

EXHIBIT 4

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**IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF VIRGINIA
ALEXANDRIA DIVISION**

**SECOND SUPPLEMENTAL OPENING EXPERT REPORT OF
JOSEPH C. McALEXANDER III
REGARDING U.S. PATENT NUMBERS 6,803,545 AND 10,420,374**

**RJR STRATEGIC HOLDINGS, INC. AND R.J. REYNOLDS VAPOR COMPANY
vs.
ALTRIA CLIENT SERVICES LLC; PHILIP MORRIS USA INC.; and
PHILIP MORRIS PRODUCTS S.A.,**

Civil Action No. 1:20-cv-00393-LO-TCB

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circuited.³⁹ In one embodiment, current discharged from the lithium ion batteries cells is cut off by the poly switches when the current rises above a certain level, which is what happens when a short circuit occurs.⁴⁰

9.1.3 Benefits Of The '545 Patent

65. The inventions claimed in the '545 Patent are foundational to enabling the use of lithium ion batteries in systems that require high discharge currents, such as electrical resistance heating elements. I describe each of these benefits in turn below.

66. First, the '545 Patent enables safe usage of lithium ion batteries in electrically heated smoking systems. As discussed above, lithium ion batteries are “not intended to deliver the discharge rates required for electrical smoking systems.”⁴¹ Absent the claimed invention, using lithium ion batteries in systems requiring such high discharge rates (such as e-cigarette devices) would require drawing current that “would exceed the amount that lithium ion batteries can safely deliver creating a risk that the battery could become hot, catch fire, or explode.”⁴² By using the invention of the '545 Patent, however, lithium ion batteries are made viable in electrical resistance smoking systems because they “can be used safely and effectively.”⁴³

³⁹ *Id.* at cl. 7.

⁴⁰ *Id.* at 10:15-35.

⁴¹ *Id.* at 9:32-37.

⁴² *Id.* at 1:56-58.

⁴³ *Id.* at 9:32-37; Deposition of R. Ripley, dated Mar. 15, 2021, at 82:3-16, 95:22-96:9, 115:3-116:8, 140:24-141:8, 195:5-13, 204:21-206:18.

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67. Second, the '545 Patent enables an electrically heated smoking system that quickly heats the heater after the user starts puffing on the device. Because lithium ion batteries have higher voltages than alternative rechargeable batteries, the lithium ion battery technology claimed in the '545 Patent enables electrically heating elements to “become hot in a very short period of time.”⁴⁴ As described by the patent, “[t]he smoking system according to the invention is operated such that the electrical resistance heaters become hot in a very short period of time after a smoker begins puffing on the cigarette.”⁴⁵

68. Third, because it enables lithium ion batteries to be safely used in electrically heated smoking systems, the technology claimed in the '545 Patent also enables the overall device to be more compact and smaller. Alternative power sources, such as nickel cadmium batteries, are relatively heavy and produce low voltage per cell, requiring more battery cells to reach the same power.⁴⁶ Meanwhile, since “lithium ion batteries have higher voltages than other rechargeable batteries, fewer lithium ion cells are required to meet the required range of voltages.”⁴⁷ Since the battery is one of the largest components of an electrically heated smoking systems, a smaller

⁴⁴ '545 Patent at 9:38-50, esp. at 43.

⁴⁵ *Id.* at 9:42-45.

⁴⁶ *Id.* at 3:5-7.

⁴⁷ *Id.* at 9:47-50.

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lithium ion battery, which is enabled to be used in e-cigarette devices because of the technology claimed in the '545 Patent, makes it possible to make a smaller, heated smoking device.⁴⁸

69. Fourth, by using the technology claimed in the '545 Patent, an e-cigarette system is also able to produce a consistent quality of smoke from puff-to-puff (throughout the entire life of the battery and cartridge). The voltage in lithium ion batteries decreases as the battery is discharged.⁴⁹ As a result, fully charged batteries (absent any controller) will deliver more power than less charged batteries, resulting in an inconsistent amount of heat being produced by the resistance heating element.⁵⁰ The '545 Patent discusses using a controller to deliver modulated pulses of electrical energy to the heater in a way that delivers precise and consistent amount of energy to the heater.⁵¹ This, in turn, will create a consistent heating to create a vapor that has a consistent flavor and designed aerosol amount irrespective of the charge of the lithium ion battery.⁵² The '545 Patent prevents the power from being inconsistent, based on battery voltage, and thus ensures receipt by the user of a consistent aerosol.

70. Fifth, because the '545 Patent describes using PWM with a lithium ion battery, consumption of the battery voltage and power can be varied through time, which provides the user

⁴⁸ See also Alternative Heat/Fuel Systems for Tobacco-Heating Cigarettes, Executive Summary, RJREDVA_000463776 at RJREDVA_000463781 (when considering different power systems, recognizing that lithium batteries are “small” and “slim”).

⁴⁹ '545 Patent at 5:31-36.

⁵⁰ *Id.* at 5:33-35.

⁵¹ *Id.* at 6:49-52.

⁵² Deposition of Sean Daugherty, dated Nov. 20, 2020, at 176:20-177:9.

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