

“IMPROVEMENTS IN/OR AND RELATING TO UTILITY CHAMBERS AND SURROUNDS AND METHODS THEREFOR”

FIELD OF THE INVENTION

5 The present invention relates to utility chambers, and more particularly, though not solely, to a cover and a frame, either singly or in combination, for a subterranean utility chamber.

 The present invention may also relate to hatches, frames and surrounds for utility chambers and in particular subsurface utility chambers or underground chambers, and also to
10 a system for retaining and locking a hatch or cover to a frame for a subsurface utility chamber. Such chambers are commonly used in the data and telecommunication industry as a chamber providing access to junctions and joints of telecommunications and data transmission means such as cables and the like.

BACKGROUND TO THE INVENTION

15 Utilities such as power, electricity, water, telecommunications, gas and similar are often contained within, and ducted by, subsurface tunnels or pipes. In many cases it is convenient to duct these utilities under the surface of the earth or a structure, for example a road, runway, footpath, a built up area (e.g. floor of a building or structure) or similar. The nature of such utilities requires periodic access, for example for maintenance. This has typically been
20 achieved by ducting the utilities through a utility chamber or similar, which has a subsurface component through which the utilities run, and a surface access component.

 A subsurface utility chamber must have a structure that is strong, rigid and largely immune to corrosion, whilst allowing the creation of various custom apertures, mounting means and access ways. Traditionally, long term subsurface chamber installations have been
25 fabricated from concrete. Whilst this has satisfied the three previous criteria the resulting structure has been cumbersome, and heavy. Installation has required various heavy lifting equipment and many personnel.

 The utility chambers are accessed via a hatch, or similar, that lies flush with the surface the chamber is set into. The chambers can house junctions of the utility, or permit access
30 thereto e.g. piped or wired utilities. As the utility chambers are located below the surface, with the access hatch flush with the surface (e.g. the surface of the road), they do not impede surface movement e.g. traffic flow. This enables the best location of the utility chamber. However, as a result the chamber, hatch and particularly the support for the hatch, must be

sufficiently strong to support surface loads, e.g. traffic passing over or static loads placed thereon.

Typically the main part of the utility chamber is of concrete or metal, set into and below the surface. Typically, the chamber also has a surface frame, also of concrete or metal, which is located above the chamber. The surface frame allows access from above the surface to the main part of the utility chamber. The chamber and frame can be cast in situ or off site. In some applications there is a sub-frame of preformed steel located partially within the surface frame to locate the hatch. The frame communicates to the main cavity of the utility chamber below and the utility therein. The frame supports the hatch or cover, or any other required element. The frame and hatch lie flush with the surface.

The frame is typically installed after the utility chamber has been placed. Boxing, shutter work or similar form work is then added from the utility chamber to stand clear of the main utility chamber hole. The voids or gaps between the form work and the sides of the hole are then filled with concrete or a similar concreitious material. This forms the frame. The sub-frame may be added prior to pouring of the concrete. Once the concrete has reached a particular strength, the form work can be removed and the construction of the road way or similar can be continued.

An alternative to using concrete to form the utility chamber is to use a pre-formed chamber that locates into the main part of the hole. The chamber is made of a metal, such as aluminium. An example of such a pre-formed chamber is described in New Zealand patent NZ511057. This chamber also has a sub-frame to receive the hatch and concrete is used in situ to form the frame including the sub-frame. Such sub-frames in the past have been purely to support the hatch and require a fill material such as concrete to define the remainder of the frame.

It should be noted that in particular, in situations where the hatch and frame of the utility chamber undergo heavy loads (for example in a road way or runway) then the frame and framework must be sufficiently strong to support these loads, and the concrete must set to a point where it will support heavy loads before the loads can be applied. When a setting material such as concrete is used, there is often a significant time period required for the material to set at least to a strength at which form work and similar can be removed, so that further construction work can be carried out around the framework. This can unduly delay construction work, particularly when a network of utilities and chambers must be installed at the same time as surrounding construction is occurring.

Typically, the upper surface of these chambers is set at a certain level, e.g. that of the road surface or similar under which the chamber is located. This is a further disadvantage. If further work is carried out at a later date (e.g. road resurfacing), this can leave the upper surface of the chamber lower or higher than the rest of the road surface. This will render an otherwise smooth surface bumpy. It is difficult to adjust the position of the frame to the new surface level without significant re-construction work, and possibly the removal and repositioning of the frame, if not the chamber also.

Contemporary subsurface chambers, or parts thereof, are increasingly being fabricated from suitable metals, such as aluminium. Metallic chamber structures satisfy strength, rigidity and corrosion immunity requirements, whilst also being low in bulk when transported to the installation site, very quick to assemble, with an appreciable drop in mass (approximately 10% of the equivalent concrete structure) and highly customisable, both in the internal mountings that can be applied and also in its ability to mount existing and new ducting.

Traditionally, hatches for frames for subsurface chambers and the like have been held down and held in position by their sheer weight. This is particularly the case when the hatch and frame are made from concrete or cast iron. The degree of strength required to lift or remove a heavy concrete or cast iron hatch is usually enough to deter people from lifting or removing the hatch and also to prevent accidental lifting by vehicles passing over it.

Increasingly, the security of utilities and similar in a subsurface chamber requires, or necessitates, the ability to lock the hatch to the frame to provide security to the utility and subsurface chamber. This is desirable when, for example, the utility itself is dangerous e.g. high voltage electricity or gas, or is a sensitive utility such as telecommunications and the like.

Once such way of securing the hatch to the frame is by use of threaded connectors, such as for example, those that thread through the hatch into receiving portions in the frame to retain the hatch to the frame.

In other methods a fastener may deploy from either the hatch or the frame to engage the other of the frame or the hatch. The fastener may be, for example, of the turnkey type where a part is deployed from the hatch or frame to engage the frame or hatch.

A shortcoming of these methods is that numerous turns of the threaded component are required to achieve sufficient security and hold down of the hatch, or the leverage required to produce a firm closure is sufficiently high to make it difficult to achieve with normal or even specialised tools. Further, such closures are not self-tensioning and therefore over time wearing or repeated vibration of the surfaces of the engagement surface of the hatch with the

frame can cause loosening. This may be destructive to the point where dynamic forces may be imparted resulting in fracturing and/or breaking of components. Such destruction is undesirable.

5 In the situation where standard connectors or fasteners are used there is little security provided because standard tools can be used to open the hatch.

It is therefore an object of the present invention to provide a utility chamber, or related utility chamber frame, or related utility chamber cover, or any of these in combination, which will go at least some way towards addressing the foregoing problems or which will at least provide the industry with a useful choice.

10 In this specification where reference has been made to patent specifications, other external documents, or other sources of information, this is generally for the purpose of providing a context for discussing the features of the invention. Unless specifically stated otherwise, reference to such external documents is not to be construed as an admission that such documents, or such sources of information, in any jurisdiction, are prior art, or form part
15 of the common general knowledge in the art.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

SUMMARY OF THE INVENTION

20 It is therefore an object of the present invention to provide improvements to sub-surface utility chambers and surrounds that at least in part overcome the disadvantages of the prior art or at least provides the public with a useful choice.

The term “comprising” as used in this specification means “consisting at least in part of”. Related terms such as “comprise” and “comprised” are to be interpreted in the same manner.

25 In a first aspect, the invention may broadly be said to be a **cover assembly for a utility chamber** or similar, comprising:

a frame comprising a side wall or walls that form the perimeter of an opening which passes through said frame, said opening in use forming an entry or opening into said utility chamber, said side wall or walls also forming or defining a seating interface or surface,

30 a cover, seating with said seating interface or surface in use and comprising a generally planar upper section sized to close or fill said opening in use,

at least one retainer attached to, or forming part of, said cover, said retainer adapted to in use engage with said frame to rigidly and/or unyieldingly secure said cover and frame in position relative to one another.

Preferably said cover and said frame are mutually adapted so that in use with said
5 retainer engaged with said frame, said cover and said frame are stabilised against movement relative to one another.

Preferably said frame further comprises a spring, said spring engaging with said retainer in use to assist in rigidly and/or unyieldingly securing said cover and frame in position relative to one another.

10 Preferably said retainer comprises at least in part a movable latch configured to act between said cover and said frame, said latch being movable between a frame engaging position and a retracted or non-frame engaging position.

Preferably said retainer comprises or includes;

a barrel accessible through said generally planar upper section of said cover,

15 a latch extending outwards from said barrel at the lower end, said latch having an outer end portion which engages with said frame when said barrel is rotated into a frame engaging position,

a sleeve, said cover and said sleeve mutually adapted so as to retain said sleeve in position relative to said cover, said sleeve enclosing at least a mid-section of said barrel and
20 laterally restraining said barrel.

Preferably an upper part of said barrel is formed or configured as a tool interface.

Preferably when said barrel is rotated into a frame engaging position, an upper surface of said latch contacts and presses against a downwards-facing surface of said frame.

Preferably said spring engages with said barrel to apply an upwards force to said barrel.

25 Preferably said spring is a leaf spring.

Preferably said sleeve further comprises a low friction bushing disposed within said sleeve to contact the outer surface of said barrel where said sleeve encloses said barrel.

Preferably said frame includes at least one cut-out section in said at least one sidewall, close to said retainer when said cover is in position in use, said outer end portion of said latch
30 rotating into said cut-out section so that the upper surface of said latch contacts the downwards-facing surface of said cut-out section.

Preferably said low friction bushing and said sleeve are translationally interlocked, or interlockable, by a complimentary key and keyway formed in said bushing and said sleeve.

Preferably said barrel further comprises a limit stop located above said latch, and said sleeve further comprises a complimentary lip located on the lower surface of said sleeve,

5 said limit stop and said complimentary lip configured to engage with one another in use to limit upward translation of the barrel.

Preferably said low-friction bushing facilitates rotation and translation of said barrel relative to the sleeve.

Preferably said spring biases said barrel upwards such that said limit stop is engaged with said complimentary lip of said sleeve when said retainer is disengaged or moved into the retracted or non-frame engaging position (for example when no external forces are applied to the cover).

Preferably said retainer further comprises or includes a generally cylindrical and hollow retainer cap, and said cover further comprises or includes at least one aperture, said retainer cap located in said aperture and arranged coaxially above said barrel and said sleeve.

15 Preferably an upper surface of said sleeve abuts with the lower surface of said retainer cap, said upper surface having a circumferential rebate formed about the perimeter of said upper surface, said rebate generally commensurate with a lower internal edge of said retainer cap so that said sleeve and said retention cap can be mutually interlocked by an interference fit that laterally restrains said sleeve and said barrel with respect to said retainer cap.

20 Preferably said cover assembly includes four retainers, each individually movable between a frame engaging position and a retracted position, each retainer being accessible through or via the top surface of said cover.

Preferably said cover also includes or further comprises cover side walls extending downwards from the underside of said generally planar upper section, at least a portion of the cover sidewall or sidewalls profiled in both depth and height to in use engage with complimentary profiled portions formed in said frame sidewall or walls, said profiled portions defining a keyed profile to position the cover relative to the frame and stabilise said cover and said frame against movement relative to one another.

30 Preferably said cover and frame sidewall face profiles are generally trapezoidal shapes formed in relief from said sidewalls, the side edges of said sidewall face profiles angled such that said trapezoidal shapes have the form of truncated triangles, said profiles formed and shaped so that said cover can be mated with said frame by inserting said cover into said frame from above.

Preferably said profiles are formed with said side edges arranged at an angle that maximises the stability of said cover and said frame against movement relative to one another.

Preferably said cover further comprises or includes at least one retainer attached to, or forming part of, said cover, said retainer adapted to in use engage with said frame to rigidly and/or unyieldingly secure said cover and frame in position relative to one another.

Preferably said cover includes or further comprises four of said retainers.

Preferably said cover has a quadrilateral shape in plan view, said retainers arranged two each on two opposed sides of said quadrilateral.

Preferably said trapezoidal shapes are arranged in the side walls of said frame such that the shorter of the parallel sides is located at or towards the base of said frame, said trapezoidal shapes sized and shaped such that there are two of said shorter sides on two opposed sides of said quadrilateral, corresponding to, and mutually positioned with, said retainers, said shorter sides shaped to include a retention interface for receiving at least a portion of said retainer.

In a second aspect, the invention may broadly be said to be a cover assembly for a utility chamber or similar, comprising:

a frame comprising a side wall or walls that form the perimeter of an opening which passes through said frame, said opening in use forming an entry or opening into said utility chamber, said side wall or walls further forming or defining a seating interface or surface,

a cover, seating with said seating interface or surface in use and comprising a generally planar upper section sized to close or fill said opening in use, said cover further comprising a sidewall or sidewalls extending from the underside of said upper section,

at least a portion of the cover sidewall or sidewalls profiled in both depth and height to in use engage with complimentary profiled portions formed in said frame sidewall or walls, said profiled portions defining a keyed profile to position the cover relative to the frame and stabilise said cover and said frame against movement relative to one another.

Preferably said cover and frame sidewall face profiles are generally trapezoidal shapes formed in relief from said sidewalls, the side edges of said sidewall face profiles angled such that said trapezoidal shapes have the form of truncated triangles, said profiles formed and shaped so that said cover can be mated with said frame by inserting said cover into said frame from above.

Preferably said profiles are formed with said side edges arranged at an angle that maximises the stability of said cover and said frame against movement relative to one another.

Preferably said cover further comprises or includes at least one retainer attached to, or forming part of, said cover, said retainer adapted to in use engage with said frame to rigidly and/or unyieldingly secure said cover and frame in position relative to one another.

Preferably said cover includes or further comprises four of said retainers.

5 Preferably said cover has a quadrilateral shape in plan view, said retainers arranged two each on two opposed sides of said quadrilateral.

Preferably said trapezoidal shapes are arranged in the side walls of said frame such that the shorter of the parallel sides is located at or towards the base of said frame, said trapezoidal shapes sized and shaped such that there are two of said shorter sides on two opposed sides of said quadrilateral, corresponding to, and mutually positioned with, said retainers, said shorter
10 sides shaped to include a retention interface for receiving at least a portion of said retainer.

Preferably said frame further comprises at least one spring, each of said spring or springs engaging with an equivalent one of said retainers in use to assist in rigidly and/or unyieldingly securing said cover and frame in position relative to one another.

15 Preferably said retainer comprises at least in part a movable latch configured to act between said cover and said frame, said latch being movable between a frame engaging position where said latch is engaged with said retention interface and a retracted or non-frame engaging position.

Preferably said retainer comprises or includes;
20 a barrel accessible through said generally planar upper section of said cover,
a latch extending outwards from said barrel at the lower end, said latch having an outer end portion which engages with said frame when said barrel is rotated into a frame engaging position,

a sleeve, said cover and said sleeve mutually adapted so as to retain said sleeve in
25 position relative to said cover, said sleeve enclosing at least a mid-section of said barrel and laterally restraining said barrel.

Preferably an upper part of said barrel is formed or configured as a tool interface.

Preferably said spring engages with said barrel to apply an upwards force to said barrel.

Preferably said spring is a leaf spring.

30 Preferably said sleeve further comprises a low friction bushing disposed within said sleeve to contact the outer surface of said barrel where said sleeve encloses said barrel.

Preferably each of said retention interfaces is a cut-out section in said sidewall, close to said retainer when said cover is in position in use, said outer end portion of said latch rotating

into said cut-out section so that the upper surface of said latch contacts the downwards-facing surface of said cut-out section.

Preferably said low friction bushing and said sleeve are translationally interlocked, or interlockable, by a complimentary key and keyway formed in said bushing and said sleeve.

5 Preferably said barrel further comprises a limit stop located above said latch, and said sleeve further comprises a complimentary lip located on the lower surface of said sleeve,

said limit stop and said complimentary lip configured to engage with one another in use to limit upward translation of the barrel.

10 Preferably said low-friction bushing facilitates rotation and translation of said barrel relative to the sleeve.

Preferably said spring biases said barrel upwards such that said limit stop is engaged with said complimentary lip of said sleeve when said retainer is disengaged or moved into the retracted or non-frame engaging position (for example when no external forces are applied to
15 the cover).

Preferably said retainer further comprises or includes a generally cylindrical and hollow retainer cap, and said cover further comprises or includes at least one aperture, said retainer cap located in said aperture and arranged coaxially above said barrel and said sleeve.

Preferably an upper surface of said sleeve abuts with the lower surface of said retainer
20 cap, said upper surface having a circumferential rebate formed about the perimeter of said upper surface, said rebate generally commensurate with a lower internal edge of said retainer cap so that said sleeve and said retention cap can be mutually interlocked by an interference fit that laterally restrains said sleeve and said barrel with respect to said retainer cap.

In a third aspect the invention may broadly be said to be a cover for use as part
25 of a cover assembly for a utility chamber or similar, said cover comprising:

a generally planar upper section,

a sidewall or sidewalls extending from the underside of said upper section,

at least a portion of said sidewall or sidewalls profiled in both depth and height to in use engage with complimentary profiled portions formed in a corresponding portion of

30 another component of said cover assembly, said profiled portions defining a keyed profile to position the cover relative to said other component and stabilise said cover against movement relative to one another.

Preferably said cover sidewall profile is generally trapezoidal shapes formed in relief from said sidewall or sidewalls, the side edges of said sidewall face profiles angled such that said trapezoidal shapes have the form of truncated triangles, said profiles formed and shaped so that said cover can be mated with another component in said cover assembly by inserting
5 said cover from above.

Preferably said profiles are formed with said side edges arranged at an angle that maximises the stability of said cover and said frame against movement relative to one another.

Preferably said cover further comprises or includes at least one retainer attached to, or forming part of, said cover, said retainer adapted to in use engage with another part of said
10 cover assembly in use to rigidly and/or unyieldingly secure said cover in position.

Preferably said cover includes or further comprises four of said retainers.

Preferably said cover has a quadrilateral shape in plan view, said retainers arranged two each on two opposed sides of said quadrilateral.

Preferably said trapezoidal shapes are arranged in the side walls of said cover such that
15 the shorter of the parallel sides is located at or towards the base of said cover, said trapezoidal shapes sized and shaped such that there are two of said shorter sides on two opposed sides of said quadrilateral.

Preferably said retainer comprises at least in part a movable latch configured to act between said cover and the remainder of said cover assembly, said latch being movable
20 between a frame engaging position where said latch is engaged with a retention interface adapted to hold said cover in position and a retracted or non-frame engaging position.

Preferably said retainer comprises or includes;

a barrel accessible through said generally planar upper section of said cover,

a latch extending outwards from said barrel at the lower end, said latch having an outer
25 end portion which engages with said frame when said barrel is rotated into a frame engaging position,

a sleeve, said cover and said sleeve mutually adapted so as to retain said sleeve in position relative to said cover, said sleeve enclosing at least a mid-section of said barrel and laterally restraining said barrel.

30 Preferably an upper part of said barrel is formed or configured as a tool interface.

Preferably said sleeve further comprises a low friction bushing disposed within said sleeve to contact the outer surface of said barrel where said sleeve encloses said barrel.

Preferably said low friction bushing and said sleeve are translationally interlocked, or interlockable, by a complimentary key and keyway formed in said bushing and said sleeve.

Preferably said barrel further comprises a limit stop located above said latch, and said sleeve further comprises a complimentary lip located on the lower surface of said sleeve,

said limit stop and said complimentary lip configured to engage with one another in use to limit upward translation of the barrel.

Preferably said low-friction bushing facilitates rotation and translation of said barrel relative to the sleeve.

Preferably said limit stop engages with said complimentary lip of said sleeve when said retainer is disengaged or moved into the retracted or non-frame engaging position and an upwards force acts on said barrel sufficient to move said barrel upwards against any equivalent downwards forces.

Preferably said retainer further comprises or includes a generally cylindrical and hollow retainer cap, and said cover further comprises or includes at least one aperture, said retainer cap located in said aperture and arranged coaxially above said barrel and said sleeve.

Preferably an upper surface of said sleeve abuts with the lower surface of said retainer cap, said upper surface having a circumferential rebate formed about the perimeter of said upper surface, said rebate generally commensurate with a lower internal edge of said retainer cap so that said sleeve and said retention cap can be mutually interlocked by an interference fit that laterally restrains said sleeve and said barrel with respect to said retainer cap.

Preferably said retainer cap further comprises or includes at least one and preferably a pair of placement lugs projecting inwardly from opposed sides of the opening perimeter of said retainer cap at the top of said retainer cap.

Preferably in said cover further comprises or includes a lattice of reinforcing cross-members or reinforcing webbing extending downwards from the underside of said cover and running between said sidewalls.

In a fourth aspect the invention may broadly be said to be a frame for use as part of a cover assembly for a utility chamber or similar, said frame comprising:

a side wall or walls that form the perimeter of an opening which passes through said frame, said opening in use forming an entry or opening into said utility chamber, said side wall or walls further forming or defining a seating interface or surface onto which a cover can seat in use,

at least a portion of said sidewall or sidewalls profiled in both depth and height to in use engage with complimentary profiled portions formed in said cover, said profiled portions defining a keyed profile to position the cover relative to the frame and stabilise said cover and said frame against movement relative to one another.

5 Preferably said sidewall face profiles are generally trapezoidal shapes formed in relief from said sidewalls, the side edges of said sidewall face profiles angled such that said trapezoidal shapes have the form of truncated triangles, said profiles formed and shaped so that a cover can be mated with said frame by inserting said cover into said frame from above.

10 Preferably said profiles are formed with said side edges arranged at an angle that in use maximises the stability of said cover and said frame against movement relative to one another.

Preferably said frame has a quadrilateral shape in plan view.

15 Preferably said trapezoidal shapes are arranged in the side walls of said frame such that the shorter of the parallel sides is located at or towards the base of said frame, said trapezoidal shapes sized and shaped such that there are two of said shorter sides on two opposed sides of said quadrilateral, said shorter sides shaped to have a retention interface.

Preferably said frame further comprises at least one spring, each of said spring or springs adapted to engage with an equivalent retainer on said cover in use to assist in rigidly and/or unyieldingly securing said cover and frame in position relative to one another.

Preferably said spring is a leaf spring.

20 Preferably each of said retention interfaces is a cut-out section in said sidewall

Preferably said spring is adapted to apply a biasing force upwards against a force applied in a downwards direction.

Preferably said frame further comprises or includes a peripheral flange, arranged substantially perpendicular to, and running outwards from, said sidewall or sidewalls.

25 Preferably said flange is formed as a continuous element.

Preferably said flange has a plurality of regularly spaced fastener apertures adapted to receive complimentary fasteners when said frame is affixed to a lower frame section during assembly of the chamber structure.

30 Preferably said frame further comprises or includes a plurality of reinforcing webs extending between said sidewalls and said flange

Preferably said reinforcing webs are generally regularly spaced.

In a fifth aspect the invention may broadly be said to be a cover assembly for a utility chamber or similar, comprising:

a frame comprising a side wall or walls that form the perimeter of an opening which passes through said frame, said opening in use forming an entry or opening into said utility chamber, said side wall or walls also forming or defining a seating interface or surface,

a cover, seating with said seating interface or surface in use and comprising a generally planar upper section sized to close or fill said opening in use,

at least one retainer attached to, or forming part of, said cover, said retainer comprising at least in part a movable latch configured to act between said cover and said frame, said latch being movable between a frame engaging position and a retracted or non-frame engaging position.

Preferably said cover and said frame are mutually adapted so that in use with said retainer engaged with said frame, said cover and said frame are stabilised against movement relative to one another.

Preferably said frame further comprises a spring, said spring engaging with said retainer in use to assist in rigidly and/or unyieldingly securing said cover and frame in position relative to one another.

Preferably said retainer comprises or includes;

a barrel accessible through said generally planar upper section of said cover,

a latch extending outwards from said barrel at the lower end, said latch having an outer end portion which engages with said frame when said barrel is rotated into a frame engaging position,

a sleeve, said cover and said sleeve mutually adapted so as to retain said sleeve in position relative to said cover, said sleeve enclosing at least a mid-section of said barrel and laterally restraining said barrel.

Preferably an upper part of said barrel is formed or configured as a tool interface.

Preferably said barrel is rotated into a frame engaging position, an upper surface of said latch contacts and presses against a downwards-facing surface of said frame.

Preferably said spring engages with said barrel to apply an upwards force to said barrel.

Preferably said spring is a leaf spring.

Preferably said sleeve further comprises a low friction bushing disposed within said sleeve to contact the outer surface of said barrel where said sleeve encloses said barrel.

In a sixth aspect the invention may broadly be said to be a tool for actuating a chamber cover lock comprising:

a tool locator configured to engage with a complimentary tool locating interface disposed adjacent the lock to secure the tool in defined relation with the lock,

an extensible shaft disposed at a defined offset from the tool locator so that engagement of the tool locator with a complimentary tool interface on a reciprocal lock
5 positions the extensible shaft adjacent an opening in the lock,

a tool head disposed at a lower end of the shaft, the tool head being configured to engage a complimentary tool interface within the lock, and

an actuation interface that acts between the tool locator and the extensible shaft to depress the shaft and actuate the lock.

10 **In a seventh aspect** the present invention may be said to broadly consist in a subsurface utility chamber, comprising:

a main housing having a base and at least one wall extending upwards from the base, shaped to define an interior of the chamber,

a frame, having a central aperture which passes through the closed perimeter of the
15 frame to allow access to the interior of the chamber, the frame adapted to receive a chamber cover to close the aperture, the frame connected to the main housing above the main housing in an adjustable manner relative to the main housing so as to allow a gap to be established between at least part of the frame and the main housing,

wherein the frame and the main housing have complementary surfaces that, when
20 engaged with each other, close the gap.

Preferably the main housing and the frame are connected to one another by a connection mechanism which is adjustable to vary the positioning in situ of the frame relative to the housing.

Preferably the connection mechanism comprises threaded bolts or rods which are
25 preferably passed through apertures on the frame and housing, and complimentary nuts which are threaded onto the bolts.

Preferably the gap between the frame and the housing is adjustable by location of the nuts on the bolts.

Preferably the at least one wall is two long side walls connected at their lower edges to
30 the base aligned substantially vertically and perpendicular to the base, and two shorter side walls which connect between substantially the ends of the longer side walls, the walls having a top flange which extends substantially horizontally (and preferably outwards) outwards from the top of the wall.

Preferably the flange is continuous.

Preferably the flange is of unitary height from the base.

Preferably the frame has downwardly facing bearing surfaces which align with the flange, the downwardly facing bearing surfaces and the flange forming the complementary surfaces that can engage with one another to close the gap.

Preferably the two shorter walls are located opposite each other.

Preferably the shorter walls have a lower edge which is located some way above the base of the main housing so that apertures are formed at each end of the chamber.

Preferably the chamber further has a cable management bracket connected to one wall which is adapted to assist in managing lengths of cable.

Preferably the chamber further has a cable protection plate, located towards the top of the chamber and sized and aligned so as to or partially shield items within the chamber such as cable from items descending from above.

Preferably the chamber may also have an extension section which in use is located between the main housing and the frame to raise the level of the frame, the lower bearing surfaces of the frame contacting the upper part of the extension section, the lower part of the extension section resting on the flange.

Preferably the extension is formed from four wall sections, each having a lower flange and an upper flange.

Preferably the connection mechanism is used to connect the frame the extension and the housing together, the threaded bolts passed through holes or apertures in each of the housing, the extension section and the frame.

Preferably the chamber further has a chamber cover which is mutually adapted with the frame to close the central aperture of the frame.

Preferably wherein an upper surface of the cover are recessed in the horizontal plane to form a shallow depression.

Preferably at least the shallow depressions contain or receive a surface treatment.

Preferably wherein the utility chamber further has a reinforcing hanger which is connected to, and extends outwardly substantially horizontally from the frame, the hanger adapted to hold reinforcing steel rod or rods.

Preferably the rod or rods form a substantially continuous or unbroken ring around the perimeter of the frame.

Preferably the hanger is adapted to hold two rings of reinforcing steel rod having slightly different sizes so that they are located at slightly different distances from the frame, around the frame.

Preferably the utility chamber further comprises two rings of reinforcing steel rod
5 having slightly different sizes.

Preferably at least one edge face of the frame is tapered inwards so that the top surface overhangs that edge of the frame directly below.

Alternatively at least a pair of opposed edge faces are tapered inwards.

Alternatively all the edge faces of the frame are tapered inwards so that in cross section
10 the frame has the appearance of a trapezoid, with the base smaller than the top surface.

Preferably when the gap is closed the housing and the frame are in a first direct weight-bearing condition where the lower surface or surfaces of the frame bear directly against the upper surface or surfaces of the housing, and when a gap is established between at least part of the frame and the main housing the housing and frame are in a second condition
15 where the rods or bolts at least partly bear the weight of the frame so that the housing is at least partly indirectly weight-bearing.

Preferably the inner surfaces of the frame which form the central aperture are substantially vertical, and when the complementary surfaces of the frame and the main housing are in contact or engaged with one another to close the gap, the inner surfaces of the
20 frame align with the inner surfaces of at least the top portion or part of the housing so that there is no step or overlap between the substantially vertical surface of the inner walls of the housing and the substantially vertical inner surfaces of the central aperture of the frame.

In an eighth aspect the invention may broadly be said to consist in a jointing chamber adapted for location below the surface of the ground, yet which presents a closable
25 opening at ground level for providing access to the interior of the jointing chamber, the opening defined by a frame that can receive a jointing chamber cover to act as a closure to the chamber, the frame supported by a main housing in a manner to allow it to assume two conditions during the installation of the jointing chamber in the ground, a first condition where at least part of the frame and the main housing are separated by a gap, and a second
30 condition where no gap exists between the frame and main housing by virtue of direct contact of complimentary surfaces of said frame and said main housing,

the first and second condition selected, when the jointing chamber is in situ, according to the requirements of the positioning of the frame relative to ground level and relative the main housing.

Preferably when the frame and the main housing are in the first condition, the gap is
5 filled with a solidifiable material (e.g. concrete).

Preferably the main housing and the frame are connected to one another by a connection mechanism which is adjustable to vary the positioning in situ of the frame relative to the housing and to adjust the size of the gap.

Preferably the connection mechanism comprises threaded bolts which are passed
10 through apertures on the frame and housing, and complimentary nuts which are threaded onto the bolts.

Preferably the gap between the frame and the housing is adjustable by location of the nuts on the bolts.

Preferably the at least one wall is two long side walls connected at their lower edges to
15 the base aligned substantially vertically and perpendicular to the base, and two shorter side walls which connect between substantially the ends of the longer side walls, the walls having a top flange which extends substantially horizontally outwards from the top of the wall, the flange forming a continuous unbroken loop of unitary height from the base.

Preferably the frame has downwardly facing bearing surfaces which align with the
20 flange, the downwardly facing bearing surfaces and the flange forming the complementary surfaces that can engage with one another to close the gap.

Preferably the two shorter walls are located opposite each other.

Preferably the shorter walls have a lower edge which is located some way above the base of the main housing so that apertures are formed at each end of the chamber.

Preferably the chamber further has a cable management bracket connected to one wall
25 which is adapted to assist in managing lengths of cable.

Preferably the chamber further has a cable protection plate, located towards the top of the chamber and sized and aligned so as to or partially shield items within the chamber such as cable from items descending from above.

Preferably the chamber may also have an extension section which in use is located
30 between the main housing and the frame to raise the level of the frame, the lower bearing surfaces of the frame contacting the upper part of the extension section, the lower part of the extension section resting on the flange.

Preferably the extension is formed from four wall sections, each having a lower flange and an upper flange.

Preferably the connection mechanism is used to connect the frame the extension and the housing together, the threaded bolts passed through holes or apertures in each of the housing, the extension section and the frame.

Preferably the chamber further has a chamber cover which is mutually adapted with the frame to close the central aperture of the frame.

Preferably an upper surface of the cover are recessed in the horizontal plane to form a shallow depression.

Preferably at least the shallow depressions contain or receive a surface treatment.

Preferably the utility chamber further has a reinforcing hanger which is connected to, and extends outwardly substantially horizontally from the frame, the hanger adapted to hold at least one ring of reinforcing steel rod, so that the rod forms a substantially continuous or unbroken ring around the perimeter of the frame.

Preferably the hanger is adapted to hold two rings of reinforcing steel rod having slightly different sizes so that they are located at slightly different distances from the frame, around the frame.

Preferably the utility chamber further comprises two rings of reinforcing steel rod having slightly different sizes.

In a ninth aspect, the invention may broadly be said to consist in an in-ground jointing chamber that comprises:

a main housing,

a frame that defines an access opening to the main housing and which is adapted to receive a jointing chamber cover to be positioned flush with the adjacent ground, the frame mounted above the main housing by a height adjustable mechanism to allow the size of the gap between the frame and the main housing to be varied so as to allow appropriate positioning of the frame relative to the adjacent ground, the mechanism also allowing the gap to be closed by way of contact between complementary surfaces on the main housing and the frame.

Preferably when the gap is any size greater than zero, the gap is filled with a solidifiable material (e.g. concrete).

Preferably the main housing and the frame are connected to one another by a connection mechanism which is adjustable to vary the positioning in situ of the frame relative to the housing and to adjust the size of the gap.

Preferably the height adjustable mechanism comprises threaded bolts which are passed
5 through apertures on the frame and housing, and complimentary nuts which are threaded onto the bolts.

Preferably the gap between the frame and the housing is adjustable by location of the nuts on the bolts.

Preferably the at least one wall is two long side walls connected at their lower edges to
10 the base aligned substantially vertically and perpendicular to the base, and two shorter side walls which connect between substantially the ends of the longer side walls, the walls having a top flange which extends substantially horizontally outwards from the top of the wall, the flange forming a continuous unbroken loop of unitary height from the base.

Preferably the frame has downwardly facing bearing surfaces which align with the
15 flange, the downwardly facing bearing surfaces and the flange forming the complementary surfaces that can engage with one another to close the gap.

Preferably the two shorter walls are located opposite each other.

Preferably the shorter walls have a lower edge which is located some way above the base of the main housing so that apertures are formed at each end of the chamber.

Preferably the chamber further has a cable management bracket connected to one wall
20 which is adapted to assist in managing lengths of cable.

Preferably the chamber further has a cable protection plate, located towards the top of the chamber and sized and aligned so as to or partially shield items within the chamber such as cable from items descending from above.

Preferably the chamber may also have an extension section which in use is located
25 between the main housing and the frame to raise the level of the frame, the lower bearing surfaces of the frame contacting the upper part of the extension section, the lower part of the extension section resting on the flange.

Preferably the extension is formed from four wall sections, each having a lower flange
30 and an upper flange.

Preferably the connection mechanism is used to connect the frame the extension and the housing together, the threaded bolts passed through holes or apertures in each of the housing, the extension section and the frame.

Preferably the chamber further has a chamber cover which is mutually adapted with the frame to close the central aperture of the frame.

Preferably an upper surface of the cover are recessed in the horizontal plane to form a shallow depression.

5 Preferably at least the shallow depressions contain or receive a surface treatment.

In a tenth aspect, the invention may broadly be said to consist in a method of providing a below surface utility chamber, comprising or including the steps of,

(i) locating a utility chamber housing in a pre-prepared pit of predetermined depth,

10 (ii) locating a frame above the housing and connecting the frame to the housing via an adjustable support connection which connects and supports the frame above the housing at a predetermined yet adjustable height so that the lower bearing surfaces of the frame contact the upper surface or surfaces of the housing and there is no gap between the lower bearing surfaces of the frame and the upper surface or surfaces of the housing,

15 the predetermined depth of the pit locating an uppermost surface of the frame member to lie flush with said surface level.

In an eleventh aspect, the invention may broadly be said to consist in a method of providing a utility chamber below the surface level of uneven or non-horizontal ground, comprising or including the steps of,

20 (i) locating a utility chamber housing in a pre-prepared pit of predetermined depth, the pit having a countersunk edge trench wider than the main portion of the pit,

(ii) locating a frame above the housing and connecting the frame to the housing via an adjustable support connection which connects and supports the frame above the housing at a predetermined yet adjustable height so that firstly the uppermost surface of the frame is generally aligned or lies flush with the surface of the ground and secondly so that a gap or gaps is/are created between the lower bearing surfaces of the frame and the upper surface or surfaces of the housing,

25 (iii) positioning concrete shuttering inside the frame and housing,
(iv) pouring a solidifiable filler material (e.g. concrete or similar) into the edge trench up to the level of the ground and the top of the frame to form a solid collar around the top of at least the frame, the shuttering preventing the filler material from entering the interior of the housing through the gap or gaps.

Preferably the method includes the intermediate step of adding a release material to the external surfaces of the frame member and the housing which will be in contact with the filler material, before the filler material is poured.

5 Preferably the method also includes the intermediate step of locating a reinforcing hanger and at least one ring of reinforcing steel rod within the edge trench, the reinforcing hanger connected to the frame and extending outwardly substantially horizontally from the frame, the rod forming a substantially continuous or unbroken ring around the perimeter of the frame.

In a twelfth aspect, the invention may broadly be said to consist in a subsurface
10 utility chamber, comprising:

a main housing having a base and at least one wall extending upwards from the base, shaped to define an interior of the chamber,

a frame, having a central aperture which passes through the closed perimeter of the frame to allow access to the interior of the chamber, the frame adapted to receive a chamber
15 cover to close the aperture,

an extension section located between the main housing and the frame, the lower surface or surfaces of the frame contacting the upper surface or surfaces of the extension section, the lower surface or surfaces of the extension section contacting the upper surface or surfaces of the housing,

20 the frame, extension section, and housing releasably connected together.

Preferably the frame is connected to the extension section in an adjustable manner relative to the extension section so as to allow a gap to be established between at least part of the frame and the extension section.

Preferably the extension is formed from four wall sections, each having a lower flange
25 and an upper flange.

Preferably a connection mechanism is used to connect the frame the extension and the housing together, the connection mechanism comprising threaded bolts which are passed through holes or apertures in each of the housing, the extension section and the frame, and nuts which are tightened onto the threaded bolts.

30 Preferably the holes in each of the housing, the extension section and the frame are formed in at least one and preferably a plurality of groups so that for each group, a single linear bolt can be passed through each hole in the group.

Preferably the position of the extension section and the frame can be adjusted in situ by way of said connection mechanism, and if required, a gap can be formed between the extension section and the frame.

Preferably the chamber further has a cable management bracket connected to one wall
5 which is adapted to assist in managing lengths of cable.

Preferably the chamber further has a cable protection plate, located towards the top of the chamber and sized and aligned so as to or partially shield items within the chamber such as cable from items descending from above.

Preferably the chamber further has a chamber cover which is mutually adapted with
10 the frame to close the central aperture of the frame.

Preferably an upper surface of the cover are recessed in the horizontal plane to form a shallow depression.

Preferably the shallow depression contains or receives a surface treatment.

Preferably the utility chamber further has a reinforcing hanger which is connected to,
15 and extends outwardly substantially horizontally from the frame, the hanger adapted to hold at least one ring of reinforcing steel rod, so that the rod forms a substantially continuous or unbroken ring around the perimeter of the frame.

Preferably the hanger is adapted to hold two rings of reinforcing steel rod having slightly different sizes so that they are located at slightly different distances from the frame,
20 around the frame.

Preferably the utility chamber further comprises two rings of reinforcing steel rod having slightly different sizes.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and
25 any or all combinations of any two or more said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

The invention consists in the foregoing and also envisages constructions of which the
30 following gives examples only.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention will be described by way of example only and with reference to the drawings, in which:

Figure 1 shows an exploded perspective view of a frame and cover according to a preferred embodiment of the present invention, the frame and cover in use forming the upper section of a subsurface utility chamber, the frame defining an opening for accessing the chamber, the cover defining a closure for the chamber and configured to engage with the frame.

Figure 2 shows a perspective view of the frame and cover of Figure 1 with the cover seated on, and engaged with, the frame, with tools for locking the cover in place on the frame also shown.

Figure 3 shows a perspective cross-section from above through two orthogonal planes of the seated and engaged frame and cover of Figures 1 and 2, the first cross-section taken along a longitudinal junction between the cover and frame and illustrating a complimentary sidewall profile that in use correctly locates the cover relative to the frame, and the second cross-section taken transverse to the cover and bisecting two retainers that form part of the cover and which in use engage with a complimentary interface on the frame to securely locate the cover in position.

Figure 4 shows a perspective cross-sectional view from below of the frame and cover of Figures 1 to 3 taken through a single vertical plane which transversely bisects the frame and cover, the cross-section also showing a detailed bisection view of two retainers that form part of the cover and which engage with a complimentary interface on the frame to securely locate the cover in position in use.

Figure 5 shows a close up detail view of one of the retainers of Figure 4, the retainer comprising a cam lock positioned between a leaf spring and an upper retainer housing, the upper retainer housing defining an opening in the top surface of the cover through which a tool can engage the base of the cam lock.

Figure 6 shows a perspective view of the frame and cover illustrated in Figure 2 with a tool shown positioned above the plate and aligned with one of the retainer openings, the tool used to engage and disengage the retainers, the tool having an actuation lever that extends perpendicularly from the tool and which can be moved between an engaged and a disengaged position.

Figure 7 shows a close up cross-section view of the tool of Figure 6 engaged with of one of the retainers of figure 4 or 5, the tool head illustrated projecting through the opening defined by upper retainer housing and engaged with the base of the cam lock, the stem of the

tool having a stem channel that engages with a complimentary lip on the upper retainer housing.

Figure 8 shows a perspective view of the frame, cover and tool of Figure 7 with the tool shown inserted into the retainer opening and the stem channel engaged with the retainer housing lip, the tool actuation lever shown in the disengaged position.

Figure 9 shows a perspective view of the frame, cover and tool of Figure 8 with the tool actuation arm shown depressed and rotated clockwise from the disengaged position to a transient position between the engaged and disengaged positions.

Figure 10 shows a perspective view of the frame, cover and tool of Figures 8 and 9 with the tool actuation arm shown secured in the engaged position.

Figure 11 shows a perspective view of a preferred form of utility chamber or jointing chamber of the present invention in use, the chamber having a main housing which is set below the frame and the surface of the road, a frame which is connected to the top of the main housing so that the frame has a top surface flush with the upper surface of a roadway or similar, the frame having a central aperture which allows access to the interior of the chamber, the central aperture closed by a removable hatch in use.

Figure 12a shows a perspective view from above of a preferred form of the frame of the present invention.

Figure 12b shows a perspective view from below of the frame of Figure 2a.

Figure 13 shows the frame of Figure 1 and Figure 2 in bottom view.

Figure 14 shows a cross-sectional view of one side of the frame of the present invention.

Figures 15, 16 and 17 show perspective views of the preferred form of main housing of the present invention.

Figures 18a and 18b show a perspective view from the top and bottom of a preferred embodiment of the hatch.

Figure 19 shows a cutaway view of one side of the chamber of the present invention in use, the main housing recessed below ground level, and the frame supported by the main housing above the housing, a connection mechanism connecting the frame and the housing.

Figure 20 shows detail of a connection mechanism used to connect the frame to the main body.

Figure 21 shows detail of a cable management bracket and a cable protection plate which are optional extras that can be installed with the chamber of the present invention.

Figure 22 shows the chamber of the preceding figures, with an extension unit used to raise the upper surface level of the frame.

Figures 22a and 22b show detail of a extension section that can be used with the chamber of the present invention, located between the main housing and the frame to raise the level of the frame.

Figure 23c shows a side cutaway view of the second preferred form of chamber, with the frame aligned at an angle to the housing, and held in position relative to the housing by adjustments to the connection mechanism which connects the two.

Figure 23d shows an end cutaway of the second preferred form of chamber, with detail of a concrete collar formed around the top portion of the chamber, and detail of an optional reinforcing steel hangar and reinforcing steel also shown.

Figure 24 shows a perspective cutaway view of the second preferred form of chamber installed in the ground, with removable concrete shuttering shown positioned inside the chamber to prevent concrete from entering the chamber during construction.

Figures 25a - c shows a second form of tool used to engage and disengage the retainers, the tool having a lever that extends from the top of the lower part of the tool and which can be moved between an engaged or vertical position where the lever pushes the tool actuation arm downwards against the spring, and a disengaged position where the lever is at an angle or horizontal/perpendicular to the lower part of the tool.

Figure 26 shows an exploded perspective view of a frame and cover according to a second preferred embodiment of the present invention, the frame and cover in use forming the upper section of a subsurface utility chamber, the frame defining an opening for accessing the chamber, the cover defining a closure for the chamber and configured to engage with the frame, the cover and frame having a complimentary sidewall profile that in use correctly locates the cover relative to the frame, the sidewall profile on all four sides of the rectangular cover and frame.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

A frame 200 and cover 100 are illustrated in Figures 1 and 2. Together, the frame 200 and cover 100 form a utility chamber cover assembly. In use, the frame 200 forms part of the upper section of a utility chamber and defines an opening for accessing the chamber. The cover 100 is configured to be seated with the frame 200 to provide a closure for the opening. The frame 200 and cover 100 are, in use, held together rigidly and unyieldingly so that when

any longitudinal tangential loading is applied to the cover, the cover remains in position relative to the frame. The preferred manner in which this can be achieved is outlined below. However, a person skilled in the art, having read the disclosure below, would realise that there are a number of ways in which the desired result could be achieved by variations of the preferred embodiment.

The frame 200 is configured to mount to the upper section of the utility chamber. The structure defining the chamber may comprise multiple frame sections (similar to the illustrated embodiment) or may be formed as a unitary frame. In both embodiments the chamber opening is closed by a suitable cover that seats with the top part of the frame defining the opening.

The frame 200 and cover 100 are particularly configured for use with a utility chamber that is formed below the surface of a road where high loading forces are anticipated. Such sub-surface chambers may house telecommunications equipment and/or other municipal utilities requiring access for maintenance checks, network expansions or other purposes.

The frame 200 defines an opening for accessing the sub-surface chamber. The shape and size of the frame 200 generally reflects a compromise between structural support for load bearing, and the need to provide adequate access to the chamber. The frame 200 defines a generally rectangular chamber opening.

The frame 200 generally comprises a seating interface or surface 202 and a peripheral flange 201. The seating interface or surface 202 of the preferred embodiment is formed from four frame sidewall sections that are connected to form a closed perimeter rectangle (however, it should be noted that the seating interface or surface could be circular, oval, trapezoidal, hexagonal, etc). The seating interface or surface 202 defines the perimeter of the chamber opening. The flange 201 is formed as a continuous element that runs around the perimeter of the seating interface or surface 202 and which extends outwards perpendicularly from the lower edges of the wall sections that form the seating interface or surface 202. The flange 201 has a plurality of regularly spaced fastener apertures that receive complimentary fasteners when the frame 200 is affixed to a lower frame section during assembly of the chamber structure. A plurality of reinforcing webs 204 extend between an outer surface of the seating interface or surface 202 and the upper face of the web 201. The reinforcing webs are generally regularly spaced around the perimeter of the seating interface or surface 202.

The cover 100 comprises a plate having a rectangular top surface 101 sized commensurately with the opening formed by the frame 200, and a sidewall 102. The sidewall

102 extends below the top surface 101 and is generally arranged about the periphery of the plate. The plate is preferably reinforced with webbing located within the confines of the top surface 101 and sidewalls 102 as visible in Figures 3 to 6. A lattice of webbing is provided below the top surface 101 of the plate (visible in Figure 4) in the embodiment shown. It should be noted, however, that the cover sidewalls (and, by extension, the webbing) are not a necessary feature of the cover. The cover assembly could work with a cover that has a retainer adapted to engage with the frame, but no sidewalls.

The cover 100 is illustrated seated with the frame 200 in Figure 2. The frame 200 receives the cover 100 so that the cover sidewall 102 is enclosed by the frame seating interface or surface 202. In use, the top surface 201 of the cover sits substantially flush with the top lip 207 of the walls that form the seating interface or surface 202, the lip 207 extending about the top of the seating interface or surface 202 when the cover 100 is seated.

Complimentary Cover and Frame Profile

The sidewall 102 of the cover 100 and the seating interface or surface 202 or sidewalls 202 of the frame 200 are complementarily profiled. In the illustrated embodiment the frame seating interface or surface 202 and the cover sidewall 102 are profiled with a reciprocal surface contour on their inner and outer faces respectfully. The contour is a stepped interface formed into the mating surfaces of the respective components to define a set of complimentary keys and keyways. In use, the keyed profile assists in locating the cover relative to the frame and can, if required, be arranged asymmetrically to facilitate a unique seating orientation. The stepped interface is profiled both in depth and height. That is, height (from top to bottom of the sidewalls), and depth (across the sidewalls). The dimensions of the profiling are chosen so as to best aid in stabilising the cover against longitudinal tangential loading.

The preferred embodiment of frame contour comprises a discontinuous boss that projects inwardly from the seating interface or surface 202. The most preferred form of frame boss comprises a series of truncated triangles 210 that are formed in, and arranged about, an inner face of one or both of the longitudinal sides or frame sidewalls of the seating interface or surface 202, and a ledge 205 that extends inwards from the base of one or both of the transverse sides. The truncated triangles have the appearance of generally trapezoidal shapes formed in relief from the sidewalls. That is, the side edges of the shapes formed in relief in the side walls are angled so that the shapes have the appearance of truncated triangles. The angles of the side walls are chosen so as to maximise the stability of the cover (and the frame)

against longitudinal loading. The frame boss is discontinuous at the corners of the frame 202 where adjacent ones of the longitudinal and transverse frame sidewalls intersect. The cover sidewall 102 has a complimentary boss that mirrors the boss on the frame 200 with truncated triangular recesses 106 on the longitudinal sides and a recessed step 105 at the base of the transverse sides.

It should be noted that although the most preferred embodiment has the truncated triangles located on one or both of the longitudinal sides, these could be located on the non-longitudinal sides as well as, or instead of, the longitudinal sides. If a non-four-sided shape is used (e.g. a circle or an oval), then one or more of the truncated triangles are located around the perimeter, either evenly spaced or non-evenly spaced. As used in this context, 'perimeter' indicates either a continuous sidewall, or a sidewall that is discontinuous around the outside the frame.

It is most preferred that the trapezoidal (truncated triangle) shapes are arranged in the side walls of the frame so that the shorter one of the parallel sides is at or towards the bottom of the frame. The trapezoidal shapes are sized and shaped such that there are two of these shorter sides on two opposed sides of the quadrilateral frame. The two shorter sides correspond to, and are mutually positioned with, cover retainers (described in detail below), the shorter sides also shaped to include a retention interface for receiving at least a portion of the retainer.

The top surfaces of the frame boss define a lip that the cover is seated on. The lip of the frame boss abuts with a complimentary lip on the cover (defined by the cover boss) to support the cover over the chamber and transmits loading on the cover 100 to the frame 200. The load transmitting interface between the illustrated cover 100 and frame 200 is therefore determined by the bearing surface area of the respective lips.

Alternate profile and loading arrangements are envisaged. A simple lip and recessed step arrangement (similar to the profile on the transverse sides of the frame 200 and cover 100) may be employed continuously about the respective components to support the cover over the opening. Alternatively, the cover sidewall may be received within a channel in the frame, with the shape of the cover sidewall defining a suitable profile that is mirrored within the channel. The disposition of the cover sidewall and the seating interface or surface of the frame may also be interchanged so that the cover straddles the frame with the sidewall enclosing the seating interface or surface.

However, the preferred form of the profiles of frame 200 and cover 100 as shown provides several advantages when applied to subterranean chambers that are subjected to tangential surface loading. Such loading is prevalent in roading applications.

5 Traffic passing over a subterranean chamber imparts both vertical and tangential force components on the cover. Vertical loading is attributable to the weight force of the vehicle. Tangential loading arises from the friction force between the top surface 101 of the cover 100 and the vehicle wheel and is related to the speed with which the vehicle is travelling.

10 Tangential loading can accelerate frame and cover wear, reducing the longevity of the components and presenting a potential hazard if not compensated for. The angled sidewall interface between the cover 100 and frame 200 supports and stabilises the cover against longitudinal tangential loading, reducing rocking and the potential for accidental disengagement. The noise generated by vehicles passing over the chamber is also reduced as the cover is more definitively located.

15 Ideally the angle of the cover interface is formed so that a reaction force that is normal to the bearing surfaces is produced in load conditions. However, the orientation of the reaction force depends on the mass and speed of the vehicle imparting the load force, and although the interface angle may be selected to reflect anticipated loading, it is unlikely to provide optimal support in all situations. In the preferred embodiment, the sidewall interface is angled at up to approximately 35° from either the horizontal or the vertical.

20 **Cover Retainers**

In use, the cover 100 is engaged with the frame 200 by seating the cover 100 in position and actuating four independent retainers 120 that are spaced about the plate. The retainers 120 interlock with a complimentary retention interface 220 on the frame 200 and urge the cover 100 and frame 200 together. The biasing force provided by the retainers further reduces movement of the cover. The retainers engage with the frame to rigidly and/or unyieldingly secure the cover and frame in position relative to one another. The preferred form of the retainers is most clearly illustrated in Figures 3 to 6.

30 Each retainer 120 includes a rotatable barrel 121 which has a latch 122. The barrel 121 and latch 122 are located in an aperture or recess in the cover 100, the recesses/apertures disposed generally towards the corners of the cover 100. The latch 122 is formed in a lower extremity of the barrel 121. A tool interface 123 is provided at an upper extremity of the barrel 121. The barrel 121, latch 122 and tool interface 123 are formed as a unitary component in the preferred embodiment.

The barrel 121 sits within, and is laterally restrained by, a sleeve 125. The sleeve 125 encloses a mid-section of the barrel 121 between the tool interface 123 and the latch. The sleeve 125 and barrel 121 have complimentary limit stops to restrain upward movement of the barrel. The barrel limit stop 124 is a circumferential disc-shaped flange that extends about the barrel 121 adjacent the latch 122. The lower face of the sleeve 125 provides a complimentary limit stop. The respective limit stops provide an upper bound to vertical translation of the barrel 121 - when the limit stop 124 contacts the lower face of the sleeve 121, it cannot move any further upwards.

The preferred form of sleeve 125 also incorporates a low friction bushing 127. The bushing 127 is disposed within the sleeve 125 between an inner surface of the sleeve 125 and an outer surface of the barrel 121 to reduce resistance to movement of the barrel 121. The sleeve 125 and the bushing 127 are interlocked by a complimentary key and keyway so that the bushing 127 cannot move laterally (i.e. up and down) within and relative to the sleeve 125. The bushing 127 is preferably fabricated from TeflonTM or another suitable low friction material.

The upper extremity of the sleeve 125 terminates in a circumferential disc 126 which extends outwards perpendicular to the lower or main part of the sleeve 125. A retainer cap 130 is arranged coaxially above the barrel 121 and sleeve 125. The retainer cap 130 is generally cylindrical and hollow, and sit within the aperture or recess in the cover 100. In use, the upper surface of the disc 126 abuts with the lower surface of the retainer cap 130. The preferred form of the disc 126 includes a circumferential rebate formed about the perimeter of the upper surface. The rebate is generally commensurate with a lower internal edge of the retainer cap 130, so that the sleeve 125 and retention cap 130 can be mutually interlocked by an interference fit that laterally restrains the sleeve 125 and barrel 121 with respect to the retainer cap 130. The retainer cap 130 and sleeve 125 may alternatively be fabricated as a unitary component.

The hollow cylindrical retainer cap 130 defines an open ended cavity that houses the barrel tool interface 123. The upper end of the retainer cap 130 terminates in an opening adjacent the plate top surface 101. The opening provides access through the top surface 101 to the barrel 121. The open end of the of the retainer cap 130 may be sheathed with a removable lid (not shown in the figures) to reduce runoff of surface water into the cavity. The most preferred form of retainer cap 130 has an upper flange that in use rests against the top surface of the plate 100 to hold the cap 130 in position - to stop the cap 130 passing through

the cover 100. The preferred form of the cover 100 can be recessed around the aperture or recess to produce a roughly flat upper surface across the top of the cover 100.

The upper opening of the retainer cap is generally circular. Two placement lugs 131 project inwardly from opposed sides of the opening perimeter. The lugs 131 are generally symmetric in shape, and are disposed symmetrically about the opening - i.e. on directly opposite sides of the opening. Each of the lugs 131 extends around a section of the opening perimeter along an arc or portion of the perimeter of the opening.

The barrel 121 is biased upward toward retainer cap 130 and top surface 101 of the plate by a biasing spring 135. The biasing spring 135 is disposed below the barrel 121 and takes the form of a leaf spring. The biasing spring 135 is supported by a portion or support face 136 of the cover 100, the cover 100 shaped to include the support face 136. Each one of the retainers has an equivalent individual biasing spring. Part of the upper surface of the biasing spring 135 presses against the lower end of the barrel 121 in use and pushes the barrel 121 upwards.

The cover 100 must be adequately seated with the frame 200 before the retainers 120 can be actuated to secure the cover 100 in position. When the cover 100 is seated, the base of each retainer 120 is situated adjacent a complimentary retention interface 220 in the frame 200, as shown in Figure 6. The retention interface 220 provides a compatible ledge for the latch 122 to slot under and engage with to interlock the cover 100 with the frame 200. The preferred form of retention interface is a cut-out section 220 in the frame sidewall, the cut-out section close to the latch 122 portion of the retainer when the cover is in position in use, the outer end portion of the latch rotating into the cut-out section so that the upper surface of the latch contacts the downwards-facing surface of the cut-out section. Preferably there are four cut-out sections, two on each of the longitudinal sidewalls of the frame, close to the corners of the frame.

To actuate each retainer 120, the barrel 121 is depressed against the biasing force of the leaf spring 135 and rotated a quarter turn. Depressing the barrel 121 provides clearance between the latch 122 and the retention interface 220, allowing the latch 121 to move without interference with the frame 200. The latch 122 is rotated from a disengaged position (aligned longitudinally with the plate), to an engaged position (transverse to the plate), where the latch 122 slots underneath the ledge 220 to engage the cover 100 with the frame 200.

The depressing force can be removed from the barrel when the latch 121 is positioned under the ledge 220. The removal of the depressing force causes the biasing force of the leaf

spring 135 to be transmitted through the barrel 121, to the latch 121, to the retention interface 220. This has the overall effect of urging the cover 100 toward the frame 200 and securely interlocking the cover 100 in position.

Similarly, the barrel 121 must be depressed by a depressing force on the cover 100 before the retainers 120 can be disengaged. Disengagement is achieved by rotating the barrel 121 through a quarter turn in the reverse direction to that used to engage or actuate the retainers. The biasing spring 135 retains the barrel limit stop 124 against the retainer sleeve 125 when the retainer 120 is disengaged and when there are no external forces acting on the barrel 121.

The biased retention mechanism further reduces play between the components during dynamic loading and helps to impede unauthorised removal of the cover.

Retainer Actuation Tool

A first embodiment of a tool for actuating the retainers 120 is illustrated in Figures 6 to 10. The tool 300 has a staggered actuation mechanism that is deployed over two distinct phases. The lower end of the tool 300 is illustrated in Figure 6, clear of the upper opening of the retainer 120, and ready for insertion into the top opening of the retainer 120. The actuation mechanism 305 is orientated for insertion into one of the retainer openings.

The actuation mechanism 305 comprises a lower section of the tool 300, and includes an outer stem 330 that has a pair of channel lugs 331 extending perpendicularly from the outer stem 330, the lugs 331 opposed circumferentially and positioned adjacent a lower extremity of the outer stem 330. The lugs 331 define the discontinuous lower lip of a circumferential channel 332 which runs between an upper lip 334 and the discontinuous lower lip defined by the lugs 331. The upper lip 334 of the channel 332 is spaced from the lower lip by an offset commensurate with the thickness of the placement lugs 131 of the retainer cap 130.

Similarly to the arrangement of the placement lugs 131 about the retainer cap 130 opening, the channel lugs 331 are disposed symmetrically about the tool stem 330. The arc length of the channel lugs 331 is roughly equivalent to the arc length of the placement lugs 131, with the respective lugs each spanning less than a quarter of a circle to provide a complimentary gap for the reciprocal lugs to fit between when the tool 300 is inserted into the retainer cap 130 opening.

The depth to which the tool 300 can be inserted into the retainer cap 130 is set by the position of the upper lip 334. Abutment of the upper channel lip 334 with the placement lugs 131 prevents further insertion of the tool 300 into the retainer cap 130 and defines the

distance between the tool head 323 and the tool interface 123 on the barrel 121. Following insertion of the tool 300, the actuation mechanism 305 is interlocked with the retainer cap 130 by rotating the tool stem 330 through half a turn so that the channel lugs 331 become generally aligned below the placement lugs 131. Aligning the respective lugs locates and
5 secures the tool in position, as illustrated in Figure 8.

The tool head 323 is disposed on the lower end of an extensible shaft 320 that is housed within the stem 300. The shaft 320 is shown in an extended position from the stem 330 in Figure 7 and retracted within the stem in Figure 6. The stem 320 and shaft 320 are arranged concentrically. The shaft 320 is extended from the stem 330 and the tool head 323 engaged
10 with the tool interface 123 on the barrel 121 by partially depressing the actuation lever 301 - i.e. towards the plate 100 from the position shown in Figure 6. Further depression of the actuation lever subsequent to engagement of the tool head 323 with the tool interface 123 is opposed by the biasing spring 135.

The tool 300 may utilise hydraulic or pneumatic assistance to offset the biasing force of the leaf spring 135. As shown in Figure 8, a pneumatic canister 306 is engaged with the tool
15 300 in the illustrated embodiment. The canister 306 and associated pneumatic system in the actuation mechanism 305 supplies the driving force to depress the shaft 320 against the biasing force of the leaf spring 330. The tool is located and translationally restrained during actuation of the retainer 120 by the interlocking channel 332 and placement lugs 131.

The illustrated tool head 323 and tool interface 123 comprise complimentary driving faces disposed on opposing sides of the tool head 323 and barrel 121 respectively. The illustrated driving faces are reciprocal flattened sections defined by a chord intersecting the respective cylinders on opposed side. The symmetrical flats permit the tool head 323 to impart a torque to the tool interface 123 and drive the barrel 112 and latch 122 rotationally.
20 The latch 122 is rotated by manually rotating the actuation lever 301 through a quarter turn as illustrated in Figures 8 to 10.

A second embodiment of tool is shown in figures 25a – c. The lower end of the tool is the same as or very similar to that described above for the first embodiment above. In a similar manner to that described above, following insertion of the tool, the actuation
30 mechanism is interlocked with the retainer cap by rotating the tool stem through half a turn so that the channel lugs become generally aligned below the placement lugs. Aligning the respective lugs locates and secures the tool in position. The rotation of the tool stem in the second embodiment is achieved by means of rotation of two manual actuation levers 1000

located generally on opposed sides of the tool stem so that the levers can be gripped and the tool stem rotated.

In a similar manner to the first embodiment, the tool head is disposed on the lower end of an extensible shaft that is housed within the stem, the stem and shaft arranged
5 concentrically. In this second embodiment, the stem is engaged with the cover so that it is fixed in position relative to the cover vertically.

A lever 1001 extends from the top of the lower end of the tool. The lever can be moved between a disengaged position where the lever is at an angle or
horizontal/perpendicular to the lower part of the tool, and the shaft is in an upwards position,
10 to and upright, engaged or vertical position. As the lever 1001 is moved to wards the vertical position, the lower end of the lever presses down on the top of the shaft, which is pushed down against the spring to disengage the spring from the latch so that the lever can be rotated in the vertical using the handle 1002 to unlock the cover latch.

The foregoing description of the invention includes preferred forms thereof.

15 Modifications may be made thereto without departing from the scope of the invention.

It should also be noted that directional terms such as 'upwards', 'downwards' 'upper', etc have been used in this specification. It is to be noted that these terms are used in relation to an 'in use' state where the upper surface of the cover is aligned substantially horizontally. It is, of course, not necessary that the chamber cover assembly system described above be used in
20 this orientation - it could be used rotated through up to 90 degrees or more onto it's side, or even upside-down (rotated through up to 180 degrees) if required. The directional terms are used as indicative terms only and are not intended to limit the use to one specific or even general orientation.

An alternative jointing or utility chamber 1 is shown in Figure 11. The chamber 1 has
25 three main parts: a main housing 20, a frame 3 which in use forms the upper part of a utility chamber, and provides or defines the opening thereto and communicates to the utility chamber below, and a removable hatch 4 which closes the opening in use.

Frame

As shown in figures 12a and 12b, the frame 3 has a generally rectangular outline when
30 viewed in plan, with a central opening or aperture 5 that passes through from the upper surface 18 of the surround of the frame 3. When the frame is installed the aperture 2 allows access to the inside of the utility chamber located below.

In cross-section, each of the four sides of the frame 1 has the shape of an inverted U or channel, as shown in Figure 14. The base portion defining the base of the inverted U channel is preferably flat and defines the upper surface 18 and surround of the frame 1. The sides of the U form two walls that extend or depend downwards from the surround when the frame 1 is aligned for use. The two walls are an inner wall 7 that runs around the inner edge central aperture 2, and an outer wall 6 that bounds the outer edge of the upper surface 18.

In the preferred form the outer wall 6 depends from the outer edge of the upper surface 18. The inner wall 7 may extend all the way down, or as shown may extend partially down before it steps or flanges inwards to form a hatch lip 11. The hatch lip 11 then has an extension or leg as shown that extends further downwards to present a downwardly directed bearing surface. The hatch lip 11 runs around a lower edge of the inner wall 7, projecting inwards from the aperture 2 to provide an upward facing hatch support surface.

In the preferred form, holes pass through the hatch lip 11, spaced at intervals around the periphery of the hatch lip 11. Typically, in the preferred embodiment, there are four holes, two on each of the longer sides of the hatch lip 11, positioned in pairs opposite each other. That is, the positions of the holes on one side correspond to the position of the holes 4 on the opposite. In alternative embodiments, the holes can be replaced by cutouts or notches if preferred.

In the preferred embodiment shown the hatch lip 11 is continuous about the central aperture 2. However in other embodiments the hatch lip 11 may be only present where needed e.g. for holes and for supporting the hatch 4.

The hollow central part of the frame 3 is divided into compartments by webs, spaced at intervals and running between the inner and outer walls 6, 7. These run perpendicular to the inner and outer walls except at the corners of the frame, where four of the webs run diagonally from the inner corners to the outer corners. The function of the webs is two-fold. The first of these is to impart strength to the frame 1. The second is to form part of a downwardly directed bearing surface.

In the preferred embodiment each of the webs join the outer and inner walls respectively. However in other embodiments where strength is not required so much as sufficient bearing surface they may join to one or two of the walls.

The inner and outer walls and the webs all extend so far to present a co-planar single or multiple surface that presents as a downwardly directed bearing surface 10.

The frame 3 (and hatch 4) are usually formed from a metal material e.g. die cast, cast or moulded aluminium, cast iron or steel. This can become slippery when wet, an undesirable characteristic for surfaces that require traction, e.g. road or foot traffic surfaces. Although as stated above, the inner and outer walls in one embodiment do not overlap above the upper surface, in another embodiment they can. The result is that the central part of the frame (the 'underside' of the u-shape) is recessed to form a shallow depression. The recessed area can therefore be filled with material that will increase the amount of grip on the uppermost surface – e.g. a thin layer of tarmac, paving or other grip enhancing material. Alternatively, a thin layer of textured rubber matting, resin or similar could be disposed in the recessed area.

The recessed area may alternatively be textured to provide sufficient grip e.g. raised stipples or similar. This stippling may also provide a keying to any material that is located in the recessed area.

The hatch 4 may also be recessed to receive a similar surface treatment.

The hatch 4 and frame 1 may be coloured also if desired either directly by the material of their construction or by application of secondary materials, e.g. paints, resins, coloured finishes (including concretionous surface finishes).

The hatch 4 is sized to fit the aperture 2, with the edges of the hatch 4 resting on the lip 11.

Hatch

The hatch 4 is preferably formed as a single planar panel, strengthened on its underside by a number of flanges, aligned perpendicular to the under surface of the hatch, so that they face vertically downwards when the hatch 4 is in position. A number of these flanges are aligned running lengthways and crossways across the underside of the hatch, parallel and perpendicular to each other, as shown.

Main housing

As shown in figures 15, 16, and 17, the preferred embodiment of main housing is formed from a base, two long side walls connected at their lower edges to the base so that they are both vertical and aligned perpendicular to the base, the two walls substantially parallel to one another, and two shorter side walls which connect between the longer side walls. The two shorter side walls and the two longer side walls all have a top flange, generally numbered as 100 on all four of the walls, which extends horizontally outwards from the top of the wall. When the walls are connected, from above, the flange has the appearance of a continuous unbroken loop. The walls are connected so that the flange is located at the same height all the

way around the closed perimeter. The two shorter walls, which are located opposite each other in the preferred form, have a lower edge which is located some way above the base of the main housing when the shorter walls are connected to the longer walls, so that apertures are formed at each end to allow cables, pipes or similar to be routed to pass through the chamber.

In use, the frame 3 is placed on top of the main housing 20, with the lower bearing surfaces 10 in direct contact with the upper flange 100 of the main housing. The frame and the main housing are connected together. This connection is achieved using a connection mechanism. In the preferred embodiment this mechanism is threaded bolts which pass through complementarily aligned holes in the frame and housing, with nuts screwed onto the threaded bolts to clamp the frame and housing together. These threaded bolts and nuts, and the corresponding apertures in the frame and housing, are shown generally as items 200 in figures 11 and 19. Detail of the connection mechanism is shown in the breakout box of Figure 20.

Method of installation

The method of installation of the utility chamber 1 will now be described. This method will firstly be described in relation to installation in ground with a horizontal surface, and with the assumption that the upper surface of the chamber can be aligned substantially with the surface of the ground without excessive difficulty. Firstly, a void, cavity, pit or hole is created. This receives and supports and holds the utility chamber 1. The base of the hole is formed from compacted bedding of sand, blue chip or similar, with a nominal depth of 200mm. However, this bedding depth is adjusted to ensure that the chamber base is accommodated at the right height so that the cover matches the finished ground level. The main housing 20 is placed into the pit pre-assembled, or is assembled in situ.

The frame is then placed on top of the housing, so that as stated above, when the frame is placed on top of the main housing, its upper surface will be level with the surface of the ground. The lower bearing surfaces of the frame rest directly onto the flange 100 of the main housing.

The main housing and the frame are then connected together using the connection mechanism 200.

Once the main housing is in place, the gap between the walls of the hole and the outer surfaces of the walls of the housing is filled with compacted backfill 150, up to a point at or close to the upper surface of the frame. As shown in figure 19, a layer of tarmac surfacing

300, pavers 400 or similar can be added, this serving to align the plane of the top surface of the frame with the surface of the ground.

As shown in the breakout boxes on figures 11 and 19, the frame rest directly on the housing, so that there is no gap between the upper surface of the flange 100 on the housing,
5 and the lower bearing surfaces of the frame.

Optional extras

Optional extras which can be used with the chamber include a cable management bracket 500 such as the one shown in figure 21, which is connected to one wall to assist in managing lengths of cable, and a cable protection plate 501, which can be used to shield the
10 cable from items descending from above.

Variants

Height extension

It can be seen that the preferred embodiment of the invention described above is most useful when the upper surface of the ground is level and is unlikely to change. However, the
15 level of road surfaces can change, for example as further layers of bitumen or tarmac are added. Also, the chambers are a standard depth, which may be too little if, for some reason, a deeper hole than usual is required.

Figures 22 and 23 show detail of a extension section 560 that can be used with the chamber of the present invention. The extension section 560 is located between the main
20 housing and the frame to raise the level of the frame. The extension is formed from four wall sections 561, as shown in figure 23a. Each of the wall sections 561 has a lower flange 562 and an upper flange 563. In use, the wall sections that form the extension section 560 are placed on top of the main housing so that the lower flanges 562 sit flush with the flange 100 of the main housing. The frame is then place on top of the extension section so that the
25 lower bearing surfaces of the frame rest against the upper flange 563. The connection mechanism described above can be used to connect the frame the extension and the housing together, by passing threaded bolts through holes in each of the members, the holes aligned linearly to allow the passage of the bolts, and then tightening nuts onto the bolts, the nuts located at appropriate positions along the length of the bolts. The overall effect is to raise the
30 level of the upper surface of the frame by the height of the extension 560.

Sloped surface

If the level of the surface into which the chamber is going to be located is sloped rather than level, then a variation of the present invention can be used to ensure that the upper

surface (i.e. the outer part of the frame and the hatch) conforms to the ground slope. This is described below.

The base/main housing are located into the hole in the same or similar manner to that outlined above for the level ground installation, with the top flange of the housing below the surface of the ground at all points.

The frame is then positioned over the housing. In this variant, as shown in Figure 23, the frame is positioned with its lower surface (which in the level ground embodiment was in contact with the upper surface of the flange) clear of the upper surface of the flange. The frame is held in position by adjustment of the connection mechanism - in the preferred embodiment by adjusting the location of the nuts on the threaded bolts so the frame rests (on the nuts) at an angle relative to the housing. The frame is not required to be out of contact with the housing at all points. It may contact the housing e.g. at a corner or edge. However, as the frame and the housing will be aligned at different angles, there will be gaps most of the way around the perimeter. The angle of the frame is adjusted so that it is parallel to the surface of the surrounding ground. As shown in Figure 24, concrete shuttering is positioned inside the frame and housing, to prevent concrete from entering the interior of the housing through the gaps.

In this embodiment, a countersunk edge trench has been dug around the top part of the hole before the housing and frame are located into the hole. Therefore, there is a gap between the outer edges of the walls of the frame and the upper part of the walls of the housing. Concrete is poured into this gap to form a concrete collar around the frame and the upper part of the housing. In the most preferred embodiment, a reinforcing hanger is connected to, and extends outwardly from, the frame, so that it is located in the trench and will be covered by the concrete once poured. The hanger holds two rings of reinforcing steel rods, the rods forming a substantially continuous ring around the perimeter of the frame, the two rings having slightly different sizes so that they are located at slightly different distances from the frame, around the frame. The ring may not actually be continuous or unbroken - it may have gaps e.g. at the corners, and when a substantially unbroken or continuous ring is referred to, it should be taken to include a ring which has at least one or more small gaps. The reinforcing hanger and the associated rods are optional.

It should be noted that different sizes and shapes of chamber and frame other than those described and shown could be utilised. For example square, circular or oval or other

shaped frames could be used without departing from the inventive concept described and claimed.

The foregoing description of the invention includes preferred forms thereof. Modifications may be made thereto without departing from the scope of the invention.

CLAIMS

What we claim is:

1. **A cover assembly for a utility chamber** or similar, comprising:

a frame comprising a side wall or walls that form the perimeter of an opening which
5 passes through said frame, said opening in use forming an entry or opening into said utility chamber, said side wall or walls also forming or defining a seating interface or surface,

a cover, seating with said seating interface or surface in use and comprising a generally planar upper section sized to close or fill said opening in use,

10 at least one retainer attached to, or forming part of, said cover, said retainer adapted to in use engage with said frame to rigidly and/or unyieldingly secure said cover and frame in position relative to one another.

2. A cover assembly as claimed in claim 1 wherein said cover and said frame are mutually adapted so that in use with said retainer engaged with said frame, said cover and said frame are stabilised against movement relative to one another.

15 3. A cover assembly as claimed in claim 1 or claim 2 wherein said frame further comprises a spring, said spring engaging with said retainer in use to assist in rigidly and/or unyieldingly securing said cover and frame in position relative to one another.

4. A cover assembly as claimed in any one of claims 1 to 3 wherein said retainer
20 comprises at least in part a movable latch configured to act between said cover and said frame, said latch being movable between a frame engaging position and a retracted or non-frame engaging position.

5. A cover assembly as claimed in any one of claims 1 to 4 wherein said retainer comprises or includes;

a barrel accessible through said generally planar upper section of said cover,

25 a latch extending outwards from said barrel at the lower end, said latch having an outer end portion which engages with said frame when said barrel is rotated into a frame engaging position,

a sleeve, said cover and said sleeve mutually adapted so as to retain said sleeve in position relative to said cover, said sleeve enclosing at least a mid-section of said barrel and
30 laterally restraining said barrel.

6. A cover assembly as claimed in claim 5 wherein an upper part of said barrel is formed or configured as a tool interface.

7. A cover assembly as claimed in claim 5 or claim 6 wherein when said barrel is rotated into a frame engaging position, an upper surface of said latch contacts and presses against a downwards-facing surface of said frame.

8. A cover assembly as claimed in any one of claims 3 to 7 where said spring engages
5 with said barrel to apply an upwards force to said barrel.

9. A cover assembly as claimed in claim 8 wherein said spring is a leaf spring.

10. A cover assembly as claimed in any one of claims 5 to 9 wherein said sleeve further comprises a low friction bushing disposed within said sleeve to contact the outer surface of said barrel where said sleeve encloses said barrel.

10 11. A cover assembly as claimed in any one of claims 7 to 10 wherein said frame includes at least one cut-out section in said at least one sidewall, close to said retainer when said cover is in position in use, said outer end portion of said latch rotating into said cut-out section so that the upper surface of said latch contacts the downwards-facing surface of said cut-out section.

15 12. A cover assembly as claimed in claim 11 or claim 12 wherein said low friction bushing and said sleeve are translationally interlocked, or interlockable, by a complimentary key and keyway formed in said bushing and said sleeve.

13. A cover assembly as claimed in any one of claims 5 to 12 wherein
said barrel further comprises a limit stop located above said latch, and
20 said sleeve further comprises a complimentary lip located on the lower surface of said sleeve,

said limit stop and said complimentary lip configured to engage with one another in use to limit upward translation of the barrel.

14. A cover assembly as claimed in claim 13 wherein said low-friction bushing facilitates
25 rotation and translation of said barrel relative to the sleeve.

15. A cover assembly as claimed in claim 13 or claim 14 wherein said spring biases said barrel upwards such that said limit stop is engaged with said complimentary lip of said sleeve when said retainer is disengaged or moved into the retracted or non-frame engaging position (for example when no external forces are applied to the cover).

30 16. A cover assembly as claimed in any one of claims 5 to 15 wherein said retainer further comprises or includes a generally cylindrical and hollow retainer cap, and said cover further comprises or includes at least one aperture, said retainer cap located in said aperture and arranged coaxially above said barrel and said sleeve.

17. A cover assembly as claimed in claim 16 wherein an upper surface of said sleeve abuts with the lower surface of said retainer cap, said upper surface having a circumferential rebate formed about the perimeter of said upper surface, said rebate generally commensurate with a lower internal edge of said retainer cap so that said sleeve and said retention cap can be mutually interlocked by an interference fit that laterally restrains said sleeve and said barrel with respect to said retainer cap.

18. A cover assembly as claimed in any of the preceding claims wherein said cover assembly includes four retainers, each individually movable between a frame engaging position and a retracted position, each retainer being accessible through or via the top surface of said cover.

19. A cover assembly as claimed in any one of the preceding claims wherein said cover also includes or further comprises cover side walls extending downwards from the underside of said generally planar upper section, at least a portion of the cover sidewall or sidewalls profiled in both depth and height to in use engage with complimentary profiled portions formed in said frame sidewall or walls, said profiled portions defining a keyed profile to position the cover relative to the frame and stabilise said cover and said frame against movement relative to one another.

20. A cover assembly as claimed in claim 19 wherein said cover and frame sidewall face profiles are generally trapezoidal shapes formed in relief from said sidewalls, the side edges of said sidewall face profiles angled such that said trapezoidal shapes have the form of truncated triangles, said profiles formed and shaped so that said cover can be mated with said frame by inserting said cover into said frame from above.

21. A cover assembly as claimed in claim 19 or claim 20 wherein said profiles are formed with said side edges arranged at an angle that maximises the stability of said cover and said frame against movement relative to one another.

22. A cover assembly as claimed in any one of claims 19 to 21 wherein said cover further comprises or includes at least one retainer attached to, or forming part of, said cover, said retainer adapted to in use engage with said frame to rigidly and/or unyieldingly secure said cover and frame in position relative to one another.

23. A cover assembly as claimed in claim 22 wherein said cover includes or further comprises four of said retainers.

24. A cover assembly as claimed in claim 23 wherein said cover has a quadrilateral shape in plan view, said retainers arranged two each on two opposed sides of said quadrilateral.

25. A cover assembly as claimed in claim 24 wherein said trapezoidal shapes are arranged in the side walls of said frame such that the shorter of the parallel sides is located at or towards the base of said frame, said trapezoidal shapes sized and shaped such that there are two of said shorter sides on two opposed sides of said quadrilateral, corresponding to, and mutually positioned with, said retainers, said shorter sides shaped to include a retention interface for receiving at least a portion of said retainer.

26. **A cover assembly** for a utility chamber or similar, comprising:

a frame comprising a side wall or walls that form the perimeter of an opening which passes through said frame, said opening in use forming an entry or opening into said utility chamber, said side wall or walls further forming or defining a seating interface or surface,

a cover, seating with said seating interface or surface in use and comprising a generally planar upper section sized to close or fill said opening in use, said cover further comprising a sidewall or sidewalls extending from the underside of said upper section,

at least a portion of the cover sidewall or sidewalls profiled in both depth and height to in use engage with complimentary profiled portions formed in said frame sidewall or walls, said profiled portions defining a keyed profile to position the cover relative to the frame and stabilise said cover and said frame against movement relative to one another.

27. A cover assembly as claimed in claim 26 wherein said cover and frame sidewall face profiles are generally trapezoidal shapes formed in relief from said sidewalls, the side edges of said sidewall face profiles angled such that said trapezoidal shapes have the form of truncated triangles, said profiles formed and shaped so that said cover can be mated with said frame by inserting said cover into said frame from above.

28. A cover assembly as claimed in claim 26 or claim 27 wherein said profiles are formed with said side edges arranged at an angle that maximises the stability of said cover and said frame against movement relative to one another.

29. A cover assembly as claimed in any one of claims 26 to 28 wherein said cover further comprises or includes at least one retainer attached to, or forming part of, said cover, said retainer adapted to in use engage with said frame to rigidly and/or unyieldingly secure said cover and frame in position relative to one another.

30. A cover assembly as claimed in claim 29 wherein said cover includes or further comprises four of said retainers.

31. A cover assembly as claimed in claim 30 wherein said cover has a quadrilateral shape in plan view, said retainers arranged two each on two opposed sides of said quadrilateral.

32. A cover assembly as claimed in claim 31 wherein said trapezoidal shapes are arranged in the side walls of said frame such that the shorter of the parallel sides is located at or towards the base of said frame, said trapezoidal shapes sized and shaped such that there are two of said shorter sides on two opposed sides of said quadrilateral, corresponding to, and mutually positioned with, said retainers, said shorter sides shaped to include a retention interface for receiving at least a portion of said retainer.

33. A cover assembly as claimed in any one of claims 26 to 32 wherein said frame further comprises at least one spring, each of said spring or springs engaging with an equivalent one of said retainers in use to assist in rigidly and/or unyieldingly securing said cover and frame in position relative to one another.

34. A cover assembly as claimed in any one of claims 29 to 33 wherein said retainer comprises at least in part a movable latch configured to act between said cover and said frame, said latch being movable between a frame engaging position where said latch is engaged with said retention interface and a retracted or non-frame engaging position.

35. A cover assembly as claimed in any one of claims 29 to 34 wherein said retainer comprises or includes;

a barrel accessible through said generally planar upper section of said cover,

a latch extending outwards from said barrel at the lower end, said latch having an outer end portion which engages with said frame when said barrel is rotated into a frame engaging position,

a sleeve, said cover and said sleeve mutually adapted so as to retain said sleeve in position relative to said cover, said sleeve enclosing at least a mid-section of said barrel and laterally restraining said barrel.

36. A cover assembly as claimed in claim 35 wherein an upper part of said barrel is formed or configured as a tool interface.

37. A cover assembly as claimed in any one of claims 33 to 36 where said spring engages with said barrel to apply an upwards force to said barrel.

38. A cover assembly as claimed in claim 37 wherein said spring is a leaf spring.

39. A cover assembly as claimed in any one of claims 5 to 9 wherein said sleeve further comprises a low friction bushing disposed within said sleeve to contact the outer surface of said barrel where said sleeve encloses said barrel.

40. A cover assembly as claimed in any one of claims 32 to 39 wherein each of said retention interfaces is a cut-out section in said sidewall, close to said retainer when said cover

is in position in use, said outer end portion of said latch rotating into said cut-out section so that the upper surface of said latch contacts the downwards-facing surface of said cut-out section.

41. A cover assembly as claimed in claim 39 or claim 40 wherein said low friction bushing and said sleeve are translationally interlocked, or interlockable, by a complimentary key and keyway formed in said bushing and said sleeve.

42. A cover assembly as claimed in any one of claims 35 to 41 wherein said barrel further comprises a limit stop located above said latch, and said sleeve further comprises a complimentary lip located on the lower surface of said sleeve,

said limit stop and said complimentary lip configured to engage with one another in use to limit upward translation of the barrel.

43. A cover assembly as claimed in claim 42 wherein said low-friction bushing facilitates rotation and translation of said barrel relative to the sleeve.

44. A cover assembly as claimed in claim 42 or claim 43 wherein said spring biases said barrel upwards such that said limit stop is engaged with said complimentary lip of said sleeve when said retainer is disengaged or moved into the retracted or non-frame engaging position (for example when no external forces are applied to the cover).

45. A cover assembly as claimed in any one of claims 35 to 44 wherein said retainer further comprises or includes a generally cylindrical and hollow retainer cap, and said cover further comprises or includes at least one aperture, said retainer cap located in said aperture and arranged coaxially above said barrel and said sleeve.

46. A cover assembly as claimed in claim 45 wherein an upper surface of said sleeve abuts with the lower surface of said retainer cap, said upper surface having a circumferential rebate formed about the perimeter of said upper surface, said rebate generally commensurate with a lower internal edge of said retainer cap so that said sleeve and said retention cap can be mutually interlocked by an interference fit that laterally restrains said sleeve and said barrel with respect to said retainer cap.

47. A cover for use as part of a cover assembly for a utility chamber or similar, said cover comprising:

a generally planar upper section,

a sidewall or sidewalls extending from the underside of said upper section,

at least a portion of said sidewall or sidewalls profiled in both depth and height to in use engage with complimentary profiled portions formed in a corresponding portion of another component of said cover assembly, said profiled portions defining a keyed profile to position the cover relative to said other component and stabilise said cover against movement relative to one another.

48. A cover as claimed in claim 47 wherein said cover sidewall profile is generally trapezoidal shapes formed in relief from said sidewall or sidewalls, the side edges of said sidewall face profiles angled such that said trapezoidal shapes have the form of truncated triangles, said profiles formed and shaped so that said cover can be mated with another component in said cover assembly by inserting said cover from above.

49. A cover as claimed in claim 47 or claim 48 wherein said profiles are formed with said side edges arranged at an angle that maximises the stability of said cover and said frame against movement relative to one another.

50. A cover as claimed in any one of claims 47 to 49 wherein said cover further comprises or includes at least one retainer attached to, or forming part of, said cover, said retainer adapted to in use engage with another part of said cover assembly in use to rigidly and/or unyieldingly secure said cover in position.

51. A cover as claimed in claim 50 wherein said cover includes or further comprises four of said retainers.

52. A cover as claimed in claim 51 wherein said cover has a quadrilateral shape in plan view, said retainers arranged two each on two opposed sides of said quadrilateral.

53. A cover as claimed in claim 52 wherein said trapezoidal shapes are arranged in the side walls of said cover such that the shorter of the parallel sides is located at or towards the base of said cover, said trapezoidal shapes sized and shaped such that there are two of said shorter sides on two opposed sides of said quadrilateral.

54. A cover as claimed in any one of claims 50 to 53 wherein said retainer comprises at least in part a movable latch configured to act between said cover and the remainder of said cover assembly, said latch being movable between a frame engaging position where said latch is engaged with a retention interface adapted to hold said cover in position and a retracted or non-frame engaging position.

55. A cover as claimed in any one of claims 50 to 54 wherein said retainer comprises or includes;

a barrel accessible through said generally planar upper section of said cover,

a latch extending outwards from said barrel at the lower end, said latch having an outer end portion which engages with said frame when said barrel is rotated into a frame engaging position,

a sleeve, said cover and said sleeve mutually adapted so as to retain said sleeve in position relative to said cover, said sleeve enclosing at least a mid-section of said barrel and laterally restraining said barrel.

56. A cover as claimed in claim 55 wherein an upper part of said barrel is formed or configured as a tool interface.

57. A cover as claimed in claim 55 or 56 wherein said sleeve further comprises a low friction bushing disposed within said sleeve to contact the outer surface of said barrel where said sleeve encloses said barrel.

58. A cover as claimed in claim 57 wherein said low friction bushing and said sleeve are translationally interlocked, or interlockable, by a complimentary key and keyway formed in said bushing and said sleeve.

59. A cover as claimed in any one of claims 55 to 58 wherein said barrel further comprises a limit stop located above said latch, and said sleeve further comprises a complimentary lip located on the lower surface of said sleeve,

said limit stop and said complimentary lip configured to engage with one another in use to limit upward translation of the barrel.

60. A cover as claimed in claim 59 wherein said low-friction bushing facilitates rotation and translation of said barrel relative to the sleeve.

61. A cover as claimed in claim 59 or claim 60 wherein said limit stop engages with said complimentary lip of said sleeve when said retainer is disengaged or moved into the retracted or non-frame engaging position and an upwards force acts on said barrel sufficient to move said barrel upwards against any equivalent downwards forces.

62. A cover as claimed in any one of claims 55 to 61 wherein said retainer further comprises or includes a generally cylindrical and hollow retainer cap, and said cover further comprises or includes at least one aperture, said retainer cap located in said aperture and arranged coaxially above said barrel and said sleeve.

63. A cover as claimed in claim 62 wherein an upper surface of said sleeve abuts with the lower surface of said retainer cap, said upper surface having a circumferential rebate formed about the perimeter of said upper surface, said rebate generally commensurate with a lower

internal edge of said retainer cap so that said sleeve and said retention cap can be mutually interlocked by an interference fit that laterally restrains said sleeve and said barrel with respect to said retainer cap.

64. A cover as claimed in claim 62 or claim 63 wherein said retainer cap further comprises or includes at least one and preferably a pair of placement lugs projecting inwardly from opposed sides of the opening perimeter of said retainer cap at the top of said retainer cap.

65. A cover as claimed in any one of claims 47 to 64 wherein said cover further comprises or includes a lattice of reinforcing cross-members or reinforcing webbing extending downwards from the underside of said cover and running between said sidewalls.

66. **A frame** for use as part of a cover assembly for a utility chamber or similar, said frame comprising:

a side wall or walls that form the perimeter of an opening which passes through said frame, said opening in use forming an entry or opening into said utility chamber, said side wall or walls further forming or defining a seating interface or surface onto which a cover can seat in use,

at least a portion of said sidewall or sidewalls profiled in both depth and height to in use engage with complimentary profiled portions formed in said cover, said profiled portions defining a keyed profile to position the cover relative to the frame and stabilise said cover and said frame against movement relative to one another.

67. A frame as claimed in claim 66 wherein said sidewall face profiles are generally trapezoidal shapes formed in relief from said sidewalls, the side edges of said sidewall face profiles angled such that said trapezoidal shapes have the form of truncated triangles, said profiles formed and shaped so that a cover can be mated with said frame by inserting said cover into said frame from above.

68. A frame as claimed in claim 66 or claim 67 wherein said profiles are formed with said side edges arranged at an angle that in use maximises the stability of said cover and said frame against movement relative to one another.

69. A frame as claimed in any one of claims 66 to 68 wherein said frame has a quadrilateral shape in plan view.

70. A frame as claimed in any one of claims 67 to 69 wherein said trapezoidal shapes are arranged in the side walls of said frame such that the shorter of the parallel sides is located at or towards the base of said frame, said trapezoidal shapes sized and shaped such that there are

two of said shorter sides on two opposed sides of said quadrilateral, said shorter sides shaped to have a retention interface.

71. A frame as claimed in any one of claims 66 to 70 wherein said frame further comprises at least one spring, each of said spring or springs adapted to engage with an equivalent retainer on said cover in use to assist in rigidly and/or unyieldingly securing said cover and frame in position relative to one another.

72. A frame as claimed in claim 71 wherein said spring is a leaf spring.

73. A frame as claimed in any one of claims 70 to 72 wherein each of said retention interfaces is a cut-out section in said sidewall.

74. A frame as claimed in claim 42 or claim 43 wherein said spring is adapted to apply a biasing force upwards against a force applied in a downwards direction.

75. A frame as claimed in any one of claims 66 to 74 wherein said frame further comprises or includes a peripheral flange, arranged substantially perpendicular to, and running outwards from, said sidewall or sidewalls.

76. A frame as claimed in claim 75 wherein said flange is formed as a continuous element.

77. A frame as claimed in claim 75 or claim 76 wherein said flange has a plurality of regularly spaced fastener apertures adapted to receive complimentary fasteners when said frame is affixed to a lower frame section during assembly of the chamber structure.

78. A frame as claimed in any one of claims 75 to 77 wherein said frame further comprises or includes a plurality of reinforcing webs extending between said sidewalls and said flange

79. A frame as claimed in claim 78 wherein said reinforcing webs are generally regularly spaced.

80. A cover assembly for a utility chamber or similar, comprising:

a frame comprising a side wall or walls that form the perimeter of an opening which passes through said frame, said opening in use forming an entry or opening into said utility chamber, said side wall or walls also forming or defining a seating interface or surface,

a cover, seating with said seating interface or surface in use and comprising a generally planar upper section sized to close or fill said opening in use,

at least one retainer attached to, or forming part of, said cover, said retainer

comprising at least in part a movable latch configured to act between said cover and said frame, said latch being movable between a frame engaging position and a retracted or non-frame engaging position.

81. A cover assembly as claimed in claim 80 wherein said cover and said frame are mutually adapted so that in use with said retainer engaged with said frame, said cover and said frame are stabilised against movement relative to one another.

82. A cover assembly as claimed in claim 80 or claim 81 wherein said frame further
5 comprises a spring, said spring engaging with said retainer in use to assist in rigidly and/or unyieldingly securing said cover and frame in position relative to one another.

83. A cover assembly as claimed in any one of claims 80 to 82 wherein said retainer comprises or includes;

a barrel accessible through said generally planar upper section of said cover,

10 a latch extending outwards from said barrel at the lower end, said latch having an outer end portion which engages with said frame when said barrel is rotated into a frame engaging position,

a sleeve, said cover and said sleeve mutually adapted so as to retain said sleeve in position relative to said cover, said sleeve enclosing at least a mid-section of said barrel and
15 laterally restraining said barrel.

84. A cover assembly as claimed in claim 83 wherein an upper part of said barrel is formed or configured as a tool interface.

85. A cover assembly as claimed in claim 83 or claim 84 wherein when said barrel is rotated into a frame engaging position, an upper surface of said latch contacts and presses
20 against a downwards-facing surface of said frame.

86. A cover assembly as claimed in any one of claims 82 to 85 where said spring engages with said barrel to apply an upwards force to said barrel.

87. A cover assembly as claimed in any one of claims 82 to 86 wherein said spring is a leaf spring.

25 88. A cover assembly as claimed in any one of claims 83 to 87 wherein said sleeve further comprises a low friction bushing disposed within said sleeve to contact the outer surface of said barrel where said sleeve encloses said barrel.

89. A chamber comprising

a container with an opening and a cover for said opening that can be moved between a
30 closed position closing said opening and an open position exposing at least part of said opening, the interface between said cover and said container including a series of nestable or complementary surfaces that interact with each other upon closing of the opening by said

cover that, under the influence of gravity, bias the cover relative to said container to positions having an ever decreasing degree of movement lateral to the vertical, as said cover moves towards the closed position.

90. A chamber as claimed in claim 89 wherein said cover also includes or further comprises cover side walls extending downwards from the underside of a generally planar upper section, at least a portion of the cover sidewall or sidewalls profiled in both depth and height to in use engage with complimentary profiled portions formed in said chamber sidewall or walls, said profiled portions defining a keyed profile to position the cover relative to the chamber and stabilise said cover and said chamber against movement relative to one another.

91. A chamber as claimed in claim 90 wherein said cover and chamber sidewall face profiles are generally trapezoidal shapes formed in relief from said sidewalls, the side edges of said sidewall face profiles angled such that said trapezoidal shapes have the form of truncated triangles, said profiles formed and shaped so that said cover can be mated with said chamber by inserting said cover into said chamber from above.

92. A chamber as claimed in claim 90 or claim 91 wherein said profiles are formed with said side edges arranged at an angle that maximises the stability of said cover and said chamber against movement relative to one another.

93. A chamber as claimed in claim 91 or claim 92 wherein said trapezoidal shapes are arranged in the side walls of said chamber such that the shorter of the parallel sides is located at or towards the base of said chamber, said trapezoidal shapes sized and shaped such that there are two of said shorter sides on two opposed sides of said quadrilateral, corresponding to, and mutually positioned with, said retainers, said shorter sides shaped to include a retention interface for receiving at least a portion of said retainer.

94. A chamber as claimed in any one of claims 89 to 93 wherein said chamber further comprises a retainer adapted to retain said cover on said chamber, so that in use with said retainer engaged, said chamber and said frame are stabilised against movement relative to one another.

95. A chamber as claimed in claim 94 wherein said chamber further comprises a spring, said spring engaging with said retainer in use to assist in rigidly and/or unyieldingly securing said chamber and frame in position relative to one another.

96. A chamber as claimed in any one of claims 94 to 95 wherein said retainer comprises at least in part a movable latch configured to act between said cover and said chamber, said latch

being movable between a chamber engaging position and a retracted or non-chamber engaging position.

97. A chamber as claimed in any one of claims 94 to 96 wherein said retainer comprises or includes;

5 a barrel accessible through said generally planar upper section of said cover,
a latch extending outwards from said barrel at the lower end, said latch having an outer end portion which engages with said chamber when said barrel is rotated into a chamber engaging position,

10 a sleeve, said cover and said sleeve mutually adapted so as to retain said sleeve in position relative to said cover, said sleeve enclosing at least a mid-section of said barrel and laterally restraining said barrel.

98. A chamber as claimed in claim 97 wherein an upper part of said barrel is formed or configured as a tool interface.

15 99. A chamber as claimed in claim 97 or claim 98 wherein when said barrel is rotated into a chamber engaging position, an upper surface of said latch contacts and presses against a downwards-facing surface of said chamber.

100. A chamber as claimed in any one of claims 97 to 99 where said spring engages with said barrel to apply an upwards force to said barrel.

101. A chamber as claimed in claim 100 wherein said spring is a leaf spring.

20 102. A chamber as claimed in any one of claims 97 to 101 wherein said sleeve further comprises a low friction bushing disposed within said sleeve to contact the outer surface of said barrel where said sleeve encloses said barrel.

103. A chamber as claimed in any one of claims 97 to 102 wherein said chamber includes at least one cut-out section in said at least one sidewall, close to said retainer when said cover is
25 in position in use, said outer end portion of said latch rotating into said cut-out section so that the upper surface of said latch contacts the downwards-facing surface of said cut-out section.

104. A chamber as claimed in claim 102 or claim 103 wherein said low friction bushing and said sleeve are translationally interlocked, or interlockable, by a complimentary key and keyway formed in said bushing and said sleeve.

30 105. A chamber as claimed in any one of claims 97 to 104 wherein
said barrel further comprises a limit stop located above said latch, and
said sleeve further comprises a complimentary lip located on the lower surface of said sleeve,

said limit stop and said complimentary lip configured to engage with one another in use to limit upward translation of the barrel.

106. A chamber as claimed in claim 105 wherein said low-friction bushing facilitates rotation and translation of said barrel relative to the sleeve.

5 107. A chamber as claimed in claim 105 or claim 106 wherein said spring biases said barrel upwards such that said limit stop is engaged with said complimentary lip of said sleeve when said retainer is disengaged or moved into the retracted or non-chamber engaging position (for example when no external forces are applied to the cover).

108. A chamber as claimed in any one of claims 97 to 107 wherein said retainer further
10 comprises or includes a generally cylindrical and hollow retainer cap, and said cover further comprises or includes at least one aperture, said retainer cap located in said aperture and arranged coaxially above said barrel and said sleeve.

109. A chamber as claimed in claim 108 wherein an upper surface of said sleeve abuts with the lower surface of said retainer cap, said upper surface having a circumferential rebate
15 formed about the perimeter of said upper surface, said rebate generally commensurate with a lower internal edge of said retainer cap so that said sleeve and said retention cap can be mutually interlocked by an interference fit that laterally restrains said sleeve and said barrel with respect to said retainer cap.

110. A chamber as claimed in any of claims 89 to 109 wherein said chamber includes four
20 retainers, each individually movable between a chamber engaging position and a retracted position, each retainer being accessible through or via the top surface of said cover.

111. A chamber as claimed in any one of claims 89 to 93 wherein said cover further comprises or includes at least one retainer attached to, or forming part of, said cover, said retainer adapted to in use engage with said chamber to rigidly and/or unyieldingly secure said
25 cover and chamber in position relative to one another.

112. A chamber as claimed in claim 111 wherein said cover includes or further comprises four of said retainers.

113. A chamber as claimed in any one of claims 94 to 112 wherein said cover has a quadrilateral shape in plan view, said retainers arranged two each on two opposed sides of said
30 quadrilateral.

114. A tool for actuating a chamber cover lock comprising:

a tool locator configured to engage with a complimentary tool locating interface disposed adjacent the lock to secure the tool in defined relation with the lock,

an extensible shaft disposed at a defined offset from the tool locator so that engagement of the tool locator with a complimentary tool interface on a reciprocal lock positions the extensible shaft adjacent an opening in the lock,

a tool head disposed at a lower end of the shaft, the tool head being configured to engage a complimentary tool interface within the lock, and

an actuation interface that acts between the tool locator and the extensible shaft to depress the shaft and actuate the lock.

115. A cover assembly substantially as herein described with reference to and as illustrated by any one or more of Figures 1 to 10.

116. A frame substantially as herein described with reference to and as illustrated by any one or more of Figures 1 to 10.

117. A cover substantially as herein described with reference to and as illustrated by any one or more of Figures 1 to 10.

118. A tool substantially as herein described with reference to and as illustrated by any one or more of Figures 6 to 10.

119. A subsurface utility chamber, comprising:

a main housing having a base and at least one wall extending upwards from the base, shaped to define an interior of the chamber,

a frame, having a central aperture which passes through the closed perimeter of the frame to allow access to the interior of the chamber, the frame adapted to receive a chamber cover to close the aperture, the frame connected to the main housing above the main housing in an adjustable manner relative to the main housing so as to allow a gap to be established between at least part of the frame and the main housing,

wherein the frame and the main housing have complementary surfaces that, when engaged with each other, close the gap.

120. A utility chamber as claimed in claim 119 wherein the main housing and the frame are connected to one another by a connection mechanism which is adjustable to vary the positioning in situ of the frame relative to the housing.

121. A utility chamber as claimed in claim 120 wherein the connection mechanism

comprises threaded bolts which are passed through apertures on the frame and housing, and complimentary nuts which are threaded onto the bolts.

122. A utility chamber as claimed in claim 121 wherein the gap between the frame and the housing is adjustable by location of the nuts on the bolts.

123. A utility chamber as claimed in any one of claims 119 to 122 wherein the at least one wall is two long side walls connected at their lower edges to the base aligned substantially vertically and perpendicular to the base, and two shorter side walls which connect between substantially the ends of the longer side walls, the walls having a top flange which extends
5 substantially horizontally outwards from the top of the wall, the flange forming a continuous unbroken loop of unitary height from the base.

124. A utility chamber as claimed in any one of claims 119 to 123 wherein the frame has downwardly facing bearing surfaces which align with the flange, the downwardly facing bearing surfaces and the flange forming the complementary surfaces that can engage with one
10 another to close the gap.

125. A utility chamber as claimed in claim 124 wherein the two shorter walls are located opposite each other.

126. A utility chamber as claimed in claim 124 or claim 125 wherein the shorter walls have a lower edge which is located some way above the base of the main housing so that apertures
15 are formed at each end of the chamber.

127. A utility chamber as claimed in any one of claims 119 to 126 wherein the chamber further has a cable management bracket connected to one wall which is adapted to assist in managing lengths of cable.

128. A utility chamber as claimed in any one of claims 119 to 127 wherein the chamber
20 further has a cable protection plate, located towards the top of the chamber and sized and aligned so as to or partially shield items within the chamber such as cable from items descending from above.

129. A utility chamber as claimed in any one of claims 119 to 128 wherein the chamber may also have an extension section which in use is located between the main housing and the
25 frame to raise the level of the frame, the lower bearing surfaces of the frame contacting the upper part of the extension section, the lower part of the extension section resting on the flange.

130. A utility chamber as claimed in claim 129 wherein the extension is formed from four wall sections, each having a lower flange and an upper flange.

30 131. A utility chamber as claimed in claim 129 or claim 130 wherein the connection mechanism is used to connect the frame the extension and the housing together, the threaded bolts passed through holes or apertures in each of the housing, the extension section and the frame.

132. A utility chamber as claimed in any one of claims 119 to 131 wherein the chamber further has a chamber cover which is mutually adapted with the frame to close the central aperture of the frame.

133. A utility chamber as claimed in claim 132 wherein an upper surface of the cover are
5 recessed in the horizontal plane to form a shallow depression.

134. A utility chamber as claimed in claim 133 wherein at least the shallow depressions contain or receive a surface treatment.

135. A utility chamber as claimed in any one of claims 119 to 134 wherein the utility chamber further has a reinforcing hanger which is connected to, and extends outwardly
10 substantially horizontally from the frame, the hanger adapted to hold at least one ring of reinforcing steel rod, so that the rod forms a substantially continuous or unbroken ring around the perimeter of the frame.

136. A utility chamber as claimed in claim 135 wherein the hanger is adapted to hold two rings of reinforcing steel rod having slightly different sizes so that they are located at slightly
15 different distances from the frame, around the frame.

137. A utility chamber as claimed in claim 136 wherein the utility chamber further comprises two rings of reinforcing steel rod having slightly different sizes.

138. A jointing chamber adapted for location below the surface of the ground, yet which presents a closable opening at ground level for providing access to the interior of the jointing
20 chamber, the opening defined by a frame that can receive a jointing chamber cover to act as a closure to the chamber, the frame supported by a main housing in a manner to allow it to assume two conditions during the installation of the jointing chamber in the ground, a first condition where at least part of the frame and the main housing are separated by a gap, and a second condition where no gap exists between the frame and main housing by virtue of direct
25 contact of complimentary surfaces of said frame and said main housing,

the first and second condition selected, when the jointing chamber is in situ, according to the requirements of the positioning of the frame relative to ground level and relative the main housing.

139. A jointing chamber as claimed in claim 138 wherein when the frame and the main
30 housing are in the first condition, the gap is filled with a solidifiable material (e.g. concrete).

140. A jointing chamber as claimed in claim 138 or claim 139 wherein the main housing and the frame are connected to one another by a connection mechanism which is adjustable

to vary the positioning in situ of the frame relative to the housing and to adjust the size of the gap.

141. A jointing chamber as claimed in claim 140 wherein the connection mechanism comprises threaded bolts which are passed through apertures on the frame and housing, and complimentary nuts which are threaded onto the bolts.

142. A jointing chamber as claimed in claim 141 wherein the gap between the frame and the housing is adjustable by location of the nuts on the bolts.

143. A jointing chamber as claimed in any one of claims 138 to 142 wherein the at least one wall is two long side walls connected at their lower edges to the base aligned substantially vertically and perpendicular to the base, and two shorter side walls which connect between substantially the ends of the longer side walls, the walls having a top flange which extends substantially horizontally outwards from the top of the wall, the flange forming a continuous unbroken loop of unitary height from the base.

144. A jointing chamber as claimed in any one of claims 138 to 143 wherein the frame has downwardly facing bearing surfaces which align with the flange, the downwardly facing bearing surfaces and the flange forming the complementary surfaces that can engage with one another to close the gap.

145. A jointing chamber as claimed in claim 144 wherein the two shorter walls are located opposite each other.

146. A jointing chamber as claimed in claim 144 or claim 145 wherein the shorter walls have a lower edge which is located some way above the base of the main housing so that apertures are formed at each end of the chamber.

147. A jointing chamber as claimed in any one of claims 138 to 146 wherein the chamber further has a cable management bracket connected to one wall which is adapted to assist in managing lengths of cable.

148. A jointing chamber as claimed in any one of claims 138 to 147 wherein the chamber further has a cable protection plate, located towards the top of the chamber and sized and aligned so as to or partially shield items within the chamber such as cable from items descending from above.

149. A jointing chamber as claimed in any one of claims 138 to 148 wherein the chamber may also have an extension section which in use is located between the main housing and the frame to raise the level of the frame, the lower bearing surfaces of the frame contacting the

upper part of the extension section, the lower part of the extension section resting on the flange.

150. A jointing chamber as claimed in claim 149 wherein the extension is formed from four wall sections, each having a lower flange and an upper flange.

5 151. A jointing chamber as claimed in claim 149 or claim 150 wherein the connection mechanism is used to connect the frame the extension and the housing together, the threaded bolts passed through holes or apertures in each of the housing, the extension section and the frame.

152. A jointing chamber as claimed in any one of claims 138 to 151 wherein the chamber
10 further has a chamber cover which is mutually adapted with the frame to close the central aperture of the frame.

153. A jointing chamber as claimed in claim 152 wherein an upper surface of the cover are recessed in the horizontal plane to form a shallow depression.

154. A jointing chamber as claimed in claim 153 wherein at least the shallow depressions
15 contain or receive a surface treatment.

155. A jointing chamber as claimed in any one of claims 138 to 154 wherein the utility chamber further has a reinforcing hanger which is connected to, and extends outwardly substantially horizontally from the frame, the hanger adapted to hold at least one ring of reinforcing steel rod, so that the rod forms a substantially continuous or unbroken ring around
20 the perimeter of the frame.

156. A jointing chamber as claimed in claim 155 wherein the hanger is adapted to hold two rings of reinforcing steel rod having slightly different sizes so that they are located at slightly different distances from the frame, around the frame.

157. A jointing chamber as claimed in claim 156 wherein the utility chamber further
25 comprises two rings of reinforcing steel rod having slightly different sizes.

158. An in-ground jointing chamber that comprises:

a main housing,

a frame that defines an access opening to the main housing and which is adapted to receive a jointing chamber cover to be positioned flush with the adjacent ground, the frame
30 mounted above the main housing by a height adjustable mechanism to allow the size of the gap between the frame and the main housing to be varied so as to allow appropriate positioning of the frame relative to the adjacent ground, the mechanism also allowing the gap

to be closed by way of contact between complementary surfaces on the main housing and the frame.

159. A jointing chamber as claimed in claim 158 wherein when the gap is any size greater than zero, the gap is filled with a solidifiable material (e.g. concrete).

5 160. A jointing chamber as claimed in claim 158 or claim 159 wherein the main housing and the frame are connected to one another by a connection mechanism which is adjustable to vary the positioning in situ of the frame relative to the housing and to adjust the size of the gap.

161. A jointing chamber as claimed in claim 160 wherein the height adjustable mechanism
10 comprises threaded bolts which are passed through apertures on the frame and housing, and complimentary nuts which are threaded onto the bolts.

162. A jointing chamber as claimed in claim 161 wherein the gap between the frame and the housing is adjustable by location of the nuts on the bolts.

163. A jointing chamber as claimed in any one of claims 158 to 162 wherein the at least one
15 wall is two long side walls connected at their lower edges to the base aligned substantially vertically and perpendicular to the base, and two shorter side walls which connect between substantially the ends of the longer side walls, the walls having a top flange which extends substantially horizontally outwards from the top of the wall, the flange forming a continuous unbroken loop of unitary height from the base.

20 164. A jointing chamber as claimed in any one of claims 158 to 163 wherein the frame has downwardly facing bearing surfaces which align with the flange, the downwardly facing bearing surfaces and the flange forming the complementary surfaces that can engage with one another to close the gap.

25 165. A jointing chamber as claimed in claim 164 wherein the two shorter walls are located opposite each other.

166. A jointing chamber as claimed in claim 164 or claim 165 wherein the shorter walls have a lower edge which is located some way above the base of the main housing so that apertures are formed at each end of the chamber.

30 167. A jointing chamber as claimed in any one of claims 158 to 166 wherein the chamber further has a cable management bracket connected to one wall which is adapted to assist in managing lengths of cable.

168. A jointing chamber as claimed in any one of claims 158 to 167 wherein the chamber further has a cable protection plate, located towards the top of the chamber and sized and

aligned so as to or partially shield items within the chamber such as cable from items descending from above.

169. A jointing chamber as claimed in any one of claims 158 to 168 wherein the chamber may also have an extension section which in use is located between the main housing and the frame to raise the level of the frame, the lower bearing surfaces of the frame contacting the upper part of the extension section, the lower part of the extension section resting on the flange.

170. A jointing chamber as claimed in claim 169 wherein the extension is formed from four wall sections, each having a lower flange and an upper flange.

171. A jointing chamber as claimed in claim 169 or claim 170 wherein the connection mechanism is used to connect the frame the extension and the housing together, the threaded bolts passed through holes or apertures in each of the housing, the extension section and the frame.

172. A jointing chamber as claimed in any one of claims 158 to 171 wherein the chamber further has a chamber cover which is mutually adapted with the frame to close the central aperture of the frame.

173. A jointing chamber as claimed in claim 172 wherein an upper surface of the cover are recessed in the horizontal plane to form a shallow depression.

174. A jointing chamber as claimed in claim 173 wherein at least the shallow depressions contain or receive a surface treatment.

175. A method of providing a below surface utility chamber, comprising or including the steps of,

(i) locating a utility chamber housing in a pre-prepared pit of predetermined depth,

(ii) locating a frame above the housing and connecting the frame to the housing via an adjustable support connection which connects and supports the frame above the housing at a predetermined yet adjustable height so that the lower bearing surfaces of the frame contact the upper surface or surfaces of the housing and there is no gap between the lower bearing surfaces of the frame and the upper surface or surfaces of the housing,

the predetermined depth of the pit locating an uppermost surface of the frame member to lie flush with said surface level.

176. A method of providing a utility chamber below the surface level of uneven or non-horizontal ground, comprising or including the steps of,

(i) locating a utility chamber housing in a pre-prepared pit of predetermined depth, the pit having a countersunk edge trench wider than the main portion of the pit,

(ii) locating a frame above the housing and connecting the frame to the housing via an adjustable support connection which connects and supports the frame above the housing at a predetermined yet adjustable height so that firstly the uppermost surface of the frame is generally aligned or lies flush with the surface of the ground and secondly so that a gap or gaps is/are created between the lower bearing surfaces of the frame and the upper surface or surfaces of the housing,

(iii) positioning concrete shuttering inside the frame and housing,

(iv) pouring a solidifiable filler material (e.g. concrete or similar) into the edge trench up to the level of the ground and the top of the frame to form a solid collar around the top of at least the frame, the shuttering preventing the filler material from entering the interior of the housing through the gap or gaps.

177. A method of providing a below surface utility chamber as claimed in claim 176

wherein the method includes the intermediate step of adding a release material to the external surfaces of the frame member and the housing which will be in contact with the filler material, before the filler material is poured.

178. A method of providing a below surface utility chamber as claimed in claim 176 or claim 177 wherein the method also includes the intermediate step of locating a reinforcing

hanger and at least one ring of reinforcing steel rod within the edge trench, the reinforcing hanger connected to the frame and extending outwardly substantially horizontally from the frame, the rod forming a substantially continuous or unbroken ring around the perimeter of the frame.

179. A subsurface utility chamber, comprising:

a main housing having a base and at least one wall extending upwards from the base, shaped to define an interior of the chamber,

a frame, having a central aperture which passes through the closed perimeter of the frame to allow access to the interior of the chamber, the frame adapted to receive a chamber cover to close the aperture,

an extension section located between the main housing and the frame, the lower surface or surfaces of the frame contacting the upper surface or surfaces of the extension section, the lower surface or surfaces of the extension section contacting the upper surface or surfaces of the housing,

the frame, extension section, and housing releasably connected together.

180. A utility chamber as claimed in claim 179 wherein the frame is connected to the extension section in an adjustable manner relative to the extension section so as to allow a gap to be established between at least part of the frame and the extension section.

5 181. A utility chamber as claimed in claim 179 or claim 180 wherein the extension is formed from four wall sections, each having a lower flange and an upper flange.

182. A utility chamber as claimed in any one of claims 179 to 181 wherein a connection mechanism is used to connect the frame the extension and the housing together, the connection mechanism comprising threaded bolts which are passed through holes or
10 apertures in each of the housing, the extension section and the frame, and nuts which are tightened onto the threaded bolts.

183. A utility chamber as claimed in claim 182 wherein the holes in each of the housing, the extension section and the frame are formed in at least one and preferably a plurality of groups so that for each group, a single linear bolt can be passed through each hole in the group.

15 184. A utility chamber as claimed in any one of claims 179 to 183 wherein the position of the extension section and the frame can be adjusted in situ by way of said connection mechanism, and if required, a gap can be formed between the extension section and the frame.

185. A utility chamber as claimed in any one of claims 179 to 184 wherein the chamber
20 further has a cable management bracket connected to one wall which is adapted to assist in managing lengths of cable.

186. A utility chamber as claimed in any one of claims 179 to 185 wherein the chamber further has a cable protection plate, located towards the top of the chamber and sized and aligned so as to or partially shield items within the chamber such as cable from items
25 descending from above.

187. A utility chamber as claimed in any one of claims 179 to 186 wherein the chamber further has a chamber cover which is mutually adapted with the frame to close the central aperture of the frame.

188. A utility chamber as claimed in claim 187 wherein an upper surface of the cover are
30 recessed in the horizontal plane to form a shallow depression.

189. A utility chamber as claimed in claim 188 wherein the shallow depression contains or receives a surface treatment.

190. A utility chamber as claimed in any one of claims 179 to 189 wherein the utility chamber further has a reinforcing hanger which is connected to, and extends outwardly substantially horizontally from the frame, the hanger adapted to hold at least one ring of reinforcing steel rod, so that the rod forms a substantially continuous or unbroken ring around the perimeter of the frame.

191. A utility chamber as claimed in claim 190 wherein the hanger is adapted to hold two rings of reinforcing steel rod having slightly different sizes so that they are located at slightly different distances from the frame, around the frame.

192. A utility chamber as claimed in claim 191 wherein the utility chamber further comprises two rings of reinforcing steel rod having slightly different sizes.

193. A **utility chamber (sub-surface or otherwise) with a frame** as herein described with or without reference to any one of more of the accompanying drawings.

194. A **method of forming a utility chamber frame** as herein described with or without reference to any one of more of the accompanying drawings.

195. A **tool** for actuating a chamber cover lock comprising:
a lower section or lower end comprising a shaft and a stem, said shaft inside said stem, an actuation lever extending from said tool for manipulation by a user both vertically and rotationally,

said stem engaging with said chamber cover or said chamber cover lock to hold said stem in position relative to said chamber cover lock both rotationally and vertically, said shaft capable of moving at least vertically relative to said stem when said stem is engaged with chamber cover to exert a downward force and assist in releasing said lock,

said actuation lever connected to said shaft to lock or unlock said chamber cover lock.

196. A tool as claimed in claim 195 wherein said tool utilises hydraulic or pneumatic assistance to offset any biasing force applied to said chamber cover lock

197. A tool as claimed in claim 195 or 196 wherein said tool is located and translationally restrained during actuation by at least one interlocking channel and at least one placement lug.

198. A **tool** for actuating a chamber cover lock comprising:

a lower section or lower end comprising a shaft and a stem, said shaft inside said stem, said stem engaging with said chamber cover or said chamber cover lock to hold said stem in position relative to said chamber cover lock both rotationally and vertically, said shaft capable of moving at least vertically relative to said stem when said stem is engaged with chamber cover,

a lever or handle connected to and extending from the upper part of said lower section, said lever or handle connected to said lower section in such a manner that said lever can be moved between a disengaged position where the lever is at an angle to the lower part of the tool, to an engaged position where the lever is substantially in line with the main axis of the lower portion, said lever engaging with said shaft so that as the lever is moved towards said engaged position, the connected end of the lever presses down on the top of the shaft and moves it through said stem to exert a downward force and assist in releasing said lock.

199. **A tool** for actuating a chamber cover lock as claimed in claim 198 wherein said tool further comprises at least one manual actuation lever connected to said stem and extending substantially perpendicularly outwards from said stem so that the lever can be gripped and the tool stem rotated.

200. **A tool** for actuating a chamber cover lock as claimed in claim 198 or claim 199 wherein said lever includes a handle adapted to allow said lever to be rotated around its own axis.