



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

(10) **Patent No.:** **US 9,510,879 B2**  
(45) **Date of Patent:** **Dec. 6, 2016**

(54) **FLEXIBLE PLATE FIXATION OF BONE FRACTURES**

(71) Applicant: **Zimmer, Inc.**, Warsaw, IN (US)  
(72) Inventors: **Michael Bottlang**, Happy Valley, OR (US); **Steven M. Madey**, West Linn, OR (US); **Kyle Wirtz**, Portland, OR (US); **Stanley Tsai**, Portland, OR (US)

(73) Assignee: **Zimmer, Inc.**, Warsaw, IN (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 126 days.

(21) Appl. No.: **14/308,286**

(22) Filed: **Jun. 18, 2014**

(65) **Prior Publication Data**  
US 2015/0025588 A1 Jan. 22, 2015

**Related U.S. Application Data**

(63) Continuation of application No. 13/490,249, filed on Jun. 6, 2012, now Pat. No. 8,790,379, which is a continuation-in-part of application No. 13/166,539, filed on Jun. 22, 2011, now Pat. No. 8,882,815.

(Continued)

(51) **Int. Cl.**  
**A61B 17/80** (2006.01)  
**A61B 17/86** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **A61B 17/8047** (2013.01); **A61B 17/8004** (2013.01); **A61B 17/8085** (2013.01); **A61B 17/863** (2013.01)

(58) **Field of Classification Search**  
CPC ..... A61B 17/8047; A61B 17/8004; A61B 17/8085

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,406,832 A 9/1946 Hardinge  
2,580,821 A 1/1952 Toufick, Nicola  
(Continued)

FOREIGN PATENT DOCUMENTS

CN 104135953 A 11/2014  
EP 0615728 A2 9/1994  
(Continued)

OTHER PUBLICATIONS

"U.S. Appl. No. 13/166,539, Notice of Allowance mailed Aug. 15, 2014", 7 pgs.

(Continued)

*Primary Examiner* — David Bates  
*Assistant Examiner* — Olivia C Chang  
(74) *Attorney, Agent, or Firm* — Schwegman Lundberg & Woessner, P.A.

(57) **ABSTRACT**

Embodiments provide methods, apparatuses, and systems for fixation of a fractured bone with a bone plate. In various embodiments, the systems and plates provide elastic suspension of the receiving holes relative to an osteosynthesis plate. This elastic suspension can promote load distribution between the screws that connect a bone segment to the plate, thereby reducing stress risers and load shielding effect. In addition, stress at the screw holes, and within the construct as a whole, is reduced by incorporation of these elastic elements in the plate. Additionally, in some embodiments where fracture healing by callus formation is desired, elastic suspension of the receiving holes relative to the osteosynthesis plate can enable small, controlled amounts of relative motion between bone fragments connected by the plate. This relative motion can promote fracture healing by callus formation.

**21 Claims, 28 Drawing Sheets**

