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② **System for distributing particulate material.**

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Description

This invention concerns a system for distributing particulate material.

The present invention has particular, although not exclusive, reference to such systems employed for distributing fuel to burners or outlets in a kiln or other equipment in which the fuel is to be burnt, for example a furnace or boiler, and in these applications can be regarded as a "firing system".

In conventional firing systems, the fuel is often conveyed pneumatically, by entrainment, from a main input point to a distribution device and thence to the burners. Moreover, this distribution device *per se* usually involves some kind of mechanism having moving parts which are prone to malfunctioning thus resulting in unsatisfactory operation of the plant concerned and high maintenance costs.

The mechanism concerned can, as a rule, only serve a limited number of delivery points and the maximum is of the order of twenty, but in some systems can be less, for example the 'Octopus' system (Registered Trade Mark) serves eight. A number of mechanisms would, therefore, be required should the number of delivery points exceed the designed capacity, thus adding appreciably to the capital cost of the plant.

Furthermore, such conventional systems, generally utilising pulverised or crushed coal, operate at low solids/air mass ratio, thus leading to an excess of air in the combustion zone.

An alternative use for such systems is to be found in the field of fluidised bed combustion wherein hot bed material needs to be transported from the combustion chamber for size classification externally of the chamber. The nature and temperature of such material render the utilisation of mechanical devices, such as rotary valves, difficult or impossible. In order to overcome the difficulties indicated, it has conventionally been the practice to employ a Venturi feeder which feeds material into a positive pressure system. However, even with the most refined Venturis, it is difficult to achieve solids to air ratios greater than about 3:1, particularly if the conveying pipework system is greater than 5 m in length. As a result, it has been necessary to utilise comparatively large diameter pipework systems to achieve worthwhile solids flow rates. Tests conducted by the Applicants on several different conventional Venturi feeders have shown that 75 mm diameter pipework should be necessary to give a solids flow rate of about 600 kg/h, and 100 mm diameter pipe-work to give about 1 tonne/h.

It is already known from EP—A—63629 (comprised in the state of the art under Article 54(3)) to provide a vessel holding a fluidised bed into which extends an air or gas line, a plurality of outlet tubes passing out of the chamber, the particles of the bed being entrained, in use, by

the air or gas and exiting through the outlet tubes. Additionally AT—B—92107 discloses a fuel dust firing system having a mixing chamber in which the fuel is kept in suspension by a fan whose inlet and outlet lines are connected separately to the chamber, a further blower being employed to convey the fuel to the point of use.

An object of the present invention is to provide an improved system for distributing particulate material substantially obviating the disadvantages of conventional systems.

A further object of the invention is to provide a method of operating such an improved system.

According to a first aspect of the invention, there is provided a system for distributing particulate material including a vessel having an inlet for particulate material, a gas manifold, a plurality of inlet tubes connected to the gas manifold and adapted to extend into the vessel, a gas inlet to the manifold, and a plurality of outlet tubes extending through the inlet tubes to define passages therebetween and having outlet connections exteriorly of the vessel, the outlet tubes defining in use, paths for entrained particulate material.

The vessel is conveniently a pressure vessel and the top thereof may incorporate the inlet for particulate material.

The gas manifold may be located externally or internally of the vessel and may be in the form of a ring main for a gas, conveniently air. The inlet tubes are connected to the gas manifold and the outlet tubes may extend coaxially therethrough to define an annular passage for the gas which, in use, would flow downwardly into the vessel.

A cylinder advantageously of shorter length than the inlet or outlet tubes may be provided within each annular passage and is preferably adapted for sliding movement relative to the inlet and outlet tubes, the cylinder being disposed near to the free ends of the inlet and outlet tubes within the vessel.

A means for adjusting the position of the cylinder is conveniently provided and may comprise a threaded rod which is secured at one end to the cylinder and protrudes outside the vessel where a simple nut adjustment assembly is provided. The purpose of the sliding cylinder is in effect to extend or shorten the length of the outlet tube thereby controlling, in use, the solids/air mass ratio and adjustment can take place during operation of the system.

As an alternative to the provision of a sliding cylinder adjustment, each outlet tube may be positionally adjustable relative to the inlet tube.

According to a second aspect of the invention, there is provided a method of operating a system for distributing particulate material according to the first aspect, the method including the steps of passing particulate material into the vessel through the inlet thereof, feeding a positive pressure gas flow to

the gas inlet of the manifold, and passing the gas through the passages defined between the inlet tubes and the outlet tubes to issue into the material in the vessel to entrain some of the material in the vicinity of the free ends of the tubes, the mixture of gas and material entrained flowing through the outlet tubes for discharge through the outlet connections.

The method may also include the step of varying the position of the cylinder to control the material to air mass ratio, each cylinder being actuatable independently and during operation of the system.

The present invention thus differs from the prior art disclosed in EP—A—63629 and AT—B—92107 in that the outlet tubes pass through the inlet tubes and only one source of conveying gas is required for distributing the particulate material.

By way of example only, one embodiment of a system for distributing particulate material according to the invention is described below with reference to the accompanying drawings in which:

Figure 1 is a side sectional view of a first embodiment of the invention;

Figure 2 is a plan view of the embodiment of Figure 1; and

Figure 3 is a sectional view of a detail shown in Figure 1.

Referring to the drawings, a system for distributing particulate material is depicted at 1 and comprises a pressure vessel 2 having in the top 4 thereof an inlet 6 for particulate material; the inlet 6 may incorporate a rotary valve (not shown) for sealing the vessel 2 and monitoring the amount of material passing therethrough into vessel 2.

A gas manifold 8 is located at the top of the vessel 2 and has an inlet 10 and a plurality of outlets 12 to each of which is connected an inlet tube 14 depending therefrom into the vessel 2 and terminating at a distance from the base 16 thereof. Extending co-axially through the inlet tubes 14 are outlet tubes 18 between each pair of which is defined an annular passage 20.

The outlet tubes 18 terminate in the vicinity of the free ends of the inlet tubes 14 and extend through the gas manifold 8 to the exterior of the vessel 2 and are suitably adapted for connection to pipes (not shown) for remote connection to points of use (not shown).

A cylinder 22 is disposed within each annular passage 20 towards the lower end thereof, as viewed in Figures 1 and 3 and has attached thereto a rod 24 having a threaded portion at least at its relatively outer end 25 for engagement with a lock nut arrangement 26, the outer end 25 having a knurled nut 27.

The system as described may be employed as a firing system for a kiln, the particulate material conveyed being crushed or pulverised coal, and the outlet tubes 18 being connected to the combustion zones of the kiln. In use, the

coal is admitted to the vessel 2 through the inlet 6 and air is passed into the manifold 8 through the inlet 10. The air then travels down through each annular passage 20 and entrains the coal in the vicinity of the free ends of the inlet tubes 14. The entrained coal is conveyed up through each outlet tube 18 for transport to an injection point in the kiln. The solids/air mass ratio may be varied by raising or lowering the cylinder 22 in each annular passage 20 thereby affording individual control on the amount of fuel passed the relevant injection point in the kiln.

In an alternative use of the system according to the invention, hot particulate material from a fluidised combustion bed, after or before size classification, is admitted through the inlet 6 and air is passed into the manifold 8 through the inlet 10. The air then travels down through each annular passage 20 and entrains the particulate material in the vicinity of the free ends of the inlet tubes 14. The entrained material is conveyed up through each outlet tube 18 for transport either directly back to the fluidised combustion bed or indirectly through a size classification system. Again, the solids/air mass ratio may be varied by raising or lowering the cylinder 22 in each annular passage 20. In this application of the system fewer outlet connections may be employed than for the kiln firing system.

The system of the present invention has no moving parts save for the adjustment of the cylinder 22 and has the capacity of achieving a high solids/air mass ratio thus avoiding the disadvantage of high excess air levels associated with conventional systems.

Claims

1. A system for distributing particulate material including a vessel (2) having an inlet (6) for particulate material, a gas inlet tube (14) adapted to extend into the vessel (2), a plurality of outlet tubes (18) having outlet connections externally of the vessel (2), the outlet tubes (18) defining, in use, paths for entrained particulate material characterised by a plurality of inlet tubes (14) connected to a gas manifold (8) and extending into the vessel (2), a gas inlet (10) to the manifold (8), and in that the outlet tubes (18) extend through the inlet tubes (14) to define passages (20) therebetween.

2. A system according to claim 1 characterised in that the vessel (2) is a pressure vessel.

3. A system according to claim 1 or 2 characterised in that the gas manifold (8) is located internally or externally of the vessel (2).

4. A system according to any one of the preceding claims characterised in that the outlet tubes (18) extend co-axially through the inlet tubes (14) to define annular passages (20) for gas.

5. A system according to any one of the preceding claims characterised in that a cylinder

(22) is located within the passage (20) defined between each inlet tube (14) and each outlet tube (18) in the vicinity of the free ends thereof within the vessel.

6. A system according to claim 5 characterised in that the cylinder (22) is movable relative to the inlet and outlet tubes (14, 18).

7. A system according to claim 6 characterised in that an adjustment rod (24) is attached to each cylinder (22) and is adapted to move the cylinder (22).

8. A firing system comprising a system (1) as claimed in any one of the preceding claims.

9. A method of operating the system (1) according to any one of the preceding claims characterised by the steps of passing particulate material into the vessel (2) through the inlet (6) thereof, feeding a positive pressure gas flow to the gas inlet (10) of the manifold (8) and passing the gas through the passages (20) defined between the inlet tubes (14) and the outlet tubes (18) to issue into the material in the vessel (2) to entrain some of the material in the vicinity of the free ends of the tubes (14, 18), the mixture of gas and material entrained flowing through the outlet tubes (18) for discharge through the outlet connections.

10. A method according to claim 9 characterised in that the position of each cylinder (22) is variable independently to vary the material to air mass ratio.

11. A method according to claim 10 characterised in that the cylinder is actuable during operation of the system (1).

Patentansprüche

1. System zum Verteilen von teilchenförmigem Material mit einem Behälter (2) mit einem Eingang (6) für teilchenförmiges Material, einem Gaseingangrohr (14), welches sich in den Behälter (2) hineinerstreckt, und mit einer Mehrzahl von Ausgangsrohren (18) mit Ausgangsanschlußstücken außerhalb des Behälters (2), wobei die Ausgangsrohre (18) im Betrieb Bahnen für mitgenommenes teilchenförmiges Material definieren, gekennzeichnet durch eine Mehrzahl von Eingangsrohren (14), welche mit einem Gasverteiler (8) verbunden sind und sich in den Behälter (2) hineinerstrecken, durch einen Gaseingang (10) zum Verteiler (8), sowie dadurch, daß die Ausgangsrohre (18) sich durch die Eingangsrohre (14) hindurcherstrecken, um hierzwischen Durchgänge (20) zu definieren.

2. System nach Anspruch 1, dadurch gekennzeichnet, daß der Behälter (2) ein Druckbehälter ist.

3. System nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Gasverteiler (8) innerhalb oder außerhalb des Behälters (2) angeordnet ist.

4. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß sich

die Ausgangsrohre (18) koaxial durch die Eingangsrohre (14) hindurch erstrecken, um ringförmige Durchgänge (20) für das Gas zu definieren.

5. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß ein Zylinder (22) innerhalb des zwischen einem jeden Eingangsrohr (14) und einem jeden Ausgangsrohr (18) definierten Durchgangs (20) in der Nachbarschaft der freien Enden hiervon innerhalb des Gefäßes angeordnet ist.

6. System nach Anspruch 5, dadurch gekennzeichnet, daß der Zylinder (22) relativ zu den Eingangs- und Ausgangsrohren (14, 18) bewegbar ist.

7. System nach Anspruch 6, dadurch gekennzeichnet, daß an einem jeden Zylinder (22) eine Einstellstange (24) befestigt ist und dazu dient, den Zylinder (22) zu bewegen.

8. Feuerungssystem mit einem System (1) gemäß einem der vorhergehenden Ansprüche.

9. Verfahren zum Betreiben des Systems (1) gemäß einem der vorhergehenden Ansprüche, gekennzeichnet durch die Verfahrensschritte, teilchenförmiges Material in den Behälter (2) durch dessen Eingang (6) hindurch einzuführen, einen Überdruck-Gasstrom dem Gaseingang (10) des Gasverteilers (8) zuzuführen und das Gas durch die Durchgänge (20), welche zwischen den Eingangsrohren (14) und den Ausgangsrohren (18) definiert sind, hindurchzuführen, so daß es in das Material innerhalb des Behälters (2) gelangt, um etwas von diesem Material in die Nachbarschaft der freien Enden der Rohre (14, 18) mitzunehmen, wobei die Mischung aus Gas und mitgenommenem Material durch die Ausgangsrohre (18) strömt, um durch die Ausgangsanschlußteile entladen zu werden.

10. Verfahren nach Anspruch 9, dadurch gekennzeichnet, daß die Position eines jeden Zylinders (22) unabhängig variierbar ist, um das Massenverhältnis Material zu Luft zu variieren.

11. Verfahren nach Anspruch 10, dadurch gekennzeichnet, daß der Zylinder während des Betriebes des Systems (1) betätigbar ist.

Revendications

1. Système pour distribuer une matière en particules, comportant un récipient (2) pourvu d'une entrée (6) pour la matière en particules, un tube d'entrée de gas (14) adapté pour s'étendre jusque dans le récipient (2), plusieurs tubes de sortie (18) comportant des raccords de sortie à l'extérieur du récipient (2), les tubes de sortie (18) définissant, en service, des trajets pour la matière en particules entraînée, caractérisé par une pluralité de tubes d'entrée (14) reliés à un collecteur de gaz (8) et s'étendant dans le récipient (2), une entrée de gaz (10) dans le collecteur (8), et en ce que les tubes de sortie (18) s'étendent au travers des tubes d'entrée (14) de façon à définir des passages (20) entre eux.

2. Système selon la revendication 1, caracté-

térisé en ce que le récipient (2) est un récipient sous pression.

3. Système selon la revendication 1 ou 2, caractérisé en ce que le collecteur de gaz (8) est placé à l'intérieur ou à l'extérieur du récipient (2).

4. Système selon l'une quelconque des revendications précédentes, caractérisé en ce que les tubes de sortie (8) s'étendent coaxialement au travers des tubes d'entrée (14) de façon à définir des passages annulaires (20) pour du gaz.

5. Système selon l'une quelconque des revendications précédentes, caractérisé en ce qu'un cylindre (22) est placé à l'intérieur du passage (20) défini entre chaque tube d'entrée (14) et chaque tube de sortie (18) au voisinage de leurs extrémités libres à l'intérieur du récipient.

6. Système selon la revendication 5, caractérisé en ce que le cylindre (22) est mobile par rapport aux tubes d'entrée et de sortie (14, 18).

7. Système selon la revendication 6, caractérisé en ce qu'une tige de réglage (24) est fixées sur chaque cylindre (22) et est adaptée pour déplacer le cylindre (22).

8. Système de combustion comprenant un

système (1) comme revendiqué dans l'une quelconque des revendications précédentes.

9. Procédé de conduite du système (1) selon l'une quelconque des revendications précédentes, caractérisé par les étapes consistant à faire passer une matière en particules dans le récipient (2) par l'intermédiaire de son entrée (6), à introduire un écoulement de gaz sous pression positive dans l'entrée de gaz (10) du collecteur (8) et à faire passer le gaz dans des passages (20) définis entre les tubes d'entrée (14) et les tubes de sortie (18) pour une sortie dans la matière se trouvant dans le récipient (2) afin d'entraîner une partie de la matière se trouvant au voisinage des extrémités libres des tubes (14, 18), le mélange de gaz et de matière entraînée s'écoulant dans les tubes de sortie (18) pour une décharge par l'intermédiaire des raccords de sortie.

10. Procédé selon la revendication 9, caractérisé en ce que la position de chaque cylindre (22) est modifiable indépendamment pour faire varier le rapport pondéral matière/air.

11. Procédé selon la revendication 10, caractérisé en ce que le cylindre peut être actionné pendant la marche du système (1).

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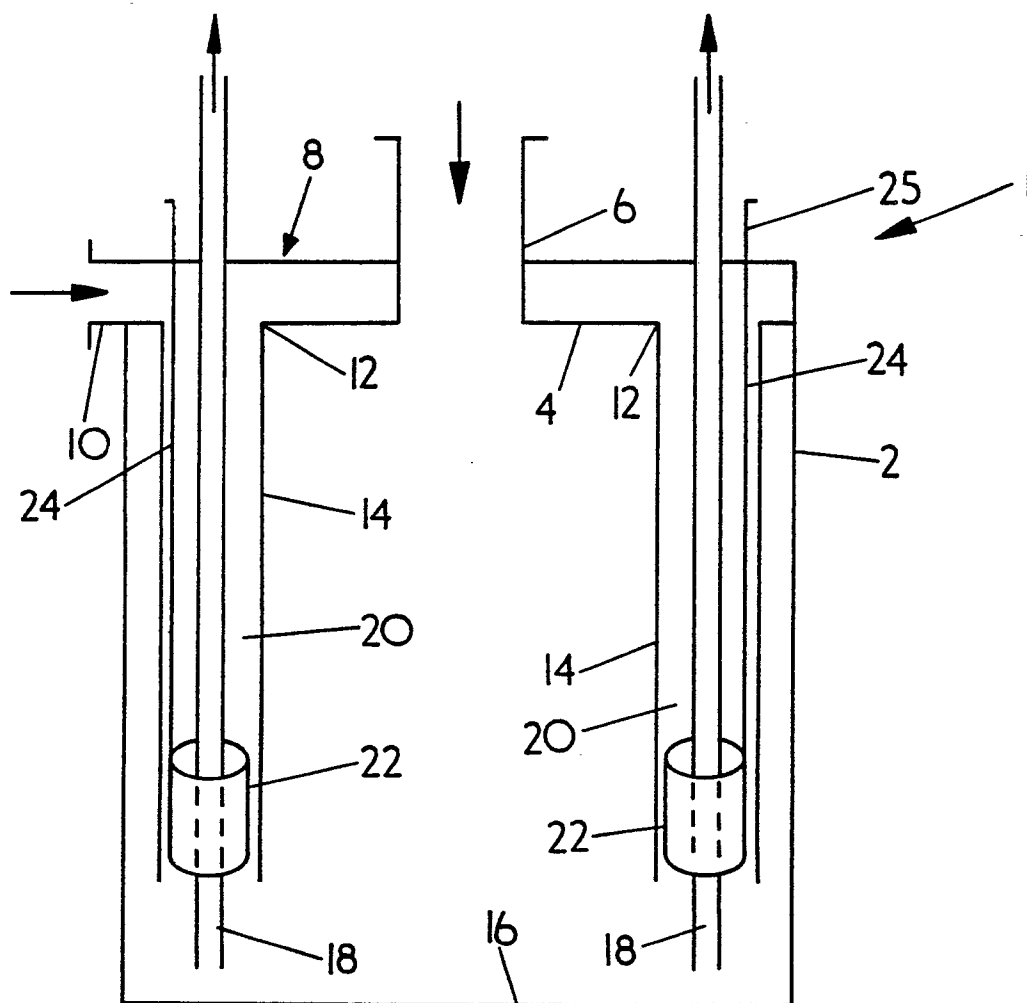


FIG. 1

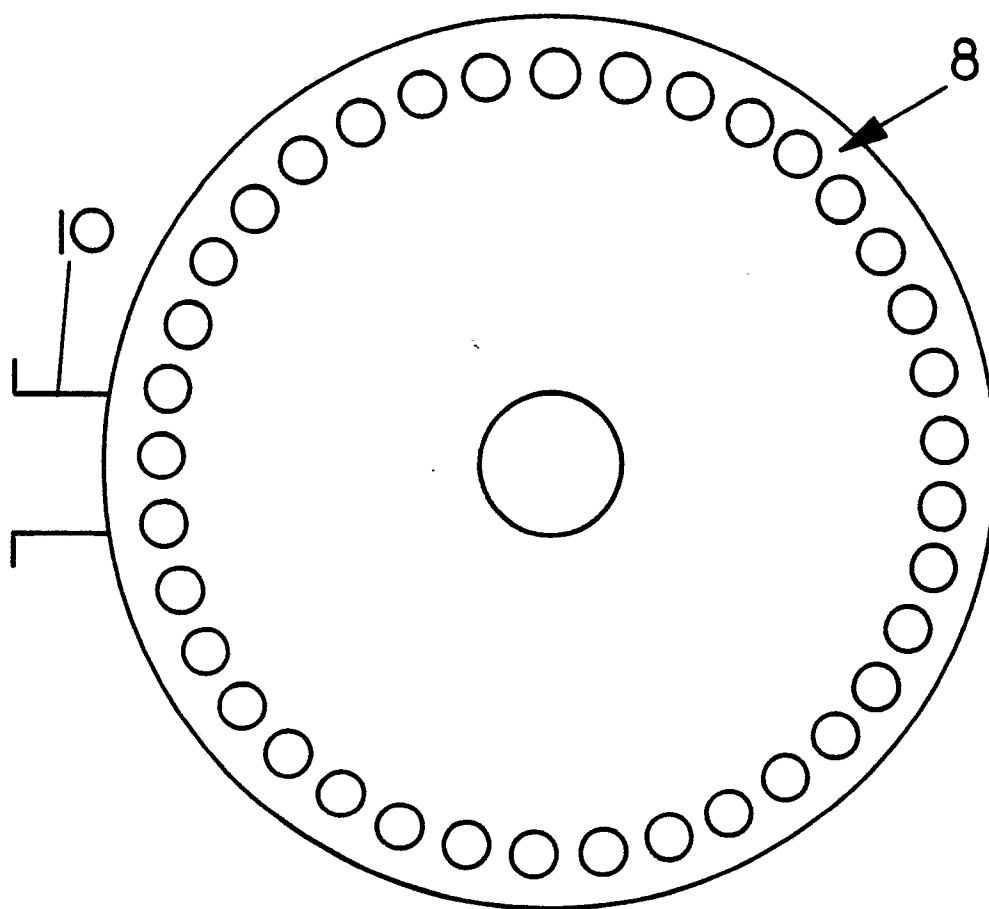


FIG. 2

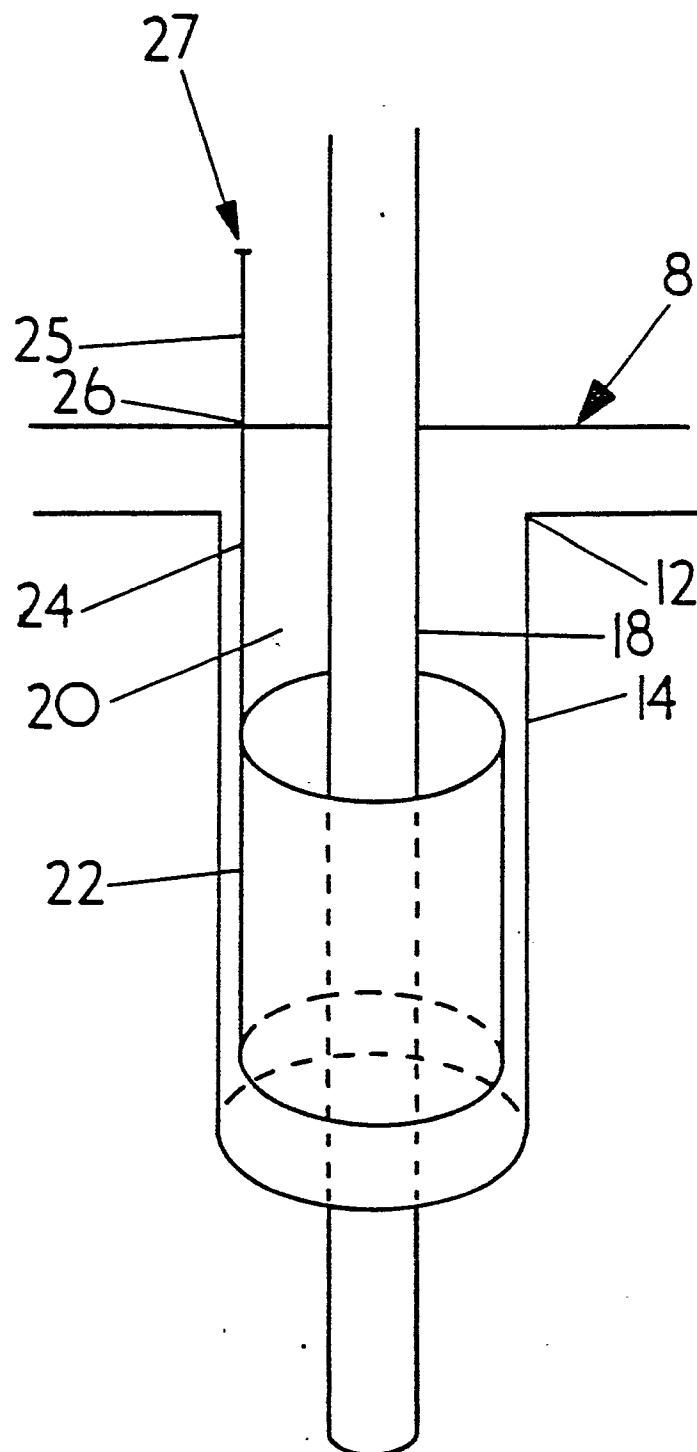


FIG. 3