



- (51) International Patent Classification:
F02B 31/06 (2006.01) *F16K 1/22* (2006.01)
- (21) International Application Number:
PCT/US2016/042306
- (22) International Filing Date:
14 July 2016 (14.07.2016)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
62/192,436 14 July 2015 (14.07.2015) US
- (72) Inventor; and
(71) Applicant : HARTMAN, Thomas A. [US/US]; 700 Cap-
pac Court, St. Louis, Missouri 63125 (US).
- (74) Agents: SMITH, Clyde L. et al.; Thompson Coburn LLP,
One US Bank Plaza, St. Louis, Missouri 63101 (US).
- (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))
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))

- (88) Date of publication of the international search report:
16 February 2017

(54) Title: SPRING RING VALVE SEAT AND BUTTERFLY VALVE WITH SPRING RING VALVE SEAT

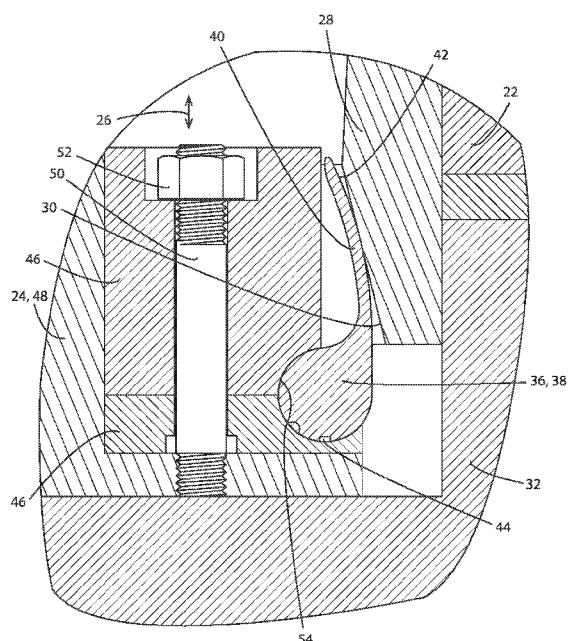


FIG. 4

(57) Abstract: A butterfly valve has a housing that has an annular valve seat and a butterfly disk that has an annular valve seat. At least one of the valve seats is a spring seat that has an annular mounting portion and an axially opposite annular engagement portion. The engagement portion is configured to contact the other valve seat and resiliently deform radially under hoop stress caused by the contact as the butterfly disk moves to the closed position. The engagement portion is connected to the main body of the respective one of housing or the butterfly disk by the mounting portion. The mounting portion is attached to the main body of the respective one of housing or the butterfly disk in a manner such that the mounting portion can articulate relative to the main body of the respective one of housing or the butterfly disk as the engagement portion resiliently deforms radially.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/42306

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F02B 31/06; F16K 1/22 (2016.01)

CPC - F16K 1/22

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(8)- F16K 1/22 (2016.01)

CPC- F16K 1/36

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

IPC(8)- F16K 1/22 F02M 11/02 F02B 31/06 (2016.01)

CPC- F16K 1/36 F16K 1/22 (keyword limited; terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Google; Google Patents; PatBase. Search terms: butterfly valve spring seat floating belleville springs annular seal disk mounting engagement Hartman Thomas a engage o-ring o ring torus

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,535,986 A (HUTCHENS et al.) 16 July 1996 (16.07.1996), entire document, especially col 5 ln 30-52, col 6 ln 1-27, and Figs. 1 and 3-4.	1-3
X	US 4,477,057 A (FRIESS) 16 October 1984 (16.10.1984); entire document, especially col 1 ln 4-7, col 2 ln 38-40, col 3 ln 4-19, col 3 ln 20-52, col 4 ln 38-50, and Figs. 1-2.	1, 4-5
A	US 4,744,572 A (AL BAHMAN et al.) 17 May 1988 (17.05.1988), entire document.	1-5
A	US 2012/0319022 A1 (HELPER et al.) 20 December 2012 (20.12.2012), entire document.	1-5
A	US 2010/0044373 A1 (DE MUINCK et al.) 25 February 2010 (25.02.2010), entire document.	1-5
A	US 4,415,170 A (BONAFOUS et al.) 15 November 1983 (15.11.1983), entire document.	1-5
A	US 4,418,889 A (KRAUSE et al.) 6 December 1983 (06.12.1983), entire document.	1-5

☐ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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

"&" document member of the same patent family

Date of the actual completion of the international search

1 December 2016

Date of mailing of the international search report

27 DEC 2016

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-8300

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/42306

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
--See Extra Sheet--

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-5

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/42306

*- Box III.0 - Explanation of Lack of Unity of Invention *-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-5 directed to a butterfly valve having a housing and a butterfly disk with annular valve seats.

Group II: Claims 6-9 directed to an annular valve seat with an elongate and arcuate engagement portion.

Group III: Claim 10 directed to a butterfly valve having a housing and a butterfly disk with a semi-circular annular recess.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

SPECIAL TECHNICAL FEATURES

The invention of Group I includes the special technical feature of the engagement portion being connected to the main body of the respective one of the housing or the butterfly disk by the mounting portion, not required by the claims of Group II or III.

The invention of Group II includes the special technical feature of the engagement portion extending axially in an arcuate and elongate manner from the mounting portion, not required by the claims of Group I or III.

The invention of Group III includes the special technical feature of the main body of the butterfly disk comprising an annular recess having a semi-circular cross-section, not required by the claims of Group I or II.

COMMON TECHNICAL FEATURES

Groups I-III share the common technical feature of an annular valve seat. However, this shared technical feature does not represent a contribution over prior art as being anticipated by US 5,535,986 (HUTCHENS) (hereinafter Hutchens), which discloses an annular valve seat (collectively 24 and 22, see Fig. 3).

Groups I and III share the common technical feature of a butterfly valve comprising a housing, the housing comprising a main body and an annular valve seat, the housing defining a fluid passageway that extends through the main body and the valve seat. However, this shared technical feature does not represent a contribution over prior art as being anticipated by Hutchens, which discloses a butterfly valve comprising a housing (12, see Fig. 1), the housing comprising a main body (12, see Fig. 3) and an annular valve seat (collectively 24 and 22, see Fig. 3), the housing defining a fluid passageway (13, see Fig. 1) that extends through the main body and the valve seat.

Groups I and III share the common technical feature of a butterfly disk, comprising a main body and an annular valve seat, the butterfly disk being pivotally mounted to the housing such that the butterfly disk is movable to and between an open position and a closed position, the butterfly disk being configured to prevent fluid from passing through the fluid passageway of the housing when the butterfly disk is in the closed position. However, this shared technical feature does not represent a contribution over prior art as being anticipated by Hutchens, which discloses a butterfly disk comprising a main body (18, see Fig. 1) and an annular valve seat (52, see Fig. 3), the butterfly disk being pivotally mounted to the housing such that the butterfly disk is movable to and between an open position and a closed position (see col 5 ln 30-42), the butterfly disk being configured to prevent fluid from passing through the fluid passageway of the housing when the butterfly disk is in the closed position (see col 5 ln 35-38).

Groups I and III share the common technical feature of a butterfly valve comprising a spring seat having an annular mounting portion and an axially opposite annular engagement portion, the engagement portion being configured to contact the other of the valve seats and resiliently deform radially under hoop stress caused by the contact as the butterfly disk moves to the closed position. However, this shared technical feature does not represent a contribution over prior art as being anticipated by Hutchens, which discloses a spring seat having an annular mounting portion (collectively portions of 22 denoted by 26, 44, 46, 48, and 50, see Fig. 3) and an axially opposite annular engagement portion (portion of 22 denoted by 52, see Fig. 3), the engagement portion being configured to contact the other of the valve seats and resiliently deform radially under hoop stress caused by the contact as the butterfly disk moves to the closed position (see col 6 ln 1-14).

As the common technical features were known in the art at the time of the invention, these cannot be considered special technical feature that would otherwise unify the groups.

Therefore, Groups I-III lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.