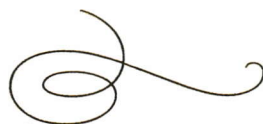
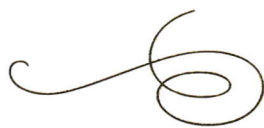


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The Director

of the United States Patent and Trademark Office has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this United States

Patent

grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

Anders Ivarsson

DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE



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

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(45) **Date of Patent:** **Feb. 18, 2020**

(54) **METHOD AND SYSTEM FOR DETECTING,
CHARACTERIZING AND ASSESSING THE
QUALITY OF A SPRAY**

G01S 7/417 (2013.01); *G01S 13/583*
(2013.01); *G01S 13/88* (2013.01); *G01S*
2007/356 (2013.01)

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(58) **Field of Classification Search**

CPC ... B05B 12/004; B05B 12/006; B05B 12/008;
G01S 7/412; G01S 2007/356; G01S
13/583; G01S 13/88

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See application file for complete search history.

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(56) **References Cited**

U.S. PATENT DOCUMENTS

2,824,284 A * 2/1958 Johnson G01P 3/665
324/642
4,467,961 A * 8/1984 Coffee A01M 7/0089
239/1

(Continued)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 145 days.

FOREIGN PATENT DOCUMENTS

EP 2756745 A1 * 7/2014 A01C 17/001

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(2013.01); *B05B 12/004* (2013.01); *B05B*
12/008 (2013.01); *G01S 7/352* (2013.01);

ABSTRACT

The present disclosure relates to a method for the detection, characterization and assessment of the quality of a spray which is produced by atomizing liquids with nozzles of different designs and constructional forms. The spray may have an application-specific droplet size distribution ranging from fine to very coarse droplets which move at different speeds. A radar signal is directed into and reflected by the spray. The reflected radar signal is subject to a Doppler shift caused by the movement of the droplets in the spray. The transmitted and received radar signals are mixed to create a low-frequency Doppler oscillation signal which is sampled at a predetermined rate with an analog-digital converter, the output of which is stored in a data array and transformed from the time domain into the frequency domain for further processing.

12 Claims, 3 Drawing Sheets

