



FLUID COUPLINGS

This invention relates to fluid couplings for negative pressure dispense systems and it particularly, but not exclusively, relates to fluid couplings that are suitable for use with drums for hazardous chemicals and the like.

There is a class of fluid dispense systems employing negative pressure dispensation of fluids from containers, such as expensive or hazardous liquid chemicals, the container being fitted with a dispense valve assembly that is to be mated with a coupling head at a point of use to enable the fluid to be pumped from the container. An example of a coupling for such a negative pressure dispense system is described in International Patent Specification No. WO 88/06693 (The Mogul Corporation); wherein the coupling does not have an air valve, relying on a screw cap 60 for container sealing.

At first sight, the obvious and cheapest source for negative pressure dispense system couplings would be to use modified positive pressure beer dispense systems; such as the "Target 2000 Closed Returnable System" marketed by Micromatic A/S of Denmark. This Micromatic system retains an air inlet port in the coupling head, with seals between the slideable ducted member and the coupling head body, both above and below the air inlet port, and a seal between the coupling head body and the dispense valve flange; all to ensure that air can only flow into the container via the coupling head air inlet port. However, by careful analysis of the usage requirements of negative pressure dispensation, especially of hazardous chemicals, the applicants have discovered that the most cost effective route is to develop purpose-designed couplings.

It is an object of the present invention to provide a fluid coupling for negative pressure dispensing of fluids wherein the dispense assembly can replace the cap of an exist-



ing drum.

According to the present invention, a fluid coupling for a negative pressure dispense system comprises a dispense assembly to be fitted as a cap to seal a drum or the like fluid container and having a valve to control the ingress of air and means to prevent the egress of fluid, a coupling head to mate with the dispense cap and seal solely with the fluid egress prevention means, complimentary features on the dispense cap and coupling head that inter-engage upon relative rotation of the coupling head with respect to the dispense cap, and the fluid egress prevention means arranged to be engaged and opened by a part of the coupling head upon mating engagement with the dispense cap.

Document GB 1348654 (The Perlick Company, Inc.) relates to a conventional gas pressure dispense system wherein the coupling head is rotated into engagement with the keg valve or spear and, as the coupling head is screwed down on to the keg valve the internal valve members are opened to form two sealed passages, one for ingress of pressured gas and the other for egress of beer; the coupling head makes no provision for passage of air.

Document US 4388997 (Thomas E. Grime) relates to a paint cup for a suction feed hand held spray gun. It has no disclosure of means to prevent egress of fluid or of complementary features on the dispense cap and coupling head with inter-engagement and relative rotation of the coupling head with respect to the dispense cap. The equivalent features on separate and on the cup body itself or on the dispense cap. There is no disclosure of fluid egress prevention means arranged to be engaged and opened by a part of the coupling head upon mating engagement with the dispense cap.

In an embodiment of the present invention, the dispense cap and the coupling head have inter-engaging screw threads.

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In another embodiment of the present invention, the dispense cap and the coupling head have inter-engaging, part-turn, bayonet-type fittings.

In a further embodiment of the present invention, the fluid egress prevention means is a membrane and the front end of the coupling head is shaped both to pierce the membrane, whereby the membrane may be breached as the coupling head is rotated into the dispense cap, and to provide a flow path for dispensed fluid.

In a still further embodiment of the present invention, the fluid egress prevention means is a fluid valve having an axially movable valve member and the front end of the coupling head is shaped both to engage the valve member, whereby the valve member may be axially displaced and the fluid valve opened as the coupling head is rotated into the dispense cap, and to provide a flow path for dispensed fluid.

In a yet another embodiment of the present invention, the fluid egress prevention means is a fluid valve having a rotatable valve member and the front end of the coupling head is shaped both to engage the valve member, whereby the valve member may be rotated and the fluid valve opened as the coupling head is rotated into the dispense cap, and to provide a flow path for dispensed fluid.

In a yet further embodiment of the present invention, the air ingress valve is a one-way valve provided in the dispense cap separately from the fluid egress prevention means.

In a still another embodiment of the present invention, the air ingress valve is a one-way valve provided in the dispense cap co-axially with the fluid egress prevention means.



The above and other features of the present invention are illustrated, by way of example in the Drawings, wherein:-

- Fig. 1 is a sectional elevation of an unmated coupling head and dispense cap in accordance with a first embodiment of the present invention;
- Fig. 2 is a similar view of the coupling head and dispense cap of Fig. 1, when mated;
- Fig. 3 is a sectional elevation of an unmated coupling head and dispense cap in accordance with a second embodiment of the present invention;
- Fig. 4 is a similar view of the coupling head and dispense cap of Fig. 3, when mated;
- Fig. 5 is a sectional elevation of an unmated coupling head and dispense cap in accordance with a third embodiment of the present invention; and,
- Fig. 6 is a similar view of the coupling head and dispense cap of Fig. 5, when mated.

The fluid coupling shown by Figs 1 and 2 generally comprises a dispense cap 10 and a mating coupling head 12. The dispense cap 10 is a plastics moulding of generally conventional cap shape, with an internally threaded skirt 14 depending from a top 16 and an internal sealing ring 18 to seal against the lip of the neck of a drum (not shown, for example a type 2001 plastic drum). The cap top 16 has a central recess 20 within which a one-way air valve 22 and a poppet type fluid valve 24 are arranged side-by-side. Air valve 22 is in a plain bore 26 having a port 28 at the bottom through which projects the stem 30 of a mushroom valve of resilient material; the head 32 of the valve seals against the underside of the cap recess 20. The fluid valve 24 is in a threaded bore 34 from the bottom of which depends a cylindrical valve body 36 which contains a spring loaded poppet valve member 38 that seals against a peripheral valve seat 40 at the top of the valve body. A plastics tube 42 depends from an inlet port in the bottom of the valve body down to the bottom of the drum.



The coupling head 12 generally comprises a radially-winged, cylindrically-shaped moulding of plastics material the front end 44 of which has an external thread to mate with the threaded bore 34 in the dispense cap 10. The coupling head has a through bore that terminates in a larger diameter bore 46. A duct 48 is located in the through bore, the duct is closed at its front end by a cap 50 and has side ports in the front end. A spring loaded non-return valve is housed in the bore 46; a cylindrical valve member 52 therefore is disposed about the duct front end, is axially slideable thereon and is loaded by a spring 54 for a sealing ring 56 to seal the side ports.

In use, the coupling head 12 is screwed into the dispense cap recess 34, rotation of the coupling head (in the direction of arrow R, see Fig. 2) being aided by the coupling head wings 62, until the duct top cap 50 engages fluid valve member 38; continued rotation of the coupling head forces valve member 38 axially downwards until the duct front end passes through the fluid valve seat 40. The fluid valve is now opened; as is the coupling head non-return valve, the valve member 52 of which rises up the duct front end uncovering the side ports with the sealing ring 56 sealing against the bottom of the threaded bore 38, circumferentially about the fluid valve seat 40. A rotary coupling 58 connects the coupling head to an output pipe 60; to enable the coupling head to be screwed into the dispense cap without twisting the output pipe.

A suction pump can be connected to the output pipe 60 and the liquid contents of the drum will be drawn along the flow path indicated by the arrows; that is up pipe 42, through the port in the bottom of the fluid valve body 36, around the fluid poppet valve member 38, through the side ports into the coupling head duct 48 and thus to output pipe 60. The pressure in the drum will fall as soon as liquid flows out and air valve 22 will automatically open to permit air to flow into the head space in the drum, as shown by the arrow.

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The cap skirt 14 may be provided with an anti-tamper ring 64 of known type and the cap threaded bore 34 may be provided with a screw-in transit bung 66.

The fluid coupling shown by Figs 3 and 4 generally comprises a dispense cap 70 and a coupling head 72. The dispense cap is a plastics moulding of generally conventional cap shape, or it could be an adapted cap, with a depending threaded skirt 74, a top 76 and a cap seal 78. A frusto-conically shaped socket 80 is co-axially, sealingly fitted into the cap top. The top of the socket is provided with a radially outwardly extending flange 82 that is attached to the cap top. The socket also has a central recess 84 and a bore 86 running from the bottom of the recess to the inner end 88 of the socket body. The lower part of bore 86 is of larger diameter than the upper part and a plastics tube 90 is fitted within the lower bore and depends to the bottom of the drum. A membrane 92 is trapped by the tube 42 against the radial shoulder between the upper and lower duct bores; the membrane seals the socket duct.

A ring of air holes 94 in the recess bottom surround the bore 86, running axially from the recess to emerge under the socket flange 82. A resilient, annular air valve diaphragm 96 is seated in a peripheral groove 98 about the exterior of the socket body and is biased against the underside of the socket flange to thereby normally seal the air holes 94. The socket recess 84 is also provided with a pair of circumferentially short, radially inwardly extending flanges 100.

The coupling head 72 generally comprises a radially winged, cylindrically shaped moulding of plastics material the front end 102 of which is provided with circumferentially short, radially outwardly extending flanges 104 that are designed to inter-engage in a bayonet type fitting with the dispense cap socket flanges 100. The coupling head has a

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through bore 106 that terminates in a larger diameter bore. A spring-loaded, non-return ball valve 108 is housed in the larger diameter bore and the ball valve body 110 extends below the coupling head front end and terminates in a pointed, hollow extension 112. A sealing ring 114 is provided about the ball valve body and against the coupling head front end. The upper end 116 of the coupling head is threaded for connection to an outlet pipe, not shown.

In use, the coupling head 72 is mated to the dispense cap 70 by introducing the coupling head 102 front end into the cap socket 80 and rotating the coupling head a part-turn relative to the dispense cap so that the coupling head bayonet flanges 104 engage under the dispense cap socket bayonet flanges 100; the flanges may have a small axial angle to provide a camming action to force the coupling head into the dispense cap socket. As the coupling head enters the dispense cap socket, the coupling head valve body extension 112 enters bore 86, encounters and then pierces the dispense cap membrane 92 and sealing ring 114 is compressed against the bottom of the bore to seal the valve body extension in the bore. Liquid can now be pumped out of the drum; passing up tube 90, through the membrane 92, up into the valve body extension 112, past the ball valve 108 to the outlet through bore 106 (as indicated by the arrows in Fig. 4). As pressure in the drum drops air will pass the coupling head front end 120, between the coupling head flanges 100, to flow through the air holes 94 into the head space in the drum; the differential air pressure lifting air valve diaphragm 96 off underside of the socket flange (again as indicated by the arrows in Fig. 4). In this embodiment a rotary coupling is not required as the coupling head only needs a part turn to engage in the dispense cap.

In the fluid coupling shown by Figs. 5 and 6, the dispense cap 120 is the same as dispense cap 70, with the exception that membrane 92 is replaced by a fluid valve 122 having a rotary valve member 124; otherwise like parts have

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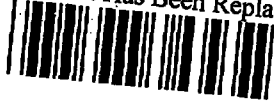
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been given the same references. The valve member 124 is of an inverted cup shape having radial ports 126 (Fig. 6) in the cup side walls 128 and can rotate about a vertical axis on a valve support member 130, part of the socket body 80, that is provided with radial ports 132 (Fig. 5) that communicate with the through bore 86. Valve member 124 can be rotated so that its ports 126 can register with the support member's ports 132, i.e the fluid valve will be open (Fig. 6). The valve is closed when the valve seal is rotated away from port registration (Fig. 5). Valve member 128 also has a cruciform depression 134 in its upper surface.

The coupling head 136 is the same as coupling head 72, with the exception that pointed non-return valve body extension 110 is replaced by a much shorter, central cruciform extension 138; with surrounding axial ports 140 communicating with non-return ball valve 108.

In use, the coupling head 136 is mated to the dispense cap 120 by introducing the coupling head 102 front end into the cap socket 80 and rotating the coupling head a part-turn relative to the dispense cap so that the coupling head bayonet flanges 104 engage under the dispense cap socket bayonet flanges 100. As the coupling head enters the dispense cap socket, the coupling head cruciform extension 138 enters fluid valve member cruciform depression 134 and, as the coupling head 136 is rotated, valve member 124 is rotated from it's closed to it's opened position. Sealing ring 114 is compressed against the bottom of the socket bore 122 to seal the coupling head front end in the dispense cap socket. Liquid can now be pumped out of the drum; passing up tube 90, through the fluid valve ports 130 & 126, through axial ports 140 up into the coupling head front end 102, past the ball valve 108 to the outlet from the coupling head (as indicated by the arrows in Fig. 6). As pressure in the drum drops air will pass the coupling head front end 120, between the coupling head flanges 100, to flow through the air holes 94 into the head space in

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the drum; the differential air pressure lifting air valve diaphragm 96 off the underside of the socket flange (again as indicated by the arrows in Fig. 6).

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CLAIMS:

1. A fluid coupling for a negative pressure dispense system comprising a dispense assembly to be fitted to a drum and a coupling head to mate with the dispense assembly characterised in that the dispense assembly is a cap (10,70,120) to seal a drum or the like fluid container and having a valve (22,96) to control the ingress of air and means (24,92,122) to prevent the egress of fluid, the coupling head (12,70,137) seals solely with the fluid egress prevention means (24,92,122), complimentary features (34&44,100&104) on the dispense cap and coupling head are provided to inter-engage upon relative rotation of the coupling head with respect to the dispense cap, and the fluid egress prevention means are arranged to be engaged and opened by a part (50,110,138) of the coupling head upon mating engagement with the dispense cap.
2. A fluid coupling as claimed in claim 1, characterised in that the dispense cap (10) and the coupling head (12) have inter-engaging screw threads (34&44).
3. A fluid coupling as claimed in claim 1, characterised in that the dispense cap (70,120) and the coupling head (72,136) have inter-engaging, part-turn, bayonet-type fittings (100&104).
4. A fluid coupling as claimed in any of claims 1 to 3, characterised in that the fluid egress prevention means is a membrane (92) and the front end (110) of the coupling head (106) is shaped both to pierce the membrane, whereby the membrane may be breached as the coupling head is rotated into the dispense cap, and to provide a flow path for dispensed fluid.



5. A fluid coupling as claimed in any of claims 1 to 3, characterised in that the fluid egress prevention means is a fluid valve (34) having an axially movable valve member (38) and the front end (50) of the coupling head (60) is shaped both to engage the valve member, whereby the valve member may be axially displaced and the fluid valve opened as the coupling head is rotated into the dispense cap, and to provide a flow path for dispensed fluid.
6. A fluid coupling as claimed in any of claims 1 to 3, characterised in that the fluid egress prevention means is a fluid valve (122) having a rotatable valve member (124) and the front end (138) of the coupling head (136) is shaped both to engage the valve member, whereby the valve member may be rotated and the fluid valve opened as the coupling head is rotated into the dispense cap, and to provide a flow path for dispensed fluid.
7. A fluid coupling as claimed in any of claims 1 to 6, characterised in that the air ingress valve is a one-way valve (22) provided in the dispense cap (10) separately from the fluid egress prevention means (24).
8. A fluid coupling as claimed in any of claims 1 to 6, characterised in that the air ingress valve is a one-way valve (96) provided in the dispense cap (70,120) co-axially with the fluid egress prevention means (92,122).
9. A fluid coupling as claimed in claim 8, characterised in that the one-way valve is an annular air valve diaphragm (96) disposed about the fluid egress prevention means (91,122) and biased to seal air inlet ports (94) in the dispense cap



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(70,120).

10. A fluid coupling as claimed in any of claims 1 to 9, characterised in that the coupling head (106,136) is provided with a non-return, fluid valve (108).
11. A dispense cap for a fluid coupling as claimed in any of the previous claims.