

- [54] ADAPTIVE ACOUSTIC ECHO CANCELLER HAVING MEANS FOR REDUCING OR ELIMINATING ECHO IN A PLURALITY OF SIGNAL BANDWIDTHS
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Related U.S. Application Data

- [63] Continuation-in-part of Ser. No. 640,477, Jan. 11, 1991, abandoned, which is a continuation of Ser. No. 637,016, Jan. 4, 1991, abandoned.
- [51] Int. Cl.⁵ H04J 1/00
- [52] U.S. Cl. 370/32.1; 379/406; 381/71
- [58] Field of Search 370/32.1; 381/46, 47, 381/66, 71, 83; 379/345, 392, 410, 406

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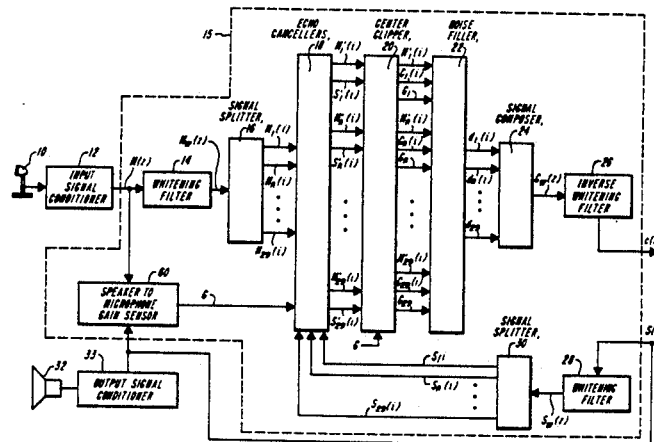
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[57] **ABSTRACT**

An echo cancelling device for reducing acoustic feedback between a loudspeaker and microphone in a full duplex communication system such as a telephone conferencing system. The device includes a whitening filter which flattens the microphone signal's spectrum and reduces its auto-correlation. A first signal splitter separates the whitened microphone signal into a plurality of bandlimited microphone signals. The loudspeaker signal is similarly whitened and separated into a plurality of bandlimited loudspeaker signals. A plurality of adaptive echo estimators estimate the echo in each frequency band defined by the above signal splitters. More specifically, each estimator generates an echo estimation signal representing an approximation of the acoustic feedback of a corresponding bandlimited loudspeaker signal into the microphone. To cancel echo, a subtractor removes each echo estimation signal from the bandlimited microphone signal of the same frequency band as the estimation signal. The device further processes the echo corrected signal in each band with a center clipper, to remove any residual echo, and with a noise filler to simulate the background signals removed by the clipper.

40 Claims, 9 Drawing Sheets



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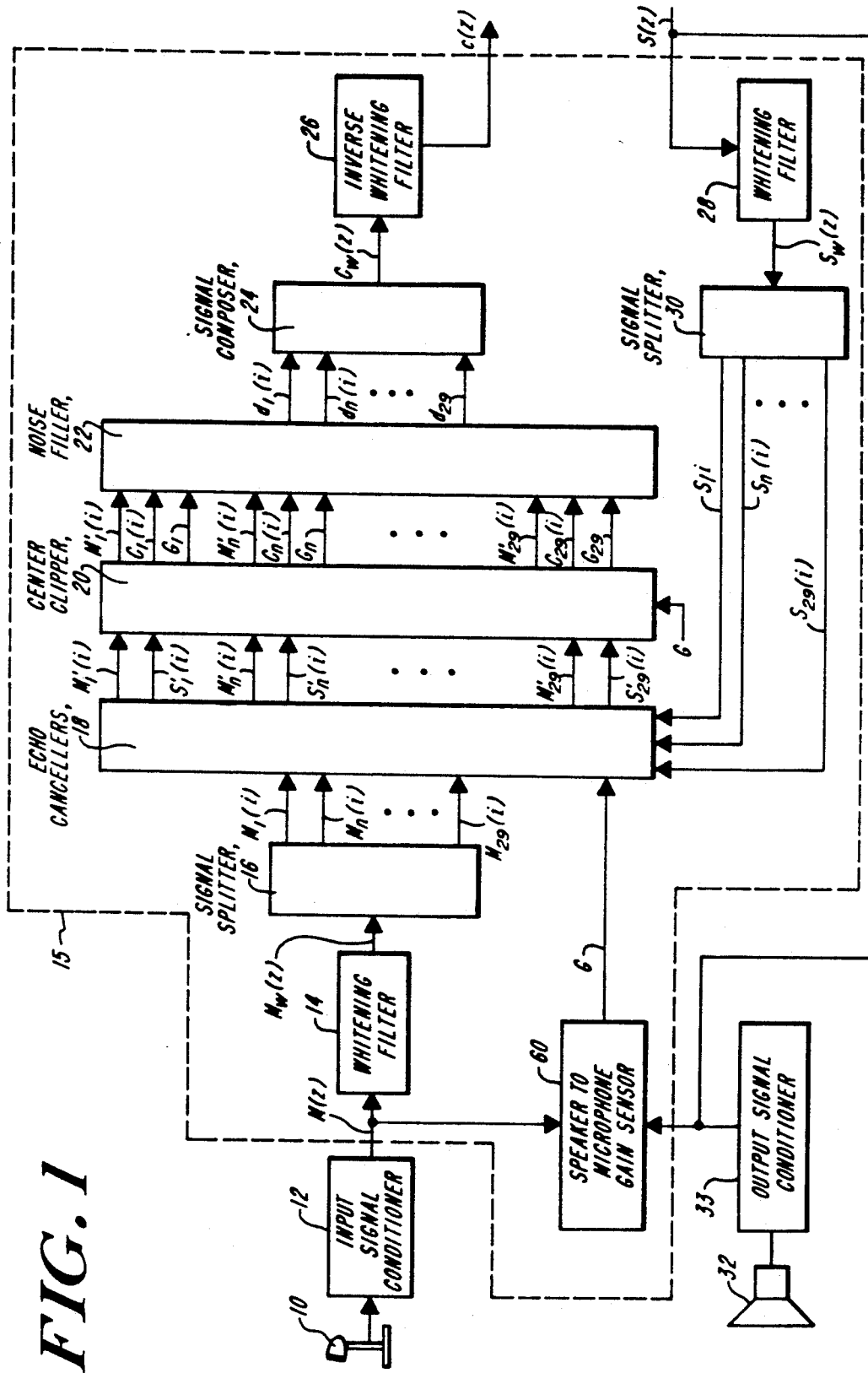


FIG. 1

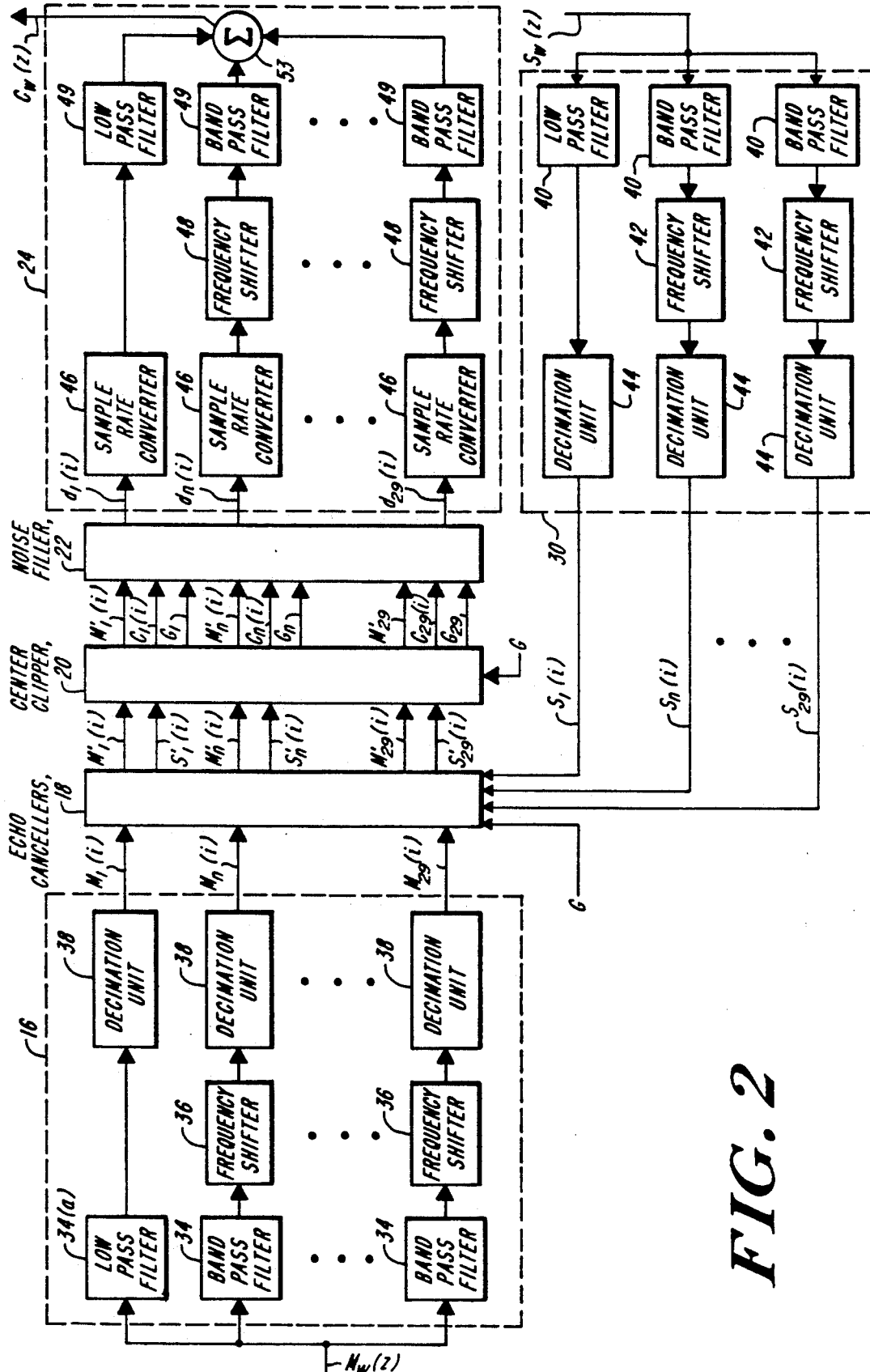


FIG. 2

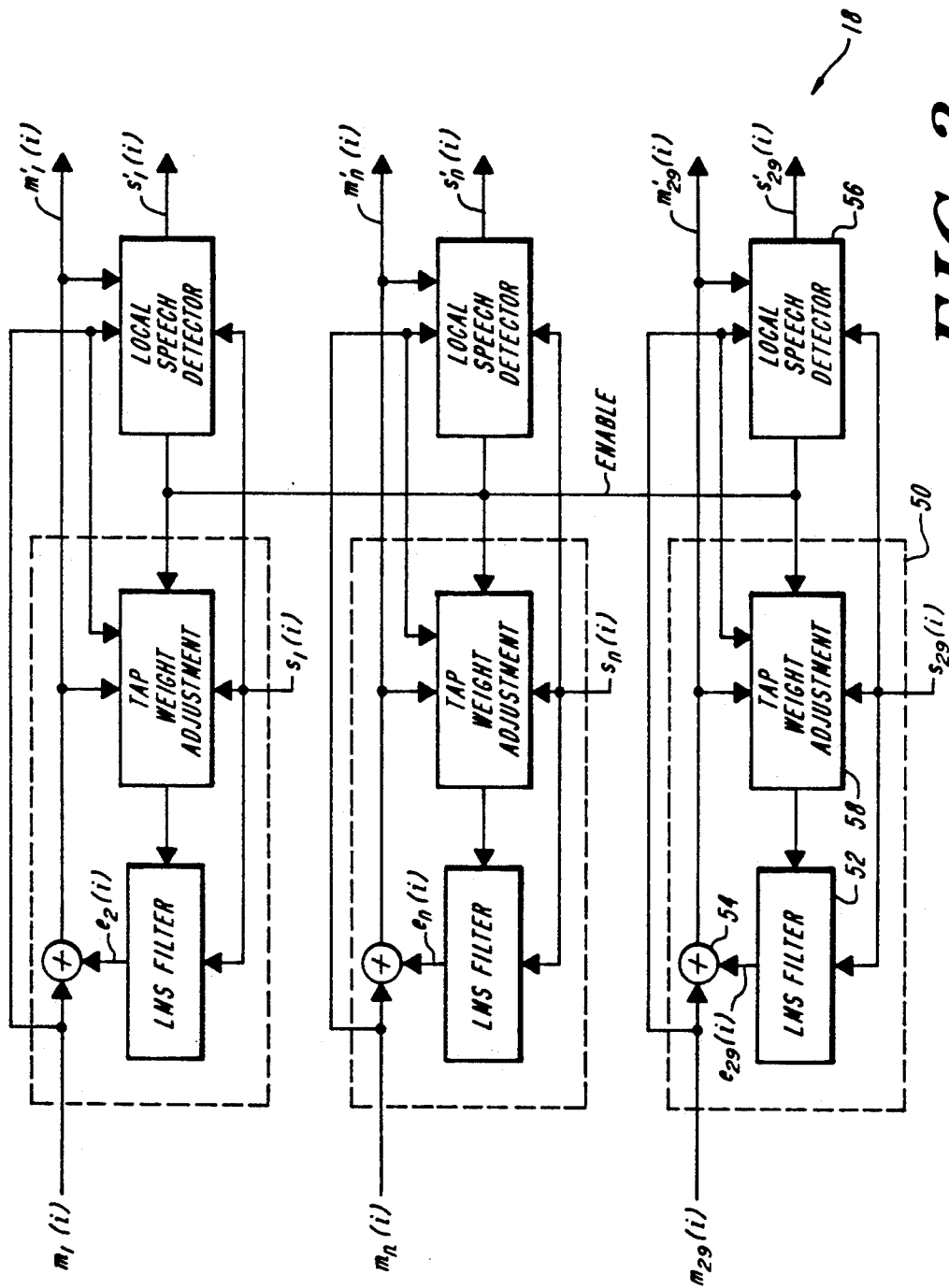


FIG. 3

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