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(12) **United States Patent**
Pirim

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(54) **IMAGE PROCESSING METHOD**

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 528 days.
This patent is subject to a terminal dis-
claimer.

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Related U.S. Application Data

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Feb. 20, 2007, now Pat. No. 7,650,015, which is a
division of application No. 09/792,294, filed on Feb.
23, 2001, now Pat. No. 7,181,047, which is a
continuation-in-part of application No. 09/230,502,
filed on Sep. 13, 1999, now Pat. No. 6,486,909, which
is a continuation-in-part of application No.
PCT/EP98/05383, filed on Aug. 25, 1998, and a
continuation-in-part of application No.
PCT/FR97/01354, filed on Jul. 22, 1997.

(30) **Foreign Application Priority Data**

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G06K 9/00 (2006.01)

(52) **U.S. Cl.**
USPC **382/103**; 382/128; 382/168

(58) **Field of Classification Search**
USPC 382/100, 103, 107, 128-132, 168-180,
382/199-206, 224, 291
See application file for complete search history.

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(57) **ABSTRACT**

A method and apparatus for localizing an area in relative
movement and for determining the speed and direction
thereof in real time is disclosed. Each pixel of an image is
smoothed using its own time constant. A binary value corre-
sponding to the existence of a significant variation in the
amplitude of the smoothed pixel from the prior frame, and the
amplitude of the variation, are determined, and the time con-
stant for the pixel is updated. For each particular pixel, two
matrices are formed that include a subset of the pixels spa-
tially related to the particular pixel. The first matrix contains
the binary values of the subset of pixels. The second matrix
contains the amplitude of the variation of the subset of pixels.
In the first matrix, it is determined whether the pixels along an
oriented direction relative to the particular pixel have binary
values representative of significant variation, and, for such
pixels, it is determined in the second matrix whether the
amplitude of these pixels varies in a known manner indicating
movement in the oriented direction. In each of several
domains, histogram of the values in the first and second
matrices falling in such domain is formed. Using the histo-
grams, it is determined whether there is an area having the
characteristics of the particular domain. The domains include
luminance, hue, saturation, speed (V), oriented direction
(D1), time constant (CO), first axis (x(m)), and second axis
(y(m)).

13 Claims, 13 Drawing Sheets

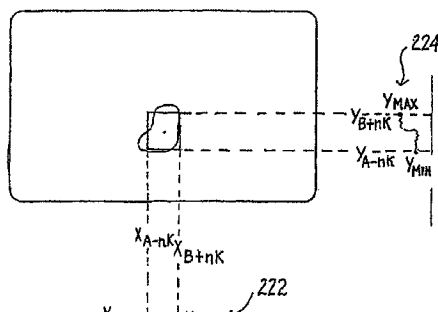


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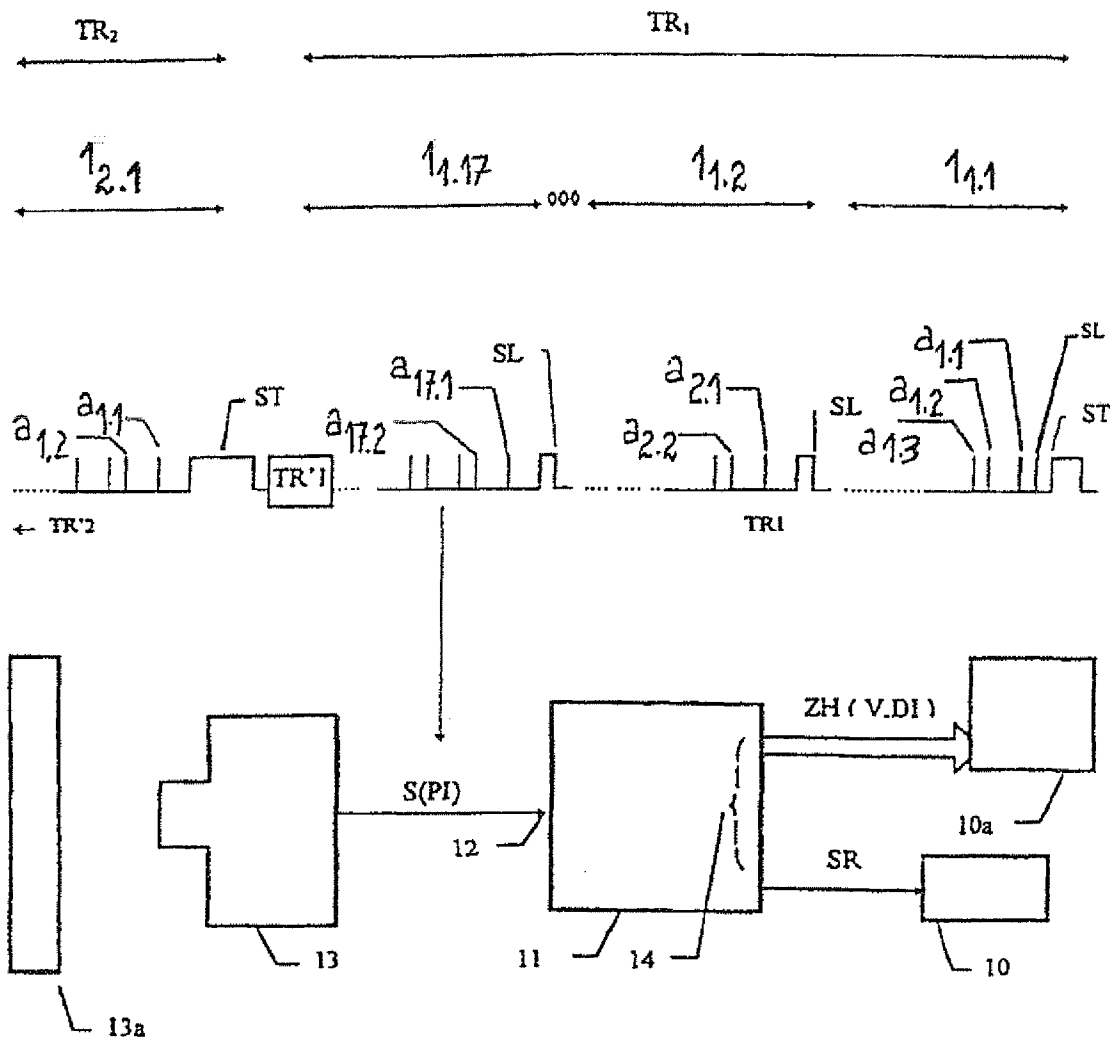


FIG. 1

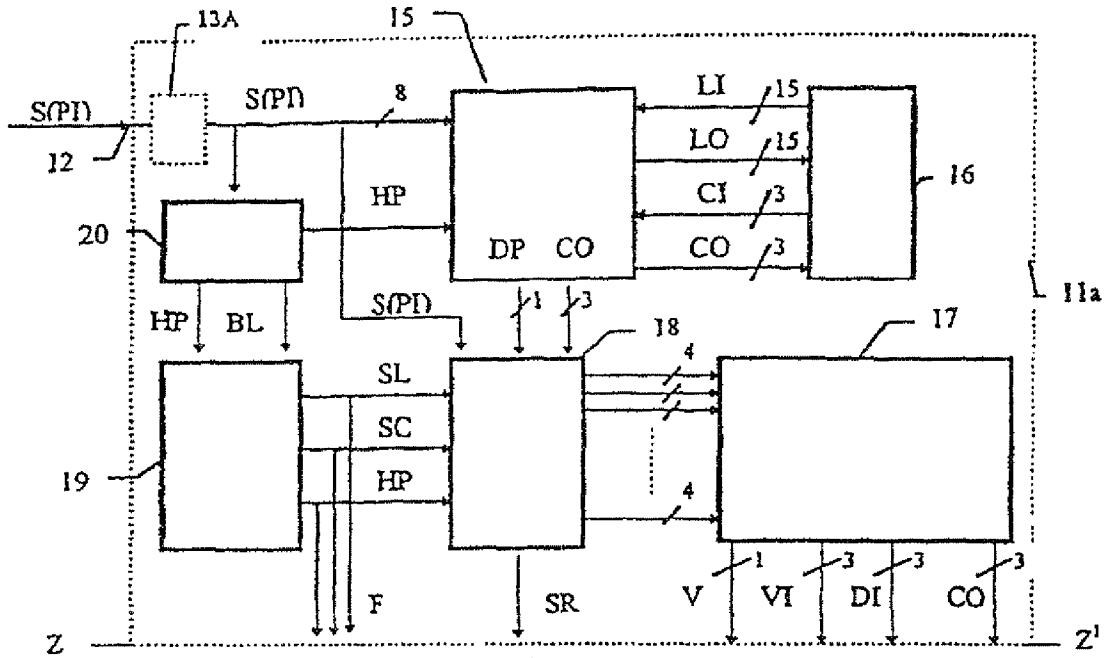


FIG. 2

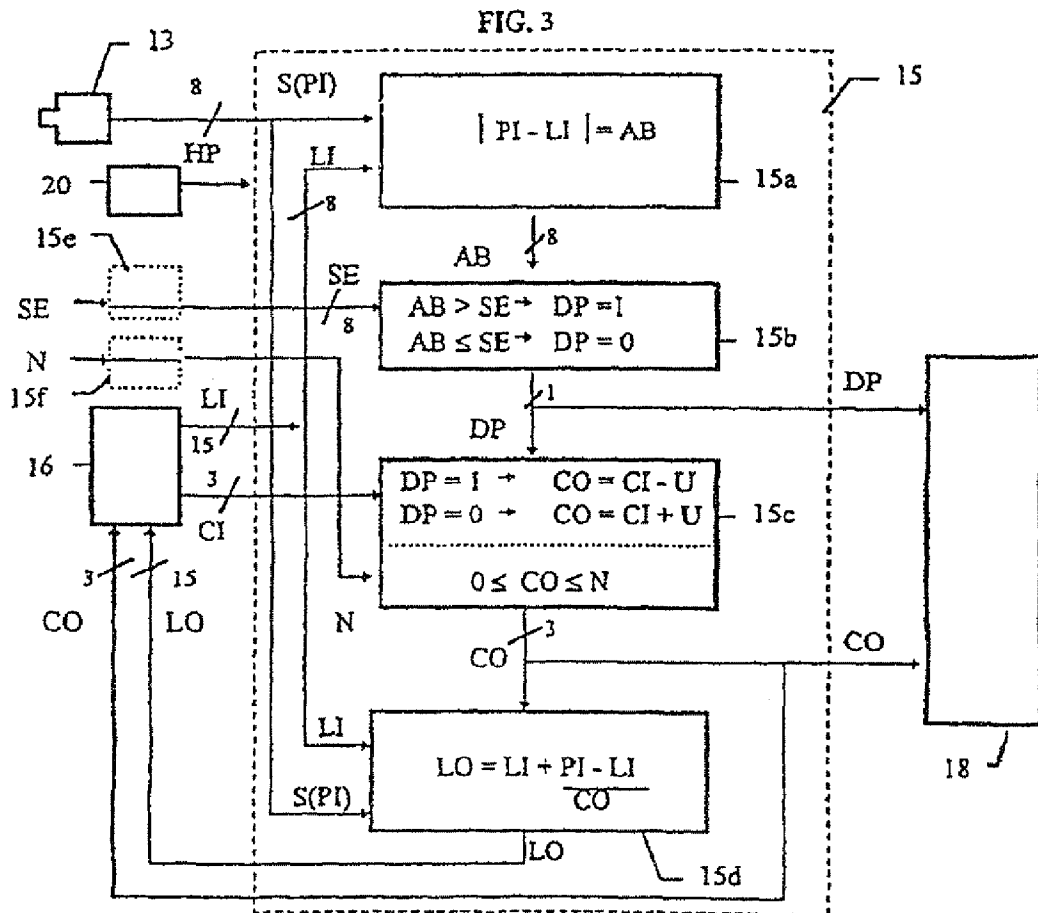


FIG. 3

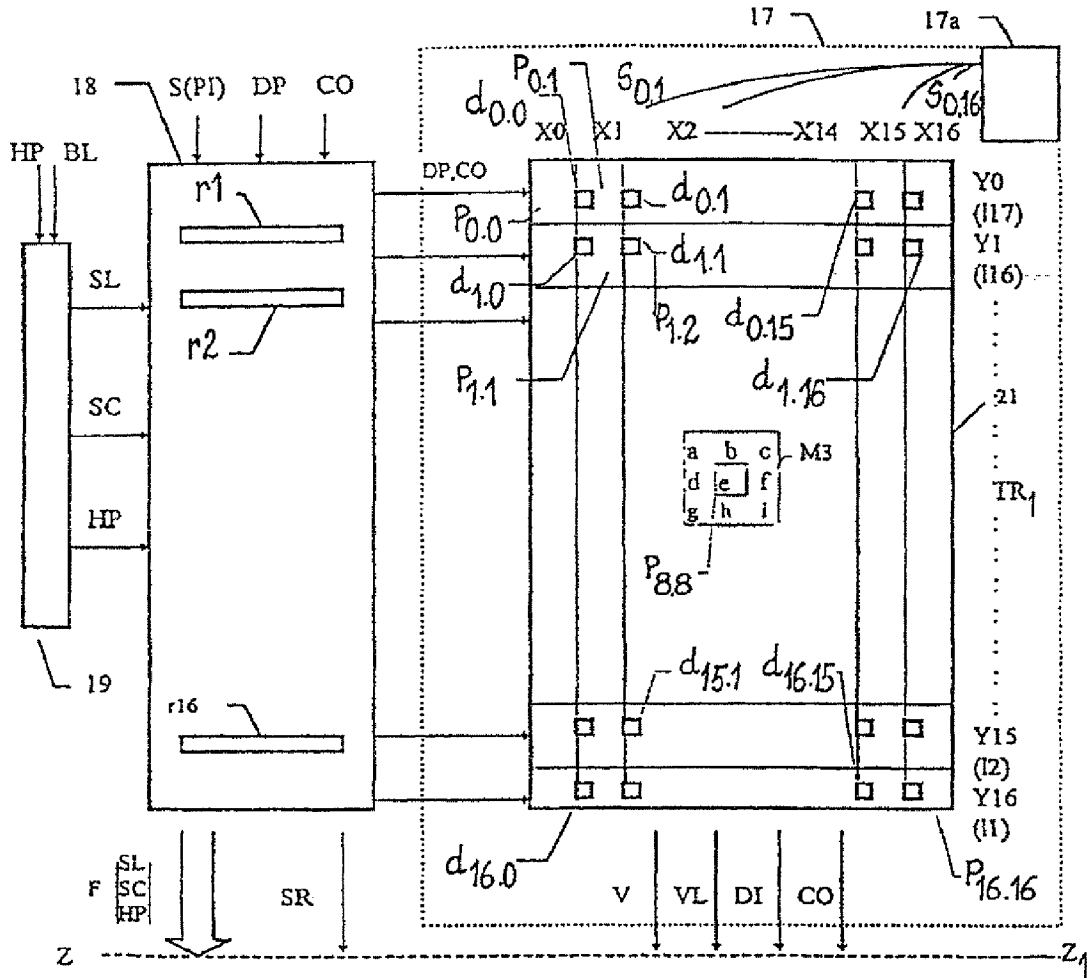


FIG. 4

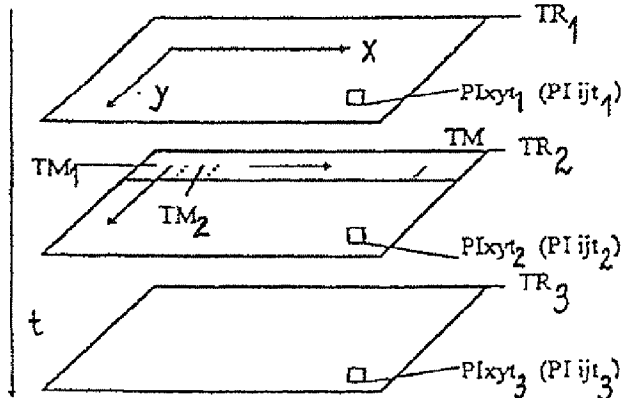


FIG. 5

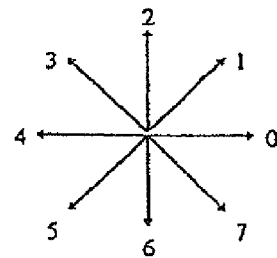


FIG. 6

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