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United States Court of Appeals for the Federal Circuit

01-1343

LIZARDTECH, INC.,

Plaintiff-Appellant,

v.

EARTH RESOURCE MAPPING, INC., and
EARTH RESOURCE MAPPING PTY LTD.,

Defendants-Appellees.

DECIDED: May 22, 2002

Before LOURIE, SCHALL, and GAJARSA, Circuit Judges.

SCHALL, Circuit Judge.

DECISION

LizardTech, Inc. (“LizardTech”) appeals the decision of the United States District Court for the Western District of Washington that granted the motion of Earth Resource Mapping, Inc., and Earth Resource Mapping Pty Ltd. (collectively, “ERM”) for summary judgment of non-infringement of U.S. Patent No. 5,710,835 (“the ‘835 patent”). The ‘835 patent is assigned to LizardTech. Because the court erred in construing the asserted claims of the ‘835 patent, we reverse and remand.

DISCUSSION

I.

This case relates to technology that enables the storage, retrieval, and display of large digital images. Essentially, large digital images contain copious data, which makes their storage and transmission, in computers and over media (such as wires or cables) in which the capacity to hold data is a scarce and valuable resource, a difficult and salient problem. One solution to this problem involves implementing a process, called a compression algorithm, which reduces the amount of data, and thus memory, required to represent the images, thereby facilitating their storage and transmission. ‘835 patent at col., ll. 59-60.

The ‘835 patent is directed to an improvement on a particular prior art compression algorithm based on the discrete wavelet transform (“DWT”). Id. at col. 1, ll. 48-53, col. 2, ll. 36-44. As defined in the ‘835 patent, the DWT is “[a] linear transformation . . . that maps a digital input signal to a collection of output sub-bands.” Id. at col. 3, ll. 64-67. The DWT transformation takes a piece of digital data from an image, runs it through a specific and complex algorithm, and turns it into multiple sub-images (called sub-bands, since each one contains a band of spatial frequencies). The sub-bands then are compressed (into less data) using another algorithm.^[1] In the DWT context, the first “transformation” step comprises running the data through mathematical “low pass” and “high-pass” frequency filters that generate four different subbands. Id. at col 5, ll. 3-36. There exists a reverse DWT decompression scheme that reconstructs the original (or at least close to the original) image from the compressed sub-bands. Id. at col. 1, ll. 41-53, col. 5, ll. 32-35.

In the prior art implementation of the algorithm, “the entire image data array is stored in computer main memory” while DWT compression is performed. Id. at col. 1, ll. 57-58. The problem with this compression scheme, as applied to very large images with a large amount of data, is that “the memory involved in performing a DWT” of the entire image is “prohibitive.” Id. at col. 1, ll. 60-61. Therefore, it is preferable to compute the DWT by dividing such a large digital image into subsections, called “tiles,” and then “computing the DWT in sections.” Id. at col. 1, ll. 66-67, col. 2, ll. 48-51. This “tiling” technique, though requiring less memory to perform the DWT compression of the images, creates imperfections, or “edge artifacts” in the images—visible upon decompression and viewing—at the edges between the tiles. Id. at col. 2, ll. 4-8.

LizardTech’s ‘835 patent, for purposes relevant to this appeal, claims a method for performing DWT-based compression on large images in subparts using a technique that minimizes the formation and appearance of such edge artifacts.^[2] First, the patent calls for breaking the large image (designated in the patent as $I(x,y)$) into “discrete tile image data subsets [designated as $T_{ij}(x,y)$] that, upon superposition, form the complete set of image data $I(x,y)$.” Id. at col. 2, ll. 48-51. In other words, the entire image $I(x,y)$ is broken up into separate pieces $T_{ij}(x,y)$ called “tiles” that, reassembled, would form the entire image. Then, the tiles are “successively input[] . . . in a selected sequence” into a DWT-based compression algorithm. Id. at col. 2, ll. 53-54. Without more, this process would be identical to the prior art DWT tiling solution described above and would accordingly suffer from the attendant “seam” and “edge artifact” problems. However, the patent seeks to mitigate these problems, which occur at the juncture of tiles, by accounting for the DWT calculations from previous tiles in performing the DWT algorithm on the present tile. That is, the result of the DWT process for tile 2 may depend not only on the particular data input from the area of the image covered by tile 2, but also the results (which include outputs called “DWT coefficients”) of the DWT calculation from neighboring tile 1. More specifically, the patent calls for storing the previous DWT coefficients (part of the output of a DWT calculation) in the accessible portion of the computer memory for use in performing DWT on ensuing tiles and then ultimately transferring that data to a more permanent memory. Id. at col. 2, ll. 45-60. Before being transferred (or “dumped”) into secondary memory, the coefficients are compressed periodically. Id. at

col. 8, ll. 5-9.

Claim 1 of the '835 patent, which the parties have agreed is a representative claim for purposes of infringement, reads, with emphasis added, as follows:

A method for selectively viewing areas of an image at multiple resolutions in a computer having a primary memory for data processing and a secondary memory for data storage, the method comprising the steps of:

storing a complete set of image data array $I(x,y)$ representing said image in a first secondary memory of said computer;

defining a plurality of discrete **tile image data** $T_{ij}(x,y)$ subsets, where said complete set of image data $I(x,y)$ is formed by superposition of said discrete tile image data $T_{ij}(x,y)$;

performing one or more discrete wavelet transformation (DWT)-based compression processes on each said tile image data $T_{ij}(x,y)$ **in a selected sequence** to output each said discrete tile image data $T_{ij}(x,y)$ as a succession of DWT coefficients in a succession of subband sets, where one subband of each set is a low-resolution representation of said discrete tile image data $T_{ij}(x,y)$ to form a sequence of low resolution representations of said image data array $I(x,y)$ to selected resolutions;

maintaining updated sums of said DWT coefficients from said discrete tile image $T_{ij}(x,y)$ to form a seamless DWT of said image and storing said sums in a first primary memory location of said computer;

periodically compressing said sums and transferring said compressed sums to a second secondary memory to maintain sufficient memory in said primary memory for data processing, wherein said secondary memory contains stored DWT wavelet coefficients;

selecting a viewing set of said image data array $I(x,y)$ to be viewed at a desired resolution; and

forming from said subset of said stored DWT wavelet coefficients a computer display of said viewing set of said image data at said desired resolution.

'835 patent at col. 11, ll. 33-62.

II.

On October 6, 1999, LizardTech filed suit against ERM, alleging infringement of the '835 patent, copyright infringement, breach of contract, false designation of origin, false description, and common law trademark infringement. Specifically, LizardTech contended that ERM's geospatial imaging software product, called ER Mapper, infringed various claims of the '835 patent. The accused ER Mapper breaks large digital images into subparts and performs DWT. The image subparts used in

the ER Mapper each comprise a single row of pixels.

In due course, ERM filed a motion for summary judgment of non-infringement. ERM argued that a row of pixels is not a “tile” as defined by the ‘835 patent, so that the accused ER Mapper does not perform the required step of “defining a plurality of discrete **tile** image data . . . subsets where said complete set of image data . . . is formed by superposition of said discrete tile image data.” ‘835 patent at col. 11, ll. 40-42.

On December 12, 2000, the district court issued an order construing the term “tile” in the ‘835 patent claims and granting ERM’s motion for summary judgment. See *LizardTech, Inc. v. Earth Resource Mapping, Inc.*, No. C99-1602C, slip op. at 1 (W.D. Wash. Dec. 12, 2000). The court construed the term “tile” as not including a row of pixels, which are the image subparts used in the ER Mapper. It based this construction on a passage from the specification that references “the four corners of a tile” and then sets forth equations for calculating the coordinates of those corners. ‘835 patent at col. 6, ll. 35-39. Since a single row of pixels would have only two different coordinates (wherein the upper-left and lower-left “corners” would share the same coordinate, as would the upper-right and lower-right “corners”), and the court was “not persuaded that where there are only two different coordinates, there are somehow four corners,” it construed the claim term “tile” to require four distinct coordinates defining the four corners of the tile. Slip. op. at 5. The court reasoned that this construction comported with the plain meaning of the word “tile,” which was “not reconcilable with a line, and thus a row of pixels.” Id. at 6. Based on its claim construction, the court held that the accused ER Mapper, which “reads in one pixel row of data at a time, for every image upon which the process may be used,” did not literally define “tiles” or infringe the ‘835 patent. Id. The court also determined that summary judgment of non-infringement under the doctrine of equivalents was appropriate, since inputting one pixel row into the DWT algorithm, as in the ER Mapper, “is not the substantial equivalent of the plaintiff’s process.” Id. at 7.

After the district court issued a certification pursuant to Fed. R. Civ. P. 54(b), LizardTech filed a timely appeal of the judgment of non-infringement. We have jurisdiction pursuant to 28 U.S.C. § 1295(a)(1).

III.

Summary judgment is properly granted when “there is no genuine issue as to any material fact and . . . the moving party is entitled to a judgment as a matter of law.” Fed. R. Civ. P. 56(c); Chiuminatta Concrete Concepts, Inc. v. Cardinal Indus., Inc., 145 F.3d 1303, 1307, 46 USPQ2d 1752, 1755 (Fed. Cir. 1998). We review a grant of summary judgment de novo, applying this standard anew, making all reasonable inferences in favor of the non-movant, in this case LizardTech. See Zodiac Pool Care, Inc. v. Hoffinger Indus., Inc., 206 F.3d 1408, 1416, 54 USPQ2d 1141, 1146 (Fed. Cir. 2000).

Our review of the district court’s summary judgment of non-infringement involves two steps. First, we construe the language in the asserted claims, without deference to the interpretation below, to determine their proper scope. Cybor Corp. v. FAS Techs., Inc., 138 F.3d 1448, 1456, 46 USPQ2d 1169, 1174 (Fed. Cir. 1998). Second, we compare the properly construed claims to the accused process. Kahn v. General Motors Corp., 135 F.3d 1472, 1476, 45 USPQ2d 1608, 1610 (Fed. Cir. 1998). Therefore, we affirm a district court’s summary judgment of non-infringement only if, “after viewing the alleged facts in the light most favorable to the non-movant, there is no genuine issue whether the accused device is encompassed by the claims.” Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1304, 51 USPQ2d 1161, 1165 (Fed. Cir. 1999).

We begin with the construction of the claim term “tile,” which the district court interpreted to exclude a single row of pixels on the basis of the language in the specification referring to “four corners” and the word’s plain and ordinary meaning. Slip. op. at 5-6. On appeal, LizardTech asserts that the district court erred in its claim construction by 1) misinterpreting the crucial portion of the specification relating to the definition of a tile and 2) improperly applying the ordinary meaning of the word tile from the inapposite realms of roofs and bathroom floors to the arena of complex computer algorithms. For its part, ERM submits that the district court properly rejected LizardTech’s construction of the term that embraced a single row of pixels as unsupported by the specification and contrary to the ordinary meaning of the word “tile.” We agree with LizardTech, for our analysis of the specification and the claim language, viewed in the context of the invention as a whole and through the lens of one skilled in the relevant art, reveals that the claim term “tile” does not exclude a single row of pixels.

The portion of the specification relating to the definition of a tile includes the disclosure that “the four corners of a tile are given by” the following equations:

$$t_{00,ij} = iW_t$$

$$t_{01,ij} = \min((i+1)W_{t-1}, W_{i-1})$$

$$t_{10,ij} = jH_t$$

$$t_{11,ij} = \min((j+1)H_{t-1}, H_{i-1}).$$

‘835 patent at col. 6, ll. 35-39. In the foregoing set of equations, the first equation defines the left boundary of the tile; the second defines the right boundary; the third defines the upper boundary; and the fourth defines the bottom boundary. LizardTech asserts, and ERM admits, that the equations permit a solution in which the top and bottom boundary have identical values, such that the equations would define a single row of pixels. Accordingly, LizardTech submits that far from precluding a construction of the claim term tile as encompassing a single row of pixels, the specification, as viewed by one skilled in the art, is fully consistent with tiles of varying heights, including a single row.^[3]

ERM responds to this argument by contending that an interpretation of a tile as including a single row, with only two unique coordinates, would conflict with the specification’s description of “the four corners of a tile.” 835 patent at col. 6, ll. 35. Simply put, a “corner” is defined as “the meeting place of two converging lines,” while the solutions to the equations for a single row tile are the two endpoints of the row, and thus not “corners” at all. Webster’s Ninth New Collegiate Dictionary (1988). In other words, ERM argues that the specification’s allusion to the “four corners” of a tile requires that the tiles defined therein contain four distinct coordinates with four distinct boundaries. We disagree.

The reading of the specification urged by ERM and adopted by the district court is at odds with a contextual reading of the specification by one skilled in the art that would account for both the significance of the equations and the purpose of the disclosed invention. We think the district court’s reliance on the specification’s use of a single word—“corner”—impermissibly infused the particular form or shape of a tile with an importance that the equations belie. See Seal-Flex, Inc. v. Athletic Track & Court Constr., 172 F.3d 836, 844-45, 50 USPQ 1225, 1230 (Fed. Cir. 1999) (rejecting an argument

that attempted to construe a claim on the basis of a single passage without regard to the context of the rest of the specification or claimed invention). There is no dispute that the equations that immediately follow the specification's reference to the "four corners" of a tile permit a solution in which a tile comprises a single row of pixels. Further, in the context of the claimed invention, the definition of the term "tile" is pertinent to a "tiling" technique for dividing a large image into subparts that form the entire image when superposed. In addition, the superposition of tiles may form the entire image irrespective of whether they contain one, two, or more rows of pixels. '835 patent at col. 11, ll. 41-43. The exclusion of one row of pixels from the definition of the term "tile," absent a demonstration that image subparts with such a shape modify the nature of the claimed invention, improperly elevates the technical meaning of a single word ("corner") used in the specification over the substance of the equations defining the tile and the purpose of the invention.[4]

Finally, we part company with the conclusion of the district court, echoed by ERM, that permitting the term "tile" to encompass a single row of pixels traduces its plain and ordinary meaning. In support of this proposition, ERM points out that we have often relied on dictionary definitions in construing words in patent claims, and in this instance, the dictionary definition of the word tile refers to something used to cover a floor, a roof, or a wall. See York Prods., Inc. v. Cent. Tractor Farm & Family Ctr., 99 F.3d 1568, 1572-73, 40 USPQ2d 1619, 1622 (referring to dictionary definitions of "substantially" and "plurality"). As an initial matter, it is not clear that the dictionary's reference to bathroom tiles and roof tiles suggests that a single row of pixels cannot constitute a tile, since the superposition of rows would form the entire image just as the superposition of bathroom tiles forms the entire floor.[5] It is true that we have indeed relied on non-technical dictionary definitions to construe non-technical terms, such as "substantially" and "plurality." See York Prods., 99 F.3d at 1572-73, 40 USPQ2d at 1622. However, the word "tile," as utilized in disclosing and claiming a patented method for transforming and compressing digital images, is manifestly a technical term. The effort to restrict the meaning of the word "tile" in the context of digital image compression on the basis of the definition of the word in the inapposite context of a bathroom floor or a roof violates the essence of the claim construction inquiry: to adduce the scope of the claimed invention. For that reason, we construe the

claim term

“tile” from the perspective of one skilled in the art, instead of a layperson reading a dictionary. See K-2 Corp. v. Salomon S.A., 191 F.3d 1356, 1365, 52 USPQ2d 1001, 1006 (Fed. Cir. 1999) (“[C]laim construction is firmly anchored in reality by the understanding of those of ordinary skill in the art.”). Based on the expert testimony presented by LizardTech and the role of “tiling” in the context of the claimed invention, we hold that the “plain and ordinary meaning” of the term “tile” to one skilled in the art includes within its scope a single row of pixels. The district court’s contrary interpretation and its resulting conclusion that the ER Mapper does not infringe the ‘835 patent as a matter of law are erroneous.

IV.

In addition to urging affirmance of the district court’s grant of summary judgment on the basis of the construction of the term “tile,” ERM advances two alternative grounds for affirming the decision on appeal. We address them in turn.

First, ERM argues that the method used by the ER Mapper does not process tiles using a DWT in a “selected sequence” as required by the representative Claim 1. ERM contends that the term “selected sequence” is limited by the selected sequence of processing tiles described in the specification, wherein the tiles are processed beginning with the tile in the upper left corner of the image. ‘835 patent at col. 7, ll. 46-64. The processing of the tiles in this selected sequence, according to ERM, is central to the claimed invention, since it permits the storage of DWT coefficients from previous tiles for use in performing a DWT on ensuing tiles. Id. at col. 2, ll. 45-60. Since the ER Mapper processes images in subparts (which we have construed to constitute “tiles”) of single-row pixels, ERM asserts that it does not utilize a processing sequence beginning in the upper-left corner of the image and that therefore, as a matter of law, it does not infringe claim 1.

We decline to affirm the district court’s summary judgment of non-infringement on this basis. To do so would require us to ignore the plain meaning of the term “selected sequence” and improperly import the characteristics of the selected sequence described in the specification to limit the claimed invention. See Comark Communications, Inc. v. Harris Corp., 156 F.3d 1182, 1186, 48 USPQ2d 1001,

1005 (Fed. Cir. 1998) (“[C]laims are to be interpreted in light of the specification and with a view to ascertaining the invention, [but] it does not follow that limitations from the specification may be read into the claims.”). The “selected sequence” limitation in the claim simply requires that the processing of tiles occur in a predetermined and planned sequence, not that it follow the *particular* sequence set forth in the specification. Simply put, we are not persuaded that a predetermined sequence of processing tiles beginning with a tile in the upper right of the image or the bottom row of pixels is not “selected.” Nor does the specification support such a conclusion, for ERM fails to point to any language indicating that the particular disclosed sequence is the only processing sequence that meets this claim limitation. Accordingly, we interpret the term “selected sequence” in conformance with its plain meaning, instead of imposing an additional requirement that it correspond to the particular sequence disclosed in the specification.

We also reject ERM’s second alternative ground for affirmance. ERM submits that the ER Mapper does not meet the claim limitation of “maintaining updated sums of said coefficients.” Simply put, ERM argues that this limitation describes a function (maintaining updated sums) “without the recital of structure, material, or acts in support thereof,” thus restricting the scope of the limitation to the specific structure disclosed in the specification pursuant to 35 U.S.C. § 112, ¶ 6. See Serrano v. Telular, Corp., 111 F.3d 1578, 1583, 42 USPQ2d 1538, 1542 (Fed. Cir. 1999). ERM argues that the only example of “maintaining updated sums” provided in the specification involves processing tiles using DWT coefficients from previously processed tiles, and it asserts that its process neither breaks the image into “tiles” (since it utilizes single rows of pixels) nor uses coefficients from subparts in which the DWT process is complete. Instead, the ER Mapper maintains coefficients obtained from part of the DWT process.

ERM’s argument is flawed. First, the claim limitation “maintaining updated sums of said coefficients,” far from reciting a function without specific acts, appears to delineate an act (“maintaining updated sums of said coefficients”) that helps achieve the desired purpose of “form(ing) a seamless DWT.” ‘835 patent at col. 11, ll. 54-56. We therefore hold that the claim limitation at issue does not, as a matter of law, implicate section 112, paragraph 6, and it is not limited accordingly. See Personalized

Media Communications, Inc. v. Int'l. Trade Comm'n, 161 F.3d 696, 702, 48 USPQ2d 1880, 1886 (Fed. Cir. 1998) (“Whether certain claim language invokes 35 U.S.C. § 112, P 6 is an exercise in claim construction and is therefore a question of law . . .”).

Second, the contention that the ER Mapper does not “maintain[] updated sums” because it does not break the image into “tiles” before performing the DWT process represents a thinly-veiled attempt by ERM to advance its claim construction position relating to the term “tile” in a different context. For the reasons explored above, ERM’s effort to escape infringement by its argument that the single pixel rows used by the ER Mapper do not constitute tiles is misguided.

Third, the fact that the ER Mapper utilizes coefficients adduced after performing only part of the DWT process in future calculations does not mandate a finding of non-infringement as a matter of law. ERM merely has identified a difference between its DWT-based image compression process and the process described in the preferred embodiment. It has not, however, met the standard of demonstrating that the ER Mapper performs a process outside the scope of the asserted claims. ERM has not propounded an argument, let alone an argument that would persuade us to grant summary judgment of non-infringement on a basis the district court did not address, articulating why the data maintained by the ER Mapper, which is obtained by performing at least part of the DWT process, do not, as a matter of law, constitute “sums of DWT coefficients.”

CONCLUSION

For the foregoing reasons, we reverse the grant of summary judgment and remand for further proceedings relating to infringement and the pending claims of copyright infringement, breach of contract, false designation of origin, false description, and common law trademark infringement. In the infringement proceedings, the district court will be guided by the construction of the term “tile image data subsets” as including any contiguous subsets of image data, including single rows of pixels, that form the complete set of image data by their superposition. Further, we construe the term “selected sequence” to require the processing of tiles in a predetermined and planned sequence.

Each party shall bear its own costs.

[1] Therefore, “DWT compression” consists of 2 separate and distinct steps. First, the transformation occurs, which produces (through a complex formula) coefficients from the image data. Then, those coefficients are compressed.

[2] The patented method also permits the interactive retrieval, display, navigation, and browsing of these images, or portions thereof, by users. ‘835 patent at col. 2, ll. 9-25. However, these features of the patented invention are not at issue in the present appeal.

[3] LizardTech supports this argument using testimony from its expert, Dr. Stanley Osher, who analyzed the meaning of the four equations and concluded that “[o]ne of ordinary skill in the

art reading the '835 Patent would recognize that the '835 Patent does not exclude a row of input image data as [a] possible tile shape, but rather clearly supports such a tile shape. DWT processing of such tiles in accordance with the '835 Patent is well within the knowledge and capability of persons of ordinary skill in the art."

[4] Because we conclude that the specification supports LizardTech's construction of the term "tile" to include rows of a single pixel, we reject ERM's argument that such a construction would violate the written description requirement of 35 U.S.C. § 112. Cf. Gentry Gallery, inc. v. Berkline Corp., 134 F.3d 1473, 1476, 45 USPQ2d 1498, 1500-01 (Fed. Cir. 1998).

[5] ERM's argument to the contrary depends on the fallacy that bathroom and roof tiles have two dimensions, while a row of pixels is only one-dimensional. As a matter of both logic and geometry, this contention is incorrect, since a row of pixels, unlike a one-dimensional line, has both a width (however many pixels are in the row) and a height (1 pixel), so that superposing each row would yield the entire image.