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(58) Field of Search:
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(54) Title of the Invention: **Apparatus for limiting leakage from a liquid supply installation in a premises**
Abstract Title: **Apparatus for limiting leakage from a liquid supply installation in a premises**

(57) The liquid supply installation (11, fig 1) includes a supply inlet (12) which provides a pressurised supply of liquid to the premises and a network of distribution pipes (14) which are fed from the supply inlet and which distribute liquid to different parts of the premises. The apparatus comprises a timer (in control board 4) which operates with a predetermined time period, a valve 3 which is responsive to the timer means to close the supply inlet against fluid flow upon expiry of the predetermined time period, and a flow sensor 1 arranged to operate the timer to commence the predetermined timing period. The flow sensor 1 is arranged to detect changes in the rate of flow through the supply inlet and the apparatus is such that, in use, the timer commences a new predetermined timing period whenever the rate of flow as measured by the flow sensor 1 changes to a value greater than zero. The invention also includes an electronic control system 4 powered by an electricity generator 2 operated by flow of liquid through the apparatus. A storage battery is arranged to be charged by the electricity generator 2. The control system 4 monitors the electrical charge within the storage battery and closes the supply inlet against fluid flow if the charge falls below a predetermined safe level.

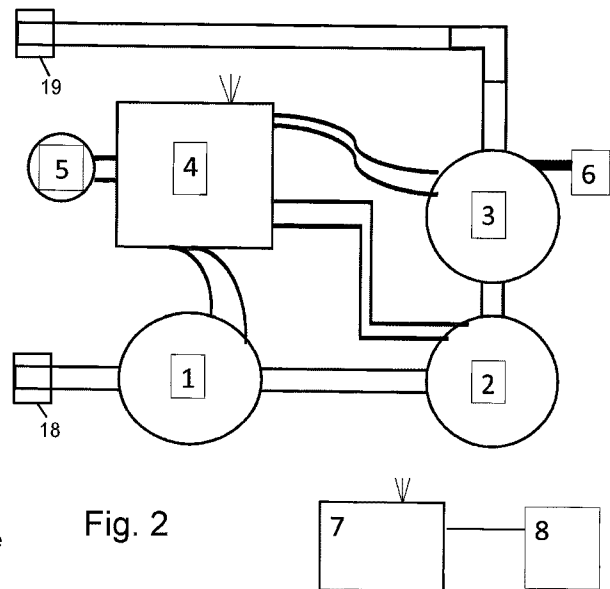


Fig. 2

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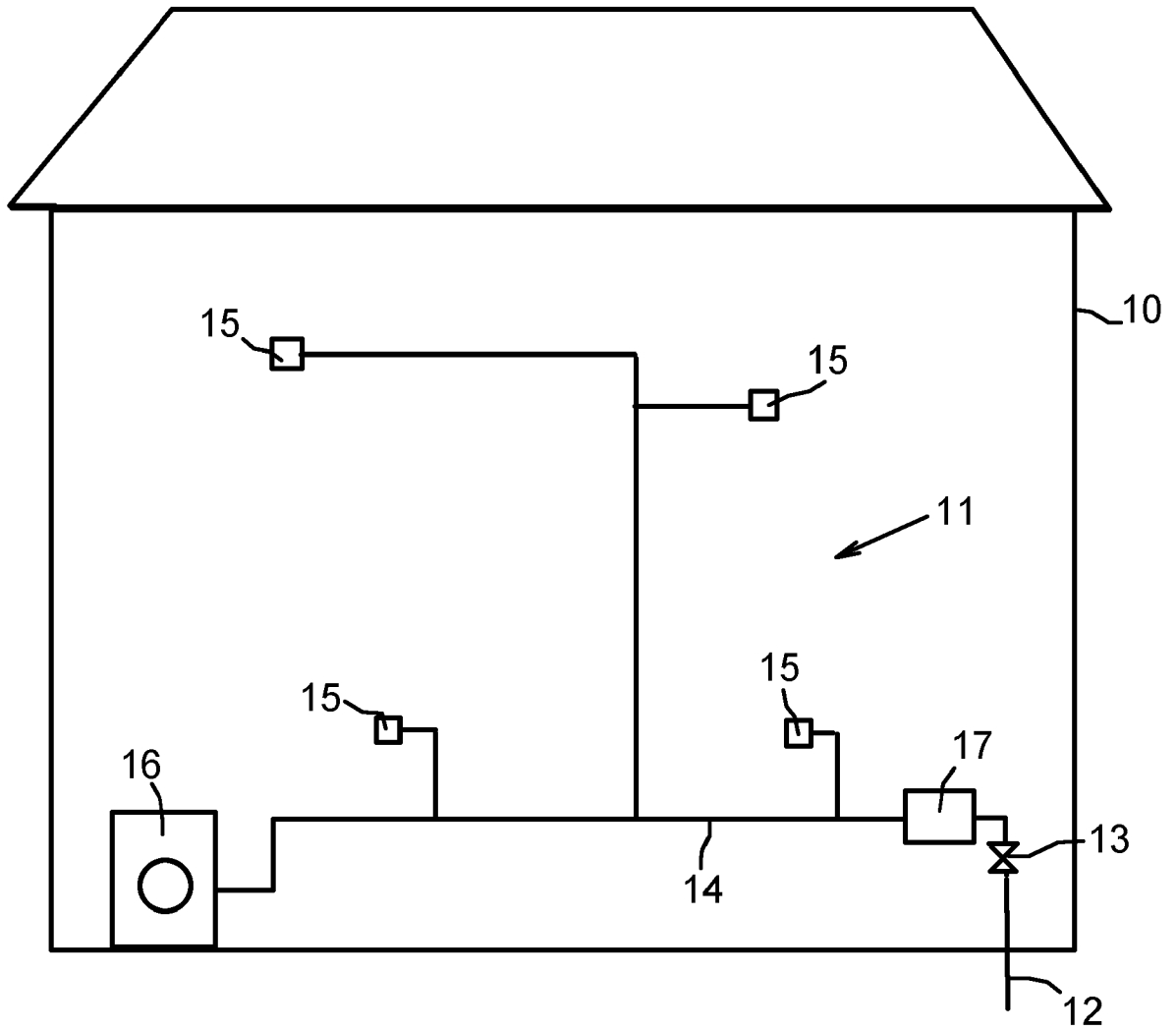


Fig. 1

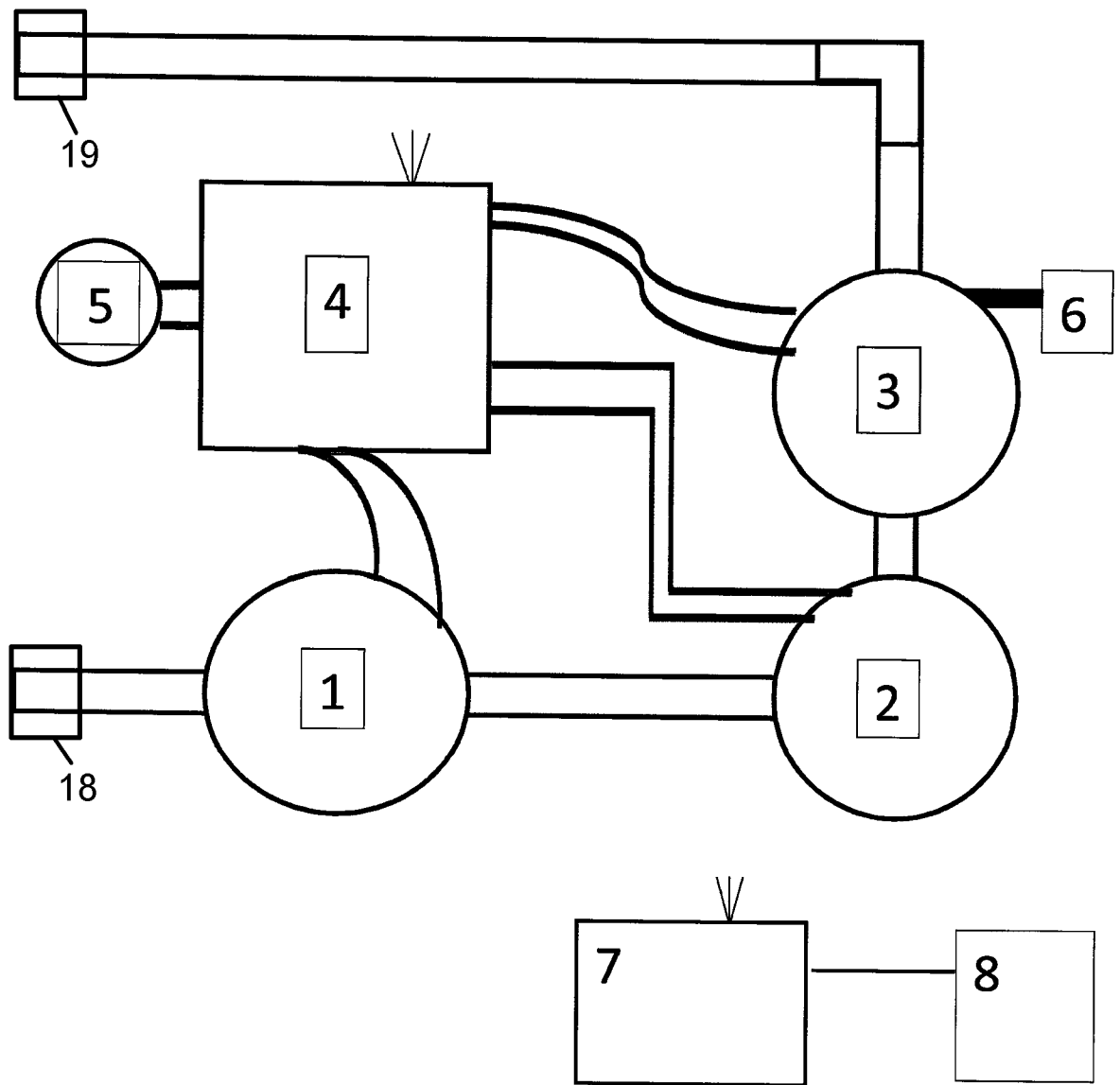


Fig. 2

**APPARATUS FOR LIMITING LEAKAGE FROM A LIQUID
SUPPLY INSTALLATION IN A PREMISES**

TECHNICAL FIELD OF THE INVENTION

This invention relates to apparatus for limiting leakage from a liquid supply installation in a premises.

BACKGROUND

Most premises are provided with a water supply installation in which water is fed to various outlets from a supply inlet through a network of distribution pipes. The outlets may include manually operated valves as well as automatic valves as found in appliances such as washing machines. Most of the time the water in the pipes is maintained under pressure. If any leaks should develop considerable damage may be caused to walls, ceilings, floor coverings or furniture.

Many solutions to this problem have been proposed. Typically, a sensor is installed at or near the supply inlet to detect water flow. Whenever water flows through the inlet a timer is started. A

timing period is necessary to detect whether the flow is caused by prolonged leakage or normal intermittent usage. If the water flows for more than a preset time period a shutoff valve is actuated to prevent any more water from flowing into the installation. The timer is normally reset when the flow ceases.

In known apparatus the timing period may be adjusted according to flow rate such that if there is a low flow rate a greater period of flow is allowed than at higher flow rates. The timing period may also be controlled by pressure changes. In normal use the pressure changes in the system may be quite small, but if a large leak develops, due to a fractured pipe for example, the supply can be cut off almost immediately. Other variations are known. For example, an override facility may be provided to allow the timing period to be exceeded when flow is required for an extended period, e.g. when watering the garden. Users may also be able to select short or long time periods depending on the period of continual use which is required.

Despite the large number of proposals, existing systems suffer from at least one of the following disadvantages:

- Frequent manual intervention is often required to prevent unnecessary activation or restore flow.
- The equipment is susceptible to false activation, e.g when large volumes of water are required for normal purposes or due to normal variations in system pressure.
- Activation does not occur quickly enough, when a considerable amount of damage has already taken place.

- The apparatus is complicated, expensive or time consuming to install.

The present invention seeks to provide a new and inventive form of apparatus for limiting leakage from a liquid supply installation in a premises.

SUMMARY OF THE INVENTION

The present invention proposes apparatus for limiting leakage from a liquid supply installation in a premises. The liquid supply installation includes a supply inlet which provides a pressurised supply of liquid to the premises and a network of distribution pipes which are fed from the supply inlet and which distribute liquid to different parts of the premises. The apparatus comprises timer means which operates with a predetermined time period, a valve arrangement associated with the supply inlet and which is responsive to the timer means to close the supply inlet against fluid flow upon expiry of the predetermined time period, and a flow sensor responsive to flow of liquid through the supply inlet and arranged to operate the timer means to commence the predetermined timing period.

The invention also provides apparatus for limiting leakage from a liquid supply installation in a premises in which a flow sensor is arranged to detect changes in the rate of flow through the supply inlet and the apparatus is such that, in use, timer means

commences a new predetermined timing period whenever the rate of flow as measured by the flow sensor changes to a value greater than zero.

The invention also provides apparatus for limiting leakage from a liquid supply installation in a premises which includes an electronic control system powered by an electricity generator operated by flow of liquid through the apparatus.

The invention also provides apparatus for limiting leakage from a liquid supply installation in a premises which includes a storage battery which is arranged to be charged by the electricity generator.

The invention also provides apparatus for limiting leakage from a liquid supply installation in a premises in which the control system is arranged to monitor the electrical charge within the storage battery and close the supply inlet against fluid flow if the charge falls below a predetermined safe level.

The invention also provides apparatus for limiting leakage from a liquid supply installation in a premises which includes a manual control operable to reset the apparatus.

The invention also provides apparatus for limiting leakage from a liquid supply installation in a premises which includes a manual control operable to select a longer predetermined time period.

The invention also provides apparatus for limiting leakage from a liquid supply installation in a premises which includes a manual control operable to change the state of a valve arrangement from open to shut or vice versa.

The invention also provides apparatus for limiting leakage from a liquid supply installation in a premises which is arranged to allow a user select an extended timing period which is automatically canceled after a set time.

The invention also provides apparatus for limiting leakage from a liquid supply installation in a premises which includes a valve arrangement which has two stable states, open and closed, either of which is selectable by applying an appropriate actuating voltage.

BRIEF DESCRIPTION OF THE DRAWINGS

The following description and the accompanying drawings referred to therein are included by way of non-limiting example in order to illustrate how the invention may be put into practice. In the drawings:

Figure 1 is a schematic diagram of a water supply installation in a premises such as a domestic house; and

Figure 2 is a block diagram of apparatus for limiting

leakage from the water supply installation.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring firstly to **Fig. 1**, a premises 10, which is typically a domestic dwelling house or a commercial establishment, has a water supply installation 11. The installation includes a supply inlet 12 which is connected to a rising main, a pumped supply from a well or borehole, or a similar source which provides a pressurised supply of potable liquid to the premises. The supply inlet 12 feeds water via a stopcock 13 to a branched network of distribution pipes 14, represented schematically, which distribute water to different parts of the premises at which water can be drawn off using manually operated valves 15 (taps or faucets, shower valves etc.) or automatic valves as in toilet cistern or washing machine 16.

Between the water supply inlet 12 and the distribution pipes 14, and downstream of the stopcock 13, there is installed apparatus 17 for limiting leakage from the liquid supply installation upon occurrence of an event such as, for example, a burst or fractured pipe, a faulty valve 15, 16, or a tap being inadvertently being left on. Referring to **Fig. 2**, the apparatus 17 is self-contained and may conveniently have push-fit inlet and outlet connectors 18 and 19 for connection to the supply inlet 12 and distribution pipe 14 respectively. The apparatus 17 includes a flow sensor 1, a actuator-operated valve 3, and an electronic control board 4

which incorporates an electronic timer. The flow sensor 1 measures the flow of water through the supply inlet and sends an electrical signal to the control board 4 to indicate the current flow rate. The electrical output from the sensor may be continuous, as in the case of an analogue flow sensor, or updated at suitably short intervals (e.g. 1 second) as in the case of a digital sensor. The actuator-operated valve 3 has two stable states, open and closed, either of which may be selected by means of a suitable actuating voltage supplied by the control board 4. Once the desired state has been selected an actuating voltage is no longer required and the valve remains in the selected state. As a safeguard against system malfunction, a manual override 6 may be provided to enable the valve 3 to be manually opened or closed, overriding any output provided by the control board.

The timer within the control board 4 operates with a predetermined time period which will generally be programmable by a service engineer or factory set. The commencement of a new timing period is initiated each time there is a change in flow rate as detected by the flow sensor 1, except when the flow rate returns to zero in which case the current timing cycle is terminated without any new timing period being initiated. Provided the timing period is set appropriately (say 30 - 45 minutes) normal changes in flow rate which occur during use such as taking a shower, filling a kettle, washing hands etc., will be sufficient to reset the timing period before it comes to an end. However, should the same rate of flow continue for more than the set period without change the control board sends a brief actuating voltage to close the valve 3

and prevent water reaching the distribution pipes 4.

In practice normal tasks such as watering the garden or running a shower will be associated with changes in flow rate which are sufficient to reset the timer, but the user will quickly learn to guard against unwanted shutdown by changing the flow at intervals. However, should unintended shutdowns occur a user control 5 such as a push button or knob is provided. The control 5 conveniently incorporates a warning light to provide the user with information to which the user may respond, as follows:

A) A red warning light is illuminated when a leak has been detected causing the solenoid valve 3 to close.

B) A short push (or turn) resets the controller to open the solenoid valve 3.

C) A long push (or turn) e.g. greater than 3 seconds selects a longer predetermined time period. After a set time the extended timing period is automatically cancelled and the system returns to normal operation.

D) Selection of the longer time period causes an amber light to illuminate.

E) Two short pushes (or turns) in quick succession changes the state of the solenoid valve from open to shut or vice versa.

Clearly additional functionality can be incorporated as required.

It is an important feature of the present apparatus that it is fully self-contained independent of external power connections or batteries which need to be replaced. This is achieved by the incorporation of a flow-operated electricity generator 2 in the flow

path through the apparatus. The generator produces a small alternating current at a voltage which, when converted to DC, is sufficient to maintain a rechargeable battery which is included on the control board 4. A normal level of water usage within the premises will produce sufficient charge to allow the device to operate and effect a shut down in the event of a leak, as described. The control board monitors the state of charge of the internal battery, and should the voltage fall below a threshold value through lack of charge, e.g. when the premises is unoccupied, the solenoid valve will automatically open to shut down the water supply. However, sufficient charge will remain to allow the solenoid valve to operate and permit flow to re-commence when normal operation is restored.

The control board 4 preferably also incorporates a wireless connection which may communicate directly with a wifi to allow remote control and monitoring of the apparatus. The control board may also provide communication with a dedicated receiver 7, located at a convenient place within the premises, which is linked to a mobile telephone or landline connection 8. The receiver 7 includes an auto-dialler to allow a warning to be sent to a pre-programmed landline or mobile telephone number and provide a remote alert when a leak is detected.

The apparatus is thus able to reliably detect leaks ranging from major bursts to very slow leaks within a relatively short time period. There is a minimum requirement for manual intervention, and the system is inexpensive, reliable and quick and simple to

install.

The apparatus may also be suitable for monitoring the supply of other liquids to a premises such as heating oil.

Whilst the above description places emphasis on the areas which are believed to be new and addresses specific problems which have been identified, it is intended that the features disclosed herein may be used in any combination which is capable of providing a new and useful advance in the art.

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CLAIMS

1. Apparatus for limiting leakage from a liquid supply installation in a premises,

- the liquid supply installation including a supply inlet which provides a pressurised supply of liquid to the premises and a network of distribution pipes which are fed from the supply inlet and which distribute liquid to different parts of the premises,

- the apparatus comprising timer means which operates with a predetermined time period, a valve arrangement associated with the supply inlet and which is responsive to the timer means to close the supply inlet against fluid flow upon expiry of the predetermined time period, and a flow sensor responsive to flow of liquid through the supply inlet and arranged to operate the timer means to commence the predetermined timing period;

in which the flow sensor is arranged to detect changes in the rate of flow through the supply inlet and the apparatus is such that, in use, the timer means commences a new predetermined timing period whenever the rate of flow as measured by the flow sensor changes to a value greater than zero.

2. Apparatus for limiting leakage from a liquid supply installation in a premises according to Claim 1 which includes an electronic control system powered by an electricity generator operated by flow of liquid through the apparatus.

3. Apparatus for limiting leakage from a liquid supply installation in a premises according to Claim 2 which includes a storage battery which is arranged to be charged by the electricity generator.

4. Apparatus for limiting leakage from a liquid supply installation in a premises according to Claim 3 in which the control system is arranged to monitor the electrical charge within the storage battery and close the supply inlet against fluid flow if the charge falls below a predetermined safe level.

5. Apparatus for limiting leakage from a liquid supply installation in a premises according to any preceding claim which includes a manual control operable to:

- reset the apparatus to open the valve arrangement;
- select a longer predetermined time period; and
- change the state of the valve arrangement from open to shut or vice versa.

6. Apparatus for limiting leakage from a liquid supply installation in a premises according to Claim 5 which is arranged such that the extended timing period is automatically canceled after a set time.

7. Apparatus for limiting leakage from a liquid supply installation in a premises according to any preceding claim in which the valve arrangement has two stable states, open and closed, either of which is selectable by applying an appropriate

actuating voltage.

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Application No: GB1702197.3

Examiner: Mr Mike Walker

Claims searched: 1 to 7

Date of search: 7 July 2017

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 - 7	GB2310068 A (CHADWICK) se abstract; page 2, line 1 to page 5, line 31
X	1 - 7	EP1580336 A2 (ANTONIO) see abstract; column 2, line 3 to column 3, line 35
X	1-3,5-7	EP2982891 A2 (CASTLEBRIDGE ENTERPRISES) whole document
X	1-3, 6,7	WO2008/046042 A1 (BURLAGE) see abstract
X	1 - 7	WO99/46526 A1 (ISAACSON) see abstract; page 8,ll.9-13
X	1, 5 -7	US2010/0000615 A1 (FINLAYSON) see abstract
X	1, 5 -7	US6317051 B1 (COHEN) see abstract; column 3,1.25 to column 4,1.30
X	1, 7	US4589435 A1 (ALDRICH) see abstract
X	1, 7	US6164319 A1 (COCHRAN) see abstract
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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	P	Document published on or after the declared priority date but before the filing date of this invention.



same category. & 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.
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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, G01M

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

EPODOC, WPI

International Classification:

Subclass	Subgroup	Valid From
G01M	0003/28	01/01/2006
E03B	0007/07	01/01/2006
G01M	0003/26	01/01/2006