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(56) Documents Cited:
US 5614119 A **US 5609784 A**
US 4726394 A **US 3949189 A**
JP H0712086

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INT CL **E03B**
Other: **EPODOC, WPI, TXTA, Internet.**

(54) Title of the Invention: **Housing**
Abstract Title: **Heated outdoor cabinet and water pump**

(57) A system comprising a protective housing 1, a water pump 11 mounted within the housing and one or more electric heating elements 22 for heating at least one component within the housing. The heating elements may be trace heating elements, such as a wire or cable, attached to the pipe 21. The pump may be mounted on a removable panel 7. The system may comprise a water meter 14 and/or a stopcock valve 17 mounted upstream of the pump and/or an isolating electrical switch 23. The cabinet may be double skinned and/or comprise an access door with thermal insulation material mounted on the inside. The access door may also be provided with a secure locking mechanism. Two methods for installing the system in a property are also disclosed.

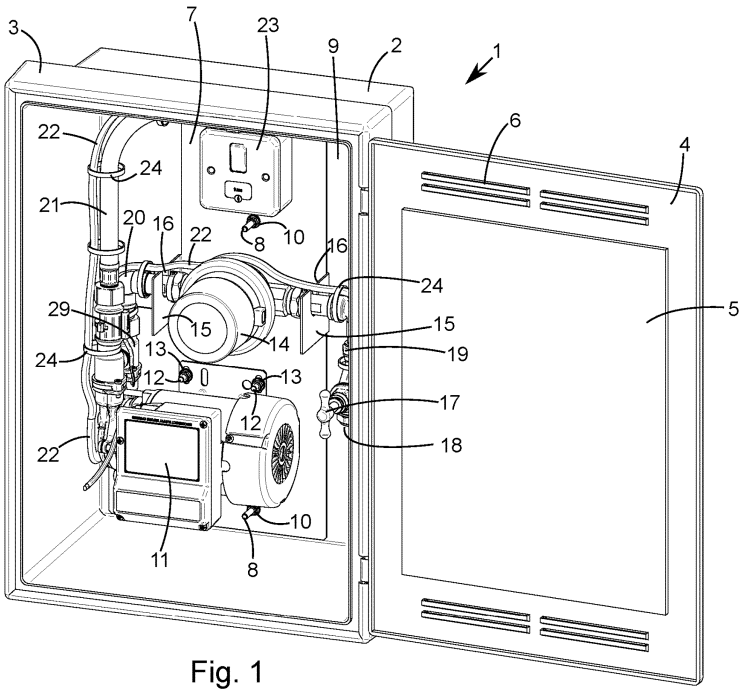

Fig. 1

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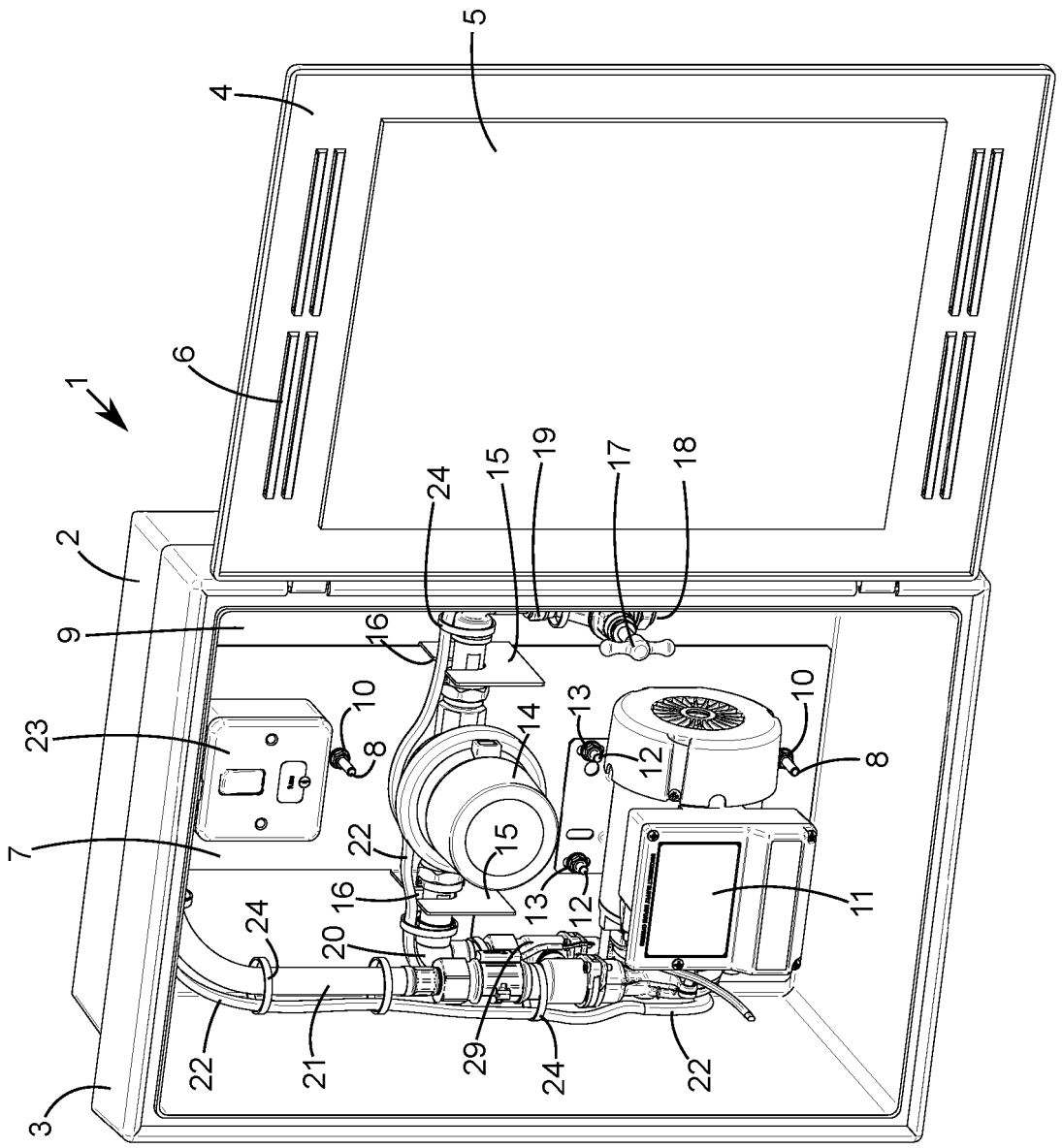

Fig. 1

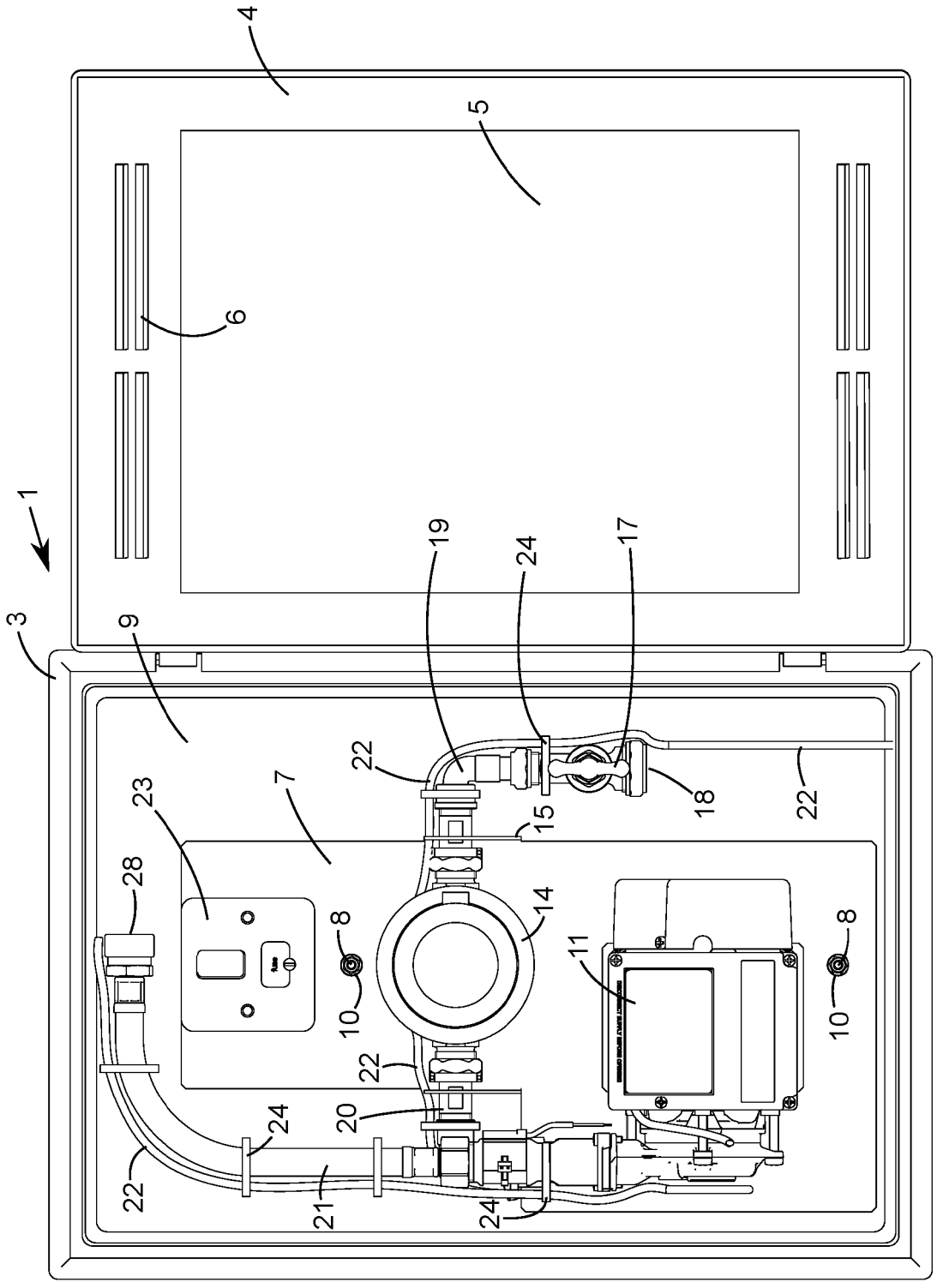

Fig. 2

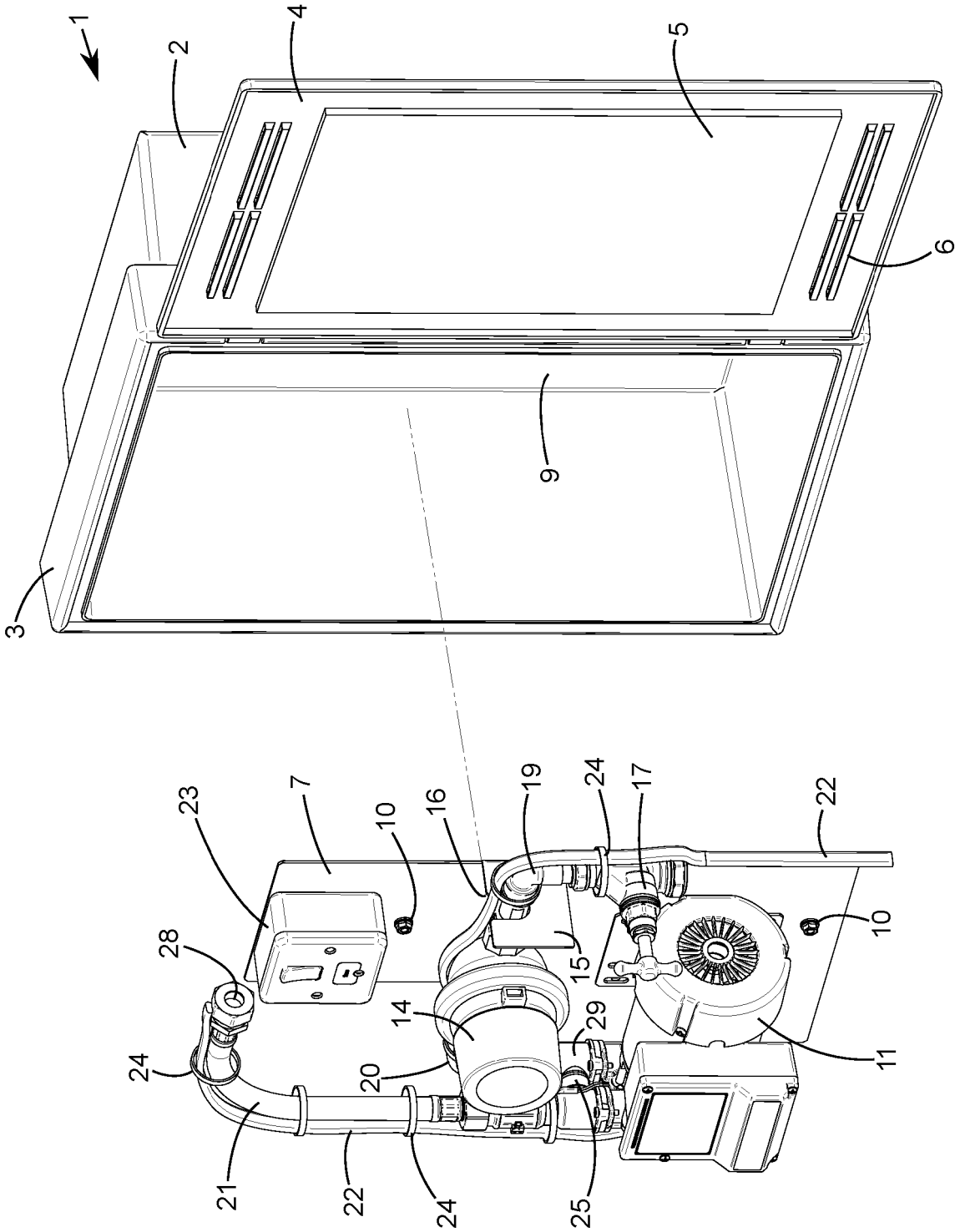

Fig. 3

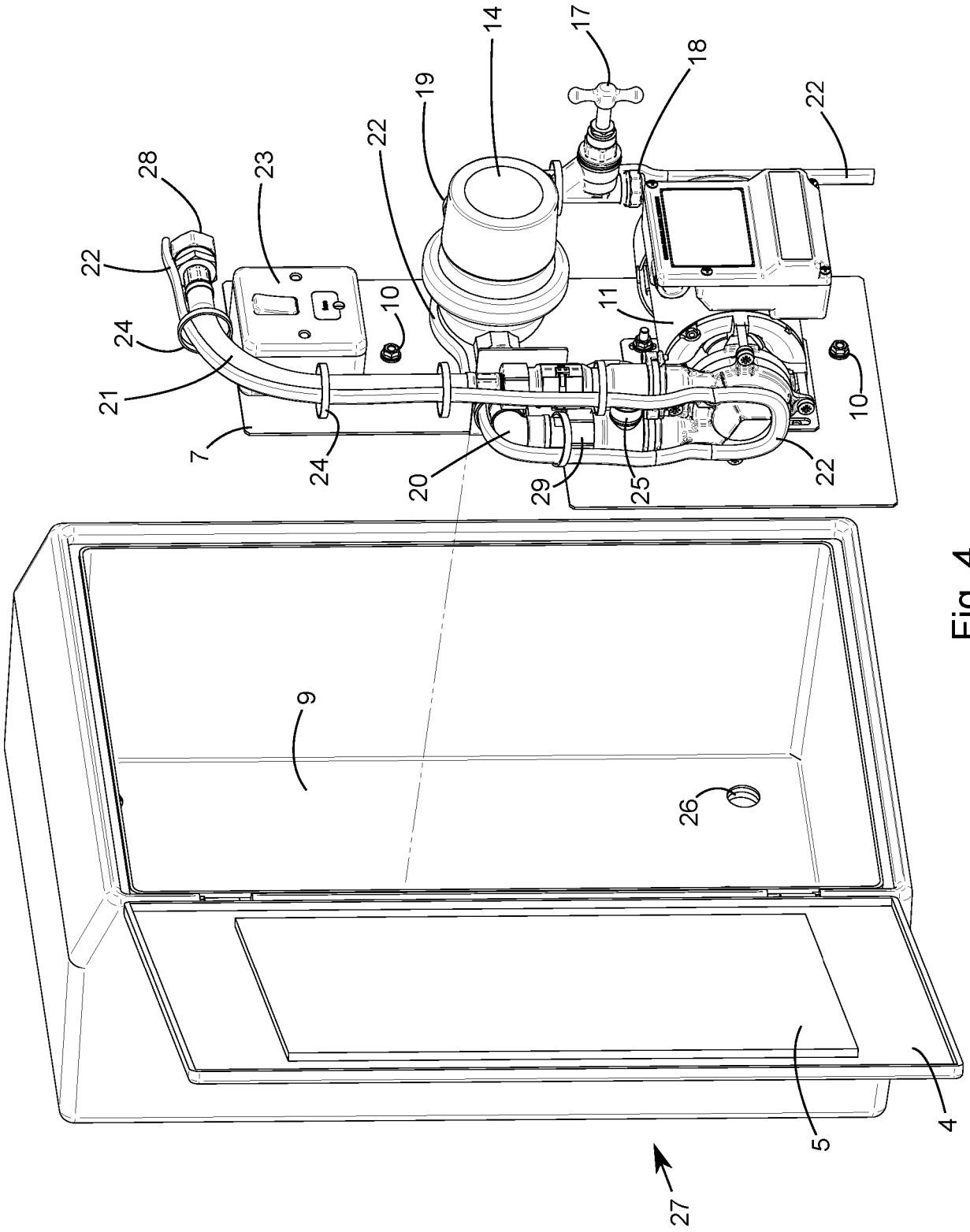

Fig. 4

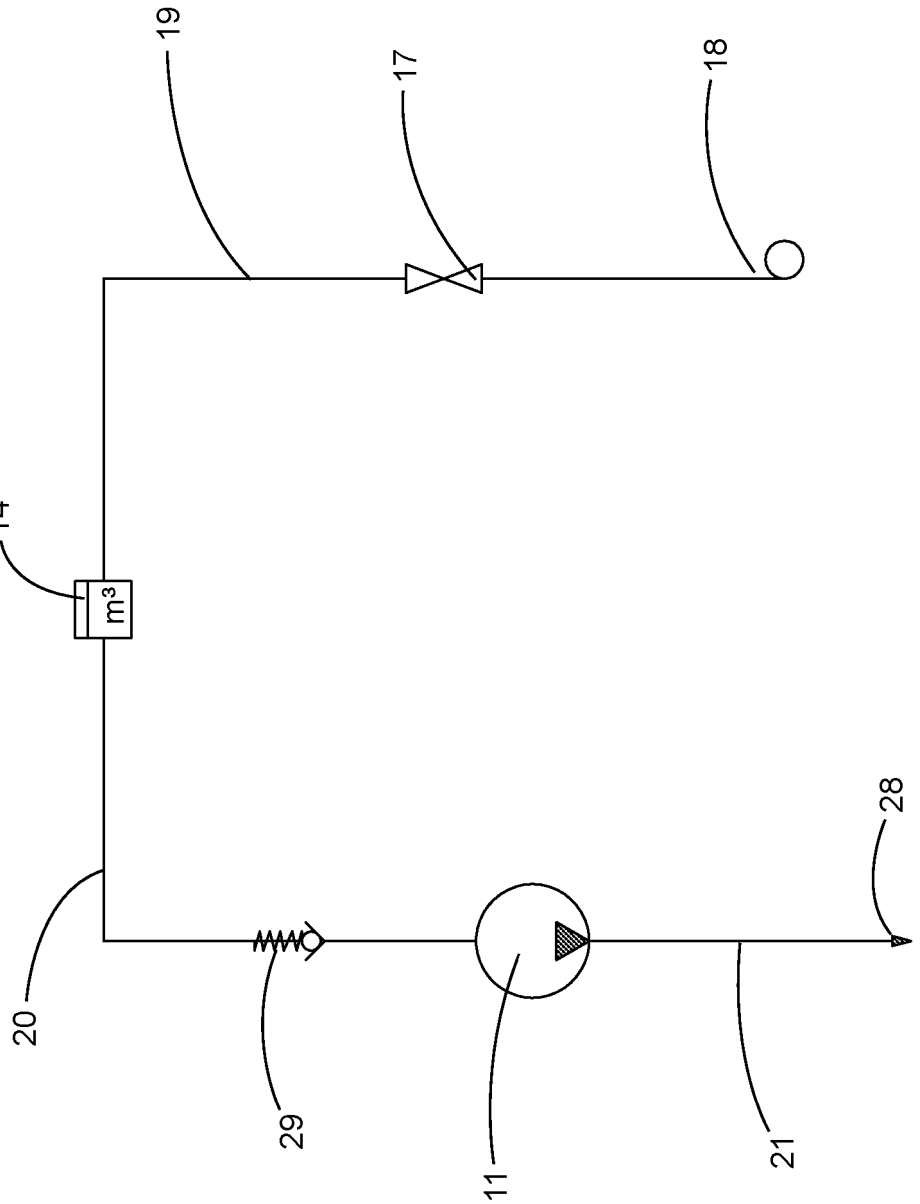

Fig. 5

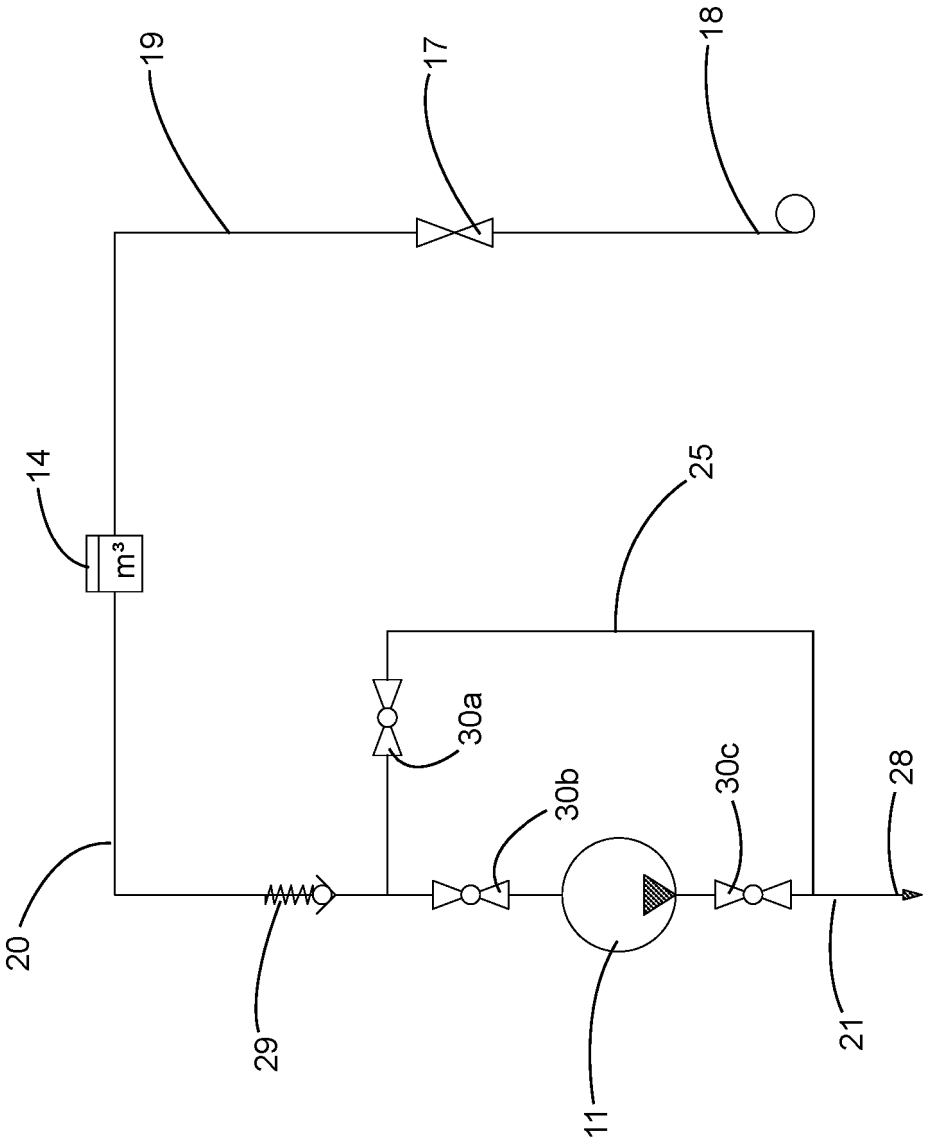

Fig. 6

Housing

The invention relates to housings or cabinets for encasing and protecting a pump and possibly other water monitoring and control devices in a property, the cabinet being accessible from outside the property.

In the UK, water authorities have an obligation to provide a certain pressure and flow rate to each property (currently 1 bar and 9 litres per minute, although this may be subject to change). In low pressure areas this can be difficult to achieve with current infrastructure. One solution is to install a pump at the consumer's property to boost the pressure and flow rate available to the consumer. As such installations would need to be made by the water authority, the authority would need access to the property not only for installation, but also for maintenance and repair as this would be the authority's responsibility.

Installing a pump within the consumer's property is problematic as the authority does not have access without the consumer's presence. This presents difficulties for arranging and timing maintenance and/or repair. For example maintenance has to be scheduled sufficiently well in advance that the consumer can arrange for someone to be home to permit access. Also, in the event of failure, repair may take longer to arrange, leaving the consumer with an inadequate or unsatisfactory supply in the meantime.

According to a first aspect, the invention provides a water mains boosting system comprising: an outdoor protective housing; a pump mounted within the housing; and one or more electric heating elements arranged to heat at least one system component within the housing.

By installing the pump within an outdoor protective housing, the pump can be protected from weather (wind rain, sun) to a certain extent. However, a major problem with such installations is that they are above ground and therefore exposed to the cold in winter and at risk of damage. The mains supply to a property is normally protected from the cold by burying the supply pipe around 18 inches deep. The supply pipe is only brought above ground inside the building which should be

adequately heated and insulated to avoid freezing temperatures. In the UK the cold does not generally penetrate more than about 9 inches below the ground surface and therefore the mains supply pipe is adequately protected by this arrangement. However, to mount a booster pump on the outside of the property means that the mains supply pipe must be brought above ground level, possibly outside the building and exposed to lower temperatures. The invention solves this problem by providing a heating element within the housing that protects against freezing temperatures by heating the system components.

External meter boxes are known and have been used for gas and electricity meters for some time so as to allow easy access for meter readings without disturbing the consumer. However these have not been an attractive prospect for water meters on account of the freezing issue with water pipes. The invention recognizes that where a pump is to be fitted for external access, electricity must be supplied to the housing to drive the pump. This electricity connection can advantageously also be used to power the heating element(s) that avoid or reduce the risk of freezing in cold weather. It should be noted that the provision of electricity to a pump and heating element(s) that are owned by and maintained by a water authority is an unusual situation as the electricity will most likely and most conveniently be supplied from the consumer's supply. This cost to the consumer will most likely have to be offset by some form of bill rebate or other compensation from the water supplier to the consumer.

The heating element(s) may of course be controlled by a thermostat to avoid unnecessary heating, e.g. during summer or during daytime at colder times of year.

The system thus allows an engineer, e.g. a plumber to access the pump for maintenance or repair without requiring access to be granted by the owner of the property. Thus maintenance can be carried out without causing scheduling problems (such as the owner having to be present) and repairs can be effected on short notice thus avoiding significant periods of down time. As well as being convenient for the customer, this makes it much easier for the water supplier to schedule its engineers for greater speed and efficiency, thus saving costs.

The heating elements may be disposed at any suitable position within the housing. However, in preferred arrangements the electric heating element(s) comprises trace heating attached to pipes within the housing. The use of trace heating elements attached to the pipes (and/or to the pump itself) provides contact heating directly to the elements that are at risk of damage. This reduces the amount of heating required and correspondingly reduces the power and cost. Thermal insulation is preferably also supplied around all pipework (and possible also around the pump and other elements) so as to maximize the heat transmitted into the system components and avoiding unnecessary heating of the rest of the housing.

The housing is preferably a cabinet designed for mounting in or to the external wall of a building. The cabinet preferably has a closure such as a lid, hatch or door, preferably being openable on the front face (i.e. an outward facing face parallel with the wall in which it is installed).

Although the pump and the heating elements may be mounted directly to the inside of the housing, it is preferred that the system further comprises a removable panel removably mounted to the inside of the housing. The pump is then mounted to the panel. Mounting the pump (and preferably also the heating elements) to the removable panel allows for particularly swift installation which can be carried out after installation of the housing. This is particularly beneficial for new build properties where the housing can be installed during the early phases of building (e.g. while building the walls), while the pump, etc. can be installed at a later time such as when the utilities are connected. This is typically a stage at which the properties are more secure than at the earlier stage. The removable panel also allows for swift maintenance and repair as the engineer can simply disconnect the water (and electrical) connections, remove the whole panel and replace it with a new panel. The faulty panel can be assessed and possibly repaired later. Thus the use of a removable panel can also minimise the down time of the system and is thus optimal for the consumer. However, in most maintenance and repair situations it will be the pump that needs servicing or replacing. Therefore preferably the pump is removably mounted to the removable panel. In such cases it is not necessary to disconnect and remove the whole panel with all components, but instead the pump alone can be disconnected, removed and replaced. Again this makes for swift and easy repair without needing access to the consumer's building.

The system may further comprise a water meter mounted within the housing. As the housing is readily accessible by the water authority, this allows for easy meter readings to be taken by the supplier for billing purposes. The consumer may also be provided with access to the housing and can thus take meter readings either to supply to the water authority or for monitoring purposes. The water meter can of course also be protected by the heating element(s).

The system may also comprise other components of a normal water supply system such as a check valve (non-return valve) connected upstream of the pump (i.e. on the inlet side of the pump) to prevent any backflow from contaminating the mains supply. Typically this is a double check valve to meet water regulations. The system may also comprise a stop cock connected upstream of the pump to allow the supply to the property to be isolated. The stop cock is upstream of the pump (i.e. between the mains supply and the pump) so that the pump can be isolated for maintenance and repair. The system may further comprise an isolating electrical switch arranged to supply electrical power selectively to the electric heating element (and also to the pump). The isolating switch allows for easy disconnection and isolation of the electrics for maintenance and repair.

The system may also comprise a bypass pipe connected in parallel with the pump (such that it bypasses the pump). This allows water to be delivered to the property even if the pump fails (albeit at a lower pressure). An isolating valve may also be provided in the bypass pipe to prevent the pump from circulating water round the bypass loop. If the pump fails, the bypass pipe can be put into service by opening the isolating valve. One or more isolating valves may also be positioned in the pump path (in parallel with the bypass pipe) which are open in normal use but can be closed to allow for disconnection and replacement of the pump.

An isolation valve may also be provided downstream of the pump so as to close off the consumer's system, preventing it from draining down while the pump is being removed and replaced.

Preferably some of these components are mounted to the aforementioned removable panel so that the system can be replaced quickly. This preferably

includes the meter and check valve. Although the stop cock and electrical switch could also be mounted on the removable board, it is preferred that these be separate from the board (they may be mounted directly to the housing or simply connected to the pipework and not attached to either the housing or the removable board). The stop cock isolates the water connection during replacement while the isolation switch allows disconnection and removal of the panel without the need for access to the consumer's property for electrical isolation. The isolation valve downstream of the pump may also be provided without being mounted on the removable panel.

The housing may be single skinned, but in some embodiments it is a double skinned housing. The single skinned housing (i.e. a single wall of plastic) may be used in installations where the housing can be installed partially within a property wall, i.e. it can be partly insulated by the wall itself. The double skinned housing (i.e. two walls, separated by a small air gap) is preferred for installations which are surface mounted as there is a greater area of housing exposed to lower temperatures without the additional insulation of a wall.

The housing preferably has an access door, e.g. on the front face which may be provided with thermal insulation material mounted on the inside thereof. The access door may be single skinned or double skinned as described above, but is more likely to be single skinned for ease of manufacturing of hinges and locking mechanisms. Additional thermal insulation may also be provided on the other interior surfaces of the housing.

The access door may have a secure locking mechanism provided thereon to restrict access to the housing and the system components therein. The lock may be of any form, e.g. a combination lock or a key lock. The water authority may have a master key to unlock all its housings at multiple properties while individual users each have an individual key.

The housing may be provided with precut holes for the water inlet (from the mains supply) to the pump, the water outlet (to the consumer's system) from the pump and for electrical supply to the pump and heating element(s). Alternatively these may be provided as push-out elements (possibly with multiple locations from which the

most appropriate can be chosen for a particular installation) or the housing can be provided without any pre-existing holes and the installer can simply make holes where required as part of the installation.

In the surface mounted arrangement, the mains supply will typically be provided through the rear wall of the housing towards the bottom of the housing. This arrangement is most suited to retro-fits in which the mains supply will already have been brought into the house underground. The installation will involve routing the mains supply from the inside back out through the wall to the rear of the surface mounted housing so that the pipe remains protected from the elements. If the housing is installed recessed into a wall, the supply pipe may be brought up within the property or within the cavity of a cavity wall to prevent any external exposure of the supply pipe. The supply pipe may then be brought in through the rear wall of the housing or through a housing side, top or bottom wall, depending on the most convenient pipe routing and housing position.

According to a further aspect, the invention provides a method of installing a water mains boosting system in a property comprising: surface mounting an outdoor protective housing on an outside wall of the property; subsequently mounting a pump within the housing; connecting a mains water supply through a wall of the housing to the pump; and attaching one or more electric heating elements to system components within the housing.

According to another aspect, the invention provides a method of installing a water mains boosting system in a property comprising: mounting an outdoor protective housing recessed into an outside wall of the property; subsequently mounting a pump within the housing; connecting a mains water supply through a wall of the housing to the pump; and attaching one or more electric heating elements to system components within the housing.

Either of these two methods may be used to retrofit an existing system for external access. This latter method may also advantageously be used in new builds as the building work is being carried out as the building's wall can be formed around the housing. Additionally siting of the housing and routing of the pipework is easier during building.

The preferred features described above in relation to the system apply equally to the methods of installation.

Thus, the electric heating element(s) preferably comprise trace heating attached to pipes within the housing. The pump is preferably mounted on a removable panel and the step of mounting the pump within the housing preferably comprises mounting the removable panel to the inside of the housing. This arrangement is particularly good for new build installations as the housing can be installed significantly in advance of the pump, etc. For example, the housing can be installed while building work is ongoing and before utilities are connected. There is no need for the pump and meter to be installed at this point and in fact it is preferred not to install them while the building site is unsecure. The pump and meter can then be easily installed at a later stage, e.g. after the utilities have been connected and shortly before the property is occupied.

As described above, the method may further comprise mounting a water meter within the housing. The method may further comprise mounting a check valve in the housing, connected upstream of the pump. The method may further comprise mounting a stop cock in the housing, connected upstream of the pump. The method may further comprise mounting an isolating electrical switch in the housing, arranged to supply electrical power selectively to the electric heating element.

The housing may be a double skinned housing. The housing may have an access door and the access door may have thermal insulation material mounted on the inside thereof. The access door may have a secure locking mechanism.

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

Fig. 1 shows an embodiment of a cabinet for recessed mounting;
Fig. 2 shows a front view of the embodiment of Fig. 1;
Fig. 3 shows an exploded view of the embodiment of Fig. 1;
Fig. 4 shows an exploded view of an embodiment of a cabinet for surface mounting;
Fig. 5 shows a schematic of a system; and

Fig. 6 shows a schematic of a system with a bypass.

A cabinet 1 for recessed mounting in a building is shown in Fig. 1. The recessed cabinet 1 comprises a rear portion 2 for recessing into a building wall and a surface mounting flange 3 which remains proud of the wall after installation.

The recessed cabinet 1 is best suited for mounting partly recessed into the external wall of a building. Such recessed mounting is preferred where possible as the building wall provides a significant amount of insulation around the sides of the recessed part 2 of the cabinet 1. Due to this insulation, the recessed part 2 can be single skinned (i.e. a single wall), thereby keeping the dimensions of the recessed part 2 as small as possible. The surface flange 3 is double skinned (i.e. a double wall, with an air gap between the two walls) to provide better insulation around this exposed part of the cabinet 1.

The cabinet 1 has a door 4 which is single skinned so as to keep the profile small and to facilitate provision of locks and hinges. The door 4 has a layer of thermal insulation 5 provided on a substantial part of its inner side to reduce heat loss across this external facing surface. Vents 6 are also provided in the door 4 to allow for some air circulation and to prevent overheating during warmer periods.

Inside the cabinet 1 is a removable panel 7 in the form of a metal plate. In Fig. 1 the panel 7 is shown attached to the inside of cabinet 1 via two bolts 8 that project out from the inside of rear wall 9 of cabinet 1. The removable panel 7 is removably held in place via nuts 10 fastened onto bolts 8 (although it will be appreciated that other fasteners than nuts and bolts may be used). Fig. 3 shows an exploded view with the panel 7 removed from cabinet 1.

A pump 11 is removably mounted onto panel 7 via bolts 12 and nuts 13. A water meter 14 is mounted to the panel 7 via brackets 15 that are integrally formed with the panel 7 (although they could be separately formed), the meter 14 slotting into slots 16 formed in the brackets 15.

A stop valve 17 is provided between the mains water inlet 18 and the meter 14, connected by pipe 19. Although Fig. 3 shows the stop valve 17 attached to the

pipework and components mounted on removable panel 7, this is simply for clarity. The stop valve 17 is not mounted to the panel 7. If the panel 7 is to be removed for replacement, the stop valve 17 would remain connected to the mains inlet to stop flow while the panel 7 and its components are removed. The outlet of meter 14 is connected to pump 11 via pipe 20. The pump 11 drives water to the consumer's system via pipe 21 which essentially acts as the mains feed for all outlets and appliances within the building.

Trace heating wire 22 follows the pipework from the inlet 18 (which is connected to the mains supply from the water authority), along pipe 19, across meter 14, along pipe 20, round the pump chamber of pump 11 and along pipe 21. Thus heating wire 22 can provide heat along the whole water path from the point at which it enters the housing 1 from the mains supply to the point where it exits the housing 1 to the downstream systems. Electricity is supplied to heating wire 22 via isolating switch 23 which is typically connected to the consumer's electricity supply. Heating wire 22 is attached to the various system components via cable ties 24 (although other attachment means may be used).

As can be seen in Fig. 3, a pump bypass channel 25 is provided that can bypass the pump 11 allowing water supply to the property to continue in case of pump failure.

Fig. 4 shows a second embodiment. The majority of the components are the same as are shown and described above in relation to the first embodiment and therefore description thereof is omitted here. Fig. 4 shows a cabinet 27 that is designed for surface mounting rather than recessed mounting. The surface mounting configuration is better suited to retrofit installations, i.e. where the pump 11, etc. are to be fitted to an existing property with an existing mains supply. In such installations it is preferred not to recess into the wall of the property as such recessing would be moderately extensive, expensive and potentially harmful to the building. Instead, the surface mounting cabinet 27 can simply be attached to the exterior wall of the building and the existing mains supply connection can be routed out through the building wall and into the cabinet 27 via hole 26 in the rear wall 9 of cabinet 27 for connection to the inlet 18 of pipe 19. The surface mounting cabinet 27 is formed from a double wall construction on the rear wall and all of the side

walls. As with the first embodiment the door 4 is not double walled, but has insulation 5 affixed to the inner face thereof. Although Fig. 4 shows no vents in the door, these may be provided.

Once the cabinet (either recessed cabinet 1 or surface mounted cabinet 27) is installed, the interior components can be easily removed for inspection or maintenance and can be easily replaced simply by disconnecting the appropriate water and electricity connections and removing the pump 11 (or if necessary the whole removable panel 7).

For example, the disconnection process may involve, turning off the mains water supply (using stop cock 17 or a separate stop cock close to the street main), isolating the building systems via a further stop valve (not shown, but downstream of the outlet 28 of pipe 21) so as to prevent drain down of the consumer's system, disconnecting the electrical supply at isolating switch 23, and disconnecting the trace heating element 22 by removing cable ties 24, and disconnecting pump 11 by removing nuts 13 from bolts 12. A replacement pump 11 can be reconnected and the trace heating element 22 reattached.

If the whole panel 7 is to be removed , inlet 18 of pipe 19 is disconnected from the mains supply, outlet 28 of pipe 21 is disconnected from the downstream systems, nuts 10 are removed from bolts 8 and panel 7 is removed together with all components mounted thereto, including all of trace heating elements 22. For a fast repair, an identical panel with replacement components may simply be installed in its place and reconnected (by reconnecting all the disconnections listed above). With the arrangement shown in the Figures, the isolating switch 23 is mounted to the panel 7. In the absence of any other accessible circuit breaker, access would be required to the property to disconnect the electrical supply. However, a circuit breaker (or other electrical isolation device) mounted within the housing, but not on the removable panel 7 could avoid this problem.

As discussed above, the recessed cabinet 1 may be installed during the building phase of new building projects, i.e. while the property's walls are being built. It is not desired to install the panel 7 at this stage as the building site may be unsecure (risk of theft) and being a construction site there is greater risk of damage. Also, as

the utility connections are generally only made later in the building project, the installation cannot be finalized at the time of installing the recessed cabinet 1. However, the removable panel 7 with all major system components thereon can simply be supplied and fitted after the water supply has been connected towards completion of the project, thus avoiding the risks associated with the earlier phase of construction.

It will be appreciated that the cabinets 1, 27 may easily be locked by fitting a mechanical (or other) lock on the door to prevent access by unauthorized persons. The lock may be openable by a unique key (owned by the consumer) as well as a master key (owned by the water authority, for accessing multiple cabinets).

Fig. 5 shows a schematic of the basic system, showing inlet 18, stop valve 17, water meter 14, non-return valve 29 and pump 11, leading to outlet 28.

Fig. 6 shows a schematic of the system of Fig. 5 with the addition of a pump bypass 25 with isolating valves 30a, 30b, 30c. In normal use the bypass 25 is closed by closing the isolating valve 30a, while the valves 30b and 30c for the pump 11 are open. The valve 30a stops the pump 11 from circulating water round the bypass loop 25. If the pump 11 fails, the valves 30b and 30c can be closed and the valve 30a opened so that mains water can pass to the consumer's system without the assistance of the pump 11. Once a repair has been carried out, the valves 30a, 30b, 30c can be returned to their normal configuration again.

Claims

1. A water mains boosting system comprising:
an outdoor protective housing;
a pump mounted within the housing; and
one or more electric heating elements arranged to heat at least one system component within the housing.

2. A system as claimed in claim 1, wherein the electric heating element(s) comprises trace heating attached to pipes within the housing.

3. A system as claimed in claim 1 or 2, further comprising a removable panel removably mounted to the inside of the housing and wherein the pump is mounted to the panel.

4. A system as claimed in claim 1, 2 or 3, further comprising a water meter.

5. A system as claimed in any preceding claim, further comprising a check valve connected upstream of the pump.

6. A system as claimed in any preceding claim, further comprising a stop cock connected upstream of the pump.

7. A system as claimed in any preceding claim, further comprising an isolating electrical switch arranged to supply electrical power selectively to the electric heating element.

8. A system as claimed in any preceding claim, wherein the housing is a double skinned housing.

9. A system as claimed in any preceding claim, wherein the housing has an access door and wherein the access door has thermal insulation material mounted on the inside thereof.

10. A system as claimed in any preceding claim, wherein the housing has an access door and wherein the access door has a secure locking mechanism.

11. A method of installing a water mains boosting system in a property comprising:

surface mounting an outdoor protective housing on an outside wall of the property;

subsequently mounting a pump within the housing;

connecting a mains water supply through a wall of the housing to the pump;

attaching one or more electric heating elements to system components within the housing.

12. A method of installing a water mains boosting system in a property comprising:

mounting an outdoor protective housing recessed into an outside wall of the property;

subsequently mounting a pump within the housing;

connecting a mains water supply through a wall of the housing to the pump;

attaching one or more electric heating elements to system components within the housing.

13. A method as claimed in claim 11 or 12, wherein the electric heating element(s) comprises trace heating attached to pipes within the housing.

14. A method as claimed in claim 11, 12 or 13, wherein the pump is mounted on a removable panel and wherein the step of mounting the pump within the housing comprises mounting the removable panel to the inside of the housing.

15. A method as claimed in any of claims 11 to 14, further comprising mounting a water meter within the housing.

16. A method as claimed in any of claims 11 to 15, further comprising mounting a check valve in the housing, connected upstream of the pump.

17. A method as claimed in any of claims 11 to 16, further comprising mounting a stop cock in the housing, connected upstream of the pump.

18. A method as claimed in any of claims 11 to 17, further comprising mounting an isolating electrical switch in the housing, arranged to supply electrical power selectively to the electric heating element.

19. A method as claimed in any of claims 11 to 18, wherein the housing is a double skinned housing.

20. A method as claimed in any of claims 11 to 19, wherein the housing has an access door and wherein the access door has thermal insulation material mounted on the inside thereof.

21. A method as claimed in any of claims 11 to 20, wherein the housing has an access door and wherein the access door has a secure locking mechanism.

Application No:	GB1601611.5	**Examiner:**	Dr Fabio Noviello
Claims searched:	1-21	**Date of search:**	27 June 2016

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-21	US5609784 A (DAVENPORT), Abstract; Figure 1 (esp. outdoor protective housing 10, electric heater 20 and stopcock valves-not numbered)); Description (esp. lines 10-15, Column 1 and lines 24-25, Column 2 - pump and line 46, Column 1- electric heater).
A	-	US4726394 A (DEVINE)
A	-	US5614119 A (OLLIS)
A	-	JP H0712086 A (HITACHI)
A	-	US 3949189 A (BILBRO & JOHNSON)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

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

E03B

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

EPODOC, WPI, TXTA, Internet

International Classification:

Subclass	Subgroup	Valid From
E03B	0007/09	01/01/2006
F16L	0059/16	01/01/2006