(12) UK Patent Application (19) GB (11) 2 438 587 (13) A

(43) Date of A Publication 05.12.2007

(21) Application No: 0610310.5

(22) Date of Filing: 24.05.2006

(71) Applicant(s):
Stephen Scott
Plas-yn-Dre, 12 Castle Street, RHUTHIN, LL15 1DP, United Kingdom

(72) Inventor(s):
Stephen Scott

(74) Agent and/or Address for Service:
Alistair Hamilton
Ty Eurgain, Cefn Eurgain Lane, Rhosesmor, MOLD, Flintshire, CH7 6PG, United Kingdom

(51) INT CL:
A62C 3/06 (2006.01) ***A62C 31/05*** (2006.01)
A62C 31/12 (2006.01)

(52) UK CL (Edition X):
A5A A14G

(56) Documents Cited:
WO 2000/012177 A1 **US 2730178 A**
US 2260733 A1 **US 1714015 A**
US 20020027171 A1

(58) Field of Search:
UK CL (Edition X) **A5A**
INT CL **A62C**
Other: **Online: WPI & EPODOC**

(54) Abstract Title: **Fire fighting in liquid storage tanks**

(57) A fire extinguishing installation for location within a liquid storage tank (10) is disclosed. The installation comprises a delivery nozzle (20) for delivering fire extinguishant, a support structure (22) for the nozzle (20), and means such as a foam generator (40) for delivering extinguishant to the nozzle (20). The support structure (22) is configured to support the nozzle (20) such that it can rotate about a generally vertical axis when in use. When the foam generator (40) is energised, the nozzle will rotate and will evenly distribute extinguishant within the tank (10). The extinguishant will subsequently rise to the surface of the liquid stored in the tank (or fall onto it if the level is low) thus creating an even surface layer to extinguish the fire effectively. A secondary effect is that the cold foam mixture rising from the bottom of the tank will create a movement of cooler fluids from the lower regions of the tank thus cooling the liquid surface and further reducing vapour emissions. The delivery nozzle (20) may comprise a single nozzle or plurality of nozzles or may be in the form of a rotating tube having a plurality of openings (48) being upwardly directed wherein the size of the openings increases with distance from the support pipe.

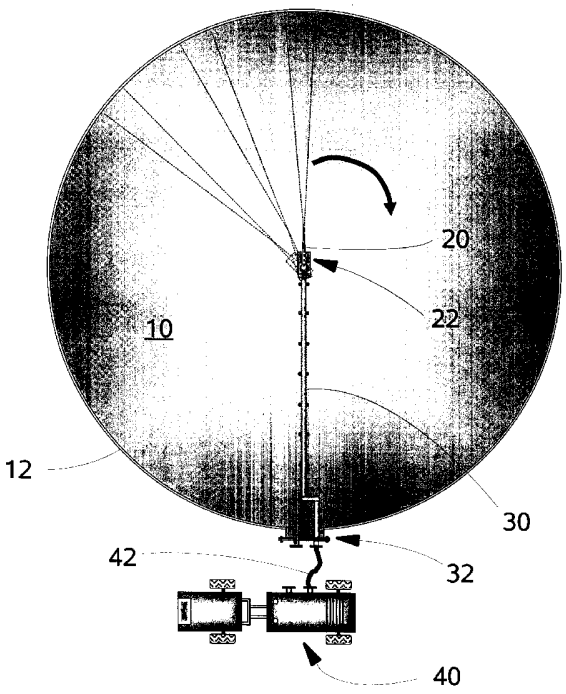

Fig 1

GB 2 438 587 A

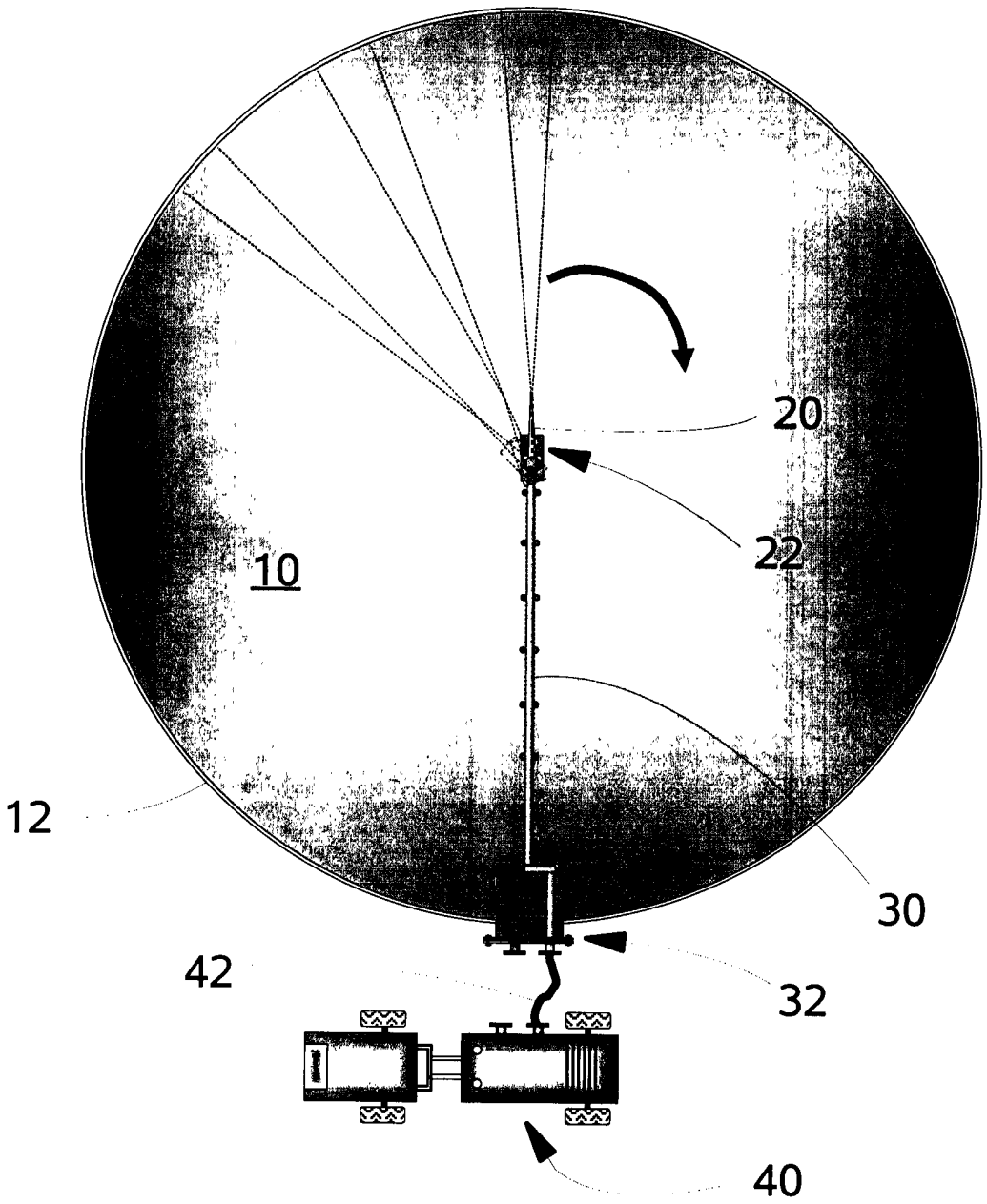

Fig 1

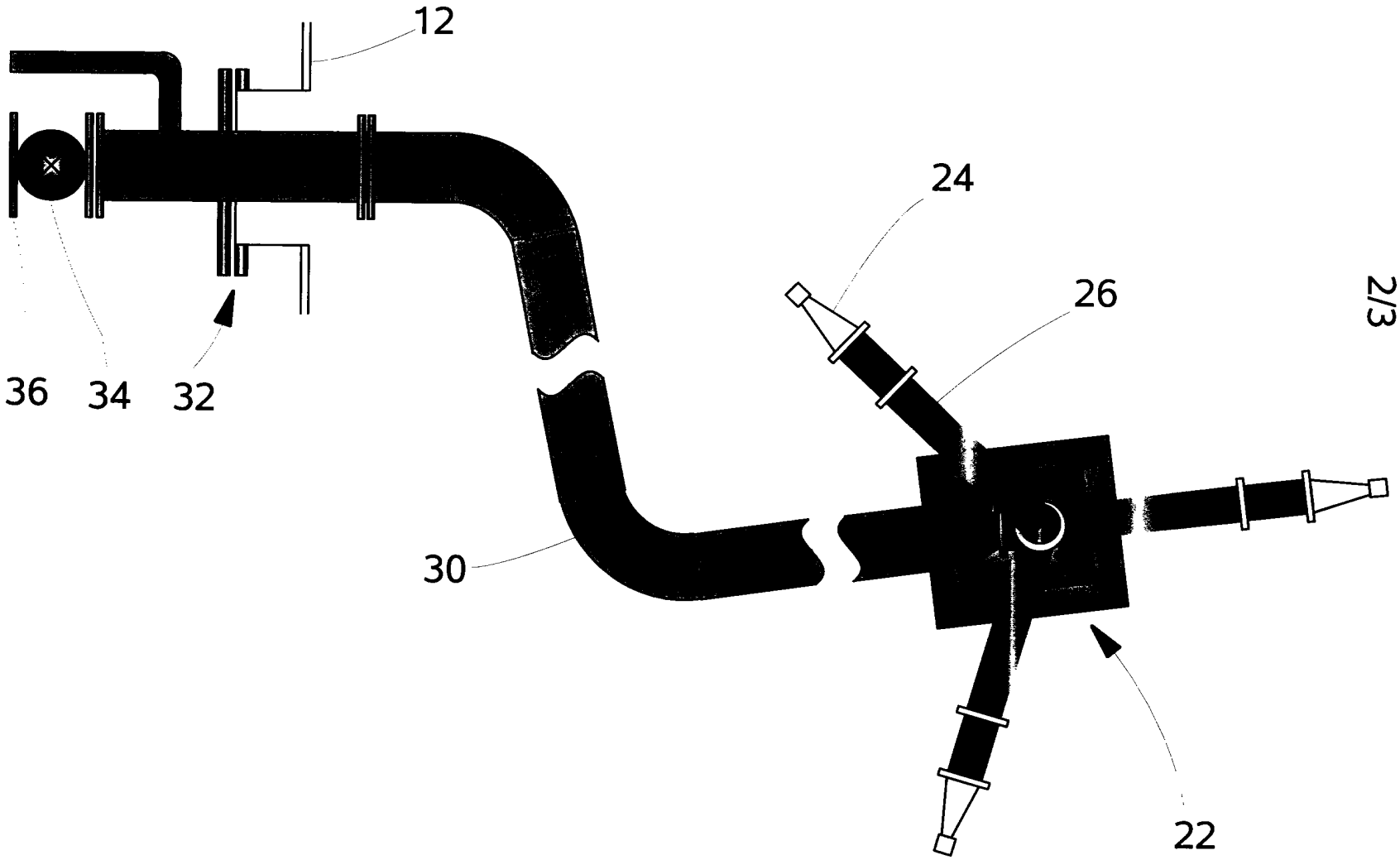

Fig 2

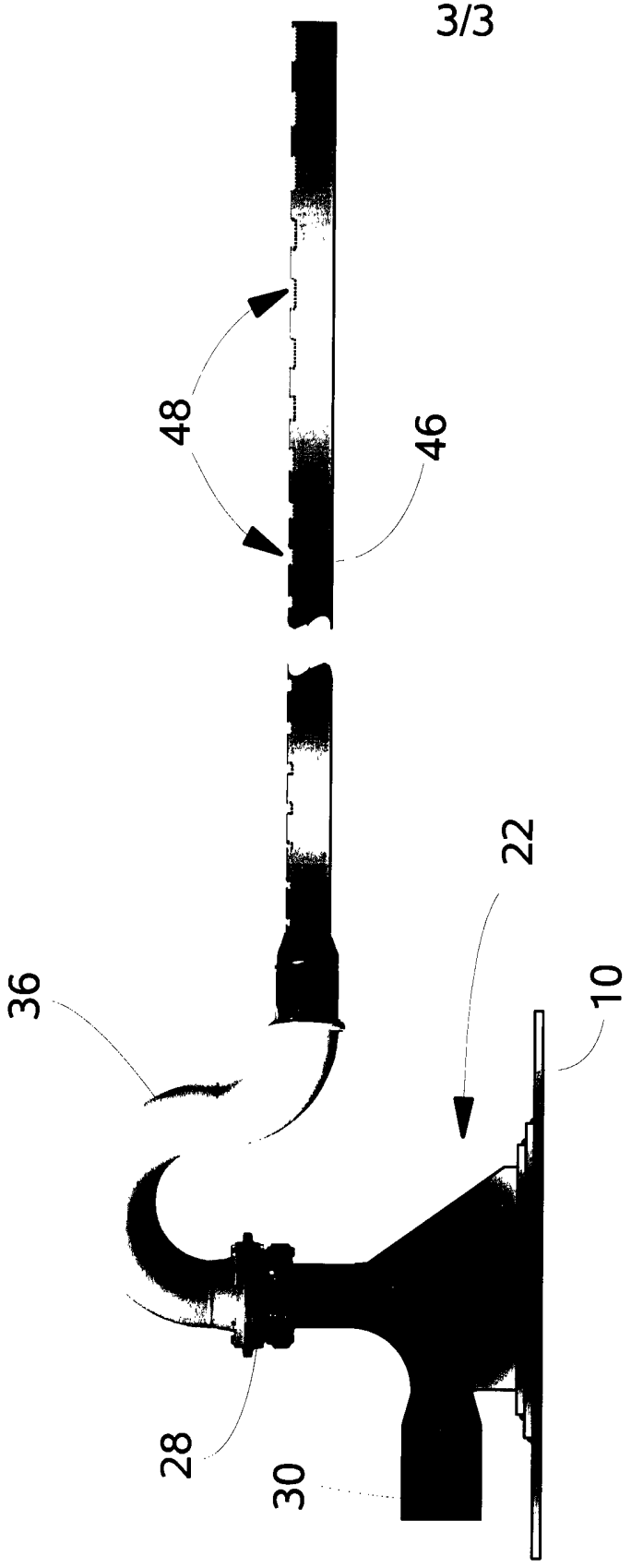

Fig 3

Fire fighting in liquid storage tanks

This invention relates to fire fighting in storage tanks for flammable liquid. In particular, it relates to fire fighting in bulk hydrocarbon storage tanks.

Known methods of fire extinction in flammable liquid storage tanks require fire fighting foam to be applied to the surface of liquid in a fixed roof tank or into the rim seal area in a floating roof tank. This foam 'blanket' is designed to create a barrier between the vapour-producing liquid surface and the air. This restricts vapour loss from the liquid surface and excludes air so that the ratio of oxygen to flammable vapour falls outside of the flammable range for the particular material that is burning. The fire is thereby extinguished. There may also be a secondary effect in that the foam layer may have a cooling effect on the liquid surface, further reducing vapour release. Many though not all tanks are fitted with fixed foam pouring devices. In the event that these devices fail to operate or do not exist, foam is applied from mobile fire-fighting equipment. Application of the foam to the liquid surface against the updraught of the burning vapours can prove extremely difficult if not impossible.

An aim of this invention is to provide apparatus that can be permanently installed in a flammable-liquid storage tank that can be operated to effectively extinguish a fire.

To this end, from a first aspect the invention provides a fire extinguishing installation for location within a liquid storage tank, the installation comprising a delivery nozzle for delivering fire extinguishant, a support structure for the nozzle, and means for delivering extinguishant to the nozzle, the support structure is configured to support the nozzle such that it can rotate about a generally vertical axis when in use. A secondary effect is that the cold foam mixture rising from the bottom of the tank will create a movement of cooler fluids from the lower regions of the tank thus cooling the liquid surface and further reducing vapour emissions.

When the means for delivering extinguishant is energised, the nozzle will rotate and will evenly distribute extinguishant within the tank. The extinguishant will subsequently rise to the surface of the liquid stored in the tank (or fall onto it if the level is low) thus creating an even surface layer to extinguish the fire effectively.

The number and diameter of the nozzles delivering the foam is variable dependant upon conditions. Simple embodiments may include a single nozzle. Alternatively, multiple nozzles (for example, three) may be included.

The nozzle may have a length that is selected in dependence upon the size of tank into which it is to be installed. The nozzle may include a jet from which extinguishant can be emitted at a small number of locations (for example, one location). In such embodiments, the extinguishant is typically emitted at a speed such that it travels a substantial distance towards a wall of the tank. Alternatively or additionally, the nozzle may include a perforated tube from which extinguishant can be emitted at a plurality of locations spaced from the support structure. In such embodiments, the perforated tube typically extends substantial distance towards a wall of the tank.

The nozzle is typically caused to rotate by drive means. Such drive means may operate using electrical, pneumatic or hydraulic power.

An installation embodying the invention may use an extinguishant in the form of a fire fighting foam.

The extinguishant may be provided from a fixed foam-generating device installed permanently at the site of the tank and permanently or semi-permanently connected to the installation. Alternatively, it may be provided from a portable foam generating device that is connected to the installation as required.

From a second aspect, this invention provides a storage facility for a flammable liquid, the storage facility comprising a tank for retaining liquid, within which is installed a fire extinguishing installation embodying the first aspect of the invention.

Typically, the installation is located substantially centrally of the tank. Alternatively, in the case of particularly large tanks, several such installations may be provided.

From a third aspect, the invention provides a method for controlling a fire in flammable liquid comprising distributing an extinguishant from a fixed installation on the floor of the tank, the fixed installation being in accordance with the first aspect of the invention.

Embodiments of the invention will now be described in detail, by way of example, and with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a liquid storage tank that includes a fire-fighting installation being a first embodiment of the invention;

Figure 2 is a plan view of a fire-fighting installation being a second embodiment of the invention; and

Figure 3 is a side view of a fire-fighting installation being a third embodiment of the invention.

With reference to Figure 1, there is shown apparatus for installation into a tank for containing flammable liquid. The tank comprises a flat, slightly domed or conical base 10 surrounded by an enclosing wall 12. Upwardly, the tank is closed by a fixed or floating roof (not shown). As described thus far, the tank is conventional.

A fire fighting installation is provided within the tank, and this will now be described.

The installation comprises a foam-dispensing nozzle 20 mounted upon a support structure 22. The support structure 22 is secured to the base 10 of the tank at the centre of the base 10. In the embodiment of Figure 1 there is one such nozzle, while in the embodiment of Figure 2, there are three such identical nozzles. The nozzle 20 comprises a foam dispensing jet 24 mounted on a radial support pipe 26.

The radial support pipe 26 is connected to a flow chamber within the support structure 22 such that fluid can flow from within the flow chamber into the radial support pipe 26 and thence pass into the jet 24.

Connection between the radial support pipe and the support structure is made such that the nozzle 20 can rotate about an axis that passes through the support structure 22 and that is substantially perpendicular to the base 10 of the tank. In the second embodiment, the nozzles 20 are constrained such that they remain equidistantly spaced about the axis. In this embodiment, the spacing between the nozzles is 120°. Within the support structure 22 of these embodiments, there is provided a drive mechanism 28 that can be energised to cause the nozzles to rotate. The drive mechanism 28 comprises a motor that can be electrically or fluid powered (for example, pneumatically or hydraulically powered) as is most convenient for a particular installation.

An extinguishant delivery pipe 30 has one end connected to the flow chamber to allow extinguishant to be delivered to the chamber. The extinguishant delivery pipe 30 extends generally radially across the base 10 of the tank to the wall 12. An opposite end of the extinguishant delivery pipe 30 is connected to a port 32 that passes through the wall 12 of the tank. To the outside of the wall 12, the port 32 has a valve 34 and a coupling flange 36.

The installation further includes extinguishant foam generating plant 40 externally of the tank. The foam generating plant 40 can be connected to the port 32 by an intermediate hose 42. In the embodiment of Figure 1, the foam generating plant 40 is mobile, and is connected to the port 32 only when required. Alternatively, the foam generating plant 40 can be permanently or semi-permanently connected to the port 32.

For use, once the generating plant 40 is connected to the port, the valve 34 is opened, the drive mechanism is energised, and the generating plant 40 is activated. Thus, foam is delivered through the port 32 into the pipe 30 and then into the flow chamber. From there it is delivered through the or each support pipe to the nozzle or nozzles 20, and then into the tank. As the nozzles rotate, foam is distributed within the liquid of the tank. It then rises to the surface of the liquid, where it forms a covering upon the liquid where it can act to extinguish a fire within the tank.

Where multiple nozzles 20 are provided, each of the nozzles may be configured to deliver the extinguishant to a different distance from the support structure, thereby ensuring a more even distribution of extinguishant within the tank.

The embodiments of Figures 1 and 2 rely upon the foam being delivered to the nozzle(s) at elevated pressure so that it emerges from the jet 24 at high speed. In this way, the foam is distributed throughout the radial extent of the tank. Moreover, the foam will disperse as it rises through the liquid within the tank. However, it may not be possible to obtain uniform distribution of foam in a large tank using such an arrangement. The embodiment of Figure 3 adopts an alternative approach.

In the embodiment of Figure 3, the or each nozzle has a tube 46 in place of a jet. The tube extends from the support structure 22 towards the wall 12 of the tank. The tube 46 receives extinguishant from the radial support pipe 26. A plurality of openings 48 are distributed along the length of the tube 46, the openings 48 being upwardly directed. The sizes of the openings increase with distance from the support pipe 26. This ensures an even distribution of extinguishant through the liquid within the tank, since the area swept by a unit length of the tube 46 increases linearly with distance from the support structure 22. This embodiment does not rely upon the pressure of the extinguishant to distribute it throughout the tank. Instead, the extinguishant is led to portions of the tank radially remote from the support structure 22 by passing along the tube 46.

Claims

1. A fire extinguishing installation for location within a liquid storage tank, the installation comprising a delivery nozzle for delivering fire extinguishant, a support structure for the nozzle, and means for delivering extinguishant to the nozzle, the support structure is configured to support the nozzle such that it can rotate about a generally vertical axis when in use.

2. A fire extinguishing installation according to claim 1 that includes a single nozzle.

3. A fire extinguishing installation according to claim 1 that includes a plurality of nozzles.

4. A fire extinguishing installation according to any preceding claim in which the nozzle is selected to have a length that is dependant upon the size of tank into which it is to be installed.

5. A fire extinguishing installation according to any preceding claim in which the nozzle includes a jet from which extinguishant can be emitted at a small number of locations.

6. A fire extinguishing installation according to any preceding claim in which the nozzle includes a perforated tube from which extinguishant can be emitted at a plurality of locations spaced from the support structure.

7. A fire extinguishing installation according to any preceding claim in which the nozzle is typically caused to rotate by powered drive means.

8. A fire extinguishing installation according to claim 7 in which the drive means operates using electrical, pneumatic or hydraulic power.

9. A fire extinguishing installation according to any preceding claim that is adapted for use with an extinguishant in the form of a fire fighting foam.

10. A fire extinguishing installation according to any preceding claim in which the extinguishant is provided from a fixed generating device installed permanently at the site of the tank and permanently connected to the installation.

11. A fire extinguishing installation according to any preceding claim in which the extinguishant is provided from a portable generating device that is connected to the installation as required.

12. A fire extinguishing installation for location within a liquid storage tank substantially as described herein with reference to any one of the drawings.

13. A storage facility for a flammable liquid, the storage facility comprising a tank for retaining liquid within which is installed an installation according to any preceding claim.

14. A storage facility according to claim 13 in which a plurality of installations according to any one of claims 1 to 12 are installed within the tank.

15. A method for controlling a fire in flammable liquid comprising distributing an extinguishant from a fixed installation on the floor of the tank, the fixed installation being in accordance with any one of claims 1 to 12.

The Patent Office

For Innovation

8

Application No:	GB0610310.5	**Examiner:**	Mr Stuart Purdy
Claims searched:	1-15	**Date of search:**	25 September 2006

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-5, 7-11, 13-15	US 1714015 A (GALLAGHER) See whole document and in particular page 1 lines 75-87;
X	1-5, 7, 8	US 2002/0027171 A1 (CRAMPTON) see whole document;
X	1-5, 7	WO 00/12177 A1 (EDVARDSEN) See whole document;
A	-	US 2730178 A (RISINGER)
A	-	US 2260733 A1 (ANFENGER)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

A5A

Worldwide search of patent documents classified in the following areas of the IPC

A62C

The following online and other databases have been used in the preparation of this search report

WPI & EPODOC