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[54] APPARATUS AND METHOD OF SIMULATING THE DETERMINATION OF CONTINUOUS BLOOD GASES IN A PATIENT SIMULATOR

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Related U.S. Application Data

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434/266, 267, 268, 272, 275; 128/774

[56] References Cited

U.S. PATENT DOCUMENTS

	3,520,071	7/1970	Abrahamson et al
	3,661,052	5/1972	Lucien et al
	3,808,706	5/1974	Mosley et al
	4,167,070	9/1979	Orden .
	4,561,851	12/1985	Ferreira et al
	4,570,640	2/1986	Barsa .
	4,878,388	11/1989	Loughlin et al
	4,907,973	3/1990	Hon.
	5,385,474	1/1995	Brindle 434/267
	5,403,192	4/1995	Kleinwaks et al
	5,509,810	4/1996	Schertz et al 434/262

OTHER PUBLICATIONS

M.L. Good, M.D., and J. S. Gravenstein, M.D., *Anesthesia Simulators and Training Device*, International Anesthesiology Clinics 27:161–164 (1989).

Good, et al., *Hybrid Lung Model for Use in Anesthesia Research and EducationAnesthesiology*, Hybrid Lung Model for Use in Anesthesia Research and Education, 71:982–984 (1989).

D.M. Gaba, M.D. and A. DeAnda, A Comprehensive Anesthesia Simulation Environment: Re–creating the Operating Room for Research and Training, Anesthesiology, 69:387–389 (1988).

M.L. Good, et al., Critical Events Simulation for Training in Anesthesiology, Journal of Clinical Monitoring, 4:140 (1988).

S. Lampotang, et al., A lung model of carbon dioxide concentrations with mechanical or spontaneous ventilation, Critical Care Medicine, 14:1055–1057, (1986).

S. Abrahamson, *Chapter 31: Human Simulation for Training in Anesthesiology*, Medical Engineering, pp. 370–374.

J.S. Densen, M.D. and S. Abrahamson, Ph.D., *A Computer–Controlled Pateint Simulator*, JAMA, 208:504–508, (1969).

Ross et al., Servocontrolled Closed Circuit Anaesthesia: A method for the automatic controlof anaethesia produced by a volatile agent in oxygen, British Journal of Anesthesia, 44:1053–1060 (1983).

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[57] ABSTRACT

An integrated patient simulator for training or other purposes capable of realistically reacting to a current physiological state and physiological model. A patient simulator and method of patient simulation wherein a physical gas composition representative of a simulated alveolar gas composition in a lung model is determined, and a simulated blood gas machine simulates an output representative of a simulated physiological state based at least in part on the simulated alveolar gas composition.

16 Claims, 7 Drawing Sheets

