



[54] **PARALLEL-PIPELINED IMAGE PROCESSING SYSTEM**

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Related U.S. Application Data

[63] Continuation-in-part of application No. 08/372,924, Jan. 17, 1995, abandoned.

[60] Provisional application No. 60/006,097, Oct. 31, 1995.

[51] **Int. Cl.⁷** **G06K 9/00**

[52] **U.S. Cl.** **382/103; 382/325; 710/129; 710/132**

[58] **Field of Search** **382/103, 107, 382/296, 307, 325; 395/800, 312, 309; 364/516; 348/149, 716; 701/1; 710/126, 129, 131, 132**

References Cited

U.S. PATENT DOCUMENTS

4,163,257	7/1979	White	358/133
4,187,519	2/1980	Vitols et al.	358/169
4,214,265	7/1980	Olesen	358/93
4,433,325	2/1984	Tanaka et al.	340/937
4,490,851	12/1984	Gerhart et al.	382/43
4,692,806	9/1987	Anderson et al.	358/209
4,839,648	6/1989	Beucher et al.	340/933
4,847,772	7/1989	Michalopoulos et al.	364/436
4,858,113	8/1989	Saccardi	395/312
4,908,874	3/1990	Gabriel	382/296
5,034,986	7/1991	Karmann et al.	382/1
5,062,056	10/1991	Lo et al.	364/516
5,161,107	11/1992	Mayeaux et al.	364/436

5,175,824	12/1992	Soderbery et al.	395/325
5,255,374	10/1993	Alderguia et al.	395/325
5,261,059	11/1993	Hedberg et al.	395/312
5,281,964	1/1994	Iida et al.	340/936
5,283,573	2/1994	Takatou et al.	340/937
5,313,295	5/1994	Taniguchi et al.	348/149
5,359,674	10/1994	van der Wal	382/41
5,586,227	12/1996	Kawana et al.	395/112
5,592,237	1/1997	Greenway et al.	348/716
5,717,871	2/1998	Hsieh et al.	395/312

FOREIGN PATENT DOCUMENTS

WO9411852 5/1994 WIPO G08G 1/015

OTHER PUBLICATIONS

English Language Abstract of WO 94/11852, Nov. 10, 1992.

Traitement Du Signal, vol. 9. No. 4, 1992 Maciej Orkisz: "Localisation D'Objets Mobiles Dans des Scenes Naturelles Filmees par Une Camera Fixe".

Two-Dimensional Vehicle Tracking using Video-Image Processing, Sep. 2, 1992, Yamamoto, Kuwahara and Misra (Presented at the 3rd Vehicle Navigation & Information Systems Conference, Oslo, Norway, Sep. 2-4, 1992.

International Search Report from corresponding PCT application PCT/US96/00022.

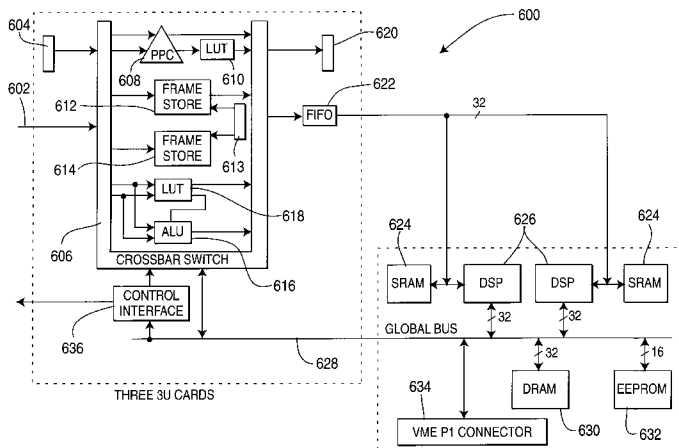
Hierarchical Model-Based Motion Estimation, Mar. 23, 1992, James R. Bergen et al., (appearing in Proc. of European Conference on Computer Vision-92).

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Attorney, Agent, or Firm—William J. Burke

[57] **ABSTRACT**

Apparatus for image processing a sequence of images containing a parallel-pipelined image processor comprised of image memories, a pyramid processing circuit, an arithmetic logic unit, a crossbar switch for video routing through the various components of the processor, signal processors to provide hardware programming through a global bus and also perform image processing operations. Images can be passed directly from the crossbar switch to internal static RAM of the signal processors through a first-in, first-out interface at full video rates.

26 Claims, 5 Drawing Sheets



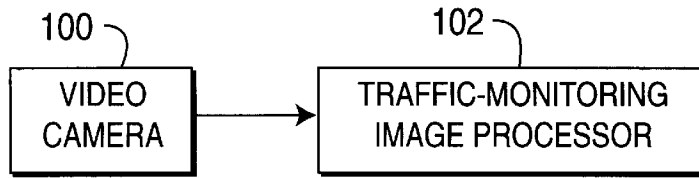


FIG. 1a

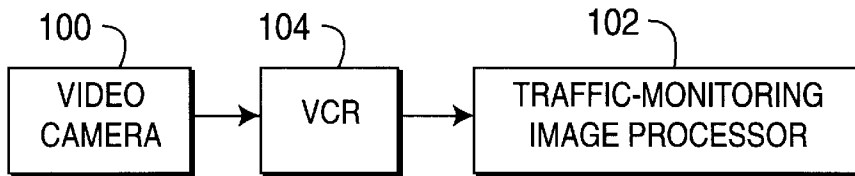


FIG. 1B

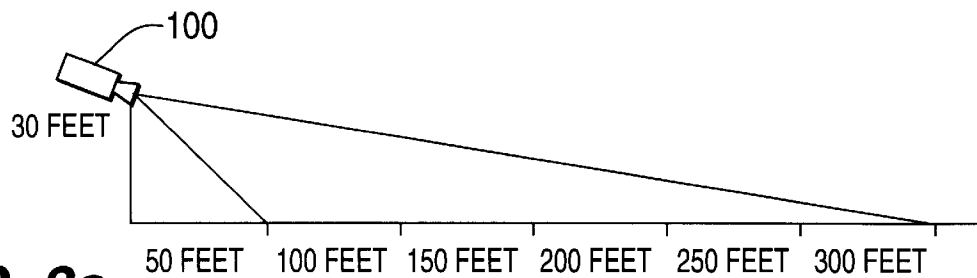


FIG. 2a

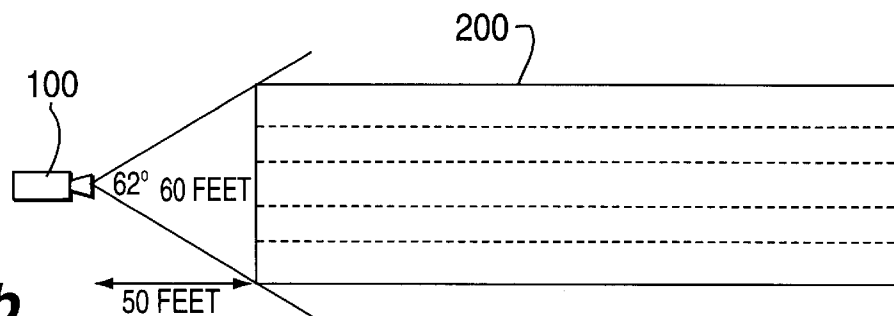


FIG. 2b

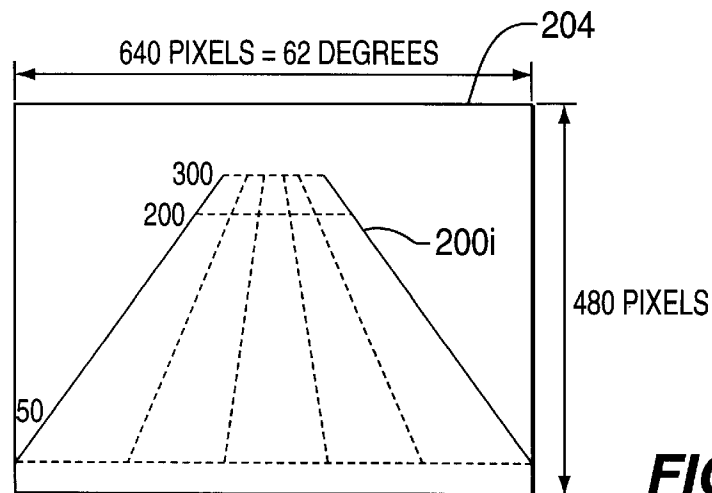


FIG. 2c

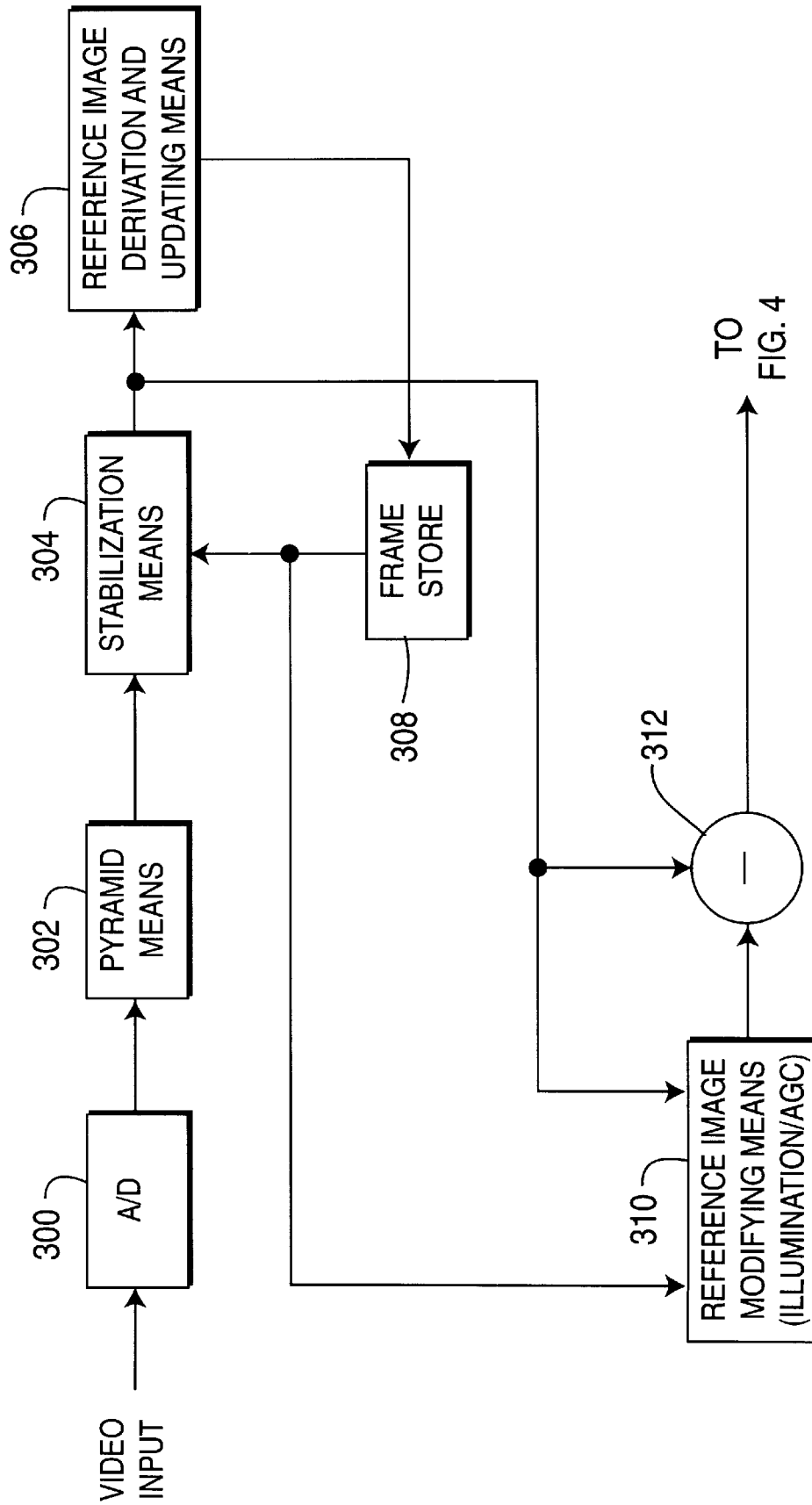


FIG. 3

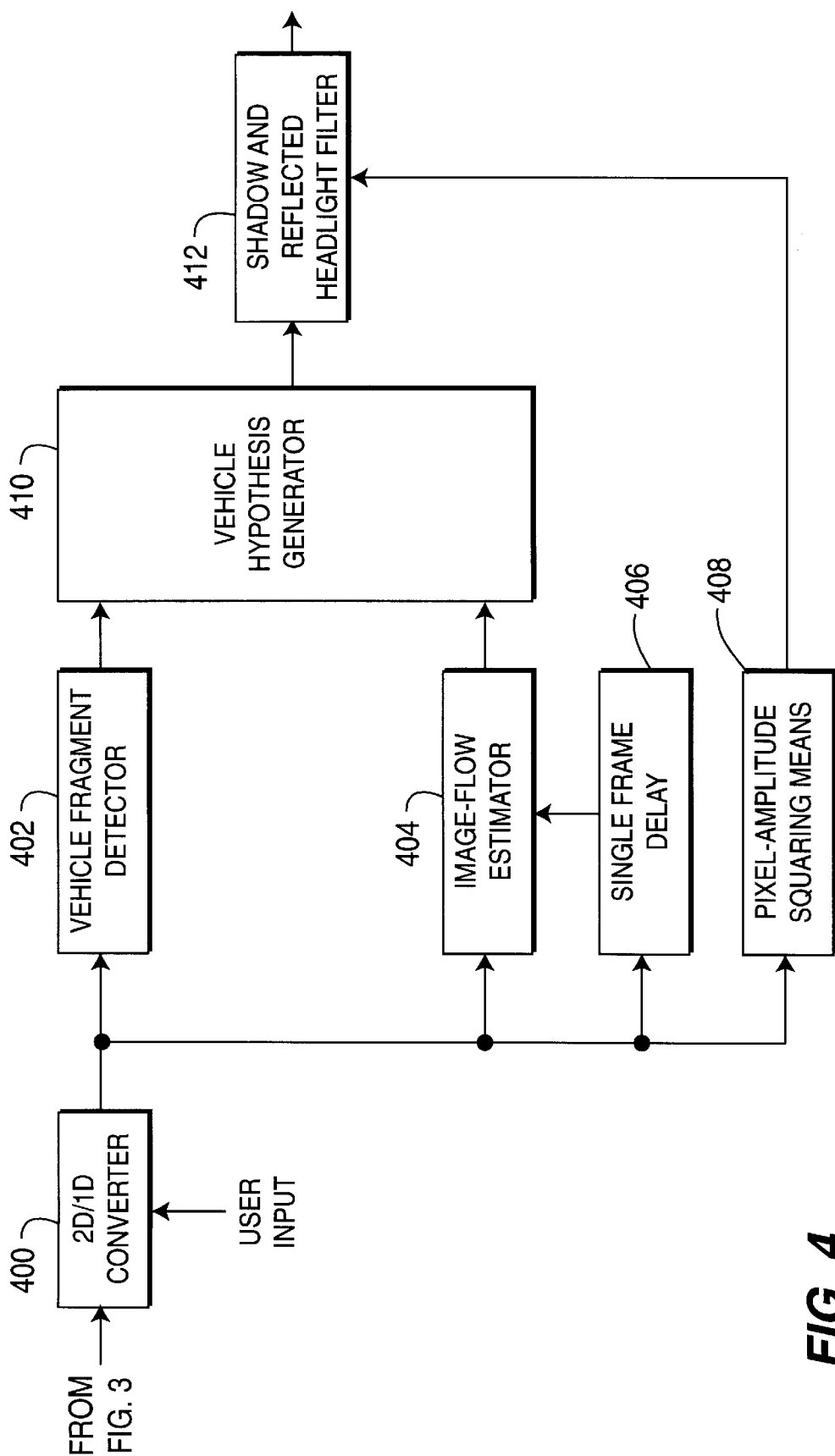


FIG. 4

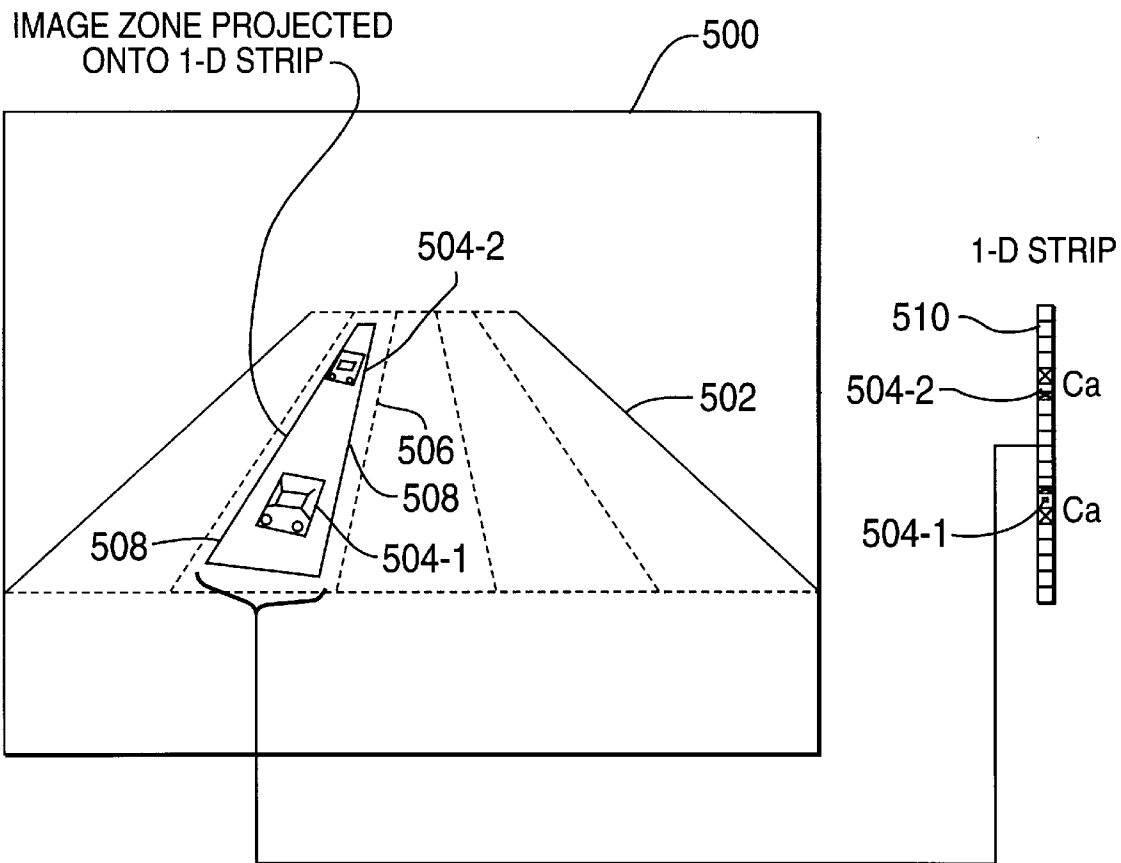


FIG. 5

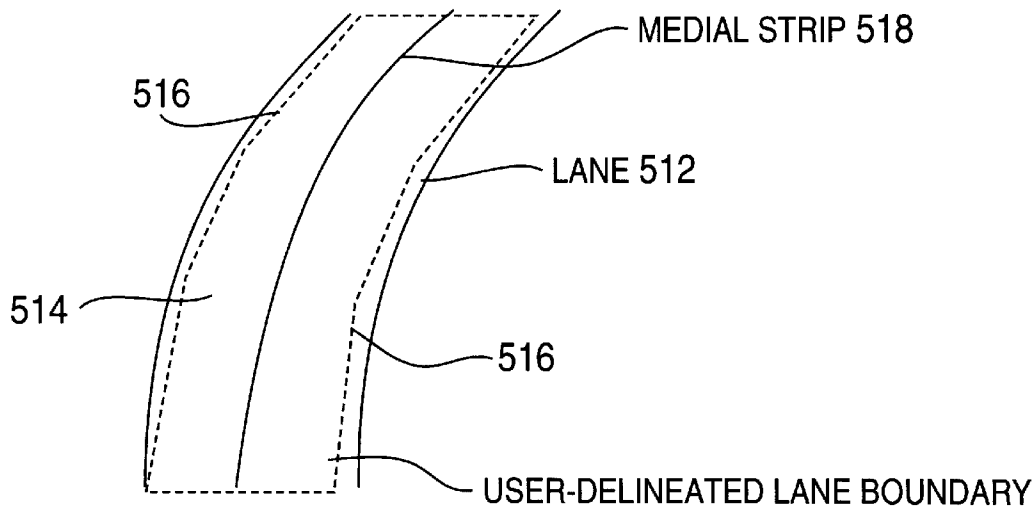


FIG. 5a

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