

US005769641*A*

Patent Number:

Date of Patent:

[45]

United States Patent [19]

Lampotang et al.

[54] APPARATUS AND METHOD FOR SYNCHRONIZING CARDIAC RHYTHM RELATED EVENTS

[75] Inventors: Samsun Lampotang; Willem L. van Meurs; Michael L. Good; Joachim S. Gravenstein; Ronald G. Carovano, all

of Gainesville, Fla.

[73] Assignee: University of Florida Research

Foundation, Inc., Gainsville, Fla.

[21] Appl. No.: 767,947

[22] Filed: Dec. 17, 1996

Related U.S. Application Data

[60] Division of Ser. No. 188,383, Jan. 27, 1994, Pat. No. 5,584,701, which is a continuation-in-part of Ser. No. 882, 467, May 13, 1992, Pat. No. 5,391,081.

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	
3,888,020	6/1975	Krause	434/266
4,167,070	9/1979	Orden .	
4,561,851	12/1985	Ferreira et al	
4,570,640	2/1986		
4,878,388	11/1989	Loughlin et al	
4,907,973	3/1990	Hon.	
5,385,474		Brindle	434/267
5,403,192		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 Education Anesthesiology. Hybrid Lung Model for Use in Anesthesia Research and Education, 71:982–984 (1989).

5,769,641

Jun. 23, 1998

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

method for the automatic controlof anaethesia produced by a volatile agent in oxygen, British Journal of Anesthesia, 44:1053–1060 (1983).

Primary Examiner—John P. Leubecker Attorney, Agent, or Firm—Needle & Rosenberg, PC

[57] ABSTRACT

An apparatus and method for synchronizing output devices related to a cardiac rhythm in real time in an integrated patient simulator during simulated medical surgery includes a manikin, at least one output device including devices for simulating a cardiac pulse and a radial pulse, a first computer associated with the patient simulator for generating an electric cardiac rhythm synchronizing pulse, a second computer for receiving the cardiac rhythm synchronizing pulse and generating a simulated response thereto, and a distributed processing network for transmitting the cardiac rhythm synchronizing pulse between the first computer and the second computer and for transmitting the simulated response between the second computer and the output device. In this way, a time offset to allow for simulated travel time or lag of the simulated cardiac pulse through the body can be added by the second computer where appropriate for certain subsystems or monitors associated with the patient simulator.

21 Claims, 7 Drawing Sheets

