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Inventor(s)	Merrett; Stanley L.

Water jet transfer device

Abstract

A water jet transfer device includes a jet transfer assembly, an intake assembly and an output barrel. The jet transfer assembly includes a body having a water-outlet end coupled to a first section of flexible tubing and a water-intake end coupled to a second section of flexible tubing. The jet transfer assembly also includes a jet tube that establishes a negative demand pressure within the body and a check valve assembly having a valve support plate and a flexible valve seal member secured to the valve support plate. The second section of flexible tubing is coupled to an intake assembly positioned in a water holding tank containing water. The first section of flexible tubing is coupled to an output barrel through which water drawn through the intake assembly and into the body responsive to the negative demand pressure is delivered to another water holding tank.

Inventors: **Merrett; Stanley L. (Dadeville, AL)**

Applicant: **ETT, L.L.C.** (Dadeville, AL)

Family ID: **1000008749341**

Assignee: **ETT, L.L.C. (Dadeville, AL)**

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Primary Examiner: Venkatesan; Umashankar

Attorney, Agent or Firm: Neustel Law Offices

Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS
(1) Not applicable to this application.
STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT
(2) Not applicable to this application.
BACKGROUND
(3) The described example embodiments in general relate to water jet transfer device for transferring water from one holding tank to another holding tank.
(4) In order to establish a sufficient water supply required for fighting fires in rural areas, which are located away from a pressurized water source such as a city water system, it is often necessary for the fire department to transport water to the scene of a fire using large tanker trucks. The water from the tanker trucks is then dumped into one or more portable holding tanks located at the fire scene. The water within the one or more portable holding tanks can then be used by a fire engine equipped with a pump. The water from the one or more portable holding tanks enters the fire engine pump via a rigid suction hose having an intake strainer attached to the end of the those. These strainers, termed low level strainers in the fire industry, provide flow to meet the fire engine pumping capacity, which is typically 1250-1500 GPM (gallons per minute).
(5) Hauling water using tankers is known as a water shuttle. The water shuttle process entails filling of the tankers at a loading site and emptying the tankers into holding tanks at the fire scene. It is customary in the instance of large fires to deploy multiple portable holding tanks. While multiple tanks allow large quantities of water to be stored on site, the water must be transferred to the suction holding tank (e.g., the portable tank from which the fire engine pump draws water). To accomplish this transfer, a six-inch diameter rigid suction hose coupled to a low-level strainer is typically used to transfer water from portable tank to portable tank to the suction holding tank. However, the six-inch suction hose is limited to 600-750 GPM, which is far less than the 1250-1500 GPM needed to meet pump requirements. Hence, the fire engine pump cannot maintain full capacity as the water is not being transferred from one tank to another at a sufficient speed to support full capacity. With an insufficient amount of water, the fire engine pump loses suction (e.g., cavitates) and quits working. To resolve this issue, the current common practice is to simultaneously utilize at least two suction hoses, and respective low-level strainers coupled thereto, to transfer water from one portable tank to another providing a water transfer rate of 1200-1500 GPM.
SUMMARY
(6) Some of the various embodiments of the present disclosure relate to a water jet transfer device that can singularly transfer water between first and second portable holding tanks at a rate sufficient to meet the pumping capability (e.g., 1250-1500 GPM) of a fire engine pump vehicle. In certain embodiments, the water jet transfer device includes a jet transfer assembly, an intake assembly and an output barrel. The jet transfer assembly includes a body having a water-outlet end coupled to a first section of flexible tubing and a water-intake end coupled to a second section of flexible tubing. The jet transfer assembly also includes a jet tube that establishes a negative demand pressure within the body and a check valve assembly having a valve support plate and a flexible valve seal member secured to the valve support plate. The second section of flexible tubing is coupled to an intake assembly positioned in a water holding tank containing water. The first section of flexible tubing is coupled to an output barrel through which water drawn through the intake assembly and into the body responsive to the negative demand pressure is delivered to another

water holding tank. In certain embodiments, the jet transfer assembly itself is coupled between the drain sleeve of a first water holding tank and the drain sleeve of a second water holding tank wherein the negative demand pressure created by the jet tube causes water to be drawn from the first water holding tank through the first drain sleeve and through the body of the jet transfer assembly to be output to the second water holding tank via the second drain sleeve.

(7) There has thus been outlined, rather broadly, some of the embodiments of the present disclosure in order that the detailed description thereof may be better understood, and in order that the present contribution to the art may be better appreciated. There are additional embodiments that will be described hereinafter and that will form the subject matter of the claims appended hereto. In this respect, before explaining at least one embodiment in detail, it is to be understood that the various embodiments are not limited in its application to the details of construction or to the arrangements of the components set forth in the following description or illustrated in the drawings. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of the description and should not be regarded as limiting.

(8) To better understand the nature and advantages of the present disclosure, reference should be made to the following description and the accompanying figures. It is to be understood, however, that each of the figures is provided for the purpose of illustration only and is not intended as a definition of the limits of the scope of the present disclosure. Also, as a general rule, and unless it is evidence to the contrary from the description, where elements in different figures use identical reference numbers, the elements are generally either identical or at least similar in function or purpose.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** is a side view of a water jet transfer device in accordance with an example embodiment.

(2) FIG. **2** is a front view of an example embodiment of an output barrel of the water jet transfer device.

(3) FIG. **3** is a top view of an example embodiment of a jet transfer assembly of the water jet **27** transfer device.

(4) FIG. **4** is a perspective view of an example embodiment of a check valve assembly of the water jet transfer device.

(5) FIG. **5** is a top view of the check valve assembly.

(6) FIG. **6** is a side view of an example embodiment of an intake assembly of the water jet transfer device.

(7) FIG. **7** is a top view of the intake assembly.

(8) FIG. **8** is perspective view of the water jet transfer device within a portable holding tank.

(9) FIG. **9** is a view an example configuration of a plurality of portable holding tanks in which the water jet transfer device is used.

(10) FIG. **10** is a perspective view of the water jet transfer device transferring water from a first portable holding tank to a second portable holding tank.

(11) FIG. **11** is a perspective view of the water jet transfer device transferring water from a first portable holding tank to a second portable holding tank.

(12) FIG. **12** is a perspective view of the water jet transfer device mounted on a vehicle for transport.

(13) FIG. **13** is a perspective view of an alternative embodiment of the water jet transfer device.

DETAILED DESCRIPTION

A. Overview

(14) Some of the various embodiments of the present disclosure relate to a singular water jet

transfer device **10** that can transfer water from one portable holding tank to another portable holding tank at a rate of 1250-1500 GPM. The functionality of the water jet transfer device **10** is particularly suited to a fire scene where a local source of pressurized water is unavailable and water for putting out the fire must be shuttled to the location of the fire scene. Other applications for which the functionality of the water transfer device are suitable are also possible.

(15) The water jet transfer device **10** of the present disclosure generally includes a jet transfer assembly **20**, a water-intake assembly **70**, and an output barrel **100**. The jet transfer assembly **20** includes a body **22** having a water-outlet end **24** coupled to a first section of flexible tubing **32** and a water-intake end **26** coupled to a second section of flexible tubing **34**. The body **22** additionally includes therein a jet tube **44** that establishes a negative demand pressure within the body **22** and a check valve assembly **50** proximate the water-intake end **26**. The check-valve assembly **50** includes a valve support plate **52** and a flexible valve seal member **64** secured to the valve support plate **52**. The valve support plate **52** includes a plurality openings **56** and the flexible valve seal member **64** flexes to expose at least a portion of the plurality of openings **56** of the valve support plate to enable an in-flow of water into the body at the water-intake end responsive to negative demand pressure established by the jet tube **44** and flexes to cover at least a portion of the plurality of openings **56** to prevent an out-flow of water from the body **22** at the water-intake end **26**. The water-intake assembly **70** is coupled to the second section of flexible tubing **34** and serves to draw water from a holding tank **120** into the body **22** responsive to the negative demand pressure. The output barrel **100** is coupled to the first section of flexible tubing **32** and delivers water expelled from the body **22** to a second holding tank **120**.

(16) In certain embodiments, the inner diameter of the body **22** is at least 8 inches while the inner diameter of the jet tube **44** is at least 0.8 inches. Further, the jet tube **44** is preferably of a curved, one-piece configuration. The flexible valve seal member **64** is secured to the valve support plate **52**, via a hinge bar **66** secured between the flexible valve seal member **64** and a mounting rib **58** of the valve support plate **52**. The hinge bar **66** serves the divide the flexible valve seal member **64** into first and second symmetrical flaps **64***a*. **64***b*. The valve support plate **52** is at least eight inches in diameter.

(17) In certain embodiments, the water intake assembly **70** includes a lower portion **75** defined by an upper plate **74** coupled to a lower plate **72** and an upper portion **71** that includes an intake pipe **76** secured to the upper plate **74**. The lower plate includes a plurality of section openings **78** to help secure the water intake assembly **70** to a floor **140** of a portable holding tank. The lower plate **72** preferably includes upwardly bent vortices-reducing first and second ends **80***a*, **80***b*. The lower portion **75** of the water intake assembly is defined by four sides with each side having a **3** water-drawing opening. A space between the upper plate **74** and the lower plate **72** includes a plurality of vortices-reducing dividers **84** that can divide the lower portion **75** into a plurality of zones, e.g., six zones. The intake pipe **76** is oriented at approximately 30 degrees relative to the upper plate **74**.

(18) In certain embodiments, the output barrel **100** includes an elongate neck portion **102** and an output head portion **104**. Further, a diffuser plate **106** is preferably included within the elongate neck portion **102**. An exterior of the output barrel **100** includes a handle **103**, one or more strap holders **112***a*, **112***b* through which a safety strap **116** can be threaded to secure the output barrel **100** to an upper railing **118** of a portable holding tank **120**, and one or more u-shaped mounting brackets **114***a*, **114***b* that are mountable atop the upper railing **118** of the portable holding tank **120** to position the output barrel **100** at an angle of approximately 30 degrees relative to the upper railing **118**. The u-shaped mounting brackets **114***a*, **114***b*, may be rotatably secured to the output head portion **104** of the output barrel **100**.

(19) In certain embodiments, one or more quick locking lever clamps **40** are used to secured the second section of flexible tubing **34** to the water-intake assembly **70** and to secure the first section of flexible tubing **32** to the output barrel **100** for quick assembly and disassembly.

(20) In certain embodiments, the water-intake assembly **70** and the output barrel **100** are removed

from the jet transfer assembly **20** enabling the jet transfer assembly **20** to be positioned intermediate a first drain sleeve **142** of a first water holding tank **120** containing water and a second drain sleeve **144** of a second water holding tank with the second section of flexible tubing **34** coupled to the first drain sleeve and the first second of flexible tubing coupled to the first section of flexible tubing **32**. In this configuration, a negative demand pressure created by the jet tube **44** within the body **22** of the jet transfer assemble causes water to be drawn from the first water holding tank **120** through the first drain sleeve **142** and into the body **22** of the jet transfer assembly **20** and expelled through the second drain sleeve **144** and into the second water holding tank **120**.

B. Jet Transfer Assembly

(21) A jet transfer assembly **20** of the water jet transfer device **10**, best seen in FIGS. **1**-**3**, includes a body **22** of a circular configuration having an outlet end **24** and an intake end **26**. The body **22** is preferably of a rigid material including a first flange **28** at the outlet end **24** of the body **22** and a second flange **30** at the intake end **26** of the body **22**. A first section **32** of flexible tubing (e.g., neoprene rubber or other appropriate material) is secured to the first flange **28** and a second section of flexible tubing **34** is secured to the second flange **30**. The flexibility of the first section **9** and the second section **34** of flexible tubing enable the jet transfer assembly **20** to be secured to the intake assembly **70** and output barrel **100** through use of one or more quick locking lever clamps **40** at the intake end **26** and the outlet end **24**. A handle **42**, positioned 90 degrees opposite a jet tube **44**, is secured to the body **22** enables easy lifting of the jet transfer assembly **20**. In certain embodiments, an outer diameter (OD**1**) of the body **22** is approximately 8.625 inches while an interior diameter (ID**1**) of the body is approximately 8.3 inches.

(22) The jet transfer assembly **20** additionally includes a jet tube **44** that extends through the body **22** and is equipped with a hose fixture **44** to interface with a priming hose **138** (see FIGS. **8** and **10**) of a fire engine pumping vehicle **136**. A support bracket **46** secured to an interior surface the body **20** supports the jet tube **44** in a suspended configuration. In certain embodiments, the jet tube **44** is of a unitary configuration (e.g., one piece) having an outer diameter (OD**2**) of approximately 1.1 inches and an interior diameter (ID**2**) of approximately 0.8 inches.

(23) The jet transfer assembly **20** further includes a check valve assembly **50**, which is best seen in FIGS. **3**-**5**. The check valve assembly **50** functions to hold water in the jet tube **44** during periods of transition and aids in priming. Further, the check valve assembly **50** provides an instant flow start-up and eliminates that friction loss associated with spring-loaded check valves that are used prior art designs. The check valve assembly **50** includes a circular valve support plate **52** having a periphery **54** bonded or otherwise secured to an inner surface of the second section of flexible tubing **34** and/or the interior surface **48** of the body **22** at the intake end **26** in an orientation that is substantially perpendicular to the intake flow to the body **22**. The support plate **52** is formed with a plurality of openings **56** arranged in concentric arrays which are designed to be large enough to admit a free flow of water into the body **22** when negative demand pressure generated by the jet tube **44** is established.

(24) The support plate **52** of the check valve assembly **50** further includes a valve seal mounting rib **58** extending along a diameter of the support plate **52**. The valve seal mounting rib **58** is formed with a plurality of radially spaced bores **60** which respectively receive a series of screws **62** used to secure a flexible valve seal member **64** (of neoprene rubber or other appropriate material) of the check valve assembly **50** with a hinge bar **66** to one side of the support plate **52** enabling the flexible valve seal member **64** to flex into the interior of the body **22**, e.g., an open position, when receiving flow through the intake end **26** of the body **22**. The flexible valve seal member **64** is also of a circular configuration and has a diameter adapted to cover the concentric arrays of openings **56** in the support plate **52** when the check valve assembly **50** is in a closed position due to the absence of flow at the intake end **26** and/or when, during the initial filling of the body **22**, the pressure of the water entering the body **22** from the jet tube **44** pushes against the flexible valve seal member **64**. In this manner, the self-closing action of the flexible valve seal member **64** against the support

plate **52** serves to retain the water within the body **22** for fast and reliable filling **17** of the body **22**.
(25) However, the support plate **52** additionally includes a series of elongate circumferentially spaced outer openings **68** (each subtending an arcuate interval of approximately 60 degrees), which are radially outwardly spaced from the periphery of the flexible valve seal member **64** when in the flat closed position. These outer openings **68** in the support plate **52** function as weep holes which serve to automatically drain the body **22** upon completion of pumping with the water jet transfer device **10**. The outer openings **68** are designed to result in a controlled leakage of the check valve assembly **50** without seriously affecting the ability of the valve to retain water within the body **22** for a sufficient time period to allow for rapid filling of the body **22** when needed.
(26) The hinge bar **66** divides the flexible valve seal member **64** into first and second symmetrical valve flaps **64***a*, **64***b* with each opening and closing about the axis defined by the hinge bar **66** in response to positive filling pressure (closing the check valve assembly **50**) or negative demand pressures (automatically opening the valve).
C. Intake Assembly
(27) The intake assembly **70** (a.k.a. strainer), best seen in FIGS. **6**-**8**, generally comprises a lower portion **71** having a substantially rectangular lower plate **72** and a substantially rectangular upper plate **74**, and an upper portion **75** comprising an intake pipe **76**; each of the plates **72**,**74** and intake pipe **76** are of rigid material that enables welding of the components. The lower plate **72** is preferably provided with a plurality of circular openings **78** to help establish suction with the floor of an underlying liner of a portable holding tank to help prevent movement of the intake assembly **70** within the portable holding tank and to help prevent the intake assembly **70** from being dislodged when arriving trucks dump their load of water into the portable holding tank. In certain embodiments, the lower plate **72** includes thirteen circular openings **78** that are one inch in diameter with three rows of three circular openings **78** positioned centrally on the lower plate **72** and one circular opening **78** in each of the four corners of the lower plate **72**. The lower plate **72** preferably includes a first end **80***a* and a second end **80***b* that extend beyond a length of the upper plate **74** and are bent upward to help eliminate vortices during water intake.
(28) The upper plate **74**, which is approximately the same length and width of the lower plate **72**, excepting the first and second ends **80***a*, **80***b* of the lower plate **72**, is separated from the lower plate **72** by a plurality of spacers **82** that are positioned between and secured (e.g., welded) to the upper plate **74** and the lower plate **72** proximate the corner, outer edges of the upper plate **74** and lower plate **72**; the spacers **82** serve to securely couple the plates while also allowing intake between the upper plate **74** and lower plate **72** on all four sides of the rectangular configuration. A plurality of zone dividers **84** are also positioned intermediate the upper plate **74** and lower plate **72**. In the illustrated embodiment, the four zone dividers **84** divide the space between the upper plate **74** and lower plate **72** into six zones (Z1-Z6). The zones (Z1-Z6) function to more evenly spread the water intake to help prevent vortices. The upper plate **74** additionally includes an opening **86** to accommodate a lower end **88** of the intake pipe **76**.
(29) The lower end **88** of the intake pipe **76** is centrally positioned atop the upper plate **74** and over the opening **86** in the upper plate **74** at an angle of 30 degrees relative to the upper plate **74**. The intake pipe **76** is configured to present an upper end **90** having a circular outflow opening **92** that is received within the second section of flexible tubing **34** of the jet transfer assembly **20**. The second section of flexible tubing **34** of the jet transfer assembly **20** is secured to and substantially scaled about the upper end **90** of the intake pipe **76** with one or more quick locking lever clamps **40** (see FIG. **8**) enabling water flow from the intake assembly **70** to the jet transfer assembly **20** upon a negative demand pressure being established in the jet transfer assembly **20**. In certain embodiments, the outflow opening **92** has an outer diameter (OD**3**) of approximately 8.6 inches **9** and an inner diameter (ID**3**) of approximately 8.3 inches.
D. Output Barrel
(30) The output barrel **100**, best seen in FIG. **1**, generally includes an elongate neck portion **102**

and output head portion **104**, each of a circular configuration. In certain embodiments, the output barrel **100** is provided with an outer diameter (OD**4**) of approximately 8.6 inches and an inner diameter (ID**4**) of approximately 8.3 inches. Further, in certain embodiments, the output barrel **100** is of a unitary configuration with all portions of the output barrel **100** being made of a lightweight aluminum tubing.

(31) The elongate neck portion **102** of the output barrel **100** includes a lower end **105** that is configured to be received within the first section **32** of flexible tubing of the jet transfer assembly **20**. The first section **32** of flexible tubing is secured to and substantially sealed about the lower end **105** of the neck portion **102** with one or more quick locking lever clamps **40** (see FIG. **12**) enabling water flow from the jet transfer assembly **20** to the output barrel **100**. A diffuser plate is provided within the interior of the elongate neck portion **102** at approximately mid-length of the elongate neck portion **102** in an orientation that is perpendicular to the water flow. The diffuser plate **106** provides additional suction to that created by the jet tube **44** enabling the water to be both pulled through the jet transfer assembly **20** and pushed through the output barrel **100**. The elongate neck portion **102** additionally includes a handle **103** for easy lifting of the output barrel **100** itself or, when used in conjunction with the handle **42** of the jet transfer assembly **20**, the combined handles **103** and **42** enable the lifting of an assembled water jet transfer device **10** including the output barrel **100**, jet transfer assembly **20**, and intake assembly **70**. A fully assembled water jet transfer device **10** can be secured (e.g., secured with belts or clamps) to a vehicle for transportation to different locations, see FIG. **12**, or easily broken down into its component parts for transportation and reassembly in a desired configuration.

(32) The elongate neck portion **102** transitions to the output head portion **104** to present the output head portion **104** in a horizontal orientation that is substantially parallel to the ground. In certain embodiments, the output head portion **104** terminates at an opening **108** defined by a plane that is perpendicular to the ground as shown in FIG. **1** while in other embodiments the output head portion **104** terminates with a downward angled spout portion **110** to direct outflowing water to a nearby portable holding tank as shown, for example, in FIGS. **10-12**.

(33) The output head portion **104** is additionally equipped with one or more strap holders **112** as well as one or more u-shaped mounting brackets **114**, both of which are best seen in FIGS. **2** and **11**. In the illustrated embodiment, two strap holders **112***a*, **112***b* (e.g., rigid outward extending loops) are upwardly positioned at ±45 degrees relative to a central axis of the output head portion **104** and are additionally positioned slightly rearward of the midpoint of the length of the output head portion **104**. The strap holders **112***a*, **112***b* provide an opening capable of receiving a safety strap **116**. The safety strap **116** is provided to help secure the position of the output barrel **100** and help prevent its movement in response to the powerful water flow. The safety strap **116** can be wrapped about an upper railing **118** of a frame of a portable holding tank **120**, to one or both sides of the output head portion **104**, and threaded through the strap holders **112***a*, **112***b* whereby the safety strap **116** can be secured tightly against the output head portion **104**.

(34) In the illustrated embodiment, two u-shaped mounting brackets **114***a*, **114***b* are rotatably secured to the output head portion **104**. The u-shaped mounting brackets **114***a*, **114***b* are downwardly positioned at ±45 relative to the central axis of the output head portion **104** and are additionally positioned slightly rearward of the midpoint of the length of the output head portion **104** below the respective strap holders **112***a*, **112***b*. The u-shaped mounting brackets **114***a*, **114***b* are rotatable to a position wherein the open end of the u-shaped mounting brackets **114***a*, **114***b* receives the upper railing **118** of the portable holding tank **120** positioning arms **122***a*, **122***b* to either side of the upper railing **118**, which enables the output barrel **100** to be installed on the frame of the portable holding tank **120** at an angle of +30 degrees relative to the upper railing **118**.

E. Operation of Preferred Embodiment

(35) An example environment in which the water jet transfer device **10** is used is illustrated in FIGS. **8-11**. As shown the environment includes two or more portable holding tanks **120**, such as a

first portable holding tank **120***a*, a second portable holding tank **120***b*, and a third portable holding tank **120***c*. Each of the portable holding tanks **120** typically includes an expandable/collapsible frame **124** defined by upper railings **118** and lower railings **126** that define a periphery of the portable holding tank **120**; the upper railings **118** and lower railings **126** are coupled together by a plurality of vertical supports **128**. A plasticized fabric tarp **130** is suspended from the upper railings **118** with rope/cording or other suitable means to form the tank itself. The example environment additionally includes one or more tanker vehicles **134** and one or more fire engine pump vehicles **136**. The tanker vehicles function as water shuttles to transport water to the site of a fire wherein the tanker vehicle **134** empties its tank into portable holding tank **120***b*, as shown in FIG. **10**. The one or more fire engine pump vehicles **136** provide a priming hose **138** that is fluidly coupled to the hose fixture **46** of the jet transfer assembly **20**.

(36) If water jet transfer device **10** is not already assembled, assembly can quickly be performed by securing the first section of flexible tubing **32** at the outlet end **24** of the jet transfer assembly **20** to the neck portion **102** of the output barrel **100** with one or more quick locking lever clamps **40** and by securing the second section of flexible tubing **34** of the jet transfer assembly **20** to the upper end **90** of the intake pipe **76** of the intake assembly **70** with an additional one or more quick locking lever clamps **40**.

(37) The intake assembly **70** of the assembled water jet transfer device **10** can then be placed on the floor **140** of the portable holding tank **120***b* (see FIG. **8**), u-shaped brackets **114** of the output head portion **104** are positioned atop the upper railing **118** of the portable holding tank **120***b*, and the safety strap is wrapped about the upper railing **118** of the portable holding tank **120***b*, through the strap holders **112**, and tightened to the water jet transfer device **10**. With water covering the intake assembly **70**, the fire engine pump vehicle **136** can pump water through the priming hose **138** to establish a desired pressure output at the jet tube **44** to establish a negative demand pressure within the body **22** of the jet transfer assembly **20** causing water to be drawn through the intake assembly **70**, past the check valve assembly **50**, into the body **22** of jet transfer assembly **20**, and out the output barrel **100** into another portable holding tank **120***a*. In the illustrated example, the portable holding tank **120***a* comprises the suction tank from which the fire engine pump vehicle **136** draws water that is sprayed onto a fire, as shown in FIG. **9**. To keep **7** up with the pumping ability of the fire engine pump vehicle **136**, a singular water jet transfer device **10** is capable of pumping 1250-1500 GPM when built consistent with the various dimensions disclosed herein thereby replacing the need for two currently available jet devices.

F. Operation of Alternative Embodiment

(38) In certain embodiments, the jet transfer assembly **20** is used without the intake assembly **70** and without the output barrel **100**. As illustrated in FIG. **13**, only the jet transfer assembly **20** is used to couple a first portable holding tank drain sleeve **142** of the first portable holding tank **120***b* with a second portable holding tank drain sleeve **144** of the second portable holding tank **120***a*. In operation, the priming hose **138** is used to establish a desired pressure output at the jet tube **44** of the jet transfer assembly **20** to establish a negative demand pressure within the body **22** of the jet transfer assembly **20** causing water to be drawn from the first portable holding tank **120***b* through the first drain sleeve **142**, past the check valve assembly **50**, into the body **22** of jet transfer assembly **20**, out the second drain sleeve **144**, and into the second portable holding tank **120***a* operating as a suction tank from which the fire engine pump vehicle **136** draws water for spraying on a fire. In this configuration, the check valve assembly **50** enables the water-receiving portable holding tank **120***a* to be at a substantially full water level and the water-supplying portable holding tank **120***b* to be at a much lower water level ready to receive additional water from another tanker vehicle **130**. This configuration also allows a water pull down of almost 100% of the water in the water-supplying portable holding tank **120***b*.

(39) While various embodiments have been described above, it should be understood that they have been presented by way of example only, and not limitation. The descriptions are not intended to

limit the scope of the technology to the particular forms set forth herein. To the contrary, the present descriptions are intended to cover such alternatives, modifications, and equivalents as May be included within the spirit and scope of the technology as defined by the appended claims and otherwise appreciated by one of ordinary skill in the art. The various embodiments of the present disclosure may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the various embodiments in the present disclosure be considered in all respects as illustrative and not restrictive. Thus, the breadth and scope of a preferred embodiment should not be limited by any of the above-described exemplary embodiments.

(40) Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. All patent applications, patents, and printed publications cited herein are incorporated herein by reference in their entireties, except for any definitions, subject matter disclaimers or disavowals, and except to the extent that the incorporated material is inconsistent with the express disclosure herein, in which case the language in this disclosure controls. Any headings utilized within the description are for convenience only and have no legal or limiting effect.

Claims

1. A water jet transfer device, comprising: a jet transfer assembly comprising: a body having a water-outlet end coupled to a first section of flexible tubing and a water-intake end coupled to a second section of flexible tubing; a jet tube within the body; and a check valve assembly proximate the water-intake end, the check valve having a valve support plate and a flexible valve seal member secured to the valve support plate; a water-intake assembly coupled to the second section of flexible tubing; and an output barrel coupled to the first section of flexible tubing.

2. The water jet transfer device of claim 1, wherein the water-intake assembly supplies water to the jet transfer assembly responsive to the jet tube establishing a negative demand pressure within the body of the jet transfer assembly.

3. The water jet transfer device of claim 1, wherein quick locking lever clamps secure the second section of flexible tubing to the water-intake assembly and secure the first section of flexible tubing to the output barrel.

4. A jet transfer assembly, comprising: a body having a water-outlet end coupled to a first section of flexible tubing and a water-intake end coupled to a second section of flexible tubing; a jet tube within the body that establishes a negative demand pressure within the body; and a check valve assembly proximate the water-intake end of the body, wherein the check valve assembly includes a valve support plate including a plurality of openings and a flexible valve seal member secured to the valve support plate, wherein the flexible valve seal member flexes to expose at least a portion of the plurality of openings of the valve support plate to enable an in-flow of water into the body at the water-intake end responsive to the negative demand pressure and wherein the flexible valve seal member flexes to cover at least a portion of the plurality of openings of the valve support plate to prevent an out-flow of water from the body at the water-intake end.

5. The jet transfer assembly of claim 4, wherein an inner diameter of the body is at least 8 inches.

6. The jet transfer assembly of claim 4, wherein an inner diameter of the jet tube is at least 0.8 inches.

7. The jet transfer assembly of claim 4, wherein the jet tube is of a curved, one-piece configuration.

8. The jet transfer assembly of claim 4, wherein the flexible valve seal member is secured to the valve support plate via a hinge bar secured between the flexible valve seal member and a mounting rib of the valve support plate.

9. The jet transfer assembly of claim 4, wherein hinge bar divides the flexible valve seal member into first and second symmetrical valve flaps.

10. The jet transfer assembly of claim 4, wherein the valve support plate is at least eight inches in diameter.
11. The jet transfer assembly of claim 4, wherein the jet transfer assembly is capable of outputting water at a rate of 1250-1500 gallons per min at the water-outlet end.
12. The jet transfer assembly of claim 4, wherein the second section of flexible tubing is coupled to a water intake assembly.
13. The jet transfer assembly of claim 12, wherein the water intake assembly includes a lower portion defined by an upper plate coupled to a lower plate and an upper portion that includes an intake pipe, wherein the intake pipe is secured to the upper plate.
14. The jet transfer assembly of claim 13, wherein the lower plate includes a plurality of suction openings.
15. The jet transfer assembly of claim 13, wherein the lower plate includes upwardly bent vortices-reducing first and second ends.
16. The jet transfer assembly of claim 13, wherein the lower portion is defined by four sides, each side having a water-drawing opening.
17. The jet transfer assembly of claim 13, wherein a space between the upper plate and the lower plate of the water intake assembly includes a plurality of vortices-reducing dividers.
18. The jet transfer assembly of claim 13, wherein the plurality of vortices-reducing dividers divide the lower portion into at least six zones.
19. The jet transfer assembly of claim 13, wherein the intake pipe is oriented at approximately 30 degrees relative to the upper plate of the water intake assembly.
20. The jet transfer assembly of claim 4, wherein the first section of flexible tubing is coupled to an output barrel.
21. The jet transfer assembly of claim 20, wherein the output barrel includes an elongate neck portion and an output head portion.
22. The jet transfer assembly of claim 21, wherein a diffuser plate is included within the elongate neck portion.
23. The jet transfer assembly of claim 21, wherein the output barrel includes an exterior handle.
24. The jet transfer assembly of claim 21, wherein the output head portion includes one or more strap holders and wherein the jet transfer assembly additionally includes a safety strap that is threaded through the one or more strap holders and is secured to the output head portion.
25. The jet transfer assembly of claim 21, wherein the output head portion includes one or more u-shaped mounting brackets that are mountable atop railing of a portable holding tank and wherein the u-shaped mounting brackets mounted atop the railing position the elongate neck portion at an angle of approximately 30 degrees relative to the railing.
26. The jet transfer assembly of claim 25, wherein the u-shaped mounting brackets are rotatably secured to the output head portion.
27. A jet transfer device, comprising: a body having a water-outlet end coupled to a first section of flexible tubing and a water-intake end coupled to a second section of flexible tubing; a jet tube within the body; and a check valve assembly proximate the water-intake end, the check valve having a valve support plate and a flexible valve seal member secured to the valve support plate, wherein the jet transfer device is configurable between a first configuration for pumping water from a water holding tank and a second configuration for pumping water from the water holding tank; wherein the first configuration comprises the jet transfer device positioned intermediate a first drain sleeve of a first water holding tank containing water and a second drain sleeve of a second water holding tank, wherein the second section of flexible tubing is coupled to the first drain sleeve and wherein the first second of flexible tubing is coupled to the second drain sleeve; and wherein the second configuration comprises the jet transfer device positioned intermediate a water-intake assembly and an output barrel, wherein the second section of flexible tubing is coupled to an intake pipe of the water-intake assembly and a lower portion of the water-intake assembly is below the

water in the first water holding tank, and wherein the first section of flexible tubing is coupled to an output barrel having an output head portion mounted atop an upper railing of the first water holding and an opening of the output head portion is directed toward the second water holding tank.