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The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 18

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte PETER T. BARRETT

Appeal No. 1996-0485
Application No. 08/139,456[1]

ON BRIEF

Before KRASS, JERRY SMITH, and BARRY, Administrative Patent Judges.

BARRY, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on the appeal under 35 U.S.C. § 134 from the final rejection of claims 1-25. We reverse.

[1] The application was filed on October 20, 1993. According to the appellant, this application is a continuation of Application 07/823,249, which was filed on January 21, 1992 is now abandoned.

BACKGROUND

The invention at issue in this appeal displays a color image stored in a YUV color format on a raster scan display that generates video in a red, green, and blue (RGB) format. It begins by dithering, i.e., adding noise to, the Y, U, and V component bits of input image data to reduce the banding that will be caused by quantization. Next, the dithered data are quantized so that they are described with fewer bits.

The bits are then concatenated and used as an index into a color space mapping table. The mapping table converts the bits into color indices, which it outputs to a frame buffer. The buffer contains data used to display each pixel on the raster scan display. It is continuously read to generate values, each of which specifies a color index for one pixel of the display. Each color index is entered into a color look-up table, which outputs an RGB pixel signal. Digital-to-analog

converters transform the RGB pixel signals into analog red, green, and blue video signals, which display an image specified by the contents of the frame buffer on the raster scan display.

Claim 1, which is representative for our purposes, follows:

> 1. An apparatus for converting input image data specified in a YUV format into display image data specified as color index values which are mapped through an RGB color palette for display on a raster scan video display, where the input image data are sequentially received input pixels, each of said input pixels including Y component bits, U component bits, and V component bits, said apparatus comprising:
>
> means for adding noise to at least one of the Y component bits, the U component bits, and the V component bits of each of the input pixels, thereby generating a dithered input pixel comprising a first number of bits for said each of the input pixels;
>
> a means for quantizing each said dithered input pixel to generate a mapping look-up table index comprising a second number of bits, where the second number is less than the first number; and
>
> a mapping look-up table means for receiving each said mapping look-up table index and outputting a color index pair in response to each said mapping look-up table index, wherein the mapping look-up

table means includes storage locations, each of the storage locations stores a pair of color index values which map to horizontally contiguous pixels of the raster scan video display, and each said color index pair consists of one said pair of color index values.

Besides admitted prior art (Admission), the references relied on by the patent examiner in rejecting the claims follow:

Cook et al. (Cook)	4,897,806	Jan. 30, 1990
Sanders	4,991,122	Feb. 5, 1991
Deacon et al. (Deacon)	5,119,186	June 2, 1992.

Claims 1-4, 6-10, and 12-17 stand rejected under 35 U.S.C. § 103 as obvious over Admission in view of Deacon. Claims 18-20 and 22-25 stand rejected under § 103 as obvious over Admission in view of Deacon further in view of Sanders. Claims 5, 11, and 21 stand rejected under § 103 as obvious over Admission in view of Deacon further in view of Cook. Rather than repeat the arguments of the appellant or examiner in toto, we refer the reader to the briefs and the answer for the respective details thereof.

OPINION

In reaching our decision in this appeal, we considered the subject matter on appeal and the rejections and evidence advanced by the examiner. We also considered the arguments of

the appellant and examiner. After considering the record before us, we cannot say that the evidence and level of skill in the art would have suggested the invention of claims 1-25. Accordingly, we reverse.

We begin our consideration of the obviousness of the claims by recalling that in rejecting claims under 35 U.S.C. § 103, the patent examiner bears the initial burden of establishing a prima facie case of obviousness. A prima facie case is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art. If the examiner fails to establish a prima facie case, an obviousness rejection is improper and will be overturned. In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). With this in mind, we consider the obviousness of claims 1-21 and 22-25 seriatim.

Obviousness of Claims 1-21

In rejecting claims 1-21, the examiner has made the following assertion: “One way to reduce banding effect is to

add noise to the signal before quantizing (applicant admitted prior art, page 3, lines 20-25)." (First Rejection at 2-3.) For his part, the appellant "denies ... that the specification includes any admission that it is known to add noise to YUV-format image data before YUV-to-RGB conversion in the claimed context (or that Appellant has otherwise made such an admission)." (Reply Br. at 4.) The examiner deems that no response to this denial is necessary. (Paper 17.)

We cannot find that the references teach or would have suggested the means for adding noise of claims 1 and 8 or the step of adding noise of claim 16. Claims 1, 8, and 16 recite in pertinent part the following limitations:

> ... adding noise to at least one of the Y component bits, the U component bits, and the V component bits of each of the input pixels, thereby generating a dithered input pixel comprising a first number of bits for said each of the input pixels;
>
> ... quantizing each said dithered input pixel ....

In short, the claims specify dithering image data, which are in the YUV format, before quantizing the data.

The appellant's specification includes the following statements to which the examiner's rejection refers.

> A well known technique to reduce the effects of quantization is to add noise to the signal before quantizing. This technique is also known as dithering. This tends to make the transition from one step to the next less uniform and therefore less apparent to a viewer.
>
> This approach to dithering has not typically been applied to image quantization. In certain experimental systems, noise has been added to the RGB components before quantization. However, when enough noise is added to reduce the banding effect, the resulting color values often have significantly different spectral content and the resulting image has unacceptable color speckling. (Spec. at 3.)

In short, the appellant admits that it was known to dither image data, which are in the RGB format, before quantizing the data.

He does not admit, however, that it was known to dither image data, which is <u>in the YUV format</u>, before quantizing the data as claimed. He does not even admit that it was known to dither data at any point in a conversion of data from the YUV format to the RGB format. The examiner erred by misconstruing the scope of the admission. Neither the addition of Deacon,

Sanders, nor Cook cures the aforementioned defect of Admission. The examiner has not identified anything in these references or the prior art as a whole that would have suggested dithering image data in the YUV format before quantizing the data.

Also regarding claims 1-21, the appellant makes the following argument.

> [A]ssuming for the purposes of argument that Deacon's teaching is combined with that of the "admitted" prior art, such combined teaching would be to perform Deacon's color palette look-up operation (step 74 of Deacon's Fig. 13) on RGB display data after YUV-to-RGB conversion; not before YUV-to-RGB conversion as in the claims on appeal. (Appeal Br. at 15.)

In response, the examiner asserts, “it has been decided by the [U.S. Court of Customs and Patent Appeals] that the test for obviousness is not whether the features of one reference may be bodily incorporated into the structure of another, and proper inquiry should not be limited to the specific structure shown by the references, but should be into [sic] the concepts fairly contained therein.” (Examiner’s Answer at 7-8.)

We cannot find that the references teach or would have suggested the look-up operation of claims 1, 8, and 16. The claims recite in pertinent part "converting input image data specified in a YUV format into display image data specified as color index values which are mapped through an RGB color palette for display on a raster scan video display ...." Claims 1 and 8 each further recite in pertinent part "a mapping look-up table means for receiving each said mapping look-up table index and outputting a color index pair in response to each said mapping look-up table index ...." Similarly, claim 16 further recites in pertinent part "supplying the mapping look-up table index to a mapping look-up table, and selecting a first color palette index and a second color palette index stored in the mapping look-up table in response to the mapping look-up table index ...." In short, claims 1, 8, and 16 specify employing a look-up operation as part of converting data from the YUV format to the RGB format.

Deacon relates to enhancing images from a limited color palette. Col. 1, ll. 6-7. A microprocessor 18 stores an

image to be enhanced in an original image storage 20. Software running on the microprocessor averages RGB component values for pels of the image. The averaged pel values are then compared to find respective perceived colors stored in a look-up table 22 having RGB components most closely matching those of each respective averaged pel pair of the original image. Each of the perceived colors in the table 22 may be generated by displaying a unique corresponding pair of input palette color pels proximally to one another that will be "blended" by the eye and thus perceived as having a certain color. The input palette colors will be of a limited number. The various combinations of them produce a larger number of RGB components of net perceived colors, each being stored in the table 22 along with the pair of input palette colors defining the particular perceived color. Col. 8, ll. 12-31.

Under control of the microprocessor 18, when the perceived color in the table 22 has been found that has RGB components most closely matching those of two averaged pels from the original image that were proximal to one another, the two input palette colors producing the perceived color are

stored in a mapped image storage 24 to replace the two averaged pels from the original image. When the process has been repeated for every such averaged pair of the original image, the digital image data in the mapped image storage 24 is output to a monitor 38 for display. Id. at ll. 32-47.

In short, Deacon teaches employing a look-up operation to enhance RGB-formatted images. The original image data are specified in the RGB format. The data remain in the RGB format throughout the enhancement and the eventual display. Contrary to the claimed invention, the look-up operation does not operate on YUV-formatted data to convert the data from the YUV format to the RGB format. We appreciate the examiner's explanation that Deacon would have suggested combining its teaching of a look-up operation with the teachings of Admission "to provide an image which can be perceived as smoother and more uniform." (First Rejection at 3.) Because Deacon teaches employing a look-up operation to enhance RGB-formatted images, however, the reference would have suggested employing its teaching on RGB-formatted data after conversion from the YUV format. It would not have suggested employing

its teaching on YUV-formatted data during conversion to the RGB format as claimed. The examiner erred by misconstruing the scope of the suggestion. Neither the addition of Sanders nor Cook cures the aforementioned defect of Admission in view of Deacon. The examiner has not identified anything in these references or the prior art as a whole that would have suggested employing a look-up operation as part of converting data from the YUV format to the RGB format.

For the foregoing reasons, the examiner failed to show that the references teach or would have suggested the means for adding noise of claims 1 and 8 and their dependent claims 2-7 and 9-15, respectively. He also failed to show that the references teach or would have suggested the step of adding noise of claim 16 and its dependent claims 17-21. In addition, the examiner failed to show that the references teach or would have suggested the look-up operation of claims 1, 8, and 16 and their dependent claims 2-7, 9-15, and 17-21, respectively. Therefore, we find that the examiner's rejection does not amount to a prima facie case of obviousness. Because the examiner has not established a prima

facie case, the rejections of claims 1-4, 6-10, and 12-17 over Admission in view of Deacon, claims 18-20 over Admission in view of Deacon further in view of Sanders, and claims 5, 11, and 21 over Admission in view of Deacon further in view of Cook are improper. Therefore, we reverse the rejection of claims 1-21 under 35 U.S.C. § 103. Next, we consider the obviousness of claims 22-25.

Obviousness of Claims 22-25

Regarding claims 22-25, the appellant argues, “neither Deacon or Sanders teaches or suggests any method including the ... steps explicitly recited in claim 22 (and which thus also limit dependent claims 23-25) ....” (Appeal Br. at 19.) In response, the examiner opines as follows.

> One feature of the appellant's claimed invention is disclosed on page 6, lines 6-9, that "unlike conventional techniques, the difference between Y components is weighted much higher to take advantage of the human eyes' sensitivitive [sic] to intensity variation". This feature is also taught by Sander in col. 2, lines 52-68 and in col. 6, wherein different weighing systems can be used to assign different weight values to the Y component to take advantage of the human eyes sensitivitive [sic] toward luminance. Thus it would have been obvious to apply Sander teaching to assign higher weight

values to the Y component to obtain better image appearance. (Examiner's Answer at 10.)

We cannot find that the references teach or would have suggested the method for generating a mapping look-up table of claim 22. The claim recites the following limitations:

> A method for generating a mapping look-up table for use in converting image data specified in a YUV format into display image data specified in a RGB format for display on a raster scan video display, said method including the steps of:
>
> determining a luminance value Y" and chrominance values U" and V" for each RGB value of an RGB color palette for the display image data;
>
> generating an expanded YUV value, comprising bits Y', U', and V', for each mapping look-up table index of a set of mapping look-up table indices; and
>
> selecting as a first color palette index for said each mapping look-up table index, an index to the RGB value which corresponds to values Y_m", U_m", and V_m", wherein the values Y_m", U_m", and V_m" are determined by minimizing an error value E over all values Y", U", and V", to determine a minimum error E_m, where E is substantially equal to LA + MB + NC, where L, M, and N are weighting factors, A is the absolute value of Y" -Y', B is the absolute value of U" - U', C is the absolute value of V" - V', $E_m = LA_m + MB_m + NC_m$, where A_m is the absolute value of Y_m" - Y', B_m is the absolute value of U_m" - U', and C_m is the absolute value of V_m" - V'.

Sanders relates to assigning color values to picture display locations. Col. 2, ll. 12-14. A central processing unit (CPU) 16 stores a description of an image in a color pattern memory 18. A pattern corresponding to a color from the memory 18 is written into a frame buffer 20 at positions designated by the CPU 16. Col. 3, ll. 55-61.

Each of the buffer's memory locations was previously assigned a color value and a weight. The patterns in the memory 18 take into account these assignments to produce the desired color from the output of the buffer 20. The output is passed through a color decode and weighting circuit 22, which produces the desired colors by decoding the bit patterns in the buffer 20 according to their assigned color values. The bits are also weighted and combined to produce an average value so that a reduced image can be presented to a cathode ray tube display 24. Col. 3, l. 62 - col. 4, l. 2.

The examiner's rejection of claims 22-25 lacks meaningful analysis. He fails to map the exact and complete language of the claims to the disclosures of the references. In addition,

the examiner omits an explanation of how the combination of Admission in view of Deacon further in view of Sanders teaches or would have suggested each of the detailed steps as claimed. In particular, he has failed to show how the combination teaches or would have suggested determining the values Y_m", U_m", and V_m" by minimizing an error value E over all values Y", U", and V", to determine a minimum error E_m, where E is substantially equal to LA + MB + NC, where L, M, and N are weighting factors, A is the absolute value of Y" -Y', B is the absolute value of U" - U', C is the absolute value of V" - V', $E_m = LA_m + MB_m + NC_m$, where A_m is the absolute value of Y_m" - Y', B_m is the absolute value of U_m" - U', and C_m is the absolute value of V_m" - V' as claimed.

For the foregoing reasons, the examiner failed to show that the references teach or would have suggested the method for generating a mapping look-up table of claim 22 and its dependent claims 23-25. Therefore, we find that the examiner's rejection does not amount to a prima facie case of obviousness. Because the examiner has not established a prima facie case, the rejections of claims 22-25 over Admission in

view of Deacon further in view of Sanders is improper.

Therefore, we reverse the rejection of claims 22-25 under 35 U.S.C. § 103.

CONCLUSION

To summarize, the decision of the examiner to reject claims 1-25 under 35 U.S.C. § 103 is reversed.

REVERSED

ERROL A. KRASS Administrative Patent Judge	)	
JERRY SMITH Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
LANCE LEONARD BARRY Administrative Patent Judge	)	

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