PARTICLE-THROWING APPARATUS
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The present invention relates to particle-throwing apparatus, more particularly to apparatus of the type shown in U.S. Patent 2,732,666, granted Jan. 31, 1956. Such apparatus includes a wheel that rotates and forcefully propels a stream of particles for impingement against work pieces that are to be cleaned, peened, or otherwise treated by the particles.

Among the objects of the present invention is the provision of novel constructions for use with the above wheels to simplify their manufacture and maintenance.

The above as well as additional objects of the present invention will be more fully recognized from the following description of several of its embodiments, reference being made to the accompanying drawings wherein:

FIG. 1 is a vertical section of a throwing wheel assembly pursuant to the present invention, the section being taken along the axis of the wheel;
FIG. 2 is a sectional view of the apparatus of FIG. 1 taken along line 2—2 with other parts broken away;
FIG. 3 is a frontal view of the apparatus of FIGS. 1 and 2 looking at it from the left in FIG. 1, with all rotating parts removed and the front of the wheel broken away;
FIG. 4 is a cross-sectional detail of the apparatus of FIGS. 1—3, taken along line 4—4 of FIG. 2;
FIG. 5 is a plan view of one of the liner plates in the assembly of FIGS. 1—4;
FIG. 6 is a side view of the liner plate of FIG. 5;
FIGS. 7 and 8 are views similar to FIGS. 5 and 6, respectively, of another liner plate in the assembly of FIGS. 1—4;
FIGS. 9 and 10 are additional views similar to FIGS. 5 and 6, respectively, of a third liner plate in the assembly of FIGS. 1—4;
FIG. 11 is a plan view of a further liner plate in the assembly of FIGS. 1—4;
FIG. 12 is an elevation and FIG. 13 is an end view of the liner plate of FIG. 11;
FIGS. 14, 15 and 16 are views similar to FIGS. 11, 12 and 13, respectively of yet another liner plate in the assembly of FIGS. 1—4.

According to the present invention a throwing wheel assembly has a housing surrounding the front and rear of the wheel as well as its top and ends, a set of wear liner segments completely covering the internal surface of the housing, the segments including front liner segments, rear liner segments, end liner segments, a top liner segment, and elongated strip segments, said strip segments joining the end segments with the front and rear segments respectively, and extending up to the junctures with the top segment, the strip segments covering all joints at said junctures and the segments overlapping each other so that no joint between segments provides a pathway that leads directly to the housing.

Nearly all, or as much as possible, of the liner segments are spaced from the internal housing surfaces pursuant to the present invention. Spacers for this purpose can be integral portions of the liner segments, and the strip segments can act as such spacers.

The rear plate assembly for wheels at least about 18 inches in diameter, can advantageously include a front subassembly of plate segments for protecting the housing surface in front of the wheel, and a rear subassembly of plate segments for protecting the housing surface of the rear of the wheel, each subassembly consisting of five segment-shaped liner plates overlapping each other at their junctures with one segment extending completely across the top of the subassembly, each segment having integrally formed bosses extending out from one face to engage the internal surface of the housing and hold the remainder of the segment spaced from said surface, said bosses containing nuts cast in place within them and having their housing-engaging faces apertured to expose the threaded portions of the nuts for threaded engagement.

The wheel housings generally taper from a narrow width at their tops to a wider width at their bottoms, and a single wear plate segment extending across the upper portion of the housing front or housing rear can be made to fit between the strip segments so that it is sufficiently shorter than the space between the end segments to allow the single upper plates to be removed through the narrow upper portion of the housing.

A wear liner segment representative of the present invention has a generally plate-shaped body with offset edges to form a labyrinth type seal with adjacent segments of the wear liner, one face of the plate having at least three integrally formed bosses, only two of which have nuts cast in place within them, said two bosses having their outer faces apertured to expose the threaded portions of their nuts for threaded engagement with mounting elements, all the bosses having their outer faces in the same plane.

Another wear liner segment incorporating the present invention is in the form of a six-sided plate with a straight upper edge, two diverging straight edges extending symmetrically from the ends of a first edge, and two converging edges extending symmetrically from the outer ends of the diverging edges, the top and the two converging edges being rabbeded to form overlapping junctures with adjacent segments, and one face of the plate having three integrally formed bosses spaced from each other, two of which bosses contain nuts cast in place in place within them, the outer faces of said two bosses being apertured to expose the threaded portions of the nuts for threaded engagement.

A still further wear liner segment typifying the present invention is in the form of a four-sided plate with an elongated straight edge and two converging straight edges extending unsymmetrically from the ends of the elongated edge, the two converging edges being rabbeded to form overlapping junctures with adjacent segment, and one face of the plate having three integrally formed bosses spaced from each other, two of which bosses contain nuts cast in place within them, the outer faces of said two bosses being apertured to expose the threaded portions of the nuts for threaded engagement.

Yet another wear liner segment in accordance with the present invention is a five-sided plate with an elongated straight edge and two converging straight edges extending unsymmetrically from the ends of the elongated edge, the first of said converging edges forming a right angle with one end of the elongated edge, the second of said converging edges extending from the second end of the elongated edge in a direction that tends to more abruptly intersect the second edge, the fourth edge and the second of the converging edges being rabbeded to form overlapping junctures with adjacent
segments, and one face of the plate having two integrally formed bosses spaced from each other, each of which bosses contains nuts cast in place within them, the outer faces of said two bosses being apertured to expose the threaded portions of the nuts for threaded engagement.

An end wear liner segment pursuant to the present invention has a straight relatively shallow channel with a group of spacer bosses integrally formed on its under surface and a nut cast in place within at least one of said bosses, the nut-carrying boss having an opening in its outer surface through which opening the threaded portion of the nut is exposed for threaded engagement, the channel having a floor which, aside from the boss structure, is of uniform thickness from one side wall of the channel to the other.

An additional wear liner segment representative of the present invention is in the form of an elongated non-rectangular parallelogram-shaped plate with its long edges rabbeded to form overlapping-type joints with adjacent segments, one of the short edges being grooved along its length to provide side walls on each side of the groove for forming a multiple overlapping-type joint with a segment adjacent that short edge, and the body of the plate having a single nut cast in place within it, an aperture in the body exposing the threaded portions of the nut for threaded engagement.

Referring now more particularly to the drawings, a complete throwing assembly according to one form of the invention is illustrated in FIG. 1 as having a spindle 10 journaled in a tubular support 12 as by bearings 13, 14. The spindle is arranged to be rotated as by means of a pulley 15 on one end in the manner shown in U.S. Patent 2,732,666. The bearings can have lubrication fittings either for periodic lubrication or connected as indicated to a lubricator 17 which is connected for gradually supplying lubricant as the wheel is operated.

On its other end the spindle is provided with a radially enlarged flange 16 which can be clamped, shrunk, keyed, or otherwise securely held in place on the spindle. In the illustration the flange is clamped to the spindle by means of an intervening split bushing 17 that has an internal generally cylindrical surface 19 that directly engages the spindle end, and has a tapered or generally frustoconical outer surface 21 that engages a correspondingly shaped socket 23 in the flange 16. The split bushing is clamped by means of a pair of set screws 25 that have conical tips and are threaded into openings 29 at the juncture of the bushing and flange which, if these openings are bordered by the flange in the outer surface of the bushing which are aligned with grooves 33 in the opposing surface of the flange socket. Grooves 31 are unthreaded and terminated in a bottom wall, but grooves 33 are threaded and are shown as extending the entire length of the flange socket. Accordingly the rotation of the set screws in the appropriate direction to advance them inwardly along the threaded grooves 33, will cause their tips to engage the floor and push the bushing into the socket. This movement of the bushing wedges it in place, its split ends 37 approaching each other and its tapered outer face becoming jammed against the socket surface.

In addition to the jamming action, the bushing is keyed to the spindle. If the bushing is to be made readily removable, it can be provided with an additional groove which is threaded and is aligned with an unthreaded groove in the spindle socket surface. The threaded groove can extend the entire length of the bushing in the same manner as the threads in grooves 33, and correspondingly the unthreaded groove can have a tapered floor similar to the grooves 33. With this arrangement the removal of the clamping screws 31 and the threading of one of these screws into the opening formed by the aforementioned threaded and unthreaded grooves will cause this screw to engage the floor of the unthreaded groove and pull the bushing out by screw action against the thread of the threaded groove. For improved clarity the bushing is illustrated in FIG. 1 in the position in which its clamping screws 31 are one above the other. In FIG. 2, however, the bushing is rotated about 90° to show these screws in a horizontal plane.

A rotor or runnerhead is secured to the front face of flange 16 as by bolts 20 shown as recessed in the rotor and threaded in the flange. A plurality of vanes 40 is secured to the exposed face 22 of the rotor as by having one edge of each vane provided with dovetail 44 that is received in a mating groove 26 in the rotor. The vanes can be locked in place by any suitable means such as the locking pin arrangement of U.S. Patents 2,732,666 or 3,629,283. These locking pins may be rectangular or round in transverse cross-section, although round pins are preferred for heavy duty use because the vane sockets can then be made without stress-raising corners.

A central feed space 28 is provided in the central region between the inner ends of the rotor vanes. In the feed space 28 a central impeller 62 is secured to the rotor and can rotate coaxially with the rotor body as by means of a central hub. The impeller has a number of spaced impeller bars 66 around its periphery. Between these bars and the inner ends of the vanes a generally cylindrical impeller case or particle-directing cage 76 is adjustably secured. In the illustrated construction this cage has its outer end open and provided with an outwardly flanged lip 72 seated against a housing 75 that covers the vanes, rotor and adjacent portion of the spindle.

The housing is secured to the spindle support 12 as by bolts, not shown, and completely surrounds the vane assembly except for opening 77 through which a portion of the wheel can project and also through which the projected particles are thrown. The direction of such projection is controlled by a slot 79 in the lip 72 that is connected for gradually supplying lubricant to the limited portion of the cage's periphery, as is well known.

A deflector ring 60 can also be fitted against the face 22 of the rotor, and can be held in place as by screws 61. This deflector ring causes any abrasive particles that might escape through the rotor end of the impeller cage to be deflected onto the outer face 22 of the rotor as well as against throwing faces of the vanes and thus prevents excessive wear of the vane-receiving grooves 26.

The housing 75 can, as illustrated, have a front wall 81 and a back wall 82, as well as side walls 84 (FIG. 2), and a top wall 195. Front wall 81 is shaped to fit under the impeller cage lip 72. An opening in the housing through which the impeller penetrates also receives a spout 88 which forms part of the particle supply mechanism and is arranged to deliver these particles to the interior of the impeller 62 where they can be moved by the impeller bars 66, and thus thrown through the cage slot 79. Spout 88 is held against the open end of cage 78, and a circular flange 90 around the rear end of the spout can cover and seal the entire opening by means of a shoulder 73 on the internal surface of lip 72 providing an effective engagement site, and a readily deformable sealing ring or gasket 92 can also be used as part of the seal between the flange 90 and lip 72.

This spout is conveniently held in place by a readily releasable clamp shown as a bail 99 pivotally mounted at 97 on front housing wall 81 on both sides of the spout, which bail carries a clamping screw 94. This screw 94 is arranged to engage a socket 96 on a boss 98 formed on the spout so as to lie on or near the axis of the circular flange 90. The clamping screw is threaded through an insert 98 in the cross arm of the bail as by providing an enlarged socket 100 in the arm, threading the insert into the socket and locking it there with a jam nut 12.

To keep from turning the clamping screw 94 through many revolutions when clamping or unclamping, the threaded passage way 104 through insert 100 can be inter-
sected by a larger unthreaded passageway 101 at a small angle, so that the mere loosening of the screw by as little as one turn will enable the screw to be tilted into the unthreaded passageway and thus retracted out of the way. For returning it to clamping engagement the steps are retracted. When disengaged the clamp hangs down completely free of the spout as well as the impeller cage.

The spout can then be pulled out slightly and the impeller cage shifted in rotary position when it is desired to change the direction of the stream of particles discharged from the wheel. The spout can then be returned to its proper place and the clamp resecured.

The plane in which the clamp screw is tilted to move to and from the quick-release passageways is illustrated as vertical in the interest of simplicity, but it is preferably horizontal, that is, parallel to the pivot axis for the ball 99. In other words, the screw tilt is horizontal and the ball movement vertical so that unintended slight loosening of the screw will not tend to permit the ball to drop. Even if the screw tilt a small amount, such tiltting will be at right angles to the direction in which the ball tends to move the screw, so that the ball will remain clamped in place.

The entire inside of the housing 75 is lined with wear-resistant material. A rear liner 119 (FIG. 1) covers the rear wall 82 of the housing, that is the wall of the housing through which spindle 10 projects. A front liner 120 correspondingly covers the opposing wall 81 of the housing. These two liners can project out to some extent through opening 77, as indicated at 79.

Front and rear liners 119 and 120 are spaced from each other and end liners 121, 122 (FIG. 2) span the spacing on each side. A top liner 123 covers this spacing at the upper portion of the liner assembly so as to complete the liner coverage.

Rear liner 119 has five liner segments 131, 132, 133, 134 and 135 (FIG. 2), with their edges overlapping each other to form a continuous subassembly in the general shape of an hourglass tapered. An opening 137 in the subassembly provides a passageway for the spindle and associated wheel parts. Segments 131 through 135 have on their rear faces integrally formed spacer bosses 140, 141, those numbered 140 being provided with internally positioned nuts 142 as by having the segments cast with the nuts directly in place. The threaded portions of the nuts 142 are expanded at the outer faces of the segments through an opening 143 that can also be cast in place. Bolts, such as indicated at 144, can then be fitted through openings in the housing wall as well as the openings 143, and then threaded into the cast-in-place nuts 142 to secure the liner segments against the housing.

On each side of the subassembly 131 through 135, is a pair of strip segments 151, 152, 153, 154 (FIG. 2) shown as resting directly against the internal face of the rear housing wall and having edges that overlap the edges of the subassembly 131 through 135. Strip segments on the respective sides also have their individual edges overlapping each at 156. The strip segments are also desirably held in position by nuts cast in place in the manner similar to that of the other segments except that in the strip segments no spacing is needed with respect to the housing wall so that the nuts can be directly cast into the body of the strip segments rather than into projecting bosses.

Front liner 120 (FIG. 3) is shown as also including a subassembly of five liner segments 161, 162, 163, 164, 165 similar to the corresponding segments of the rear liner, along with similar strip segments 171, 172, 173, 174. The front and rear liners can be identical except that it is preferred to have the rear liner (FIGS. 1 and 2) provided with a circular rib 147 relatively closely spaced against the periphery of the runnerhead to minimize the impact of ricocheting particles upon the periphery of the runnerhead and to minimize particle entrance into the area proximate to the spindle bearings. The lower portion of the rib can have funnel-shaped passageways 148 (FIG. 1) with relatively small external openings to permit outward passage of any particles that get trapped between the runnerhead and the rear liner. On the other hand, at the top of the rib 147 its free end can be cut out as indicated at 149 (FIG. 2) for the purpose of providing clearance through which the vanes can be slid onto and out from the rotor.

Each of the end liners 121, 122 (FIG. 2) is illustrated as having an upper segment 181 and a lower segment 182 both of generally channel shape with side lips 184 (FIG. 4) that form an overlap with the strip segments which can have correspondingly rabbeted sides, as indicated at 185. The upper and lower end liner segments are also overlapped with each other by means of the overlap 187 (FIG. 2) formed in one of the adjoining edges. As with the main portions of the front and rear liners, the end liners are spaced from the housing by spacer bosses 140, 141 and held in position by means of nuts cast in place in the bosses 140. Two nut-carrying bosses are sufficient for each of the upper end segments and one for each of the lower end segments.

Top liner 123 (FIGS. 1 and 2) is of one-piece construction and has its edges overlapping the front, rear and end liners. In the illustrated embodiment a pair of spaced ribs 191, 192 encircle the lower face of the top liner and provide between them a groove in which the upper edges of the front, rear and end liners are received.

The top liner also carries integral bosses 140 to space it from the inside surface of the housing top, and threaded studs 150 are cast in place in these bosses to provide a fastening means. Each stud can be threaded at each of its ends with the cast-in-place end having its thread flattened along one portion of its periphery to keep the stud from unscrewing out of the liner boss. The top liner is conveniently secured directly to a removable lid 195 that covers the top of the housing and can be hinged in place.

FIG. 1 shows such a hinge formed of a block 111 fixed to the upper surface of the housing, an arm 112 secured to the lid 195, and a hinge pin 113 extending through aligned passageways in the block and arm.

The internal rib 192 has its outer faces 193 not more than about ½ inch deep and vertical, that is perpendicular to the plane of the liner 123 so that this liner can be pivoted into and out of sealing engagement by merely tilting the housing lid 195 into opening and closing positions on its hinges. The faces 193 can also be inclined away from the vertical and toward the center of the housing lid, but this is not as desirable because it increases the offset or thickness needed for the upper edges 188 of the adjacent segments in order to provide good sealing. Correspondingly the inner faces 194 of the external rib 191 can be vertical, or, as illustrated, inclined away from the center of the housing. Such inclination of faces 194 is, however, not undesirable. If not inclined, as in the faces engaging the front and rear liners, these faces 194 should also be no more than about ½ inch deep so as to permit tilting with the lid 123.

The fit between the ribs 191, 192 and the upper edges of the adjacent segments can be made fairly close and still permit the tilting with the lid 195. If the fit is extremely close it may be advisable when first assembling the equipment to tilt the top liner 123 into place slowly and then when it nears its seated position to loosen the clamping to the lid at the studs 150 to permit the liner to adjust itself into fitting engagement. The clamping to the lid can then be tightened to hold the liner in its adjusted position for future lid openings and closings. If desired the lid can be equipped with a sealing gasket or the like, as illustrated.

The individual segments of the front and end liners are more fully shown in FIGS. 5 through 16 and they cooperate to form a particularly desirable and effective combination. Because of the spacing between the liners
and the internal surface of the housing, inspection will much more readily reveal when a hole has been worn through a liner and the housing wall is in danger of being eroded. The presence of any such hole will make itself evident by penetration of light so that it is readily observable. This does not happen with liners which abut directly against the housing surface. It will be noted that wherever the liners of the present invention engage the housing their thickness is enlarged so that they are not likely to be worn through in those places.

In addition, all joints between the liner segments are overlapped so that there is no direct passageway from the wheel to the housing wall. Before any particle can work its way through a liner joint, it must be small enough to fit in a crevice and it must also undergo one or more abrupt changes in direction. Particles of such small size after such a change in direction lose essentially all of their abrading ability.

Another feature of the present invention is that the upper segments 131, 161 of the front and rear liners extend completely across between the strip liners and yet these upper segments can be easily removed through the top of the housing. Because of the use of the strip liners the upper segments 131, 161 have a length which, although extending completely across the top of the five-part assembly 130, 132, 133, 134, 135, 160, 161, 162, 163, 164, 165, they are still shorter than the space between the top of the end liners. The upper segments 131, 161 are accordingly simple to install and to replace. The remaining segments of the five-part assemblies are readily removed from the bottom of the housing.

Without the strip segments 151, 152, 153, 154, it seems to be impractical to provide adequately overlapped joints that do not leave any direct passageway through the liner. For this purpose it is not necessary to have the joint 156 between the upper and lower strip segments offset with respect to the joints between the individual segments 131 through 135 and 161 through 165. It is likewise not necessary to have the joint between the upper and lower strip segment offset from the joint between the upper and lower end segments. The use of the strip segments accordingly provides several advantages.

Liner segment 134 is shown more fully in FIGS. 5 and 6 as a six-sided generally plate-shaped member with an upper edge 281, two diverging straight edges 202, 203 extending symmetrically away from edge 201, and two converging straight edges 204, 205 extending symmetrically from the outer ends of the diverging edges. The sixth side is an arcuate shaped edge 206 connecting the outer ends of converging edges 204, 205. Edges 281, 202, 203 are not rabbeted but are overlapped by the strip segments which have their margins located so as to lie between the segment 131 and the adjacent housing wall. Edge 206 is not rabbeted either but in the form shown has a lip 211 that extends into close engagement with the adjacent housing wall and thus reduces the possibility of having particles thrown outwardly by the spindle against the lid 123 through the space between the housing and the segment. The lip is not otherwise protected in these locations. Segment 131 also carries section 212 of the circular rib 147 that cooperates with the runnerhead periphery. It is particularly desirable to chamfer the inner edge of the free end of the rib section 212, as indicated at 215, as well as all other sections of this rib, to better clear the adjacent portions of the vane which can project somewhat in this location 216 where their dovetail-shaped bases terminate and blend into the vane bodies.

The use of a one-piece top segment that extends across the top of the rear liner assures the absence of any gap in the lip 211 that protects the lid.

The front liner segment 161 that corresponds to segment 131 can be identical except that the rib section 212 and the lip 211 can both be omitted.

Rear liner segment 133 is also shown in greater detail in FIGS. 7 and 8. It has four sides, an elongated straight edge 221 with two converging straight edges 222, 223 extending unsymmetrically from the ends of edge 221 and an arcuately shaped edge 224 connecting the outer ends of edges 222, 223. Edges 222 and 223 are the only ones shown rabbeted. Edge 221 is overlapped by the strip segments and does not need rabbeting with the above arrangement. Edge 224 likewise does not need rabbeting and does not need a lip such as lip 211. Another section 213 of the circular rib 147 is also carried by segment 133.

Rear liner segment 132 can be the mirror image of segment 133. Rear liner segment 135 is more fully shown in FIGS. 9 and 10, and is of five-sided construction. It has an elongated straight edge 231 with a rectangularly extending rabbeted edge 232 on one end and a circular rib 147 on the other end a straight edge 233 that converges toward edge 232. The fourth straight edge 234, which is rabbeted, extends from the outer end of edge 233 and more rapidly converges toward edge 232. The fifth edge 235 is of arcuate shape and connects the outer ends of edges 232 and 234. Liner segment 136 carries a section 214 of the circular rib 147. Edges 231, 233 and 235 are not rabbeted, edge 233 being overlapped by the strip segment, edge 231 being a portion of the discharge mouth of the liners through which the wheel throws its projected particles so that no joint is here needed. Edge 235 also does not need a lip such as lip 211.

Rear liner segment 134 can be the mirror image of liner 135 with the additional inversion of the rabbeted rectangular edge corresponding to 232 so that it meets with the rabbeted edge 232 to form an overlap joint. The lower segments 164 and 165 of the front liner can be identical with the rear liner segments 134, 135 except that the rib section 214 is not used on the front liner, and neither is lip 211 required there.

Lower strip segment 154 is shown in isololated condition in FIGS. 11, 12 and 13. It has a central or body portion 241 of substantial thickness sufficient to receive a cast-in-place nut 142. This can be approximately twice as thick as the principal portions of liner segments 131 through 135 and 161 through 165. Body 241 extends the length of the segment except for a rabbeted end 242. On each side of body portion 241 there are wings 251, 252 of reduced thickness that overlap with the adjacent margins of adjoining liner segments. Strip segment 154 has an overall non-rectangular parallelogram shape so as to conform with the tapered nature of the housing and allow rabbeted end 242 to form an overlapped joint with the adjacent upper strip segment 152 and still have the lower strip segment follow the flare of the housing. One entire face 254 of strip segment 154 can be generally flat to directly engage the abutting surface of the housing and a single cast-in-place nut is then adequate to securely and accurately position the segment.

Upper strip segment 152 is similarly shown in FIGS. 14, 15 and 16 and is of similar construction and configuration except for its ends 156 and 157. End 156 has a rabbet 261, so as to leave a relatively thin flange 264 for overlapping with rabbeted edge 242 and its adjacent lower strip segment. End 157 is ground on 266 along its length so as to leave a ribbed flange 271, 272, 273 that form a multiple overlap joint with the top liner 123.

Strip segment 151 can be the mirror image of strip segment 152 and correspondingly strip segment 153 the mirror image of strip segment 154. Similarly, the front liner strip segments 171, 172, 173, 174 can correspond respectively with rear strip segments 152, 154, 151, 153.

The construction of the end segments is set forth in FIGS. 2 and 4. They are of generally channel shape and segment 182 is essentially only such a channel with a
single nut-carrying spacer 140 along with a pair of simple spacers 141. The spacers 141 are spaced from each other on each side of the long axis of the channel and also spaced from spacer 140 which is near the upper end of the segment. End segment 181 generally corresponds except that it has the offset 187 on one end of the channel to overlap the upper end of segment 182, an extension 188 that fits in the groove between ribs 191, 192 in top liner 193, and a second nut-carrying spacer 140. The nut-carrying spacers 140 for end segments 181 and 182 are preferably located along the longitudinal axis of the channel that these spacers form.

If desired the offset 187 of segment 181 can be made of appropriate dimensions so as to act as a spacer in addition to or in lieu of the spacers 141 of that segment.

The above wear liner arrangements provide a maximum protection for the housing, coupled with ease of inspection and relative simplicity of construction in that only a single layer of liner segments is used to protect any housing section. The protection afforded by the elimination of straight-through gaps is particularly significant and the entire combination of features is something the blasting art has long needed.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed:

1. A housing for a throwing wheel that projects a stream of blastant particles primarily in one general direction, said housing surrounding the front and rear of the wheel as well as its top and ends, a set of wear liner segments completely covering the internal surface of the housing including segments having front liner segments, rear liner segments, tie bar end liner segments, a top liner segment, and elongated strip segments, said strip segments joining the end segments with the front and rear segments respectively, and extending up to the junctures with the top segment, the strip segments covering all joints at said junctures and the segments overlapping each other so that no joint between segments provides a pathway that leads directly to the housing.

2. The combination of claim 1 in which nearly all of the segments are spaced from the internal housing surface by spacers.

3. The combination of claim 2 in which the strip segments that help hold the adjacent segments spaced from the internal housing surface.

4. The combination of claim 2 in which the spacers are integral portions of the segments.

5. The combination of claim 1 in which the housing tapers from a narrow width at its top to a wider width at its bottom, a single liner segment extends across the upper portion of the housing front, a single liner segment extends across the upper portion of the housing rear, said single liners being shorter than the space between the opposite end segments so that the single liners can be removed from the top of the housing.

6. An end segment for a wear liner assembly of a particle-throwing wheel housing, said segment being a straight relatively shallow channel with a set of spacer bosses integrally formed on its under surface and a nut cast in place within at least one of said bosses, the nut-carrying boss having an opening in its outer surface through which opening the threaded portion of the nut is exposed for threaded engagement, the channel having a floor which aside from the boss structure is of uniform thickness from one side wall of the channel to the other.

7. A segment of a wear liner plate assembly for a particle-throwing wheel housing, said segment being a generally plate-shaped body with offset edges to form a labyrinth type seal with adjacent segments of the wear liner, one face of the plate having at least three integrally formed bosses, only two of which have nuts cast in place within them, said two bosses having their outer faces apertured to expose the threaded portions of their nuts for threaded engagement with mounting elements, all the bosses having their outer faces in the same plane.

8. A wear plate assembly for covering the internal surface of a housing for a particle-throwing wheel at least about eighteen inches in diameter, the assembly including a front subassembly of plate segments for protecting the housing surface in front of the wheel, and a rear subassembly of plate segments for protecting the housing surface of the rear of the wheel, each subassembly consisting of five segment-shaped liner plates overlapping each other at their junctures with one segment extending completely across the top of the subassembly, each segment having integrally formed bosses extending out from one face to engage the internal surface of the housing and hold the remainder of the segment spaced from said surface, said bosses containing nuts cast in place within them and having their boss-engaging faces apertured to expose the threaded portions of the nuts for threaded engagement.

9. A wear liner segment for covering the internal surface of a housing for a particle-throwing wheel, said segment being a six-sided plate with a straight upper edge, two diverging straight edges extending symmetrically from the ends of the edge and two converging edges extending symmetrically from the outer ends of the diverging edges, the top and the two converging edges being rabbed to form overlapping junctures with adjacent segments, and one face of the plate having three integrally formed bosses spaced from each other, two of which bosses contain nuts cast in place within them, the outer faces of said two bosses being apertured to expose the threaded portions of the nuts for threaded engagement.

10. A wear liner segment for covering the internal surface of a housing for a particle-throwing wheel, said segment being a four-sided plate with an elongated straight edge and two converging straight edges extending unsymmetrically from the ends of the elongated edge, the two converging edges being rabbed to form overlapping junctures with adjacent segments, and one face of the plate having three integrally formed bosses spaced from each other, two of which bosses contain nuts cast in place within them, the outer faces of said two bosses being apertured to expose the threaded portions of the nuts for threaded engagement.

11. A wear liner segment for covering the internal surface of a housing for a particle-throwing wheel, said segment being a five-sided plate with an elongated straight edge and two converging straight edges extending unsymmetrically from the ends of the elongated edge, the second of said converging edges forming a right angle with one end of the elongated edge, the second of said converging edges extending from the second end of the elongated edge in a direction that tends to gradually intersect the other converging edge, a fourth straight edge extending from the second converging edge in a direction that tends to more abruptly intersect the second edge, the fourth edge and the second of the converging edges being rabbed to form overlapping junctures with adjacent segments, and one face of the plate having two integrally formed bosses spaced from each other, each of which bosses contain nuts cast in place within them, the outer faces of said two bosses being apertured to expose the threaded portions of the nuts for threaded engagement.

12. A set of wear liner segments for completely covering the internal surface of a housing for a particle-throwing wheel, the segments including front liner segments, rear liner segments, tie bar end liner segments, a top liner segment, and elongated strip segments, said strip segments joining the end segments with the front and rear segments respectively, and extending up to the junctures with the top segment, the strip segments covering all joints at said junctures and the segments overlapping each other so that no joint between segments provides a pathway that leads directly to the housing.
13. A wear liner segment for covering the internal surface of a housing for a particle-throwing wheel, said segment being an elongated non-rectangular parallelogram-shaped plate with its long edges rabbeted to form overlapping-type joints with adjacent segments, one of the short edges being grooved along its length to provide side walls on each of the groove for forming a multiple overlapped-type joint with a segment adjacent that short edge, and the body of the plate having a single nut cast in place within it, an aperture in the body exposing the threaded portions of the nut for threaded engagement.

14. A wear liner for a housing of a particle-throwing wheel, the liner being generally plate-shaped with a pair of spaced ribs extending in generally parallel arrangement around the margin of one face of the plate to define a groove between them, each of the ribs being about $\frac{1}{2}$ inch high, and the inner side wall of the groove being substantially perpendicular to the plane of the plate.

15. A wear plate assembly for covering the internal surface of a housing for a particle-throwing wheel, the assembly including a rear subassembly of plate segments for protecting the housing surface of the rear of the wheel and consisting of five segment-shaped liner plates overlapping each other at their junctures with one segment extending completely across the top of the subassembly, each segment having integrally formed bosses extending outward from one face to engage the internal surface of the housing and hold the remainder of the segment spaced from said surface, said bosses containing nuts cast in place within them and having their boss-engaging faces apertured to expose the threaded portions of the nuts for threaded engagement, and the top segment having a lip extending toward the adjacent housing to reduce the escape of particles into the space between the housing and the segment.

16. The combination of claim 9 in which the sixth edge of the plate has a lip extending substantially its entire length and in the same direction the bosses extend.

17. The combination of claim 1, wherein said joints are lapped, and said lapped joints being of substantially greater thickness than a single segment.

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