



US009641938B2

(12) **United States Patent**
Bushko et al.

(10) **Patent No.:** **US 9,641,938 B2**
(45) **Date of Patent:** **May 2, 2017**

(54) **ELECTRO-ACOUSTIC TRANSDUCER WITH
RADIATING ACOUSTIC SEAL AND
STACKED MAGNETIC CIRCUIT ASSEMBLY**

(56) **References Cited**

U.S. PATENT DOCUMENTS

(71) Applicant: **BOSE CORPORATION**, Framingham,
MA (US)

(72) Inventors: **Darek Bushko**, Framingham, MA (US);
Wit Bushko, Framingham, MA (US)

(73) Assignee: **BOSE CORPORATION**, Framingham,
MA (US)

(*) 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.: **14/718,470**

(22) Filed: **May 21, 2015**

(65) **Prior Publication Data**

US 2016/0345099 A1 Nov. 24, 2016

(51) **Int. Cl.**

H04R 7/18 (2006.01)
H04R 7/20 (2006.01)
H04R 9/02 (2006.01)
H04R 7/04 (2006.01)

(52) **U.S. Cl.**

CPC **H04R 7/20** (2013.01); **H04R 7/18**
(2013.01); **H04R 9/025** (2013.01); **H04R 7/04**
(2013.01); **H04R 2307/201** (2013.01)

(58) **Field of Classification Search**

CPC ... **H04R 7/20**; **H04R 9/06**; **H04R 7/16**; **H04R**
7/18; **H04R 7/24**; **H04R 7/26**
See application file for complete search history.

2,069,242 A * 2/1937 Graham H04R 7/20
181/172
2,439,666 A * 4/1948 Marquis H04R 7/20
181/172
3,019,849 A * 2/1962 King H04R 7/20
181/172
4,228,327 A * 10/1980 Sawafuji H04R 9/047
381/398
4,284,167 A * 8/1981 Kozlow H04R 7/04
181/172
4,547,631 A * 10/1985 Nieuwendijk H04R 7/20
381/161
5,317,552 A 5/1994 Yamasaki
6,714,655 B2 3/2004 Iwasa et al.
6,739,425 B1 * 5/2004 Griffin G10K 11/16
181/171
6,973,194 B2 12/2005 Iwasa et al.
7,006,654 B2 2/2006 Stiles et al.

(Continued)

FOREIGN PATENT DOCUMENTS

JP H1155789 A 2/1999
JP 3893694 B2 3/2007

(Continued)

Primary Examiner — Matthew Eason

(74) *Attorney, Agent, or Firm* — Patterson + Sheridan,
LLP

(57)

ABSTRACT

An electro-acoustic transducer includes an accordion-type structure that functions as both an acoustic radiation element and an acoustic seal. In one example, the transducer includes parallel, accordion-type structures that attach to a flat, rectangular diaphragm. The diaphragm is connected to a voice coil. The voice coil and an associated frame are positioned between a magnet arrangement. The magnet arrangement includes stacked magnet pairs positioned between pole pieces to focus magnetic flux.

23 Claims, 9 Drawing Sheets

