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(54) Title: POOL CLEANERS

(57) Abstract: Wheeled automatic swimming pool cleaners are detailed. These cleaners may include mechanisms for tensioning drive chains associated with one or more of the wheels. They also may drive one or more wheels directly. Water-management systems within the cleaners may locate most or all wearing components so that merely removing a bottom cover causes these components to be accessible for repair or replacement.

POOL CLEANERS

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application No. 61/035,882 filed on March 12, 2008, the contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

This invention relates generally to devices for cleaning swimming pools or other vessels and more particularly, although not necessarily exclusively, to wheeled, pressure-side automatic pool cleaners.

BACKGROUND OF THE INVENTION

Commonly-owned U.S. Patent No. 6,665,900 to Wichmann, et al., illustrates an exemplary automatic swimming pool cleaner. The cleaner may include a contoured external housing encasing a hydraulic drive system, which system drives multiple wheels. Also included as part of the cleaner may be a hydraulic vacuum system for drawing debris-laden fluid (e.g. pool water) through a bag to filter the debris from the fluid. According to the Wichmann patent, the cleaner

has a modular construction with the hydraulic drive and vacuum system components mounted onto an internal frame . . . for easy access to the modular components by removal of the external housing if repair or replacement of a component is necessary. See Wichmann, col. 4, ll. 28-32.

Also disclosed in the Wichmann patent are aspects of a drive unit for the cleaner. Forming parts of the unit are drive and idler sprockets as well as ladder-type drive chains. The drive sprockets engage the chains “at a common forward-drive rotational speed, for correspondingly driving the cleaner wheels to transport the pool cleaner over submerged floor and side wall surfaces of the swimming pool.” See id., col. 11, ll. 8-11 (numerals omitted). The contents of the Wichmann patent are incorporated herein in their entirety by this reference.

SUMMARY OF THE INVENTION

The present invention provides alternatives to the pool cleaner shown in the Wichmann patent. These cleaners too may have external housings (contoured if desired) encasing hydraulic drive systems for rotating one or more wheels. They likewise may have hydraulic vacuum systems and utilize bags or other objects as filters.

Preferably, however, cleaners of the present invention include mechanisms for tensioning drive chains. Such mechanisms may include one or more spring-loaded rollers for biasing the chains at selected locations. In at least some embodiments of the invention, further, a turbine or other hydraulic device may drive a wheel directly.

Additionally included in cleaners of the current design are water-management and drive systems in which most--if not all--wearing parts are accessible at the bottom of the device. As a consequence, removing merely a bottom cover of the housing renders accessible many or all of these wearing parts. (Alternatively, some or all wearing parts may be positioned so as to be accessible from the top of the device following removal of a top cover.) Better control of the center of gravity (CG) of the cleaner also may be achieved by incorporating weighting into the frame of the cleaner.

Innovative cleaners of the present invention additionally may include multiple openings at or adjacent the rears of their bodies. Such multiple openings allow water flow through the bodies, reducing drag as the cleaners move forward. The holes further may permit certain-sized debris to exit the cleaners rather than potentially being trapped within the bodies.

Moreover, cleaners of the present invention may, if desired, include turbines with multiple side walls. Surrounding both sides of each turbine blade with walls admits more efficient power transfer from the pressurized water to the blades. Preferably one side wall is molded integrally with the blades to form a base assembly, while the other side wall is not. Instead, the non-integral wall preferably is snap fitted onto the base assembly, concurrently capturing a bearing between the walls. Nevertheless, persons skilled in the relevant art will recognize that the side walls and blades may be attached or connected in manners other than those expressly described and illustrated herein.

It thus is an optional, non-exclusive object of the present invention to provide devices for cleaning fluid-containing vessels such as, but not limited to, swimming pools.

It is an additional optional, non-exclusive object of the present invention to provide cleaners utilizing wheels for purposes of movement within the vessels.

It is another optional, non-exclusive object of the present invention to provide cleaners supplying tensioning mechanisms for chains employed to drive one or more of the wheels.

It is also an optional, non-exclusive object of the present invention to provide cleaners utilizing both direct and indirect drives of wheels.

It is, moreover, an optional, non-exclusive object of the present invention to provide cleaners in which most, if not all, wearing parts are accessible merely by removing one cover of a housing.

It is a further optional, non-exclusive object of the present invention to provide cleaners incorporating weighting into their frames for better CG control.

It is yet another optional, non-exclusive object of the present invention to provide cleaners including multiple rear openings to reduce drag when travelling in the water.

It is also an optional, non-exclusive object of the present invention to provide cleaners with turbines having side walls to both side of their blades, at least one of which walls may be snap fitted into place.

Other objects, features, and advantages of the present invention will be apparent to those skilled in appropriate fields with reference to the remaining text and the drawings of this application.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a right side elevational view of an exemplary cleaner of the present invention.

FIG. 2 is a left side elevational view of the cleaner of FIG. 1.

FIG. 3 is a front elevational view of the cleaner of FIG. 1.

FIG. 4 is a rear elevational view of the cleaner of FIG. 1.

FIG. 5 is a top plan view of the cleaner of FIG. 1.

FIG. 6 is a bottom plan view of the cleaner of FIG. 1.

FIGS. 7-8 illustrate, among other things, aspects of a drive chain assembly of the cleaner of FIG. 1.

FIG. 9 is a perspective view of a turbine of the cleaner of FIG. 1.

FIG. 10 is an exploded view of the turbine of FIG. 9.

DETAILED DESCRIPTION

Depicted in FIGS. 1-6 is cleaner 10 of the present invention. Cleaner 10 may comprise housing 14 and one or more wheels 18. As shown in FIGS. 1-6, cleaner 10 preferably (although not necessarily) includes three wheels 18A-C, with two wheels 18A-B positioned at right side 22 of housing 14 and one wheel 18C positioned at left side 26 of the housing 14.

When in use, cleaner 10 is designed to traverse floors and side walls of a fluid-containing vessel such as a swimming pool. Debris-containing water is evacuated from the pool into mouth 30 of housing 14 and thence via outlet 34 into a bag or other structure. The bag or other structure preferably is porous and configured such that water may flow therethrough so as to return to the pool, whereas debris of certain size is retained therein. When the bag or other structure is partially or completely filled with debris, it may be separated from outlet 34 and emptied outside of the pool.

Both the drive and vacuuming systems of cleaner 10 may be hydraulically powered. Preferred versions of cleaner 10 connect to a main filtration system of a swimming pool. In particular, these versions of cleaner 10 connect to filtration (or booster) pump outlets via a hose attached to mast 38 of housing 14. Pressurized water exiting the pump travels through the hose into the housing 14 so as to supply power for the drive and vacuuming systems. Thrust jet 42 may be positioned at or near rear 46 of housing 14 and oriented to exhaust some of the pressurized water rearward of the cleaner 10 so as to assist forward movement thereof. Likewise positioned and oriented may be sweep hose fitting 50, to which a sweep hose may be connected when cleaner 10 is in use. In at least some embodiments of cleaner 10, thrust jet 42 may be configured to be reoriented (as by a user) in use to supply any or all of an upward, downward, or lateral vector to the exhausted water flow.

FIGS. 7-8 illustrate aspects of chain drive assembly 54 of cleaner 10. Assembly 54 is used to drive wheels 18A-B concurrently, employing hydraulic power yielded by turbine 56 (see FIGS. 9-10) within housing 14. Those skilled in the art will recognize that other sources of power may be employed in connection with assembly 54, however.

Coupled to the power source are drive sprockets 58A-B, one associated with (and connected directly or indirectly to) each of wheels 18A-B. Positioned about and engaging both sprockets 58A-B is continuous chain 62. Chain 62 also engages idler sprocket 66 positioned between sprockets 58A-B.

Additionally included as part of assembly 54 may be tensioning mechanism 68, which includes rollers 70 and 74, connector 78, and (coil or other) spring 82. Although each of rollers 70 and 74 is adapted to rotate about its respective axis 86 and 90, rollers 70 and 74 are coupled via connector 78 so they move together linearly. Stated differently, at all times the distance between axes 86 and 90 should be the same.

Furthermore, roller 74 is connected to an end of spring 82, whose opposite end is connected to internal frame 94. Spring 82 biases roller 74 downward (in the direction of arrow A of FIG. 7). Because of the connection between rollers 70 and 74, roller 70 is biased downward as well.

Rollers 70 and 74 may be spool shaped (see FIG. 8) and receive chain 62 about their central cores. By threading chain 62 about rollers 70 and 74 below their respective axes 86 and 90, both rollers 70 and 74 push the chain 62 downward because of the biasing force of spring 82. Should any slack occur in chain 62, such slack will result in spring 82 expanding, forcing rollers 70 and 74 downward so as to increase slightly the travel path of chain 62. This increase in travel path operates to remove the slack from chain 62, hence tensioning it.

Other features of cleaner 10 include weighting incorporated into frame 94 and buoyancy means 98 incorporated into cowling 102. Incorporating weighting into the frame 94 allows better control over the CG of cleaner 10. Fixing position of buoyancy means 98 (which may be a float) relative to cowling 102 allows for balancing cleaner 10 without concern about buoyancy means 98 moving in use.

Depicted in FIG. 6 is bottom cover 106 of housing 14. Cover 106 may be attached either to internal frame 94 or to another portion of housing 14. Although FIG. 6

illustrates three screws 110 connecting cover 106 to frame 94, more or fewer screws may be utilized as desired, as may fasteners other than screws. Merely removing cover 106 (see, e.g., FIG. 8) allows ready access to most--if not all--wearing components within housing 14 should any need replacement or repair.

Body 14 additionally may incorporate at least one, and preferably multiple, openings 112 located at or near rear 46. Openings 112 allow water within body 14 to exit as cleaner 10 moves forward in pool water, thus reducing drag experienced by the cleaner 10 while in transit. Openings 112 also may help prevent debris from being trapped within, and possibly clogging, body 14, by providing the debris multiple opportunities to exit the body 14.

FIGS. 9-10 illustrate turbine 56 of cleaner 10. As shown especially in FIG. 10, turbine 56 may comprise base assembly 114, bearing 118, and first side wall 122. Assembly 114 in turn may comprise second side wall 126, boss 130, upstanding wall 134, and multiple curved blades 138 extending from the upstanding wall 134. Components of assembly 114 preferably are integrally formed (as by molding), although such integral formation is not absolutely necessary.

Boss 130 may be centrally positioned radially relative to second side wall 126. To form turbine 56, bearing 118 may be placed within boss 130, with first side wall 122 then being snap fitted onto assembly 114. So fitting first side wall 122 captures bearing 118 between the first and second side walls 122 and 126. It also provides walls to both sides of each blade 138.

The foregoing is provided for purposes of illustrating, explaining, and describing embodiments of the present invention. Modifications and adaptations to these embodiments will be apparent to those skilled in the art and may be made without departing from the scope or spirit of the invention. Directional terms such as "right" and "left" (as well as "front," "rear," "top," and "bottom") are relative and defined for purposes of this application as though cleaner 10 were upright and operating in its most frequent direction of travel. These terms are not absolute, however.

We claim:

1. An automatic swimming pool cleaner comprising:
 - a. a first wheel having a first drive sprocket associated therewith;
 - b. a second wheel having a second drive sprocket associated therewith;
 - c. a chain engaging the first and second drive sprockets; and
 - d. means, comprising coupled first and second rollers, for tensioning the chain.
2. An automatic swimming pool cleaner according to claim 1 further comprising a spring to which the second roller is connected.
3. An automatic swimming pool cleaner according to claim 2 in which the spring biases the second roller downward when the cleaner is upright.
4. An automatic swimming pool cleaner according to claim 3 further comprising an internal frame to which the spring is connected.
5. An automatic swimming pool cleaner according to claim 4 in which (a) the first roller rotates about a first axis, (b) the second roller rotates about a second axis, and (c) the first and second rollers are coupled so that the linear distance between the first and second axes remains constant.
6. An automatic swimming pool cleaner according to claim 5 in which, when the cleaner is upright, the chain contacts (a) the first roller below the first axis and (b) the second roller below the second axis.
7. An automatic swimming pool cleaner according to claim 6 further comprising an idler sprocket which the chain engages.
8. An automatic swimming pool cleaner according to claim 7 further comprising a turbine for driving at least one of the first and second drive sprockets.

9. An automatic swimming pool cleaner according to claim 1 further comprising a body having a rear portion defining a multiplicity of spaced openings through which at least some water within the body may exit as the cleaner moves forward.
10. An automatic swimming pool cleaner according to claim 1 further comprising a turbine for directly or indirectly driving the first and second wheels, the turbine comprising:
- a. a first side wall; and
 - b. a base assembly comprising:
 - i. a second side wall;
 - ii. an upstanding wall; and
 - iii. a plurality of curved blades extending from the upstanding wall.
11. An automatic swimming pool cleaner according to claim 1 (a) further comprising a housing comprising (i) an internal frame, (ii) a cover, and (iii) at least one fastener removably connecting the cover to the internal frame and (b) in which removing the cover allows ready access to the first and second drive sprockets and the first and second rollers.
12. An automatic swimming pool cleaner comprising:
- a. a body having a rear portion defining a multiplicity of spaced openings through which at least some water within the body may exit as the cleaner moves forward;
 - b. a thrust jet directing water rearward of the cleaner as the cleaner moves forward; and
 - c. at least one wheel connected directly or indirectly to the body.
13. An automatic swimming pool cleaner comprising:
- a. a body;
 - b. at least one wheel connected directly or indirectly to the body; and
 - c. a turbine for directly or indirectly driving the at least one wheel, the turbine comprising:
 - i. a first side wall; and

- ii. a base assembly comprising:
 - A. a second side wall;
 - B. an upstanding wall; and
 - C. a plurality of curved blades extending from the upstanding wall.
14. An automatic swimming pool cleaner according to claim 13 in which the first side wall is attached to the base assembly.
15. An automatic swimming pool cleaner according to claim 14 in which the base assembly further comprises a boss centrally positioned radially relative to the second side wall.
16. An automatic swimming pool cleaner according to claim 15 further comprising a bearing placed within the boss.
17. An automatic swimming pool cleaner comprising:
 - a. at least one wheel;
 - b. a housing comprising:
 - i. an internal frame;
 - ii. a cover; and
 - iii. at least one fastener removably connecting the cover to the internal frame; and
 - c. a multiplicity of wearing components within the housing; andin which removing the cover allows ready access to the multiplicity of wearing components.
18. An automatic swimming pool cleaner according to claim 17 in which the internal frame has a lower portion, the at least one fastener removably connects the cover to the lower portion of the internal frame, and removing only the cover from the lower portion of the frame allows ready access to the multiplicity of wearing components.

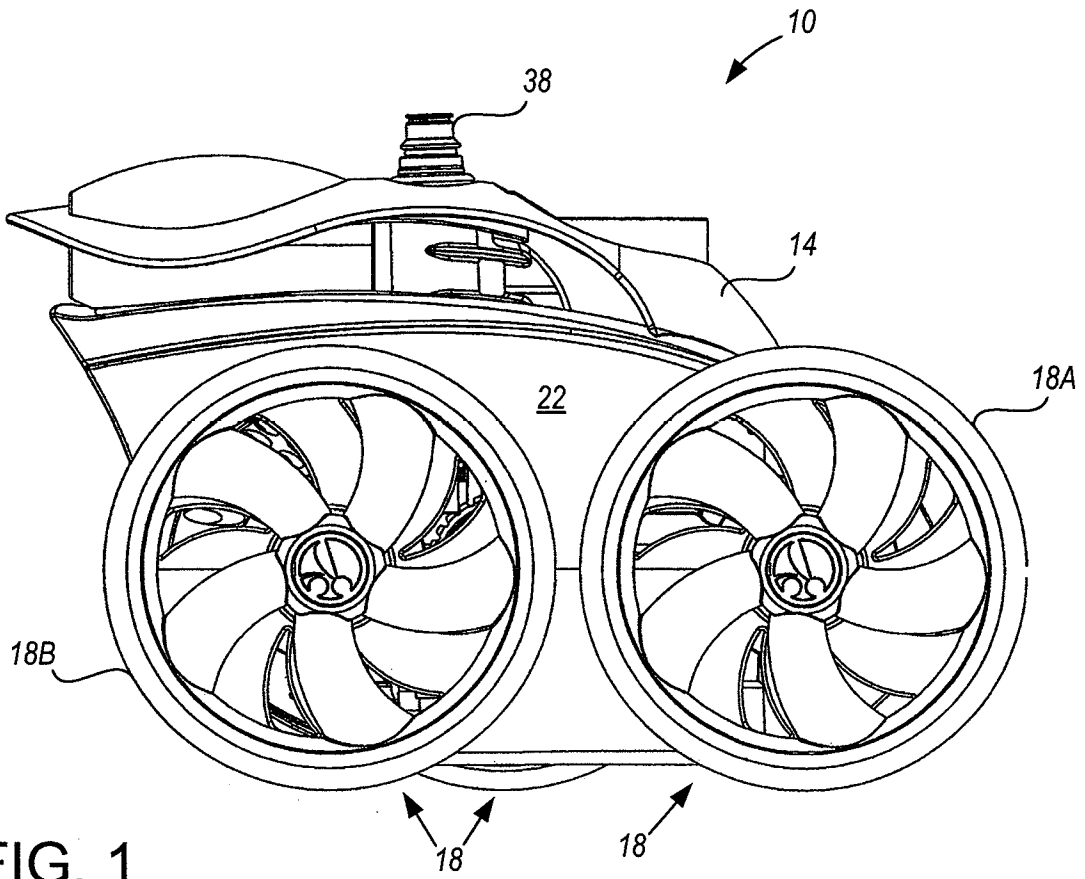


FIG. 1

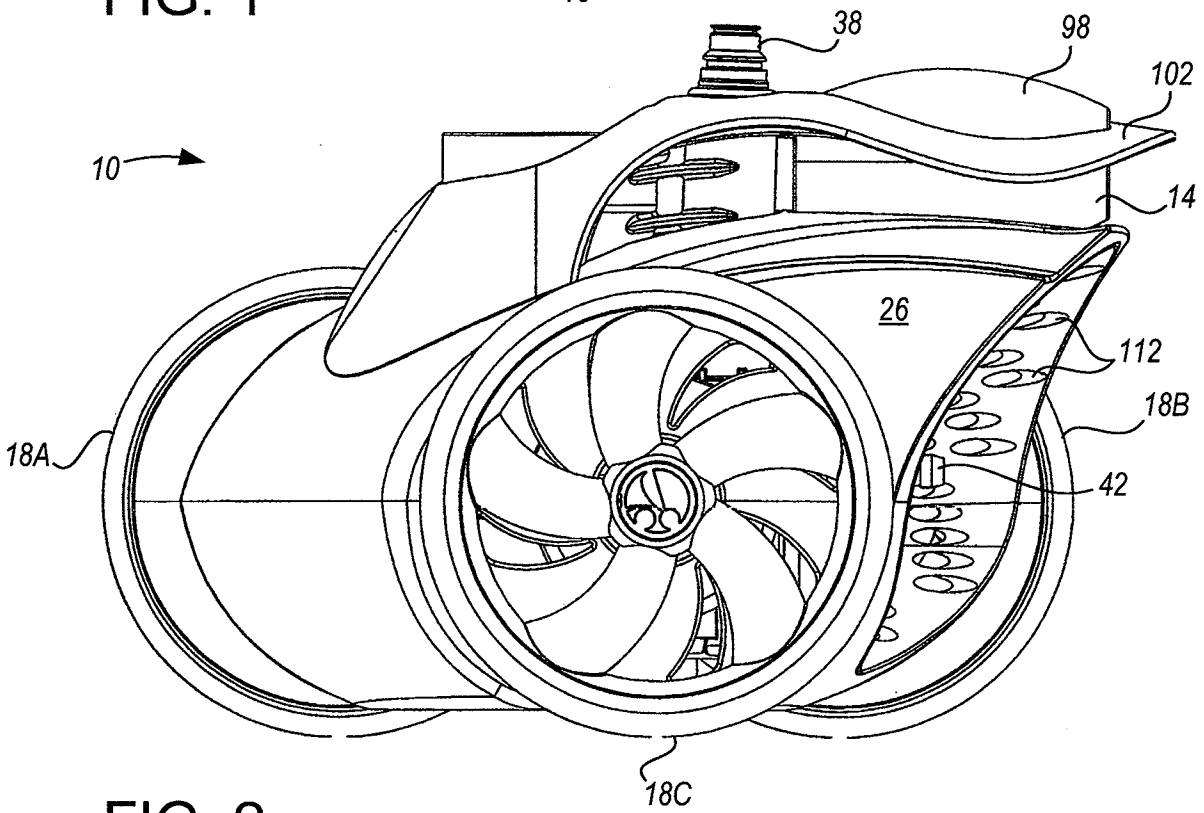


FIG. 2

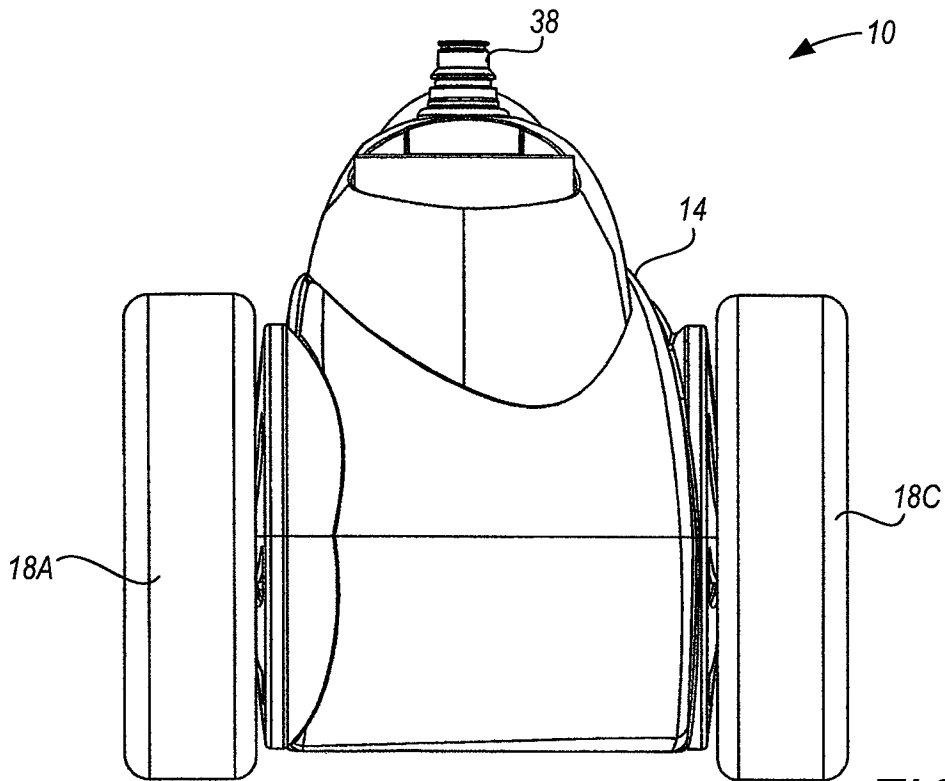


FIG. 3

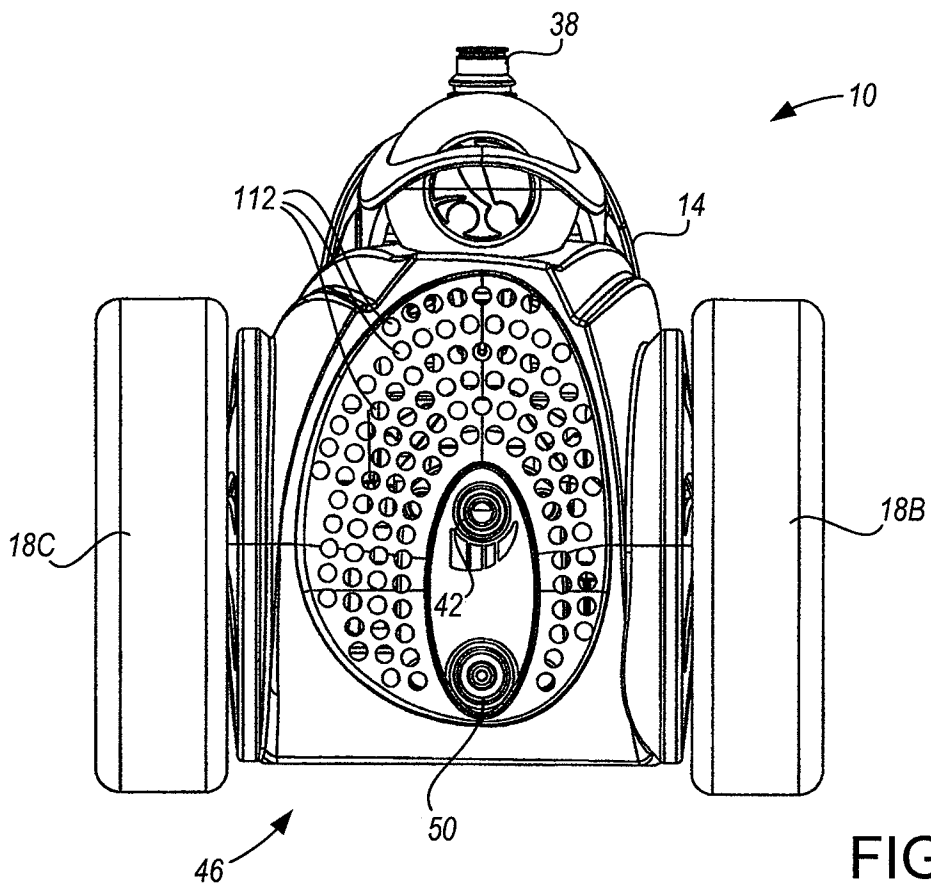


FIG. 4

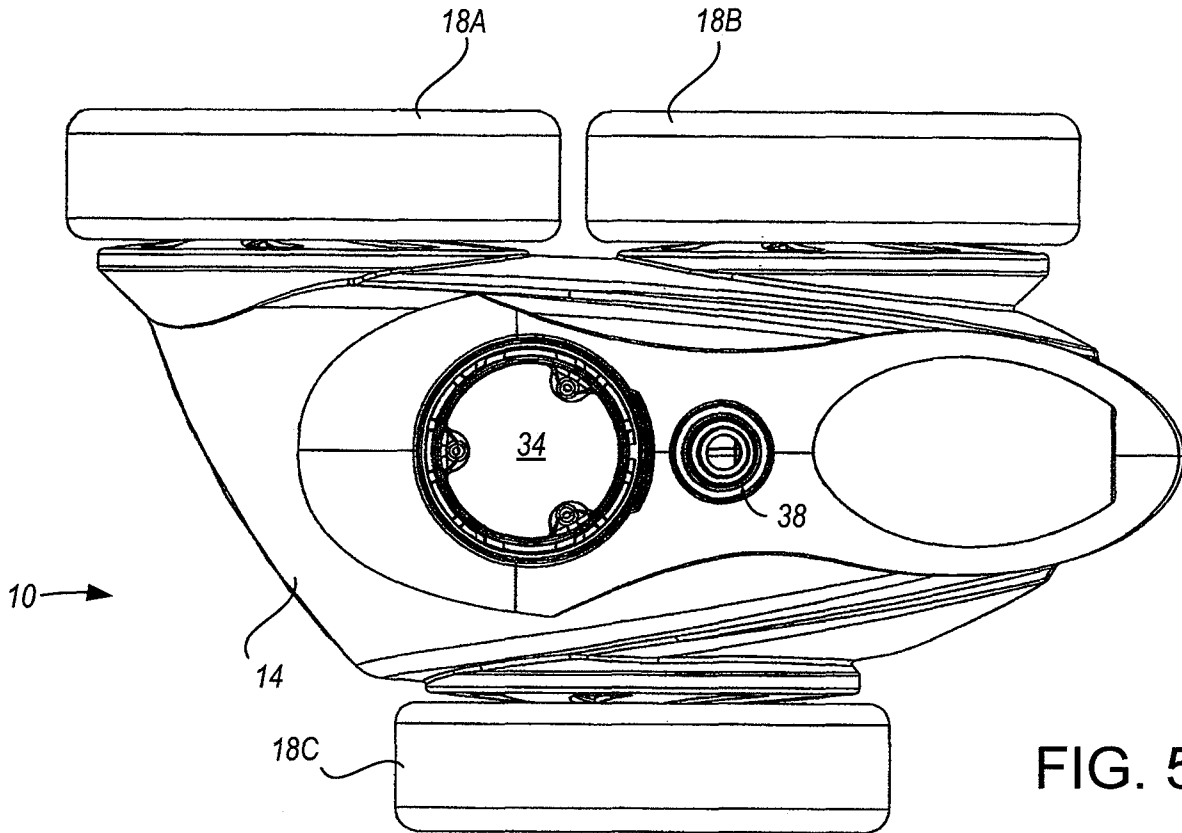


FIG. 5

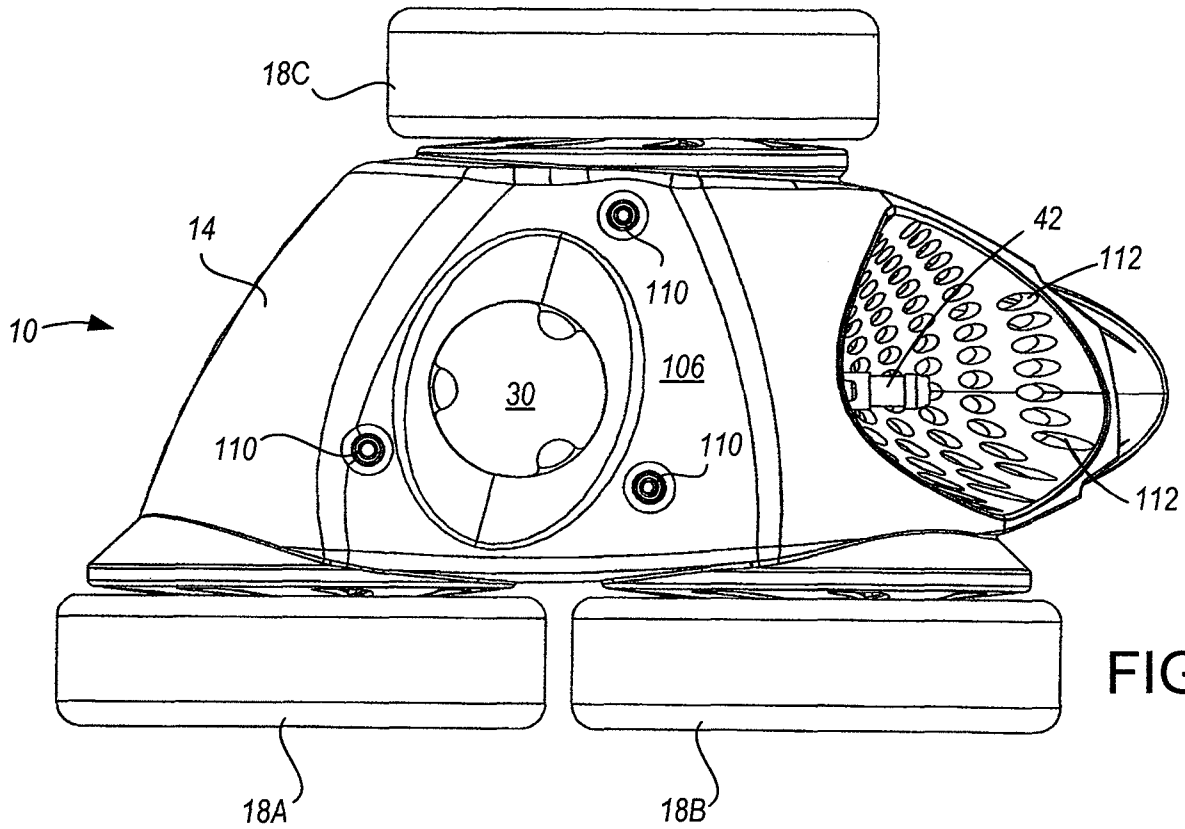


FIG. 6

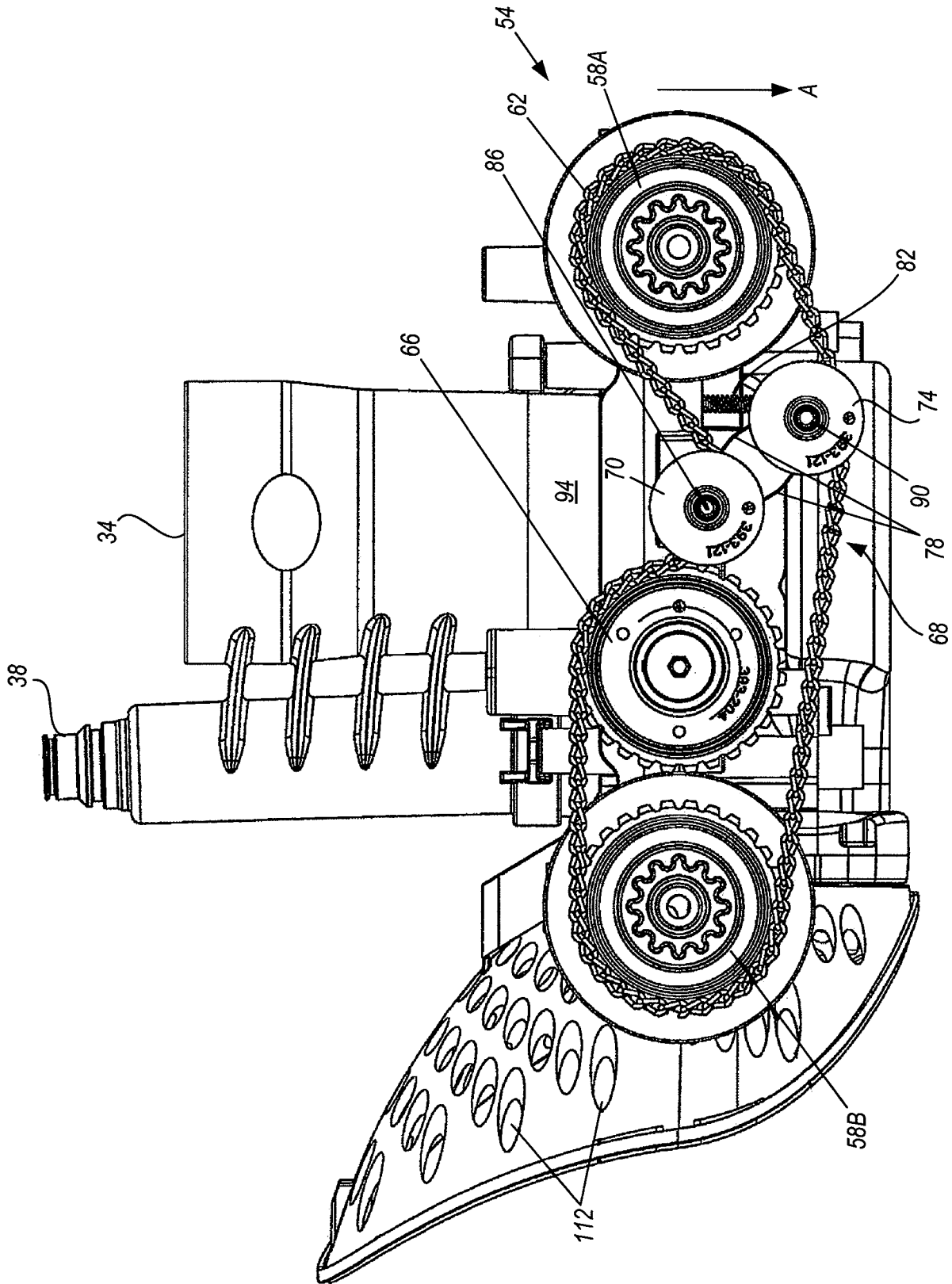


FIG. 7

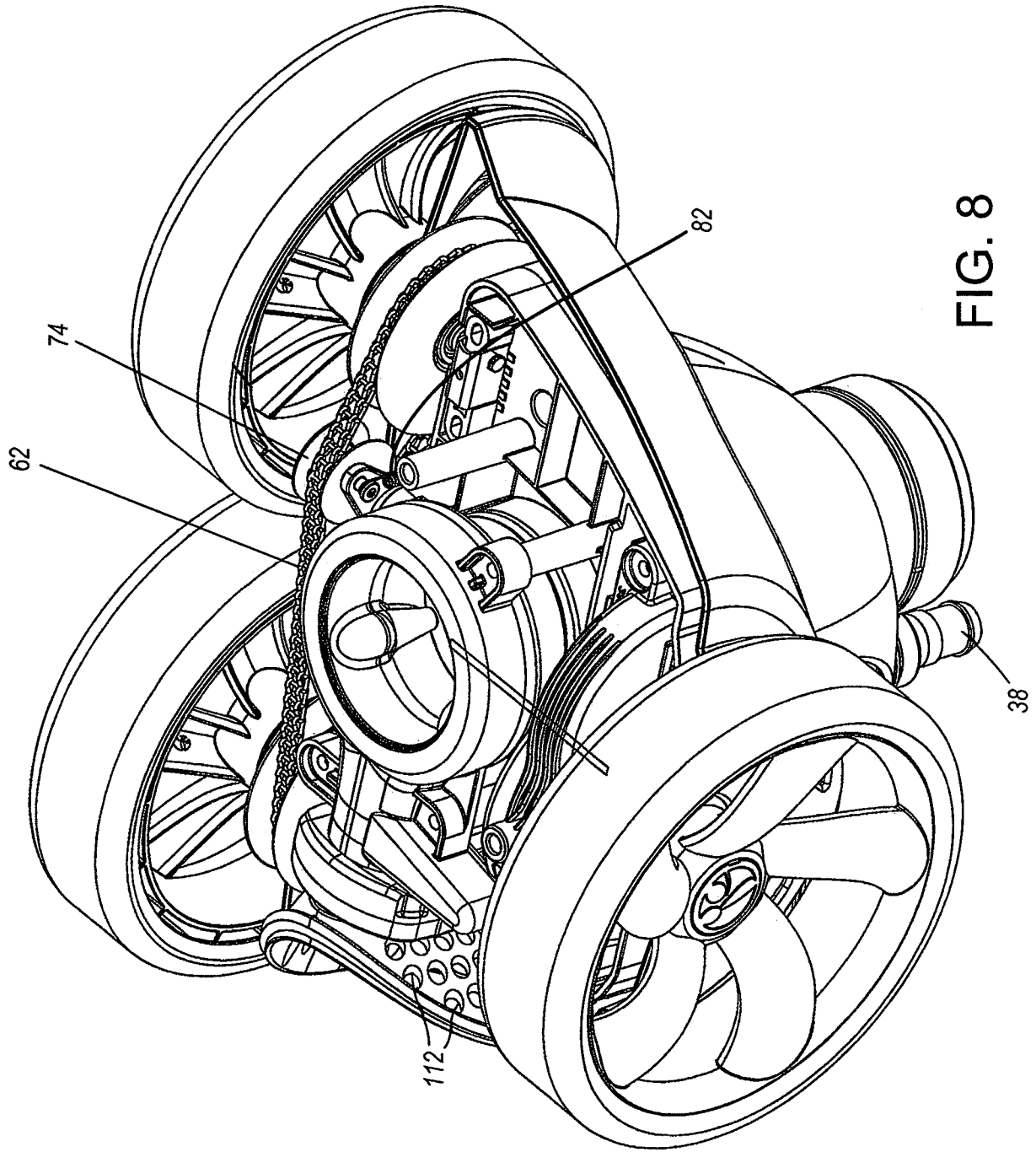


FIG. 8

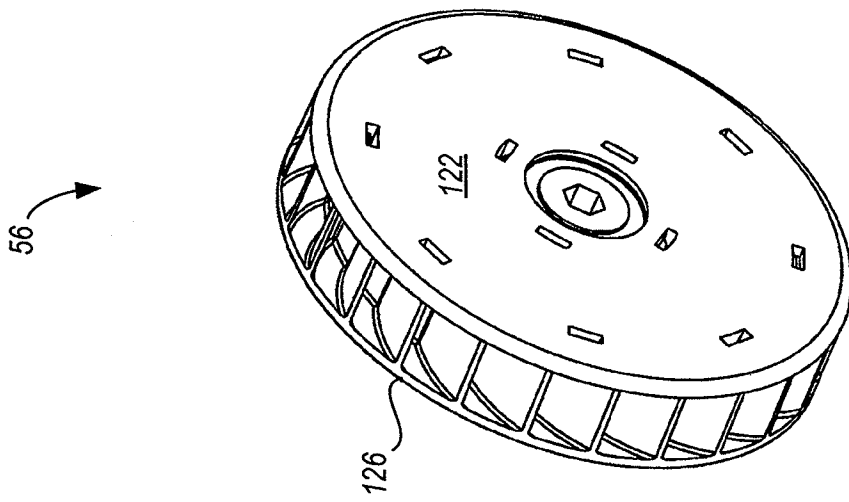


FIG. 9

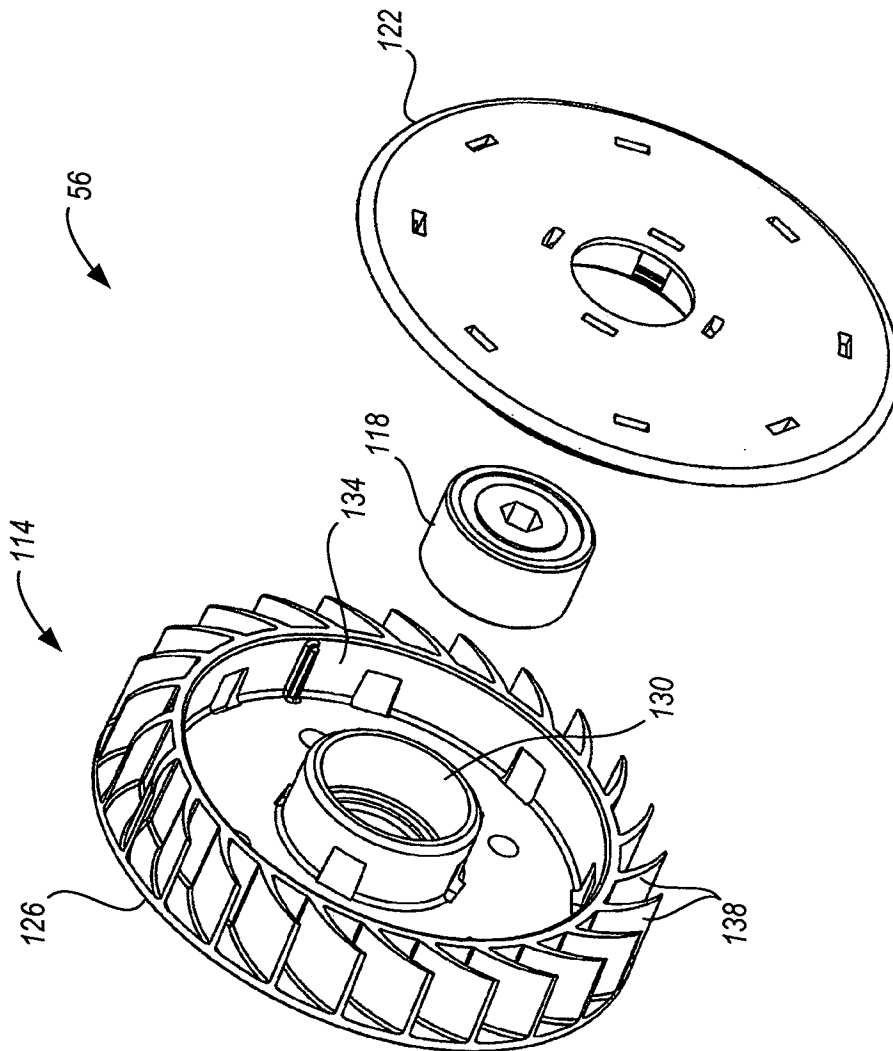


FIG. 10