



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/AU81/00139 (22) International Filing Date: 22 September 1981 (22.09.81)</p> <p>(71) Applicant (for all designated States except US): B.C. RICHARDS & CO. PTY. LTD. [AU/AU]; 288 Bilsen Road, Geebung, QLD 4034 (AU).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only) : RICHARDS, Cecil, Graham [AU/AU]; 246 Maundrell Terrace, Aspley, QLD 4034 (AU).</p> <p>(74) Agent: GRANT ADAMS & COMPANY; 333 Adelaide Street, Brisbane (G.P.O. Box 1413), QLD 4000 (AU).</p> <p>(81) Designated States: AT (European patent), AU, CH (European patent), DE (European patent), FR (European patent), GB (European patent), JP, NL (European patent), SE (European patent), US.</p>		<p>Published <i>With international search report.</i></p>
<p>(54) Title: STEM SEALS FOR BALL VALVES</p>		
<p>(57) Abstract</p> <p>A 'fire safe' stem seal arrangement for ball valves. The stem (28) is rotatably mounted in a stepped bore (22) in the stem housing (21) in the valve body (10) and is provided with a collar (30) with abutment faces (31, 32) opposed to corresponding abutment faces (25, 27) in the stepped bore (22). A lower stem seal (33) of PTFE or nylon provides a sealing between the abutment faces (25, 31). In the event of a fire, the lower stem seal (33) is softened or destroyed and the stem (28) moves upwardly in the stem housing (21) to compress an upper stem seal (34), of high temperature fire resistant material, between the abutment faces (27, 32) to prevent flames escaping to the atmosphere. An external seal (46) seals the stem (28) to the stem housing (21) to prevent the entry of corrosive atmospheric materials into the valve body (10).</p>		

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TITLE: "STEM SEALS FOR BALL VALVES"

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 This invention relates to stem seals for ball valves.

2. Description of the Prior Art

10 In many applications, e.g. in the plastics- and petroleum industries, any ball valves used in such industries must comply with British Standard 5146. B.S. 5146 specifies, inter alia, that "stem blow out" must not occur which would allow any flames of a pipeline fire to escape to the atmosphere from the ball valve.

15 Tests have shown that the ball valves presently available cannot fully comply with the specifications laid down in the British Standard. In some valves, the intense pressures generated in the valve during a fire can cause the stem to be physically blown-out of the valve body. With other valves, the internal seal between the stem and the body fails and flames can escape between
20 the stem and the body.

BRIEF SUMMARY OF THE PRESENT INVENTION

It is an object of the present invention to provide an effective "fire safe" sealing arrangement between the stem and valve body in the event of a fire.

25 It is a preferred object to provide two seals between the stem and the body, the seals comprising a primary seal and a secondary seal, the latter acting only as an emergency seal in the event of fire.

30 It is a further preferred object to provide a collar on the stem, the line pressure in the valve applying a back-seating pressure on the seals to increase the effectiveness of the seals.

35 It is a still further preferred object to provide an external seal between the stem and the valve body to prevent corrosive atmospheric materials from entering the



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valve body and damaging the primary and secondary seals.

Other preferred objects of the present invention will become apparent from the following description.

In one aspect, the present invention resides in a
5 ball valve of the type having:

a valve body;

a ball chamber in the valve body;

an inlet to, and outlet from, the ball chamber;

10 a valve ball rotatably mounted in the ball
chamber;

a stem housing in the valve body;

a stem rotatably mounted in the stem housing and
engaged in the valve ball to enable the valve ball to be
rotated to open or close the valve; characterized in
15 that:

the stem housing has a stepped bore;

a collar on the stem is rotatably mounted in the
stepped bore; and

primary and secondary seals are provided between
20 the collar and the stepped bore, the secondary seal
comprising a high-temperature fire-resistant material
providing an emergency seal between the stem and the
valve body in the event of fire.

Throughout the description and claims, the term
25 "ball valve" shall be used to include other types of
rotary or "quarter-term" valves, such as plug valves or
butterfly valves.

Preferably the primary seal, e.g. of PTFE or
nylon, is completely enclosed and provides the normal
30 seal between the stem and the valve body.

Preferably the primary seal is damaged or destroyed
in the event of fire to enable the stem to move and
bring the secondary seal into effect.

Preferably line pressure on the collar applies a
35 back-seating pressure on the seals to increase their

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effectiveness.

Preferably the seals are maintained under a constant seating pressure by a spring under the stem lock nuts, which secure the stem in the stem housing, and the valve body.

Preferably an external seal is interposed between the stem lock nuts and the valve body to prevent the entry of corrosive atmospheric material into the stem housing.

10. BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

To enable the invention to be fully understood, a preferred embodiment will now be described with reference to the accompanying drawings, in which:

15 FIG. 1 is a sectional side view of a ball valve in accordance with the present invention; and

FIG. 2 is an enlarged view of portion A of FIG. 1.

20 The ball valve has a body 10 with end flanges 11 and 12. An inlet passage 13 and an outlet passage 14 are respectively connected to a ball chamber 15 in the body 10.

A valve ball 16 is rotatably mounted in the ball chamber 15 and has a fluid passage 17. Seal assemblies 18, 19 seal the ball 16 to the walls of the ball chamber. A socket 20 is formed in the upper side of the ball.

25 A stem housing 21 in the body 10 has a stepped bore 22. The lower portion 23 of the bore is connected to a reduced diameter intermediate portion 24 by a first annular abutment face 25, while the intermediate portion 24 is connected to the further reduced diameter upper portion 26 by a second annular abutment face 27.

30 The stem 28 has a central stem body 29 rotatably mounted in the upper portion 26 of the stepped bore 22.

35 A stepped collar 30 is formed integrally with the stem at the lower end of the stem body and has first and second annular abutment faces 31, 32 complementary to



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the first and second abutment faces 25, 27 respectively. A very small clearance is provided between the collar 30 and the lower and intermediate portions 23, 24 of the stepped bore 22.

5 A lower stem seal 33, e.g. of PTFE (sold under the name "Teflon", a Registered Trade Mark of Du Pont) or nylon is fitted between the first abutment face 25 in the stepped bore 22 and the first abutment face 31 on the collar 30, while an upper stem seal 34, of high temperature fire resistant material, e.g. of graphite or
10. asbestos, is fitted between the second abutment face 27 on the stepped bore 22 and the second abutment face 32 on the collar 30. As shown both seals 33, 34 are fully enclosed and protected from any corrosive line medium
15 passing through the valve.

A tongue 35 on the lower end of the stem 28 engages the socket 20 in the valve ball 16 to enable the latter to be rotated.

20 Anti-static devices 36 provide electrical paths between the stem 28 and body 10, and the stem 28 and ball 16 to prevent flashing in the valve.

An annular stop plate 37 is fitted to the stem 28, located by a stop pin 38 fixed in the stem housing 21, bears against the upper annular face 39 of the stem
25 housing around the bore 22.

A pair of stem lock nuts 40 are screwthreadably mounted on the upper body 41 of the stem 28 to prevent the stem from being drawn into the ball chamber 15. A wavy spring 42 is interposed between the stop plate 37
30 and the stem lock nuts 40 to compress the lower stem seal 33, to ensure an effective seal between the stem 28 and the body 10.

The wrench 43 is secured to the upper end of the stem 28 by a suitable retainer 44.

35 An annular groove 45 is provided around the upper



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end of the stepped bore 22 at its junction with the upper annular face 37. An external seal 46 is fitted in the groove 45 and compressed against the stem 28 to prevent the entry of corrosive material into the stem housing 21.

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In normal operation, the wavy spring 42, and the line pressure in the ball chamber 15 applied against the underside face of the collar 30, will compress the lower internal seal 33 between the first abutment faces 25, 31 in the stepped bore 22 and on the collar 30 respectively to form an effective seal between the stem 28 and body 10. Little, if any, sealing action is provided by the upper stem seal 34. However, in the event of a fire, the lower stem seal 33 becomes softened or destroyed. The stem 28 moves upwardly in the stem housing 21 until the upper stem seal 34 is compressed between the second abutment faces 27, 32 on the stepped bore 22 and on the collar 30 respectively. As this seal 34 is formed of high-temperature fire resistant material, it will not be affected by the fire and the flames cannot escape to the atmosphere.

25
In certain conditions, the abutment faces 25, 31 may come into metal-to-metal sealing contact to further enhance the "fire safe" sealing arrangement. The small clearance between the collar 30 and the lower and intermediate portions 23, 24 of the stepped bore further limits any access of the fire to the upper stem seal 34.

30
As the collar 30 is of larger diameter than the upper portion 26 of the stepped bore 22 and is opposed by the abutment faces 25, 27, the stem 28 cannot be forced out of the body 10 by the high pressures generated in the valve during a fire.

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As will be readily apparent to the skilled addressee, the embodiment described provides a simple, yet effective "fire safe" sealing arrangement for ball



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valves.

Various changes and modifications may be made to the embodiment described without departing from the scope of the present invention.

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CLAIMS:

1. A ball valve of the type having:
 - a valve body (10);
 - a ball chamber (15) in the valve body (10);
 - an inlet (13) to, and outlet (14) from, the ball chamber (15);
 - a valve ball (16) rotatably mounted in the ball chamber (15);
 - a stem housing (21) in the valve body (10);
 - a stem (28) rotatably in the stem housing (21) and engaged in the valve ball (16) to enable the valve ball (16) to be rotated to open or close the valve;
 - characterized in that:
 - the stem housing (21) has a stepped bore (22);
 - a collar (30) on the stem (28) is rotatably mounted in the stepped bore (22);
 - primary and secondary seals (33, 34) are provided between the collar (30) and the stepped bore (22), the secondary seal (34) comprising a high-temperature fire resistant material providing an emergency seal between the stem (28) and the valve body (10) in the event of a fire.
2. A ball valve as claimed in Claim 1 and further characterized in that:
 - the primary seal (33), of PTFE or nylon material, is completely enclosed and provides the normal seal between the stem (28) and the valve body (10).
3. A ball valve as claimed in Claim 1 or Claim 2 and further characterized in that:
 - in the event of a fire, the primary seal (33) is damaged or destroyed to enable the stem (28) to move in the stem housing (21) to be compressed, and provide the seal between the collar (30) and the stepped bore (22).
4. A ball valve as claimed in Claim 1 or Claim 2 and further characterized in that:



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the line pressure in the ball chamber (15) applies a force on the collar (30) to compress the primary seal (33) or secondary seal (34).

5. A ball valve as claimed in Claim-4 and further characterized in that:

stem lock nuts (40) are provided on the stem (28) to axially locate the stem (28) in the stem housing (21); and

a spring (42) is interposed between the stem lock nuts (40) and the valve body (10) to apply a constant compression force on the primary seal (33) or secondary seal (34) to increase the effectiveness of the seal between the stem (28) and the valve body (10).

6. A ball valve as claimed in Claim 1 or Claim 2 and further characterized in that:

an external seal (46) is fitted in an annular groove (45) in the stepped bore (22), the external seal (46) being in sealing engagement with the stem (28) to prevent the entry of corrosive atmospheric material into the valve body (10).



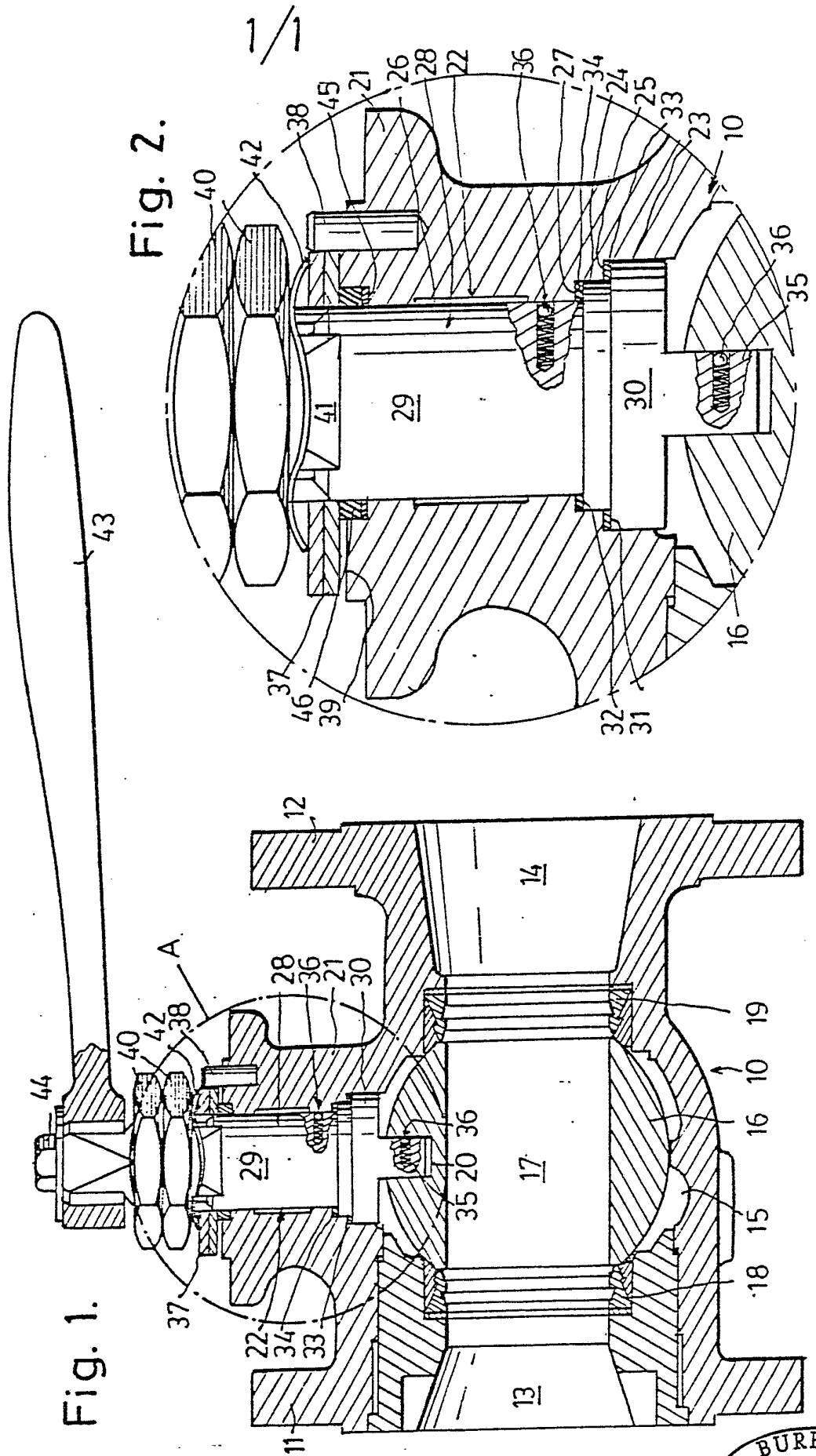


Fig. 1.

Fig. 2.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/AU 81/00139

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ³				
According to International Patent Classification (IPC) or to both National Classification and IPC				
Int. Cl. ³ F16K 5/06, 5/08. 41/00				
II. FIELDS SEARCHED				
Minimum Documentation Searched ⁴				
Classification System	Classification Symbols			
IPC	F16K 5/06, 5/08, 41/00			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵				
AU:IPC as above, Australian Classification 74.71				
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴				
Category *	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸		
X	DE, A, 2014237 (WESTARK - GmbH ARMATURENFABRIK) 14 October 1971 (14.10.71) see pages 4 and 5	(1)		
A	US, A, 3788600 (ALLEN) 29 January 1974 (29.01.74)	(1)		
A	US, A, 4006881 (GAILLARD) 8 February 1977 (08.02.77)	(1)		
A	CA, A, 1100467 (COMBUSTION ENGINEERING, INC.) 5 May 1981 (05.05.81) (& AU, A, 49954/79)	(1)		
<p>* Special categories of cited documents: ¹⁵</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> <p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> </td> <td style="width: 50%; border: none; vertical-align: top;"> <p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or 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</p> <p>"X" document of particular relevance</p> </td> </tr> </table>			<p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p>	<p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or 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</p> <p>"X" document of particular relevance</p>
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IV. CERTIFICATION				
Date of the Actual Completion of the International Search ¹	Date of Mailing of this International Search Report ²			
1 December 1981 (01.12.81)	02 DECEMBER 1981 (02-12-81)			
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