United States Patent	12385272
Kind Code	B2
Date of Patent	August 12, 2025
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Mobile nozzles and associated systems for cleaning pools and spas

Abstract

Mobile nozzles and associated systems for cleaning pools and spas are provided. One or more mobile nozzles traverse a pool or spa, dislodge settled debris from the floors thereof, and direct the debris to one or more outlets for removal and/or filtration. Each of the mobile nozzles can include a body, a water intake, a discharge nozzle configured to expel pressurized water, one or more sensors adapted for navigation and/or to locate debris within the pool or spa, a propulsion system, and a control system including a memory and a processor. The discharge nozzle can be movable between a plurality of orientations relative to the body, or can have a fixed orientation. The processor is operable to identify debris in the pool or spa and cause the discharge nozzle to be positioned such that the pressurized water expelled therethrough directs the debris toward a debris collection zone or outlet.

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Family ID: **1000008747800**

Appl. No.: **17/575106**

Filed: **January 13, 2022**

Prior Publication Data

Document Identifier	Publication Date
US 20220220762 A1	Jul. 14, 2022

Related U.S. Application Data

us-provisional-application US 63136913 20210113

Publication Classification

Int. Cl.: **E04H4/16** (20060101); **B25J11/00** (20060101)

U.S. Cl.:

CPC **E04H4/1654** (20130101); **B25J11/0085** (20130101);

Field of Classification Search

CPC: E04H (4/1654); E04H (4/169); E04H (4/1636); E04H (4/14); B25J (11/0085); B05B (15/74)

USPC: 15/1.7

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Background/Summary

RELATED APPLICATIONS (1) The present application claims the benefit of priority to U.S. Provisional Patent Application No. 63/136,913, filed on Jan. 13, 2021, the entire disclosure of which is expressly incorporated by reference herein.

BACKGROUND

Technical Field

(1) The present disclosure relates generally to the field of nozzle cleaning systems for pools and spas. More specifically, the present disclosure relates to mobile nozzles and associated systems for cleaning for pools and spas that dislodge debris from the floors and walls thereof, and direct the dislodged debris to one or more outlets for removal and/or filtration.

Related Art

(2) Swimming pools commonly require a considerable amount of maintenance. Beyond the treatment and filtration of pool water, the bottom wall (the “floor”) and side walls of a pool (the floor and the side walls are referred herein collectively as the “walls” of the pool) must be scrubbed or otherwise cleaned regularly. Additionally, leaves and other debris often elude a pool filtration system and settle on the bottom of the pool.

(3) Various devices and systems have been developed to clean swimming pool walls and swimming pool water, e.g., by dislodging and removing dirt and debris from the walls. For example, in-floor nozzle systems have been developed that utilize a series of pipes and nozzles, e.g., pop-up nozzles, that discharge a stream of water to dislodge dirt and debris from pool walls and direct the dirt and debris to a drain. In particular, such systems include multiple pipes and nozzles that are installed in the floor and/or walls of the pool and connected with a pressurized source of water, e.g., a pool pump. The pool pump provides pressurized water to the pipes and, in turn, the nozzles, which discharge the pressurized water across a surface of the pool to dislodge, entrain, and move contaminants, e.g., dirt and debris, from the walls toward a drain that is installed in the floor. The contaminants are then removed from the pool through the drain. However, these systems require pipes and nozzles to be installed either below or within the walls, and cleaning zones/nozzle placement to be developed for each pool to ensure that the entire area of the pool is covered. The materials and labor required to install the piping and nozzles can be costly, and if incorrectly installed, e.g., if the nozzles are incorrectly placed and do not adequately clean the pool walls, can be difficult and expensive to correct.

(4) Additionally, various types of automated pool cleaning devices, e.g., swimming pool cleaners, have been developed that traverse the pool walls and skim the pool water surface, cleaning as they go. These pool cleaners are generally categorized by their source of power and include positive pressure pool cleaners, suction (negative pressure) pool cleaners, and robotic/electric pool cleaners.

(5) Positive pressure pool cleaners are in fluidic communication with a source of pressurized water. This source of pressurized water could include, for example, a booster pump or pool filtration system. Generally, this requires a hose running from the pump or system to the swimming pool cleaner through which pressurized water is provided to the pool cleaner. Some positive pressure pool cleaners discharge the pressurized water through one or more internal nozzles to create a suction effect at a bottom opening of the swimming pool cleaner, drawing debris through the bottom opening and into a retention device, e.g., a debris bag, of the swimming pool cleaner. Additionally, some positive pressure pool cleaners discharge a portion of the pressurized water externally through one or more nozzles to cause locomotion of the pool cleaner.

(6) On the other hand, suction pool cleaners are in fluidic communication with a suction source that draws water from the pool through the suction pool cleaner. This is often achieved through a suction hose that is connected between the suction pool cleaner and the suction source, which can be a wall fitting in communication with the suction side of a pool pump. This suction effect causes water and debris to be drawn through the suction pool cleaner and in turn the suction hose to a filter basket where the debris is collected. Additionally, suction pool cleaners can utilize the water being drawn therethrough to cause the pool cleaner to move across the pool walls.

(7) Finally, many robotic/electric pool cleaners utilize electric power provided through an electrical

cable or wire from an external power source to move and operate. In particular, the electrical power received by the pool cleaner is often used to power various internal motors and pumps. The motors can be utilized to turn wheels or circulate continuous tracks in order move the pool cleaner along the pool walls. Additionally, the motors and/or pumps can be used to generate a suction effect at a bottom opening of the pool cleaner to draw debris into a container within or on the pool cleaner.

(8) However, the hoses and wires implemented with positive pressure, suction, and robotic/electric pool cleaners are visibly distracting and a nuisance to swimmers. Additionally, these swimming pool cleaners must often be removed from the pool between cleanings. Accordingly, there is a need for improvements in pool cleaning devices and systems that are capable of cleaning pool walls without requiring high installation costs and without having the nuisance of hoses or wires.

SUMMARY

(9) The present disclosure relates to mobile nozzles and associated systems for cleaning pools and spas that dislodge settled debris from pool and spa floors and direct the debris to one or more outlets for removal and/or filtration.

(10) According to one embodiment of the present disclosure, a mobile nozzle for expelling pressurized water toward a debris collection zone displaced from the mobile nozzle is provided. The mobile nozzle includes a body, a water intake configured to receive water, a discharge nozzle in fluidic communication with the water intake and configured to expel pressurized water, and a computer system including a memory and a processor. The processor is operable identify the debris collection zone, cause the mobile nozzle to move to a first location in a pool or spa, and cause the pressurized water to be expelled through the discharge nozzle toward the debris collection zone to cause debris to move away from the mobile nozzle and toward the debris collection zone when the mobile nozzle is positioned at the first location.

(11) According to certain aspects of the present disclosure, the processor causes the mobile nozzle to move to a second location in the pool or spa and causes the pressurized water to be expelled through the discharge nozzle toward the debris collection zone to cause debris to move away from the mobile nozzle and toward the debris collection zone, when the mobile nozzle is positioned at the second location. According to further aspects, the processor is operable to communicate with a first beacon positioned at the first location, locate a position of the first beacon based on the communication with the first beacon, communicate with a second beacon positioned at the second location, and locate a position of the second beacon based on the communication with the second beacon. According to other aspects, the processor is operable to communicate with a beacon positioned at the debris collection zone, and locate the debris collection zone based on the communication with the beacon.

(12) According to other aspects of the present disclosure, the discharge nozzle is positioned on a front of the body and is configured to expel the pressurized water in a generally forward and downward direction. In some aspects, the discharge nozzle can be adjustable and can be rotatable in a sweeping motion. In other aspects, the mobile nozzle is configured to rotate about a pivot point to cause the discharge nozzle to move in a sweeping motion. The mobile nozzle can also include a second discharge nozzle in fluidic communication with the water intake, the second discharge nozzle being configured to expel the pressurized water and cause locomotion of the mobile nozzle.

(13) According to certain aspects of the present disclosure, the mobile nozzle includes a lift nozzle positioned at a bottom of the body that is configured to expel the pressurized water away from the bottom of the body. The mobile nozzle can also include a bottom skirt that extends about a perimeter of the body and defines a pressure chamber, the bottom skirt being configured to contain the pressurized water expelled by the lift nozzle within the pressure chamber to cause the mobile nozzle to lift. In some aspects, the mobile nozzle includes a plurality of wheels and in further aspects, the plurality of wheels are retractable.

(14) According to other aspects of the present disclosure, the mobile nozzle includes a rechargeable battery and a first inductive power coupling, which includes an inductor circuit and is configured to

inductively receive power from a second inductive power coupling and recharge the rechargeable battery when positioned proximate to the second inductive power coupling. The second inductive power coupling can include a charging housing.

(15) According to aspects of the present disclosure, the mobile nozzle is configured to be housed within a niche located in one or more of a wall and a floor of the pool or spa and the mobile nizzle further includes a rechargeable battery configured to receive power from a power source of the niche.

(16) According to other aspects of the present disclosure, the mobile nozzle includes a means for preventing motion of the mobile nozzle when expelling pressurized water through the discharge nozzle.

(17) According to some aspects of the present disclosure, the mobile nozzle includes a pump in fluidic communication with the water intake and the discharge nozzle, which is configured to draw water in through the water intake and expel the water out from the discharge nozzle. In further aspects, the pump can be reversible and configured to draw water in through the discharge nozzle and expel the water out from the water intake.

(18) According to aspects of the present disclosure, the processor of the mobile nozzle is operable to automatically determine an optimal position for the first location in the pool or spa. In some aspects, the processor is operable to identify the location of the debris collection zone based on user input. In other aspects, the processor is operable to receive a user defined map of the pool or spa, the user defined map including a position of the debris collection zone and a position of the first location. In further aspects, the processor is configured to receive an indication that a pump in fluidic communication with the debris collection zone is operational and causes pressurized water to be expelled through the discharge nozzle based on the indication.

(19) According to other aspects of the present disclosure, the mobile nozzle includes a second discharge nozzle in fluidic communication with the water intake and the discharge nozzle and a valve in fluidic communication with the discharge nozzle, the second discharge nozzle, and the water intake. The valve can be configured to control the flow of water between the discharge nozzle, the second discharge nozzle, and the water intake.

(20) According to another embodiment of the present disclosure a method of collecting debris in a debris collection zone using a mobile nozzle is provided. The method includes identifying the debris collection zone, causing the mobile nozzle to move to a first location in a pool or spa, the mobile nozzle comprising a body, a water intake configured to receive water, a discharge nozzle in fluidic communication with the water intake and configured to expel pressurized water, and a computer system including a memory and a processor, and expelling pressurized water through the discharge nozzle of the mobile nozzle toward the debris collection zone to cause debris to move away from the mobile nozzle and toward the debris collection zone when the mobile nozzle is positioned at the first location.

(21) According to certain aspects of the present disclosure, the method includes moving to a second location in the pool or spa and expelling pressurized water through the discharge nozzle toward the debris collection zone to cause the debris to move away from the mobile nozzle and toward the debris collection zone when the mobile nozzle is positioned at the second location. In some aspects, the method includes communicating with a first beacon positioned at the first location, locating a position of the first beacon based on the communication with the first beacon, communicating with a second beacon positioned at the second location, and locating a position of the second beacon based on the communication with the second beacon. According to further aspects, the method includes communicating with a beacon positioned at the debris collection zone and locating the debris collection zone based on the communication with the beacon. In still further aspects, the step of identifying the debris collection zone is performed by the processor of the mobile nozzle.

(22) According to other aspects of the present disclosure, the discharge nozzle is positioned on a front of the body and configured to expel pressurized water in a generally forward and downward

direction. In some aspects, the discharge nozzle is adjustable. In further aspects, the method includes rotating the discharge nozzle in a sweeping motion while expelling pressurized water through the discharge nozzle. In other aspects, the method includes rotating the mobile nozzle about a pivot point to cause the discharge nozzle to move in a sweeping motion while expelling pressurized water through the discharge nozzle.

(23) According to certain aspects of the present disclosure, the mobile nozzle includes a second discharge nozzle in fluidic communication with the water intake, and the step of causing the mobile nozzle to move to a first location in a pool or spa includes expelling pressurized water through the second discharge nozzle. In some aspects, the mobile nozzle includes a lift nozzle positioned at a bottom of the body and configured to expel pressurized water away from the bottom of the body and a bottom skirt extending about a perimeter of the body and defining a pressure chamber, the bottom skirt being configured to contain the pressurized water expelled by the lift nozzle within the pressure chamber to cause the mobile nozzle to lift. The mobile nozzle can also include a plurality of wheels and the plurality of wheels can be retractable.

(24) According to another aspect of the present disclosure, the mobile nozzle includes a rechargeable battery and a first inductive power coupling including an inductor circuit, the first inductive power coupling being configured to inductively receive power from a second inductive power coupling and recharge the rechargeable battery when positioned proximate to the second inductive power coupling. In some aspects, the method includes moving the mobile nozzle toward the second inductive power coupling, positioning the first inductive power coupling proximate the second inductive power coupling, receiving by the first inductive power coupling power from the second inductive power coupling, and recharging the rechargeable battery with the power received by the first inductive power coupling. The second inductive power coupling can include a charging housing.

(25) According to aspects of the present disclosure, the method includes positioning the mobile nozzle within a niche located in one or more of a wall and a floor of the pool or spa. In further aspects, the mobile nozzle receives power from a power source of the niche and the method includes recharging a rechargeable battery of the mobile nozzle with the power received by the mobile nozzle.

(26) According to some aspects of the present disclosure, the mobile nozzle includes means for preventing motion of the mobile nozzle when expelling pressurized water through the discharge nozzle.

(27) According to another aspect of the present disclosure, the mobile nozzle comprises a pump in fluidic communication with the water intake and the discharge nozzle, the pump being configured to draw water in through the water intake and expel the water out from the discharge nozzle. In some aspects, the pump is reversible and configured to draw water in through the discharge nozzle and expel the water out from the water intake.

(28) According to some aspects of the present disclosure, the processor determines an optimal position for the first location in the pool or spa. In further aspects, the step of identifying the debris collection zone is performed based on user input. The method can also include receiving a user defined map of the pool or spa including a position of the debris collection zone and a position of the first location.

(29) According to some aspects of the present disclosure, the method includes receiving an indication that a pump in fluidic communication with the debris collection zone is operational and controlling the mobile nozzle to expel the pressurized water through the discharge nozzle of the mobile nozzle, based on the indication received.

(30) According to other aspects, the mobile nozzle includes a second discharge nozzle in fluidic communication with the water intake and the discharge nozzle and a valve in fluidic communication with the discharge nozzle, the second discharge nozzle, and water intake. The valve can be configured to control the flow of water between the discharge nozzle, the second discharge

nozzle, and the water intake.

(31) According to another embodiment of the present disclosure, mobile nozzle for agitating debris in a pool or a spa is provided. The mobile nozzle includes a body, a water intake configured to receive water, a discharge nozzle in fluidic communication with the water intake, the discharge nozzle configured to expel pressurized water, and a computer system including a memory and a processor. The processor is operable to identify a first agitation location in the pool or the spa, cause the mobile nozzle to move to the first agitation location, expel pressurized water through the discharge nozzle to agitate debris at the first agitation location, identify a second agitation location in the pool or the spa, cause the mobile nozzle to move to the second agitation location; and expel pressurized water through the discharge nozzle to agitate debris at the second agitation location. The processor can be further operable to cause the mobile nozzle to move in a navigation pattern, the navigation pattern including the first agitation location and the second agitation location. According to some aspects, the processor is further operable to communicate with a first beacon positioned at the first location, locate a position of the first beacon based on the communication with the first beacon, communicate with a second beacon positioned at the second location, and locate a position of the second beacon based on the communication with the second beacon.

(32) According to other aspects of the present disclosure, the discharge nozzle is positioned on a front of the body and is configured to expel the pressurized water in a generally forward and downward direction. In some aspects, the discharge nozzle can be adjustable and can be rotatable in a sweeping motion. In other aspects, the mobile nozzle is configured to rotate about a pivot point to cause the discharge nozzle to move in a sweeping motion. In further aspects, the mobile nozzle is configured to rotate 360 degrees. The mobile nozzle can also include a second discharge nozzle in fluidic communication with the water intake, the second discharge nozzle being configured to expel the pressurized water and cause locomotion of the mobile nozzle.

(33) According to certain aspects of the present disclosure, the mobile nozzle includes a lift nozzle positioned at a bottom of the body that is configured to expel the pressurized water away from the bottom of the body. The mobile nozzle can also include a bottom skirt that extends about a perimeter of the body and defines a pressure chamber, the bottom skirt being configured to contain the pressurized water expelled by the lift nozzle within the pressure chamber to cause the mobile nozzle to lift. In some aspects, the mobile nozzle includes a plurality of wheels and in further aspects, the plurality of wheels are retractable.

(34) According to other aspects of the present disclosure, the mobile nozzle includes a rechargeable battery and a first inductive power coupling, which includes an inductor circuit and is configured to inductively receive power from a second inductive power coupling and recharge the rechargeable battery when positioned proximate to the second inductive power coupling. The second inductive power coupling can include a charging housing.

(35) According to aspects of the present disclosure, the mobile nozzle is configured to be housed within a niche located in one or more of a wall and a floor of the pool or spa and the mobile nizzle further includes a rechargeable battery configured to receive power from a power source of the niche.

(36) According to other aspects of the present disclosure, the mobile nozzle includes a means for preventing motion of the mobile nozzle when expelling pressurized water through the discharge nozzle.

(37) According to some aspects of the present disclosure, the mobile nozzle includes a pump in fluidic communication with the water intake and the discharge nozzle, which is configured to draw water in through the water intake and expel the water out from the discharge nozzle. In further aspects, the pump can be reversible and configured to draw water in through the discharge nozzle and expel the water out from the water intake.

(38) According to certain aspects of the present disclosure, the processor is operable to automatically determine an optimal position for the first agitation location and the second agitation

location in the pool or spa. In other aspects, the processor is operable to receive a user defined map of the pool or spa, which can include a position of the first agitation location and a position of the second agitation location. According to further aspects, the processor is configured to receive an indication that a pump in fluidic communication with a pool or spa skimmer is operational, and causes pressurized water to be expelled through the discharge nozzle based on the indication.

(39) According to other aspects of the present disclosure, the mobile nozzle includes a second discharge nozzle in fluidic communication with the water intake and the discharge nozzle and a valve in fluidic communication with the discharge nozzle, the second discharge nozzle, and the water intake. The valve can be configured to control the flow of water between the discharge nozzle, the second discharge nozzle, and the water intake.

(40) According to another embodiment of the present disclosure, a method of agitating debris in a pool or spa using a mobile nozzle is provided. The method includes identifying a first agitation location in the pool or spa, causing the mobile nozzle to move to the first agitation location, the mobile nozzle comprising a body, a water intake configured to receive water, a discharge nozzle in fluidic communication with the water intake and configured to expel pressurized water, and a computer system including a memory and a processor, expelling pressurized water through the discharge nozzle of the mobile nozzle to agitate debris at the first agitation location, identifying a second agitation location in the pool or spa, causing the mobile nozzle to move to the second agitation location, and expelling pressurized water through the discharge nozzle of the mobile nozzle to agitate debris at the second agitation location.

(41) According to certain aspects of the present disclosure, the first agitation location and the second agitation location are a portion of a navigation pattern. In some aspects, the method includes communicating with a first beacon positioned at the first agitation location, locating a position of the first beacon based on the communication with the first beacon, communicating with a second beacon positioned at the second agitation location, and locating a position of the second beacon based on the communication with the second beacon.

(42) According to other aspects of the present disclosure, the discharge nozzle is positioned on a front of the body and configured to expel pressurized water in a generally forward and downward direction. In some aspects, the discharge nozzle is adjustable. In further aspects, the method includes rotating the discharge nozzle in a sweeping motion while expelling pressurized water through the discharge nozzle. In other aspects, the method includes rotating the mobile nozzle about a pivot point to cause the discharge nozzle to move in a sweeping motion while expelling pressurized water through the discharge nozzle. in further aspects, the mobile nozzle can be rotated 360 degrees.

(43) According to certain aspects of the present disclosure, the mobile nozzle includes a second discharge nozzle in fluidic communication with the water intake, and the step of causing the mobile nozzle to move to a first location in a pool or spa includes expelling pressurized water through the second discharge nozzle. In some aspects, the mobile nozzle includes a lift nozzle positioned at a bottom of the body and configured to expel pressurized water away from the bottom of the body and a bottom skirt extending about a perimeter of the body and defining a pressure chamber, the bottom skirt being configured to contain the pressurized water expelled by the lift nozzle within the pressure chamber to cause the mobile nozzle to lift. The mobile nozzle can also include a plurality of wheels and the plurality of wheels can be retractable.

(44) According to another aspect of the present disclosure, the mobile nozzle includes a rechargeable battery and a first inductive power coupling including an inductor circuit, the first inductive power coupling being configured to inductively receive power from a second inductive power coupling and recharge the rechargeable battery when positioned proximate to the second inductive power coupling. In some aspects, the method includes moving the mobile nozzle toward the second inductive power coupling, positioning the first inductive power coupling proximate the second inductive power coupling, receiving by the first inductive power coupling power from the

second inductive power coupling, and recharging the rechargeable battery with the power received by the first inductive power coupling. The second inductive power coupling can include a charging housing.
(45) According to aspects of the present disclosure, the method includes positioning the mobile nozzle within a niche located in one or more of a wall and a floor of the pool or spa. In further aspects, the mobile nozzle receives power from a power source of the niche and the method includes recharging a rechargeable battery of the mobile nozzle with the power received by the mobile nozzle.
(46) According to some aspects of the present disclosure, the mobile nozzle includes means for preventing motion of the mobile nozzle when expelling pressurized water through the discharge nozzle.
(47) According to another aspect of the present disclosure, the mobile nozzle comprises a pump in fluidic communication with the water intake and the discharge nozzle, the pump being configured to draw water in through the water intake and expel the water out from the discharge nozzle. In some aspects, the pump is reversible and configured to draw water in through the discharge nozzle and expel the water out from the water intake.
(48) According to some aspects of the present disclosure, the processor determines an optimal position for the first agitation location and the second agitation location in the pool or spa. In further aspects, identifying the first agitation location and identifying the second agitation location are performed by the processor based on user input. The method can also include receiving a user defined map of the pool or spa including a position of the first agitation location and a position of the second agitation location.
(49) According to some aspects of the present disclosure, the method includes receiving an indication that a pump in fluidic communication with a pool or spa skimmer is operational, and expelling pressurized water through the discharge nozzle of the mobile nozzle, based on the indication received.
(50) According to other aspects, the mobile nozzle includes a second discharge nozzle in fluidic communication with the water intake and the discharge nozzle and a valve in fluidic communication with the discharge nozzle, the second discharge nozzle, and water intake. The valve can be configured to control the flow of water between the discharge nozzle, the second discharge nozzle, and the water intake.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) The foregoing features of the present disclosure will be apparent from the following Detailed Description of the Invention, taken in connection with the accompanying drawings, in which:
(2) FIG. **1** is a schematic representation depicting the overall operation of a mobile pool or spa cleaning nozzle, hereinafter referred to as a mobile nozzle, according to the present disclosure;
(3) FIG. **2**A is a schematic block diagram illustrating components of the mobile nozzle of FIG. **1**;
(4) FIG. **2**B is a schematic block diagram illustrating components of another mobile nozzle of the present disclosure;
(5) FIG. **2**C is a top view of the mobile nozzle of FIG. **2**B;
(6) FIG. **2**D is a schematic block diagram illustrating components of another mobile nozzle of the present disclosure;
(7) FIG. **2**E is a schematic block diagram illustrating components of another mobile nozzle of the present disclosure;
(8) FIG. **3** is a block diagram illustrating components of a communication and control system of the mobile nozzle of FIG. **1**;

(9) FIG. **4**A is a diagram illustrating the mobile nozzle of FIG. **1** positioned within a floor niche of a pool or spa;
(10) FIG. **4**B is a diagram illustrating the mobile nozzle of FIG. **1** exiting the floor niche of FIG. **4**A;
(11) FIG. **4**C is a diagram illustrating another mobile nozzle of the present disclosure positioned within a wall niche of a pool or spa;
(12) FIG. **5** is a diagram illustrating exemplary features of a pool or spa in connection with the mobile nozzle cleaning system of the present disclosure;
(13) FIG. **6** is a diagram illustrating a cleaning cycle of the mobile nozzle cleaning system for the pool or spa of FIG. **5**;
(14) FIG. **7**A is a diagram showing the mobile nozzle cleaning system in a first position of the cleaning cycle of FIG. **6**;
(15) FIG. **7**B is a diagram showing the mobile nozzle cleaning system in another position of the cleaning cycle of FIG. **6**;
(16) FIG. **7**C is a diagram showing the mobile nozzle cleaning system in yet another position of the cleaning cycle of FIG. **6**;
(17) FIG. **8** is a diagram illustrating exemplary features of another pool or spa in connection with another mobile nozzle cleaning system of the present disclosure;
(18) FIG. **9** is a diagram illustrating a cleaning cycle of the mobile nozzle cleaning system for the pool or spa of FIG. **8**;
(19) FIG. **10**A is a diagram showing the mobile nozzle cleaning system in a first position of the cleaning cycle of FIG. **9**;
(20) FIG. **10**B is a diagram showing the mobile nozzle cleaning system in another position of the cleaning cycle of FIG. **9**;
(21) FIG. **10**C is a diagram showing the mobile nozzle cleaning system in yet another position of the cleaning cycle of FIG. **9**;
(22) FIG. **11**A is a diagram of another mobile nozzle of the present disclosure, including a system for preventing movement thereof and positioned in a first configuration;
(23) FIG. **11**B is a diagram of the mobile nozzle of FIG. **11**A, positioned in a second configuration; and
(24) FIG. **11**C is a diagram of the mobile nozzle of FIG. **11**A, including another system for preventing movement thereof.

DETAILED DESCRIPTION

(25) The present disclosure relates to mobile nozzle cleaning systems for pools and spas that dislodge debris from the floors and walls thereof, and direct the dislodged debris to one or more outlets for filtration and/or removal therefrom, as described in detail below in connection with FIGS. **1-11**C.

(26) With initial reference to FIG. **1**, a mobile pool or spa cleaning nozzle device (hereinafter “mobile nozzle”) **10** is provided to dislodge debris from a floor **132**, walls **133**, and other surfaces of a swimming pool or spa **50**. The mobile nozzle **10** includes a water-tight body **12** that is adapted for submersion in the pool or spa **50** and houses one or more of a pump **14**, a nozzle **32**, a propulsion system **16**, wheels **44***a-d*, a navigation system **18**, one or more sensors **20**, a nozzle control system **22**, a buoyancy system **24**, a brush system **25**, one or more light sources **26**, and a communication and control system **28**. Additional aspects of the foregoing systems and/or components of the mobile nozzle **10** are discussed in greater detail herein.

(27) FIG. **2**A is a schematic diagram illustrating hardware and software components of the mobile nozzle **10** in greater detail. As shown, the pump **14** is adapted for drawing water into the mobile nozzle **10** and expelling a stream of pressurized water from the nozzle **32** thereof. The propulsion system **16** can include one or more motive systems, such as wheels **44***a-d*, that enable the mobile nozzle **10** to move about the pool or spa **50**. The navigation system **18** is configured to receive and

process information from one or more sensors **20** and transmit navigational commands to the propulsion system **16**. The nozzle control system **22** is configured to control the orientation of the nozzle **32**. The buoyancy system **24** is provided for monitoring and altering the buoyancy of the mobile nozzle **10**. The brush system **25** includes a brush and can include means for actuating said brush to "scrub" the floor **132** and/or walls **133** of the pool or spa **50** as the mobile nozzle **10** travels therealong. The one or more light sources **26** are provided for illuminating the pool or spa **50** and allow the mobile nozzle **10** to function as a submerged mobile lighting system that is viewable by a user or swimmer. The communication and control system **28** can be configured to provide communication between, and control of, one or more of the foregoing systems and one or more remote devices or computer systems. The power system **30** is configured to provide electrical energy to one or more of the foregoing systems and/or components. The pump **14**, the propulsion system **16**, the navigation system **18**, the sensors **20**, the nozzle control system **22**, the buoyancy system **24**, the light sources **26**, and/or the power system **30** can be communicatively coupled to the communication and control system **28** and can therefore communicate with each other. Additional aspects of the foregoing systems and/or components of the mobile nozzle **10** are discussed in greater detail herein. It is also noted that or more of the foregoing systems and/or components may not be located within the body **12**, but can be positioned on the exterior of the body **12**, or can extend from an interior of the body **12** to an exterior thereof, such as the wheels **44***a-d* of the propulsion system **16**.

(28) The nozzle **32** can be positioned on an underside of a bottom wall **34** of the mobile nozzle **10** and is in fluid communication with the pump **14**. The pump **14** can include a motor **36** configured to rotatably drive an impeller **38**, which, when rotatably driven, draws water from the pool or spa **50** into an inlet **40** positioned on a sidewall **54** of the body **12**, through a water supply conduit **42**, into the pump **14**, and expels the water through the nozzle **32** as a pressurized stream of water **70** that dislodges debris that has settled on the pool or spa **50** floor (e.g., floor **132** described in connection with FIGS. **4**A and **4**B). Alternatively, the nozzle **32**, or one or more additional nozzles, can be positioned on other sidewalls **54** of the body **12**, such as for example, a front wall **55** (see FIG. **2**B). Similarly, the inlet **40** could be positioned on other walls of the body **12**, such as for example, on a bottom wall **34** (see FIG. **2**C), or elsewhere.

(29) The motor **36** can also be configured to rotatably drive the impeller **38** in a reverse direction in order to expel any debris (e.g., leaves or other pool/spa debris) that has been drawn into the inlet **40**, which would otherwise hinder performance of the mobile nozzle **10** if not removed. For example, when the motor drives the impeller **38** in a reverse direction, water is drawn from the pool or spa **50** through the nozzle **32**, into the pump **14**, through the water supply conduit **42**, and expelled through the inlet **40**, along with debris that may have been lodged within the mobile nozzle **10**. The mobile nozzle **10** can reverse the direction of the motor **36** periodically (e.g., per a predetermined maintenance schedule) or upon detecting a blockage due to debris (e.g., by detecting that the motor **36** is drawing increased current, indicating a blockage).

(30) The nozzle **32** can be fixed in a single orientation and/or direction relative to the body **12**. Alternatively, the nozzle **32** can be rotatable and/or pivotable between one more different orientations and/or directions relative to the body **12**. For example, the nozzle **32** can be fixed in a substantially vertical orientation (such as the vertical orientation shown in FIG. **2**A) such that it expels the pressurized stream of water directly toward and normal to the floor **132** of the pool or spa **50** to dislodge and/or agitate debris that has settled thereon, or the nozzle **32** can be fixed in a substantially horizontal orientation (such as the horizontal orientation shown in FIGS. **11**A and **11**B) such that it expels the pressurized stream of water generally parallel with the floor **132** of the pool or spa **50** to dislodge the debris from the floor **132** and "push" the debris toward a desired location, such as a drain or collection zone, as will be discussed in greater detail herein in connection with FIGS. **5-10**C. Alternatively, the nozzle **32** can be rotatable and/or pivotable, or otherwise movable, between the vertical and horizontal positions described above. However, it

should also be understood that the nozzle **32** can be movable to a plurality of orientations relative to the body **12** other than the above described vertical and horizontal positions, allowing the mobile nozzle **10** to agitate or push debris in a plurality of directions while remaining stationary.

(31) For example, as shown in FIG. **2**A, the nozzle **32** can be fluidly coupled to the pump **14** by way of a spherical, or other infinitely variable, fitting **46** and can be pivoted in the direction of arrows A and rotated in the direction of arrows B, thereby providing for adjustment of the nozzle **32** in a plurality of orientations with respect to the bottom wall **34** of the body **12**. As but one example, the nozzle **32** can perform a sweeping motion as it rotates back and forth in the direction of arrows B. The fitting **46** can also be coupled to the nozzle control system **22**, which can include mechanical and/or electrical means for selectively altering the orientation of the nozzle **32**, such as one or more motors, gearing, positional sensors, and the like. Those of ordinary skill in the art will understand that additional means for selectively controlling and/or altering the orientation of the nozzle **32** can be employed without departing from the spirit and scope of the present disclosure.

(32) The propulsion system **16** includes one or more motive systems that move the mobile nozzle **10** about the pool or spa **50**. For example, as shown in FIG. **2**A, the mobile nozzle **10** can include wheels **44***a-d* that are driven and controlled by the propulsion system **16**, which can include a motor, gearing, etc. In this exemplary configuration, the propulsion system **16** can cause two or more of the wheels to move in the same direction and speed in order to move in a linear (e.g., forward or reverse) direction. Similarly, the propulsion system **16** can cause two or more of the wheels to move in different directions and/or speeds in order to cause the mobile nozzle **10** to change orientation (e.g., turn or pivot). Those of ordinary skill in the art will understand that the wheels **44***a-d* are but one example of a motive system that can be implemented to move the mobile nozzle **10** about the pool or spa **50**, and other motive systems can be employed without departing from the spirit and scope of the present disclosure, such as one or more continuous treads, or propulsion by way of a pressurized stream of water, discussed in connection with FIG. **2**B.

(33) The navigation system **18**, in combination with the propulsion system **16** and the one or more sensors **20**, can control movement of the mobile nozzle **10** about the pool or spa **50**. For example, the navigation system **18** can receive information from the one or more sensors **20**, process the sensor information to determine a current and/or desired orientation and position, and can transmit an instruction to the propulsion system **16** (e.g., change orientation x degrees, move forward y feet, etc.), which carries out the instruction to arrive at the desired orientation and position. The sensors **20** can include one or more optical sensors, proximity sensors, RFID sensors, acoustic (e.g., sonar) sensors, inductive loop sensors, and the like. In the case of acoustic sensors, frequencies in the range of 3-300 Hz are ideally suited for underwater communication, but it should be understood that frequencies exceeding 300 Hz can also be used. According to some embodiments of the present disclosure, one or more navigational beacons can positioned in the pool or spa. Accordingly, the sensors **20** can include one or more devices capable of detecting and/or communicating with the beacons, which the navigation system **18** can communicate with in determining a desired orientation and position for the mobile nozzle **10**. According to further embodiments of the present disclosure, the navigation system **18** can also include, and/or be in communication with one or more vision systems and/or sensors capable of identifying debris within the pool or spa **50**, such that the mobile nozzle **10** can identify the location of debris and travel thereto. Additional aspects of the navigation system **18** are discussed in greater detail herein.

(34) As referenced above, the power system **30** is configured to provide electrical energy to one or more of the systems and/or components of the mobile nozzle **10** and can include one or more of a rechargeable battery, capacitor, or other replenishable energy storage device **48** (hereinafter "battery **48**") and can be adapted to receive energy from an inductive power coupling **52**. In this regard, the inductive power coupling **52** can be configured to inductively receive electrical power from a corresponding inductive power coupling **136** that is connected to and receives power from a power source **140** (see FIGS. **4**A and **4**B), thereby enabling the mobile nozzle **10** to traverse the

pool or spa **50** without being tethered to an external power source. The coupling **52** includes a water-tight housing **56** containing an inductor circuit which allows for the inductive reception of electrical power. The housing **56** could be made of a plastic material such as polyvinyl chloride (PVC) or any other sturdy waterproof material that does not interfere with electrical field transmission, and which is an electrical insulator. It should be understood that other materials could be utilized in constructing the housing **56**. As shown in FIG. **2**A, one or more inductive couplings **52** can be disposed through one or more sidewalls **54**, or other surfaces, of the mobile nozzle **10** and can be sealingly attached thereto, so as to maintain the water-tight integrity of the body **12**. Additionally and/or alternatively, the one or more inductive couplings **52** can be positioned on other sidewalls **54** of the body **12**, such as for example, the bottom wall **34**. Additional aspects of the power system **30**, with specific regard to features of the inductive power coupling, are discussed in greater detail in connection with FIGS. **4**A and **4**B. Alternatively or in addition to the battery **48** and the inductive power coupling **52**, the power system **30** can be directly coupled to, and receive power from the power source **140** by way of a cord, cable, power conduit, or other means for conducting electrical energy.

(35) According to embodiments of the present disclosure, the power system **30** can provide electrical energy to one or more of the systems and/or components of the mobile nozzle **10** via the communication and control system **28** or the power system **30** can provide electrical energy to one or more of the systems and/or components of the mobile nozzle **10** via a direct connection thereto. For example, the power system **30** can provide power to low-power systems, such as one or more of the sensors **20**, via the communication and control system **28**, and the power system **30** can provide power to one or more high-power systems, such as the motor **36**, via a direct electrical connection thereto.

(36) FIGS. **2**B and **2**C are schematic diagrams illustrating hardware and software components of another mobile nozzle **10***a* of the present disclosure. Specifically, FIG. **2**B is a partial cross-sectional diagram of the mobile nozzle **10***a* and FIG. **2**C is a top view of the mobile nozzle **10***a*. The mobile nozzle **10***a* can be substantially similar in construction to the mobile nozzle **10** described in connection with FIGS. **1** and **2**A. Accordingly, the mobile nozzle **10***a* can include one or more of the pump **14**, nozzle **32**, propulsion system **16**, wheels **44***a-d*, navigation system **18**, sensors **20**, nozzle control system **22**, buoyancy system **24**, brush system **25**, light sources **26**, communication and control system **28**, and power system **30**, as shown and described in connection with mobile nozzle **10** and FIG. **2**A. The mobile nozzle **10***a* can also include a second nozzle **32***a* (e.g., in addition to, or in place of, the nozzle **32**). Similar to the operation of nozzle **32**, the pump **14** can include the motor **36** configured to rotatably drive the impeller **38**, which, when rotatably driven, draws water from the pool or spa **50** into the inlet **40**, through water supply conduit **42**, into the pump **14**, and through a water conduit **42***a*, and expels the water through the nozzle **32***a* as a pressurized stream of water **70***a*.

(37) As shown in FIG. **2**B, the nozzle **32***a* can be fluidly coupled to the pump **14** by way of a spherical, or other infinitely variable, fitting **46***a* and can be pivoted in the direction of arrows G, rotated in the direction of arrows H, and swept in the direction of arrow I (see FIG. **2**C), thereby providing for adjustment of the nozzle **32***a* in a plurality of orientations with respect to the front wall **55***a* of the mobile nozzle **10***a*. As one example, the nozzle **32***a* can perform a sweeping motion back and forth in the direction of arrow I as it pivots back and forth in the direction of arrows G in order to dislodge debris from the floor **132** and/or walls **133** of the pool or spa **50**. According to aspects of the present disclosure, one or more of the nozzles **30**, **32***a* can supplement, or act as, the propulsion system **16** of the mobile nozzle **10***a*, in addition to directing a stream of water to dislodge debris from the floor **132** and/or walls **133** of the pool or spa **50**. In such a configuration, the wheels **44***a-d* can be retracted into the mobile nozzle **10***a*, or the mobile nozzle **10***a* can be provided without the wheels **44***a-d*. For example, nozzle **32***a* can be controlled to be positioned toward the floor **132** of the pool or spa **50** to dislodge debris therefrom and then positioned to

provide propulsion (e.g., generally horizontally) and directional control (e.g., by rotation in the direction of arrow I) for the mobile nozzle **10***a*. Additionally, the nozzle **32** can provide lift and/or supplemental propulsion. Furthermore, the mobile nozzle **10***a* can also include controllable valves **65***a-c* to selectively control the flow of water through the inlet **40**, nozzle **32**, and nozzle **32***a*. Accordingly, the mobile nozzle **10***a* can optimize lift, buoyancy, propulsion, and cleaning performance by selectively controlling the flow of water through the inlet **40**, nozzle **32**, and nozzle **32***a* by way of the valves **65***a-c*.

(38) According to further embodiments of the present disclosure, the mobile nozzle **10***a* can include a skirt **72** configured to assist with providing lift to the mobile nozzle **10***a* while the mobile nozzle **10***a* traverses the pool or spa **50**, and/or to anchor the mobile nozzle **10***a* to the floor **132** of the pool or spa **50** during cleaning. For example, as shown in FIGS. **2**B and **2**C, the skirt **72** can be disposed around a lower portion of the body **12** of the mobile nozzle **10***a* and extend to the floor **132** of the pool or spa **5**. The skirt **72** defines a central plenum **74**, such that as the stream of water **70** is expelled from the nozzle **32** it is distributed within the central plenum **74**. This configuration creates a higher pressure region within the central plenum **74** compared to the water surrounding the mobile nozzle **10***a*, with pressurized water only capable of escaping at the interface of the skirt **72** and the floor **132**. Accordingly, as the water escapes from the skirt **72**, the mobile nozzle **10***a* is lifted and can "hover" just above the floor **132**. Alternatively, the mobile nozzle **10***a* can create a negative pressure within the central plenum **74** by drawing water through the nozzle **32**. For example, the mobile nozzle **10***a* can reverse operation of the motor **14** and/or close valve **65***a* in communication with the inlet **40**, thereby creating a negative pressure within the central plenum and generating a suction effect. The valve **65***c* can remain open, thereby allowing the mobile nozzle **10***a* to be securely anchored to the floor **132** while the nozzle **32***a* remains operational to perform a cleaning operation. After completing the cleaning operation, the mobile nozzle **10***a* can reverse the direction of the motor and/or actuate one or more of the valves **65***a-c* to release the mobile nozzle **10***a* from the floor **132**, and the mobile nozzle can then move to another location.

(39) FIG. **2**D is a schematic diagram illustrating hardware and software components of another mobile nozzle **10***b* of the present disclosure. The mobile nozzle **10***b* can be substantially similar in construction to the mobile nozzle **10** described in connection with FIGS. **1** and **2**A. Accordingly, the mobile nozzle **10***b* can include one or more of the pump **14**, propulsion system **16**, wheels **44***a-d*, navigation system **18**, sensors **20**, nozzle control system **22**, buoyancy system **24**, brush system **25**, light sources **26**, communication and control system **28**, and power system **30**, as shown and described in connection with mobile nozzle **10** and FIG. **2**A. The mobile nozzle **10***b* can also include a nozzle **32***b* in fluidic communication with the motor **14** by way of a water conduit **42***b*. Similar to the operation of nozzle **32**, described in connection with FIG. **2**A, the pump **14** can include the motor **36** configured to rotatably drive the impeller **38**, which, when rotatably driven, draws water from the pool or spa **50** into the inlet **40**, through water supply conduit **42**, into the pump **14**, and through the water conduit **42***b*, and expels the water through the nozzle **32***b* as a pressurized stream of water **70***b*.

(40) The mobile nozzle **10***b* can also reverse the direction of the motor **36**, thereby drawing water through the nozzle **32***b*, into the pump **14**, and out through the inlet **40**, thereby providing lift and allowing the mobile nozzle **10***b* to exit a niche (e.g., niche **130**, shown and described in connection with FIGS. **4**A and **4**B) in the floor **132** of the pool or spa **50**, ascend within the pool or spa **50**, and/or move between stairs of the pool or spa **50**. For example, if the batteries of mobile nozzle **10***b* are nearly drained (e.g., below a predetermined threshold) and recharging is not possible, the mobile nozzle **10***b* can ascend to the surface of the pool and draw air therein, such that the mobile nozzle **10***b* remains buoyant and floats at the water surface allowing it to be easily retrieved. Alternatively, as described herein, the mobile nozzle **10***b* can ascend to the surface of the pool or spa **50** when instructed by a user.

(41) The nozzle **32***b* can be fluidly coupled to the pump **14** by way of a spherical, or other infinitely

variable, fitting **46***b* and can be pivoted in the direction of arrows J, rotated in the direction of arrows K, and swept in the direction, for example, of arrow I (see FIG. **2**C), thereby providing for adjustment of the nozzle **32***b* in a plurality of orientations with respect to a top wall **55***b* of the mobile nozzle **10***b*. As one example, the nozzle **32***b* can perform a sweeping motion back and forth in the direction of arrow I as it pivots back and forth in the direction of arrows J in order to agitate debris within the pool or spa **50** for eventual removal, or direct debris suspended in the pool water toward a skimmer.

(42) FIG. **2**E is a schematic diagram illustrating hardware and software components of another mobile nozzle **10***c* of the present disclosure. The mobile nozzle **10***c* can be substantially similar in construction to the mobile nozzle **10***a* described in connection with FIGS. **2**B and **2**C. For example, the mobile nozzle **10***c* can include one or more of the nozzles **32**, **32***a*, water inlet **40**, propulsion system **16**, wheels **44***a-d*, navigation system **18**, sensors **20**, nozzle control system **22**, buoyancy system **24**, brush system **25**, light sources **26**, communication and control system **28**, power system **30**, and skirt **72** as shown and described in connection with mobile nozzle **10***a* of FIGS. **2**B and **2**C. The mobile nozzle **10***c* can also include a pump assembly **14***a*, a water distribution manifold **15**, and a plurality of water supply conduits **42***a-d* which fluidly couple the water inlet **40**, the buoyancy system **24**, and nozzles **32**, **32***a* to the water distribution manifold **15**. The water distribution manifold **15** is can also be fluidly coupled to the inlet and/or outlet of the pump assembly **14***a* and can be communicatively coupled to one or more systems (e.g., communication and control system **28**) of the mobile nozzle **10***c*. Additionally, the water distribution manifold **15** can include a plurality of valves (not shown) that can be selectively controlled (e.g., by way of communication and control system **28**) to direct water through the inlet of the pump assembly **14***a* from one or more of the water supply conduits **42***a-d*. Likewise, the water distribution manifold **15** can be selectively controlled to direct water from the outlet of the pump assembly **14***a* through another of the one or more water supply conduits **42***a-d*. According to some embodiments of the present disclosure, a first water distribution manifold **15** could be coupled to the inlet of the pump assembly **14***a* and/or a second water distribution manifold **15** could be coupled to the outlet of the pump assembly. According to further embodiments, the first and second water distribution manifolds **15** could also be fluidly coupled, such that water can be directed therebetween without passing through the pump assembly **14***a*.

(43) The pump assembly **14***a* can include a motor (not shown) configured to rotatably drive an impeller **38***a*, which, when rotatably driven, can draw water from the pool or spa **50** through one or more of the inlet **40** and nozzles **32**, **32***a*, through one or more of the water supply conduits **42***a-d*, through the water distribution manifold **15**, into the pump **14**, out through the water distribution manifold **15** and one or more of the water supply conduits **42***a-d*, and expels the water through one or more of the nozzles **32**, **32***a* and inlet **40** as a pressurized stream of water (e.g., water streams **70**, **70***a*, **70***b*). Accordingly, the mobile nozzle **10***c* can selectively draw water through one or more of the inlet **40** and nozzles **32**, **32***a* and expel the water through one or more of the nozzles **32**, **32***a* and inlet **40**, without requiring that the rotational direction of the motor be reversed.

(44) As shown in FIG. **2**E, the nozzles **32**, **32***a* can be fluidly coupled to the pump assembly **14***a* by way of spherical, or other infinitely variable, fittings **46**, **46***a*, thereby providing for adjustment of the nozzles **32**, **32***a* in a plurality of orientations with respect to the mobile nozzle **10***c*. As one example, the nozzle **32***a* can perform a sweeping motion and pivot back and forth in order to dislodge debris from the floor **132** and/or walls **133** of the pool or spa **50**. According to aspects of the present disclosure, one or more of the nozzles **30**, **32***a* can supplement, or act as, the propulsion system **16** of the mobile nozzle **10***a*, in addition to directing a stream of water to dislodge debris from the floor **132** and/or walls **133** of the pool or spa **50**. For example, nozzle **32***a* can be controlled to be positioned toward the floor **132** of the pool or spa **50** to dislodge debris therefrom and then positioned to provide propulsion (e.g., generally horizontally) and directional control for the mobile nozzle **10***a*. Additionally, the nozzle **32** can provide lift, suction, and/or supplemental

propulsion.

(45) As similarly discussed in connection with the mobile nozzle **10***a*, the skirt **72** can be configured to assist with providing lift to the mobile nozzle **10***c* while the mobile nozzle **10***c* traverses the pool or spa **50**, and/or to anchor the mobile nozzle **10***c* to the floor **132** of the pool or spa **50** during cleaning. For example, the mobile nozzle **10***c* can create a high pressure region within the skirt **72** by directing the stream of water **70** out through the nozzle **32**, allowing the mobile nozzle **10***c* to be lifted and "hover" just above the floor **132** and, conversely, can create a negative pressure region within the skirt **72** by drawing water through the nozzle **32**, thereby generating a suction force that anchors the mobile nozzle **10***c* to the floor **132**.

(46) As described, the water distribution manifold **15** of the mobile nozzle **10***c* can include controllable valves to selectively control the flow of water through the inlet **40**, nozzle **32**, and nozzle **32***a*. Accordingly, the mobile nozzle **10***a* can optimize lift, buoyancy, propulsion, and cleaning performance by selectively controlling the flow of water through the inlet **40**, nozzle **32**, and nozzle **32***a* by way of water distribution manifold **15**. For example, the mobile nozzle **10***a* can control the water distribution manifold **15** to prevent the flow of water through the inlet **40**, draw water through nozzle **32**, and expel the water through nozzle **32***a*, thereby maximizing the negative pressure within the skirt **72** and securely anchoring the mobile nozzle **10***c* to the floor **132**, while also maximizing the flow of water through nozzle **32***a* to perform a cleaning operation. After completing the cleaning operation, the mobile nozzle **10***c* can control the water distribution manifold **15** to allow the flow of water through the inlet **40** and expel water through nozzle **32** and through nozzle **32***a*, thereby releasing the mobile nozzle **10***c* from the floor **132**, providing lift via nozzle **32**, and providing propulsion and/or directional control via nozzle **32***a*.

(47) FIG. **3** is a block diagram illustrating components of the communication and control system **28** of the monitoring device **12** of FIG. **2**A in greater detail. It should also be understood by those of ordinary skill in the art that, according to some embodiments or the present disclosure, the communication and control system **28** can include or embody features of one or more of the propulsion system **16**, the navigation system **18**, the sensors **20**, the nozzle control system **22**, the buoyancy system **24**, the light sources **26**, and the power system **30**.

(48) A power supply **80** provides the communication and control system **28** with power and can also provide power to one or more components and/or systems electrically coupled to the communication and control system **28**. For example, the power supply **80** can be in electrical communication with, and receive power from, the power system **30**, discussed in connection with FIG. **2**A. According to some embodiments of the present disclosure, the power supply **80** can also can include a lithium ion battery, a capacitor, or other form of replenishable/rechargeable energy storage device known to those of ordinary skill in the art. According to some embodiments, the power supply **80** could have ON/OFF capability such that the communication and control system **28** could be powered ON when necessary and turned OFF when not in use to prolong battery life.

(49) A processor **86** provides local processing capability for the communication and control system **28**. The processor **86** is in communication with a random access memory **84**, and one or more non-volatile memories **88**. The non-volatile memory **88** could store one or more local programs **90** for providing local control of the communication and control system **28** and other systems in communication therewith. The control programs **90** can be, for example, polling schedules for the one or more sensors **20**, or cleaning schedules, as described in connection with FIGS. **5-10**C. A TCP/IP stack **82** is provided for allowing the communication and control system **28** to obtain an Internet protocol address, and to provide Internet connectivity and/or other remote communication for the mobile nozzle **10**. The processor **86** could communicate with a wired communication subsystem **92**, a wireless communication subsystem **94** and a sensor interface subsystem **98** by way of a bus **96**.

(50) As shown, the communication and control system **28** can provide for a wide variety of wired and wireless connections to the mobile nozzle **10**. For example, the wired communication

subsystem **92** can communicate with an Ethernet transceiver **100** and a serial transceiver **102**. The serial transceiver **102** could support one or more suitable serial communication protocols, such as RS-485, RS-232, USB, etc., and can be utilized for communication with one or more of the internal systems (e.g., the propulsion system **16**, the navigation system **18**, the nozzle control system **22**, the buoyancy system **24**, the power system **30**, etc.) of the mobile nozzle **10** and for communication with an external device, such as a computer or mobile device, employed for programming and/or configuration of the mobile nozzle **10**. The wireless communication subsystem **94** could include a Wi-Fi transceiver **104**, a Bluetooth (or Bluetooth LE) transceiver **106**, a cellular data transceiver **108**, a satellite transceiver **110**, an infrared transceiver **112**, and a radiofrequency/RF mesh transceiver **114**. The cellular data transceiver **108** could support one or more cellular data communications protocols, such as 4G, LTE, 5G, etc. The radiofrequency/RF mesh transceiver **114** could support one or more RF mesh network protocols, such as ZWave, Zigbee, Thread, Weave, etc. Accordingly, the mobile nozzle **10** could connect to a mobile device and/or a remote server or "cloud" platform via the communication and control system **28** to allow for remote and/or web-based control thereof. For example, the mobile nozzle **10** could communicate with a user's mobile device, such that the user could program a cleaning schedule, remotely and manually control operation of the mobile nozzle **10**, and designate a point in the pool or spa **50** where the mobile nozzle **10** can surface for servicing, should any be required. The radiofrequency/RF mesh transceiver **114** could also communicate with one or more navigational beacons or secondary mobile nozzles, as described herein.

(51) The sensor interface subsystem **98** could include an analog connection interface **116**, a digital connection interface **118**, and one or more analog-to-digital converters **120**. The sensor interface subsystem **98** allows the communication and control system **28** to obtain information from the one or more sensors **20** discussed herein, as well as a wide variety of other sensors that can be associated with the mobile nozzle **10**. In this regard, it should be understood that the other types of sensors are contemplated for integration and/or use with the mobile nozzle **10**. The wired communication subsystem **92** and/or the wireless communication subsystem **94** allow the communication and control system **28** to connect to a network (e.g., the Internet) via one or more of the communication means described above, or other communication means known to those of ordinary skill in the art. This allows the mobile nozzle **10** to transmit data to one or more remote computer systems, as well as to be remotely controlled by such systems.

(52) FIGS. **4**A and **4**B are diagrams illustrating a docking niche **130** located in a floor **132** of the pool or spa **50** configured to receive, and to provide power to, the mobile nozzle **10**. More specifically, FIG. **4**A is a diagram illustrating the mobile nozzle **10** positioned within the niche **130** and FIG. **4**B is a diagram illustrating the mobile nozzle **10** exiting the niche **30**.

(53) As shown, one or more reciprocal inductive power couplings **136** can be installed in walls **134** of the niche **130**. Of course, one or more of the couplings **136** could also be installed in the floor **138** of the niche **130**. The niche **130** can also be formed as a separate structure (e.g., a basket) that includes the one or more couplings **136** and can be installed in an existing pool or spa recess, e.g., by being inserted into the recess. Alternatively, the walls **134** and the floor **138** of the niche **130** can be integrally formed in/with the walls **133** and/or floor **132** of the pool or spa **50**. Further still, one or more of the couplings **136** could be also be installed in one or more walls of the pool or spa **50**, such that the mobile nozzle **10** can inductively receive power therefrom, without entering the niche **130**.

(54) A power source **140** provides electrical power to the inductive power coupling **136** via a conduit **142**, which can extend below ground. The inductive power coupling **136** and the power conduit/cable **142** function to provide for inductive transmission of electrical energy from the power source **140** to the inductive power coupling **52** of the mobile nozzle **10**. As shown in FIG. **4**A, the reciprocal inductive power couplings **52**, **136** can be positioned on the mobile nozzle **10** and within the niche **130**, respectively, such that they are aligned and/or in contact so as to be

inductively coupled when the mobile nozzle **10** is positioned within the niche **130**.
(55) Similar to the inductive power coupling **52** of the mobile nozzle **10**, the coupling **136** includes a housing **144** which is generally embedded in the wall **134** of the niche **130** or one or more other walls of pool or spa **50**. The housing **144** could be made of a plastic material such as polyvinyl chloride (PVC) or any other sturdy waterproof material that does not interfere with electrical field transmission, and which is an electrical insulator. It should be understood that other materials could also be utilized in constructing the housing **144**. The housing **144** encloses an inductor circuit, which is connected to the power conduit **142**, thereby providing power to the coupling **136** and allowing for the inductive transmission of electrical power to the mobile nozzle **10**.
(56) According to some embodiments of the present disclosure, the inductive power couplings **52**, **136** of the mobile nozzle **10** and niche **130**, respectively, can be configured to mate or otherwise be mechanically or magnetically coupled to each other, thereby providing a stable inductive power transfer. For example, the housing **144** of the coupling **136** could define a recess or cavity, which receives the correspondingly shaped inductive power coupling **52** of the mobile nozzle **10**, or conversely, the housing **56** of the coupling **52** could define a recess or cavity, which receives the correspondingly shaped inductive power coupling **136** of the niche **130**. Additionally, the housing **56** of the coupling **52** could enclose one or more of magnetic or ferrous materials, which can be attracted to one or more corresponding magnetic or ferrous materials enclosed within the housing **144** of the coupling **136**, thereby magnetically attracting the couplings **52**,**136** to each other and providing for a solid and stable inductive power transfer.
(57) As can be seen in FIG. **4**A, the couplings **52**, **136** allow the mobile nozzle **10** to be removably connected to a power source **140** for charging the battery **48** of the power system **30**. The couplings **52**, **136** also allow the mobile nozzle **10** to automatically return to the niche **130** and electrically couple itself to the power source **140** and initiate a charging cycle, without requiring a user to make the connection or any other form of intervention. Advantageously, the couplings **52**, **136** allow for quick connection and disconnection, and due to their insulated nature, the risk of electric shock is obviated. Moreover, since the couplings **52**, **136** have smooth surfaces, they are easy to clean. According to some embodiments of the present disclosure, the niche **130** can also be provided for one or more status indicators (e.g., LEDs or similar lighting devices) that can be positioned so that they are viewable from an exterior of the pool **250** and a user can monitor the status (e.g., operation mode, problem condition, on/off status, charging status, power interruption, etc.) of the niche **130** and/or mobile nozzle **210** without entering the pool **250**.
(58) One or more additional niches **130**, docking areas, stations, or ports could be provided in the floor **132** or walls (see FIG. **4**C) of the pool or spa **50** and could include one or more additional inductive charging couplings **136**. For example, one or more inductive charging mats (not shown) could be placed on the floor **132** of the pool or spa **50** and coupled to an external power source (e.g., power source **140**) by way of a cord, cable, wire, or the like, thereby providing for inductive charging capabilities where a docking niche is not practical (e.g., an above-ground pool). Accordingly, the mobile nozzle **10** can be configured to automatically travel to and enter the one or more niches **130**, or other areas, to periodically recharge the on-board battery **48** of the mobile nozzle **10**. In such circumstances, a power cable need not be provided to couple the mobile nozzle **10** to an external power source (e.g., power source **14**) during prolonged periods of operation and the mobile nozzle **10** can operate without user intervention for an indefinite period of time.
(59) As shown in FIG. **4**A, the niche **130** can be sized so as to minimize the amount of room between the body **12** of the mobile nozzle **10** and the walls **134** of the niche **130**, thereby reducing the likelihood that debris, or other foreign material can enter the niche **130**. The niche **130** can also be sized such that a top wall **58** of the mobile nozzle **10** is substantially flush, or coplanar, with the floor **132** of the of the pool or spa **50** when the mobile nozzle **10** is docked within the niche **130**. Additionally, the top wall **58** of the mobile nozzle **10** can be provided with a recess **60**, aperture, or other means for receiving an insert **62** that matches the material and/or visual appearance of the

floor **132** of the pool or spa **50**. Accordingly, when charging or not in use, e.g., when docked within the niche **130**, the mobile nozzle **10** can be obscured from view.

(60) Additionally, the niche **130** can be provided with a suction or return fitting therein and the mobile nozzle **10** can be configured to generate electrical power when water is drawn therethrough. For example, the motor **36** of the mobile nozzle **10** could function as a generator when the mobile nozzle **10** is docked in the niche **130** and water is allowed to flow therethrough and into the return or suction fitting. Accordingly, the mobile nozzle **10** can charge the internal battery **48** without requiring the inductive couplings **56**, **136** in the walls **54**, **134** or the mobile nozzle **10** and niche **130**, respectively.

(61) FIG. **4**B is a diagram illustrating the mobile nozzle **10** exiting the niche **130** to begin a cleaning cycle. According to some embodiments of the present disclosure, the mobile nozzle **10** can exit the niche **130** by directing (e.g., by way of nozzle control system **22**) the nozzle **32** toward the bottom wall **138** of the niche **13** and expelling a pressurized stream of water **70**, thereby propelling the mobile nozzle **10** out of the niche **130**. The mobile nozzle **10** could then direct the nozzle **32** to another (e.g., horizontal) orientation, thereby propelling the mobile nozzle **10** away from the niche **130**, such that the mobile nozzle **10** is not positioned above the niche **130** and does not reenter same.

(62) As discussed above, the mobile nozzle **10** can also include a buoyancy system **24**. The buoyance system **24** can include a reservoir or tank **64** that is in fluid communication with the water conduit **42**. The buoyancy system **24** can selectively provide water **68** to the tank **64** by way of a controllable inlet valve **65**, and can selectively expel the water **68** from the tank **64** by way of a controllable outlet valve **66**. Accordingly, the mobile nozzle **10** can selectively decrease its buoyancy by filling some, or a portion, of the tank **64** with water **68** and can increase its buoyancy by expelling some, or a portion, of the water **68** from the tank **64**. For example, as shown in FIG. **4**A, the tank **64** of the mobile nozzle **10** can be, at least, partially filled with water **68**, thereby decreasing its buoyancy and maintain the position of the mobile nozzle **10** during charging. Conversely, as shown in FIG. **4**B, the buoyancy system **24** can, at least, partially expel the water **68** from the tank **64**, thereby increasing the buoyancy of the mobile nozzle **10** and allowing the mobile nozzle **10** to more easily exit the niche **130** under the power of the pressurized stream of water **70** expelled from the nozzle **32**. Likewise, after the mobile nozzle **10** has moved away from the niche **130**, as described above, the buoyancy system **24** can again, at least, partially fill the tank **64** with water, thereby decreasing the buoyancy of the mobile nozzle **10** and allowing the mobile nozzle **10** to sink or return to the pool floor to begin a cleaning operation.

(63) FIG. **4**C is a diagram illustrating a docking niche **130***a* located in a wall **133** of the pool or spa **50** configured to receive and to provide power to a mobile nozzle **10***c*. The niche **130***a* and the mobile nozzle **10***c* can be substantially similar in construction to the niche **130** and mobile nozzle **10** described in connection with FIGS. **4**A and **4**B. Accordingly, the niche **130***a* can also be sized such that a front wall **55** of the mobile nozzle **10***c* is substantially flush, or coplanar, with the wall **133** of the of the pool or spa **50** when the mobile nozzle **10***c* is docked within the niche **130***a*. Additionally, the front wall **55** of the mobile nozzle **10***a* can be provided with an insert or covering **62***a* that matches the material and/or visual appearance of the wall **133** of the pool or spa **50**. Accordingly, when charging or not in use, e.g., when docked within the niche **130***a*, the mobile nozzle **10***c* can be obscured from view.

(64) FIG. **5** is a diagram of a mobile nozzle cleaning system **200** of the present disclosure that includes a mobile nozzle **210** and a pool or spa **250** having a niche (or docking station) **230**, a floor **232**, walls **252***a-d*, one or more deck jets **254***a-d*, a skimmer or other filtration device **256**, stairs **258***a-d*, and a primary pool or spa drain or outlet **260**. The mobile nozzle **210** can be substantially similar in construction to the mobile nozzle **10** described in connection with FIGS. **1-4**B. Accordingly, the mobile nozzle **210** can include one or more of the pump **14**, nozzle **32**, propulsion system **16**, wheels **44***a-d*, navigation system **18**, sensors **20**, nozzle control system **22**, buoyancy

system **24**, brush system **25**, light sources **26**, and communication and control system **28** discussed in connection with the mobile nozzle **10** shown in and described in connection with FIG. **2**A.
(65) According to some embodiments of the present disclosure, the pool or spa **250** can also include one or more fixed nozzles **262***a*, **262***b* that supplement the mobile nozzle **210** and are configured to emit pressurized streams of water **270***a*,**270***b*, respectively, toward the primary drain **260**. The pool or spa **250** can include a collection zone **272** (e.g., "water curtain"), which is an area that the mobile nozzle **210** is configured to direct debris into. The one or more deck jets **254***b*, **254***d*, the primary drain **260**, and the fixed nozzles **262***a*, **262***b* can be positioned within the collection zone **272**, and configured to capture debris that is directed into the collection zone **272** by the mobile nozzle **210** and direct the debris within the collection zone **272** toward the primary drain **260** for extraction from the pool or spa **250**.
(66) FIG. **6** is a diagram illustrating a directional mobile nozzle cleaning program that can be stored on the memory **88**, described in connection with FIG. **3**, and executed by the mobile nozzle **210** to operate the mobile nozzle **210** in a first mode of operation. As shown, the cleaning program can cause the mobile nozzle **210** to move to one or more primary positions **264***a-d* and one or more secondary positions **268***a-d* within the pool or spa **250**. Each of the primary positions **264***a-d* can be located such that the mobile nozzle **210** can progressively direct or "push" pool or spa debris contained within one or more corresponding and overlapping zones **266***a-e* toward the main drain **260** and/or collection zone **272**. As will be discussed in greater detail herein, the mobile nozzle **210** can discharge a pressurized stream of water **270***c* (see FIGS. **7**A-C) at, and/or between, each of the primary positions **264***a-d* and secondary positions **268***a-d* to dislodge the debris and direct it toward the main drain **260** and/or collection zone **272**. Additionally, as discussed in connection with FIGS. **7**A-C, the mobile nozzle **210** can "sweep" the zones **266***a-e* with the pressurized stream of water **270***c* by rotating the nozzle **32**, or by rotating its body at each position. The mobile nozzle **210** could also be in communication with one or more pool or spa components (e.g., skimmer **256**, a pump, one or more valves, etc.) and/or a pool or spa control system via one or more of the communication protocols discussed in connection with FIG. **3** and the communication and control system **28**. Accordingly, the mobile nozzle **210** could be controlled based on information received from the one or more pool or spa components and/or pool or spa control system. For example, the mobile nozzle **210** could be controlled to operate only when the pool or spa pump is operating (e.g., interlocked therewith) and the one or more deck jets **254***a-d*, the skimmer or other filtration device **256**, the primary pool or spa drain or outlet **260**, and the nozzles **262***a*, **262***b* of the collection zone **272** are operational. Alternatively, the mobile nozzle **210** could be controlled to operate only when the pool or spa pump is operating in a "high-speed" mode, or in a "low-speed" mode. For example, the mobile nozzle **210** can be configured to operate only when the pool or spa pump is in a low-speed mode of operation, where the system **200** includes a venturi powered skimmer **256** and mobile nozzle **210** is used in connection therewith. Of course, it is not necessary that the pool or spa pump be operational for operation of the mobile nozzle **210**. According to yet another example, the mobile nozzle **210** can direct debris towards the main drain **260**, as discussed herein, or to another location (e.g., in a pile), where it can be collected at a later time. Alternatively, the mobile nozzle **210** can transmit a signal to the pool or spa pump or control system which communicates that debris is ready for collection, or the mobile nozzle **210** can transmit an instruction to the pool or spa pump or control system to activate once the debris is ready for collection.
(67) According to some embodiments of the present disclosure, the cleaning systems described herein (e.g., cleaning system **200** and cleaning system **300**, described in connection with FIGS. **8-10**C) can include, and the cleaning programs can control, a plurality of mobile nozzles that can cooperate (e.g., work in unison) to remove debris from the pool or spa. For example, as shown in FIG. **6**, the cleaning system **200** can include a second niche **230***a* with a second mobile nozzle **210***a* located therein. The second mobile nozzle **210***a* can be substantially similar to the mobile nozzle

210 and, as such, can include a directional mobile nozzle cleaning program that can be stored on a memory (e.g., memory **88**, described in connection with FIG. **3**), and executed by the mobile nozzle **210***a* to cause the mobile nozzle **210** to move to the one or more primary positions **264***a-d* and one or more secondary positions **268***a-d* within the pool or spa **250**. Additionally, the mobile nozzles **210**, **210***a* and their respective cleaning programs can communicate with each another via one or more of the communication protocols described in connection with FIG. **3**, such shat the mobile nozzles **210**, **210***a* can cooperate to remove the debris from the pool or spa **250**. For example, each of the mobile nozzles **210**, **210***a* could travel to a predefined subset of the one or more primary positions **264***a-d* and one or more secondary positions **268***a-d* within the pool or spa **250** so that the mobile nozzles **210**, **210***a*, together, can travel to all of the one or more primary positions **264***a-d* and one or more secondary positions **268***a-d* and complete a cleaning operation in a reduced amount of time. Each of the mobile nozzles **210**, **210***a* could also travel to the one or more primary positions **264***a-d* and one or more secondary positions **268***a-d* based on proximity thereto, and to each other. For example, the mobile nozzles **210**, **210***a* could be programed to travel to the primary position **264***a-d* or secondary position **268***a-d* that it is closest to (e.g., using sensors **20**, navigation system **18**, and/or navigational beacons described herein). In order to prevent the mobile nozzles **210**, **210***a* from traveling to the same location, or running into each other during operation, the mobile nozzles **210**, **210***a* could also determine the location of the other mobile nozzle. Alternatively, each of the mobile nozzles **210**, **210***a* can determine its own location (e.g., relative to a fixed location or within the pool **250**) and communicate said location to the other mobile nozzle **210**, **210***a*. Of course, it should be understood that the cleaning system **200** does not require two or more mobile nozzles (e.g., mobile nozzles **210**, **210***a*) and can function as described herein with only mobile nozzle **210**.

(68) FIGS. **7**A-C are diagrams of the system **200**, illustrating the progression of the mobile nozzle **210** moving to each of the primary positions **264***a-e*, as directed by the cleaning program. For example, as shown in FIG. **7**A, the cleaning program has already been initiated (e.g., according to a cleaning schedule, or manually initiated by a user), the mobile nozzle **210** has exited the niche **230** (e.g., as discussed in connection with FIGS. **4**A and **4**B), and the mobile nozzle **210** is positioned at the first primary position **264***a*. Once the mobile nozzle **210** has reached the first primary position **264***a*, the mobile nozzle can expel a pressurized stream of water **270***c* in a direction that is generally directed at the drain **260**, thereby propelling debris in the path of the stream **270***c* toward the drain. Additionally, if the pool or spa **25** includes more than one drain **260**, the mobile nozzle **210** can identify the closest drain **260** and direct the debris thereto. Alternatively, the mobile nozzle **210** can direct the debris to a predetermined drain **260** based on the location of the mobile nozzle **210** within the pool or spa **250**. The stream **270***c* can be generally parallel to the floor **232** of the pool or spa **250**, as shown, for example, in FIGS. **11**A and **11**B (see stream **470**). The communication and control system **28** can cause the mobile device **210** to alter the orientation of the stream **270***c* in the direction of arrow C, thereby allowing the mobile nozzle **210** to cover a greater area of the zone **266***a*, without departing from position **264***a*. For example, the propulsion system **16** of the mobile nozzle **210** could cause the entire body of the mobile nozzle **210** to pivot about position **264***a*, thereby “sweeping” zone **266***a* with the pressurized stream **270***c*. Alternatively, the nozzle control system **22** could cause the movable nozzle **32** of the mobile nozzle **210** to rotate relative to the body of the mobile nozzle **210**, in the direction of arrow C, also sweeping zone **266***a* with the pressurized stream **270***c*.

(69) FIG. **7**B shows the cleaning program after the mobile nozzle **210** has finished cleaning zone **266***a*, has spent a duration of time at position **264***b* cleaning zone **266***b*, and has progressed to position **264***c* to clean zone **266***c*. As shown, once the mobile nozzle **210** has reached position **264***c*, the mobile nozzle **210** can expel the pressurized stream of water **270***c* in a direction that is generally directed at the drain **260**, thereby propelling debris in the path of the stream **270***c* toward the drain **260**. It should be understood that the stream **270***c* can be disengaged as the mobile nozzle

210 progresses between each of the positions **264***a-e* (e.g., to conserve battery power), or the stream **270***c* can remain engaged as the mobile nozzle **210** progresses between each of the positions **264***a-e*. As similarly described in connection with FIG. **7**A, the communication and control system **28** can also cause the mobile device **210** to alter the orientation of the stream **270***c* in the direction of arrow D, thereby allowing the mobile nozzle **210** to cover a greater area of the zone **266***c*, without departing from position **264***c*.

(70) FIG. **7**C shows the cleaning program after the mobile nozzle **10** has finished cleaning zones **266***a-d*, having spent a duration of time at each of positions **264***a-d*, and has progressed to position **264***e* to clean zone **266***e*. As shown, once the mobile nozzle **210** has reached position **264***e*, the mobile nozzle can expel the pressurized stream of water **270***c* in a direction that is generally directed at the drain **260**, thereby propelling debris in the path of the stream **270***c* toward the drain **260**. As similarly described in connection with FIGS. **7**A and **7**B, the system **200** can also cause the mobile device **210** to alter the orientation of the stream **270***c* in the direction of arrow E, thereby allowing the mobile nozzle **210** to cover a greater area of the zone **266***c* without departing from position **264***c*.

(71) Once the mobile nozzle **210** has progressed through all of the primary positions **264***a-e* and has cleaned zones **266***a-e*, the cleaning program can direct the mobile nozzle **210** to one or more of the secondary positions **268***a-d* (see FIG. **6**), following a similar procedure and steps as those described in connection with FIGS. **7**A-C. According to some aspects of the present disclosure, the secondary positions **268***a-e* can correspond to features of the pool or spa **250** that are not flush with the floor **232** of the pool or spa **250**. For example, as shown best in FIG. **6**, the secondary positions **268***a-e* can correspond to steps **258***a-d* of the pool or spa **250** and each of the steps **258***a-d* can have a different height. Accordingly, the mobile nozzle **210** can be provided with means for altering the height thereof in order to reach one or more positions that are not flush with the floor **232** and/or to enable the mobile nozzle **210** to traverse a greater number of areas of the pool or spa **250**. It is noted that the mobile nozzle **210** can be dimensioned such that it can rest on a step **258***a-d* and move along the length of the step **258***a-d*. It should also be understood that the mobile nozzle **210** can clean the secondary positions **268***a-e* prior to the primary positions **264***a-e*, or the mobile nozzle **210** can alternate therebetween, depending on the configuration of a particular pool and the determined optimal cleaning pattern.

(72) As discussed above, the mobile nozzle **210** can be substantially similar to the mobile nozzle **10**, discussed in connection with FIGS. **2-4**C, and as such can include similar movable nozzle **32** and buoyancy systems **24**. Accordingly, the mobile nozzle **210** can traverse the floor **232** of the pool or spa **258** until it encounters a feature (e.g., step **258***d*) that is not flush with the floor **232** at which point the mobile nozzle **210** can cause its nozzle **32** to move to a substantially vertical orientation and can expel the pressurized stream **270***c* towards the floor **232** of the pool or spa **250**, thereby propelling the mobile nozzle **210** in an opposite and upward direction. At the same time, the mobile nozzle **210** can also increase its buoyancy by expelling an amount of water from the buoyancy system **24**, as described in connection with FIGS. **4**A and **4**B. Once the mobile nozzle **210** has reached, or exceeded, the height of the feature, the mobile nozzle **210** can cause its nozzle **32** to move to a second orientation so as to expel the pressurized stream **270***c* in a direction generally opposite to the direction of the feature, thereby propelling the mobile nozzle **210** toward the feature. The mobile nozzle **210** can then decrease its buoyancy by filling at least a portion of the buoyancy system **24** with water, until the mobile nozzle **210** is able to settle on the feature (e.g., at the secondary position **268***e*). The mobile nozzle **210** can then remove debris from the feature by discharging the pressurized stream **270***c* to direct the debris toward the drain **260**, or by a using the pressurized stream **270***c* to agitate the debris, e.g., by directing the stream **270***c* in a direction normal to the feature, thereby dispersing the debris as discussed in connection with FIGS. **8-10**C.

(73) FIG. **8** is a diagram illustrating another mobile nozzle cleaning system **300** (e.g., an agitation system) that includes a mobile nozzle **310** and another pool or spa **350** having a niche **330**, a floor

332, a plurality of walls **352**, a skimmer or other filtration device **356**, stairs **358***a-e*, a primary pool or spa drain or outlet **360**, and a secondary suction outlet **334**.

(74) FIG. **9** is a diagram illustrating another mobile nozzle cleaning program, which can be executed by the mobile nozzle cleaning system **300** to operate in a second mode of operation, e.g., an agitation mode of operation. The agitation mode of operation can include a series of overlapping positions to which the mobile nozzle **310** travels and directs a pressurized stream of water against a pool or spa **350** floor, thereby causing debris that has settled on the pool or spa **350** floor to be dislodged/agitated and suspended in the pool or spa **350**. The debris can then be removed through normal water turnover operations, such as through a main drain **360** or through one or more skimmers **334**. The mobile nozzle **310** moves to each of the series of positions and agitates the debris and continues to repeat the series, maintaining the debris in suspension until all of the debris is removed from the pool or spa **350**.

(75) As shown in FIG. **9**, the cleaning program can direct the mobile nozzle **310** to one or more primary positions **364***a-j* and one or more secondary positions **368***a-d* within the pool or spa **350**. Each of the primary positions **364***a-j* can be located such that the mobile nozzle **310** can "agitate" pool or spa debris that has settled on the floor **332** within one or more corresponding and overlapping zones **366***a-j*, such that the debris can be dislodged from the floor **332** and removed from the pool or spa **350** by way of the drain **360**, the skimmer **310**, or one or more secondary suction outlets **334**. The mobile nozzle **310** could also be in communication with one or more pool or spa components (e.g., skimmer **356**, a pump, one or more valves, etc.) and/or a pool or spa control system via one or more of the communication protocols discussed in connection with FIG. **3** and the communication and control system **28**. Accordingly, the mobile nozzle **310** could be controlled based on information received from the one or more pool or spa components and/or pool or spa control system. For example, the mobile nozzle **310** could be controlled to operate only when the pool or spa pump is operating (e.g., interlocked therewith) and one or more deck jets and the skimmer or other filtration device **356** are operational. Alternatively, the mobile nozzle **310** could be controlled to operate only when the pool or spa pump is operating in a "high-speed" mode, or in a "low-speed" mode. Of course, it is not necessary that the pool or spa pump be operational for operation of the mobile nozzle **310**. For example, the mobile nozzle **310** can continuously agitate debris until it can be collected at a later time (e.g., when the skimmer **356** is operational). Alternatively, the mobile nozzle **310** can transmit a signal to the pool or spa pump or control system which communicates that debris is ready for collection, or the mobile nozzle **310** can transmit an instruction to the pool or spa pump or control system to activate once the debris is ready for collection. According to another example, the mobile nozzle **310** can be configured to operate only when the pool or spa pump is in a low-speed mode of operation, where the system **300** includes a venturi powered skimmer **356** and mobile nozzle **310** is used in connection therewith.

(76) As described in greater detail in connection with cleaning system **200** and corresponding FIGS. **5**-**7**C, cleaning system **300** can include, and the cleaning programs can control, a plurality of mobile nozzles **310** that can cooperate (e.g., work in unison) to remove debris from the pool or spa **350**. Of course, it should be understood that the cleaning system **300** does not require two or more mobile nozzles **310** and can function as described herein with a single mobile nozzle **310**.

(77) FIGS. **10**A-C are diagrams of the system **300**, illustrating the progression of the mobile nozzle **310** moving to each of the primary positions **364***a-j* when in the second mode of operation, as directed by the cleaning program. For example, as shown in FIG. **10**A, the cleaning program has already been initiated (e.g., according to a cleaning schedule, or manually initiated by a user), and the mobile nozzle has exited the niche **330** (e.g., as discussed in connection with FIGS. **4**A and **4**B) and is positioned at the first primary position **364***a*. Once the mobile nozzle **310** has reached position **264***a*, the mobile nozzle **310** can expel a pressurized stream of water **370***c* (not shown) in a direction that is generally directed at the floor **332** of the pool or spa **350**, thereby "agitating" the debris and propelling the debris radially away from the position **364***a*, such that the debris can float

to the water surface of the pool or spa **50** where it can be captured by the one or more skimmers **356**. Of course, a portion of the dislodged debris could also be captured by the drain **360** and the one or more secondary suction outlets **334**. The pressurized stream **370***c* can also be directed at the floor **332** at an angle that is less than perpendicular, while still being able to agitate the debris of the pool or spa **350** in the manner described in connection with FIGS. **10**A-C. However, it should be understood that the angle of the pressurized stream **370***c* with respect to the floor **332** when used to "agitate" the debris is generally greater than, for example, the angle of the pressurized stream **270***c* described in connection with FIGS. **6**A-C, for "directing" the debris toward the main drain **260**. FIG. **10**B shows the cleaning program after the mobile nozzle **10** has finished cleaning zone **366***a*, has spent a duration of time at positions **364***b* and **364***c* and cleaned zones **366***b* and **366***c*, and has progressed to position **364***d* to clean zone **366***d*. As shown, once the mobile nozzle **310** has reached position **364***d*, the mobile nozzle **310** can expel a pressurized stream of water (not shown) in a direction that is generally directed at the floor **332** of the pool or spa **350**, thereby "agitating" the debris and propelling the debris radially away from the position **364***d* such that the debris can float to the water surface of the pool or spa **50**. It should be understood that the stream **370***c* can be disengaged as the mobile nozzle **310** progresses between each of the positions **364***a-j* (e.g., to conserve battery power), or the stream **370***c* can remain engaged as the mobile nozzle **310** progresses between each of the positions **264***a*-J.

(78) FIG. **10**C shows the cleaning program after the mobile nozzle **310** has finished cleaning zones **366***a-e*, having spent a duration of time at each of positions **364***a-e*, and has progressed to position **364***f* to clean zone **366***f*. As shown, once the mobile nozzle **310** has reached position **364***f*, the mobile nozzle can expel a pressurized stream of water (not shown) in a direction that is generally directed at the floor **332** of the pool or spa **350**, thereby "agitating" the debris and propelling the debris radially away from the position **364***f* such that the debris can float to the water surface of the pool or spa **50**.

(79) Once the mobile nozzle has progressed through all of the primary positions **364***a-j* and has cleaned zones **366***a-j*, the cleaning program can direct the mobile nozzle **310** to one or more of the secondary positions **368***a-d*, following a similar procedure and steps as those described in connection with FIGS. **7**A-C. According to some aspects of the present disclosure, the secondary positions **368***a-d* can correspond to features of the pool or spa **350** that are not flush with the floor **332** of the pool or spa **350**. Accordingly, the mobile nozzle **310** can be provided with means for altering the height thereof in order to reach one or more positions that are not flush with the floor **332** and/or to enable the mobile nozzle **310** to traverse a greater number of areas of the pool or spa **350**.

(80) It should be understood that the mobile nozzle **310** can be substantially similar to the mobile nozzle **10**, discussed in connection with FIGS. **2-4**C, and as such can include similar movable nozzle **32** and buoyancy systems **24**. Accordingly, the mobile nozzle **310** can traverse the floor **332** of the pool or spa **358** until it encounters a feature that is not flush with the floor **332** and can adjust its height to traverse said feature, as similarly described in connection with FIGS. **7**A-C.

(81) According to some embodiments of the present disclosure, the mobile nozzle cleaning systems **200**, **300** can include one or more beacons (e.g., RFID, magnetic, sonic, optical, etc.) positioned permanently or semi-permanently at one or more of the primary and/or secondary positions **264***a-e*, **268***a-e*, **364***a-j*, **368***a-d* in order to guide the mobile nozzles **410** to the positions **264***a-e*, **268***a-e*, **364***a-j*, **368***a-d*. Additionally or alternatively, the main drains **260**, **360** or niches **130** can contain a beacon to provide a fixed reference coordinate and one or more pool or spa features (e.g., primary and/or secondary positions **264***a-e*, **268***a-e*, **364***a-j*, **368***a-d*, drains **260**, **360**, skimmers **256**, **356**, etc.) can be mapped based on their location relative to the beacon. The mobile nozzle niches **130**, **230**, **330** disclosed herein can also be provided with a home beacon that emits a home signal, allowing the mobile nozzles **10**, **210**, **310**, **410** to locate and return to the niches **130**, **230**, **330** from anywhere in the pool **50**, **250**, **350**, **450**. Accordingly, the mobile nozzles **10**, **210**, **310**, **410**

disclosed herein can be provided with one or more sensors **20** for locating the beacons and communicating this information to the navigation system **18** of the mobile nozzles **10**, **210**, **310**, **410**. Further still, the mobile nozzles **10**, **210**, **310**, **410** of the present disclosure can be programmed to travel to pre-determined locations based on a pre-programmed map of the pool or spa **50**, **250**, **350**, **450**, the mobile nozzles **10**, **210**, **310**, **410** can be provided with proximity, optical, or other sensors **20** enabling the mobile nozzles **10**, **210**, **310**, **410** to generate a map of the pool or spa **50**, **250**, **350**, **450** (e.g., the mobile nozzles **10**, **210**, **310**, **410** can self-learn the shape of the pool or spa). Alternatively, the map/layout of the pool or spa can be programmed on-site by an owner or installation technician.

(82) According to further embodiments of the present disclosure, the mobile nozzles **10**, **210**, **310**, **410** can include one or more sensors (e.g., optical, proximity, etc.), vision systems, or other means for detecting debris as the mobile nozzles **10**, **210**, **310**, **410** traverse the pool or spa **50**, **250**, **350**, **450**. For example, the cleaning programs of the mobile nozzle cleaning systems disclosed herein could be configured to detect debris as the mobile nozzles **10**, **210**, **310**, **410** traverse primary and/or secondary positions (e.g., **264***a-e*, **268***a-e*, **364***a-j*, **368***a-d*) and the cleaning programs could include a mode of operation whereby the mobile nozzles **10**, **210**, **310**, **410** reposition themselves upon detecting debris to either direct the debris toward a main drain or agitate the debris for collection by a skimmer. The cleaning programs could also include a mode of operation whereby the mobile nozzles **10**, **210**, **310**, **410** can identify one or more areas having debris and return to same areas after traversing the primary and/or secondary positions (e.g., **264***a-e*, **268***a-e*, **364***a-j*, **368***a-d*). The mobile nozzles **10**, **210**, **310**, **410** could also include another mode of operation, whereby the mobile nozzles **10**, **210**, **310**, **410** first traverse the pool or spa **50**, **250**, **350**, **450** with the brush systems **25**, **225**, **325**, **425** engaged, to loosen debris, and can then traverse the pool or spa **50**, **250**, **350**, **450** with the nozzles **32**, **232**, **332**, **432** engaged, so as to direct the debris toward a main drain or agitate the debris for collection by a skimmer.

(83) FIGS. **11**A and **11**B are block diagrams illustrating another exemplary mobile nozzle **410** of the present disclosure, including means **472** for securing the mobile nozzle **410**. For example, the means **472** can adjust the position of wheels **444***a-d* of the mobile nozzle **410** so that one or more rigid protrusions of the mobile nozzle **410** engages and rests on the pool floor **476**. The mobile nozzle **410** can be substantially similar in both form and function to the mobile nozzles **10**, **210**, **310** discussed in connection with FIGS. **1-10**C except for distinctions noted herein, and can be used in connection with systems **200** and **300** of the present disclosure.

(84) Accordingly, the mobile nozzle **410** can include a water-tight body **412** that is adapted for submersion in the pool or spa **450** and houses one or more of a pump **414**, a nozzle **432**, a propulsion system **416**, wheels **444***a-d*, a navigation system **418**, one or more sensors **420**, a nozzle control system **422**, a buoyancy system **424**, a brush system **425**, one or more light sources **426**, and a communication and control system **428** and a rechargeable power system **430** for providing electrical power to the foregoing systems, among other components. Additionally, as referenced above, the mobile nozzle **410** can include means **472***a-d* for securing the mobile nozzle **410**, which can adjust the position of the wheels **444***a-d* relative to the body **412** and can include one or more rigid protrusions **474** positioned on a bottom wall **434** of the body **412** adjacent to the floor **476** of the pool or spa **450**. According to some embodiments of the present disclosure, means **472***a-d* can include one or more hydraulic cylinders, pneumatic cylinders, gearing systems, etc., coupled to the wheels **444***a-d* and associated systems for enabling retraction thereof, which can be in communication with one or more of the control systems of the mobile nozzle **410** disclosed herein.

(85) As shown in FIGS. **11**A and **11**B, the pressurized stream of water **470** can be expelled from the nozzle **432** in a direction that is generally horizontal and substantially parallel with the floor **476** of the pool or spa **450**. As will be understood by those of ordinary skill in the art, this arrangement causes a force, shown as arrow F, to be applied to the mobile nozzle **410** in a direction that is opposite to the trajectory of the pressurized stream **470**, which can cause the mobile nozzle **410** to

move in the direction of arrow F and drift to another portion of the pool or spa **450** if, for example, rotation of the wheels **444***a-d* is not inhibited or movement of the mobile nozzle **410** is not otherwise prevented.

(86) The mobile nozzle **410** addresses this problem by disengaging the wheels **444***a-d* from the floor **476** of the pool or spa **450** and allowing the mobile device to “sit” on the floor **476** of the pool or spa **450**. More specifically, means **472***a-d* coupled to the wheels **444***a-d* of the mobile nozzle **410** can move the wheels **444***a-d* from a first deployed position, shown in FIG. **11**A, where the wheels **444***a-d* contact the floor **476** to a second retracted position, shown in FIG. **11**B, where the wheels are raised, such that the protrusions **474***a-d* come to rest on the floor **476**, thereby preventing the mobile nozzle **410** from moving when the nozzle **432** is operated in a substantially horizontal orientation.

(87) FIG. **11**C is a block diagram illustrating the mobile nozzle **410***a* including another means **480** for securing the mobile nozzle **410**. The means **480** for securing the mobile nozzle **410** can supplement, or replace, the means **472** for securing the mobile nozzle **410**, described above in connection with FIGS. **11**A and **11**B. As shown, the means **480** includes a latch **482** that can be removably coupled to an anchor **484** affixed to the floor **476** of the pool or spa **450**. The latch **482** can be controlled by, or in communication with, one or more of the control systems, e.g., the communication and control system **27** shown and described in connection with FIG. **2**A and mobile nozzle **10**, of the mobile nozzle **410** disclosed herein, such that the mobile nozzle **410** can selectively couple the latch **482** to the anchor **484**. According to embodiments of the present disclosure, the means **480** can comprise a latch **482** configured as a hook (e.g., as shown in FIG. **11**C), a magnetic latch, or a suction-driven latch and can further include reciprocal anchors **484**, e.g., a loop for the hook to engage, an oppositely charged magnetic latch, a ferromagnetic latch, etc. According to still further embodiments of the present disclosure, the anchor **484** can include a beacon (e.g., RFID, magnetic, sonic, optical, etc.) and the anchor **484** can be positioned permanently or semi-permanently at one or more of the primary and/or secondary positions **264***a-e*, **268***a-e*, **364***a-j*, **368***a-d* in order to guide the mobile nozzle **410** to the positions **264***a-e*, **268***a-e*, **364***a-j*, **368***a-d*.

(88) Having thus described the system and method in detail, it is to be understood that the foregoing description is not intended to limit the spirit or scope thereof. It will be understood that the embodiments of the present disclosure described herein are merely exemplary and that a person skilled in the art may make any variations and modification without departing from the spirit and scope of the disclosure. All such variations and modifications, including those discussed above, are intended to be included within the scope of the disclosure.

Claims

1. A mobile nozzle for expelling pressurized water toward a debris collection zone displaced from the mobile nozzle, the mobile nozzle comprising: a body; a water intake configured to receive water; a discharge nozzle in fluidic communication with the water intake, the discharge nozzle configured to expel pressurized water; and a computer system including a memory and a processor, the processor operable to: identify the debris collection zone; cause the mobile nozzle to move to a first location in a pool or spa; and cause pressurized water to be expelled through the discharge nozzle toward the debris collection zone to cause debris to move away from the mobile nozzle and toward the debris collection zone when the mobile nozzle is positioned at the first location.
2. The mobile nozzle of claim 1, wherein the processor is further operable to: cause the mobile nozzle to move to a second location in the pool or spa; and cause pressurized water to be expelled through the discharge nozzle toward the debris collection zone to cause debris to move away from the mobile nozzle and toward the debris collection zone when the mobile nozzle is positioned at the second location.

3. The mobile nozzle of claim 2, wherein the processor is operable to: communicate with a first beacon positioned at the first location; locate a position of the first beacon based on the communication with the first beacon; communicate with a second beacon positioned at the second location; and locate a position of the second beacon based on the communication with the second beacon.
4. The mobile nozzle of claim 3 in combination with the first beacon and the second beacon.
5. The mobile nozzle of claim 1, wherein the processor is operable to communicate with a beacon positioned at the debris collection zone, and locate the debris collection zone based on the communication with the beacon.
6. The mobile nozzle of claim 5 in combination with the beacon.
7. The mobile nozzle of claim 1, wherein the discharge nozzle is adjustable.
8. The mobile nozzle of claim 1, wherein the discharge nozzle is rotatable in a sweeping motion.
9. The mobile nozzle of claim 1, wherein the mobile nozzle is configured to rotate about a pivot point to cause the discharge nozzle to move in a sweeping motion.
10. The mobile nozzle of claim 1, comprising a plurality of wheels.
11. The mobile nozzle of claim 1, wherein the mobile nozzle is configured to be housed within a niche located in one or more of a wall and a floor of the pool or spa, and the mobile nozzle includes a rechargeable battery.
12. The mobile nozzle of claim 1, comprising a pump in fluidic communication with the water intake and the discharge nozzle, the pump configured to draw water in through the water intake and expel the water out from the discharge nozzle.
13. The mobile nozzle of claim 12, wherein the pump is reversible and configured to draw water in through the discharge nozzle and expel the water out from the water intake.
14. The mobile nozzle of claim 1, wherein the processor is further operable to automatically determine an optimal position for the first location in the pool or spa.
15. The mobile nozzle of claim 1, wherein the processor is operable to identify a location of the debris collection zone based on user input.
16. The mobile nozzle of claim 1, wherein the processor is further operable to receive a user defined map of the pool or spa, the user defined map including a position of the debris collection zone and a position of the first location.
17. The mobile nozzle of claim 1, wherein the processor is configured to receive an indication that a pump in fluidic communication with the debris collection zone is operational, and cause the pressurized water to be expelled through the discharge nozzle based on the indication.
18. A method of collecting debris in a debris collection zone using a mobile nozzle, comprising: identifying the debris collection zone; causing the mobile nozzle to move to a first location in a pool or spa, the mobile nozzle comprising a body, a water intake configured to receive water, a discharge nozzle in fluidic communication with the water intake and configured to expel pressurized water, and a computer system including a memory and a processor; and expelling pressurized water through the discharge nozzle of the mobile nozzle toward the debris collection zone to cause debris to move away from the mobile nozzle and toward the debris collection zone when the mobile nozzle is positioned at the first location.
19. The method of claim 18, further comprising: causing the mobile nozzle to move to a second location in the pool or spa; and expelling pressurized water through the discharge nozzle toward the debris collection zone to cause debris to move away from the mobile nozzle and toward the debris collection zone when the mobile nozzle is positioned at the second location.
20. The method of claim 19, further comprising: communicating with a first beacon positioned at the first location; locating a position of the first beacon based on the communication with the first beacon; communicating with a second beacon positioned at the second location; and locating a position of the second beacon based on the communication with the second beacon.
21. The method of claim 18, wherein identifying the debris collection zone comprises:

communicating with a beacon positioned at the debris collection zone; and locating the debris collection zone based on the communication with the beacon.
22. The method of claim 21, wherein identifying the debris collection zone is performed by the processor of the mobile nozzle.
23. The method of claim 18, wherein the discharge nozzle is adjustable.
24. The method of claim 18, further comprising: rotating the discharge nozzle in a sweeping motion while expelling the pressurized water through the discharge nozzle.
25. The method of claim 18, further comprising: rotating the mobile nozzle about a pivot point to cause the discharge nozzle to move in a sweeping motion while expelling the pressurized water through the discharge nozzle.
26. The method of claim 18, wherein the mobile nozzle comprises a plurality of wheels.
27. The method of claim 18, further comprising: positioning the mobile nozzle within a niche located in one or more of a wall and a floor of the pool or spa.
28. The method of claim 27, further comprising recharging a rechargeable battery of the mobile nozzle.
29. The method of claim 18, wherein the mobile nozzle comprises a pump in fluidic communication with the water intake and the discharge nozzle, the pump configured to draw water in through the water intake and expel the water out from the discharge nozzle.
30. The method of claim 29, wherein the pump is reversible and configured to draw water in through the discharge nozzle and expel the water out from the water intake.
31. The method of claim 18, further comprising: determining, by the processor, an optimal position for the first location in the pool or spa.
32. The method of claim 18, wherein identifying the debris collection zone is performed based on user input.
33. The method of claim 18, further comprising: receiving a user defined map of the pool or spa including a position of the debris collection zone and a position of the first location.
34. The method of claim 18, further comprising receiving an indication that a pump in fluidic communication with the debris collection zone is operational, wherein expelling of the pressurized water through the discharge nozzle of the mobile nozzle is performed based on the indication received.
35. A mobile nozzle for agitating debris in a pool or a spa, the mobile nozzle comprising: a body; a water intake configured to receive water; a discharge nozzle in fluidic communication with the water intake, the discharge nozzle configured to expel pressurized water; and a computer system including a memory and a processor, the processor operable to: identify a first agitation location in the pool or the spa; cause the mobile nozzle to move to the first agitation location; expel pressurized water through the discharge nozzle toward a surface of the pool or spa to agitate debris at the first agitation location and cause the agitated debris to be suspended in water of the pool or spa and moved away from the mobile nozzle; identify a second agitation location in the pool or the spa; cause the mobile nozzle to move to the second agitation location; and expel pressurized water through the discharge nozzle toward a surface of the pool or spa to agitate debris at the second agitation location and cause the agitated debris to be suspended in the water of the pool or spa and moved away from the mobile nozzle.
36. The mobile nozzle of claim 35, wherein the processor is further operable to: cause the mobile nozzle to move in a navigation pattern, the navigation pattern including the first agitation location and the second agitation location.
37. The mobile nozzle of claim 35, wherein the processor is further operable to: communicate with a first beacon positioned at the first location; locate a position of the first beacon based on the communication with the first beacon; communicate with a second beacon positioned at the second location; and locate a position of the second beacon based on the communication with the second beacon.

38. The mobile nozzle of claim 37 in combination with the first beacon and the second beacon.
39. The mobile nozzle of claim 35, wherein the discharge nozzle is adjustable.
40. The mobile nozzle of claim 35, wherein the discharge nozzle is rotatable in a sweeping motion.
41. The mobile nozzle of claim 35, wherein the mobile nozzle is configured to rotate about a pivot point to cause the discharge nozzle to move in a sweeping motion.
42. The mobile nozzle of claim 41, wherein the mobile nozzle is configured to rotate 360 degrees.
43. The mobile nozzle of claim 35, comprising a plurality of wheels.
44. The mobile nozzle of claim 35, wherein the mobile nozzle is configured to be housed within a niche located in one or more of a wall and a floor of the pool or spa, and the mobile nozzle includes a rechargeable battery.
45. The mobile nozzle of claim 35, comprising a pump in fluidic communication with the water intake and the discharge nozzle, the pump configured to draw water in through the water intake and expel the water out from the discharge nozzle.
46. The mobile nozzle of claim 45, wherein the pump is reversible and configured to draw water in through the discharge nozzle and expel the water out from the water intake.
47. The mobile nozzle of claim 35, wherein the processor is further operable to automatically determine an optimal position for the first agitation location and the second agitation location in the pool or spa.
48. The mobile nozzle of claim 35, wherein the processor is further operable to receive a user defined map of the pool or spa, the user defined map including a position of the first agitation location and a position of the second agitation location.
49. The mobile nozzle of claim 35, wherein the processor is configured to receive an indication that a pump in fluidic communication with a pool skimmer or spa skimmer is operational, and cause the pressurized water to be expelled through the discharge nozzle based on the indication.
50. A method of agitating debris in a pool or spa using a mobile nozzle, comprising: identifying a first agitation location in the pool or spa; causing the mobile nozzle to move to the first agitation location, the mobile nozzle comprising a body, a water intake configured to receive water, a discharge nozzle in fluidic communication with the water intake and configured to expel pressurized water, and a computer system including a memory and a processor; expelling pressurized water through the discharge nozzle of the mobile nozzle toward a surface of the pool or spa to agitate debris at the first agitation location and cause the agitated debris to be suspended in water of the pool or spa and moved away from the mobile nozzle; identifying a second agitation location in the pool or spa; causing the mobile nozzle to move to the second agitation location; and expelling pressurized water through the discharge nozzle of the mobile nozzle toward a surface of the pool or spa to agitate debris at the second agitation location and cause the agitated debris to be suspended in the water of the pool or spa and moved away from the mobile nozzle.
51. The method of claim 50, wherein the first agitation location and the second agitation location are a portion of a navigation pattern.
52. The method of claim 50, further comprising: communicating with a first beacon positioned at the first agitation location; locating a position of the first beacon based on the communication with the first beacon; communicating with a second beacon positioned at the second agitation location; and locating a position of the second beacon based on the communication with the second beacon.
53. The method of claim 50, wherein the discharge nozzle is adjustable.
54. The method of claim 50, further comprising: rotating the discharge nozzle in a sweeping motion while expelling the pressurized water through the discharge nozzle.
55. The method of claim 50, further comprising: rotating the mobile nozzle about a pivot point to cause the discharge nozzle to move in a sweeping motion while expelling the pressurized water through the discharge nozzle.
56. The method of claim 55, wherein the mobile nozzle is rotated 360 degrees.
57. The method of claim 50, wherein the mobile nozzle comprises a plurality of wheels.

58. The method of claim 50, further comprising: positioning the mobile nozzle within a niche located in one or more of a wall and a floor of the pool or spa.
59. The method of claim 58, further comprising recharging a rechargeable battery of the mobile nozzle.
60. The method of claim 50, wherein the mobile nozzle comprises a pump in fluidic communication with the water intake and the discharge nozzle, the pump configured to draw water in through the water intake and expel the water out from the discharge nozzle.
61. The method of claim 60, wherein the pump is reversible and configured to draw water in through the discharge nozzle and expel the water out from the water intake.
62. The method of claim 50, further comprising: determining, by the processor, an optimal position for the first agitation location and the second agitation location in the pool or spa.
63. The method of claim 50, wherein identifying the first agitation location and identifying the second agitation location are performed based on user input.
64. The method of claim 50, further comprising: receiving a user defined map of the pool or spa including a position of the first agitation location and a position of the second agitation location.
65. The method of claim 50, further comprising receiving an indication that a pump in fluidic communication with a pool skimmer or spa skimmer is operational, wherein expelling of the pressurized water through the discharge nozzle of the mobile nozzle is performed based on the indication received.