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Akagiri et al.

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

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.^{6}** **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

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,166,686	11/1992	Sugiyama	341/155
5,185,800	2/1993	Mahieux	704/500
5,241,603	8/1993	Akagiri et al.	704/205
5,285,498	2/1994	Johnston	381/2
5,341,457	8/1994	Hall, II et al.	704/226
5,471,558	11/1995	Tsutsui	704/219
5,481,614	1/1996	Johnston	381/2
5,490,170	2/1996	Akagiri et al.	375/240
5,491,773	2/1996	Veldhuis et al.	395/2.38
5,535,300	7/1996	Hall, II et al.	395/2.36
5,539,829	7/1996	Lokhoff et al.	381/2
5,664,056	9/1997	Akagiri	704/229
5,687,157	11/1997	Imai et al.	369/124

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[57] **ABSTRACT**

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.
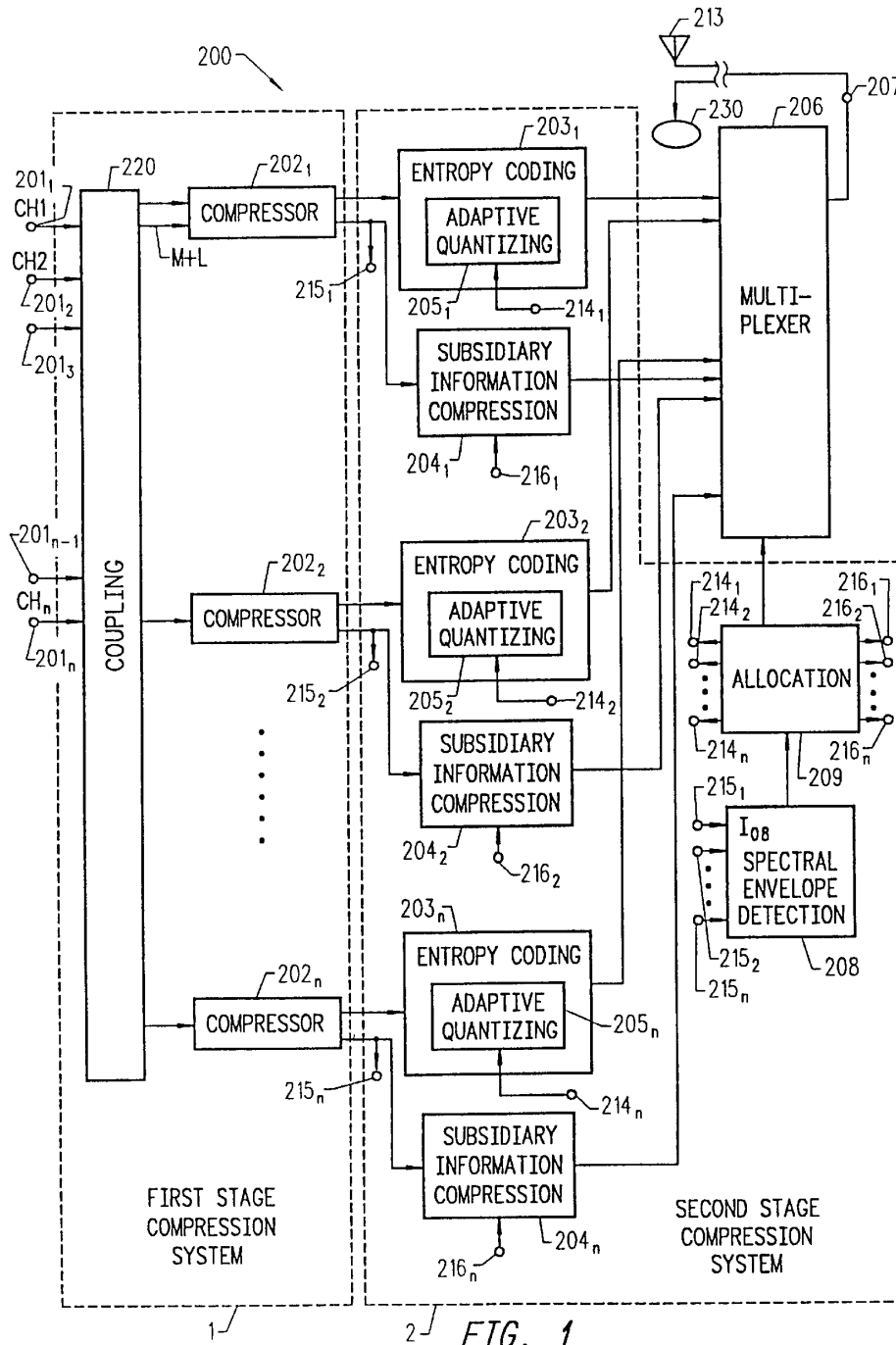
16 Claims, 10 Drawing Sheets
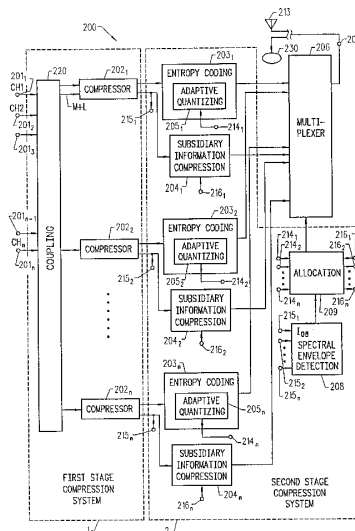
FIG. 1

FIG. 2
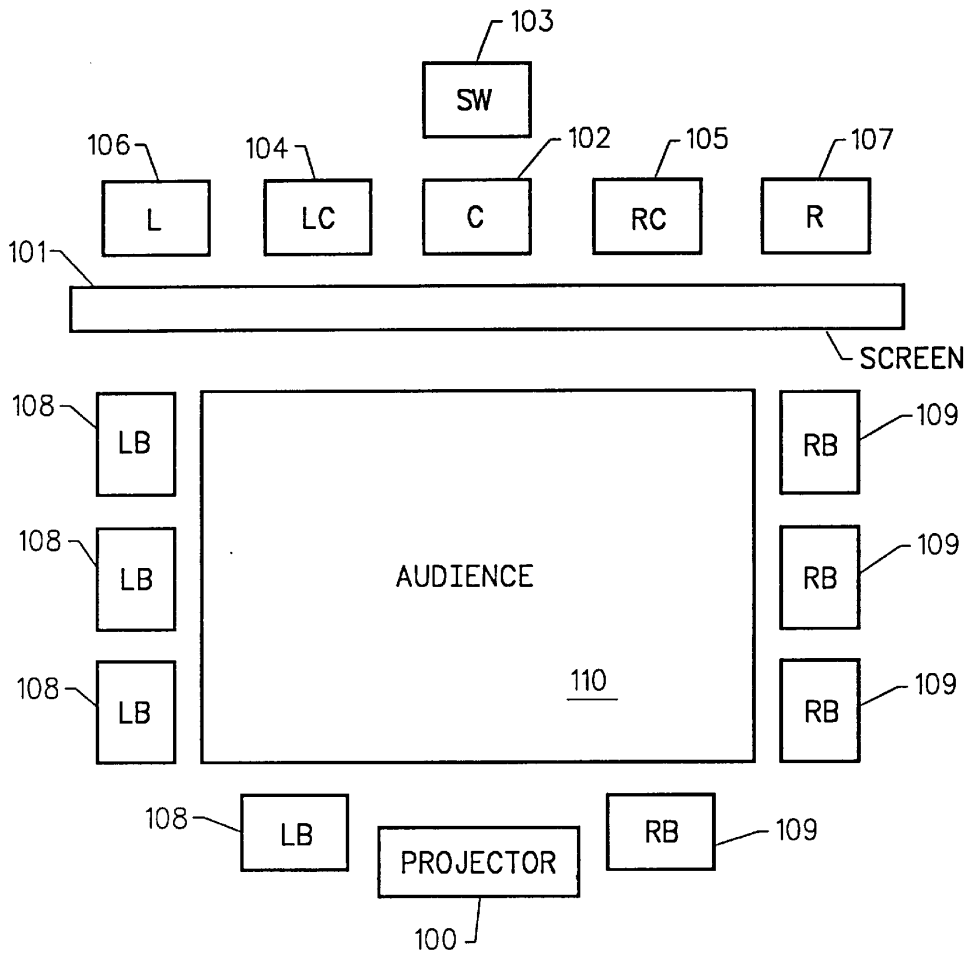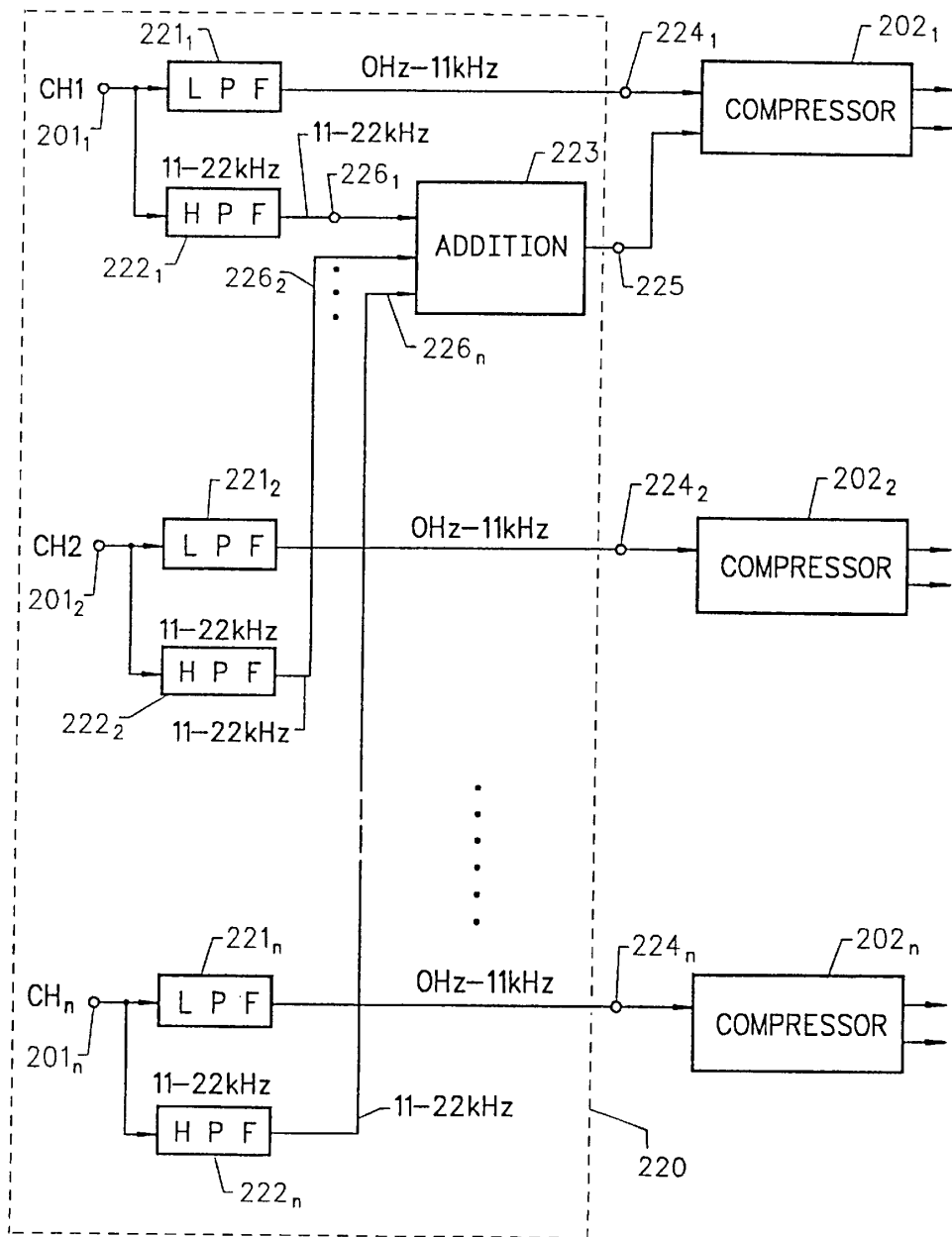
FIG. 3

FIG. 4

DOCKET ALARM
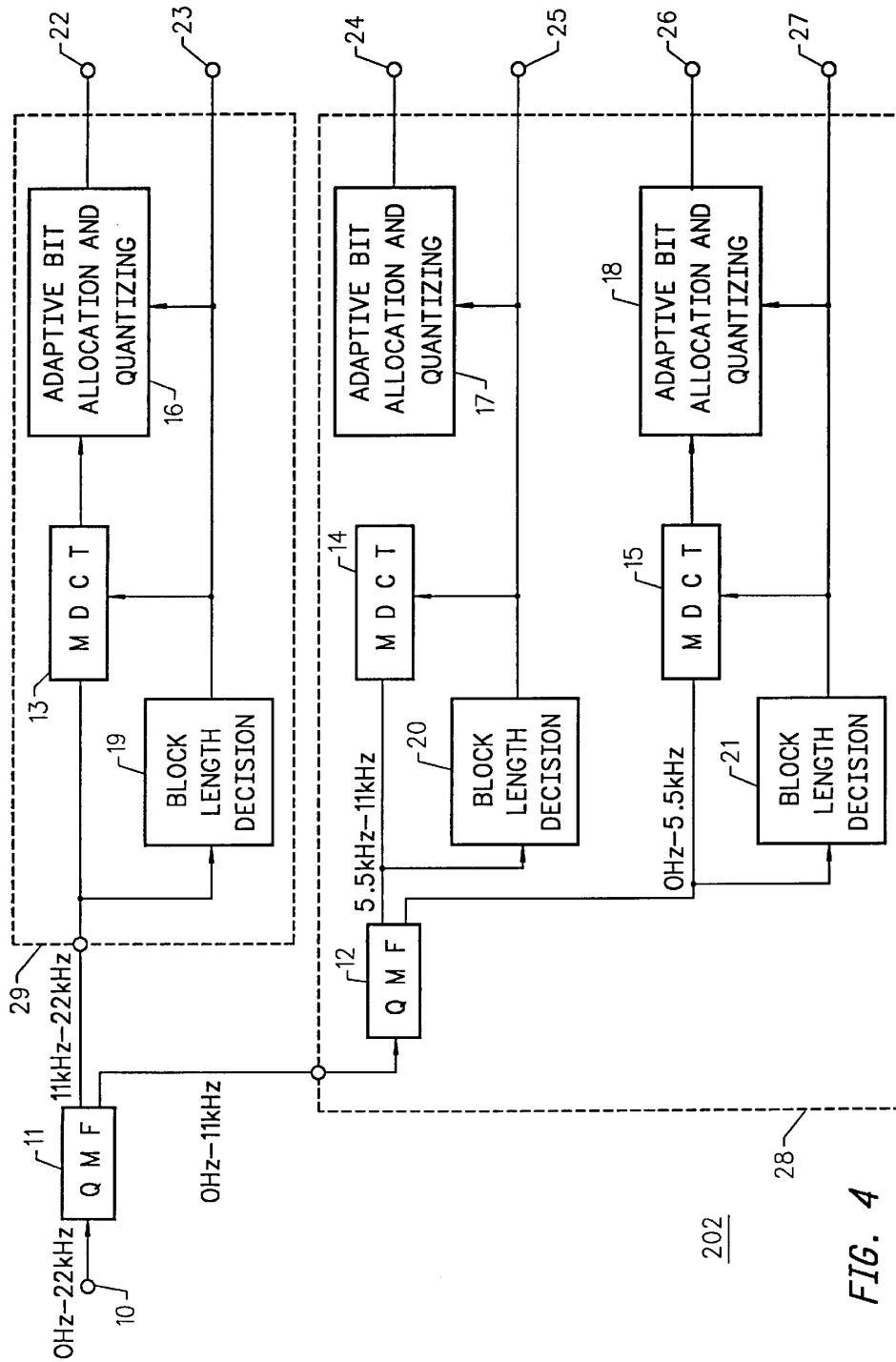
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