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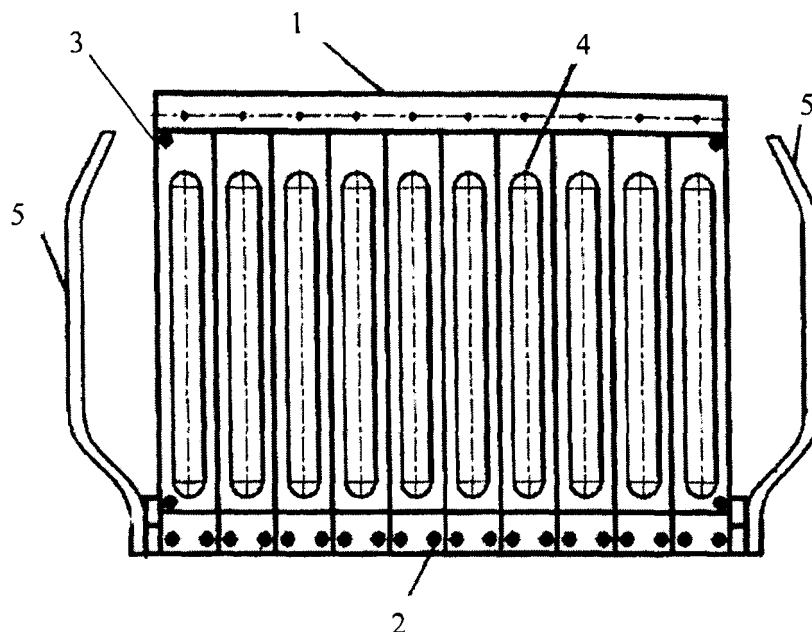
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(54) **Safety device**

(57) A safety device comprising retaining means configured to support and retain at least one container

and an enclosing means configured to encase the at least one container, wherein any breakage of the container is contained by the enclosing means.

Figure 1



Description

Field of the Invention

[0001] The present invention relates to a safety device suitable for use in particular, but not exclusively, in the measurement of surfactant characteristics.

Background of the Invention

[0002] The investigation of phase behaviour between two or more liquids is usually carried out in a closed glass tube, in which the liquids are placed and observed before and after mixing. Such a test is useful when testing new potential surfactant materials for enhanced oil recovery, as it is important to test the ability of such materials to emulsify a mixture of oil (either crude oil or a single hydrocarbon) and water. The test is generally carried out by agitating a quantity of the surfactant to be tested in water or a salt solution (e.g. brine) with an amount of oil and measuring the depths and appearance of the phases/emulsions formed, either immediately or after the phases have been allowed to equilibrate for some time. By using a glass tube, the different phases/emulsions can easily be observed, allowing the ready measurement of their depth and appearance. To simulate oil well conditions, the water and oil are suitably heated to a temperature of up to 140 °C. In a closed test-tube system, this can create an increased pressure of 1500 kPa or higher. In a glass test-tube such conditions may cause breakage of the glass and possibly an explosion, and thus, safety concerns for the handler of the apparatus, in terms of broken glass and spilled hot liquid. Further, in a laboratory environment, such breakage may also affect nearby apparatus and glassware. It would, therefore, be desirable to provide an apparatus suitable for testing the suitability of detergents for use in enhanced oil recovery, in which such safety concerns were overcome.

[0003] Further, it would be desirable to provide apparatus suitable for the testing of multiple samples at any one time.

Summary of the Invention

[0004] According to the present invention there is provided a safety device comprising retaining means configured to support and retain at least one container and an enclosing means configured to encase the at least one container, wherein any breakage of the container is contained by the enclosing means.

Brief Description of the Drawings

[0005]

Figure 1 shows a rear view of a safety device according to one embodiment of the present invention;

Figure 2 shows a front view of the safety device of Figure 1;

Figure 3 shows a side view of the safety device of Figure 1;

Figure 4 shows a top view of the safety device of Figure 1; and

Figure 5 shows a cross section of the base of the safety device of Figure 1.

Detailed Description of the Invention

[0006] It has now surprisingly been found that safety problems associated with the determination of phase characteristics of a mixture of two or more liquids can be overcome by the use of a safety device comprising retaining means configured to support and retain at least one container and an enclosing means configured to encase the at least one container, wherein any breakage of the container is contained by the enclosing means. Furthermore, such a device can allow testing of multiple samples at any one time.

[0007] The safety device with a retained container can be placed in a laboratory oven maintained at the test temperature that simulates the oil reservoir temperature.

The retaining means is configured to support and retain the at least one container. The retaining means suitably comprises a base and one or more lateral members configured to support and retain the at least one container.

[0008] The base may be formed as an integral structure with the lateral members or, alternatively, may be constructed separately and fixed to the lateral members by connecting means, such as solder, glue or mechanical connecting means, for example, one or more screws. In a preferred embodiment, the base is constructed separately and may suitably be constructed of a different material to the lateral members.

[0009] Suitably, the base is constructed of any material capable of withstanding the heat applied to the liquid mixture. Suitable materials include, but are not limited to, metals and thermally-stable plastics, such as PEEK, Teflon and polycarbonate. Preferably, the base is made of plastic.

[0010] The base may be flat or may, preferably, contain wells or indentations into which the one or more containers can fit. Such wells or indentations provide extra support and stability for the containers.

[0011] The one or more lateral members partially surround the containers. By preference, the one or more lateral members are upstanding from the base. More preferably, the one or more lateral members are upstanding perpendicular to the base. In one embodiment of the present invention, in which there is more than one lateral member, the lateral members are mutually spaced. Preferably, where there are three or more lateral members, said members are equi-distant from one another. In other embodiments, two of the lateral members may form end-plates attachable to opposing ends of the base. The one or more lateral members may comprise flat plates, cyl-

inders or partial cylinders. In a preferred embodiment, the one or more lateral members are positioned to provide a series of bays into which the containers are fitted. Such bays provide visual access to the containers while preventing the breakage of a single container causing damage to any of the other containers in the safety device. In the case where the one or more lateral members are cylinders, said visual access may be provided by a portion of said cylinder being cut away.

[0012] The one or more lateral members are constructed of any material capable of withstanding the heat applied to the liquid mixture. Suitable materials include, but are not limited to, metals and thermally-stable plastics. Preferably, the one or more lateral members are metal.

[0013] In one embodiment of the present invention, additional support for the container may be provided by an additional retaining device attached to the one or more lateral members. A suitable additional retaining device includes, but is not limited to, an elastically deformable retaining device and/or a clip. In an alternative embodiment, the additional retaining device comprises an upper member which can be fixed in place over the one or more containers in order to provide further support and retention of the one or more containers. In a preferred embodiment, said upper member may be attached to the end-plates.

[0014] The one or more lateral members, base and/or upper member may, in one embodiment of the present invention be equipped to allow heat to be applied directly to the safety device, e.g. by the flow of electricity, hot air, or hot water.

[0015] The at least one container is suitably a container that is capable of withstanding the heat applied to the liquid mixture and any pressure build-up caused by said heat. Preferably, the containers are made of a transparent, or semi-transparent material to allow visual measurements of the contents of the containers to be made. In a preferred embodiment of the present invention, the containers are formed from glass.

[0016] Preferably, the containers are marked with a scale to allow depth measurements of the phases to be carried out in situ without requiring additional equipment.

[0017] The one or more containers must be constructed to allow addition of the materials to be tested. In one embodiment, therefore, the containers have an opening, preferably toward one end of the container. This opening must then be capable of closure in order for agitation of the safety device and its contents, without spillage of the materials to be tested.

[0018] In a preferred embodiment, the closure is effected by means of a closing device which is configured to fit the opening in the container by any suitable means that allows retention of said closing device under the conditions to which the safety device is exposed. Preferred closing devices include a lid or cap that is retained in place by a screw fitting, crimping of the lid or cap or by a tight fit between the opening and the closing device.

[0019] In a preferred embodiment of the present inven-

tion, the safety device may be configured to retain and support more than one container in order to allow the parallel testing of multiple samples under consistent conditions.

[0020] The enclosing means is configured to encase the at least one container. Suitably it is configured such that the container is visible therethrough, e.g. by provision of an aperture or the use of a transparent material. In one preferred embodiment of the present invention, the enclosing means is formed of a mesh. Preferably, the enclosing means comprises a metal mesh. In another preferred embodiment of the present invention, the enclosing means is formed of a transparent material. Preferably, said material is polycarbonate.

[0021] In use of the safety device under the temperature, pressure and agitation conditions to which it is subjected, a possibility of breakage of one or more containers is introduced. Thus, the enclosing means is configured such that the majority of any fragments of the container (s) are retained within the device, thereby ensuring the safety of the user.

[0022] The enclosing means is preferably attached to the retaining means in a manner such that it is not dislodged during agitation of the test liquids within the safety device. Such a manner may comprise a clip or a screw fixture.

[0023] The safety device may contain other features that contribute to its ease of use. For example, the safety device may be equipped with one or more handles to allow manual manipulation and agitation of the device. Alternatively, the safety device may be configured to fit securely to an automated agitation device.

[0024] Further, the safety device may be equipped with supporting means configured to hold the safety device in a vertical position. Such supporting means may comprise stabilising members extending from the safety device, for example from the base of the retaining means. Alternatively, the supporting means may be a separate device into which the safety device may be fitted.

[0025] In a further embodiment of the present invention, the safety device may be attached to a horizontal axis which is rotated, either manually or by an electric motor. This allows the liquids in the glass tubes to be mixed in a controlled manner.

Specific Description of the Invention

[0026] In the accompanying Figures like features are depicted by the same reference numerals throughout.

[0027] Figure 1 shows a safety device according to a preferred embodiment of the present invention. The safety device comprises a retaining means (1) having a base (2) formed of a heat-resistant plastic material. Connected to the base (2) and upstanding perpendicularly therefrom are lateral members (3). In the depicted embodiment the lateral members (3) are flat metal plates. Two of the lateral members (3) form end-plates connected to opposing ends of the base (2) whilst further lateral members (3)

are spaced at equal distances between the two end-plates. A pair of adjacent lateral members (3) delimit a bay (4) in which a container (not shown) is retained and supported.

[0028] Handles (5) are attached to opposing ends of the base (2) of the safety device, thereby providing the user with means to hold the safety device. It is much by preference that the handles (5) are not in thermal communication with the remainder of the safety device thereby ensuring that the handles (5) remain at a temperature at which the user can readily grasp them for manipulation of the device. It will be readily understood that in an alternative embodiment of the present invention the handles of the device may be in thermal communication with the remainder of the device, in which embodiment the user would be required to wear heat resistant hand wear, gloves for example, in order to hold the device in use.

[0029] Figure 2 depicts a front plan view of the safety device depicted by rear plan view in Figure 1. All features of the device of Figure 2 are identical to those of Figure 1 except for the clips (6). Clips (6) are retaining devices which provide additional support to a container (not shown) within a bay (4). Alternative retaining devices, such as clamps for example, will be well within the understanding of the skilled artisan in light of the present disclosure. Each bay (4) has a clip (6) positioned therein to engage and retain a container (not shown). The clips (6) are preferably positioned so as to engage with an upper part of a container, the neck portion of a test-tube, for example.

[0030] Figure 3 shows a side elevation of the safety device depicted in Figures 1 and 2. The safety device has an enclosing means (7) which is hingedly connected to the base (2) of the safety device by a hinge (8). The enclosing means (7) is retained in its operational condition in which it encases the containers retained in the device, by way of a screw fitting (9) located centrally between the two end-plates on top of the retaining means (1).

[0031] The enclosing means (7) depicted is formed of a polycarbonate material which is adapted and positioned to cover the front and top of each and all of the bays (4). It will be readily understood that in alternative embodiments of the present invention, the enclosing means (7) may be configured to completely cover the bays at the top, front and rear thereof. In a further alternative arrangement, the enclosing means (7) may be a full box with a removable or hinged lid into which the retaining means of the invention may be placed.

[0032] The enclosing means (7) may also be formed from any suitable material, although polycarbonate material is preferred as it allows the user visual access to the contents of containers in the device and also prevents glass and/or the contents of the container from being projected towards the user in the event of container breakage. In an alternative embodiment, the enclosing means (7) comprises a wire mesh that covers at least the front and top of the bays (4) in the retaining means

(1) or fits over the retaining means as a cage (not shown).

[0033] The safety device also has two stabilising members (10) arranged at the opposing end of the base (3). The stabilising members (10) provide support in addition to the base (2) of the device when same is to be rested against a planar surface in the vertical (upright) position. The stabilising members (10) extend from the base (2) and may be formed integrally therewith. Alternatively, the stabilising members (10) may be formed separately from the base (2) and may be attached thereto by any suitable means such as screw fittings, for example.

[0034] Figure 4 shows a top plan view of the safety device of Figures 1 to 3. The screw fitting (9) may be tightened to retain the polycarbonate enclosing member (7) when same is in the closed, operational position wherein it covers the top and front of the retaining means (1). The screw fitting (9) is loosened to release the polycarbonate enclosing member (7) such that same can hinge into an open, non-operational position whereby access may be gained to the containers within the device.

[0035] Figure 5 depicts the base (2) of the safety device shown in Figures 1-4 in greater detail.

[0036] The base (2) contains indentations in the form of wells (11) which provide additional support to the bottoms of the containers when placed in the safety device.

[0037] In use of the safety device shown in the drawings, a test-tube of glass is pre-filled with a crude oil or a hydrocarbon or a mixture of hydrocarbons, a surfactant and water, water in which salt or combinations of salts are dissolved, (or brine) and closed by way of a screw cap fitting. The device can also be used with an alkaline component (such as sodium carbonate) and/or a polymer dissolved in the aqueous phase, this simulating alkaline-polymer-surfactant flooding enhanced oil recovery processes. The filled test-tube is then pushed into clip (6) in a bay (4) and supported in a well (11) in base (2). Any number of test-tubes may be placed into a bay (4) in the device up to the number of bays (4) in the device. The polycarbonate enclosing member (7) is then hinged about hinge (8) from an open position to a closed position and held in that closed position by tightening of screw fitting (9). The device may then be heated in an oven (or by any other suitable means) to a temperature of about 140 degrees Celsius. The user may then grip handles (5) and manually agitate the liquids in the test-tube(s) or mix the liquids in the tubes by rotation of the safety device about a horizontal axis. Any breakage of the test-tube whilst the enclosing member (7) is in the closed position will be retained in the device and prevented from reaching the user. The phases / emulsions formed in the experiments are observed visually and rated in appearance in terms of type, clarity and colour. In addition, the viscosity of the emulsions formed and their tendency to wet the glass surface are noted as the tubes are gently swayed from side to side. This methodology has been reported elsewhere.

Claims

mixture.

1. A safety device comprising retaining means configured to support and retain at least one container and an enclosing means configured to encase the at least one container, wherein any breakage of the container is contained by the enclosing means. 5
2. The safety device of claim 1, wherein the safety device comprises a base and one or more lateral members configured to support and retain the at least one container. 10
3. The safety device of claim 2, wherein the base is formed as an integral structure with the lateral members. 15
4. The safety device of claim 2, wherein the base is constructed separately and fixed to the lateral members by connecting means. 20
5. The safety device of any one of claims 2 to 4, wherein the base is constructed of any material capable of withstanding the heat applied to the safety device. 25
6. The safety device of any one of claims 2 to 5, wherein the one or more lateral members partially surround the containers.
7. The safety device of claim 6, wherein the one or more lateral members are positioned to provide a series of bays into which the containers are fitted. 30
8. The safety device of any one of claims 2 to 7, wherein the one or more lateral members are constructed of any material capable of withstanding the heat applied to the safety device. 35
9. The safety device of any one of claims 2 to 8, comprising an additional retaining device attached to the one or more lateral members. 40
10. A method of testing the phase behaviour of a mixture of an aqueous liquid, one or more hydrocarbons and, optionally a surfactant, said method comprising the steps of 45
 - i) partially filling a container with the aqueous liquid, one or more hydrocarbons and, optionally, the surfactant; 50
 - ii) closing and sealing said container;
 - iii) placing said sealed container in the safety device of any one of claims 1 to 9;
 - iv) heating the safety device to a temperature up to 140°C; 55
 - v) agitating the safety device to mix the liquids; and
 - vi) visually observing the phase behaviour of the

Figure 1

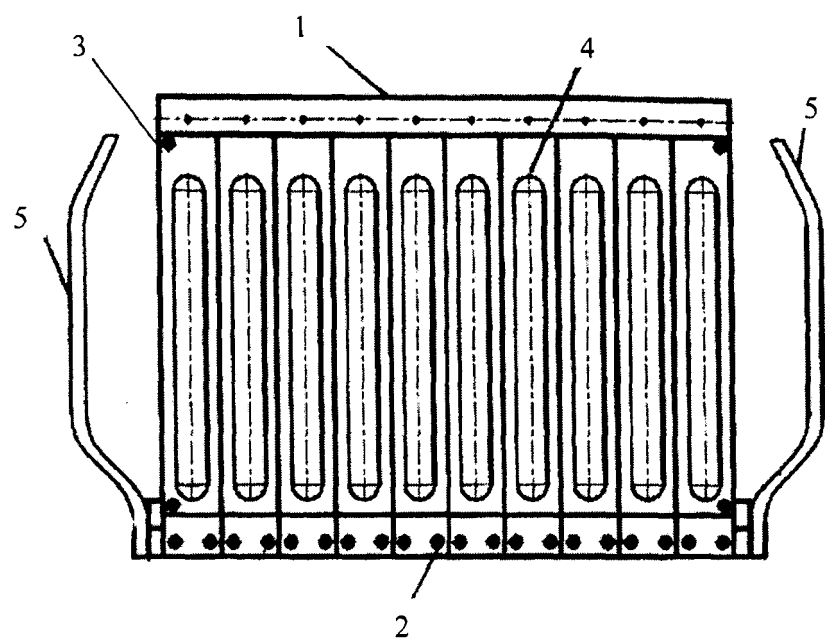


Figure 2

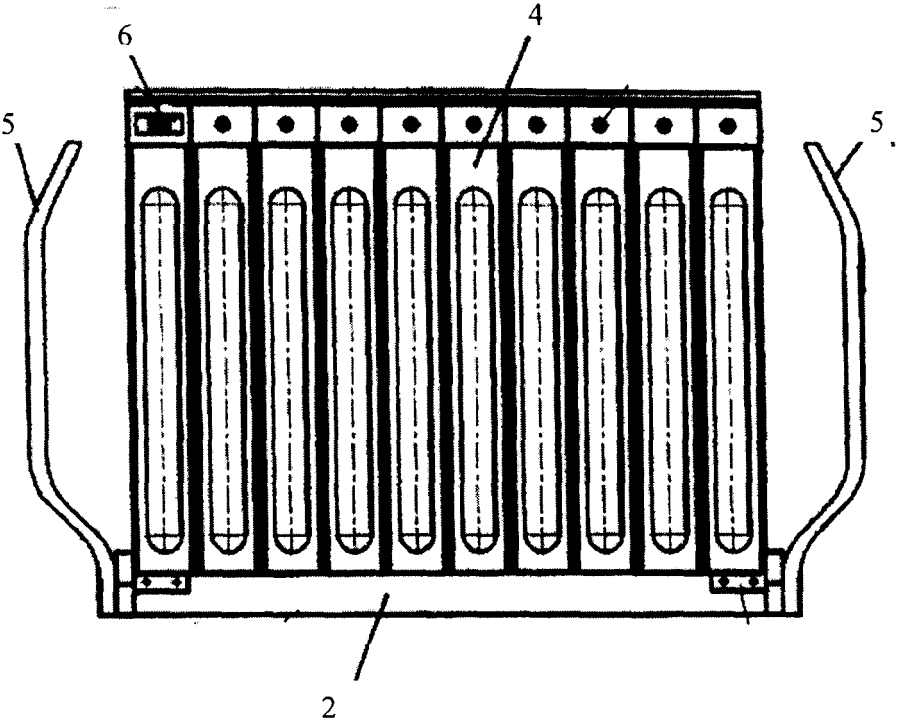


Figure 3

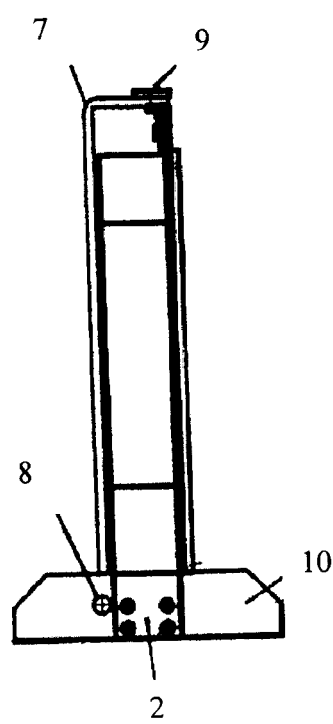


Figure 4

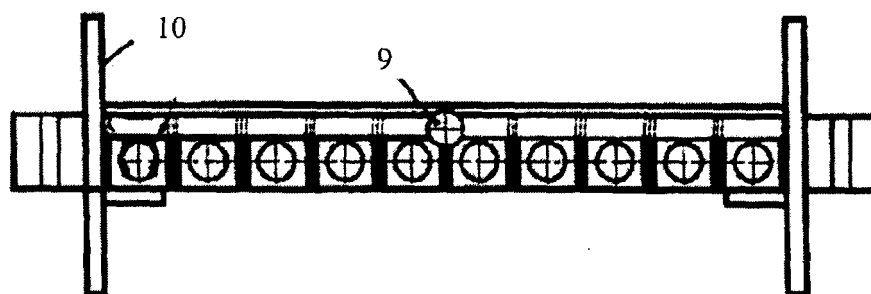
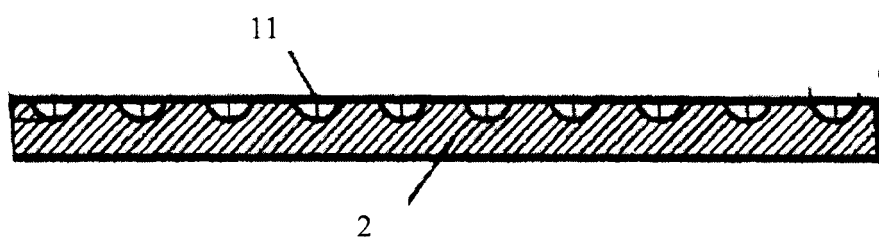


Figure 5





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 11 0953

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 December 2007	Examiner Tragoustis, Marios
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 07 11 0953

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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