FLUID FITTING WITH INTEGRATED FLUID MANAGEMENT DEVICE

Abstract

What is presented is a fluid fitting used in a facility that has a plurality of surfaces and a source of fluid pressure. The fluid fitting comprises a mounting component, a conduit adapter, a port, and a fluid management device. The mounting component makes the fluid fitting mountable on the external side of the surface. The conduit adapter is connectable to the fluid handling conduit on the internal side of the surface. The port has a flow path to the conduit adapter that enables a fluid connection between the conduit adapter and the port. The fluid management device is permanently incorporated in the flow path such that the fluid management device is permanently connected to the port at the fluid dispensing point.
FLUID FITTING WITH INTEGRATED FLUID MANAGEMENT DEVICE

[0001] This application takes priority from U.S. non-provisional application Ser. No. 11/559,542 filed Nov. 14, 2006 which is incorporated herein by reference.

BACKGROUND

[0002] In facilities with fluid pressure sources, networks of fluid handling, conduits are used to distribute fluids or provide vacuum with fluid fittings installed where fluid is dispensed or vacuum is provided. An improved fluid fitting for connection to fluid handling conduits is provided.

SUMMARY

[0003] What is presented is a fluid fitting used in a facility that has a surface and a source of fluid pressure. The surface has an external side and an internal side. The facility has a fluid handling conduit that extends from the source of fluid pressure to the surface and the fluid fitting can be connected to this fluid handling conduit.

[0004] The fluid fitting comprises a mounting component, conduit adapter, port, and fluid management device. The mounting component makes the fluid fitting mountable to the external side of the surface. The conduit adapter is connectable to the fluid handling conduit on the internal side of the surface. The port protrudes from the fluid fitting on the external side of the surface and has a fluid dispensing point on the external side of the surface. The port also has a flow path to the conduit adapter that enables a fluid connection between the conduit adapter and the port. The flow path establishes a fluid connection from the fluid handling conduit to the port through the external side of the surface. The fluid management device is permanently incorporated in the flow path such that the fluid management device is permanently connected to the port at the fluid dispensing point. Moreover, the fluid management device provides functionality on the external side of the surface.

[0005] The fluid fitting could comprise a second port that protrudes from the fluid fitting on the external side of the surface. The second port has a second fluid dispensing point on the external side of the surface. The second port also has a second flow path to the conduit adapter to enable a fluid connection between the conduit adapter and the second port.

[0006] The fluid management device could provide functionality on the external side of the surface or the fluid management device could provide functionality on both the internal and external sides of the surface. The fluid management device could comprise a flow meter. It is possible that the flow meter has one or more selectable calibrated orifices that are used to select the fluid flow rate in the flow path. The fluid fitting could also comprise a flow measuring device that is for indicating the rate of fluid flow in the flow path. The fluid management device could be a Thorpe tube and ball that comprises a vertically mounted tube and an indicator floater placed within the vertically mounted tube.

[0007] The surface could be one of the following: a wall, a semi-recessed flat wall, a service column, a horizontal headwall, a ceiling mounted service column, an equipment rail, a wall panel, a floor panel, a ceiling panel, a bed, a surgical table, or a floor pedestal. The fluid fitting could supply fluid under positive pressure.

BRIEF DESCRIPTION OF DRAWINGS

[0008] For a more complete understanding and appreciation of this invention, and its many advantages, reference will be made to the following detailed description taken in conjunction with the accompanying drawings.

[0009] FIG. 1A is a schematic outlining the layout of an embodiment of a fluid fitting attached to a fluid handling conduit that is connected to a fluid supply source;

[0010] FIG. 1B is a schematic outlining the layout of an embodiment of a fluid fitting attached to a fluid handling conduit that is connected to a vacuum system;

[0011] FIG. 2A is a schematic outlining the layout of an embodiment of a fluid fitting attached to a fluid handling conduit that is connected to a fluid supply source;

[0012] FIG. 2B is a schematic outlining the layout of an embodiment of a fluid fitting attached to a fluid handling conduit that is connected to a vacuum system;

[0013] FIG. 3 is a perspective view of the front of an embodiment of the fluid fitting;

[0014] FIG. 4 is a perspective view of the rear of the embodiment of the fluid fitting shown in FIG. 3;

[0015] FIG. 5 is an exploded view of the front of the embodiment of the fluid fitting shown in FIG. 3;

[0016] FIG. 6 is a cross sectional view through the line 6-6 shown in FIG. 3;

[0017] FIG. 7 is a cross sectional view through the line 7-7 shown in FIG. 3;

[0018] FIG. 8 is a cross sectional view through the line 8-8 shown in FIG. 3;

[0019] FIG. 9 is an exploded view of the rear of the embodiment of the fluid fitting shown in FIG. 3;

[0020] FIG. 10 is a close up perspective view of the flow meter of the embodiment of the fluid fitting shown in FIG. 3;

[0021] FIG. 11 is a perspective view of the flow meter of the embodiment of the fluid fitting shown in FIG. 10;

[0022] FIG. 12 is a close up perspective view of another embodiment of a flow meter that could be used as the fluid management device of the fluid fitting;

[0023] FIG. 13 is a different perspective view of the flow meter shown in FIG. 12;

[0024] FIG. 14 is a perspective view of the front of another embodiment of the fluid fitting;

[0025] FIG. 15 is a cross sectional view through the line 15-15 shown in FIG. 14;

[0026] FIG. 16 is an exploded view of the front of the embodiment of the fluid fitting shown in FIG. 14;

[0027] FIG. 17 is a schematic outlining the layout of another embodiment of a fluid fitting;

[0028] FIG. 18 is a perspective view of an example of implementation of the schematic shown in FIG. 17;

[0029] FIG. 19 is a cross sectional view through the line 19-19 shown in FIG. 18;

[0030] FIG. 20 is a schematic outlining the layout of another embodiment of a fluid fitting;

[0031] FIG. 21 is a perspective view of an example of implementation of the schematic shown in FIG. 20;

[0032] FIG. 22 is a cross sectional view through the line 22-22 shown in FIG. 21;

[0033] FIG. 23 is an exploded view of the front of another embodiment of a fluid fitting;

[0034] FIG. 24 is a perspective view of the front of another embodiment of the fluid fitting that includes a fluid flow indicator;
FIG. 25 is a cross sectional view of one embodiment of a fluid flow indicator when there is no fluid passing through it;

FIG. 26 is a cross sectional view of the embodiment of a fluid flow indicator shown in FIG. 25 when there is fluid passing through it;

FIG. 27 is a cross sectional view of another embodiment of a fluid flow indicator;

FIG. 28A is a perspective view of the front of a modified knob;

FIG. 28B is a perspective view of the rear of a modified knob;

FIG. 29A is a perspective view of the front of a knob spring assembly to which the knob shown in FIGS. 28A and 28B may be connected;

FIG. 29B is a perspective view of the front of a knob spring assembly to which the knob shown in FIGS. 28A and 28B may be connected;

FIG. 30 is an exploded view of the front of an embodiment of the fluid fitting that incorporates the knob and knob spring assembly shown in FIGS. 28A through 28B;

FIG. 31A is a perspective view of an assembled knob and knob spring assembly show in FIGS. 28A through 28B in a stable position;

FIG. 31B is a cross-sectional view through the line 31B-31B shown in FIG. 31A;

FIG. 32A is a perspective view of an assembled knob and knob spring assembly show in FIGS. 28A through 28B in an unstable position;

FIG. 32B is a cross-sectional view through the line 32B-32B shown in FIG. 32A;

FIG. 33 is a perspective view of another embodiment of a fluid fitting; and

FIG. 34 is side view of the embodiment of fluid fitting shown in FIG. 3 that is being used in a mobile facility.

DETAILED DESCRIPTION

Referring to the drawings, some of the reference numerals are used to designate the same or corresponding parts through several of the embodiments and figures shown and described. Corresponding parts are denoted in specific embodiments with the addition of lowercase letters. Variations of corresponding parts in form or function that are depicted in the figures are described. It will be understood that generally variations in the embodiments can be interchanged without deviating from the invention.

Fluid handling systems installed in facilities generally involve supplying fluid to or removing fluids from various points in the facility and generally comprise a source of fluid pressure with fluid handling conduits that connect the fluid pressure source to the point of use. The fluid pressure is positive, for example in an oxygen supply line in a medical facility, or negative, for example in a vacuum supply in surgical rooms for the removal of bodily fluids. In either situation, a fluid fitting of some sort is required for connection to the fluid handling conduit at the dispensing point to allow users access to the fluid supply or vacuum. What is provided is an improved fluid fitting in which a fluid management device or devices are incorporated into the fluid fitting. The improved fluid fittings can have any number of ports to provide multiple connections at a single fluid fitting.

FIG. 1A shows a schematic of a fluid fitting 20 connected to fluid handling conduit 18 that is attached to a fluid source 16. The fluid fitting 20 comprises a housing 32 with a port 26 at the fluid dispensing point, a conduit adapter 28 connectable to the fluid handling conduit 18, a supply channel 29 that creates a flow path from the port 26 to the conduit adapter 28, and a fluid management device 22 incorporated in the flow path between the port 26 and the conduit adapter 28. A mounting component 24 enables the fluid fitting 20 to be attached to a surface in the facility where the fluid is to be dispensed.

The fluid management device 22 can be any device that maintains, regulates, monitors, or otherwise provides the user some additional functionality to the fluid fitting 20. For example, the fluid management device 22 can be a flowmetering device, flow rate measuring device, a fluid flow indicator, a fluid regulator, a fluid conserver, a chemical composition sensor, or any other device that adds functionality to the fluid fitting 20. These devices can be mechanical or electronic. As described herein, the flow path between the port 22 and the conduit adapter 28 can incorporate a single fluid management device 22 or multiple devices.

The fluid fitting 20 can be mounted on walls in front of fluid handling conduits, on the headwalls above patient beds, semi-recessed flat walls, free standing power and utility service columns, horizontal headwalls, ceiling mounted service columns, equipment rails, floor mounted pedestals, wall panels, floor panels, ceiling panels, beds, surgical tables, or any other location at which a fluid fitting is required. The fluid fittings could be used in facilities such as hospitals, laboratories, schools, etc. As shown in FIG. 34, the fluid fitting 20 could be used in mobile in mobile facilities 23, such as ambulances (as shown), aircraft, ships, etc.

FIG. 1B shows another embodiment of the fluid fitting 20a mounted to fluid handling conduit 18a that is connected to a vacuum source 17a. In this embodiment fluid flows in the opposite direction as that shown in FIG. 1A and the port 26a serves as a fluid inlet. The fluid management device 22a could be any device appropriate for the management of vacuum lines.

The fluid fitting can also integrate more than one port. FIG. 2A shows a fluid fitting 20b connected to a fluid supply source 16b that integrates a second port 30b connected to the conduit adapter 28b through an unregulated supply channel 33b that is integrated into the housing 32b. The schematic shown in FIG. 2A shows the second port 30b without an integrated fluid management device, but an additional fluid management device could be incorporated with the second port 30b if so desired. The fluid fitting 20b can be designed to have additional ports with or without integrated fluid management devices as required by the particular application. FIG. 2B shows a fluid fitting 20c with two ports 26c and 30c connected to a vacuum source 17c.

FIGS. 3 through 11 show one embodiment of a fluid fitting 20d having a first port 26d and a second port 30d. The first port 26d has an integrated fluid management device 22d in the flow path between the first port 26d and the conduit adapter 28d. The second port 30d has no fluid management device associated with it. In this embodiment, the fluid management device 22d is a flowmeter 22d. Comparing FIGS. 3 and 4, the fluid fitting 20d comprises a mounting component 24d with a housing 32d for the internal components of the fluid fitting 20d. Mounting screws 34d secure the fluid fitting 20d in place through holes 43d on a mounting bracket 41d on a fluid handling conduit 18d. The mounting bracket 41d is typically located behind a surface of the facility, such as a wall or a utility column. The conduit adapter 28d connects the fluid
fitting 20d to the conduit socket 27d of the fluid handling conduit 18d to establish a fluid connection between the fluid fitting 20d and the fluid handling conduit 18d. The flowmeter (22d shown in subsequent figures) is located within the housing 32d and is installed in the flow path between the first port 26d and the conduit adapter 28d. An unregulated supply channel (33d shown in FIG. 8) located within the housing 32d connects the second port 30d to the conduit adapter 28d.

[0057] Facilities with fluid distribution systems often require distribution of more than one kind of fluid with independent fluid handling conduits 18d each supplying different fluids or vacuum. Thus it is important to be able to identify the function of a fluid handling conduit 18d. To differentiate between the contents of different fluid handling conduits, an indexing system has been adopted by the industry. The fluid fitting 20d incorporates such a system. Each location along the fluid handling conduit 18d that a fluid fitting 20d may be connected has a mounting bracket 41d on which a conduit socket 27d is provided. The mounting bracket 41d is installed recessed behind a surface with screws (not shown) through holes 45d so that an installed fluid fitting 20d does not extend much beyond the surface. The mounting bracket 41d is equipped with a set of conduit indexing sockets 37d. The type of fluid supplied by the fluid handling conduit determines the number and spacing of the conduit indexing sockets 37d. As shown in FIG. 4, the rear of the housing 32d includes a number of fitting indexing sockets 38d that correspond to every possible combination of conduit indexing sockets 37d. Indexing pins 36d are inserted in various combinations within the fitting indexing sockets 38d to correspond to conduit indexing sockets 37d on the fluid handling conduit 18d. The fluid fitting 20d may only be connected to a fluid handling conduit 18d if the appropriate combination of indexing pins 36d are inserted in the fitting indexing sockets 38d to match up with the conduit indexing sockets 37d on the mounting bracket 41d. The indexing pins 32d are installed in fluid fitting 20d during the manufacturing process and cannot be removed or rearranged by the user. This reduces incidences of fluid fittings 20d being connected to the wrong fluid handling conduit 18d. The relationship between a particular combination of indexing pins 32d to the function of the fluid handling conduit 18d is established by industry practice.

[0058] As can be best understood by comparing FIGS. 3 and 5, the components of the flowmeter 22d are installed in an orifice chamber 48d located within the housing 32d. A faceplate 42d with identifying information for the particular application of the fluid fitting 20d is mounted onto a recess in the housing 32d. A knob 46d is installed on a knob stem 86d to control the flowmeter 22d. Mounting screws 34d are inserted into the appropriate holes 35d in the faceplate 42d and the housing 32d for installation on the mounting bracket 41d.

[0059] As can be best understood by comparing FIGS. 5 and 6, the flowmeter 22d comprises an orifice disc 50d, a washer 52d, a sealing disc 54d with a groove 57d into which an o-ring 56d fits, and a knob stem 86d. The sealing disc 54d and the oring 56d are sized to form a seal against the sides of the orifice chamber 48d. The orifice chamber 48d includes a spring recess 68d into which a spring 58d and a ball 60d are placed. As will be described in greater detail below, to help maintain the flowmeter 22d at a selected position, the spring 58d pushes against the ball 60d, which pushes against the orifice disc 50d. The orifice chamber 48d also includes a counter bore 70d that provides a fluid connection from the conduit adapter 28d to the flowmeter 22d through a supply hole 72d. A pair of o-rings 62d are placed in the count bore 70d. The orings 62d are sized to form a seal against the sides of the regulated port chamber 66d and the unregulated port chamber 64d, respectively. As shown in FIG. 7, supply channel 29d connects the orifice chamber 48d to the regulated port chamber 66d. FIG. 8 shows the fluid flow path of the unregulated second port 30d. An unregulated supply channel 33d connects the conduit adapter 28d to the unregulated port chamber 64d and the second port 30d. The unregulated supply channel 33d is formed by drilling through the housing 32d to the inlet chamber 76d. The resulting hole in the housing 32d is sealed with a plug 39d.

[0060] As can be best understood by comparing FIGS. 4 and 9, a sealing washer 76d is placed between the conduit adapter 28d and the inlet chamber 76d to ensure a leak free seal. The indexing pins 32d are inserted in the appropriate housing indexing sockets 38d to correspond to the indexing sockets on the fluid handling conduit. A back plate 40d, with appropriately sized holes to accommodate the indexing pins 36d, the conduit adapter 28d, and the mounting screws 34d, is installed to the back of the housing 32d with rivets 80d. The conduit adapter 28d is further secured with an adapter washer 82d and washer screws 84d.

[0062] A close-up of the flowmeter 22d used in the embodiments shown in FIGS. 3 through 9 is depicted in FIG. 10 showing the o-ring 56d installed within the groove 57d of the sealing disc 54d. The washer 52d is shown at its installed location adjacent the sealing disc 54d. The o-ring 56d is sized to press against the side of the orifice chamber 48d to form a leak-free seal, as shown in FIG. 6. The orifice disc 50d comprises a knob stem 86d that extends through the center of the orifice disc 50d. A stem extension 88d extends slightly from the rear of the orifice disc 50d. The stem extension 88d fits in to the stem hole 74d shown in FIG. 6 to help keep the flowmeter 22d aligned in the fluid fitting 20d. The base of the knob stem 86d has grooves 87d to seat the sealing disc 54d and the washer 52d. The distal end 86d of the knob stem 86d has a D-shape to accommodate the knob 46d and to prevent the knob 46d from slipping on the knob stem 86d.

[0063] As can be best understood by comparing FIGS. 10 and 11, the orifice disc 50d includes a series of orifice holes 90d drilled in a circle near the outer circumference of the orifice disc 50d. Each of the orifice holes 90d is sized to allow a predetermined fluid flow rate through it at a specific pressure. The fluid supply systems of medical facilities typically operate at around 50 to 60 pounds per square inch (psi). Each orifice hole 90d empties into a secondary chamber 92d that houses a ball bearing 94d. The ball bearing 94d is used for calibration of the flow through the orifice hole 90d. Each secondary chamber 92d has a secondary orifice 96d located around the perimeter of the orifice disc 50d. As shown in FIG. 6, when the flowmeter 22d is installed in the fluid fitting 20d, each secondary orifice 96d opens to the orifice chamber 48d in the housing 32d.

[0064] Referring again to FIGS. 10 and 11, each orifice hole 90d has a corresponding click index 98d located closer to the stem extension 88d. The click indices 98d are semispheri-
eral grooves that allow the proper alignment of the orifice holes 90/d with the supply hole 72/d. As can be best understood by comparing FIGS. 10, 11, and 6, when the flowmeter 22/d is installed in the fluid fitting 20/d, the spring 58/d in the spring recess 68/d presses the ball 60/d up against one of the click indices 98/d. The spring 58/d is strong enough to maintain the position of the flowmeter 22/d at a selected setting, but weak enough that turning the knob 46/d pushes the ball 60/d into the spring recess 68/d and allows the orifice disc 50/d to rotate about its axis. This rotation moves another click index 98/d over the spring recess and another orifice hole 90/d into position over the supply hole 72/d. The supply hole 72/d can be sized to limit the fluid flow rate to a predetermined maximum or can incorporate a flow restrictor (not shown).

[0065] Other designs of flowmeters can be incorporated as flow management devices in the fluid fitting. FIGS. 12 and 13 show another flowmeter embodiment comprising an orifice disc 50/e. As can be best understood by comparing FIGS. 12 and 13, the orifice disc 50/e comprises a series of orifice holes 90/e drilled in a circle near the outer circumference of the orifice disc 50/e through the thickness of the orifice disc 50/e. Each of orifice hole 90/e is sized to allow a predetermined fluid flow rate through it at a specific pressure. Counter bores 106/e are drilled into the orifice disc 50/e to reduce the depth to which each orifice hole 90/e must be drilled. The orifice holes 90/e open to the orifice chamber in which the flowmeter 22/e is installed. Other functions of this embodiment of the orifice disc 50/e perform similarly to the flowmeter embodiment depicted in FIGS. 10 and 11.

[0066] Other embodiments of the fluid fitting can include other types of flowmeters as fluid management devices such as adjustable flow control valves. As shown in FIGS. 14, 15, and 16, in one embodiment the adjustable flow control valve is a needle valve 22/x. The needle valve 22/x is located along the centerline of the counter bore 70/f. A flow restrictor 100/f calibrated to limit the fluid flow rate to a predetermined maximum is installed in the supply hole 72/f. The flow restrictor 100/f allows for calculations of the fluid flow rate based on the position of the needle valve 22/x in the counter bore 70/f.

[0067] As can be best understood by comparing FIGS. 15 and 16, the needle valve 22/x is housed within an orifice chamber 48/x. The needle valve 22/x comprises a stem 86/x with a shaft 102/x having external threads inserted into the fluid fitting 20/x. The tip of the shaft 102/x has a tapered needle 104/x that is aligned with the counter bore 70/f in the orifice chamber 48/x such that when the needle valve 22/x is in the closed position, the walls of the needle 104/x press against circumference of the flow restrictor 100/x to form a seal. The counter bore 70/f within the orifice chamber 48/x has internal threads to accommodate the external threads of the shaft 102/x. The shaft 102/x forms a leak-free seal against the counter bore 70/f. An o-ring 56/x is installed within the groove 57/x of the sealing disc 54/x. Washer 52/x is installed adjacent the sealing disc 54/x. The o-ring 56/x is sized to press against the side of the orifice chamber 48/x to form a leak-free seal.

[0068] The distal end of the knob stem 86/y has a D-shape to accommodate a corresponding D-shaped recess (not shown) in the knob 46/y. When the knob 46/y is turned, the knob stem 86/y is twisted counterclockwise to pull the shaft 102/y and the needle 104/y away from the flow restrictor 100/y. The resulting opening between the needle 104/y and the flow restrictor 100/y creates a fluid pathway from the inlet chamber 78/y to the supply channel (not shown), the regulated port chamber 66/y, and the first port 26/y. Further counterclockwise turning of the knob 46/y will increase the size of the opening between the needle 104/y and the flow restrictor 100/y, which increases the fluid flow rate through the first port 26/y. A valve stop (not shown) can be used to limit how far the knob 46/y can be turned in the counterclockwise direction. Turning the knob 46/y in a clockwise direction decreases the size of the opening between the needle 104/y and the flow restrictor 100/y, which decreases the fluid flow rate through the first port 26/y.

[0069] More than one fluid management device can be incorporated into the fluid path between a port and a conduit adapter. For example, flow measuring devices can be incorporated with flowmeters in the fluid fittings so that the fluid flow rate can be monitored. FIG. 17 is a schematic of a possible fluid fitting 20/g incorporating one type of flow measuring device 105/g that comprises an electronic flow sensor 106/g. While the embodiment shown in FIG. 17 comprises an electronic flow sensor 106/g, the flow measuring device 105/g can be electronic or mechanical (for example a Thorpe tube and ball or a rotating indicator like a paddle wheel or turbine). The flow sensor 106/g is connected to a digital display 108/g with a wire 107/g. The measured flow rate is displayed on the digital display 108/g. FIG. 18 shows a perspective view of a fluid fitting 20/h incorporating the features shown in FIG. 17. As shown in FIG. 19, the flow sensor 106/h is located in the flow path upstream of the flowmeter 22/h, but the sensor can be located downstream of the flowmeter 22/h, for example, in the regulated port chamber (not shown) or in the first port 26/h.

[0070] FIG. 20 is a schematic of another possible fluid fitting 20/i incorporating two fluid management devices, in this case a Thorpe tube 110/i as a flow measuring device 105/i and a flowmeter 22/i. FIG. 21 shows a perspective view of a fluid fitting 22/i incorporating the features depicted in FIG. 20. As can be best understood by comparing FIGS. 21 and 22, a Thorpe tube 110/i comprises a vertically mounted tube 110/i within which an indicator float 112/i is placed. The regulated supply channel 73/i is directed to the bottom of the vertically mounted tube 110/i and continues from the top of the vertically mounted tube 110/i to end at the flow restrictor 100/i. To operate the needle valve 22/j, the knob 46/j is twisted counterclockwise to pull the shaft 102/j and the needle 104/j away from the flow restrictor 100/j to create a fluid pathway from the inlet chamber 78/j to the first port 26/j. As fluid flows through the regulated supply channel 73/j, it enters the vertically mounted tube 110/j and pushes the indicator float 112/j upwards. The design of the indicator float 112/j is such that fluid is allowed to flow past it to continue through the vertically mounted tube 110/j. The higher the fluid flow rate, the higher the indicator float 112/j is pushed. The vertically mounted tube 110/j is marked to indicate the flow rate corresponding to the height of the indicator float 112/j in the tube. It will be noted that the Thorpe tube 110/j, 110/j can be upstream of the flowmeter 22/i, 22/i as in FIG. 20 or downstream of the flowmeter 22/i, 22/i as in FIG. 22.

[0071] The fluid fitting can include a fluid management device that merely maintains the integrity of the fluid flow path between the port and the conduit adapter. For example, FIG. 23 shows an exploded view of a fluid outlet which includes a stopper 150/k that plugs the orifice chamber 48/k while maintaining the fluid flow path between the port 26/k and the conduit adapter 26/k. The stopper 150/k has a pair of retaining arms 140/k that fit into the corresponding slots 142/k in the housing 32/k. An o-ring 56/k helps maintain a seal between the orifice chamber 48/k and the stopper 150/k. The
stopper 150k may be removed and replaced with different fluid management devices as required.  

Another fluid management device that the fluid fitting can have is a fluid flow indicator that provides a visual indication of fluid flow passing through whichever port the fluid flow indicator is in fluid connection with. FIG. 24 shows an example of a fluid fitting 20n in which a fluid flow indicator 114n is in fluid connection with the first port 26n. In this particular embodiment, the fluid fitting 20n comprises two fluid management devices—a stopper 150n and the fluid flow indicator 114n. As shown in FIGS. 25 and 26, the fluid flow indicator 114n comprises a casing 116n that includes a recess 118n, inlet and outlet connections 120n and 122n, and an indicator device 124n. FIG. 25 shows the indicator device 124n as a light plastic ball, but any device that would generally not impede the fluid flow through the fluid flow indicator 114n can be used. A window 126n is provided in the faceplate 42n through which the casing 116n is visible. The casing 116n can be made of a clear material or can include clear material on the side facing the window 126n such that the recess 118n is visible through the window 126n. As shown in FIG. 25, when there is no fluid flow passing through the port 26n that the fluid flow indicator 114n is connected to, the indicator device 124n lies in the flow path of the inlet connection 120n and cannot be seen through the window 126n. As shown in FIG. 26, when fluid flows through the fluid flow indicator 114n, the indicator device 124n is pushed into the recess 118n, which allows the fluid to continue past the indicator device 124n and thus the outlet connection 122n to the port 26n. The indicator device 124n is visible through the window 126n when it is pushed into the recess 118n by the fluid flow. For improved visibility, the indicator device 124n can be of a bright color or a color that contrasts with the color of the faceplate 42n. While only one fluid flow indicator is shown in the embodiment depicted in FIGS. 24 through 26, each port in the fluid fitting can have dedicated fluid flow indicators.

FIG. 27 shows an example of a fluid flow indicator 114m with a rotating indicator device 124m, in this case a paddle wheel 124m, installed in the fluid path between the inlet connection 120m and the outlet connection 122m. The paddle wheel 124m is installed with about halfway inside a recess 118m. The casing 116m can be made of a clear material or can include clear material on the side facing the window 126m such that the paddle wheel 124m is visible through the window 126m. When fluid flows through the fluid flow indicator 114m the paddles wheel 124m rotate and this movement is visible though the window 126m. For improved visibility, the paddle wheel 124m can be of a bright color or a color that contrasts with the color of the housing or each alternate paddle can be of a different color. Other rotating indicator devices such as turbines can also be used.

In fluid fittings that have fluid management devices that are flowmeters of the orifice disc types depicted in FIGS. 3 through 11, the flowmeter 22n has to be at discrete positions in order to establish a fluid connection between the fluid handling conduit 28n and the port 26n. Users must be certain that the orifice 90n corresponding to the selected flow rate is aligned with the supply hole 72n. This is also true of the flowmeter depicted in FIGS. 12 and 13 and any other type of flowmeter that has to be in a discrete position in order to maintain a fluid connection between the fluid handling conduit and the port.

One possible method of assuring this alignment is shown in FIGS. 28A through 32B. As can be best understood by comparing FIGS. 28A through 30, the underside of a knob has gears 128n surrounding the D-shaped recess 130n. This knob 46n is sized to fit over a knob 46n and rotate in the orifice chamber 48n of the fluid fitting 20n between the sealing disc 54n and the faceplate 42n. The housing 32n has slots 142n to accommodate the retaining arms 140n of the knob spring assembly 132n that serve to prevent the knob spring assembly 132n from rotating. The D-shaped recess 130n of the knob 46n fits over the knob stem 86n so that when the knob 46n turns, the orifice disc 50n will turn as well.

In its stable condition, the gears 128n of the knob 46n fit between the spring arms 138n, as shown in FIGS. 31A and 31B. When the knob 46n is twisted in either direction the springs arms 138n and the gears 128n are placed in an unstable position, as shown in FIGS. 32A and 32B, in which the spring arms 138n exert pressure on the gears 128n such that the knob 46n will be biased to return to a stable position. Each stable position corresponds to a particular flow rate setting on the flowmeter 22n such that, with the exception of an “off” setting, a fluid connection is maintained between the fluid handling conduit 28n and the port 26n.

Fluid fittings for connection to fluid handling conduits that carry vacuum can have fluid management devices designed for vacuum systems. For example, FIG. 33 shows a fluid fitting 20o with one port 26o with three fluid management devices: a pressure regulator 22o with a knob 46o, an analog gauge 144o for reading the regulated negative pressure, and a selector switch 146o with three modes—off, regulate, and full line pressure.

Other possible fluid management devices include vacuum pressure regulators and flowmeters of other designs, fluid conservers, fluid regulator, fluid flow rate sensors, chemical composition sensors, fluid flow indicators, and any other device that is capable of integration into a fluid fitting.

This invention has been described with reference to several preferred embodiments. Many modifications and alterations will occur to others upon reading and understanding the preceding specification. It is intended that the invention be construed as including all such alterations and modifications in so far as they come within the scope of the appended claims or the equivalents of these claims.

1. A fluid fitting for use in a facility having a surface and a source of fluid pressure, comprising: the surface having an external side and an internal side; the facility having a fluid handling conduit extending from the source of fluid pressure to the internal side of the surface; said fluid fitting comprising: a mounting component to enable said fluid fitting to be mounted to the external side of the surface; a conduit adapter connectable to the fluid handling conduit in the internal side of the surface; a port protruding from said fluid fitting on the external side of the surface, said port having a fluid dispensing point on the external side of the surface and said port having a flow path to said conduit adapter to enable a fluid connection between said conduit adapter and said port, said flow path establishing a fluid connec-
tion from said fluid handling conduit to said port through the external side of the surface; and 

a fluid management device permanently incorporated in said flow path such that said fluid management device is permanently connected to said port.

2. The fluid fitting of claim 1 further comprising:

a second port protruding from said fluid fitting on the external side of the surface, said second port having a second fluid dispensing point on the external side of the surface; and

said second port having a second flow path to said conduit adapter to enable a fluid connection between said conduit adapter and said second port.

3. The fluid fitting of claim 1 wherein said fluid management device provides functionality on the external side of the surface.

4. The fluid fitting of claim 1 wherein said fluid management device provides functionality between the internal side and external side of the surface.

5. The fluid fitting of claim 1 wherein said fluid management device comprises a flow measuring device for indicating the rate of fluid flow in said flow path.

6. The fluid fitting of claim 1 wherein said fluid management device comprises a flow measuring device for indicating the rate of fluid flow in said flow path and said flow measuring device is a Thorpe tube and ball.

7. The fluid fitting of claim 1 wherein said fluid management device comprises a flow measuring device for indicating the rate of fluid flow in said flow path; said flow measuring device is a Thorpe tube comprising a vertically mounted tube and an indicator floater placed within said vertically mounted tube.

8. The fluid fitting of claim 1 wherein:
said fluid management device provides functionality on the external side of the surface; and

said fluid management device comprises:
a flowmeter to receive and control the fluid flow rate in said flow path;
a flow measuring device for indicating the fluid flow rate in said flow path; and

said flow measuring device is a Thorpe tube comprising a vertically mounted tube and an indicator floater placed within said vertically mounted tube.

9. The fluid fitting of claim 1 wherein:
said fluid management device provides functionality on the external side of the surface; and

said fluid management device comprises:
a flowmeter with one or more selectable calibrated orifices to select the fluid flow rate in said flow path;
a flow measuring device for indicating the fluid flow rate in said flow path; and

said flow measuring device is a Thorpe tube comprising a vertically mounted tube and an indicator floater placed within said vertically mounted tube.

10. The fluid fitting of claim 1 wherein said surface is a wall, a semi-recessed flat wall, a service column, a horizontal headwall, a ceiling mounted service column, an equipment rail, a wall panel, a floor panel, a ceiling panel, a bed, a surgical table, or a floor pedestal.

11. The fluid fitting of claim 1 wherein the fluid fitting supplies fluid under positive pressure.

12. The fluid fitting of claim 1 wherein the fluid fitting supplies a vacuum.

13. A fluid fitting for use in a facility that has a surface and a source of fluid pressure, comprising:

the surface having an external side and an internal side; the facility having a fluid handling conduit extending from the source of fluid pressure to the internal side of the surface; and

said fluid fitting comprising:
a mounting component to enable said fluid fitting to be mounted to the external side of the surface; a conduit adapter connectable to the fluid handling conduit in the internal side of the surface; a port protruding from said fluid fitting on the external side of the surface, said port having a fluid dispensing point on the external side of the surface and said port having a flow path to said conduit adapter to enable a fluid connection between said conduit adapter and said port, said flow path establishing a fluid connection from said fluid handling conduit to said port through the external side of the surface; a second port protruding from said fluid fitting on the external side of the surface, said second port having a second flow path to said conduit adapter to enable a fluid connection between said conduit adapter and said second port; a fluid management device permanently incorporated in said flow path such that said fluid management device is permanently connected to said port, said fluid management device provides functionality on the external side of the surface; and

said fluid management device comprises:
a flowmeter to receive and control the fluid flow rate in said flow path; and

a Thorpe tube for indicating the fluid flow rate in said flow path, said Thorpe tube comprises a vertically mounted tube and an indicator floater placed within said vertically mounted tube.

14. The fluid fitting of claim 12 wherein said surface is a wall, a semi-recessed flat wall, a service column, a horizontal headwall, a ceiling mounted service column, an equipment rail, a wall panel, a floor panel, a ceiling panel, a bed, a surgical table, or a floor pedestal.

15. The fluid fitting of claim 1 wherein the fluid fitting supplies a vacuum.

16. The fluid fitting of claim 12 wherein the fluid fitting supplies fluid under positive pressure.