(12) UK Patent Application (19) GB (11) 2 448 815 (13) A

(43) Date of A Publication 29.10.2008

(21) Application No: 0807319.9

(22) Date of Filing: 22.04.2008

(30) Priority Data:
(31) 0708018 (32) 25.04.2007 (33) GB

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(51) INT CL:
F16L 55/165 (2006.01) ***F16L 55/164*** (2006.01)

(56) Documents Cited:
GB 2082285 A
WO 1992/002755 A1
US 4936386 A
US 3123101 A
EP 0794238 A2
FR 002857726 A1
US 4357960 A

(58) Field of Search:
INT CL **B29C, F16L**
Other: **Online: WPI, EPODOC, TXTUS0, TXTUS1, TXTUS2, TXTUS3, TXTEP1, TXTGB1, TXTWO1, TXTAU1**

(54) Abstract Title: **Closing off flow passages using a thixotropic material**

(57) For closing off a flow passage, particularly an annular space 22 between an old gas service pipe 18 and a replacement pipe 20 inserted inside it, a thixotropic composition is used. The thixotropic material may be passed in using an applicator gun 26, which, due to the nature of the thixotropic material, can be re-used after cleaning. Furthermore, the resulting barrier may be removed subsequently, e.g. by a water jet, to allow removal of the inner pipe 20. The composition may be bentonite (30-40%.w/w) in water, preferably milled swelling-type bentonite of particle size 60-80μm.

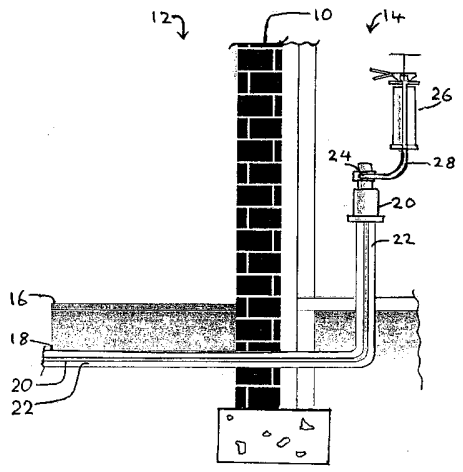

Fig 1

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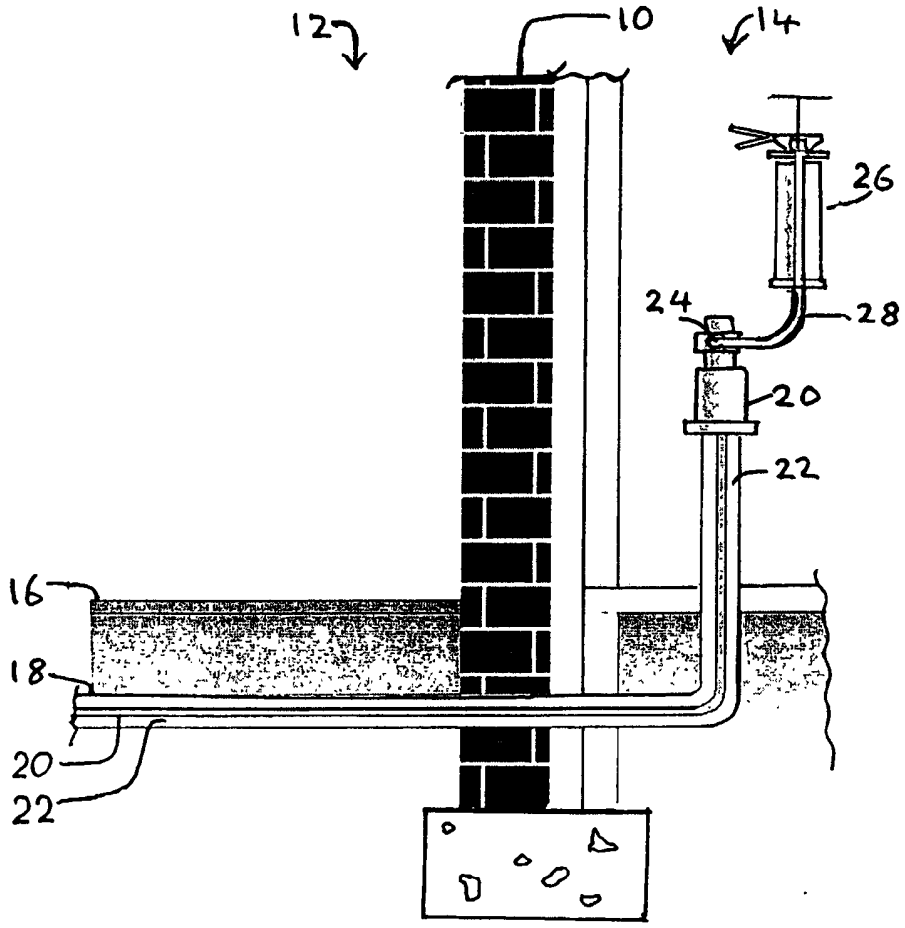

Fig 1

CLOSING OFF FLOW PASSAGES

The present invention relates to closing off flow passages, particularly flow passages along gas service pipes. In various aspects it relates to methods, apparatus for use in the methods, and piping containing seals as produced by the methods.

In the process of installing new gas service pipes (typically of polyethylene) to replace old gas pipes (typically of steel or cast iron), it is common to leave the old pipe in place, and to insert a new pipe of slightly smaller diameter into the old pipe. The old pipe now becomes irrelevant. It is desirable to seal off the annular space between the old and new pipes. A method of achieving this was described in our earlier patent publication GB 2,123,919. This involves passing into the annular space a sealant material which sets to form a resiliently deformable seal. The sealant material is generally produced from a two-part polyurethane foam composition. Two components have to be mixed, and at once begin to generate foam and expand. The mixture is rapidly passed into the annular space, where it expands and sets (cures). The use of such curing foam compositions is now well established: see, for example, our later patent publications GB 2,157,390

and GB 2,226,855, and also the patent publication GB 2,324,350 of BG Plc.

Such methods, involving curable, expandable foam compositions, have been very successful. However, they are not without problems. Several of our patent applications have been concerned with protecting personnel from contact with the chemical foam compositions and/or with facilitating disposal of soiled equipment after use. Thus it can be said that such curable foams have environmental problems, due to the chemicals they contain, and due to the need to dispose of various components containing or otherwise contaminated by cured material.

Furthermore, once the foam has been injected and has set, the pipes are permanently bonded together. There is no possibility of subsequently removing the inner pipe, e.g. for replacement. It is virtually impossible to repair a damaged inner pipe in situ. In the urban environment, a hole in the ground is a valuable asset, and it is regrettable if it becomes unusable.

The present invention arises from the realisation that it is possible to produce seals using non-curing compositions. Such techniques can have advantages such as (1) the use of unpleasant chemicals can be minimised or even avoided altogether; (2) equipment can readily be

cleaned for re-use, and/or (3) seals can be removed, e.g. to allow removal and/or repair and/or replacement of a pipe.

Preferred materials used in the present invention have the further advantage of economy, both because the sealant materials are cheap in themselves, and because they avoid the need for disposable components.

Broadly, the present invention provides a method of sealing off a flow passage in a gas pipe by passing into the pipe a thixotropic material to close off the flow passage. A suitable material is a mixture of bentonite and water. Desirably the composition is essentially free of "curing" components.

The method is particularly applicable to sealing the annular space between an old gas pipe and a replacement pipe that has been inserted into it.

After the material has been passed into the flow passage, the apparatus used for the purpose can be removed and cleaned for re-use.

There might be a subsequent step of removing the seal, e.g. by directing a jet of water at it.

An embodiment of the invention will now be described in more detail with reference to the accompanying drawing, in which Fig. 1 is a schematic sectional view showing apparatus for providing a seal within the annular

space between a new polyethylene gas service pipe and an old steel gas service pipe.

The drawing shows a house wall 10 dividing an interior space 12 from the exterior 14. The ground level is shown at 16. An old gas service pipe 18 passes from a service head adaptor 20, outside the house, under the ground, and through the wall 10, below ground level. A replacement service pipe 20 has been passed into the old pipe 18.

There is an annular space 22 between the old and new pipes 18,20. The service head adaptor 20 includes a conduit communicating with this annular space 22, and an inlet 24 opening into this conduit.

A cartridge applicator gun 26 is coupled to the inlet 24 via a flexible tube 28. The applicator gun 26 is a conventional applicator gun. In the present case, it is used to force a bentonite/water composition along the pipe 28, and into the annular space 22.

The codes of practice in the UK gas industry call for the annular space 22 to be filled with a suitable sealant from the meter attachment point inside the house to a position at least two metres beyond the house wall 10. This is to prevent the passage of gas from some nearby source of leakage through the annular space 22 and

into the interior of the house, which might produce a risk of explosion.

Tests have shown that it is possible to produce thixotropic bentonite/water compositions that allow injection of the mixture through a typical annular space 22 over a length of 10 metres or more, with the material still having sufficient stiffness not to slump or disperse.

Our preferred material is a milled swelling type bentonite with a mean particle size of between 50 and 90 μm, preferably between 60 and 80 μm.

The mix ratio of bentonite to water is preferably in the range 30% to 40% by weight.

Typical combinations of diameters of old and new gas service pipes are: a polyethylene pipe with an outer diameter (OD) of 20mm inserted into a steel pipe having an inner diameter (ID) of 25mm; and a polyethylene pipe of 25mm OD inserted into a steel pipe of 32mm ID. Thus the annular space that requires to be filled generally has a thickness of a few millimetres (say 2-10mm).

CLAIMS

1. A method of closing off a flow passage by passing into the passage a thixotropic material to create a barrier to flow.

2. A method according to claim 1 wherein the thixotropic material comprises a mixture of bentonite and water.

3. A method according to claim 2 wherein the bentonite is a milled swelling-type bentonite.

4. A method according to claim 2 or claim 3 wherein the bentonite in its dry state has a mean particle size of 50-90 μM.

5. A method according to claim 4 wherein said mean particle size is 60-80 μm.

6. A method according to any of claims 2-5 wherein said mixture of bentonite and water contains 30-40% by weight of bentonite.

7. A method according to any preceding claim wherein the flow passage is the space between an outer pipe and an inner pipe extending along its interior.

8. A method according to claim 7 wherein the pipes are gas service pipes.

9. A method according to claim 8 wherein the pipes extend from a meter attachment point in the interior of a house to the exterior of the house, and the barrier extends from adjacent the meter attachment point to a point at least 2m in pipe length from the house.

10. A method according to any preceding claim wherein the material is passed into the passage using an applicator gun, and there is a subsequent step of cleaning the gun for re-use.

11. A method according to any preceding claim including a subsequent step of removing the barrier.

12. A method according to claim 11 wherein the barrier is removed by directing a jet of water at it.

13. A method according to claim 11 and 12 as appendant, directly or indirectly, on claim 7, wherein the inner pipe is removed after removal of the barrier.

14. A method of closing off a flow passage using a thixotropic material substantially as described herein with reference to the accompanying drawing.

15. Apparatus for carrying out the method of any preceding claim comprising an applicator charged with a thixotropic material in flow communication with a flow passage to be closed off.

16. Piping defining a flow passage which is closed off by a barrier of thixotropic material.

17. Piping according to claim 16 comprising an inner pipe extending inside an outer pipe, the closed-off flow passage being the space between the inner and outer pipes.

Application No: GB0807319.9 **Examiner:** Dr Steven Chadwell

Claims searched: 1-17 **Date of search:** 30 July 2008

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	1-7, 11-13 & 15-17	US 3123101 A (BLOUNT et al) see column 4 line 70 to column 6 line 6, and column 7 lines 36 to 57 in particular
X	1-6, 11, 12, 15 & 16	US 4357960 A (HAN) see whole document
X	1, 7-10 & 15-17	WO 92/02755 A1 (BAYLIS et al) see whole document, especially page 14 lines 12 to 23 and page 15 lines 16 to 30
X	1-3, 6, 7 & 15-17	US 4936386 A (COLANGELO) see whole document, especially figures 1-6 and 10
X	1, 7-9 & 15-17	EP 0794238 A2 (TOKYO GAS CO et al) see whole document, especially the abstract and figures
X	1, 7-9 & 15-17	GB 2082285 A (INSITUFORM) see whole document, especially figure 1 and the abstract
X	1-5, 15 & 16 at least	FR 2857726 A1 (CERESOLI) see the figures and WPI Abstract Accession No. 2005-094177 [11] in particular

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] :

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

B29C; F16L

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

WPI, EPODOC, TXTUS0, TXTUS1, TXTUS2, TXTUS3, TXTEP1, TXTGB1, TXTWO1, TXTAU1

International Classification:

Subclass	Subgroup	Valid From
F16L	0055/165	01/01/2006
F16L	0055/164	01/01/2006