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(54) **THRUSTER ARRANGEMENT FOR A BOAT**

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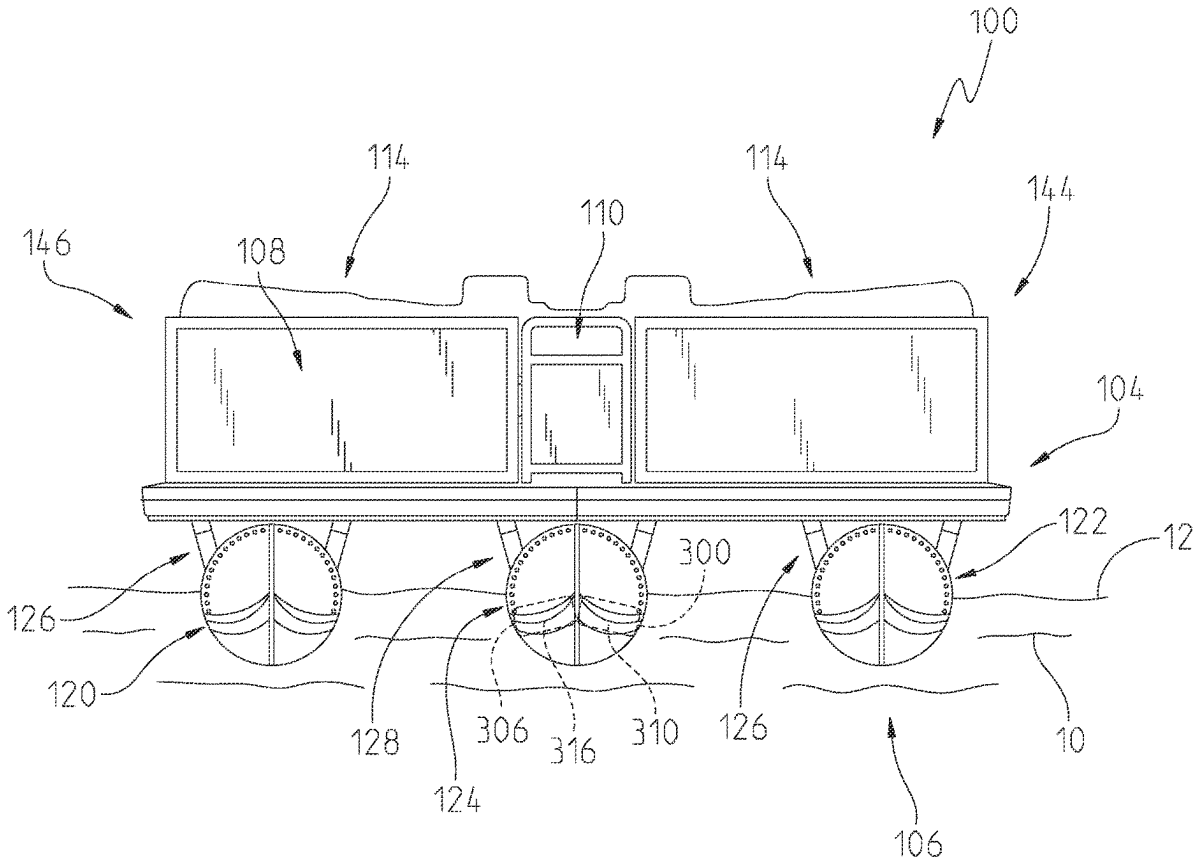
B63H 11/00	(2006.01)

(52) **U.S. Cl.**

CPC ***B63H 11/02*** (2013.01); ***B63B 35/38*** (2013.01); *B63H 2011/008* (2013.01)

(57) **ABSTRACT**

A pontoon boat including a thruster system is disclosed.



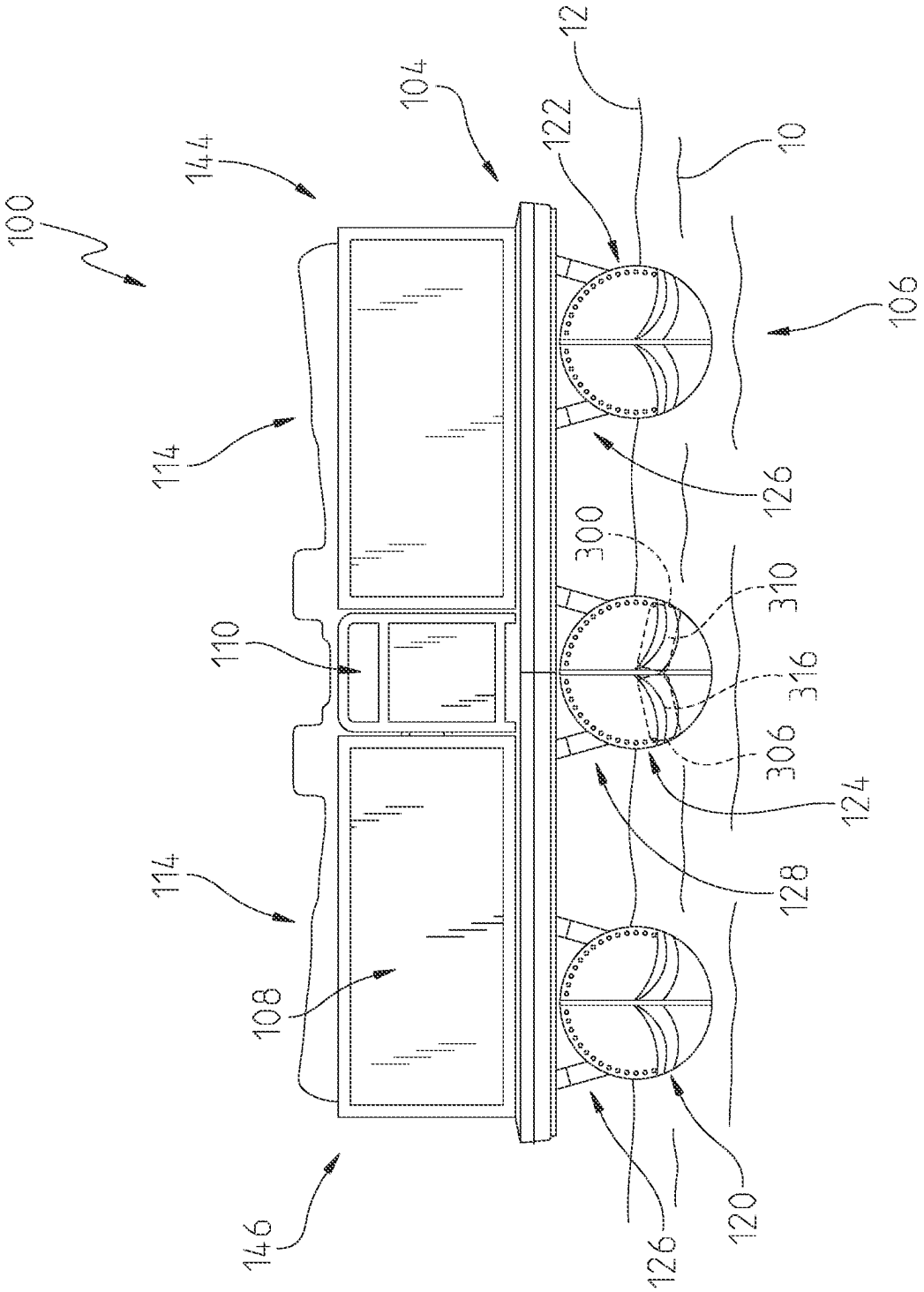

100
144
104
12
122
10
106
114
126
300
310
110
316
306
124
128
114
108
146
126
120

FIG. 1

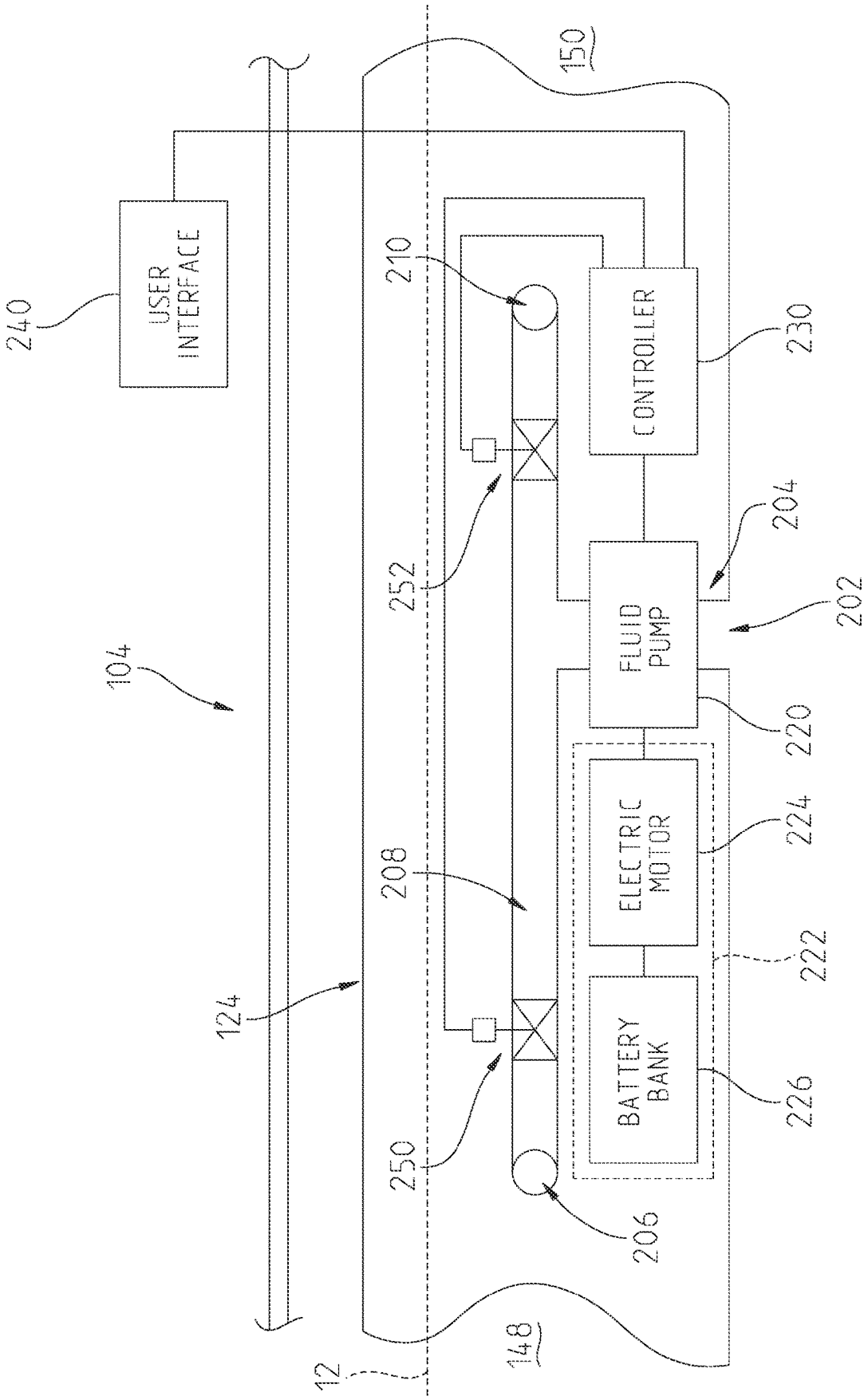

150
USER INTERFACE
240
210
CONTROLLER
230
204
252
FLUID PUMP
202
104
220
ELECTRIC MOTOR
224
208
222
124
BATTERY BANK
226
250
206
148
12

FIG. 2

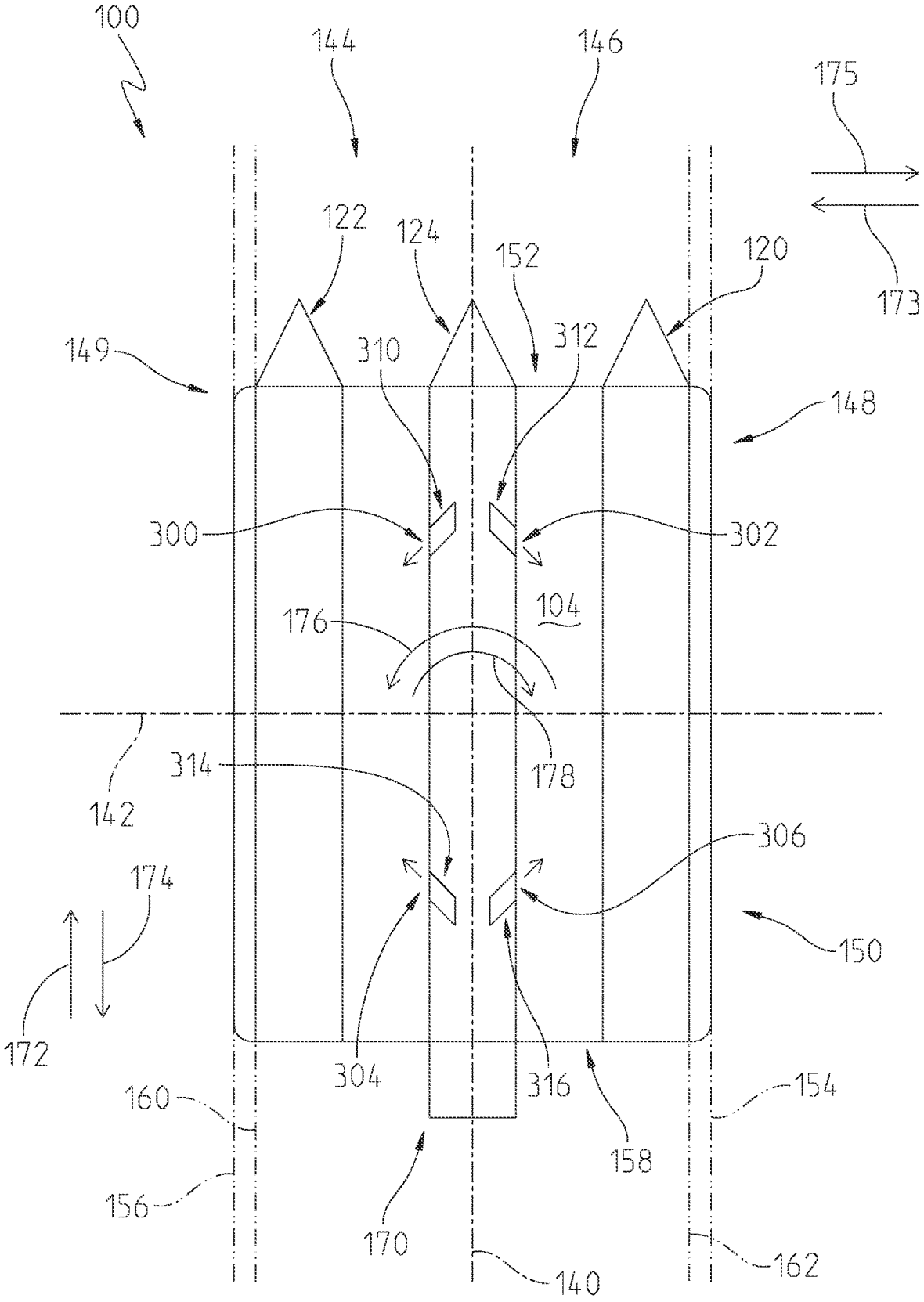
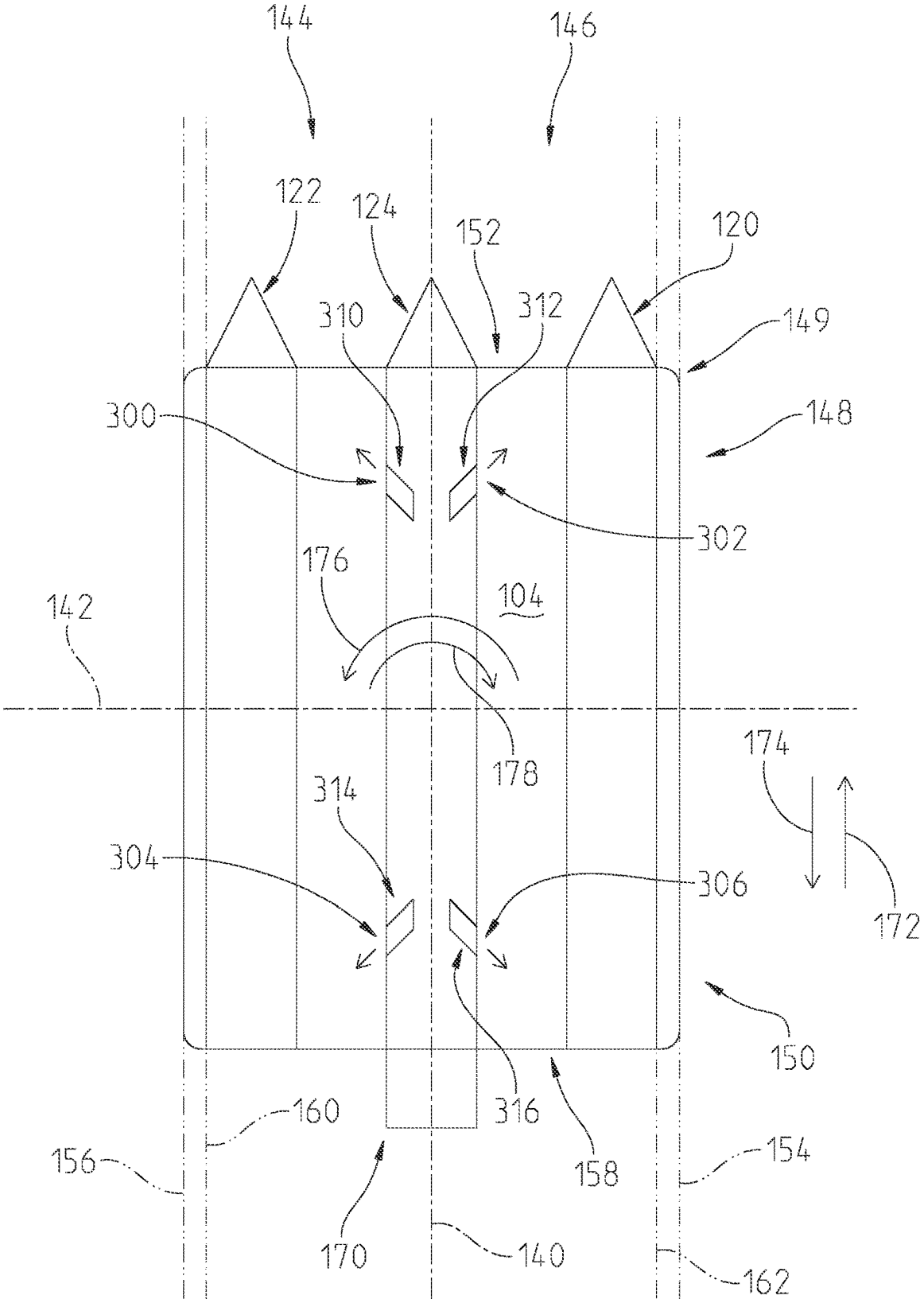

100
144
146
175
122
124
152
120
173
149
310
312
148
300
302
104
176
178
142
314
306
174
150
172
304
316
160
154
158
156
170
162
140

FIG. 3


144
146
122
124
152
120
310
312
149
300
148
302
176
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142
178
174
314
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306
172
150
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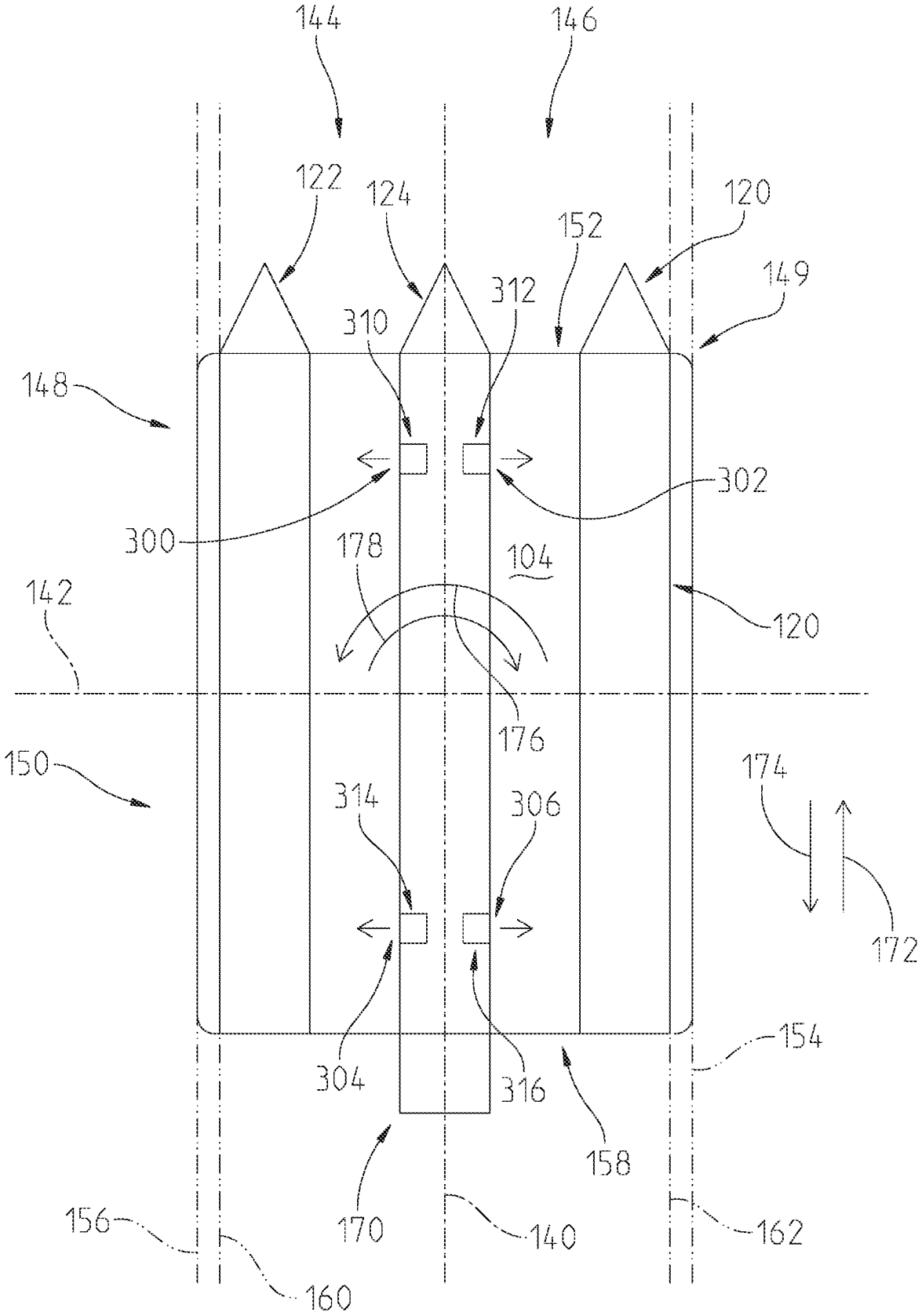
158
156
154
170
140
162

FIG. 4


144
146
122
124
120
152
149
312
310
148
302
300
178
104
142
120
176
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174
314
306
172
154
304
316
158
170
140
156
162
160

FIG. 5

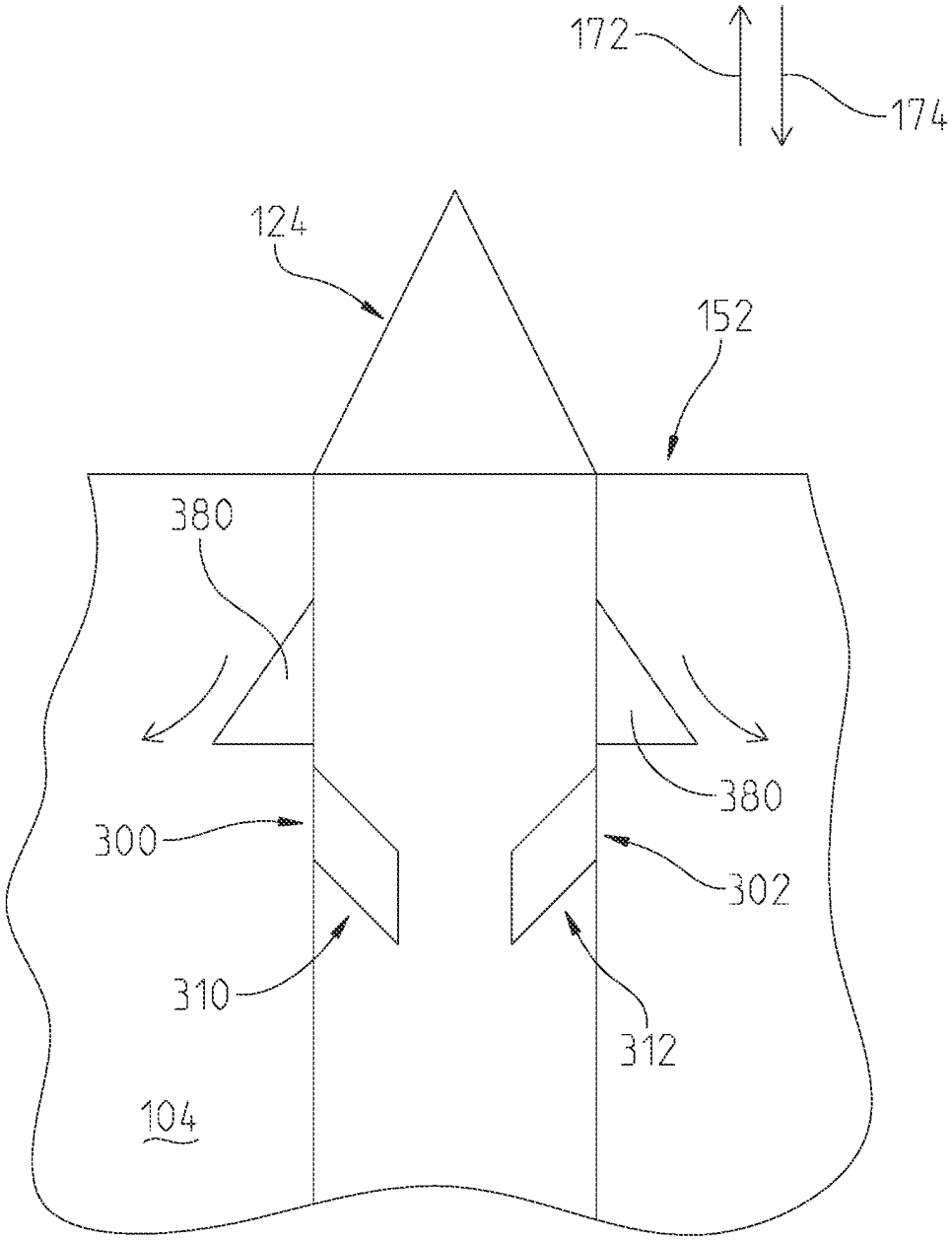

FIG. 6

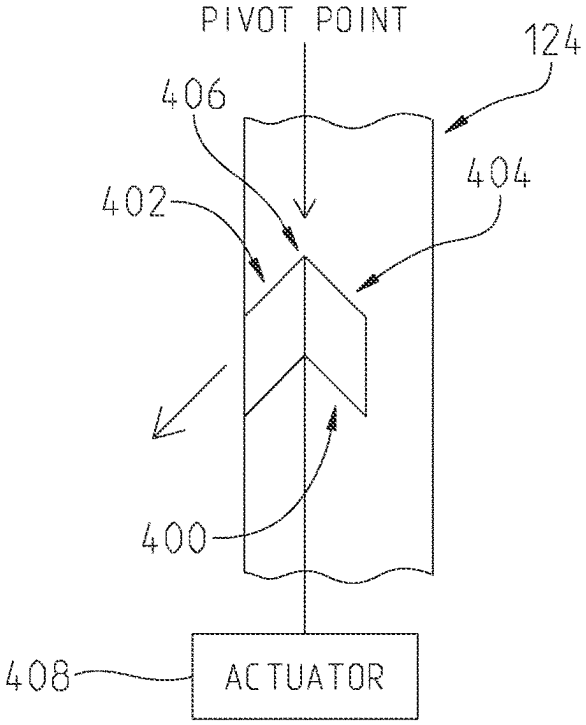

FIG. 7A

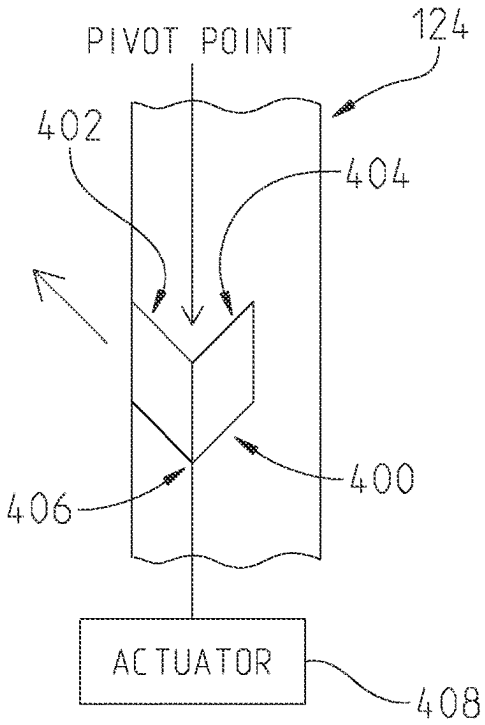

FIG. 7B

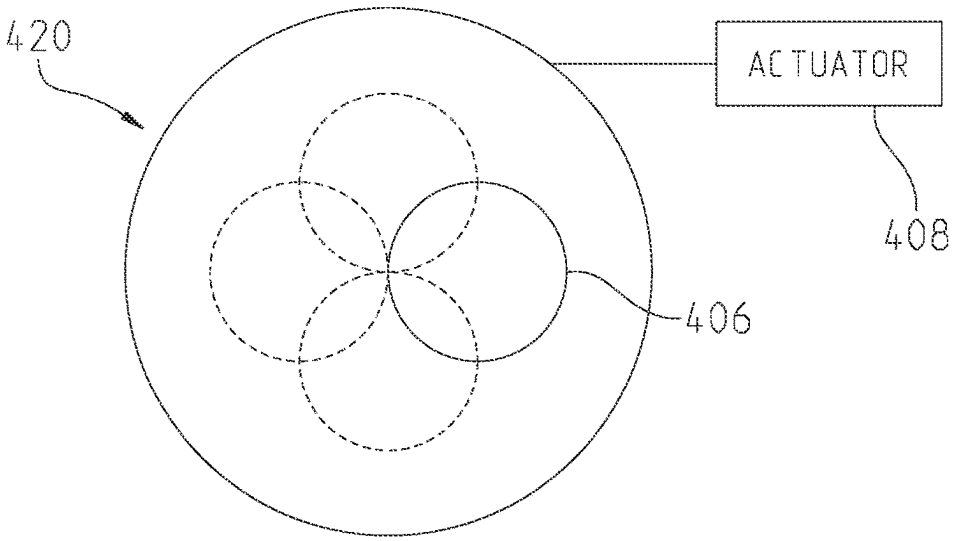

FIG. 8

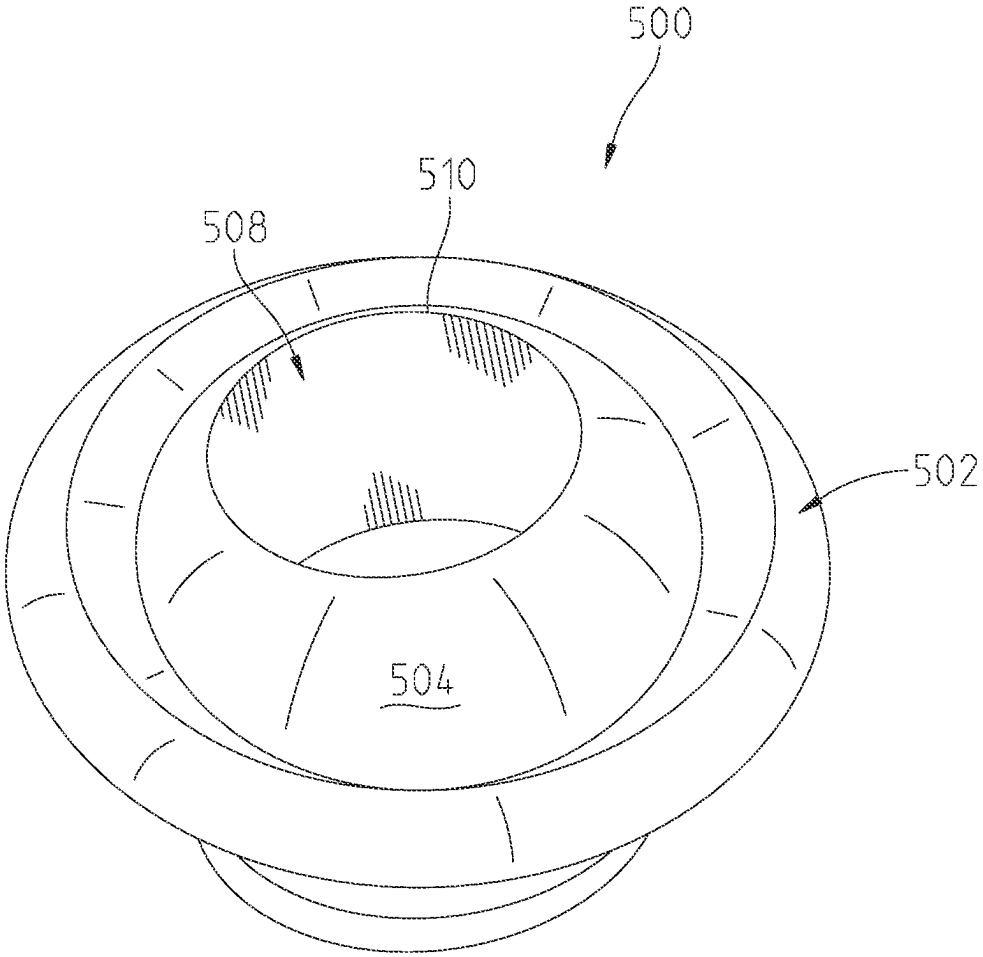

FIG. 9

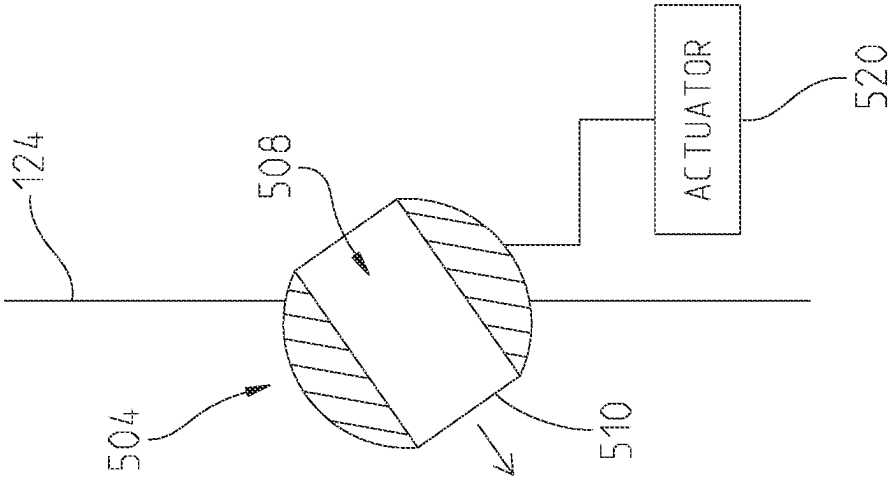

FIG. 12

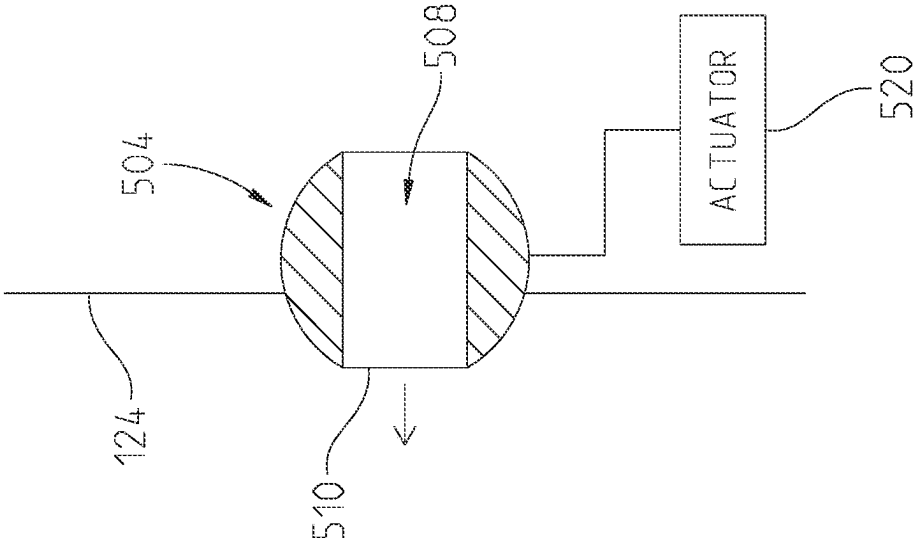

FIG. 11

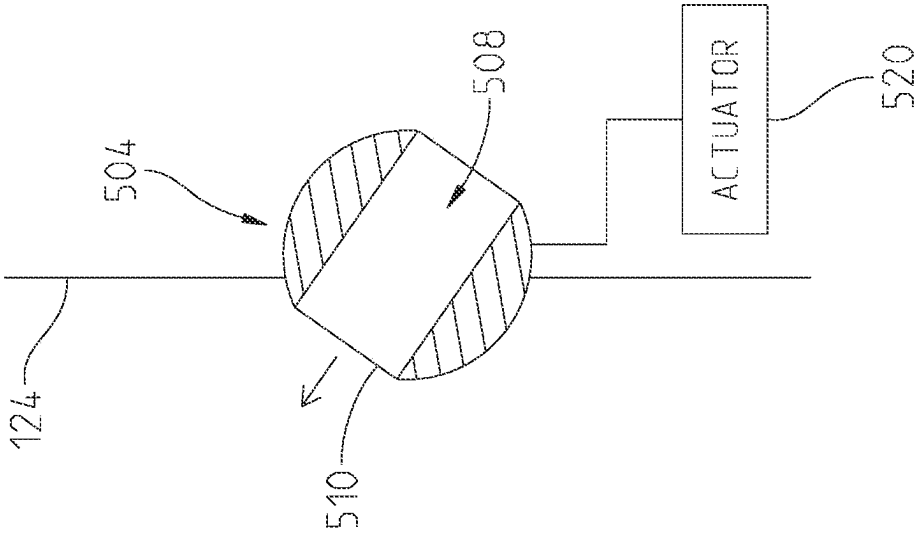

FIG. 10

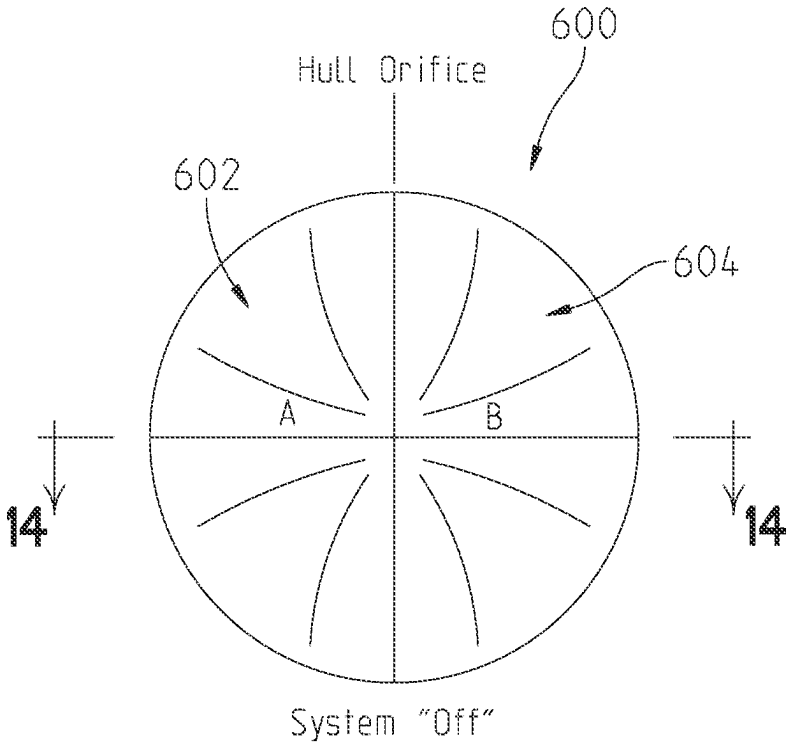
600
Hull Orifice
602
604
A
B
14
14
System "Off"

FIG. 13

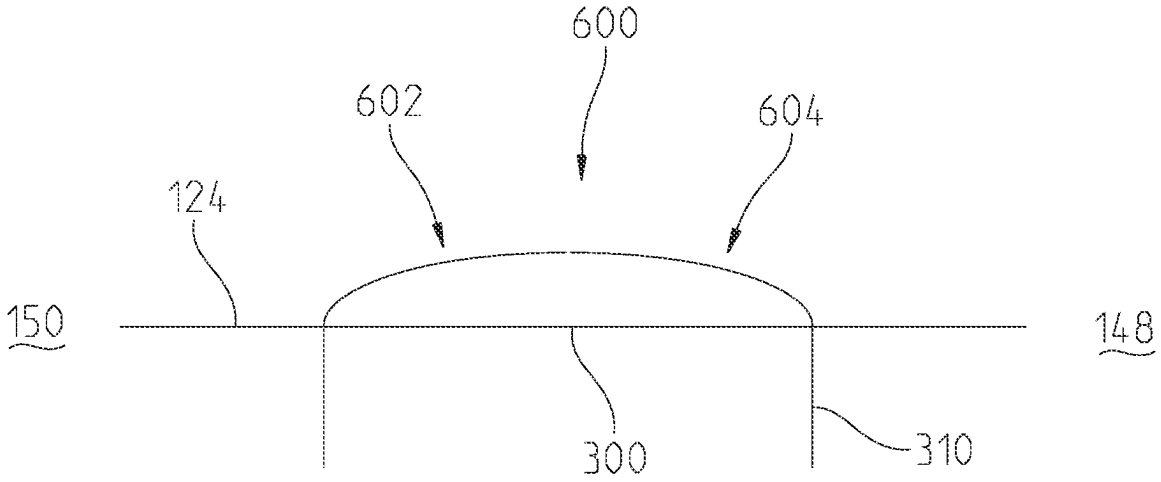
600
602
604
124
150
148
300
310

FIG. 14

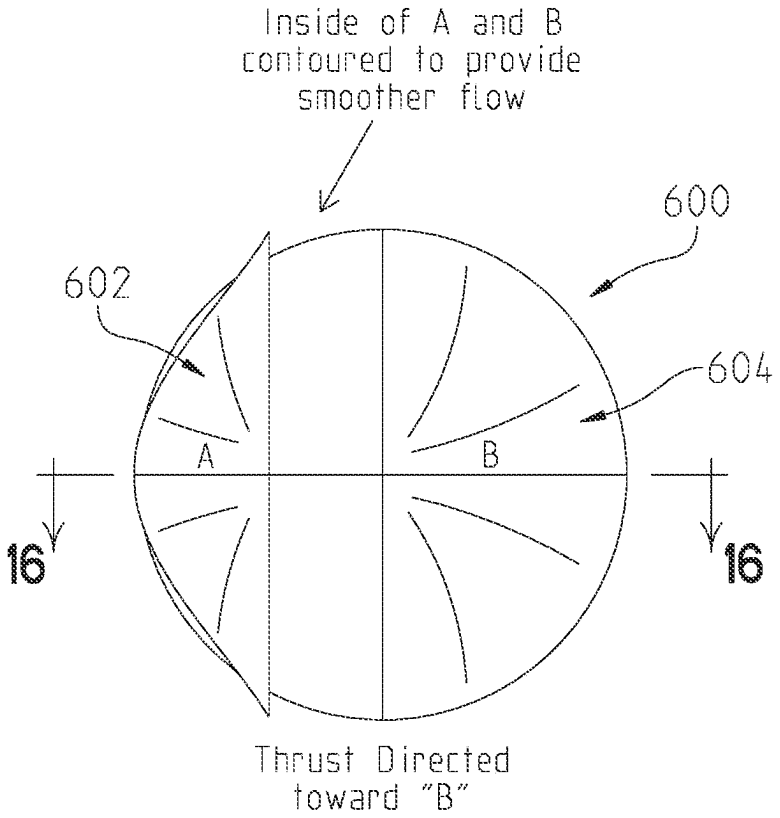
Inside of A and B
contoured to provide
smoother flow
600
602
604
A
B
16
16
Thrust Directed
toward "B"

FIG. 15

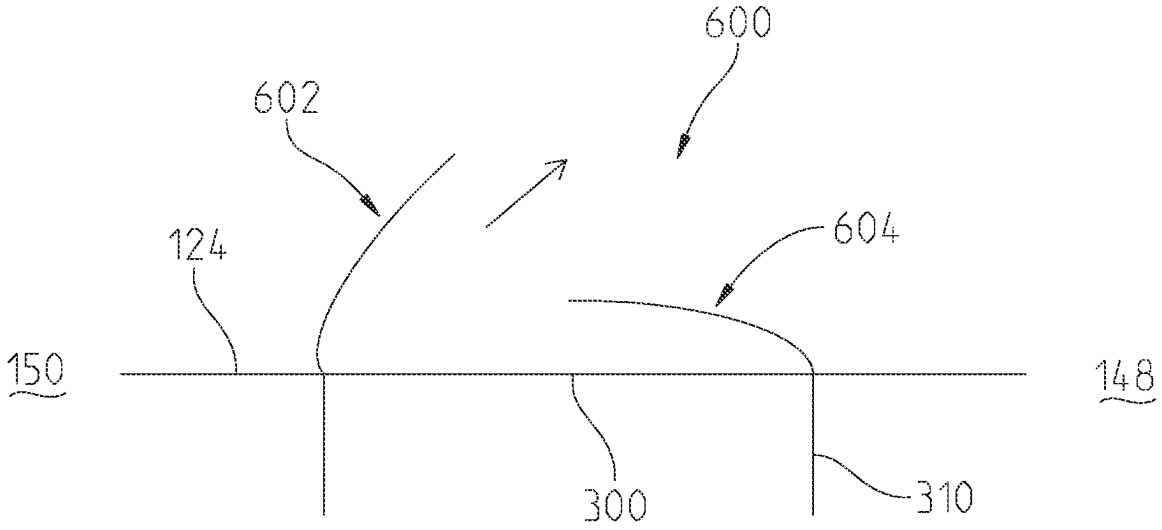
600
602
604
124
150
148
300
310

FIG. 16

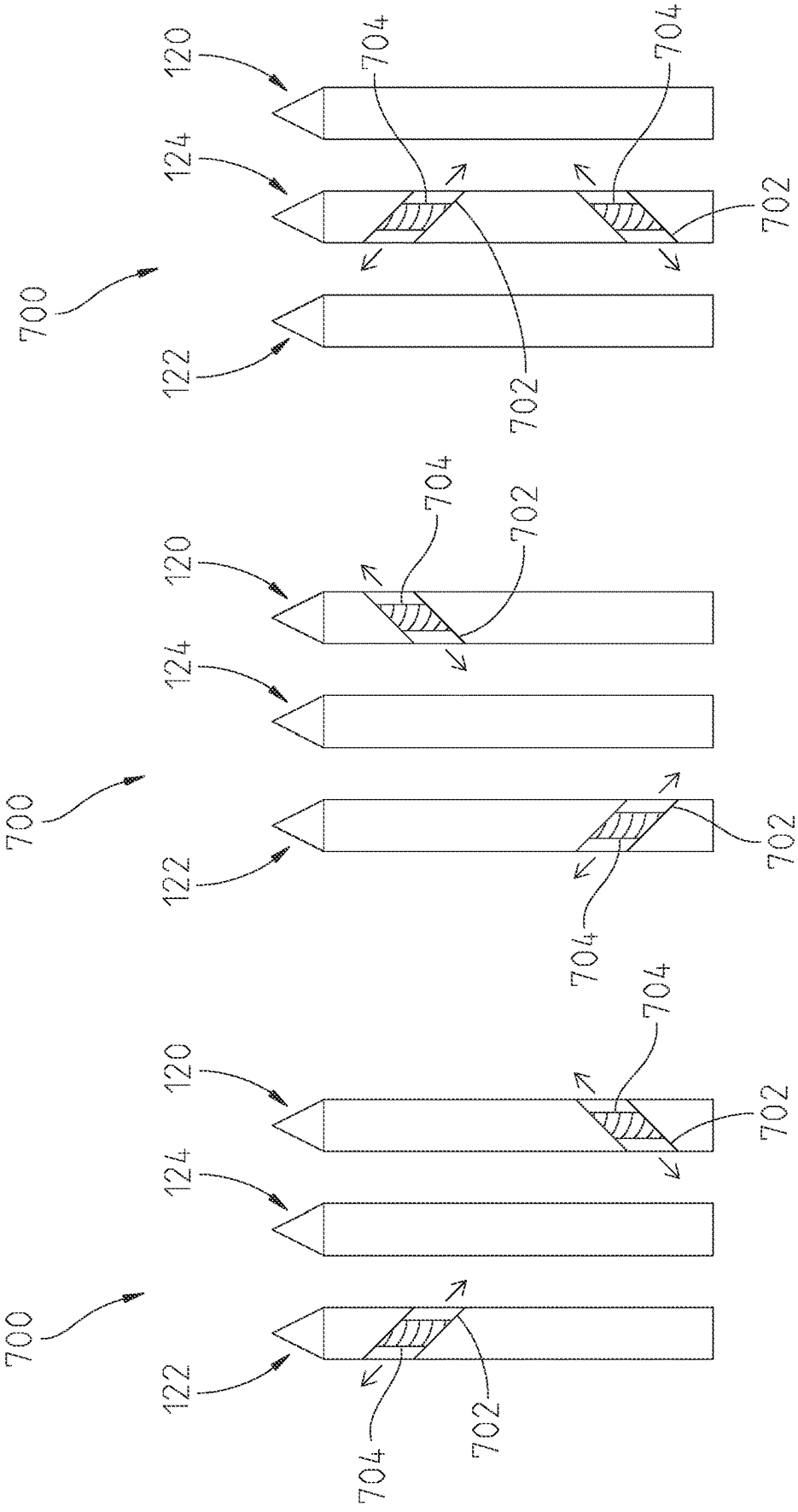

FIG. 19

FIG. 18

FIG. 17

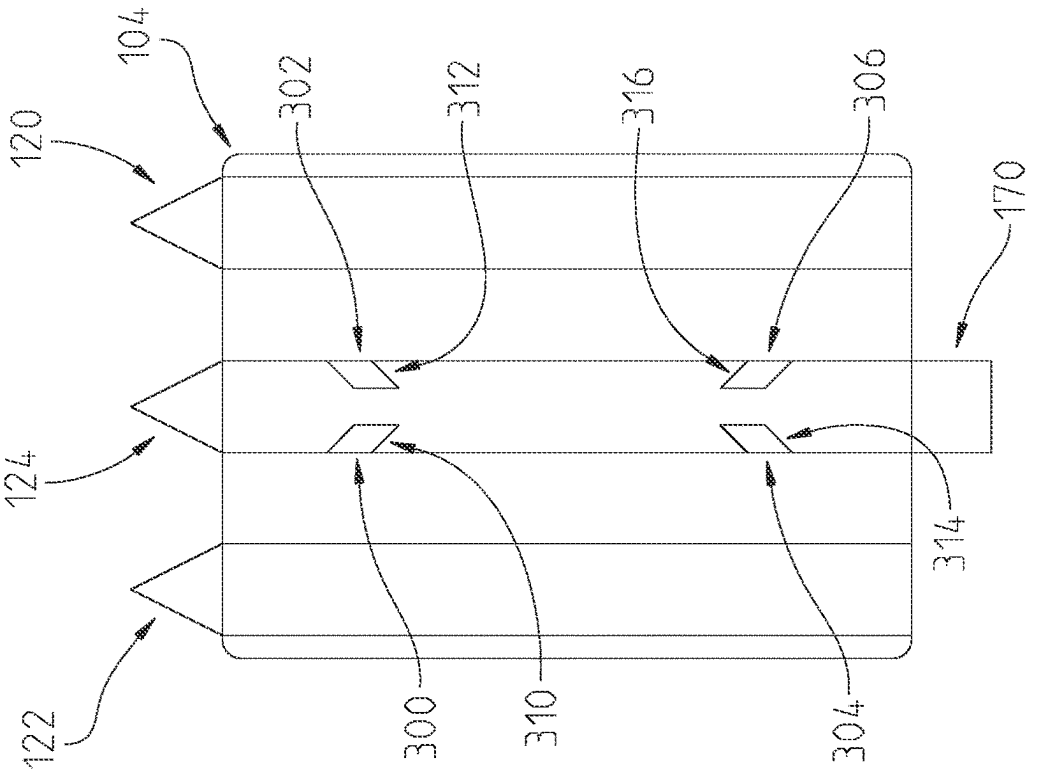

FIG. 20B

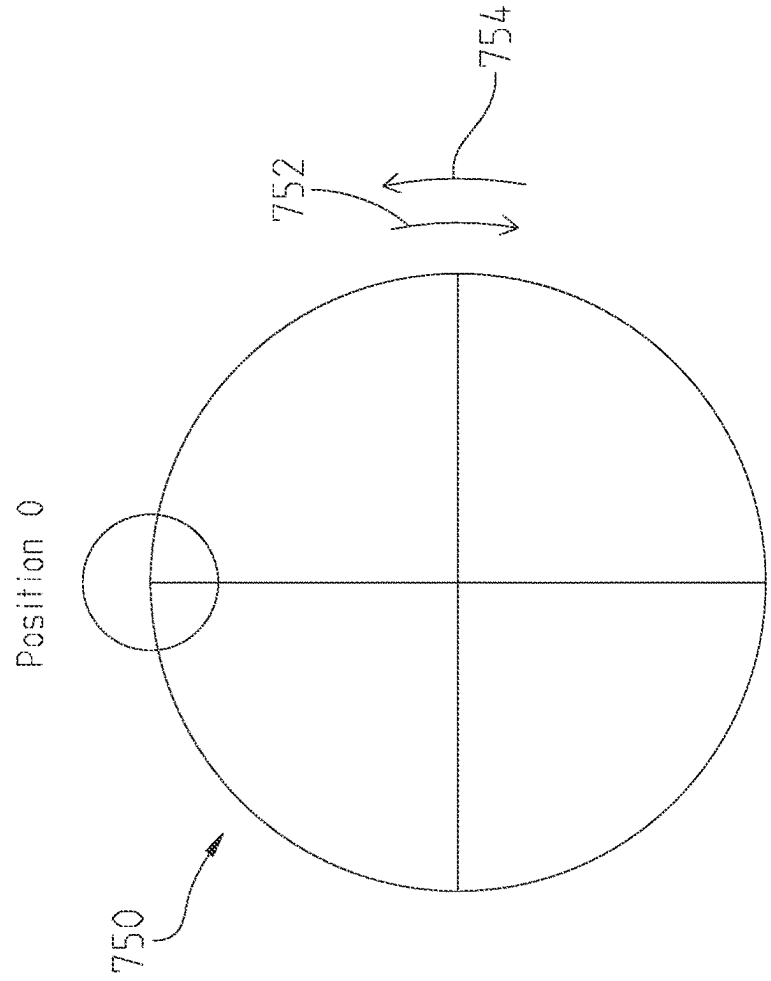

FIG. 20A

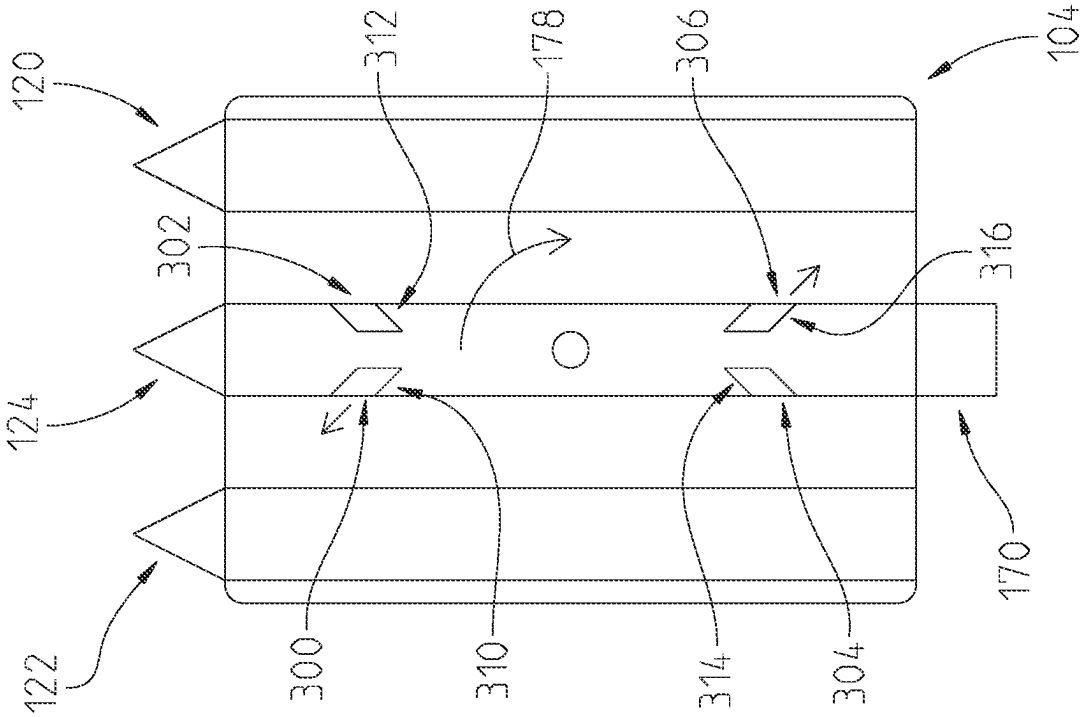

FIG. 21B

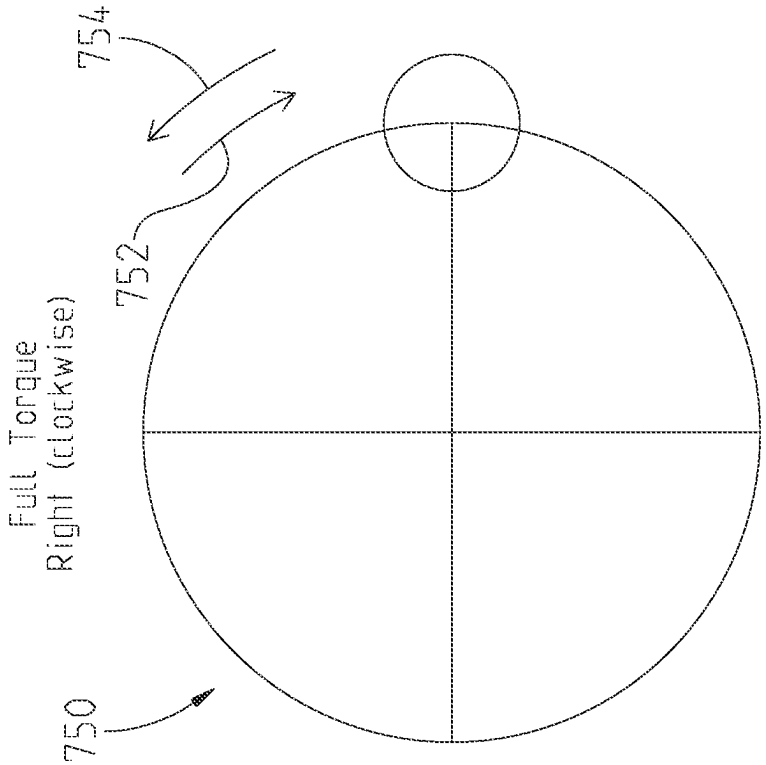

FIG. 21A

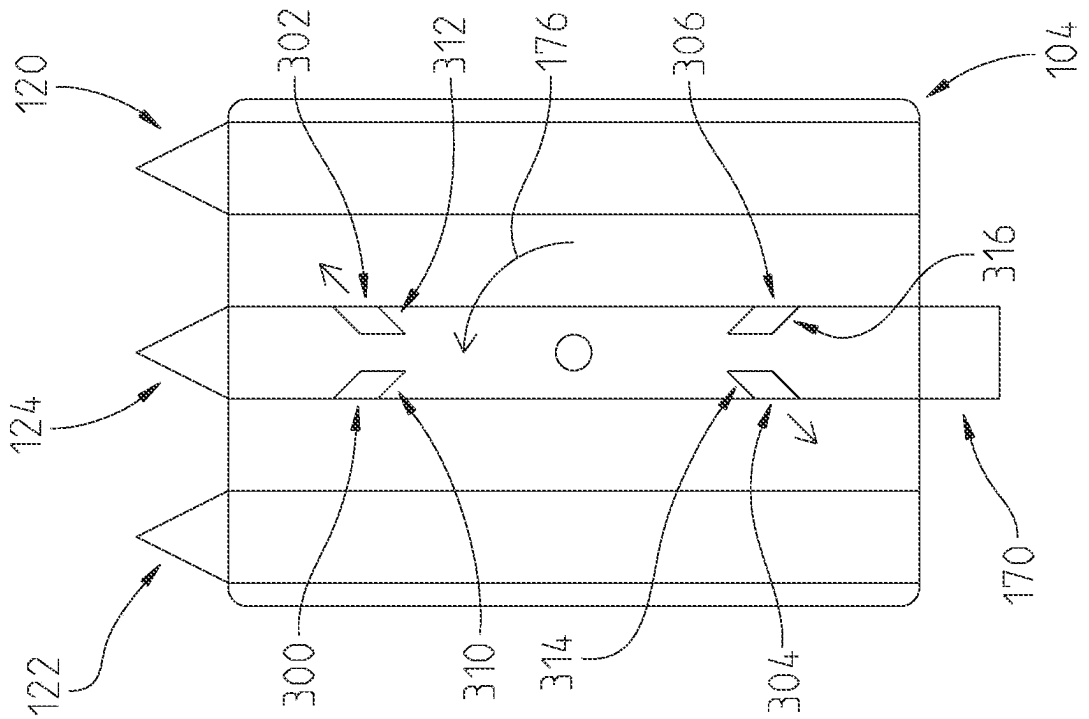

FIG. 22B

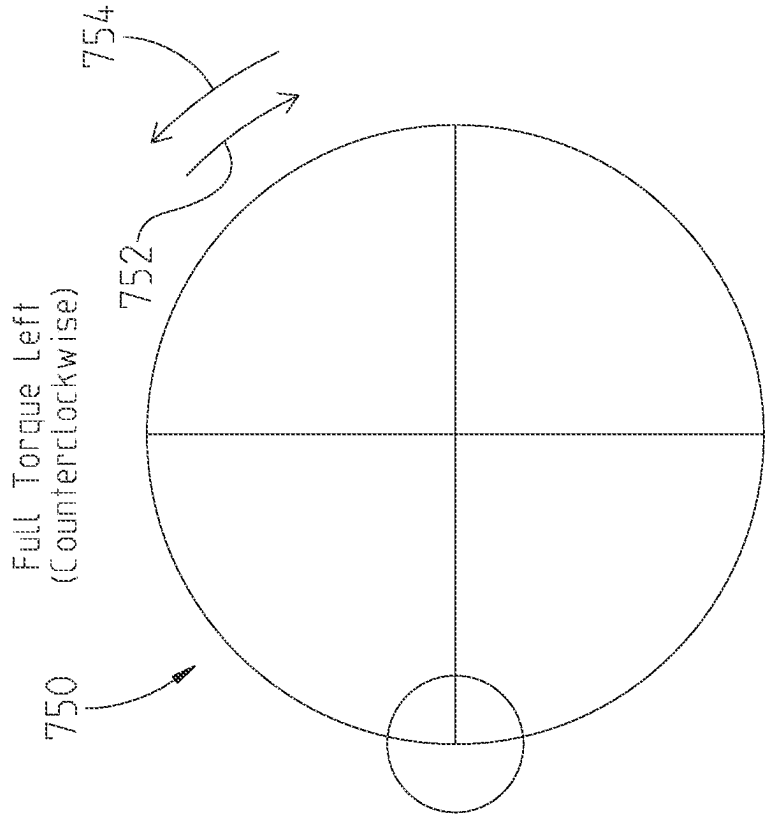

FIG. 22A

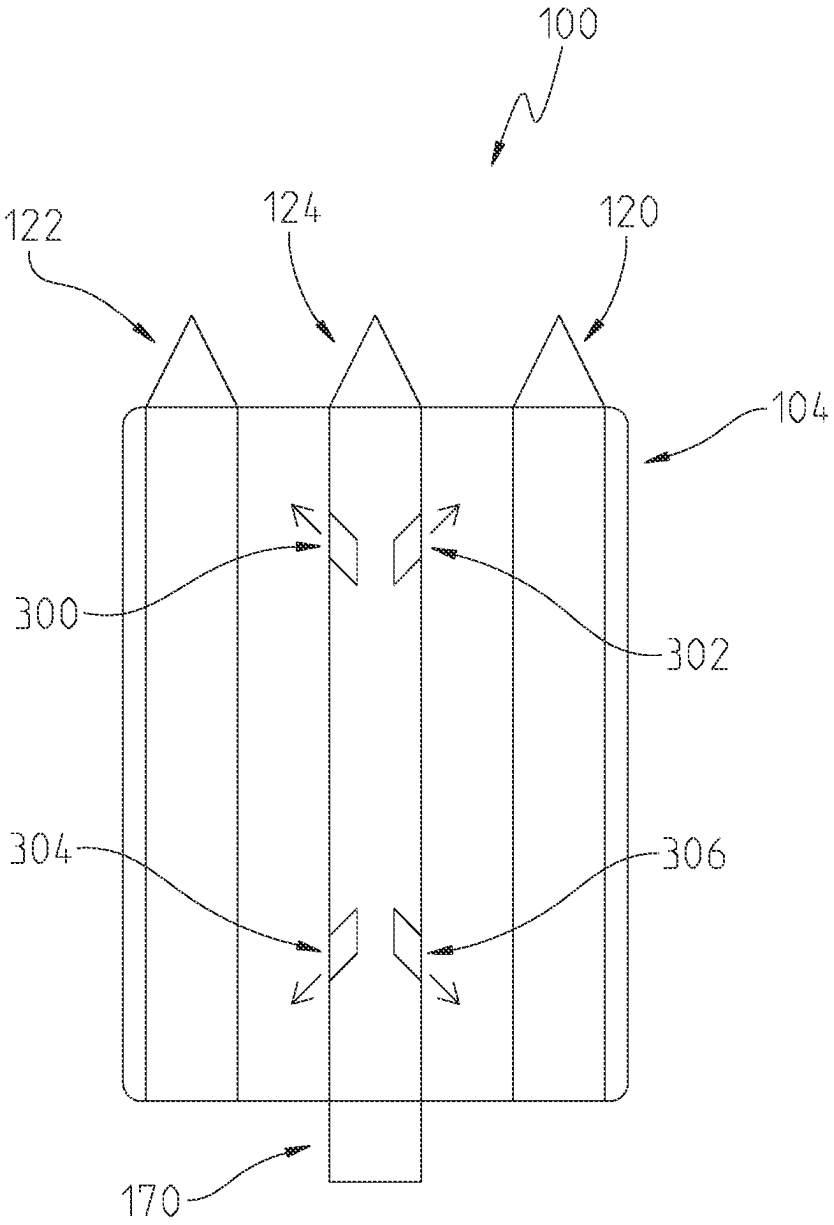

FIG. 23

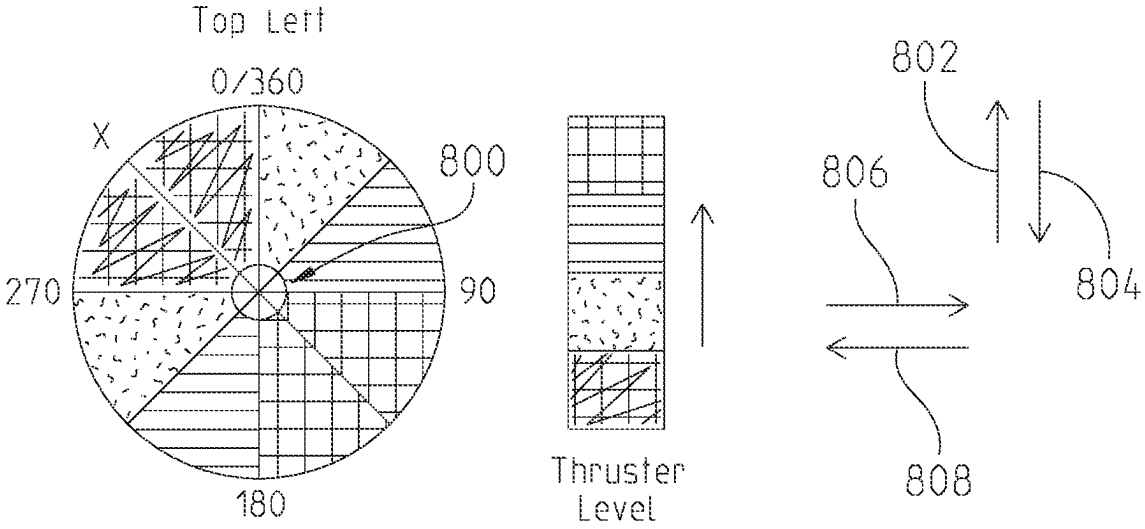
Top Left
0/360
X
800
270
90
180
Thruster Level
802
806
804
808

FIG. 24

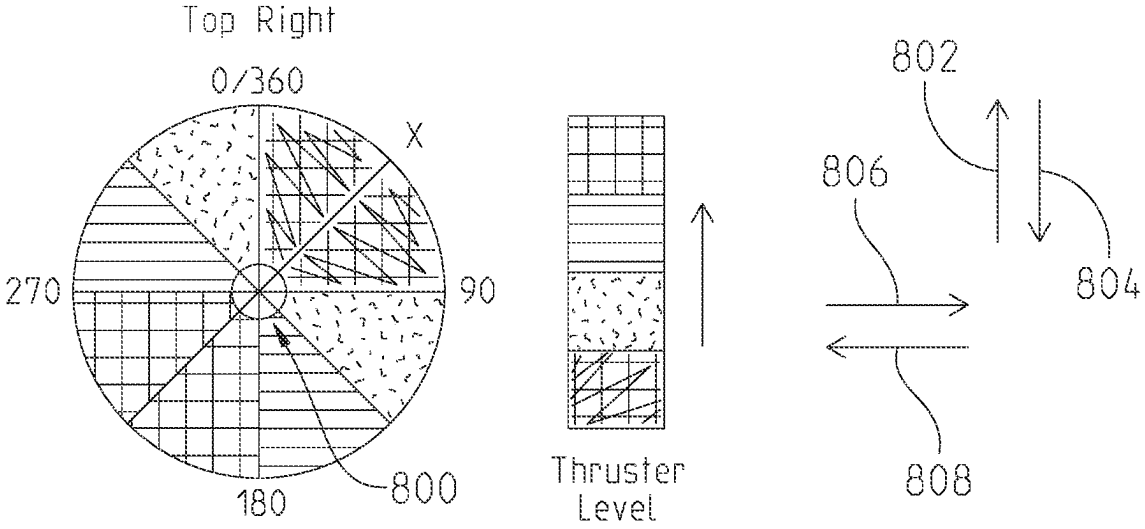
Top Right
0/360
X
270
90
180
800
Thruster Level
802
806
804
808

FIG. 25

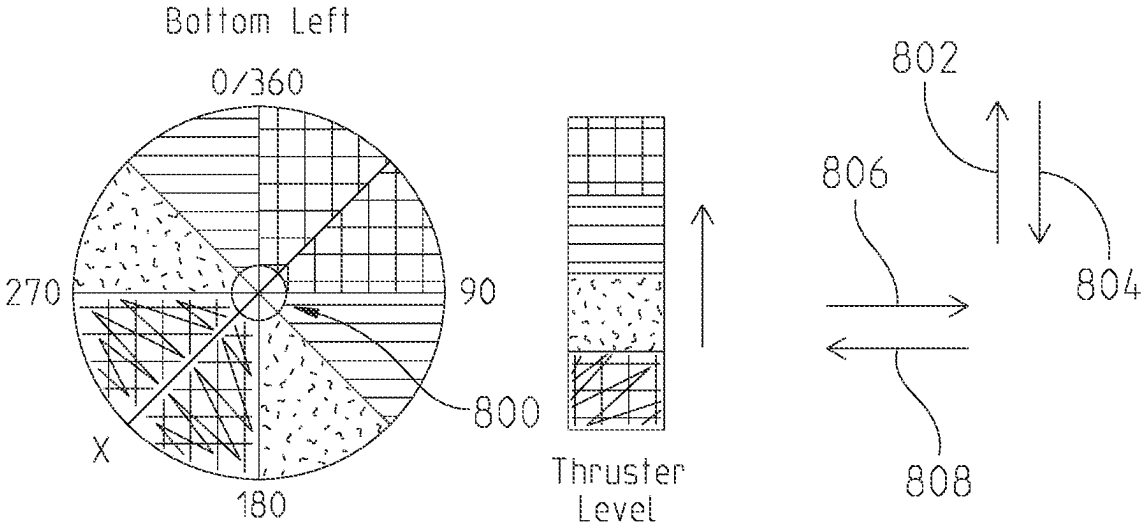
Bottom Left
0/360
270
90
800
X
180
Thruster Level
802
806
804
808

FIG. 26

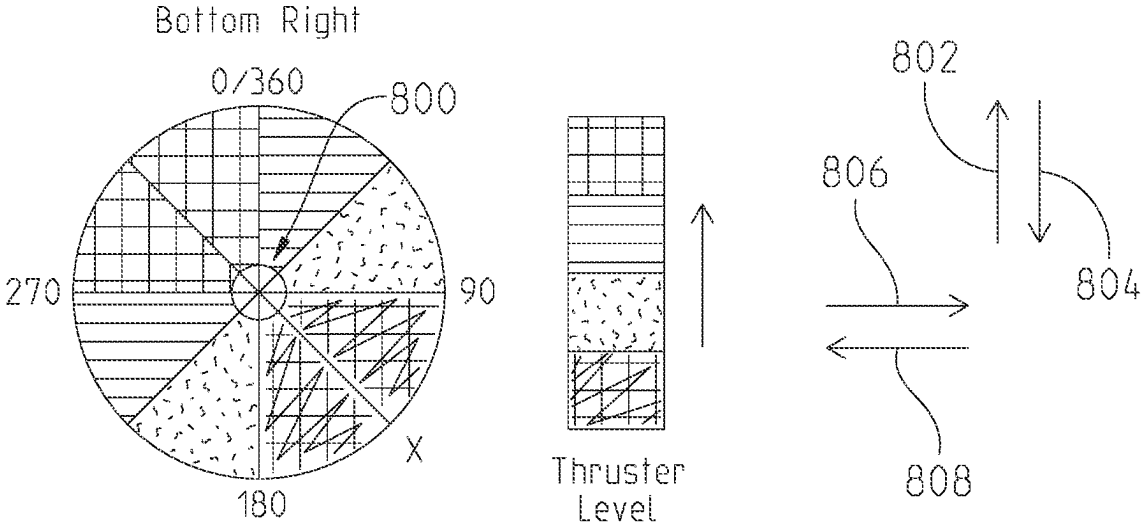
Bottom Right
0/360
800
270
90
X
180
Thruster Level
802
806
804
808

FIG. 27

THRUSTER ARRANGEMENT FOR A BOAT

RELATED APPLICATION

[0001] This application is a continuation of U.S. patent application Ser. No. 18/222,071, filed Jul. 14, 2023, which application is a continuation of U.S. patent application Ser. No. 17/405,797, filed Aug. 18, 2021, now U.S. Pat. No. 11,738,841 issued on Aug. 29, 2023, which application is a continuation of U.S. patent application Ser. No. 16/889,272, filed Jun. 1, 2020, now U.S. Pat. No. 11,208,188 issued on Dec. 28, 2021, which claims the benefit of priority to U.S. Provisional Application No. 62/859,507, titled THRUSTER ARRANGEMENT FOR A BOAT, filed Jun. 10, 2019, the entire disclosures of which are expressly incorporated by reference herein.

FIELD

[0002] The present disclosure relates to systems and methods to change position of a boat and in particular a thruster system to position the boat.

BACKGROUND

[0003] Pontoon and other types of multi-hull boats are known. It is known to include at least one outboard engine positioned at the stern of the boat to propel the boat through the water.

SUMMARY

[0004] In an exemplary embodiment of the present disclosure, a pontoon boat is provided. The pontoon boat comprising a plurality of pontoons, a deck supported by the plurality of pontoons, and a thruster system. The plurality of pontoons defining a port side envelope of the plurality of pontoons and a starboard side envelope of the plurality of pontoons. The deck having an outer perimeter. The thruster system including at least one water inlet in the plurality of pontoons and a plurality of water outlets in the plurality of pontoons. The plurality of water outlets being positioned within the outer deck perimeter and between the port side envelope of the plurality of pontoons and the starboard side envelope of the plurality of pontoons.

[0005] In an example thereof, the plurality of pontoons includes a port side pontoon, a starboard side pontoon, and a third pontoon positioned between the port side pontoon and the starboard side pontoon, each of the plurality of pontoons extending longitudinally under the deck. In a variation thereof, the at least one water inlet and the plurality of water outlets are provided in the third pontoon.

[0006] In another example thereof, the plurality of water outlets includes a port-bow outlet. In a further example thereof, the plurality of water outlets includes a port-stern outlet. In yet another example thereof, the plurality of water outlets includes a starboard-bow outlet. In still another example thereof, the plurality of water outlets includes a starboard-stern outlet.

[0007] In still another example, the thruster system further includes at least one fluid pump which pumps fluid from the at least one inlet towards at least one of the plurality of outlets.

[0008] In yet still another example, the pontoon boat further comprises an outboard motor positioned at a stern of the pontoon board.

[0009] In still a further example, a first one of the plurality of water outlets is directed in a port-bow direction and a second one of the plurality of water outlets is directed in a starboard-bow direction.

[0010] In yet still another example, a first one of the plurality of water outlets is directed in a port-bow direction and a second one of the plurality of water outlets is directed in a starboard-stern direction.

[0011] In yet still a further example, a first one of the plurality of water outlets is directed in a port-bow direction and a second one of the plurality of water outlets is directed in a port-stern direction.

[0012] In a still yet further example, a first one of the plurality of water outlets is directed in a port-stern direction and a second one of the plurality of water outlets is directed in a starboard-bow direction.

[0013] In a further still example, a first one of the plurality of water outlets is directed in a port-stern direction and a second one of the plurality of water outlets is directed in a starboard-stern direction.

[0014] In another still example, a first one of the plurality of water outlets is directed in a starboard-bow direction and a second one of the plurality of water outlets is directed in a starboard-stern direction.

[0015] In a further yet example, a first one of the plurality of water outlets is positionable in a plurality of directions. In a variation thereof, the first one of the plurality of water outlets is moveable between a first position corresponding to a port-bow direction and a second position corresponding to a port-stern direction. In another variation thereof, the first one of the plurality of water outlets is moveable between a first position corresponding to a starboard-bow direction and a second position corresponding to a starboard-stern direction.

[0016] In a further yet example, the plurality of pontoons includes a port side pontoon, a starboard side pontoon, and a third pontoon positioned between the port side pontoon and the starboard side pontoon, the at least one water inlet being positioned within the outer deck perimeter and between the port side envelope of the plurality of pontoons and the starboard side envelope of the plurality of pontoons. In a variation thereof, the at least one water inlet is positioned in the third pontoon.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The above-mentioned and other features and advantages of this disclosure, and the manner of attaining them, will become more apparent and will be better understood by reference to the following description of exemplary embodiments taken in conjunction with the accompanying drawings, wherein:

[0018] FIG. **1** illustrates a front view of a pontoon boat having a deck supported by a plurality of pontoons;

[0019] FIG. **2** illustrates a representative view of a portion of one of the plurality of pontoons including a thruster system;

[0020] FIG. **3** illustrates a representative top view of the pontoon boat of FIG. **1** including a thruster system having a first group of thruster outlets positioned in a bow portion of the pontoon boat and directed towards the stern portion of the pontoon boat with a first one directed towards port and a second one directed towards starboard and a second group of thruster outlets positioned in a stern portion of the pontoon boat and directed towards the bow portion of the

pontoon boat with a first one directed towards port and a second one directed towards starboard;

[0021] FIG. **4** illustrates a representative top view of the pontoon boat of FIG. **1** including a thruster system having a first group of thruster outlets positioned in a bow portion of the pontoon boat and directed towards the bow of the pontoon boat with a first one directed towards port and a second one directed towards starboard and a second group of thruster outlets positioned in a stern portion of the pontoon boat and directed towards the stern of the pontoon boat with a first one directed towards port and a second one directed towards starboard;

[0022] FIG. **5** illustrates a representative top view of the pontoon boat of FIG. **1** including a thruster system having a first group of thruster outlets positioned in a bow portion of the pontoon boat and with a first one directed towards port and a second one directed towards starboard and a second group of thruster outlets positioned in a stern portion of the pontoon boat and with a first one directed towards port and a second one directed towards starboard;

[0023] FIG. **6** illustrates a portion of the representative view of FIG. **4** with deflectors positioned proximate the outlets of the first group of thrusters;

[0024] FIGS. **7**A and **7**B illustrates a representative view of a first thruster direction control system including an adjustable fluid conduit which is configurable to alter an output direction of the thruster system;

[0025] FIG. **8** illustrates an exemplary actuator for the adjustable fluid conduit of FIGS. **7**A and **7**B;

[0026] FIG. **9** illustrates a representative view of a second thruster direction control system including a ball member including a fluid conduit therethrough terminating in an outlet of the thruster system, the ball member being positionable by an actuator;

[0027] FIG. **10** illustrates the ball member in a first orientation orienting the outlet towards the bow of the pontoon boat and the port side of the pontoon boat;

[0028] FIG. **11** illustrates the ball member in a second orientation orienting the outlet towards the port side of the pontoon boat;

[0029] FIG. **12** illustrates the ball member in a third orientation orienting the outlet towards the stern of the pontoon boat and the port side of the pontoon boat;

[0030] FIG. **13** illustrates a representative view of a third thruster control system including a plurality of deflectors positionable to change a direction of the thrust output, each of the plurality of deflectors being in a closed position;

[0031] FIG. **14** illustrates a representative view along lines **14-14** in FIG. **13**;

[0032] FIG. **15** illustrates a representative view of the thruster control system of FIG. **13** with a first deflector in an open position and a second deflector in a closed position resulting in the thrust output being directed towards the stern of the pontoon boat;

[0033] FIG. **16** illustrates a representative view along lines **16-16** in FIG. **15**;

[0034] FIG. **17** illustrates a representative top view of the pontoon boat of FIG. **1** including another exemplary thruster system having a first reversible impeller positioned in a first pontoon of the pontoon boat and a second reversible impeller positioned in a second pontoon of the pontoon boat;

[0035] FIG. **18** illustrates a representative top view of the pontoon boat of FIG. **1** including another exemplary thruster system having a first reversible impeller positioned in a first pontoon of the pontoon boat and a second reversible impeller positioned in a second pontoon of the pontoon boat;

[0036] FIG. **19** illustrates a representative top view of the pontoon boat of FIG. **1** including another exemplary thruster system having a first reversible impeller and a second reversible impeller positioned in a pontoon of the pontoon boat;

[0037] FIG. **20**A illustrates a position of a first user input device, a dial controller, and the corresponding output of the thrust system of FIG. **4**, as represented in FIG. **20**B;

[0038] FIG. **20**B illustrates the output of the thrust system of FIG. **4** corresponding to the position of the first user input device in FIG. **20**A;

[0039] FIG. **21**A illustrates a position of a first user input device, a dial controller, and the corresponding output of the thrust system of FIG. **4**, as represented in FIG. **21**B;

[0040] FIG. **21**B illustrates the output of the thrust system of FIG. **4** corresponding to the position of the first user input device in FIG. **21**A;

[0041] FIG. **22**A illustrates a position of a first user input device, a dial controller, and the corresponding output of the thrust system of FIG. **4**, as represented in FIG. **22**B;

[0042] FIG. **22**B illustrates the output of the thrust system of FIG. **4** corresponding to the position of the first user input device in FIG. **22**A;

[0043] FIG. **23** illustrates the thrust system of FIG. **4**; and

[0044] FIGS. **24-27** illustrate various positions of a second user input device, a joystick, and the corresponding thrust outputs for the thrust system of FIG. **23**.

[0045] Corresponding reference characters indicate corresponding parts throughout the several views. The exemplification set out herein illustrates an exemplary embodiment of the invention and such exemplification is not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION OF THE DRAWINGS

[0046] For the purposes of promoting an understanding of the principles of the present disclosure, reference is now made to the embodiments illustrated in the drawings, which are described below. The embodiments disclosed herein are not intended to be exhaustive or limit the present disclosure to the precise form disclosed in the following detailed description. Rather, the embodiments are chosen and described so that others skilled in the art may utilize their teachings. Therefore, no limitation of the scope of the present disclosure is thereby intended. Corresponding reference characters indicate corresponding parts throughout the several views.

[0047] The terms "couples", "coupled", "coupler" and variations thereof are used to include both arrangements wherein the two or more components are in direct physical contact and arrangements wherein the two or more components are not in direct contact with each other (e.g., the components are "coupled" via at least a third component), but yet still cooperate or interact with each other.

[0048] In some instances throughout this disclosure and in the claims, numeric terminology, such as first, second, third, and fourth, is used in reference to various components or features. Such use is not intended to denote an ordering of the components or features. Rather, numeric terminology is used to assist the reader in identifying the component or

features being referenced and should not be narrowly interpreted as providing a specific order of components or features.

[0049] Referring to FIG. **1**, an exemplary pontoon boat **100** is floating in a body of water **10** having a top surface **12**. Pontoon boat **100** includes a deck **104** supported by a plurality of pontoons **106**. The deck supports a railing **108** including a gate **110** positioned in a bow portion **112** of pontoon boat **100**. Pontoon boat **100** may further include a plurality of seats **114**, a canopy (not shown), and other components supported by deck **104**.

[0050] The plurality of pontoons **106** include a starboard pontoon **120**, a port pontoon **122**, and a central pontoon **124**. Each of starboard pontoon **120**, port pontoon **122**, and central pontoon **124** support deck **104** through respective brackets **126**. Each of starboard pontoon **120**, port pontoon **122**, and central pontoon **124** support deck **104** above top surface **12** of water **10**. Although three pontoons are illustrated, the plurality of pontoons **106** may be limited to two pontoons or have four or more pontoons. Further, the thruster systems described herein may be used with a single hull vessel.

[0051] Referring to FIG. **3**, pontoon boat **100** has a longitudinal centerline **140** and a lateral centerline **142**. Longitudinal centerline **140** divides pontoon boat **100** into a port side **144** of pontoon boat **100** and a starboard side **146** of pontoon boat **100**. Lateral centerline **142** divides pontoon boat **100** into a bow portion **148** of pontoon boat **100** and a stern portion **150** of pontoon boat **100**. Deck **104** of pontoon boat **100** includes an outer perimeter **149** including a bow perimeter portion **152**, a starboard perimeter portion **154**, a stern perimeter portion **158**, and a port perimeter portion **156**. The plurality of pontoons **106** define a port extreme extent **160** corresponding to an outer extent of port pontoon **122** and a starboard extreme extent **162** corresponding to an outer extent of starboard pontoon **120**.

[0052] Pontoon boat **100** includes an outboard motor **170** which extends beyond stern perimeter portion **158** of deck **104**. In embodiments, outboard motor **170** is an internal combustion engine which power rotation of an impeller (not shown). The impeller may be rotated in a first direction to propel pontoon boat **100** forward in a direction **172** or in a second direction to propel pontoon boat **100** rearward in a direction **174**. In embodiments, outboard motor **170** is rotatably mounted relative to deck **104** such that an orientation of the impeller may be adjusted to turn pontoon boat **100** in one of direction **176** and direction **178**. In embodiments, multiple outboard motors **170** may be provided.

[0053] Referring to FIG. **2**, pontoon boat **100** further includes a thruster system **200**. Thruster system **200** provides additional control over a position and/or orientation of pontoon boat **100**. In embodiments, at least one of the plurality of pontoons **106**, illustratively central pontoon **124**, includes at least one water inlet, illustratively water inlet **202** of fluid conduit **204** is shown, and at least one water outlet, illustratively water outlet **206** and water outlet **210** both of fluid conduit **208**, are shown. Fluid conduit **208** is fluidly coupled to fluid conduit **204**. As shown in FIG. **2**, each of water inlet **202**, water outlet **206**, and water outlet **210** are positioned below top surface **12** of water **10**.

[0054] Thruster system **200** includes a fluid pump **220** positioned in fluid conduit **204** to move water from proximate water inlet **202** of fluid conduit **204** towards water outlet **206** and water outlet **210** of fluid conduit **208**. Exemplary fluid pumps include the JT-30, JT-50, JT-70, and JT-90 series pumps available from Holland Marine Parts B.V. located at Donker Duyvisweg 297, 3316 BL Dordrecht (NL). Fluid pump **220** is powered by a power source **222**. Illustratively power source **222** includes an electric motor **224** and a battery bank **226** which power electric motor **224**.

[0055] The operation of fluid pump **220** is controlled with a controller **230**. In embodiments, controller **230** is an electronic controller including processing circuits and memory. In embodiments, controller **230** is microprocessor-based and memory is a non-transitory computer readable medium which includes processing instructions stored therein that are executable by the microprocessor of controller to control operation of fluid pump **220**. Exemplary non-transitory computer-readable mediums include random access memory (RAM), read-only memory (ROM), erasable programmable read-only memory (e.g., EPROM, EEPROM, or Flash memory), or any other tangible medium capable of storing information.

[0056] In embodiments, controller **230** is one of wired or wirelessly coupled to a user interface **240** positioned above deck **104**. User interface **240** includes one or more input devices. Exemplary input devices **320** include switches, dials, joysticks, touch screens, and other suitable input devices for receiving a user input. In embodiments, user interface **240** is provided on a personal mobile device, such as a smart phone or tablet, and the personal mobile device includes processing instructions which provide input to controller **230** over a wireless connection.

[0057] As shown in FIG. **2**, in embodiments, controller **230** is also operatively coupled to a first valve **250** and a second valve **252**. Controller **230** controls whether fluid from fluid pump **220** reaches water outlet **206** based on whether first valve **250** is open or closed by controller **230**. Controller **230** controls whether fluid from fluid pump **220** reaches water outlet **210** based on whether second valve **252** is open or closed by controller **230**. In embodiments, controller **230** may control additional valves to control fluid flow to additional water outlets. In embodiments, thruster system **200** does not include valves **250** and **252**. Rather, in one embodiment, fluid pump **220** is fluidly coupled to only water inlet **202** and water outlet **206** and a separate fluid pump **220** is provided to fluidly couple water inlet **202** and water outlet **210**.

[0058] Referring to FIG. **3**, an embodiment of thruster system **200** is illustrated. In FIG. **3**, thruster system **200** includes four water outlets, a bow-port outlet **300**, a bow-starboard outlet **302**, a stern-port outlet **304**, and a stern-starboard outlet **306**. Bow-port outlet **300** has a corresponding fluid conduit **310** which causes water to exit bow-port outlet **300** in a direction, indicated by the arrow, towards both port side **144** of pontoon boat **100** and stern portion **150** of pontoon boat **100**. Bow-starboard outlet **302** has a corresponding fluid conduit **312** which causes water to exit bow-starboard outlet **302** in a direction, indicated by the arrow, towards both starboard side **146** of pontoon boat **100** and stern portion **150** of pontoon boat **100**. Stern-port outlet **304** has a corresponding fluid conduit **314** which causes water to exit stern-port outlet **304** in a direction, indicated by the arrow, towards both port side **144** of pontoon boat **100** and bow portion **148** of pontoon boat **100**. Stern-starboard outlet **306** has a corresponding fluid conduit **316** which causes water to exit stern-starboard outlet **306** in a direction,

indicated by the arrow, towards both starboard side **146** of pontoon boat **100** and bow portion **148** of pontoon boat **100**.

[0059] In embodiments, each of fluid conduits **310-316** are angled downward (see FIG. **1**). An advantage, among others, of angling the fluid conduits **310-316** downward is increased stability of pontoon boat **100** in water **10**.

[0060] In embodiments, each of fluid conduit **310**, fluid conduit **312**, fluid conduit **314**, and fluid conduit **316** are fed by a respective fluid pump **220** from one or more water inlets **202** in central pontoon **124**. In embodiments, a plurality of fluid conduit **310**, fluid conduit **312**, fluid conduit **314**, and fluid conduit **316** are fed by a common fluid pump **220** and one or more valves are included to control which of the plurality of fluid conduit **310**, fluid conduit **312**, fluid conduit **314**, and fluid conduit **316** are in fluid communication with the common fluid pump **220**.

[0061] Referring to FIG. **4**, another embodiment of thruster system **200** is illustrated. In FIG. **4**, thruster system **200** includes water outlets **300-306** and corresponding fluid conduits **310-316**. The embodiment of FIG. **4** differs from the embodiment of FIG. **3** based on the directions water exits the various ones of bow-port outlet **300**, bow-starboard outlet **302**, stern-port outlet **304**, and stern-starboard outlet **306**. Fluid conduit **310** corresponding to bow-port outlet **300** causes water to exit bow-port outlet **300** in a direction, indicated by the arrow, towards both port side **144** of pontoon boat **100** and bow portion **148** of pontoon boat **100**. Fluid conduit **312** corresponding to bow-starboard outlet **302** causes water to exit bow-starboard outlet **302** in a direction, indicated by the arrow, towards both starboard side **146** of pontoon boat **100** and bow portion **148** of pontoon boat **100**. Fluid conduit **314** corresponding to stern-port outlet **304** causes water to exit stern-port outlet **304** in a direction, indicated by the arrow, towards both port side **144** of pontoon boat **100** and stern portion **150** of pontoon boat **100**. Fluid conduit **316** corresponding to stern-starboard outlet **306** causes water to exit stern-starboard outlet **306** in a direction, indicated by the arrow, towards both starboard side **146** of pontoon boat **100** and stern portion **150** of pontoon boat **100**.

[0062] Referring to FIG. **5**, another embodiment of thruster system **200** is illustrated. In FIG. **4**, thruster system **200** includes water outlets **300-306** and corresponding fluid conduits **310-316**. The embodiment of FIG. **5** differs from the embodiment of FIG. **3** based on the directions water exits the various ones of bow-port outlet **300**, bow-starboard outlet **302**, stern-port outlet **304**, and stern-starboard outlet **306**. Fluid conduit **310** corresponding to bow-port outlet **300** causes water to exit bow-port outlet **300** in a direction, indicated by the arrow, towards port side **144** of pontoon boat **100**. Fluid conduit **312** corresponding to bow-starboard outlet **302** causes water to exit bow-starboard outlet **302** in a direction, indicated by the arrow, towards starboard side **146** of pontoon boat **100**. Fluid conduit **314** corresponding to stern-port outlet **304** causes water to exit stern-port outlet **304** in a direction, indicated by the arrow, towards port side **144** of pontoon boat **100**. Fluid conduit **316** corresponding to stern-starboard outlet **306** causes water to exit stern-starboard outlet **306** in a direction, indicated by the arrow, towards starboard side **146** of pontoon boat **100**.

[0063] In the illustrated embodiment, thruster system **200** is associated with only central pontoon **124**. In embodiments, thruster system **200** may have one or more water inlets and one or more water outlets with corresponding fluid pumps associated with one or both of starboard pontoon **120** and port pontoon **122**. In embodiments, more or less water outlets may be provided on central pontoon **124** in bow portion **148** of pontoon boat **100**, stern portion **150** of pontoon boat **100**, on the port side **144** side of central pontoon **124**, and/or on the starboard side **146** side of central pontoon **124**.

[0064] Referring to FIG. **6**, in embodiments, thruster system **200** further includes deflectors **380** supported by central pontoon **124**. Deflectors **380** direct water away from bow-port outlet **300** and bow-starboard outlet **302** in the directions indicated by the arrows as pontoon boat **100** travels in forward direction **172**.

[0065] In embodiments, one or more of fluid conduit **310**, fluid conduit **312**, fluid conduit **314**, and fluid conduit **316** and thus the direction water generally exits the corresponding bow-port outlet **300**, bow-starboard outlet **302**, stern-port outlet **304**, and stern-starboard outlet **306** is defined. In embodiments, one or more of fluid conduit **310**, fluid conduit **312**, fluid conduit **314**, and fluid conduit **316** are moveable and thus the direction water generally exits the corresponding bow-port outlet **300**, bow-starboard outlet **302**, stern-port outlet **304**, and stern-starboard outlet **306** may also be altered.

[0066] Referring to FIGS. **7**A, **7**B, and **8**, one example of a movable fluid conduit is shown. Referring to FIGS. **7**A and **7**B, fluid conduit **400** includes first conduit portion **402** which terminates in fluid outlet **300** and a second conduit portion **404** which receives fluid from fluid pump **220** and is fluidly coupled to first conduit portion **402** to provide fluid to first conduit portion **402**. First conduit portion **402** of fluid conduit **400** is coupled to second conduit portion **404** of fluid conduit **400** at a ring **406**.

[0067] A position of ring **406** is controlled by an actuator **408**. In a first position of ring **406**, first conduit portion **402** directs water in the same direction as fluid conduit **310** in FIG. **3**, as shown in FIG. **7**A. In a second position of ring **406**, first conduit portion **402** directs water in the same direction as fluid conduit **310** in FIG. **4**, as shown in FIG. **7**B. By having fluid conduit **400** be moveable, actuator **408** is able to provide both the embodiments depicted in FIGS. **3** and **4** with a single thruster system. Exemplary actuators **408** include linkages, gear trains, and other suitable actuation systems.

[0068] Referring to FIG. **8**, an exemplary actuation system is shown. A wheel **420** includes an aperture which corresponds to ring **406**. First conduit portion **402** of fluid conduit **400** and second conduit portion **404** of fluid conduit **400** are secured to the wall of the aperture forming ring **406**. An actuator **408**, such as a gear, rotates wheel **420** to position fluid conduit **400**. In one embodiment, the position of ring **406** in FIG. **8** corresponds to the arrangement of fluid conduit **400** shown on the right side of FIG. **7**. By rotating wheel **420** one-half revolution, ring **406** is positioned to correspond to the arrangement of fluid conduit **400** shown in the left side of FIG. **7**.

[0069] Referring to FIG. **9**, another example of a moveable fluid conduit **500** is shown. Moveable fluid conduit **500** includes a base **502** which is coupled to central pontoon **124** and a ball member **504** which is rotatable relative to base **502**. Ball member **504** includes a fluid passage **508** through which fluid can pass. In embodiments, fluid conduit **500** is coupled to central pontoon **124** and an outlet **510** of fluid passage **508** serves as a water outlet of thruster system **200**.

[0070] Referring to FIGS. **10-12**, ball member **504** is rotatable by an actuator **520** to alter a direction that water exits ball member **504**, as indicated by the arrows. Assuming outlet **510** corresponds to bow-port outlet **300** in FIGS. **3-5**, the position of ball member **504** in FIG. **10** results in outlet **510** directing water in the same direction as bow-port outlet **300** in FIG. **4**, the position of ball member **504** in FIG. **11** results in outlet **510** directing water in the same direction as bow-port outlet **300** in FIG. **5**, and the position of ball member **504** in FIG. **12** results in outlet **510** directing water in the same direction as bow-port outlet **300** in FIG. **3**. Exemplary actuators include linkages, gear trains, and other suitable actuators.

[0071] Referring to FIGS. **13-16**, a cover **600** for bow-port outlet **300** is illustrated. Cover **600** covers bow-port outlet **300** when thruster system **200** is not in use. Additional covers **600** may be provided for the remaining outlets of thruster system **200**. In the illustrated embodiment, cover **600** includes a first door **602** and a second door **604**. Referring to FIGS. **13** and **14**, cover **600** is shown in a closed position. Referring to FIGS. **15** and **16**, cover **600** is shown in an open position wherein door **602** is opened to permit fluid to exit fluid conduit **310** through bow-port outlet **300** in the direction indicated by the arrow. As illustrated in FIG. **16**, by having door **602** open, cover **600** approximates the arrangement of FIG. **4**. If door **604** is opened and door **602** remains closed, cover **600** approximates the arrangement of FIG. **3**. If both doors **602** and **604** are open, cover **600** approximates the arrangement of FIG. **5**. The opening and closing of each of doors **602** and **604** may be controlled through an actuator. Exemplary actuators include linkages, gear trains, and other suitable actuation devices.

[0072] Referring to FIGS. **17-19**, various arrangement of a thruster system **700** are shown. Each arrangement includes a plurality of fluid conduits **702** in respective pontoons **106**. Positioned within each fluid conduit **702** is a reversible impeller **704** which may be rotated in a first direction to move water through the respective fluid conduit from a first opening in the pontoon towards a second opening in the pontoon and rotated in a second direction, opposite the first direction, through the respective fluid conduit from the second opening in the pontoon towards the first opening in the pontoon.

[0073] Referring to FIG. **20**B, the arrangement of FIG. **4** is illustrated wherein no water is being pushed out of any one of bow-port outlet **300**, bow-starboard outlet **302**, stern-port outlet **304**, and stern-starboard outlet **306** by thruster system **200**. Referring to FIG. **20**A, an exemplary input device, a rotatable dial **750**, of user interface **240** is illustrated. Dial **750** is in an off position which provides an input to controller **230** to place thruster system **200** in the condition shown in FIG. **20**B.

[0074] Referring to FIG. **21**B, the arrangement of FIG. **4** is illustrated wherein water is being pushed out of bow-port outlet **300** and stern-starboard outlet **306** by thruster system **200** to rotate pontoon boat **100** clockwise in direction **178**. Referring to FIG. **21**A, dial **750** is in a full torque right position, rotated 90° in direction **752** from the off position of FIG. **20**A, which provides an input to controller **230** to place thruster system **200** in the condition shown in FIG. **21**B.

[0075] Referring to FIG. **22**B, the arrangement of FIG. **4** is illustrated wherein water is being pushed out of bow-starboard outlet **302** and stern-port outlet **304** by thruster system **200** to rotate pontoon boat **100** counterclockwise in direction **176**. Referring to FIG. **22**A, dial **750** is in a full torque left position, rotated 90° in direction **754** from the off position of FIG. **20**A, which provides an input to controller **230** to place thruster system **200** in the condition shown in FIG. **21**B.

[0076] An advantage, among others, for utilizing thruster system **200** to turn pontoon boat **100** is that thruster system **200** can execute a tighter turn than outboard motor **170** due to bow-port outlet **300**, bow-starboard outlet **302**, stern-port outlet **304**, and stern-starboard outlet **306** being located within the perimeter **149** of deck **104**. One or more of bow-port outlet **300**, bow-starboard outlet **302**, stern-port outlet **304**, and stern-starboard outlet **306** may be used to move pontoon boat **100** forward in direction **172** (see FIG. **3**), rearward in direction **174** (see FIG. **3**), laterally towards port in direction **173** (see FIG. **3**), laterally towards starboard in direction **175** (see FIG. **3**), or combinations thereof.

[0077] Referring to FIGS. **24-27**, an exemplary input device, a joystick **800**, of user interface **240** is illustrated. Joystick **800** has a home position (its location illustrated in each of FIGS. **24-27**). Joystick **800** is movable in any one of directions **802**, **804**, **806**, and **808** or combinations thereof. The direction of movement provides an input to controller **230** of which outlets **300-306** of thruster system **200** should have water pushed out of and the magnitude of the displacement from the home position provides an input to controller **230** of the volume of water to be pushed out of the respective outlets **300-306**.

[0078] Referring to FIG. **24**, joystick **800** is displaced to the location marked by "X". In this position, controller **230** pushes water out of stern-starboard outlet **306** at a first level, pushes water out of stern-port outlet **304** and bow-starboard outlet **302** at a second level less than the first level, and pushes no water out of bow-port outlet **300**. The result is that pontoon boat **100** moves forward and towards port.

[0079] Referring to FIG. **25**, joystick **800** is displaced to the location marked by "X". In this position, controller **230** pushes water out of stern-port outlet **304** at a first level, pushes water out of bow-port outlet **300** and stern-starboard outlet **306** at a second level less than the first level, and pushes no water out of bow-starboard outlet **302**. The result is that pontoon boat **100** moves forward and towards starboard.

[0080] Referring to FIG. **26**, joystick **800** is displaced to the location marked by "X". In this position, controller **230** pushes water out of bow-starboard outlet **302** at a first level, pushes water out of bow-port outlet **300** and stern-starboard outlet **306** at a second level less than the first level, and pushes no water out of stern-port outlet **304**. The result is that pontoon boat **100** moves rearward and towards port.

[0081] Referring to FIG. **27**, joystick **800** is displaced to the location marked by "X". In this position, controller **230** pushes water out of bow-port outlet **300** at a first level, pushes water out of stern-port outlet **304** and bow-starboard outlet **302** at a second level less than the first level, and pushes no water out of stern-starboard outlet **306**. The result is that pontoon boat **100** moves rearward and towards starboard.

[0082] In embodiments, the thruster systems described herein may be used in conjunction with an autonomous system to position or move the boat. Exemplary autonomous systems includes sensors to determine the surroundings of the boat and utilize the thruster systems to move the boat relative to the surroundings.

[0083] While this invention has been described as having exemplary designs, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains.

1. A pontoon boat comprising:

a plurality of pontoons defining a port side envelope of the plurality of pontoons and a starboard side envelope of the plurality of pontoons, wherein the plurality of pontoons includes a port side pontoon, a starboard side pontoon, and a third pontoon positioned between the port side pontoon and the starboard side pontoon;

a fluid conduit connected to at least one pontoon of the plurality of pontoons, the fluid conduit angled downward relative to a waterline, and the fluid conduit including a water inlet and a water outlet; and

a thruster system associated with the at least one pontoon of the plurality of pontoons, the thruster system including a fluid pump positioned in the fluid conduit, the fluid pump configured to move water from proximate the water inlet to the water outlet to deliver a thrust output from the at least one pontoon.

2. The pontoon boat of claim **1**, including at least one valve positioned along the fluid conduit and configured to regulate at least one of water flow through the fluid conduit and water flow out of the water outlet.

3. The pontoon boat of claim **1**, including one or more of a bow-port water outlet, a bow-starboard water outlet, a stern-port water outlet and a stern-starboard water outlet.

4. The pontoon boat of claim **1**, including one or more deflectors configured to modify the thrust output.

5. The pontoon boat of claim **1**, including a controller operatively coupled with the thruster system, the controller configured to control fluid flow through the fluid conduit.

6. The pontoon boat of claim **5**, wherein the controller is configured to control one or more valves positioned along the fluid conduit;

wherein the controller is configured to control the one or more valves to control water exiting from one or more of a bow-port water outlet, a bow-starboard water outlet, a stern-port water outlet and a stern-starboard water outlet to control a direction of travel of the pontoon boat.

7. The pontoon boat of claim **1**, wherein the fluid conduit extends within the third pontoon.

8. A pontoon boat comprising:

a plurality of pontoons including a port side pontoon, a starboard side pontoon, and a middle pontoon located between the port side pontoon and the starboard side pontoon;

wherein at least one pontoon of the plurality of pontoons includes a fluid conduit connected to the at least one pontoon, the fluid conduit angled downward relative to a waterline;

a deck supported by the plurality of pontoons;

a thruster system including:

at least one water inlet in at least one pontoon of the plurality of pontoons;

at least one movable water outlet in the at least one pontoon of the plurality of pontoons;

one or more valves positioned within the fluid conduit, the one or more valves configured to regulate a fluid flow through the fluid conduit; and

a fluid pump positioned along the fluid conduit; and

a controller in communication with the thruster system, the controller configured to control fluid flow to at least one water outlet.

9. The pontoon boat of claim **8**, wherein the at least one water inlet and at least one water outlet are provided in the middle pontoon.

10. The pontoon boat of claim **8**, the controller in communication with the one or more valves;

wherein the controller controls opening and closing the one or more valves.

11. The pontoon boat of claim **8**, wherein the fluid pump is fluidly coupled with one or more movable water outlets.

12. The pontoon boat of claim **8**, wherein the fluid pump includes a first fluid pump coupled with a first movable water outlet and a second fluid pump coupled with a second movable water outlet to deliver a thrust output from the at least one pontoon.

13. The pontoon boat of claim **8**, includes a plurality of fluid conduits;

wherein the fluid pump is fluidly coupled with each of the plurality of fluid conduits to move water from proximate a water inlet toward the at least one movable water outlet.

14. The pontoon boat of claim **8**, wherein the controller is configured to provide instructions to the at least one movable water outlet;

wherein the instructions correspond to a desired direction of movement of the pontoon boat.

15. A method of operating a thruster system of a pontoon boat in water, the pontoon boat including a plurality of pontoons including exteriors in contact with the water, the plurality of pontoons including a first pontoon including a thruster unit positionable in an interior thereof, the method comprising:

providing an input to a controller corresponding to a desired thrusting force direction, the controller operatively coupled with a fluid pump of the thruster unit;

wherein the fluid pump is positioned within a fluid conduit in the first pontoon;

wherein the fluid conduit is angled to increase stability of the pontoon boat;

providing instructions, with the controller, to the fluid pump corresponding to fluid flow through the fluid conduit; and

controlling, with the controller, a volume of water flowing through the fluid conduit.

16. The method of operating the thruster system of the pontoon boat of claim **15**, wherein the fluid conduit includes one or more valves, the method including:

adjusting the one or more valves according to a desired fluid flow through the fluid conduit.

17. The method of operating the thruster system of the pontoon boat of claim **15**, wherein the fluid conduit includes a plurality of fluid conduits, and the fluid pump is coupled with each of the plurality of fluid conduits, the method including:

selectively directing a fluid flow with the fluid pump to each of the plurality of fluid conduits.

18. The method of operating the thruster system of the pontoon boat of claim **15**, wherein the fluid conduit is moveable, the method including:

altering a direction of water from a water outlet of the fluid conduit by moving the fluid conduit.

19. The method of operating the thruster system of the pontoon boat of claim **15**, wherein the first pontoon is positioned between a second pontoon and a third pontoon.

20. The method of operating the thruster system of the pontoon boat of claim **15**, including a first thruster unit including a first movable portion and a second thruster unit including a second movable portion, the method including:

altering a position of the first movable portion and the second movable portion; and

directing a flow of water with the first movable portion and the second movable portion to cause a desired movement of the pontoon boat.

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