

United States Patent [19]

Athan et al.

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OTHER PUBLICATIONS

"Optimization of Portable Pulse Oximetry Through Fourier Analysis," John E. Scharf et al., IEEE, Jun. 1993, pp. 233-235, first available on Apr. 2, 1993, at the IEEE, 12th Southern Biomedical Conference at Tulane University, New Orleans, LA, held Apr. 2-4, 1993.

"Pulse Oximetry Through Spectral Analysis," John E. Scharf et al., 1993 IEEE, Jun. 1993, pp. 227-229, first available on Apr. 2, 1993, at the IEEE, 12th Southern Biomedical Conference at Tulane University, New Orleans, LA, held Apr. 2-4, 1993.

"Direct Digital Capture of Pulse Oximetry Waveforms," John E. Scharf et al., 1933 IEEE, Jun. 1993, pp. 230-232, first available on Apr. 2, 1993, at the IEEE, 12th Southern Biomedical Conference at Tulane University, New Orleans, LA, held Apr. 2-4, 1993.

Light-To-Frequency Converter-TSL220, Texas Instruments Inc., D3619, Aug. 1990, Rev. Jun. 1991.

Programmable Light-To-Frequency Converter-TSL230, Texas Instruments Inc., SOES007A, Dec. 1992, Rev. Dec.

CMOS-8-Bit Buffered Multiplying DAC-AD7524, Digital-to-Analog Converters, Rev. A, pp. 2-399, 402-403. Burr-Brown ACF2101 Advertisement and Product Data Sheet (PDS-1079, Mar. 1991).

"Integrator IC Converts Picoamperes to Volts," Frank Goodenough, Electronic Design, Jun. 13, 1991, pp. 132-134.

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ABSTRACT [57]

A diagnostic instrument for determining a cardiovascular system parameter. In one embodiment, the instrument takes the form of a portable pulse oximeter comprising a light to frequency converter (LFC) as a sensor. Also provided is a light to frequency converter comprising a photoresistor and capacitor in circuit communication with an inverting Schmitt trigger and configured such that the inverter generates a periodic electrical signal corresponding to the amount of electromagnetic radiation illuminating the photoresistor.

22 Claims, 6 Drawing Sheets

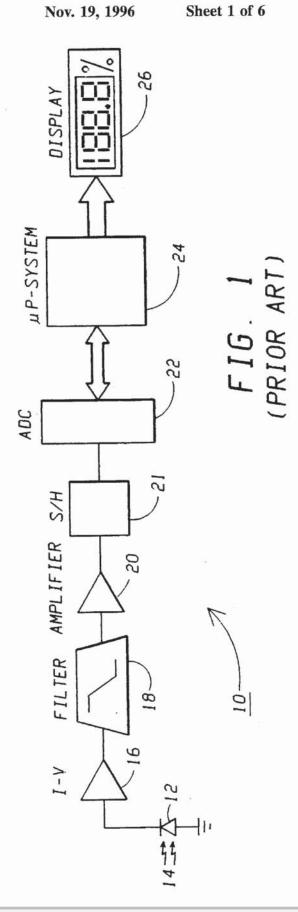
3/1992 WITO 120/90	,
54 = 58 COUNTER 54 = 58 66 Red = 58 LED Red = 60 LED	DISPLAY 188.8% 68 50
Drivers	

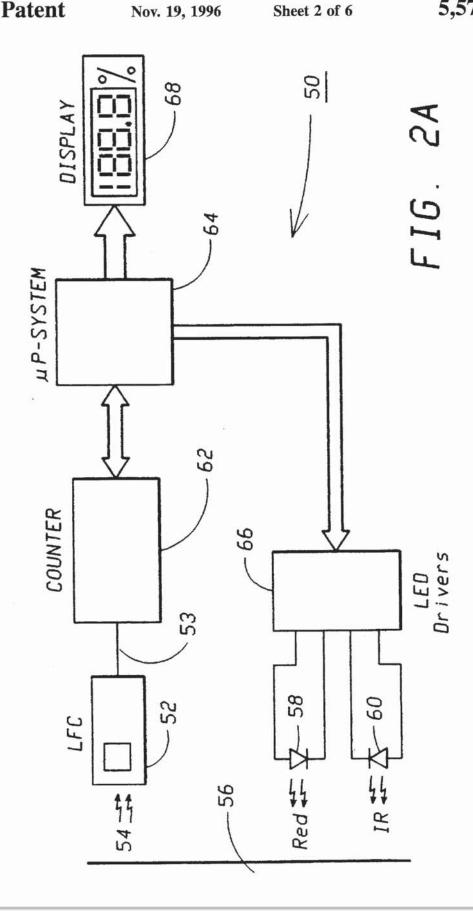
[54] PORTABLE PULSE OXIMETER Inventors: Stephan P. Athan, Tampa; John E. Scharf, Oldsmar, both of Fla. Assignee: University of South Florida, Tampa, [21] Appl. No.: 221,958 Apr. 1, 1994 [22] Filed: U.S. Cl. 128/633; 356/41 356/41; 250/214 A, 214 L; 607/60 [56] References Cited U.S. PATENT DOCUMENTS 3,802,774 4/1974 Tchang.

3,815,583 6/1974 Scheidt	120//05
4,167,331 9/1979 Nielsen .	
4,266,554 5/1981 Hamaguri .	
4,357,105 11/1982 Loretz.	
4,407,290 10/1983 Wilber.	
4,447,150 5/1984 Heinemann .	
4,498,020 2/1985 Gloima et al	
4,586,513 5/1986 Hamaguri .	
4,694,833 9/1987 Hamaguri .	
4,800,495 1/1989 Smith .	
4,807,630 2/1989 Malinouskas .	
4,807,631 2/1989 Hersh et al	
4,824,242 4/1989 Frick et al	128/633
4,869,254 9/1989 Stone et al	
4,883,353 11/1989 Hausman et al	
4,911,167 3/1990 Corenman et al	
4,934,372 6/1990 Corenman et al	
5,078,136 1/1992 Stone et al	
5,111,817 5/1992 Clark et al	128/633
5,113,861 5/1992 Rother.	
5,149,503 9/1992 Kohno et al	
5,167,230 12/1992 Chance	128/633
5,190,038 3/1993 Polson .	

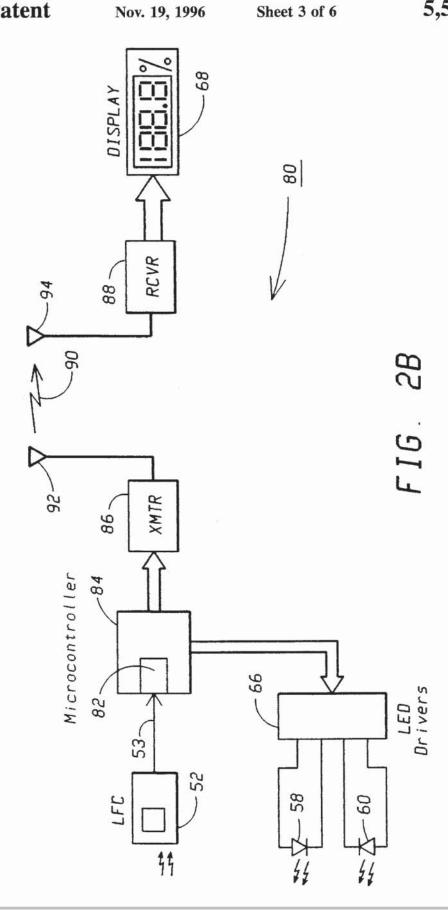
FOREIGN PATENT DOCUMENTS

1377605	2/1988	U.S.S.R.	 250/214 L
9207505	5/1992	WIPO	128/903









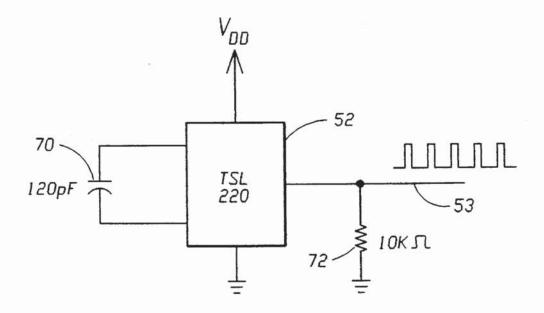


FIG. 3A

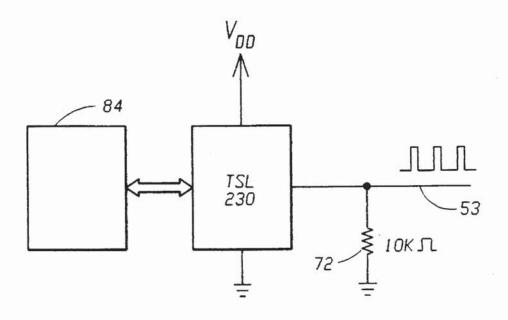


FIG. 3B



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