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QUICK CONNECT FOR A SPRAY SYSTEM

Abstract

A hose is connected to a spray gun or a pressurized fluid source by a quick connect coupler. The quick connect coupler can be integrated with the hose to form a hose assembly or can be integrated with a spray gun or pump. The quick connect coupler includes an internal piston that is pressure biased into sealing engagement with a fitting connected to the quick connect coupler.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION(S) [0001] This application claims priority to U.S. Provisional Application No. 63/555,692 filed Feb. 20, 2024 and entitled "QUICK

CONNECT FOR A SPRAY SYSTEM,” the disclosure of which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] The present disclosure relates generally to quick connect couplers. More particularly, this disclosure relates to quick connect couplers in fluid dispensing systems, such as fluid spray systems.

[0003] Quick connect couplings are configured for quick and easy couplings. Quick connect couplings provide connections between fluid passages. Such couplings do not require a tool to form fluid tight connections. Quick connect couplings can be bulky or configured for lower pressure operations, which can render such couplings unsuitable for fluid dispense operations, such as fluid spraying systems. Push to connect couplers generally require rigid tubing and not flexible hosing. Further, such connectors are generally configured to operate at pressures below those required for fluid spraying. Plug-and-socket style quick connectors are generally large, which is unwieldy when connected to spray guns and within spray systems. Further, such connectors can suffer from side-load sensitivity. Cam-and-groove style quick connectors are generally large and heavy, which is unwieldy when connected to spray guns and within spray systems.

[0004] Fluid spray systems typically operate at high pressures that operate at too high of pressure for quick connect couplings or for which quick connect couplings are unwieldy. The couplings in fluid spray systems typically require the use of a tool, such as a wrench, to form the fluid tight fittings suitable for conveying fluid in such a system.

SUMMARY

[0005] According to an aspect of the disclosure, a hose assembly configured to convey pressurized fluid in a fluid dispensing system includes a flexible hose; and a quick connect coupler mechanically and fluidly connected to the hose. The quick connect coupler includes a coupler body having a mount end and a distal end, the mount end configured to interface with a fitting; a hose connector extending out of the coupler body through the distal end of the coupler body, the hose connector disposed at least partially within the flexible hose; a piston disposed within the coupler body, the piston having a piston body, a piston passage extending fully through the piston body along a coupler axis, a first seal groove formed on the piston body, and a second seal groove formed on the piston body; a first piston seal mounted in the first seal groove, the first piston seal engaging the coupler body and the piston; and a second piston seal mounted in the second seal groove, the second piston seal extending axially beyond the piston body and oriented towards the mount end. The piston is movable along the valve axis relative to the coupler body.

[0006] According to an additional or alternative aspect of the disclosure, a spray gun includes a gun body supporting a nozzle; a fluid flowpath at least partially disposed within the gun body, the fluid flowpath configured to convey a pressurized fluid to the nozzle; and a quick connect coupler supported by the gun body and configured to mechanically and fluidly connect a hose assembly to the spray gun. The quick connect coupler includes a coupler body having a mount end and a distal end, the mount end configured to interface with a fitting of the hose assembly; a piston disposed within the coupler body, the piston having a piston body, a piston passage extending fully through the piston body along a coupler axis, a first seal groove formed on the piston body, and a second seal groove formed on the piston body; a first piston seal mounted in the first seal groove, the first piston seal engaging the coupler body and the piston; and a second piston seal mounted in the second seal groove, the second piston seal extending axially beyond the piston body and oriented towards the mount end. The piston is movable along the valve axis relative to the coupler body.

[0007] The present summary is provided only by way of example, and not limitation. Other aspects of the present disclosure will be appreciated in view of the entirety of the present disclosure, including the entire text, claims, and accompanying figures.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a block diagram of a fluid dispensing system.

[0009] FIG. 2 is an isometric view of a spray gun.

[0010] FIG. 3A is an enlarged view of a hose assembly including quick connect coupler.

[0011] FIG. 3B is a cross-sectional view of the hose assembly and quick connect coupler shown in FIG. 3A.

[0012] FIG. 4 is a cross-sectional view of a hose assembly including quick connect coupler.

[0013] FIG. 5 is a simplified cross-sectional view of a spray gun including a quick connect coupler.

[0014] FIG. 6 is a simplified cross-sectional view of a spray gun including a quick connect coupler.

[0015] FIG. 7A is an isometric view of a spray system including automatic spray guns.

[0016] FIG. 7B is a perspective view of sprayers of the spray system shown in FIG. 7A.

[0017] FIG. 8 is an isometric view of an automatic spray gun.

[0018] While the above-identified figures set forth one or more embodiments of the present disclosure, other embodiments are also contemplated, as noted in the discussion. In all cases, this disclosure presents embodiments by way of representation and not limitation. It should be understood that numerous other modifications and embodiments can be devised by those skilled in the art, which fall within the scope and spirit of the principles of the disclosure. The figures may not be drawn to scale, and applications and embodiments of the present disclosure may include features and components not specifically shown in the drawings.

DETAILED DESCRIPTION

[0019] According to aspects of the present disclosure, components of a spray system can be fluidly and mechanically connected together by a quick connect coupling. The quick connect coupling is integrated into components of the spray system to form the mechanical and fluid connections.

[0020] According to aspects of the disclosure, a hose assembly is configured to convey fluid between a pressure source and a fluid dispenser. The hose assembly includes a flexible hose configured to convey pressurized, which fluid can be pressurized gas or liquid such as paint, lacquer, solvent, varnish, fine finishes, high-gloss finishes, waterborne coating, solvent-borne coating, texture material, etc. The hose assembly further includes a quick connect coupling for connecting the hose. The quick connect coupling can be configured to connect the hose to the fluid dispenser, the pressure source, another hose, among other options. The quick connect coupling is configured such that the coupling can be attached by hand without the use of other tools. The quick connect coupling is configured such that the pressure of the flowing fluid enhances the seal formed by the quick connect coupling.

[0021] According to aspects of the disclosure, a spray gun is configured to emit a spray of material for application on a substrate. The spray gun receives one or more flows of pressurized fluid (e.g., compressed gas and/or pressurized spray material) and outputs a spray of spray material. A quick connect coupling can be integrated into the spray gun to facilitate connection of a flexible hose to the spray gun, the flexible hose configured to convey the pressurized fluid to the spray gun. The quick connect coupling facilitate connection of and removal of the hose from the spray gun without the use of tools.

[0022] According to aspects of the disclosure, a pressure source, such as a pump, is configured to output pressurized fluid to a flexible hose. For example, the pressure source can emit pressurized gas or pressurized spray material for spraying by a downstream spray gun. A quick connect coupling can be integrated into an outlet fitting of the pressure source to facilitate connection of a flexible hose to the pressure source, the flexible hose configured to convey the pressurized fluid from the pressure source. The quick connect coupling facilitate connection of and removal of the hose from the pressure source without the use of tools.

[0023] Components can be considered to radially overlap when those components are disposed at common axial locations along an axis. A radial line extending from the axis will extend through each of the radially overlapping components. Components can be considered to axially overlap when those components are disposed at common radial and circumferential locations relative to an axis such that an axial line parallel to the axis extends through the axially overlapping components. Components can be considered to circumferentially overlap when aligned about the axis, such that a circle centered on the axis passes through the circumferentially overlapping components.

[0024] FIG. 1 is a block diagram of fluid dispensing system 10. Fluid dispensing system 10 includes pressure source 12, dispenser 14, and hose assembly 14. In the example shown, hose assembly 14 includes hoses 18a, 18b (collectively herein “hose 18” or “hoses 18”) and quick connect couplers 20a, 20b, 20c (collectively herein “quick connect coupler 20” or “quick connect couplers 20”).

[0025] Fluid dispensing system 10 is configured to output fluid under pressure. Pressure source 12 is configured to put the fluid under pressure and convey the fluid to dispenser 14. It is understood that, in some examples, fluid dispensing system 10 can include multiple pressure sources that deliver multiple fluids to dispenser 14. For example, a first pressure source can be configured to provide a liquid to dispenser 14 and a second pressure source 12 can provide compressed gas to dispenser 14. Pressure source 12 can be of any configuration suitable for driving pressurized fluid to dispenser 14. For example, pressure source 12 can be a pressurized container holding fluid under pressure (e.g., a pressure pot for compressed gas or liquid), a pump (e.g., a piston, plunger, diaphragm, peristaltic, gear, or other pump), an air compressor, among other options.

[0026] Dispenser 14 is configured to output pressurized fluid. For example, dispenser 14 can be configured to output a spray of spray fluid under pressure. Dispenser 14 can be configured as a spray gun, automatic or manual, that outputs fluid under pressure. In some examples, dispenser 14 can include an internal valve that controls flow of one or more pressurized fluids out of a nozzle of the dispenser 14. In some examples, dispenser 14 can be configured to receive flows of both compressed gas and liquid and can output both the pressurized gas and pressurized liquid as a spray.

[0027] Hose assembly 14 extends between and connects pressure source 12 and dispenser 14. Hose assembly 14 fluidly connects the pressure source 12 to the dispenser 14 and is configured to convey pressurized fluid from the pressure source 12 to dispenser 14 under pressure. In the example shown, hose assembly 14 includes multiples hoses 18 that are connected together to form a passage for conveying the fluid to dispenser 14. Hoses 18 are flexible hoses. It is understood, however, that hose assembly 14 can include a single hose 18 extending between pressure source 12 and dispenser 14. In examples in which dispenser 14 is configured to receive flows of multiple fluids (e.g., compressed gas and pressurized liquid) multiple hose assemblies 16 can extend between the multiple pressure sources 12 and dispenser 14. For example, a first hose assembly 14 can connect the dispenser 14 and the pressure source 12 configured to provide compressed gas and a second hose assembly 14 can connect dispenser 14 and the pressure source 12 configured to provide pressurized liquid.

[0028] Quick connect couplers 20 form connections for the hose assembly 14. In the example shown, quick connect coupler 20a connects hose assembly 14 to dispenser 14, quick connect coupler 20b connects hose assembly 14 to pressure source 12 and quick connect coupler 20c connects hose 18a and hose 18b together. While hose assembly 14 is shown as including multiple quick connect couplers 20, it is understood that not all examples are so limited. For example, hose assembly 14 can be configured with a single quick connect coupler 20, such as to connect hose assembly 14 to dispenser 14, to connect hose assembly 14 to pressure source 12, or to connect hoses 18 of the hose assembly 14. It is understood that hose assembly 14 can include any desired number of quick connect couplers 20 for forming mechanical and fluid connections.

[0029] Quick connect couplers 20 are configured for quick attachment and detachment of hose

assembly **14**. Quick connect couplers **20** can be connected by hand and removed by hand without the use of tools, such as a wrench. As discussed in more detail below, quick connect couplers **20** are configured such that the pressurized fluid flowing within hose assembly **14** enhances the fluid seal formed by the quick connect coupler **20**.

[0030] Hose assembly **14** including quick connect couplers **20** provides significant advantages. Quick connect couplers **20** allow hose assembly **14** to be quickly and efficiently connected to dispenser **14** and/or pressure source **12**. Quick connect couplers **20** can facilitate quick assembly of hose assembly **14** in examples in which hose assembly **14** includes multiple hoses **18**. Quick connect couplers **20** can reduce downtime and provide for more efficient spray operations while also lessening the need for tools required to form other types of couplings.

[0031] FIG. **2** is an isometric view of spray gun **21**. FIG. **2**. Spray gun **21** includes gun body **22**, handle **24**, trigger **26**, nozzle **28**, material intake **30**, and gas intake **32**. Hose **18**, quick connect coupler **20**, and crimp **76** of hose assembly **14** are shown.

[0032] Spray gun **21** is configured to intake flows of pressurized fluid and to output the pressurized fluid as a fluid spray. Gun body **22** can contain one or more valves for controlling flow of the pressurized flow to nozzle **28**. The spray gun **21** is configured to output the fluid spray through nozzle **28**. Handle **24** is a projecting portion of gun body **22**. Handle **24** is configured to be grasped by a single hand of a user such that the user can aim and cause spraying by spray gun **21** with the single hand. Handle **24** can be formed monolithically with other portions of gun body **22** or can be formed separately from other portions of gun body **22**. Handle **24** can, in some examples, be removably connected to other portions of gun body **22**. Trigger **26** is connected to gun body **22** and is configured to control spraying by spray gun **21**. Actuation of trigger **26** can open valving within spray gun **21** to cause emission of the spray fluid by spray gun **21**. Release of trigger **26** can cause the valving to close to stop spraying by spray gun **21**.

[0033] Material intake **30** is configured to connect to a material supply hose to provide spray material (e.g., a spray liquid such as paint) to spray gun **21** under pressure. Material intake **30** can be configured as a threaded fitting, among other options. Material intake **30** can be configured as a male fitting or a female fitting. Gas intake **32** is configured to connect to a gas supply hose to provide compressed gas to spray gun **21** under pressure. Gas intake **32** can be configured as a threaded fitting, among other options. Gas intake **32** can be configured as a male fitting or a female fitting. In the example shown, gas intake **32** is configured as a male connector and quick connect coupler **20** is configured as a female coupler for connecting to the male gas intake **32**. As discussed in more detail below, however, quick connect coupler **20** can be configured as a male coupler configured to connect to a female fitting. In various other examples, quick connect coupler **20** can be integrated into spray gun **21** or into a pressure source **12** such as a pump.

[0034] Quick connect coupler **20** is configured to quickly and easily connect a flexible hose **18** to spray gun **21**. In the example shown, a first hose assembly **14** is connected to spray gun **21** at material intake **30** to provide spray material to spray gun **21** under pressure and a second hose assembly **14** is connected to spray gun **21** at gas intake **32** to provide compressed gas to spray gun **21**.

[0035] FIG. **3A** is an enlarged elevational view of quick connect coupler **20** connected to spray gun **21**. FIG. **3B** is an enlarged cross-sectional view of quick connect coupler **20** coupled to a fitting **34** (e.g., material intake **30** or gas intake **32**). Quick connect coupler **20** includes coupler body **36**, piston **38**, and hose connector **40**. Coupler body **36** includes fitting end **42**, system end **44**, piston chamber **46**, piston shoulder **48a**, piston shoulder **48b**, and connector shoulder **50**. Piston **38** includes piston body **52**, seal groove **54a**, seal groove **54b**, and piston passage **56**. Hose connector **40** includes connector body **58**, barb **60**, and body groove **62**. Piston seal **64a**, piston seal **64b**, and connector seal **66** are also shown. Quick connect coupler **20** is configured to mechanically and fluidly connect hose assembly **14** to fitting **34**.

[0036] Coupler body **36** houses other components of quick-connect coupler **20**. Coupler body **36**

defines piston chamber **46** within an interior of coupler body **36**. A passage extends fully through coupler body **36** such that coupler body **36** is open in a first axial direction AD1 along coupler axis CA and in a second axial direction AD2 along coupler axis CA. In the example shown, coupler body **36** includes body portion **68a** and body portion **68b**. Body portion **68a** and body portion **68b** are connected together to form coupler body **36**. For example, body portion **68a** and body portion **68b** can be connected together by interfaced threading, among other options. While coupler body **36** is shown as formed by body portion **68a** and body portion **68b**, it is understood that not all examples are so limited. For example, coupler body **36** can be monolithic or formed from more than two component parts.

[0037] Fitting end **42** of coupler body **36** is configured to interface with fitting **34** to connect quick connect coupler **20** to fitting **34**. For example, fitting end **42** can include threads configured to interface with corresponding threads on fitting **34** to form a threaded interface therebetween. In the example shown, fitting end **42** includes interior threading configured to interface with exterior threading on fitting **34**. In the example shown, the threading is formed on body portion **68a** of coupler body **36**. System end **44** is disposed at an opposite axial end of coupler body **36** from fitting end **42**. System end **44** is configured to be oriented towards the hose **18** of the hose assembly **14** including quick connect coupler **20**. System end **44** is configured to be oriented towards the system that quick connect coupler **20** is integrated into. In the example shown, system end **44** is oriented towards hose **18**. System end **44** can be oriented towards spray gun **21** in examples in which quick connect coupler **20** is integrated into spray gun **21**. System end **44** can be oriented towards the pressure source **12**, such as towards a pump, in examples in which quick connect coupler **20** is integrated into the pressure source **12**.

[0038] Hose connector **40** is partially disposed in coupler body **36** and extends out of coupler body **36**. Hose connector **40** is configured to connect to a hose **18**. In the example shown, hose connector **40** includes connector body **58** that is disposed within coupler body **36**. Barb **60** extends from connector body **58** and out of coupler body **36**. Barb **60** is configured to extend into a hose **18** to connect to the hose **18**. Connector shoulder **50** extends to axially overlap with connector body **58** to retain connector body **58** within coupler body **36**. Crimp **76** secures the hose **18** to the barb **60**.

[0039] Body groove **62** is formed on hose connector **40**. Connector seal **66** is disposed in body groove **62** and is configured to form a fluid tight seal between the exterior of hose connector **40** and the interior of coupler body **36**. Connector seal **66** can be of any desired configuration, such as an o-ring seal, among other options.

[0040] In the example shown, hose connector **40** is freely rotatable on coupler axis CA. Hose connector **40** is not rotationally limited such that hose connector **40** can freely swivel on coupler axis CA. Connector seal **66** maintains sealing engagement with coupler body **36** as hose connector **40** swivels on coupler axis CA. Hose connector **40** being freely rotatable on coupler axis CA allows for hose **18** to swivel relative to the spray gun **21** or pressure source **12** during operation. Such a configuration can provide for more ergonomic and efficient spray operations. Piston **38** is disposed within coupler body **36**. Piston **38** is configured to be biased into engagement with the fitting that quick connect coupler **20** is mounted to seal the connection between quick connect coupler **20** and the fitting. Piston **38** is movable relative to coupler body **36** along coupler axis CA. Piston passage **56** extends fully axially through piston **38** such that a flowpath is formed through piston **38**. The pressurized fluid flows through piston **38** as the fluid flows through the quick connect coupler **20**.

[0041] Piston **38** supports piston seal **64a** and piston seal **64b**. Seal groove **54a** is formed on a radial exterior of piston **38**. Seal groove **54a** extends fully annularly about piston **38**. Piston seal **64a** is disposed within seal groove **54a**. Piston seal **64a** seals between the exterior of piston **38** and the interior of coupler body **36**. Seal groove **54a** retains piston seal **64a** in both axial directions AD1, AD2. Seal groove **54b** is formed on an end of piston **38**. Seal groove **54b** extends radially outward from piston passage **56**. Piston seal **64b** is disposed in seal groove **54b**. In the example shown, piston seal **64b** extends out of seal groove **54b** and axially beyond piston body **52**. Piston

seal **64b** projects beyond piston **38** such that piston seal **64b** can interface with and seal against seal face **74** of the fitting **34**. Piston seal **64b** projects beyond piston **38** such that a portion of piston seal **64b** radially overlaps with piston **38** and a portion of piston seal **64b** does not radially overlap with piston **38**.

[0042] Piston seal **64a** has a larger diameter than piston seal **64b**. The seal interface between piston **38** and fitting **34**, which can be referred to as a fitting sealing interface **70**, has diameter **D1** while the seal interface between piston **38** and coupler body **36**, which can be referred to as a piston sealing interface **72**, has diameter **D2**. Diameter **D2** is larger than diameter **D1**. The pressure acting on piston **38** at the piston sealing interface **72** biases piston **38** in axial direction **AD1** while the pressure acting on piston **38** at the fitting sealing interface **70** biases piston **38** in axial direction **AD2**. The larger diameter **D2** at the piston sealing interface **72** means that a greater force is acting on piston **38** axially relative to the coupler axis **CA** at the piston sealing interface **72** than at the fitting sealing interface **70**. As such, the fluid pressure biases piston **38** in the first axial direction **AD1**. Piston **38** is biased such that piston seal **64b** is pushed against seal face **74** of fitting **34** to maintain a sealing interface with fitting **34**.

[0043] Piston shoulder **48a** is disposed at a first end of piston chamber **46** and piston shoulder **48b** is disposed at a second end of piston chamber **46**. Piston shoulders **48a**, **48b** retain piston **38** within piston chamber **46**. Piston shoulder **48a** extends to axially overlap with piston body **52** of piston **38**. Piston shoulder **48b** extends to axially overlap with piston body **52** of piston **38**. Piston shoulders **48a**, **48b** axially overlapping with piston body **52** limit displacement of piston **38** along coupler axis **CA**. In some examples, piston shoulder **48a** can be formed by the threading of coupler body **36** that interfaces with the threading of fitting **34**. As such, the threading of coupler body **36** can facilitate mechanical connection to fitting **34** while also limiting displacement of piston **38** in first axial direction **AD1**. Piston seal **64b** is configured such that piston seal **64b** can project axially in first axial direction **AD1** beyond piston shoulder **48a**. Piston seal **64b** extending axially beyond piston shoulder **48a** can facilitate engagement between piston seal **64b** and fitting **34**.

[0044] During operation, quick connect coupler **20** facilitates quick and easy connection of hose assembly **14**. Quick connect coupler **20** connect to fitting **34**, which can be a fitting of a spray gun **21** (e.g., material intake **30** or gas intake **32**) or to a fitting of a pressure source. Coupler body **36** is connected to fitting **34** and fitting **34** extends into coupler body **36**. Quick connect coupler **20** is threaded onto fitting **34** until quick connect coupler **20** is finger tight. Threading quick connect coupler **20** onto fitting **34** causes seal face **74** of fitting **34** to engage with piston seal **64b**. In some examples, quick connect coupler **20** is configured such that fitting **34** biases piston **38** into piston shoulder **48b** such that piston seal **64b** and piston **38** resist further threading of coupler body **36** onto fitting **34**, thereby making quick connect coupler **20** finger tight on fitting **34**.

[0045] Two modes of operation are discussed in more detail, the mode depending on whether fitting **34** is receiving pressurized fluid (e.g., at a spray gun **21**) or outputting pressurized fluid (e.g., from pressure source **12**). It is understood that fitting **34** can be connected to a hose **18** similar to quick connect coupler **20** such as when quick connect coupler **20** is couples multiple flexible hoses together to form a hose assembly **14**. In such an example, the fitting **34** can be configured as a fluid output or a fluid receiver.

[0046] In examples in which fitting **34** is a fluid receiver, such as on a spray gun, the fluid flows in axial direction **AD1** such that axial direction **AD1** is the downstream direction and axial direction **AD2** is the upstream direction. The pressurized fluid enters into quick connect coupler **20** through hose connector **40**. The pressurized fluid flows through hose connector **40**, through piston passage **56**, and into fitting **34**. The fluid pressure acts on piston **38** to bias piston **38** into sealing engagement with fitting **34**. As the fluid pressure increases, the pressure forces acting on piston **38** increase, thereby further biasing piston **38** into fitting **34** to further enhance the seal therebetween.

[0047] In examples in which fitting **34** is a fluid output, the fluid flows in axial direction **AD2** such that axial direction **AD2** is the downstream direction and axial direction **AD1** is the upstream

direction. The pressurized fluid enters into quick connect coupler **20** through fitting end **42**. The pressurized fluid flows through piston passage **56**, through hose connector **40**, and is output to hose **18**. The fluid pressure acts on piston **38** to bias piston **38** into sealing engagement with fitting **34**. As the fluid pressure increases, the pressure forces acting on piston **38** increase, thereby further biasing piston **38** into fitting **34** to further enhance the seal therebetween.

[0048] As discussed above, the fitting sealing interface **70** between piston **38** and fitting **34** has diameter **D1** while the piston sealing interface **72** between piston **38** and coupler body **36** has diameter **D2**. Diameter **D2** is larger than diameter **D1**. The larger diameter **D2** at the piston sealing interface **72** means that a greater force is acting on piston **38** at the piston sealing interface **72** than at the fitting sealing interface **70** to bias piston seal **64b** into seal face **74** of fitting **34**.

[0049] In examples in which quick connect coupler **20** outputs pressurized fluid to the fitting **34**, such that axial direction **AD1** is the downstream direction, the pressure acting on piston **38** at the piston sealing interface **72** biases piston **38** in axial direction **AD1** while the pressure acting on piston **38** at the fitting sealing interface **70** biases piston **38** in axial direction **AD2**. The fluid pressure biases piston **38** in the downstream first axial direction **AD1** due to the different diameters at the fitting sealing interface **70** and the piston sealing interface **72**. In examples in which quick connect coupler **20** receives pressurized fluid from the fitting **34**, such that axial direction **AD1** is the upstream direction, the pressure acting on piston **38** at the piston scaling interface **72** biases piston **38** in axial direction **AD1** while the pressure acting on piston **38** at the fitting sealing interface **70** biases piston **38** in axial direction **AD2**. The fluid pressure biases piston **38** in the first axial direction **AD1**. The fluid pressure biases piston **38** in the upstream first axial direction **AD1** due to the different diameters at the fitting sealing interface **70** and the piston sealing interface **72**. As such, quick connect coupler **20** provides mechanical and fluid connections between hose **18** and fitting **34** regardless of whether fitting **34** is configured as a fluid receiver or a fluid output.

[0050] Quick connect coupler **20** and hose **18** are assembled together as hose assembly **14**. Hose assembly **14** provides significant advantages. Quick connect coupler **20** facilitates faster coupling and decoupling of flexible hoses **18** with less effort. Such a configuration lowers the burden to assemble and disassemble hose assembly **14** from a fitting **34** and also increases the likelihood that a user will properly service, clean, and use hose assembly **14**. Quick connect coupler **20** does not require tools to couple and decouple from fitting **34**. Such a configuration facilitates quicker and easier assembly and disassembly as the user is not required to find and use a tool. Quick connect coupler **20** provides a smaller footprint as compared to other types of quick connectors, which is particularly advantageous when coupled to a spray gun **21** which is held and manipulated by a user. Bulkier quick connectors provide less room for the user to hold the spray gun **21** while heavier quick connectors can fatigue the user. As such, quick connect coupler **20** provides for more ergonomic operation with hose assembly **16**.

[0051] FIG. **4** is a cross-sectional view of quick connect coupler **120**. Quick connect coupler **120** is substantively similar to quick connect coupler **20** (best seen in FIGS. **3A** and **3B**) except that quick connect coupler **120** is configured as a male connector configured to interface with a female fitting **134**. Components of quick connect coupler **120** similar to components of quick connect coupler **20** are indicated with the same reference number except increased by "100." Quick connect coupler **120** includes coupler body **136**, piston **138**, and hose connector **140**. Coupler body **136** includes fitting end **142**, system end **144**, piston chamber **146**, piston shoulder **148a**, piston shoulder **148b**, and connector shoulder **150**. Piston **138** includes piston body **152**, seal groove **154a**, seal groove **154b**, and piston passage **156**. Hose connector **140** includes connector body **158**, barb **160**, and body groove **162**. Piston seal **164a**, piston seal **164b**, and connector seal **166** are also shown.

[0052] Quick connect coupler **120** is configured to mate to fitting **134** to provide a mechanical and fluid connection between hose **18** and fitting **134**. Coupler body **136** houses other components of quick connect coupler **120**. Coupler body **136** defines piston chamber **146** within an interior of coupler body **136**. A passage extends fully through coupler body **136** such that coupler body **136** is

open in a first axial direction AD1 along coupler axis CA and in a second axial direction AD2 along coupler axis CA. In the example shown, coupler body **136** includes body portions **168a**, **168b**. Body portion **168a** and body portion **168b** are connected together to form coupler body **136**. For example, body portion **68a** and body portion **68b** can be connected together by interfaced threading, among other options. While coupler body **136** is shown as formed by body portion **68a** and body portion **68b**, it is understood that not all examples are so limited. For example, coupler body **136** can be monolithic or formed from more than two component parts.

[0053] Fitting end **142** of coupler body **136** is configured to interface with fitting **134** to mechanically connect quick connect coupler **120** and fitting **134**. For example, fitting end **142** can include threads configured to interface with corresponding threads on fitting **134** to form a threaded interface therebetween. In the example shown, fitting end **142** includes exterior threading configured to interface with interior threading on fitting **134**. In the example shown, the threading is formed on body portion **68a** of coupler body **136**. System end **144** is disposed at an opposite axial end of coupler body **136** from fitting end **142**. System end **144** is configured to be oriented towards the hose **18** of the hose assembly **16** including quick connect coupler **120**.

[0054] Hose connector **140** is partially disposed in coupler body **136** and extends out of coupler body **136**. Hose connector **140** is configured to connect to a hose **18**. In the example shown, hose connector **140** includes connector body **158** that is disposed within coupler body **136**. Barb **160** extends from connector body **158** and out of coupler body **136**. Barb **160** is configured to extend into a hose **18** to connect to the hose **18**. Connector shoulder **150** extends to axially overlap with connector body **158** to retain connector body **158** within coupler body **136**. As shown in FIGS. 2 and 3A, a crimp **76** can secure the hose **18** to the hose connector **140**.

[0055] Body groove **162** is formed on hose connector **140**. Connector seal **166** is disposed in body groove **162** and is configured to form a fluid tight seal between the exterior of hose connector **140** and the interior of coupler body **136**. Connector seal **166** can be of any desired configuration, such as an o-ring seal, among other options.

[0056] In the example shown, hose connector **140** is freely rotatable on coupler axis CA. Hose connector **140** is not rotationally limited such that hose connector **140** can freely swivel on coupler axis CA. Connector seal **166** maintains sealing engagement with coupler body **136** as hose connector **140** swivels on coupler axis CA.

[0057] Piston **138** is disposed within coupler body **136**. Piston **138** is configured to be biased into engagement with the fitting **134** to seal the connection between quick connect coupler **120** and fitting **134**. Piston passage **156** extends fully axially through piston **138** such that a flowpath is formed through piston **138**. The fluid flows through piston **138** as the fluid flows through the quick connect coupler **120**.

[0058] Piston **138** supports piston seal **164a** and piston seal **164b**. Seal groove **154a** is formed on a radial exterior of piston **138**. Seal groove **154a** extends fully annularly about piston **138**. Piston seal **164a** is disposed within seal groove **154a**. Piston seal **164a** seals between the exterior of piston **138** and the interior of coupler body **136**. The sealing interface between piston seal **164a** and coupler body **136** forms piston sealing interface **172**. Seal groove **154a** retains piston seal **164a** in both axial directions AD1, AD2. Seal groove **154b** is formed on an end of piston **138**. Seal groove **154b** extends radially outward from piston **138**. Piston seal **164b** is disposed in seal groove **154b**. In the example shown, piston seal **164b** extends out of seal groove **154b** and axially beyond piston **138**. Piston seal **164b** projects beyond piston **138** such that piston seal **164b** can interface with and seal against seal face **174** of the fitting **134**. The sealing interface between piston seal **164b** and fitting **134** forms fitting sealing interface **170**.

[0059] The fitting sealing interface **170** has diameter D1 while the piston sealing interface **172** has diameter D2. Diameter D2 is larger than diameter D1. The pressure acting on piston **138** at the piston sealing interface **172** biases piston **138** in axial direction AD1 while the pressure acting on piston **138** at the fitting sealing interface **170** biases piston **138** in axial direction AD2. The larger

diameter D2 at the piston sealing interface 172 means that a greater force is acting on piston 138 at the piston sealing interface 172 than at the fitting sealing interface 170. The fluid pressure biases piston 138 in the first axial direction AD1.

[0060] Piston shoulder 148a is disposed at a first end of piston chamber 146 and piston shoulder 148b is disposed at a second end of piston chamber 146. Piston shoulders 148a, 148b retain piston 138 within piston chamber 146. Piston shoulder 148a extends to axially overlap with piston body 152 of piston 138. Piston shoulder 148b extends to axially overlap with piston body 152 of piston 138. Piston shoulders 148a, 148b axially overlapping with piston body 152 limit displacement of piston 138 along coupler axis CA.

[0061] In the example shown, piston 138 is configured such that piston seal 164b extends axially out of coupler body 136 to interface with seal face 174 of fitting 134. Piston body 152 includes extension 178 that is configured to position piston seal 164b axially beyond fitting end 142 to interface with seal face 174. Extension 178 can, in some examples, extend out of coupler body 136 beyond fitting end 142.

[0062] During operation, quick connect coupler 120 facilitates quick and easy connection of hose assembly 16. Quick connect coupler 120 can connect to a fitting 134 of a spray gun (e.g., material intake 30 or gas intake 32) or to a fitting 134 of a pressure source. Quick connect coupler 120 is threaded into fitting 134 until quick connect coupler 120 is finger tight. Threading quick connect coupler 120 onto fitting 134 causes seal face 174 of fitting 134 to engage with piston seal 164b. In some examples, quick connect coupler 120 is configured such that fitting 134 biases piston 138 into piston shoulder 148b such that piston seal 164b and piston 138 resist further threading of coupler body 136 into fitting 134, thereby making quick connect coupler 120 finger tight on fitting 134. Piston body 152 is configured such that piston seal 164b projects to sealingly engage with seal face 174 with piston body 152 engaging shoulder 148b.

[0063] Two modes of operation are discussed in more detail, the mode depending on whether fitting 134 is receiving pressurized fluid (e.g., at a spray gun 21) or outputting pressurized fluid (e.g., from pressure source 12). It is understood that fitting 134 can be connected to a hose 18 such as when quick connect coupler 120 is couples multiple flexible hoses together to form a hose assembly 16. In such an example, the fitting 134 can be configured as a fluid output or a fluid receiver.

[0064] In examples in which fitting 134 is a fluid receiver, such as on a spray gun, the fluid flows in axial direction AD1 such that axial direction AD1 is the downstream direction and axial direction AD2 is the upstream direction. The pressurized fluid enters into quick connect coupler 120 through hose connector 140. The pressurized fluid flows through hose connector 140, through piston passage 156, and into fitting 134. The fluid pressure acts on piston 138 to bias piston 138 into sealing engagement with fitting 134. As the fluid pressure increases, the pressure biases the piston 138 into the fitting 134 to further enhance the seal therebetween.

[0065] In examples in which fitting 134 is a fluid output, the fluid flows in axial direction AD2 such that axial direction AD2 is the downstream direction and axial direction AD1 is the upstream direction. The pressurized fluid enters into quick connect coupler 120 through fitting end 142. The pressurized fluid flows through piston passage 156, through hose connector 140, and is output to the hose 18. The fluid pressure acts on piston 138 to bias piston 138 into sealing engagement with fitting 134. As the fluid pressure increases, the pressure biases the piston 138 into the fitting 134 to further enhance the seal therebetween.

[0066] As discussed above, the fitting sealing interface 170 between piston 138 and fitting 134 has diameter D1 while the piston sealing interface 172 between piston 138 and coupler body 136 has diameter D2. Diameter D2 is larger than diameter D1. The larger diameter D2 at the piston sealing interface 172 means that a greater force is acting on piston 138 at the piston scaling interface 172 than at the fitting sealing interface 170 to bias piston seal 164b into seal face 174 of fitting 134. Quick connect coupler 120 provides mechanical and fluid connections between hose 18 and fitting

134 regardless of whether fitting **134** is configured as a fluid receiver or a fluid output.

[0067] Quick connect coupler **120** and hose **18** are assembled together as hose assembly **16**. Hose assembly **16** provides significant advantages. Quick connect coupler **120** facilitates faster coupling and decoupling of flexible hoses **18** with less effort. Such a configuration lowers the burden to assemble and disassemble hose assembly **16** from a fitting **134** and also increases the likelihood that a user will properly service, clean, and use hose assembly **16**. Quick connect coupler **120** does not require tools to couple and decouple from fitting **134**. Such a configuration facilitates quicker and easier assembly and disassembly as the user is not required to find and use a tool. Quick connect coupler **120** provides a smaller footprint as compared to other types of quick connectors, which is particularly advantageous when coupled to a spray gun **21** which is held and manipulated by a user. Bulkier quick connectors provide less room for the user to hold the spray gun **21** while heavier quick connectors can fatigue the user. As such, quick connect coupler **120** provides for more ergonomic operation with hose assembly **16**.

[0068] FIG. 5 is a cross-sectional view of a spray gun **221** including an integrated quick connect coupler **220**. Gun body **222**, handle **224**, trigger **226**, quick connect coupler **220**, fluid pathway **280**, and valve **282** of spray gun **221** are shown. Quick connect coupler **220** is substantially similar to quick connect coupler **20** (best seen in FIGS. 3A and 3B). Components of quick connect coupler **220** similar to components of quick connect coupler **20** are indicated with the same reference number except increased by “200.” Components of spray gun **221** similar to components of spray gun **21** are indicated with the same reference number except increased by “200.” Quick connect coupler **220** includes coupler body **236** and piston **238**. Coupler body **236** includes fitting end **242**, system end **244**, piston chamber **246**, piston shoulder **248a**, piston shoulder **248b**, and connector shoulder **250**. Piston **238** includes piston body **252**, seal groove **254a**, seal groove **254b**, and piston passage **256**. Piston seal **264a** and piston seal **264b** are also shown.

[0069] Spray gun **221** is configured to emit a spray of a spray fluid onto a substrate. Spray gun **221** is fluidly connected to a hose assembly **216** to receive fluid from the hose assembly **216**. As discussed above, the fluid can be a liquid configured to be emitted as the spray fluid for application on the substrate or can be a compressed gas, such as compressed gas meant to assist in atomization and/or expulsion of the spray fluid from the spray gun **221**. While spray gun **221** is shown as connected to a single hose assembly **216**, it is understood that spray gun **221** can be connected to multiple hose assemblies **216** to receive pressurized fluids from the multiple hose assemblies **216**. For example, spray gun **221** can be connected to a first hose assembly **216** to receive pressurized gas and spray gun **221** can be connected to a second hose assembly **216** to receive pressurized spray material, similar to spray gun **21**.

[0070] Handle **224** is an extension of gun body **222**. Handle **224** can be grasped by a single hand of a user to aim spray gun **221** and during actuation of spraying by spray gun **221**. While handle **224** is shown as formed monolithically with gun body **222**, it is understood that not all examples are so limited. Trigger **226** is supported by gun body **222** and is configured to actuate valve **282** open to allow emission of spray fluid. Valve **282** is supported by gun body **222** and is configured to be actuated to an open state by trigger **226**. With valve **282** in the open state, the pressurized fluid can flow downstream to nozzle **228** for emission of the spray fluid. Nozzle **228** can be shaped to shape a pattern of the emitted spray, such as into a fan or cone among other options. Valve **282** shifting to a closed state shuts off flow of the spray fluid to the nozzle **228**. The valve **282** can be shifted to and held in a closed state by a spring, among other options.

[0071] Hose assembly **216** connects to spray gun **221** and is at least partially mechanically supported by spray gun **221**. Fitting **234** is connected to flexible hose **218** to form hose assembly **216**. Hose assembly **216** is fluidly connected to spray gun **221** to provide the pressurized fluid to spray gun **221**. Quick connect coupler **220** mechanically and fluidly connects hose assembly **216** to spray gun **221**.

[0072] Quick connect coupler **220** is part of spray gun **221** in the example shown. Quick connect

coupler **220** is integrated into spray gun **221** such that quick connect coupler **220** remains with spray gun **221** with hose assembly **216** disconnected from spray gun **221**. While quick connect coupler **220** is shown as disposed at least partially within handle **224**, it is understood that quick connect coupler **220** can be integrated with spray gun **221** at any desired location at which spray gun **221** is configured to receive fluid under pressure. For example, quick connect coupler **220** can be integrated into handle **224** to receive compressed gas or compressed spray liquid, quick connect coupler **220** can be integrated into gun body **222**, such as at a material intake similar to material intake **30**, quick connect coupler **220** can be integrated into a valve housing removable mounted to the gun body **222** and that includes the valve **282**, among other options.

[0073] In the example shown, quick connect coupler **220** is formed as a threaded receiver configured to receive the threaded fitting **234** of hose assembly **216**. Coupler body **236** houses other components of quick connect coupler **220**. Coupler body **236** defines piston chamber **246** within an interior of coupler body **236**. The piston chamber **246** can be at least partially defined by handle **224** or by a flow directing component (e.g., tube among other options) disposed within handle **224**. Coupler body **236** is at least partially disposed within handle **224**. Body portion **268a** can be connected to other portions of handle **224**, such as by interfaced threading among other options. In some examples, coupler body **236** can be formed by material forming handle **224**. In some examples, body portion **268b** can be formed by tubing in the handle **224** or a flowpath formed by the handle **224**.

[0074] Fitting end **242** of coupler body **236** is configured to interface with fitting **234** to connect fitting **234** to quick connect coupler **220**. For example, fitting end **242** can include threads configured to interface with corresponding threads on fitting **234** to form a threaded interface therebetween. In the example shown, fitting end **242** includes interior threading configured to interface with exterior threading on fitting **234**. In the example shown, quick connect coupler **220** is configured as a female receiver and fitting **234** is configured as a male connector.

[0075] Piston **238** is disposed within coupler body **236**. Piston **238** is at least partially disposed within handle **224**. Piston **238** can be fully disposed within handle **224** in some examples. Piston **238** is configured to be biased into engagement with the fitting **234** mounted to quick connect coupler **220** to seal the connection between quick connect coupler **220** and the fitting **234**. Piston passage **256** extends fully axially through piston **238** such that a flowpath is formed through piston **238**. The fluid flows through piston **238** as the fluid flows through the quick connect coupler **220**.

[0076] Piston **238** supports piston seal **264a** and piston seal **264b**. Seal groove **254a** is formed on a radial exterior of piston **238**. Seal groove **254a** extends fully annularly about piston **238**. Piston seal **264a** is disposed within seal groove **254a**. Piston seal **264a** seals between the exterior of piston **238** and the interior of coupler body **236**. Seal groove **254a** retains piston seal **264a** in both axial directions AD1, AD2. Seal groove **254b** is formed on an end of piston **238**. Seal groove **254b** extends radially outward from piston **238**. Piston seal **264b** is disposed in seal groove **254b**. In the example shown, piston seal **264b** extends out of seal groove **254b** and axially beyond piston **238**. Piston seal **264b** projects beyond piston **238** such that piston seal **264b** can interface with and seal against seal face **274** of the fitting **234**.

[0077] Piston shoulder **248a** is disposed at a first end of piston chamber **246** and piston shoulder **248b** is disposed at a second end of piston chamber **246**. Piston shoulders **248a**, **248b** retain piston **238** within piston chamber **246**. Piston shoulder **248a** extends to axially overlap with piston body **252** of piston **238**. Piston shoulder **248b** extends to radially overlap with piston body **252** of piston **238**. Piston shoulders **248a**, **248b** radially overlapping with piston body **252** limit displacement of piston **238** along coupler axis CA.

[0078] During operation, quick connect coupler **220** facilitates quick and easy connection of hose assembly **216**. Quick connect coupler **220** can connect to fitting **234** of hose assembly **216** to receive pressurized fluid into spray gun **221**. Fitting **234** is threaded onto quick connect coupler **220** at a finger tight interface. Threading fitting **234** into quick connect coupler **220** causes seal face

274 of fitting **234** to engage with piston seal **264b**. Piston **238** is movable within piston chamber **246** along coupler axis CA. In some examples, quick connect coupler **220** is configured such that fitting **234** can push piston **238** into piston shoulder **248b** such that piston seal **264b** and piston **238** resist further threading of fitting **234** into quick connect coupler **220**, thereby making fitting **234** finger tight on quick connect coupler **220**.

[0079] The fitting sealing interface **270** has diameter D1 while the piston sealing interface **272** has diameter D2. Diameter D2 is larger than diameter D1. The pressure acting on piston **238** at the piston sealing interface **272** biases piston **238** in axial direction AD2 while the pressure acting on piston **238** at the fitting sealing interface **270** biases piston **238** in axial direction AD1. The larger diameter D2 at the piston sealing interface **272** means that a greater force is acting on piston **238** at the piston sealing interface **272** than at the fitting sealing interface **270**. As such, the fluid pressure biases piston **238** in the second axial direction AD2, which is also the upstream direction in this example.

[0080] Quick connect coupler **220** is configured to receive pressurized fluid from fitting **234** such that fitting **234** is a fluid output. The fluid flows in axial direction AD1 such that axial direction AD2 is the upstream direction and axial direction AD1 is the downstream direction. The pressurized fluid enters into quick connect coupler **220** through fitting end **242**. The pressurized fluid flows through piston passage **256** and is output to fluid pathway **280** within the spray gun **221**. The fluid pressure acts on piston **238** to bias piston **238** into sealing engagement with fitting **234**. As the fluid pressure increases, the pressure differential acting at piston sealing interface **272** and fitting sealing interface **270** increases to increase the force biasing the piston **238** into the fitting **234**, further enhancing the seal between piston **238** and fitting **234**.

[0081] While quick connect coupler **220** is shown as integrated into spray gun **221** such that quick connect coupler **220** receives fluid from the hose assembly **216**, it is understood that not all examples are so limited. For example, quick connect coupler **220** can be integrated into the housing of a pump, such as a piston pump, diaphragm pump, peristaltic pump, plunger pump, gear pump, etc. In one example, the quick connect coupler **220** can be integrated at the outlet of the pump such that the hose assembly **216** receives pressurized fluid from the pump through quick connect coupler **220**. In such an example, the pressurized fluid flows in second axial direction AD2 to be output from quick connect coupler **220** and into the hose assembly **216**.

[0082] Quick connect coupler **220** and spray gun **221** are assembled together such that spray gun **221** includes an integrated quick connect coupler **220**. Quick connect coupler **220** facilitates faster coupling and decoupling of flexible hoses **218** with less effort. Such a configuration lowers the burden to assemble and disassemble hose assembly **216** from a spray gun **221**, or a pump, and also increases the likelihood that a user will properly service, clean, and use hose assembly **216**. Quick connect coupler **220** does not require tools to couple and decouple fitting **234**. Such a configuration facilitates quicker and easier assembly and disassembly as the user is not required to find and use a tool. Quick connect coupler **220** provides a smaller footprint as compared to other types of quick connectors, which is particularly advantageous when integrated into a spray gun **221**, which is held and manipulated by a user. Bulkier quick connectors provide less room for the user to hold the spray gun **221** while heavier quick connectors can fatigue the user. As such, quick connect coupler **220** provides for more ergonomic operation with hose assembly **216**. Quick connect coupler **220** being integrated into spray gun **221** allows users to continue operating with standard hoses such that a user is not required to change hose configuration to operate a spray gun **221** with quick connect coupler **220**. Such a configuration can provide decreased costs and can ease use for the user.

[0083] FIG. 6 is a cross-sectional view of a spray gun **321** including an integrated quick connect coupler **320**. Gun body **322**, fluid pathway **380**, valve **382**, handle **324**, trigger **326**, and quick connect coupler **320** of spray gun **321** are shown. Quick connect coupler **320** is substantially similar to quick connect coupler **120** (best seen in FIG. 4). Components of quick connect coupler

320 similar to components of quick connect coupler **120** are indicated with the same reference number except increased by “200.” (e.g., coupler body **136** and coupler body **336**). Components of spray gun **321** similar to components of spray gun **21** are indicated with the same reference number except increased by “300.” Components of spray gun **321** similar to components of spray gun **221** are indicated with the same reference number except increased by “100.” Quick connect coupler **320** includes coupler body **336** and piston **338**. Coupler body **336** includes fitting end **342**, system end **344**, piston chamber **346**, piston shoulder **348a** and piston shoulder **348b**. Piston **338** includes piston body **352**, seal groove **354a**, seal groove **354b**, and piston passage **356**. Piston seal **364a** and piston seal **364b** are also shown.

[0084] Spray gun **321** is configured to emit a spray of a spray fluid onto a substrate. Spray gun **321** is fluidly connected to a hose assembly **316** to receive fluid from the hose assembly **316**. As discussed above, the fluid can be a liquid configured to be emitted as the spray fluid for application on the substrate or can be a compressed gas, such as compressed gas meant to assist in atomization and/or expulsion of the spray fluid from the spray gun **321**. While spray gun **321** is shown as connected to a single hose assembly **316**, it is understood that spray gun **321** can be connected to multiple hose assemblies **316** to receive pressurized fluids from the multiple hose assemblies **316**. For example, spray gun **321** can be connected to a first hose assembly **316** to receive pressurized gas and spray gun **321** can be connected to a second hose assembly **316** to receive pressurized spray material, similar to spray gun **21**.

[0085] Handle **324** extends from gun body **322**. Handle **324** can be grasped by a single hand of a user to aim spray gun **321** and during actuation of spraying by spray gun **321**. Trigger **326** is supported by gun body **322** and is configured to actuate valve **382** open to allow emission of spray fluid. Valve **382** is supported by gun body **322** and is configured to be actuated to an open state by trigger **326**. With valve **382** in the open state, the pressurized fluid can flow downstream to nozzle **328** for emission of the spray fluid. Nozzle **328** can be shaped to shape a pattern of the emitted spray, such as into a fan or cone among other options. Valve **382** shifting to a closed state shuts off flow of the spray fluid to the nozzle **328**. The valve **382** can be shifted to and held in a closed state by a spring, among other options.

[0086] Hose assembly **316** connects to spray gun **321** and is at least partially mechanically supported by spray gun **321**. Fitting **334** is connected to flexible hose **318** to form hose assembly **316**. Hose assembly **316** is fluidly connected to spray gun **321** to provide the pressurized fluid to spray gun **321**. Quick connect coupler **320** mechanically and fluidly connects hose assembly **316** to spray gun **321**.

[0087] Quick connect coupler **320** is part of spray gun **321** in the example shown. Quick connect coupler **320** is integrated into spray gun **321** such that quick connect coupler **320** remains with spray gun **321** with hose assembly **316** disconnected from spray gun **321**. While quick connect coupler **320** is shown as disposed at least partially within handle **324**, it is understood that quick connect coupler **320** can be integrated with spray gun **321** at any desired location at which spray gun **321** is configured to receive fluid under pressure. For example, quick connect coupler **320** can be integrated into handle **324** to receive compressed gas or compressed spray liquid, quick connect coupler **320** can be integrated into gun body **322**, such as at material intake **30**, quick connect coupler **320** can be integrated into a valve housing removable mounted to the gun body **322** and that includes the valve **382**, among other options. In the example shown, quick connect coupler **320** is disposed at least partially outside of handle **324** such that coupler body **336** can be received by fitting **334**.

[0088] In the example shown, quick connect coupler **320** is formed as a threaded connector configured to be received by the threaded fitting **334** of hose assembly **316**. Coupler body **336** houses other components of quick connect coupler **320**. Coupler body **336** defines piston chamber **346** within an interior of coupler body **336**. The piston chamber **346** can be at least partially defined by handle **324** or by a flow directing component (e.g., tube among other options) disposed within

handle **324**. Coupler body **336** can be at least partially disposed within handle **324**. Coupler body **336** can be monolithic or formed from more than two component parts. In some examples, body portion **368b** can be formed by tubing in the handle **324** or a flowpath formed by the handle **324**. In some examples, body portion **368a** can be connected within handle **324** to retain piston **338** within handle **324** and handle **324** can include the exterior threading that interfaces with fitting **334**. In such an example, the receiver of handle **324** within which quick connect coupler **320** is at least partially disposed can include interior threading to connect to body portion **368a** and exterior threading to connect to fitting **334**.

[0089] Fitting end **342** of coupler body **336** is configured to interface with fitting **334** to connect quick connect coupler **320** to fitting **334**. For example, fitting end **342** can include threads configured to interface with corresponding threads on fitting **334** to form a threaded interface therebetween. In the example shown, fitting end **342** includes exterior threading configured to interface with interior threading on fitting **334**. Fitting end **342** can be formed by body portion **368a**, can be formed by material of handle **324**, or can be formed by additional or alternative components.

[0090] Piston **338** is disposed within coupler body **336**. Piston **338** is at least partially disposed within handle **324**. Piston **338** can be disposed fully within handle **324** in some examples and piston **338** can be disposed fully outside of handle **324** in some examples. Piston **338** is configured to be biased into engagement with the fitting **334** mounted to quick connect coupler **320** to seal the connection between quick connect coupler **320** and the fitting **334**. Piston passage **356** extends fully axially through piston **338** such that a flowpath is formed through piston **338**. The fluid flows through piston **338** as the fluid flows through the quick connect coupler **320**.

[0091] Piston **338** supports piston seal **364a** and piston seal **364b**. Seal groove **354a** is formed on a radial exterior of piston **338**. Seal groove **354a** extends fully annularly about piston **338**. Piston seal **364a** is disposed within seal groove **354a**. Piston seal **364a** seals between the exterior of piston **338** and the interior of coupler body **336**. Seal groove **354a** retains piston seal **364a** in both axial directions AD1, AD2. Seal groove **354b** is formed on an end of piston **338**. Seal groove **354b** extends radially outward from piston **338**. Piston seal **364b** is disposed in seal groove **354b**. In the example shown, piston seal **364b** extends out of seal groove **354b** and axially beyond piston **338**. Piston seal **364b** projects beyond piston **338** such that piston seal **364b** can interface with and seal against seal face **374** of the fitting **334**. In the example shown, piston **338** is configured such that piston seal **364b** can project axially beyond coupler body **336** in second axial direction AD2.

[0092] Piston shoulder **348a** is disposed at a first end of piston chamber **346** and piston shoulder **348b** is disposed at a second end of piston chamber **346**. Piston shoulders **348a**, **348b** retain piston **338** within piston chamber **346**. Piston shoulder **348a** extends to axially overlap with piston body **352** of piston **338**. Piston shoulder **348b** extends to axially overlap with piston body **352** of piston **338**. Piston shoulders **348a**, **348b** axially overlapping with piston body **352** limit displacement of piston **338** along coupler axis CA.

[0093] In the example shown, piston **338** is configured such that piston seal **364b** can extend axially out of coupler body **336** to interface with seal face **374** of fitting **334**. Piston **338** includes extension **478** that is configured to position piston seal **364b** axially beyond fitting end **342** to interface with seal face **374**. Extension **478** can, in some examples, extend out of coupler body **336** beyond fitting end **342**.

[0094] During operation, quick connect coupler **320** facilitates quick and easy connection of hose assembly **316** to spray gun **321**. Fitting **334** is connected to the flexible hose **318** to form the hose assembly **316**. Fitting **334** is threaded onto quick connect coupler **320** at a finger tight interface. Threading fitting **334** onto quick connect coupler **320** causes seal face **374** of fitting **334** to engage with piston seal **364b**. Piston **338** is movable within piston chamber **346** along coupler axis CA and relative to coupler body **336**. In some examples, quick connect coupler **320** is configured such that fitting **334** biases piston **338** into piston shoulder **348b** such that piston seal **364b** and piston **338**

resist further threading of fitting **334** onto quick connect coupler **320**, thereby making fitting **334** finger tight on quick connect coupler **320**.

[0095] The fitting sealing interface **370** has diameter **D1** while the piston sealing interface **372** has diameter **D2**. Diameter **D2** is larger than diameter **D1**. The pressure acting on piston **338** at the piston sealing interface **372** biases piston **338** in axial direction **AD2** while the pressure acting on piston **338** at the fitting sealing interface **370** biases piston **338** in axial direction **AD1**. The larger diameter **D2** at the piston sealing interface **372** means that a greater force is acting on piston **338** at the piston sealing interface **372** than at the fitting sealing interface **370**. As such, the fluid pressure biases piston **338** in the second axial direction **AD2**, which is also the upstream direction in this example.

[0096] Quick connect coupler **320** is configured to receive pressurized fluid from fitting **334** such that fitting **334** is a fluid output. The fluid flows in axial direction **AD1** such that axial direction **AD2** is the upstream direction and axial direction **AD1** is the downstream direction. The pressurized fluid enters into quick connect coupler **320** through fitting end **342**. The pressurized fluid flows through piston passage **356** and is output to fluid pathway **380** within the spray gun **321**. The fluid pressure acts on piston **338** to bias piston **338** into sealing engagement with fitting **334**. As the fluid pressure increases, the pressure differential acting at piston sealing interface **372** and fitting sealing interface **370** increases to increase the force biasing the piston **338** into the fitting **334**, further enhancing the seal between piston **338** and fitting **334**.

[0097] While quick connect coupler **320** is shown as integrated into spray gun **321** such that quick connect coupler **320** receives fluid from the hose assembly **316**, it is understood that not all examples are so limited. For example, quick connect coupler **320** can be integrated into the housing of a pump, such as a piston pump, diaphragm pump, peristaltic pump, plunger pump, gear pump, etc. In one example, the quick connect coupler **320** can be integrated at the outlet of the pump such that the hose assembly **316** receives pressurized fluid from the pump through quick connect coupler **320**. In such an example, the pressurized fluid flows in second axial direction **AD2** to be output from quick connect coupler **320** and into the hose assembly **316**.

[0098] Quick connect coupler **320** and spray gun **321** are assembled together such that spray gun **321** includes an integrated quick connect coupler **320**. Quick connect coupler **320** facilitates faster coupling and decoupling of flexible hoses **318** with less effort. Such a configuration lowers the burden to assemble and disassemble hose assembly **316** from spray gun **321** and also increases the likelihood that a user will properly service, clean, and use hose assembly **316**. Quick connect coupler **320** does not require tools to couple and decouple fitting **334**. Such a configuration facilitates quicker and easier assembly and disassembly as the user is not required to find and use a tool. Quick connect coupler **320** provides a smaller footprint as compared to other types of quick connectors, which is particularly advantageous when integrated into a spray gun **321** which is held and manipulated by a user. Bulkier quick connectors provide less room for the user to hold the spray gun **321** while heavier quick connectors can fatigue the user. As such, quick connect coupler **320** provides for more ergonomic operation. Quick connect coupler **320** being integrated into spray gun **321** allows users to continue operating with standard hoses such that a user is not required to change hose configuration to operate a spray gun **321** with quick connect coupler **320**. Such a configuration can provide decreased costs and can ease use for the user.

[0099] FIG. 7A is an isometric view of a spray system **510** containing multiple dispensers **514**. FIG. 7B is an isometric view of dispensers **514** of spray system **510**. Spray system **510** is substantially similar to dispensing system **10** (best seen in FIG. 1) and can be a version of dispensing system **10**. In spray system **510**, dispensers **514** are configured as automatic spray guns that are manipulated and caused to spray by a machine. Components of spray system **510** similar to components of dispensing system **10** are indicated by the same reference number except increased by "500" (e.g., dispenser **14** and dispenser **514**). Spray system **510** can have multiple dispensers **514** and each dispenser **514** can have a varied spray tip orientation to maximize uniformity of

coverage and minimize product waste.

[0100] FIG. 8 is an isometric view of dispenser 514. Dispenser 514 includes gun body 522 material intakes 530 and gas intakes 532. In the example shown, dispenser 514 is an automatic spray gun in that dispenser 514 can be operated automatically by a machine rather than directly by the user. Gun body 522 is configured to receive flows of spray fluid and, in some examples, compressed gas. Gun body 522 supports other components of dispenser 514.

[0101] Dispenser 514 is configured to emit an atomized spray of the spray fluid for application to a substrate. The spray fluid is emitted through the nozzle 528 as the atomized fluid spray. Dispenser 514 can, in some examples, include one or more integrated quick connect couplers (e.g., quick connect coupler 220, quick connect coupler 320) at one or more of gas intakes 532 and material intakes 530. In some examples, dispenser 514 can connect to a hose assembly (e.g., hose assembly 16 (FIGS. 3 and 4)) having a quick connect coupler (e.g., quick connect coupler 20, quick connect coupler 120).

[0102] While the invention has been described with reference to an exemplary embodiment(s), it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. The particular offsets and ratios illustrated and described herein are offered only by way of example, not limitation. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment(s) disclosed, but that the invention will include all embodiments falling within the scope of the appended claims.

Claims

1. A hose assembly configured to convey pressurized fluid in a spray system, the hose assembly comprising: a flexible hose; and a quick connect coupler mechanically and fluidly connected to the hose, the quick connect coupler comprising: a coupler body having a mount end and a distal end, the mount end configured to interface with a fitting; a hose connector extending out of the coupler body through the distal end of the coupler body, the hose connector disposed at least partially within the flexible hose; a piston disposed within the coupler body, the piston having a piston body, a piston passage extending fully through the piston body along a coupler axis, a first seal groove formed on the piston body, and a second seal groove formed on the piston body; a first piston seal mounted in the first seal groove, the first piston seal engaging the coupler body and the piston; and a second piston seal mounted in the second seal groove, the second piston seal extending axially beyond the piston body and oriented towards the mount end; wherein the piston is movable along the valve axis relative to the coupler body.
2. The hose assembly of claim 1, wherein the flexible hose is crimped to the quick connect coupler.
3. The hose assembly of claim 1, wherein the mount end includes interior threading.
4. The hose assembly of claim 1, wherein the mount end includes exterior threading.
5. The hose assembly of claim 4, wherein the second piston seal is at least partially disposed outside of the coupler body.
6. The hose assembly of claim 4, wherein the second piston seal projects axially beyond the mount end.
7. The hose assembly of claim 4, wherein an extension extends axially from the piston body, and wherein the extension at least partially defines the second seal groove.
8. The hose assembly of claim 7, wherein the extension projects axially out of the coupler body.
9. The hose assembly of claim 1, wherein the coupler body includes a first piston shoulder axially overlapping with the piston body to limit displacement of the piston in a first direction along the valve axis and the coupler body includes a second piston shoulder axially overlapping with the piston body to limit displacement of the piston in a second direction along the valve axis, the

second direction opposite the first direction.

- 10.** The hose assembly of claim 1, wherein the hose connector includes a connector body disposed in the coupler body and a barb extending out of the couple body and into the flexible hose.
 - 11.** The hose assembly of claim 1, wherein the hose connector includes a connector body disposed in the coupler body, a connector seal groove is formed on the connector body, and a connector seal is disposed in the connector seal groove and interfacing with the connector body and the coupler body.
 - 12.** The hose assembly of claim 10, wherein the hose connector is freely rotatable on the valve axis.
 - 13.** The hose assembly of claim 1, wherein a diameter of the first piston seal is larger than a diameter of the second piston seal.
 - 14.** The hose assembly of claim 1, wherein the piston passage defines a portion of a flowpath of the pressurized fluid through the quick connect coupler.
 - 15.** A spray gun comprising: a gun body supporting a nozzle; a fluid flowpath at least partially disposed within the gun body, the fluid flowpath configured to convey a pressurized fluid to the nozzle; and a quick connect coupler supported by the gun body and configured to mechanically and fluidly connect a hose assembly to the spray gun, the quick connect coupler comprising: a coupler body having a mount end and a distal end, the mount end configured to interface with a fitting of the hose assembly; a piston disposed within the coupler body, the piston having a piston body, a piston passage extending fully through the piston body along a coupler axis, a first seal groove formed on the piston body, and a second seal groove formed on the piston body; a first piston seal mounted in the first seal groove, the first piston seal engaging the coupler body and the piston; and a second piston seal mounted in the second seal groove, the second piston seal extending axially beyond the piston body and oriented towards the mount end; wherein the piston is movable along the valve axis relative to the coupler body.
 - 16.** The spray gun of claim 15, further comprising: a handle; and a trigger supported by the gun body, the trigger configured to control spraying through the nozzle.
 - 17.** The spray gun of claim 15, wherein the second piston seal is oriented out of the gun body.
 - 18.** The spray gun of any claim 16, wherein the quick connect coupler is at least partially disposed in the handle.
 - 19.** The spray gun of claim 18, wherein the quick connect coupler projects out of the handle.
 - 20.** The spray gun of claim 15, wherein the mount end includes one of exterior threading and interior threading.
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