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Apparatus for cleaning a surface with a liquid jet and related methods

Abstract

Apparatus for cleaning a surface with a liquid jet, the apparatus having: a main housing; a primary fluid conduit having a longitudinal axis and two ends, a fluid-intake end and a fluid-exit end; a gear assembly configured to engage the primary fluid conduit and rotate the primary fluid conduit about the primary-fluid-conduit longitudinal axis; a nozzle connected pivotally to the pivot pin; the hydraulic cylinder mounted to the main housing and configured to move the hydraulic-cylinder rod along a linear path by exerting a unidirectional force upon the first end of the hydraulic-cylinder rod; the hydraulic-cylinder rod positioned within the fluid conduit and the second end of the hydraulic-cylinder rod pivotally connected to the nozzle; and the nozzle configured to pivot about the pivot-pin longitudinal axis as the hydraulic-cylinder rod moves along the linear path.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This patent application claims priority to U.S. provisional patent application 63/214,759 filed on Jun. 24, 2021; the subject matter of which is incorporated into this application in its entirety.

BACKGROUND OF THE INVENTION
(1) Storage tanks, such as those used to store crude oil or other carbon-containing fluids, are well known. There remains a need for an apparatus that can be used to clean the interior surfaces of storage tanks that are used to store crude oil or other carbon-containing fluids.
BRIEF SUMMARY OF THE INVENTION
(2) Apparatus for cleaning a surface with a liquid jet, the apparatus having: a main housing; a primary fluid conduit having a longitudinal axis and two ends, a fluid-intake end and a fluid-exit end; a gear assembly configured to engage the primary fluid conduit and rotate the primary fluid conduit about the primary-fluid-conduit longitudinal axis; a motor mounted to the main housing and configured to engage the gear assembly and thereby rotate the primary fluid conduit about the primary-fluid-conduit longitudinal axis; a bifurcated head connected to the primary-fluid-conduit fluid-exit end, the bifurcated head having at least one fluid conduit; a hydraulic cylinder; a hydraulic-cylinder rod having a first end and a second end; a pivot pin having a longitudinal axis and the pivot pin being attached to the bifurcated head; a nozzle connected pivotally to the pivot pin; the hydraulic cylinder mounted to the main housing and configured to move the hydraulic-

cylinder rod along a linear path by exerting a unidirectional force upon the first end of the hydraulic-cylinder rod; the hydraulic-cylinder rod positioned within the fluid conduit and the second end of the hydraulic-cylinder rod pivotally connected to the nozzle; and the nozzle configured to pivot about the pivot-pin longitudinal axis as the hydraulic-cylinder rod moves along the linear path.

(3) Apparatus for cleaning a surface with a liquid jet, the apparatus having: a main housing; a primary fluid conduit having a longitudinal axis and two ends, a fluid-intake end and a fluid-exit end; a gear assembly configured to engage the primary fluid conduit and rotate the primary fluid conduit about the primary-fluid-conduit longitudinal axis; a motor mounted to the main housing and configured to engage the gear assembly and thereby rotate the primary fluid conduit about the primary-fluid-conduit longitudinal axis; a bifurcated head connected to the primary-fluid-conduit fluid-exit end, the bifurcated head having parallel fluid conduits; a hydraulic cylinder; a hydraulic-cylinder rod having a first end and a second end; a pivot pin having a longitudinal axis and the pivot pin being attached to the bifurcated head; a nozzle connected pivotally to the pivot pin; the hydraulic cylinder mounted to the main housing and configured to move the hydraulic-cylinder rod along a linear path by exerting a unidirectional force upon the first end of the hydraulic-cylinder rod; the hydraulic-cylinder rod positioned within the fluid conduit and the second end of the hydraulic-cylinder rod pivotally connected to the nozzle; the nozzle configured to pivot about the pivot-pin longitudinal axis as the hydraulic-cylinder rod moves along the linear path; a mounting flange upon which the apparatus is configured to mount to a substantially planar surface; a controller configured to independently rotate the primary fluid conduit by engaging the motor and independently pivot the nozzle by engaging the hydraulic cylinder; and a rotational positional sensor that is configured to sense the rotational position of the primary fluid conduit.

(4) Apparatus for cleaning a surface with a liquid jet, the apparatus having: a main housing; a primary fluid conduit having a longitudinal axis and two ends, a fluid-intake end and a fluid-exit end; a gear assembly configured to engage the primary fluid conduit and rotate the primary fluid conduit about the primary-fluid-conduit longitudinal axis; a motor mounted to the main housing and configured to engage the gear assembly and thereby rotate the primary fluid conduit about the primary-fluid-conduit longitudinal axis; a bifurcated head connected to the primary-fluid-conduit fluid-exit end, the bifurcated head having at least one fluid conduit; a cylinder; a cylinder rod having a first end and a second end; a pivot pin having a longitudinal axis and the pivot pin being attached to a head having a fluid-conduit therein; a nozzle connected pivotally to the pivot pin; the cylinder mounted to the main housing and configured to move the cylinder rod along a linear path by exerting a unidirectional force upon the first end of the cylinder rod; the cylinder rod positioned within the fluid conduit and the second end of the cylinder rod pivotally connected to the nozzle; and the nozzle configured to pivot about e pivot-pin longitudinal axis as the cylinder rod moves along the linear path.

Description

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

(1) FIG. **1** is a cross-sectional side view of an embodiment.
(2) FIG. **2** is a side view of an embodiment.
(3) FIG. **3** is a cross-sectional side view of a portion of an embodiment.
(4) FIG. **4** is a side view of an embodiment.
(5) FIG. **5** is a side view of a portion of an embodiment.
(6) FIG. **6** is a cross-sectional perspective view of a portion of an embodiment.
(7) FIG. **7** is a cross-sectional perspective view of a portion of an embodiment.
(8) FIG. **8** is a cross-sectional perspective view of a portion of an embodiment.

(9) FIG. **9** is a schematic of a computing-system embodiment.
(10) FIG. **10** is a side view of an embodiment mounted to a storage-tank rooftop.
(11) FIG. **11** is a perspective view of an embodiment mounted to a storage-tank rooftop.
(12) FIG. **12** is a perspective view of an embodiment mounted to a storage-tank sidewall.
(13) FIG. **13** is a side view of an embodiment mounted to a storage-tank rooftop and in use.

DETAILED DESCRIPTION OF THE INVENTION

(14) Very generally, inventive embodiments are directed to an apparatus for cleaning a surface with a liquid jet.

(15) With reference to the figures, apparatus **10** has main housing **110** that houses a plurality of mechanical elements and also acts as a fixed substrate upon which a plurality of mechanical elements are mounted. Hydraulic cylinder **160** is fixedly mounted on an exterior end portion of main housing **110** and hydraulic cylinder **160** is configured to implement a unidirectional force upon hydraulic-cylinder rod **170** wherein as hydraulic cylinder **160** moves from a retracted position towards the bottom of the hydraulic-cylinder stroke, a downward force is exerted upon hydraulic-cylinder-rod first end **172** thereby causing hydraulic-cylinder rod **170** to move along a linear path away from a retracted position towards an extended position. Conversely, as hydraulic cylinder **160** moves from the bottom of the hydraulic-cylinder stroke towards a retracted position, hydraulic cylinder **160** relieves the downward force upon hydraulic cylinder rod **170** thereby causing hydraulic cylinder rod **170** to move away from an extended position and towards a retracted position. By causing hydraulic cylinder rod **170** to extend and retract along a linear path, hydraulic cylinder **160** indirectly causes nozzle **190** to pivot between two positions; the first position being a position that nozzle **190** is in as a result of hydraulic cylinder **160** being in a fully retracted position (as shown in FIGS. **2**, **4**, and **10**) and the second position being a position that the nozzle is in as a result of hydraulic cylinder **160** being in a fully extended position (as shown in FIGS. **5** and **8**). In an embodiment, hydraulic cylinder **160** includes a linear sensor (not shown) configured to sense the position of a piston's relative position within the cylinder, thereby enabling a calculation directed to determining nozzle **190**'s angular degree of pivot relative to primary-fluid-conduit longitudinal axis **122**.

(16) In an embodiment, the angle created by the nozzle first position and the nozzle second position is greater than 90°. In another embodiment, the angle created by the nozzle first position and the nozzle second position is at least 80°. In still another embodiment, the angle created by the nozzle first position and the nozzle second position is about 110°.

(17) Nozzle **190** pivots between nozzle first position and nozzle second position by pivoting about pivot pin longitudinal axis **182** that is shown in FIG. **5**. Pivot pin **180** is fixedly attached to bifurcated head **150** in a position that is perpendicular or radial to the linear path of hydraulic cylinder rod **170**, and nozzle **190** pivots about pivot pin **180**. Hydraulic-cylinder-rod second end **174** is pivotally connected to nozzle **190** such that when hydraulic-cylinder rod **170** is in a retracted position, nozzle **190** is pivoted into nozzle first position (as shown in FIGS. **2**, **4**, and **10**) about pivot-pin longitudinal axis **182**. And when hydraulic-cylinder rod **170** is fully extended from its retracted position, nozzle **190** is pivoted into nozzle second position (as shown in FIGS. **5** and **8**) about pivot-pin longitudinal axis **182**. Nozzle **190** is configured to pivot in a plane between the nozzle first position and the nozzle second position. Hydraulic-cylinder rod **170** is positioned within primary fluid conduit **120** and extends out of primary fluid conduit **120** to its pivotal connection to nozzle **190**. Nozzle **190** may occupy any intermediate position between the nozzle first position and the nozzle second position; the position of nozzle **190** as shown in FIG. **1** is an example of such an intermediate nozzle position.

(18) Apparatus **10** is further configured to rotate primary fluid conduit **120** at least 360° in either direction about primary-fluid-conduit longitudinal axis **122**. As shown in the figures, because rotatable primary-fluid-conduit fluid-exit end **126** is connected to nozzle **190** via bifurcated head **150**, nozzle **190** also rotates about primary-fluid-conduit longitudinal axis **122** as primary fluid

conduit **120** rotates about primary-fluid-conduit longitudinal axis **122**; as one rotates so does the other in an equal degree. Motor **140** is mounted to main housing **110** and configured to engage gear assembly **130** that is further configured to engage and rotate the primary fluid conduit **120** about primary-fluid-conduit longitudinal axis **122**. Motor **140** and gear assembly **130** are configured to rotate primary fluid conduit **120** at least 360° in either a first direction or a second direction. In embodiments, motor **140** and gear assembly **130** are configured to rotate primary fluid conduit **120** continuously in a first direction, e.g., clockwise, or in a second direction, e.g., counterclockwise. In an embodiment, rotational position sensor **220** is mounted to main housing **110** in a location that allows for sensing either directly or through gear movement, the rotational position of primary fluid conduit **120**.

(19) In an embodiment, apparatus **10** is configured to independently pivot nozzle **190** at least 90° in a plane while also being independently configured to rotate nozzle **190** at least 360° about primary-fluid-conduit longitudinal axis **122**. Because apparatus **10** has an independently pivoting nozzle **190** and an independently rotating nozzle **190**, apparatus **10** is capable of emitting a substantially linear fluid jet or fluid spray to a target substrate in a wide variety of patterns and configurations.

(20) Fluid flow into and out of apparatus **10** is as follows. In operation, and as shown in FIG. **13**, a pressurized hose, conduit, pipe, or known fluid-flow element introduces fluid into apparatus **10** through fluid intake port **115** and then fluid flows from fluid intake port **115** into primary fluid conduit **120** via primary-fluid-conduit fluid-intake end **124**. As shown in the figures, primary-fluid-conduit fluid-intake end is positioned substantially within main housing **110**, and fluid intake port **115** is configured to removably attach to a hose, conduit, pipe, or known fluid-flow element that is configured to deliver fluid into fluid intake port **115**. After entering into fluid intake port and then into primary fluid conduit **120** via primary-fluid-conduit fluid-intake end **124**, and as illustrated with the arrows (in FIG. **7**) showing fluid-flow path **300**, fluid flows through primary fluid conduit **120** and into bifurcated head **150**. Then, from bifurcated head **150**, the fluid enters into and subsequently exits nozzle **190**. In embodiments, primary fluid conduit **120** is tubing having a three-inch diameter. Bifurcated head **150** is configured to split fluid flow from primary fluid conduit **120** into each of the two fluid-flow paths or parallel fluid conduits **152**, **154** within bifurcated head **150**. Bifurcated head **150** is configured such that both of the parallel fluid conduits **152**, **154** lead from primary fluid conduit **120** and enter into nozzle **190**. In embodiments, the parallel fluid conduits **152**, **154** are respectively configured to enter into opposite sides of nozzle **190**. In embodiments, nozzle **190** includes nozzle straightener **192** and nozzle tip **194**. In embodiments, nozzle straightener **192** is tubular having a diameter that is 1.5 inches. In embodiments, nozzle **190** has nozzle tip **194** having a fluid-emitting orifice that has a diameter ranging from 0.5 to 1.0 inches. Nozzle tip **194** can be any known nozzle tip and can be configured to emit a substantially linear jet of fluid or any variety of known fluid spray configurations. In embodiments, the emitted jet of fluid is substantially non-diffused and linear.

(21) Controller **210** is mounted to main housing and configured to control motor **140** and hydraulic cylinder **160**. In an illustrative embodiment, controller **210** is implemented as a computing system **222**, as shown in FIG. **9**, that is configured and/or programmed with one or more of the example systems and methods described herein, and/or equivalents. As shown, the computing system **222** includes processing circuitry **224** that is responsive to input instructions corresponding to operational states of the apparatus **10**, to control adjustment of a position, orientation, or other property of the nozzle **190** as described herein. For example, the input instructions can be included as a data structure pre-programmed and stored in a non-transitory, computer-readable medium **226**; manually input by an operator during operation of the apparatus **10** via a network device **228** such as a user interface, for example; correspond to control signals transmitted by an automated network device **228** such as one or more sensors to be received by the processing circuitry **224**, any combination thereof, or otherwise transmitted to the processing circuitry **224**.

(22) As an example, the processing circuitry **224** includes a processor **232**, an integrated memory

234, and input/output ports **236** controlled by an input/output (I/O) interface **244** operably connected by a data bus **238**. Examples of the processor **232** include, but are not limited to single or multi-processor architectures. The processing circuitry **224** can include nozzle positioning logic **240** that controls a position and/or orientation of the nozzle **190** as described herein. The nozzle positioning logic **240** may be implemented in hardware, a computer-readable medium with stored instructions that are executable by processor **232**, firmware, and/or combinations thereof. While the nozzle positioning logic **240** is illustrated as a hardware component attached to data bus **238**, it is to be appreciated that in other embodiments, the nozzle positioning logic **240** could be implemented in processor **232**, stored in memory **234**, or stored in a remote computer-readable medium **226** or other electronic storage device that is separate from, but operatively connected to processing circuitry **224**. For embodiments including remote computer-readable medium **226**, computer-readable medium **226** may be operably connected to processing circuitry **224** via, for example, an input/output (I/O) interface (e.g., card, device) **244**, which includes one or more of the input/output ports **236**.

(23) The processing circuitry **224** described above can be integrated with, and form a portion of apparatus **10**. As another example, nozzle positioning logic **240** and/or processing circuitry **224** can constitute a means (e.g., structure: hardware; non-transitory, computer-readable medium; firmware; etc.) for performing the actions described herein that is remotely located, but operatively connected to the apparatus **10** via a suitable communication channel. Examples of such embodiments include, but are not limited to processing circuitry **224** configured as a server or other terminal operating in a cloud computing system, such as a smartphone, laptop, desktop, tablet computing device, and so on, that remotely transmits control instructions to apparatus **10** for controlling nozzle **190**, and accordingly, a direction of fluid spray. Such means may be implemented, for example, as an application-specific integrated circuit ("ASIC"), programmed to receive relative or absolute positional data for controlling nozzle **190**, parse the positional data to generate the corresponding control instruction that, when executed, drives motor **140** and/or hydraulic cylinder **160** as described herein. As another example, the means may also be implemented as stored computer-executable instructions that are presented to processing circuitry **224** as data **242** from a remote source over a communication network, that are temporarily stored in memory **234** and then executed by processor **232**. Examples of the communication network include, but are not limited to, a local area network ("LAN"), a wide area network ("WAN"), and other networks.

(24) The processing circuitry **224** may interact with one or more of the network devices **246** via. I/O interfaces **244** and input/output ports **236**. Input/output devices may be, for example, any type of user interface that allows an operator to input a command for controlling the position of nozzle **190**. According to some embodiments, examples of I/O devices **246** include, but are not limited to, a keyboard, a microphone, a pointing and selection device, joystick, cameras, video cards, displays, the computer-readable medium **226**, other devices operatively connected to the processing circuitry **224** via a communication network, and so on. The input/output ports **236** may include, for example, serial ports, parallel ports, USB ports, wireless communication channels (e.g., Bluetooth radios, IEEE 802.1x compliant radios, etc).

(25) In one or more embodiments, the disclosed methods or their equivalents are performed by either: computer hardware configured to perform the method; or computer instructions embodied in a module stored in computer-readable medium where the instructions are configured as an executable algorithm configured to perform the present processes when executed by at least a processor of processing circuitry **224**.

(26) The following includes definitions of selected terms employed herein. The definitions include various examples and/or forms of components that fall within the scope of a term and that may be used for implementation. The examples are not intended to be limiting. Both singular and plural forms of terms may be within the definitions.

(27) References to "one embodiment," "an embodiment," "one example," "an example," and so on,

indicate that the embodiment(s) or example(s) so described may include a particular feature, structure, characteristic, property, element, or limitation, but that not every embodiment or example necessarily includes that particular feature, structure, characteristic, property, element, or limitation. Furthermore, repeated use of the phrase "in one embodiment" does not necessarily refer to the same embodiment, though it may.

(28) A "data structure," as used herein, is an organization of data in a computing system that is stored in a memory, a storage device, or other computerized system. A data structure may be any one of, for example, a data field, a data file, a data array, a data record, a database, a data table, a graph, a tree, a linked list, and so on. A data structure may be formed from and contain many other data structures (e.g., a database includes many data records). Other examples of data structures are possible as well, in accordance with other embodiments.

(29) "Computer-readable medium" and "memory," as used herein, refer to a non-transitory medium that stores instructions and/or data configured to perform one or more of the disclosed functions when executed by at least a processor. Data may function as instructions in some embodiments. A computer-readable medium **226** and memory **234** may take forms, including, but not limited to, non-volatile media, and volatile media. Non-volatile media may include, for example, optical disks, magnetic disks, and so on. Volatile media may include, for example, semiconductor memories, dynamic memory, and so on. Common forms of a computer-readable medium **226** and memory **234** may include, but are not limited to, a floppy disk, a flexible disk, a hard disk, a magnetic tape, other magnetic medium, an application specific integrated circuit (ASIC), a programmable logic device, a compact disk (CD), other optical medium, a random access memory (RAM), a read-only memory (ROM), a memory chip or card, a memory stick, solid-state storage device (SSD), flash drive, and other media from which a computer, a processor or other electronic device can retrieve and store data and/or instructions. Each type of media, if selected for implementation in one embodiment, may include stored instructions of an algorithm configured to perform one or more of the disclosed and/or claimed functions.

(30) "Logic," as used herein, represents a component that is implemented with computer or electrical hardware (e.g., computer-readable medium **226** and/or memory **234**), a non-transitory medium with stored instructions of an executable application or program module, and/or combinations of these to perform any of the functions or actions as disclosed herein, and/or to cause a function or action from another logic, method, and/or system to be performed as disclosed herein. Equivalent logic may include firmware, a microprocessor programmed with an algorithm, a discrete logic (e.g., ASIC), at least one circuit, an analog circuit, a digital circuit, a programmed logic device, a memory device containing instructions of an algorithm, and so on, any of which may be configured to perform one or more of the disclosed functions. In one embodiment, logic may include one or more gates, combinations of gates, or other circuit components configured to perform one or more of the disclosed functions. Where multiple logics are described, it may be possible to incorporate the multiple logics into one logic. Similarly, where a single logic is described, it may be possible to distribute that single logic between multiple logics. In one embodiment, one or more of these logics are corresponding structure associated with performing the disclosed and/or claimed functions. Choice of which type of logic to implement may be based on desired system conditions or specifications. For example, if greater speed is a consideration, then hardware would be selected to implement functions. If a lower cost is a consideration, then stored instructions/executable application would be selected to implement the functions.

(31) An "operable connection," or a connection by which entities are "operably connected," is one in which signals, physical communications, and/or logical communications may be sent and/or received. An operable connection may include a physical interface, an electrical interface, and/or a data interface. An operable connection may include differing combinations of interfaces and/or connections sufficient to allow operable control. For example, two entities can be operably connected to communicate signals to each other directly or through one or more intermediate

entities (e.g., processor, operating system, logic, non-transitory computer-readable medium). Logical and/or physical communication channels can be used to create an operable connection.
(32) Mounting flange **200** is fixedly attached to main housing **110** and configured to facilitate mounting apparatus **10** to a substantially planar surface. In embodiments, and as shown in FIGS. **10** and **11**, mounting flange **200** is configured to facilitate mounting apparatus **10** onto a substantially planar fluid storage tank roof (shown but not numerated) such that when mounted, main housing **110** is positioned above the fluid-storage-tank roof and both primary fluid conduit **120** and nozzle **190** are positioned within the fluid storage tank. For the purposes of this invention, a fluid storage tank roof having slight curvature is considered to be substantially planar. In a fluid-storage-tank-roof-mounted embodiment, primary fluid conduit **120** extends approximately four feet below mounting flange **200** and into a storage tank. In still other roof mounting embodiments, primary fluid conduit **120** extends below mounting flange **200** and into a storage tank any useful distance as is determined through routine experimentation; stated differently, primary fluid conduit **120** can be any useful length as is determined through routine experimentation.
(33) In other embodiments, as shown in FIG. **12**, mounting flange **200** is configured to mount apparatus **10** to a fluid-storage-tank sidewall such that when mounted, primary fluid conduit **120** is perpendicular or normal to a substantially planar fluid storage tank sidewall; for the purposes of this invention, a fluid storage tank sidewall having slight curvature is considered to be substantially planar. In embodiments, mounting flange **200** is configured to mount apparatus **10** onto a substantially planar fluid-storage-tank sidewall such that when mounted, main housing **110** is positioned outside of the fluid-storage-tank sidewall and both primary fluid conduit **120** and nozzle **190** are positioned within the fluid storage tank. In another sidewall mounted embodiment, primary fluid conduit **120** extends approximately four feet into a storage tank. In still other fluid-storage-tank sidewall mounting embodiments, primary fluid conduit **120** extends into a storage tank any useful distance as is determined through routine experimentation; stated differently, primary fluid conduit **120** can be any useful length as is determined through routine experimentation. In sidewall mounting embodiments, the angle created by nozzle first position and the nozzle second position is about 160°; in other embodiments, the angle created by nozzle first position and the nozzle second position is about 180°.
(34) Apparatus **10** is configured to withstand fluid pressures up to 1,000 psi. In embodiments, operating pressures range from 300 psi to 600 psi.
(35) In addition to the above embodiments that describe hydraulically driven components, in alternate embodiments, those hydraulically driven components can be replaced or interchanged with pneumatically driven components. Persons of ordinary skill in the art will be able to interchange pneumatic and hydraulic components without having to exercise undue experimentation.
(36) While the disclosed embodiments have been illustrated and described in considerable detail, it is not the intention to restrict or in any way limit the scope of the appended claims to such detail. It is, of course, not possible to describe every conceivable combination of components or methodologies for purposes of describing the various aspects of the subject matter. Therefore, the disclosure is not limited to the specific details or the illustrative examples shown and described.

Claims

1. An apparatus for cleaning a surface with a liquid jet, the apparatus comprising: a main housing; a primary fluid conduit having a longitudinal axis and two ends, a fluid-intake end and a fluid-exit end; a gear assembly; a motor mounted to the main housing and configured to engage the gear assembly and thereby rotate the primary fluid conduit about the primary-fluid-conduit longitudinal axis; a bifurcated head connected to the primary-fluid-conduit fluid-exit end, the bifurcated head having two fluid conduits; a hydraulic cylinder; a hydraulic-cylinder rod having a first end and a

second end; a pivot pin having a longitudinal axis and the pivot pin being attached to the bifurcated head; a nozzle connected pivotally to the pivot pin; the hydraulic cylinder mounted to the main housing and configured to move the hydraulic-cylinder rod along a linear path by exerting a unidirectional force upon the first end of the hydraulic-cylinder rod; the hydraulic-cylinder rod positioned within the primary fluid conduit and the second end of the hydraulic-cylinder rod pivotally connected to the nozzle; and the nozzle configured to pivot about the pivot-pin longitudinal axis as the hydraulic-cylinder rod moves along the linear path.

2. The apparatus of claim 1, further comprising a mounting flange upon which the apparatus is configured to mount to a substantially planar surface.

3. The apparatus of claim 1, further comprising a controller configured to rotate the primary fluid conduit by engaging the motor and pivot the nozzle by engaging the hydraulic cylinder.

4. The apparatus of claim 1, wherein the motor is a hydraulic motor.

5. The apparatus of claim 1, wherein the apparatus further comprises a rotational positional sensor that is configured to sense the rotational position of the primary fluid conduit.

6. The apparatus of claim 1, wherein the bifurcated head has parallel fluid conduits.

7. An apparatus for cleaning a surface with a liquid jet, the apparatus comprising: a main housing; a primary fluid conduit having a longitudinal axis and two ends, a fluid-intake end and a fluid-exit end; a gear assembly; a motor mounted to the main housing and configured to engage the gear assembly and thereby rotate the primary fluid conduit about the primary-fluid-conduit longitudinal axis; a bifurcated head connected to the primary-fluid-conduit fluid-exit end, the bifurcated head having parallel fluid conduits; a hydraulic cylinder; a hydraulic-cylinder rod having a first end and a second end; a pivot pin having a longitudinal axis and the pivot pin being attached to the bifurcated head; a nozzle connected pivotally to the pivot pin; the hydraulic cylinder mounted to the main housing and configured to move the hydraulic-cylinder rod along a linear path by exerting a unidirectional force upon the first end of the hydraulic-cylinder rod; the hydraulic-cylinder rod positioned within the primary fluid conduit and the second end of the hydraulic-cylinder rod pivotally connected to the nozzle; the nozzle configured to pivot about the pivot-pin longitudinal axis as the hydraulic-cylinder rod moves along the linear path; a mounting flange upon which the apparatus is configured to mount to a substantially planar surface; a controller configured to rotate the primary fluid conduit by engaging the motor and pivot the nozzle by engaging the hydraulic cylinder; and a rotational positional sensor that is configured to sense the rotational position of the primary fluid conduit.

8. An apparatus for cleaning a surface with a liquid jet, the apparatus comprising: a main housing; a primary fluid conduit having a longitudinal axis and two ends, a fluid-intake end and a fluid-exit end; a gear assembly; a motor mounted to the main housing and configured to engage the gear assembly and thereby rotate the primary fluid conduit about the primary-fluid-conduit longitudinal axis; a bifurcated head connected to the primary-fluid-conduit fluid-exit end, the bifurcated head having at least one fluid conduit; a cylinder; a cylinder rod having a first end and a second end; a pivot pin having a longitudinal axis and the pivot pin being attached to a head having a fluid-conduit therein; a nozzle connected pivotally to the pivot pin; the cylinder mounted to the main housing and configured to move the cylinder rod along a linear path by exerting a unidirectional force upon the first end of the cylinder rod; the cylinder rod positioned within the primary fluid conduit and the second end of the cylinder rod pivotally connected to the nozzle; and the nozzle configured to pivot about the pivot-pin longitudinal axis as the cylinder rod moves along the linear path.

9. The apparatus of claim 8, further comprising a mounting flange upon which the apparatus is configured to mount to a substantially planar surface.

10. The apparatus of claim 8, further comprising a controller configured to rotate the primary fluid conduit by engaging the motor and pivot the nozzle by engaging the cylinder.

11. The apparatus of claim 8, wherein the motor is a hydraulic motor.

12. The apparatus of claim 8, wherein the apparatus further comprises a rotational positional sensor that is configured to sense the rotational position of the primary fluid conduit.
13. The apparatus of claim 8, wherein the bifurcated head has parallel fluid conduits.