a key 46, is a runner-head 47, which supports all of the rotating elements of our blasting machine. Runner-head 47 is provided with an annular flange 48 that cooperates with the impeller blades in a manner to be hereinafter described.

Secured to head 47, by means of bolt and nut assemblies 49 are a plurality of guide blocks 51 which are provided with inclined faces 52. With particular reference to Figure 6, the neighboring sides of blocks 51 form dove-tail grooves in which the abrasive impelling blades are adapted to be retained.

A plurality of blade members 54 are mounted upon head 47 and are provided with dove-tailed portions 55 which are disposed within the guide grooves defined by blocks 51. As indicated in Figure 4, blade members 54 are inserted from the center of the assembly and are slid outwardly until they engage flange 48 of head 47, which restrains them from outward displacement in response to centrifugal force. Any suitable means may be employed to restrain blades 54 from sliding inwardly under the influence of gravity when the head is at rest, but we preferably employ frictional means which takes the form of flat leaf springs 56 which seat in recesses 57 located in portions 55 of blades 54, and bear against the radial face of head 47.

Referring more particularly to Figures 4 and 6, blades 54 are provided with substantially flat abrasive-impelling surfaces 58, which extend from the outer periphery of the blades to a point near the inner ends thereof. The inner ends of the blades are provided with curved impelling surfaces 59 for a purpose that will presently appear. As seen in Figure 3, the blades decrease in width toward their outer periphery in view of the fact that the velocity of the abrasive increases as it approaches the outer periphery of the blades, and in order to prevent the abrasive from escaping laterally from the blades we preferably provide blades 54 with ribs 61, which are coextensive with their impelling surfaces.

The abrasive may be fed into the center of the blade assembly by any suitable means, but we preferably employ the following mechanism for this purpose. A short shaft 62 is mounted for rocking movement in a bearing 63, which is provided with a pair of diametrically opposed arms 64. Arms 64 bridge a bearing recess located in the left hand end of base 10 and are provided with recesses 65. A pair of nut and bolt assemblies 66 extend through recesses 65 and secure member 63 to the top of base 10.

Secured to the right-hand end of shaft 62, by means of a set screw 67 or the like, is an arcuately shaped bracket 68, to which a substantially cylindrical abrasive distributing member 69 is secured by means of cap screws 70. Member

69 is provided with an annular boss 71, having preferably four notches 72, and a preferably single abrasive outlet 73. A plurality of teeth 74 are provided on the inner cylindrical wall of member 69 for a purpose that will presently appear.

In view of the fact that member 69 may undergo rocking movement with shaft 62, abrasive outlet or distributing aperture 73 may be angularly adjusted with respect to blades 54 so as to predetermine a point at which the abrasive shall enter the abrasive receiving space defined by blades 54 and head 47. Abrasive is supplied to member 69 by means of a cone member 75 having a flange 76 which frictionally rests against a gasket 77 disposed in contact with boss 72. Cone member 75 may be secured in place by any suitable means, but we preferably employ a plurality of eccentric members 78, having pivot portions 79 extending through apertures in member 69. Members 78 bear against flange 76 and maintain cone 75 in fluid-tight relationship with gasket 77. This action is also augmented by the vacuum developed within cone 75 when the machine is in operation. When it is desired to remove cone 75, members 78 are rocked about portions 79 as axes by means of handles 80 and are removed from their apertures.

Cone 75 is provided with an aperture 81 through which a spout member 82 projects. Spout 82 is provided with a hopper portion 83, through which abrasive may be supplied in any suitable manner, and a distributing, or nozzle portion 84 through which abrasive is supplied to member 69. Spout member 82 is preferably provided with a gasket 85 which rests in frictional engagement with the top face of cone 75 to prevent air from leaking directly from the atmosphere into member 69. Spout member 82 is provided with an arm 86 which is secured to bearing member 63 by means of cap screws 87 or the like.

Shaft 62 may be rocked in any suitable manner, but we preferably provide a handle 88, having the hub portion 89 mounted upon shaft 62, and which is secured thereto in any suitable manner. Bearing member 63 is provided with an upstanding flange 91 having an arcuate slot 92 formed therein. A nut and bolt assembly 93 extends through slot 92 and through an aperture in handle 88 and may be taken up to maintain handle 88 and shaft 62 in any desired adjusted position.

In view of the fact that rotation of head 47 causes blades 54 to function as a centrifugal fan, a high vacuum is developed within the member 69 and spout 82, with the result that any abrasive supplied to spout 82 will be drawn into member 69 and thence through aperture 73 to the blades. We preferably, however, provide head 47 with an auxiliary rotor or fan mechanism for more intimately mixing the incoming sand with the incoming air prior to delivery to aperture 73, and it preferably takes the form of a generally cylindrical boss 95 which fits into a recess in head 47 and it is secured to shaft 25 by means of a cap screw 96. Member 95 consists of a plurality, preferably four, heavy blade members 97, which are joined at their ends by cylindrical portions 98 and 99. Member 95 is assembled within member 69 by aligning blades 97 with two recesses 100 formed in the flange provided on member 69, which are preferably disposed in angular alignment with recesses or notches 72 formed in boss 71. Member 95 is then slid into place, with blades 97, which project beyond portions 98, 99, passing through recesses 100 and 72, and bolted to head 47. Although we preferably associate the parts in this manner, so as to provide an annular abrasive chamber that extends inwardly beyond blades 97 at either end of auxiliary rotor 95, it is to be understood that if desired, notches similar to 72 may be provided in flange 102 of casing 69, so that the latter may be removed without first detaching member 95, and the appended claims are intended to embrace our machine when it is constructed in this manner. As seen in Figure 3, portion 98 of member 95 provides a conical chamber which is aligned with cylindrical chamber 101 defined by the inner edges of blades 97 and also is axially aligned with the delivery end 84 of spout 82, and communicates with the spaces between the blades 97.

Operation

The work is placed under the cabinet in registry with the discharge opening of the device and it is preferably mounted on a truck or conveyor or the like so that it may be moved around to expose various areas of it to the blast. Shaft 25 may be rotated at any desired speed, but we find that with the machine illustrated, a speed of approximately 2400 revolutions per minute, in the direction indicated in Figure 4, is suitable for satisfactory operation of the machine. Nut assembly 93 is then loosened and handle 88 is actuated to bring member 69, and hence aperture 73 into the proper abrasive delivering position, as dicated by the type of abrasive used, the shape and size of the blades, and the nature of the work. For instance, with reference to Figure 4, the point at which the abrasive leaves the wheel is determined by the point at which the abrasive is admited to the wheel, and as the time it takes for a particle to traverse the blades depends upon the length of the blade and nature of the abrasive, it is obvious that it is necessary to adjust the point of admission of the abrassive to cause it to discharge through the bottom of the machine.

Bolt and nut assembly 93 is then tightened and the machine is ready for operation. If desired however, the adjustment of handle 88 may be deferred until the machine is actually in operation, as the operator can then, by observing the character, and the discharge point of the blast, properly manipulate the handle to give the best results.

Sand or other abrasive is preferably allowed to drop by gravity into hopper portion 83 of spout 82 and it is preferably supplied thereto in uniform quantities as by means of a screw or like conveyor operating at a predetermined constant speed. Rotation of head 47 causes blades 54 to establish a partial vacuum within member 69 and the interior of spout 82, so that the sand entering the spout is picked up by an air stream and enters passage 101 in auxiliary rotor 95. Blades 97 of rotor 95 cause the abrasive to pass outwardly between them to their periphery, where it is agitated or "churned" around within member 69. Sand lodges within teeth 74 and the abrasive thus accumulated protects the interior of member 69 from excessive wear.

A forwardly rotating dispersion of air and abrasive is accordingly established in the annular space defined by member 69 and member 95, and it is uniformly withdrawn from member 69

through aperture 73 by virtue of its velocity and the suction effect of blades 54.

It should be observed, referring more particularly to Figure 4, that as the abrasive is exhausted from aperture 73, it possesses angular as well as radial velocity in view of the impelling action of blades 97. This initial velocity feature, when taken in connection with the fact that the inner ends of blades 54 are curved, operates to minimize any abrading action as blades 54 pick up the abrasive. In other words, the abrasive exhausted from aperture 73 travels outwardly and angularly, defining a spiral, and as the angular component of the velocity of an individual particle of abrasive is not greatly lower than the velocity of the inner portions of blades 54 that picks it up, and as these portions of blades 54 are curved, they strike the abrasive a "glancing blow" and wear thereof under such action is minimized.

The abrasive is accordingly supplied to blades 54 in a predetermined limited angular position, and as it travels outwardly each particle defines a spiral path as indicated in Figure 4, and is directed against the work over a definite region, none of the abrasive striking housing 17 or base 10. In view of the fact that the abrasive passing outwardly over blades 54 is increasingly accelerated until it leaves the blades, and it also possesses an angular velocity due to the rotation of the blades, it leaves them at an angle thereto. With reference to Figure 4, the velocity of the abrasive under discharge conditions is diagrammatically illustrated, wherein the radial or outward velocity is represented as V_1 and the instantaneous angular velocity of the sand as it is about to leave the tip of the blade is represented as V_2. These component velocities when combined result in a velocity Vr and although the values indicated have not been computed they are thought to fairly well represent the conditions existing in the machine during operation. It should be observed that as abrasive is delivered from only a small angular region of the rotor, which in the present case is below the axis of the members and through the openings between the housings 13 and 15, all of the abrasive is utilized for useful work, as no energy whatever is lost by abrasive being thrown against stationary housing 17.

Although we have illustrated our blast machine as discharging the sand blast downwardly against the work to be cleaned, and we prefer to utilize the device shown as it has proven to be the most convenient, it is to be understood that the device may be designed to discharge at any other angular point by properly rocking member 69 into the proper position to cause the abrasive stream to be delivered to the desired point, and the opening in the housing members may be properly angularly modified to meet the changed conditions, and the appended claims are intended to embrace our device when it is used in this manner.

Prior to assembling blades 54 upon head 47 they are carefully tested for hardness. Eight blades of substantially identical hardness are then selected and assembled upon head. The blades are selected in this manner so that when they are in use in the machine they will wear away evenly, and hence lose mass uniformly, with the result that dynamic and static balance of the runner-head assembly is maintained until the blades become so worn as to require replacement.

It should be particularly observed that runner-head 47 is of considerable mass, with the result that should blades 54 wear slightly unevenly, despite the fact that they are selected in sets of eight of substantially equal hardness, the change in the dynamic balance of the blades will not seriously affect the dynamic balance of the runner-head assembly as a whole. However, when it does become necessary to replace blades 54, it is only necessary to loosen bolt and nut assemblies 66 and slide the bearing support 63 to the left, after removing cap screw 96. This leaves the central space of the rotor unobstructed and blades 54 may accordingly be slipped inwardly and removed and new blades substituted therefor. Wear element 21 may be readily replaced by removing housing 17.

With reference now to Figures 7 and 8, we have illustrated a modified form of centrifugal blast machine, and the major difference thereof over the machine just described resides in the fact that the auxiliary impeller is omitted and a compressed air stream is employed for agitating the abrasive air mixture and for imparting an initial velocity thereto.

With continued reference to these figures, a hopper 105 is supported upon base 10 in any suitable manner and member 106, which divides it into an abrasive passage 107 and an air passage 108. Abrasive is adapted to be supplied to passage 107 by means of a pipe 109, and the abrasive so supplied is adapted to be picked up by an air stream set up by an air jet 111, which is connected to any suitable source of compressed air. The action of air jet 111 sets up an aspirating effect and causes a partial vacuum to be established in the bottom of the hopper, which causes air to enter passage 108 and carry the abrasive gravitating into passage 107 into the blast of air issuing from jet 111.

The abrasive air mixture enters a hollow member 112 which in the present instance takes the form of a pipe and it is preferably adjustably secured to hopper 105 by means of a set screw 113 or the like. Member 112 extends into the central space defined by the inner ends of blades 54, and is flattened to provide an elongated opening 114 terminating adjacent blades 54.

Member 112, adjacent opening 114, is preferably provided with a plurality of steps 115, which exert an agitating effect upon the abrasive-air mixture and cause it to be evenly distributed over the faces of blades 54. As seen in Figure 8, the passage in member 112 decreases in width with the result that the velocity of the abrasive-air mixture increases as it approaches opening 114.

The operation of this machine is similar to that of the machine previously described as set screw 113 may be loosened and member 112 rocked within hopper 105 to bring into the desired angular position. The quantity of abrasive supplied the machine may be regulated by regulating the flow of abrasive through pipe 109, and the degree of agitation, and the initial velocity of the abrasive may be controlled by varying the quantity of air supplied jet 111.

Although we have illustrated member 112 as being constructed of a cylindrical pipe or tube, it may be of cast construction or be formed in any other suitable manner, so long as it provides a discharge opening adjacent the inner ends of blades 54, without departing from the spirit of our invention. Moreover, if desired the compressed air blast nozzle may be omitted and the suction set up by rotation of head 47 relied upon to agitate and carry the abrasive to blades 54, and the appended claims are intended to embrace our machine when it is used in this manner.

Also member 112 may extend loosely through recesses in housing 17a and base 10a but it is shown as fitting fairly closely therein in order to provide a substantially air-tight joint so as to enable the suction set up by blades 54 to be utilized in assisting in feeding the abrasive from member 112.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a centrifugal blasting machine, a rotatably supported member having a plurality of outwardly extending abrasive impelling blades projecting therefrom, the inner ends of said blades terminating short of the axis of rotation of said member and defining an abrasive supplying space, a cylindrical sleeve element non-rotatably held within said space and having an inwardly extending flange adjacent the rotatably supported member defining an abrasive impelling chamber, and a passageway in the cylindrical wall of the sleeve element defining a communication opening of limited peripheral extent to discharge abrasive from the chamber into the blades over a limited range to effect directional control of the abrasive by the revolving blades, and a plurality of rotatable abrasive impelling vanes on said member and disposed within said sleeve, said vanes extending outwardly beyond the inner periphery of said flange.

2. In an abrading machine, a rotor having a plurality of blades terminating short of the axis of said rotor to define an abrasive admitting space, driving mechanism connected to rotate the rotor about its axis, a non-rotatable abrasive feeding device of an external diameter less than the radius of the rotor extending into said space and having a discharge opening therein disposed to one side of the axis of said rotor and located between the planes of rotation defined by the sides of said blades for delivering abrasive to the inner ends of said blades, said blades terminating sufficiently close to said feeding device to pick up the discharged abrasive with a minimum impact and discharge it from the outer ends of said blades at an abrading velocity when said rotor is rotated, a rotatable impeller comprising a plurality of impeller vanes disposed within said feeding device, said vanes being joined adjacent said rotor by a generally circular flange structure, said vanes extending inwardly, to a region closely adjacent the axis to define a comparatively small axially extending passage, and means for introducing abrasive into said passage and over the inner edges of said vanes, said driving mechanism being connected to rotate the vane-carrying impeller to impel abrasive through said discharge opening, said impeller vanes being axially spaced from said rotor and said feeding device having an inwardly extending abrasive-retaining flange disposed between said impeller and said rotor, and having an internal diameter which is less than the overall external diameter of said impeller vanes.

3. A centrifugal blasting device comprising, in combination, a stationary sleeve, said stationary sleeve having a peripheral aperture, means for feeding an uninterrupted supply of abrasive through the peripheral aperture in said stationary sleeve, a rotary impeller mounted peripherally of said stationary sleeve, said rotary impeller having at least one throwing blade mounted for rotation around the sleeve to engage the abrasive fed through the aperture and impel it at high speed from its periphery, said blade having an abrasive engaging surface which extends substantially radially from its periphery to a zone adjacent its inner terminus, and in this zone smoothly and gradually inclines forwardly with respect to the direction of rotation, said surface shape accelerating the abrasive smoothly and continuously and without abrupt change, from the initial contact to the final discharge.

4. A centrifugal blasting device comprising, in combination, a stationary sleeve, said stationary sleeve having a peripheral aperture, means for feeding an interrupted supply of abrasive through the peripheral aperture in said stationary sleeve, a rotary impeller mounted peripherally of said stationary sleeve, said rotary impeller having a plurality of throwing blades disposed radially with respect to the sleeve, driving structure connected to rotate the impeller about the sleeve to engage the abrasive fed through the aperture and impel it at high speed from its periphery, said blades having an abrasive engaging surface which extends substantially radially from its periphery to a zone adjacent its inner terminus, and in this zone smoothly and gradually inclines forwardly with respect to the direction of rotation, said surface shape accelerating the abrasive smoothly and continuously and without abrupt change, from the initial contact to the final discharge.

5. In an abrading apparatus, a rotor comprising a disc-like member mounted on a shaft and having a plurality of blades terminating short of the axis of said rotor to define an abrasive admitting space; a normally stationarily supported abrasive feeding device of an external diameter less than the diameter of the abrasive admitting space, extending into said space and having a discharge opening therein disposed to one side of the axis of said rotor for delivering abrasive to the inner ends of said blades; said blades terminating sufficiently close to said feeding device to pick up the abrasive with a minimum of impact, driving mechanism connected to rotate the rotor shaft, said blades having substantially straight, smooth and uninterrupted abrasive propelling surfaces of sufficient length to accelerate the abrasive smoothly and continuously without abrupt changes in direction and discharge it from the outer ends of said blades at an abrading velocity when said rotor is rotated; means for introducing abrasive into said feeding device; and an impeller disposed within said feeding device and being rotatable about the axis of said rotor and having abrasive impelling surfaces connected for rotation by the driving mechanism to impel abrasive through said discharge opening, the impelling surfaces of said impeller being axially spaced from said disc-like member and said feeding device having an inwardly extending abrasive-retaining end-wall disposed between said impelling surfaces and said member.

6. A centrifugal device for throwing abrasive at blasting velocities including, a set of throwing blades rotatably mounted with respect to an axis and extending outwardly from said axis, said blades being spaced from said axis to define a

central abrasive inlet, a non-rotatable tubular control member fixed in said inlet and having a discharge opening positioned to supply abrasive and direct the supply substantially radially into the path of rotation of said blades, and air blast structure connected to the tubular member for forcing supplied abrasive out through the discharge opening.

7. In a centrifugal blasting machine, a disc-shaped rotor journalled for rotation about an axis perpendicular to the plane of the disc and passing through its center, a plurality of throwing blades carried by said rotor and extending from its periphery close to, but short of its center, to define a central abrasive feed opening, driving mechanism connected to the rotor to rotate it about said axis, abrasive feed structure in said opening having control elements positioned close to the outer portion of said opening to feed abrasive to the blades in a limited segment of the rotating travel to cause the rotating blades to engage, accelerate and discharge the abrasive at high velocity from their periphery over a relatively short arc, and supply elements connected to deliver abrasive to the feed structure, said control elements including a tubular member adjustably held in fixed position in said feed opening coaxially of the rotor and having an abrasive feed passageway of limited peripheral extent in its side wall and within the span of the blades to limit the pick-up of the abrasive by the rotating blades to a small segment of the rotation and thereby effect directional control of the abrasive thrown out from the periphery of the blades, and a set of impelling vanes rotatably mounted about the rotor axis within the tubular member and in the span of its passageway, said driving mechanism being connected to rotate the impelling vanes to discharge through this passageway the abrasive delivered by the supply elements, said tubular member having the inner surface of its peripheral wall provided with inwardly directed ridges extending axially to reduce the erosion by the abrasive rotated by the impelling vanes.

8. In a centrifugal blasting machine, a disc-

shaped rotor journalled for rotation about an axis perpendicular to the plane of the disc and passing through its center, a plurality of blades each extending generally radially of the disc from adjacent its periphery close to, but short of its center, to define a central abrasive feed opening, driving mechanism connected to the rotor to rotate it about said axis, abrasive feed structure in said opening having control elements positioned close to the outer portion of said opening to feed abrasive to the blades in a limited segment of the rotating travel to cause the rotating blades to engage, accelerate and discharge the abrasive at high velocity from their periphery over a relatively short arc, and supply elements connected to deliver abrasive to the feed structure, said blades extending out from the rotor and having radially directed margins one of which has a thickened dovetail portion holding the blade in place in a mating dovetail groove in the rotor to provide a detachable flush blade mounting with the blades otherwise.

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