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FLUID DISTRIBUTION SYSTEM AND A JUNCTION ELEMENT THEREFOR

FIELD OF THE INVENTION

The present invention is in the field of fluid flow control systems and more specifically it is concerned with valving and junction means for controlling fluid flow within supply lines and branching lines of a Fluid Distribution System (FDS).

BACKGROUND OF THE INVENTION

In many instances, it is required to provide fluids to a plurality of consumers via a main supply line which branches into a plurality of branch supply lines, each connected to a consumer.

Consumers, as referred to in this respect, may be, for example, patients in a medical institute connected to an oxygen supply line, or a mechanical device or chemical process in which fluid is provided, e.g. a coolant fluid, a lubricant, a rinsing liquid or any chemical substance which may be required for carrying out a process.

However, a serious problem occurs when it is required to connect another consumer to the main supply line or whenever it is required to modify the construction of the line or to maintain the lines, whereby it is required to shut off flow through the main supply line for carrying out the required plumbing and installations for connecting the branching line leading to the new consumer. In some cases, this might be impossible, e.g. in the case of an oxygen supply line where shutting off oxygen supply might be fatal.

In other cases, shutting off the main supply line might be extremely costly, e.g. in certain manufacturing processes where shutting off the supply line of a certain fluid entails halting the entire process. Restarting many processes requires purification of the supply system, which is a costly and time consuming procedure. An example of such a process, is for example the manufacture of computer chips and the like, in which extreme purification conditions are required and any interference in the supply line e.g. adding a branching line, entails purification of the entire supply system.

U.S. Patent No. 5,335,686 discloses a steam trap including a Y-fitting having a single fluid inlet, a primary outlet for returning water to a boiler, and a secondary outlet for testing only, and a main valve in series with the primary outlet. An object of that patent is to simplify the replacement of an orifice device within the main valve. Other objects of that patent are to improve worker safety by reducing the likelihood of accidental exposure to steam while replacing or checking an orifice, and to enable to observe fluid flow through an auxiliary orifice for determining proper size of the orifice before a main orifice is replaced.

It is thus the object of the present invention to provide a fluid supply system provided with integral valving means in which the above drawback is substantially reduced or overcome.

SUMMARY OF THE INVENTION

By a first aspect of the present invention there is provided a junction element for a fluid delivery system according to claim 1.

By a preferred embodiment of the present invention, the junction element is integrally formed with an up-stream pipe section and a down-stream pipe section, typically having a length suitable for connecting to an adjacent down-stream pipe section or up-stream pipe section, respectively, or to an intermediate pipe section such as, for example, by orbital welding.

By another embodiment, the inlet port and the outlet port of the junction elements are each formed with a connecting end for connecting thereto a main up-stream pipe section and a main down-stream pipe section, respectively. By a specific embodiment the connecting end is a stub end fitted for orbital welding.

In a junction element in accordance with the present invention, the valve member is adapted for sealing a respective duct portion extending between said delivery element and a cavity formed within said junction element; said cavity being in flow communication with the inlet port and the outlet port.

By a second aspect of the present invention there is provided a fluid delivery system for connecting one or more branch pipes to a main delivery pipe, said fluid delivery system being characterized in that the main delivery pipe is fitted with at least one junction element according to claim 1.

In the fluid delivery system in accordance with the present invention, said junction element comprises an inlet port for connecting to a main up-stream pipe section, and an outlet port for connecting to a main down-stream pipe section, which pipe sections are integrally formed with the junction element.

By a further embodiment, the inlet port and the outlet port of the junction element are each formed with a connecting end for connecting thereto a main up-stream section and a main down-stream section, respectively.

Preferably, but not exclusively, the valve member of the junction element is a ball-type valve.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a junction element in accordance with the present invention comprising two branching outlets;

Fig. 2 is a perspective view of the junction element seen in Fig. 1 where a delivery element is coupled to each of the outlets;

Fig. 3 is an exploded isometric view of the junction element seen in Fig. 2;

Fig. 4 is a longitudinal cross-section of the junction element taken along line IV-IV in Fig. 2;

Fig. 5 is a longitudinal cross-sectional view along line V-V in Fig. 2;

Fig. 6 is a perspective view of a junction element fitted with two splitting devices at each of its branching outlets; and

Fig. 7 is an exploded view of a junction element fitted with another splitting device.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

Attention is first directed to Fig. 1 of the drawings illustrating a junction element generally designated 10 comprising a block-like housing member 11 fitted with an inlet port 12 and an outlet port 14 each fitted with a stub end 16 and 18, respectively. Stub end 16 is connected to a main up-stream pipe section 20 whereas stub end 18 is connected to a main down-stream pipe section 22. Typically, the stub ends 16 and 18 are connected to the respective pipe sections 20 and 22 by orbital welding or soldering, as known *per se*, although other types of weldings or connections are possible as well, in which case instead of a stub end there shall be provided a suitable connecting end, e.g. a clamping end, etc.

As can be seen in all the figures, the junction element is symmetrical about the longitudinal axis extending through the main pipe sections and accordingly, for the sake of convenience, further reference will be made to one side of the junction element. However, it will be appreciated that these are only some examples selected out of many others.

As can be seen in Figs. 4 and 5, the housing member 11 is formed with a duct portion 28 transversely extending with respect to the main pipe sections 20 and 22 passing through a main cavity 30 of the housing, which cavity is intermediate the inlet 12 and outlet 14, whereby ducts 28 are in flow communication with the main supply line. Each of duct portions 28 extends towards a coupling end 32 of housing 11.

A ball-type valve assembly 37 is integrally fitted within the housing 11 for controlling flow through duct 28. Each valve assembly comprises a ball-valve element 38 and a plurality of seals and packing rings generally designated 40 sealingly packed within a valve receiving portion 42 of the housing 11 and retained by threaded ring 41, as can be seen in Fig. 3. The valve is operable by a valve handle 44 fitted with lateral projections 46 and 48 adapted for engagement with a pin 50 projecting from the housing for limiting angular displacement of handle 44. The handle communicates with the ball-valve element 38 via stem 45 to which it is secured by nut 46. In the figures, the valves are shown in their closed position, i.e. in which fluid flows through duct 28 is shut off. The artisan will have no difficulty in replacing the ball-type valve assembly 37 with another type of valve.

Coupling end 32 is a flanged member integrally extending from housing 11 and is adapted for coupling thereto a delivery element 65 (shown in Figs. 2, 3 and 5) and attachment thereto is carried out by means of bolts 66 and nuts 68. Obviously, the coupling end may be of other types.

The delivery element 65, as seen in Figs. 2, 3 and 5, serves for connecting a branching pipe (not shown) to pipe segment 70 integral with the delivery element 65, e.g. by orbital welding or otherwise, as known *per se*.

The arrangement of the junction element as illustrated in the figures is such that fluid flowing through the duct portions 28 may be shut off at any time without interrupting fluid flow through the main delivery

pipe sections 20 and 22. This enables connection or disconnection of delivery distribution members, e.g. member 65, without having to first shut off fluid flow in the main line, but merely by closing valve member 38.

Attention is now directed to Fig. 6 which differs from the embodiment seen in Figs. 1 to 5 only in the delivery element which is a splitting device generally designated 74 and accordingly, all like elements were given the same reference numerals as in the previous embodiment.

The splitting device 74 is connected to the coupling end 32 by bolts 76 and nuts 68 as can readily be understood. Splitting device 74 is integrally fitted with two branching outlets generally designated 78 and 80, with a valve member (not seen) integrally and sealingly received within a respective valve housing 82 and 84 and operable by valve operating handle 86 and 88, respectively. Each of the outlets 78 and 80 is fitted with coupling means 32 similar to the arrangement illustrated with reference to Figs. 1 to 5, for coupling thereto a branch pipe 90 and 92 respectively, similar to the embodiment illustrated with reference to Figs. 1-3.

The embodiment seen in Fig. 7 differs from the embodiment seen in Fig. 6 in that the splitting device 98 is formed with an additional outlet 100 to which another branching member 102 may be connected, the latter being integrally fitted with a valve member 104 and adapted for coupling to a branch pipe 106. Branching member 102 and splitting device 98 are connected to the housing 11 by bolts 108 extending through elements 102 and 98 and fastened by bolts 68 of coupling end 32 of the housing 11. Other components of this embodiment are similar or identical with those of the previous embodiments and accordingly it is presumed that the artisan will be familiar with their construction and operation.

It will further be appreciated that a variety of other assemblies may be carried out for performing different plumbing connections as may be required.

The junction element in accordance with the present invention has some other significant advantages as compared with heretofore known junction elements. One advantage is that owing to integration of the valve member within the housing provided minimal *dead volume* i.e., the volume of the duct 28 extending between the valve assembly end the cavity 30 of the housing. This is of particular importance in drainage and purification procedures, whereby a minimal amount of fluid is entrapped in said *dead volume* and so optimal drainage is obtained.

Another advantage is that the junction element according to the invention maintains an essentially equal diameter through its length, thus ensuring essentially identical flow through the cross-section of the device.

CLAIMS

1. A junction element (10) for a fluid delivery system, the junction element comprising a housing (11) fitted with an inlet port (12) for connecting to a main up-stream pipe section (20) and an outlet port (14) for connecting to a main down-stream pipe section (22), wherein said outlet port (14) of the junction element is in flow communication with said inlet port (12) defining between them a continuous, uninterrupted main flow path; and the junction element (10) comprises at least one duct portion (28), each of the at least one duct portion (28) being in flow communication with the main flow path comprising a valve member (37) located inside the housing (11) of the junction element (10), and having coupling means (32) for coupling thereto a delivery element (65), whereby fluid flow through the duct portion (28) may be shut off without interrupting fluid flow through the main flow path.
2. A junction element (10) according to Claim 1, wherein the up-stream pipe section (20) and the down-stream pipe section (22) are integrally formed with the junction element (10).
3. A junction element (10) according to Claim 1, wherein the inlet port (12) and the outlet port (14) are each formed with a connecting end (16;18) for connecting thereto a main up-stream pipe section (20) and a main down-stream pipe section (22), respectively.
4. A junction element according to any one of Claims 1 to 3, wherein the valve member (37) is adapted for sealing a duct portion (28) extending between a delivery element (65) and the main flow path (30) extending between the inlet port (12) and the outlet port (14).

5. A junction element according to Claim 4, wherein said valve member (37) is a ball-type valve (38).

6. A junction element according to Claim 1, wherein the delivery element (65) is a splitting device (74; 98) adapted for splitting fluid flow towards at least two branching elements (90:92), each of which being integrally fitted with a valve member (82:84) and each having coupling means (32) for coupling thereto a branch pipe.

7. A fluid delivery system for connecting one or more branch pipes to a main delivery pipe, said fluid delivery system being characterized in that the main delivery pipe defines a continuous, uninterrupted main flow path (30) fitted with at least one junction element (10) according to Claim 1.

8. A fluid delivery system according to Claim 7, wherein said junction element (10) comprises an inlet port (12) for connecting to a main up-stream pipe section (20), and an outlet port (14) for connecting to a main down-stream pipe section (22), which pipe sections are integrally formed with the junction element (10).

9. A fluid delivery system according to Claim 7, wherein the inlet port (12) and the outlet port (14) are each formed with a connecting end (16;18) for connecting thereto a main up-stream pipe section (20) and a main down-stream pipe section (22), respectively.