

United States Patent [19]

[11] **Patent Number:** 5,561,610

Schricker et al.

[45] **Date of Patent:** Oct. 1, 1996

[54]	METHOD AND APPARATUS FOR INDICATING A FAULT CONDITION	4,583,176	4/1986	Yamato et al.	364/431.11
		4,749,987	6/1988	Ishii	340/587
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[75]	Inventors: David R. Schricker, Dunlap; Satish M. Shetty, East Peoria, both of Ill.	4,803,469	2/1989	Matsushita	340/577
		4,825,195	4/1989	Berruyer	340/501
		4,967,381	10/1990	Lane et al.	364/551.01
[73]	Assignee: Caterpillar Inc., Peoria, Ill.	5,155,468	10/1992	Stanley et al.	340/501
		5,258,923	11/1993	Imam et al.	364/508
		5,303,163	4/1994	Ebaugh et al.	364/550

[21] Appl. No.: 268,693

[22] Filed: Jun. 30, 1994

[51] Int. Cl.⁶ G08B 23/00

[52] U.S. Cl. 364/551.01; 340/679

[58] Field of Search 340/679, 680; 364/550, 551.01, 551.02

Primary Examiner—Edward R. Cosimano
 Attorney, Agent, or Firm—Steven R. Janda; Mario J. Donato

[57] **ABSTRACT**

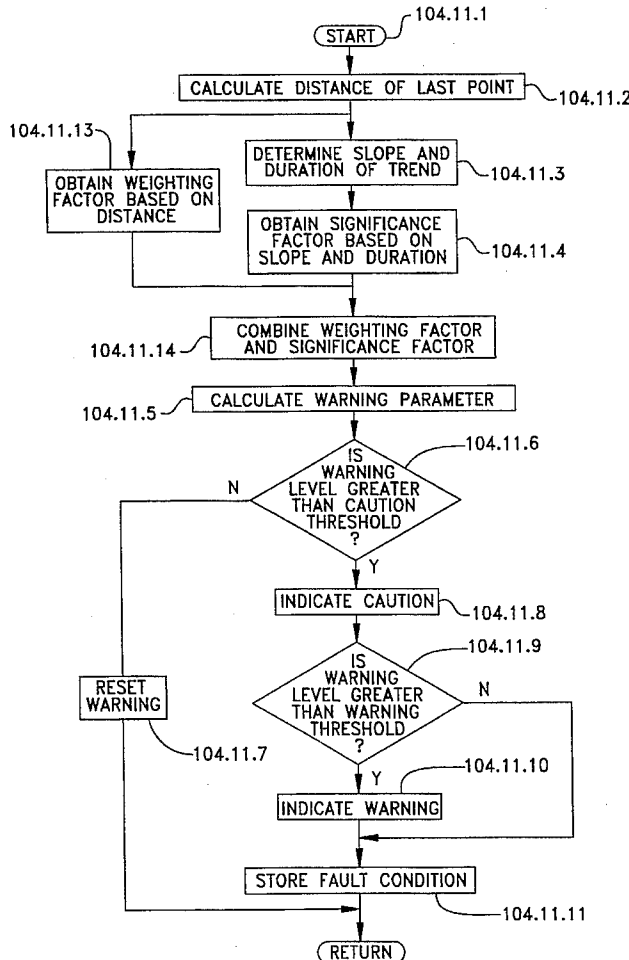
An apparatus is provided for indicating a fault condition in a machine having a plurality of parameters each having levels being dependent upon machine performance. The apparatus includes a sensor adapted to produce an electrical signal in response to the level of one of the parameters; and a processor for identifying a trend in the parameter level in response to the electrical signal, calculating the duration and slope of the trend; and determining whether a first warning threshold is exceeded in response to the duration and slope of the trend, the first warning threshold being a function of duration and slope.

[56] **References Cited**

U.S. PATENT DOCUMENTS

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16 Claims, 10 Drawing Sheets



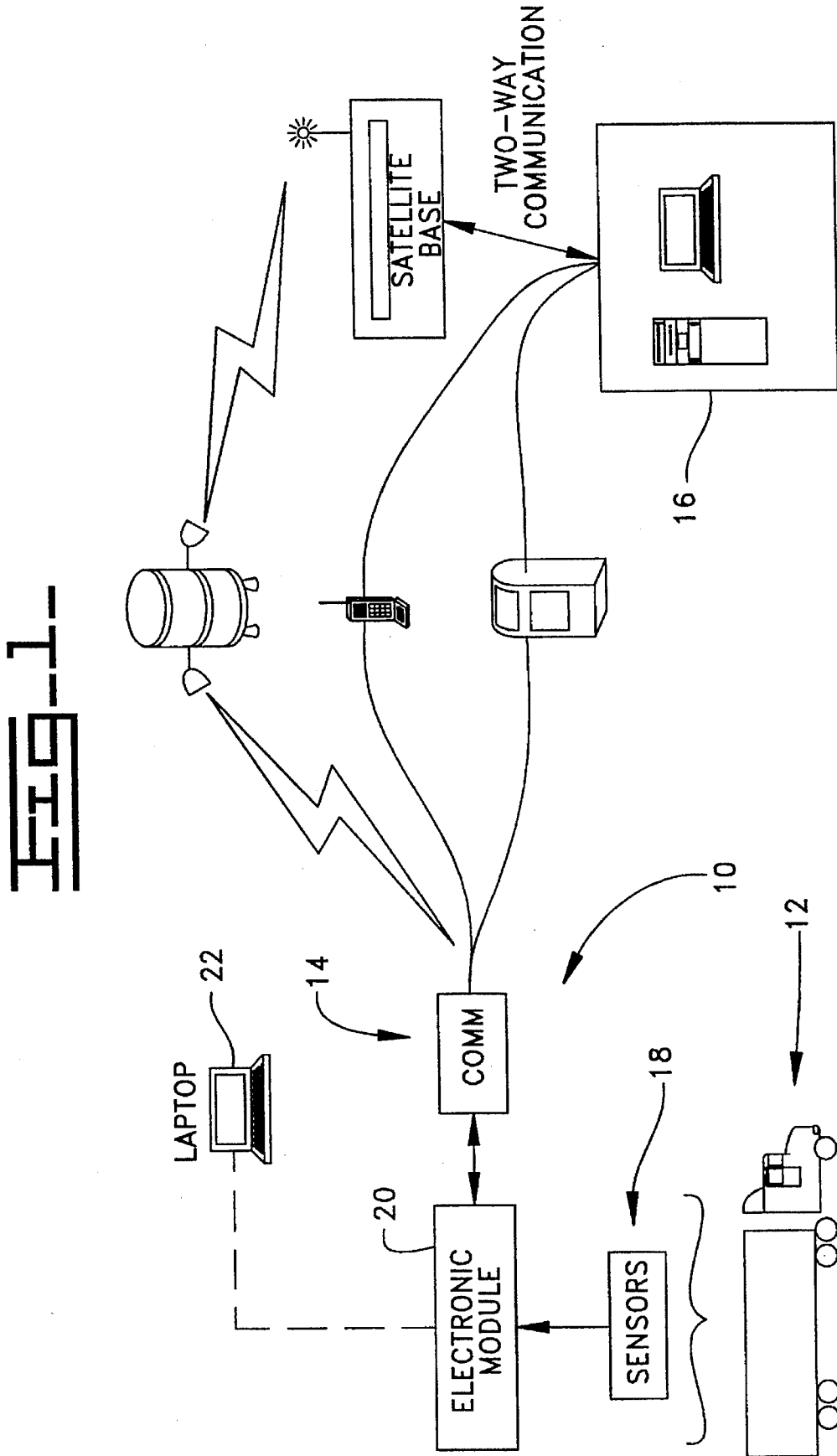


FIG. 2-

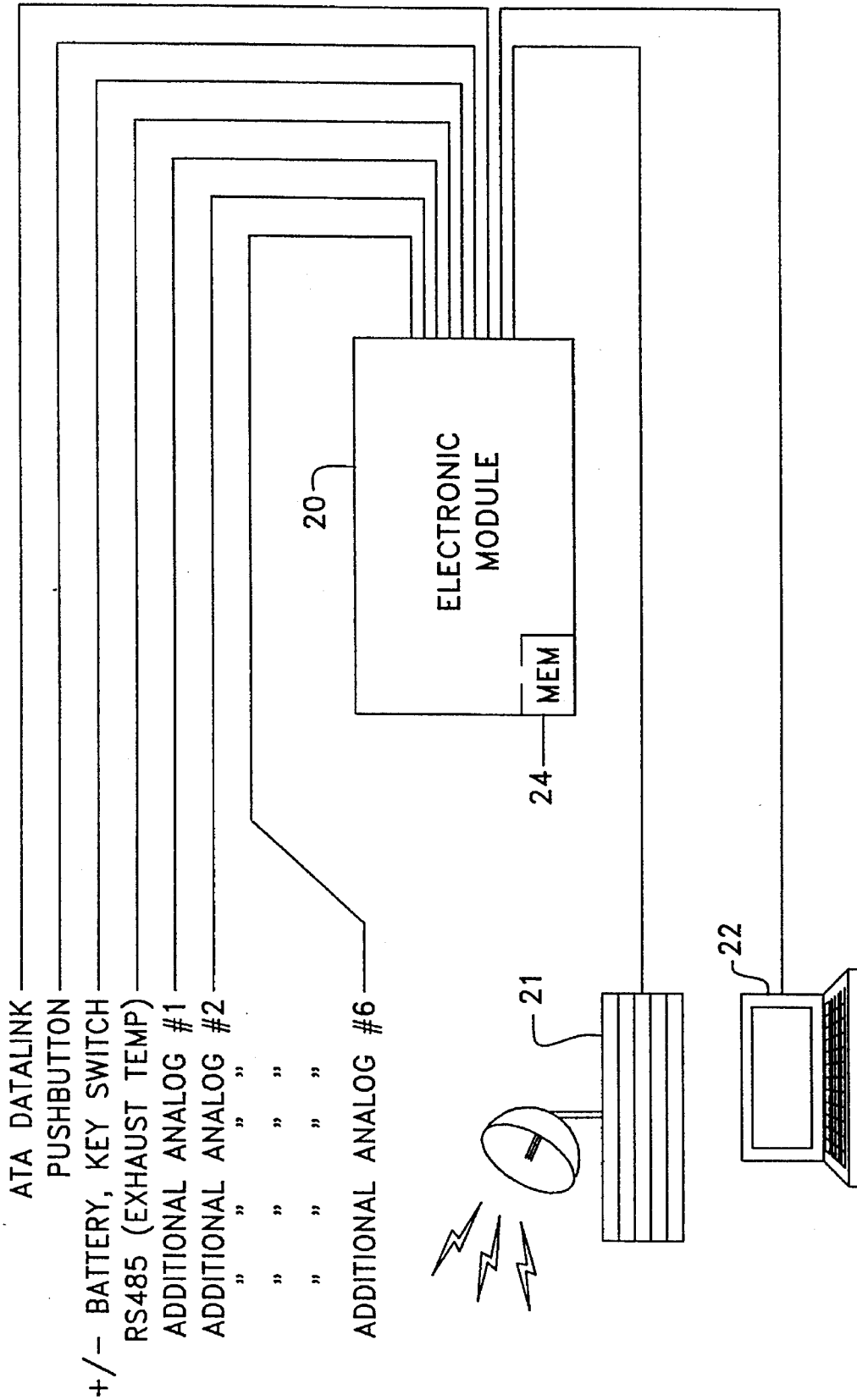


FIG. 3.

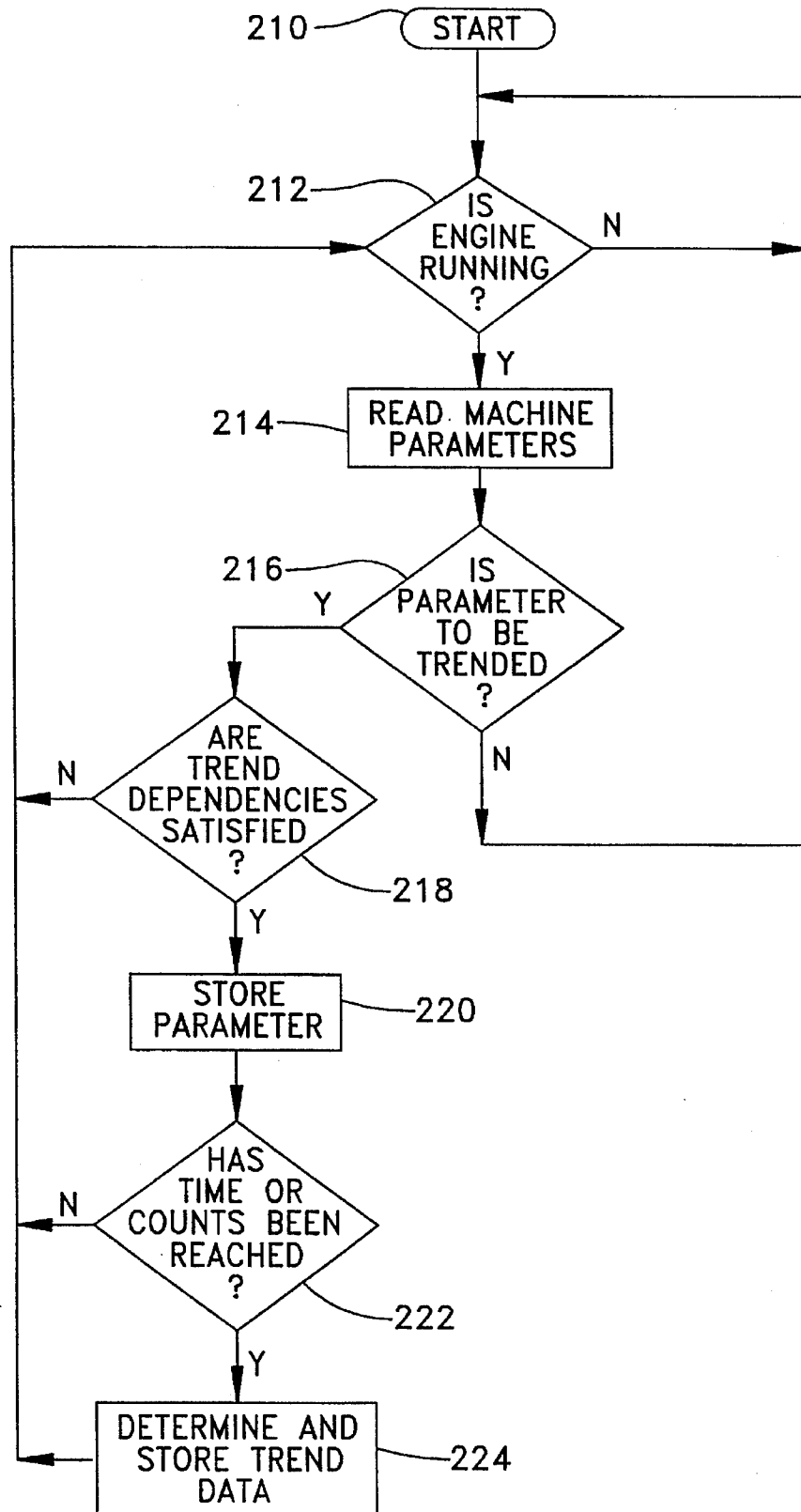
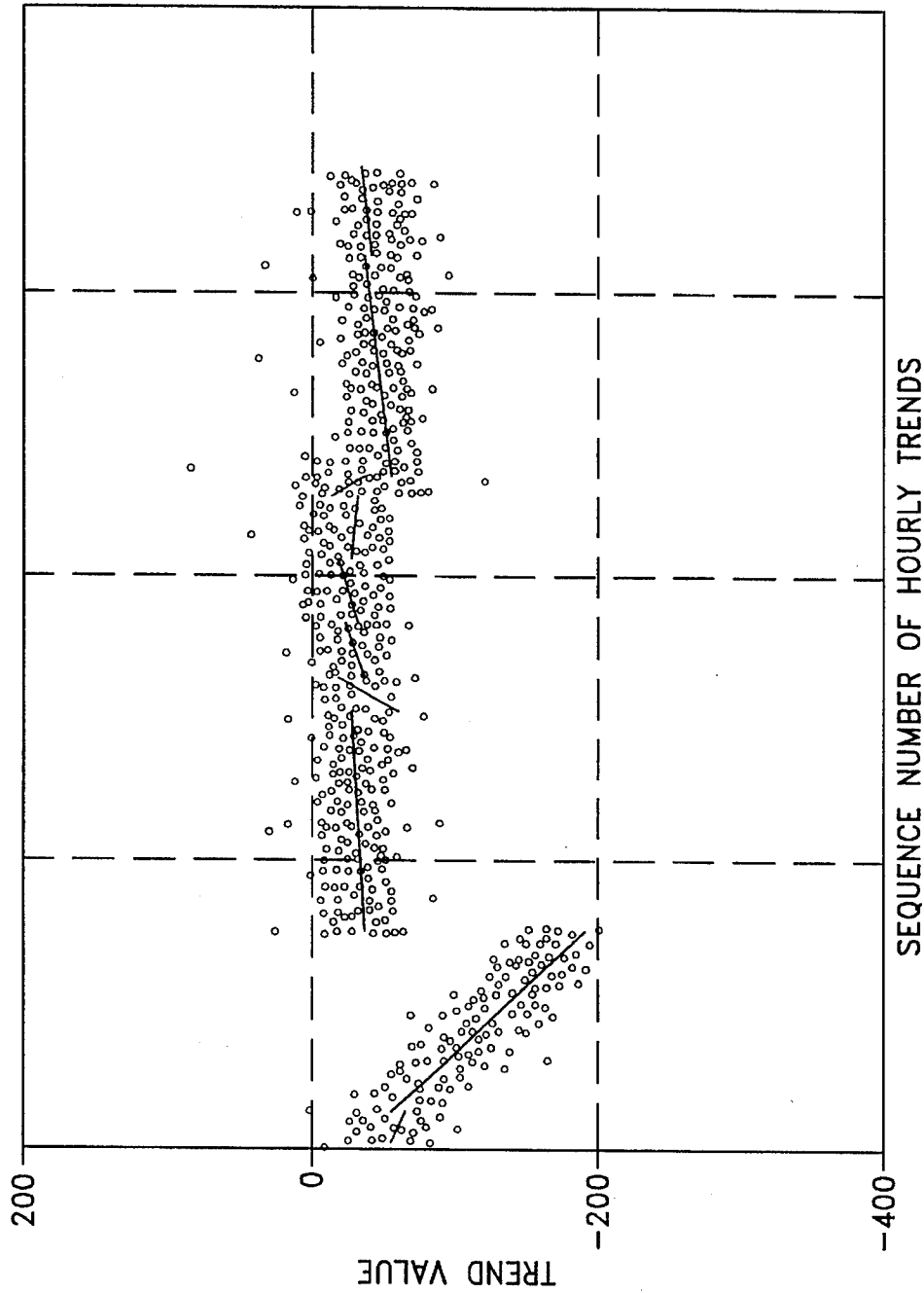


FIG-4-



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