Title: GAS PIPE ISOLATION DEVICE

Abstract: A gas pipe blocking system comprises an electromechanical device (4) which in turn comprises at least one protruding member (10) arranged so as to lock the device (4) in place inside the bore of a pipe when the member (10) is in a first position. The member (10) is arranged such that the members (10) are moved to a second position in which the device (4) ceases to be locked in position when a power source is applied to move the members (10).
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published: — with international search report (Art. 21(3))
The present invention relates to a gas pipe isolation device.

5 Gas Distribution Operators (GDOs) are obliged to isolate gas supplies to properties that have not used the gas supply for 12 months. This involves removing the gas meter and disabling the gas supply.

One method for isolating the supply is cutting off the service at the gas main.

10 This method is often used, but it is unpopular in many types of property (particularly multi-dwelling units) because a) an individual supply cannot be isolated at the main, and b) it can result in costly disabling and reinstatement for a returning or new customer, with significant disruption.

15 For the cases where the main supply cannot be disabled the gas supply can be disabled by closing off the Emergency Control Valve (ECV) normally fitted in the meter cabinet. Methods are then needed to prevent an unauthorised person re-enabling the gas supply to use gas without paying for it by simply opening the ECV. Devices have been used which either prevent the flow of gas if the ECV is opened, or lock the ECV in the closed position. However such known existing devices have drawbacks and none is considered ideal. Examples are:

20 a Ball and Chain/Long Distance Stopper, a flexible tube which is inserted down the pipe through the emergency control valve (ECV) and is then inflated. This is unfavoured as it is not always retrievable and provides no guarantee that the service has not been altered or damaged;

25 Wormald Clamps, a U-bend clamp that is placed over the ECV to prevent movement of the ECV handle from the closed position, which is secured with a lock. The device is recognized as being too easily removed as the lock can simply be sawn off;

30 a spin cap with the use of two caps; one is applied directly onto the thread at the top of the ECV, the second is placed on top of the first and secured with a pin to avoid it being winched off. This second cap simply spins round freely if removal is attempted, protecting the first cap. This is too easily removed by simply sawing the top off.
These current solutions used by the GDOs are no longer considered to be wholly effective against unlawful use of gas.

It is generally considered that key attributes for a device are that such a device should a) avoid the cost of cutting off at the main, b) be easy to fit, c) be simple for a network employee to subsequently remove whilst preventing unauthorised third parties from doing so, and d) be long-lasting. In particular, a solution device should not be wholly situated above or around the ECV as it can be sawn off. The device should preferably not be situated inside a modified ECV as it can be unscrewed and removed, and a special ECV design would be needed. The device should not be situated a long way down the pipe below the ECV as the supply can be mistaken for "dead" and become a safety risk. It is also important that a device, if it sits in the gas normally, must be intrinsically safe (IS) if it contains electrical or electronic parts, and the device must be compatible with varying sizes and shapes of ECV bore and varying gas pipe bores and materials.

The present invention seeks to provide a gas pipe isolation device which meets the above requirements.

According to the present invention there is provided a gas pipe blocking system comprising an electromechanical device comprising at least one protruding member arranged so as to lock the device in place inside the bore of a tube when the member(s) are in a first position; the member being arranged such that the members are moved to a second position in which the device ceases to be locked in position when a power source is applied to move the members.

An example of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a schematic side view of a gas pipe isolation device according to the present invention;
Figure 2 is a side schematic cross-sectional view of the coded isolation plug of Figure 1;

Figures 3a and 3b show installation of a device according to the present invention and removal of a device according to the present invention respectively; and

Figure 4 shows the plug of Figure 2 in conjunction with a plug release tool for a further arrangement of the present invention.

Referring to Figure 1, the conventional emergency control valve 1 with fitting handle 2 is provided over a gas supply pipe 5. The system of the invention comprises at least a first part in the form of a plug 4 but preferably also has a bung 3 which sits at the other side of the pipe 5 from the ECV 1 when compared to the bung 4. As shown in Figure 2, the plug 4 comprises a magnetic metal piece 6 and field coils 7. Control electronics are provided in a component 8 and are in communication with an actuator 9. Locking members 10 are provided and are biased by springs 11. Position 12 shows the lock position of locking members 10 and actuator 9 in a position where the plug is unpowered and is maintained in that position by the biasing strength of the springs 11. Position 13, with the dotted lines, shows the locking members 10 and actuator 9 when the plug is powered.

As shown in Figures 3a and 3b, the system of the present invention is operated as follows. Firstly, a bung 3 is inserted into the pipe 5 via ECV 1 using a conventional tool. Once the bung 3 is in place the ECV 1 can be removed and the plug 4 can be inserted with it locking in position by engagement of the locking members 10 within the pipe 5. The ECV 1 can then be replaced and closed.

Removal is shown in Figure 3b in which the ECV 1 is removed, an appropriate tool 15 is used to remove the plug 4, the ECV 1 is replaced and a conventional tool 14, potentially with a screw thread for appropriate engagement, is positioned
to remove the bung 3. The ECV 1 is then closed and the gas supply reconnected.

Figure 4 shows how a specialised removal tool 15 may be employed, that tool comprising a power supply in the form, in this example, of a battery 16 with associated control electronics 17. Field coils 18 activate a magnet 19. In use Field Coils 18 generate an electromagnetic field which passes from the removal tool 15 through to the plug 4 via its coils to activate the actuator 9 and locking members 10 to enable removal. Magnet 19 attracts the plug 4 to facilitate removal of plug 4. The electronics in both components may be configured such that they only interact to allow removal when an appropriate coding is matched between the two. This allows additional security.

The invention is a two-part solution, with a sealing bung 3 plus miniature mechatronic assembly ("plug") 4 that fits inside the pipes, close below the ECV 1. The bung 3 disables the flow, whilst the plug prevents removal of the bung. The plug can only be removed when an appropriate field provides energy and the unlocking code. The plug electronics are powered inductively by a low-frequency RF field applied from above (or from outside through the pipe walls) using a custom tool so that no battery is needed in the plug. Optionally the field exhibits modulation that contains a code that must match the pre-programmed plug device ID, related to the property address, such that only when the correct code is applied can the plug 4 be removed.

As mentioned above the device of the invention operates as follows. Firstly the bung is inserted and removed as per current existing ECV change procedures, in which a tool is used to insert the bung (the tool is screwed into the bung; the flexible bung is inserted through the open ECV; the tool is unscrewed and removed to leave bung in place. The ECV can now be removed without gas escaping).

For removal when the inductive field is applied with sufficient energy and the appropriate code by way of a second tool, the legs actuate to release the plug from its locked position, and the plug can then be removed by magnetic force
The leg actuation mechanism uses either solenoid action or shape-memory alloy (SMA) shape change powered from the inductive field.

The present invention provides a 2-part solution with separated functions: a) supply sealing (bung) and b) locking (plug). When sealing below the plug, ECV removal is allowed; this brings significant benefits in that:

The plug is not situated in an area supplied with gas and thus the requirement for IS (Intrinsic Safety) approvals is mitigated;

The plug does not have to fit though the ECV bore, simplifying the design of the plug).

In this embodiment plugs are sized to match the pipe size rather than one size fits all, with some common parts being used in different size plugs.

Alternatively a one-piece solution consisting of bung and plug could be considered.

Also coding of the field used to release the plug lock can be optional though it adds security. Application of the electromagnetic field from above rather than through the pipe wall improves coupling and energy transfer although a through-wall alternative is possible and may be used to avoid a potential issue if the plug has been pushed down the pipe.
CLAIMS

1. A gas pipe blocking system comprising an electromechanical device comprising at least one protruding member arranged so as to lock the device in place inside the bore of a pipe when the member is in a first position; the member being arranged such that the members are moved to a second position in which the device ceases to be locked in position when a power source is applied to move the members.

2. A system according to claim 1, in which the at least one member is configured such that locking is unidirectional, allowing insertion into a pipe but not allowing extraction from the closed pipe when the member is in the first position.

3. A system according to claim 1 or 2 in which the power is supplied from an external source using an RF inductive field.

4. A system according to claim 1 or 2 in which the power is supplied from an external source through electrical contacts.

5. A system according to claim 1 or 2, in which power is supplied to the electromechanical device from an internal source.

6. A system according to any preceding claim in which a coded signal is supplied to the electromechanical device from an external source and in which said members of the electromechanical device move to the unlocked position only when the externally applied code matches a predetermined code stored in the device.

7. A system according to claim 6 in which the coded signal is supplied by an RF source.

8. A system according to claim 6 in which the coded signal is supplied through electrical contacts.
9. A system according to claim 7 or 8 in which a coded modulation is applied to an externally supplied power source for the electromechanical device, and in which said members of the electromechanical device move to the unlocked position only when the externally applied code matches a predetermined code stored in the device.

10. A system according to any preceding claim further comprising a second element arranged to stop, in use, the flow of gas in the pipe prior to insertion of the electromechanical device.

11. A system according to claim 10, in which removal of said second element from the pipe is prevented by the electromechanical device when both are in use.

12. A system according to any preceding claim in which the electromechanical device can be extracted from the pipe when said members are in the unlocked position using magnetic attraction.

13. A system according to any preceding claim comprising a further extracting device arranged to supply at least one of an external power source, a locking code, and magnetic attraction, to the electromechanical device to extract the electromechanical device from the pipe in use.

14. A system according to any preceding claim in which the electromechanical device is arranged to be suitable for more than one pipe bore size.
**INTERNATIONAL SEARCH REPORT**

**PCT/GB2016/050151**

A. **CLASSIFICATION OF SUBJECT MATTER**

INV. F16L55/128  F16L55/136
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. **FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
F16L G01M E21B

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. **DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>wo 2007/055586 Al (TDW OFFSHORE SERVICES AS [NO]; ALEKSANDERSEN JOSTEIN [NO]; SYSE HARALD) 18 May 2007 (2007-05-18) abstract: figures page 1, line 19 - page 2, line 2 page 5, line 26 - page 6, line 21</td>
<td>1-14</td>
</tr>
<tr>
<td>X</td>
<td>wo 2010/085154 Al (HOLSTAD EVALD [NO]) 29 July 2010 (2010-07-29) abstract: figures page 18, line 23 - page 19, line 26</td>
<td>1,2,4-14</td>
</tr>
<tr>
<td>X</td>
<td>US 2 339 455 A (BRITTON LOYAL H) 18 January 1944 (1944-01-18) page 2, lines 4-60; figures</td>
<td>1,2, 6-11,13, 14</td>
</tr>
</tbody>
</table>

[X] Further documents are listed in the continuation of Box C.  
[X] See patent family annex.

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) one of which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"A" document member of the same patent family

Date of the actual completion of the international search 31 March 2016

Date of mailing of the international search report 12/04/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016

Untermann, Ni l s

Form PCT/ISA/210 (second sheet) (April 2005)
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 6 029 709 A (BURGESS JAMES GORDON [US]) 29 February 2000 (2000-02-29) abstract; figures column 5, lines 26-60</td>
<td>1, 2, 6-11, 13, 14</td>
</tr>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>WO 2007055586 A1</td>
<td>18-05-2007</td>
<td>NONE</td>
</tr>
<tr>
<td>WO 2010085154 A1</td>
<td>29-07-2010</td>
<td>AU 2010207074 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2752067 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 102317672 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EA 201190122 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 2389531 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NO 328302 B1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2011278022 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 2010085154 A1</td>
</tr>
<tr>
<td>US 2339455 A</td>
<td>18-01-1944</td>
<td>NONE</td>
</tr>
<tr>
<td>US 6029709 A</td>
<td>29-02-2000</td>
<td>NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2625479 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 101283214 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 102135219 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 1941204 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2008211228 A1</td>
</tr>
</tbody>
</table>