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Hienerwadel et al.

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[54] **HYBRID ENCODER FOR VIDEO SIGNALS COMPRISING A MOTION ESTIMATOR AND AN INTER-INTRAFRAME ENCODING SELECTOR WHICH COMPRISE A COMMON CALCULATION MODULE**

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[21] Appl. No.: **333,485**

[22] Filed: **Apr. 5, 1989**

[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**[5] **H04N 7/12**

[52] **U.S. Cl.** **358/135**; 358/136; 358/105

[58] **Field of Search** 358/105, 135, 136, 134

[56] **References Cited**

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Assistant Examiner—Victor R. Kostak
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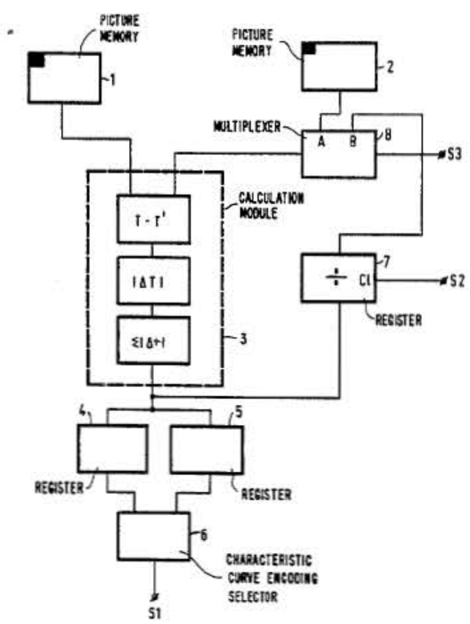
[57] **ABSTRACT**

A hydrid encoder for video pictures comprising a motion estimator, and an inter-intraframe encoding selector which comprise a common calculation module. Known hybrid encoders for transmitting video pictures comprise a motion estimator and an inter-intraframe encoding selector. Due to the required high processing rate the motion estimator and the inter-intraframe encoding selector must have a parallel processing structure which leads to quite a considerable number of components. To this end a calculation module is proposed which can be used in the motion estimator and in the inter-intraframe encoding selector. Use of this invention, for example in hybrid encoders for video telephone apparatus.

6 Claims, 3 Drawing Sheets



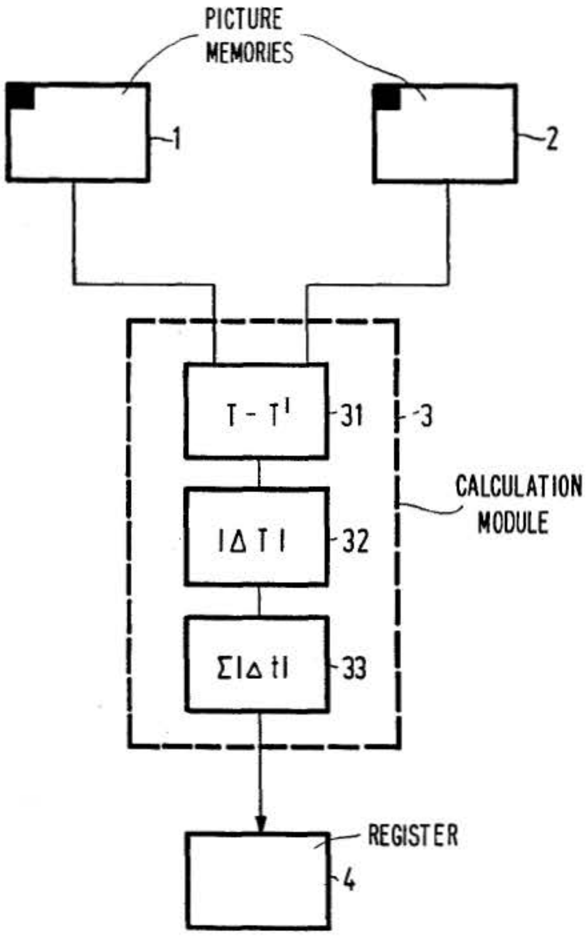

PICTURE
MEMORIES
1
2
T - T'
31
3
CALCULATION
MODULE
|Δ T |
32
Σ|Δ t|
33
REGISTER
4

FIG.1

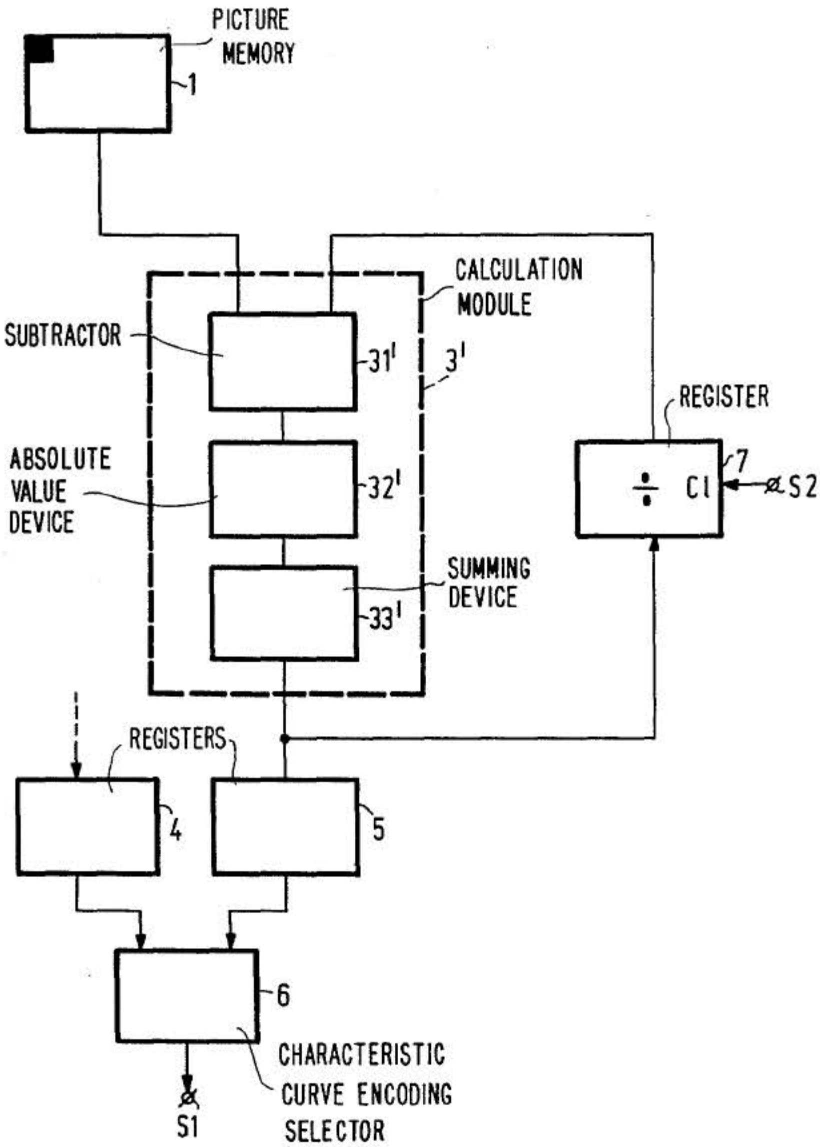

PICTURE MEMORY
1
CALCULATION MODULE
SUBTRACTOR
31'
3'
REGISTER
ABSOLUTE VALUE DEVICE
32'
7
÷ C1
S2
SUMMING DEVICE
33'
REGISTERS
4
5
6
CHARACTERISTIC CURVE ENCODING SELECTOR
S1

FIG.2

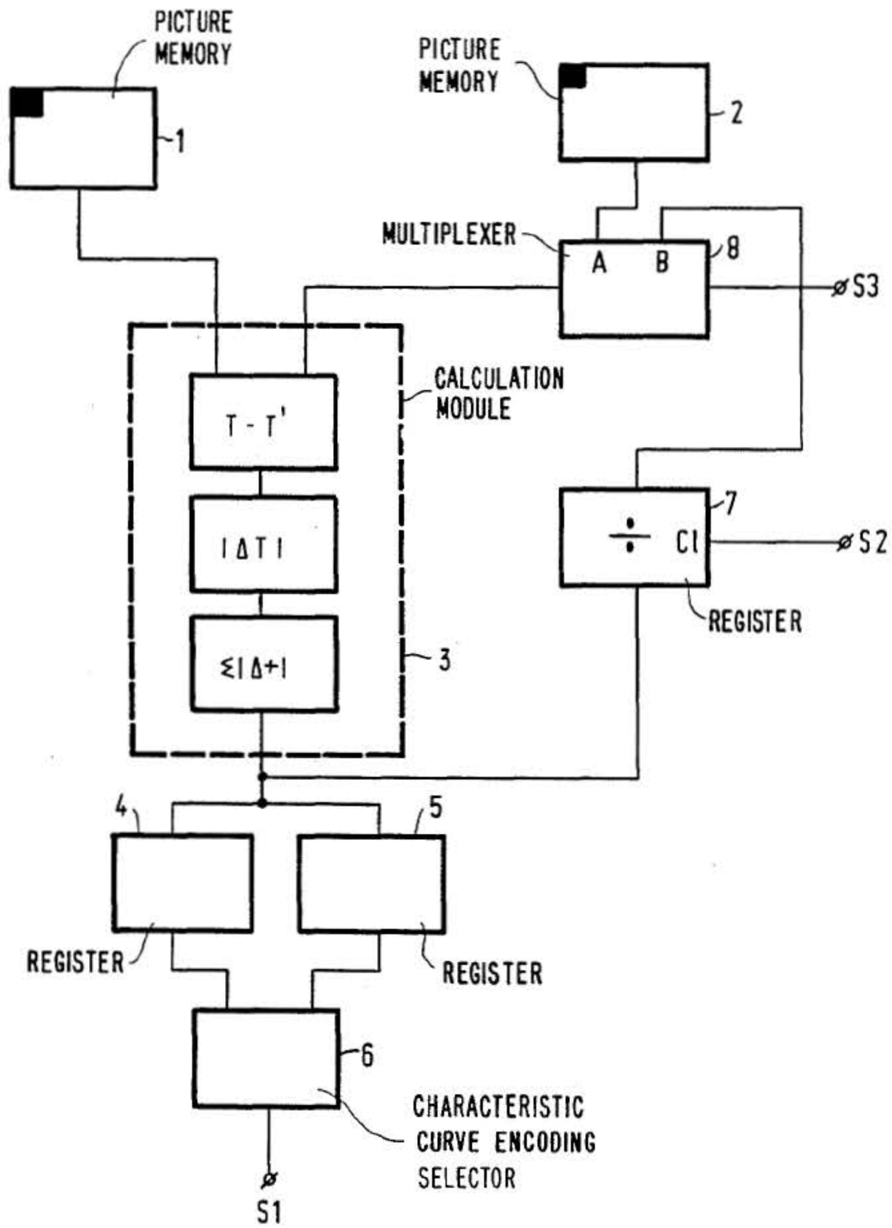

PICTURE MEMORY
1
PICTURE MEMORY
2
MULTIPLEXER
A
B
8
S3
CALCULATION MODULE
T - T'
| Δ T |
Σ| Δ+|
3
7
÷
Cl
S2
REGISTER
4
5
REGISTER
REGISTER
6
CHARACTERISTIC CURVE ENCODING SELECTOR
S1

FIG.3

HYBRID ENCODER FOR VIDEO SIGNALS COMPRISING A MOTION ESTIMATOR AND AN INTER-INTRAFRAME ENCODING SELECTOR WHICH COMPRISE A COMMON CALCULATION MODULE

BACKGROUND OF THE INVENTION

The invention relates to a hybrid encoder for video pictures in which neighboring pixels of a video picture are combined into sub-blocks, which encoder comprises a motion estimator and an inter-intraframe encoding selector.

A hybrid encoder of this type is known, for example from UPDATED SPECIFICATION FOR THE FLEXIBLE PROTOTYPE n×384 kbit/s VIDEO CODEC, CCITT SGXV, Working Party XV/1, Specialists Group on Coding for Visual Telephony, document #249, Jul. 1987. A hybrid encoder provides the possibility of encoding video data from a video data source into a signal having a low bit rate with a small loss of information. In this process two encoding principles, hence the name hybrid encoder, are used: the interframe principle and the intraframe principle.

In the interframe principle the correlation between time-sequential video pictures (this designation is used in this respect for frames and fields) is utilized. To this end the video data to be encoded are compared with prediction values and only the signal differences between these two signals are encoded and transmitted. The better the prediction values correspond to the video data to be encoded, the smaller the bit rate of the signal to be transmitted. In the intraframe principle the original contents of a video picture are transmitted while a bit rate reduction is achieved, for example by means of an adaptive quantizer.

Furthermore, it is known from the afore-mentioned publication that prediction values can be formed by means of a motion estimator. In video pictures with moving scenes successive video pictures have a comparable picture content. Some parts of the picture contents of two successive video pictures do not change at all (for example, a stationary background) while other parts of the picture contents in the actual picture only change their position with respect to the previous picture (for example, movements of a speaking person's mouth) and other parts are completely new as compared with the previous picture. If neither brightness nor colour content of a moved picture section change in the case of a movement, the position at which this picture section occurs in the subsequent video picture can be adequately characterized by means of a vector. Since the encoding of such a vector requires much fewer encoding data than the encoding of the entire picture section, the bit rate can be reduced in this manner.

To this end the video picture prior to the actual video picture is stored in a picture memory. A video picture is build up in the form of a matrix comprising a succession of pixels. Each pixel can be represented by three numerical values. The first numerical value is a measure of the brightness of the pixel (hereinafter referred to as luminance value). The second and third numerical values of a pixel represent the colour of the pixel (hereinafter referred to as chrominance value). The actual video picture is subdivided into a plurality of actual sub-blocks. To this end neighboring pixels of the video picture are joined to form each sub-block. A sub-block has, for example the size of eight by eight pixels and represents a section of the video picture. A plurality of previous sub-blocks located in the vicinity of an actual sub-block is selected by means of a search circuit from the previous video pictured stored in the picture memory. These previous sub-blocks are compared with the actual sub-block. The previous sub-block which is least distinguishable from the actual sub-block or which in the ideal case is identical to the actual sub-block is selected as a prediction value.

The transmission of the motion vector and the differences between the actual sub-block and previous sub-block selected as a prediction value only provides advantages if there is little distinction between the actual sub-block and the selected previous sub-block. With given picture contents it is more favorable under certain circumstances to transmit the entire actual sub-block. For this reason an inter-intraframe encoding selector checks which method is most favorable for transmitting the actual sub-block and it activates corresponding signal path switches.

Due to the required high processing rate, motion estimators and inter-intraframe encoding selectors should have a parallel processing structure with view to the currently available components, which leads to quite a considerable number of components.

SUMMARY OF THE INVENTION

The present invention has for its object to constitute a hybrid encoder of the type described in the opening paragraph in such a way that its structure is simplified.

In a hybrid encoder of the type described in the opening paragraph this object is solved in that the motion estimator and the inter-intraframe encoding selector have a common calculation module.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention will be described in greater detail with reference to the accompanying drawings in which

FIG. **1** shows a motion estimator

FIG. **2** shows an inter-intraframe encoding selector

FIG. **3** shows a combination of a motion estimator and an inter-intraframe encoding selector.

DETAILED DESCRIPTION OF THE INVENTION

The motion estimator and the inter-intraframe encoding selector form part of a hybrid encoder (not shown) for transmitting video pictures. The motion estimator determines, from previous sub-blocks of a previous video picture, a previous sub-block which among the previous sub-blocks available for selection is the best to be used as a prediction value for transmitting an actual sub-block. The inter-intraframe encoding selector decides whether the data quantity which is required for transmitting the actual sub-block by means of the selected previous sub-block serving as a prediction value, is less than the data quantity which is required for transmitting the actual sub-block as a whole.

The motion estimator shown in FIG. **1** comprises a first and a second picture memory **1**, **2**, a calculation module **3** and a minimum value register **4**. The calculation module **3** is composed of a subtractor **31**, a device **32** for forming an absolute value and a summing device **33**.

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