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United States Patent [19]

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Zolock

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[54] **TECHNIQUE FOR SUBSTANTIALLY ELIMINATING TEMPERATURE INDUCED MEASUREMENT ERRORS FROM A CORIOLIS METER**

FOREIGN PATENT DOCUMENTS

0275367 7/1988 European Pat. Off. 73/861.38
0151518 9/1983 Japan 73/861.38

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[57] ABSTRACT

[21] Appl. No.: **728,546**

Apparatus and accompanying methods for inclusion in a Coriolis meter that substantially eliminate temperature induced measurement errors which might otherwise be produced by performance differences existing between the separate input channels contained in the meter. Specifically, two pairs of input channels are used in the meter. In operation, the meter repetitively measures the internal phase delay of each of these pairs and then subtracts the delay associated with each pair from actual flow based measurement data subsequently obtained therefrom. While one channel pair is measuring actual flow, the other channel pair is measuring its internal phase delay, with the channels being continuously cycled between these functions. Because both channel pairs are cycled at a sufficiently rapid rate, the current value of the internal phase delay for each of the pairs accurately reflects any temperature induced changes then occurring in the performance of that pair thereby eliminating substantially all temperature induced error components from the flow measurements subsequently obtained therefrom. In addition, the meter measures flow tube temperature in a manner that removes temperature induced errors therefrom.

[22] Filed: **Jul. 11, 1991**

[51] Int. Cl.⁵ **G01F 1/84**

[52] U.S. Cl. **73/861.38; 324/76.82;**
324/601

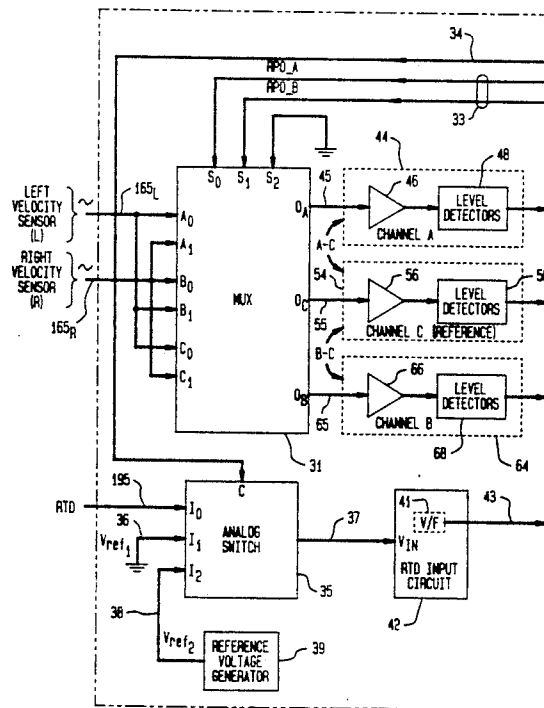
[58] Field of Search 73/861.37, 861.38;
324/84 D, 84 Q, 601

[56] References Cited

U.S. PATENT DOCUMENTS

3,585,841	6/1971	Brandau et al.	73/4
4,422,338	12/1983	Smith	73/861.38
4,491,025	1/1985	Smith et al.	73/861.38
4,817,448	4/1989	Hargarten et al.	73/861.38
4,843,890	7/1989	Samson et al.	73/861.38
4,852,409	8/1989	Herzl	73/861.38
4,872,351	10/1989	Ruesch	73/861.04
4,876,879	10/1989	Ruesch	73/32 A
4,879,911	11/1989	Zolock	73/861.38
4,896,282	1/1990	Orwell	364/571.05
4,934,196	6/1990	Romano	73/861.38
5,009,109	4/1991	Kalotay et al.	73/861.38
5,027,662	7/1991	Titlow et al.	73/861.38

26 Claims, 14 Drawing Sheets



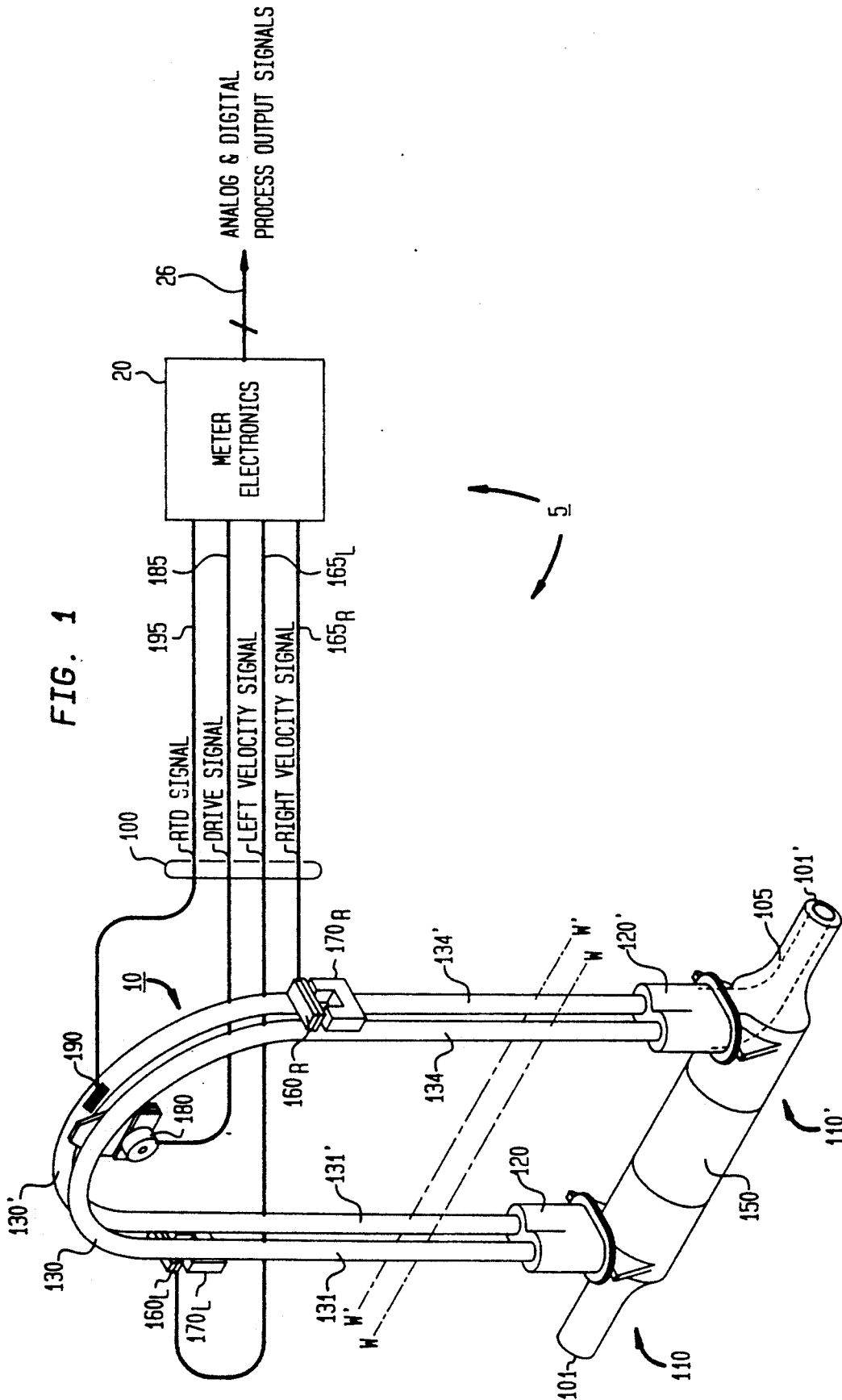


FIG. 3

FIG. 3A	FIG. 3B
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FIG. 3A

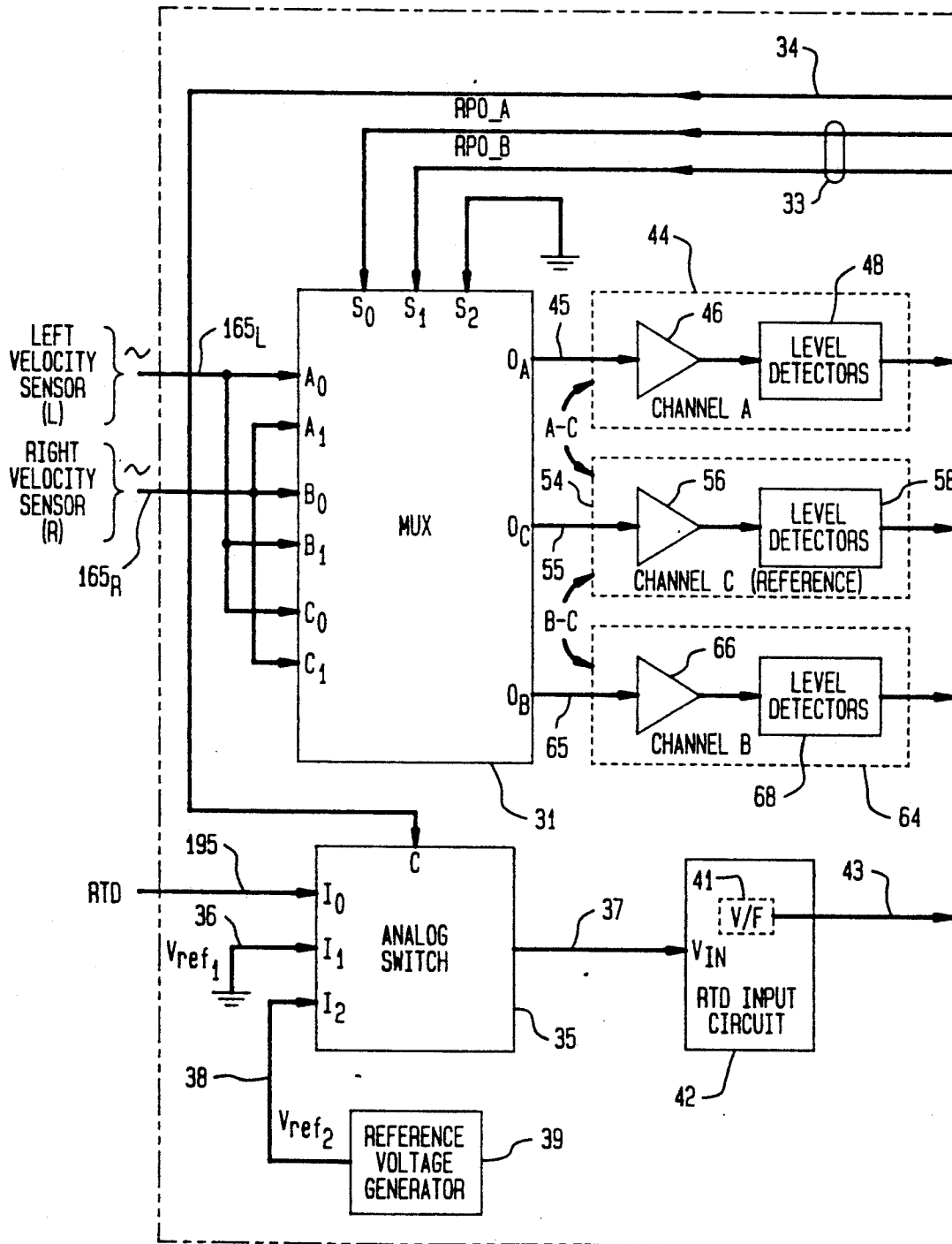
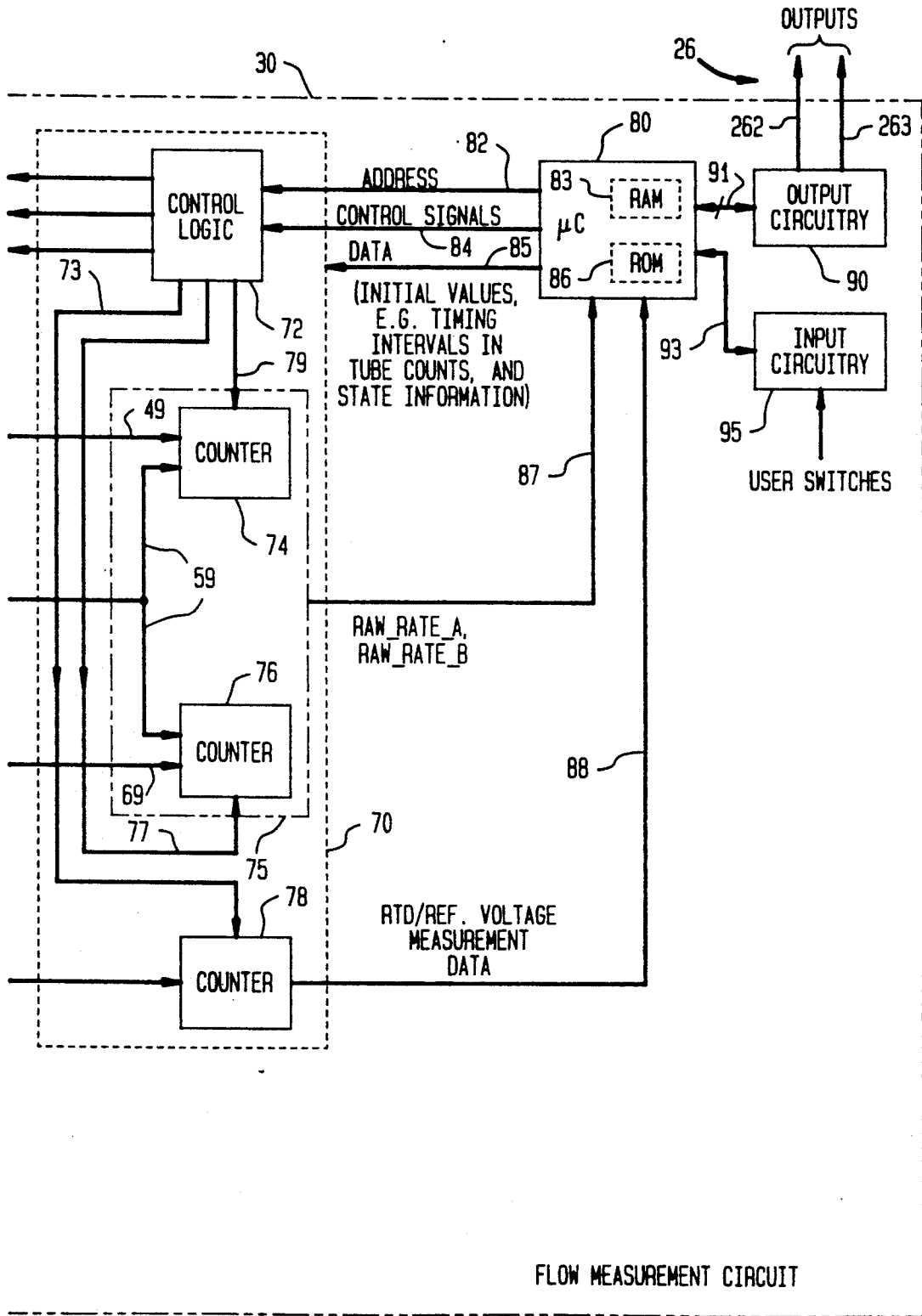


FIG. 3B



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