



US005100380A

United States Patent [19]

[11] Patent Number: **5,100,380**

Epstein et al.

[45] Date of Patent: **Mar. 31, 1992**

[54] **REMOTELY PROGRAMMABLE INFUSION SYSTEM**

[75] Inventors: **Paul Epstein**, Brookline; **Harry Petschek**, Lexington; all of Mass., **Eric LaWhite**, South Royalton, Vermont, **Clair Strohl**, Norfolk, Mass., **Henry Coyne**, Framington; **Edward Kaleskas**, Jefferson; **George Adaniya**, Swampscott

[73] Assignee: **Abbott Laboratories**, Abbott Park, Ill.

[21] Appl. No.: **355,035**

[22] Filed: **May 16, 1989**

Related U.S. Application Data

[63] Continuation of Ser. No. 62,064, Jun. 11, 1987, abandoned, which is a continuation of Ser. No. 873,478, Jun. 11, 1986, Pat. No. 4,696,671, which is a continuation of Ser. No. 578,180, Feb. 8, 1984, abandoned.

[51] Int. Cl.³ **A61M 31/00**

[52] U.S. Cl. **604/67**; 128/DIG. 12; 128/DIG. 13

[58] Field of Search 128/DIG. 12, DIG. 13; 604/65, 66, 67, 152, 258

[56] References Cited

U.S. PATENT DOCUMENTS

1,853,811 4/1932 Hewitt .
2,672,051 3/1954 Butler 73/209
2,767,277 10/1956 Wirth 200/83

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

1110137 10/1981 Canada .
2855713 6/1980 Fed. Rep. of Germany ... 128/DIG. 13

OTHER PUBLICATIONS

Edgerton, "Multiplexer Unit for Controlled Infusion of Fluids", *Medical Research*, Aug.-Sep., 1969, pp. 17-19.

"Intravenous Infusion Pumps Justification and Selection and Utilization" by Terry L. Pipp, Mar./Apr. 1978, *Infusion*, pp. 45-58.

"Intravenous Infusion Pumps—an Added Dimension to

Parenteral Therapy" by John J. Monahan and John W. Webb, *The American Society of Hospital Pharmacists, Inc.*, 1972.

Primary Examiner—Lee S. Cohen

Assistant Examiner—J. P. Lacyk

Attorney, Agent, or Firm—Weingarten, Schurgin, Gagnebin & Hayes

[57] ABSTRACT

An infusion system for administering multiple infusates at individually programmable rates, volumes, and sequences in any order from any one or more of plural fluid input ports through a patient output port and into the circulatory system of a patient. Infusates may be either continuously or time sequentially administered, and infusates may be either intermittently administered at selectively regular intervals or in time overlap to administer a dilution. Various error conditions are automatically detected and alarms generated in the event of conflicts between infusates, to identify times of no infusions, and to identify system malfunctions. The system is selectively operable, among others, in a priming mode, a maintenance mode, a normal-on mode, and a manual override mode. The system is operative to adapt actual to desired flow rates in normal operation. All fluids flow through a unitary disposable cassette without making any other system contact. Air bubbles in the fluid line are automatically detected and disposed of. Fluid pressures are monitored and system operation adjusted as a function of such pressures. Infusates may be administered from syringes as well as from standard bag or bottle containers. Infusate from a selected input port may be controllably pumped into a syringe for unsticking the syringe plunger. The system is selectively operable to adjust total fluid volume and rate to below preselected values for patients whose total fluid intake must be restricted. The system is operable to maintain an accurate record of total infusion history. The system may be controlled by a terminal or a computer located remotely from the patient location. The system may include auxiliary pumps in addition to a primary pump, all controlled by a single computer.

19 Claims, 14 Drawing Sheets

