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F2V

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(54) Bathing apparatus

(57) The present invention relates to bathing apparatus comprising a bath 21, fig. 4, having a plurality of spaced apart jets 20 mounted in its bottom wall 24 and connected by conduit means 28 to a pressurized air supply for blowing streams of air into the bath 21. Each jet 20 includes a non-return valve 1, fig. 1, comprising a valve housing 2 having an inlet 5 and an outlet 6, a valve passage 11 extending therebetween, a valve seat 13 extending around said passage 11 and a movable valve member 17 having a closed position in which it sealingly engages said valve seat 13. The valve member 17 and housing 2 are formed and arranged so that said valve member 17 is movable under the influence of pressurized air at said inlet 5, from said closed position to an open position spaced from said valve seat 13 to permit fluid passage therebetween. One of said valve member 17 and said housing 2 has a first, magnetic field generating means, the other having a second, magnetic field generating and/or inducible means 15 formed and arranged for interacting with said first magnetic field generating means so as to urge said valve member 17 towards its closed position.

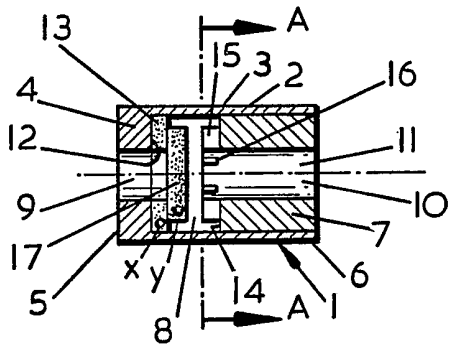

FIG. 1

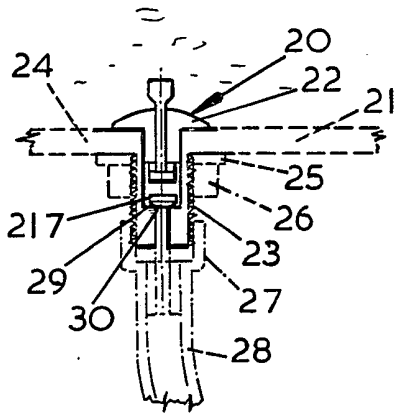

FIG. 4

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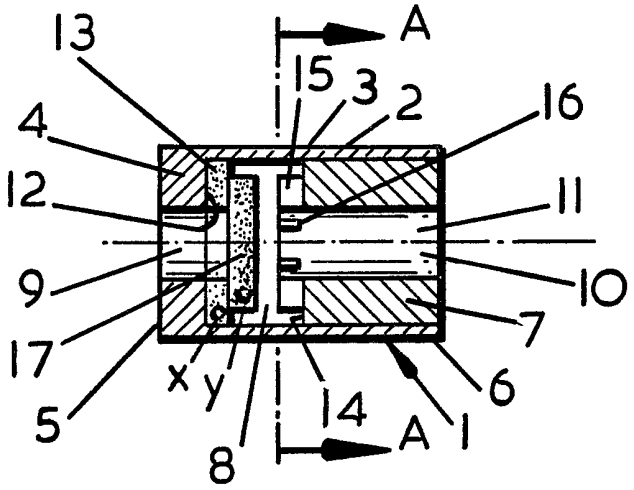

FIG. 1

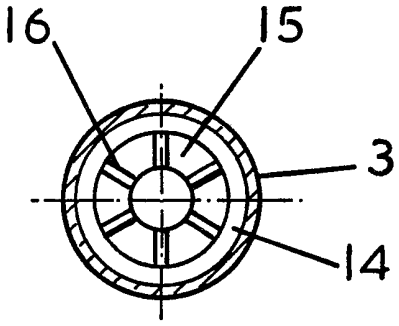

FIG. 2

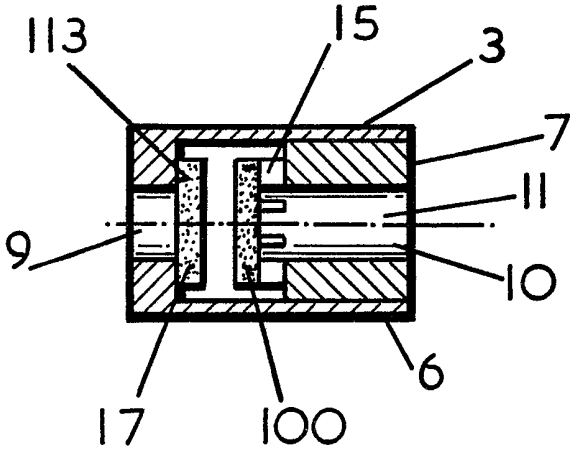

FIG. 3

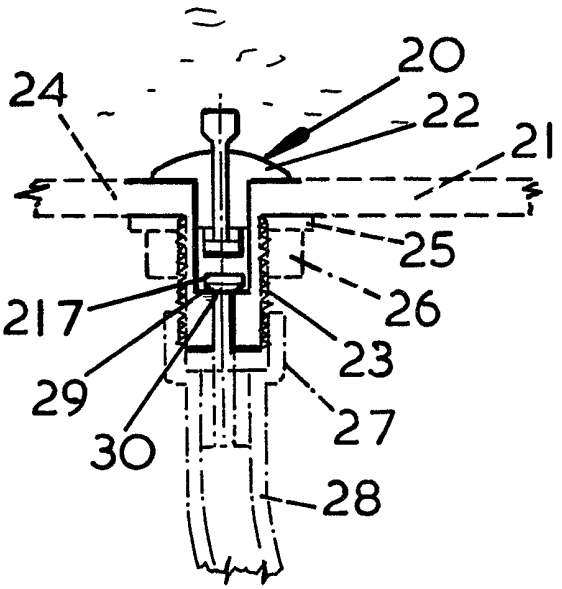

FIG. 4

SPECIFICATION

Bathing apparatus

This invention relates to bathing apparatus and non-return valves suitable for use therein and controlling the passage of pressurized fluid therethrough.

There are many situations ranging from domestic water supply installations to chemical processing plant where it is desired to provide a fluid flow in one direction whilst being vitally important to prevent any fluid flow in the return direction to prevent contamination of the first mentioned fluid supply and/or apparatus upstream of the discharge for that fluid. One example that may be mentioned is in the context of bathing apparatus where it is desired to admit an upward pressurized air flow into a body of water whilst preventing any possibility of backflow of the bath water into the pressurized air supply system since this could result in contamination of a fresh body of water in the bath on a subsequent bathing occasion with the water admitted to the air supply system which could be soiled to a greater or lesser extent and contain bacterial and other dangerous contaminants.

It is therefore important that whenever there is a significant fall in the pressure of the pressurised fluid supply sufficient to permit a back-flow into the pressurised flow supply system, the flow passage should be closed as quickly and reliably as possible.

Various forms of non-return valves have been previously proposed for such situations. In general these rely on gravity and/or spring means to constantly urge the valve member into a closed position, from which it is displaced only when the pressure of the pressurised fluid supply exceeds a predetermined value. Such known valves however suffer from various disadvantages including slowness of response and closing, relatively short life of the spring means, and difficulty in providing accurate and reliable performance when relatively low pressurised fluid supply pressures are required to be used.

It is an object of the present invention to avoid or minimize one or more of the above disadvantages.

It has now been found that an improved non-return valve functioning can be obtained by means of the use of magnetic forces to urge the valve member into its closed position.

Thus the present invention provides a non-return valve comprising a valve housing having an inlet and an outlet, a valve passage extending from said inlet to said outlet, a valve seat extending around said passage and a movable valve member having a closed position in which it sealingly engages said valve seat, said valve member and housing being formed and arranged so that said valve member is movable in use of the valve, under the influence of pressurised fluid at said inlets, from said closed position to an open position spaced from said valve seat to permit fluid passage therebetween, one of said valve member and said housing having a first, magnetic field generating means, the other having a second, magnetic field generating and/or inducible means formed and arranged for interacting with said first magnetic field generating means so as to urge said valve member towards its closed position.

With a non-return valve of the present invention there is obtained a reliable and rapid operation of the valve in a simple and economic manner with a minimum of moving parts.

Various different arrangements are possible using either magnetic attraction to hold the valve member in its closed position against the seal or magnetic repulsion to urge the valve member away from its open position into its closed position.

Further preferred features and advantages of the invention will appear from the following detailed description given by way of example of a preferred embodiment. Illustrated with reference to the accompanying drawings in which:

Fig. 1 is a longitudinal section through a first non-return valve of the invention;

Fig. 2 is a transverser section of the valve of Fig. 1 on the line A—A;

Fig. 3 is a longitudinal section corresponding to Fig. 1 of a second embodiment; and

Fig. 4 is a longitudinal section through a jet for a therapeutic bath, and incorporating a non-return valve of the invention.

Fig. 1 shows a non-return valve 1 having a generally tubular housing 2 of a non-magnetic material for example a metal such as brass or a substantially rigid plastics material, for example, a suitable polyamide, polyvinyl chloride etc. In more detail the housing 2 comprises an outer tubular member 3 having an inwardly extending annular flange 4 at an inlet end 5. At its opposite, outlet, end 6, is disposed an inner housing member 7 which is a push-fit inside the outer member 3 and extends towards the flange 4 but is spaced axially therefrom to define an enlarged diameter annular valve chamber 8 intermediate the inlet and outlet ends 9, 10 of an axially extending valve passage 11.

At the inward end face 12 of the flange 4 is provided a ring shaped valve seat means 13 around the valve passage 9 and which is permanently magnetised with opposite poles at its opposite axial ends.

At this inward end face 14 of the inner housing member 7 is provided an annular spacer ring 15 having a plurality of circumferentially spaced radial apertures 16 (see also Fig. 2).

Between the valve seat 13 and the spacer ring 15 is provided a disc-shaped valve member 17 also permanently magnetised with opposite poles at opposite axial ends such that the opposed faces of the valve seat 13 and valve member 17 have opposite magnetic poles whereby these are attracted towards each other. Thus the valve member 17 is held to the valve seal 13 in sealing contact therewith in a closed position preventing passage of fluid from the outlet 100 to the inlet 9.

The valve member 17 is movable away from

the valve seat 13 under the influence of a pressurised fluid supply above a predetermined pressure at said inlet 9 to an open position in which it is spaced from the valve seat 13. As the pressure increases the valve member 17 moves into contact with the spacer ring 15 the fluid flow continuing through the ring apertures 16. As soon as the fluid pressure drops below the predetermined value, the valve member 17 is immediately attracted back into sealing contact with the valve seat 13 thereby immediately closing the valve and preventing any back-flow.

The second embodiment of Fig. 3 is generally similar to the first embodiment, like parts being indicated by like reference indicia, except that in this case the valve seat 113 is formed integrally with the outer member flange 4 at its inner end face 12 and is not magnetised or of magnetisable material, and instead the housing is provided with a permanently magnetised disc 100 secured to the spacer ring 15. In this case the valve member 17 is disposed so that the opposed faces of the valve member 17 and disc 100 have like magnetic poles whereby the valve member 17 is repelled away from the outlet end 6 of the valve and spacer ring 15 into its closed position in sealing contact with the valve seat 113.

In Fig. 4 is shown a jet 20 for a therapeutic bath 21, which jet has a dome-shaped outlet nozzle head 22 at the outlet end of the inner housing member 7, and an external screwthread 23 along the outer housing member 3. The jet 20 may be secured in the base of the bath 21 so as to extend therethrough, by clamping the bath wall 24 between the head 22 and a nut and washer 25, 26 screwed onto the outer housing 3. A conventional hose connector 27 is then secured to the outer housing 3 to enable connection thereto of a pressurized air line 28.

The operational elements of the valve are generally similar in nature to those of the second embodiment in Fig. 3 except that in this case the valve member 217 is provided at its end face 29 opposite the valve seat 13 with a flexible seal means 30.

It will be apparent from the above that the present invention may be practised in various different forms and arrangements. In the first embodiment both the valve member 17 and valve seat 13 are permanently magnetised and thus constitute magnetic field generating means. In this case though either one (but not both) of these elements could simply be of a magnetisable material e.g. non-magnetised iron or steel and thus constitute a magnetic field inducible magnetic field generating means i.e. the magnetic field generated by the first permanently magnetised element induces a temporary magnetisation of the second element which in turn generates a magnetic field which interacts with that produced by the first element.

Instead of using permanently magnetised elements it would also be possible to use one or both elements in the form of electromagnetic means wherein an electrical current is applied so as to generate a magnetic field. In general though such elements are less convenient.

Where permanently magnetized elements are used these may be of suitable steel or may conveniently be of plastics or ceramic material containing particulate magnetic material. Where the plastics material is sufficiently flexible the magnetic field generating element itself can produce a good sealing effect in the closed position. In other cases where a good sealing effect is required a separate sealing element secured to the magnetic element (as in Fig. 4) and/or to the valve seat may be used instead.

The 'fixed' magnetic element may be secured to the housing in any conventional manner but conveniently with the aid of adhesive e.g. an epoxy adhesive. In some cases the 'fixed' magnetic element may be formed integrally with the spacer ring 15 or even the inner housing 7 itself. The 'opening' pressure of the valve member may be readily selected to suit any of a wide range of valves by varying the strength of magnetization of the material used, the size of the elements, and/or the shape thereof, and/or by the use of non-magnetic spacer means between the elements.

With a preferred form of valve in which opposite magnetic poles are opposed, for example, as shown in Fig. 3 or 4 it is possible to achieve reliable opening at pressures as low as 15 to 20 cm. water pressure, together with reliable closing. Although relatively low opening pressures can be obtained with other forms of non return valve, it is not possible to achieve reliable closing due to the effects of surface tension on the very light valve members that have to be used, which tends to result in incorrect seating of the valve member.

It will be appreciated that various modifications may be made to the above described embodiments without departing from the scope of the present invention. Thus for example the valve member may be provided with a guide cage or other guide means for use in guiding movement of the valve member between its open and closed positions to facilitate correct seating thereof.

CLAIMS

1. Bathing apparatus comprising a bath having a plurality of spaced apart jets mounted in its bottom wall and connected by conduit means to a pressurized air supply for blowing streams of air into the bath in use thereof, each said jet including a non-return valve comprising a valve housing having an inlet and an outlet, a valve passage extending from said inlet to said outlet, a valve seat extending around said passage and a movable valve member having a closed position in which it sealingly engages said valve seat, said valve member and housing being formed and arranged so that said valve member is movable in use of the valve, under the influence of pressurised air at said inlets, from said closed position to an open position spaced from said valve seat to permit fluid passage therebetween, one of said

valve member and said housing having a first, magnetic field generating means, the other having a second, magnetic field generating and/or inducible means formed and arranged for interacting with said first magnetic field generating means so as to urge said valve member towards its closed position.

2. Bathing apparatus as claimed in claim 1 wherein said pressurized air supply comprises air blower apparatus.

3. Bathing apparatus as claimed in claim 1 or claim 2 wherein is provided a heating means formed and arranged for heating the flow of pressurized air upstream of said jets.

4. A non-return valve apparatus comprising a substantially non-magnetic valve housing having an inlet and an outlet, a valve passage extending from said inlet to said outlet, a valve seat extending around said passage and a valve member having a sealing surface and formed and arranged so as to be movable between a closed position in which said sealing surface thereof sealingly engages said valve seat, and an open position in which said valve seat and sealing surface are spaced apart to permit passage of fluid therebetween, said valve member and housing being formed and arranged so that the said valve member is movable, in use of the valve, under the influence of pressurized fluid at said inlet from said closed position to said open position, one of said valve member and said housing having a first, magnetic field generating means, the other having a second, magnetic field generating and/or inducible means formed and arranged for interacting with said first magnetic field generating means so as to urge said valve member towards its closed position, each of said valve seal and valve member sealing surface comprising a complementary surface which is substantially flat, and said magnetic field generating and/or inducible means being formed and arranged so that the magnetic poles of the valve member are axially spaced with respect to the direction of movement thereof and the magnetic field lines of force within the valve member extend generally parallel to said direction of movement.

5. A bathing apparatus according to any one of claims 1 to 3 wherein said non-return valve is as defined in claim 4.

6. Apparatus according to any one of claims 1 to 5 wherein said magnetic field generating means is in the form of a permanent magnet.

7. Apparatus according to claim 6 wherein said permanent magnet comprises a substantially solid body of a ferromagnetic material.

8. Apparatus according to claim 7 wherein said body is formed from a particulate material.

9. Apparatus according to claim 8 wherein said material comprises one or more of barium ferrite and strontium ferrite.

10. Apparatus according to any one of claims 1 to 9 wherein said magnetic field and/or inducible means is formed and arranged for urging said valve member towards its closed position with a force such that said valve member is displacable from its closed position with an opening pressure or with a fluid pressure of as little as 30 cm water pressure.

11. Apparatus according to any one of claims 1 to 10 wherein said valve seat and sealing surface have at least a surface layer of a generally inert non-rusting material.

12. Apparatus according to claim 11 wherein at least one of said valve seal and sealing surface is provided with a surface coating of a plastic material.

13. Apparatus according to claim 12 wherein said plastic material is polytetrafluoroethylene.

14. Apparatus according to any one of claims 1 to 13 wherein at least one of said valve seal and valve member is of a dimensionally stable substantially non-resilient material.

15. Apparatus according to any one of claims 1 to 14 wherein each of said magnetic field generating means comprises a permanent magnet formed and arranged so as to have their like magnetic poles adjacent the valve seat-sealing surface interface.

16. Bathing apparatus substantially as described hereinbefore with particular reference to any one of Figs. 1 to 4 of the accompanying drawings.

17. A non-return valve according to claim 4 substantially as described hereinbefore with particular reference to any one of Figs. 1 to 4 of the accompanying drawings.

18. A conversion kit suitable for use in converting a conventional bath into a bathing apparatus according to claim 1 which kit comprises a plurality of jets with non-return valves as defined in claim 1 said jets being formed and arranged for mounting in apertures in the bottom wall of said bath, a blower means, and conduit means formed and arranged for connecting said jets to said blower means in use of the kit.

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