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United States Patent [19]

Numazaki et al.

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[54] **METHOD AND APPARATUS FOR GENERATING INFORMATION INPUT USING REFLECTED LIGHT IMAGE OF TARGET OBJECT**

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[51] **Int. Cl.^{7}** **G09G 5/08**

[52] **U.S. Cl.** **345/156**; 345/157; 345/158

[58] **Field of Search** .... 345/158, 157, 345/156, 419, 425; 463/31, 32, 33, 36, 37; 250/200, 206.1, 208.1, 214 R

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[57] **ABSTRACT**

A method and an apparatus for generating information input which are capable of realizing a direct command type information input scheme by which the gesture or the motion can be inputted easily. The apparatus has a timing signal generation unit for generating a timing signal; a lighting unit for emitting a light whose intensity vary in time, according to the timing signal generated by the timing signal generation unit; and a reflected light extraction unit having a sensor array for detecting a reflected light from a target object resulting from the light emitted by the lighting unit, in synchronization with the timing signal generated by the timing signal generation unit, so as to obtain a spatial intensity distribution of the reflected light in a form of a reflected light image indicative of an information input related to the target object, in separation from an external light that is illuminating the target object.
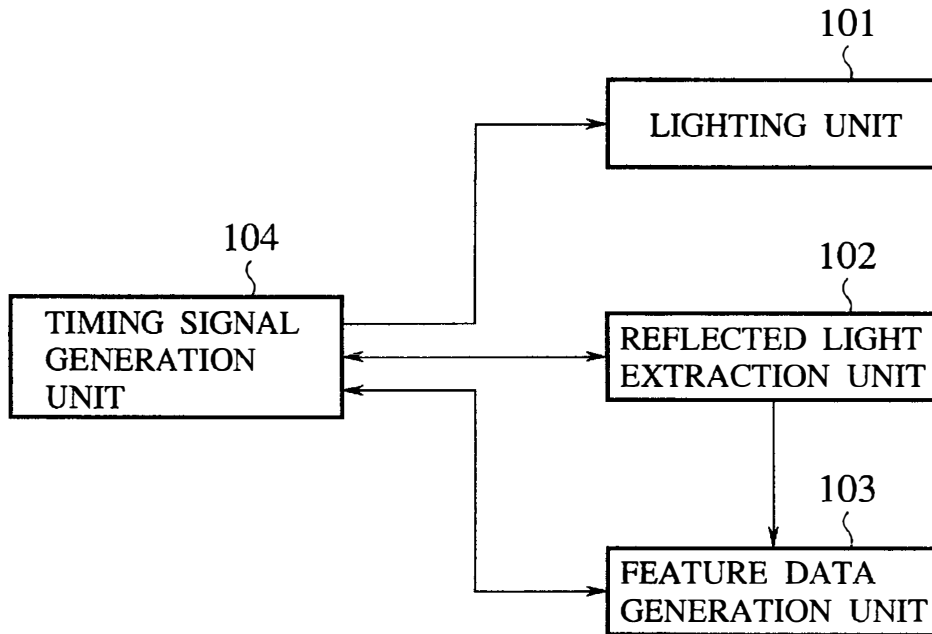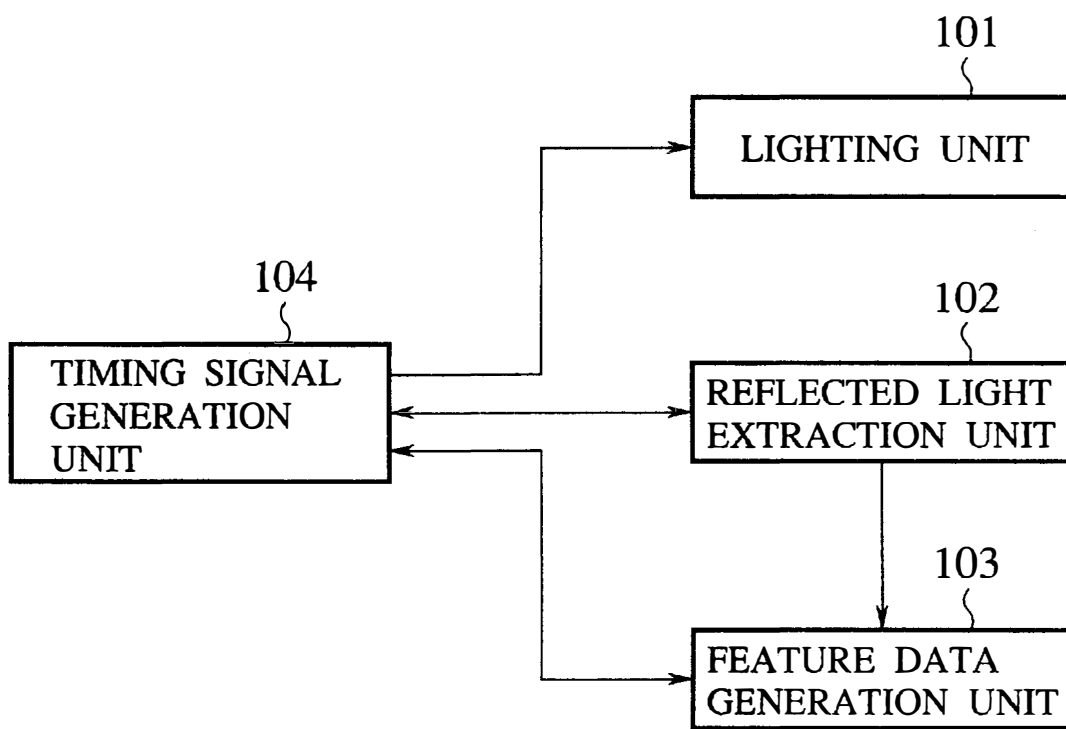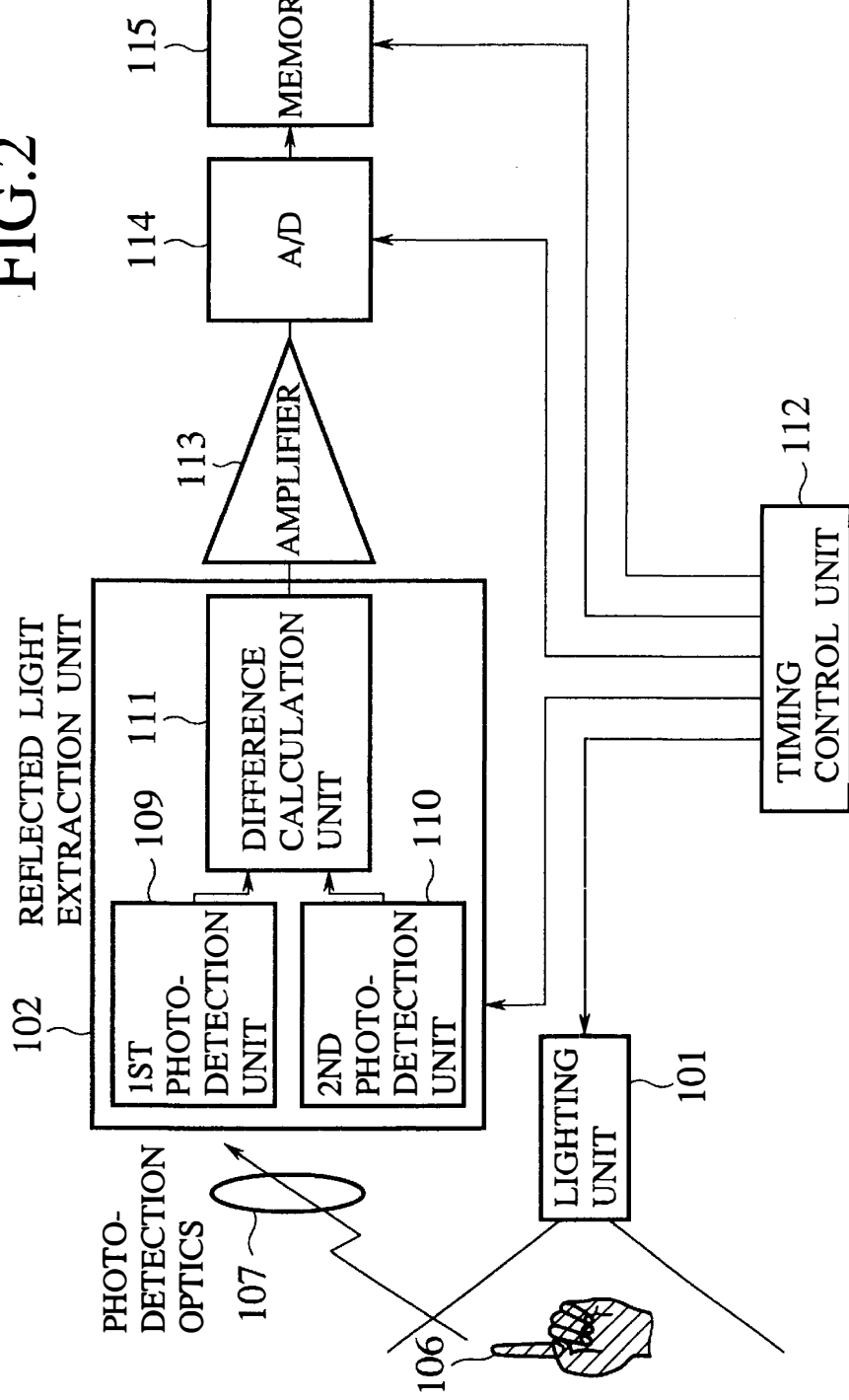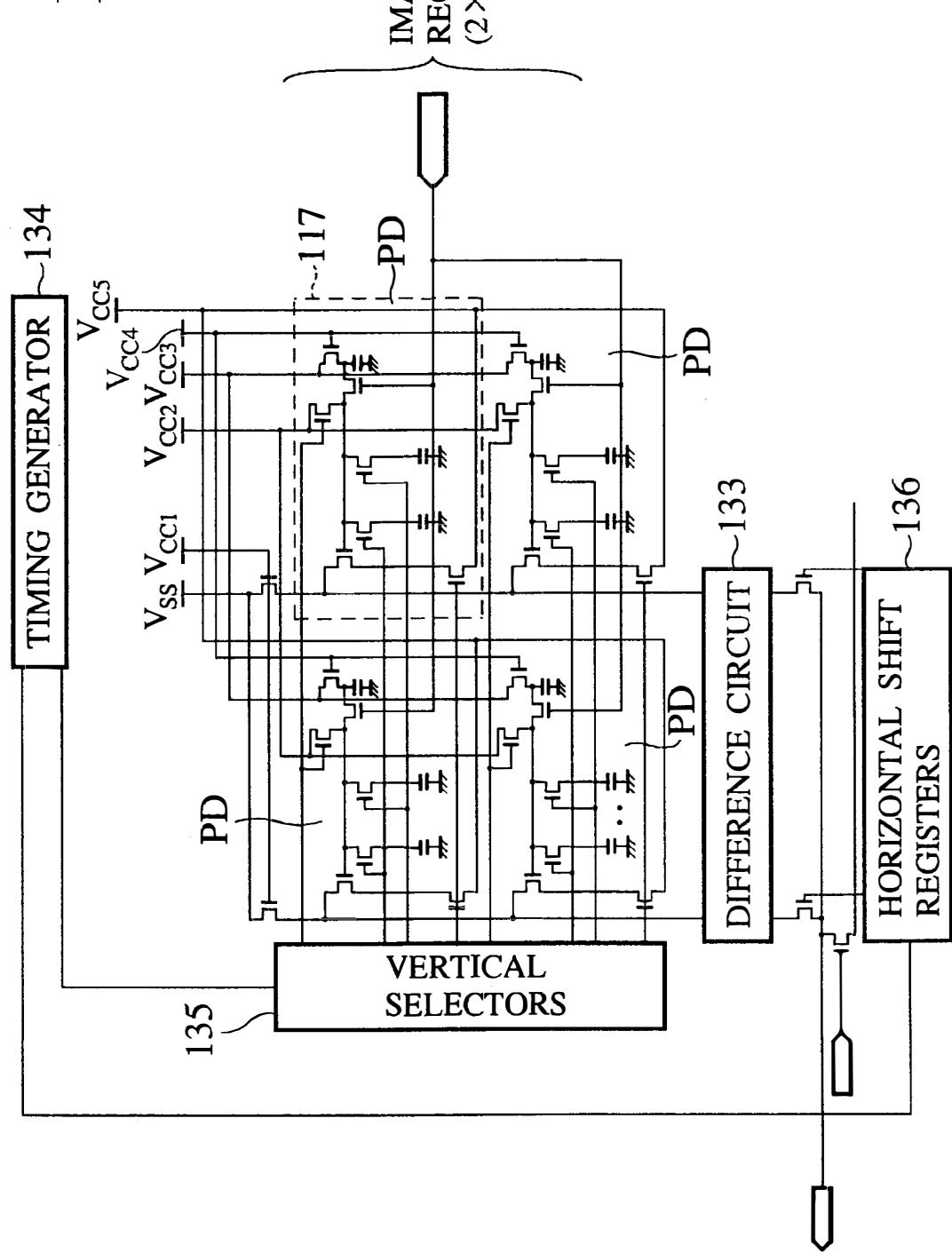
96 Claims, 101 Drawing Sheets

FIG.1

101

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                                    ┌─────────────────────┐
                        ───────────▶│   LIGHTING  UNIT     │
                        │           └─────────────────────┘
                        │
     104                │                                          102
┌────────────────────┐  │              ┌─────────────────────────┐
│ TIMING  SIGNAL     │  │   ◀────────▶ │ REFLECTED  LIGHT        │
│ GENERATION         │  │   ◀──────    │ EXTRACTION  UNIT         │
│ UNIT               │  │        │     └─────────────────────────┘
└────────────────────┘  │        │                  │
                        │        │                  │        103
                        │        │     ┌─────────────────────────┐
                        └────────┴────▶│ FEATURE  DATA           │
                                       │ GENERATION  UNIT         │
                                       └─────────────────────────┘
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FIG.2

REFLECTED LIGHT EXTRACTION UNIT — 102

1ST PHOTO-DETECTION UNIT — 109

2ND PHOTO-DETECTION UNIT — 110

DIFFERENCE CALCULATION UNIT — 111

AMPLIFIER — 113

A/D — 114

MEMORY — 115

TIMING CONTROL UNIT — 112

PHOTO-DETECTION OPTICS — 107

LIGHTING UNIT — 101

106

FIG.4

124

121

122

125

123

119

120

ADDRESS LINE 127

VERTICAL
SIGNAL LINE
126

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