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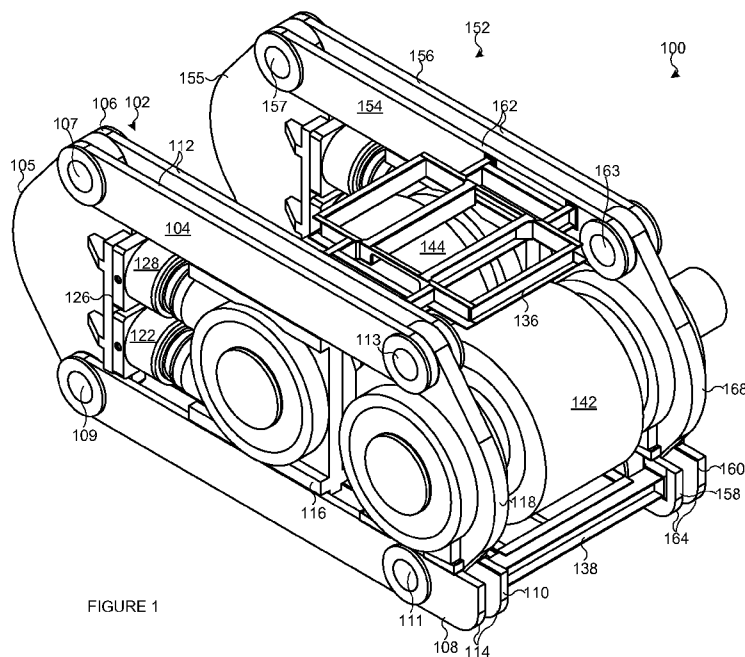


FIGURE 1

(57) Abstract: Disclosed herein are embodiments of a roller press and frame therefore. The frame may include members that comprise split rails. The roller press may include a fixed rolling device connected directly to top and bottom members of the frame using bearing housings. The bearing housings may connect to top and bottom members of the frame using pin connections. The bearing housings may include wedge portions configured to provide a lower coefficient of friction to the frame when in an extraction configuration, and configured to be positioned in an operation configuration during operation. Connection points may include shims.



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ROLLER PRESS AND FRAME THEREFORE

CROSS-REFERENCE TO RELATED APPLICATIONS

[01] This application claims priority from United States Provisional application 61/825,215, filed 20 May 2013; United States Provisional application 61/825,218, filed 20 May 2013; and United States Provisional application 61/825,220, filed 20 May 2013.

TECHNICAL FIELD

[02] This disclosure relates generally to roller presses and frames therefore. Specifically, this disclosure relates to frames for roller presses that are advantageous in that they include fewer parts, have increased stiffness or rigidity, and are easier to manufacture.

BRIEF DESCRIPTION OF THE DRAWINGS

[03] Non-Limiting and non-exhaustive embodiments of the disclosure are described, including various embodiments of the disclosure, with reference to the figures, in which:

[04] Figure 1 illustrates a perspective view of a roller press frame therefore according to one embodiment.

[05] Figure 2 illustrates a side view of a roller press frame according to one embodiment.

[06] Figures 3A and 3B illustrates a side view of a fixed roller bearing housing of a roller press frame with extraction wedges in operational configuration and in extraction configuration, according to one embodiment.

[07] Figure 3C illustrates a perspective view of a roller press and frame therefore in a stage of extraction according to one embodiment.

[08] Figure 3D illustrates a perspective view of a roller press and frame therefore in a stage of extraction according to one embodiment.

[09] Figure 4 illustrates a flow chart of a method for extracting a rolling device of a roller press according to one embodiment.

[10] Figures 5A and 5B illustrate a perspective view of bearing housings according to one embodiment.

[11] Figure 5C illustrates a perspective view of a roller press and frame therefore according to one embodiment.

[12] Figure 6 illustrates a top view of a first and second bearing housing mounting a roller device to a roller press frame according to one embodiment.

[13] Figure 7 illustrates a top view of a first and second bearing housing mounting a roller device to a roller press frame according to one embodiment.

DETAILED DESCRIPTION

[14] This disclosure relates to crushing, grinding, and comminution equipment, and more particularly to roller presses such as high pressure grinding roller (HPGR) systems, pelletizing, briquetting, roll breakers, roll crushers, sizers, shredders, and the like that may be used, for example, in mining, cement, minerals processing, slag, pozzolan, supplementary cementitious materials, food, charcoal, and other industries. Roller presses are systems that typically include at least two rolling devices which may be rotatably supported using a frame. The rolling devices may be substantially cylindrical in shape and disposed substantially in parallel with a space therebetween. A grinding force therebetween may be adjustable according to a desired particle size or other result.

[15] One factor for the rate of processing of a feed material through a roller press is the size of the roller press. Accordingly, advances have been made to increase the size of roller presses including the size of the roller devices and the roller device frame. Roller press frames typically are formed from a limited number of pre-formed pieces, the ease of manufacturability of which decreases as the size of the frame increases. Further, the weight and expense of the frame increases with size. Roller press frames according to the embodiments herein include a plurality of pieces designed to increase ease of manufacturability of the pieces, decrease weight of the frame, and increase stiffness (or rigidity) of the frame.

[16] Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment. In particular, "an embodiment" may be a system, an article of manufacture, a method, or a product of a process.

[17] The phrases "connected to" and "in communication with" refer to any form of interaction between two or more components, including mechanical, electrical, magnetic, and electromagnetic interaction. Two components may be connected to each other even though they are not in direct contact with each other and even though there may be intermediary devices between the two components.

[18] In some cases, well-known features, structures, or operations are not shown or described in detail. Furthermore, the described features, structures, or operations may be combined in any suitable manner in one or more embodiments. The components of the embodiments, as generally described and illustrated in the figures herein, can be arranged and designed in a wide variety of different configurations. In addition, the steps of the described methods do not necessarily need to be executed in any specific order, or even sequentially, nor need the steps be executed only once, unless otherwise specified.

[19] The embodiments of the disclosure are best understood by reference to the drawings, wherein like parts are designated by like numerals throughout. In the following description, numerous details are provided to give a thorough understanding of various embodiments; however, the embodiments disclosed herein can be practiced without one or more of the specific details, or with other methods, components, materials, and the like. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of this disclosure.

[20] Figure 1 illustrates a perspective view of one embodiment of a roller press system 100 that eliminates the need for one side of each frame assembly, and shortens the top and bottom members of each frame assembly while still allowing for similarly sized rolling devices as existing roller press systems. The roller press system 100 generally includes a frame comprising a first frame assembly 102 and a second frame assembly 152; a fixed rolling device 142; and a moveable roller device 144. In one embodiment, the first frame assembly 102 and the second frame assembly 152 may be substantially similar. The first frame assembly 102 may include a top member 112, a bottom member 114, and a first side member 105. The top member 112 may be substantially parallel with the bottom member 114, and substantially perpendicular to the first side member 105. Similarly, the second frame assembly 152 may include a top member 162, a bottom member 164, and a first side member 155. The top member 162 may be substantially parallel with the bottom member 164, and substantially perpendicular to the first side member 155.

[21] The first and second frame assemblies 102 and 152 may be configured substantially in parallel with each other. To facilitate use of the roller press 100, a feed support member 136 may be attached to the first and second top members 112, 162. The feed support member 136 may be configured to support a hopper or other feed mechanism for directing a feed into the roller press 100, into an area between the fixed (i.e. non-movable) rolling device 142 and the moveable rolling device 144. Furthermore, a lower support member 138 may be attached to the first and second bottom members 114, 164. The lower support member 138 may be configured to support a guide (such as hopper 220, illustrated in Figure 2) for pressed material leaving the roller press 100, and directing the pressed material to further processing, such as a conveyor or the like.

[22] To the first and second frame assemblies 102 and 152 may be mounted (i) fixed first and second bearing housings 118, 168 for the fixed rolling device 142, said first and second fixed bearing housings 118, 168 serving to mount

fixed rolling device 142 to the frame assemblies, and(ii) moveable first and second bearing housings 116, 166 for the moveable rolling device 144, said first and second movable bearing housings 116, 166 serving to mount movable rolling device 144 to the frame assemblies. The fixed first and second bearing housings 118, 168 may be fixed in the respective first and second frame assemblies 102, 152, such that when in use, the fixed rolling device 142 is held with substantially no movement parallel to the top members 112, 162 or the side members 105, 155. It should be understood that some minor movement of the fixed rolling device 142 when the roller press 100 is in use due to, for example, minor elastic deformations, thermal expansion, skew, or the like of the fixed rolling device 142, its shaft, the bearing housings 118, 168, members of the first and second frame assemblies 102, 152, and the like, may be expected, but such movement should be minor in comparison with the intended available movement of the moveable rolling device 144.

[23] In various embodiments, the fixed first and second bearing housings 118, 168 may be fixed by mounting to the top and bottom members 112, 114, 162, 164. As mentioned above, pin connectors may be used to mount the fixed first and second bearing housings 118, 168 to the top and bottom members 112, 114, 162, 164. In such embodiments, the top and bottom members 112, 114, 162, 164 may be shorter with such mounting directly to the fixed first and second bearing housings 118, 168 than in embodiments where the top and bottom members 112, 114, 162, 164 are mounted to second side members. Indeed, in several embodiments such as illustrated in Figure 1, second side members are not needed.

[24] In several embodiments, the moveable bearing housings 116, 166 may be configured to be moveable in a direction in parallel with the top and bottom members 112, 162, 114, 164. In one embodiment, the moveable bearing housings 116, 166, may be configured with a "tongue-and-groove" configuration in top and bottom faces thereof for a moveable connection with the top and bottom members 112, 162, 114, 164. In one embodiment, the moveable bearing housings 116, 166, include tongue portions of the tongue-

and-groove configurations and the first and second top and bottom members 112, 114, 162, 164 as split rails make up the groove portions of the tongue-and-groove configurations. Thus, during construction, maintenance, and the like, the moveable bearing housings 116, 166 may be moved into place by sliding along the top and bottom members 112, 114, 162, 164. Such "tongue-and-groove" configuration is described in further detail herein in conjunction with Figures 5A-5C.

[25] The moveable bearing housings 116, 166 may be moveably mounted with the first and second frame assemblies 102, 152 to facilitate the movement of for the moveable rolling device 144. The moveable first and second bearing housings 116, 166 may be moveable in the respective first and second frame assemblies 102, 152, such that when in use, the moveable rolling device 144 is permitted some movement in parallel with the top members 112, 162.

[26] Force generation devices 122 and 128 may be used to mount the moveable bearing housing 116 to the first side member 105. Plates 120 and 126 may be used to mount the force generation devices 122 and 128 to the first side member 105. Similar force generation devices may be used to mount moveable bearing housing 166 to the first side member 154. Force generation devices 122 and 128 may be any device capable of applying force to the moveable bearing housings 116, 166, such that the moveable rolling device 144 is held in proximity to the fixed rolling device 142. Force generation devices 122 and 128 may further be capable of absorbing forces from the moveable rolling device 144 in the direction of the first side members 105, 155. Force generation devices 122 and 128 may be devices such as hydraulic cylinders, hydraulic rams, springs and the like. Force generation devices 122 and 128 may be configured to maintain the moveable rolling device 144 at a predetermined distance or force from the fixed rolling device 142, and absorb forces from the moveable rolling device 144 when in use. In one alternative embodiment, the moveable bearing housings 116, 166 may be fixed in place for use, but capable of adjustment using the force generation devices 122, 128. Force generation devices 122 and 128 in combination with the moveable rolling

device 144 may be beneficial to avoid damage to the fixed and moveable rolling devices 142, 144 from certain feed.

[27] In one embodiment, the first and second frame assemblies 102, 152 may be supported by leg devices (not separately illustrated). Leg devices may include blocks, plates, spacers, isolators, or the like. In one embodiment the first and second frame assemblies 102, 152 may be held in place by leg devices by fixing leg devices to a floor, frame, or other such assembly, or rails mounted to a floor, subframe, foundation, plates, bed plates, sole plates, or the like.

[28] In one embodiment, the first and second frame assemblies 102, 152 may be constructed using rotatable connections such as pin connections. Turning first to the first frame assembly 102, the side member 105 having a top end adjacent to top member 112 may be removably connected to the top member 112 using pin 107 and having a bottom end adjacent to bottom member 114 be removably connected to the bottom member 114 using pin 109. Turning now to the second frame assembly 152, the side member 155 having a top end adjacent to top member 112 may be removably connected to the top member using pin 157, and having a bottom end (not depicted) adjacent to bottom member 164 be removably connected to the bottom member 164 using a pin (not illustrated).

[29] In one embodiment, the first and second frame assemblies 102, 152 may include certain members constructed of multiple sub-members. In the illustrated embodiment, the top members 112, 162 and bottom members 114, 164 include sub-members. That is, top member 112 includes first and second sub-members 104 and 106. Top member 162 includes first and second sub members 154 and 156. Furthermore, the bottom member 114 includes first and second sub-members 108, 110. Bottom member 164 includes first and second sub members 158 and 160.

[30] As discussed in more detail above, certain embodiments may replace certain members with sub-members. For example, although illustrated in Figure 1 are top and bottom members 112, 114, 162, 164 that are further comprised of sub-members, one or both of side members 105, 155 may also

include sub-members. Various combinations of top, bottom, and side members being made up of sub-members may be used including, for example, two or more top, bottom, and side members, as well as all members being made up of sub-members.

[31] Further, as discussed in more detail above, certain members may include split rails. A split rail may refer to a pair of sub-members each extending from a first common connection point to a second common connection point. Split rails may be separated, as illustrated. According to one embodiment, split rails are separated by another frame member. For example, top member 112 may comprise split rails 104 and 106 separated by side member 105 on one end and fixed bearing housing 118 on another end. Split rails may include sub-members that are substantially in parallel and for the same length. In one embodiment, each sub-member of a split rail is identical. For example, as illustrated in Figure 1, top and bottom members 112, 114, 162, 164 comprise split rails. Each sub-member of a split rail may be separated, as illustrated. In one embodiment, one sub-member of a split rail may extend further beyond a common connection point than another sub-member of a split rail. According to some embodiments, each sub-member of split rails may be of different thicknesses, different widths, constructed of different materials, or the like. In certain embodiments, a split rail may include more than two sub-members. For example, in one embodiment, a split rail includes three sub-members, each separated and each extending from a first common connection point to a second common connection point. According to certain other embodiments a split rail may include more than three sub-members.

[32] The embodiments illustrated in Figure 1 include first and second frame assemblies 102, 152 that include top members 112, 162, side members 105, 155, and bottom members 114, 164, but do not include second side members. The embodiments illustrated in Figure 1 include the first fixed bearing housing 118 being mounted directly to the first top and bottom members 112, 114, and the second fixed bearing housing 168 being mounted directly to the second top and bottom members 162, 164. In the embodiments illustrated in Figure 1,

because the fixed bearing housings 118, 168 mount directly to the top and bottom members 112, 114, 162, 164, such top and bottom members do not need to extend past the fixed bearing housings 118, 168 to second side members. Thus, the embodiments illustrated in Figure 1 may include top and bottom members that are shorter than those of previous roller press frames.

[33] Figure 2 illustrates a side view of a roller press frame according to one embodiment. Clearly seen in Figure 2 is the roller press frame 100 including a first side member 105, a first top member 112, and first bottom member 114. The first top member 112 is connected to the first fixed bearing housing 118 with pin 113. The first fixed bearing housing 118 is connected to the first bottom member 114 with pin 111. Also illustrated is horizontal line 202 extending through the center of the first fixed bearing housing 118 and the center of the first moveable bearing housing 116. Further, vertical line 204 extends through pin 113, center of the first fixed bearing housing 118, and pin 111. Also illustrated is vertical line 208 at the outermost surface of the first fixed bearing housing 118.

[34] As can be seen, in one embodiment, first and second top members 112, 162 do not extend past the fixed bearing housings 118, 168 (past line 208). In one embodiment, first and second bottom members 114, 164 do not extend past the fixed bearing housings 118, 168 (past line 208).

[35] As discussed above, connections between the fixed bearing housings 118, 168 and the first and second top and bottom members 112, 114, 162, 164 may be rotatable connections. Such connections may be pin connections, such as illustrated pin connections 113, 111, 163. That is, pin connection 113 may removably connect the first top member 112 with the first fixed bearing housing 118, which first fixed bearing housing 118 may be removably connected with the first bottom member 114 via pin connection 111. Pin connection 163 may removably connect the second top member 162 with the second fixed bearing housing 168, which second fixed bearing housing 168 may be removably connected with the second bottom member 164 with a pin connection.

[36] In one embodiment, pin connections 111, 113, 163 may not extend past the first and second fixed bearing housings 118, 168. In one embodiment, pin connections 111, 113 may be collinear (line 204) with a center axis 206 of the first fixed bearing housing 118. Pin connections 163 may be collinear with a center axis of the second fixed bearing housing. Pin connections 111, 113, 163 may be coplanar. Pin connections 111, 113, 163 may be coplanar with a center axis that extends from a center of the first fixed bearing housing 206 to a center of the second fixed bearing housing.

[37] In one embodiment, as illustrated in Figures 1 and 2, certain members may extend further than other members. As illustrated, the first and second bottom members 114, 164 extend further than the first and second top members 112, 162. In one embodiment, the first and second fixed bearing housings 118, 168 may be selectively removable from the first and second frames 102, 152. In such embodiments, the extended first and second bottom members 114, 164 may be used in such selective removal of the first and second fixed bearing housings 118, 168, as described in more detail herein.

[38] In one embodiment, certain members may extend past the first and/or second fixed bearing housings (past line 208).

[39] In certain embodiments, pin connections may also extend past the first and/or second fixed and/or movable bearing housings. Specifically with respect to Figure 2, pin connection 111 may be closer to or further from line 208 than pin connection 113 is to line 208. Pin connection 113 may be closer to or further from line 208 than pin connection 111 is to line 208. Further, either or both of pin connections 111, 113 may be closer to or further from line 208 than point 206 is to line 208. Similarly, pin connection 109 may be closer to or further from line 208 than pin connection 107 is to line 208. Pin connection 107 may be closer to or further from line 208 than pin connection 109 is to line 208.

[40] Rolling devices such as fixed rolling device 142 and moveable rolling device 144 typically require periodic maintenance and/or replacement. According to several embodiments of the roller press and frame therefore

disclosed herein are configured to allow for access to or extraction of one or more of the fixed and/or moveable rolling devices. Such access to or extraction of the one or more rolling devices may be for maintenance, repair, replacement, or the like. Accordingly, the roller press frame may be configured for effective extraction of the rolling devices.

[41] As discussed in more detail above, a roller press frame may be constructed using selectively removable connection devices such as pins. According to one embodiment, the fixed roller bearing housings 118, 168 may be connected to the first and second top and bottom members 112, 114, 162, 164 using selectively removable connection devices such as pins 111, 113, 161, 163. In operation, some or all of such pins 111, 113, 161, 163 may bear some or all of the weight of the fixed rolling bearing housing as well as some or all of the weight of the fixed rolling device 142, and possibly other equipment supported by the fixed roller bearing housings 118, 168 (for example, bearings, shafts, shims, drive shafts, drive devices, and the like). Thus, such pins 111, 113, 161, 163 may be difficult to remove due to the weight born thereby.

[42] Figures 3A and 3B illustrate a front and back views of the first fixed roller bearing housing 118. It should be appreciated that although the first fixed roller bearing housing 118 is illustrated, both of the fixed roller bearing housings 118, 168 may include the features described herein. Indeed, the first and second fixed roller bearing housings 118, 168 may be similar. In particular, Figure 3A illustrates a front and back view of the first fixed roller bearing housing 118 in operational configuration, and Figure 3B illustrates a front and back view of the first fixed roller bearing housing 118 in extraction configuration. Fixed roller bearing housing 118 may include front-side mount supports 302, 304 and back-side mount supports 301, 303. Mount supports 301-304 may be configured to selectively provide support to the fixed roller bearing housing 118 by contact with the first lower frame member 114.

[43] Mount supports 301-304 may include wedge portions 305, 306, 307, and 308. Each wedge portion 305-308 may include a tapered upper portion 313, 314, 315, 316 configured to contact a similarly tapered portion of the mount

supports 301-304. In another embodiment, the tapered upper portion 313-314 may be configured to contact a flat portion of the mount supports 301-304, where the flat portion of the mount support is somewhat horizontal or parallel with the first and/or second bottom frame members 114, 164. In yet another embodiment, the upper portion of the wedge 313-316 may be flat (horizontal or parallel with the first and/or second bottom members 114, 164), and configured to contact a tapered bottom portion of the mount supports 301-304.

[44] In these embodiments, the wedge portions 305-308 may be configured such that when moved from a first (operation) position to a second (extraction) position they provide additional upward support to the fixed roller bearing housing. That is, the wedges may transfer at least a portion of the weight of the fixed roller from the pin connections to the wedges, thus at least partially unloading the pin connections. In one embodiment, the pin connections are completely unloaded before removal. In another embodiment, the pin connections are partially unloaded before removal.

[45] In one embodiment, as illustrated, as the wedge portions 305-308 are moved closer together, they provide additional support to the fixed roller bearing housing. For example, the wedges may be in pairs (each pair on the same face of the same bearing housing). That is, in a first position, as illustrated in Figure 3A, the wedge portions 305-308 provide less, or even no upward support to the fixed roller bearing housing 118 than the wedge portions 305-308 illustrated in Figure 3B, where the wedge portions 305-308 of each pair have been moved closer together than they are in Figure 3A. It should be noted that in the first (operation) position, the wedge portions 305-308 may be completely removed or partially removed.

[46] Various wedge and mount configurations may be used. In certain embodiments, wedges may increase support to the fixed roller bearing housing as they are moved in a direction longitudinal to the frame. In certain other embodiments, wedges may increase support to the fixed roller bearing housing as they are moved in a direction axial to the fixed rolling device. In one embodiment, the wedges may increase support to the fixed roller bearing

housing as each wedge of a pair of wedges is moved away from the other wedge in the pair of wedges. Such movement away may be longitudinal to the frame. In another embodiment, the wedges may increase support to the fixed roller bearing housing as they are moved axially (in the direction of the axis of the fixed rolling device) toward or away from the fixed rolling device. In yet another embodiment, the wedge portions may increase support as they are moved toward or away from the moveable rolling device. It should further be noted that, unless otherwise indicated, the movements of the wedges as described herein are in relation to the fixed roller bearing housing.

[47] Wedges 305-308 may be formed from a material with a compressive strength sufficient to bear forces applied thereto from the fixed roller bearing housings, fixed rolling device, shafts, and such equipment. In one embodiment, the wedges 305-308 are formed from the same material as the fixed roller bearing housing 118. In one embodiment, the wedges 305-308 are formed from the same material as the first and second bottom members 114, 164. As indicated above, Figure 3B illustrates the wedge portions 305-308 in extraction configuration. That is, as wedge portions 305-308 assume some or all of the support of the fixed roller bearing housing 118, pins 111, 113, 161, 163 are relieved or some or all of the support provided thereby, and removal thereof may be easier. Thus, once the wedge portions 305-308 are in extraction configuration, pins 111, 113, 161, 163 may be removed. With the pins 111, 113, 161, 163 removed the fixed roller bearing housings may be removed by sliding along the frame bottom and/or top members 112, 162, 114, 164.

[48] To further facilitate extraction of the fixed rolling device, mount supports 301-304 may include a sliding portion 309, 310, 311, 312 along a bottom edge of the wedge portion 305-308. Sliding portion 309-312 may be disposed between the bottom of the wedge portion 305-308 and the frame bottom member. Sliding portions 309-312 may be formed from a substance that exhibits a lower coefficient of friction (static and/or kinetic) than would be exhibited without the sliding portions 309-312. In one embodiment, the sliding portions 309-312 may be formed from a substance that exhibits a coefficient of

friction (static and/or kinetic) with the frame bottom members than a coefficient of friction (static and/or kinetic) between the wedge portions 305-308 and the mount supports 301-304. In various embodiments, the sliding portions 309-312 may be formed from materials typically suited for plain or sliding bearings, such as Babbitt metal, impregnated metals, matrix metals, composite materials, polymers, bronze, copper, iron, steel, graphite, ceramic, any alloy involving the previous items, or similar materials. Such materials may include, for example: an aluminum-bronze alloy; a copper alloy; a copper-tin alloy; a copper-nickel-tin alloy; a copper-beryllium alloy; a tin-lead alloy; a composite material (such as, for example, thermoset composite bearing materials such as those sold under the tradename Orkot® by Dotmar EPP Pty Ltd of Australia); a self-lubricating bearing material (such as, for example, those sold under the trade names deva.metal®, deva.bm® and deva.glide® by Federal-Mogul Deva GmbH of Germany); polytetrafluoroethylene (PTFE); high-density polytetrafluoroethylene (HDPTFE); polyamides (such as, for example, Nylon, Technyl, and the like); polyimides; polyether ether ketone; polyphenylene sulfide; polyoxymethylene; polyethylenes (such as for example, low-density polyethylene, linear low-density polyethylene, medium-density polyethylene, high-density polyethylene, ultra high molecular weight polyethylene, cross-linked polyethylene, and the like); and the like.

[49] Thus, as described above, a function of the wedge portions may be to unload pin connections for removal. Another function of the wedge portions may be to provide a sliding portion to facilitate removal of the bearing housings. Placing wedges into operating position for operation may preserve the useful life of the sliding portions by, for example, unloading the sliding portions for a period of time. Further, placing wedges into operating position for operation may ensure proper positioning of the fixed roller device by placing the load of the fixed bearing housings on the connection pins.

[50] In one embodiment, the sliding portion comprises a portion of the wedge. In another embodiment, the entire wedge may be formed from a sliding material as discussed above.

[51] Figure 3C illustrates a perspective view of a roller press and frame therefore 300 in extraction configuration. As described above, the fixed roller bearing housings 118, 168 have been supported by configuring the wedge portions 305-308 in extraction configuration. Pins 111, 113, 161, 163 have been removed from receivers 311, 313, 363. Further, a bearing housing support device in the form of bottom member extensions 362, 364 has been positioned to facilitate extraction. With the fixed roller bearing housings 118, 168 supported by the mount supports 301-304, the pins removed, and the bearing housing support device in extraction position, the fixed bearing housings 118, 168 may be maneuvered along bottom members 114, 164 and bottom member extensions 362, 364 to be extracted.

[52] Figure 3D illustrates a perspective view of the roller press and frame therefore of Figure 3C with the fixed roller bearing housings (along with the fixed rolling device 142) maneuvered along the first and second bottom members 114, 164 and bottom member extensions 362, 364 and ready to be further extracted, or in position for maintenance, repair, or the like.

Alternatively, it may be desirable to extract the fixed rolling device 142 completely. Once the fixed roller bearing housings (and fixed rolling device 142) have been extracted completely, the moveable rolling device 144 may then be extracted. As with the extraction of the fixed rolling device 142, the moveable roller bearing housings 116, 166 may be maneuvered along the bottom members 114, 164 into an extraction position, allowing access for maintenance, repair, extraction, or the like.

[53] It should be noted that the roller press frame as illustrated where the first and second top members connect directly to the first and second fixed roller bearing housings 118, 168, the amount of travel along the first and second bottom frame members 114, 164 and the bottom member extensions 362, 364 required to extract the rolling devices is shorter than in prior frames with top members that include additional side members beyond the fixed roller bearing mounts.

[54] Once the desired maintenance, repair, or the like has been performed on the fixed rolling device 142, and if no further maintenance is needed, the moveable and fixed roller bearing housings 118, 168 may be maneuvered back into operational position, the pins 111, 113, 161, 163 re-installed into receptacles 311, 313, 361, 363, bearing housing support device removed, and wedges 305-308 re-positioned into operational configuration.

[55] Figure 4 illustrates a simplified flow chart of a method 400 for extraction of a fixed rolling device. The method 400 starts with supporting the fixed roller bearing housings using wedges 402 such as the wedge portions 308-308 discussed above. Once the fixed roller bearing housings are supported, the pins connecting the fixed roller bearing housings to the frame may be removed 404. The bearing housing support device 362, 364 may be positioned into extraction configuration 406. It should be noted that in various embodiments, the bearing housing support device 362, 364 may be positioned into extraction configuration at any point in the method 400. Once the roller bearing housings are supported, the pins have been removed, and the bearing housing support device 362, 364 has been positioned into extraction configuration, the fixed rolling device may be maneuvered along the frame and the bearing housing support device 408 into extraction position. It should be noted that such maneuvering may be by sliding (using sliding portions 309-312), or by other methods such as rolling on rollers, skates, casters, or the like. If it is further needed to remove the moveable rolling device, once the fixed rolling device has been extracted, the moveable rolling device may be maneuvered along the frame and bearing housing support device into extraction position 410. The method may end. The moveable rolling device and fixed rolling device may be installed (or re-installed) into the roller press frame by reversing the method 400.

[56] As discussed above, fixed and moveable roller bearing housings 116, 118, 166, 168 may be maneuvered along the first and second top and/or bottom members 112, 114, 162, 164. To facilitate maneuvering along the top and/or bottom members, the bearing housings may form a tongue-and-groove

connection with the top and bottom members. Figures 5A-5C illustrate an embodiment of the tongue-and-groove connection.

[57] Figure 5A illustrates a perspective view of a first moveable bearing housing 116. The housing 116 is configured with tongue portions 582, 584. Second moveable bearing housing 166 may include similar tongue portions. Figure 5B illustrates a perspective view of a first fixed roller bearing housing 118. The housing 118 is configured with tongue portions 586, 588. Second fixed bearing housing 168 may include similar tongue portions.

[58] Figure 5C illustrates a perspective view of a roller press and frame therefore. The frame includes a first top groove 592 in the first top member 112, a first bottom groove 594 in the first bottom member 114, a second top groove 596 in the second top member 162, and a second bottom groove 598 in the second bottom member. In one embodiment, as illustrated, the grooves 592, 594, 596, 598 are formed by a gap between two sub members of each top and bottom member. In various other embodiments, the grooves may be formed in single top and bottom members. As installed, top tongue portions 582 586 coincide with the first top groove 592, and bottom tongue portions 584, 588 coincide with first bottom groove 594. Similar top and bottom tongue portions on second moveable and fixed bearing housings 166, 168 may coincide with second top and bottom members 162, 164.

[59] As noted above, in some embodiments split rails may include three or more separated sub-members, thus making two or more groove portions. Accordingly, bearing housings may be formed to include two or more tongue portions to correspond with the two or more groove portions of such split rails. Furthermore, even in such cases where three or more sub-member split rails make two or more groove portions, bearing housings may include fewer tongue portions than there are groove portions, the tongue portions corresponding with predetermined groove portions.

[60] Figure 6 illustrates an exploded top view of a portion of a roller press and frame therefore. The roller press and frame therefore illustrated in Figure 6 includes first top member 112 sub-members 104, 106 on opposite front and

back faces of the first fixed bearing housing 118; as well as second top member 162 sub-members 154, 156 on opposite front and back faces of the second fixed bearing housing 168. As previously described, the connection of the first and second fixed bearing housings 118, 168 and the first and second top members 112, 152 may be made using a selectively removable connection device such as a rotatable connection device. The connection devices may be pin connectors 113, 163.

[61] The roller press and frame may be subjected to temperature change from various sources. Such temperature changes may affect thermal expansion in members of the roller press and frame. Such heat sources may include process heat and bearing heat. Process heat may be applied to the roller press and frame when a feed of higher temperature than the roller press and frame are fed to the roller press. For example, in a cement plant a hot feed such as hot clinker material may be fed to the roller press. Heat from the feed may be transferred to the rolling devices, which may thermally expand in a direction axial to the rolling devices. Further, bearings may generate a certain amount of heat due to the rotation of the rolling device and the various forces applied thereto. To reduce stresses on certain members of the roller press frame, shims may be used at connection points to allow for thermal expansion and/or contraction during use without applying undue stresses on other members of the roller press and frame.

[62] Figure 6 illustrates connection points between first and second fixed roller bearing housings 118, 168 and first and second top member sub-members 104, 106, 154, 156. Shims 691, 692, 693, 694 are used between housing 168 and sub member 154, and shims 695, 697, 696, 698 are used between housing 168 and sub member 156. Pin 163 passes through sub members 154, 156, housing 168, and shims 691-698. Although a specific connection point is illustrated, any of the connection points may include shims. Shims 682, 683, 684, and 685 are used between housing 118 and sub-member 106, while shim 681 is used between housing 118 and sub-member 104.

[63] Shims may be used to maintain connection between bearing housings and frame members during thermal expansion of, for example, a rolling device. As illustrated in Figure 6, rolling device 142 may be subjected to heat from a feed such as hot cement clinker. As mentioned above, such heat may be transferred to the rolling device, causing thermal expansion in the axial direction as indicated by arrows 678. Because the rolling device 142 is mounted to the frame using bearing housings 118, 168, thermal expansion in the axial direction may provide a force to the bearing housings in the direction of arrow 678. Such force may result in stresses on certain members of the frame. However, according to the embodiment illustrated in Figure 6, a single shim 681 is used between bearing housing 118 and sub-member 104, allowing for some movement of bearing housing 118 in the direction of arrow 679. Thus thermal expansion of the rolling device results in less stress on frame members due to at least a portion of such thermal expansion being absorbed between bearing housing 118 and sub-member 104.

[64] It should be noted that although the shim arrangement is illustrated on the fixed bearing housings in Figure 6, both or either of the fixed and moveable bearing housing arrangements may include similar shim arrangements, thus allowing for thermal expansion of either or both of the fixed and moveable rolling devices. Furthermore, although Figure 6 illustrates certain numbers of shims, any number of shims may be used so long as thermal expansion is allowed to occur in a direction.

[65] It should be noted that although certain components as illustrated in Figure 6 shows extensive spacing therebetween, such spacing may be reduced in any embodiment. For example, although space may be shown between spacers, between spacers and sub-members, and/or between spacers and a housing, in use such spacing may be decreased, or no spacing may be used.

[66] In one embodiment, each of the fixed and moveable rolling devices may be rotated in operation using drives. Such drives may be connected to the rolling devices using shafts. The roller press may be designed to absorb the thermal expansion on a specific side of the roller press frame. In one

embodiment, the roller press frame may be configured to absorb thermal expansion on a side opposite of the drives for the roller devices such that further stresses are not imposed on the drives, drive shafts, gearing, or the like. In another embodiment, the roller press frame may be configured to absorb thermal expansion on the same side as a drive system for the roller devices.

[67] Figure 7 illustrates an exploded top view of a portion of a roller press and frame therefore according to another embodiment. The roller press and frame therefore illustrated in Figure 7 includes first top member 712 as a single member, as well as second top member 762 as a single member. First fixed bearing housing 718 includes a clevis-type portion with outer portion 717 and inner portion 719 forming a "groove" that fits over the first top member 712. Second fixed bearing housing 768 similarly includes a clevis-type portion with outer portion 769 and inner portion 767 forming a "groove" that fits over the second top member 762. Thus, the first and second fixed bearing housings provide a "groove" portion and the first and second top members 712, 762 provide a "tongue" portion of "tongue-and-groove" connection points. As mentioned above, selectively removable connection devices such as rotatable connection devices may be used to connect the fixed bearing housings to the top members. Illustrated are pin connectors 113 and 163.

[68] As above, the roller press and frame may be subjected to temperature change from various sources that effect thermal expansion in various members. Thus, the roller device 142 may thermally expand in an axial direction, such as indicated by arrow 778. Such thermal expansion in the axial direction may force the first bearing housing 718 in a direction indicated by arrow 779. As described above, a series of shims may be used to relieve or avoid certain stresses in members of the frame, drive system, roller device, and/or bearing housing due to such thermal expansion. Specifically, shims 791, 792, 793, 794 may be used between inner portion 767 and second top member 762, while shims 795, 796, 797, 798 may be used between outer portion 769 and second top member 762. Shims 782, 783, 784, 785 may be placed

between outer portion 717 and top member 712, while fewer shims, such as one shim 781 may be used between inner portion 719 and top member 712. Fewer shims between the inner portion 719 and top member 712 allows for some movement of the first fixed bearing housing 718 in the direction of arrow 779 as the rolling device 142 undergoes thermal expansion in the axial direction. As mentioned above, placement of the bearings may be configured to encourage expansion in a specific direction or place so as to avoid additional stresses on certain other members such as drive systems for the roller press.

What is claimed is:

1. A roller press, comprising:

A first roller device;

a second roller device;

a frame comprising a first frame assembly and a second frame assembly, said first frame assembly comprising a first top member, a first side member and a first bottom member; with the first side member being removably attached to both the first top member and the first bottom member, wherein at least one of the first top and bottom members is further comprised of sub-members, and said second frame assembly comprising a second top member, a second side member and a second bottom member; with the second side member being removably attached to both the second top member and the second bottom member, wherein at least one of the second top and bottom members is further comprised of sub-members;

means to mount the first roller device to the frame; and

means to mount the second roller device to the frame.

2. The roller press of claim 1, wherein the sub-members comprising the at least one of the first top and bottom members and the at least one of the second top and bottom members are two separated rails.

3. The roller press of claim 1, further comprising first and second bearing housings mounting the first roller device to the first frame assembly and the second frame assembly.

4. The roller press of claim 3, wherein the means to mount the first roller device to the frame are first and second fixed bearing housings.

5. The roller press of claim 3, wherein the means to mount the first roller device to the frame are first and second movable bearing housings.

6. The roller press of claim 1, side member is removably attached to the wherein the first top and first bottom member using a rotatable pin connection.

7. The roller press of claim 1, comprising bearing housings mounting the first and second roller devices to the first frame assembly and the second frame assembly wherein:

the first and second top and bottom members each comprise separated rails and the first and second fixed bearing housings and first and second movable bearing housings are each mounted to the first and second top and bottom members by a tongue-and-groove mounting wherein the bearing housings provide tongue portions of the tongue-and-groove mountings and the first and second top and bottom separated rail members provide groove portions of the tongue-and-groove mountings.

8. The roller press of claim 1 further comprising a plurality of wedge supports in communication with the first and second fixed bearing housings, the wedge supports having an operation position and an extraction position.

9. The roller press of claim 8, wherein each of the wedge supports comprise:

a top surface; and,
a bottom surface with a coefficient of friction lower than a coefficient of friction of the top surface..

10. The roller press of claim 9, further comprising pin connections between the first frame assembly and the first fixed bearing housing and between the second frame assembly and the second fixed bearing housing; and, wherein when in the extraction position at least a portion of the weight of the fixed roller device is transferred from the pin connections to the wedge supports.

11. The roller press of claim 1 wherein the means to mount the first roller device to the frame comprises a fixed roller bearing housing and the first and second top and bottom members each comprise separated rails, the fixed roller bearing housing comprising connection portions positioned between each of the separated rails of the first and second top and bottom members and connected thereto using a rotatable connection;

said roller press further comprising a plurality of shims between the fixed roller bearing housing and at least one rail, the shims connected to the fixed roller bearing housing and the at least one rail by a rotatable connection.

12. A roller press, comprising:

a roller device;

a drive system in communication with the roller device for driving the roller device;

a roller press frame that includes a first frame assembly and a second frame assembly;

a first and a second roller bearing housing mounting the roller device to the first and second frame assembly; and,

a plurality of shims disposed between the first and second roller bearing housings and the first and second frame assemblies, the plurality of shims configured to allow thermal expansion of the roller device in a predetermined direction.

13. The roller press of claim 12, wherein the predetermined direction is away from the drive system.

14. The roller press of claim 12, wherein

the first and second frame assemblies comprise split rails forming groove portions;

the first and second roller bearing housings comprise tongue portions corresponding with the groove portions; and

the shims are disposed within the groove portions.

15. The roller press of claim 14, wherein fewer shims are disposed between the tongue portion and the groove portion furthest from the drive system.

16. The roller press of claim 11, wherein:

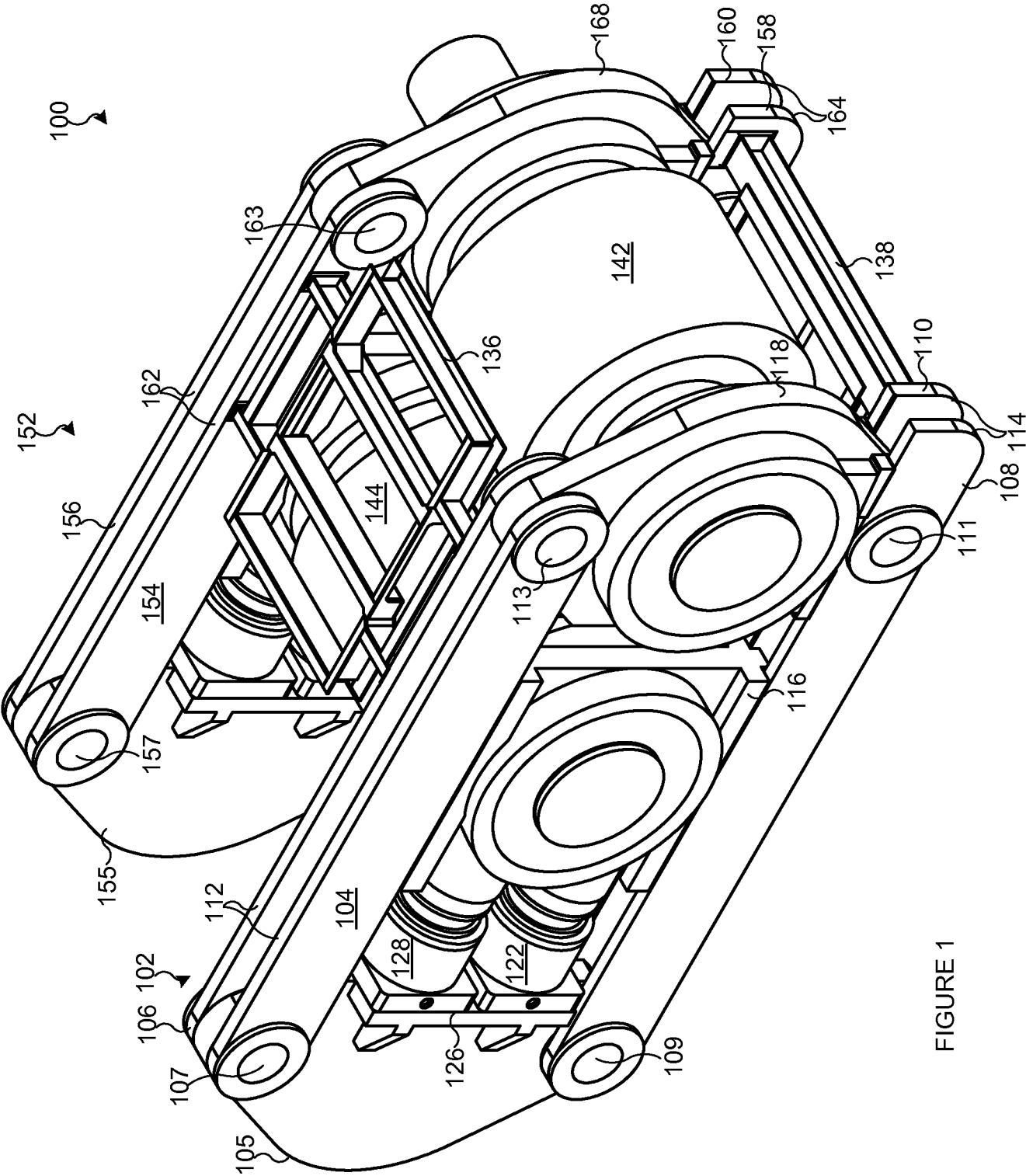
the first and second frame assemblies comprise tongue portions;

the first and second roller bearing housings comprise groove portions corresponding with the tongue portions;

the shims are disposed within the groove portions.

17. The roller press of claim 12, further comprising an extraction support that comprises a sliding portion, and is configured for placement in one of an operation position and an extraction position.

18. The roller press of claim 18, wherein the extraction position is located between the first roller bearing housing and the first frame assembly.



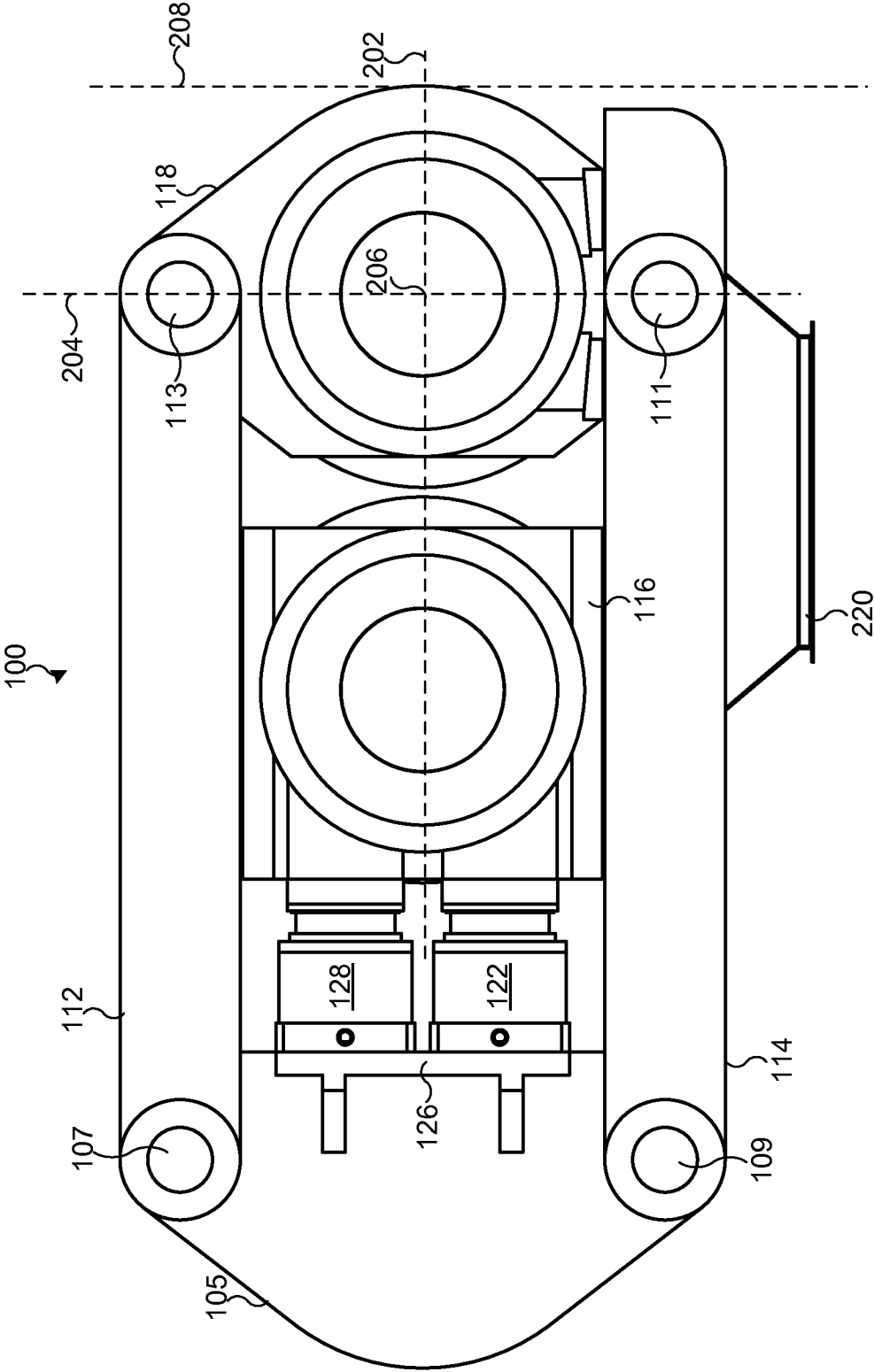
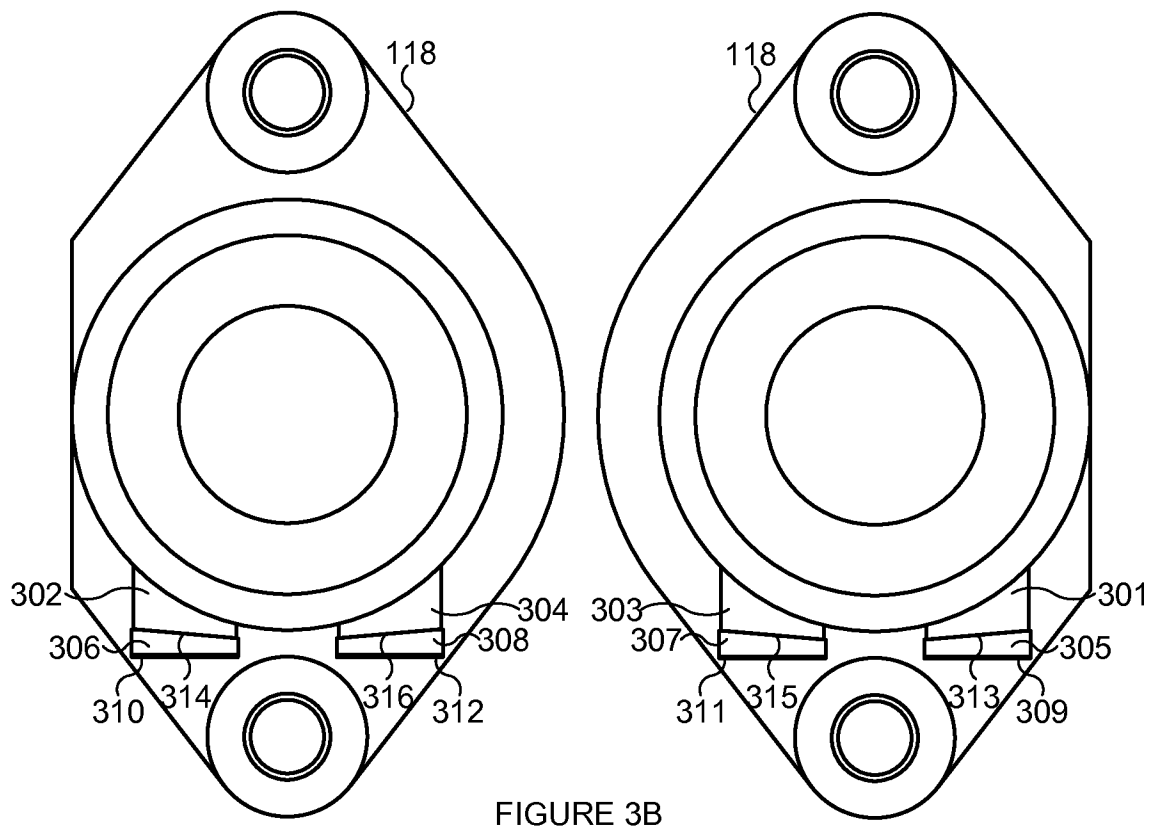
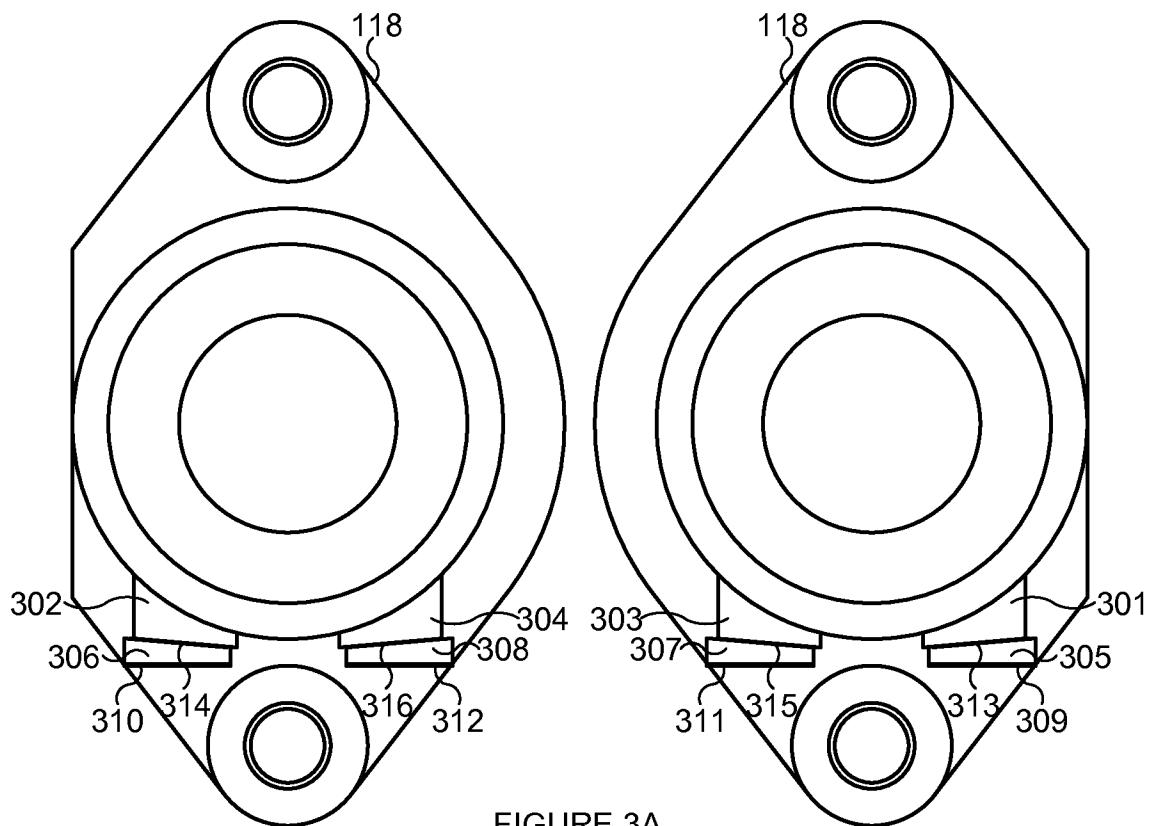


FIGURE 2



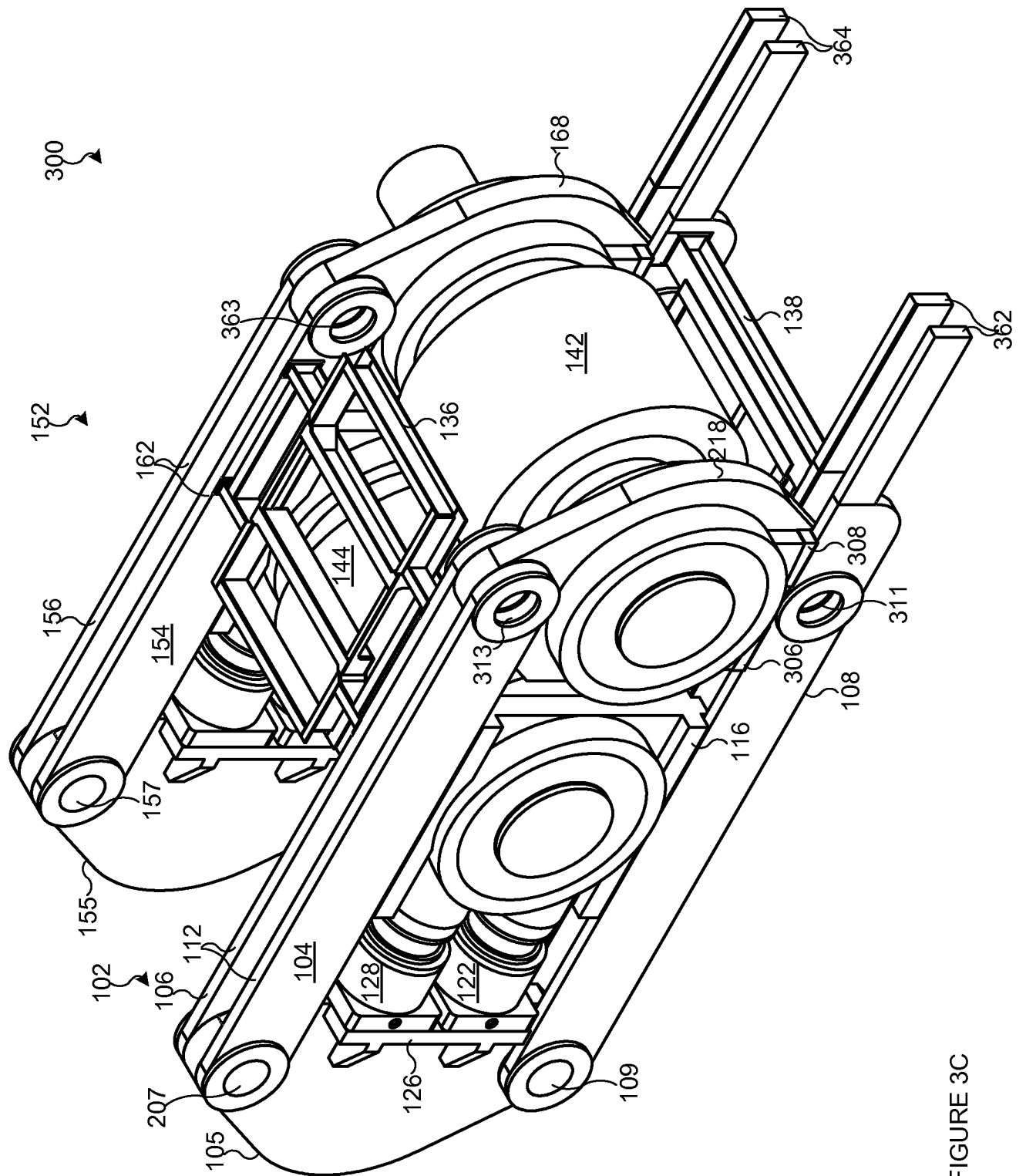


FIGURE 3C

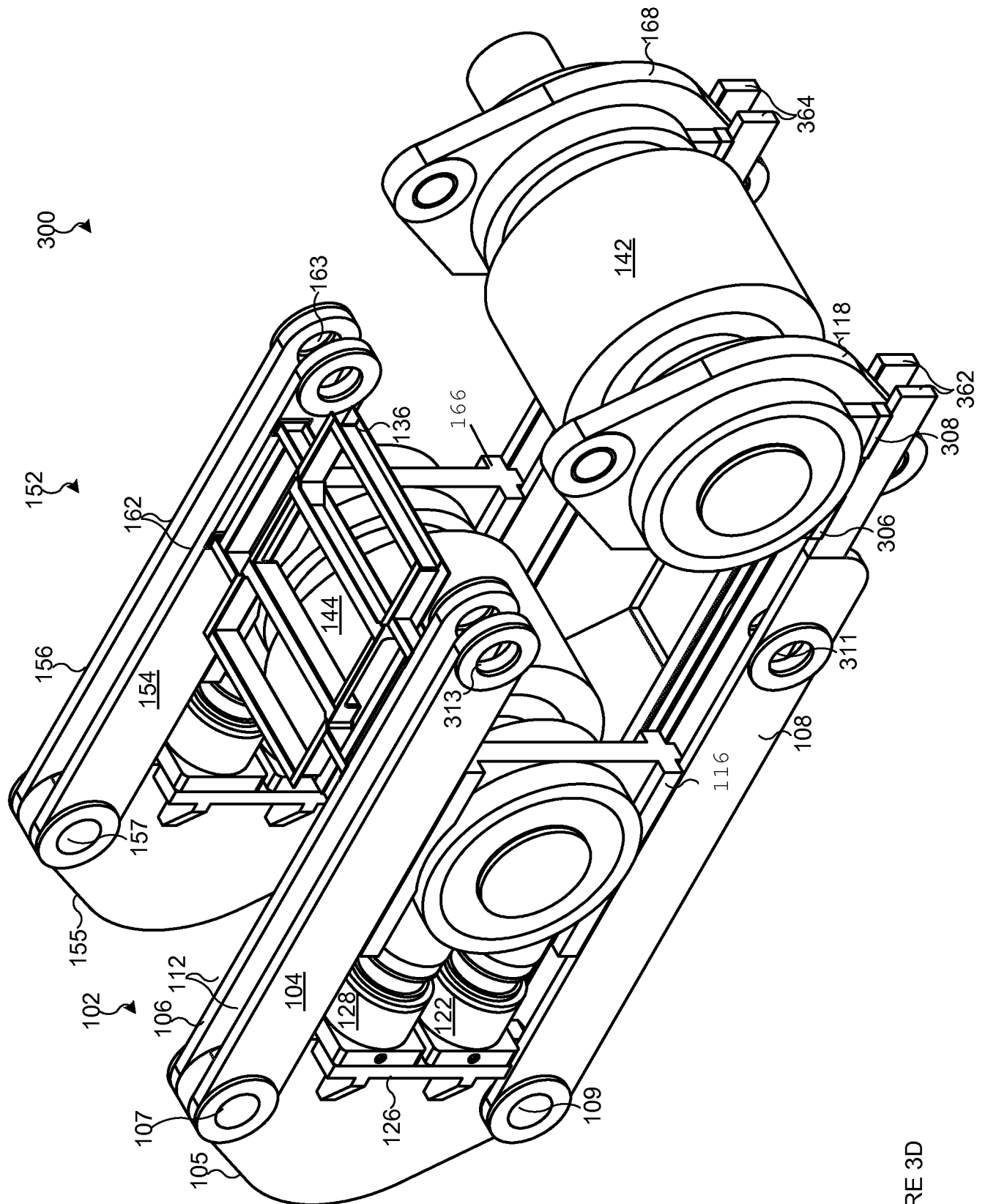


FIGURE 3D

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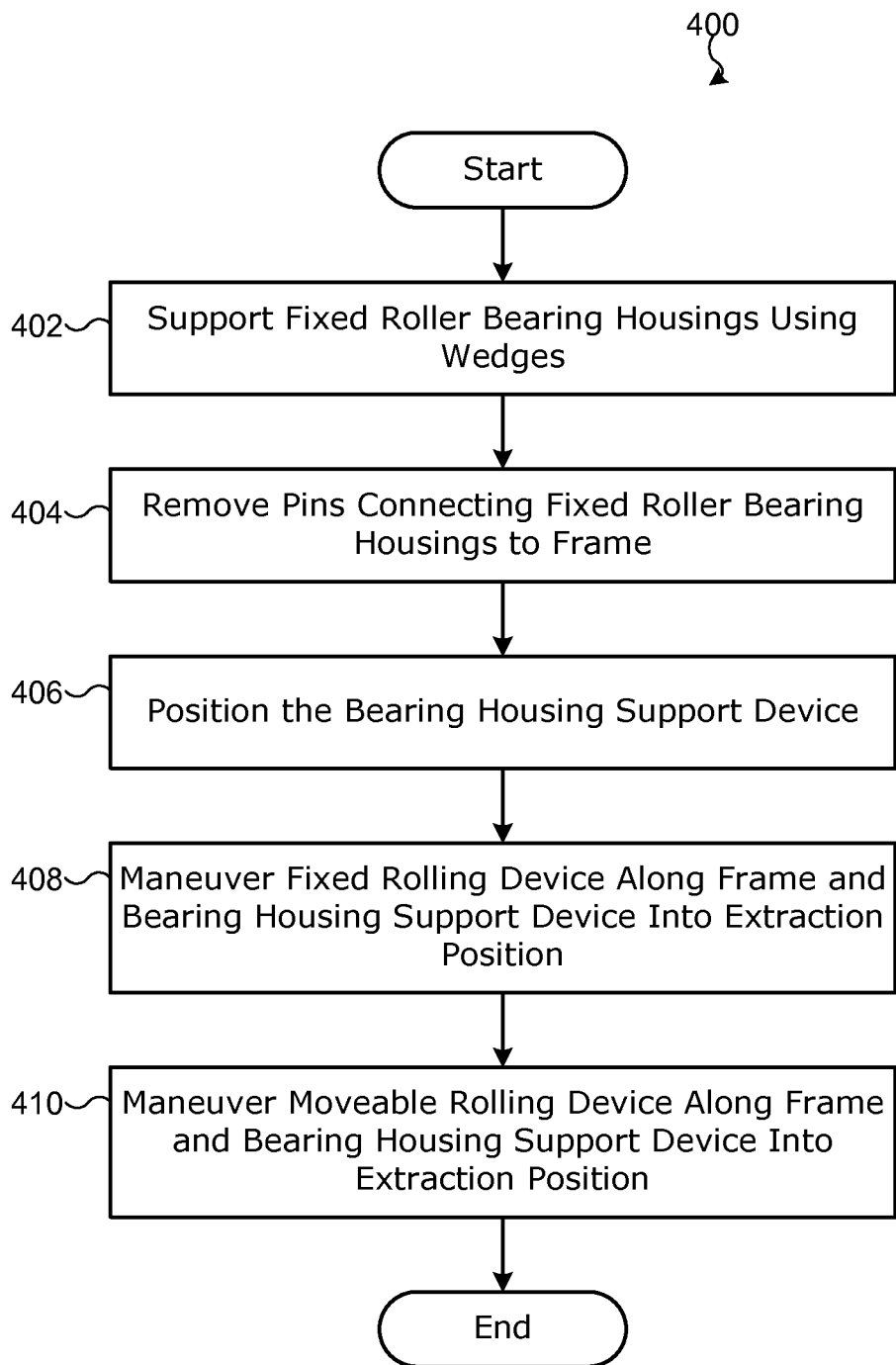


FIGURE 4

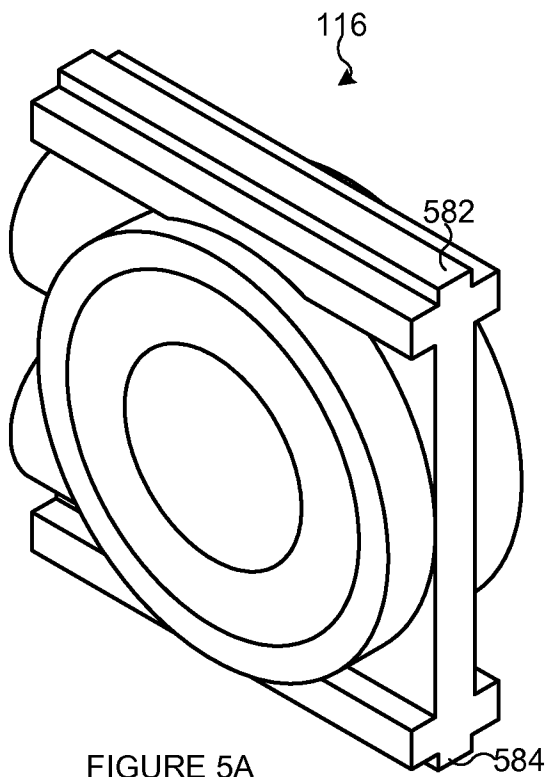


FIGURE 5A

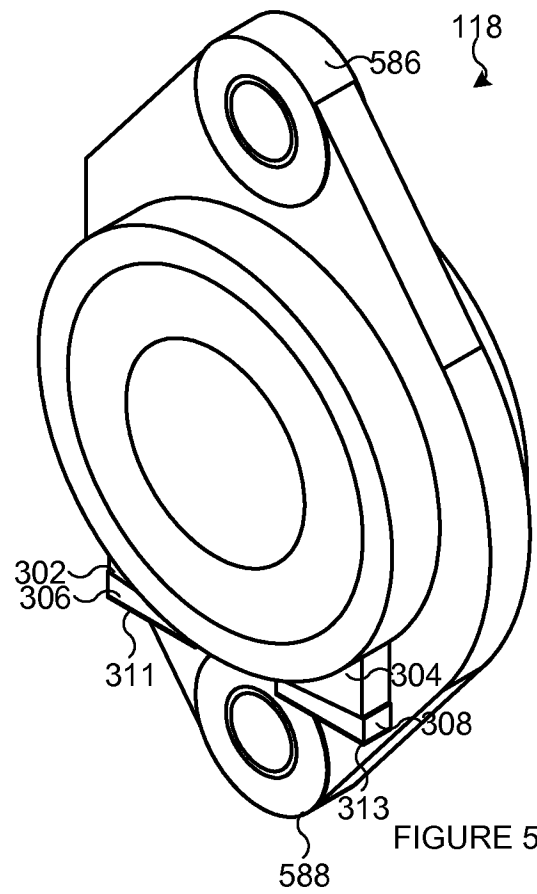


FIGURE 5B

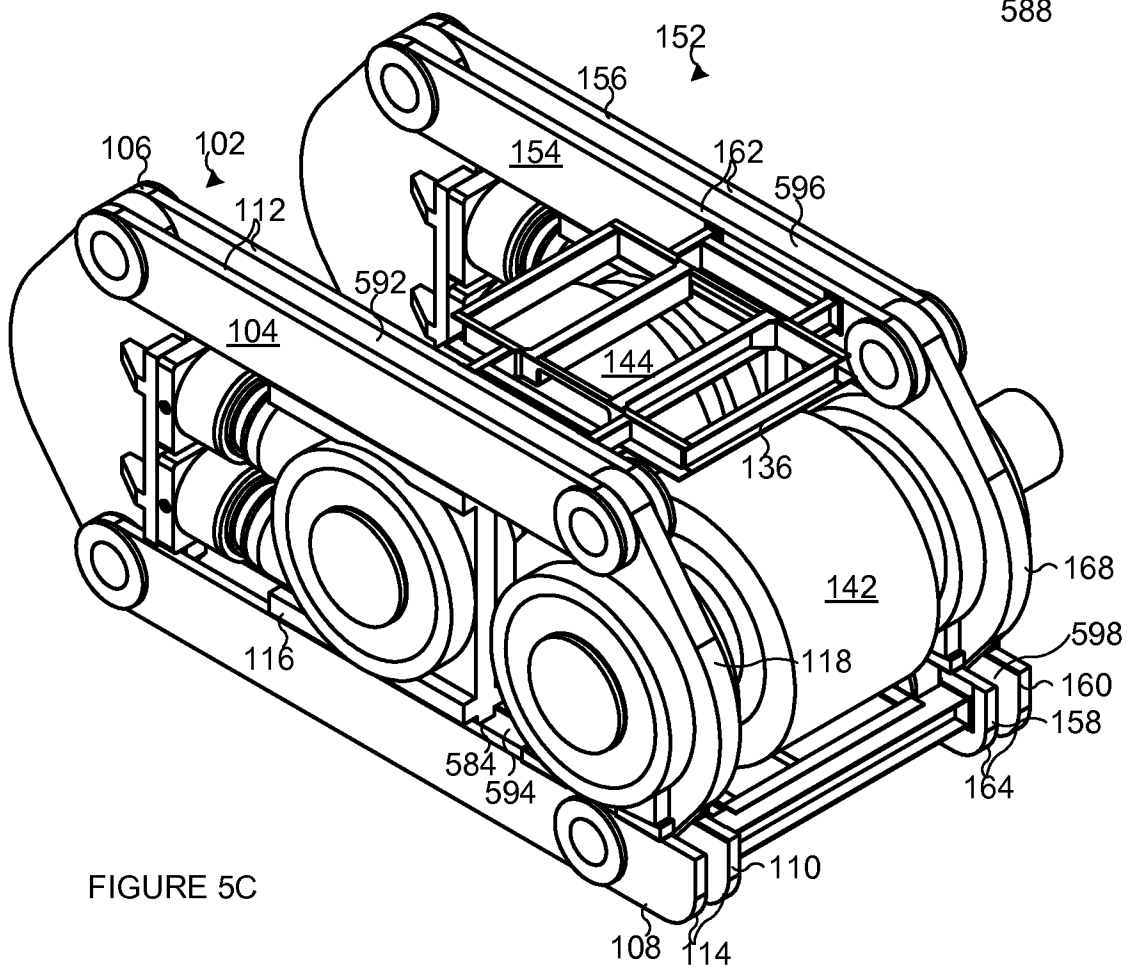


FIGURE 5C

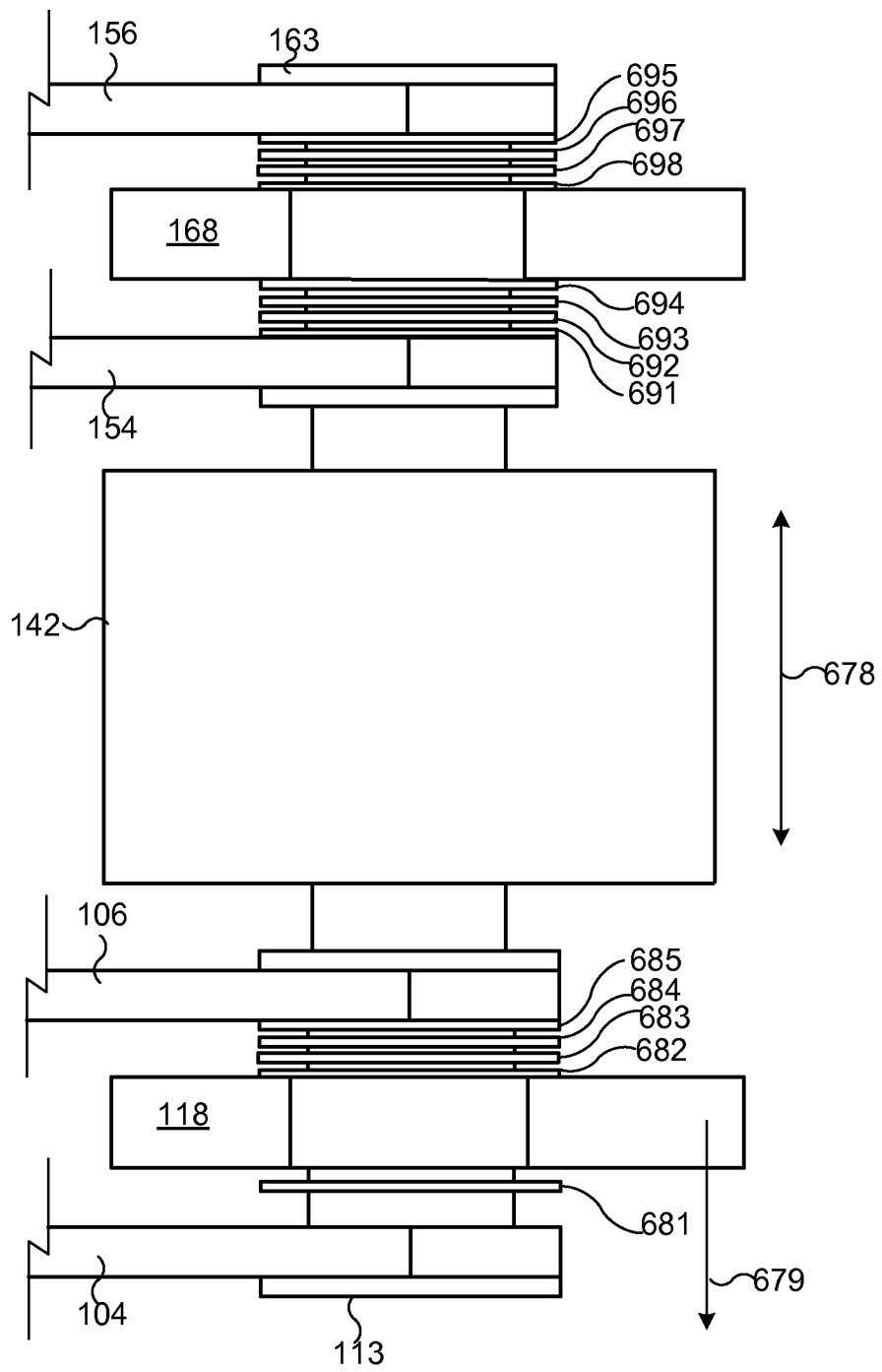


FIGURE 6

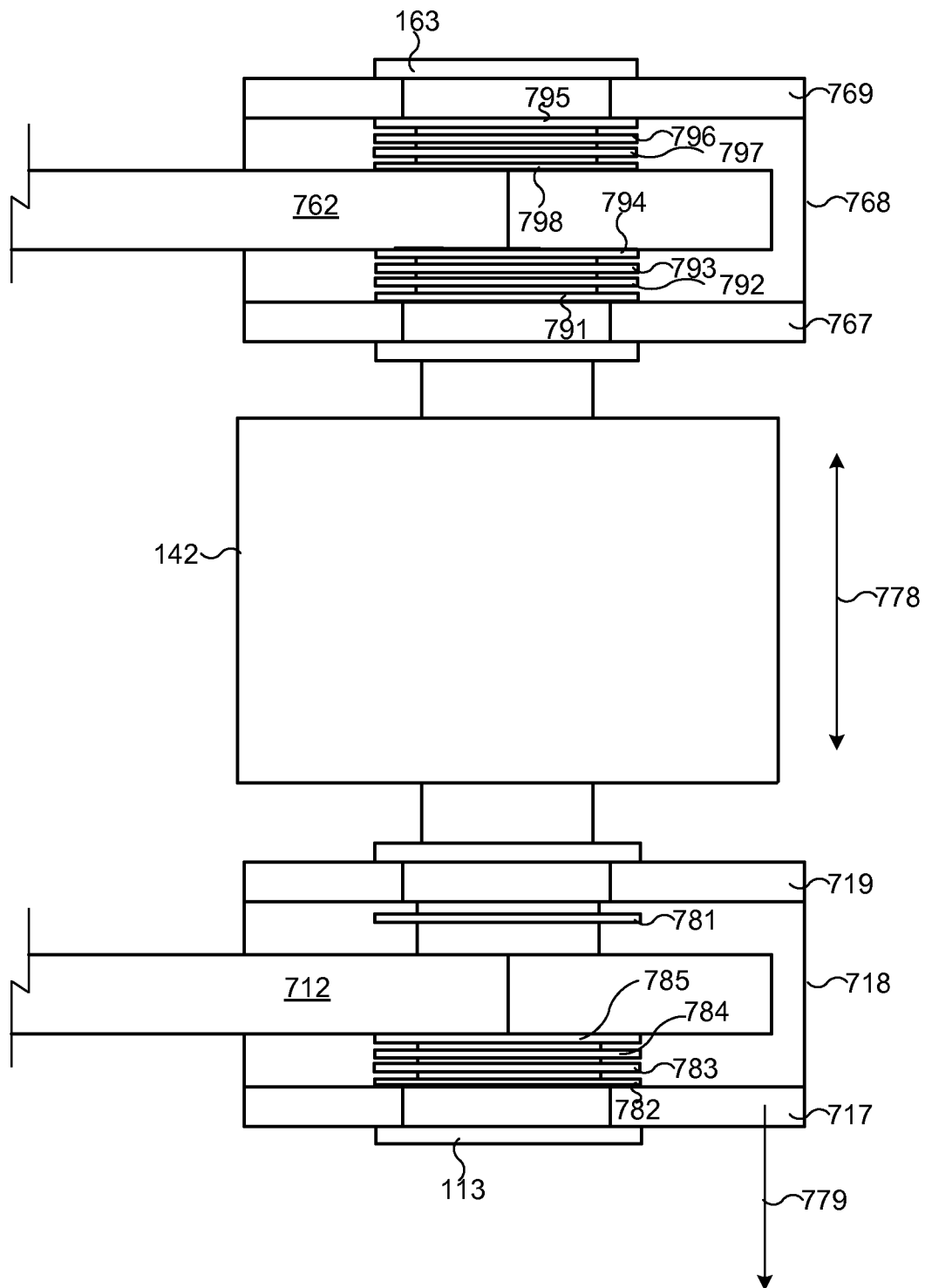


FIGURE 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/038773

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B30B 15/04 (2014.01)

CPC - B30B 15/045 (2014.07)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - B02C 23/02; B30B 3/00, 3/02, 3/04, 15/04, 15/30 (2014.01)

CPC - B02C 4/02, 4/28, 4/32; B30B 3/02, 3/04, 15/04, 15/045 (2014.07)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 72/238, 241.2; 100/168, 176; 241/222, 224, 230, 285.2

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Orbit, Google Patents, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 8,297,183 B2 (HÖRSTER et al) 30 October 2012 (30.10.2012) entire document	1, 3-5 ----- 6
Y	US 7,841,552 B2 (FRANGENBERG et al) 30 November 2010 (30.11.2010) entire document	6
A	US 5,553,796 A (BETTENWORTH) 10 September 1996 (10.09.1996) entire document	1-18
A	US 8,297,847 B2 (NIKLEWSKI et al) 30 October 2012 (30.10.2012) entire document	1-18
A	US 2010/0310702 A1 (SPLINTER) 09 December 2010 (09.12.2010) entire document	1-18

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“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

08 September 2014

Date of mailing of the international search report

29 SEP 2014

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