Paper No. 22

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SHIYU GO

Appeal No. 1998-1895
Application No. 08/425,990

ON BRIEF

Before FLEMING, RUGGIERO, and BARRY, Administrative Patent Judges.

BARRY, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the rejection of claims 1-6, 8-10, 12-19, 26-33 and 79-86. We reverse.

BACKGROUND

The invention at issue in this appeal relates to compressive image encoding and decoding. Compression is essential to efficient storage and transmission of digitized

images. Compression methods have been described by the Joint Photographic Experts Group (JPEG) for still images and the Motion Picture Experts Group (MPEG) for moving images. The JPEG method involves a discrete cosine transform, followed by quantization and variable-length encoding. The MPEG method involves detecting motion vectors. Both methods require extensive computation, with the detection of motion vectors being particularly demanding.

The appellant's invention encodes a digitized image by detecting edges in the image, encoding the position and sharpness of the detected edges, filtering the image by a low-pass filter to generate a low-frequency image, and encoding the low-frequency image. A digitized image encoded in this way is reconstructed by generating a horizontal edge image and a vertical edge image from the encoded edge position and sharpness, synthesizing a pair of high-frequency images by filtering the horizontal and vertical edge images with an edge synthesis filter, decoding the low-frequency image, and performing an inverse wavelet transform on the decoded low - frequency image and the high frequency images. Synthesizing

the high-frequency images from the edge images enables high compression, without recourse to extensive computation.

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

> 1. A method of encoding and decoding a digitized image consisting of pixel values, comprising the steps of:
>
> detecting sharpness of edges in said digitized image;
>
> encoding position and sharpness values of edge points having sharpness values exceeding a certain threshold, thereby generating edge information;
>
> filtering said digitized image by a low-pass filter, thereby generating a low-frequency image;
>
> encoding said low-frequency image, thereby generating low-frequency information;
>
> sending said edge information and said low-frequency information to an input/output device;
>
> receiving said edge information and said low-frequency information from said input/output device;
>
> generating a horizontal edge image and a vertical edge image from said edge information;
>
> synthesizing a pair of high-frequency images by filtering said horizontal edge image and said vertical edge image with an edge synthesis filter;

decoding said low-frequency information, thereby obtaining a decoded low-frequency image; and

performing an inverse wavelet transform on said decoded low-frequency image and said pair of high-frequency images.

Besides the appellant's admitted prior art (AAPA), the references relied on in rejecting the claims follow:

Schreiber	3,035,121	May 15, 1962
Toriu et al. (Toriu)	4,908,872	Mar. 13, 1990
Ohsawa et al. (Ohsawa)	5,124,811	June 23, 1992
van der Wal	5,359,674	Oct. 25, 1994 filed Dec. 11, 1991
Carnahan	5,414,780	May 9, 1995 filed Jan. 27, 1993.

Claims 1-5, 15-19, 26, and 79 stand rejected under 35 U.S.C. § 103 as obvious over Schreiber in view of van der Wal further in view of Carnahan or AAPA. Claims 6 and 8 stand rejected under § 103 as obvious over Schreiber in view of van der Wal further in view of Carnahan or AAPA even further in view of Ohsawa. Claims 9, 10, 12-14, 27-33, and 80-86 stand rejected under § 103 as obvious over Schreiber in view of van der Wal

further in view of Carnahan or AAPA even further in view of Toriu. Rather than repeat the arguments of the appellant or examiner in toto, we refer the reader to the brief and answer for the respective details thereof.

OPINION

In deciding this appeal, we considered the subject matter on appeal and the rejection advanced by the examiner. Furthermore, we duly considered the arguments and evidence of the appellant and examiner. After considering the totality of the record, we are persuaded that the examiner erred in rejecting claims 1-6, 8-10, 12-19, 26-33, and 79-86. Accordingly, we reverse.

We begin by noting the following principles from In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993).

> In rejecting claims under 35 U.S.C. Section 103, the examiner bears the initial burden of presenting a prima facie case of obviousness. In re Oetiker, 977

> F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992).... "A prima facie case of obviousness 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." In re Bell, 991 F.2d 781, 782, 26 USPQ2d 1529, 1531 (Fed. Cir. 1993) (quoting In re Rinehart, 531 F.2d 1048, 1051, 189 USPQ 143, 147 (CCPA 1976)).

With these principles and finding in mind, we consider the examiner's rejections and appellant's argument.

The combination of references applied in each of the examiner's rejections includes the subcombination of Schreiber in view of van der Wal. Regarding the subcombination, the examiner asserts, "[i]t would have been obvious ... to use the pyramid filtering of van der Wal, since the system of van der Wal also applies to coding as noted in col. 20, lines 63-68, which is commonly used in subband image coding, because van der Wal further provides for image enhancement and noise reduction, and because both Schreiber and van der Wal obtain edge data." (Examiner's Answer at 5.) The appellant argues, "van der Wal would not lead an ordinarily skilled person to modify Schreiber ...." (Appeal Br. at 17.)

"Obviousness may not be established using hindsight or in view of the teachings or suggestions of the inventor." Para-Ordnance Mfg., 73 F.3d at 1087, 37 USPQ2d at 1239 (citing W.L. Gore & Assocs., Inc., 721 F.2d at 1551, 1553, 220 USPQ at 311, 312-13 (Fed. Cir. 1983)). "It is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." In re Fritch, 972 F.2d 1260, 1266, 23 USPQ2d 1780, 1784 (Fed. Cir. 1992) (citing In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984)). "[T]o establish obviousness based on a combination of the elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant." In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1316 (Fed. Cir. 2000) (citing In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998) and In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984)).

Here, the examiner fails to identify a sufficient suggestion to combine van der Wal with Schreiber. Schreiber teaches "bandwidth-reduction systems ...." Col. 1, l. 9. For its part, van der Wal discloses "multiresolution signal processing circuitry which has been simplified so that it may be implemented as a single IC. The circuitry includes a filter and is configured to accept input signals having imbedded
timing signals." Col. 2, ll. 50-54. Although van der Wal teaches that "[i]n this configuration, multiple signal processing circuits may be coupled in cascade to produce a multi-stage pyramid processing system", id. at ll. 58-60, the examiner fails to identify a sufficient suggestion to add the multi-stage pyramid processing system to the systems of Schreiber.

As aforementioned, the examiner relies only on certain lines in van der Wal for a suggestion to combine van der Wal with Schreiber. To put the lines in context, the full paragraph of the reference that contains the lines follows.

> FIG. 10 illustrates a configuration of two pyramid ICs, **1002** and **1004**, and two frame stores **1006** and **1008** as a reduce-expand pyramid module. This module may be used for encoding and decoding images for data reduction, image enhancement, noise reduction image merging and other image processing functions where it is desirable to reconstruct an image from a pyramid after some processing is performed on pyramid images.

Col. 20, l. 63 - col. 21, l. 2. In summary, the paragraph teaches that van der Wal's reduce-expand pyramid module is useful "where it is desirable to reconstruct an image from a pyramid after some processing is performed on pyramid images." There is no evidence, however, that Schreiber employs, let alone processes, such pyramid images such that it would be desirable to reconstruct an image from a pyramid.

Relying on AAPA as evidence that "wavelets provide for efficiency and high compression ratios" (Examiner's Answer at 6), on Carnahan to "demonstrate[] the commonality of using a wavelet transform in image coding" (id.), on Ohsawa to "provide[] for a series of low-pass filters in an encoding apparatus" and "for different cut-off frequencies" (id. at 8), and on Toriu "only ... as an example to show the commonality of a typical horizontal and vertical gradient operations" (id.

at 9), the examiner fails to allege, let alone show, that these references cure the deficiency of Schreiber and van der Wal. Because there is no evidence that van der Wal's reduce-expand pyramid module would have been desirable in Schreiber's systems, we are not persuaded that teachings from the prior art would have suggested the combination.

In addition, claims 1-6, 8-10, and 12-14 specify in pertinent part the following limitations: "synthesizing a pair of high-frequency images by filtering said horizontal edge image and said vertical edge image with an edge synthesis filter ... and performing an inverse wavelet transform on said decoded lowfrequency image and said pair of high-frequency images." Similarly, claims 26-33 specify in pertinent part the following limitations: "synthesizing a pair of high-frequency images by filtering said horizontal edge image horizontally with an edge synthesis filter, and filtering said vertical edge image vertically with said edge synthesis filter; ... performing an inverse wavelet transform on said high-frequency images and said low-frequency image, thereby obtaining said digitized image ...." Also similarly, claims

79-86 specify in pertinent part the following limitations: "synthesizing a pair of high-frequency images by filtering said pair of edge images with an edge synthesis filter; and an inverse wavelet transform processor, coupled to said up sampler and said edge synthesizer, for performing an inverse wavelet transform on said decoded low-frequency image and said pair of high-frequency images, thereby obtaining said digitized image." Accordingly, claims 1-6, 8-10, 12-14, 26-33, and 79-86 require performing an inverse wavelet transform on a pair of high-frequency images that were synthesized by filtering a pair of edge images with an edge synthesis filter.

The examiner fails to show a suggestion of the limitations in the prior art. He admits, "[n]either van der Wal nor Schreiber explicitly provide for an inverse wavelet transform on the low and high-frequency images ...." (Examiner's Answer at 5.) In terms of the AAPA, the appellant acknowledges "much interest in the wavelet transform as a means of obtaining high compression ratios with relatively modest amounts of computation." (Spec. at 1.) Although the AAPA also discloses

the performance of "[a]n inverse wavelet transform ... to obtain the original image" (id. at 2-3), the inverse transform is not performed on a pair of high-frequency images that were synthesized by filtering a pair of edge images with an edge synthesis filter. To the contrary, the AAPA's inverse wavelet transform is performed on inter alia high-frequency data resulting from a wavelet transform. The specific admission follows.

> Another prior-art wavelet encoding scheme employs a basic wavelet that is the first derivative of a smoothing filter (that is, the first derivative of a low-pass filtering function). This type of wavelet acts as a highpass filter. High-frequency information is obtained by detecting local peaks (local maxima of absolute values) in the result of the wavelet transform, which correspond to edges in the original image. The size and location of the peak values at a selected scale are encoded, along with a low-frequency image obtained by smoothing at the largest scale of the wavelet transform. Fairly high compression ratios can be obtained in this way.
>
> To reconstruct the original image from the encoded data, this prior-art method employs an algorithm derived from a mathematical procedure involving iterated projections in Hilbert space. Under ideal conditions, the projections converge toward a unique set of data that (i) have the required local peak values and (ii) are within the range of the wavelet transform operator. An inverse wavelet transform is then carried out on the converged data to obtain the original image.

(Id.)

Similarly, although Carnahan discloses an "[i]nverse image transformation circuit **64**", col. 12, l. 67, the circuit does not perform its inverse transformation on a pair of high-frequency images that were synthesized by filtering a pair of edge images with an edge synthesis filter. To the contrary, the reference's inverse transformation is performed on image data resulting from a wavelet transform. Specifically, "[i]nverse image transformation circuit **64** performs (recursively) the inverse operations performed by circuit **52**. In a preferred embodiment, circuit **64** has the same structure does [sic] circuit **52** except that each filter of circuit **64**'s analyzers ... generates an 'inverse' set of coefficients to the coefficients generated by the corresponding filter of circuit **52**. Each N×M image data block output from circuit **64** is a reconstructed version of a corresponding N×M image data block received by circuit **52**."
Col. 12, l. 67 - col. 13, l. 8.

Relying on Ohsawa and Toriu for the aforementioned reasons, the examiner fails to allege, let alone show, that either reference cures the deficiency of Schreiber, van der Wal, AAPA, and Carnahan. Because AAPA and Carnahan teach performing an inverse wavelet transform only on data resulting from a wavelet transform, we are not persuaded that teachings from the prior art would have suggested the limitations of "synthesizing a pair of high-frequency images by filtering said horizontal edge image and said vertical edge image with an edge synthesis filter ... and performing an inverse wavelet transform on said decoded lowfrequency image and said pair of high-frequency images"; "synthesizing a pair of high-frequency images by filtering said horizontal edge image horizontally with an edge synthesis filter, and filtering said vertical edge image vertically with said edge synthesis filter; ... performing an inverse wavelet transform on said high-frequency images and said low-frequency image, thereby obtaining said digitized image"; or "synthesizing a pair of high-frequency images by filtering said pair of edge images with an edge synthesis filter; and an inverse wavelet transform processor, coupled to said up sampler and said edge synthesizer, for

performing an inverse wavelet transform on said decoded low-frequency image and said pair of high-frequency images, thereby obtaining said digitized image." For the foregoing reasons, we reverse the rejection of claims 1-5, 15-19, 26, and 79 as obvious over Schreiber in view of van der Wal further in view of Carnahan or AAPA; the rejection of claims 6 and 8 as obvious over Schreiber in view of van der Wal further in view of Carnahan or AAPA even further in view of Ohsawa; and the rejection of claims 9, 10, 12-14, 27-33, and 80-86 as obvious over Schreiber in view of van der Wal further in view of Carnahan or AAPA even further in view of Toriu.

CONCLUSION

In summary, the rejection of claims 1-5, 15-19, 26, and 79 under 35 U.S.C. § 103 as obvious over Schreiber in view of van der Wal further in view of Carnahan or AAPA is reversed. The rejection of claims 6 and 8 under § 103 as obvious over Schreiber in view of van der Wal further in view of Carnahan or AAPA even further in view of Ohsawa is also reversed. In addition, the rejection of claims 9, 10, 12-14, 27-33, and 80-86 under § 103 as obvious over Schreiber in view of van der

Wal further in view of Carnahan or AAPA even further in view of Toriu is reversed.

REVERSED

MICHAEL R. FLEMING Administrative Patent Judge	)	
JOSEPH F. RUGGIERO Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
LANCE LEONARD BARRY Administrative Patent Judge	)	

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