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**Petty et al.**

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(54) **CONSTANT CONCENTRATION DELIVERY DEVICE AND METHOD FOR VAPORIZED SUBSTANCES**

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(58) **Field of Search** ..... 261/24, 30, 104, 261/78.2, DIG. 65; 427/69; 422/28

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 947,726 A | | 1/1910 | Zimmer | |
| 1,034,777 A | | 8/1912 | Foster | |
| 1,528,640 A | | 3/1925 | Tvrzicky et al. | |
| 2,614,820 A | | 10/1952 | Boydjieff | 261/26 |
| 3,577,710 A | | 5/1971 | Feldman | 55/316 |
| 4,208,902 A | | 6/1980 | Kim et al. | 73/19 |
| 5,906,794 A | * | 5/1999 | Childers | 422/28 |
| 6,030,436 A | | 2/2000 | Barclay | 95/45 |
| 6,234,455 B1 | | 5/2001 | Wittek | 261/30 |

* cited by examiner

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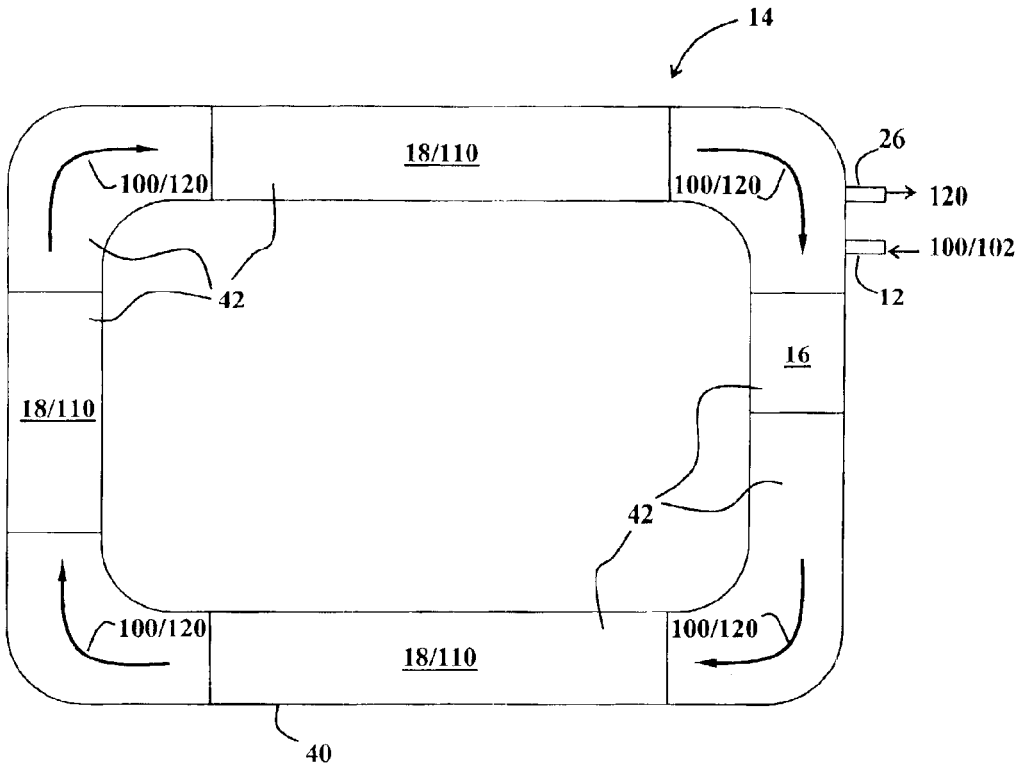
(57) **ABSTRACT**

A zero emmission device and method for delivering constant concentration of a vaporized substance allows for the regulated use of chemical or biological substances, such as calibrating, exposure or therapeutic substances.

**19 Claims, 11 Drawing Sheets**