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PARTICLE-THROWING APPARATUS

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This application is a division of our application Ser. No. 240,801, filed Nov. 29, 1962, now Patent No. 3,160,990, dated Dec. 15, 1964.

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 projects a directional 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 front 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 housing 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 a different 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 also spaced from the internal housing surface 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 the edge and two converging edges extending symmetrically from the outer ends of the diverging edges, the top and the two converging edges being rabbetted 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 rabbetted 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 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 rabbetted 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 rabbetted 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 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.

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 an automatic lubricator **18** that 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 setscrews **25** that have conical tips and are threaded into openings **29** at the juncture of the bushing and the flange. These openings are formed by grooves **31** 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 setscrews 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 is 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 complete 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 floor of groove **31**. 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 threadedly engaged 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 2,869,289. These locking pins may be rectangular or round in transverse cross-section, although round pins are preferred for heavy duty use because the pin 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 and held coaxially with the rotor as by means of bolt **64**. 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 **70** 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 impeller cage. This slot, which can be rectangular, triangular, etc., is confined to a 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 cage 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 **70**, and a circular flange **90** around the rear end of the spout can cover and seal the entire open cage end. An internal shoulder **73** on the internal surface of lip **72** provides 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 **102**.

To keep from turning the clamping screw **94** through many revolutions when clamping or unclamping, the threaded passageway **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 or two turns 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 retraced. When disengaged the clamp hangs down completely free of the spout as well as the impeller cage **70**. 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 bail **99**. In other words, the screw tilting is horizontal and the bail movement vertical so that unintended slight loosening of the screw will not tend to permit the bail to drop. Even if the screw tilts a small amount, such tilting will be at right angles to the direction in which the bail tends to move the screw, so that the bail 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 isosceles trapezoid. 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 exposed at the outer faces of the bosses 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 other 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 liner 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 impacts 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 offset **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, 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 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 observed. 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 any 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 segment subassambly **131**, **132**, **133**, **134**, **135** and **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 **131** is shown more fully in FIGS. 5 and 6 as a six-sided generally plate-shaped member with an upper straight edge **201**, 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 arcuately shaped edge **206** connecting the outer ends of converging edges **204**, **205**. Edges **201**, **204** and **205** are rabbeted, as indicated at **208**, **209** and **210** so as to overlap the segments that adjoin these edges. Edges **202** and **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 lid 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 vanes 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 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 towards edge **232**. The fifth edge **235** is of arcuate shape and connects the outer ends of edges **232** and **234**. Liner **135** also 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 isolated 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 portion **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 grooved at **266** along its length so as to leave two flanges **271**, **272** 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, 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.

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 are spacers 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 having 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 sixsided 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 rabbeted 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 rabbeted 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 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 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 rabbetted 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.

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 rabbetted 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 ½ 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 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, 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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PARTICLE-THROWING APPARATUS

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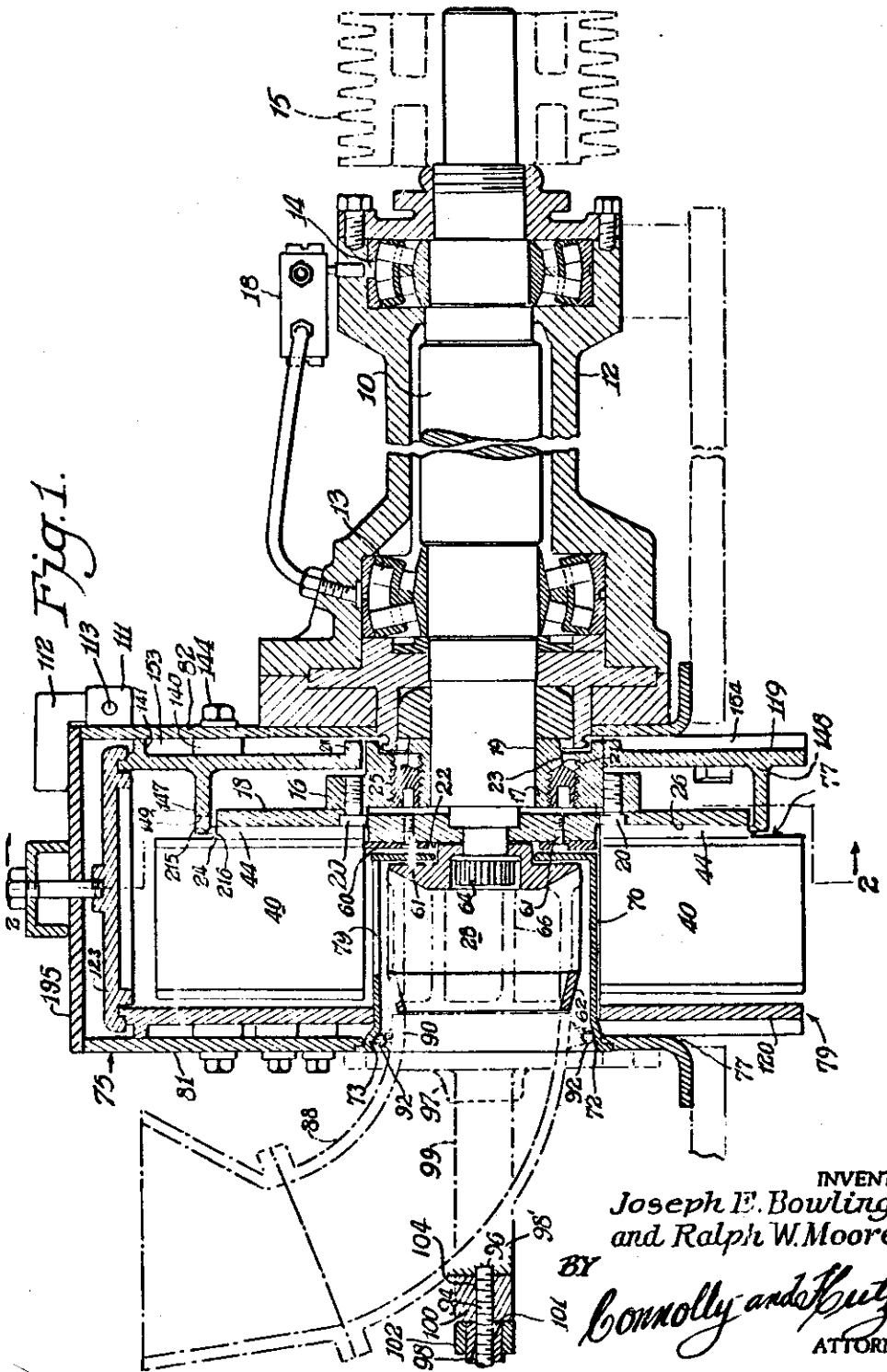
Fig. 1.



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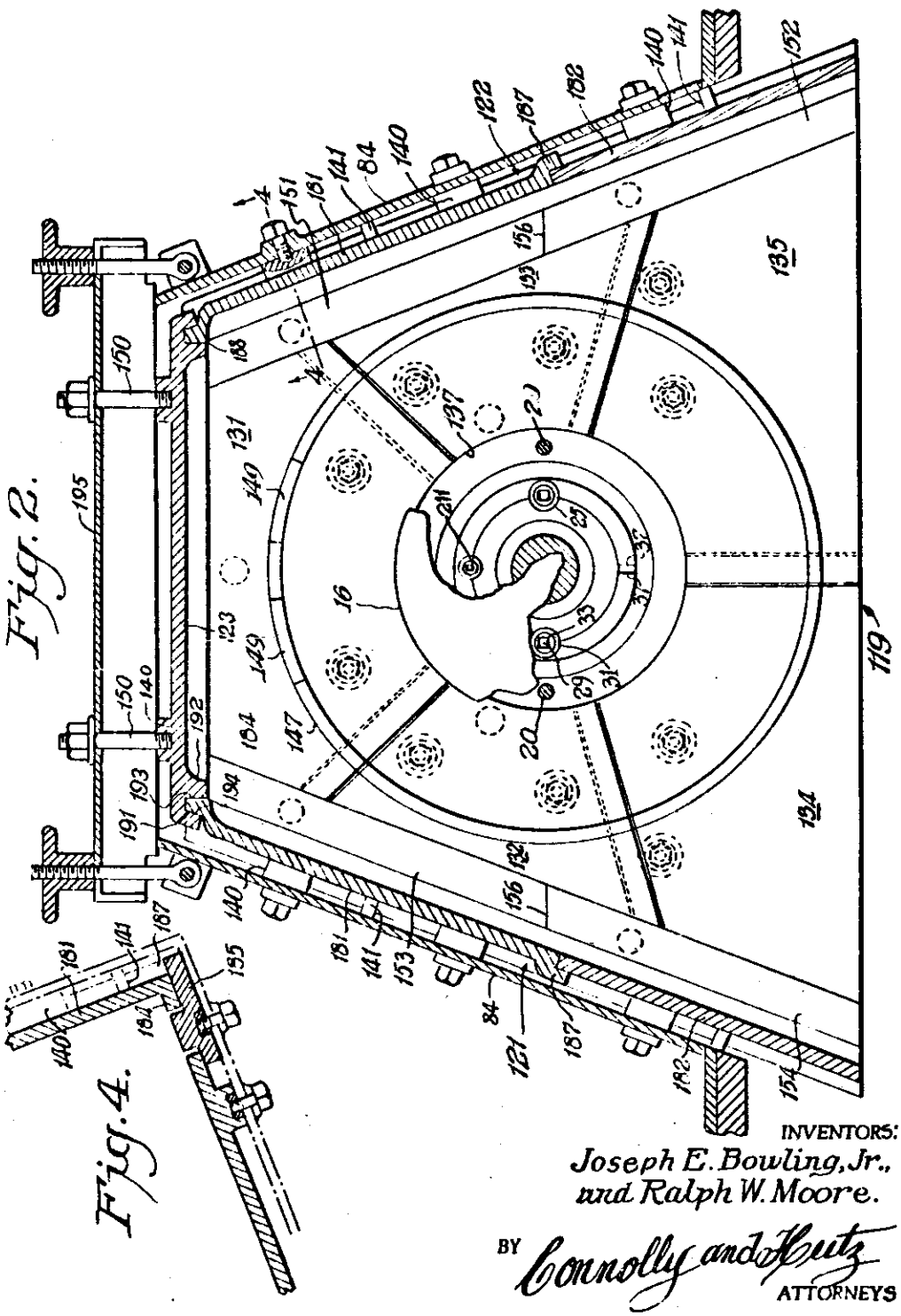

Fig. 2.

Fig. 4.

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Fig. 3.

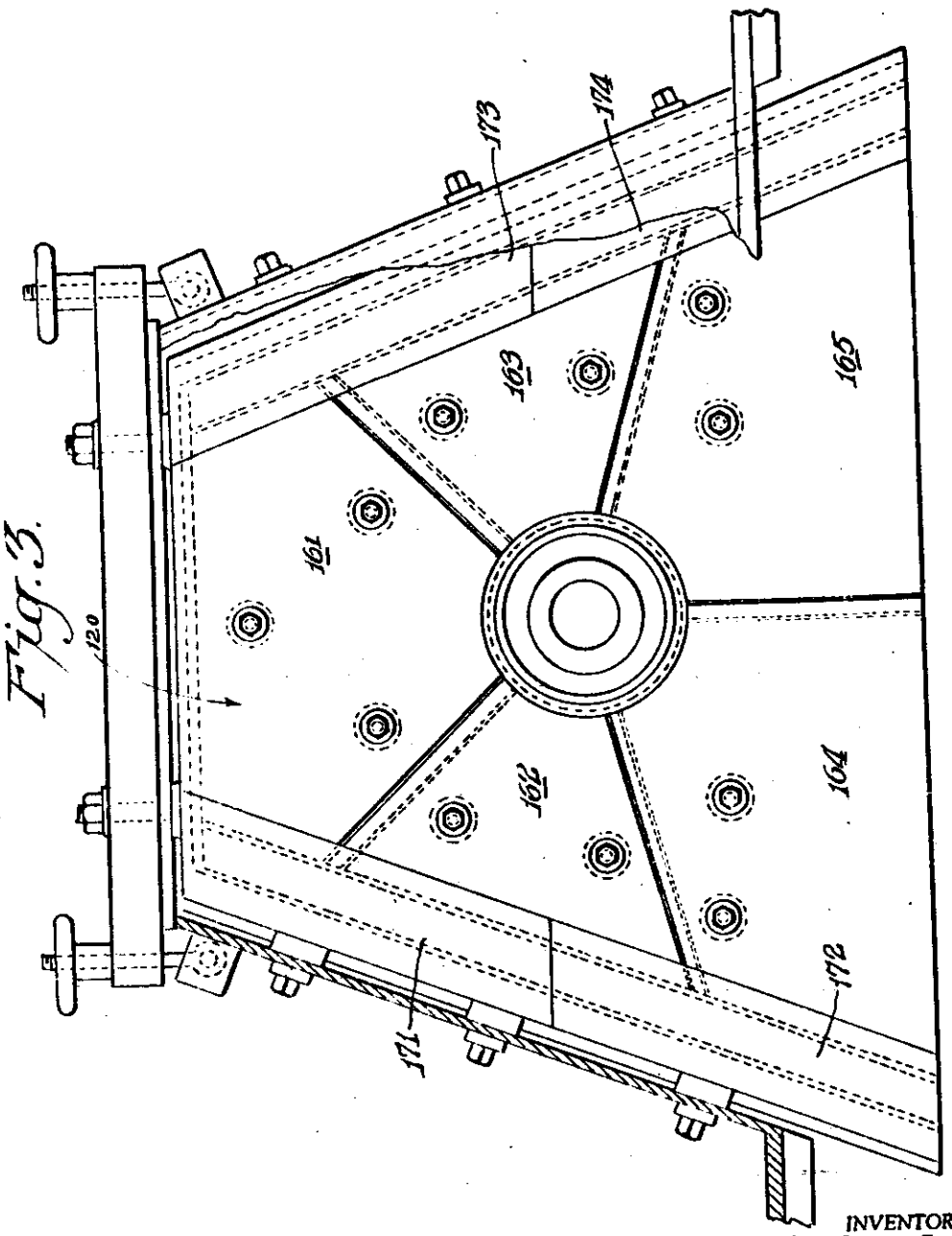

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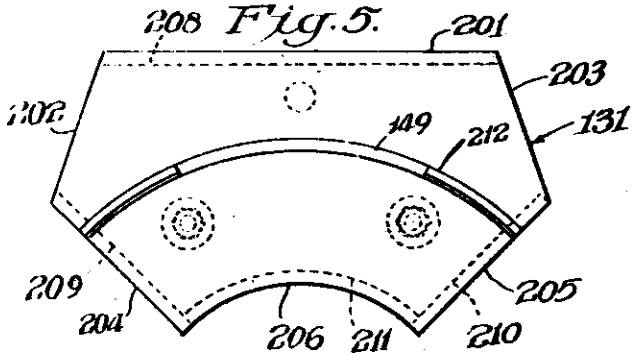
Fig. 5.



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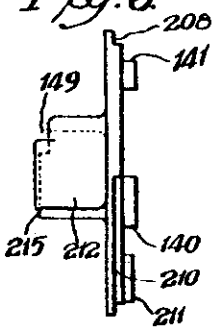

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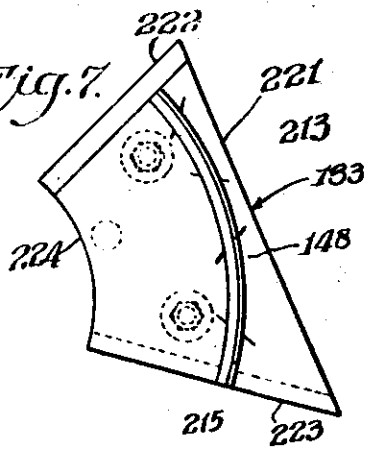

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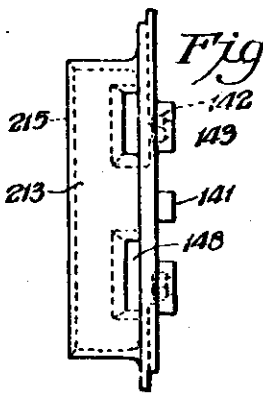

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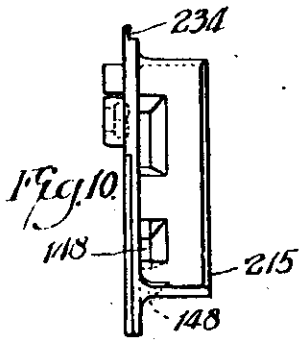

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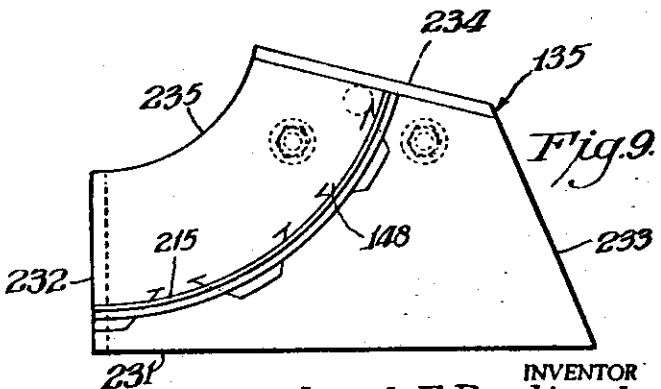

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Fig. 11.

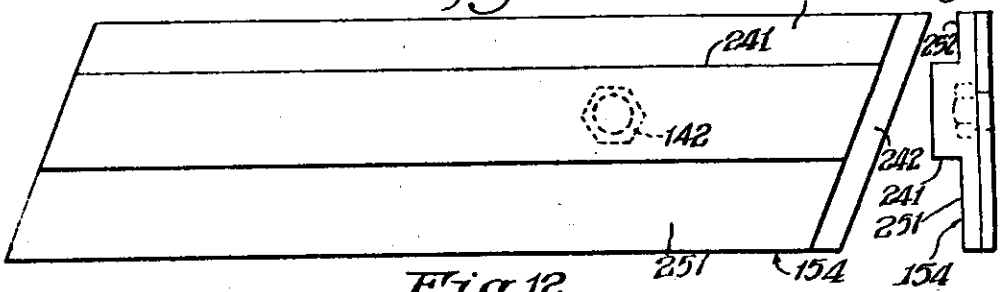
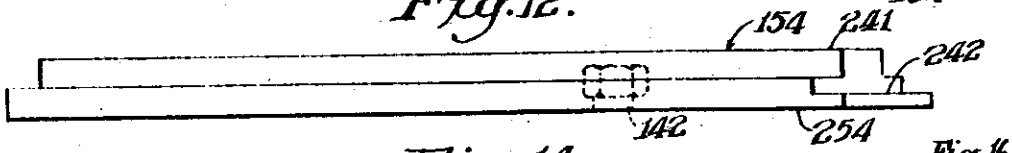


Fig. 13.

Fig. 12.



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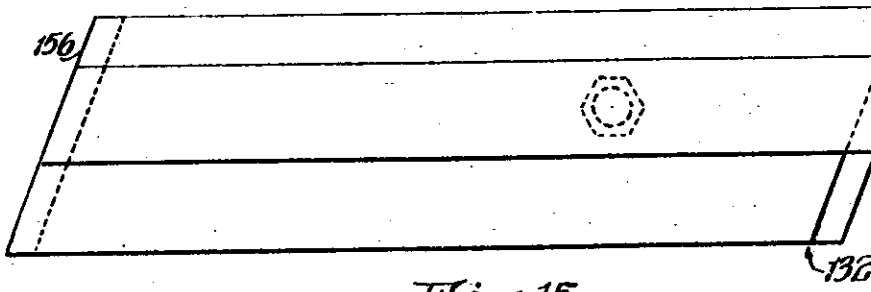
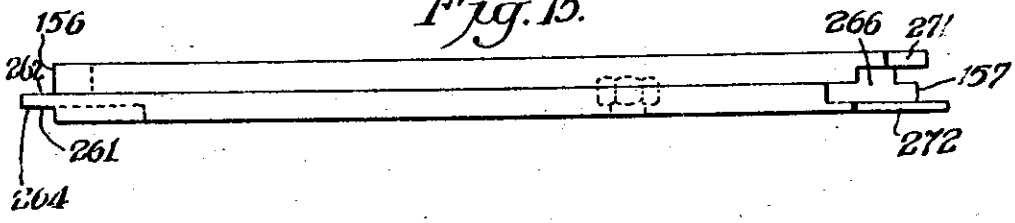


Fig. 16

Fig. 15.



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