Abstract: The object of this invention is to provide a connector with a function of preventing illegal use of public utility gas. The connector is connected between a gas control valve (7) and a gas meter’s leading pipe (1b). In the connector, a pipe piece (10) has an axial gas path (11), with a key insert hole (14) radially formed in the piece (10) to perpendicularly meet the gas path (11). A control member (20), having a ball-shaped body with a control path (24), is set in the pipe piece (10) to be moved by a key (50) so as to close or open the gas path (11). The locking member (30), having a gas hole (32), is inserted into the gas path (11) of the piece (10) to hold the piece (10) without allowing an undesired movement of the piece (10).
Published:
— with international search report
CONNECTOR WITH FUNCTION OF PREVENTING ILLEGAL USE OF PUBLIC UTILITY GAS

Technical Field

The present invention relates, in general, to connectors with a function of preventing illegal use of public utility gas and, more particularly, to a connector which is connected between a gas control valve and a gas meter, with a control member designed to be moved only by an authorized key so as to open or close a gas path of the connector, thus preventing illegal use of public utility gas.

Background Art

As well known to those skilled in the art, a gas meter is mounted on a gas supply pipe through which public utility gas is supplied to each user’s house, and the gas meter indicates the amount of gas consumed by each user. An employee or a clerk of the concerned public utility gas company checks the consumed amount of gas in each user’s house through the gas meter on a monthly basis, and on this basis the monthly gas rate is charged to each user according to the amount of gas consumed by him.

However, there have been some users who have not paid gas bills for several months although bills for the gas rate were issued every month. In such a case, the public utility gas company has suspended supply of gas to those users.

In a conventional art, the gas valve has been opened and closed simply by rotating a lever thereon. For this reason, some of the users, to whom the gas supply was suspended because they have not paid the gas bill for several months, have been able to easily open the gas valve without authorization, by rotating the lever, after the
clerk of the gas company has left their houses, and they have continued to use the public utility gas unconscionably.

However, the gas company has been unable to punish such illegal users of the public utility gas by legal action. For this reason, the gas company has suffered from such illegal use of the gas. Therefore, in order to avoid or reduce the loss resulting from such unauthorized use on the gas company’s side, a method of suspending supply of gas effectively is need.

In addition, even though the gas fitting work has been finished, the gas company was not allowed to supply gas to each user’s house until a variety of administrative permits or measures and safety inspection, etc. as necessary have all been met and completed. Currently, a valve handle is removed from the gas valve installed in each user’s house, and is separately kept in order to prevent unauthorized use of gas and avoid a variety of safety accidents possibly resulting from such unauthorized use. Nevertheless, some users have illegally used the gas by connecting the valve and the handle without permission. For several years, safety accidents resulting from the unauthorized use of gas have increasingly occurred. Nevertheless, the gas company supplying the public utility gas has no methods or alternatives to prevent such unauthorized use.

Disclosure of the Invention

Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a connector which is connected between a gas control valve and a gas meter, and is designed to be controlled only by an authorized key so as to open or close a gas path thereof, thus having a function of preventing illegal use of public utility gas.
Another object of the present invention is to provide a connector with a function of preventing illegal use of public utility gas, which is designed to control a precise rotation angle of the authorized key, thus completely opening or closing the gas path during a process of controlling the gas path.

In order to accomplish the above object, the present invention provides a connector with a function of preventing illegal use of public utility gas, comprising: a pipe piece connected at an upper end thereof to a gas control valve of a gas supply pipe and at a lower end thereof to a leading pipe of a gas meter, with a gas path axially formed in the pipe piece, a key insertion hole formed at an intermediate portion of a sidewall of the pipe piece in a radial direction to be perpendicular to the gas path, and an internal annular step formed on an inner surface of the pipe piece at a position around the key insertion hole; a control member having a ball shape, with a keyhole formed on the control member at a position corresponding to the key insertion hole of the pipe piece, and a gas control path formed through the control member so as to allow gas to pass through the control member in a direction aligned with the gas path of the pipe piece, the control member being set in the pipe piece to be rotated by a key inserted into the keyhole; and a locking member assembled in the gas path of the pipe piece, thus holding the control member along with the internal annular step of the pipe piece so as to prevent an undesired movement of the control member in the pipe piece, the locking member having a gas hole communicating with the gas control path of the control member.

In the connector, a rotation control slot having an arc shape is formed on the sidewall of the pipe piece at a position around the key insertion hole, and a stop protrusion is formed at a predetermined portion of the key so as to be inserted into and guided along the rotation control slot, whereby the gas path is completely opened when the key is rotated to allow the stop protrusion to be stopped by a first end of the rotation
control slot, and the gas path is completely closed when the key is rotated to allow the stop protrusion to be stopped by a second end of the rotation control slot.

Brief Description of the Drawings

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a front view showing a gas meter having a connector with a function of preventing illegal use of public utility gas, according to the present invention;

Fig. 2 is a perspective view of a connector and an authorized key, according to a primary embodiment of the present invention;

Fig. 3 is an exploded sectional view showing the construction of the parts of the connector and the authorized key, according to the primary embodiment of the present invention;

Fig. 4 is a sectional view of the connector according to the primary embodiment of present invention, with the parts of the connector being assembled into a single body and a gas path of the connector being opened by the authorized key;

Fig. 5 is a sectional view of the connector according to the primary embodiment of the present invention, with the gas path being closed by a control member rotated by the authorized key of Fig. 4;

Fig. 6 is a perspective view of a connector and an authorized key, according to a second embodiment of the present invention;

Fig. 7 is a sectional view of the connector according to the second embodiment of present invention, with a gas path of the connector being opened by the authorized key;
Fig. 8 is a sectional view of the connector according to the second embodiment of present invention, with the gas path of the connector being closed by a control member rotated by the authorized key of Fig. 7;

Fig. 9 is a sectional view of the connector according to the present invention, with a key insertion hole of the connector being closed by a plug; and

Figs. 10, 11 and 12 are perspective views of authorized keys and key slots formed on control members of the connectors, according to different embodiments of the present invention.

Best Mode for Carrying Out the Invention

Reference should now be made to the drawings, in which the same reference numerals are used throughout the different drawings to designate the same or similar components.

Fig. 1 is a front view showing a gas meter having a connector with a function of preventing illegal use of public utility gas, according to the present invention.

As shown in the drawing, a display 1a is provided at the front surface of the gas meter 1 for displaying the consumed amount of gas, and a leading pipe 1b is connected to a side of the top of the gas meter 1. The connector with the function of preventing illegal use of public utility gas according to the present invention is connected between the leading pipe 1b and a gas control valve 7 of a gas supply pipe 3. A gas feeding pipe 5 extends from another side of the gas meter 1 to a designated user’s house, thus feeding public utility gas to the user’s house.

The gas control valve 7 of the gas supply pipe 3 is provided with a lever 9 exposed to the atmosphere, so that a user is allowed to open or close the gas control valve 7 by rotating the lever 9 in either direction.
Figs. 2 to 5 show a connector with the function of preventing illegal use of public utility gas according to a primary embodiment of the present invention.

That is, Fig. 2 is a perspective view of the connector and an authorized key, according to the primary embodiment of the present invention. Fig. 3 is an exploded sectional view showing the construction of the parts of the connector and the authorized key. Figs. 4 and 5 show the assembled connector, in which Fig. 4 shows the connector with a gas path being opened by the authorized key, and Fig. 5 shows the connector with the gas path being closed by the authorized key.

As shown in the drawings, the connector of the present invention is connected between the leading pipe 1b of the gas meter 1 and the gas control valve 7 of the gas supply pipe 3. The connector comprises a cylindrical pipe piece 10, a control member 20 set in the pipe piece 10 to close or open a gas path 11 of the pipe piece 10, and a locking member 30 for holding the control member 20 without allowing an undesired movement of the control member 20.

The cylindrical pipe piece 10 has the axial gas path 11, with an externally threaded part 15 formed at an upper portion of the pipe piece 10 to connect the pipe piece 10 to the gas supply pipe 3 through a screw-type coupling process, and a stop shoulder 16 externally formed around a lower end of the pipe piece 10. A packing material 19 having an annular shape is fitted over the lower end of the stop shoulder 16, at which the pipe piece 10 is in surface contact with the leading pipe 1b of the gas meter 1. The packing material 19 thus prevents leakage of gas through the junction of the pipe piece 10 and the leading pipe 1b.

An adapter 40 is fitted over the pipe piece 10 such that the adapter 40 is axially moved along the pipe piece 10. The adapter 40 is tightened to the leading pipe 1b of the gas meter 1 to connect the pipe piece 10 to the leading pipe 1b.

That is, an annular pipe guide 41 is inwardly formed around the upper end of
the adapter 40 so as to correspond to the stop shoulder 16 of the pipe piece 10, so that 
the adapter 40 is stopped at the pipe guide 41 by the stop shoulder 16 of the pipe piece
10. An internally threaded part 42 is formed at the lower portion of the adapter 40 and 
is tightened to an externally threaded part of the leading pipe 1b, thus connecting the
pipe piece 10 to the leading pipe 1b.

A locking hole 12 and a key insertion hole 14 are formed at diametrically 
opposite positions of an intermediate portion of the sidewall of the pipe piece 10 in 
radial directions such that the two holes 12 and 14 are perpendicular to the gas path 11.
The locking hole 12 and the key insertion hole 14 are aligned with each other on a
straight line.

A center pin 13 is inserted into the locking hole 12 through a forcible fitting 
process, thus being fixed in the locking hole 12. In such a case, the inside end of the 
center pin 13 is projected into the gas path 11, and the projected inside end of the center 
pin 13 is preferably pointed to have a conical shape.

An internal annular step 17 for holding the lower end of the control member 20 
is formed around the inner surface of the pipe piece 10 at a position under the key 
insertion hole 14, and an internally threaded part 18 is formed at an intermediate portion 
of the inner surface of the pipe piece 10. The control member 20 is a ball-shaped 
body, and is set in the pipe piece 10 to be rotated around the center pin 13 by an
authorized key 50.

The control member 20 has a center hole 21 at a position corresponding to the 
locking hole 12 of the pipe piece 10, and receives the pointed inside end of the center 
pin 13. A key hole 22 is formed on the control member at a position diametrically 
opposite to the center hole 21. That is, the key hole 22 corresponds to the key insertion
hole 14 of the pipe piece 10. A locking slot 23 is formed on the inside end surface of 
the key hole 22.
A gas control path 24 is formed through the control member 20 in a direction perpendicular to the keyhole 22, and allows gas to selectively pass through the control member 20. In the pipe piece 10, two sealing members 25 cover the opposite sides of the control member 20 at positions around the locking hole 12 and the key insertion hole 14, respectively, so as to seal the two holes 12 and 14, thus preventing leakage of gas through the two holes 12 and 14.

The key 50, used for rotating the control member 20 in the pipe piece 10, comprises a longitudinal shank having a diameter capable of allowing the shank to pass through the key insertion hole 14 prior to being fitted into the keyhole 22 of the control member 20. A handle 51 is perpendicularly mounted to the outside end of the shank of the key 50, and a locking projection 52 is axially formed at the inside end of the shank of the key 50. The locking projection 52 of the key 50 is inserted into the locking slot 23 of the keyhole 22.

The locking member 30 has an externally threaded part 31 on its external surface, so that the locking member 30 is inserted into the pipe piece 10 and is tightened to the internally threaded part 18 of the pipe piece 10 at the externally threaded part 31. The locking member 30 thus holds the control member 20 along with the internal annular step 17 of the pipe piece 10, thus preventing an undesired movement of the control member 20 in the pipe piece 10.

A gas hole 32 is axially formed through the locking member 30 such that the gas control path 24 of the control member 20 selectively communicates with the gas hole 32. An annular ring seat groove 33 is formed around the external surface of the locking member 30 at a position not having the externally threaded part 31. An O-ring 34 is seated into the annular ring seat groove 33, so that desired sealing effect capable of preventing leakage of gas through the junction of the pipe piece 10 and the locking member 30 is achieved. A tool insertion hole 35 is formed on the upper surface of the
locking member 30, and a tool (not shown) is inserted into the hole 35 to rotate the
locking member 30 relative to the pipe piece 10.

The assembling and installing process and operational effect of the connector
having the above-mentioned construction will be described herein below.

In order to assemble and install the connector, the control member 20 is
primarily inserted into the gas path 11 of the pipe piece 10 until the control member 20
is seated on the internal annular step 17. In such a case, the two sealing members 25
each having a hole are installed between the control member 20 and the pipe piece 10 to
cover the opposite sides of the control member 20 at positions around the locking hole
12 and the key insertion hole 14, respectively. It is also necessary to place the control
member 20 such that the center hole 21 and the keyhole 22 of the control member 20 are
aligned with the center hole 12 and the key insertion hole 14 of the pipe piece 10,
respectively.

Thereafter, the center pin 13 is inserted into the center hole 12 to rotatably hold
the control member 20, and the locking member 30 having the O-ring 34 is inserted into
the gas path 11 of the pipe piece 10.

In such a case, the locking member 30 is tightened at its externally threaded
part 31 to the internally threaded part 18 of the gas path 11 of the pipe piece 10, and
pushes the control member 20 downward, so that the control member 20 is compressed
by both the internal annular step 17 and the locking member 30. The control member
20 is thus held by the internal annular step 17 and the locking member 30, and is
prevented from undesired movement.

Thereafter, the adapter 40 is movably fitted over the pipe piece 10. The upper
dend of the pipe piece 10 is coupled to the gas control valve 7 through a screw-type
coupling process, while the lower end of the pipe piece 10 is coupled to the leading pipe
1b of the gas meter 1 by using the adapter through a screw-type coupling process. The
process of assembling and installing the connector is thus finished.

When it is necessary for an authorized person to open or close the gas path 11 of the pipe piece 10, the key 50 is inserted into the keyhole 22 of the control member 20, and is handled to rotate the control member 20, thus opening or closing the gas path 11.

As described above, the control member of the connector of the present invention is designed to be moved only by an authorized key 50 so as to open or close the gas path of the pipe piece 10. Therefore, the connectors of the present invention almost completely prevent illegal use of public utility gas by some users, to whom the gas supply was suspended because they have not paid the gas bill for several months, or who want to illegally use gas without permission.

When the supply of public utility gas is suspended by using the connector of the present invention, the gas supply pipe 3 is primarily closed by the gas control valve 7, and is secondarily closed by the connector of the invention, so that it is possible to almost completely suspend the supply of gas.

Figs. 6 to 8 show a connector and an authorized key, according to a second embodiment of the present invention.

That is, Fig. 6 shows the connector and the authorized key, according to the second embodiment of the present invention. Figs. 7 and 8 are sectional views showing the construction and operation of the connector, in which Fig. 7 shows a gas path of the connector being opened by the authorized key, and Fig. 8 shows the gas path of the connector being closed by the authorized key.

In the second embodiment of the present invention, the general shape of the connector remains the same as that described for the primary embodiment, but the connector of the second embodiment has a structure allowing an employee or a clerk of a concerned public utility gas company to clearly confirm the opened or closed state of
the gas path, different from the connector of the primary embodiment. Therefore, the
following description for the second embodiment is to explain the construction, object
and operational effect of the connector different from those of the primary embodiment.

In the connector according to the second embodiment of the present invention,
a rotation control slot 100 having an arc shape is formed on the sidewall of the pipe
piece 10 at a position around the key insertion hole 14. The arc-shaped rotation
control slot 100 is designed such that two lines extending between the key insertion hole
14 and both ends of the slot 100 meet each other at a right angle. That is, a first end of
the slot 100 is positioned on a longitudinal line of the pipe piece 10, while a second end
is positioned on a latitudinal line of the pipe piece 10.

In a detailed description, the shape of the rotation control slot 100 is designed
such that the gas path is completely opened when the handle 51 of the key 50 is
positioned in a longitudinal direction of the pipe piece 10 with a stop protrusion 202 of
the key 50 being stopped by the first end of the slot 100, and the gas path is completely
closed when the handle 51 of the key 50 is positioned in a latitudinal direction of the
pipe piece 10 with the stop protrusion 202 of the key 50 being stopped by the second
end of the slot 100.

A contact plate 200 is mounted to the end of the shank of the key 50 opposite to
the handle 51 so as to come into contact with the external surface of the pipe piece 10
when rotating the control member 20 by using the key 50. The stop protrusion 202 is
formed on the contact plate 200 at a position corresponding to the rotation control slot
100, so that the stop protrusion 202 is movably inserted into the slot 100 when the key
50 is inserted into the key insertion hole 14.

In such a case, it is preferred to design the contact plate 200 such that the plate
200 is brought into close contact with the external surface of the pipe piece 10 when the
locking projection 52 of the key 50 is inserted into the locking slot 23 of the keyhole 22
of the control member 20. In the preferred embodiment, the contact plate 200 has a Circular shape, as an example. However, it should be understood that the plate 200 may have another shape, for example, a rectangular shape, without affecting the functioning of the present invention.

As a further alternative, the stop protrusion may be connected to a predetermined portion of the key 50 by using a connector (not shown) in place of the contact plate 200.

The assembling and installing process of the connector according to the second embodiment of the present invention remains the same as that described for the primary embodiment, and further explanation is thus not deemed necessary.

The gas path of the connector is opened or closed by using the key 50 as follows. That is, in order to opened or close the gas path of the connector, the key 50 is inserted into the keyhole 22 of the control member 20 through the key insertion hole 14 of the pipe piece 10 such that the stop protrusion 202 of the key 50 is inserted into the rotation control slot 100 of the pipe piece 10 and the locking projection 52 of the key 50 is inserted into the locking slot 23 of the keyhole 22 of the control member 20.

When the key 50 which is inserted into the keyhole 22 is rotated in a direction to allow the handle 51 of the key 50 to be positioned in the longitudinal direction of the pipe piece 10 as shown in Fig. 7, the control member 20 is rotated to open the gas path.

In such a case, when the key 50 is fully rotated in the same direction until the first end of the slot 100 stops the stop protrusion 202 of the key 50, the gas path is completely opened.

When the key 50 is rotated in the reverse direction to allow the handle 51 of the key 50 to be positioned in the latitudinal direction of the pipe piece 10 as shown in Fig. 8, the control member 20 is rotated to close the gas path. In such a case, when the key 50 is fully rotated in the same direction until the second end of the slot 100 stops the
stop protrusion 202 of the key 50, the gas path is completely closed.

As described above, the completely opened or closed state of the gas path of the connector according to the second embodiment of the present invention is accomplished by simply rotating the key in either direction until the stop protrusion 202 of the key 50 is stopped by either end of the rotation control slot 100, so that an employee or a clerk of a concerned public utility gas company is able to easily and clearly confirm the opened or closed state of the gas path.

The connector according to the second embodiment of the present invention is designed to allow an employee or a clerk of a concerned public utility gas company to easily and clearly confirm the opened or closed state of the gas path as described above, so it is possible to almost completely prevent leakage of gas through an opening which remains in the gas path of the connector even after closing the gas path.

In the present invention, it is preferred to design the connector such that the key insertion hole 14 is selectively closed by a rubber plug 60, as shown in Fig. 9.

When the key insertion hole 14 is exposed to the atmosphere without being covered or closed by any covering or closing means, impurities, such as dust, may be deposited in the key insertion hole 14 and, in winter, snow or rain may be easily introduced into the hole 14 to be frozen. In such a case, the key may fail to perform a precise action in the key insertion hole. Therefore, it is preferred to close the key insertion hole 14 by using the rubber plug 60. The rubber plug 60 collaterally functions to prevent leakage of gas from the gas path through the key insertion hole 14 even though a user of the connector is not aware of the gas leakage. The rubber plug 60 thus enhances operational safety of the connector.

In the preferred embodiments of the present invention, only one locking slot 23 is formed in the keyhole 22, and only one locking projection 52 is formed at the end of the key 50 at a position corresponding to the slot 23, thus allowing the key 50 to rotate
the control member 20. However, it should be understood that the locking projection 52 and the locking slot 23 are not limited in their numbers and shapes to those described in the preferred embodiments. That is, the structure for allowing an authorized person to rotate the control member 20 may be freely altered from that of the preferred embodiment if the structure does not allow an unauthorized person to rotate the control member by using a general tool, such as a screwdriver, without permission.

For example, a locking projection 23-1 may be formed in the keyhole 22, and a locking slot 52-1 may be formed at the end of the key 50 at a position corresponding to the locking projection 23-1, as shown in Fig. 10. Alternatively, a plurality of locking slots 23-2 may be formed in the keyhole 22, and the same number of locking projections 52-2 may be formed at the end of the key 50 at positions corresponding to the slots 23-2, as shown in Fig. 11. As a further alternative, an arc-shaped locking slot 23-3 may be formed in the keyhole 22, and an arc-shaped locking projection 52-3 may be formed at the end of the key 50 at a position corresponding to the slot 23-3, as shown in Fig. 12.

Industrial Applicability

As described above, the present invention provides a connector with a function of preventing illegal use of public utility gas. The connector is designed such that its gas path is opened or closed only by using an authorized key, thus almost completely preventing illegal use of public utility gas by some users, to whom the gas supply was suspended because they have not paid the gas bill for several months, or who want to illegally use gas without permission. In addition, the connector is designed to limit the rotating angle of the key relative to the connector, so that the gas path is completely and safely opened or closed without failure.
In addition, the connector of the present invention almost completely prevents any occurrence of unconscious error in key action or another unconscious operational error of an authorized person, thus preventing safety hazards caused by such errors.
Claims

1. A connector with a function of preventing illegal use of public utility gas, comprising:
   a pipe piece connected at an upper end thereof to a gas control valve of a gas supply pipe and at a lower end thereof to a leading pipe of a gas meter, with a gas path axially formed in the pipe piece, a key insertion hole formed at an intermediate portion of a sidewall of said pipe piece in a radial direction to be perpendicular to the gas path, and an internal annular step formed on an inner surface of the pipe piece at a position around the key insertion hole;
   a control member having a ball shape, with a keyhole formed on the control member at a position corresponding to the key insertion hole of the pipe piece, and a gas control path formed through the control member so as to allow gas to pass through the control member in a direction aligned with the gas path of the pipe piece, said control member being set in said pipe piece to be rotated by a key inserted into the keyhole; and
   a locking member assembled in the gas path of the pipe piece, thus holding the control member along with the internal annular step of the pipe piece so as to prevent an undesired movement of the control member in the pipe piece, said locking member having a gas hole communicating with the gas control path of the control member.

2. The connector according to claim 1, wherein said pipe piece has an externally threaded part formed at an upper portion of the pipe piece to connect the pipe piece to the gas supply pipe through a screw-type coupling process, and a stop shoulder formed around a lower end of the pipe piece; and an adapter is fitted over the pipe piece such that the adapter is axially moved along the pipe piece and is stopped by the stop shoulder, with an internally threaded part formed at a lower portion of said adapter so as
to be tightened to the leading pipe of the gas meter.

3. The connector according to claim 1 or 2, wherein a locking hole is formed at the intermediate portion of the sidewall of said pipe piece at a position opposite to the key insertion hole, a center pin is inserted into said locking hole such that a part of the center pin is projected into the gas path of the pipe piece, and a center hole is formed on the control member at a position opposite to the keyhole and receives the projected part of said center pin.

4. The connector according to claim 1 or 2, wherein two sealing members cover opposite sides of the control member in the pipe piece at positions around a locking hole and the key insertion hole of the control member, respectively, so as to seal the locking hole and the key insertion hole and prevent leakage of gas through the locking hole and the key insertion hole.

5. The connector according to claim 1 or 2, wherein a rotation control slot having an arc shape is formed on the sidewall of said pipe piece at a position around the key insertion hole, and a stop protrusion is formed at a predetermined portion of said key so as to be inserted into and guided along the rotation control slot, whereby the gas path is completely opened when the key is rotated to allow the stop protrusion to be stopped by a first end of said rotation control slot, and the gas path is completely closed when the key is rotated to allow the stop protrusion to be stopped by a second end of said rotation control slot.

6. The connector according to claim 5, wherein said rotation control slot is designed such that two lines extending between the key insertion hole and the first and
second ends of said rotation control slot meet each other at a right angle.

7. The connector according to claim 5, wherein a contact plate is mounted to a predetermined portion of said key so as to come into contact with an external surface of the sidewall of the pipe piece, and has the stop protrusion at a predetermined portion thereof.

8. The connector according to claim 5, wherein said key insertion hole is closed by a plug, so that the key insertion hole is prevented from being exposed to the atmosphere.
FIG. 12
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC7 F17C 13/02

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)
IPC7 F17C13/02, F16K

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
NPS*"key, gas, close, open, lock, sphere, ball, valve"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>US4,523,608A(Shafo Industries Inc)June.18.1985 See the figs, Abstract.</td>
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<td>A</td>
<td>US4,523,608A(Shafo Industries Inc)June.18.1985 See the figs, Abstract.</td>
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<tr>
<td>A</td>
<td>US4,650,157A(Ronald L. Silliman)Mar.17.1987 See the figs.</td>
<td>1-8</td>
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<tr>
<td>A</td>
<td>KR1996-29261U(Song peung-soo)Sep.17.1996</td>
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Further documents are listed in the continuation of Box C.

X 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
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  "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

Date of the actual completion of the international search
14 MARCH 2003 (14.03.2003)

Date of mailing of the international search report
14 MARCH 2003 (14.03.2003)

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
920 Dumsan-dong, Seo-gu, Daejeon 302-701,
Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer
KIM, Mu Kyoung
Telephone No. 82-42-481-5422

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