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# United States Patent [19]

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Keith

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## [54] MULTIPLYLESS DISCRETE COSINE TRANSFORM

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 [73] Assignee: Intel Corporation, Santa Clara, Calif.  
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 [51] Int. Cl.<sup>5</sup> ..... G06F 7/38  
 [52] U.S. Cl. .... 364/725  
 [58] Field of Search ..... 364/725, 726

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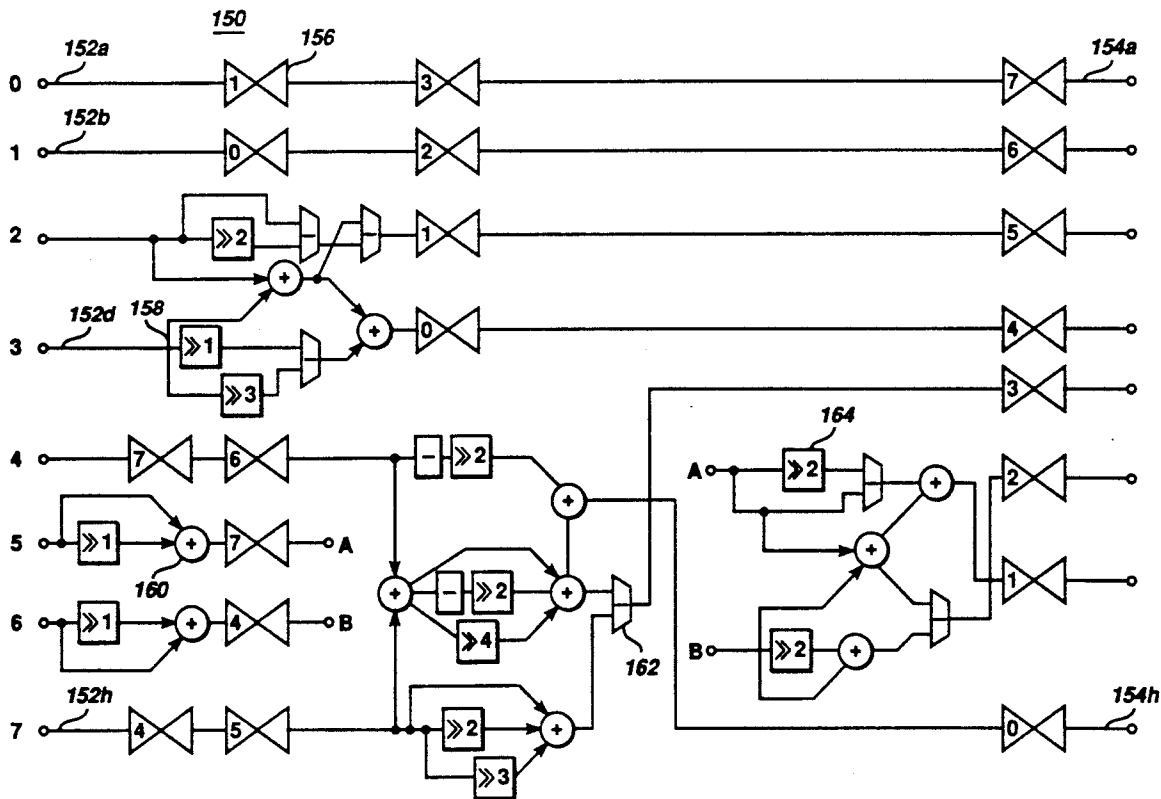
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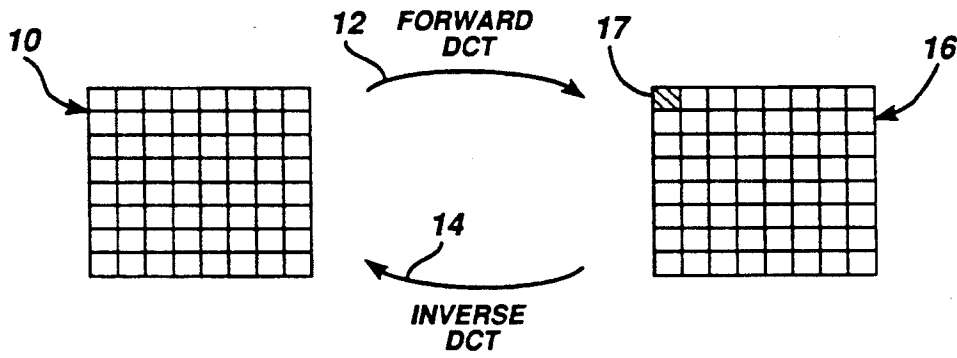
Primary Examiner—Tan V. Mai  
 Attorney, Agent, or Firm—Carl L. Silverman; James E. Jacobson; William H. Murray

## [57] ABSTRACT

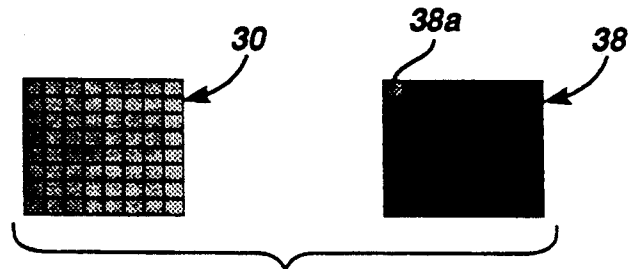
A method is disclosed for performing a discrete cosine transform on a transform input value wherein the discrete cosine transform has a plurality of predetermined transform coefficients. A number  $N_1$  of shift operations is determined independently of the transform input value in order to provide a set of  $N_1$  of shift operations. A number  $N_2$  of add operations is determined independently of the transform input value in order to provide a set of  $N_2$  add operations. The transform input value is operated upon only by the  $N_1$  shift operations and the  $N_2$  add operations to provide a discrete cosine transform output value without any multiplication. This method may be applied to both forward and inverse discrete cosine transforms. The transform coefficients are simplified coefficients which are provided by truncating and modifying prior art transform coefficients. This simplification is adapted to provide coefficients which require fewer than a predetermined number of shift and add operations in order to determine an approximation of the product which would result from a multiplication by the coefficient. The simplification of the coefficients causes degradation of a video image transformed using the simplified coefficients. Therefore the simplification is constrained to cause an acceptable amount of image degradation.

20 Claims, 5 Drawing Sheets

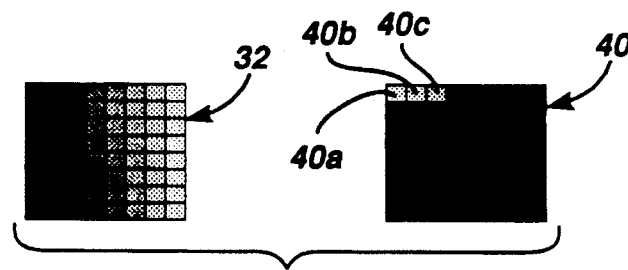




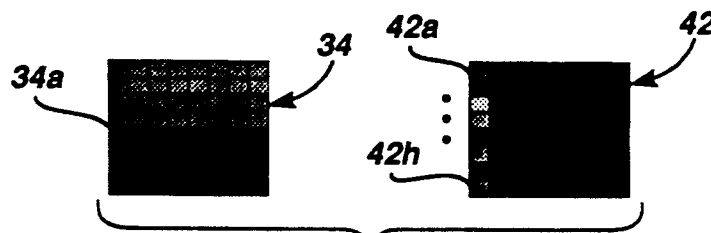
**FIG. 1**  
**Prior Art**



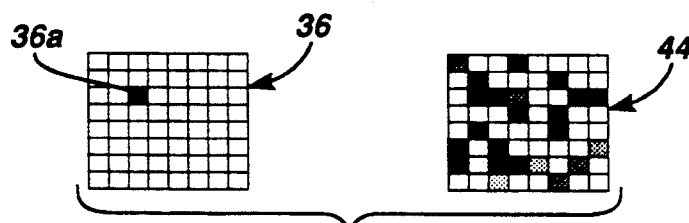
**FIG. 2A**  
**Prior Art**



**FIG. 2B**  
**Prior Art**



**FIG. 2C**  
**Prior Art**



**FIG. 2D**  
**Prior Art**

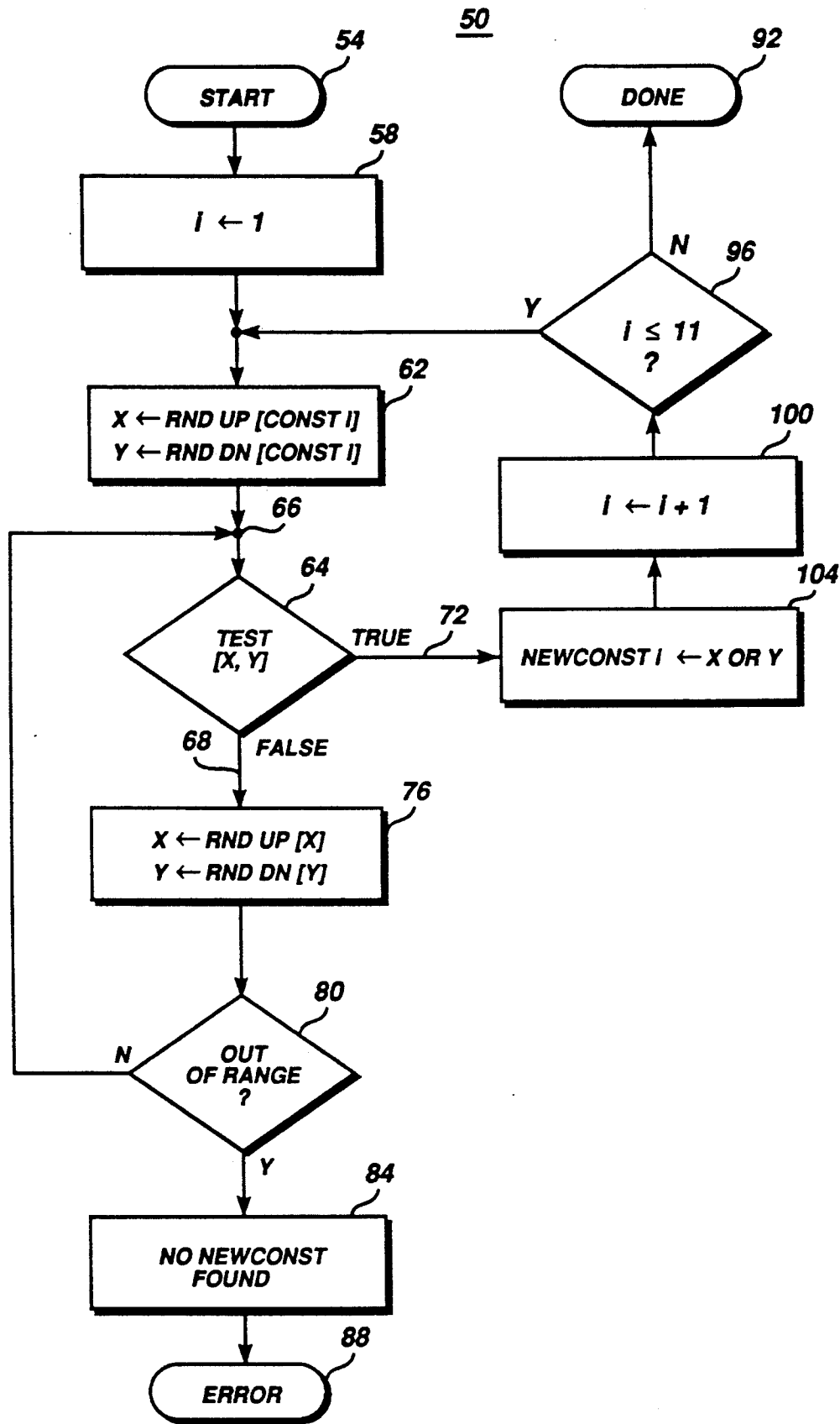


FIG. 3

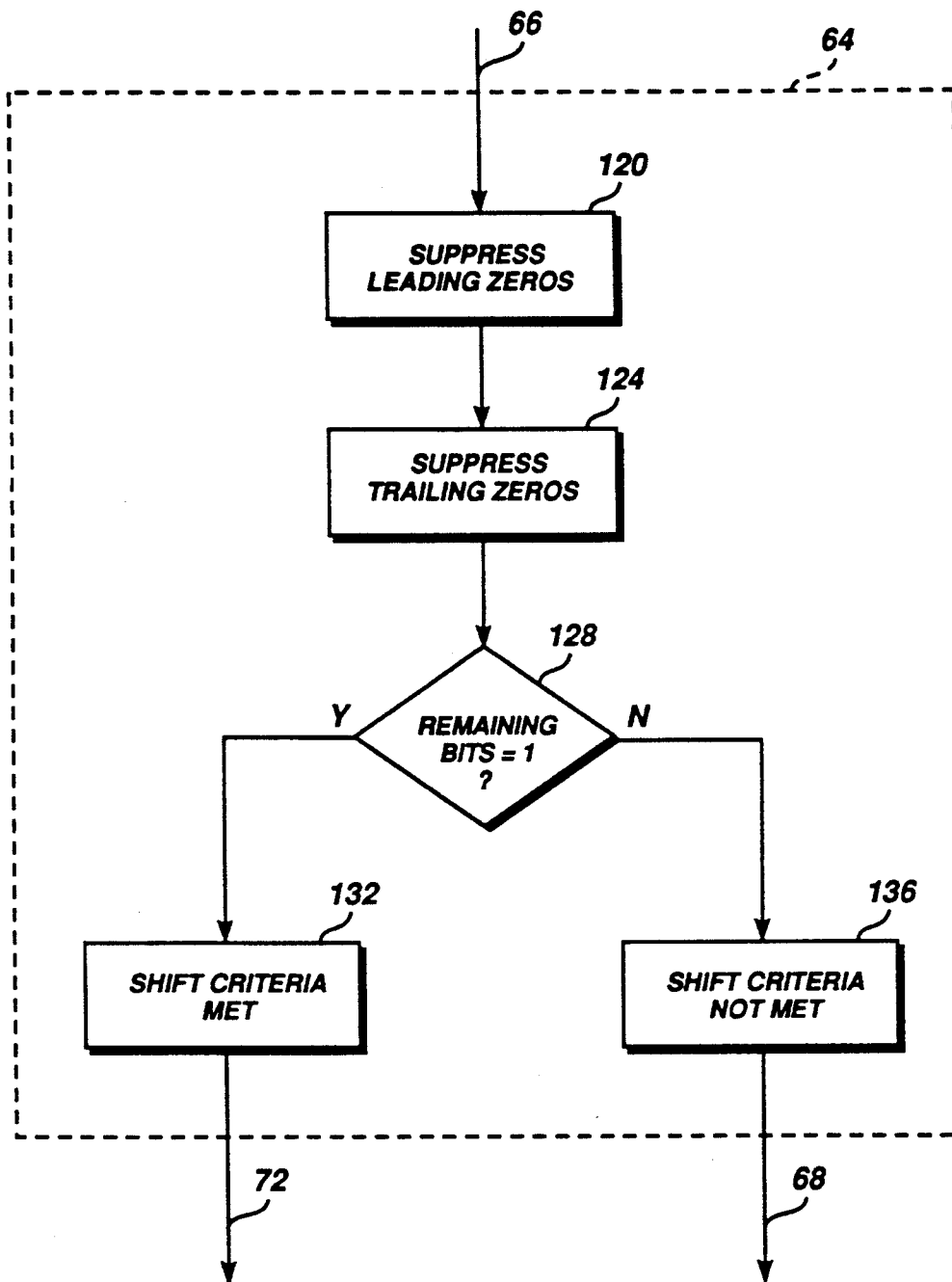


FIG. 4

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