US005894841A

United States Patent [19]

Voges

[11] Patent Number: 5,894,841

[45] Date of Patent: *Apr. 20, 1999

[54] **DISPENSER**

[75] Inventor: **Robert Martin Voges**, Sanctuary Cove, Australia

[73] Assignee: **Ponwell Enterprises Limited**, Wanchai, The Hong Kong Special Administrative Region of the People's Republic of China

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **08/578,707**

[22] PCT Filed: **Jun. 28, 1994**

[86] PCT No.: **PCT/AU94/00355**

§ 371 Date: **Dec. 28, 1995**

§ 102(e) Date: **Dec. 28, 1995**

[87] PCT Pub. No.: **WO95/11137**

PCT Pub. Date: **Jan. 12, 1995**

[30] **Foreign Application Priority Data**

Jun. 29, 1993	[AU]	Australia	PL9673
Jul. 2, 1993	[AU]	Australia	PL9769
Aug. 31, 1993	[AU]	Australia	PM0925
Oct. 8, 1993	[AU]	Australia	PM1709

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

[52] **U.S. Cl.** **128/203.12**; 128/200.14; 128/200.16; 128/203.21; 239/102.2

[58] **Field of Search** 128/203.12, 200.14, 128/200.16, 200.18, 200.21, 200.23, 200.22, 203.21, 203.26; 239/102.2, 4, 406

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,934,358	6/1990	Nilsson et al.	128/200.23
4,966,579	10/1990	Polaschegg	604/65
4,987,861	1/1991	Lemire et al.	119/159
5,156,776	10/1992	Loedding et al.	128/203.12
5,284,133	2/1994	Burns et al.	128/200.23
5,511,726	4/1996	Greenspan et al.	239/102.2
5,685,485	11/1997	Moele et al.	239/102.2

FOREIGN PATENT DOCUMENTS

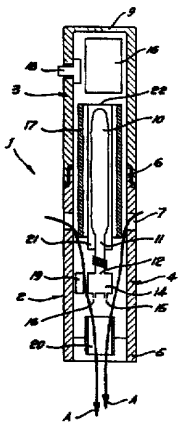
0042468	12/1981	European Pat. Off. .	
0213753	3/1987	European Pat. Off. .	
0234842	9/1987	European Pat. Off.	128/200.14
0343501	11/1989	European Pat. Off. .	
0432992	6/1991	European Pat. Off. .	
047557	11/1991	European Pat. Off. .	
0542723A2	5/1993	European Pat. Off.	239/102.2
205820	1/1984	Germany .	
39/08909	9/1990	Germany .	
61-272163	2/1986	Japan .	
2272389	5/1994	United Kingdom	239/102.2
87/04354	7/1987	WIPO .	
89/06147	7/1989	WIPO .	
92/11050	7/1992	WIPO .	
92 15353	9/1992	WIPO .	
93/03856	3/1993	WIPO .	
93 11866	6/1993	WIPO .	
93/10910	6/1993	WIPO	239/102.2
93/13730	7/1993	WIPO .	

Primary Examiner—John G. Weiss
Assistant Examiner—V. Srivastava
Attorney, Agent, or Firm—Wilson Sonsini Goodrich and Rosati

[57] **ABSTRACT**

A dispenser (FIG. **1**, **1**) comprises a reservoir (**10**) of a physiologically active substance and a droplet ejection device (**14**), for example a bubble jet or pizeoelectric device, which is controlled to issue a predetermined number of discrete droplets of the substance from ejection orifices (**15**) upon actuation. Device (**14**) may be actuated by a pressure transducer (**19**) responsive to inhalation and issue the droplets into an airstream (A) which enters at slot (**7**) and is then inhaled via mouthpiece (**5**). In other embodiments (FIG. **5**) the dispenser is finger actuated and directed by hand for topical application. The number and/or frequency of droplets issued is programmatically controlled by a control circuit (**16**) whereby average and total dose of the substance are predetermined.

42 Claims, 3 Drawing Sheets



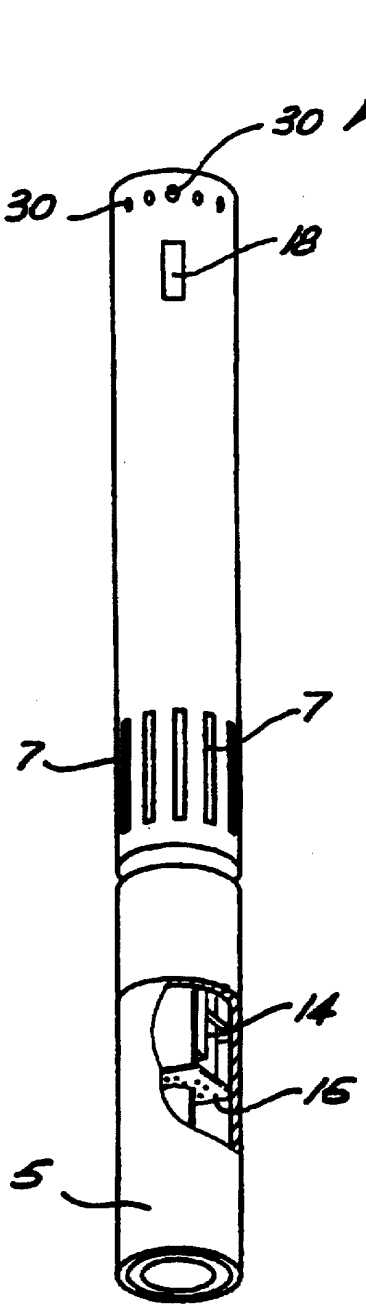


FIG. 1

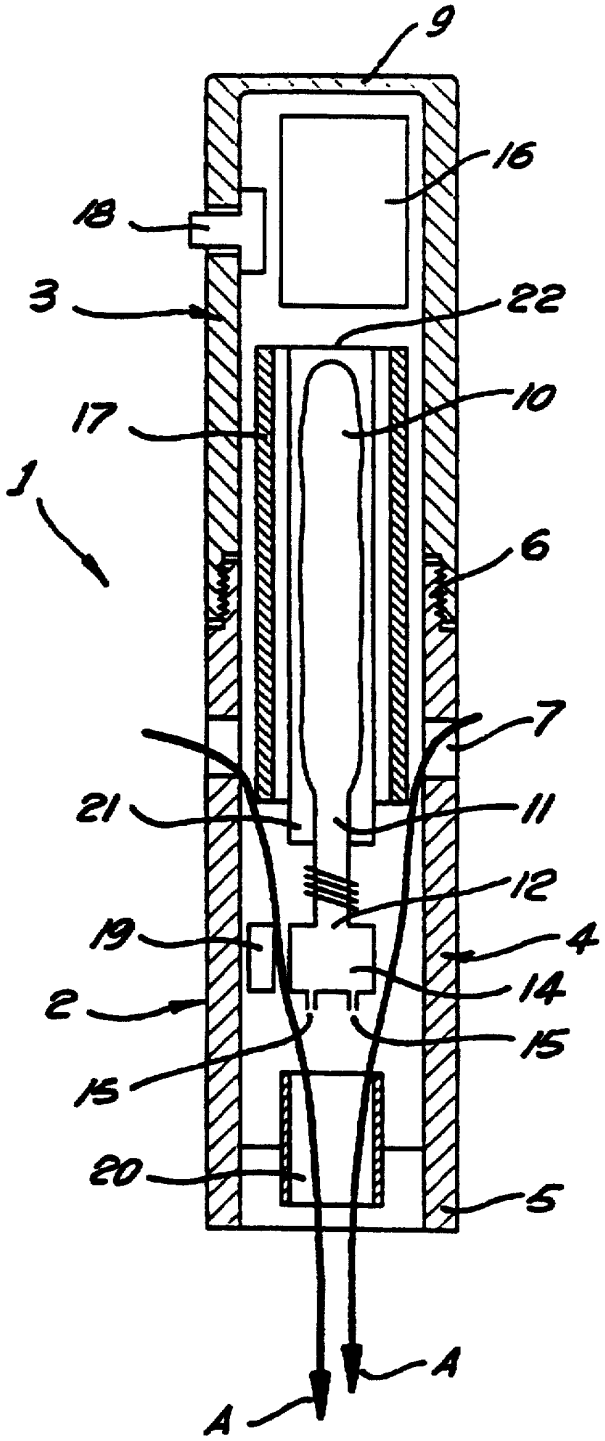


FIG. 2

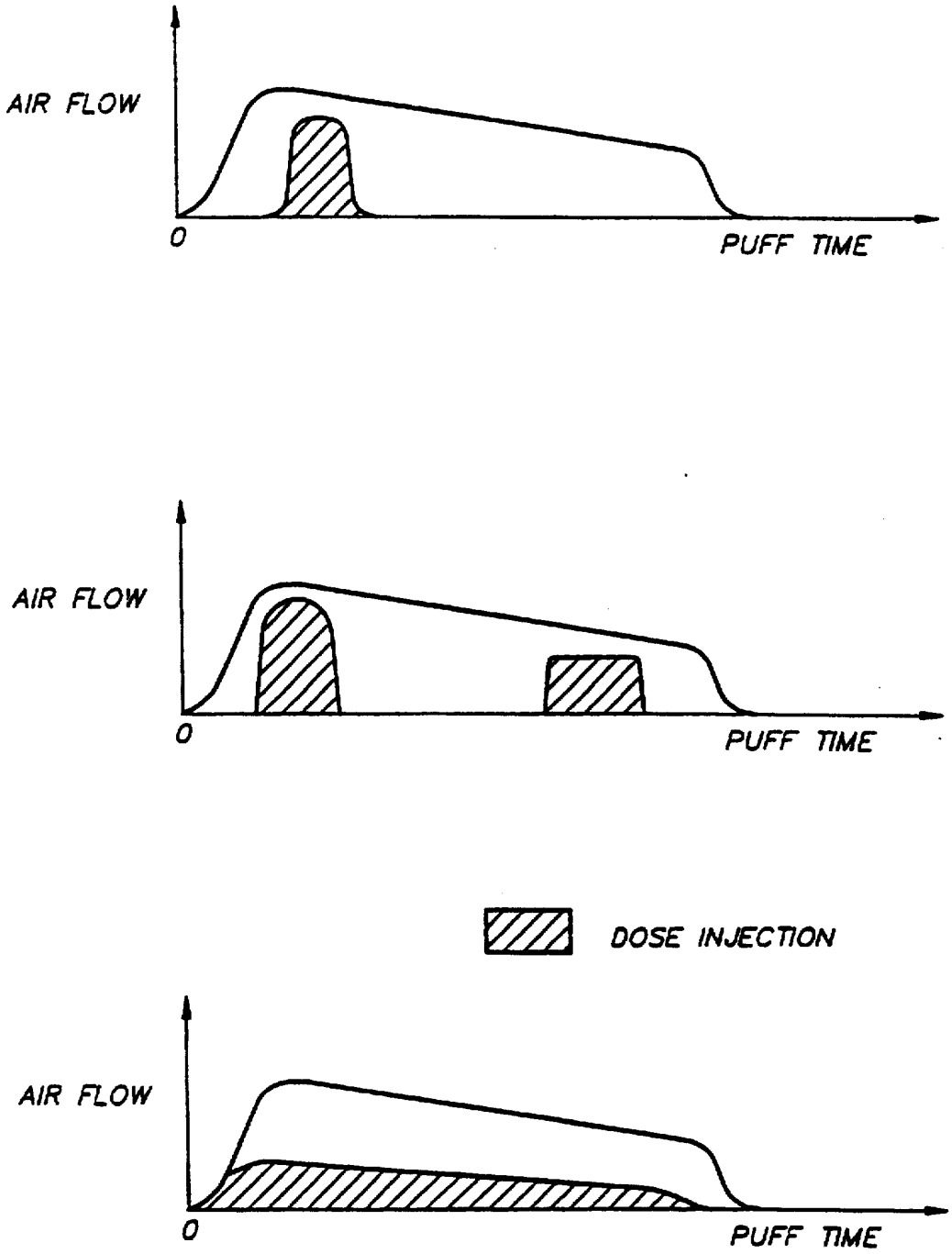


FIG. 3

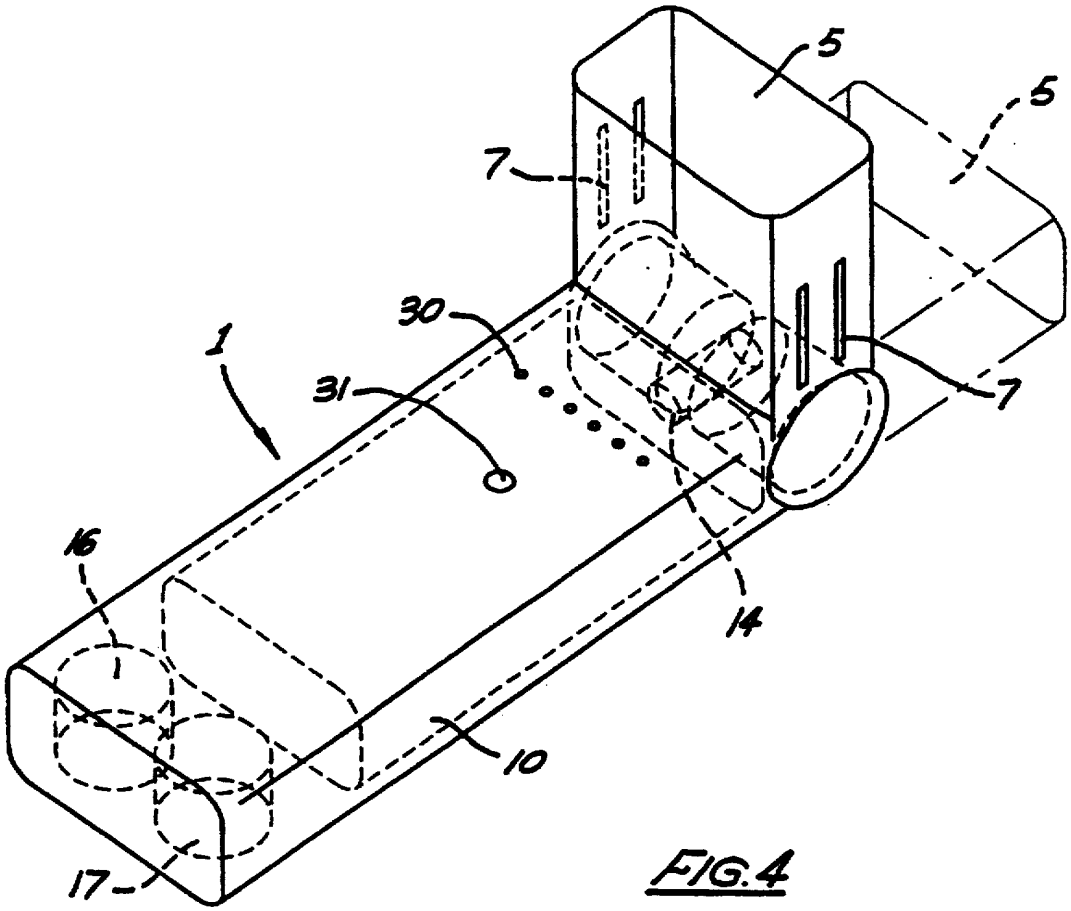


FIG. 4

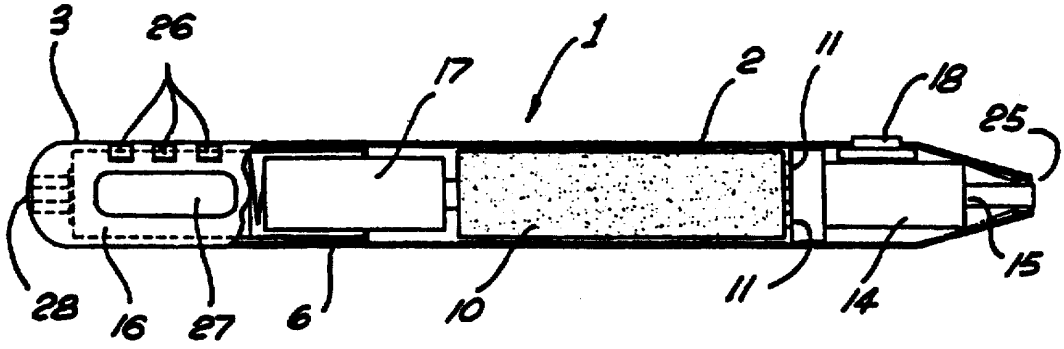


FIG. 5

DISPENSER

FIELD OF THE INVENTION

This invention relates to a hand held dispensing device. The device is of particular suitability for the self-administration of physiologically active substances by inhalation and will be herein described with primary emphasis on that use but may be used for other purposes.

BACKGROUND OF THE INVENTION

There are currently three main methods for drug delivery via the respiratory tract, namely metered dose inhalers, dry powder inhalers, and nebulisers.

Metered dose inhalers ("MDI") are widely used in the management of asthma. The MDI comprises a drug packaged with a propellant in a pressurised aerosol container can having a valve which releases a volumetric metered dose of aerosol upon actuation. These devices are portable, small, and convenient to carry but deliver a dose which varies in quantity, delivery speed, and droplet size distribution as the vapour pressure of the propellant varies. The propellant pressure varies with temperature and decreases progressively as the content becomes depleted so that the range in dose variation may be substantial. Incomplete evaporation of the propellant may cause "sticking" and localised concentration of drug droplets at an impact area, and this in turn can cause undesirable side effects. For example bronchosteroids can cause local immuno-suppression and local fungal infection while local concentration of bronchodilator can lead to swallowing, with unwanted systemic affects. In addition, the use of an MDI requires a degree of synchronisation between manual valve actuation and inhalation which many users find difficult.

Dry powder inhalers ("DPI") devices rely upon a burst of inspired air to fluidise and draw a dose of an active powder into the bronchial tract. While this avoids the synchronisation problem of the MDI, DPI's are sensitive to humidity and may provoke asthma attacks in some individuals sensitive to inhaled powder. Moreover, because the force of inspiration varies from person to person, the dose administered varies.

Nebulisers generate an aerosol by atomising a liquid in a carrier gas stream and require a continuous gas compressor or bulky supply of compressed gas. In general, the droplet size of the aerosol is a function of carrier gas pressure and velocity and hence cannot be easily varied independently of concentration of the active substance in the gas stream. Inhalation reduces the pressure at the nebulizer nozzle and thus dosage and particle size are also influenced by the duration and strength of each breath. Most nebulisers operate continuously during inhalation and exhalation but special control systems can be employed to meter the aerosolised gas flow from the nebuliser to a holding chamber from which the user may draw a charge.

In general the precision of dose delivery of each of these devices is less accurate than desirable and restricts their use to drugs which have broad dosage tolerance. In each case delivery of the active agent to the intended application site is overly dependent on user technique and is variable from dose to dose and person to person. Not only is an improved delivery system required to optimise current nasal and pulmonary therapies utilising locally acting drugs but there has long been recognised a potential for the administration of many additional local and systemic drugs if a more satisfactory means of delivery were available. Medical advances suggest that pulmonary delivery of drugs such as

peptides, proteins and analgesics might be of considerable advantage compared with conventional oral or injection delivery means. For example it has been suggested that insulin for diabetics may be delivered via the pulmonary route if a suitable means of delivery were available. The deposition of drug particles on lung tissue is a function of size, shape and density of particles or droplets. For many drugs, control of one or more of these factors along with precise dose or dose rate control would be desirable. However, at the present time no means of drug delivery is available which adequately meets such requirements.

Many attempts have been made to provide a cigarette substitute which provides nicotine by inhalation but which avoids the need for combustion of tobacco. Provision of a cigarette substitute involves complexities additional to those involved in the administration of a therapeutic agent. Although it is relatively easy to administer nicotine (for example in tablet form, via transdermal patches and the like), such forms do not satisfy habitual smokers because they do not satisfy important complex physiological and psychological affinities acquired by habitual smokers of combustible cigarettes.

In an attempt to provide an acceptable alternative, many cigarette substitutes have been proposed which provide nicotine on inhalation without combustion of tobacco. Conceptually, such devices are less harmful to the inhaler than smoking, avoid the hazards of passive smoking among bystanders and avoid the fire hazard and environmental problems associated with cigarette smoking. However, despite these major advantages, no device so far proposed has met with consumer acceptance.

Early cigarette substitutes employed a porous carrier impregnated with a liquid nicotine containing composition through which an air stream could be drawn to volatilize nicotine. This approach yielded insufficient nicotine per puff, suffered from a tendency for the carrier to dry out and delivered a variable amount of nicotine per puff, depending on factors such as air temperature, humidity, lung capacity of the user and amount of liquid composition remaining in the carrier.

Subsequent devices delivered nicotine from a pressurised aerosol container from which nicotine can be released by mechanical valve actuator. In one such device the valve is microprocessor controlled to limit the frequency and duration of actuation. However, the dose delivered varies with the vapour pressure of aerosol remaining in the container as well as with duration of valve actuation. The disposable pressure container, aerosol valve, and CFC propellant add considerably to active substance cost. These devices share the disadvantages of MDI devices previously discussed.

In yet other devices a nicotine containing substance is heated to vapourise an amount of nicotine which is then available for inhalation. The amount of nicotine delivered by such devices is difficult to control and is temperature dependant. In one such device a plurality of nicotine-containing pellets may be heated sequentially so that each liberates a predetermined dose. However, in that case, the dose is fixed during pellet manufacture, particle size of the aerosol is uncontrolled, and temperature of the inhaled air cannot be varied independently of dose.

Factors such as the quantity of nicotine per puff, the temperature of the puff, the draw, the presence and size distribution of flavour particles in the puff and like factors are of considerable importance in satisfying habitual smokers. The various alternatives proposed to date have simply proved unacceptable to most smokers.

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.