

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
5 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
10 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
15 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
20 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.

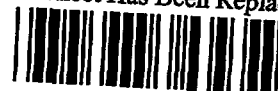
It is thus the object of the present invention to provide a fluid supply system provided with integral valving means in which the above drawback is substantially reduced or overcome.

SUMMARY OF THE INVENTION

By a first aspect of the present invention there is provided a junction element for a fluid delivery system, the junction element comprising 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, said outlet port being in flow communication with said inlet port; characterized in that the junction element is integrally fitted with at least one duct portion, each of the at least one duct portion being in flow communication with the inlet port or the outlet port and being integrally fitted with a valve member and having coupling means for coupling thereto a delivery element, whereby fluid flow through the duct portion may be shut off without interrupting the fluid flow through the main delivery pipe sections.

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

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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
5 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
10 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
15 delivery pipe, said fluid delivery system being characterized in that the main delivery pipe is fitted with at least one junction element, each said junction element being integrally fitted with at least one duct portion, each at least one duct portion being in flow communication with the delivery pipe and is integrally fitted with a valve member and a coupling means associated with
20 each duct portion, whereby fluid flow through the duct portion may be shut off without interrupting the fluid flow through the main delivery pipe.

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
25 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

5 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;

10 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;

15 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

20 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 generally designated 74 and accordingly, all like elements were given the same reference numerals as in the previous embodiment.

The delivery member 74 is in fact a distribution element connected to the coupling end 32 by bolts 76 and nuts 68 as can readily be understood. Delivery element 74 is in fact a splitting device 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 delivery element 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 delivery member 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.

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

An other 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.

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CLAIMS:



1. A junction element 10 for a fluid delivery system, the junction element comprising 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, said outlet port 14 being in flow communication with said inlet port 12; whereby the junction element 10 is integrally fitted with at least one duct portion 28, each of the at least one duct portion 28 being in flow communication with the inlet port 12 or the outlet port 14 and being integrally fitted with a valve member 37 and having coupling means 32 for coupling thereto a delivery element, whereby fluid flow through the duct portion 28 may be shut off without interrupting the fluid flow through the main delivery pipe sections.
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 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 a cavity 30 formed within said junction element 10; said cavity 30 being in flow communication with 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 fluid delivery system for connecting one or more branch pipes to a main delivery pipe, said fluid delivery system being characterized in that the

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main delivery pipe is fitted with at least one junction element 74, each of said junction elements being integrally fitted with at least one duct portion 28, each of the at least one duct portion being in flow communication with the delivery pipe and is integrally fitted with a valve member 37 and a coupling means
5 associated with each duct portion, whereby fluid flow through the duct portion may be shut off without interrupting the fluid flow through the main delivery pipe.

7. A fluid delivery system according to Claim 6, wherein said junction element comprises an inlet port 12 for connecting to a main up-stream pipe
10 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.

8. A fluid delivery system according to Claim 6, wherein the inlet port and the outlet port are each formed with a connecting end for connecting thereto a main up-stream pipe section and a main down-stream pipe section,
15 respectively.

9. A junction element according to Claim 1, wherein the delivery element 74 is a branch pipe 90:92.

10. A junction element according to Claim 1, wherein the delivery element is a splitting device 74 adapted for splitting fluid flow towards at least two
20 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.

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