US009846315B2

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

(10) **Patent No.: US 9,846,315 B2**
(45) **Date of Patent: Dec. 19, 2017**

(54) **ELECTROMAGNETIC ACTUATORS FOR DIGITAL CAMERAS**

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(*) 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.: **15/256,691**

(22) Filed: **Sep. 5, 2016**

(65) **Prior Publication Data**

US 2016/0370601 A1 Dec. 22, 2016

Related U.S. Application Data

(63) Continuation of application No. 14/373,490, filed as application No. PCT/IB2014/062836 on Jul. 3, 2014, now Pat. No. 9,448,382.
(Continued)

(51) **Int. Cl.**
G02B 7/02 (2006.01)
G02B 27/64 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G02B 27/646*** (2013.01); ***G02B 7/04*** (2013.01); ***G02B 7/08*** (2013.01); ***G03B 3/10*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC ... G11B 7/0908; G11B 7/0925; G11B 7/0927; G11B 7/093; H02K 41/0356; G02B 7/04
(Continued)

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(57) **ABSTRACT**

Electro-magnetic actuators used to provide a displacement of an optical element such as a lens carrier comprise at least one ferromagnetic frame associated with a large air gap and at least one ferromagnetic member parallel to and separated from an elongated section of a frame by a small air gap. Actuation causes a magnetic circuit that appears in the at least one frame, the at least one member and small air gaps and by-passes or bridges the large air gap. In some embodiments, the resultant magnetic force moves the at least one member and leads to the displacement of an optical element attached thereto. In some embodiments, at least one frame and at least one member are arranged to provide a center hole and are dimensioned to enable insertion of a lens carrier in the hole. In some embodiments, the displacement is for auto-focus. In other embodiments, the displacement is for optical image stabilization.

17 Claims, 14 Drawing Sheets