



US 20230232147A1

(19) **United States**(12) **Patent Application Publication****Zhang et al.**(10) **Pub. No.: US 2023/0232147 A1**(43) **Pub. Date: Jul. 20, 2023**(54) **EARPHONE AND METHOD FOR IDENTIFYING WHETHER AN EARPHONE IS BEING INSERTED INTO AN EAR OF A USER****Publication Classification**

(51) **Int. Cl.**
H04R 1/10 (2006.01)
G06F 3/01 (2006.01)
G01P 15/18 (2006.01)

(52) **U.S. Cl.**
CPC *H04R 1/1041* (2013.01); *G06F 3/011* (2013.01); *G01P 15/18* (2013.01)

(71) Applicant: **Robert Bosch GmbH**, Stuttgart (DE)(72) Inventors: **Rui Zhang**, Wannweil (DE); **Juergen Gut**, Tuebingen (DE); **Sergej Scheiermann**, Reutlingen (DE)(21) Appl. No.: **17/998,133**(22) PCT Filed: **Jul. 22, 2021**(86) PCT No.: **PCT/EP2021/070478**

§ 371 (c)(1),

(2) Date: **Nov. 7, 2022**(30) **Foreign Application Priority Data**

Sep. 9, 2020 (DE) 10 2020 211 299.1

(57) **ABSTRACT**

An earphone including a proximity sensor, an acceleration sensor, and a signal analysis device. The signal analysis device identifies an approaching movement of the earphone to an object using the proximity sensor signal. The signal analysis device ascertains whether the approaching movement is a movement of the earphone to an ear of the user. By filtering the acceleration sensor signal, the signal analysis device generates a high-pass filtered acceleration signal and a low-pass filtered acceleration signal. The signal analysis device determines an end time of the approaching movement based on a stabilization of the acceleration, using the low-pass filtered acceleration signal. The signal analysis device confirms that the approaching movement is a movement of the earphone to an ear of the user based on changes in the high-pass filtered acceleration signal after the ascertained end time of the approaching movement.

