A LIQUID SIPHONING APPARATUS FOR SIPHONING LIQUID OUT OF A GAS PIPE AND A METHOD FOR SIPHONING A LIQUID FROM A GAS FLOW PIPE

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ABSTRACT:

A liquid siphoning apparatus for siphoning liquid out of a subterranean gas flow pipe having a pipe wall and a pipe interior is disclosed. In one embodiment the apparatus comprises a support mounted externally on a pipe wall and a siphon tube mounted on the support. The siphon tube has a siphon inlet, a siphon outlet, and a flow passage extending from the siphon inlet to the siphon outlet. The siphon tube projects in through an upper region of the gas flow pipe into the pipe interior and extends to a lower region of the pipe interior to siphon out liquid in the lower region of the pipe interior. Another embodiment includes a launch tube and a bendable siphon tube that can be displaced longitudinally along a live gas flow pipe inside the pipe is also disclosed.

FIGURE 2 FOR PUBLICATION
A LIQUID SIPHONING APPARATUS FOR SIPHONING LIQUID OUT OF A GAS PIPE
AND A METHOD FOR SIPHONING A LIQUID FROM A GAS FLOW PIPE

FIELD OF THE DISCLOSURE

This disclosure relates to a liquid siphoning apparatus for siphoning liquid out of a gas pipe and a method for siphoning a liquid from a gas flow pipe. The disclosure extends to an apparatus for performing this task. The disclosure further extends to a pipeline installation having an apparatus for siphoning a liquid from a gas pipe. Yet further the disclosure extends to a method of installing a liquid siphoning apparatus on a gas flow pipeline and a method of servicing a liquid siphoning apparatus on a gas flow pipeline.

This disclosure relates particularly but not exclusively to an apparatus and method for siphoning water from a subterranean or underground live gas flow pipe forming part of a gathering system used for the extraction of a hydrocarbon gas, e.g. coal seam gas, from a well in the ground. It will therefore be convenient to hereinafter describe the disclosure with reference to this example application. However at the same time it must be recognised that the disclosure is capable of broader application. For example the teachings in the disclosure could be used for removing a liquid, e.g. water or any other liquid, from a pipe that is being used to transport any gases in a myriad of different applications.

DEFINITION

In the specification the term “comprising” shall be understood to have a broad meaning similar to the term “including” and will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps. This definition also applies to variations on the term “comprising” such as “comprise” and “comprises”.

In the specification the term “siphoning” shall be given a broad application and shall include any process where a liquid is driven up a tube by a pressure differential including a positive pressure at the inlet end of the siphon tube. It shall not be limited to a situation where liquid is sucked up a tube by a negative pressure at the outlet end of the siphon tube.
BACKGROUND TO THE DISCLOSURE

The coal seam gas industry involves extracting hydrocarbons from the ground by means of a gas well and then processing these hydrocarbons to obtain useful products. The matter which issues from the well contains both water and hydrocarbon gas. This mixture of gas and water is passed through to a separator which separates water from gas. The gas and water streams are then passed from the separator through a network of pipes to a compressor, or a main line, or a gas plant. One stream taken off the separator contains gas in a gas flow pipe and the other stream contains water in a water flow pipe. There will typically be a degree of contamination in the gas and water streams in the respective gas and water flow pipes. That is the gas stream will contain some moisture and vice versa.

This network of pipes is called a gathering system and is a complex infrastructure of polyethylene pipelines, valves, fabricated risers and manifolds. CSG gathering systems utilise PE (polyethylene pipe) as the material of choice for gas flow lines upstream of field compressor stations.

Gas flow pipes are prone to receiving water which can collect in the pipe, particularly at local low points along the pipe. In large enough quantities the water can form a water seal which acts as a barrier to smooth gas flow through the pipe and severely hamper operation of the gas flow pipe. It is therefore desirable to remove any collected moisture from the gas flow pipe.

In the prior art it is known to use a drain with a tap located in a lower region of the pipe to drain water from the pipeline. However a low drain point is prone to being blocked by debris and if blocked it may not be able to drain the water from the pipe quickly and efficiently.

Further gas flow pipes are received within the ground and each gas flow pipe has a substantial diameter. Thus an underside of each pipe is located quite deep beneath the ground surface and a lot of work is involved in accessing an underside of the pipe to install a drain and tap for draining accumulated water through the tap.

SUMMARY OF THE DISCLOSURE

Applicant has recognised it would be advantageous if an improved technique for removing accumulated water from a gas flow pipe could be devised, particularly in relation to subterranean pipes that are received within the ground.
According to one aspect of the disclosure there is provided a liquid siphoning apparatus for siphoning liquid out of a live gas flow pipe, e.g. a subterranean or underground gas flow pipe, under pressure having a pipe wall and a pipe interior, the apparatus comprising:

- a support mounted externally on a pipe wall; and
- a siphon tube mounted on the support, the siphon tube having a siphon inlet, a siphon outlet, and a flow passage extending from the siphon inlet to the siphon outlet, the siphon tube projecting in to the gas flow pipe to access liquid and draw the liquid through the siphon tube out of the pipe.

The siphon tube may project in through an upper region of the gas flow pipe into the pipe interior and extending to a lower region of the pipe interior to access liquid and siphon it out.

The siphon tube may extend substantially vertically down through the gas flow pipe to the lower region of the pipe.

The support may include a saddle that is fixed in a sealing fashion to an outer surface of the gas flow pipe, and the support may further include a branch pipe extending up from the saddle.

The branch pipe may include a saddle pipe formation projecting from the saddle and a branch pipe section operatively coupled to the saddle pipe formation.

The support may include a branch shut off valve mounted in-line with the branch pipe for selectively shutting off the branch pipe from the gas flow pipe and opening the branch pipe to the gas flow pipe.

The branch pipe may include a sealing gland defining an opening through which the siphon tube passes and the sealing gland may be more remote from the gas flow pipe than the branch shut off valve.

The sealing gland may further include at least one O-ring, preferably two axially spaced O-rings, mounted on the sealing formation and bearing up against the siphon tube.
The sealing gland may seal the siphon tube to the branch pipe and resist the passage of gas or liquid between the sealing gland and the siphon tube.

The siphon tube may be substantially rigid and may extend in a substantially linear fashion from the siphon inlet to the siphon outlet.

The siphon tube may include a strainer extending across the inlet for resisting debris from being drawn into the siphon tube.

The siphon tube may be capable of sliding displacement relative to the support. In particular the siphon tube may be capable of sliding relative to the sealing gland between a retracted position in which it is withdrawn from the pipe interior and an extended position where it extends into the pipe interior.

The siphon tube may include an external stop formation for limiting the siphon tube from being withdrawn through the sealing gland. The external stop formation may be located at a position along the length of the siphon tube so that it is adjacent the sealing gland when the terminal end of the siphon tube is retracted out of the gas flow pipe.

The siphon tube may include a discharge valve which can be selectively opened to allow the passage of water up the siphon tube and out of the gas flow pipe. The discharge valve may be positioned outside the branch pipe, e.g. adjacent to the siphon tube outlet, and be capable of manual operation by an operator. When opened, the water discharge valve draws pooled liquid in through the siphon tube inlet, up through the siphon tube, and out through the siphon tube outlet to transfer it out of the gas flow pipe. The driving force for displacing the water up the siphon tube and out of the gas flow pipe is the elevated pressure in the gas flow pipe above atmospheric pressure.

The apparatus may include at least one gas purge system for purging the support and siphon tube of oxygen before the apparatus is opened to gas in the gas flow pipe. The apparatus may have two gas purge systems which may purge the system with an inert gas, e.g. nitrogen.
The apparatus may be capable of being installed on a live gas flow pipe where gas is flowing through an operational gas flow pipe without isolation of the gas flow pipe. Further the siphon tube may be capable of being detached from and removed from the support on an operational gas flow pipe without any isolation thereof.

According to another aspect of the disclosure there is provided a liquid siphoning apparatus for siphoning liquid out of a subterranean gas flow pipe, e.g. a subterranean gas flow pipe, having a pipe wall and a pipe interior, the apparatus comprising:

- a support mounted externally on the pipe wall;
- a siphon arrangement for siphoning water out of the gas flow pipe including:
  - a launch tube mounted on the support.
  - a siphon tube passed through the launch tube, having a siphon inlet, a siphon outlet and a flow passage extending from the siphon inlet to the siphon outlet, the siphon tube capable of projecting through the pipe wall into the pipe interior so that the inlet thereof can siphon liquid out of the gas flow pipe,
  - wherein the launch tube guides the siphon tube in a selected direction within the gas flow pipe.

The siphon tube may project in through an upper region of the gas flow pipe into the pipe interior and extending to a lower region of the pipe interior to access liquid and siphon it out.

The siphon tube may be bendable along at least part of its length to enable it to bend in the gas flow pipe and travel along a length of the pipe. The siphon tube needs to have sufficient stiffness to enable it to be displaced through a sealing gland while still being bendable to enable it to bend in the gas flow pipe and track along the length of the pipe.

Optionally the siphon tube may comprise a substantially rigid tube portion proximate to the support and a bendable tube portion remote from the rigid tube portion. Further optionally the siphon tube may be bendable along its full length.

The launch tube may have a kicker guide towards a terminal end thereof for directionally guiding the siphon tube in a specific direction.
The kicker guide may include a guide opening in the launch tube through which the siphon tube passes that extends only part of the way around the circumference of the launch tube whereby to directionally guide a siphon tube that is fed out through the guide opening.

The launch tube may have a cylindrical wall and the guide opening may be formed in one side only of the cylindrical wall to direct the siphon tube in a specific direction along the length of the pipe.

That is the guide opening may be positioned and configured on a circumferential portion of the launch tube to direct a siphon tube issuing therefrom in the direction in which the guide opening faces.

The kicker guide may further include a formation that helps the siphon tube to pass out of the guide opening in the launch tube when it reaches the guide opening.

The support may include a saddle that is fixed in a sealing fashion to an outer surface of the gas flow pipe and a branch pipe projecting up from the saddle.

The branch pipe may include a branch shut off valve for selectively shutting off the branch pipe from the gas flow pipe and opening the branch pipe to the gas flow pipe.

The support may include a first sealing gland for sealing the launch tube to the branch pipe that is positioned more remote from the gas flow pipe than the branch shut off valve.

The support may include a second sealing gland for sealing the siphon tube to the launch tube, e.g. which is positioned more remotely from the gas flow pipe than the first sealing gland.

The siphon tube may include a water discharge valve which can be selectively opened to allow the passage of water up the siphon tube and out of the gas flow pipe. The discharge valve may be capable of manual operation by an operator and the elevated pressure in the gas flow pipe provides the driving force for drawing the water up the siphon tube and out of the gas flow pipe.
The apparatus in accordance with the second aspect may have any one or more of the optional features of the apparatus in the first aspect of the disclosure. For example the apparatus in the second aspect may include a strainer extending across the siphon tube inlet for resisting debris from being drawn into the siphon tube and/or including a vibration retarding plate for resisting development of excessive vibration of the launch tube due to gas flow in the gas flow pipe and/or the launch tube includes an external stop formation for limiting the siphon tube from being withdrawn through the sealing gland.

The pipe wall of the gas flow pipe may have an operatively upper region, and the siphon tube may pass through the operatively upper region thereof.

According to another aspect of the disclosure there is provided a method for drawing liquid out of a gas flow pipe, e.g. a subterranean pipe, including a pipe wall and a pipe interior, the method including:

inserting a siphon tube having a siphon tube inlet and a siphon tube outlet through the pipe wall into the pipe interior so that the siphon inlet is received within the pipe interior; and siphoning the liquid through the siphon tube inlet up through the siphon tube and discharging the liquid through the siphon tube outlet into an external environment outside of the gas flow pipe.

The method may include inserting the siphon tube through an upper region of the gas flow pipe into the interior space so that at least part of the siphon tube extends downward into the pipe interior, e.g. substantially vertically downward, and the siphon tube inlet is positioned adjacent the bottom of the pipe interior space.

The method may include opening a discharge valve to open the siphon tube to draw liquid into the siphon tube from an external environment, and thereby remove liquid from the gas flow pipe.

The method may include using a pressure differential between positive pressure within the gas flow pipe and a lesser pressure in the separate and external environment to provide the driving force to draw liquid in the gas flow pipe up into the siphon tube and discharge the liquid out through the outlet. Thus the discharge valve opens to an environment that is
at lower pressure than the pressure within the gas flow pipe and the pressure difference draws liquid up through the flow passage and out of the flow pipe.

The opening of the discharge valve may include manually opening an operating valve on the elongate member to place the flow passage in communication with the environment at lower pressure.

In one form called the drop leg form, the method includes positioning the siphon tube inlet directly beneath the point at which the siphon tube enters the gas flow pipe.

In another form the method may include displacing the siphon inlet in a selected direction along the length of the pipe so as to position the siphon inlet in a body of liquid longitudinally spaced from the position at which the siphon tube passes through the pipe wall into the pipe interior.

The method may include using a launch tube to direct the siphon tube in a selected direction along the length of the gas flow pipe.

Using a launch tube may include manually rotating the launch tube from outside the pipe to adjust the orientation of a launch opening of the launch pipe so as to direct the siphon tube in the selected direction along the pipe.

The gas in the gas flow pipe may be a hydrocarbon gas, e.g. coal seam gas or shale gas, and the liquid that is siphoned out of the pipe may be water.

Optionally the gas flow pipe may be a subterranean pipe of PE forming part of a gathering system for a gas production facility.

The disclosure extends to a pipeline installation including the liquid siphoning apparatus defined above in any of the preceding aspects of the disclosure.
In particular the liquid siphoning apparatus may include any one or more of the optional features of the liquid siphoning apparatus defined in any of the preceding aspects of the disclosure above.

The pipe may be a subterranean gas flow pipe, the liquid may be water and the gas may be a hydrocarbon gas, e.g. coal seam gas or shale gas. Optionally the gas flow pipe may form part of a gathering system for a gas production plant.

The disclosure further extends to a method of installing a liquid siphoning apparatus on a subterranean gas flow pipeline, including:

excavating ground adjacent a location where water is collecting in a gas flow pipe;

installing a support on a live gas flow pipe; and

mounting a siphon arrangement on the support for drawing liquid out of the gas flow pipe.

The siphon arrangement may include a siphon tube having an inlet and an outlet.

The method may include an initial excavation to expose an upper region of the subterranean gas flow pipe.

Installing a support on a live gas flow pipe may include suitable setting up a branch connection on the live gas pipe by means of a hot tapping operation.

The support may include a pipe branch and a saddle, and the hot tapping operation may include installing the saddle on the gas flow pipe, e.g. by means of heat welding, or solvent welding.

The method may further include mounting the siphon arrangement on the support, e.g. by operatively connecting pipe flanges on each of the support and siphon arrangement to each other.

The method may include providing a permanent access shaft from the ground surface down to the gas flow pipe, surrounding the branch pipe, that is circumferentially spaced from the branch pipe, whereby to provide ongoing access to the gas flow pipe for maintenance and
the like. Optionally the method may include covering up the excavation once the support has been installed and the elongate member has been mounted on the support.

The support and the siphon arrangement may include any of the features in any preceding aspect of the disclosure.

The disclosure also extends to method of servicing a liquid siphoning apparatus comprising a support and a siphon arrangement including a siphon tube having an inlet and an outlet, where the apparatus is mounted on a live operating gas flow pipe having a pipe wall and a pipe interior, the method including:
removing the siphon tube from the pipe interior into a branch pipe; and
isolating the siphon tube from the interior of the live gas flow pipe.

The apparatus may include a branch shutoff valve on the branch pipe and isolating the siphon tube may include closing the branch shut off valve.

The method may include removing the siphon arrangement from its mounting on the support while the gas flow pipe is live, and also re-instating the siphon arrangement and inserting it into the gas flow pipe while the gas pipe is live so that it can siphon liquid out of the pipe.

The disclosed arrangements for allowing insertion of a siphon tube into an interior of a gas flow pipe can also be used to allow insertion of other apparatus into the interior of a gas flow pipe.

In some circumstances it is desirable to view the interior of a gas flow pipe, for example to inspect for blockages or damage to the pipe. The present disclosure extends to an apparatus in which instead of a siphoning apparatus the apparatus is a pipe interior imaging apparatus.

In such an apparatus the arrangement provides insertion of a camera or other radiation receiving apparatus (such as the receiving end of a fibre-optic cable arrangement) into a subterranean gas flow pipe, instead of a siphon tube. Cameras suitable for imaging the interior of pipes, and elongate supports for allowing support and or positioning of such cameras within pipes, are known per se and will not be described herein.
Yet another aspect of the present disclosure provides a pipe-interior imaging apparatus for allowing viewing of the interior of a subterranean gas flow pipe having a pipe wall and a pipe interior, the apparatus comprising:

- a support mounted externally on the pipe wall;
- an imaging arrangement for providing an image of the interior of the gas flow pipe, the pipe-interior viewing apparatus including:
  - a launch tube mounted on the support,
  - an elongate imaging support passed through the launch tube, having an interior radiation receiver end, an exterior end for supporting the imaging support from the exterior of the gas flow pipe, and an intermediate region extending between the interior radiation receiver end and the exterior end, the elongate imaging support capable of projecting through the pipe wall into the pipe interior so that the interior end is received in the interior of the gas flow pipe, whereby the launch tube guides the elongate imaging support in a selected direction within the gas flow pipe.

It will be appreciated that features described in relation to embodiments of the liquid siphoning apparatus can apply mutatis mutandis to the disclosed pipe-interior imaging apparatus. For example, the pipe-interior imaging apparatus may include any one or more of the optional features of the liquid siphoning apparatus defined in the preceding aspects of the disclosure.

In some circumstances it is desirable to be able to take action to clear an obstruction in the interior of a gas flow pipe, for example using a pipe clearing apparatus which expels a fluid under pressure from a nozzle, sometimes called a water jetter or water jet apparatus.

The present disclosure extends to an apparatus in which instead of a siphoning apparatus the apparatus is a fluid pressure pipe clearing apparatus.

In such an apparatus the arrangement provides insertion of a hose including a nozzle apparatus into a subterranean gas flow pipe, instead of a siphon tube. Pressure clearing apparatuses in which a fluid such as water is supplied to a nozzle via a hose, for clearing the interiors of pipes are known per se and will not be described herein.
Yet another aspect of the present disclosure provides a pipe clearing apparatus for a subterranean gas flow pipe having a pipe wall and a pipe interior, the apparatus comprising:

- a support mounted externally on the pipe wall;
- a pipe clearing arrangement for use in cleating obstructions from the interior of the gas flow pipe, the pipe-clearing apparatus including:
  - a launch tube mounted on the support,
  - an elongate hose passed through the launch tube, having an nozzle end, a fluid inlet end and an intermediate region extending between fluid inlet end and nozzle end, the elongate hose capable of projecting through the pipe wall into the pipe interior so that the nozzle end is received in the interior of the gas flow pipe to allow clearing of obstructions in the interior of the gas flow pipe,

wherein the launch tube guides the elongate hose in a selected direction within the gas flow pipe.

It will be appreciated that features described in relation to embodiments of the liquid siphoning apparatus can apply mutatis mutandis to the disclosed pipe clearing apparatus. For example the pipe clearing apparatus may include any one or more of the optional features of the liquid siphoning apparatus defined in the preceding aspects of the disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

An apparatus and a method for removing standing liquid, e.g. water, from a gas flow pipe in accordance with this disclosure may manifest itself in a variety of forms. It will be convenient to hereinafter describe several embodiments of the disclosure in detail with reference to the accompanying drawings. The purpose of providing this detailed description is to instruct persons having an interest in the subject matter of the disclosure how to carry the disclosure into practical effect. However it is to be clearly understood that the specific nature of this detailed description does not supersede the generality of the preceding broad description. In the drawings:

- Figure 1 is a schematic drawing of a gas well and an associated gathering system;
- Figure 2 is a schematic front view of a drop leg liquid siphoning apparatus in accordance with one embodiment of the disclosure;
- Figure 3 is an exploded front view of the drop leg liquid siphoning apparatus of Figure 2;
Figure 4 is a schematic front view of a drop leg liquid siphoning apparatus installed on a gas pipe;

Figure 5 is a schematic exploded view of a liquid siphoning apparatus having extension along a length of the pipe in accordance with another embodiment of the disclosure;

Figure 6 is a schematic front view of the liquid siphoning apparatus of Figure 5 showing the detail of certain features and showing a siphon tube prior to insertion into a launch tube;

Figure 7 is a schematic front view of the liquid siphoning apparatus of Figure 5 in use siphoning water out of a live gas flow pipe;

Figure 8 is a schematic front view of a flexible liquid siphoning apparatus installed on a gas pipe that is used for siphoning liquid out of a gas pipe spaced away from the point of insertion into the gas flow pipe;

Figure 9 comprises several schematic drawings of an apparatus for filming a pipe interior of a live gas flow pipe; and

Figure 10 is a schematic front view of an apparatus for jetting a pipe interior of a live gas flow pipe to remove debris.

Figure 1 illustrates some basic features of a gas collection system used for gas extraction. Figure 1 in particular shows a gas well that is operatively connected to a separator for separating gas from liquid. Two pipelines extend from the separator to a compressor and then ultimately to a gas collection plant. This network of pipes extending from the separator to the gas collection plant is called a gathering system. This drawing has been described generally in the background section above and will not be described further in this specific description.

Figure 2 illustrates a drop leg liquid siphoning apparatus used for siphoning liquid which has pooled at a low point of a gas flow pipe out of the gas flow pipe. The drop leg siphoning device is used for siphoning out water pooled directly beneath an entry point of the siphoning device into the gas pipe. The siphoning device is not able to siphon out liquid that is spaced a distance along the pipe away from the entry point of the siphon device because it is rigid and does not have the ability to be longitudinally displaced along the length of the pipe.

The liquid siphoning apparatus is indicated generally by the reference numeral 10 and comprises broadly a support 12 that is physically mounted on an external surface of a gas
flow pipe 13 and a siphon arrangement including a siphon tube 14 mounted on the support 12. The siphon tube 14 and support 12 will each be described in more detail below.

The support 12 includes a saddle 18 that can be fixed in a sealing fashion to the gas flow pipe 13 by heat welding or adhering the saddle 18 to the outer surface of the pipe 13. The support 12 also includes a branch pipe 16 projecting away from the saddle 18 transverse to the direction or axis of the pipe 13. Typically this is formed by a saddle pipe formation and a branch pipe section that is operatively connected to the saddle pipe formation.

The support 12 further includes a branch shut off valve 20 mounted in-line with the branch pipe 16 for selectively shutting off the branch pipe 16 from the gas flow pipe 13 and isolating an outer region of the branch pipe 16 from the live gas flow pipe 13. The branch valve 20 can be moved between an open position that permits gas from the gas flow pipe 13 to flow through the branch valve 20 up towards a distal or upper end of the pipe branch 16 and a closed position that shuts off gas flow through the branch valve 20. This is particularly useful when the siphon arrangement is installed and also when the siphon tube 14 is detached from the apparatus 10 because it enables it to be done on a live gas flow pipe as will be described in more detail below.

The support 12 further includes a sealing gland 24 mounted on the branch pipe 16 that is more remote from the gas flow pipe 13 than the branch shut off valve 20. The sealing gland 24 comprises a sealing formation, e.g. machined in a pipe flange, defining a circular gland opening through which the siphon tube 14 passes and two axially spaced O-rings, mounted on the sealing formation extending circumferentially around the gland opening. The gland opening and the O-rings of the sealing gland 24 are sized and configured to bear up against the siphon tube 14 and seal the siphon tube 14 thereto. This resists the passage or liquid or gas between the sealing gland 24 and the siphon tube 14.

The support 12 further includes a pipe coupling arrangement 16 in the form of a pipe flange 28 or a union coupling on an upper end of the pipe branch that is remote from the saddle 18. An end plate can be used to blank off or block off the pipe branch 16 by mounting it on the pipe flange 28 when the siphon arrangement is removed from the support 12, e.g. a matching flange can be mounted to the pipe flange 28 on the pipe coupling arrangement.
The siphon tube 14 has a siphon inlet 30 at one end of the tube, a siphon outlet 32 at an opposed end of the tube, and a flow passage extending from the siphon inlet 30 to the siphon outlet 32. The siphon tube 14 is designed to project into an interior of the live gas flow pipe 13 through an upper or top region of the pipe 13 and extend down through the pipe interior to a lower or bottom region thereof. This enables the siphon tube 14 to draw liquid which is water into the siphon tube inlet 30 in the lower region of the pipe interior. In the illustrated embodiment the siphon tube 14 extends substantially vertically down to the siphon inlet 30.

The siphon tube 14 is capable of sliding displacement relative to the support 12 and slides relative to the sealing gland 24. The siphon tube 14 is slidably displaced between a retracted position in which it is withdrawn from the pipe interior and received in the pipe branch 16 and an extended position where it extends into the pipe interior shown in Figure 4. The siphon tube 14 is sized to extend across the full diameter of the gas flow pipe 13 in the extended position so that it can reach down to a lower region of the pipe interior where water is pooled. In the retracted position the siphon tube 14 is withdrawn out of the gas flow pipe to the point where its inlet 30 is positioned above the branch shut off valve 20 and below the sealing gland 24. This enables the branch shut off valve 20 to isolate the siphon tube 14 from the live gas flow pipe for maintenance or for removal of the tube 14.

In the illustrated embodiment the siphon tube 14 is substantially rigid and extends in a substantially linear fashion vertically down from the siphon inlet 30 to the siphon outlet 32. However it should be appreciated that a bendable siphon tube 14 could also be used. Further the siphon tube 14 illustrated in the drawings has a strainer 36 extending across the inlet 30 for resisting debris from being drawn into the siphon tube. Yet further the siphon tube includes an external stop formation 38 (not shown in Figure 2 of the drawings) for preventing the siphon tube 14 from being drawn through the sealing gland 24 and ensuring that the sealing is maintained. The external stop formation 38 may be formed by an external ring mounted on the tube 14 that is located at a position along the length of the siphon tube 14 so that it is adjacent the sealing gland 24 when the terminal end of the siphon tube 14 is retracted out of the gas flow pipe 13.

Additionally the siphon tube 14 includes a vibration retarding plate shown as numeral 39 in Figure 2 for resisting development of resonance frequencies in the siphon tube 14 due to
the flow of gas under pressure in the live gas flow pipe. As shown in the drawings the vibration retarding plate is sized to fit tightly within the pipe branch and forms an opening within which the siphon tube is snugly but slidably received. This holds the siphon tube firmly and resists development of vibration along the full length of the tube.

The siphon arrangement also includes a water discharge valve mounted in-line with the siphon tube towards its outer end and which is positioned outside the live pipe where it can be accessed by an operator. The key function of the water discharge valve is to operate the siphon arrangement by initiating the conditions that lead to water being siphoned out of the live gas flow pipe. The water discharge valve is operatively connected to the siphon tube by means of a flanged connection as shown in the drawings.

Additionally the liquid siphoning apparatus also includes a gas purge and bleed arrangement between the branch shut off valve and the sealing gland. The gas purge and bleed arrangement includes a connector and a valve. The connector can be coupled to an inert gas which is flushed through the system by passing it through the branch pipe down to the branch shut off valve and then up through the siphon tube inlet and out through the outlet. This is an important safety feature which enables gas, e.g. atmospheric gas containing oxygen, to be purged from the apparatus before it is placed in gas contact with hydrocarbon gas in the live gas pipe. It also enables gas to be bled off to de-pressurise the branch pipe between the branch shut off valve and the sealing gland before the siphon arrangement is removed. Additionally the siphoning apparatus includes a further gas bleed and purge arrangement that is positioned between the sealing gland and the end of the pipe branch which operates in a similar way to the first purge and bleed arrangement.

In use the liquid siphoning apparatus can be used to siphon water out of the gas flow pipe.

To do this the water discharge valve can be selectively opened by a manual operation by an operator. Standing water in the gas flow pipe can be drawn in through the siphon tube inlet, up through the siphon tube and discharged through the siphon tube outlet outside of the gas flow pipe. The driving force or pressure difference sucking the water
up the siphon tube 14 and out of the gas flow pipe is provided by the elevated pressure in the gas flow pipe 13 which is about 2-3 times atmospheric pressure. When the discharge valve is cracked open the siphon tube outlet 32 is effectively opened to atmospheric pressure which is at a substantially lower pressure than the gas flow pipe 13. The pressure difference drives the water through the siphon tube 4 and out of the pipe 13.

The gas flow pipes 13 which are made of PE pipe of 1-2 m diameter are situated with their uppermost surface about 1 to 2m beneath the surface of the ground. During installation the ground above the pipe 13 is excavated to expose an upper region of the pipe 13. Thereafter the support 12 comprising the branch pipe 16 and saddle 18 is mounted on the exposed upper surface of the pipe. The saddle 18 is operatively mounted on the pipe by heat or solvent welding techniques as are known in the art. The isolation or shut off valve 20 in the branch pipe 16 is in the shut off position as shown in the drawings to maintain sealing of the live gas pipe when the live gas flow pipe is tapped.

Thereafter the siphon arrangement 30 is mounted on the branch pipe 16 of the support 12. To do this the siphon tube 14 is inserted into the branch pipe 16 and passed through the sealing gland 24. At this stage the pipe branch shut off valve 20 and the water discharge valve 40 are in the closed position to seal off the live pipe 13.

Thereafter the branch shut off valve 20 is opened and the siphon tube 14 is projected past the branch shut off valve 20 and into a bottom region of the pipe interior of the live gas flow pipe 13. The sealing gland 24 seals off the pipe branch 16 beyond the branch shut off valve 20 and enables the shut off valve 20 to be opened to the live gas flow pipe 13. Thus in this state the sealing gland 24 preserves overall sealing in the liquid siphoning apparatus. The water discharge valve 40 can then be opened to siphon water out the pipe.

After use the liquid siphoning apparatus 10 can be decommissioned and the siphon arrangement detached and removed while the gas flow pipe remains live. This is achieved by the shut off valve 20 in combination with the sealing gland 24 operating in a similar way to that described above. When the siphon tube is removed from the pipe it can be isolated from the pipe by closing the valve 20 and then removed while the gas flow pipe is live.
Figures 5 to 8 illustrate a liquid siphoning apparatus in accordance with a second embodiment of the disclosure. When describing this other arrangement unless otherwise indicated the same reference numerals will be used to refer to the same components.

This apparatus 10 can be used to tap or siphon water from a low point along the gas flow pipe 13 that is spaced a longitudinal distance away from where the siphon tube 14 is inserted into gas flow pipe 13. This contrasts with the earlier embodiment where the siphoned water is directly beneath the point of insertion into the gas flow pipe 13.

The siphon arrangement which is indicated generally by numeral 130 includes a launch tube 134 that can be received within the branch pipe 16. The launch tube 134 is projected down through the branch shut off valve 20 and into the gas flow pipe 13 in an operative extended position. The launch tube 134 has a kicker guide 136 with a guide opening towards its lower or distal end that faces outward in one direction while the launch tube 134 is closed in other directions around the circumference. The kicker guide 136 is for directing a siphon tube in a specific direction along the length of the gas flow pipe.

The siphon arrangement 130 further includes a bendable siphon tube 140 that is at least partly received within the launch tube 134. The siphon tube 140 has an inlet 142 at its distal end and an outlet 144 outside the launch tube 134. A mesh or strainer 146 is mounted over the siphon tube inlet 142 to resist debris in the liquid in the pipe from being drawn into the siphon tube 140.

A water discharge valve 150 is operatively mounted on the siphon arrangement 130 upstream of the outlet 144 for enabling liquid in the siphon tube 140 to be discharged from the siphon tube 140. The discharge valve 150 is typically manually operable by an operator and is selectively opened to place the siphon tube 140 in communication with an external environment at a different pressure to the gas flow pipe and draw liquid up through the tube 40 and then discharge it into the external environment.

The siphon apparatus includes a first sealing gland sealing the launch tube to the branch pipe. This ensures that water cannot escape between the branch pipe 16 and the launch tube 134 when the branch shut off valve 20 is opened exposing live gas in the pipe. In addition the apparatus has a second sealing gland sealing the siphon tube to the launch
tube. This ensures that water cannot escape between the launch tube 134 and the siphon tube when the branch shut off valve 20 is opened. The structure and function of the sealing glands described above with reference to the drawings is similar to that described above for the first embodiment.

As shown in Figure 5 of the drawings the siphon arrangement 130 comprises two sub-assemblies namely assemblies 1 and 2. Assembly 1 provides the basic structure that is mounted on the branch pipe 16 including the launch tube 134. Assembly 2 includes the siphon tube 140 with the discharge valve 150 mounted in line on the siphon tube 140 adjacent the siphon tube outlet 144. The siphon tube 140 is manually inserted into the first assembly and then a section of the second assembly is operatively connected to a section of the first assembly, e.g. by fastening elements.

In this embodiment when the siphon arrangement 130 is deployed, the siphon tube 140 is projected through the launch tube 134 out through its guide opening 136 and into the gas flow pipe 13. The siphon tube 140 is bendable and this enables the tube 140 to bend when it is introduced into the gas flow pipe and travel along the length of the gas flow pipe 13.

The launch tube 134 projects down to a central or middle point in the gas flow pipe 13 approximately midway between the lowest and uppermost points of the pipe 13, e.g. at a so-called or mid-height within the pipe 13. This feature where the siphon tube 140 issues from the launch tube at a height that is above a bottom of the pipe confers working advantage. It helps to initiate displacement of the distal end and inlet of the siphon tube along the pipe in a selected direction. The launch tube 135 is manually rotated until the guide opening 136 faces in a direction along the pipe towards the water that needs to be siphoned. The siphon tube 140 which is flexible is then paid out or fed out of the guide opening 136 and the inlet 142 thereof is displaced along the length of the flow pipe 13 to a local low point in the pipe which may often be underneath a road or a creek. An operator can gauge the position of the siphon tube inlet 142 within the pipe 13 by measuring the length of siphon tube that has been fed out of the guide opening 136 and comparing this with the distance from the entry point to the low point of the pipe.

Once the inlet 142 of the siphon tube 140 is received within the pool of water the discharge valve 150 can be cracked open thereby causing the pressure differential to siphon the water up the siphon tube 140 and discharge it through the outlet 144. All this occurs while the
gas flow pipe is ‘live’ and there is normal operational flow of gas through the flow pipe 13 which opens the siphon tube to the pressure outside the pipe. The gas flow pipe 13 operates at a positive pressure of typically 2-3 times atmospheric pressure when it is ‘live’ conveying gas to a downstream location which internal gas pipe pressure is higher than the pressure outside of the discharge valve 150 close to atmospheric pressure.

Once the water has been siphoned off the siphon tube 140 might typically be left in its position within the pipe 13. However at any time, the launch tube 134 and the siphon tube 140 can be withdrawn into the branch pipe 16 above the branch shut off valve 20 and isolated from the live gas flow pipe 13. The siphon tube 140 can be displaced back through the pipe 13 in a reverse direction, to the launch tube 145 then up through the launch tube 145. The launch tube 145 with received siphon tube 140 can then in turn be retracted back into the branch pipe 16 above the branch shut off valve 20. If necessary the siphon arrangement 130 can be isolated from the gas flow pipe by closing the shut off valve 20 and be removed. This enables the siphon arrangement to be removed and used elsewhere or maintained and then be reinstated with the siphon tube in the live gas pipe as required.

This occurs while the gas flow pipe is live as per normal operation of the pipe and can be achieved because the branch shut off valve and the sealing glands seal against the launch tube and the siphon tube respectively. This is a particularly useful and beneficial feature of this system.

In use the liquid siphoning apparatus 10 described above and shown in the drawings can be used to siphon pooled liquid, e.g. water, out of a lower region of the interior of the gas flow pipe at a distance set away from the point of insertion of the siphon tube.

If the siphon tube 140 is in a retracted position positioned above the shut off valve 20, a first step is to open the valve 20 and project the launch tube 134 and siphon tube 140 through the valve 20 into the interior space of the pipe 13. The siphon tube 140 is then displaced along the pipe 13 to a point where the inlet 142 of the siphon tube 140 is received in a pool of water in a lower region of the gas flow pipe 13. This is shown in Figure 8. Thereafter the discharge valve 150 adjacent to the outlet 144 on the siphon tube 140 is opened siphoning the water out of the pipe 13.
The second embodiment described above is installed in a similar way to the first embodiment described above.

Figure 9 discloses a pipe-interior imaging apparatus for allowing viewing of the interior of a subterranean gas flow pipe having a pipe wall and a pipe interior. Unless otherwise indicated the same reference numerals will be used to refer to the same components in the earlier embodiments.

The pipe-interior imaging apparatus comprises broadly a support mounted externally on the pipe wall and an imaging arrangement for providing an image of the interior of the gas flow pipe. The pipe-interior viewing apparatus includes a launch tube mounted on the support and an elongate imaging support passed through the launch tube, having an interior radiation receiver end, an exterior end for supporting the imaging support from the exterior of the gas flow pipe. It also includes an intermediate region extending between the interior radiation receiver end and the exterior end. The elongate imaging support is capable of projecting through the pipe wall into the pipe interior. The launch tube guides the elongate imaging support in a selected direction within the gas flow pipe and the elongate imaging support allows imaging of the interior of the gas flow pipe.

The apparatus provides insertion of a camera or other radiation receiving apparatus (such as the receiving end of a fibre-optic cable arrangement) into a subterranean gas flow pipe, instead of a siphon tube. Cameras suitable for imaging the interior of pipes, e.g. digital video cameras, and elongate supports for allowing support and or positioning of such cameras within pipes, are known per se and will not be described herein.

In use this enables an operator to view the interior of a gas flow pipe, for example to inspect for blockages or damage to the pipe. This can be particularly useful in managing and maintaining pipelines.

Figure 10 discloses a pipe-clearing apparatus for clearing an obstruction in the interior of a gas flow pipe. The pipe clearing apparatus which expels a fluid under pressure from a nozzle, is sometimes called a water jetter or water jet apparatus. Unless otherwise indicated the same reference numerals will be used to refer to the same components.
Pressure clearing apparatuses in which a fluid such as water is supplied to a nozzle via a hose, for clearing the interiors of pipes are known per se and will not be described herein. The pipe clearing apparatus comprises broadly a support mounted externally on the pipe wall, and a pipe clearing arrangement for use in clearing obstructions from the interior of the gas flow pipe. The pipe-clearing apparatus includes a launch tube mounted on the support and an elongate hose passed through the launch tube, having a nozzle end, a fluid inlet end and an intermediate region extending between fluid inlet end and nozzle end. The nozzle end is received in the interior of the gas flow pipe to allow clearing of obstructions in the interior of the gas flow pipe.

An advantage of the water withdrawal device described above with reference to the drawings is that it provides for a live tap of the gas flow pipe, i.e. while the gas flow pipe remains operational for transporting gas. Further applicant has appreciated that water can be siphoned directly out through an upper region of the pipe utilising the positive pressure within the live gas flow pipe. The apparatus is able to use the operating pressure within the gas flow pipe to provide the driving force for driving the water out of the pipe.

Another advantage is that the siphon arrangement and the siphon tube in particular enters an upper or top region of the pipe, which is closer to the ground surface, and then projects down to the bottom of the pipe inside the pipe. This way the vertical distance from the surface to the point of entry into the gas flow pipe is substantially less and less excavation work is required to achieve access to water in the pipe. Further there are technical problems with draining off liquid from a bottom of the pipe including debris accumulation.

Further the apparatus can be installed on a live gas pipe while there is gas flowing through the pipe. This capability exists because of the branch shut off valve and the sealing glands that enable the siphon tube to be isolated from the gas flow pipe and then opened to the gas flow pipe while still closing off the siphon tube from the external atmosphere.

Another important advantage of the second embodiment of the apparatus described above with reference to the figures is that it enables the siphon tube to access pooled water that is displaced a longitudinal distance away from the actual apparatus along the length of the pipe. This is very useful as very often dips and low points in the gas collection pipes occur underneath roads and other structures where a drop leg apparatus capable of accessing
water directly beneath the access point would not be suitable. The siphon tube apparatus is installed onto pressurised gas pipelines in conjunction with hot tapping operations. The hot tapping operation is used to set up a branch connection on the live gas pipe.

A further advantage of the method and apparatus described above is that the elongate siphon tube through which the water is drawn can be removed from the gas flow pipe and isolated from the gas flow pipe.

The liquid siphoning apparatus described above provides an elegant and affordable solution to a significant problem in the management of gathering systems in gas wells and their associated plants. Yet another advantage is that the apparatus uses basic engineering components that are readily available which are then combined in a certain way to create the overall apparatus described above.

It will of course be realised that the above has been given only by way of illustrative example of the invention and that all such modifications and variations thereto, as would be apparent to persons skilled in the art, are deemed to fall within the broad scope and ambit of the invention as is herein set forth.
CLAIMS:

1. A liquid siphoning apparatus for siphoning liquid out of a live gas flow pipe under pressure having a pipe wall and a pipe interior, the apparatus comprising:
   a support mounted externally on a pipe wall; and
   a siphon tube mounted on the support, the siphon tube having a siphon inlet, a siphon outlet, and a flow passage extending from the siphon inlet to the siphon outlet, the siphon tube projecting in through an upper region of the gas flow pipe into the pipe interior and extending to a lower region of the pipe interior whereby to access liquid in the lower region of the pipe interior and draw the liquid through the siphon tube out of the pipe.

2. A liquid siphoning apparatus according to claim 1, wherein the siphon tube extends substantially vertically down through the gas flow pipe to the lower region of the pipe.

3. A liquid siphoning apparatus according to claim 1 or claim 2, wherein the support includes a saddle that is fixed in a sealing fashion to an outer surface of the gas flow pipe, and the support further includes a branch pipe extending up from the saddle.

4. A liquid siphoning apparatus according to claim 3, wherein the support includes a branch shut off valve mounted in-line with the branch pipe for selectively shutting off the branch pipe from the gas flow pipe and opening the branch pipe to the gas flow pipe.

5. A liquid siphoning apparatus according to claim 3 or claim 4, wherein the branch pipe includes a sealing gland on the branch pipe which is positioned more remotely from the gas flow pipe than the branch shut off valve.

6. A liquid siphoning apparatus according to claim 5, wherein the sealing gland defines a gland opening through which the siphon tube passes which seals the siphon tube to the branch pipe and resists the passage of gas or liquid between the sealing gland and the siphon tube.
7. A liquid siphoning apparatus according to claim 6, wherein the sealing gland includes at least one O-ring extending circumferentially around the sealing opening and bearing up against the siphon tube.

8. A liquid siphoning apparatus according to claim 6 or claim 7, wherein the siphon tube includes an external stop formation for limiting the siphon tube from being withdrawn through the sealing gland, and the external stop formation is located at a position along the length of the siphon tube so that it is adjacent the sealing gland when a terminal end of the siphon tube is retracted out of the gas flow pipe.

9. A liquid siphoning apparatus according to any one of claims 1 to 8, wherein the siphon tube is substantially rigid and extends in a substantially linear fashion substantially vertically from the siphon inlet to the siphon outlet.

10. A liquid siphoning apparatus according to any one of claims 1 to 9, wherein the siphon tube is capable of sliding displacement relative to the support between a retracted position in which it is withdrawn from the pipe interior and an extended position where it extends into the pipe interior.

11. A liquid siphoning apparatus according to any one of claims 1 to 10, wherein the siphon tube includes a discharge valve which can be selectively opened to open the siphon tube to atmospheric pressure and draw liquid from the gas flow pipe up the siphon tube, and wherein the driving force for displacing the liquid up the siphon tube and out of the gas flow pipe is the elevated pressure in the gas flow pipe above atmospheric pressure.

12. A liquid siphoning apparatus according to any one of claims 1 to 11, wherein the siphon tube includes a strainer extending across the siphon tube inlet for resisting debris from being drawn into the siphon tube and/or including a vibration retarding plate for resisting development of excessive vibration on the siphon tube due to gas flow in the gas flow pipe and/or the siphon tube includes an external stop formation for limiting the siphon tube from being withdrawn through the sealing gland.

13. A liquid siphoning apparatus according to any one of claims 1 to 12, wherein the apparatus includes at least one gas purge system for purging the support and siphon tube
of oxygen before the apparatus is opened to gas in the gas flow pipe and also for bleeding gas from branch pipe and siphon tube.

14. A liquid siphoning apparatus for siphoning liquid out of a subterranean gas flow pipe having a pipe wall and a pipe interior, the apparatus comprising:
   a support mounted externally on the pipe wall;
   a siphon arrangement for siphoning liquid out of the gas flow pipe including:
      a launch tube mounted on the support.
      a siphon tube passed through the launch tube, having a siphon inlet, a siphon outlet and a flow passage extending from the siphon inlet to the siphon outlet, the siphon tube capable of projecting through the pipe wall into the pipe interior so that the inlet thereof can siphon liquid out of the gas flow pipe, wherein the launch tube guides the siphon tube in a selected direction within the gas flow pipe.

15. A liquid siphoning apparatus according to claim 14, wherein the siphon tube is bendable along at least part of its length to bend in the gas flow pipe and travel along a length of the pipe while still having sufficient stiffness to enable it to be displaced through a sealing gland.

16. A liquid siphoning apparatus according to claim 14, wherein the siphon tube is formed from a material that is bendable along substantially its full length.

17. A liquid siphoning apparatus according to any one of claims 14 to 16, wherein the launch tube has a kicker guide towards a terminal end thereof for directionally guiding the siphon tube in a specific direction.

18. A liquid siphoning apparatus according to claim 17, wherein the kicker guide includes a guide opening in the launch tube through which the siphon tube passes that extends only part of the way around the circumference of the launch tube whereby to directionally guide a siphon tube that is fed out through the guide opening.
19. A liquid siphoning apparatus according to claim 18, wherein the launch tube has a cylindrical wall and the guide opening is formed in one side of the cylindrical wall to direct the siphon tube along the pipe in the direction corresponding to the guide opening.

20. A liquid siphoning apparatus according to claim 19, wherein the support includes a first sealing gland for sealing the launch tube to the branch pipe that is positioned more remote from the gas flow pipe than the branch shut off valve, and the support includes a second sealing gland for sealing the siphon tube to the launch tube which is positioned more remotely from the gas flow pipe than the first sealing gland.

21. A liquid siphoning apparatus according to claim 20, wherein the siphon tube includes a liquid discharge valve which can be selectively opened to allow the passage of liquid up the siphon tube and out of the gas flow pipe, and wherein the elevated pressure in the gas flow pipe provides the driving force for drawing the liquid up the siphon tube and out of the gas flow pipe.

22. A liquid siphoning apparatus according to any one of claims 14 to 21, wherein the siphon tube includes a strainer extending across the siphon tube inlet for resisting debris from being drawn into the siphon tube and/or including a vibration retarding plate for resisting development of excessive vibration of the launch tube due to gas flow in the gas flow pipe and/or the launch tube includes an external stop formation for limiting the siphon tube from being withdrawn through the sealing gland.

23. A liquid siphoning apparatus according to any one of claims 1 to 12, wherein the apparatus includes at least one gas purge system for purging the support, the launch tube and the siphon tube of oxygen before the apparatus is opened to gas in the gas flow pipe and also for bleeding gas from branch pipe and siphon tube.