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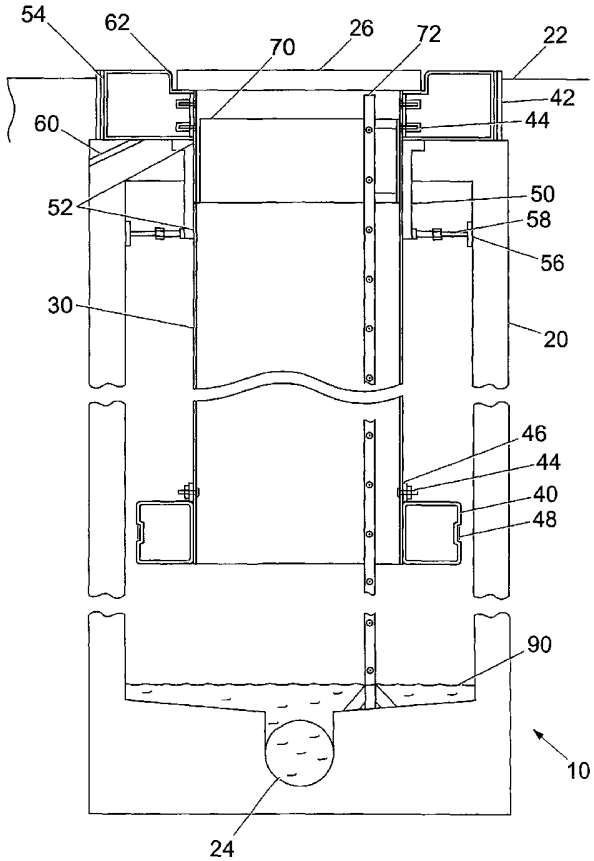
(54) Title: APPARATUS FOR FLOOD PROTECTION OF MANHOLES AND ACCESS COVERS



(57) Abstract: An apparatus for flood protection of a manhole (10) comprises a vertical pipe slidably mounted for vertical movement within the casing of a manhole (20), and a seal (52) adapted to seal between the pipe and the casing. The pipe has at least one buoyant portion (40, 42) such that the pipe (30) rises vertically as the buoyant portion (40, 42) rises.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Apparatus for Flood Protection of Manholes and Access Covers

The present invention relates to an apparatus for flood protection of manholes and other access chambers. Within the present specification, the term 'manhole' is used to denote any artificial ground hole prone to flooding.

Manholes are provided at regular intervals for inspection of sewage pipe-work systems. These sewage systems are often provided near waterways. During flood conditions, flood water can access the sewage system via the manholes causing the water level to rise until the water and sewage spills out of the manhole. Also, flooding can cause a surcharge or overflow of the sewage system due to the access of flood water at other parts of the system, again causing the spillage of water and sewage from the manhole. Thus, sewage can be displaced from the system to the area surrounding the manhole and into neighbouring waterways. This

event is undesirable because of the environmental and health hazards that it creates.

According to the present invention, there is provided an apparatus for flood protection of a manhole comprising:

a substantially vertical pipe slidably mounted for vertical movement within the casing of a manhole;

at least one seal adapted to seal between the pipe and the casing; wherein

the pipe has at least one buoyant portion such that the pipe rises vertically as the buoyant portion rises.

The term "pipe" is to be interpreted as any tubular member.

In a first embodiment of the present invention, the apparatus includes a first buoyant portion within the casing, the first buoyant portion being adapted to cause said pipe to rise with the level of rising water within said casing. Water can rise in the casing under surcharge conditions, and under such conditions the pipe will rise so that rising water is prevented from reaching the upper end of the pipe.

Preferably the first buoyant portion comprises an annular ring provided around the pipe. Preferably the annular ring is located proximal to the lower end of the pipe and is adapted to rise with the

level of water within the casing. Alternatively the pipe may be double-skinned or may comprise two or more concentric pipes such that the space between each skin or concentric pipe provides the buoyant portion. The space between each skin or concentric pipe may be filled with foam.

In a second embodiment of the present invention, the apparatus includes a second buoyant portion above the casing, the second buoyant portion being adapted to cause said pipe to rise with the level of rising flood water above said casing. Water can flow onto the ground in which manholes are positioned under flood conditions, and under such conditions the pipe will rise so that flood water is prevented from reaching the upper end of the pipe.

Preferably the second buoyant portion comprises an annular ring provided around the pipe. Preferably the second buoyant portion is provided proximal to the upper end of the pipe and is adapted to rise with the level of water outside the casing.

Preferably the second buoyant portion is positioned within a channel formed in the ground when the pipe is in the lowered position. Preferably one or more drainage passages are provided at the channel to drain water away from the or each buoyant member.

In a third embodiment of the present invention the apparatus includes both a first and second buoyant portion as described above.

Preferably the manhole casing includes a guide adapted for guiding the pipe in a substantially vertical direction. Preferably the guide member comprises a sleeve that encloses the pipe. Preferably the or each seal is provided between the pipe and the sleeve. Preferably the or each seal is an 'O' ring type seal. The or each seal is adapted to allow vertical sliding of the pipe relative to the guide member.

Preferably a lateral support member is provided to support the pipe. Preferably the lateral support member comprises one or more support arms extending from the sleeve to the casing wall. Preferably a plurality of equally spaced support arms radiate from the sleeve to the casing wall. Alternatively an annular support ring may be provided around the outer circumference of the pipe, the support ring allowing vertical movement of the pipe relative to the support ring, and the support arms radiate from the support ring to the casing wall. Preferably the length of one or more of the support arms is adjustable.

Preferably a cover is provided at the upper end of the pipe. Preferably the apparatus is arranged such that the upper surface of the cover is substantially at ground level when the pipe is in the lowered position. Alternatively the upper end of the casing is above ground level and the cover is positioned at a height from the ground.

Preferably the or each annular ring is connected to the pipe by a securing band. Preferably the or each annular ring is further connected to the pipe using fasteners, such as bolts and nuts. Alternatively the annular ring is bonded to the pipe. Alternatively the annular ring is moulded integral with the pipe. Preferably the outer vertical edge of one or more annular rings is tapered. A guard ring may enclose one or more of the annular rings.

Preferably at least one end stop is provided on the pipe to limit the vertical travel of the pipe. The end stop may be provided by the first buoyant portion. Alternatively at least one end stop may be provided on the guide member.

Preferably an annular support ring is provided at the internal diameter of the pipe. Preferably a ladder is connected to the support ring. Preferably the ladder is fixedly attached to the base of the manhole. Preferably the pipe is adapted to slide relative to the support ring.

Preferably the lower end of the pipe is located at a predetermined distance from the base of the manhole when the pipe is in the lowered position. Preferably this distance is greater than one metre.

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

Fig. 1 is a sectional side view of the apparatus according to the third embodiment of the present invention as described above;

Fig. 2 is a sectional perspective view of the pipe and ladder of the apparatus of Fig. 1;

Fig. 3 is a plan view of the pipe and ladder of the apparatus of Fig. 1; and

Fig. 4 is a sectional side view of a modification to the apparatus of Fig. 1.

Fig. 1 shows an embodiment of the apparatus 10 for flood protection of manholes. The manhole comprises a concrete casing 20 provided in the ground 22 and connected to the pipe-work 24 of a sewage system. The manhole provides access for personnel to inspect the sewage system. A manhole lid 26 covers the manhole.

The apparatus 10 comprises a vertical pipe 30 within the manhole casing 20 and depending from the uppermost portion of the manhole. Connected near to the base and the top of the pipe 30 are buoyant portions in the form of annular rings or first and second collars 40, 42. It should be appreciated that the apparatus 10 can operate if only one of the collars 40, 42 is present.

The first and second collars 40, 42 are connected to the pipe 30 using conventional fasteners 44, such as nuts and bolts or screws. The second collar 42 is screwed or clamped to the pipe 30 for ease of assembly. Other means of fastening the collars 40, 42 are possible such as bonding the collars to the pipe 30, or the collars 40, 42 may be moulded integral with the pipe 30. The second collar 42 is screwed to the pipe 30. A flange 46 is provided on the first collar 40 for bolting to the pipe 30. The first collar 40 is also connected to the pipe 30 using a securing band 48.

A guide member or sleeve 50 is fixed to the casing 20. The pipe 30 is positioned within this sleeve 50 and two seals in the form of 'O' ring type seals 52 are provided between the sleeve 50 and pipe 30. The seals 52 are adapted to allow vertical sliding of the pipe 30 relative to the sleeve 50. It is to be understood that other forms of seals may be used. A mastic type seal (not shown) is also provided between the sleeve 50 and casing 20.

A lateral support member 56 is fixed to the sleeve 50 and the casing wall. The support member 56 comprises a number of support arms 58 that radiate from the sleeve 50 to the casing wall. The support member 56 braces the pipe 30 and inhibits lateral movement of the pipe 30 when the pipe 30 is in the raised condition and flowing water acts upon the pipe 30. The length of each support arm 58 is adjustable.

The first collar 40 also performs the function of an end stop. When the pipe 30 has been sufficiently raised, the first collar 40 will contact the sleeve 50 and prevent further raising of the pipe 30.

The second collar 42 is positioned in a channel 54 provided in the ground. A drainage passage 60 is provided in the casing 20, with a first end provided at the channel 54. This allows water that accumulates in the channel 54 to be drained away during normal conditions. Therefore, the apparatus remains in a lowered position with the manhole lid at ground level during normal conditions. However, it is to be understood that the casing 20 may have an upper end that is at some height from ground level. A non-return valve (not shown) may be provided at one of the ends of the drainage passage 60 so that ground water may not travel up the drainage passage 60 and into the channel 54.

A groove portion 62 is provided at the second collar 42 to accommodate the manhole lid 26. In existing manholes, the casing 20 is provided with the groove portion to accommodate the manhole lid. For the present apparatus 10, the groove portion of the casing 20 is taken up by a flange provided on the sleeve 50. It is therefore relatively straightforward to fit the present apparatus 10 to existing manholes.

The outer vertical surface of the second collar 42 is tapered to avoid the second collar 42 being trapped by earth that may become hard packed. Alternatively a guard ring (not shown) may be provided around the annular ring to prevent the accumulation of earth around the second collar 42.

Within the internal diameter of the pipe 30 is an annular support ring 70. Attached to the support ring 70 is a ladder 72 to allow access for personnel to the base of the manhole. The ladder 72 extends to the base of the manhole where it is firmly supported, such as by grouting. The support ring 70 is attached to the pipe 30 such that the pipe 30 may slide relative to the support ring 70. Bearings (not shown) may be provided between the pipe 30 and support ring 70. The lateral support member 56 provides lateral support when personnel are climbing up or down the ladder 72. The support ring 70 and ladder 72 are shown more clearly in Figs. 2 and 3.

The pipe 30 terminates at a distance from the base of the manhole. This distance is typically greater than one metre to allow freedom of movement for personnel at the base of the manhole.

Fig. 4 shows a modification to the third embodiment of the present apparatus 10, with this view being normal to the longitudinal axis of the sewage pipe 24. Only the second of the collars 42 is provided. The pipe 30 is double-skinned, or may be formed from two concentric pipes, and the first buoyant portion

is provided by the annular space 36 between the two skins 32, 34. The lower end of the skins 32, 34 is sealed to prevent the ingress of water. Foam may be provided in the annular space 36.

The pipe 30 is provided with end stops 80 to limit the vertical travel of the pipe 30. Fig. 4 shows the sleeve 50 as having a greater length to offer increased support to the pipe 30 in the raised position. Therefore, in this embodiment, the lateral support member 56 is omiited.

In use, the apparatus is in the lowered position during normal conditions, as shown in the accompanying figures. The water level 90 in the sewage system is typically lower than that of the first collar 40. During flood conditions, the level of water (and sewage) 90 can rise due to an accumulation of water from another part of the sewage system.

As the water level 90 rises within the casing, reaching and then passing the first collar 40, the first collar 40 will also begin to rise. Therefore, the pipe 30 will also rise until the upper end is above ground level. When the water level 90 reaches the top of the casing 20, it can only travel further via the pipe 30, due to the presence of the seals 52. The water will be contained within the pipe until and unless the water level 90 exceeds the maximum height of the pipe 30 above ground level.

Alternatively or in addition, flood water may be present on the surface of the ground. The presence of water above the second collar 42 will produce an upwards force on the second collar 42 due to its buoyancy and the second collar 42 will rise. Therefore, the pipe 30 will also rise. Flood water may flow into the channel 54 but cannot enter the casing 20 due to the presence of the seals 52.

The second collar 42 maintains the upper end of the pipe 30 above the level of the flood water until the maximum travel of the pipe 30 has been reached. The second collar 42 also provides stability for the pipe when floating in flood water which may be flowing due the action of tides, sloping terrain and so on.

Various modifications and improvements can be made without departing from the scope of the present invention. For example, only one of the first or second collars 40, 42 may be provided or the concentric pipes 32, 34 having an annular space 36 between the pipes may be provided with or without the collars. The buoyant portions may be in any suitable form to provide the buoyancy required. The support ring 70 and ladder 72 may not be provided and a temporary ladder used when access is required. Alternatively, the pipe 30 may be provided with hand and foot holds to allow access to the base of the manhole.

Claims

1. An apparatus for flood protection of a manhole comprising:

a substantially vertical pipe slidably mountable for vertical movement within the casing of a manhole; and

at least one seal adapted to seal between the pipe and the casing; wherein

the pipe has at least one buoyant portion such that the pipe rises vertically as the buoyant portion rises.

2. An apparatus as claimed in Claim 1, wherein the buoyant portion includes a first buoyant portion within the casing, the first buoyant portion being adapted to cause said pipe to rise with the level of rising water within said casing.

3. An apparatus as claimed in Claim 2, wherein the first buoyant portion comprises an annular ring provided around the pipe and located proximal to the lower end of the pipe.

4. An apparatus as claimed in Claim 2, wherein the pipe comprises two or more concentric pipes, and the first buoyant portion comprises the space between each concentric pipe.

5. An apparatus as claimed in Claim 4, wherein the space between each concentric pipe is filled with foam.

6. An apparatus as claimed in any preceding claim, wherein the buoyant portion includes a second buoyant portion above the casing, the second buoyant portion being adapted to cause said pipe to rise with the level of rising flood water above said casing.

7. An apparatus as claimed in Claim 6, wherein the second buoyant portion comprises an annular ring provided around the pipe and located proximal to the upper end of the pipe.

8. An apparatus as claimed in Claim 6 or 7, wherein the second buoyant portion is positioned within a channel formed in the ground when the pipe is in the lowered position.

9. An apparatus as claimed in Claim 8, wherein one or more drainage passages are provided at the channel to drain water away from the second buoyant portion.

10. An apparatus as claimed in any preceding claim, wherein the manhole casing includes a guide adapted for guiding the pipe in a substantially vertical direction.

11. An apparatus as claimed in any preceding claim, wherein one or more seals are provided between the pipe and the sleeve.

12. An apparatus as claimed in any preceding claim, wherein a lateral support member is provided to support the pipe, and wherein the lateral support member comprises one or more support arms extending from the sleeve to the casing wall.

13. An apparatus as claimed in any preceding claim, wherein a cover is provided at the upper end of the pipe, and wherein the apparatus is arranged such that the upper surface of the cover is substantially at ground level when the pipe is in the lowered position.

14. An apparatus as claimed in any preceding claim, wherein an annular support ring is provided at the internal diameter of the pipe.

15. An apparatus as claimed in Claim 14, wherein a ladder is connected to the support ring, the ladder being fixedly attached to the base of the manhole, and wherein the pipe is adapted to slide relative to the support ring.

16. An apparatus as claimed in any preceding claim, wherein the lower end of the pipe is located at a predetermined distance from the base of the manhole when the pipe is in the lowered position.

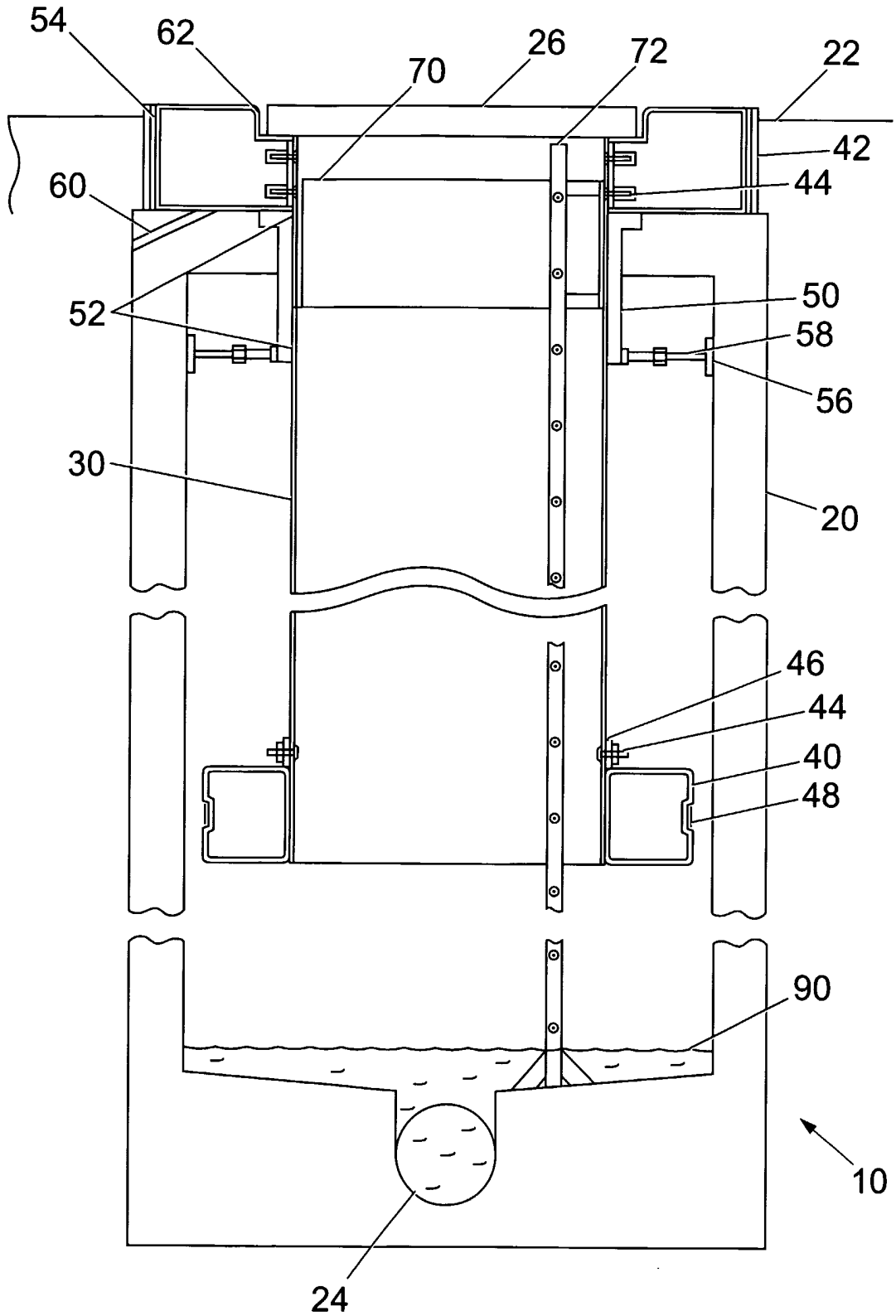

Fig. 1

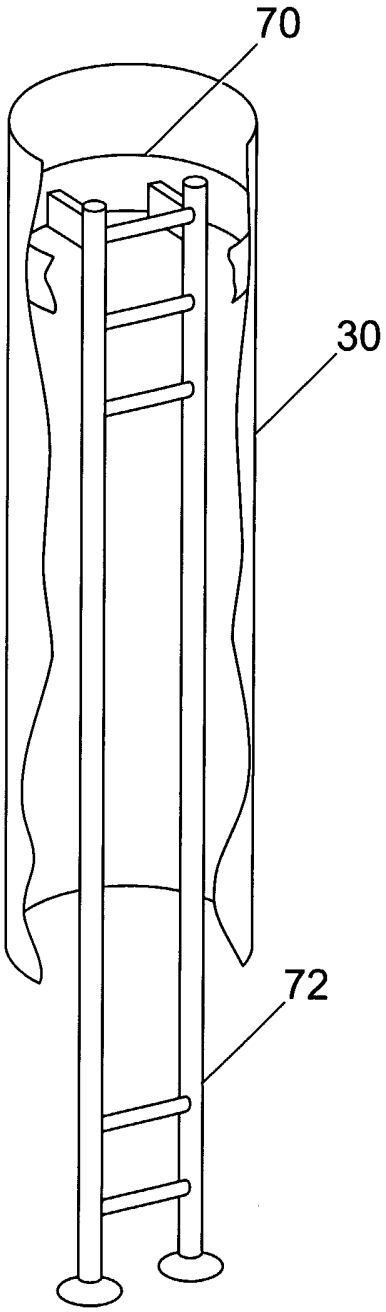

Fig. 2

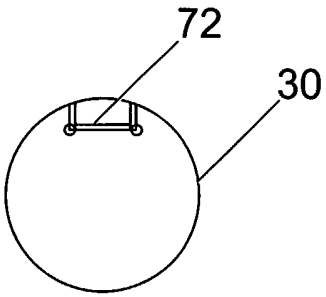

Fig. 3

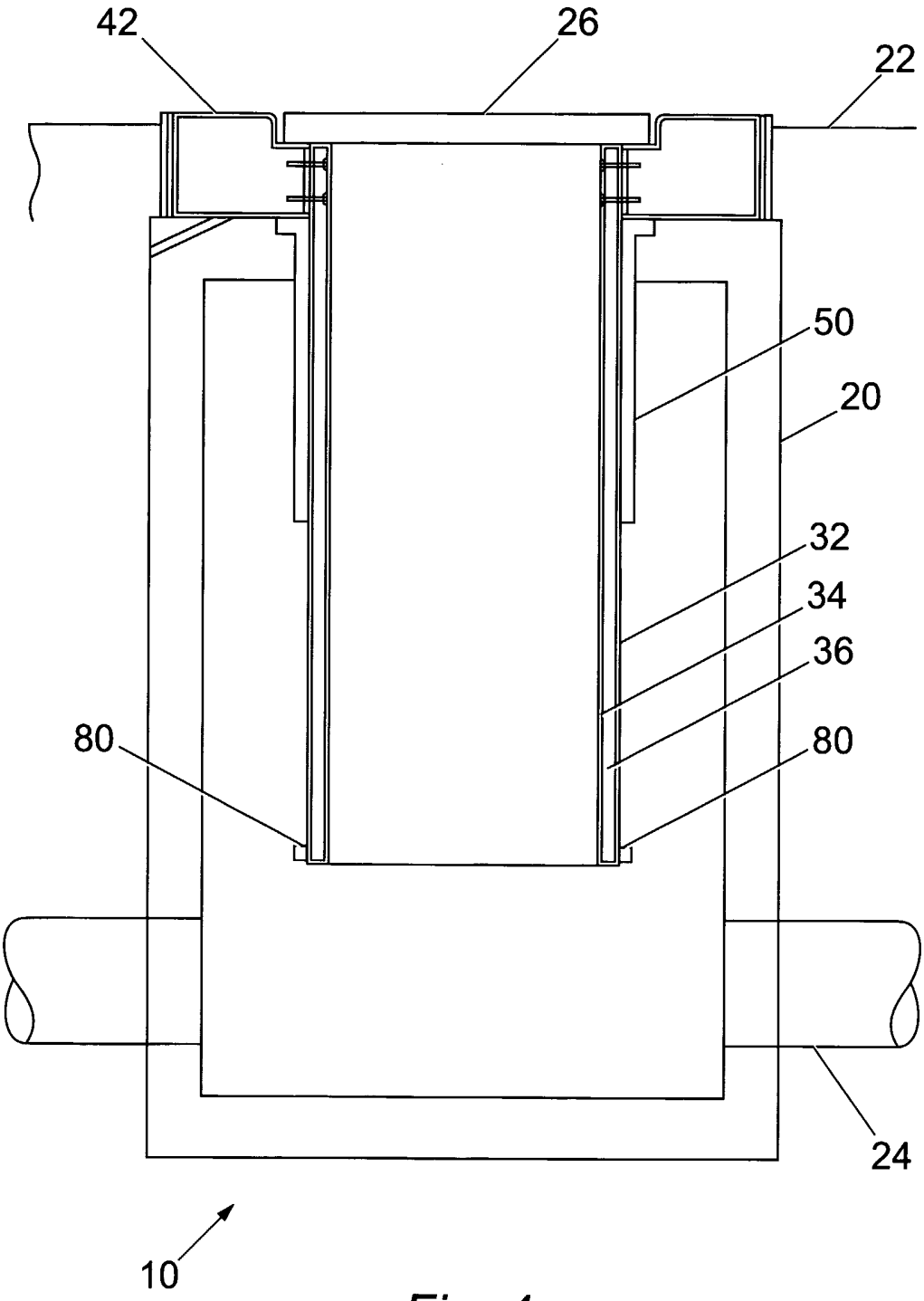

Fig. 4

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 03/03547

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E03F5/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E03F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 912 111 A (KOVAC JR STEVE) 10 November 1959 (1959-11-10) column 1, line 23 - line 26; figures 1,2,6 column 1, line 55 - line 67 column 2, line 39 -column 3, line 12 column 4, line 4 - line 36 column 4, line 52 -column 5, line 7 ---	1,2,10, 12-16
X	US 2 478 976 A (CHESTER MODLIN) 16 August 1949 (1949-08-16) the whole document ---	1,2,10, 12,13
A	US 3 294 000 A (PELSUE THURMAN A) 27 December 1966 (1966-12-27) column 1, line 37 - line 46 --- -/--	1

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
14 November 2003	26/11/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Flygare, E

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 03/03547

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	GB 224 959 A (JOSEPH WALTER LOWE) 24 November 1924 (1924-11-24) the whole document ---	1
A	US 1 457 637 A (SIEVERS WILLIAM O) 5 June 1923 (1923-06-05) the whole document -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 03/03547

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2912111 A	10-11-1959	NONE	
US 2478976 A	16-08-1949	NONE	
US 3294000 A	27-12-1966	GB 1032839 A	15-06-1966
GB 224959 A	24-11-1924	NONE	
US 1457637 A	05-06-1923	NONE	