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(71) Applicant(s):
Adam Kirk Steward
83 Shearwater Road, Offerton, Stockport, Cheshire, SK2 5UZ, United Kingdom

(72) Inventor(s):
Anthony Steward

(74) Agent and/or Address for Service:
Wilson Gunn
5th Floor, Blackfriars House, The Parsonage, MANCHESTER, M3 2JA, United Kingdom

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(56) Documents Cited:
GB 2472265 A **GB 2432405 A**
US 5105844 A **US 3162211 A**

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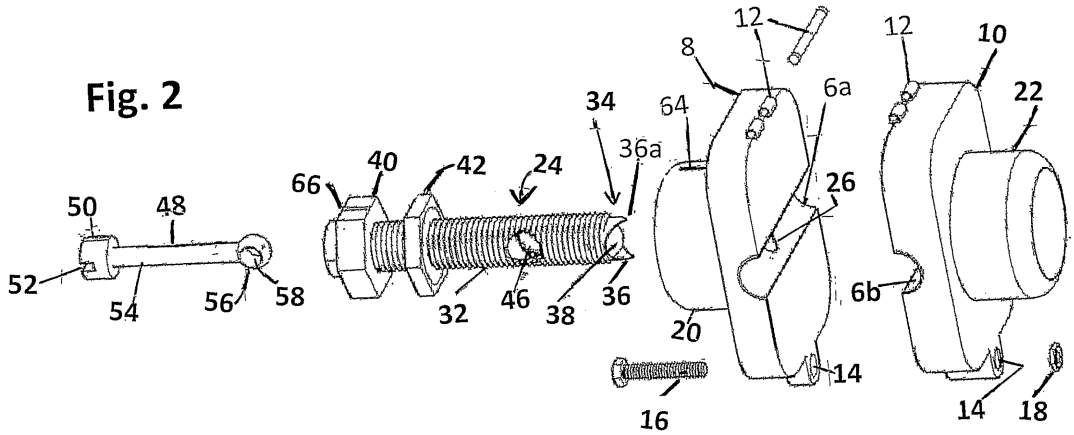
Other: **Online: WPI, EPODOC**

(54) Title of the Invention: **Fluid isolation valve**
Abstract Title: **Fluid isolation valve**

(57) A fluid isolation valve has a housing 8, 10 which can be clamped around a pipe. A pipe cutting bolt 24 has a pipe cutter with spaced concave blades 36 mounted opposite each other and annularly around the periphery of the tip. A round slug pusher 38 is mounted on the tip and is located between the blades 36. The pipe cutting bolt 24 is advanced into the housing 8, 10 when clamped around the pipe, and is turned so that the blades 36 cut through the pipe and sever a length of pipe within the housing. The blades 36 sweep the cut section of pipe onto the slug pusher 38 and it is collected and prevented from entering the fluid in the pipe. A flow shutoff valve 48 is rotationally mounted in a bore of the bolt 24.

Fig. 2



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

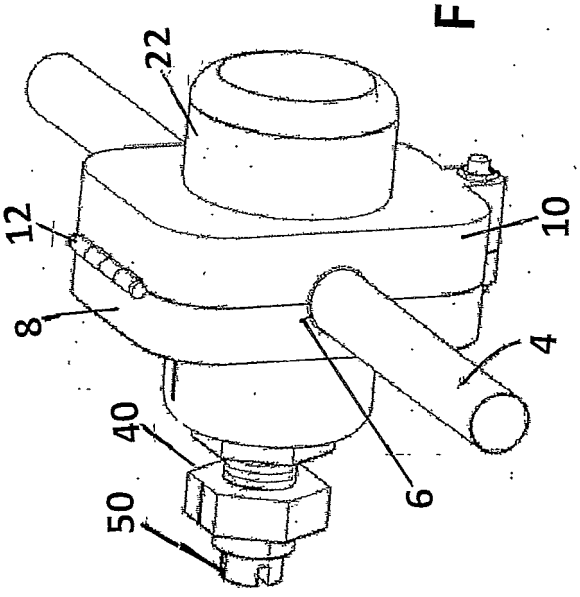
22
12
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Fig. 1

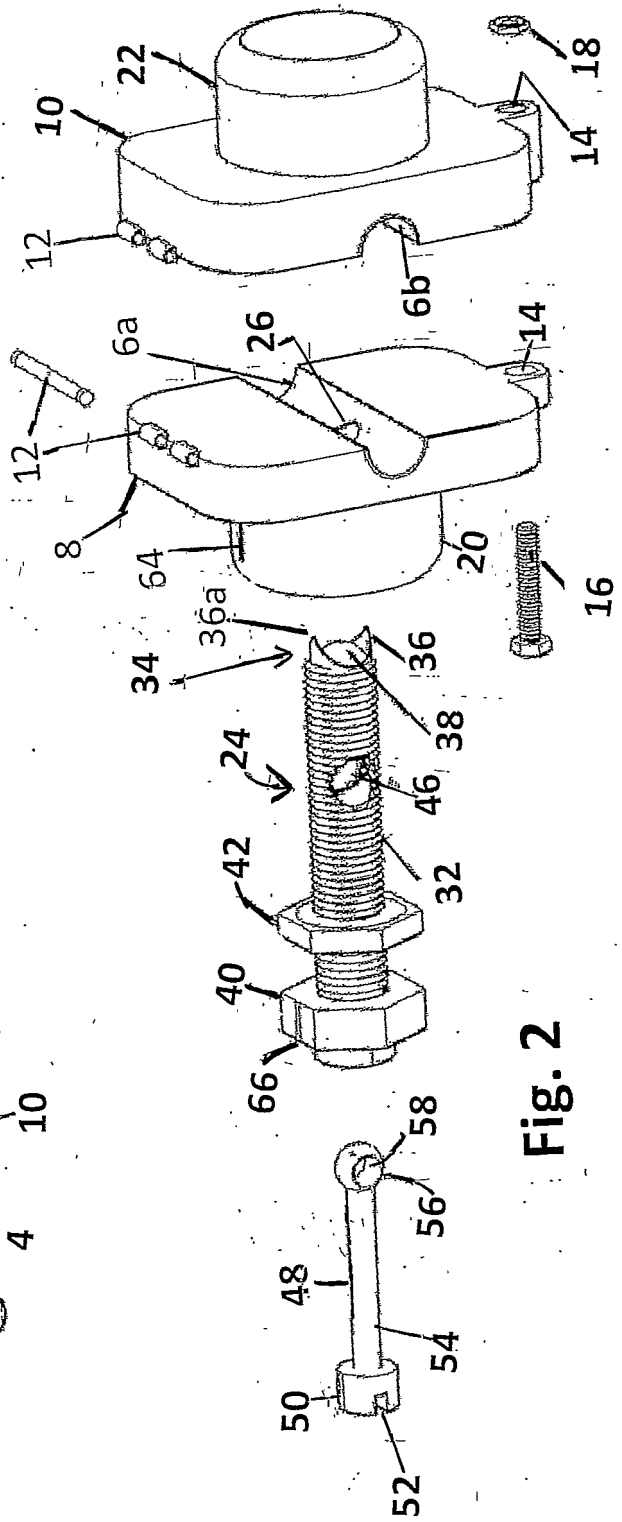
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Fig. 2

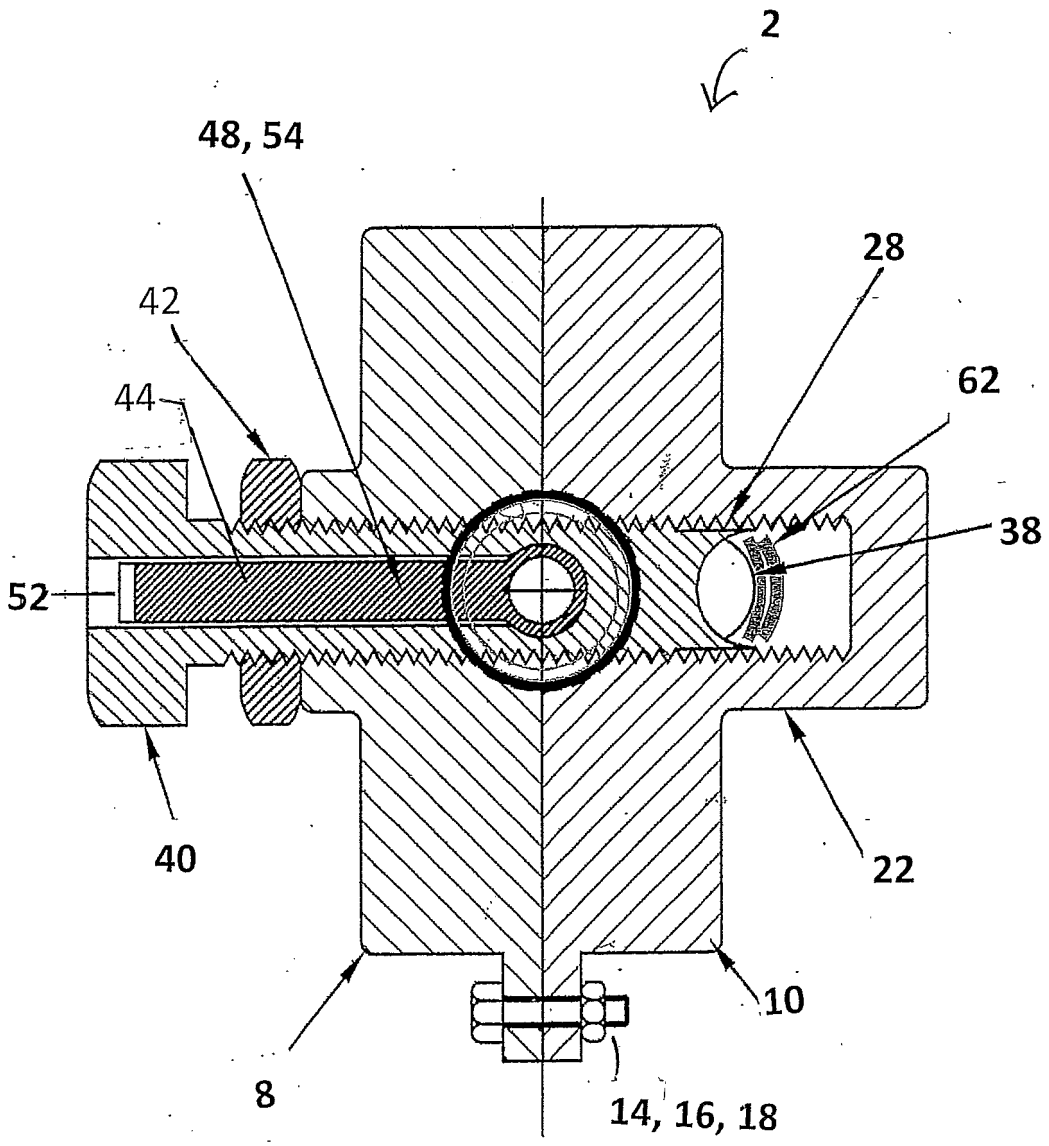

Fig. 3

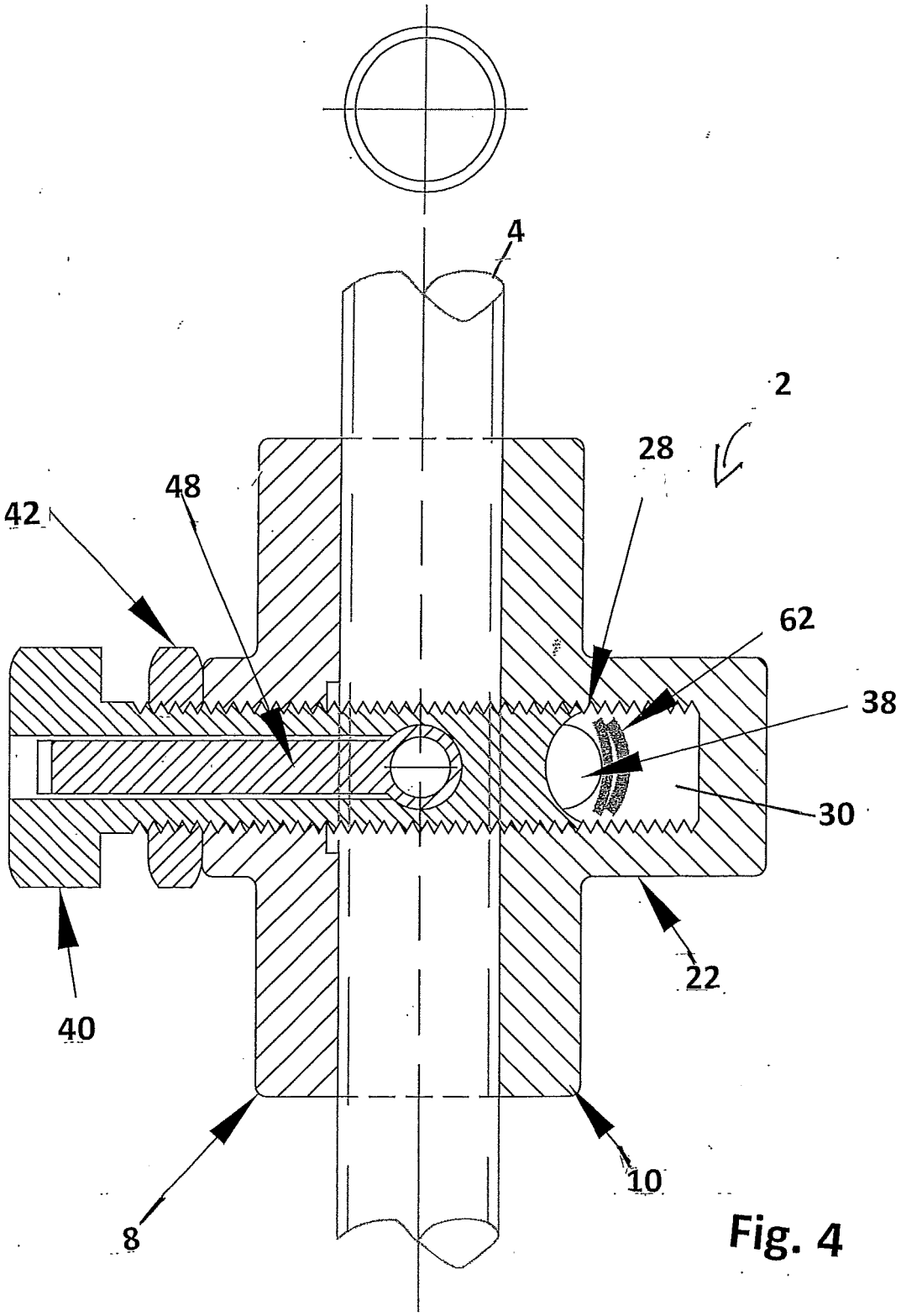

Fig. 4

Fluid Isolation Valve

The present invention relates to a fluid isolation valve and in particular a fluid isolation valve which can be retrofitted to an existing fluid supply.

Isolation valves are traditionally used in plumbing or heating applications to isolate an appliance from the fluid flow in the system, in order to enable service of that appliance for example its repair, replacement or maintenance. However, if the appliance does not have an isolation valve, or the isolation valve is defective, it becomes necessary to shut off the fluid supply to the full system of which the appliance is only a part. This may mean having to locate the main stopcock and/or any water storage tanks in order to switch off their gate valves. It may also mean at least a partial drain of the fluid system, which is wasteful. Also during the service it may be necessary to switch the supply on and off several times in order to test the appliance, which is time consuming and leads to further waste. It is also inconvenient to users of other appliances served by the fluid supply by preventing use of for example toilets, sinks, washing machines, dishwashers etc.; this leading to loss of productivity in a commercial environment. Also in some fluid systems a stopcock may not be present or may be defective, therefore it is not possible to switch the supply off when there is a leak or when a repair is necessary.

It is an object of the present invention to provide an isolation valve which can be retrofitted to an existing fluid supply without having to switch the supply off at the mains during its fitting and which can then be used to isolate an appliance from the flow through the system during service of the appliance, or which enables use of the isolation valve as a replacement for a defective stopcock, or to be installed as a stopcock on a fluid system where there is currently no stopcock fitted.

In accordance with the present invention there is provided a fluid isolation valve having a housing with a through-bore for containment of a selected section of a pipe of a fluid supply, a cutter bolt sealibly mountable in the housing for advancement into the housing to remove a portion of pipe contained in the housing, wherein a tip of the bolt cutter carries a pipe cutter and a slug pusher, the pipe cutter having at least two separate, spaced blades mounted opposite each other and annularly around the periphery of the tip, the slug pusher being located between the blades of the cutter, and wherein the cutter bolt is mounted for a rotatable advancement through the housing.

The slug pusher may have a substantially convex surface.

Each blade may have at least one cutting edge which depends from the tip, which cutting edge may have a substantially concave profile.

The pipe cutter may be selectively detachable from the tip.

The cutter bolt may be mounted in the housing in a substantially transverse manner to the longitudinal axis of the housing through-bore.

The cutter bolt may have a through-bore and may have a flow valve in its through-bore which is selectively operable to control flow through the cutter bolt through-bore.

The isolation valve may further comprise locking means to fix the position of the cutter bolt in its final position in the housing after it has severed a pipe, in which position the cutter bolt closes the housing through-bore wherein, the cutter bolt through-bore may be located coaxial to the housing through-bore.

The isolation valve may comprise alignment means to locate the cutter bolt in its final position and/or the condition of the flow valve, that is whether it is opened or closed.

The opposite end of the cutter bolt to its tip may carry a fixed bolt end which extends out of the housing. The alignment means may comprise markings and at least one alignment marking is located on the fixed bolt end and another on the housing.

The flow valve may be located in a blind-bore in the cutter bolt, which bore extends longitudinally through the cutter bolt, with the blind-bore intersecting the cutter bolt through-bore.

The isolation valve may be rotatable inside the cutter bolt.

In a preferred embodiment, the pipe cutter has a diameter slightly wider than a diameter of a pipe to be cut. The diameter of the pipe cutter may be between 13 to 34% larger than that of a pipe.

The isolation valve may comprise a collecting chamber within the housing to receive a slug of pipe severed and which is sealable by the pipe cutter tip.

The housing may be a two part housing interconnected by a hinge which enables a pivotal movement between the two parts, the housing further having a single fastening point to secure the two housing parts together to contain a selected section of pipe therein.

By way of example only specific embodiments of the invention will now be described with reference to the accompanying drawings, in which:-

Fig.1 is a perspective view of an isolation valve constructed in accordance with one embodiment of the present invention shown in place on a pipe;

Fig.2 is an exploded view of the isolation valve of Fig.1;

Fig.3 is a longitudinal sectional view of the valve of Fig.1; and

Fig.4 is a transverse sectional view of the valve of Fig.1.

In Fig.1 an isolation valve 2 constructed in accordance with the present invention is shown connected to a fluid pipe 4. The isolation valve 2 has an integral bore 6 through which in use the pipe 4 extends, the valve 2, sealing about the section of the pipe 4 which extends there through.

In order to connect the isolation valve 2 to an existing pipe 4, and as best illustrated in Figs. 1 and 2, the isolation valve 2 comprises a two part housing 8, 10 which includes a front valve body 8 and a rear valve body 10. One edge of each of the front and rear valve bodies 8, 10 are interconnected by a hinge mounting 12 which enables a pivotal movement between the two bodies 8, 10. The through bore 6 is formed between the two-valve bodies 8, 10 and extends in a substantially parallel plane to a rotation axis of the valve bodies 8, 10 formed by the hinge mounting 12.

Each valve body 8, 10 carries an opposite hemispherical length 6a, 6b of the through bore 6. In use the two valve bodies 8, 10 can be pivoted apart and, for example the rear valve body 10 brought into contact with a selected section of pipe 4 such that the pipe 4 is placed in the section 6b of the through bore 6 therein. The front valve body 8 can then be pivoted back towards the rear valve body 10 to encapsulate the pipe 4 between the two valve bodies 8, 10. By this means a section of the intact pipe 4 is enclosed by the valve housing 8, 10 and extends through the valve housing 8, 10 via the through bore 6.

On an opposite edge of each valve body 8, 10, to that of the hinge 12 is a further through bore 14. The bores 14 align when the valve bodies 8, 10 are brought together about the pipe 4 to form a connection means 14, 16, 18. The connection means 14, 16, 18 enables the valve 2 to be clamped to the pipe 4. To this end the connection means 14, 16, 18 further comprises a single clamping bolt 16 and clamping nut 18. The clamping bolt 16 is inserted through the aligned bores 14 and fastened in place by the clamping nut 18, to clamp the front and rear bodies 8, 10 of the valve 2 in place on the pipe 4. This enables an easy connection of the valve 2 to the pipe 4, because the two valve bodies 8, 10 of the valve 2 are joined by the hinge 12, and therefore can be simply pivoted with respect to each other about the hinge 12; with the hinge 12 forming a rotational axis. The opened assembly can be placed around the pipe 4 using one hand and closed around the pipe 4. The valve is then clamped to the pipe 4 by fastening it thereto by the single connection point 14, 16, 18.

The pipe receiving through bore 6 is lined with sealing material, such as a rubber seal to thereby provide a seal about the pipe 4 enclosed by the valve 2.

Each of the front and rear valve bodies 8, 10 carries a respective tapped boss 20, 22, which receive a pipe cutting bolt 24 therein. Each boss 20, 22 is provided on a respective opposite face of the valve bodies 8, 10 to that which carries the pipe through-bore 6a, 6b. Each valve body 8, 10 has a threaded bore 26, 28 which extends transversely to the longitudinal axis of the respective pipe through bores 6a, 6b, and are in line when the valve housing parts 8, 10 are brought together.

The threaded bore 26 in the front valve body 8 is a through-bore and it extends between the pipe through bore 6a and an outside face of the boss 20, to provide a channel through the front valve body 8. The threaded bore 28 in the rear valve body 10 is a blind-bore which opens into the pipe through bore 6b. The opposite end of the blind-bore is contained in the rear valve body boss 22, where it forms an enclosed chamber 30 at the end of the threaded bore 28.

The pipe cutting bolt 24 is threaded along its shank 32 and is adapted to be received within the threaded bores 26, 28 of each valve body 8, 10. On one end of the pipe cutting bolt 24, its tip 34, carries a pipe cutter 36 and a waste pusher 38. The pipe cutter 36 comprises two separate, spaced blades mounted opposite each other and annularly around the periphery of the tip 34 of the shank 32. Each blade has a substantially, curved triangular profile and

depends from the tip 34 of the bolt shank 32. Each blade terminates with a serrated point 36a, remote from the tip 34. Each blade has two cutting edges 36b, which extend either side of the serrated point 36a and fan outwardly towards the tip 34. Each cutting edge 36b is curved in a concave manner. The waste pusher 38 is mounted on the end of the tip 34 and is located between the blades of the cutter 36. In use the serrated ends of the cutter blades 36a extend beyond the waste pusher 38. The waste pusher 38 is in the form of a hemispherical knob which forms an arched or convex surface between the blades of the cutter 36. As mentioned above the blades of the cutter 36 are spaced, therefore the waste pusher 38 is not fully enclosed by the blades 36. Moving around the tip 34 there are alternate sections of blade and sections of waste pusher 38 around the periphery of the tip 34 of the pipe cutting bolt 24; the waste pusher 38 becoming increasingly less surrounded by the blade 36 towards the blade point 36a. The diameter of the pipe cutter 36 is slightly larger than that of the diameter of the pipe to be cut, for example a couple of millimetres. By way of example a typical pipe has a diameter of 15 mm, and therefore the cutter diameter could be for example 18 mm.

The opposite end of the pipe cutting bolt 24 to its tip 34 carries a fixed bolt end 40. The bolt end 40 provides a means to which a spanner can be engaged in use to turn the pipe cutting bolt 24. A locking nut 42 is threadedably mounted on the threaded shank 32 between the fixed bolt end 40 and the tip 34.

As can be best seen in Fig.3 and 4 a blind-bore 44 is provided in the threaded shank 32 of the pipe cutting bolt 24. The shank bind-bore 44 extends longitudinally through the pipe cutting bolt 24 and is concentric to the longitudinal axis thereof. The shank blind-bore 44 is open to the fixed bolt end 40 of the pipe cutting bolt 24. A through-bore 46 is provided through the threaded shank 32. The shank through-bore 46 extends transversely to the longitudinal axis of the shank blind-bore 44 and intersects the shank blind-bore 44.

A rotating flow valve 48 is rotatably retained in the shank blind-bore 44. The rotatable flow valve 48 has a head 50 with an end slot 52 for receipt of a turning implement, for example a screwdriver. The rotatable flow valve 48 further has a shank 54 and a ball end 56, which ball end 56 is at the opposite end of its shank 54 to that of its head 50. The ball end 56 has a through bore 58. In use, when the rotatable flow valve 48 is in the shank blind-bore 44, the ball end 56 lies adjacent the shank through-bore 46.

In order to cut through the pipe 4, the valve 2 is clamped to the pipe 4 as described above. The pipe cutting bolt 24 is then placed tip 34 first into the front valve body threaded bore 26 and the head 40 end thereof is engaged by a spanner (not shown). The pipe cutting bolt 24 is turned by the spanner and this progresses the pipe cutting bolt 24 through the front valve body bore 26 until it reaches the pipe 4 clamped between the valve bodies 8, 10. At this point further rotation of the pipe cutting bolt 24 causes the point 36a of pipe cutter 36 to cut through the pipe 4 in a circular manner, thereby removing a section 60 of the pipe 4. As the pipe material is cut away the waste material or slugs 62 are collected by the waste pusher 38 as the bolt turns; to this end the convex end of the waste pusher 38 pushes the cut edges down between the blades as is rotates with the pipe cutting bolt 24 and collects the cut waste 62 around its surface between the blades of the cutter. Also, as the cutter 36 cuts into the pipe 4, the circular movements of the blades effectively peels away the pipe 4. Furthermore, because the blade diameter across the tip 34 of the bolt 24 is marginally wider than the diameter of the pipe 4 it is cutting through, when the cutter 36 reaches the mid-point of the pipe being cut the front side wall of the cut pipe is not severed from the rear side wall of the section of pipe to be cut i.e. it remains attached, in that the front cut away portion or slug 62 remains attached to the rear to be cut away slug 62, as the cutter passes through the mid-section. The waste pusher 38 then concaves the connected front slug cut section 62 of the pipe into the rear slug section 62 as it is cut, allowing the cutting process to continue through the pipe 4 in to the collecting chamber 30; where the complete cut away section of pipe or slug 62 is then contained inside the collecting chamber 30. This ensures that the front slug 62 is not disconnected from the section of pipe which is removed and then remains contained. This prevents the front slug 62 becoming separated and entering the pipe 4, where it could create damage or a blockage. This prevents the cut away-pieces 62 of pipe 4 entering the fluid system via the pipe 4. The pipe waste pusher 38 also folds the cut pipe edges strengthening the cut edge of the remaining pipe 4. The pipe cutter bolt 24 is further rotated and engages in the rear valve body's 10 threaded bore 28 and is progressed there through towards the chamber 30 in the rear boss 22. This has the advantage that the waste 62 is pushed into the enclosed chamber 30 and is retained therein. The chamber 30 is now fully closed to the pipe receiving bore 6b by receipt of the pipe cutting bolt 24 in the rear boss 22. Furthermore chamber 30 provides a flow chamber for fluid from the pipe 4, which may escape during the cutting process.

The pipe cutting bolt 24 is progressed through the valve 2 until the shank through-bore 46 is brought into line with the pipe through-bore 6, and lies in the section of pipe 4 which has been cut away.

The pipe cutting bolt 24 is then rotated to ensure that its through-bore 46 provides a flow channel through the pipe 4, i.e. a longitudinal axis of the shank through-bore 46 is concentric with the longitudinal axis of the pipe receiving bore 6. To this end alignment markings 64, 66 are provided on the front boss 20 and the bolt head 40 respectively, which when aligned indicate that the shank through-bore 46 is correctly aligned with the flow channel through the pipe 4. At this point the locking nut 42 is tightened to secure the pipe cutting bolt 24 in place and thereby fix the final position of the pipe cutting bolt 24. By this means the pipe 4 has been severed, but is held in place by the pipe cutting bolt 24 and the valve bodies 8, 10, and is also sealed therein.

The flow through the pipe 4 can be selectively stopped by the rotatable flow valve 48. Its ball end 56 lies in the shank through-bore 46 and by rotating the flow valve 48 the through-bore 58 in its ball end 56 can be aligned with the flow through the shank through-bore 46 to enable the flow, and turned through 90° to prevent the flow, whereby the annular body of the ball end 56 closes the channel through the shank through-bore 46 in the pipe cutting bolt 24. To this end the slot 52 on the head 50 provides a further alignment mark, which when aligned with the alignment mark 66 on the head 40 of the pipe cutting bolt 24 means that the rotatable flow valve 48 is turned to prevent flow through the pipe 4. Furthermore, when it is turned through 90° and not aligned, then flow is enabled through the pipe 4. This opens the isolation valve 2 and enables fluid flow in the fluid system to which it has been fitted. A second alignment marking could be provided to indicate this second position (not illustrated). It is to be understood that this described function could be reversed whereby the alignment of the slot 52 on the head 50 with the alignment mark 66 on the bolt head 50 indicates that flow is enabled, and the ball through-bore 58 is coaxially aligned with the shank-through bore 46 which is coaxially aligned with the flow through the pipe 4.

By this mean the isolation valve can be simply fitted using a spanner which provides a large amount of torque to move the pipe cutting bolt 24 through the valve 2 and to cut through the pipe 4. The pipe cutting bolt 24 remains in a fixed position and does not move further. It provides support for the remaining pipe. Also because the rotating flow valve 48 is

contained within the pipe cutting bolt 24, there are no moving parts touching the remaining pipe during operation of the isolation valve, hence maintaining long term pipe integrity.

The tip end 34 of the pipe cutting bolt 24 could be provided as a screw fitting enabling the flow valve 48 to be easily fitted within the pipe cutting bolt 24 by unscrewing the tip 34 and sliding it therein head 50 first. The opposite end of the pipe cutting bolt 24 could be provided with a seat (not illustrated) to retain the flow value 48 inside the pipe cutting bolt 24 in the correct position. Once fitted the tip 34 can be screwed back in place. This enables proper receipt of the ball end 56 within the shank through-bore 46. Furthermore, this has the advantage that different cutters 36 could be mounted to the pipe cutting bolt 24, enabling its easy adaption to cut different types of pipe, for example copper, plastics etc.

Whilst two cutters have been illustrated and described, any number of cutters could be provided. Whilst a triangular shaped cutter with two cutting blades has been described, the or each cutter could have, for example. A half-moon shape, or have an ovolo or convex profile.

Whilst a rotatable flow valve has been described it is to be understood that the flow valve could instead be moveable longitudinally inside the pipe cutting bolt, to bring its through-bore 58 into and out of alignment with the cutting bolt through-bore 46.

It will of course be understood that the invention is not intended to be restricted to the details of the described embodiment which is described by way of example only.

Claims

1. A fluid isolation valve having a housing with a through-bore for containment of a selected section of a pipe of a fluid supply, a cutter bolt sealibly mountable in the housing for advancement into the housing to remove a portion of pipe contained in the housing, wherein a tip of the bolt cutter carries a pipe cutter and a slug pusher, the pipe cutter having at least two separate, spaced blades mounted opposite each other and annularly around the periphery of the tip, the slug pusher being located between the blades of the cutter, and wherein the cutter bolt is mounted for a rotatable advancement through the housing.

2. An isolation valve according to claim 1, wherein the slug pusher has a substantially convex surface.

3. An isolation valve according to claim 1 or 2, wherein each blade has at least one cutting edge which depends from the tip, which cutting edge has a substantially concave profile.

4. An isolation valve according to any one of claims 1, 2 or 3, wherein the pipe cutter is selectively detachable from the tip.

5. An isolation valve according to any one of the preceding claims, wherein the cutter bolt is mounted in the housing in a substantially transverse manner to the longitudinal axis of the housing through-bore.

6. An isolation valve according to any one of the preceding claims, wherein the cutter bolt has a through-bore and has a flow valve in its through-bore which is selectively operable to control flow through the cutter bolt through-bore.

7. An isolation valve according to claim 6, further comprising locking means to fix the position of the cutter bolt in its final position in the housing after it has severed a pipe, in which the cutter bolt closes the housing through-bore, the cutter bolt through-bore being located coaxial to the housing through-bore.

8. An isolation valve according to claim 7, wherein alignment means are provided to locate the cutter bolt in its final position and/or the condition of the flow valve that is whether it is opened or closed.

9. An isolation valve according to claim 8, wherein the opposite end of the cutter bolt to its tip carries a fixed bolt end which extends out of the housing wherein the alignment means comprises markings and at least one alignment marking is located on the fixed bolt end and another on the housing.

10. An isolation valve according to any one of claims 6 to 9, wherein the flow valve is located in a blind-bore in the cutter bolt, which bore extends longitudinally through the cutter bolt, with the blind-bore intersecting the cutter bolt through-bore.

11. An isolation valve according to any one of claims 6 to 10, wherein the isolation valve is rotatable inside the cutter bolt.

12. An isolation valve according to any one of the preceding claims, wherein the pipe cutter has a diameter slightly wider than a diameter of a pipe to be cut.

13. An isolation valve according to claim 12, wherein the diameter of the pipe cutter is between 13 to 34% larger than that of a pipe.

14. An isolation valve according to any one of the preceding claims comprising a collecting chamber within the housing to receive a slug of pipe severed and which is sealable by the pipe cutter tip.

15. A fluid isolation valve according to any one of the preceding claims, wherein the housing is a two part housing interconnected by a hinge which enables a pivotal movement between the two parts, the housing further having a single fastening point to secure the two housing parts together to contain a selected section of pipe therein.

16. A fluid isolation valve constructed and adapted to operate substantially as described herein with reference to the accompanying drawings.

Application No:	GB1423302.7	**Examiner:**	Vaughan Phillips
Claims searched:	1-16	**Date of search:**	16 June 2015

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
A	-	GB 2472265 A (NLB) see abstract
A	-	GB 2432405 A (WESTACOTT) see abstract
A	-	US 5105844 A (KING) see abstract
A	-	US 3162211 A (BARUSCH) see the figures

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

F16K; F16L

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

Online: WPI, EPODOC

International Classification:

Subclass	Subgroup	Valid From
F16K	0043/00	01/01/2006
F16L	0055/07	01/01/2006