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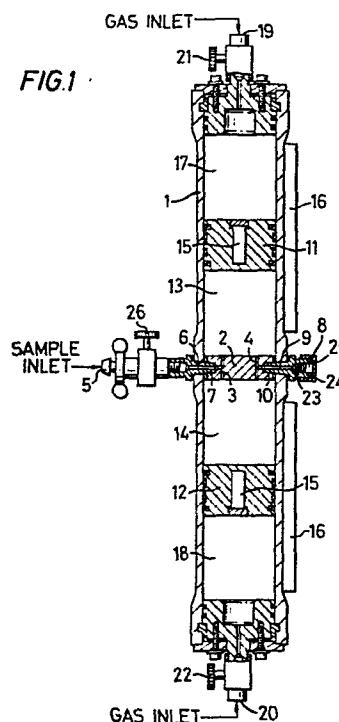
54 **Sample receiving and mixing device.**

57 This invention relates to a device for receiving and mixing samples comprising an enclosed cylindrical chamber (1) provided with:

- (a) a fixed, centrally located transverse baffle (2) which has at least one port (3) to allow a sample to pass from one side thereof to the other,
- (b) two pistons (11) and (12) capable of movement in response to applied fluid pressure on either side of the baffle which define two fluid-tight sub-chambers (13) and (14) of variable volume,
- (c) means (5) and (8) for introducing and withdrawing sample from the sub-chambers, and
- (d) means (19) and (20) for applying fluid pressure onto the pistons,

whereby the movement of the pistons in tandem with respect to the baffle forces the sample from one sub-chamber to the other through the baffle ports thereby achieving mixing.

The improved sample receiving and mixing device is particularly suitable for storing materials having a high vapour pressure such as 'spiked' crude oils which are crude oils into which light hydrocarbons have been injected, or, live crude oil which is crude oil as extracted prior to degasification. The device has no external dynamic seals susceptible to leakage.



SAMPLE RECEIVING AND MIXING DEVICE

The present invention relates to a new and improved sample receiving and mixing device which is particularly suitable for storing materials having a high vapour pressure such as 'spiked' crude oils which are crude oils into which light hydrocarbons have been injected, or, live crude oil which is crude oil as extracted prior to degasification.

It is frequently necessary to take samples of materials such as live crude oil and store them for subsequent analysis of smaller samples. This presents several problems. The bulk sample should preferably be maintained at all times above its inherent vapour pressure to avoid loss of volatile components which may lead to inaccurate analysis. In some cases pressures of about 13.5 bar must be maintained. During shipment and storage of the bulk sample there must be no leakage from its container since any leakage would result in the preferential loss of light or heavy components thus destroying the representative nature of the sample. Furthermore, such leaks are potentially dangerous. During storage, materials such as live crude oil tend to stratify into inhomogeneous components and therefore it is necessary to ensure when taking aliquots of the sample for analysis that these samples are truly representative. To satisfy this requirement, the bulk sample must be thoroughly mixed and it is sometimes necessary to heat the sample to facilitate mixing.

Some systems have an external pumped loop and use a static mixer element. This suffers from the disadvantage of having an external dead space. Another system has a self-contained, hand operated mixing

baffle housed in a cylinder and which is smaller in its cross-section than the diameter of the cylinder and consequently does not wipe the cylinder walls to which some components of the sample may adhere.

This construction uses several sliding seals and is prone to wear and leakage. Furthermore, it has a vulnerable projecting shaft.

We have now designed a sample receiving and mixing device provided with a sample chamber which possesses no external dynamic seals susceptible to leakage therefrom and in which mixing is achieved by forcing the contents through ports in a static baffle by means of pistons.

Accordingly, the present invention is a device for receiving and mixing samples comprising an enclosed cylindrical chamber provided with:

- (a) a fixed, transverse baffle located substantially centrally therein and having at least one port capable of allowing a sample to pass from one side thereof to the other,
 - (b) two pistons disposed on either side of the baffle so as to define therewith two fluid-tight sub-chambers of variable volume, said pistons being capable of movement along the axis of the cylinder in response to applied fluid pressure,
 - (c) means for introducing a sample into and withdrawing sample from said sub-chambers, and
 - (d) means for applying fluid pressure onto the side of the pistons, furthest from the baffle,
- whereby the movement of the pistons in tandem with respect to the baffle forces the sample from one sub-chamber to the other through the baffle ports thereby achieving mixing.

The fixed, transverse baffle is preferably a block which may be integral with or removably mounted within the chamber. Where it is removably mounted, it is preferably inserted in position within the chamber and held in place by means of one or more spigots extending transversely from the walls of the chamber. The spigot has an internal channel or channels to enable the sample to be injected into and withdrawn from said sub-chambers via the port or ports in the baffle.

In the chamber, the space behind each of the pistons away from the sub-chambers is connected to a means for applying pressure on each of the pistons. Pressure is applied preferably by means of a fluid introduced into the space through fluid inlets. The fluid is preferably a gas. Thus a gaseous cushion is provided behind each of the pistons. The space behind each piston is also connected to a relief valve such that when the gas inlet is open on a pressurising stroke of one piston the respective relief valve is closed and when the piston is in its retracting stroke, the respective gas inlet is closed but the relief valve is open. In the chamber there is more than adequate ullage space to prevent excessive pressure build-up due to temperature changes. Thus when gas pressure is applied alternately to each of the pistons, the pair of pistons is caused to slide back and forth retaining the sample between them. The sliding movement of the pistons forces the sample from one sub-chamber to the other through the baffle ports thereby causing rapid mixing of the retained sample in the sub-chambers.

In a preferred embodiment, there are two diametrically opposed spigots, each with an internal channel, extending transversely from walls of the chamber, one acting as a sample inlet and the other as a sample outlet. The spigots may either be integral with the walls of the chamber or may be inserted as a plug, which may be a screw-threaded unit, into holes machined in the walls of the chamber such that each spigot is adapted to receive the means for introducing a sample into and/or withdrawing a sample from either sub-chamber. The centrally located baffle has two ports capable of allowing passage of sample from one sub-chamber to the other. These ports are preferably in open communication with the channels in the spigots thereby enabling a sample to be introduced into and withdrawn from the sub-chambers.

The sample inlet is preferably connected to a sample source through a conventional regulating valve such as a needle valve.

The sample is preferably withdrawn from the sub-chambers through the baffle ports by a septum and syringe arrangement well-known to those skilled in the art. Use of a septum/syringe arrangement enables the external dead space in the device to be substantially eliminated.

In this embodiment, the sample inlet is connected to a sample source and the sample flows via the spigot channels and through the baffle ports into the sub-chambers. Gas pressure is then applied on one of the pistons to force the sample through the port into the opposing sub-chamber. The process is then reversed by applying gas pressure on the other piston thereby forcing the sample through the baffle ports into the first chamber. After a dozen or so traverses of the pistons, thorough mixing and homogenisation of the sample is achieved and a syringe is introduced through the septum in the outlet to withdraw the mixed sample. The sample withdrawn is then analysed.

It will be apparent to those skilled in the art that a single entry into the chamber wall can serve both as an inlet and an outlet for samples by connecting appropriate valve, septum and syringe arrangements through said entry.

In order to improve the efficiency of the mixing, the ports in the baffle may be shaped in such a way that their surfaces are uneven, eg a screw-threaded type. The unevenness of the surface enables turbulence to be created as the sample is forced through the ports thereby aiding mixing. Moreover, the internal surfaces of the sub-chambers are preferably coated or lined with a material which minimises adhesion of sample components to the walls thereof. In the case where "spiked" or live crude oil is being sampled, it is preferable to line the walls of the sub-chamber with a hydrophobic material such as polytetrafluoroethylene (PTFE) to minimise the adhesion of the sample components such as water to the walls of the sub-chamber. Such an expedient ensures that the sample being analysed is representative of the bulk.

The pistons preferably carry monitors, suitably magnetic, by means of which their position can be determined by sensors or indicators located outside the chamber. If the monitors carried by the pistons are magnetic, the external sensors or indicators are suitably also magnetic. Input of sample into the inlet will cause the pistons to move away from the baffle thereby causing movement of the external magnetic indicator. By using appropriate colours on the magnetic indicator e.g. one colour such as green for normal and

another such as red for abnormal, overfilling of the sub-chamber will be immediately apparent.

5 An alternative arrangement to locate the piston position and thereby to monitor the degree of filling of the chamber is to measure the pressure of the fluid sealed in the spaces behind each of the pistons. Normally, these two pressures will always be the same and their value will indicate the extent of compression of the volume within the respective spaces.

10 The invention is further illustrated and described with reference to the accompanying drawings.

Figure 1 represents a sectional view of the sample receiving and mixing device and Figure 2 shows an enlarged section of the sample outlet arrangement.

15 In the drawings, the device has a cylindrical chamber (1) provided with a centrally located fixed, transverse baffle (2) having ports (3) and (4) and being held in position by spigots (7) and (10). Port (3) is connected to sample inlet (5) regulated by a needle valve (26) through channel (6) in the spigot (7) and port (4) is connected to sample outlet (8) via channel (9) in spigot (10). Two
20 pistons (11) and (12) are disposed on either side of the baffle (2) defining therewith sub-chambers (13) and (14) respectively. The pistons are provided with magnetic monitors (15) and movement of the piston is detected by an external magnetic ladder indicator (16) responsive to the impulses generated by the monitors (15). Two
25 spaces (17) and (18) behind the respective pistons (11) and (12) are gas cushions connected respectively to gas inlets (19) and (20). Associated with each gas inlet is a respective gas valve (21) and (22). The sample outlet is closed by a septum (23) in a septum holder (24) provided with a safety cap (25). To withdraw an aliquot
30 of the sample, the cap (25) is removed and a syringe (not shown) introduced through the septum (23) extending into the spigot channel (9).

In operation, the sample outlet (8) is closed by safety cap (25) and a sample of "live" crude oil is introduced into the sub-chambers
35 by connecting the sample inlet (5) directly to the crude oil source.

Upon introducing the sample into the sub-chambers and by maintaining a differential pressure in the two pistons through the gas inlets, the piston (12) is caused to move away from the baffle (2). When the piston (12) reaches the end of its travel by abutting against the end of the chamber, the other piston (11) begins to move away from the baffle thereby indicating that the first sub-chamber (14) has received a full quota of the sample. The sample inlet is then closed and increased gas pressure is applied on the piston (12) furthest from the baffle (2) causing the sample to flow into the opposing

0 sub-chamber (13) through the baffle ports (3) and (4). The applied pressure on the piston (12) is maintained until piston (11) has reached the end of its travel on the opposite side. Thereafter the applied pressure on the piston (12) is withdrawn and pressure applied on piston (11) thereby reversing the process and causing the sample to
5 flow back into sub-chamber (14). The process is repeated several times until thorough mixing and homogeneity is achieved. Thereafter, the sample outlet (5) is opened by first removing the safety cap (25) and then introducing a syringe (not shown) through the septum (23) to withdraw an aliquot of the sample for analysis.

20 The advantage of this process is that the continuous movement of the pistons need not be stopped during the withdrawal of the sample thereby ensuring thorough mixing until the moment of sampling. Moreover, the design is such that there is no dynamic seal liable to allow leakage from the chamber and the sample, once trapped, cannot
25 accidentally escape. The sliding action of the piston also ensures that the cylindrical walls are scraped clean of any component of the mixture, especially oil/water mixture, which might otherwise not be removed by rapid fluid motion. In the event of accidental leakage past a piston into the gas cushion space a sample of the inert gas can
30 be analysed for hydrocarbon gases and an appropriate correction made. This would be an abnormal occurrence but serves to demonstrate the double security of the design.

Claims:

1. A device for receiving and mixing samples comprising an enclosed cylindrical chamber provided with:

- (a) a fixed, transverse baffle located substantially centrally therein and having at least one port capable of allowing a sample to pass from one side thereof to the other,
- (b) two pistons disposed on either side of the baffle so as to define therewith two fluid-tight sub-chambers of variable volume, said pistons being capable of movement along the axis of the cylinder in response to applied fluid pressure,
- (c) means for introducing a sample into and withdrawing sample from said sub-chambers, and
- (d) means for applying fluid pressure onto the side of the pistons furthest from the baffle,

whereby the movement of the pistons in tandem with respect to the baffle forces the sample from one sub-chamber to the other through the baffle ports thereby achieving mixing.

2. A device according to claim 1 wherein the baffle is a block removably mounted within the chamber.

3. A device according to claim 2 wherein the baffle is inserted in position within the chamber and held in place by means of one or more spigots extending transversely from the walls of the chamber.

4. A device according to any one of the preceding claims wherein the spigot has an internal channel or channels to enable the sample to be injected into and withdrawn from said sub-chambers.

5. A device according to any one of the preceding claims wherein the means for applying pressure on each of the pistons is a gas introduced through gas inlets into a space behind each of the pistons.

6. A device according to any one of the preceding claims wherein each of the spaces behind the pistons is also connected to a relief valve.

7. A device according to any one of the preceding claims wherein the means for withdrawing sample from the sub-chambers through the baffle ports comprises a septum through which a syringe can be inserted.

5 8. A device according to any one of the preceding claims wherein the internal surfaces of the sub-chambers are coated with a hydrophobic material.

9. A device according to any one of the preceding claims wherein the pistons carry monitors by means of which their position within
10 the chamber can be determined by sensors located outside the chamber.

10. A sample receiving and mixing device according to claim 1 as hereinbefore illustrated and described with reference to the accompanying drawings.

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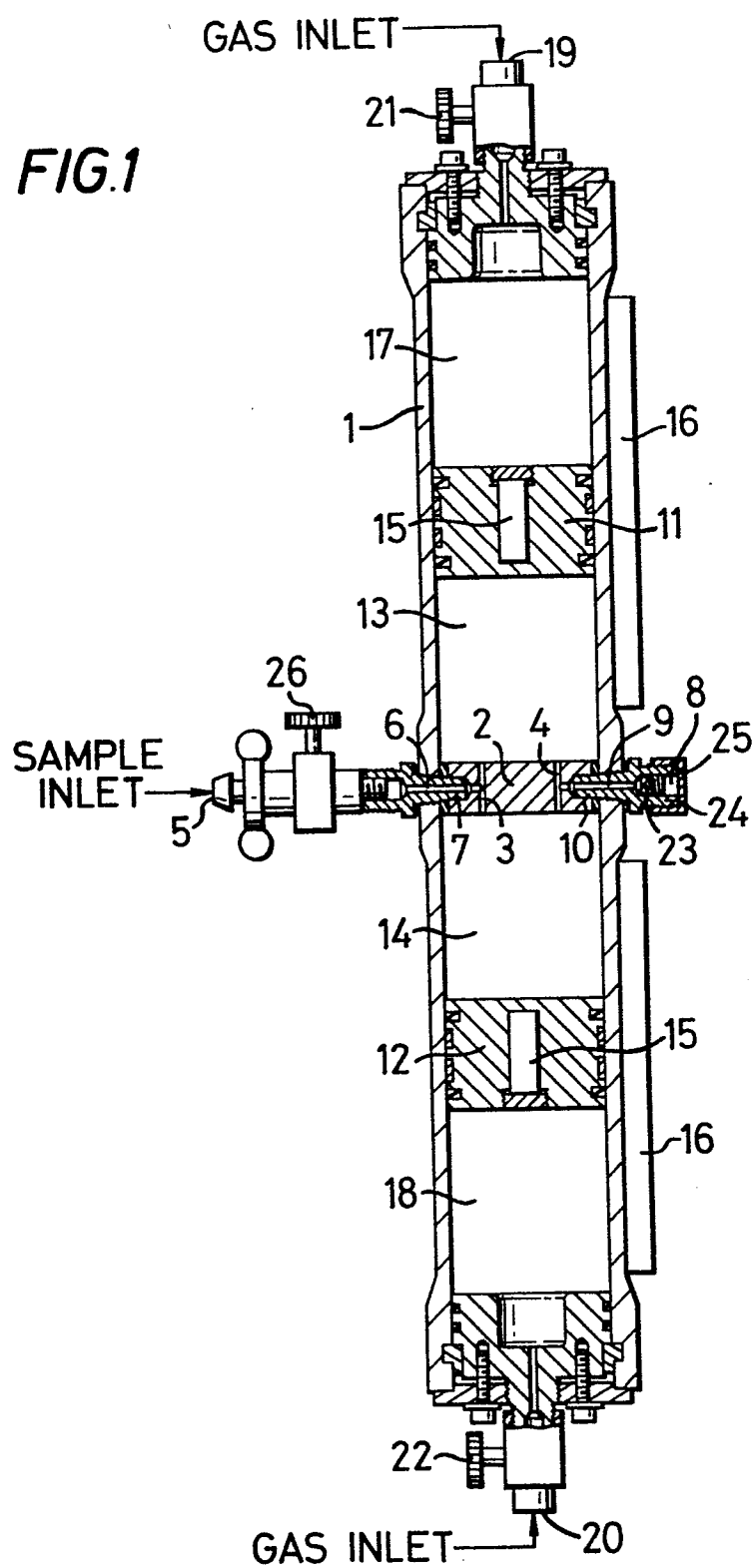
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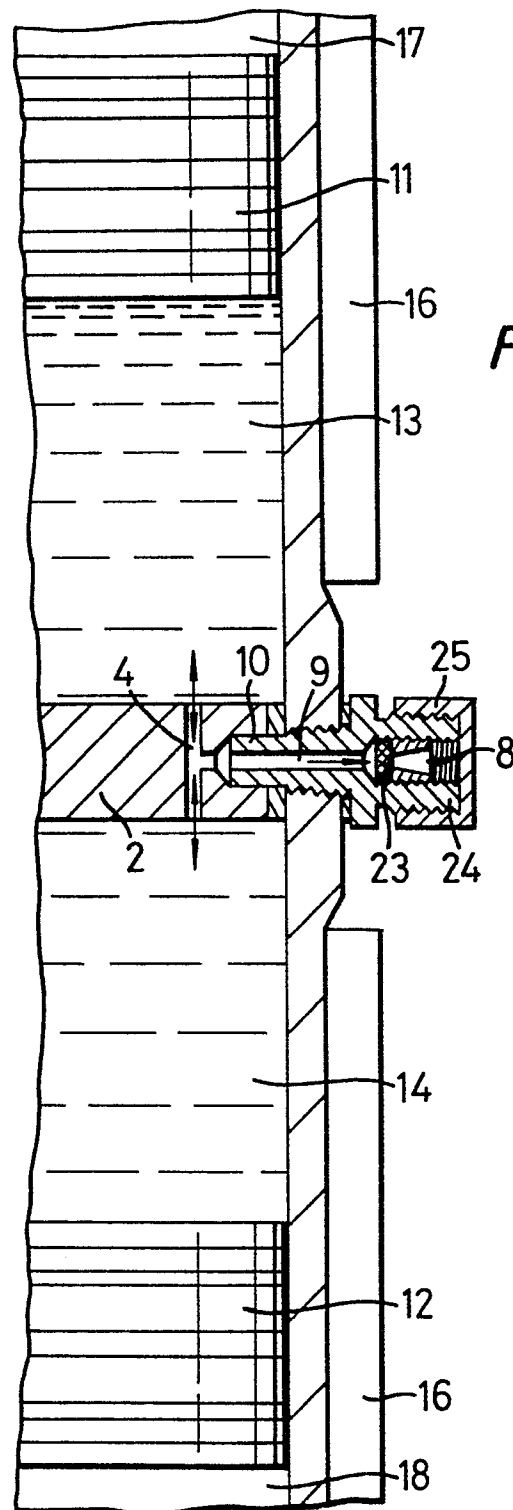
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FIG. 1







DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
X	FR-A-2 447 260 (EURO-LINEA S.N.C.) * Page 2, lines 11-20; page 3, lines 9-13; figures 1,2 *	1,5,6	B 29 B 1/06 B 01 F 5/12 E 21 B 49/08 B 01 L 11/00
A	FR-A-2 172 334 (HÜRLIMANN H.P.) * Page 1, lines 1-8; page 4, lines 9-21; figure 1 *	1,2	
A	FR-A-2 152 452 (MERLIN GERIN)	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			G 01 N 1/00 E 21 B 49/00 F 15 B 15/00 B 01 F 5/00 B 29 B 1/00 B 01 L 11/00
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29-07-1983	Examiner ERRANI C.
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			