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(54) **QUICK-DISCONNECT, REDUCER
NOZZLE/VALVE ASSEMBLY FOR FILLING
FIREFIGHTING BACKPACK TANKS**

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(57) **ABSTRACT**

A universal, fluid transfer, Q-D coupling assembly for connecting water supply hoses to fire-fighter's wild-fire backpack tanks comprising a two or three-part combination: #1) a 5/8" female member having an axially-slideable detent collar and an internal, spring-biased fluid shut off flap, and #2) a male nozzle/reducer/collar member having a detent engaging groove. A ball valve is connected to element #2, either integral as #2A, or as a separate assembly element #3. Both elements #2 and #3 have a female threaded collar that receives the nominal 1" male fitting of a garden hose. The parts can be supplied as a kit. Element #2 is a unitary fitting combining a hydraulic-sized, male Q-D nozzle, a reducer section and a standard garden hose-sized, female internally-threaded fixed collar. This element is preferably supplied with an integral ball valve intermediate the reducer portion and the female collar.

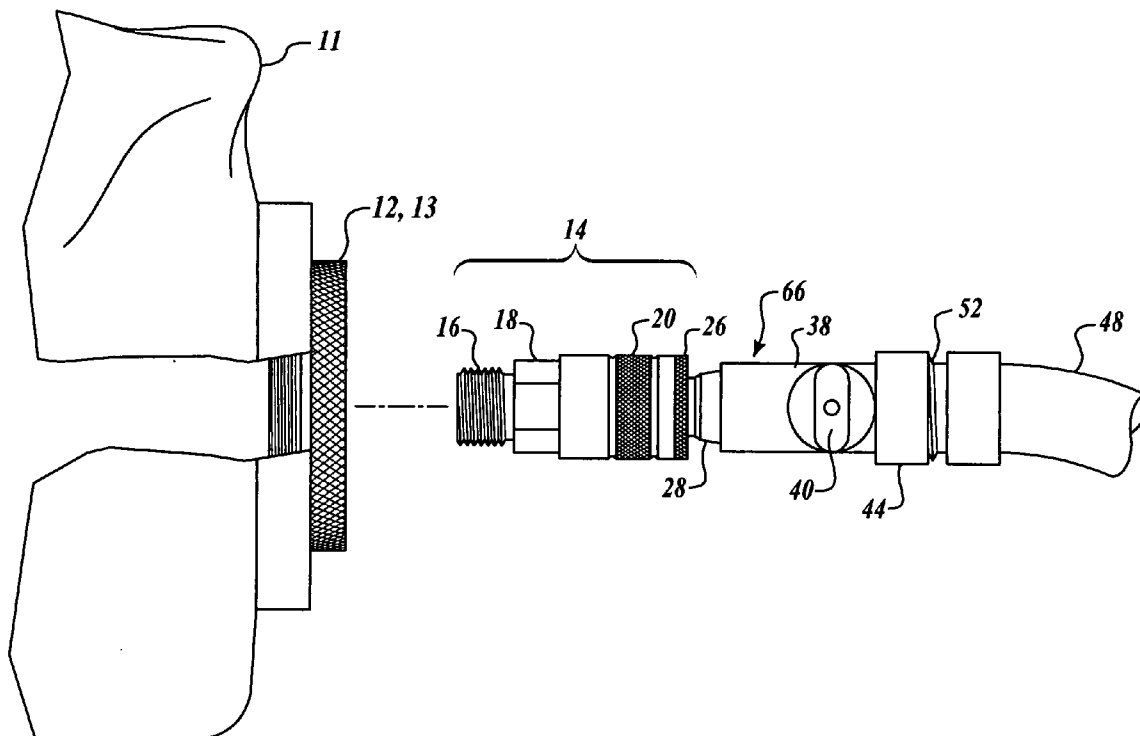
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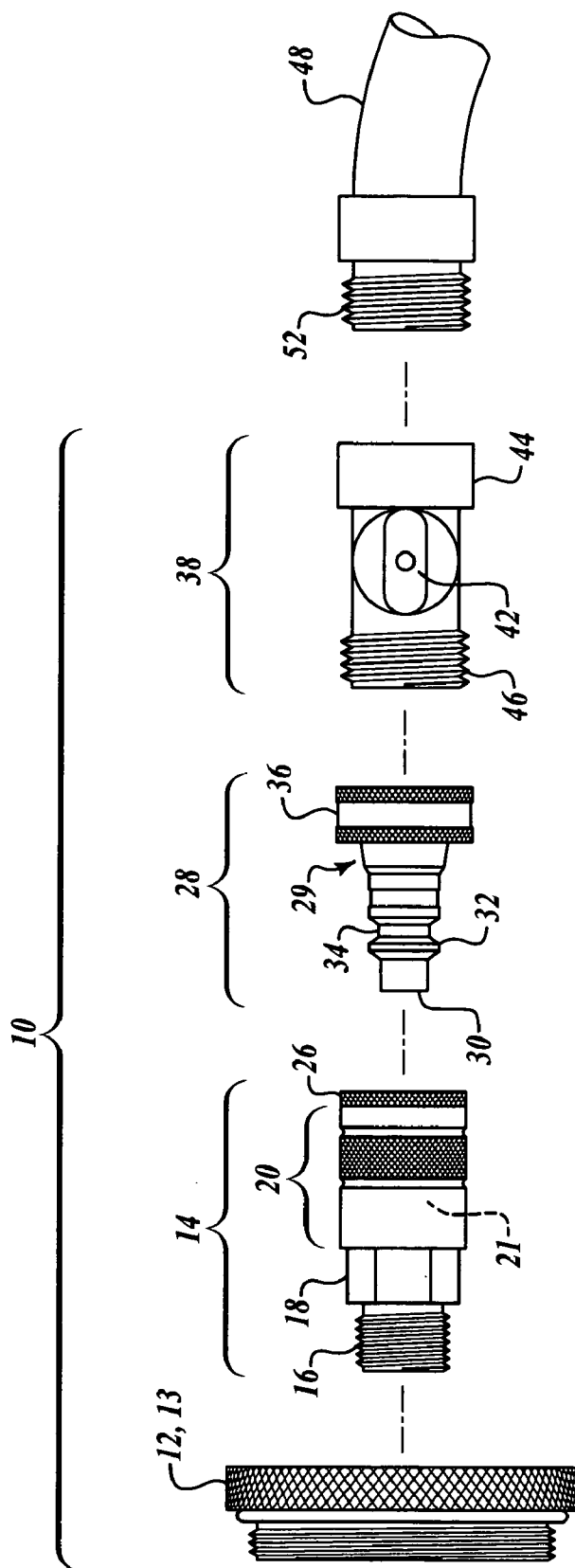


FIG. 1

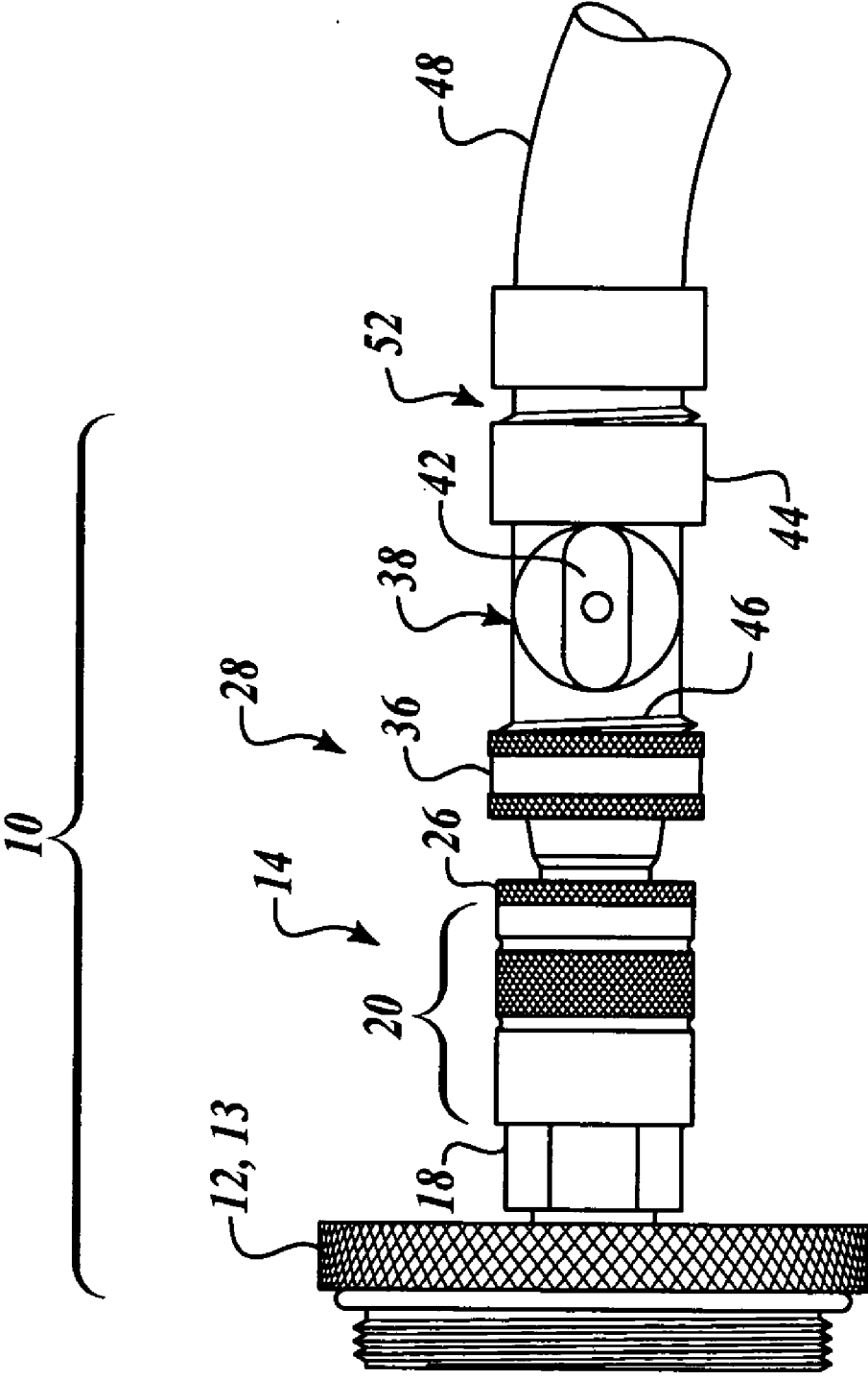


FIG. 2

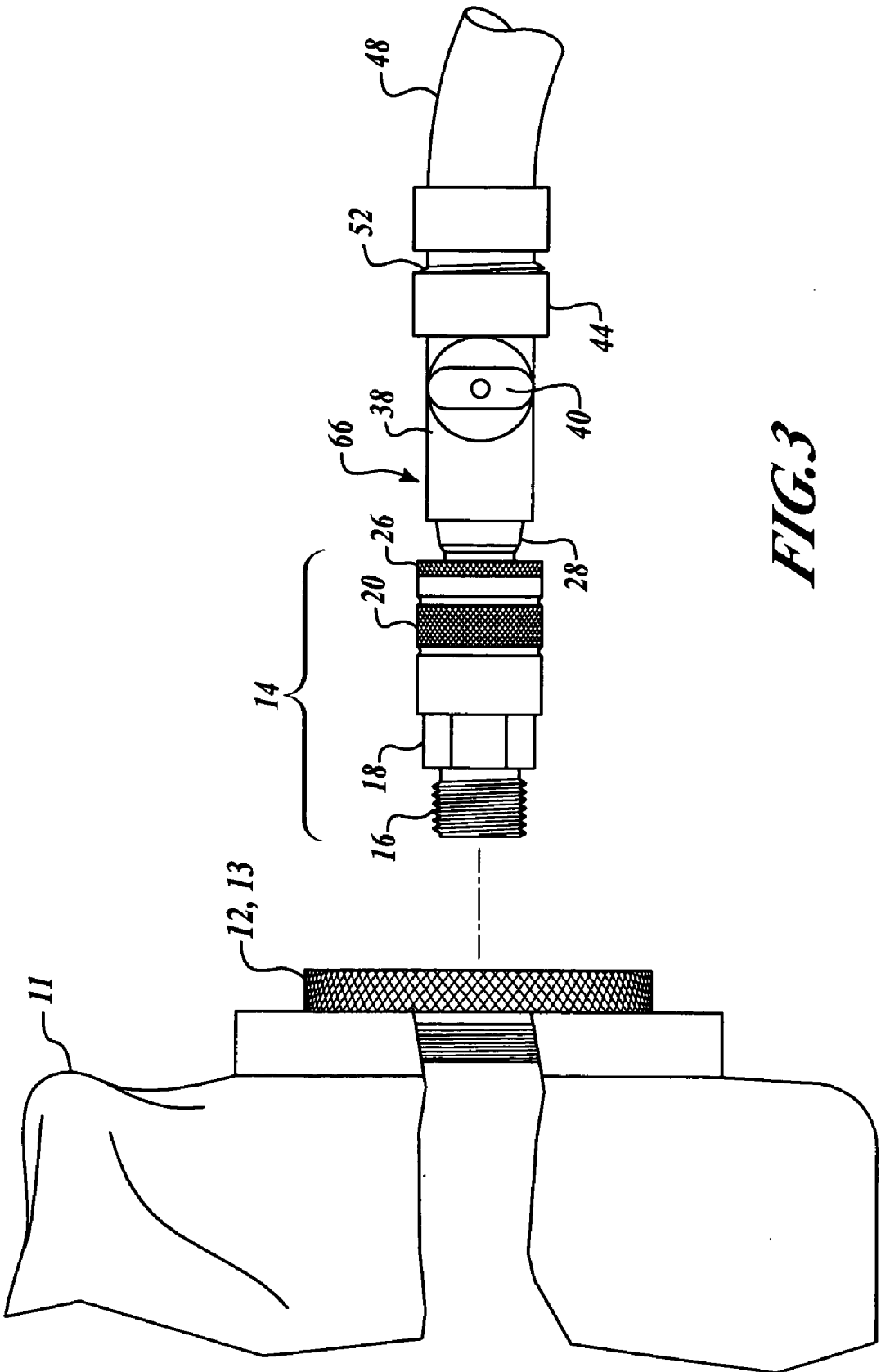


FIG. 3

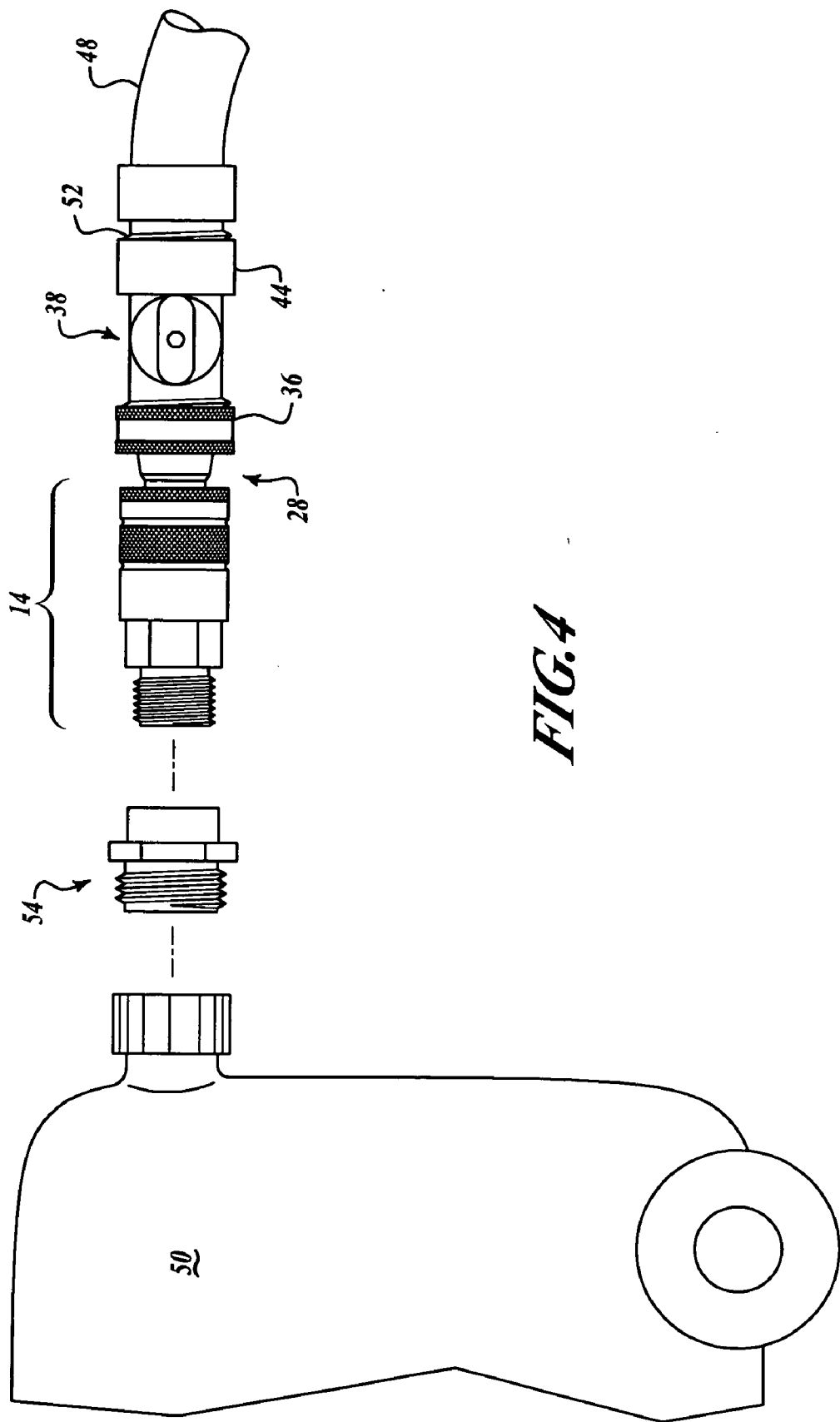


FIG. 4

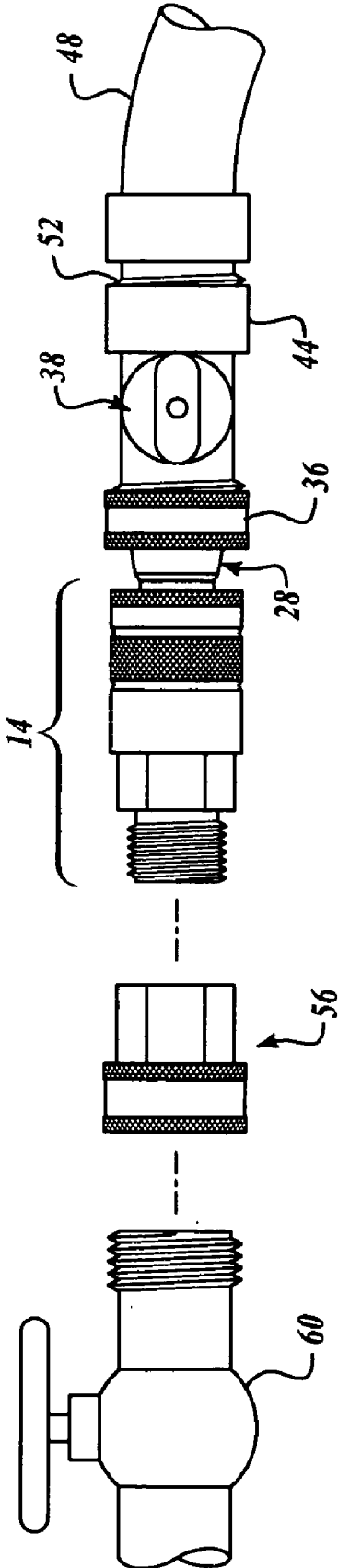


FIG. 5

QUICK-DISCONNECT, REDUCER NOZZLE/VALVE ASSEMBLY FOR FILLING FIREFIGHTING BACKPACK TANKS

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is related to Provisional Application Ser. No. 60/650,356 filed on Feb. 4, 2005 under the title Quick-Disconnect/Reducer Nozzle and Assembly for Filling Firefighting Backpack Pumps, the priority of which is claimed under 35 US Code §§ 119 and 120, and the entire subject matter of which is hereby incorporated by reference.

FIELD

[0002] The invention relates to the field of wildfire fighting equipment, more particularly to universal fluid transfer couplings that include a quick connect/disconnect adaptor, comprising a quick-disconnect reducer and valve coupling assembly, for faster and easier filling of the rigid tank and collapsible bag-type reservoirs of backpack firefighting pumps during remote wild land fire suppression. The inventive coupling is also useful in a wide variety of fluid transfer applications, including but not limited to pressure washers, sprayers and fluid conduits to hoses, and the like.

BACKGROUND

[0003] In the field of remote wild land fire suppression, fires often extend into road-less areas of extremely rocky or forested terrain characterized by steep changes in elevation, which are inaccessible to tanker trucks. In these cases, firefighter backpack reservoirs are standard in the arsenal of firefighter tools. Firefighters don these water-filled, collapsible bag or hard-sided backpacks which hold 5-8 gallons of water, equipped with a flexible hose and long-nozzle, manual slide pump to extend on foot beyond the range of tanker hoses. This allows firefighters to walk into such difficult terrain carrying their own reservoirs of water or fire suppression foam to douse hot spots, knock down grass fires, and attend to fire suppression in difficult-to-reach areas.

[0004] The weight of a backpack filled with 5 gallons of water is more than 40 pounds, which fire-fighters must carry in addition to their other heavy equipment such as shovels, chainsaws, hard hats, axes and heavy boots. But 5 gallons of water is exhausted quickly, requiring firefighters to repeatedly trek back over rough terrain to the water source, typically a parked tanker truck equipped with a large fabric hose, to refill the backpack reservoir. Because of the service requirements, the back-pack reservoir, slide pump and supply hose for the pump, and the various fitting must be robust.

[0005] Standard issue for many fire departments includes a backpack reservoir, such as the Indian Fedco Collapsible (bag-type) or Galvanized Steel Backpack Firefighting Pump, available from Forestry Suppliers Inc. of Jackson, Miss., the Flexpak collapsible bag-type backpack tank from Firehouse International Inc. of Anchorage Ak., or the Wildfire Backpack or Neoprene Collapsible Backpack available from Wildfire Equipment of Lachine, Canada.

[0006] The current method for refilling these reservoirs is to remove the backpack from the back, unscrew the threaded cap, insert a hose, and allow the pack to fill with water while the firefighter holds it upright to prevent spillage. Large

cotton hoses connected to the tanker truck are generally stepped down to fit a length of standard, 3/4" diameter, "toy" or garden hose that typically terminates in a plastic ball valve union. Once the garden hose is inserted into the backpack bag, the valve is opened to allow water to flow.

[0007] Soft-sided, collapsible backpacks, the preferred embodiment of such packs (preferred for their compact size, foldability and ease of transport when empty), are made either with a screw cap at the upper bag end and a pump hose port at the lower bag end, or with a combined cap and pump hose port located at the bottom of the bag. Regardless of bag design, both are filled by holding the screw cap opening in an upright position during filling. For some bags, this means turning it upside down. Both types of bags must be supported during filling, as it is the water itself which fills out their shape. At the same time, the hose must be held in the other hand to prevent it from slipping out of the relatively large cap hole under its weight and the pressure of the flowing water. In addition, for bottom-cap bags, they must be taken off; they cannot even be filled by others helping the wearer. Often, water overflows the bag as the firefighter struggles to support the bag while turning the shut-off valve. The result is a muddy, wet pack to put on his or her back before hiking back out into the wildfire area.

[0008] One aspect of the unsolved problem in the art is that standard garden hose quick-disconnect fittings both do not match the backpack fittings and are not sufficiently robust for wild fire field work. In addition, garden-type female quick-disconnect fittings do not have an auto-shut-off feature, that is they do not have an internal closure to prevent leakage when the male quick-disconnect fitting is removed. The fittings mis-match is deliberate; the purpose of the mis-match is to prevent parts from being used for the wrong application, that is, garden-type fittings cannot be used in hydraulic applications.

[0009] Hence, there is an unmet need in the art for a fast, efficient mode of filling backpack reservoirs that precludes the need to remove the bag cap and hold the hose inside the bag while simultaneously supporting the bag to prevent spilling, yet permits filling from toy hose water supplies via special fittings that are robust enough for the service conditions encountered in fighting wild fires.

THE INVENTION

Summary, Including Objects and Advantages:

[0010] Broadly speaking, the invention comprises a universal, fluid transfer, quick-connect/disconnect coupling union assembly (herein "Q-D" assembly) comprising a two or three part combination of elements: 1) a female member, and 2) a male nozzle/reducer member. The first, female member includes a collar that is axially slidable to permit ball detents to lockingly engage angled shoulders on the male nozzle/reducer end of the second (element #2), male quick-disconnect coupling member, and includes a conventional internal, spring biased fluid shut-off internal to the assembly. In addition, a valve union assembly is connected to the male Q-D member, either as an integral portion of the male reducer element, together being element 2A (and referred herein also as a "nozzle/reducer/valve" union or assembly), or as a separate threaded element of the assembly, as such being element 3. The valve union has a female end comprising a standard female-threaded rotating collar

(nominal 1") that can be threaded onto a standard "toy" or "pencil" (garden-sized) hose. For purposes of discussion, reference will be made below to backpack bags, it being understood that the term applies equally to collapsible bags and to rigid containers, whether of the backpack type, wheeled, portable or fixed. The parts can be supplied as a kit.

[0011] With respect to the male reducer member, element #2 above, in its most basic aspect, this element of the inventive combination is a unitary fitting comprising a combination of a hydraulic-sized, male quick-disconnect nozzle with a standard garden hose-sized, female internally threaded collar. This sub-combination element is an independently inventive fitting apart from the combination, and can be supplied alone or as part of the kit.

[0012] The size of all standard garden hose terminal fittings, regardless of the size of the hose (1/2"5/8" or 3/4" capacity), are the same. The chart below illustrates the disparity between standard garden terminal fittings and hydraulic fitting sizes:

Part	Standard Garden Hose Fitting	Hydraulic Fitting
Male exterior threads, to thread roots	1 1/4" (nominal 1")	1 1/4" (nominal 3/4)
Male exterior threads, to thread tips	1"	3/4"
Female opening of Q-D	2 3/32" (nominal 3/4")	3/4" (nominal 5/8)
Male nozzle delivery tip, exterior diameter	5/8" (nominal 5/8")	1 3/32" (nominal 3/8)
Male nozzle delivery tip I.D.	5/16"	3/32"

[0013] The inventive Q-D fluid transfer assembly is thus universal, in that it provides multiple configurations to match the wide variety of backpack bags available in the industry. There are two main bag configurations: A. Bags with a 2-4" screw cap at the top for filling and a hose pump port at the bottom; and B. bags with a combined 2-4" screw cap (or other fitting, which may be permanently secured to the reservoir wall) with a hose pump port built into the cap or a in a flange, either located at the bottom of the bag. Hose pump ports, always located at the bottom of the bag (for gravity feed), come in two general configurations: 1) those with fixed fittings (such as a brass elbow and hose barb for connecting to the sprayer/slide-pump hose); and 2) those with a female quick-disconnect fitting, into which a male quick-disconnect fitting of the sprayer/slide-pump hose is snapped for use. In the second configuration, the male quick-disconnect fitting is connected to the hose via a barb or small tube onto which the hose is forced, and may also include a screw clamp to retain the hose on the barb or tubing.

[0014] The inventive universal coupling solves the need in the art since although nominal 5/8" is standard size for the female quick-disconnect fitting of pump ports having such fittings (see chart above), there is no standard fitting for transition from a nominal 1" garden ("toy") hose fitting to a quick disconnect male nozzle that fits such pump port female fittings.

[0015] In addition, commercial garden hose materials do not have the necessary service life for the rough conditions

of wildfire fighting. For firefighting conditions, brass or stainless steel is preferred for its robust qualities and lack of corrosion by firefighting chemicals. Where plastic is considered for lighter weight, a much higher, tougher grade is required, such as polycarbonate or Delrin, to provide the necessary service life robustness.

[0016] In the current best mode embodiment, where the backpack bag includes a female quick-disconnect fitting at the bottom of the bag for mounting the water outlet delivery hose, the inventive male nozzle/reducer/collar (element #2 above), or nozzle/reducer/valve assembly (element #2A above), connects to the quick-connect/disconnect female fitting mounting of the hose pump port at the bottom of the bag, permitting filling from the bottom up, including filling, at the fire fighter's election, without taking the bag off his/her back. The inlet end of the inventive male fitting, in either embodiment (integral or two-part) comprises a standard, nominal 1", female threaded, rotatable collar (collar O.D. 1 1/8") which permits a standard garden hose male fitting (nominal 1") to be connected for filling the bag through the pump port.

[0017] In the current best mode embodiment, where the bag has a threaded cap with a non-quick disconnect female fitting, e.g. an elbow connecting to the sprayer/slide pump tubing, there are two alternative approaches of the invention: First, a second threaded hole is provided in the cap, and the female quick-disconnect fitting is threaded into this second hole. It is reserved for filling; it is left in place and does not leak due to the internal shut off. The male inventive quick-disconnect reducer/valve/collar assembly is attached to a supply hose and jacked into this second port when needed for refilling the bag. Second, the elbow fitting can be removed and replaced with the female portion of the inventive assembly; in this instance the inventive male Q-D reducer/valve assembly is used as before, and a male nozzle with barb assembly will be fitted into the end of the slide/pump hose.

[0018] For those bladder bags that have a separate screw cap at the upper end of the bag (and a non-threaded, separate pump hose port at the bottom of the bag), or for those situations where it is preferable not to disconnect the pump hose during refilling, a second embodiment of the inventive quick connect-disconnect assembly includes a retrofittable cap threaded with a 5/8" female quick connect/disconnect port, provided exclusively for refilling. The inventive male Q-D reducer/valve/collar assembly (element #2) is used as before to fill the bag from the top.

[0019] The embodiment just above may also be used with rigid backpack pump systems. The reservoirs are not air-tight vessels so that there is no vacuum lock during use (draining). They are filled through a threaded cap located at the top of the rigid tank. In this embodiment, an inventive retrofittable cap is provided as described just above. This inventive cap assembly includes the threaded cap, sized to fit the backpack fill hole, and the cap is fitted with a 5/8" female quick-connect/disconnect port. The inventive male nozzle/reducer/collar element #2 is connected to the fill hose and it jacks into the female quick-disconnect port in the cap for filling.

[0020] In all these embodiments, the inventive male nozzle/reducer/collar element #2 is the same as in the first embodiment; it fits into either the pump hose female quick-

disconnect port provided with the bladder bag, the inventive threaded cap retrofitted to the bladder bag, or the inventive threaded cap retrofitted to the rigid tank.

[0021] For a female quick-disconnect to be employed in a bag with an upper screw cap, a hole is drilled into the cap to retrofit it with a female quick-disconnect fitting, so that the inventive male nozzle/reducer/collar connected to a garden hose may be employed to top-fill the bag. If the available bag employs a combined screw cap/pump port located at the bottom of the bag, the cap is drilled with a second hole (next to the fixed pump port) into which the female quick disconnect is placed, so that the inventive male nozzle/reducer may be used to fill the bottom-fill the bag adjacent to the pump port fittings.

[0022] Although most female disconnect fixtures used in these bags include an auto-shut-off, in all embodiments of the inventive male nozzle/reducer/collar, it is preferred to include a valve union connected between the male reducer fitting member and the toy hose water supply for ease of control of the rate of fill, and for ON/OFF control next to the point of delivery, that is, at the bag end, rather than have to go to the other end of the hose (the tanker truck) for shut-off control.

[0023] In another alternative embodiment, the quick-disconnect male and female elements can be reverse-mounted. That is, the screw cap is retrofitted with the inventive male nozzle/reducer/valve union, either of elements #2A or #3 above. The toy hose may then be fitted with an auto-shut-off female quick disconnect (hydraulic sized at the Q-D end, and standard garden hose sized at the hose end), so that no auto shut-off is required on the bag. The valve in the male union assembly prevents water loss from the bag. In the alternative, the valve portion of element #2A/3 may be omitted, and element #2 with a flap covering the inlet hole from the male nozzle is used to prevent water loss and at the same time permit air inlet to prevent vacuum lock.

[0024] Thus, in its broad aspects the inventive system is a fluid transfer connector assembly, comprising in operative combination: a) a quick-disconnect coupling union including: i) a first, female member having a first, threaded end for threaded coupling to a bag or container for dispensing fluid therefrom, said threaded end being selected from a male-threaded end and a female-threaded rotating collar, and a second end having a collar that is axially reciprocable to releasably receive a second, male quick-disconnect coupling reducer member and having an internal auto-shut off; ii) a second, male quick-disconnect coupling reducer member having a first end having a nozzle that is releasably engagable into the first coupling union female member, and a second end that has a rotatable female-threaded collar; b) a fluid supply union member selected from at least one of a valve union and a fluid delivery hose, wherein the valve union has a first, male-threaded end for engaging the quick-disconnect male member female-threaded collar, a second end having a female-threaded collar, and a manually rotatable valve element disposed centrally between its ends to control the flow of fluid through the valve union, to and through said quick-disconnect coupling union and into the bag or container; and d) the fluid delivery hose includes an end coupling having male threads for selectively engaging directly to the quick-disconnect male fitting member or the valve union.

[0025] Where a $\frac{5}{8}$ " female quick disconnect union is provided as a standard connection for the flexible hose and sprayer/slide pump assembly that is included with many backpack pump systems, the use of the inventive system is as follows: Instead of unscrewing the cap (which may be located at the top or bottom of the bag) to refill the reservoir, the firefighter simply quick-disconnects the pump hose, and quick-connects the inventive nozzle/reducer/valve element #2A or the nozzle/reducer/collar plus valve union, together as element #3, which is sized specifically to reduce the flow diameter from a standard $\frac{3}{4}$ " flexible hose into the $\frac{5}{8}$ " female port. Since flexible backpack reservoirs are vacuum types, that is they collapse as they are emptied, there is no need for an air inlet, vacuum break, valve in this embodiment. Where needed, a one-way air inlet flap valve can be provided in the cap along with the quick disconnect union as a vacuum breaker.

[0026] All fire trucks, which generally travel with standard $1\frac{1}{2}$ " cotton-jacketed hose, are required to carry reducer-connectors, to step down their large hose to 1" for connecting a smaller hose to extend their reach and enable connectivity to more standard commercial and household plumbing connections. Hence, the addition of the inventive nozzle/reducer/collar-or-valve enables standard backpack pumps to be quick connected to standard fire hose reducers.

[0027] The inventive device provides several benefits:

[0028] It saves water by eliminating the overflow often associated with the current method of refilling the bags, that is, an unsealed $2\frac{1}{4}$ " bag opening into which is inserted a $\frac{3}{4}$ " water hose, and a firefighter who must hold the bag upright with one hand and fill it with the other, then close the shut-off valve of the hose at precisely the right moment to prevent overflow, without letting go of the collapsible bag, thereby causing water to pour out of the non-rigid vessel;

[0029] It makes it possible for the backpack to be connected and thereby sealed in a water-tight fashion to the hose to fill without having to be propped up or otherwise attended by a firefighter, thus allowing the firefighter a short respite between forays into the fire area;

[0030] It enables one firefighter to "hook up" another's backpack to the hose, while the pack is still worn on the back of the second firefighter, thus saving time and conserving firefighter energy;

[0031] The tanker truck can transport a 10-foot or longer (often in excess of 100') toy hose, with the inventive shut-off valve union and quick-disconnect reducer/nozzle/collar element already attached, so that in less than one minute, the set-up can be assembled in the field for use by a crew who must move quickly and efficiently to control fast-moving fires.

[0032] The nozzle/reducer/collar and valve assembly (or the integral nozzle/reducer/valve element) can be used for both collapsible backpack portable sprayers, typically made of neoprene, nylon, acrylic, Kevlar or other durable water-proof fabric, or for metal can-type rigid backpack sprayers, typically made of galvanized or stainless steel, by retrofitting the cap with a threaded union attached to a quick disconnect female fitting.

[0033] The inventive quick-connect/disconnect male nozzle/reducer/collar-or-valve is made of stainless steel,

nickel bronze or Delrin plastic, depending upon the desired durability or government specification, if applicable.

[0034] To use the inventive nozzle/reducer/valve for a bottom fill backpack, only three steps are needed:

[0035] 1. Quick-disconnect the pump hose from the backpack;

[0036] 2. Quick-connect the re-fill hose (via the inventive nozzle/reducer and valve union); and

[0037] 3. Turn the water on at the valve next to the inventive nozzle/reducer

The same three steps in reverse are required to reconnect the hose pump to the backpack:

[0038] 1. Turn the water off at the refill hose valve;

[0039] 2. Quick-disconnect the re-fill hose;

[0040] 3. Quick-connect the pump hose to the backpack.

[0041] Because the inventive nozzle/reducer/collar-or-valve solves a need in the art for a reducer transition fitting between a $\frac{5}{8}$ " quick disconnect nozzle and a standard 1" garden hose terminal fitting, it is suitable for uses well beyond those of the wildfire fighting field. At the consumer level, it may be used to connect a variety of equipment (power sprayers and the like) to the home garden hose.

[0042] In alternate embodiments, the backpack fluid delivery system is used for the delivery of a variety of environmental treatment fluids, including insecticides, herbicides, fertilizers, moss control, fungicides, algacides, mildew control, fire suppressants, water proofing, stain repellants, pest control and cleaning solutions.

[0043] A note about terminology: It should be understood that what is known in the wild fire field as a " $\frac{3}{4}$ " fitting is a reference to a fitting for a standard toy, pencil or garden hose of $\frac{3}{4}$ " size, and such fittings, by measure are nominal 1" fittings. The garden hose fittings (male and female) are the same size, regardless of hose size, whether $\frac{1}{2}$ ", $\frac{5}{8}$ " or $\frac{3}{4}$ ".

BRIEF DESCRIPTION OF THE DRAWINGS

[0044] The invention is described in detail by reference to the drawings, all of which are electronic photographs of an actual, full sized prototype of the inventive tube trap in which:

[0045] **FIG. 1** is an exploded view of the parts which, when assembled, allow a backpack bag to be directly connected to a "toy"-type garden hose, and which can be supplied as a kit;

[0046] **FIG. 2** is a plan view of the same configuration as **FIG. 1**, with the parts assembled;

[0047] **FIG. 3** is a plan view of the same configuration as **FIGS. 1 and 2**, this time showing the inventive integral quick-disconnect male nozzle/reducer/valve element as part of the total fluid transfer assembly;

[0048] **FIG. 4** is a plan view showing the inventive quick disconnect reducer assembly can be adapted for male-female connections to containers other than standard wildfire backpacks, a pressure washer being shown; and

[0049] **FIG. 5** is a plan view showing the inventive Q-D system can be adapted for male-male and female-female connections to water sources other than standard wildfire backpacks.

DETAILED DESCRIPTION OF THE INVENTION, INCLUDING THE BEST MODE

[0050] The following detailed description illustrates the invention by way of example, not by way of limitation of the scope, equivalents or principles of the invention. This description will clearly enable one skilled in the art to make and use the invention, and describes several embodiments, adaptations, variations, alternatives and uses of the invention, including what is presently believed to be the best modes of carrying out the invention.

[0051] In this regard, the invention is illustrated in the several figures, and is of sufficient complexity that the many parts, interrelationships, and sub-combinations thereof simply cannot be fully illustrated in a single patent-type drawing. For clarity and conciseness, several of the drawings show in schematic, or omit, parts that are not essential in that drawing to a description of a particular feature, aspect or principle of the invention being disclosed. Thus, the best mode embodiment of one feature may be shown in one drawing, and the best mode of another feature will be called out in another drawing.

[0052] All publications, patents and applications cited in this specification are herein incorporated by reference as if each individual publication, patent or application had been expressly stated to be incorporated by reference.

[0053] The Figures are numbered and annotated so that one skilled in the art of hydraulic or pneumatic flexible hose fitting, by reference to the attached parts list will easily be able to understand the materials and method of construction and will be able to easily assemble the parts to achieve the functionality shown. In this connection, note that neither the bladder bag nor the fire hose are shown; it should be understood that the cap connects to the bladder bag, and the valve union connects to the fire hose.

[0054] **FIG. 1** shows an exploded view, and **FIG. 2** shows the corresponding assembled view, of the inventive fluid transfer assembly **10** between a supply, reservoir, bag or tank **50** (best seen in **FIG. 3**) and the water supply hose **48** (the $1\frac{1}{2}$ " fire hose is not shown; it will be to the right of toy hose **48**). Starting at the left hand side of the figure, the threaded bag cap **12** (or pump port **13**), fitted directly into bag or tank, is fitted with a standard $\frac{5}{8}$ " hydraulic female quick disconnect union, comprising a threaded male end **16** (not visible in **FIG. 2**) connected to a segment having a plurality of nut-type flats **18** to permit engagement by a wrench for tightening. This Q-D union includes a knurled, non-slip ball detent actuation sleeve **20**, which is spring-loaded over internal detent body **21** and ending in a stop **26**. To the right of the Q-D female union **14** is the inventive hose coupling nozzle/ reducer/collar element (element #2) **28**, which includes a male nozzle end **30** having shoulders **32** and groove **34** that retain the internal detent balls of union **14**. having one or more medial step-down or tapered reducer sections **29**. At the other end of the element **28** is a fixed female collar **38** that is sized to receive nominal 1" garden hose male threaded end-fitting. This can be a standard collar brazed onto the nozzle reducer section. The inventive fluid

transfer assembly also includes a standard 1" shut-off ball valve union 38, having a nominal 1" male threaded end and a nominal 1" threaded female collar 44, and contains a manual ball valve insert 42 medial of the ends. A length of garden hose 48 having male nominal 1" threaded fitting is connected to the ball valve collar 44. The other end of the garden hose (not shown) generally includes a reducer to engage a larger, 12" gauge, cotton-jacketed firefighting hose (not shown).

[0055] Visible in this exploded view are the quick-connect/disconnect female 14 and male 28 halves of the inventive connector assembly, as they would be separated when the backpack is out in the field. The female port 14 is connected into either the bottom or top cap or flange 12, 13, as the case may be, either as a retrofit, or as an already-provided fitting for receiving the sprayer/slide pump hose (not shown). The supply hose 48, ball valve union 38 and nozzle/reducer/collar element 28 remain connected to the tanker truck hose assembly (not shown). In use, when the detent sleeve 20 is axially retracted away its stop 26, the internal detent steel balls (not shown) located radially around the inside of the body, are released to move outward, thus permitting insertion of the inventive Q-D male nozzle/reducer/collar element 28. Upon release of the sleeve 20, the steel balls are pushed into the detent groove 34, locking around the retaining shoulder 32, so that the delivery end 30 (which has a 5/16" inner diameter) of the nozzle 28 is securely sealed inside the female union 14. Connected to the threaded female collar end 36 of the male nozzle/reducer/collar element 28 is a standard, garden type shut-off ball valve union 38. The valve 38 is kept in the closed position 40 while the connections are being made, and is opened 42, by manually rotating the knob to allow water to flow once the delivery end 30 is securely seated in the female fitting 14.

[0056] FIG. 2 shows the assembled configuration of the components shown in FIG. 1: male threaded end 16 (not visible) is threadingly engaged inside screw cap 12 (or pump port 34); the inventive male nozzle/reducer/collar element 28 has been snapped into the female Q-D fitting. The collar 36 engages the male threads 46 of the ball valve union 38, and in turn the collar 44 is threaded onto a 1" hose end 52, connected to hose 48. In FIGS. 1 and 2, valve 42 is shown in the open (horizontal) position; FIG. 3 shows it in the closed position, 40.

[0057] FIG. 3 shows quick connect female 14, with the threaded male end 16 disconnected from a hole in bag cap 12. In this view, the nozzle/reducer element 28 and ball valve 38 are integral, comprising an example of the element #2A. There is one less male/female threaded connection, the collar 44 being sized to connect directly to the standard, nominal 1" garden hose fitting 52. Note the female collar 44 is an integral part of the combined nozzle/reducer/valve fitting element #2A, item 66 in FIG. 4.

[0058] FIG. 4 shows how the same assembly parts—female quick-disconnect fitting/pump port 14, inventive male Q-D nozzle/reducer/collar 28, ball valve union 38—can be adapted to fit a variety of tanks or bags 50 by using transition fittings, such as a male-female union adapter member 54.

[0059] FIG. 5 shows a female-female transition union adapter member 56 used to connect a male supply pipe, such as a hose bib (optionally with a shut-off valve), to the female

Q-D fitting 14. The orientation of the combination assembly 14, 28, 38 (or 14, 66; see FIG. 3) could be reversed end for end where the supply 60 terminates in a female collar, in which case a male-male transition union adapter member could be used to connect to the collar 44 of the shut-off valve 38. The same kinds of connections can be assembled to connect a fluid source other than a backpack to a delivery system other than a pump sprayer.

[0060] A kit containing the fittings 28 and 38 can be packed in a poly bag and sold as such. In the alternative a single combined fitting 66 may be supplied, alone or with fitting 14 and, optionally a retrofit cap having a fitting 14 installed therein. Other fittings, such as 54 and 56 may be provided.

INDUSTRIAL APPLICABILITY

[0061] It is clear that the inventive quick disconnect reducer nozzle has wide applicability to the wildland firefighting industry, namely to enable firefighters to refill backpack reservoirs quickly, neatly and without having to support the bag or the hose while doing so.

[0062] It should be understood that various modifications within the scope of this invention can be made by one of ordinary skill in the art without departing from the spirit thereof and without undue experimentation. For example, if 1" nominal toy or "pencil" garden-type hose is not the standard in certain firefighting regions, a quick-connect reducer nozzle following the principles of this invention can be fabricated to step such hose down to fit the female connector fitted into a bladder bag cap. Or if bladder bag designs should change over time, resulting in an inlet fitting or cap of a different size or fabrication, such cap or fitting can easily be fitted with an appropriate quick disconnect female to allow the inventive Q-D elements to be used therewith.

[0063] Parts List: This parts list is provided as an assist to examination; it may be canceled upon allowance

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- 10 Four-part Connection Assembly between bladder bag and fire hose
 - 11 Bladder Bag
 - 12 Bladder Bag Cap (top or bottom)
 - 13 Pump Port
 - 14 Quick Disconnect Union, Female (pump hose port)
 - 16 Male Threaded end (nipple)
 - 18 Nut Portion
 - 20 Knurled (non-slip) Ball Detent Actuation Sleeve
 - 21 Detent Body
 - 22 Detent Steel Balls
 - 26 Stop on End of Detent Body
 - 28 Quick Disconnect Nozzle/Reducer, collar element
 - 29 Reducer Sections
 - 30 Nozzle Delivery End
 - 32 Angled Shoulders doe engaging detent balls
 - 34 Detent Ball Groove
 - 36 Female Hose-Coupling Collar of Male Quick Disconnect Element 28
 - 38 Ball Valve Union
 - 40 Ball Valve stem closed position
 - 42 Ball valve stem open position
 - 44 Female collar for Ball Valve Union
 - 46 Male Threaded End for Ball Valve Union

-continued

48	Garden "toy" or "pencil" hose
50	Pressure Washer
52	Male 1" hose end
54	Male-female transition union adapter member
56	Female-female transition union adapter member
58	Male-male transition union adapter member
60	Hose bib
62	Female hose end
64	
66	Integral nozzle/reducer/valve element

1) A fluid transfer connector assembly, comprising in operative combination:

- a) a quick-disconnect coupling union including:
 - i) a first, female member having a first, threaded end for threaded coupling to a container for dispensing fluid therefrom, said threaded end being selected from a male-threaded end and a female-threaded rotating collar, and a second end having a collar that is axially reciprocable to releasably receive a second, male quick-disconnect coupling reducer member;
 - ii) a second, male quick-disconnect coupling reducer member having a first end having a nozzle that is releasably engagable into said first coupling union female member, and a second end that has a female-threaded collar;
- b) a fluid supply union member selected from at least one of a valve union and a fluid delivery hose;
- c) said valve union having a first, male-threaded end for engaging said quick-disconnect male member female-threaded collar, a second end having a female-threaded collar, and a manually rotatable valve element disposed centrally between said ends to control the flow of fluid through said valve union, to and through said quick-disconnect coupling union and into said container; and
- d) said fluid delivery hose includes an end coupling having male threads for selectively engaging directly to said quick-disconnect male member or said valve union.

2) A fluid transfer connector assembly as in claim 1 wherein said first, quick-disconnect coupling member first threaded end terminates in male threads, and which includes a container fitting having a female-threaded aperture for engaging the male-threaded end of said female quick-disconnect coupling union member.

3) A fluid transfer connector assembly as in claim 1 wherein said valve union and said male member portion of said quick-disconnect coupling union are integral, so that said second end of said second male member is eliminated and said valve union first end is eliminated and said integral connector is continuous between said valve and said nozzle.

4) A fluid transfer connector assembly as in claim 1 wherein said first, female quick-disconnect coupling union member has a first end terminating in a female-threaded rotating collar.

5) A fluid transfer connector assembly as in claim 1 which additionally includes a transition union adapter member for adapting the size of said male threaded end of said female quick-disconnect coupling union member to a standard

hose-size female-threaded collar, useful for connecting to supply pipes or hoses, pressure washers, and the like.

6) A fluid transfer connector assembly as in claim 1 which additionally includes a male-male transition union adapter member for adapting said female-threaded collar end of said valve union member to a male threaded end for coupling to a female-threaded collar, useful for connecting to supply pipes, hoses and the like.

7) Improved backpack-type fluid delivery system comprising in operative combination:

- a) a fluid container having a generally planar cap or flange disposed in at least one location selected from an upper end and a lower end, and including a generally centrally-located female-threaded aperture;
- b) a quick-disconnect coupling union comprising a female member having a first, male-threaded end for threaded coupling to said central aperture for dispensing fluid therefrom into said container, and a second end having a collar that is axially reciprocable to releasably receive a second, male quick-disconnect coupling reducer member; and
- c) a second, male quick-disconnect coupling reducer member having a first end having a nozzle that is releasably engagable into said first coupling union female member, and a second end that has a female-threaded collar sized for connection to a nominal 1" fluid delivery hose fitting.

8) Improved backpack fluid delivery system as in claim 7 which includes, intermediate of said said reducer member and said fluid delivery hose, a valve union having a first, male-threaded end for engaging said quick-disconnect male member female-threaded collar, a second end having a female-threaded collar, and a manually rotatable valve element disposed centrally between said ends to control the flow of fluid through said valve union, to and through said quick-disconnect coupling union and into said container; and said fluid delivery hose includes an end coupling having male threads for selectively engaging directly to said quick-disconnect male member or said valve union.

9) Improved backpack fluid delivery system as in claim 8 wherein said valve union and said male member portion of said quick-disconnect coupling union are integral, so that said second end of said second male member is eliminated and said valve union first end is eliminated and said integral connector is continuous between said valve and said nozzle.

10) Improved backpack fluid delivery system as in claim 8 wherein said backpack container is selected from a fabric-type bag and a rigid container.

11) Improved backpack fluid delivery system as in claim 10 wherein said container is a collapsible fabric-type bag.

12) Improved backpack fluid delivery system as in claim 10 wherein said system is adapted for wildfire fighting, and environmental treatment fluid delivery.

13) Improved backpack fluid delivery system as in claim 12 wherein said environmental treatment fluid delivery system is selected from insecticides, herbicides, fertilizers, moss control, fungicides, algacides, mildew control, fire suppressants, water proofing, stain repellants, pest control and cleaning solutions.

14) A kit of quick-disconnect fittings permitting transition from standard, nominal 1" garden hose fluid delivery systems to standard, nominal 5/8" hydraulic fittings comprising at least one male reducer fitting having a 5/8" fluid delivery

nozzle, an intermediary transition portion, and a fixed female threaded collar of nominal 1" size.

15. A kit as in claim 14 which includes a ball valve union having a first male threaded end, and a second threaded female collar, both threaded ends being nominal 1" size, and having a manual ball valve medial of the two ends, said male end of said union being sized to threadedly engage the female collar of said male reducer fitting.

16. A kit as in claim 14 wherein said male reducer fitting includes a manual ball valve medial between said collar and said reducer section.

17. A kit as in claim 15 which includes a nominal 5/8" female quick-disconnect fitting.

18. A kit as in claim 16 which includes a nominal 5/8" female quick-disconnect fitting.

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