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(54) Magnetic sludge filter

(57) Accurate dosing of heating systems with water treatment chemicals such as inhibitor can be difficult. By providing a separable vessel (1, 21, 31, 41) of suitable inherent volumetric size or with markings (25) or an insert (3, 23) the volume of inhibitor chemical (42) can be more accurately controlled or selected.

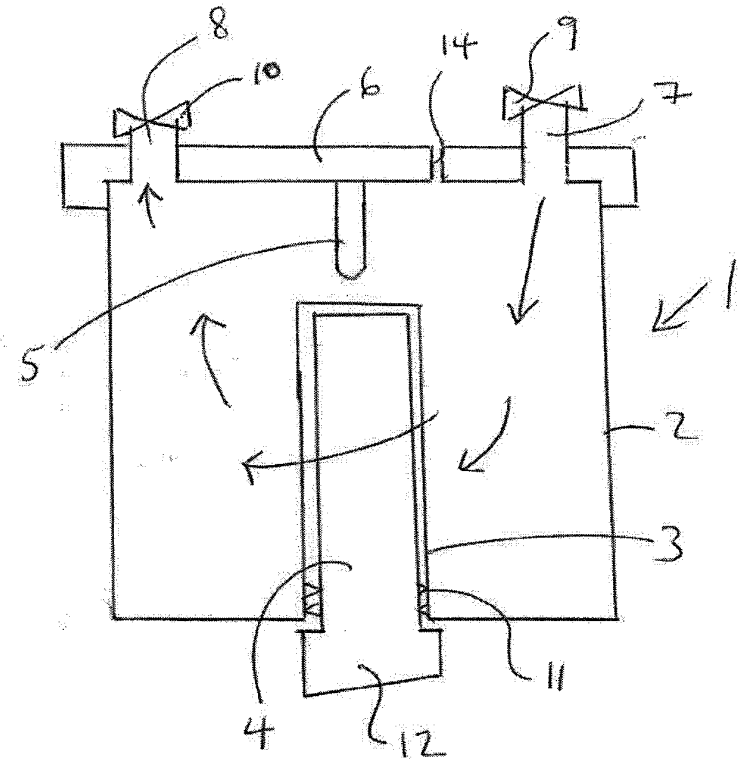

Figure 1

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Description

[0001] The present invention relates generally to magnetic sludge filters and more particularly to magnetic sludge filters for wet central heating systems.

[0002] Wet central heating systems are well-known and use water as the medium to take heat from a boiler to radiators using gravity and normally a pump to drive flow. Some wet central heating systems use a header tank to ensure a head of water is maintained in the system but more recently closed systems have been provided such as with a combi-boiler. Whether an open system or a closed system it will be appreciated that the water in the wet system is subject to fouling for example from installation materials such as solder flux and products of corrosion of pipes, joints, radiators etc. in the system. The particulate matter in the central heating flow can be referred to collectively as sludge or dirt. A significant proportion of such magnetic sludge at least is susceptible to magnetic interaction so a range of magnetic sludge filters or collectors have been provided in which a magnet is located in a vessel so that the magnetic sludge is attracted to the magnet and so removed from the flow.

[0003] The magnets are integral within a prior magnetic sludge filter so typically the whole filter or magnet assembly needs to be removed from the system so that the magnetic sludge can be disposed of by flushing the magnet directly and it has been difficult to tune or provide magnets for particular situations or dosing with particular dosing agents to act as inhibitors to corrosion within the wet central heating system.

[0004] In accordance with first aspects of the present invention there is provided a magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a separable magnetic element located externally within the recess, the filter having means to direct a fluid flow in use into the cavity about the recess whereby magnetically inducible particulate matter in the flow is attracted to the surface of the recess.

[0005] In accordance with second aspects of the present invention there is provided a magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a magnetic element comprising a probe to extend from the exterior into the recess, the probe having apertures to receive magnetic elements edge to edge in a stack in the direction of the probe.

[0006] In accordance with third aspects of the present invention there is provided a magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a magnetic element, the filter having a vane extending towards the recess across the vessel and in association with a manifold for closure of the vessel, the manifold having an inlet and an outlet with the vane extending between them to act as a baffle to direct flow of a fluid in use between the inlet and the outlet.

[0007] Further in accordance with some aspects of the present invention the filter may have a separable vessel and manifold. The manifold may have an inlet valve and outlet valve with each valve operable in use to isolate the filter from the heating system. The separable vessel and manifold may have a seal between them. The seal may comprise an inner seal and outer seal. The seals may be O rings or gasket seals. The manifold is associated with the vessel by a screw thread. The vessel may be a canister or cartridge with a transportation and/or storage seal to retain a dosing portion within and the seal removable or displaceable prior to and/or upon association with the manifold.

[0008] Further in accordance with some aspects of the present invention the recess may be central within the vessel. The recess may be reciprocally shaped to envelope the magnetic element. The recess may have a rectangular cross-section. The recess and the magnetic element may have an interference inter-lock association to retain location of the magnetic element within the recess. An inner surface of the recess may be shaped to increase surface area exposed to a fluid flow in use. The inner surface may be undulating or ribbed or have castellation. The inner surface of the recess may have a separable removable disposable cover to help cleaning, protection and/or to facilitate retention of sludge. The disposable cover may be adhesive to further capture particulate matter. The disposable cover is removable from the recess. The recess may be transparent. The disposable cover may be transparent. The disposable cover may be arranged to sag in use as particulate matter is associated with the disposable cover and/or recess under attraction to the magnetic element

[0009] Further in accordance with some aspects of the present invention the magnetic element may comprises a frame to receive a plurality of magnetic parts edge to edge. The magnetic parts may be discs. The magnetic parts may be made from rare earth Neodymium magnets. The magnetic element may have different combinations of magnetic parts associated with the element to provide a desired magnetic performance for the magnetic element in use within the recess and the vessel. The poles of the magnetic elements may be orientated so that the axis of the magnets is perpendicular to the axis of the vessel so that the effect of the magnetic field in attracting magnetic particulate matter is maximised. A plurality of magnetic elements may be provided as a kit for a magnetic sludge filter, each magnetic element having a different performance in use. The recess and magnetic element may be matched by configuration and/or size for a particular combination. The magnetic element may be matched by colour to a type of filter, a vessel type, a heating system type and/or size or a chemical/inhibitor type. The magnetic parts may be stacked edge to edge in pairs with juxtaposition of opposite magnetic poles. Typically, two magnetic parts may be provided with opposite poles next to each other in a stack for magnetic attraction with particulate matter in a fluid flow through

the filter and for location in the frame.

[0010] Further in accordance with some aspects of the present invention the vessel may include markings indicative of volume. The vessel may include an insert to vary the volume of the vessel. The insert may include a pocket to receive a solid element. The insert may float within the vessel. The insert may float when the solid element has dissolved.

[0011] The magnetic element may be configured by parts orientated so that the magnetic axis of each part is perpendicular to the axis of the vessel whereby the magnetic field for attracting magnetic particulate matter is provide about the recess and maximised.

[0012] In accordance with a fourth aspect of the present invention there is provided a magnetic sludge filter for a wet heating system, the filter comprising a vessel and a magnetic element externally mounted within a recess of the vessel, the vessel associated with a manifold having a valve operable to remove air from the vessel.

[0013] The valve may be a pressure relief valve. The pressure relief valve may be arranged to operate to open one way when a pre-determined pressure is reached in the vessel. The valve may be manually operable and/or automatic.

[0014] In accordance with fifth aspects of the present invention there is provided a magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a magnetic element located externally within the recess, the vessel securable to and separable from a manifold through fastening means with the magnetic element retained in association with the vessel, the manifold associated in use with a wet heating system through a valve arrangement and the vessel configured or chosen for consistency with a desired dosing portion volume for a wet heating system associated with the filter in use.

[0015] In accordance with sixth aspects of the present invention there is provided a method of providing a desired dosing portion of a regulator/inhibitor chemical to a wet heating system, the method comprising isolating a magnetic sludge filter from fluid flow in a heating system through configuration of a valve arrangement associated with a manifold, detaching a vessel associated with the manifold of the magnetic sludge filter with a magnetic element retained within a recess in the vessel, emptying the vessel of liquid, refilling the vessel with the regulation/inhibitor chemical to a mark within the vessel up to and including a rim for the vessel and attaching the vessel to the manifold and re-configuring the valve arrangement to re-connect fluid flow from the heating system through manifold and the vessel of the magnetic sludge filter.

[0016] In accordance with seventh aspects of the present invention there is provided a method of providing a desired dosing portion of a regulator/inhibitor chemical to a wet heating system, the method comprising isolating a magnetic sludge filter from fluid flow in a heating system through configuration of a valve arrangement associated with a manifold and attaching a vessel to the manifold containing the desired dosing portion of the regulator/inhibitor, the vessel selected from a range of possible vessels having fastening means to allow attachment the manifold and the vessel selected for consistency with a desired dosing portion in terms of volume and/or suitable dosing receptacle whereby the vessel volume and/or the configuration of the dosing receptacle is indicative of the correct dosing portion for an associated heating system.

[0017] Further in accordance with some aspects of the present invention there is provided pre-filing of the vessel with the regulation/inhibitor chemical with a seal for transportation. The seal may be removable upon attaching the vessel to the manifold.

[0018] The filter and method may include a valve associated with the filter typically in a manifold to allow air removal from the vessel and/or pressure relief in the filter.

[0019] Embodiments of the invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a schematic illustration of a magnetic sludge filter in accordance with aspects of the present invention;

Figure 2 is a front elevation of a magnetic sludge filter; and

Figure 3 is a cross-section of a magnetic sludge filter in accordance with particular aspects of the present invention;

Figure 4 is a schematic cross-section of a vessel from a magnetic sludge filter in accordance with aspects of the present invention;

Figure 5 is a schematic cross-section of a vessel from a magnetic sludge filter in accordance with further aspects of the present invention; and,

Figure 6 is a schematic cross-section of a vessel from a magnetic sludge filter in accordance with additional aspects of the present invention.

[0020] Wet central heating systems generally use water as a fluid pumped or driven around pipe work to radiators from a boiler with a thermostat and other controls to regulate operation. Various parts of the heating system may result in particulate matter in the system. For example parts of the radiators and boiler may be ferrous so that corrosion creates a characteristic magnetic sludge in the heating system. It is normal to add an inhibitor generally in the form of a solution or liquid chemical portion to a desired dosing level but such inhibitors are not absolute and a certain level of magnetic sludge is inevitable particularly with waters having certain characteristics including hardness values and acidity levels, the use of dissimilar metals in contact in contact with each other and some dissolved oxygen from adventitious air ingress. The magnetic sludge should be removed to maintain the efficiency of the system and life of components.

[0021] Being ferrous it will be appreciated that it is known to provide a magnetic element which extends

through a header cap into a flow vessel of a prior magnetic sludge filter in order to attract the magnetically inducible particulate matter to it. The vessel is connected to the heating system with an inlet and an outlet with a cumbersome process needed to remove the magnetic sludge or particulate matter involving releasing the magnetic element with the cap and then draining the vessel thorough a drain valve at the bottom of the vessel. The process is messy, time consuming and it will be understood that once the magnetic element is removed the magnetic sludge is released into the vessel rather than kept in a tight concentration near to the magnetic element. In such circumstances a part of the released magnetic sludge may be returned to the heating system by gravity and siphoning effects. Aspects of the present invention provide a magnetic sludge filter for a wet central heating system in which the magnetic sludge can be retained within a flow vessel until disposal and flushing of the vessel. Figure 1 provides a schematic illustration of a cross-section of a magnetic sludge filter 1 in accordance with aspects of the present invention. A first aspect is the provision of a readily detachable flow vessel 2 with a recess or pocket 3 extending into the vessel 2. The recess 3 accommodates a magnetic element 4 externally but which also extends into the recess 3 or pocket in the vessel 2. A second aspect of the present invention is that the magnetic element 4 comprises a frame with a plurality of magnetic parts in an edge to edge stack in a pole to opposite pole orientation. By the second aspect the magnetic element 4 can have a much greater magnetic flux density in comparison with prior magnetic elements. A third aspect of the invention relates to provision of a vane 5 which extends across the vessel generally aligned with the recess 3 and extending towards the recess 3. The vane 5 is generally part of or associated with a manifold 6 such that a fluid flow shown by arrowheads can flow from an inlet 7 to an outlet 8 past the recess 3 rather than directly between them. As seen normally the vane 5 does not extend completely to contact the recess 3 as this is unnecessary to urge desired flow past the recess 3 such that by magnetic attraction inducible particulate matter can become associated and adhere to an inner surface of the recess. All of these aspects along with other features as described below may be included together or separately in a magnetic sludge filter in accordance with aspects of the present invention.

[0022] The manifold 6 and the vessel 2 are associated together in operation with normally a screw thread and seals, an inner O ring seal and an outer gasket seal as described later. The inlet 7 and the outlet 8 have a respective valve 9, 10 which can be shut or closed to fluid flow and so effectively isolate the magnetic sludge filter 1 from the remainder of the heating system. In such circumstances it will be appreciated that with the valves closed then the vessel 2 can be detached from the manifold 6 with the magnetic element 4 still within the recess 3. In such circumstances the magnetic element 4 will ensure that magnetically induced particulate matter remains adhered to the inner surface of the recess 3 under the attraction of the magnetic element 4. The liquid in the vessel 2 can be poured away, then the magnet element 4 removed and the vessel 2 then flushed in an appropriate manner to remove the now less adhered particulate matter (magnetic attraction from the magnetic element has been removed) from the inner surface of the recess 3.

[0023] The recess 3 and the magnetic element 4 are shaped and sized so that there is a reciprocal association. The magnetic element 4 will normally be a close fit within the recess 3 to maximise the magnetic field and flux for attraction of particulate matter and so that there is interference for retention of location of the magnetic element in the recess 3 and so the magnetic sludge filter 1. Orientation of the magnetic element 4 and magnet parts therein is a key element to maximizing use of the field to catch as much magnetic sludge as possible. The magnet parts and magnet element will generally be aligned with the major longitudinal direction of the major part of the recess and typically the vessel so that the parts are edge to edge, pole to opposite pole to maximise magnetic flux substantially perpendicular to that axis for attraction of sludge particles in the fluid flow. To ensure or further ensure appropriate location and retention of that location in the recess 3 normally some form of inter-lock is provide so in the example illustrated in figure 1 respective detents 11, 12 are provided to inter-engage with each other unless a displacement force is applied to push the magnetic element 4 into the recess 3 or pull the magnetic element 4 out of the recess 3.

[0024] The recess 3 is normally centrally located within the vessel 2 and so in the main fluid flow between the inlet 7 and the outlet 8. However, it will be appreciated that more than one recess and so magnetic element could be provided in the same vessel for respective interaction with the fluid flow.

[0025] It will be appreciated that there may be situations where different levels of magnetic interaction with the fluid flow may be desirable. For example at initial heating system set up or when the system has been subject to a flush with a flushing solution then more rapid removal of magnetic sludge may be desirable. In such circumstances the magnetic element 4 may be pushed further into the recess 3 than normally so a greater part of the inner surface of the recess is then available for adhesion of particulate matter under the influence of the magnetic element or simply a more powerful magnetic element introduced. In either event it will be appreciated on a like for like basis more magnetic sludge will be removed in a quicker time returning the heating system to equilibrium.

[0026] In the normal course of events the vessel 2 and the magnetic element 4 will be matched for a particular heating system. The vessel 2 will have a size adequate to act as a magnetic sludge filter for the associated heating system; it will be understood that a four radiator system will generally not generate as much magnetic sludge as a twelve radiator system. The size of the magnetic

sludge filter may be a drag on the pump for the heating system. In such circumstances the recess for each vessel will be sized and shaped so at it will only accommodate and retain in position magnetic elements of a particular size and configuration so ensuring that the correct magnetic element is used. Furthermore the vessel 2 and the magnetic element 4 could be matched by colour so that the correct combination is used.

[0027] The vessel 2 will normally have a volume in the order of a 250ml or 500ml and so may provide a convenient means of access to dose the heating system with an inhibitor chemical. This could be particularly useful in systems which do not have a header tank. The vessel 2 as indicated acts to allow a through flow when associated with the manifold. The vessel 2 could be canister or cartridge pre-loaded with an inhibitor chemical.

[0028] A magnetic sludge filter 1 in accordance with aspects of the present invention as indicated above will have the manifold 6 associated with the vessel 2 with a head unit to connect them. The manifold 6 allows the filter 1 to be secured through the inlet 7 and outlet 8 to the heating system pipe work. The vessel 2 in the form of a canister provides means for flow about the recess 3 and hence the externally associated magnetic element 4. A fluid tight association must be provided between the head unit of the manifold 6 and the vessel 2 and this is generally done with a screw thread and appropriate seals. The magnetic element 4 is generally a plastic frame or tray made of plastic to receive magnetic parts such as pairs of disc magnets formed from a suitable material e.g. Neodymium rare earth magnets. The discs are edge to edge, pole to opposite pole in a stack along the length of the magnetic element.

[0029] It will be understood that the magnetic sludge filter 1 by necessity needs to be robust so an appropriate material will be used for the manifold 6, the vessel 2 and any retaining ring (not shown in figure1). Suitable materials include a cast austenitic stainless steel for example steel number 1.4301 listed in BS EBN 10088-1:2005 or equivalent (such as the former designation 304). An all metal structure is preferred to a plastic structure to provide greater durability and long term integrity. However, the magnetic element 4 will tend to be a plastic frame to allow easy of mounting and presentation of the magnetic elements in the recess 3.

[0030] The inlet 7 and the outlet 8 as indicated above generally have valves 9, 10 respectively to allow isolation of the filter 1 so that the vessel 2 can be readily removed. These valves 9, 10 may be integral within the inlet 7/outlet 8 or separate but in either arrangement provide normally through compression type fittings connections to the remainder of the heating system.

[0031] The vessel 2 and the magnetic element 4 are removable from the manifold 6/header together so that the magnetic sludge particles remain enthralled with the magnet element 4 through the walls of the recess 3. The element 4 remains in place through an interference fit and/or an interlock arrangement 11 so it can be separated. It will also be understood that a handle or knob 12 will normally be provided at one end of the magnetic element 4 to allow manipulation of the element 4 into and out of the recess. Such a handle 12 may also allow the element 4 to be turned periodically and/or adjustment in and out of the vessel if necessary. The vessel 2 is moulded or cast or shaped to provide an internal central rectangular recess 3 for reception of the magnetic element 4 though an opening in the base of the vessel 2.

[0032] By provision of an internally extending recess it will be noted that the recess can be centrally located with the magnet compared to prior arrangements where the magnet element was attached to and protruded from the side of the bowl. Such external mounting of the magnetic element into a pocket recess allows magnetic filtering out of the magnetic sludge to adhere to the inner surface of the recess without direct contact with a fixed magnetic element. Such an association allow dis-assembly with the magnetic element and then flushing along with greater flexibility with respect to magnetic element design along with other elements of the magnetic sludge filter. The magnetic element traps magnetic material in the fluid flow but the magnetic element may be rectangular or at least the frame for magnetic parts can be rectangular with those magnetic parts assembled in a variety of magnetic forms. The magnetic element can therefore be designed in a rectangular form or otherwise so that the magnetic parts and hence the magnetic field is presented to a fluid (water) flow in the heating system to optimise magnetic attraction of suspended magnetic particles with magnetic fields orthogonal to fluid flow.

[0033] A rectangular magnet housing for the magnetic element allows options for presenting the magnetic field to the fluid flow with restricted flow past the short side and unrestricted flow past the long side. Thus, as described in a preferred embodiment and in accordance with second aspects of the present invention a magnetic element 4 is provided comprising two pairs of magnetic parts in the form of discs. It will be appreciated that other forms and numbers of magnetic parts is possible. The magnetic parts are aligned in a frame or housing with opposite poles side by side or edge to edge in order to enhance and amplify the magnetic attraction and also as opposite poles attract a light plastic frame is all that is need to retain the magnetic parts together as they are attracted to each other.

[0034] It will be understood that whilst it is advantageous to render the vessel 2 separable from the manifold 6 it is important to maintain the integrity and operation of the filter 1. In such circumstances as described above the vessel 2 is either attached directly by a screw thread association. Alternatively, a screw thread collar is provided to extend between the vessel 2 and the manifold 6 over external threads. By such a configuration the screw thread collar will ensure that the screw thread does not come into contact with the fluid of the central heating system and so will not suffer problems of seizure after long periods. To further restrict such seizure problems

as described previously a double seal approach is advantageous in that a gasket seal is provide about an outer association between the head or manifold 6 and the screw thread retaining collar and an O ring seal provided as an inner seal in contact with or wetted by the fluid of the wet central heating system. It will also be understood that by using a retaining collar the rather than applying force to the vessel itself to demount the vessel 2 the releasing forces are applied to the collar or retaining ring causing less disturbance of the vessel 2 and of scattering or release of adhered/trapped magnetic particles taken from the fluid flow. The vessel 2 and the magnetic element 4 are removed together with the fluid/trapped magnetic sludge. The fluid is removed by inverting the vessel 2 with the magnetic element 4 still in place within the recess 3. The magnetic element 4 can then be withdrawn from the recess 3 in the vessel 2. The trapped magnetic sludge can then be rinsed from the vessel 2 with the magnet element 4 withdrawn and under better controlled conditions reducing mess and waste.

[0035] The provision of valves 9, 10 allows the filter 1 to be isolated in a heating system or possibly fluid flow in the heating system to be diverted into a by-pass. In either event the vessel 2 can be removed and magnetic sludge flushed out. Furthermore in accordance with aspects of the present invention the vessel 2 can be seen as a convenient way of dosing an effectively closed wet heating system such as used for example with combination boilers. As background it will be understood that traditional gravity fed boiler arrangements have a header tank and so this header tank has provide a convenient if inefficient means of introducing inhibitor chemicals to a heating systems. In modern systems generally the header tank is replaced with an expansion tank as the heating system is closed. In such circumstances it is quite normal to introduce the inhibitor chemical through any convenient means such as identifying the highest radiator and partially draining the system so that inhibitor chemicals can be introduced through a funnel into the bleed plug of the radiator. Clearly this is not ideal but avoids a more substantial drain down of the system.

[0036] With a separable vessel 2 it will be understood that this vessel 2 may be loaded or filled with a dosing portion of inhibitor chemical after removal of magnetic sludge. Thus, by rendering the vessel 2 separable through the valves 9, 10 an easy approach to introducing inhibitor chemical is achieved. Furthermore, more surety that the correct dosage has been introduced can be achieved. The dosage can be measured into the vessel dependent upon the size of the heating system and with more specification along with accuracy to the particular fluid volumes in the system reducing use of potentially noxious chemical and costs. Alternatively, the vessel itself can be a measure either through graduations or markings for volume in the vessel or the vessel having a known volume so when fully filled that volume of chemical is introduced to the system. Typically the vessel 2 will be designed to have a volume at least greater than 250 ml so that the vessel 2 can facilitate dosing of inhibitor chemicals in 250ml quantities.

[0037] It will also be understood that an insert may be provided within the vessel 2 which changes its volume to that required in terms of a dose of inhibitor chemical or provides a means to present inhibitor chemical in a solid form to dissolve as required and possibly to an extent necessary for the heating system when the filter is re-attached to the heating system and fluid flows again.

[0038] A vent 14 is typically provided within the header part of the manifold 6 for venting any air within the vessel 2. Furthermore the vent 14 may be used to extract small samples of heating system fluid for testing in terms of condition and inhibitor effectiveness by laboratory analysis, on site chemical testing or dipping of electronic test devices. The vent will normally be a valve which may also be pressure relieving with manual or automatic control.

[0039] By providing the recess 2 and the magnetic element 4 towards the bottom of the vessel 2 it will be understood that means are needed to ensure the recess 3 is 'washed' by a substantial proportion of the heating system fluid flow. In accordance with third aspects of the present invention the vane 5 protrudes towards the recess 3 to direct flow over the central recess 3 and so near to the magnetic element 4. Magnetic particles in flow will then be attracted by the element 4 so that these magnetic particles adhere to the inner surface of the recess 3. The vane 5 is typically flat and rectangular across the vessel 2. The vane 5 acts as a flow divider or baffle to inhibit direct flow between the inlet 7 and the outlet 8 so diverting some flow at least towards the recess 3.

[0040] The vane 5 may be associated with fittings to facilitate a power flushing action within the vessel 2 when the inlet 7 and outlet 8 are closed. The vane 5 could be attach to a suitably designed fitting in place of the canister and the vane 5 employed as a blanking plate separating the in and out flow channels. The fitting would have hose or other attachments for connecting with a power flushing machine, and hence provide a simple and effective means of connecting the system with a power flushing machine for cleansing the system (not the canister or vessel of the filter).

[0041] Figures 2 and 3 show further aspects of the present invention in a more practical form with consistent reference nomenclature used for comparison with figure 1. In such circumstance is will be noted in the front elevation depicted in figure 2 a vessel 2 in the form of a canister or cartridge is provided and secured in association with a manifold through a retaining ring or collar 6a. The manifold 6 has an inlet 7 and an outlet 8 to allow the magnetic sludge filter 1 to be secured to a wider heating system (not shown). The retaining ring or collar 6a acts through a screw thread to bridge external screw threads in the respective vessel 2 and manifold 6. A handle or knob 12 part of a magnetic element (not fully shown) extends below the vessel 2. The knob 12 allows insertion and retraction of the magnetic element 4 as required.

The manifold 6 includes a pressure relief and sampling vent 14 in the outlet part 8 of the manifold.

[0042] Figure 3 provides a cross-section of the magnetic sludge filter 1 shown in figure 2. Thus, the vessel 2 is secured to the manifold 6 by a retaining collar or ring 6a with a vane 5 extending into the vessel 2 towards a recess 3 in the vessel 2. Within the recess 3 a magnetic element 4 is located and secured by an interference fit and/or an interlock detent 11 towards an opening end of the recess 3. As described previously a fluid flows from the inlet 7 to the outlet 8 through the vessel 2. The vane 5 ensures that a more significant proportion of the flow is forced near to recess 3 and so the magnetic element 4.

[0043] The magnetic element 4 comprises a frame made of plastic with apertures 21 to receive respective magnetic parts (not shown) in opposite pole to opposite pole configuration to maximise the magnetic field. In the example illustrated the apertures are circular to accept magnetic parts in the form of discs. In use the heating system fluid will flow about the recess 3 so that with the element 4 within the recess 3 it will be appreciated those magnetic particles will be attracted and adhere to the inner surface 3a of the recess 3 and will remain attracted whilst the element 4 remains within the recess 3.

[0044] It will be understood from above that magnetic sludge is a problem with regard to wet heating systems. Thus, it is important to filter such magnetic sludge from the fluid flow using a magnetic sludge filter and preferably such a filter which is less likely to clog such as with a mesh or membrane filter or restrict flow either consistently or variable. Wet heating systems should be low maintenance and to a certain extent fit and forget until the next scheduled service. In such circumstances inhibitor chemicals are used to inhibit magnetic sludge depositions and corrosion in a heating system. Traditionally dosing has been based roughly on the size of the system in terms of radiators with a margin for error. However, such chemicals can be relatively expensive and not environmentally friendly. It will also be understood that the inhibitor chemical is 'consumed' at different rates dependent upon a number of factors including the age of the system, the hardness/pH of the water base of the fluid in the heating system and operation. Ideally a heating system will be drained upon each inhibitor chemical change but it is possible that instead the system will simply be partially drained so that a full dose of inhibitor chemical can be added. Such an approach is not best practice and is wasteful but the limitations of heating systems prevents more accurate dosing possibly as a result of even rudimentary analysis.

[0045] As indicated above the vessel 2 is separable from the manifold 6 or at least a header part of the manifold of the magnetic sludge filter 1 in accordance with aspects of the present invention. The vessel 2 is normally rigid and so dimensionally stable such that the volume capacity of the vessel 2 is fixed. It will be appreciated that the vessel 2 may also be softer and so squeezable about the recess or to facilitate release of an interference fit for the magnetic element 4 but this will tend not to be normal in view of the expected life of the magnetic sludge filter, the temperatures involved and possibly attack by the inhibitor chemicals. Nevertheless in situations where the vessel 2 is a disposable canister or cartridge such an approach and materials may have advantages. For example in a very large heating system with lots of radiators it may be that several magnetic sludge filters are provided and these need changing or flushing regularly so having a disposable cartridge would have advantageous with the manifold 6 staying in position, the vessel would simply be removed with the magnet element then the magnet element withdrawn after the fluid tipped out or not, the old cartridge thrown away and a new cartridge with the old magnet then returned to association with the manifold. The disposable cartridge may be pre-charged with inhibitor chemical to a desired volume or concentration in a liquid or solid or gel form probably under some form of tear seal. If the old magnet element is not sufficient a stronger or different magnetic flux configuration element can then be introduced.

[0046] A vessel 21 in accordance with fifth aspects of the present invention has a screw thread 22 or other fastening means to allow the vessel 21 to be secured to a manifold (not shown). The vessel 21 has a central recess 23 for a magnetic element (not shown). The vessel 21 itself has a volume to accommodate a dose of inhibitor chemical 24. Thus, if filled to the brim of the vessel 21 as illustrated then a known volume of inhibitor chemical will be introduced to a central heating system when the vessel 21 and dose 24 are re-associated with the manifold and the valves opened. Alternatively, graduations or marks 25 may be provided to indicate certain volumes of inhibitor chemical. The marks 25 may relate to absolute values e.g. 250ml or numbers of radiators e.g. 4, 6 etc. or be associated with a particular manufacturer's bottle e.g. red, green, blue so the correct volume/concentration etc. used. In any event the vessel 21 will provide a more positive indicator to a user as to the correct amount of inhibitor chemical to add.

[0047] It will be appreciated that rudimentary as well as accurate tests can be performed on the fluid in a wet heating system. Rudimentary testing may relate to specific gravity or pH of the heating system fluid compared to a reference or base water value either taken at the time of test or in a reference receptacle at the time the heating system was filled or a generic reference value or sample carried. In either event a result will be provided which will give a rough idea but more related to the actual needs of the heating system than the previous one dosing volume fits all situations. The result might be adding nothing or a specific amount of chemical or add a particular manufacturer's bottle e.g. red, green etc. through the vessel 21. The test itself may just be a relative liquid chromatography or litmus style test with separate tabs, tapes or columns of test material exposed at one end to a sample of the actual heating system fluid and the reference so that by relative tidemark position differences or colours

or combinations compared to a look up table so the correct dosing volume of inhibitor chemical can be chosen. The method may only be a marginal improvement but it will be understood where previously the fail safe mode was add 500ml of inhibitor chemical if that can be reduced in half of the situations to really only needing 125ml or 250ml or 375ml of inhibitor chemical then significant amounts of expensive chemical is saved reducing costs and potential environmental damage.

[0048] By having a separable vessel 21 the method of dosing of a heating system is rendered far easier. The method will involve isolating the magnetic sludge filter 1 by closing valve arrangements or configuring such arrangements to a by-pass for the inlet and the outlet for the filter 1. Releasing the vessel 21 or the retaining collar/ring so that the vessel 21 is separated and the isolated manifold remains part of the system. Emptying the vessel 21 of system fluid and replenishing the vessel with a dose of inhibitor chemical to a desired determined volume. The filled vessel 21 is then re-associated with the manifold and system fluid flow returned by opening the valve arrangements or reconnection away from the by-pass path using the valve arrangements. The desired volume may be determined by analysis or test prior to release of the vessel 21 or of the system fluid before being emptied away.

[0049] As also described above the present invention involves providing a magnetic sludge filter so the process of release and separation of the vessel from the manifold is used to remove magnetic sludge in a sixth aspect of the invention. The method includes the steps as above of separating the vessel but until the step of emptying the vessel of system fluid the separable magnetic element remains in the recess so ensuring the magnetic particles or magnetic sludge remain associated with the inner surface of the recess. Once the system fluid is emptied then the magnetic element is removed so loosing association of the magnetic particles or magnetic sludge with the inner surface of the recess allowing less messy flush removal of the magnetic sludge as required. It will also be understood as the magnetic sludge is effectively concentrated about the inner surface of the recess whilst the magnetic element is inserted within the recess so it may be easier to take a smear sample of the magnetic sludge for analysis.

[0050] In accordance with aspects of the present invention as indicated relatively easy separation of the vessel from the manifold is provided. Such an approach with a standardised association through a screw thread and a retaining collar/ring allows a range of vessel sizes to be provided. Thus, it can be that disposable cartridges or canisters of fixed volumes of inhibitor chemical in the vessel may be provided and the correct cartridge/canister chosen based at least initially on system size (e.g. number of radiators) or actual testing or simply experience after being able to look at the system fluid after a period of operation. In such circumstances experience may be reinforced by a simple sight test of a test tube or smear of system fluid against a white background with comparison with a grey level test to determine whether the magnetic sludge filter and/or inhibitor level is adequate or not. One vessel may be set up with a flushing magnet for flushing with other vessels and magnets for on-going operation of the filter. The ease of separation of the vessel and/or magnetic element allows such operation.

[0051] As indicated above vessel volume is important in terms of inhibitor chemical dosing. One approach is to provide markings 25 or vessels of desired volumetric size in accordance with a seventh aspect of the invention but another approach as illustrated as an example in figure 5 is to provide an insert 31 (other reference nomenclature is consistent with figure 4). The insert 31 effectively provides a volume displacement within the vessel 21 to reduce the effective volumetric capacity of the vessel as required. In such circumstance a range of inserts may be provide for a set vessel so that an insert could be chosen to achieve an absolute volume of inhibitor chemical or a related to the size of the system (number of radiators) or relate to a particular inhibitor chemical suppliers bottle type or characteristics. It may be easier to carry as a stock arrange of inserts rather than a range of vessel sizes giving a more convenient manner of achieving more accurate inhibitor chemical dosing in use.

[0052] The recess 23 effectively gives a guide along a bottom portion 32 and it may be possible with an inverted cone portion 33 to swirl the system fluid in the direction of the arrowheads about the recess 23 and so nearer the magnetic insert (not shown) to facilitate operation as a magnetic sludge filter.

[0053] It will be understood the fluid flow in a heating system is driven and forced. In such circumstances if the insert is buoyant in the fluid then when they system is not pumped the insert may rise with that buoyancy. However, when the system returns to operation the flow will force the insert downwards so that if the guiding recess to insert has a scraping function then on the downward motion some of the magnetic sludge may be swept into receptor depressions 34 in a lower part of the insert 31. This may reduce the thickness of magnetic sludge retained on the recess 23 so rendering the relative effectiveness of the magnetic attraction of the magnetic insert for longer. Alternatively the system pressure of forced flow may simply marginally compression a compliant insert into a bulge engagement with the sides of the vessel aiding position retention.

[0054] Inhibitor chemical dosing which is more accurate than previously would be advantageous as the correct level of chemical will reduce wastage and costs. However, it is also important that the process should be relatively simple for a so called do-it-yourself enthusiast. One solution as suggested above is to provide cartridges or canisters pre-loaded with chemical. Figure 6 provides an example of a vessel in the form of a cartridge 41 (other reference nomenclature is consistent with figures 4 and 5). The cartridge 41 has an insert carrier for a solid in-

hibitor chemical 42 although a liquid sachet could also be used. The insert 41 sits upon the recess 23 upon re-association of the cartridge 41 vessel with a manifold in accordance with aspect of the present invention. A seal can be broken prior to seating the insert 41 upon the recess 23 or possibly the inflow pressure of the system fluid flow could be used to break the seal about the solid inhibitor chemical so releasing it to dissolve in use or squeeze concentrated inhibitor chemical from a rupture by downward pressure. By such an approach and where appropriate rather than a slug of inhibitor chemical slewing around the heating system a slower release of inhibitor chemical can be provided. In some circumstances it may be possible to test the system periodically e.g. every day as the level of inhibitor chemical builds up by slow release then remove the insert by separating the vessel from the manifold to remove the partially dissolved solid inhibitor or other conditioning chemical then re-associating the vessel or cartridge with the manifold with a now stable and relatively fixed level of chemical in the heating system fluid.

[0055] It will be understood that each of the aspects of the invention described above are separable as inventions in their own right as well as in combinations to provide particular performance criteria as required for a sludge filter in use.

[0056] It will be appreciated by those skilled in the art that any number of combinations of the aforementioned features and/or those shown in the appended drawings provide clear advantages over the prior art and are therefore within the scope of the invention described herein.

Claims

1. A magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a separable magnetic element located externally within the recess, the filter having means to direct a fluid flow in use into the cavity about the recess whereby magnetically inducible particulate matter in the flow is attracted to the surface of the recess.

2. A magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a magnetic element comprising a probe to extend from the exterior into the recess, the probe having apertures to receive magnetic elements edge to edge in a stack in the direction of the probe.

3. A magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a magnetic element, the filter having a vane extending towards the recess across the vessel and in association with a manifold for closure of the vessel, the manifold having an inlet and an outlet with the vane extending between them to act as a baffle to direct flow of a fluid in use between the inlet and the outlet.

4. A magnetic sludge filter for a wet heating system, the filter comprising a vessel and a magnetic element externally mounted within a recess of the vessel, the vessel associated with a manifold having a valve operable to remove air from the vessel.

5. A magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a magnetic element located externally within the recess, the vessel securable to and separable from a manifold through fastening means with the magnetic element retained in association with the vessel, the manifold associated in use with a wet heating system through a valve arrangement and the vessel configured or chosen for consistency with a desired dosing portion volume for a wet heating system associated with the filter in use .

6. A filter as claimed in any of claims 3 to 5 and any claim dependent thereon wherein the manifold has an inlet valve and an outlet valve with each valve operable in use to isolate the filter from the heating system.

7. A filter as claimed in any of claims 3 to 5 and any claim dependent thereon wherein the separable vessel and manifold have a seal comprising an inner seal and outer seal between them.

8. A filter as claimed in any proceeding claim wherein an inner surface of the recess is shaped to increase surface area by undulation or ribbed or castellation exposed to a fluid flow in use.

9. A filter as claimed in any proceeding claim wherein the magnetic element comprises a frame to receive a plurality of magnetic parts edge to edge.

10. A filter as claimed in claim 9 wherein the magnetic parts are stacked edge to edge in pairs or more and with juxtaposition of opposite magnetic poles.

11. A filter as claimed in claim 9 or claim 10 wherein the magnetic element is configured by the magnetic parts orientated so that the axis of each part is perpendicular to the axis of the vessel whereby the magnetic field for attracting magnetic particulate matter is provide about the recess.

12. A filter as claimed in any proceeding claim wherein the recess and the magnetic element are matched by respective configuration and/or size for a particular combination in a specific filter.

13. A method of providing a desired dosing portion of a regulator/inhibitor chemical to a wet heating system, the method comprising isolating a magnetic sludge filter from fluid flow in a heating system through configuration of a valve arrangement associated with a manifold, detaching a vessel associated with the manifold of the magnetic sludge filter with a magnetic element retained within a recess in the vessel, emptying the vessel of liquid, refilling the vessel with the regulation/inhibitor chemical to a mark within the vessel up to and including a rim for the vessel and attaching the vessel to the manifold and re-configuring the valve arrangement to re-connect fluid flow from the heating system through manifold and the vessel of the magnetic sludge filter.

14. A method of providing a desired dosing portion of a regulator/inhibitor chemical to a wet heating system, the method comprising isolating a magnetic sludge filter from fluid flow in a heating system through configuration of a valve arrangement associated with a manifold
and attaching a vessel to the manifold containing the desired dosing portion of the regulator/inhibitor, the vessel selected from a range of possible vessels having fastening means to allow attachment of the manifold and the vessel selected for consistency with a desired dosing portion in terms of volume and/or suitable dosing receptacle whereby the vessel volume and/or the configuration of the dosing receptacle is indicative of the correct dosing portion for an associated heating system.

15. A method as claimed in claim 13 wherein the magnetic element is removed when emptying the vessel of fluid when detached.

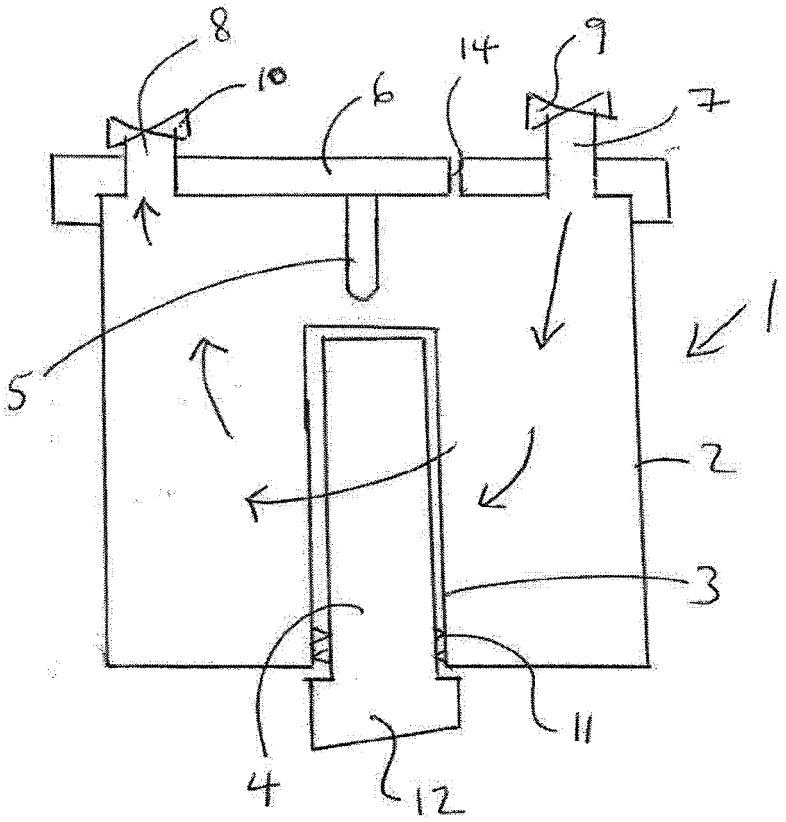

Figure 1

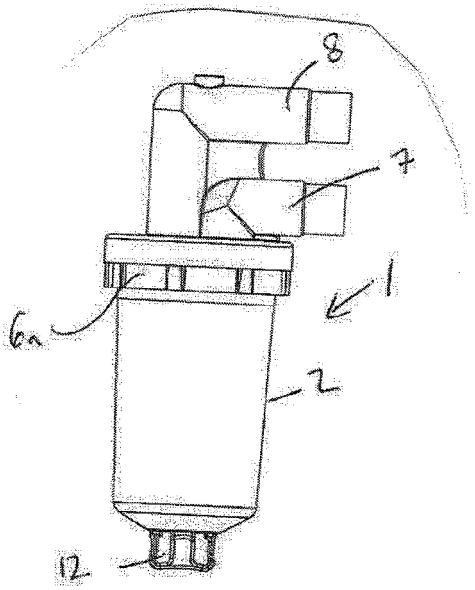

Figure 2

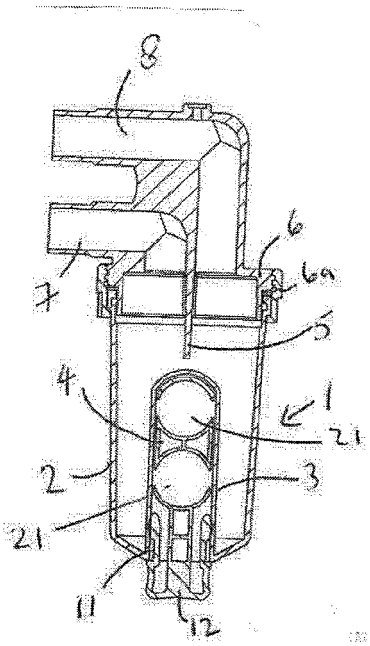

Figure 3

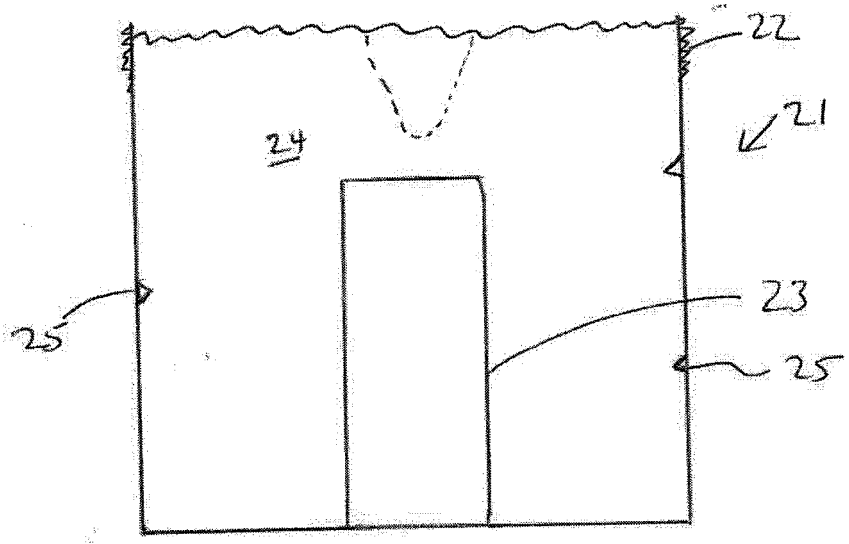

Figure 4

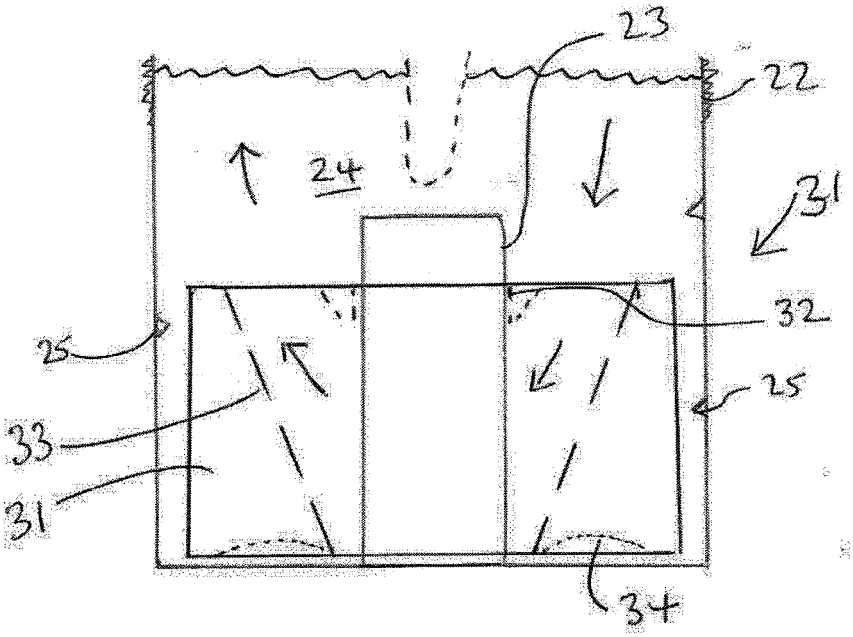

Figure 5

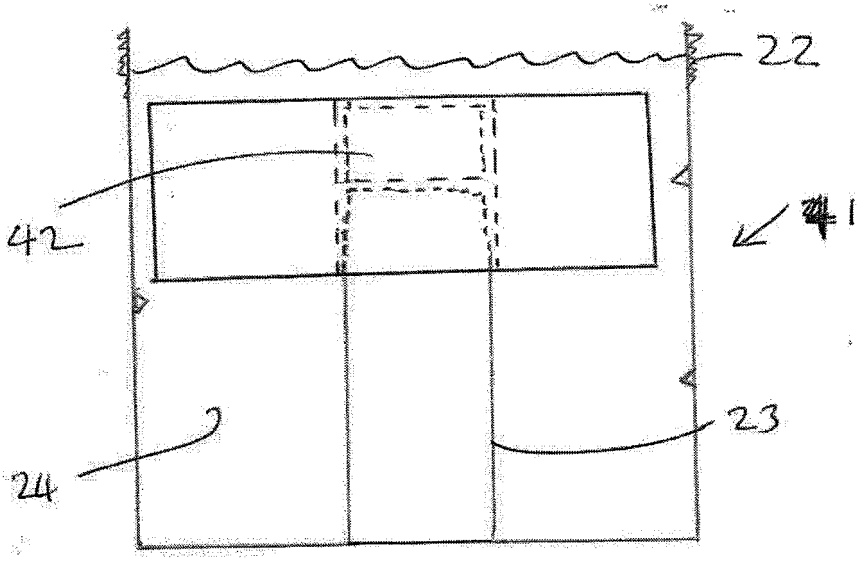

Figure 6