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# United States Patent [19]

[11] Patent Number: **5,672,972**

McCoy et al.

[45] Date of Patent: **Sep. 30, 1997**

[54] **DIAGNOSTIC SYSTEM FOR A CAPACITOR DISCHARGE IGNITION SYSTEM**

5,208,540	5/1993	Hoeflich	324/388
5,216,369	6/1993	Toyama	324/388
5,237,279	8/1993	Shimasaki et al.	324/391

[75] Inventors: **Steven R. McCoy**, Washington; **Horst Scheel**, Peoria, both of Ill.

### FOREIGN PATENT DOCUMENTS

0 389 775	10/1990	European Pat. Off.
2 493 414	5/1982	France
WO 88/01690	3/1988	WIPO

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[21] Appl. No.: **946,491**

*Attorney, Agent, or Firm*—Kirk A. Vander Leest; R. Carl Wilbur

[22] PCT Filed: **May 27, 1992**

[86] PCT No.: **PCT/US92/04515**

### [57] ABSTRACT

§ 371 Date: **Nov. 9, 1992**

An apparatus is provided for monitoring ignition in individual cylinders of a multi-cylinder engine of the type having an ignition system which includes a separate transformer for each cylinder. Each transformer has primary and secondary coils. The secondary coil is connected in series with a spark gap in an associated one of the cylinders. The ignition system further includes selector switches for receiving cylinder select signals and responsively connecting respective transformer primary coils. The current flows through the primary coil resulting in a voltage potential across an associated spark gap which normally increases to a magnitude sufficient to cause a spark across the spark gap. A first circuit receives the cylinder select signals, senses time delay between the reception of a cylinder select signal and sparking in a respective cylinder and responsively produces a delay signal indicative of the sensed time delay. A diagnostics controller receives the delay signal, compares the delay signal to a plurality of preselected thresholds and responsively produces a status signal indicating the status of ignition in a respective cylinder.

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PCT Pub. Date: **Oct. 12, 1992**

[51] Int. Cl.<sup>6</sup> ..... **F02P 5/145; F02P 17/00**

[52] U.S. Cl. .... **324/393; 123/605; 324/388; 324/391**

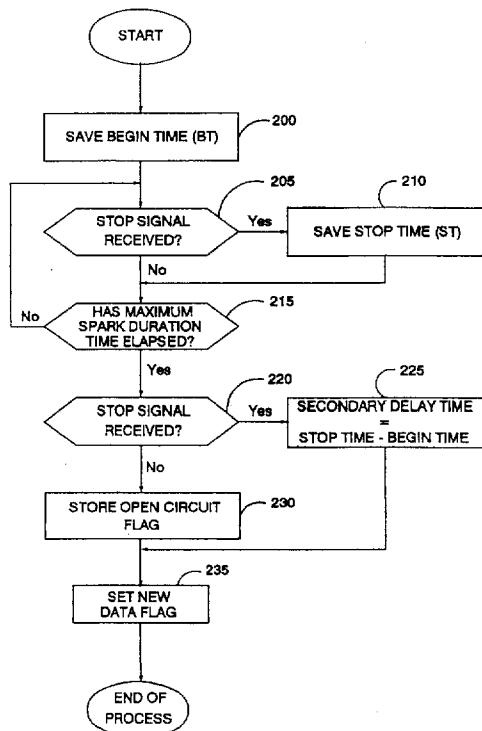
[58] Field of Search ..... **324/380, 388, 324/391, 393, 399, 402; 73/116, 117.3; 123/605**

### [56] References Cited

#### U.S. PATENT DOCUMENTS

4,312,043	1/1982	Frank et al.	324/391
4,413,508	11/1983	Kamamura et al.	324/391
5,019,779	5/1991	Ookawa	324/388
5,060,623	10/1991	McCoy	123/605
5,156,127	10/1992	Ghaem	324/391

**15 Claims, 10 Drawing Sheets**



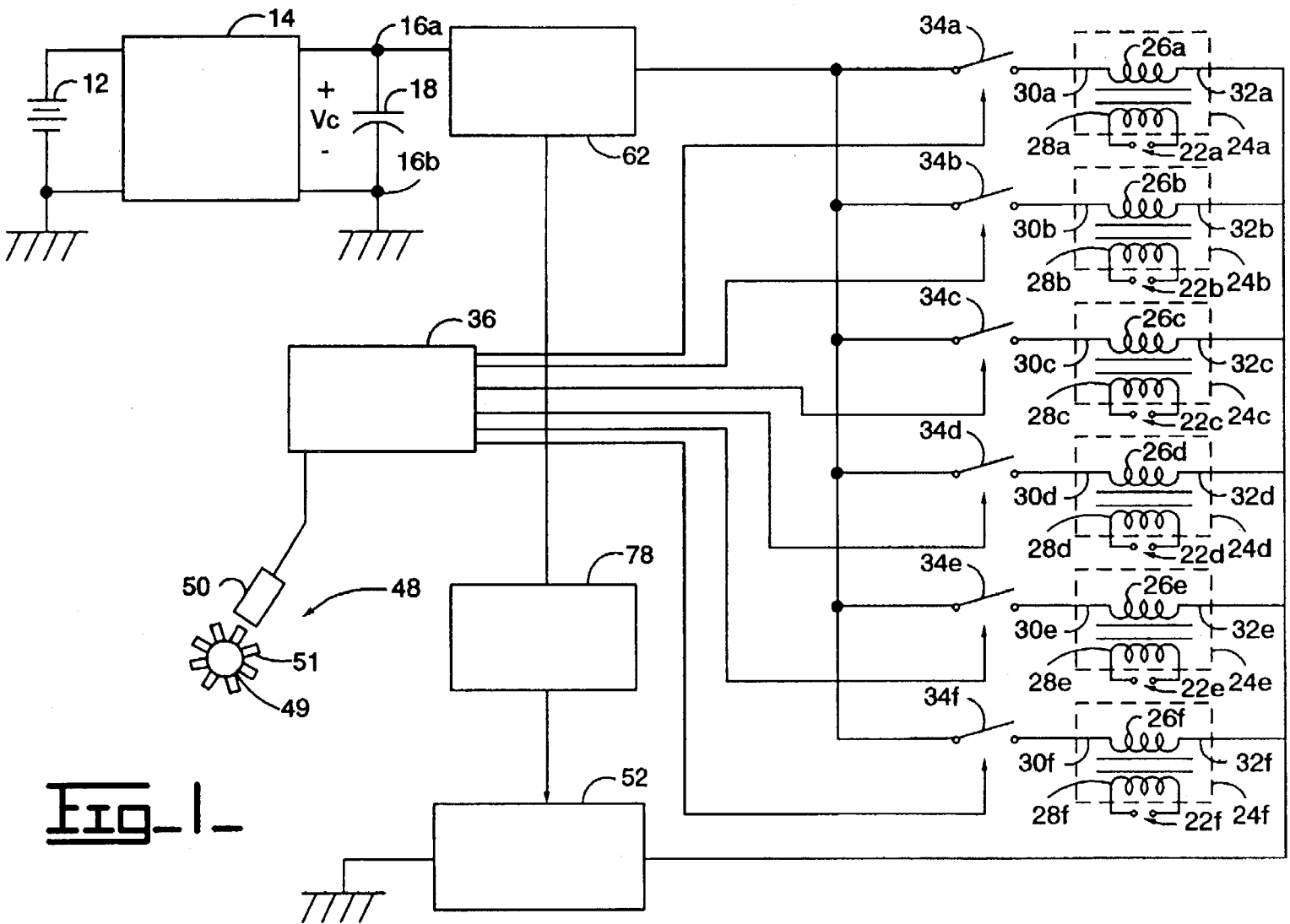


Fig. 1

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FIG. 2.

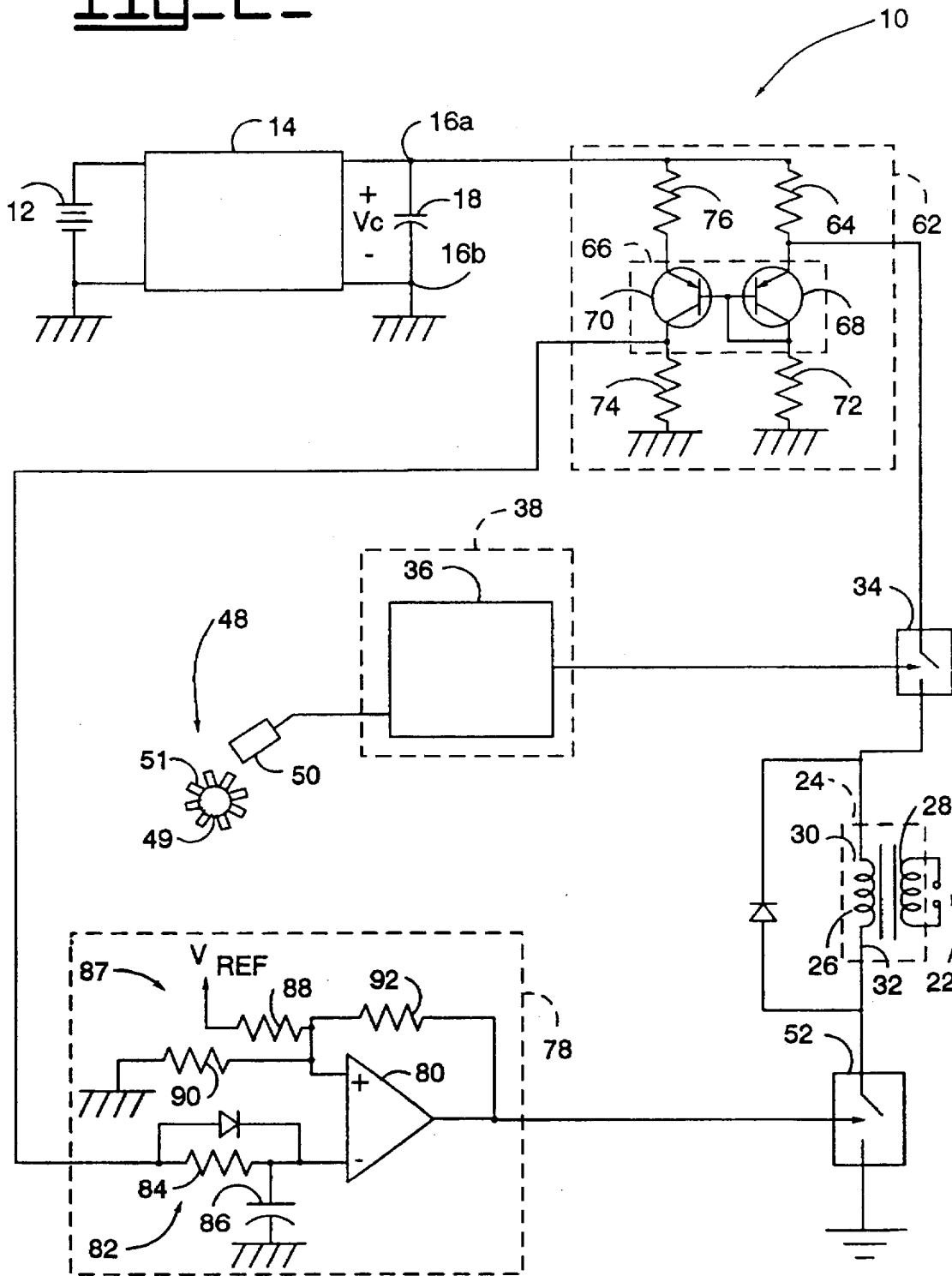




Fig. 4.

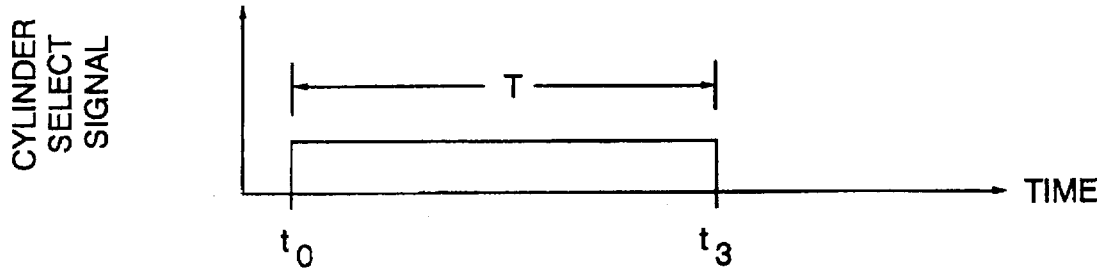


Fig. 5.

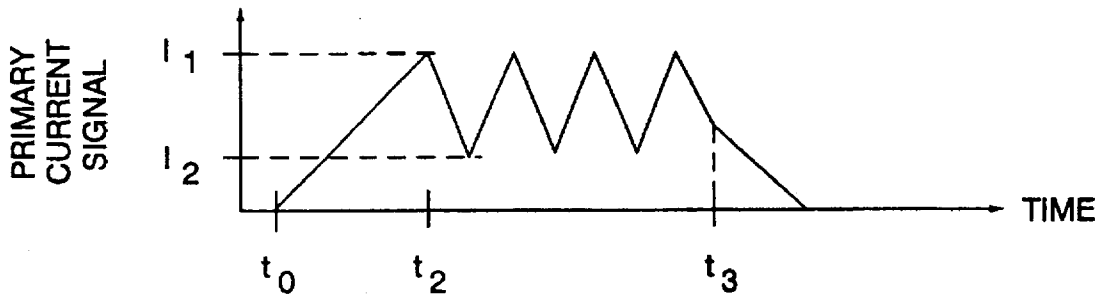
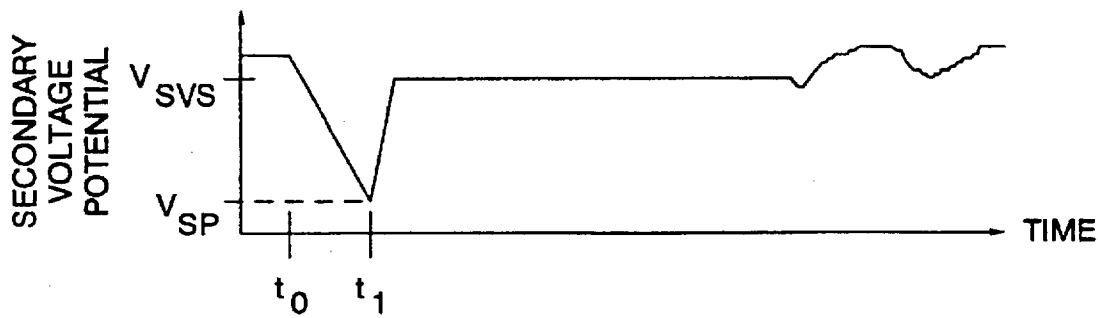


Fig. 6.



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