

**United States Patent** [19]

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**Lloyd et al.**

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[54] **SYSTEMS FOR THE INTRAPULMONARY DELIVERY OF AEROSOLIZED AQUEOUS FORMULATIONS**

[75] Inventors: **Lester J. Lloyd**, Orinda; **Peter M. Lloyd**, Oakland; **Reid M. Rubsamen**; **Jeffrey A. Schuster**, both of Berkeley, all of Calif.

[73] Assignee: **Aradigm Corporation**, Hayward, Calif.

[21] Appl. No.: **247,012**

[22] Filed: **May 20, 1994**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 166,972, Dec. 14, 1993, Pat. No. 5,497,763, which is a continuation-in-part of Ser. No. 65,660, May 21, 1993.

[51] **Int. Cl.<sup>6</sup>** ..... **A61M 11/00**

[52] **U.S. Cl.** ..... **128/200.14**; 128/200.22; 128/203.12

[58] **Field of Search** ..... 128/200.14, 200.22, 128/203.12; 222/541.3, 541.4; 206/531, 532

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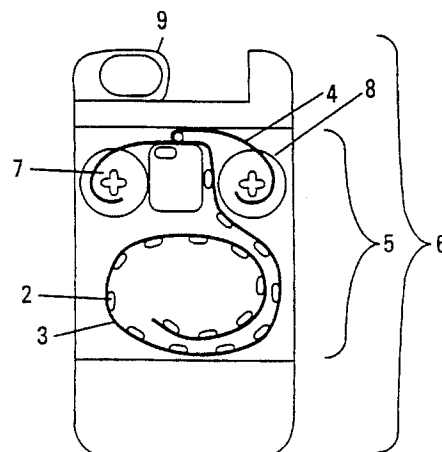
*Primary Examiner*—Aaron J. Lewis

*Attorney, Agent, or Firm*—Karl Bozicevic; Fish & Richardson P.C.

[57] **ABSTRACT**

A disposable package, tape, and cassette are provided which makes it possible to hold and disperse therefrom liquid, flowable formulations including aqueous formulations (solutions or dispersions with particles less than 0.25 microns in diameter) of a pharmaceutically active drug. In one embodiment formulation is packaged in individual dosage unit containers which containers are preferably interconnected. The package is designed to be integrated into a cassette which can be loaded into a dispersing device capable of individually opening dosage unit containers and aerosolizing the contents through a porous membrane, into a mouth piece on the cassette, for delivery to a patient. In addition to and alongside of each porous membrane, the package may include one or more openings through which air is forced in order to aid in avoiding the accumulation of aerosolized particles. The package may be configured so that the formulation is held in a container not positioned directly vertical to and below the porous membrane, thus making it necessary to channel formulation horizontally to the porous membrane and making it possible to include a vibrating mechanism directly below a chamber covered by the porous membrane. Release of aerosolized drug is breath actuated based on simultaneous measurements of inspiratory flow and volume so as to provide for repeatable dosing of drug to the patient.

**17 Claims, 17 Drawing Sheets**



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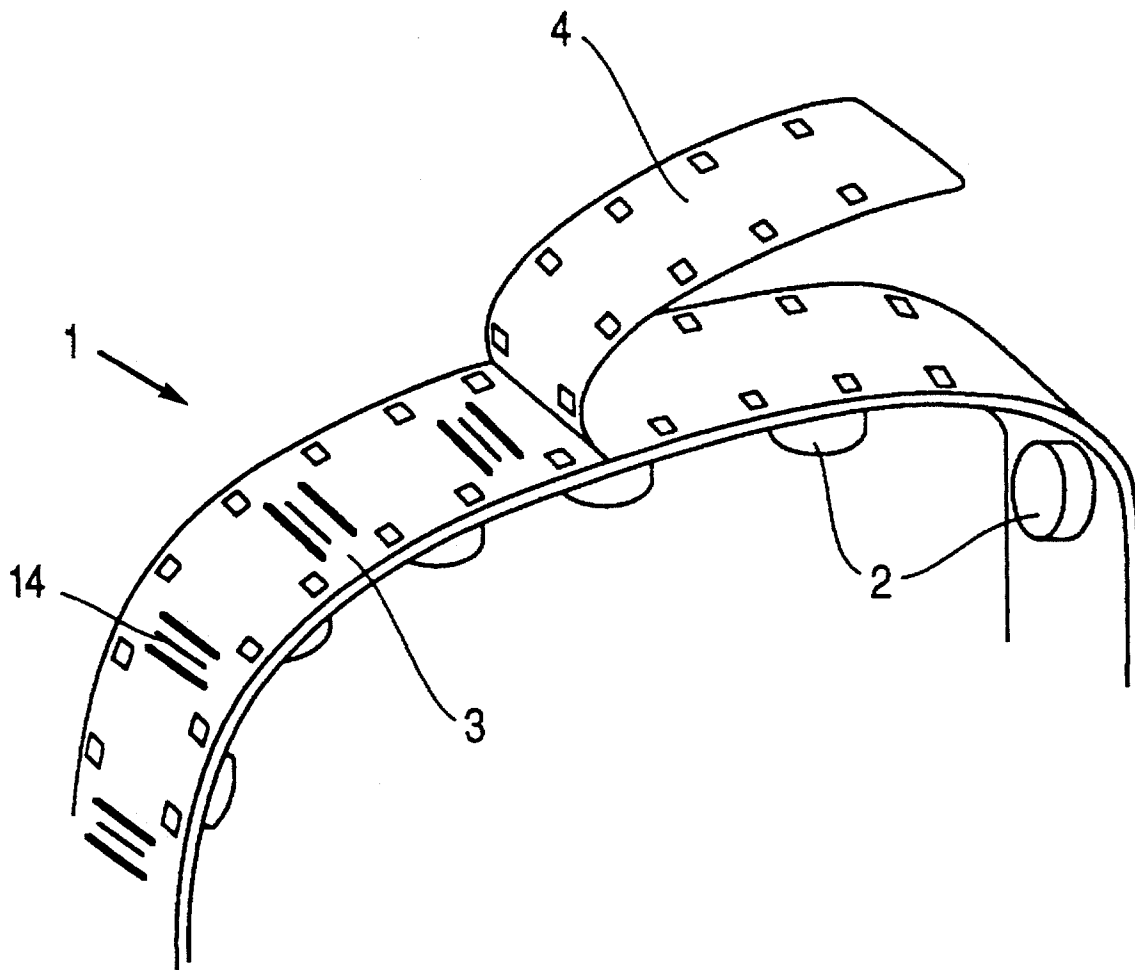


FIG. 1

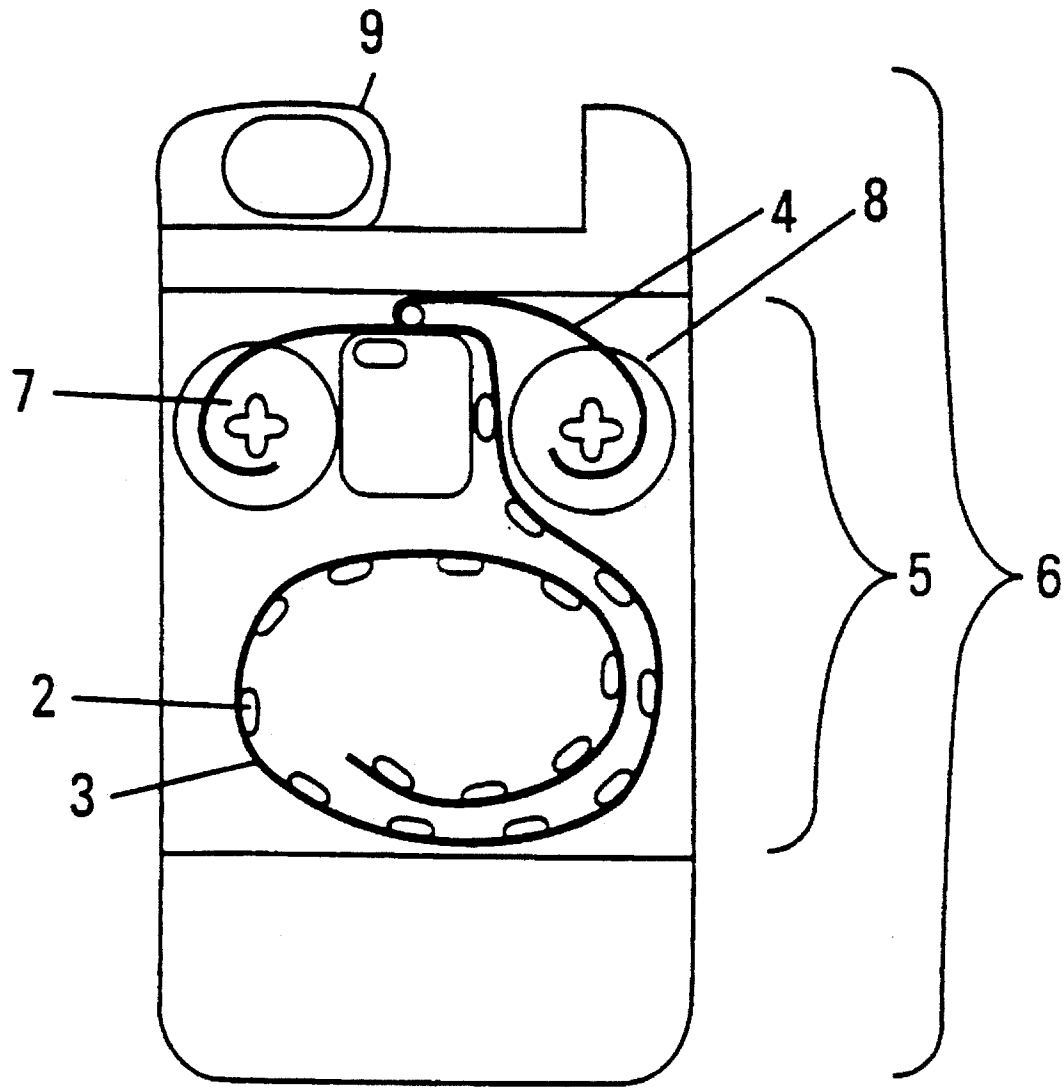


FIGURE 2

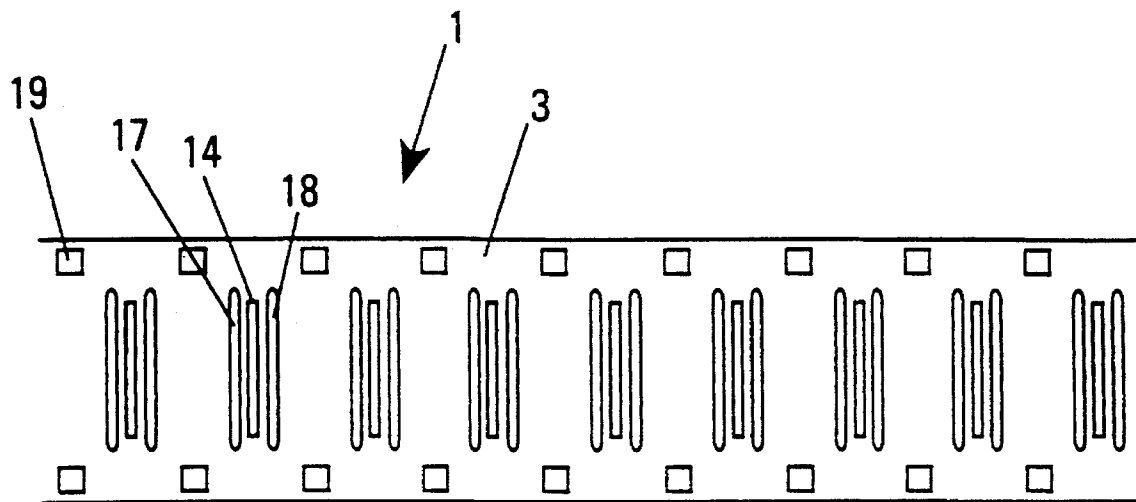


FIGURE 3

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