



[54] DIGITAL PHASE LOCKED LOOP SIGNAL PROCESSING FOR CORIOLIS MASS FLOW METER

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[51] Int. Cl.⁶ G01F 1/84

[52] U.S. Cl. 73/861.356; 364/510

[58] Field of Search 73/861.355, 861.356, 73/861.357; 364/510

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Primary Examiner—George M. Dombroske

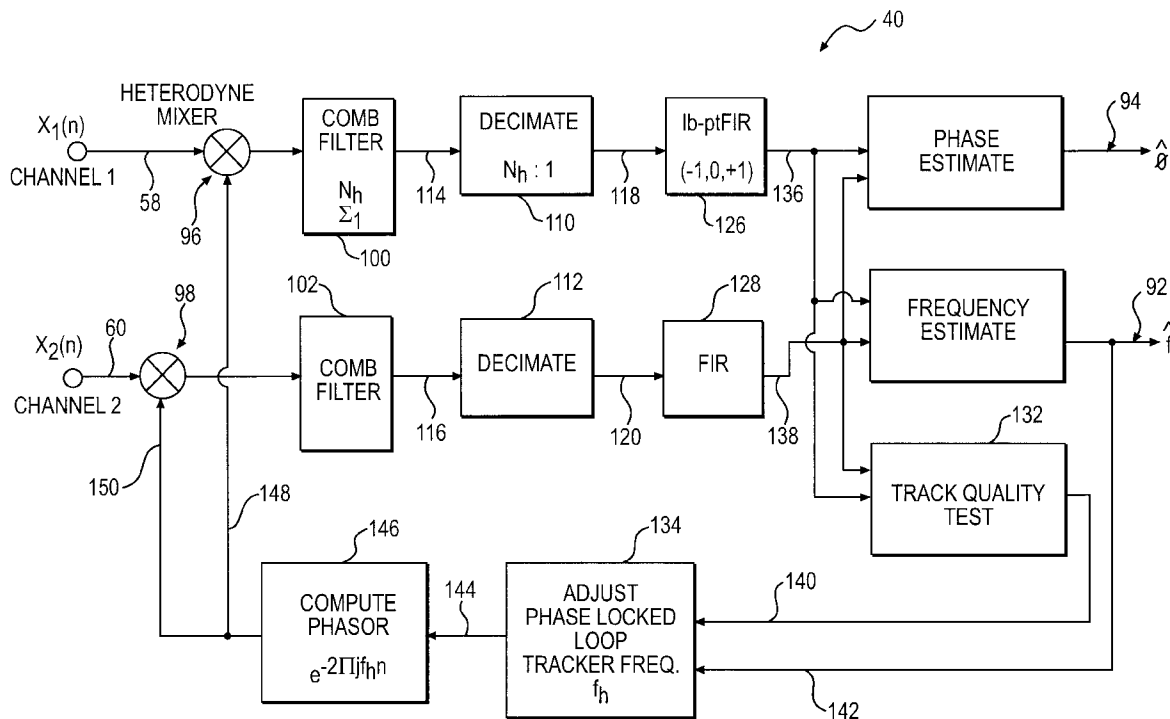
Assistant Examiner—Harshad Patel

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[57] ABSTRACT

A Coriolis-type fluid flow rate measuring system uses phase locked loop-based signal processing to estimate a tube vibration signal and maintain optimum tube vibrations. Analog sinusoidal sensor signals from the flow meter are digitized and processed through heterodyne mixing as part of phase locked loop tracking of the fundamental vibration or oscillation frequency. Digital signal processing is used to implement filtering and signal manipulation so as to respectively determine phase and frequency estimates for both of the two digitized signals. Frequency estimate data is used to adjust the tracker frequency mixed with the respective sensor signals. Digitally obtained phase and frequency estimate data are used to determine an optimized drive signal for continuing tube vibration. Phase estimate information for the two respective sensor signals is used to determine phase shift data, used in turn to determine a fluid flow rate through the flow meter.

29 Claims, 6 Drawing Sheets



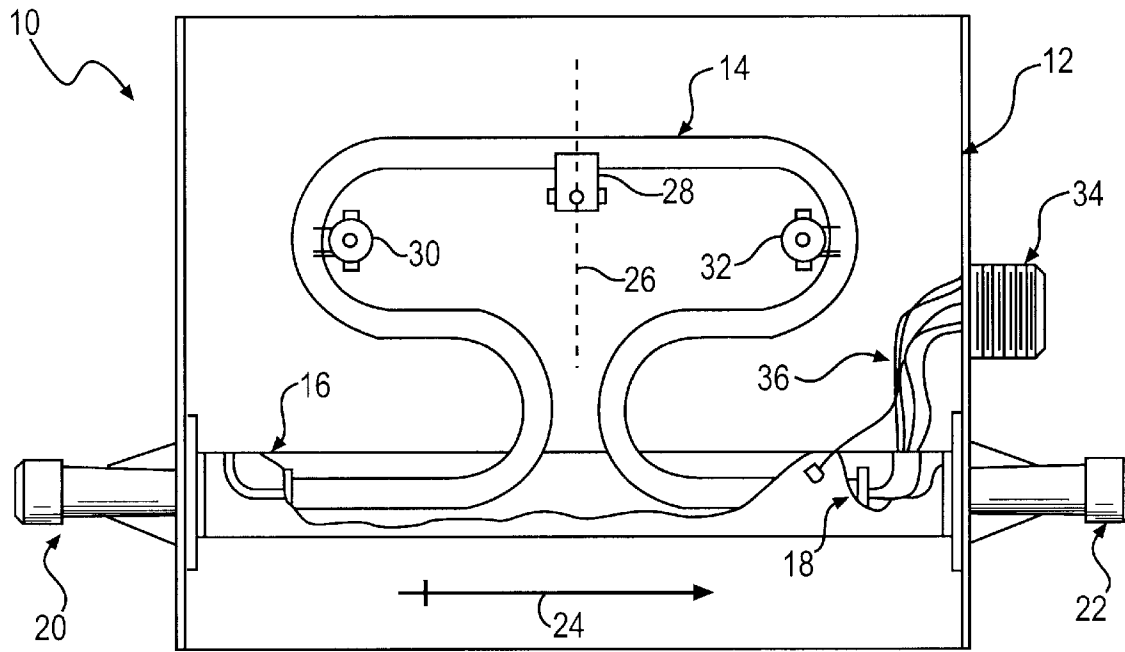


FIG. 1
(PRIOR ART)

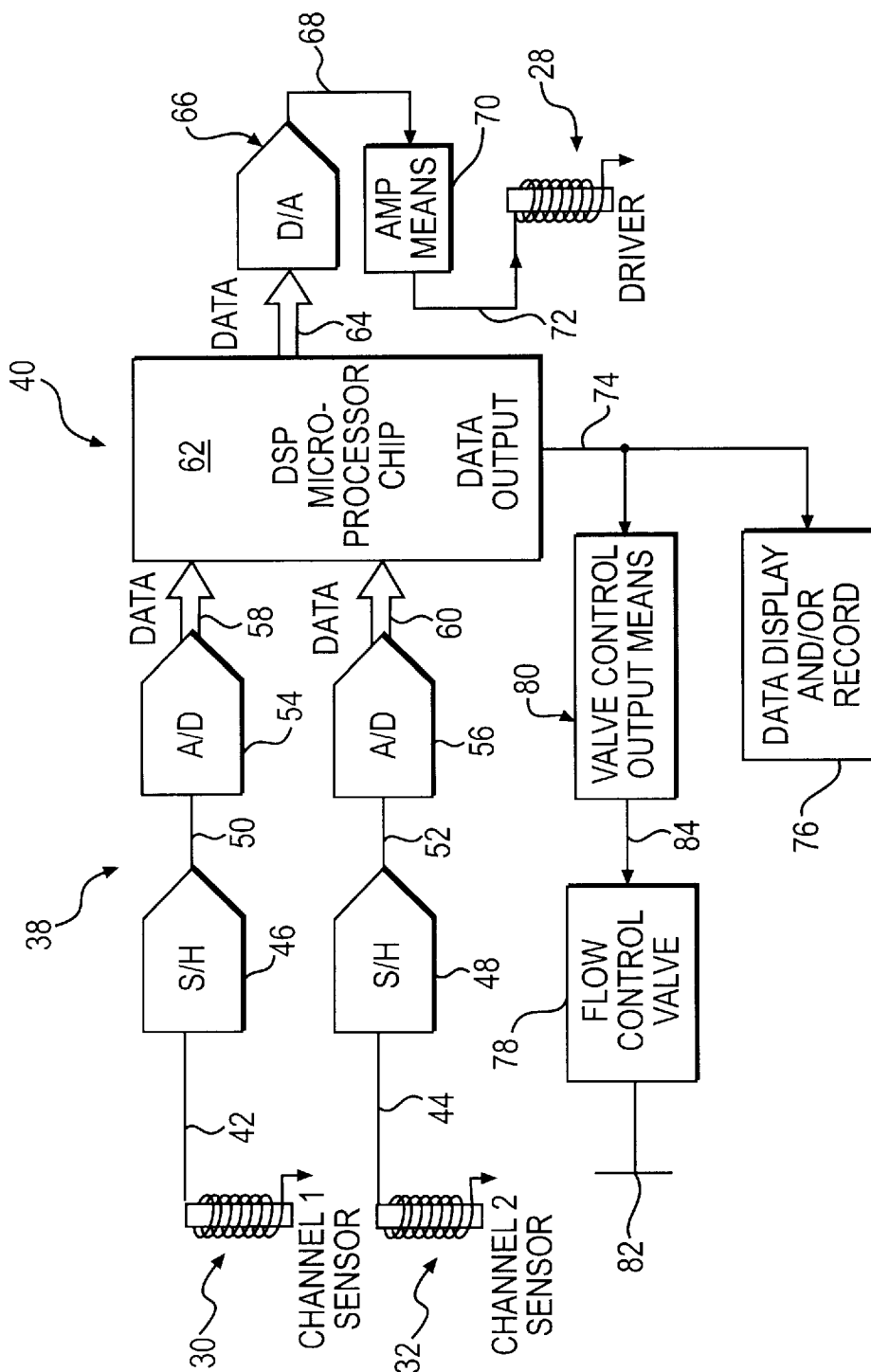


FIG. 2

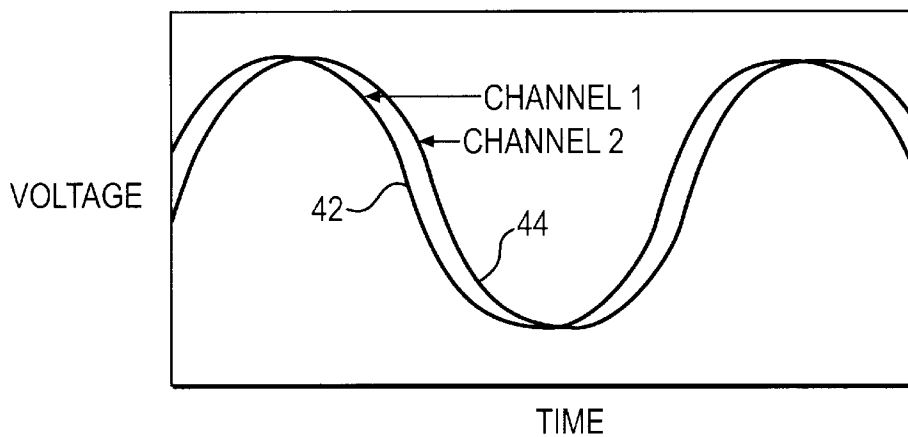


FIG. 3

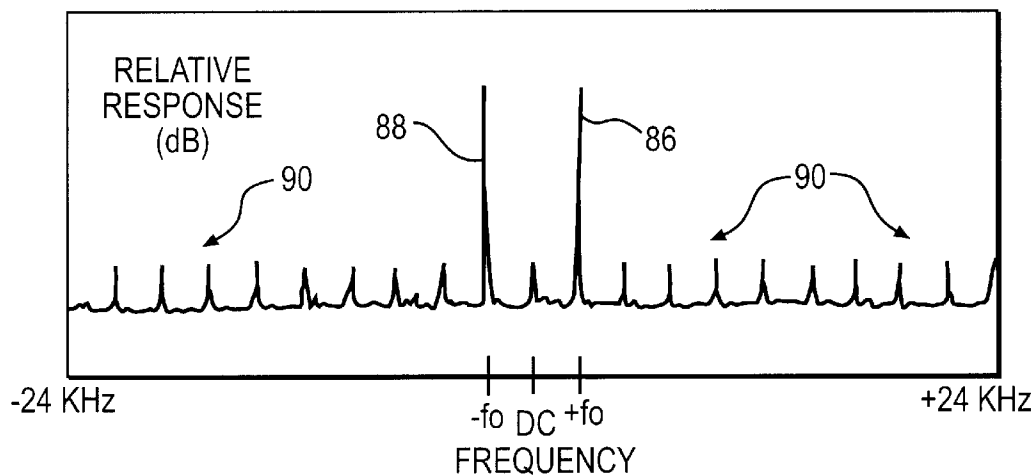


FIG. 4

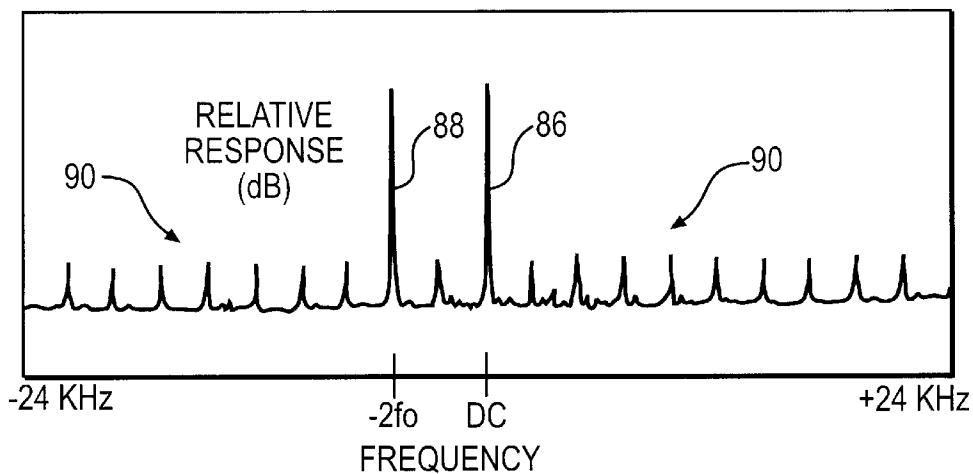


FIG. 6

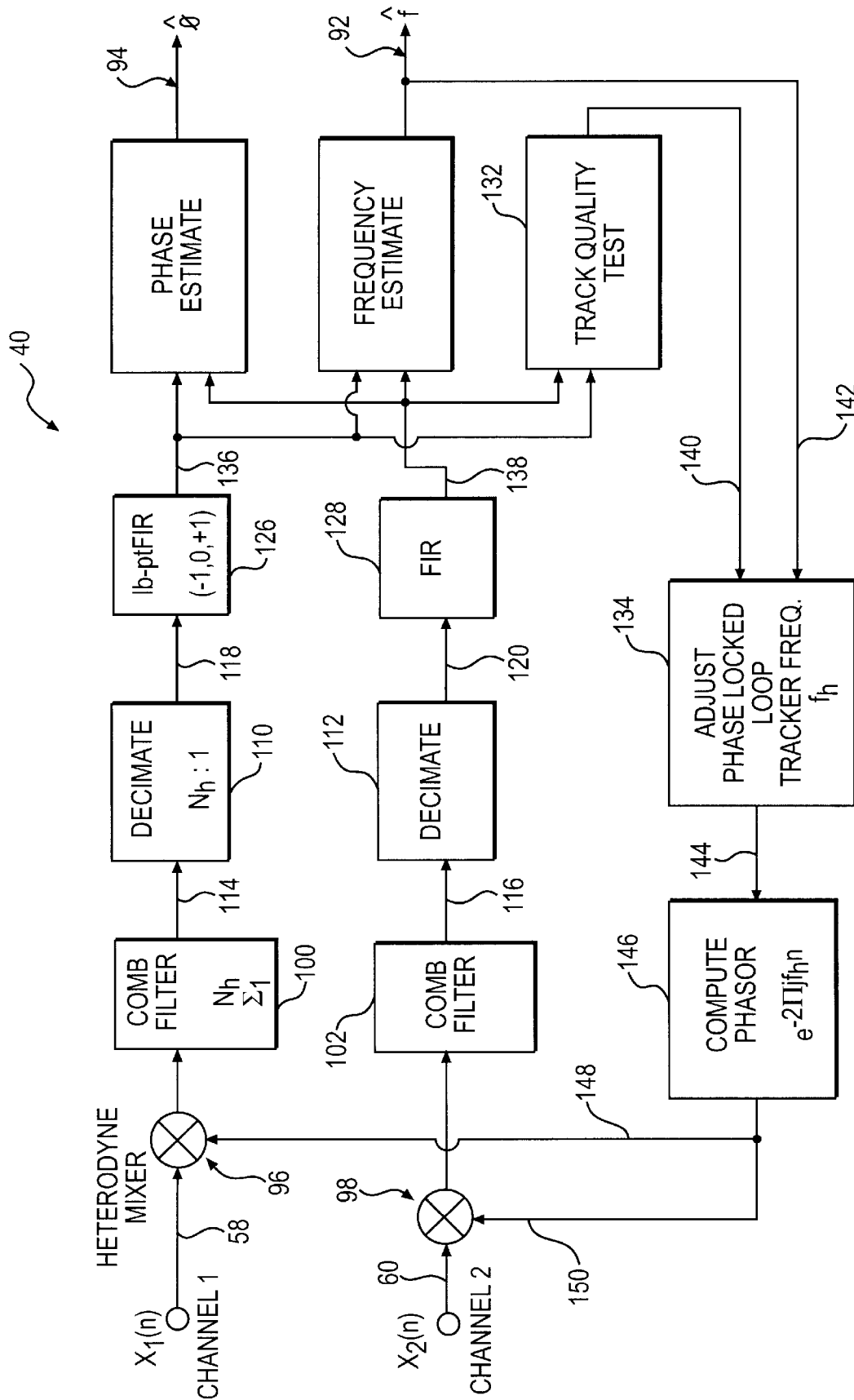


FIG. 5

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