



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

(10) **Patent No.:** **US 9,410,874 B2**
(45) **Date of Patent:** **Aug. 9, 2016**

(54) **SIMULATED IMPACT-TYPE ROCK BURST EXPERIMENT APPARATUS**

(75) Inventors: **Manchao He**, Beijing (CN); **Xuena Jia**, Beijing (CN); **Dongqiao Liu**, Beijing (CN)

(73) Assignee: **China University of Mining & Technology (Beijing)**, Beijing (CN)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 15 days.

(21) Appl. No.: **14/389,338**

(22) PCT Filed: **Mar. 31, 2012**

(86) PCT No.: **PCT/CN2012/073440**

§ 371 (c)(1),
(2), (4) Date: **Sep. 29, 2014**

(87) PCT Pub. No.: **WO2013/143152**

PCT Pub. Date: **Oct. 3, 2013**

(65) **Prior Publication Data**

US 2015/0168282 A1 Jun. 18, 2015

(51) **Int. Cl.**
G01N 3/24 (2006.01)
G01N 3/313 (2006.01)
G01N 3/08 (2006.01)

(52) **U.S. Cl.**
CPC **G01N 3/24** (2013.01); **G01N 3/313** (2013.01); **G01N 3/08** (2013.01); **G01N 2203/0256** (2013.01)

(58) **Field of Classification Search**
CPC ... G01N 2203/0256; G01N 3/08; G01N 3/24; G01N 3/13
USPC 73/784, 841, 803
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,444,058 A	4/1984	Ratigan	
5,025,668 A *	6/1991	Sarda	G01N 3/10 73/795
5,025,669 A *	6/1991	Sarda	G01N 3/10 73/798
5,063,785 A *	11/1991	Labuz	G01N 3/10 73/821

(Continued)

FOREIGN PATENT DOCUMENTS

CN	101051011 A	10/2007
CN	101140207 A	3/2008

(Continued)

OTHER PUBLICATIONS

He M C et al. "rock burst process of limestone and its acoustic emission characteristics under true-triaxial unloading conditions," *International Journal of Rock Mechanics and Mining Sciences*, vol. 47, No. 2, Feb. 1, 2010, pp. 286-298.

(Continued)

Primary Examiner — Max Noori

(74) *Attorney, Agent, or Firm* — Yunling Ren; Eaton & Van Winkle

(57) **ABSTRACT**

A simulated impact-type rock burst experiment apparatus includes a bracket, a specimen box assembly, an X-direction, Y-direction and Z-direction loading mechanisms mounted on the bracket, and control systems. Each loading mechanism includes four supporting posts in a rectangular arrangement, a first and second frames aligned with each other and fixedly connected to both ends of the four supporting posts, a loading hydraulic cylinder and a lead screw mounted on the two frames respectively.

19 Claims, 5 Drawing Sheets

