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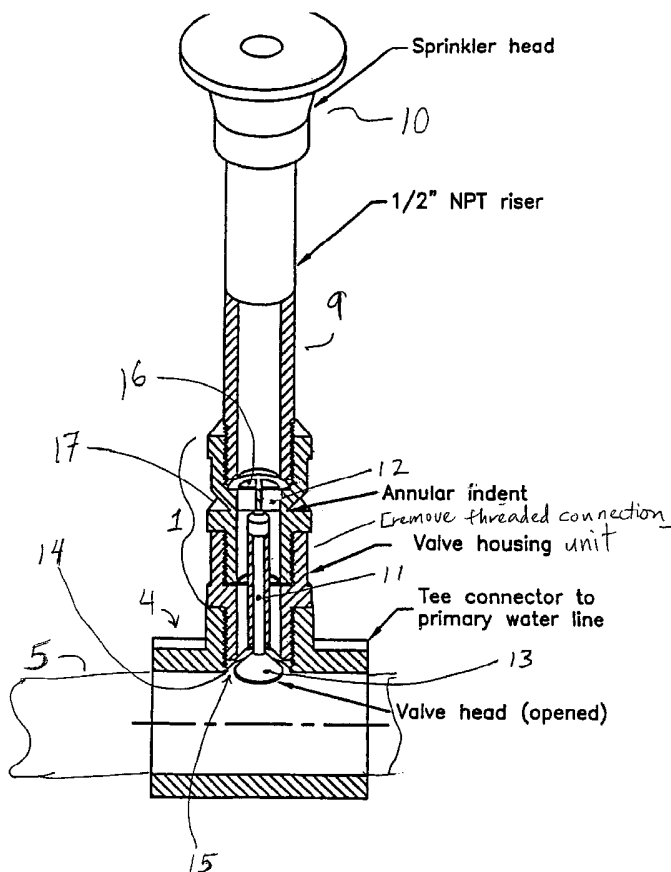
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[Continued on next page]

(54) Title: AUTOMATIC EMERGENCY SPRINKLER SHUTOFF VALVE



(57) Abstract: An automatic emergency sprinkler shutoff unit (1) is connected to a tee fitting (4) in a horizontal supply pipe (5). A threaded pipe (9) is connected to the downstream side of the unit (1) and to a sprinkler head (10). A valve piston (11) is held in position by a retainer (12) such that stopper (13) is held away from seat (14) allowing water to pass through opening (15), unit (1), openings (16) threaded pipe (9) and to sprinkler head (10). Retainer (12) is positioned above a frangible zone (17) such that, upon fracturing of the frangible zone (17), retainer (12) is no longer held in position holding the valve open thus permitting the force of water to act on stopper (13) closing the valve to fluid flow.

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— *of inventorship (Rule 4.17(iv)) for US only*

Published:

— *with international search report*

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AUTOMATIC EMERGENCY SPRINKLER SHUTOFF VALVE**BACKGROUND OF THE INVENTION**

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Field of Invention

This invention relates to irrigation systems and particularly to the riser pipes and sprinkler heads used to dispense the irrigation water with a means to protect the riser pipe from damage and automatically shut off the supply of water when the sprinkler head and/or the pipe attached thereto are damaged or dislodged. Sprinkler heads are often connected to plastic pipe and they are commonly placed in areas where they are exposed to damage from various sources. As such, sprinkler heads and riser pipes may be damaged or dislodged by automobile traffic, by foot traffic, by workers using landscape maintenance equipment or tools, or by vandals. Sprinkler systems can be damaged at any time, but typically they are under pressure for only a limited portion of a given day. As a result, a sprinkler head or riser pipe can be damaged or broken, without the damage becoming evident until after the system has been pressurized. Ultimately, when the system is pressurized, the broken sprinkler head or pipe becomes a point of least resistance for the unintended release of water, and water typically floods at the point of the break. If no person is present to observe the condition and shut off the water, much water can be wasted at great cost. Further, the flooding can cause erosion or damage to adjacent areas and structures.

This problem of broken sprinkler heads and pipes can be minimized by using pipes and sprinkler heads made of metal, but the use of plastic for these items offers advantages not found with metal parts. Plastic pipe requires fewer tools to install, and is lighter, less costly to manufacture, easier to maintain, and more resistive to degradation than steel or iron. Until now, absent careful repeat inspections, identifying broken sprinkler heads or piping has been accomplished largely in response to the evidence of breakage deriving from flooding, wasted water and/or resultant damage. This flooding, wasted water, and resultant damage could be avoided, while still allowing the utility of plastic pipe, if there were a valve that would protect against damage to the sprinkler riser piping and automatically shut off the supply of water to any sprinkler head or pipe that was damaged or dislodged.

Related Prior Art

Other mechanisms have been designed to prevent the flow of water in the absence of a sprinkler head, e.g.: U.S. Pat. No. 4,562,962 to Hartman; U.S. Pat. No. 4,762,140 to Davis; U.S. Pat. No. 4,852,602 to McKinnon; U.S. Pat. No. 5,174,500 to Yianilos; U.S. Pat. No. 5,335,857 to Hagon; U.S. Pat. No. 5,372,306 to Yianilos; U.S. Pat. No. 6,000,632 to Wallace; and U.S. Pat. No. 6,178,982 to Longstreth. Typically, these mechanisms do not fully address the aforementioned problems of flooding and piping system damage, consist of multiple field-assembled components, rely on variable design elements of other parts of the system, and/or incorporate springs or other mechanisms of limited life expectancy and which are subject to failure.

The present invention provides a reliable design that enables all of the necessary elements to be incorporated into a single unit, thus making it more compact, more reliable, less expensive to manufacture, and/or more useful in connection with existing systems than prior mechanisms.

These objects and other objects, advantages, and features of the invention will be apparent from the following description when studied in conjunction with the provided drawings.

SUMMARY OF INVENTION

Accordingly, an object of the invention is to provide a frangible zone at which the invention will break if the sprinkler head is struck or strained. In the event of damage, the invention is designed to automatically shut off the supply of water to avoid flooding and the wasting of water.

By this means, the piping upstream of the invention which serves the sprinkler head is protected from damage. The invention comprises a valve housing unit for receiving pressurized water, a frangible zone, a normally open valve which closes in the presence of water pressure when there has been a break in the frangible zone, a retainer installed--in or above the frangible zone which allows water to flow under normal conditions by preventing the closure of the valve, the location of the retainer being such that when the valve housing unit is broken in the

frangible zone, the retainer is displaced and the valve is closed by the force of water pressure, thus shutting off the supply of water.

BRIEF DESCRIPTION OF THE DRAWINGS

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FIG. 1 is a side view showing one possible embodiment of the invention in its relative position prior to installation in the piping system.

10 **FIG. 2** is a side view showing a different possible embodiment of the invention in its relative position prior to installation in the piping system.

FIG. 3 is a sectional view of the invention with the appurtenant piping and sprinkler head attached, under normal operating conditions.

15 **FIG. 4** is a sectional view of the invention illustrating a condition where the sprinkler head has been dislodged and the stopper has sealed against the seat, shutting off the flow of water.

20 **FIG. 5** is a top view of the invention showing one particular embodiment of the retainer which holds the valve open under normal operating conditions.

FIG. 6 shows a possible alternate embodiment of the retainer.

FIG. 7 shows a possible alternate embodiment of the retainer.

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FIG. 8 shows a possible alternate embodiment of the retainer.

FIG. 9 shows a possible alternate embodiment of the retainer.

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FIG. 10 shows a possible alternate embodiment of the retainer.

FIG. 11 shows a possible alternate embodiment of the retainer.

FIG. 12 shows a possible alternate embodiment of the retainer.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

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Referring first to **FIG. 1**, one possible embodiment of the valve housing unit **1**, utilizing a male thread at the point of upstream connection **2**, and a female thread at the downstream point of connection **3**, is shown in a side view in its relative position to the appurtenant components of the piping system, whereby the valve housing unit **1**, will be installed by means of the threaded connection **2**, to a tee fitting **4**, in the piping system **5**, and the male threaded sprinkler head **6**, will be fastened directly to the valve housing unit **1**, by means of a female threaded connection **3**.

Referring now to **FIG. 2**, one possible embodiment of the valve housing unit **7**, utilizing a female thread for the upstream connection **8**, is shown in a side view in its relative position to the appurtenant components of the piping system, whereby the valve housing unit **7**, will be installed above the horizontal supply piping **5**, by means of a threaded connection to a threaded pipe **9**, which extends from a tee fitting **4**, and the male threaded sprinkler head **6**, will be fastened directly to the valve housing unit **7**, by means of a female threaded connection **3**.

Referring now to **FIG. 3**, the valve housing unit **1**, is shown in a third alternative installation configuration, wherein the connections have been made and the system is functional, such that the valve housing unit is connected to a tee fitting **4**, in the horizontal supply piping **5**, and where a threaded pipe **9**, is connected to the downstream side of the valve housing unit **1**, which threaded pipe **9**, connects to a female threaded sprinkler head **10**.

Referring again to **FIG. 3**, the normal operating condition of the invention is illustrated: the valve piston **11**, is being held in position by the retainer **12**, such that the stopper **13**, is held away from the valve seat **14**, and the valve remains open **15**, thus allowing water to pass through the opening **15**, through the valve housing unit **1**, through the openings **16**, in the retainer **12**, through the threaded pipe **9**, and out of the sprinkler head **10**; the retainer **12**, is positioned above the frangible zone **17**, which is shown in one potential embodiment as an annular indent **17**.

Referring now to **FIG. 4**, the emergency shutoff and piping system protection capabilities of the device are illustrated: the valve housing unit **1**, has broken at the frangible

zone 17, and the sprinkler head 10, threaded pipe 9, and upper part 18, of the valve housing unit 1, which includes the retainer 12, are dislodged from the lower part 19, of the valve housing unit 1; as the retainer is no longer in position, the piston 11, is free to move, and the force of the water 20, presses against the stopper 13, moving it into position against the valve seat 14, thus closing the valve (comprised of the stopper 13, and the seat 14), and shutting off the further supply of water 20. So long as the system is pressurized, the force of the water 20, will hold the stopper 13, in a closed position against the seat 14; should the system become de-pressurized, the absence of water pressure will allow the valve 13, 14, to open, but re-pressurization of the system, will cause the valve 13, 14, to again close, as described above, until the retainer is replace with a new valve housing unit 1.

Referring now to FIG. 5, a top view of the valve housing unit 1, is shown, which illustrates one possible embodiment of the retainer 12, the top of the valve piston 11, which is in position against the underside of the retainer 12, and the openings 16, in the retainer, which allow water to pass during the normal operation of the valve housing unit 1.

Referring now to FIG. 6, a top view of a possible alternate embodiment of the retainer is illustrated 21.

Referring now to FIG. 7, a top view of a possible alternate embodiment of the retainer is illustrated 22.

Referring now to FIG. 8, a top view of a possible alternate embodiment of the retainer is illustrated 23.

Referring now to FIG. 9, a top view of a possible alternate embodiment of the retainer is illustrated 24.

Referring now to FIG. 10, a top view of a possible alternate embodiment of the retainer is illustrated 25.

Referring now to FIG. 11, a top view of a possible alternate embodiment of the retainer is illustrated 26.

Referring now to FIG. 12, a top view of a possible alternate embodiment of the retainer is illustrated 27.

Although the preferred embodiments of the invention have been described and illustrated above, it should be understood that various modifications and rearrangements of the parts may be accomplished without departing from the scope of the invention as disclosed and claimed herein.

For example, the valve housing unit could be manufactured using various means; it could be cast as a single piece, or to facilitate the manufacture of the device, it could be made from two or more pieces which are assembled then joined by gluing, welding, or some other permanent means.

5 The valve and retainer could also be manufactured in alternate configurations while still remaining within the scope of the invention claimed and disclosed. For example, there could be a flapper type which is held open by a retainer which protrudes from the frangible zone to hold the valve open. The valve could also consist of a piece of flexible tubing with the frangible zone acting as the retainer, such that when the frangible zone is intact, the tubing
10 within it is maintained in a straight and open position, but when the frangible zone is broken, the tubing returns to its original cast bent position acting to shut off the supply of water.

CLAIMS

What is claimed is:

- 5 1. An automatic emergency sprinkler shutoff valve, comprising:
a valve housing unit constructed of plastic, metal, or glass, with a frangible zone;
a means for connection of the valve housing unit to the upstream pipe or fitting;
a means for connection of the valve housing unit to the downstream sprinkler head or
riser; and
10 an automatic shutoff valve.
2. An emergency shutoff valve as set forth in claim 1, wherein the automatic shutoff valve
comprises a seat, a stopper which is attached to a sliding piston, which is normally held open
by a retainer installed downstream of the frangible zone, which retainer has openings to allow
15 the passage of water during normal operating conditions.
3. An emergency shutoff valve as set forth in claim 1, wherein the automatic shutoff valve
comprises a seat, a flapper which is attached to a hinge, which flapper is normally held open by
a retainer which is attached to or protrudes from the frangible zone to allow the passage of
20 water during normal operating conditions.
4. An emergency shutoff valve as set forth in claim 1, wherein the automatic shutoff valve
comprises a hollow flexible tube installed within or outside the valve housing unit and up
through the frangible zone, which frangible zone also acts as the retainer to maintain the
25 flexible tube in a straight and normally open position, but which, when broken, allows the
flexible tube to be kinked or to return to a normally unrestrained kinked condition, thus acting
to shut off the flow of water.
5. An emergency shutoff valve as set forth in claim 1, wherein the frangible zone consists
30 of a single annular indent in the exterior of the valve housing unit.

6. An emergency shutoff valve as set forth in claim 1, wherein the frangible zone consists of multiple annular indents in the exterior of the valve housing unit.
7. An emergency shutoff valve as set forth in claim 1, wherein the frangible zone consists of a single annular indent in the interior of the valve housing unit.
8. An emergency shutoff valve as set forth in claim 1, wherein the frangible zone consists of multiple annular indents in the interior of the valve housing unit.
9. An emergency shutoff valve as set forth in claim 1, wherein the frangible zone consists of at least one annular indent in the interior of the valve housing unit and at least one annular indent in the exterior.
10. An emergency shutoff valve as set forth in claim 1, wherein the retainer is constructed in the shape of an "X".
11. An emergency shutoff valve as set forth in claim 1, wherein the retainer is constructed in any configuration such that the center of the retainer is solid, and one or more openings of any sufficient minimum dimension to allow the passage of water, and of any shape, are located in the retainer.
12. An emergency shutoff valve as set forth in claim 1, wherein the means for connection to the upstream and downstream piping is accomplished by any combination of the following: a male threaded connection, a female threaded connection, a glued connection, a soldered connection, a brazed connection, a welded connection, a swaged connection, a grooved/mechanical coupling connection, or any other effective means of connecting pipe and/or fittings.
13. An emergency shutoff valve as set forth in claim 1, wherein the valve housing unit comprises a single unit.

14. An emergency shutoff valve as set forth in claim 1, wherein the valve housing unit comprises two pieces that are fastened together by means of a threaded connection such that when the device is broken, the upper part of the valve housing unit can be replaced to restore the invention to normal operating condition.

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15. An emergency shutoff valve as set forth in claim 1, wherein the valve housing unit comprises two pieces that are fastened together by means of a mechanical connection such that when the device is broken, the upper part of the body can be replaced to restore the invention to normal operating condition.

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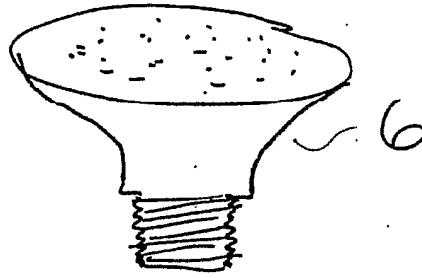
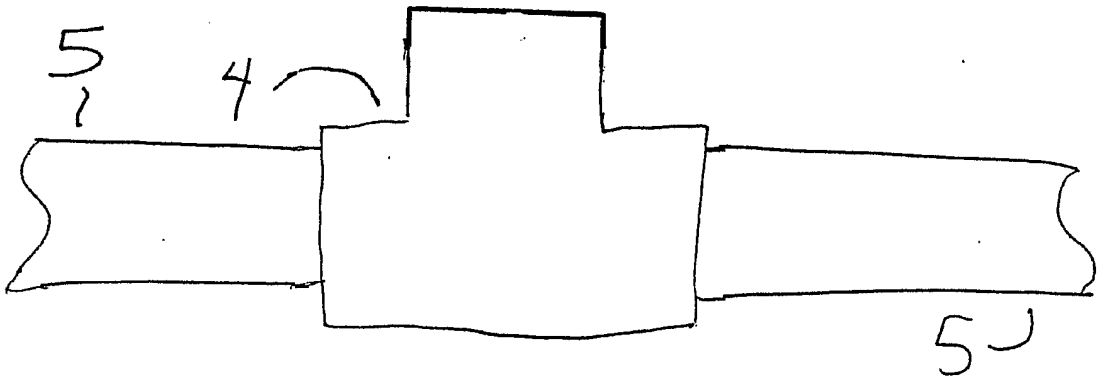
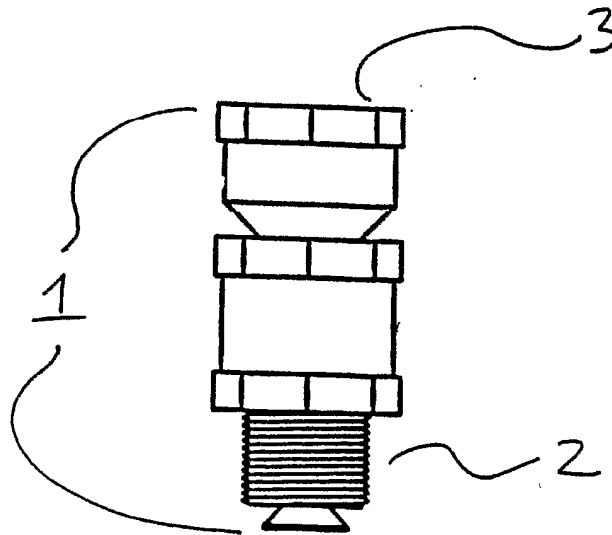


Fig. 1



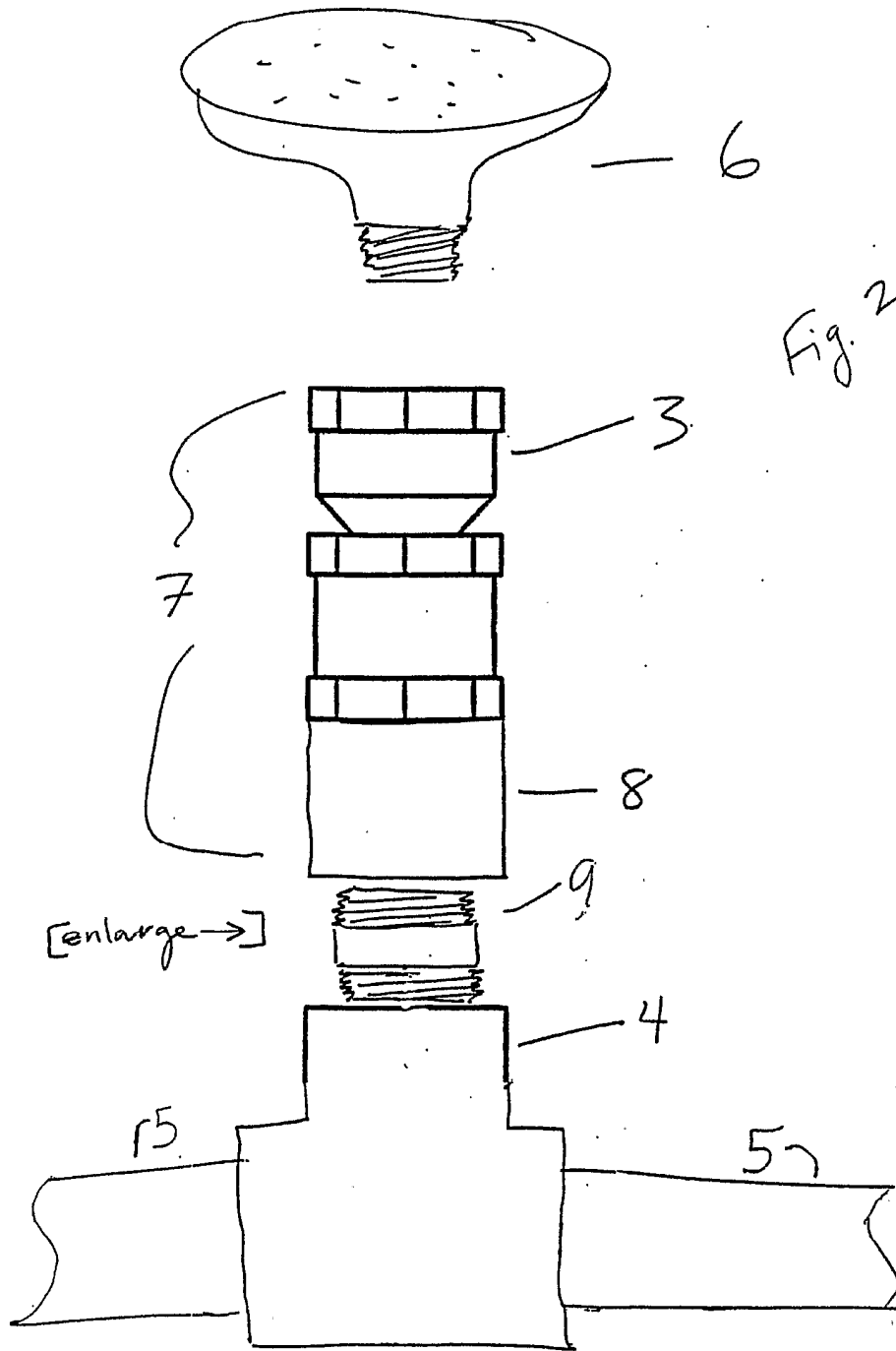
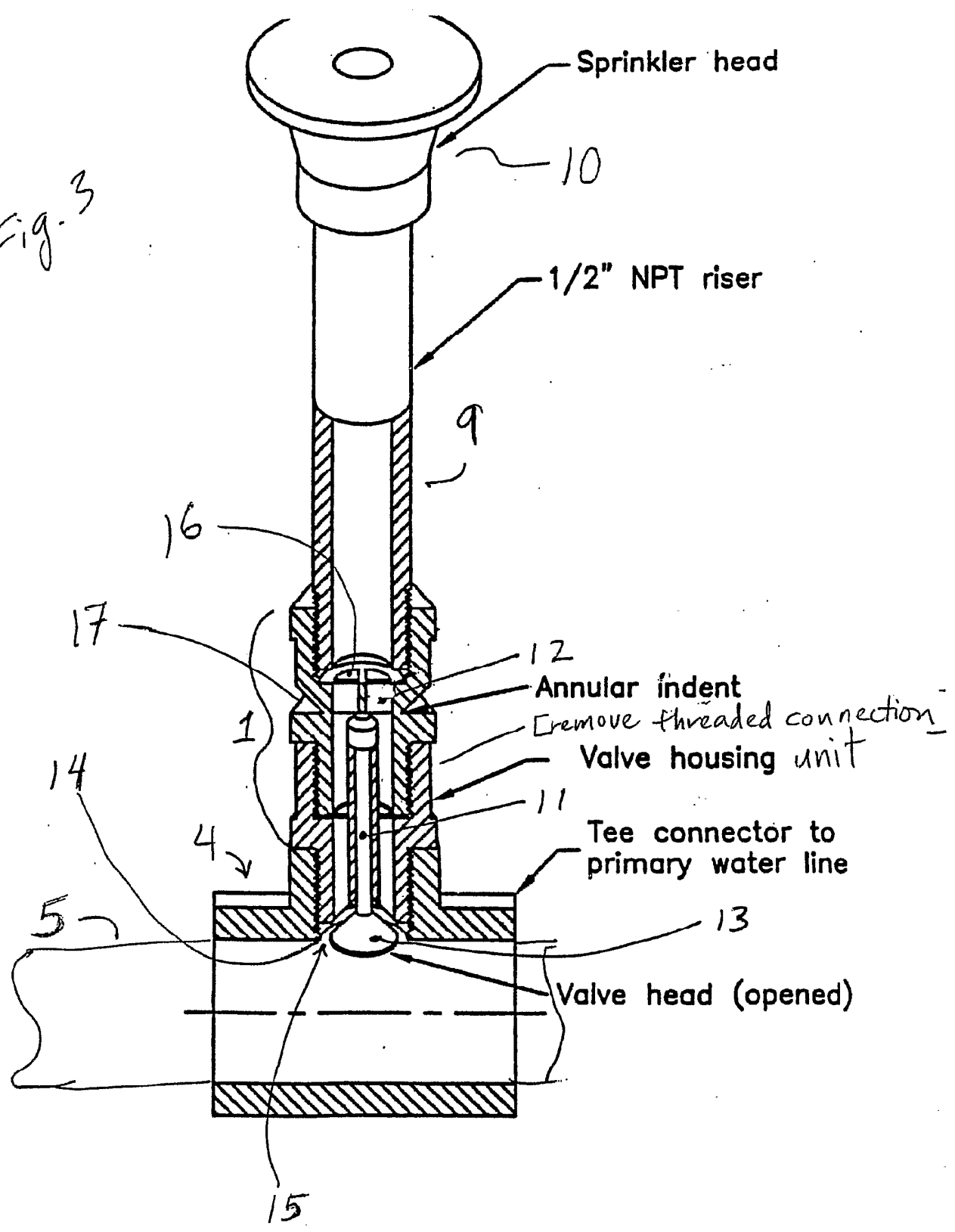


Fig. 3



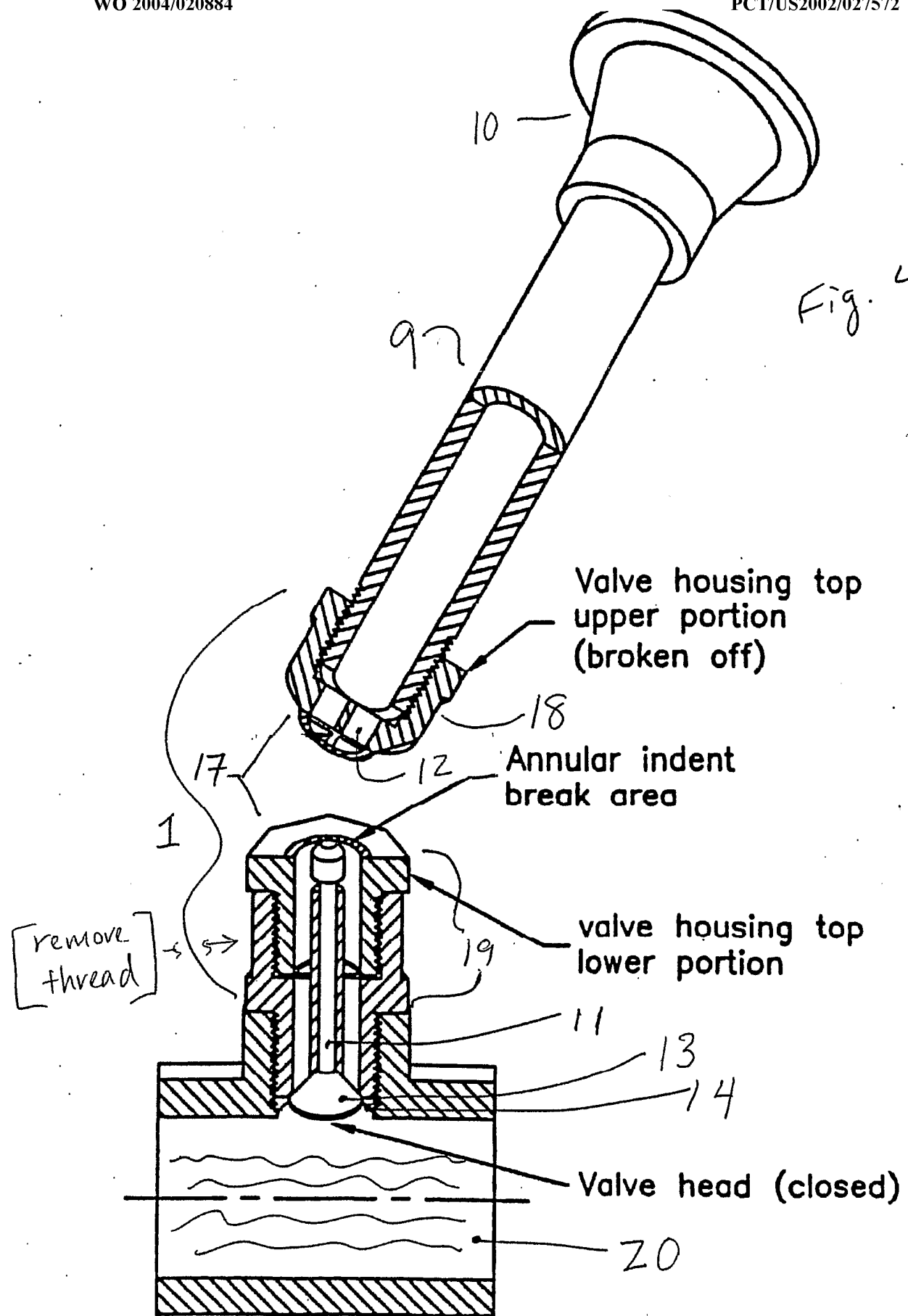


Fig. 5.

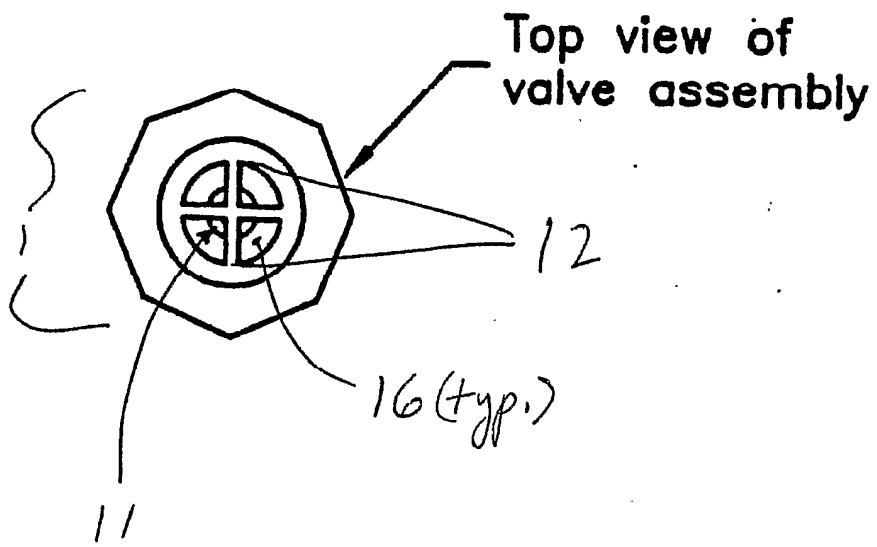


Fig. 6



Fig. 7

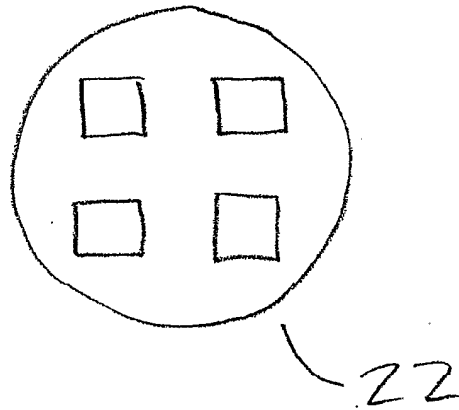


Fig. 8

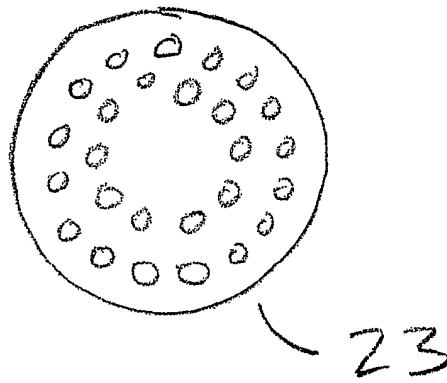


Fig. 9

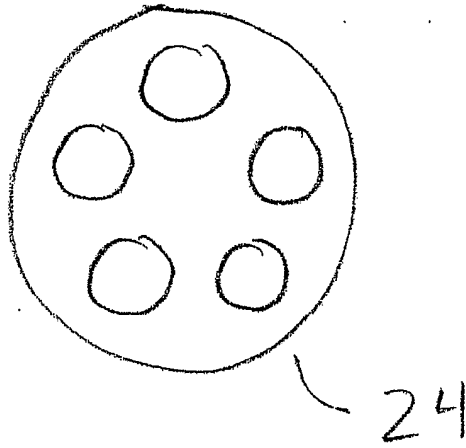


Fig. 10

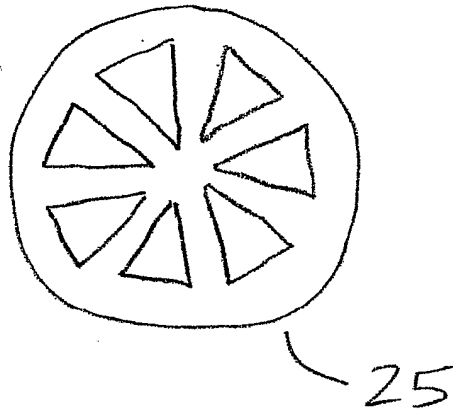
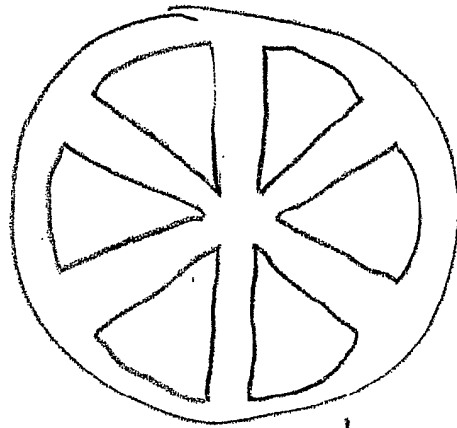
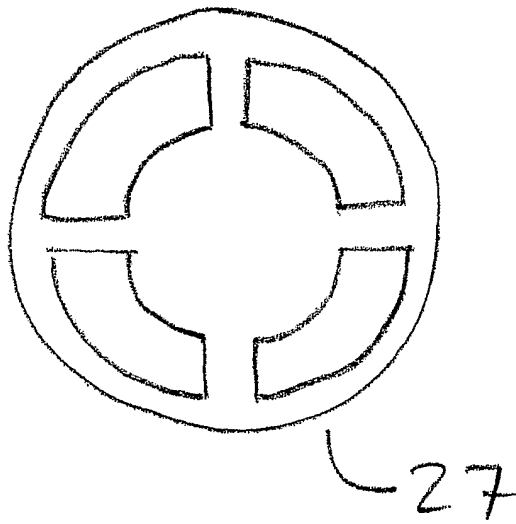


Fig. 11



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Fig. 12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/27572

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : F16K 17/36
 US CL : 137/68.14, 71

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)
 U.S. : 137/68.14, 71; 239/572, 571

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 practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,762,140 A (DAVIS) 09 August 1988 (09.08.1988), see entire document.	1, 2, 5, 12, 13
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Y		3, 4, 6-11, 14, 15
Y	US 2,054,561 A (GREENBERG) 15 September 1936 (15.09.1936), fig. 1 and page 1, lines 12-55.	3
Y	US 3,963,055 A (DEROSA) 15 June 1976 (15.06.1976), figs. 2-4, column 2, lines 15-40.	4
Y	US 2,048,387 A (JOHNSEN) 21 July 1936 (21.07.1936), fig. 11, page 4, left column, lines 11-20.	6, 8, 9
Y	US 3,995,694 A (FREIBURGER) 07 December 1976 (07.12.1976), figs. 4-5, column 3, line 8 through column 4, line 9.	10, 11, 14, 15

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means		
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Date of the actual completion of the international search 30 October 2002 (30.10.2002)	Date of mailing of the international search report 19 DEC 2002
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