



(43) International Publication Date
22 September 2016 (22.09.2016)

(51) International Patent Classification:
F16K 15/03 (2006.01)

(21) International Application Number:
PCT/IN2016/000050

(22) International Filing Date:
25 February 2016 (25.02.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
822/MUM/2015 13 March 2015 (13.03.2015) IN

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: A PROCESS OF PRODUCING A COMPACT SWING TYPE CHECK VALVE BODY WITH REDUCED WEIGHT

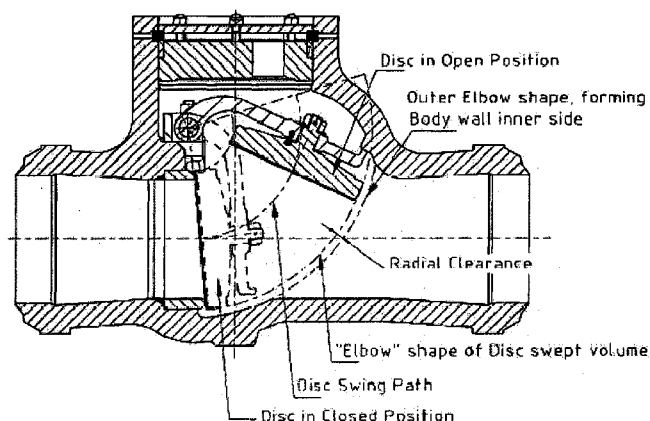


FIGURE - 2

(57) Abstract: A process of producing a compact swing type check valve body with reduced weight, the valve comprising a valve body (1) accommodating a sub-assembly of a disc (2) and a disc carrier (3) the sub-assembly (2, 3) constructed and disposed to swing about a hinge pin (4) during the valve operation, the valve body consisting of one each flow bore area and a neck area which together configure an interior volume for disc opening travel constituting a swept volume including a core clearance to allow interference-free swing travel of the subassembly inside the valve body wall, the process comprising the steps of constructing the swept volume in an elbow shape to allow free swinging or curvilinear travel of the disc, the swept volume forming the inner side or the core of the valve body; forming a radial clearance between the outer diameter of the disc and inner wall of the valve body; forming an outer profile of the valve body over the inner wall including the flow bore and neck areas, wherein the radial clearance is contracted based on the casting tolerances, profile of the disc, and associated valve body production parameters, wherein a dimensional offset is maintained from the formed elbow towards outer side by the disc swept volume, and wherein a wall thickness is built over the inner wall to outer wall constituting said outer profile.



WO 2016/147200 A1

TITLE:

A PROCESS OF PRODUCING A COMPACT SWING TYPE CHECK VALVE BODY WITH REDUCED WEIGHT

FIELD OF THE INVENTION

The present invention generally relates to check valves, in particular swing type check valves. More particularly, the invention relates to a process of producing a compact swing type check valve body with reduced weight.

BACKGROUND OF THE INVENTION

Check valves are basically used for Non Return function in a fluid flow line. There are various types of check valves used in a wide variety of applications, like Swing Check Valve, Ball type Check Valve, Piston Lift type Check Valve, Multi Door Check Valves and so on.

In a Swing type Check Valve, the Disc – which is a movable part to stop the reverse flow, is mounted on a Disc Carrier. The Disc Carrier swings on a hinge pin – towards Seat to close the valve (to stop reverse flow), or away from Seat to open the valve (due to the forward flow). In most of the cases, large sizes Check Valves are of Swing type.

According to prior art, a process of constructing a Swing type check valve, it needs to be ensured that inside the Valve Body, when the Disc is swinging for Opening, a clearance between Disc outer diameter and inside walls of the Valve Body is to maintained so that the Disc travel is nowhere hindered by inside walls of the Body.

Due to absence of specific and clear guidelines about the type and magnitude of clearance to be kept, a designer, at his discretion, keeps the inside shape of the Valve Body with limited logic for example, the Disc outer diameter should not touch Body inner walls. Thus, cross sections of Body around the Disc swing path were not essentially uniform, according to prior art. Therefore, the clearance

between Disc outer diameter and inner wall of the Body were neither uniform nor optimum.

Disadvantages of the methods used at present:

The prior art in absence of an innovative concept, a safe and arbitrary method, clearances between Disc travel path and Body inner wall, on higher sides, which were not really needed. This results in bulkier shape as well as wall thickness and ultimately higher weight of the Valve Body or Valve as a product, and its product cost.

OBJECTS OF THE INVENTION

It is therefore, an object of the invention to propose a process of producing a compact swing type check valve body with reduced weight.

Another object of the invention is to propose a process of producing a compact swing type check valve body with reduced weight, in which a radial clearance between the valve-disc and inner wall of the valve body is optimized and made uniform.

SUMMARY OF THE INVENTION

Accordingly, there is provided a process of producing a compact swing type check valve body with reduced weight, the valve comprising a valve body accommodating a sub-assembly of a disc and a disc carrier the sub-assembly constructed and disposed to swing about a hinge pin during the valve operation, the valve body consisting of one each flow bore area and a neck area which together configure an interior volume for disc opening travel constituting a swept volume including a core clearance to allow interference-free swing travel of the subassembly inside the valve body wall, the process comprising the steps of

constructing the swept volume in an elbow shape to allow free swinging or curvilinear travel of the disc, the swept volume forming the inner side or the core of the valve body; forming a radial clearance between the outer diameter of the disc and inner wall of the valve body; forming an outer profile of the valve body over the inner wall including the flow bore and neck areas, wherein the radial clearance is contracted based on the casting tolerances, profile of the disc, and associated valve body production parameters, wherein a dimensional offset is maintained from the formed elbow towards outer side by the disc swept volume, and wherein a wall thickness is built over the inner wall to outer wall constituting said outer profile.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

Figure 1 – shows a general assembly of a Swing type Check Valve

Figure 2 – shows schematically Disc and Disc Carrier Sweep Path in a swing type check valve according to the present invention

Figure 3 – shows a Valve Body outer profile over the inner wall according to the invention

Figure 4 – shows a typical shape of a Valve Body Casting constructed with optimum shape and dimension according to the present invention.

Figure 5 – shows a typical “non optimum” shape of Valve Body Casting according to the prior art

DETAIL DESCRIPTION OF THE INVENTION

Figure 1 illustrates a typical swing type check valve. A assembly of a Disc (2) and

a Disc Carrier (3), which swings about a Hinge Pin (4), during the valve operation. Shell of the Valve Body (1) excluding the flow bore area and neck area, is connected to configure an interior volume for –

- a. Disc opening travel (swept volume), and
- b. Core clearances for an uninterrupted swing travel, so that the Disc (2) does not interfere with inside of the Body / Shell wall (1).

Figure 2 illustrates a Disc swing path from the Close position to Open position. “Elbow” shape of the swept volume is crated by the Disc’s swinging (or curvilinear) travel. A radial clearance between the Disc outer

diameter and the inner side of the Body wall is required for an uninterrupted travel of the Disc. Minimum value of the radial clearance is estimated considering the Casting tolerances allowances, the Disc profile and manufacturing requirements. This value of the minimum radial clearance can vary according to size of the valve.

A dimensional offset is taken from the "Elbow" formed by said Disc swept volume, towards outer side. Value of the outward offset is equal to the minimum radial clearance requirement. This new outer swept volume forms the inner side or Core of the Valve Body, in this region. A shape of the inner side of the Body/shell wall is formed with the least possible volume. This inner side shape is the Optimum Core.

Figure 3 illustrates the forming of the Valve Body outer profile over the inner wall. After constructing the inner side of the Body wall, over the Optimum Core, as well as flow bores and neck, a wall thickness according to standards and codes is built over the inner wall which in turn forms the outer profile of the Valve Body.

Body casting formed with this optimum construction method of the invention, produces a casting with least possible weight.

Figure 4 shows a typical shape of the Valve Body casting produced according to the invention. Only for a comparison sake, Figure 5 is given to show a typical shape of Valve Body casting according to prior art.

Table 1 : Summary of average percentage saving in overall product weight :

ANSI Pressure Class #	Valve Nominal Size Group, NPS	Average Percentage saving in Overall Product Weight = (Old weight - New Weight) / Old Weight
900	2" to 6"	29%
	8" to 12"	32%
1500	2" to 6"	41%
	8" to 12"	36%
	14" to 24"	33%
2500	2" to 6"	30%
	8" to 10"	25%
	14" to 24"	48%

Validation of the inventive process

The products (Swing type Check Valves) are designed and developed in various size and pressure classes, with the Body construction method described in this disclosure. Most of the products are hydro tested for Body / Seat tests, for the test pressures / durations and guidelines in the relevant product testing standard (API 598). The products have successfully passed the tests, showing no sign of leakage or unacceptable deformation.

Advantages of the invention

This method of constructing Valve Body for Swing Check valve is the unique and Optimum Method, resulting least possible weight in the Swing Area.

A summary of average percentage weight saving in different product size groups of Swing type Check Valves, is given in Table-1. Saving in product size groups ranges between 25% to 48%. While individual product

weights saving is in a range of 16% to 53%, depending on the scope available according to produce size, pressure class and the geometry of corresponding old designs.

Although, a few other weight reduction measures have contributed in overall weight reduction, the major weight reduction comes from application of the optimum Body Shell construction method described in this invention document.

WE CLAIM

1. A process of producing a compact swing type check valve body with reduced weight, the valve comprising a valve body (1) accommodating a sub-assembly of a disc (2) and a disc carrier (3), the sub-assembly (2,3) constructed and disposed to swing about a hinge pin (4) during the valve operation, the valve body (1) consisting of one each flow bore area and a neck area which together configure an interior volume for disc opening travel constituting a swept volume including a core clearance to allow interference-free swing travel of the subassembly inside the valve body wall, the process comprising the steps of : -

- constructing the swept volume in an elbow shape to allow free swinging or curvilinear travel of the disc, the swept volume forming the inner side or the core of the valve body;
- forming a radial clearance between the outer diameter of the disc and inner wall of the valve body;
- forming an outer profile of the valve body over the inner wall including the flow bore and neck areas,

wherein the radial clearance is contracted based on the casting tolerances, profile of the disc, and associated valve body production parameters, wherein a dimensional offset is maintained from the formed elbow towards outer side by the disc swept volume, and wherein a wall thickness is built over the inner wall to outer wall constituting said outer profile.

2. The process as claimed in claim 1, wherein the product weight interalia weight of the valve body is reduced between 16% to 53% depending on the product size, pressure class and geometry of the valve.

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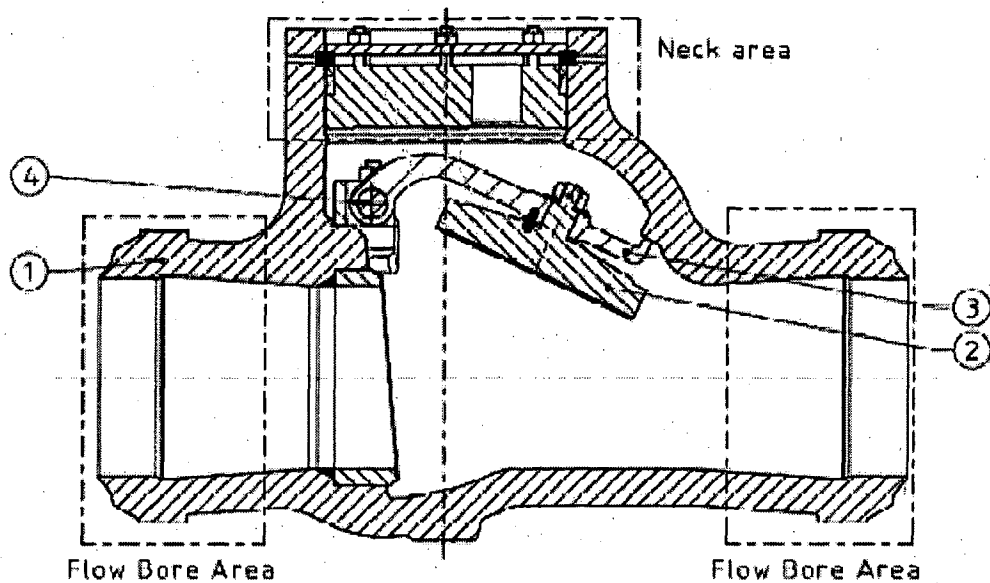


FIGURE - 1

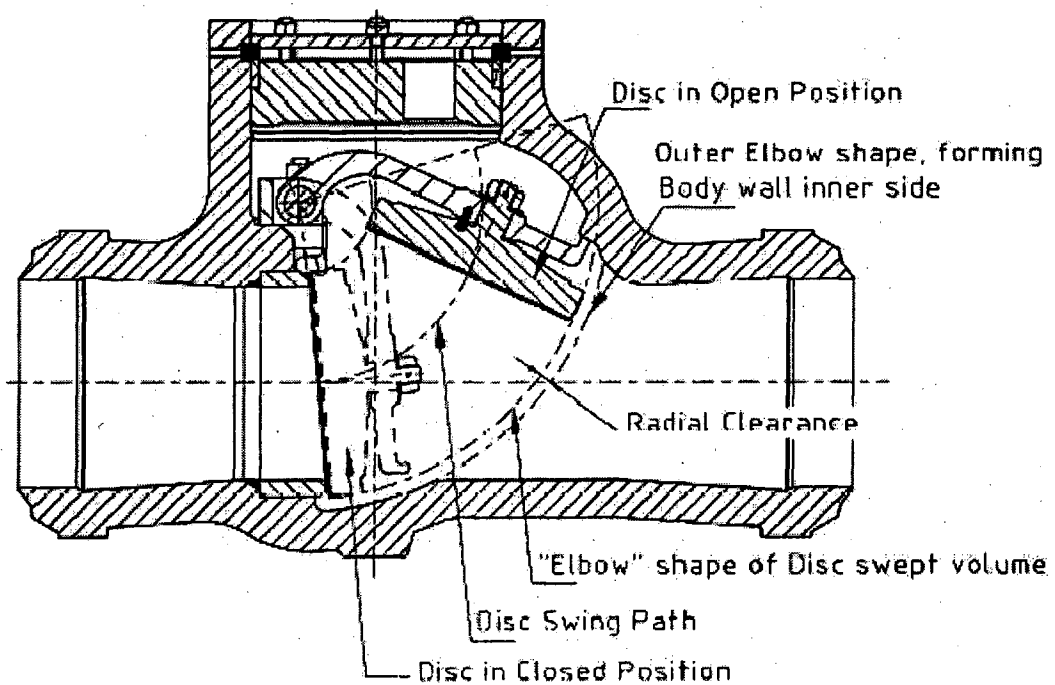


FIGURE - 2

2/3

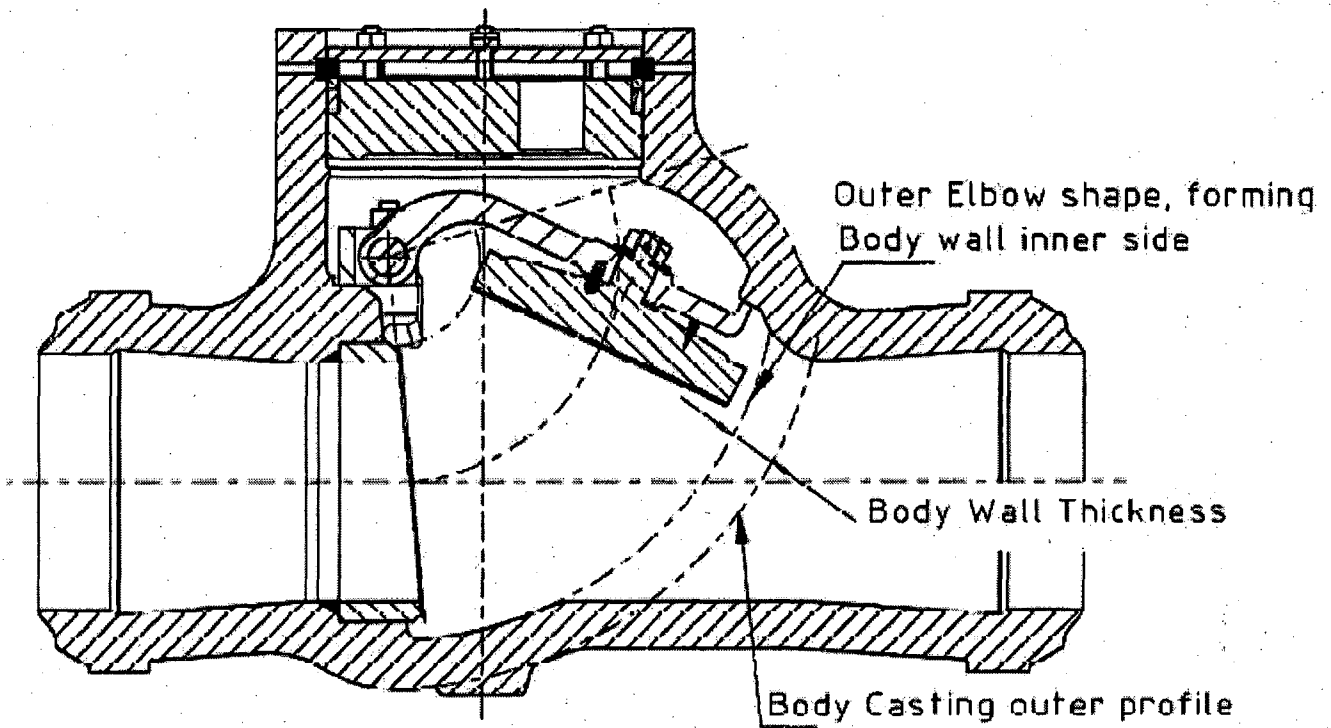


FIGURE - 3

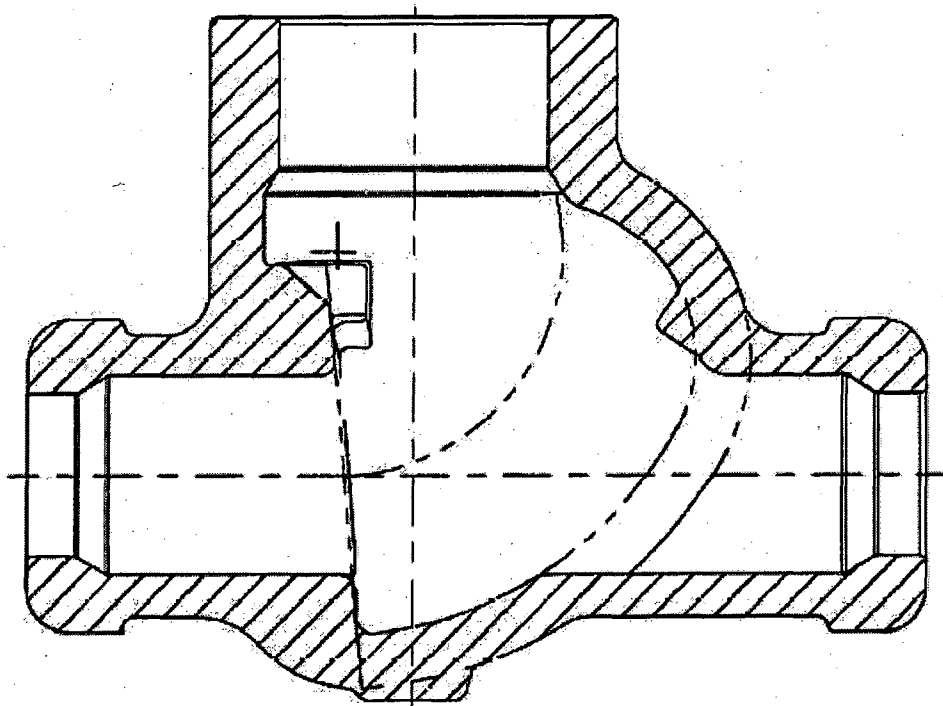


FIGURE - 4

3/3

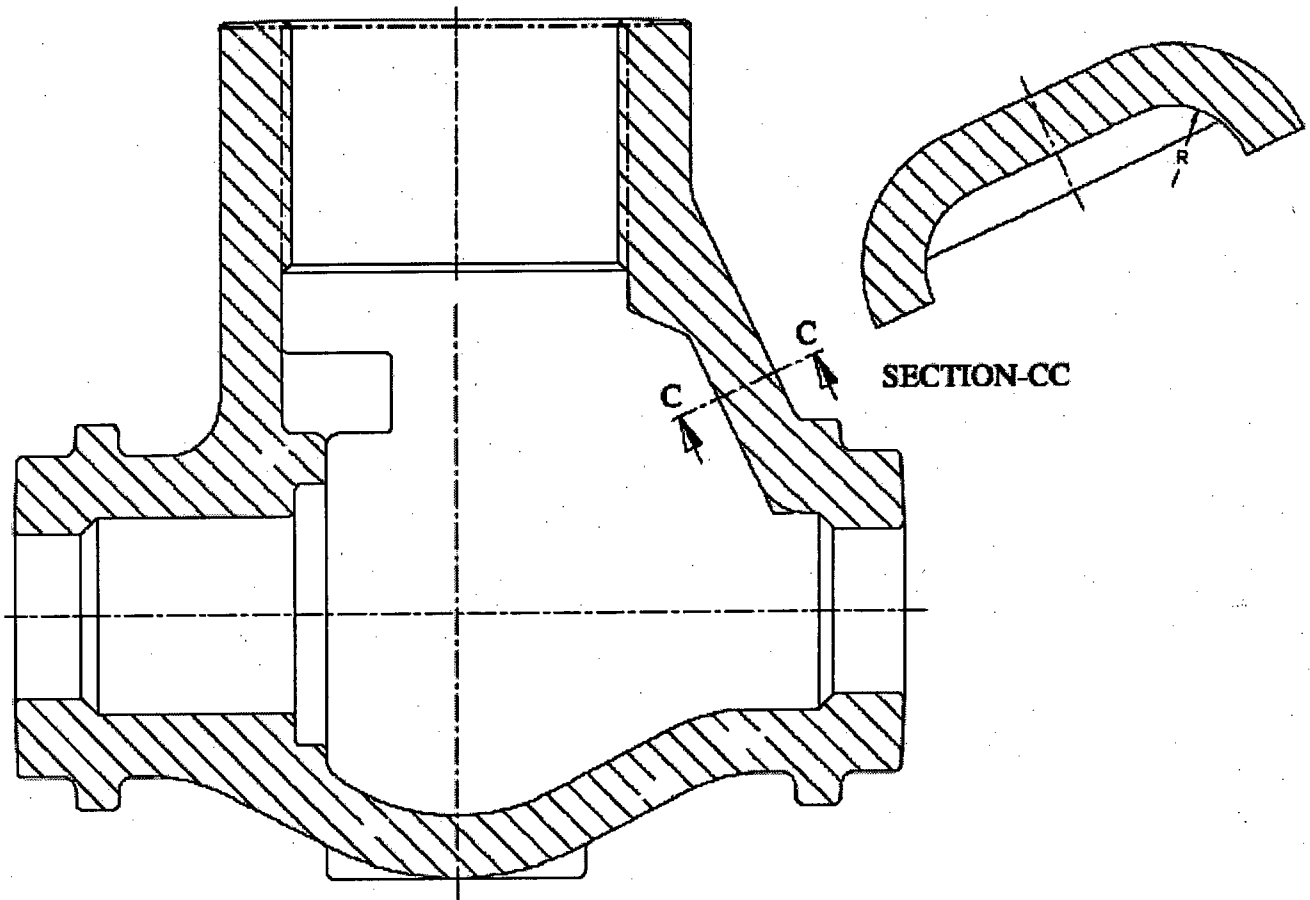


FIGURE - 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/IN2016/000050

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16K15/03
ADD.

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)
F16K

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)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 894 718 A (ENGLERT JOSEPH A) 14 July 1959 (1959-07-14) column 1, lines 44-70; figure 1 column 3, lines 43-45 -----	1,2
X	US 4 120 318 A (JOURDAN JERRY W) 17 October 1978 (1978-10-17) column 2, lines 15-28; figure 1 -----	1,2
X	WO 99/32816 A1 (AIRVAC INC [US]; FEATHERINGILL BURTON ADDISON [US]; GROOMS JOHN MERRIL) 1 July 1999 (1999-07-01) page 8, lines 13-15; figures 2, 4, 6-7 -----	1,2



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

27 June 2016

Date of mailing of the international search report

05/07/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IN2016/000050

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2894718	A	14-07-1959	NONE

US 4120318	A	17-10-1978	NONE

WO 9932816	A1	01-07-1999	AU 2003399 A 12-07-1999
			GB 2347198 A 30-08-2000
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