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(54) **TYPES-BASED, LOSSY DATA EMBEDDING**

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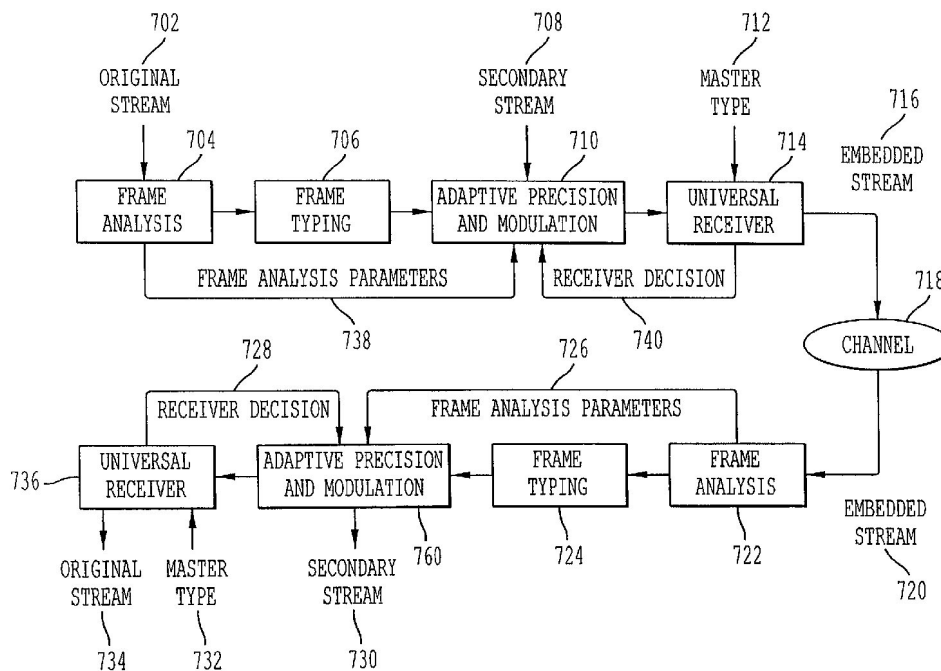
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(57) **ABSTRACT**

A new approach to data embedding within ITU G.722 and ITU G.711 based upon the method of types and universal classification is disclosed. A secondary data sequence is embedded in the original (host) data stream using the method of types. The embedded data is extracted using a type-based universal receiver, with or without the use of a key. The choice of type and rate for the embedded data is based upon an analysis of portions of the original ITU G.722 or ITU G.711 coded data stream. The universal receiver learns the type from the received data alone, and hence, there is no side information required as in previous data embedding techniques. The embedding process and the receiver may both be data adaptive, so the original data stream can be reconstructed at the decoder without error.

702

ORIGINAL
STREAM

708

SECONDARY
STREAM

712

MASTER
TYPE

716

EMBEDDED
STREAM

704

| FRAME
ANALYSIS |

706

| FRAME
TYPING |

710

| ADAPTIVE PRECISION
AND MODULATION |

714

| UNIVERSAL
RECEIVER |

FRAME ANALYSIS PARAMETERS

RECEIVER DECISION

738

740

718

CHANNEL

728

RECEIVER DECISION

726

FRAME ANALYSIS PARAMETERS

736 — | UNIVERSAL
RECEIVER | | ADAPTIVE PRECISION
AND MODULATION | | FRAME
TYPING | | FRAME
ANALYSIS |

EMBEDDED
STREAM

720

ORIGINAL
STREAM

MASTER
TYPE
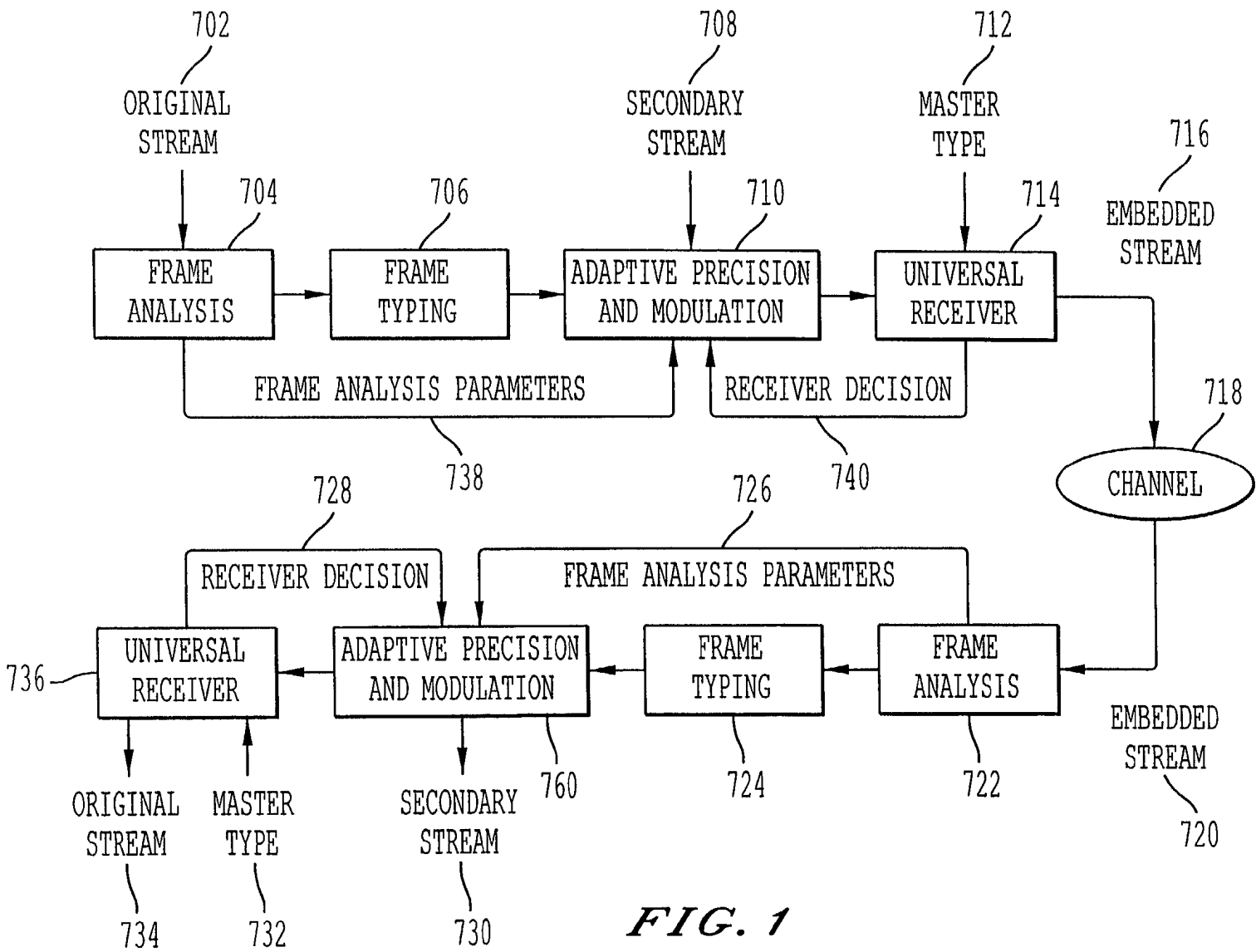
SECONDARY
STREAM

760

724

722

734

732

730

FIG. 1

HISTOGRAM OF ORIGINAL G.711 CODEWORD DATA

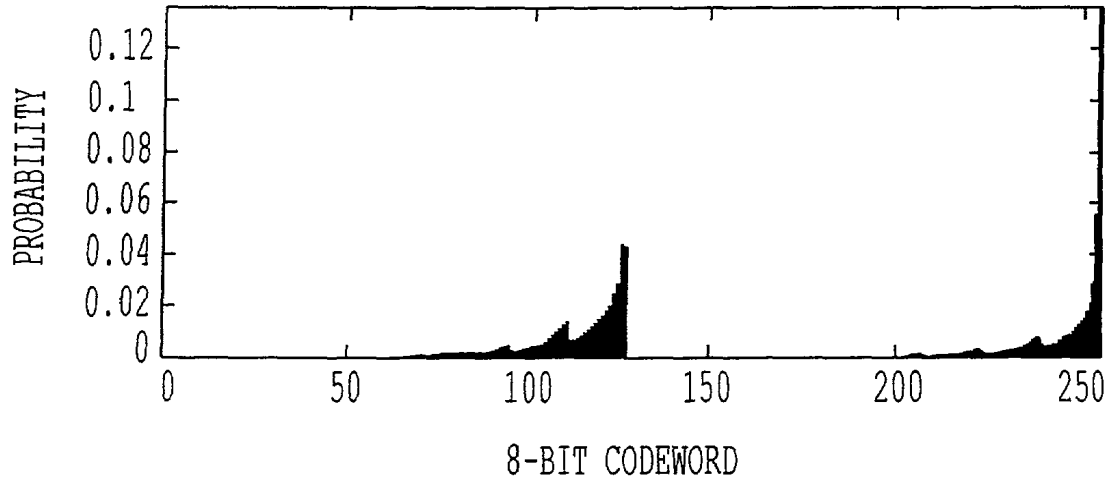FIG.2(a)

HISTOGRAM OF MAPPED G.711 CODEWORD DATA (i.e. MASTER TYPE)

FIG.2(b)
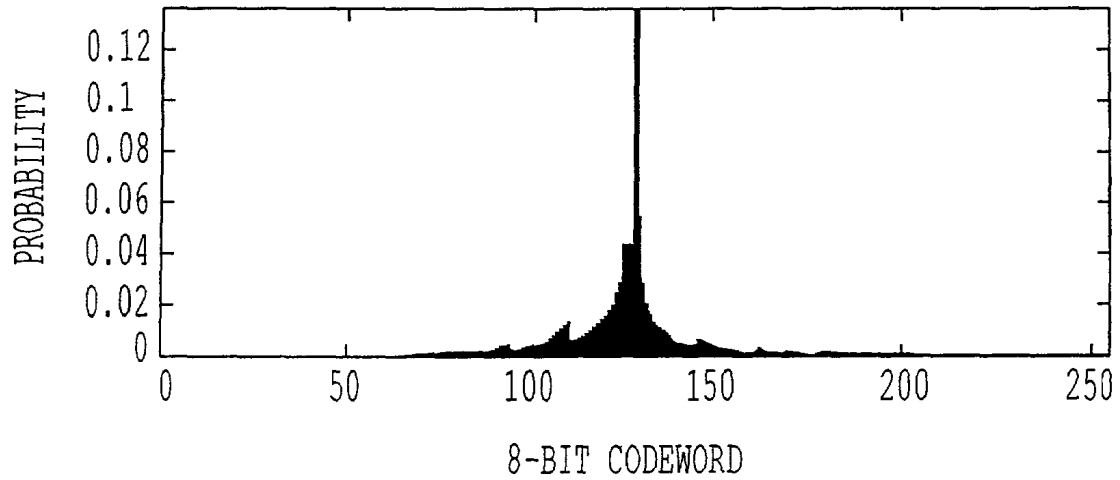
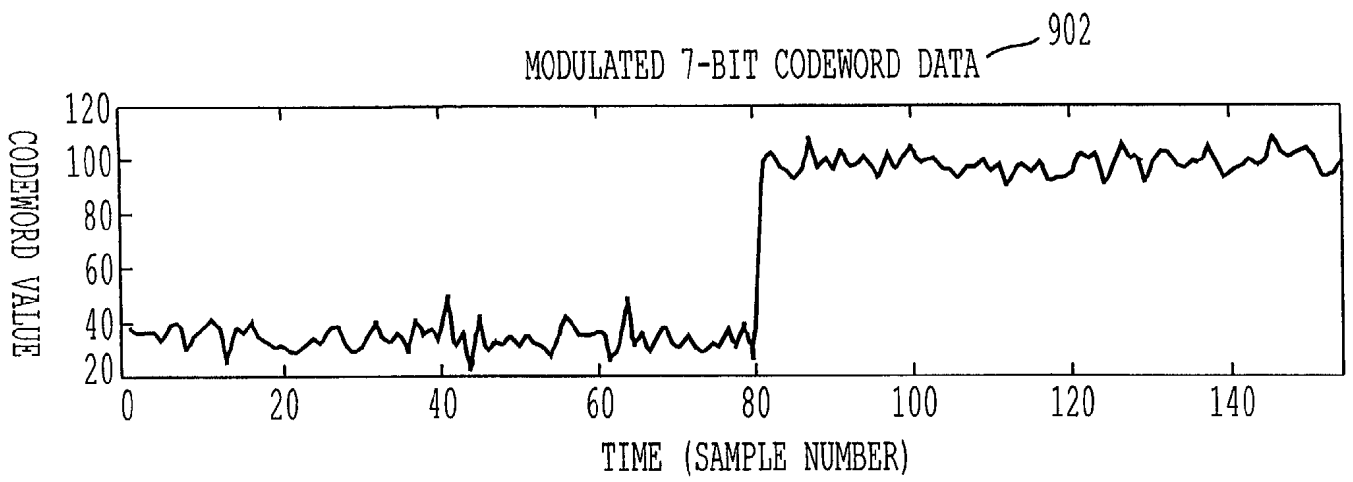MODULATED 7-BIT CODEWORD DATA —902

FIG. 3(a)

904 — TYPE ZERO

FIG. 3(b)

906 — TYPE ONE

FIG. 3(c)

ENCODER

102

108

LB

UB

110

FRAME SIZE

104

UNCOMPRESSED
SPEECH

106

122
SECONDARY
SOURCE
BITSTREAM

124

126

128

114

112

| G.722 ENCODER MODULE | DATA FRAMING MODULE | FORWARD MAPPING MODULE | DATA EMBEDDING MODULE | MUX |

COMPRESSED
BITSTREAM

116   118   120

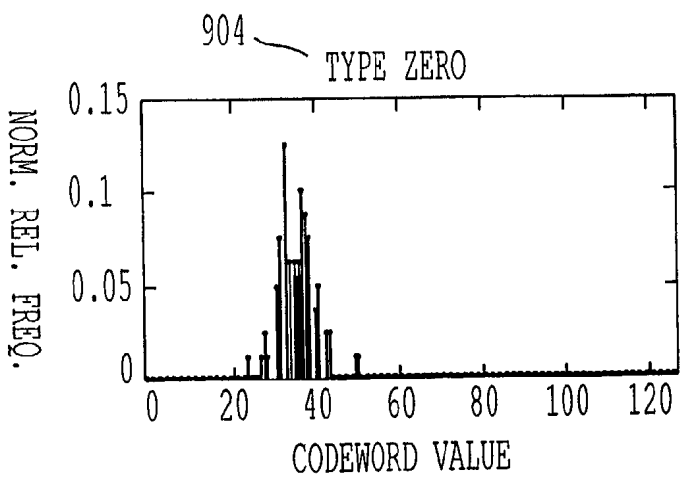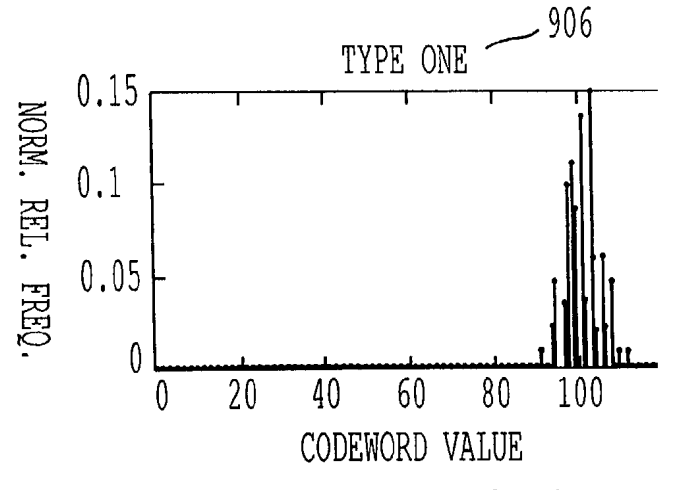| MINIMUM ENTROPY TYPE | HYPOTHESIS TESTING MODULE | PRECISION MODULE |

FIG. 4(a)

DOCKET ALARM
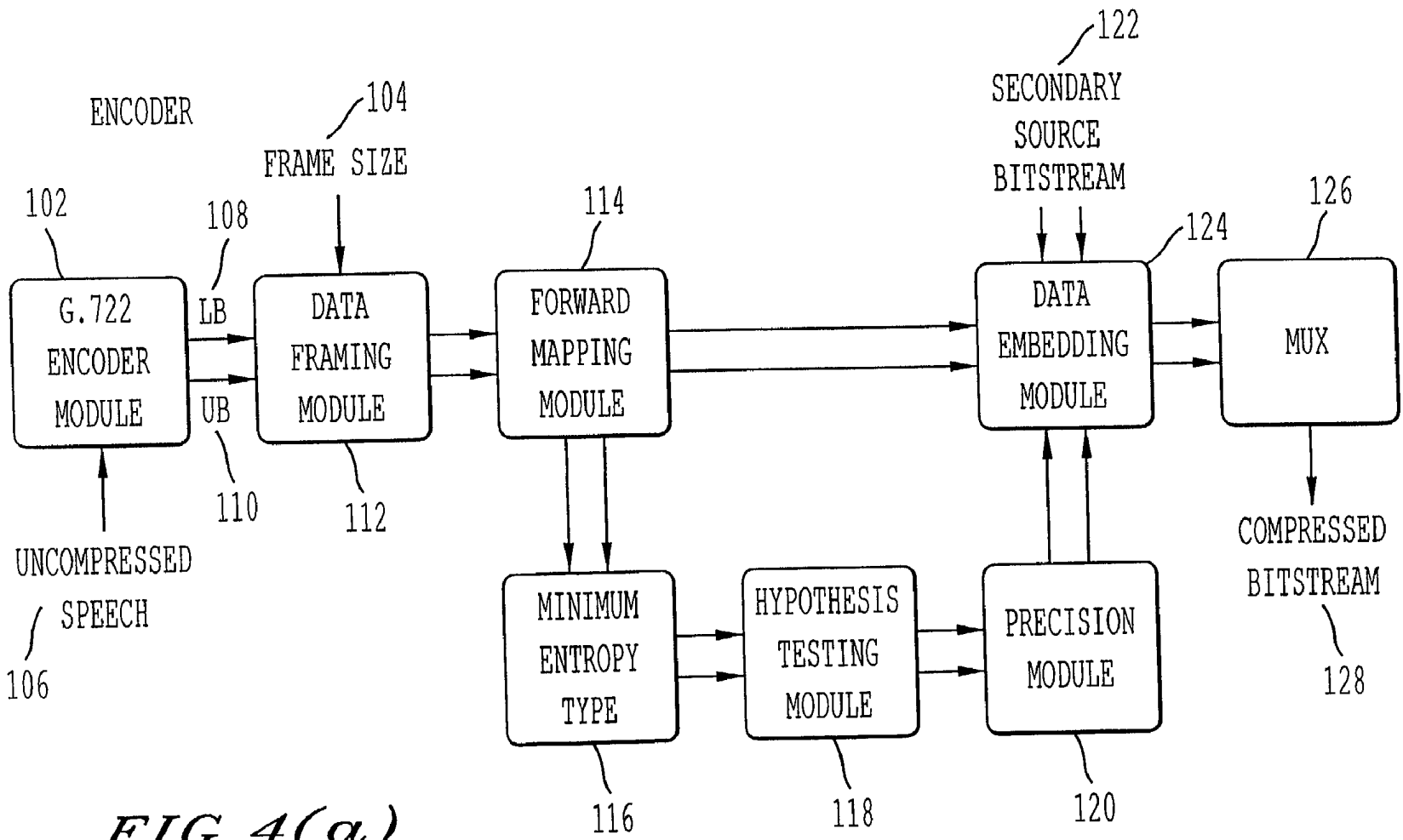
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