US009410638B2

(12) **United States Patent**
Ambrosi

(10) **Patent No.: US 9,410,638 B2**
(45) **Date of Patent: Aug. 9, 2016**

(54) **SOLENOID VALVE WITH SHAPED SPRING**

(71) Applicant: **Massimiliano Ambrosi**, Marbach (DE)

(72) Inventor: **Massimiliano Ambrosi**, Marbach (DE)

(73) Assignee: **Robert Bosch GmbH**, Stuttgart (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/524,799**

(22) Filed: **Oct. 27, 2014**

(65) **Prior Publication Data**

US 2015/0090914 A1 Apr. 2, 2015

Related U.S. Application Data

(63) Continuation of application No. 13/181,787, filed on Jul. 13, 2011, now Pat. No. 8,870,160.

(30) **Foreign Application Priority Data**

Jul. 13, 2010 (DE) 10 2010 031 275

(51) **Int. Cl.**
F16K 31/06 (2006.01)
B60T 8/36 (2006.01)

(52) **U.S. Cl.**
CPC ***F16K 31/0665*** (2013.01); ***B60T 8/363*** (2013.01)

(58) **Field of Classification Search**
CPC F16K 27/029; F16K 27/048; F16K 31/06; F16K 31/0655; F16K 31/0696; B60T 8/363; F16F 1/025; F16F 1/34
USPC 251/64, 129.15, 337
See application file for complete search history.

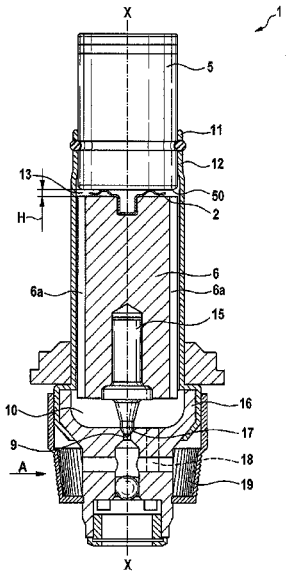
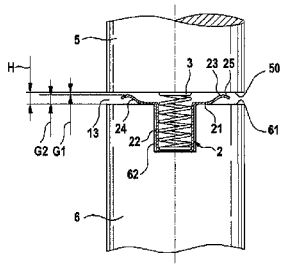
(56) **References Cited**

U.S. PATENT DOCUMENTS

2,140,149	A	12/1938	Arutunoff
2,631,612	A	3/1953	Buescher
2,706,491	A	4/1955	Köhler
3,114,388	A	12/1963	Hoen
3,207,961	A	9/1965	Lohr
3,653,630	A	4/1972	Ritsema
4,108,420	A	8/1978	West et al.
4,465,267	A	8/1984	Chatelin
4,569,504	A	2/1986	Doyle
4,682,135	A	7/1987	Yamakawa
4,971,290	A	11/1990	Dahlmann
5,033,505	A	7/1991	Eidsmore
6,267,350	B1	7/2001	Slawinski et al.
6,729,347	B2	5/2004	Ittlinger et al.
6,776,391	B1	8/2004	Goossens et al.
6,837,478	B1	1/2005	Goossens et al.
7,108,242	B2	9/2006	Goossens et al.
8,047,503	B2	11/2011	Hirt
2001/0023931	A1	9/2001	Fukano
2002/0083979	A1	7/2002	Suzuki
2002/0088493	A1	7/2002	Suzuki
2005/0151104	A1	7/2005	Goossens et al.
2007/0246673	A1	10/2007	Bircann
2008/0272208	A1	11/2008	Anderson et al.

Primary Examiner — Matthew W Jellett
(74) *Attorney, Agent, or Firm* — Maginot, Moore & Beck LLP

(57) **ABSTRACT**

A solenoid valve for controlling fluids includes a pole core, an armature which is connected to a closing element, and a spring element which is arranged in a working gap between the pole core and the armature. The spring element includes a shaped spring of substantially disk-shaped design. The shaped spring has a curvature with at least one flank region and one dome region, a tangent to the dome region being parallel to an end surface of the pole core.

11 Claims, 4 Drawing Sheets