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United States Patent [19]  
Akagiri et al.

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[45] Date of Patent: Feb. 16, 1999

[54] TWO-STAGE COMPRESSION AND EXPANSION OF COUPLING PROCESSED MULTI-CHANNEL SOUND SIGNALS FOR TRANSMISSION AND RECORDING

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[75] Inventors: Kenzo Akagiri, Tokyo, Japan; Mark Franklin Davis, Pacifica, Calif.; Craig Campbell Todd, Mill Valley, Calif.; Ray Milton Dolby, San Francisco, Calif.

Primary Examiner—David R. Hudspeth  
Assistant Examiner—Tālvāldis Ivars Šmits  
Attorney, Agent, or Firm—Limbach & Limbach LLP

[73] Assignee: Sony Corporation, Tokyo, Japan

[57] ABSTRACT

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[86] PCT No.: PCT/US94/14267

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§ 102(e) Date: Nov. 20, 1995

A multi-channel signal compressor for compressing digital sound signals in the respective channels of a multi-channel sound system. The apparatus comprises a first-stage compression system and a second-stage compression system. In the first-stage compression system, a coupling circuit performs coupling between the digital sound signals of at least two of the channels to generate coupling-processed signals, one for each of the channels. A compressor circuit receives the coupling-processed signals from the coupling circuit and frequency divides each coupling-processed signal into frequency range signals in respective frequency ranges, and compresses the frequency range signals obtained by dividing each coupling-processed signal to generate a first-stage compressed signal. In the second-stage compression system, a determining circuit receives the first-stage compressed signal for each channel from the first-stage compression system and determines an energy for each channel from the first-stage compressed signal of the respective channel. A channel bit apportionment decision circuit operates in response to the determining circuit, and apportions a predetermined number of bits among the channels to apportion a number of bits to each channel. Finally, an additional compressor additionally compresses the first-stage compressed signal of each channel using, for each channel, the number of bits apportioned to the respective channel by the channel bit apportionment decision circuit.

[30] Foreign Application Priority Data

Dec. 7, 1993 [JP] Japan ..... 5-306898

[51] Int. Cl.<sup>6</sup> ..... H04S 3/00; H04B 1/66; H04H 5/00

[52] U.S. Cl. .... 704/500; 381/2; 704/227; 704/229

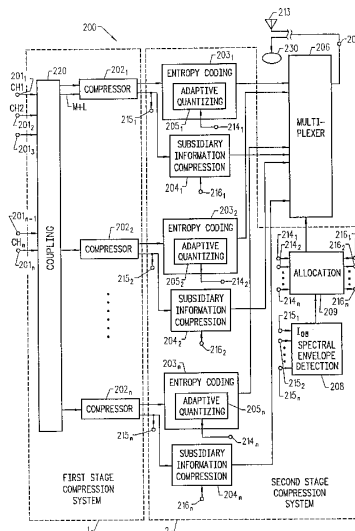
[58] Field of Search ..... 395/2.36, 2.38, 395/2.39; 381/2; 704/227, 229, 230, 500

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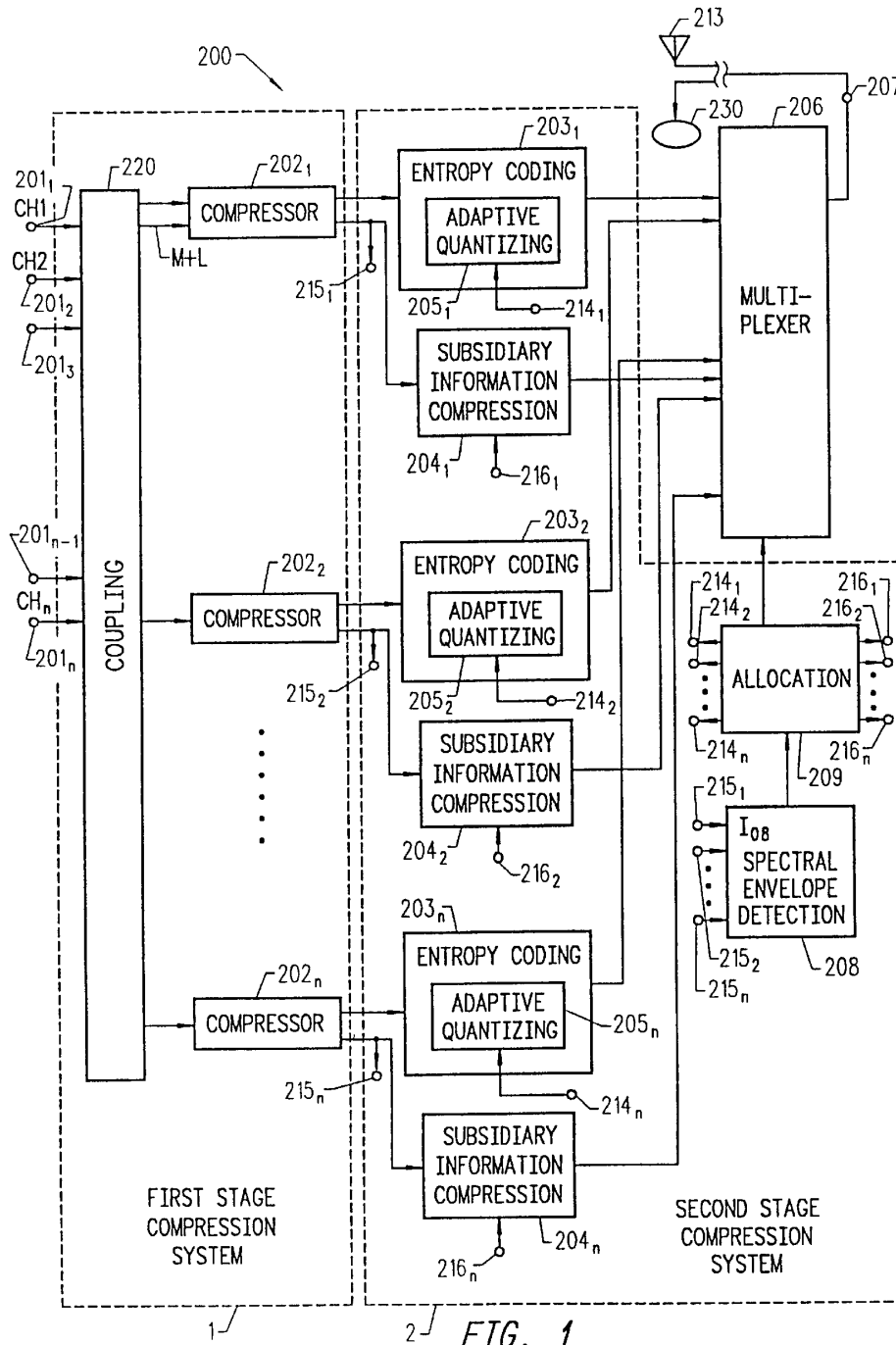
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16 Claims, 10 Drawing Sheets



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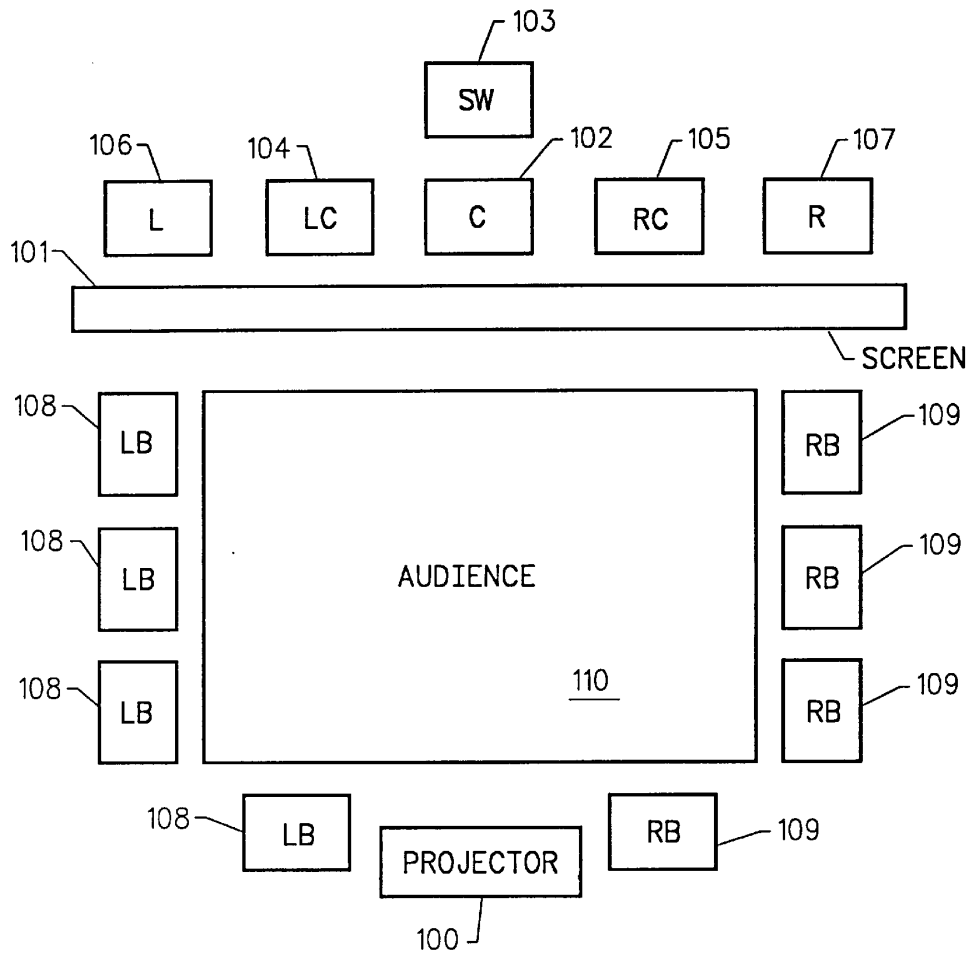


FIG. 2

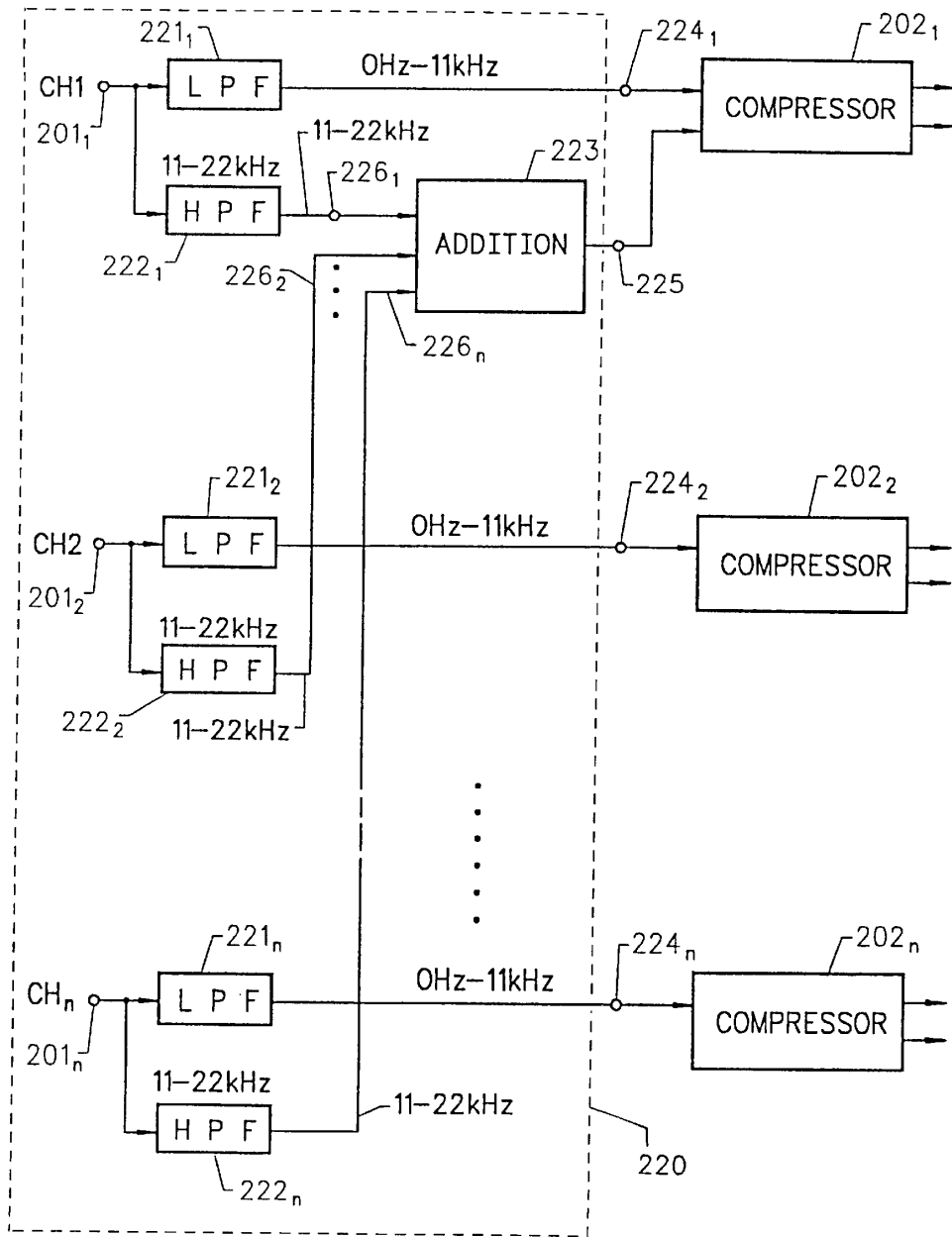
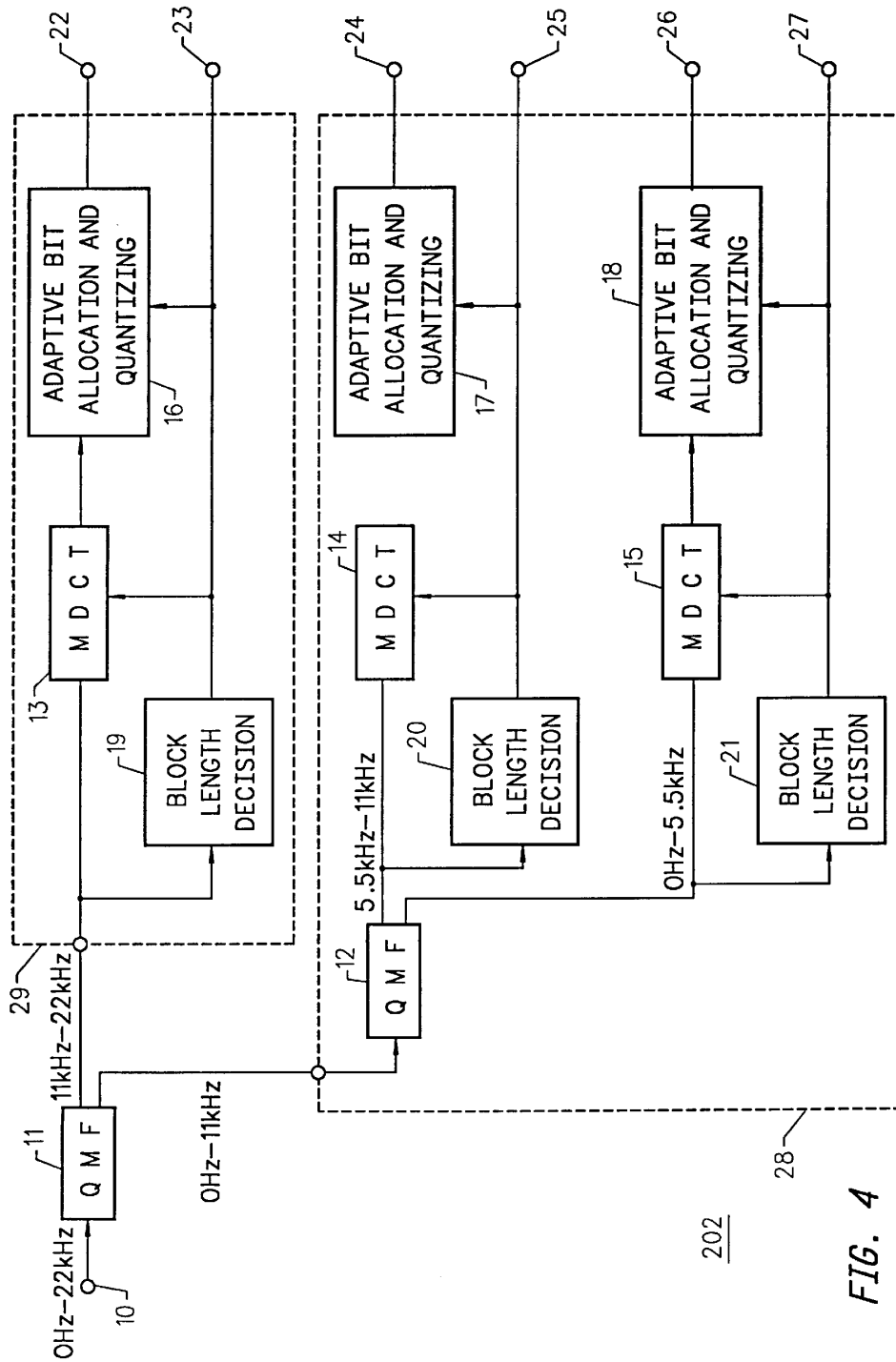


FIG. 3



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