UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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AROMA360, LLC,

Petitioner,

v.

AIR ESSCENTIALS, INC.,

Patent Owner.

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Case IPR 2025-00705
U.S. Patent No. 9,527,094

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# DECLARATION OF GERALD MICKLOW, Ph.D.

**I, Dr. Gerald J. Micklow, declare as follows:**

## I. INTRODUCTION

1. Air Esscentials, Inc. ("Air Esscentials") has retained my services in connection with the above-captioned *Inter Partes* Review (IPR) of U.S. Patent No. 9,527,094 (the "'094 Patent"). I have been asked to study and provide my opinions as an independent expert witness regarding the technology at issue in this proceeding. I am being compensated at my usual and customary rate for my time. My compensation is not contingent on the outcome of this proceeding, and the outcome does not affect my compensation in any way.
2. My qualifications and professional experience are described in my curriculum vitae, a copy of which will be submitted with this declaration. *See* Exhibit 2003. The following is a summary of my relevant background and expertise.
3. I received a Ph.D. in Mechanical Engineering from Virginia Polytechnic Institute and State University in 1989. I previously earned an M.S. in Aerospace Engineering from The Pennsylvania State University in 1981 and a B.S. in Aerospace Engineering from The Pennsylvania State University in 1975.
4. I have more than four decades of professional experience in mechanical, aerospace, and automotive engineering, with specialized expertise in fluid dynamics, thermodynamics, computational fluid dynamics, gas turbine

engines, advanced fan and compressor design, compressible gas dynamics, combustion systems, turbomachinery, internal combustion engines, and propulsion systems.

5. I am currently Professor Emeritus and former Head of Automotive Engineering in the Department of Mechanical and Civil Engineering at the Florida Institute of Technology, where I also previously served as Director of the Florida Center for Automotive Research. Prior to that, I held faculty appointments at East Carolina University, the University of North Carolina at Charlotte, the University of Alabama, the University of Florida, and Virginia Polytechnic Institute and State University.

6. In addition to my academic career, I have held engineering and consulting positions in industry, including with Pratt & Whitney Aircraft, Tracor Aerospace, and Allison Gas Turbines, where my work focused on advanced compressor and fan design, unsteady aerodynamics, flutter prediction, hypersonic aerodynamics, and propulsion system performance.

7. Throughout my career, I have designed, analyzed, and tested fluid-flow and combustion systems involving air handling components such as compressors, fans, blowers, flow restriction devices, injectors, and atomization systems. My work has included the modeling and experimental validation of fuel-air

mixing, spray atomization, turbulent flows, and multi-phase fluid systems relevant to propulsion, power generation, and industrial applications.

8. I have served as principal investigator or co-principal investigator on numerous federally and privately funded research programs sponsored by, among others, NASA, the U.S. Department of Energy, the U.S. Army, the Federal Aviation Administration, and major industrial partners. These projects have addressed advanced combustion, fuel injection systems, propulsion heat transfer, turbine and compressor performance, and computational modeling of complex fluid systems.

9. I am a licensed Professional Engineer and an active member of several professional societies, including the American Society of Mechanical Engineers (ASME), the American Institute of Aeronautics and Astronautics (AIAA), the Society of Automotive Engineers (SAE), and the American Society of Engineering Education (ASEE). I have served on numerous technical committees within these organizations, including long-standing service on propulsion, turbomachinery, combustion, and fuel systems committees.

10. I have authored or co-authored an extensive body of technical literature, including peer-reviewed journal articles, conference papers, government technical reports, and industry studies in the areas of fluid mechanics,

combustion, propulsion, turbomachinery, and automotive engineering. I have also served as a reviewer and editor for multiple scholarly journals in these fields.

11. I have taught undergraduate and graduate-level courses in fluid mechanics, thermodynamics, combustion, propulsion, computational fluid dynamics, and advanced powertrain systems. In these roles, I have provided instruction on the fundamental principles governing airflow, pressure dynamics, turbulence, atomization, and energy conversion in mechanical and fluid systems.

12. Based on my education, professional experience, research background, and teaching activities, I possess specialized expertise in the design, analysis, and operation of mechanical and fluid-dynamic systems involving air handling, flow control, atomization, combustion, and propulsion technologies relevant to the issues addressed in this proceeding.

## II. MATERIALS REVIEWED

13. In reaching the conclusions described in this declaration, I have relied on the documents and materials cited herein as well as those identified in the List of Exhibits set forth in the Patent Owner's Response ("POR"). These materials comprise patents, related documents, printed publications, and documents filed in the instant IPR, including the Declaration of Christopher White, Ph.D. Exhibit 1002. I have also relied on the sources cited in Exhibits 2005-2014. My opinions are also based upon my education, training, research, knowledge, and personal and professional experience.

14. I understand that certain issues in an IPR, such as claim construction and whether a claim is invalid as obvious, are assessed from the view of a hypothetical person of ordinary skill in the relevant art at the time of the invention. I understand there are multiple factors relevant to determining the level of ordinary skill in the art, including: (1) the level of education and experience of persons working in the field at the time of the invention; (2) the sophistication of the technology; (3) the rapidity with which innovations are made; (4) the types of problems encountered in the field; and (5) the prior art solutions to those problems.

15. In view of the above and based on my experience and knowledge, I believe a hypothetical Person of Ordinary Skill in The Art (POSITA) with regard to the

’094 Patent would have either: (1) a bachelor’s degree in mechanical engineering, aerospace engineering, chemical engineering, or a closely related field, and at least two years of work experience designing or developing products involving fluid dynamics; or (2) a master’s degree in mechanical engineering, aerospace engineering, chemical engineering, or a closely related field, and at least one year of work experience in fluid dynamics or fluid systems engineering.

16. Based on my education, experience, and background, I believe I qualify as at least a person of ordinary skill in the art.

17. After reviewing the Declaration of Christopher White, Ph.D. (Exhibit 1002), the following are points of disagreement.

18. References herein to prior art of record may be shortened based on the adopted naming conventions of the parties to the IPR.

## III. THE CLAIMS OF THE '094 PATENT AS COMPARED TO THE PRIOR ART ASSERTED THE IN THE IPR

### A. GROUND 1

19. Restricting or disrupting fluid flow does not inherently dampen sound.

20. Forcing fluid, particularly air, through constricted or obstructed pathways often increases turbulence, which can generate or amplify sound rather than suppress it.

21. When air is forced through a narrow opening, a high-velocity stream is created that interacts with surrounding edges to produce oscillating vortices and pressure fluctuations that generate sound waves. These oscillations can resonate within a chamber, amplifying sound rather than attenuating it.

22. The reference numeral 98 of Sevy (Exhibit 1009) increases turbulence and associated noise when an atomization passes it, and does not dampen it.

23. The reference numeral 98 of Sevy would not "have a dampening effect on sound waves" or an atomization, and thus does not attenuate sound.

### B. GROUND 2

24. Droplets expelled from the reference numeral 14a of Zeng (Exhibit 1011) would adhere to the outer surface of a noise-reduction head 20, which, in turn, would lead to the merging of similar droplets adhering to the same surface, ultimately resulting in an appreciable gain in size.

25. A person of ordinary skill in the art would not have been motivated to incorporate Zeng's reference numeral 20 and reference numeral 30 downstream of Sevy's refercne numeral 98, at least in part because such a substitution would be expected to inhibit atomization due to fuel coalescence.

26. The incorporation of at least Zeng's reference numeral 20 and reference numeral 30 downstream of Sevy's reference numeral 98 would not appreciably dampen sound waves generated during operation of a fluid dispersion assembly, aside from any incidental interaction with fluid flow.

27. Introducing a thin metal structure into an unsteady flow may increase vibration-induced noise rather than suppress it.

**C. GROUND 3**

28. The reference numeral 13 of Goubet (Exhibit 1016) would not function as a baffle, nor the reference numeral 13 in conjunction with the reference numeral 14 and the reference numeral 16 as a silencer. It is likely that the turbulent airflow therein, in connection with the like diameters of reference numeral 14 and reference numeral 16, would have no quieting effect on the ultimate ejection of the fluid dispersion.

29. A POSITA would appreciate that the circular shape of the baffled path of Goubet necessitates that the droplets twist and turn several times, which will cause the droplets to remain in close contact with one another and result in the

coalesce of fluid droplets into larger sizes. Fine atomization of a liquid is also time dependent. The amount of time that the droplets spend in the baffle will be relatively short resulting in a non-uniform spray. It will not meet the limitation of "fluid dispersion."

**D. GROUND 4**

30. Kaiser (Exhibit 1014) operates through an electrospray mechanism in which a microjet breaks into a stream of electrically charged droplets emitted from relatively large-bore capillaries, a process that inherently differs from the gas-nozzle-based atomization system disclosed in the '094 Patent.

31. The droplets in Kaiser originate from a semi-conducting liquid that sustains electric charge for electrostatic breakup, rather than from an operative fluid designed for mechanical dispersion through gas-flow interaction as required by the '094 Patent.

32. In Kaiser, droplet formation and charging occur simultaneously at the capillary under a high electrical potential, whereas the '094 Patent introduces an uncharged liquid into a chamber and relies on subsequent fluid-dynamic forces for atomization, reflecting fundamentally different generation mechanisms.

33. The dispersion of droplets in Kaiser is driven by Coulombic repulsion between like-charged particles, which induces self-spreading and prevents

coalescence, in contrast to the ’094 Patent’s reliance on gas-flow and liquid-particle interaction to achieve dispersion.

34. Because Kaiser’s atomization is strictly electrostatic, it is decoupled from gas-flow processes altogether, making the governing physical principles materially different from the fluid-flow-based atomization described and claimed in the ’094 Patent.

35. Given that Kaiser’s system depends on electrostatic control of charged droplets and omits the flow-interaction mechanisms central to the ’094 Patent, a person of ordinary skill in the art, whose training would typically center on mechanical and fluid-dynamic atomization systems, would not reasonably look to an electrostatic atomizer like Kaiser for guidance in the context of the claimed technology. Moreover, a person of ordinary skill in the art would not have classwork or experience to consider Kaiser when looking for guidance in the context of the claimed technology.

## E. GROUND 5

36. The silencer assembly of the ’094 Patent, as claimed and described, is a purpose-designed acoustic structure in which the silencer inlet, baffle, and silencer outlet cooperate to divide the fluid stream into multiple flow paths that are recombined downstream in a controlled manner, thereby phasing

unsteady pressure peaks and reducing the amplitude of acoustic pressure waves generated during operation. This configuration functions as an acoustic attenuator by introducing impedance mismatches that are deliberately structured to cancel pressure fluctuations rather than merely obstruct flow.

37. The structure identified in Gao (Exhibit 1013) consists only of a flat divider plate that forces fluid to route around it, without any geometry or spatial arrangement capable of splitting the flow into phased paths, introducing controlled acoustic impedance discontinuities, or reducing unsteady pressure amplitudes, and therefore does not function as a baffle in the acoustic sense required by the ’094 Patent.

38. From a fluid-mechanics and acoustics standpoint, simply disrupting or restricting flow through abrupt, non-contoured obstructions amplify turbulence intensity and generate broadband flow-induced noise rather than attenuating it. Such flow restrictions raise, rather than reduce, the magnitude of unsteady pressure fluctuations, meaning that Gao’s configuration lacks the physical mechanisms necessary to operate as a silencer assembly.

39. Gao’s design further promotes droplet coalescence and condensation when the dispersed fluid impinges on interior walls and stagnation zones created by dead-flow regions within the chamber. These conditions lead to liquid film formation and re-entrainment of larger droplets, producing a wide and

uncontrolled particle-size distribution that degrades spray uniformity and directly affects scent consistency and delivery efficiency.

40. This behavior stands in marked contrast to the ’094 Patent, which uses controlled flow disruption within the silencer assembly to manage acoustic energy while maintaining stable flow fields that preserve droplet integrity and promote a more uniform and effective spray profile.

41. For these reasons, Gao does not disclose, teach, or render obvious the silencer assembly claimed in the ’094 Patent, even under the labeling proposed by Petitioner, because the physical structures and governing mechanisms of operation are fundamentally different.

42. A person of ordinary skill in the art would therefore recognize that Gao lacks a structurally and functionally comparable baffle, lacks a true silencer assembly, and operates according to acoustic and fluid-dynamic principles that diverge materially from those underlying the silencer assembly of the ’094 Patent.

## IV. OATH

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: January 15, 2026

By: _____
Gerald Micklow, Ph.D.