

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC,
Petitioner

v.

UNILOC 2017 LLC,
Patent Owner

Patent No. 6,519,005

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 6,519,005**

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Ex. 1001	U.S. Patent No. 6,519,005 to Bakhmutsky (“the ’ 005 patent”)
Ex. 1002	Declaration of Majid Rabbani, Ph.D.
Ex. 1003	Curriculum Vitae of Majid Rabbani, Ph.D.
Ex. 1004	Prosecution History of U.S. Patent No. 6,519,005
Ex. 1005	U.S. Patent No. 6,122,317 to Hanami et al.
Ex. 1006	Mitchell et al., MPEG Video Compression Standard, Chapman & Hall (1996)
Ex. 1007	U.S. Patent No. 5,745,183 to Lam
Ex. 1008	Certified English-language translation of Japanese Patent Application Publication No. H7-250328 to Ishihara et al., Original Japanese Patent Application Publication No. H7-250328, and Translation Certificate
Ex. 1009	Ishihara et al., A Half-pel Precision MPEG2 Motion-Estimation Processor with Concurrent Three-vector Search, IEEE Journal of Solid-State Circuits, Vol. 30, No. 12, pp. 1502-1509 (Dec. 1995)
Ex. 1010	Information Technology – Generic Coding of Moving Picture and Associated Audio – Recommendation H.262 (ISO/IEC 13818-2), International Organization for Standardisation (ISO/IEC JTC1/SC29/WG11) (March 25, 1994)
Ex. 1011	Wiegand <i>et al.</i> , Special Section on the Joint Call for Proposals on High Efficiency Video Coding (HEVC) Standardization, IEEE Transactions on Circuits and Systems for Video Technology, Vol. 20, No. 12, pp. 1661-1666 (December 2010)
Ex. 1012	U.S. Patent No. 5,905,542 to Linzer
Ex. 1013	U.S. Patent No. 6,035,069 to Nagai <i>et al.</i>
Ex. 1014	<i>Uniloc 2017 LLC. AT&T Services, Inc., et al.</i> , 2:18-cv-00514-JRG (E.D. Tex), Dkt. No. 51

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Ex. 1015	<i>Uniloc 2017 LLC v. Verizon Communications Inc., et al.</i> 2:18-cv-00513-JRG (E.D. Tex), Dkt. No. 46
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Ex. 1017	<i>Uniloc USA Inc., et al. v. Google, Inc.</i> , 2:17-cv-00231-JRG, 00214-JRG, 00224-JRG, 00465-JRG, 00466-JRG, 00467-JRG , Dkit. No. 47
Ex. 1018	Declaration of Ingrid Hsieh-Yee, Ph.D.

I. INTRODUCTION

Google LLC (“Petitioner”) requests *inter partes* review (“IPR”) of claims 1-3, 5, 6, 8, 39 and 41 (“the challenged claims”) of U.S. Patent No. 6,519,005 (“the ’005 patent”) (Ex. 1001) assigned to Uniloc 2017 LLC (“Patent Owner” or “PO”). For the reasons below and accompanying evidence, including the declaration of Dr. Majid Rabbani (Ex. 1002), the challenged claims should be found unpatentable and canceled.

II. MANDATORY NOTICES

Real Parties-in-Interest: Pursuant to 37 C.F.R. § 42.8(b)(1), Petitioner identifies the following as the real parties-in-interest: Google LLC.¹

Related Matters

Civil Actions: The ’005 patent is the subject of the following civil actions:

- *Uniloc 2017 LLC v. Google LLC et al.*, Case No. 2-18-cv-00500 (E.D. Tex).
- *Uniloc 2017 LLC v. Roku, Inc.*, Case No. 8-19-cv-00295 (C.D. Cal)

¹ Google LLC is a subsidiary of XXVI Holdings Inc., which is a subsidiary of Alphabet Inc. XXVI Holdings Inc. and Alphabet Inc. are not real parties-in-interest to this proceeding.

- *Uniloc 2017, LLC v. Sling TV, LLC*, Case No. 1-19-cv-00278 (D. Col)
- *Uniloc 2017 LLC v. Bitmovin, Inc.*, Case No. 1-19-cv-00179 (D. Del)
- *Uniloc 2017 LLC v. Brightcove Inc. et al.*, Case No. 1-19-cv-00180 (D. Del)
- *Uniloc 2017 LLC v. Dailymotion, Inc. et al.*, Case No. 1-19-cv-00181 (D. Del)
- *Uniloc 2017 LLC v. Telestream LLC*, Case No. 1-19-cv-00182 (D. Del)
- *Uniloc 2017 LLC v. Vudu, Inc.*, Case No. 1-19-cv-00183 (D. Del)
- *Uniloc 2017 LLC v. Roku, Inc.*, Case No. 1-18-cv-01126 (W.D. Tex)
- *Uniloc 2017 LLC v. Netflix, Inc.*, Case No. 8-18-cv-02055 (C.D. Cal)
- *Uniloc 2017 LLC v. American Broadcasting Companies, Inc.*, Case No. 8-18-cv-02056 (C.D. Cal)
- *Uniloc 2017 LLC v. ESPN, Inc.*, Case No. 8-18-cv-02057 (C.D. Cal)
- *Uniloc 2017 LLC v. Hulu, LLC*, Case No. 8-18-cv-02058 (C.D. Cal)
- *Uniloc 2017 LLC v. Verizon Communications Inc. et al.*, Case No. 2-18-cv-00513 (E.D. Tex)
- *Uniloc 2017 LLC v. AT&T Services, Inc. et al.*, Case No. 2-18-cv-00514 (E. D. Tex)

PTAB Proceedings: The '005 patent is the subject of the following PTAB proceedings:

- *Unified Patents Inc. v. Uniloc 2017 LLC*, Case No. IPR2019-01126
("Unified IPR")
- *Sling TV LLC et al v. Uniloc 2017 LLC*, Case No. IPR2019-01270
("Sling TV IPR")

Counsel and Service Information: Lead counsel: Naveen Modi (Reg. No. 46,224). Backup counsel: (1) Joseph E. Palys (Reg. No. 46,508), (2) Quadeer Ahmed (Reg. No. 60,835).

Service information is Paul Hastings LLP, 875 15th St. N.W., Washington, D.C., 20005, Tel.: 202.551.1700, Fax: 202.551.1705, email: PH-Google-Uniloc-IPR@paulhastings.com. Petitioner consents to electronic service.

III. PAYMENT OF FEES

The PTO is authorized to charge any fees due during this proceeding to Deposit Account No. 50-2613.

IV. GROUNDS FOR STANDING

Petitioner certifies under 37 CFR § 42.104(a) that the '005 patent is available for review and Petitioner is not barred or estopped from requesting review on the grounds identified herein.

**V. PRECISE RELIEF REQUESTED AND GROUNDS RAISED UNDER
37 C.F.R. § 42.104(b)**

A. Claims for Which Review Is Requested

Petitioner respectfully requests review of claims 1-3, 5, 6, 8, 39 and 41 of the '005 patent and cancellation of these claims as unpatentable.

B. Statutory Grounds of Challenge

The challenged claims should be canceled as unpatentable in view of the following grounds:

Ground 1: Claims 1-3, 5, 6, 8, 39 and 41 are anticipated under pre-AIA 35 U.S.C. § 102(e) by U.S. Patent No. 6,122,317 to Hanami *et al.* (“*Hanami*”) (Ex. 1005); and

Ground 2: Claims 2 and 5 are unpatentable under pre-AIA 35 U.S.C. § 103(a) over *Hanami* in view of Mitchell *et al.*, MPEG Video Compression Standard (“*Mitchell*”) (Ex. 1006).

The '005 patent issued on February 11, 2003, from U.S. Patent Application No. 09/303,316, filed on April 30, 1999. (Ex. 1001 at Cover.) For purposes of this proceeding, Petitioner assumes the earliest effective filing date of the '005 patent is April 30, 1999.

Hanami was issued on September 19, 2000, from U.S. Patent Application No. 08/975,207, filed November 20, 1997 and thus qualifies as prior art with

respect to the '005 patent at least under pre-AIA 35 U.S.C. § 102(e). (Ex. 1005 at Cover.).

Mitchell, which is a textbook published by Chapman & Hall, was publically available at least as early as June 21, 1996 and no later than August 2, 1997, as confirmed by the declaration of Dr. Ingrid-Hsieh Yee (Ex. 1018), an expert in the field of library cataloging and classification. (Ex. 1018 at ¶¶1-17.) Dr. Hsieh-Yee testifies that *Mitchell* was indexed by subject matter at the Library of Congress such that any interested persons could search for *Mitchell* at least as early as June 21, 1996, and such persons could have searched for and physically accessed *Mitchell* no later than August 2, 1997. (*Id.* at ¶¶27-28 (citing Appendices 1006-A and 1006-B), 30; *see also id.* at ¶¶18-26 (providing a description of *Mitchell* and explaining the procedure for indexing the book at the Library of Congress with reference to *Mitchell*'s records).) Moreover, *Mitchell* was cited in other papers at least 102 times, with at least six citations to *Mitchell* in 1997-1998, including as early as November 1997, further demonstrating its public availability. (*Id.* at ¶¶29-30 (citing Appendix 1006-C).)

Thus, *Mitchell* qualifies as prior art with respect to the '005 patent at least under pre-AIA 35 U.S.C. § 102(b).

The above references were not considered by the Patent Office during prosecution of the '005 patent. (*See, e.g.*, Ex. 1001 at Cover (“References Cited” section); *see also generally* Ex. 1004.)

VI. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art at the time of the alleged invention of the '005 patent (“POSITA”) would have had a Bachelor’s degree in Electrical Engineering, Computer Science, or the equivalent thereof, and two or more years of experience with data compression systems and algorithms, including video coding. (Ex. 1002 at ¶¶14-16.)² More education can supplement practical experience and vice versa. (*Id.*)³

² Petitioner submits the declaration of Dr. Majid Rabbani (Ex. 1002), an expert in the field of the '005 patent. (Ex. 1002 at ¶¶3-13; Ex. 1003.)

³ Petitioner’s qualifications for a POSITA are generally consistent with those proposed in the prior petitions challenging claims of the '005 patent. Unified IPR, Paper 1 at 26 (May 28, 2019); Sling TV IPR, Paper 2 at 15-16 (June 25, 2019).

VII. OVERVIEW OF THE '005 PATENT AND THE PRIOR ART

A. The '005 Patent

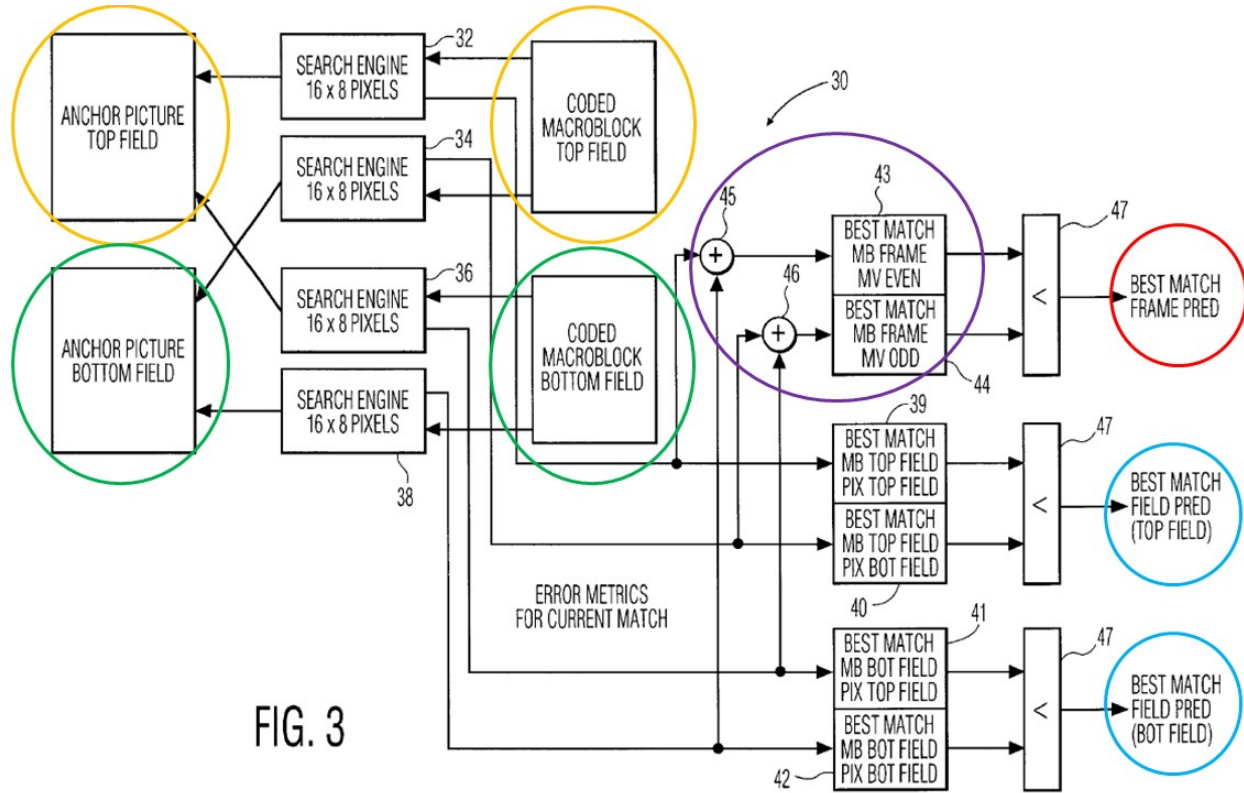
1. Overview of the '005 Patent

The '005 patent is directed to techniques for “motion estimation” in a plurality of “prediction modes” in the context of video coding. It purports to describe techniques for performing “*concurrent*” motion estimation in a plurality of prediction modes. (Ex. 1001 at 1:6-11 (emphasis added); Ex. 1002 at ¶¶53-59.)

The '005 patent concedes that motion estimation was already a well-known video compression technique. (Ex. 1001 at 1:40-55.) The '005 patent similarly concedes that performing motion estimation in a plurality of “prediction modes,” such as the six prediction modes defined by the MPEG-2 standard, was well-known. (Ex. 1001 at 2:49-54, 3:7-13, 4:24-25.) According to the '005 patent, in conventional methods, a prediction mode “generally” needs to be specified for a given macroblock before motion estimation is performed. (*Id.* at 3:7-20.) However, there may be many cases where determining the optimum prediction mode would require performing more than one motion estimation for a given macroblock, and doing so is “not a practical option.” (*Id.* at 3:15-24.) The '005 patent purports to solve this problem by disclosing the allegedly “novel scheme” of performing motion estimation for multiple prediction modes *concurrently*. (*Id.* at 3:54-67; Ex. 1002 at ¶54.)

The specification describes concurrent motion estimation in the context of six prediction modes in the context of frame and field pictures. (Ex. 1001 at 9:36-54, 10:66-11:9.) In particular, three of these prediction modes are directed to frame pictures and the other three to field pictures. (*Id.* at 4:23-26.) (Ex. 1002 at ¶55.)

For example, for **frame pictures**, “the motion estimation may be performed, in a frame picture, for both *frame* and *field* prediction modes simultaneously, during the same search of the anchor picture.” (Ex. 1001 at 8:9-13 (emphasis added).) This is possible because, as shown in an annotated version of Figure 3 below, if the macroblock is split into its constituent fields (*i.e.*, two 16-by-8 arrays) [top field annotated in orange and bottom field annotated in green] and each field is searched using *field prediction mode* against the top and bottom fields of the anchor picture [top field annotated in orange and bottom field annotated in green], respectively, the sum of the resulting error metrics is equal to the error of the full 16-by-16 block [annotated in purple] if searched in *frame prediction mode*. (*Id.* at 8:14-44.)



(*Id.* at FIG. 3; *see also id.* at 8:49-9:35; Ex. 1002 at ¶56.)

This technique allows for the performance of two prediction modes (*frame* prediction mode or *field* prediction mode) based on the same search operation.⁴ (Ex. 1001 at 9:27-32.) Dual-prime mode can be examined after performing motion estimation for field prediction, based on the results of the same search operation,

⁴ Figure 3 includes 3 “outputs.” These outputs, however, correspond to only two prediction modes. Field prediction mode for frame pictures results in two motion vectors: one for the top field, and one for the bottom field [both annotated in blue above] and frame prediction mode [annotated in red above].

by evaluating relationships between the resulting motion vectors.⁵ (*Id.* at 12:19-42; Ex. 1002 at ¶57; *see also id.* at ¶58 (describing similar concurrent motion estimation performance with respect to **field pictures**).)

All of the above concepts were well-known before the alleged invention of the '005 patent. (Ex. 1002 at ¶59; *see also id.* at ¶¶17-52 (explaining the state of the art with reference to Exhibits 1001, 1005-1010⁶); *see also infra* Section IX.)

2. Prosecution History

During prosecution, in response to an anticipation rejection based on U.S. Patent No. 5,905,542 (“*Linzer*”) (Ex. 1012), Applicant argued that “generating a motion vector in response to the determining step” (claim 1) or “generating one or more motion vectors using the selected prediction mode” (issued claim 41, then claim 50) is not disclosed by *Linzer* because the motion vectors disclosed in *Linzer*

⁵ While the '005 patent specification describes a dual-prime mode, the challenged claims do not require this feature. (Ex. 1002 at ¶57 n.11.)

⁶ Exhibit 1009 is an article by Ishihara *et al.* published in a widely circulated IEEE journal. (Ex. 1009 at 1.) This journal was indexed by subject matter at the Library of Congress such that any interested person could have searched for and physically accessed the article no later than March 8, 1996. (Ex. 1018 at ¶46; *see also id.* at ¶¶31-45 (citing Appendices 1009-A to 1009-D).)

are not generated in response to the selection of an optimum prediction mode. (Ex. 1004 at 78-79, 81-90, 94-100.) The Examiner rejected this argument, explaining that *Linzer* discloses producing candidate vectors corresponding to different prediction modes and eliminating candidate vectors based on the prediction mode that is selected, and a final motion vector is generated based on the selected prediction mode (and subsequently, this motion vector and the selected prediction mode are output to the downstream encoding circuitry). (*Id.* at 105-107.) In response, Applicant acquiesced to the Examiner's interpretation and newly argued that *Linzer* did not disclose determining an optimum prediction mode "based on which mode is optimum or produces an optimum result," as set forth in some variation in issued claims 1 and 41. (*Id.* at 122; Ex. 1002 at ¶60.)

Without addressing this new argument, the claims were allowed and the reasons for allowance referenced claim limitations that are not recited in challenged independent claims 1, 39, and 41. In particular, the claims were allowed because they allegedly recite "a method for motion coding a digital video data stream which includes '. . . determining which of the first, second, third, and fourth error metrics, and first and second composite metrics has the lowest value, and selecting one of the plurality of possible motion estimation prediction modes on the basis of such determination . . . ' which is a feature that is not anticipated nor obvious over the art of record." (Ex. 1004 at 137.) That is, despite being

previously rejected, the challenged claims do not recite these limitations. Instead, these limitations are found in other claims not challenged here. (Ex. 1002 at ¶61.)

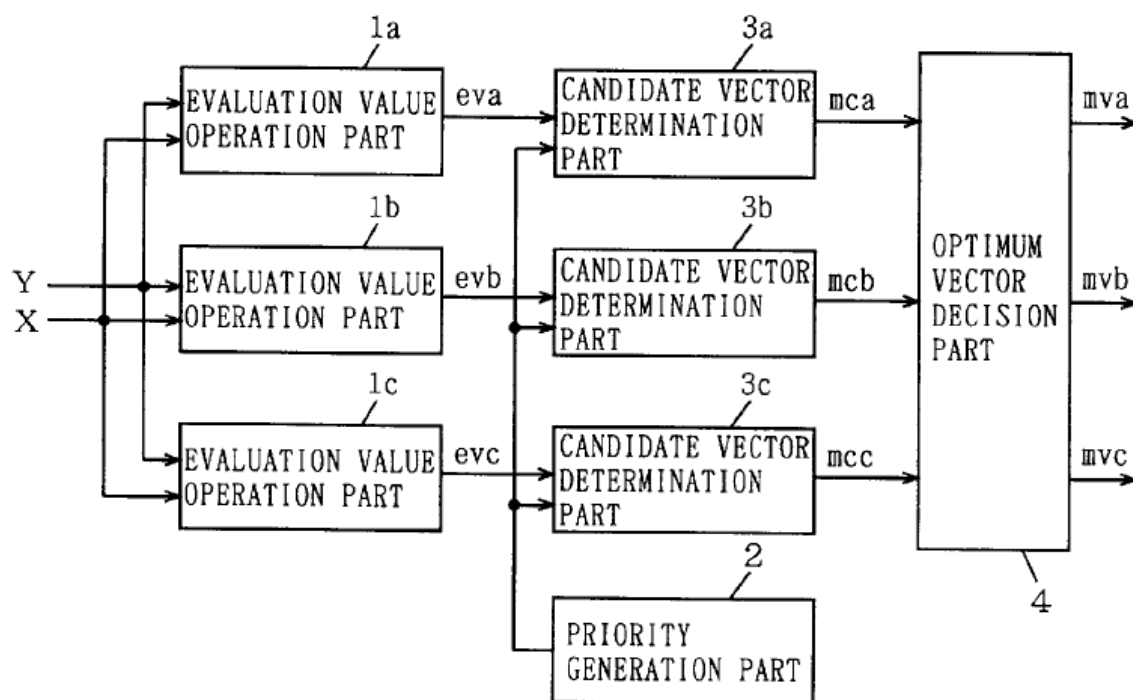
B. Overview of *Hanami*

Hanami discloses techniques for detecting motion vectors employed for motion compensation of moving images (“method for motion coding an uncompressed digital video data stream”). (Ex. 1005 at Abstract, 1:5-8; *see also id.* at 1:10-56, 6:48-55, FIGS. 1-4, 83; Ex. 1002 at ¶¶64-83.)

Indeed, just like the '005 patent, *Hanami* discloses that an “object of the present invention is to provide a motion vector detector which can *simultaneously detect optimum vectors* efficiently coded for *a plurality of predictive modes in parallel with each other.*” (Ex. 1005 at 6:52-55 (emphasis added); Ex. 1002 at ¶65.)

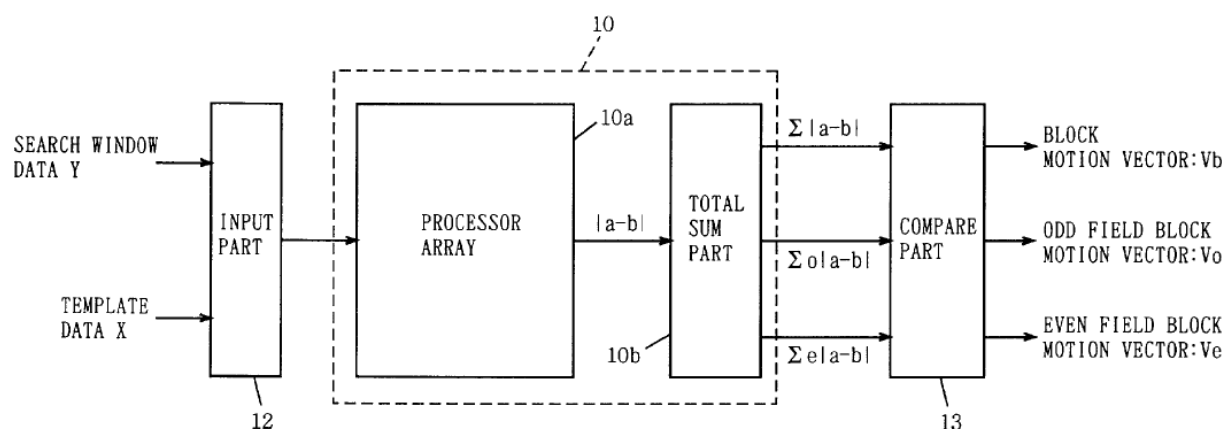
Even the process by which *Hanami* accomplishes parallel detection of one or more optimum motion vector(s) for a plurality of predictive modes is basically the same as the '005 patent's technique described above. (Ex. 1002 at ¶66.) This is reflected generally by way of *Hanami*'s Figure 1 and more specifically by way of Figure 4 along with the corresponding description of these figures.

FIG. 1



(Ex. 1005 at FIG. 1.)

FIG. 4



(*Id.* at FIG. 4.)

For example, just like the '005 patent, *Hanami* discloses splitting a macroblock into two fields (e.g., even and odd fields) and searching each field using field prediction mode against the even and odd fields of a reference picture (i.e., an anchor picture), respectively. Then, the sum of the resulting error metrics is equal to the error of the full macroblock if searched in frame prediction mode. (*Compare* Ex. 1005 at 13:58-14:10 (reproduced below) (*Hanami* describing that for computing evaluation value of a frame predictive mode, evaluation values of the even and odd fields are simply added up with each other), FIG. 4 *with* Ex. 1001 at 8:14-44 ('005 patent describing that for computing the error of the frame prediction mode, the error metrics of the top and bottom fields are summed up), FIG. 3.)

A frame includes even and odd fields, and even and odd field pixels are alternately arranged on horizontal scan lines on the screen. Therefore, outputs of the element processors [in processor array 10a of Figure 4] arranged in correspondence to even and odd field pixels express the components of evaluation values in accordance with the even and odd field predictive modes respectively . . .
In case of the frame predictive mode, the evaluation values of the even and odd fields are simply added up with each other.

(Ex. 1005 at 13:58-14:10 (emphasis added); *see also id.* at 13:29-40, FIG.4; Ex. 1002 at ¶67.)⁷ Indeed, a POSITA would have readily understood from *Hanami*'s figures and description that *Hanami*, like the '005 patent, allows for concurrently performing motion estimation in a plurality of prediction modes (e.g., frame prediction mode for frame pictures and field prediction mode for frame pictures) based on the same search operation. (Ex. 1002 at ¶68; *see also id.* at ¶¶69-83.) (*See also infra* Section IX.A.)

VIII. CLAIM CONSTRUCTION

For IPR proceedings, the Board applies the claim construction standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). *See* 83 Fed. Reg. 51,340-51,359 (Oct. 11, 2018). Under *Phillips*, claim terms are typically given their ordinary and customary meanings as would have been understood by a POSITA, at the time of the invention, having taken into consideration the language of the claims, the specification, and the prosecution history of record. *Phillips*, 415 F.3d at 1313; *see also id.* at 1312-16.

The Board, however, only construes claims when necessary to resolve the underlying controversy. *Toyota Motor Corp. v. Cellport Systems, Inc.*, IPR2015-

⁷ *Hanami*'s even and odd fields correspond to the '005 patent's top and bottom fields, respectively. (Ex. 1002 at ¶67. n.14)

00633, Paper No. 11 at 16 (Aug. 14, 2015) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Petitioner believes that no express constructions of the claims are necessary to assess whether the prior art reads on the challenged claims.⁸ (Ex. 1002 at ¶62.) In the Sling TV and Unified IPRs (*supra* Section II), Sling TV and Unified proposed constructions of certain claim terms as summarized in the table below. Unified IPR, Paper 1 at 26-28; Sling TV IPR, Paper 2 at 16-25. To the extent the Board adopts any of the proposed constructions in the prior IPRs, Petitioner explains below that the prior art discloses the relevant claim terms under the proposed constructions. (*See, e.g., infra* Sections IX.A.1.b)-IX.A.1.c); Ex. 1002 at ¶63.)

⁸ Petitioner reserves all rights to raise claim construction and other arguments in district court as relevant and necessary to those proceedings. For example, Petitioner has not raised all challenges to the '005 patent in this petition, including invalidity under 35 U.S.C. § 101 or § 112. A comparison of the claims to any accused products in litigation may raise controversies that need to be resolved through claim construction that are not presented here given the similarities between the references and the patent.

Claim Term	Sling TV's Proposed Construction	Unified's Proposed Construction
“concurrently perform[ing]/[s] motion estimation [for]/[using] each of a plurality of different [motion estimation] prediction modes” (Claims 1, 39, 41)	<i>Performing motion estimation according to each of a plurality of prediction modes during the same search operation for a given macroblock, without performing a separate search on the same macroblock for each such mode. Sling TV IPR, Paper 2 at 16-19.⁹</i>	<i>Not construed</i>
“optimum” (Claims 1, 39, 41)	<i>Best or most suitable. Sling TV IPR, Paper 2 at 23-24.</i>	<i>At least includes the prediction mode that yields the smallest value of an error metric. Unified IPR, Paper 1 at 26-27.</i>
“a best match” (Claim 1)	<i>The second pixel array within a specified search range of the reference picture having the smallest value of an error metric. Sling TV IPR, Paper 2 at 24-25.</i>	<i>At least includes the array included in the search having the smallest value of an error metric. Unified IPR, Paper 1 at 27-28.</i>

⁹ Sling TV also construed “concurrently” in the context of claims 7 and 12 of the ’005 patent. Sling TV IPR, Paper 23 at 19-23. Since claims 7 and 12 are not being challenged herein, Petitioner is not addressing that construction.

IX. DETAILED EXPLANATION OF GROUNDS

As detailed below, the challenged claims are unpatentable. (Ex. 1002 at ¶¶90, 166.)

A. Ground 1: *Hanami* Anticipates Claims 1-3, 5, 6, 8, 39 and 41

1. Claim 1

- a) A method for motion coding an uncompressed digital video data stream, including the steps of:

To the extent the preamble of claim 1 is limiting, *Hanami* discloses the elements therein. (Ex. 1002 at ¶¶91-94.)

For example, *Hanami* discloses an image coding system and corresponding techniques for coding an uncompressed digital video signal. (“method for motion coding an uncompressed digital video data stream”). (Ex. 1005 at Abstract (“provided is an image coding system which can reduce the amount of codes of motion vectors with excellent picture quality”); *see also id.* at 1:5-8 (disclosing “detecting motion vectors employed for motion compensation of moving images”), 1:10-56, 6:48-55, FIGS. 1-4, 83.) As *Hanami* explains, “[a] data compression technique suppressing the data redundancy and reducing the quantity of transmission data is called highly efficient coding” and that “[s]ystems of such highly efficient coding include a predictive coding system.” (*Id.* at 1:13-18.) *Hanami* discloses that the predictive coding processing includes ***motion-compensated interframe (or interfield) predictive coding***, which in turn involves

computation of motion vectors. (*Id.* at 1:18-36; *see also id.* at 1:44-2:12 (describing overall structure of an encoder for coding image data with reference to Figure 83), FIG. 83.) (Ex. 1002 at ¶91.)

Hanami discloses these fundamental techniques with respect to a “conventional motion-compensated predictive coding method” (Ex. 1005 at 1:44-47), but as Dr. Rabbani explains, a POSITA would have readily understood that *Hanami*’s disclosure (with the objective of providing a “motion vector detector”) builds on these fundamental techniques and does not repeat them in its detailed description. (*Id.* at 6:48-55, 10:55-11:11, 12:51-55, 13:23-29, FIGS. 1-4.) In other words, *Hanami* does not propose to change the “overall structure of an encoder for coding image data” as shown in Figure 83 (*id.* at 1:44-47) but instead discloses that one of its objectives is to change how certain data is processed within a macroblock layer 1100 in Figure 87 without changing the structure of the image. (*Id.* at 7:18-21; *see also id.* at 5:49-67; 6:39-45; 12:22-37, FIG. 87.) Therefore, *Hanami*’s disclosures generally relate to methods of motion coding an uncompressed digital video data stream, as claimed. (Ex. 1002 at ¶92.)

Moreover, a POSITA would have readily understood based on *Hanami*’s disclosure of motion-compensated predictive coding with respect to its background section (discussed above) and its detailed description section including Figures 1 and 4 (discussed below with respect to claim elements 1(b)-1(d)) that the image

signals including pixel data being coded (e.g., the pixel data of a current frame and previous frame used to compute the motion vectors in the background section or the pixel data X and pixel data Y in Figure 4) are part of an uncompressed digital video data stream, as claimed. (*See, e.g.*, Ex. 1005 at 1:10-56, 12:50-13:13, FIGS. 4, 83.) First, pixels are part of a digital image and a sequence of such digital images constitutes an uncompressed (e.g., not yet coded) digital video stream, as claimed.¹⁰ Second, the purpose of the motion-compensated predictive coding, as *Hanami* explains, is to “suppress[] the data redundancy and reduc[e] the quantity of transmission data” of “image signals having an enormous quantity of data.” (*Id.* at 1:10-32.) The concept of motion compensation (e.g., eliminating data redundancy, reducing the amount of data to be transmitted, etc.) is applied to uncompressed moving images (image signals) which have an enormous quantity of data, not to already compressed data. Plus, *Hanami* is directed to a motion vector detector, and motion vectors are detected during the process of encoding an uncompressed signal. (Ex. 1002 at ¶¶93; *see also id.* at ¶¶20-24.)

¹⁰ *Hanami*’s motion-compensated coding is applied to a sequence of images comprising pixel data, i.e., a sequence of digital images, as discussed below with reference to claim elements 1(b)-1(d).

Thus, *Hanami* discloses motion coding an uncompressed digital video data stream. (*See also* analysis and citations below with respect to claim elements 1(b)-1(d); Ex. 1002 at ¶94.)

- b) [1] comparing pixels of a first pixel array in a picture currently being coded with pixels of a plurality of second pixel arrays in at least one reference picture and
- [2] concurrently performing motion estimation for each of a plurality of different prediction modes in order to determine which of the prediction modes is an optimum prediction mode;

Hanami discloses this claim element. (Ex. 1002 at ¶¶95-116.)

As an initial matter, a POSITA would have understood based on the knowledge of such a POSITA and the disclosure of the '005 patent itself that the “comparing” step set forth in claim element 1(b)[1] may be performed as part of the “concurrently performing motion estimation” step set forth in claim element 1(b)[2]. (*Id.* at ¶96.) That is, a POSITA would have understood based on the disclosure of the '005 patent itself that “performing motion estimation” would necessarily involve block-matching to obtain the absolute differential sums/evaluation values for a current block being coded. For example, the '005 patent discloses:

For all MPEG-2 prediction modes, the fundamental technique of motion estimation consists of comparing the current macroblock with a given 16-by-16 pixel array in the anchor picture, estimating the quality of the match according to the specified metric, and repeating this procedure for every such 16-by-16 pixel array located within the search range . . . [T]he match having the smallest value of the corresponding sum is selected as the best match within the specified search range, and its horizontal and vertical positions relative to the current macroblock therefore constitute the motion vector.

(Ex. 1001 at 2:49-3:1 (emphasis added); Ex. 1002 at ¶96.)

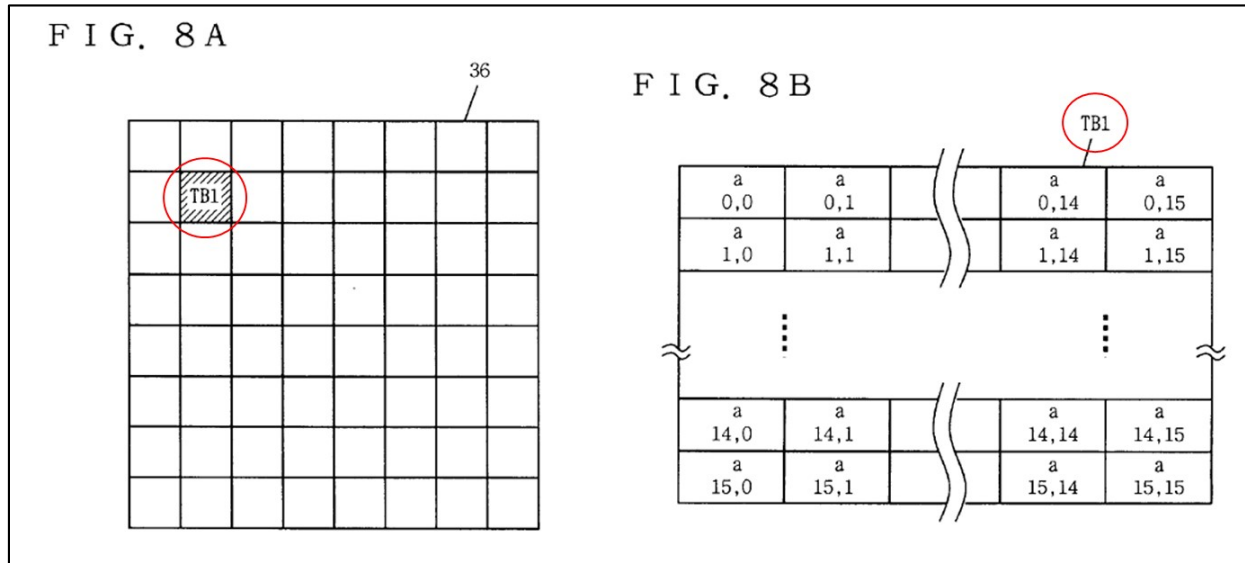
Thus, the '005 patent discloses that the process of comparing pixels of a first pixel array in a picture currently being coded with pixels of a plurality of second pixel arrays in at least one reference picture is performed as part of the motion estimation for each of a plurality of different prediction modes. (*Id.* at ¶97; *see also id.* at ¶¶75-83.) (Ex. 1002 at ¶97.)

The block-matching disclosed by *Hanami* encompasses comparing pixels of a first pixel array in a picture currently being coded with pixels of a plurality of second pixel arrays in at least one reference picture, as claimed. (Ex. 1002 at ¶98; *see also id.* at ¶¶75-78.) Specifically, as to *Hanami*'s disclosure of claim elements 1(b)[1] and 1(b)[2], *Hanami* discloses "obtaining evaluation values which indicate similarity between a current image block [e.g., 'first pixel array'] of a prescribed

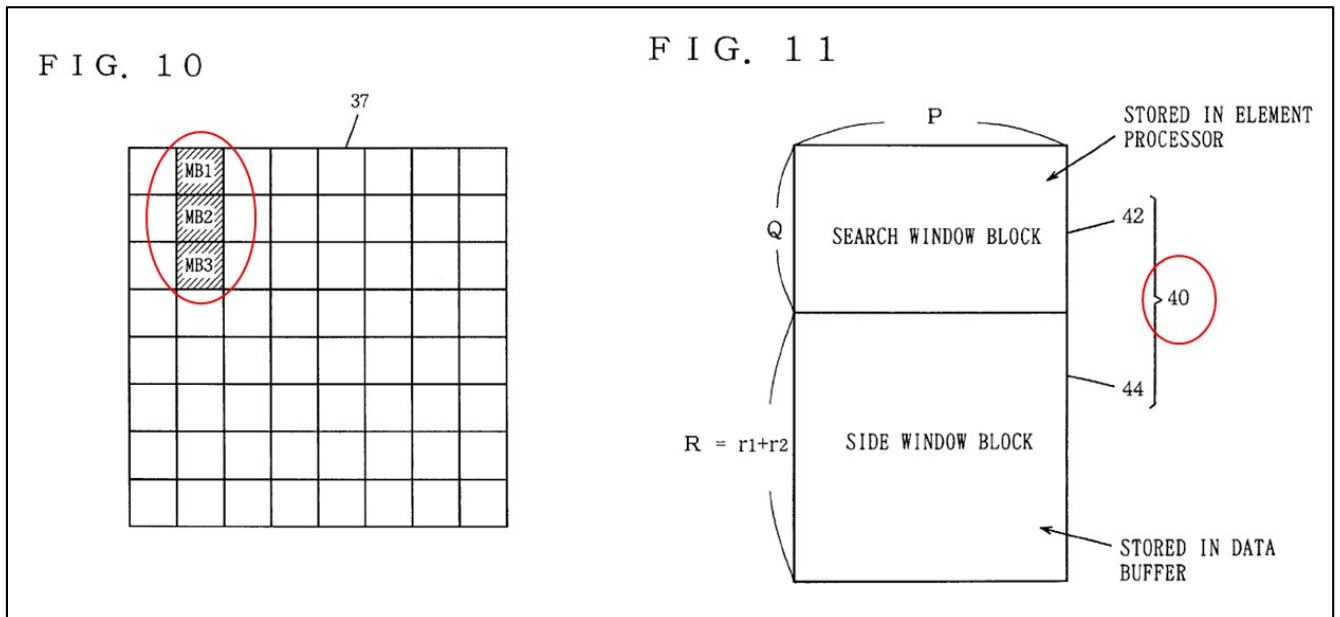
size to be subjected to motion vector detection in a current screen [e.g., ‘picture currently being coded’] and respective ones of a plurality of reference image blocks [e.g., ‘plurality of second pixel arrays’] in a search area in a reference screen [e.g., ‘at least one reference picture’] related to the current image block and are decided in accordance with respective ones of a plurality of predetermined predictive modes [e.g., ‘different prediction modes’] in parallel with each other [e.g., ‘concurrently’] for the respective reference blocks” in order to determine which of the predictive modes is an optimum prediction mode. (Ex. 1005 at 6:57-65; FIG. 4; Ex. 1002 at ¶98.) *Hanami*’s disclosure of claim elements 1(b)[1] and 1(b)[2] is further described below.

Claim element 1(b)[1]

As described above and further discussed below, in *Hanami*’s examples, the current image block being coded is represented by a template block 1 (TB1) of a current frame 36 shown in Figures 8A-8B (reproduced below) and the reference image blocks in a search area include the collection of macroblocks MB1-MB3 in a reference frame 37 shown in Figures 10-11 (reproduced below). (Ex. 1002 at ¶99; *see also id.* at ¶72-74 (noting that the search area includes, but is not limited to, macroblocks MB1-MB3).)



(Ex. 1005 at FIGS. 8A-8B (annotated); Ex. 1002 at ¶¶99.)



(Ex. 1005 at FIGS. 10-11 (annotated); Ex. 1002 at ¶¶99.)

Hanami discloses that the template block TB1 and the reference image blocks (e.g., MB1-MB3) included in the search area are both pixel arrays, as

claimed. For example, *Hanami* discloses that template block TB1 “*is formed by the macro block* shown by slant lines in the one-frame image 36 . . . [and that] the template block TB1 [is] *arranged in 16 rows and 16 columns*, as shown in FIG. 8B.” (Ex. 1005 at 15:39-47 (emphasis added); *see also id.* at 16:48-53, FIG. 15 (showing template block data 43 in the form of a 16 x 16 pixel array).) Thus, the template block TB1 discloses the claimed first pixel array. Similarly, the reference image blocks (e.g., represented by the collection of macroblocks MB1-MB3) are also arranged in 16 rows and 16 columns. (*Id.* at 16:53-55, FIG. 15 (showing search window block data 42 in the form of a 16 x 16 pixel array); *see also id.* at 14:11-14, 15:64-16:10, FIGS. 5, 11.)

FIG. 5

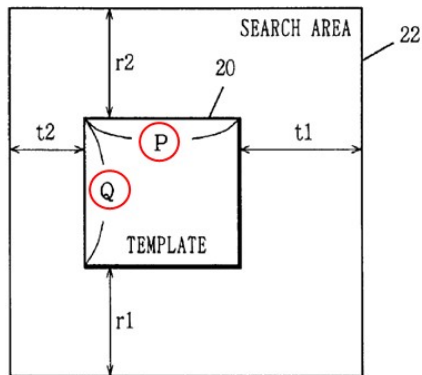
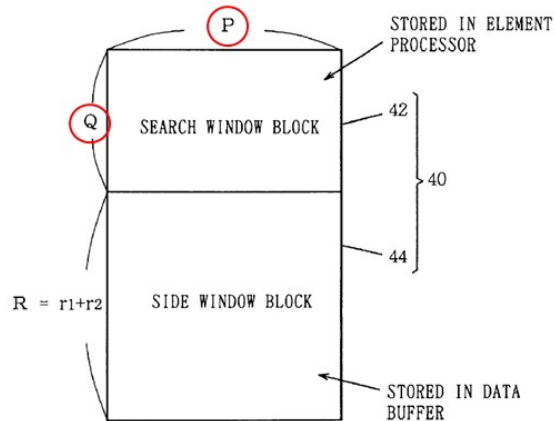
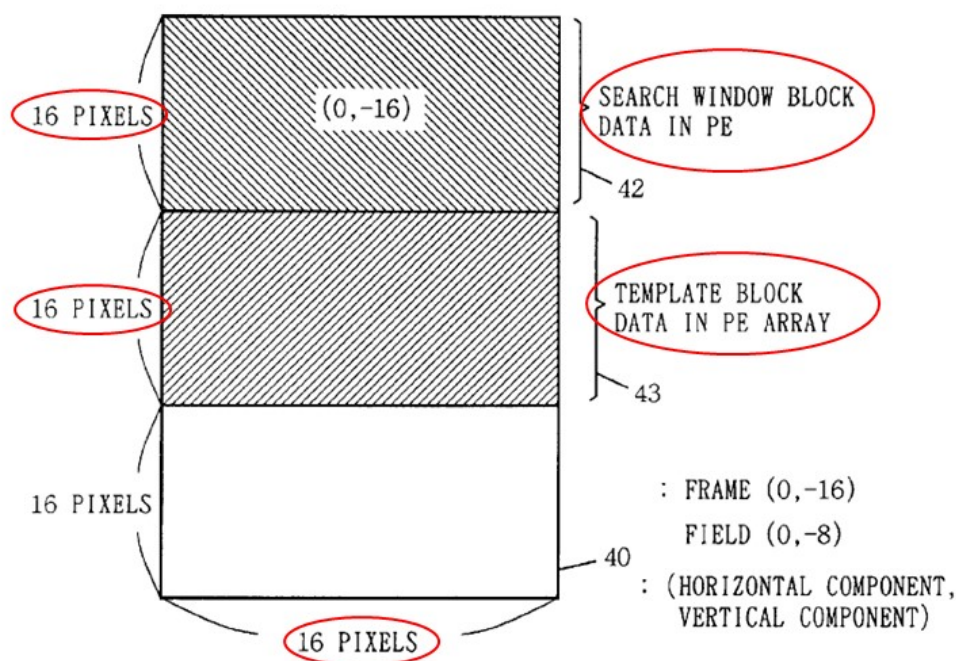


FIG. 11



(Ex. 1005 at FIG. 5 (left) (annotated), FIG. 11 (right) (annotated); Ex. 1002 at ¶100.)

FIG. 15



(Ex. 1005 at FIG. 15 (annotated); Ex. 1002 at ¶100.)

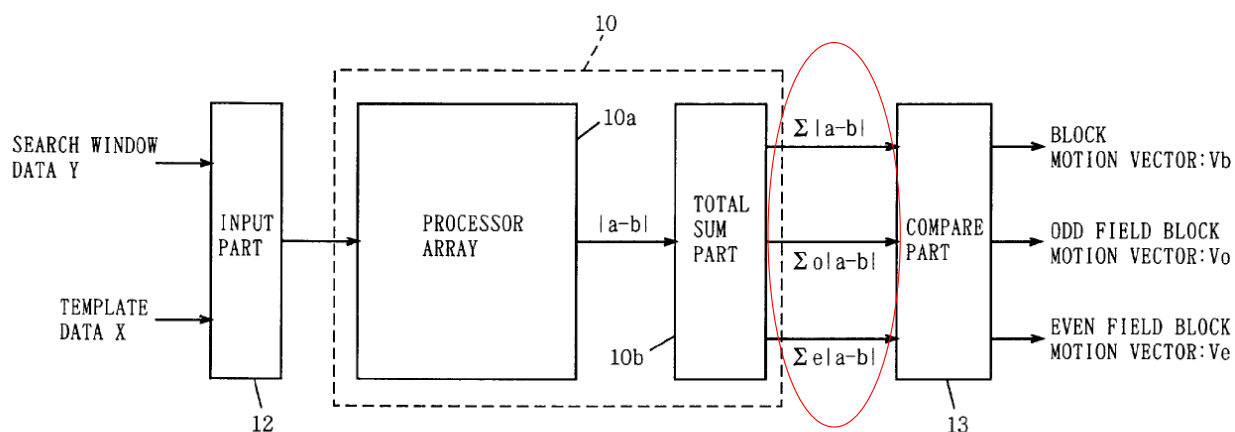
Coming to the comparison of pixels of the template block TB1 (of current frame 36) currently being coded and the reference image blocks (e.g., MB1-MB3) included in the search area of reference frame 37, *Hanami* discloses that:

“[t]he different element processors included in the processor array 10a store data of different template block pixels [e.g., “first pixel array”]. The pixel data of the reference image block in the search area [e.g., “second pixel arrays”] related to the template block are successively transmitted along a one-way direction through the element processors. The element processors provided in the processor array 10a execute operations of the template block pixel data and pixel data of a single

search window block (reference image block).
Therefore, each element processor computes [e.g.,
“comparing”] the component of an *evaluation value*
indicating the correlation between a single template
block and the search window block.”

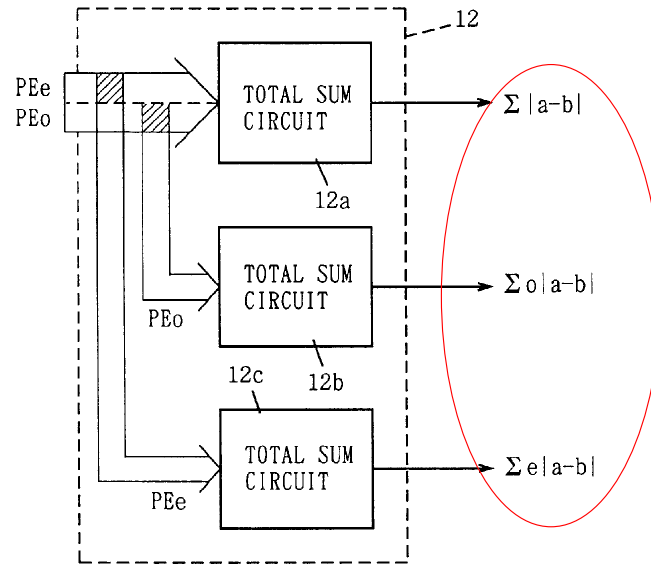
(Ex. 1005 at 13:41-53 (emphasis added); FIG. 4; *see also id.* at 15:64-16:34; FIG.
25; Ex. 1002 at ¶101.)

F I G. 4



(Ex. 1005 at FIG. 4 (annotated); Ex. 1002 at ¶101.)

FIG. 25



(Ex. 1005 at FIG. 25 (annotated); Ex. 1002 at ¶101.)

That is, as shown above with respect to Figure 25 (illustrating structure of the total sum part 10b from Figure 4), after receiving all the outputs of the element processors PE in processor array 10a in parallel with each other, “[t]he total sum circuits 12a to 12c are provided in correspondence to *the respective predictive modes* and *driven in parallel with each other*, whereby *the evaluation values* [$\Sigma|a-b|$, $\Sigma o|a-b|$ and $\Sigma e|a-b|$] *corresponding to the respective predictive modes can be computed and outputted in parallel with each other.*” (Ex. 1005 at 20:48-52 (emphasis added), FIG. 25; *see also id.* at 13:4-14 (explaining that evaluation values $\Sigma|a-b|$, $\Sigma o|a-b|$ and $\Sigma e|a-b|$ correspond to the frame predictive mode, the odd

field predictive mode, and the even field predictive mode, respectively), 20:27-48.)
(Ex. 1002 at ¶102.)

In view of the foregoing, *Hanami* discloses “comparing pixels of a first pixel array in a picture currently being coded with pixels of a plurality of second pixel arrays in at least one reference picture,” as set forth in claim element 1(b)[1]. (Ex. 1002 at ¶103.)

Claim element 1(b)[2]

Hanami further discloses “concurrently performing motion estimation for each of a plurality of different prediction modes in order to determine which of the prediction modes is an optimum prediction mode,” as set forth in claim element 1(b)[2], as it discloses performing motion estimation in parallel (“concurrently”) for at least a frame predictive mode, odd field predictive mode, and even field predictive mode (“each of a plurality of different prediction modes”) in order to determine which of the predictive modes is an optimum predictive mode. (Ex. 1002 at ¶104.)

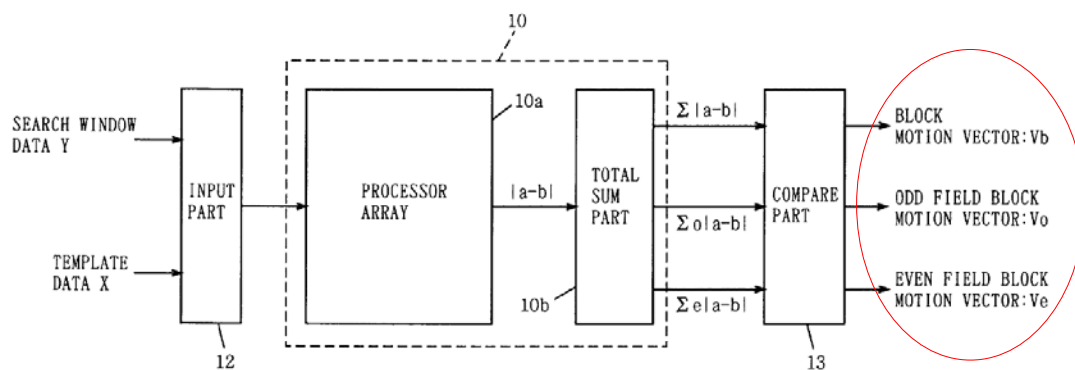
For example, *Hanami*’s objective is to “simultaneously detect optimum vectors efficiently coded for a plurality of predictive modes in parallel with each other” such that “[a] motion vector is produced on the basis of the optimum vector.” (Ex. 1005 at 6:52-55, 7:13-14, 11:9-11, 15:38-39 (disclosing that “a motion vector is detected for each macroblock”), 24:3-8.) Thus, a POSITA would

have readily understood that *Hanami* performs concurrent motion estimation to produce the evaluation values $\Sigma|a-b|$, $\Sigma o|a-b|$ and $\Sigma e|a-b|$ corresponding to the different predictive modes in order to determine which of the predictive modes is an optimum predictive mode, as claimed. (*See id.* at 6:1-10 (explaining that “to attain excellent coding efficiency,” it is “necessary” to perform motion detection for a plurality of predictive modes to select the optimum predictive mode and detect motion vectors in accordance with the optimum predictive mode); Ex. 1002 at ¶105.)

Put another way, given that “[i]t is necessary to transmit a motion vector per pixel block” (Ex. 1005 at 3:26), once *Hanami*’s motion vector detector concurrently computes evaluation values $\Sigma|a-b|$, $\Sigma o|a-b|$ and $\Sigma e|a-b|$ corresponding to the frame predictive mode, the odd field predictive mode, and the even field predictive mode, respectively, these evaluation values serve as candidates for determining the optimum prediction mode. (Ex. 1002 at ¶106.) To this end, as discussed below with respect to claim element 1(c), *Hanami* discloses that its motion vector detector includes “a compare part 13 for receiving the three evaluation values $\Sigma|a-b|$, $\Sigma o|a-b|$ and $\Sigma e|a-b|$ obtained in the operation part 10” (*see* Ex. 1005 at 12:65-13:3) and “[t]he compare part 13 outputs motion vectors (optimum vectors) decided in accordance with the respective predictive modes, i.e., a block motion vector V_b decided in accordance with the frame predictive

mode, an odd field block motion vector V_o decided in accordance with the odd field predictive mode and an even field block motion vector V_e decided in accordance with the even field predictive mode in parallel with each other” (*id.* at 13:15-23.) (*See infra* Section IX.A.1.c.)

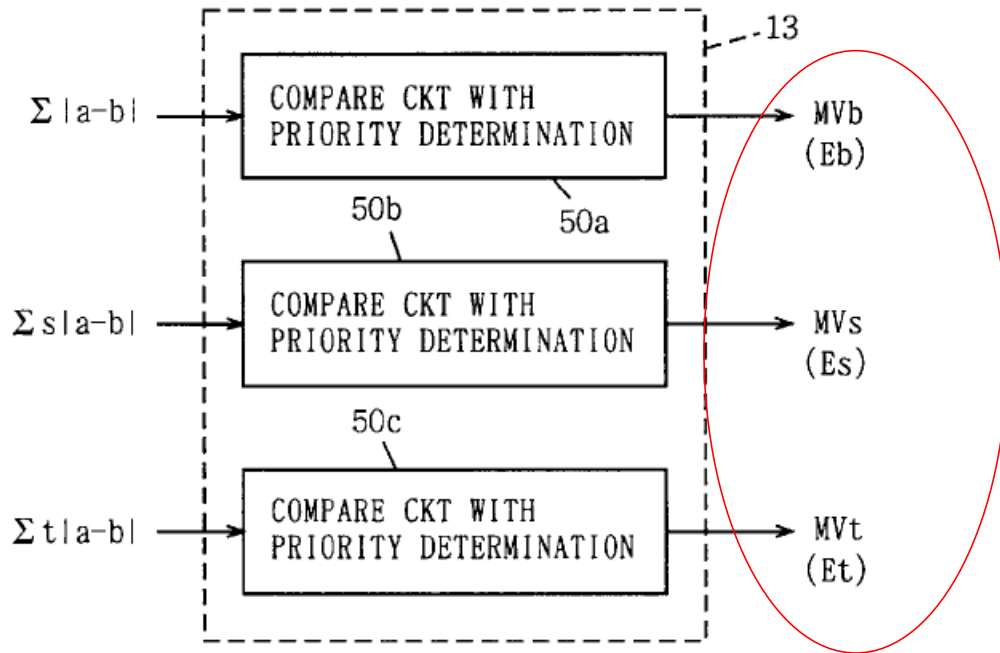
FIG. 4



(Ex. 1005 at FIG. 4 (annotated); Ex. 1002 at ¶106.)

Hanami discloses a detailed configuration of its compare part 13 by way of Figure 32. (Ex. 1005 at 8:55-56, 23:49-24:15, FIG. 32.)

FIG. 32



(Ex. 1005 at FIG. 32 (annotated); Ex. 1002 at ¶107.)

As an initial matter, Petitioner notes that it relies on the embodiment of compare part 13 described with respect to Figure 32 including any optional features of the compare part 13 described therein. For example, within its description of Figure 32, *Hanami* discloses that “[t]he compare part 13 evaluates the evaluation values and outputs optimum vectors MVb , MVs and MVt [annotated above in red] corresponding to the respective predictive modes,” as illustrated in Figure 32. (Ex. 1005 at 24:1-3, FIG. 32.) *Hanami* further discloses that “why these vectors MVb , MVs and MVt are called *not motion vectors but optimum vectors* is that a structure of performing further selection from the

plurality of predictive modes and *deciding a motion vector in accordance with the predictive system having the minimum evaluation value* may be employed.” (*Id.* at 24:3-8 (emphasis added).) While this structure is described in optional terms within the Figure 32 embodiment of compare part 13, Petitioner is relying on the embodiment in Figure 32 of the compare part 13 including this optional structure. (Ex. 1002 at ¶108.)

Thus, by disclosing that its compare part 13 decides a motion vector based on the predictive mode having a minimum evaluation value, *Hanami* discloses “determin[ing] which of the prediction modes is an optimum prediction mode,” as claimed, based on the concurrent performance of motion estimation for the plural predictive modes. This is consistent with what a POSITA at the time of the alleged invention would have understood as the objective of performing motion estimation in different prediction modes—to determine an optimum prediction mode for a current macroblock being coded. (Ex. 1002 at ¶109 (citing Ex. 1007 at 2:66-3:12, Ex. 1005 at 6:1-37); *see also id.* at ¶¶40-42 (describing this well-known objective), ¶¶43-52 (describing the well-known concept of accomplishing this objective by performing concurrent motion estimation).) In *Hanami*, the predictive mode having a minimum evaluation value would correspond to the claimed “optimum prediction mode” from among the frame predictive mode and the even/odd-field predictive modes. (Ex. 1002 at ¶110 (citing Ex. 1005 at 24:3-8).)

(1) “Concurrently” Under *Sling TV’s Proposed Construction*

As discussed above, Sling TV proposes construing “concurrently performing motion estimation for each of a plurality of different prediction modes” as set forth in claim element 1(b)[2] as “performing motion estimation according to each of a plurality of prediction modes during the same search operation for a given macroblock, without performing a separate search on the same macroblock for each such mode.” (*See supra* Section VIII.) *Hanami* discloses claim element 1(b)[2] under this proposed construction. (Ex. 1002 at ¶111.)

For example, *Hanami* discloses performing motion estimation (e.g., *Hanami’s* block matching between the template block 1 (TB1) of a current frame 36 (FIGS. 8A-8D) and reference image blocks (e.g., MB1-MB3) included a search area in reference frame 37 (e.g., FIGS. 10-11)) according to each of a plurality of prediction modes (e.g., *Hanami’s* frame predictive mode, odd field predictive mode, and even field predictive mode) during the same search operation for a given macroblock (e.g., during the same search operation for TB1 as the total sum part 10b computes and outputs the evaluation values $[\Sigma|a-b|, \Sigma o|a-b|$ and $\Sigma e|a-b|]$ corresponding to the respective predictive modes in parallel with each other), without performing a separate search on the same macroblock (e.g., TB1) for each such mode. (*See supra* Section IX.A.1.b); Ex. 1002 at ¶112.)

In particular, as discussed above, *Hanami* repeatedly and explicitly discloses that for a given template block TB1, evaluation values $[\Sigma|a-b|, \Sigma_o|a-b|$ and $\Sigma_e|a-b|]$ respectively corresponding to the frame predictive mode, odd field predictive mode, and even field predictive mode are simultaneously computed and output (e.g., by the total sum part 10b illustrated in Figures 4 and 25). (Ex. 1005 at 13:41-53, 20:48-52 (disclosing that “the evaluation values corresponding to the respective predictive modes can be computed and outputted **in parallel** with each other”) (emphasis added), FIGS. 4, 25; *see also id.* at 13:4-14, 15:64-16:34, 20:27-48.) (*See also supra* Section IX.A.1.b.) Thus, a POSITA would have understood that since these evaluation values (which are indicative of the correlation between TB1 in current frame 36 and the reference blocks in the search area in the reference frame 37) are computed in parallel for a given template block TB1, these evaluation values are being computed during the same search operation for TB1. (Ex. 1002 at ¶113.) In other words, *Hanami* does not disclose performing a separate search on the same TB1 for each of the prediction modes (e.g., a separate search with respect to TB1 for the frame predictive mode, and then a separate search with respect to TB1 for the even/odd field predictive modes). (*Id.*) Accordingly, *Hanami* discloses this claim term to the extent the construction proposed by Sling TV is adopted.

(2) ***“Optimum” Under Sling TV’s and Unified’s Proposed Constructions***

As discussed above, Sling TV proposes construing “optimum” as set forth in claim element 1(b)[2] as “best or most suitable” while Unified proposes construing the same term as at least including “the prediction mode that yields the smallest value of an error metric.” (See *supra* Section VIII.) *Hanami* discloses claim element 1(b)[2] under these proposed constructions. (Ex. 1002 at ¶114.)

With respect to Sling TV’s proposed construction, as discussed above, *Hanami* expressly discloses that “[i]n order to attain excellent coding efficiency (to reduce the quantity of coded data), it is necessary to perform motion detection in accordance with a plurality of predictive image detection systems (predictive coding systems), ***thereafter select the optimum predictive image detection system,*** and detect motion vectors in accordance with the optimum predictive image detection system.” (Ex. 1005 at 6:3-10 (emphasis added); see also *id. generally* at 6:1-37; Ex. 1002 at ¶109 n.17.) Thus, given that *Hanami* discloses selecting an “optimum” predictive mode in order to attain “excellent coding efficiency” that is based on the concurrent motion estimation performance for the frame predictive mode and the even/odd-field predictive modes applied in the relied-upon disclosures of *Hanami*, a POSITA would have understood that the “optimum”

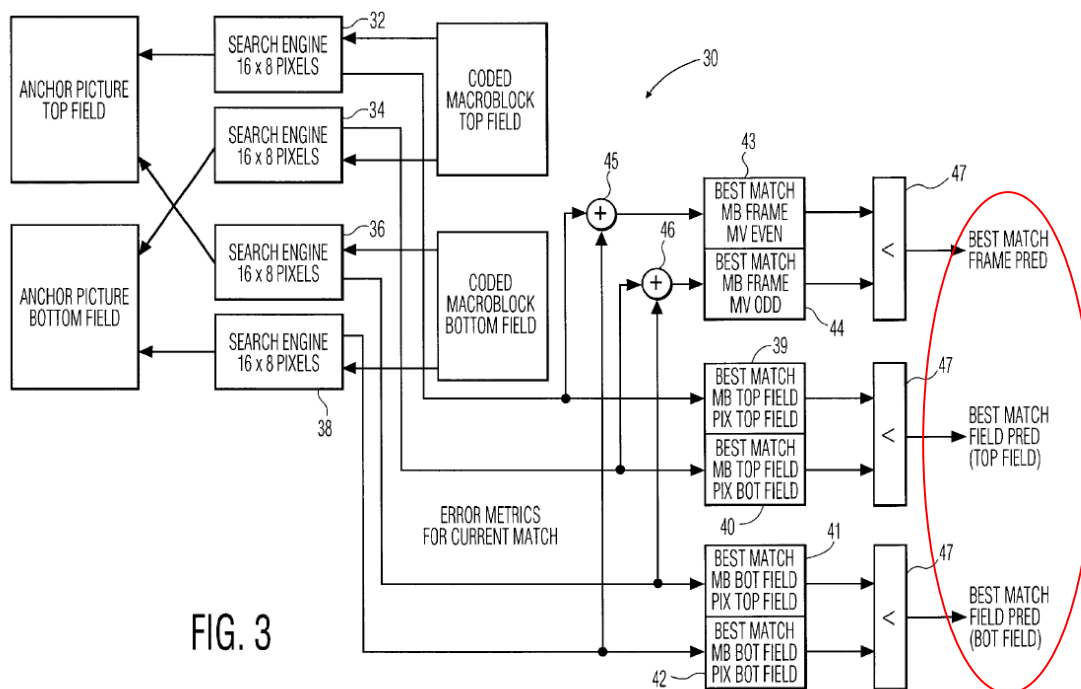
predictive mode would have been the “best or most suitable” predictive mode under Sling TV’s proposed construction. (Ex. 1002 at ¶115.)

This is further evidenced by *Hanami*’s disclosure considering Unified’s proposed construction. In particular, as noted above, *Hanami* specifically discloses that its compare part 13 employs a structure where, from among the optimum motion vectors generated for the plurality of predictive modes, a motion vector “with the predictive system [i.e., predictive mode] having ***the minimum evaluation value***” is determined, where “[t]he absolute differential sums [representing, e.g., displacement between the block TB1 in current frame and reference blocks MB1-MB3 included in the search area in the reference frame] are generally called evaluation values.” (Ex. 1005 at 24:3-8 (emphasis added), 3:2-25.) (Ex. 1002 at ¶¶75-79.) Thus, because *Hanami* discloses determination of a motion vector based on which predictive mode has the minimum evaluation value (“smallest value of an error metric”), *Hanami* discloses determining the prediction mode that yields the smallest value of an error metric under Unified’s proposed construction. Furthermore, such a predictive mode with the minimum evaluation value would have been the “best or most suitable” predictive mode under Sling TV’s construction as it would be the closest approximation to the current block being processed. (Ex. 1002 at ¶116.)

- c) determining which of the second pixel arrays constitutes a best match with respect to the first pixel array for the optimum prediction mode; and,

Hanami discloses this claim element. (Ex. 1002 at ¶¶117-125.)

First, as discussed above with respect to claim elements 1(b)[1] and 1(b)[2], the claimed “motion estimation” encompasses the block-matching technique. (*See supra* IX.A.1.b).) Here, the “block-matching” technique would include “determining which of the second pixel arrays constitutes a best match with respect to the first pixel array for the optimum prediction mode,” as claimed. (Ex. 1002 at ¶118.) The ’005 patent’s disclosure is consistent with this understanding, as it does not disclose a separate step (outside of the motion estimation processing) that determines a best block match for the optimum prediction mode. (Ex. 1001 at 2:49-3:1.) In other words, the best block match for each prediction mode (including the optimum prediction mode) is identified as part of the motion estimation when the different prediction modes are concurrently applied. (*Id.*; *see also id.* at 8:49-9:27, FIG. 3 (outputs of block 47).)



(*Id.* at FIG. 3 (annotated); Ex. 1002 at ¶118.)

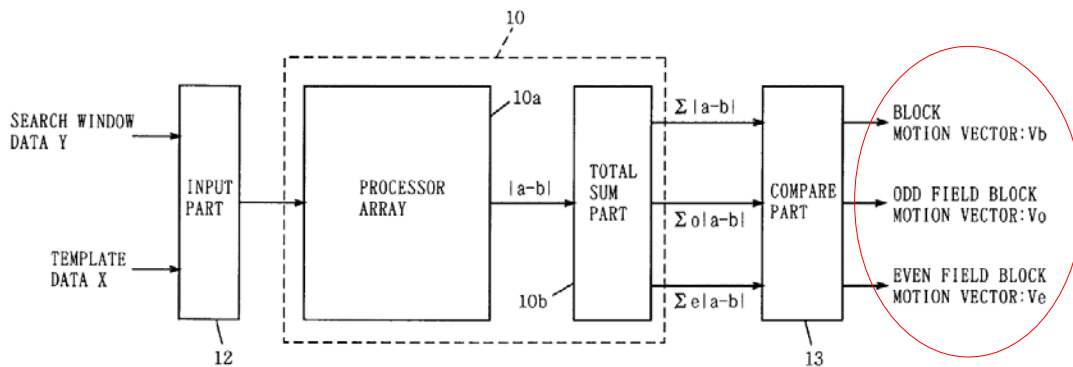
Coming to *Hanami*'s disclosure regarding claim element 1(c), *Hanami* discloses determining which of the reference candidate blocks (e.g., MB1-MB3) included a search area in a reference frame (FIGS. 10-11) ("second pixel arrays") constitutes a best match with respect to the template block TB1 (FIGS. 8A-8B) ("first pixel array") for the optimum prediction mode. (Ex. 1002 at ¶119.)

As discussed above with respect to claim elements 1(b)[1]-(2), *Hanami*'s objective is to "simultaneously detect optimum vectors efficiently coded for a plurality of predictive modes in parallel with each other" such that "[a] motion vector is produced on the basis of the optimum vector." (Ex. 1005 at 6:1-10, 6:52-55, 7:13-14, 11:9-11, 15:38-39, 24:3-8.) And given that "[i]t is necessary to

transmit a motion vector per pixel block” (*id.* at 3:27), once *Hanami*’s motion vector detector computes evaluation values $\Sigma|a-b|$, $\Sigma_o|a-b|$ and $\Sigma_e|a-b|$ corresponding to the frame predictive mode, the odd field predictive mode, and the even field predictive mode, respectively, one of these evaluation values must be considered as a best match based on the optimum prediction mode. (Ex. 1002 at ¶120.)

To this end, as discussed above, *Hanami* discloses that its motion vector detector includes “a compare part 13 for receiving the three evaluation values $\Sigma|a-b|$, $\Sigma_o|a-b|$ and $\Sigma_e|a-b|$ obtained in the operation part 10” (*see* Ex. 1005 at 12:65-13:3) and “[t]he compare part 13 outputs motion vectors (optimum vectors) [V_b , V_o , V_e] decided in accordance with the respective predictive modes” (*see* Ex. 1005 at 13:15-23.) (*See supra* Section IX.A.1.b.)

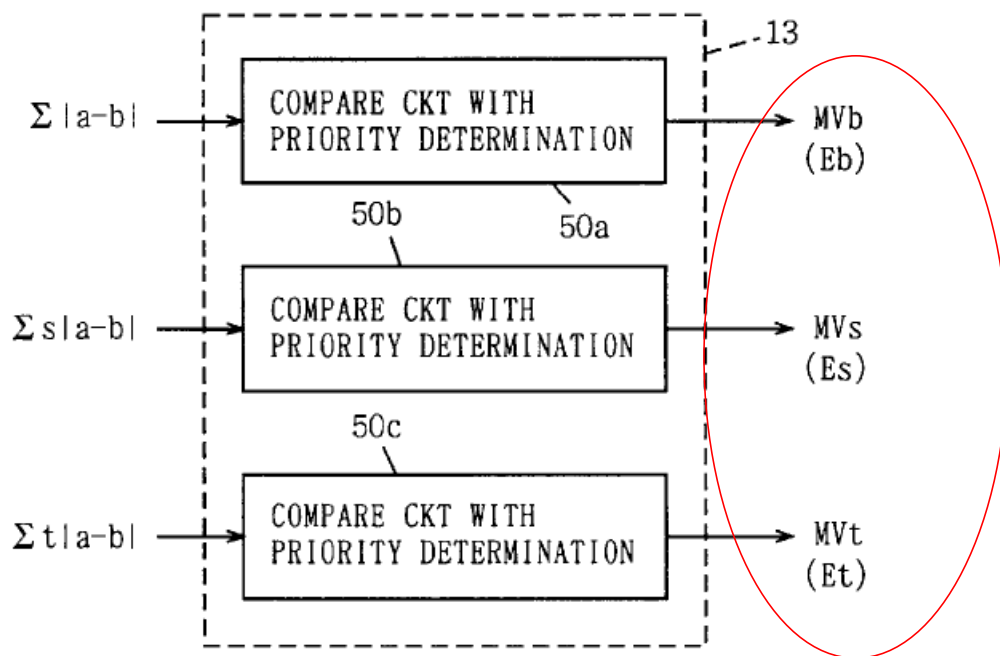
FIG. 4



(Ex. 1005 at FIG. 4 (annotated); Ex. 1002 at ¶121.)

As discussed above with respect to claim element 1(b), *Hanami* specifically discloses that its compare part 13 employs a structure where, from among the optimum vectors generated for the plurality of predictive modes, a motion vector “with the predictive system [i.e., predictive mode] having the minimum evaluation value” is decided. (*Id.* at 24:3-8; *see also id.* at 8:55-56, 23:49-24:15.) (*See also supra* Section IX.A.1.b).)

F I G. 3 2



(Ex. 1005 at FIG. 32 (annotated); Ex. 1002 at ¶122.)

Thus, by disclosing that a motion vector is decided based on the predictive mode having a minimum evaluation value, *Hanami* discloses “determining which of the second pixel arrays constitutes a best match with respect to the first pixel

array for the optimum prediction mode,” as claimed. This is consistent with the objective of block matching as would have been understood by a POSITA and confirmed by *Hanami*. (Ex. 1002 at ¶123 (citing Ex. 1005 at 6:1-37); *see also id.* at ¶¶40-42.) As discussed above, the predictive mode having a minimum evaluation value (“best match”) would correspond to the claimed “optimum prediction mode” from among the frame predictive mode and the even/odd-field predictive modes applied in *Hanami*’s relied-upon disclosures. (*Id.* (citing Ex. 1005 at 24:3-8).) (*See supra* Section IX.A.1.b).)¹¹

(1) “Best match” Under Sling TV’s and Unified’s Proposed Constructions

As discussed above, Sling TV proposes construing “best match” as set forth in claim element 1(c) as “the second pixel array within a specified search range of the reference picture having the smallest value of an error metric” while Unified proposes construing the same term as at least including the array included in the search “having the smallest value of an error metric.” (*See supra* Section VIII.)

¹¹ Given the way the claims are drafted, where claim elements 1(b) and 1(c) both encompass the same video coding process of “motion estimation” (e.g., block-matching), Petitioner is citing to and relying upon similar disclosures from *Hanami* to disclose the claimed “optimum prediction mode” in claim element 1(b) and “best match” in claim element 1(c). (*See supra* Section IX.A.1.b).)

Hanami discloses claim element 1(c) under these proposed constructions. (Ex. 1002 at ¶124.)

Under either construction, as discussed above, *Hanami* discloses that its compare part 13 employs a structure where, from among the optimum motion vectors generated for the plurality of predictive modes, a motion vector “with the predictive system [i.e., predictive mode] having *the minimum evaluation value*” is determined, where “[t]he absolute differential sums [representing, e.g., displacement between the block TB1 in current frame and reference blocks (e.g., MB1-MB3) included in a search area in the reference frame] are generally called evaluation values.” (Ex. 1005 at 24:3-8 (emphasis added), 3:2-25.) (Ex. 1002 at ¶¶75-83.) Thus, because *Hanami* discloses determination of a motion vector based on which predictive mode has the minimum evaluation value, a POSITA would have understood that *Hanami* discloses determining which one of the reference blocks (e.g., MB1-MB3) included in the search area in reference frame 37 (“the second pixel array within a specified search range of the reference picture”) has the minimum evaluation value (“having the smallest value of an error metric”) as contemplated by the constructions proposed by Sling TV and Unified. (Ex. 1002 at ¶125; *see also supra* Section IX.A.1.b)(2).)¹²

¹² *See supra* n.11.

- d) generating a motion vector for the first pixel array in response to the determining step.

Hanami discloses this claim element, including for reasons similar to those discussed above with respect to claim element 1(c). (Ex. 1002 at ¶¶126-133.)

In particular, as discussed above with respect to Figures 4 and 32, the compare circuit 13 outputs optimum vectors (block motion vector V_b corresponding to frame predictive mode, odd field block motion vector V_o corresponding to the odd field predictive mode, and even field block motion vector V_e corresponding to the even field predictive mode) based on receiving the evaluation values $\Sigma|a-b|$, $\Sigma_o|a-b|$ and $\Sigma_e|a-b|$ obtained from the operation part 10. (*See supra* Section IX.A.1.c); Ex. 1002 at ¶127.)

Hanami discloses with respect to its overall motion vector detection structure that after the optimum motion vectors are generated based on the evaluation values computed for the different predictive modes, a “[m]otion vector for a single macro block [i.e., the template block] is decided on the basis of these optimum vectors.” (Ex. 1005 at 11:9-11; *see also id.* at 3:26, 3:39-40, 15:38-39, 24:3-8.) *Hanami* specifically discloses that its compare part 13 employs a structure where, from among the optimum vectors generated for the plurality of predictive modes, a motion vector “with the predictive system [i.e., predictive mode] having the minimum evaluation value” is determined. (*Id.* at 24:3-8, FIG. 32.) (*See also supra* Section IX.A.1.b.) Thus, *Hanami* discloses generating a motion vector for

the template block TB1 (e.g., “first pixel array”) in response to determining the best block match for the optimum prediction mode (e.g., the prediction mode having a minimum evaluation value). (Ex. 1002 at ¶128.)

A POSITA would have understood that *Hanami*’s motion vector detector chooses one of the optimum vectors generated by the compare part 13 as a motion vector for the template block TB1 based on, e.g., the minimum absolute value of the corresponding evaluation values of the motion vectors. This is confirmed by the above-noted disclosure of *Hanami* with respect to Figure 32 (*see, e.g.*, Ex. 1005 at 24:3-8) and also because, as *Hanami* acknowledges, “[i]t is necessary to transmit a motion vector per pixel block.” (*Id.* at 3:26; *see also id.* at 3:39-40 (“Motion vector detection is executed in the units of the blocks.”).) Thus, for each template block being coded, a motion vector must be chosen for transmission to a decoder (after the motion vector is encoded) based on whether it corresponds to the best block match for the optimum prediction mode. (Ex. 1002 at ¶129.)

This is consistent with the ’005 patent’s description of a “motion vector” and how the motion vector for the best match is output based on the optimum prediction mode. (Ex. 1002 at ¶130.) For example, the ’005 patent’s discloses a motion vector in the context of the “fundamental technique of motion estimation” (Ex. 1001 at 2:49-50), stating that “the match having the smallest value of the corresponding sum is selected as the best match within the specified search range,

and its horizontal and vertical positions relative to the current macroblock therefore constitute the motion vector.” (*Id.* at 2:64-3:1.) The ’005 patent further states that once the best match results for the different prediction modes are compared to identify the optimum prediction mode, “[t]he corresponding motion vector for the best match produced by the selected prediction mode is then output.” (*Id.* at 9:28-35; Ex. 1002 at ¶130.)

As such, a POSITA would have understood in light of the ’005 patent’s disclosure that the claimed “generating a motion vector for the first pixel array in response to the determining step” as set forth in claim element 1(d) encompasses outputting a motion vector chosen or selected from amongst the vectors corresponding to the best match results for the different prediction modes. (Ex. 1002 at ¶131.) This is what *Hanami* discloses—i.e., as discussed above, *Hanami* discloses that, after the optimum vectors are generated based on the evaluation values computed for the different predictive modes, a “[m]otion vector for a single macro block [i.e., the template block] is decided on the basis of these optimum vectors.” (Ex. 1005 at 11:9-11; *see also id.* at 3:26, 3:39-40, 24:3-8; Ex. 1002 at ¶132 (further describing how *Hanami* goes to great pains to reiterate that the vectors MVb, MVs and MVt output from its compare part 13 in Figure 32 are not called “motion vectors” but instead “optimum vectors” because the compare part

13 has additional structure for deciding a motion vector based on the predictive mode having a minimum evaluation value).)

It was suggested during prosecution that “generating a motion vector,” as claimed, is limited to newly creating a motion vector after determining the best match corresponding to the optimum prediction mode. (*See supra* Section VII.A.2.) Even if the claim is interpreted this way, *Hanami* discloses this feature as it discloses “***performing further selection*** from the plurality of predictive modes and ***deciding a motion vector*** in accordance with the predictive system having the minimum evaluation value.” (Ex. 1005 at 24:3-8; *see also id.* at 11:9-11, 15:38-39.) That is, a POSITA would have understood that until the “further selection” from the plural predictive modes is performed, no “motion vector” for the template block TB1 currently being coded is decided and thus no specific “motion vector” for the template block TB1 exists at that time since each of the optimum vectors would be a candidate vector. (Ex. 1002 at ¶133.) Once the “further selection” is made based on the minimum evaluation value from amongst the different predictive modes, then “a motion vector” is decided, i.e., a “motion vector” is generated for the template block TB1. (*Id.*)

2. Claim 2

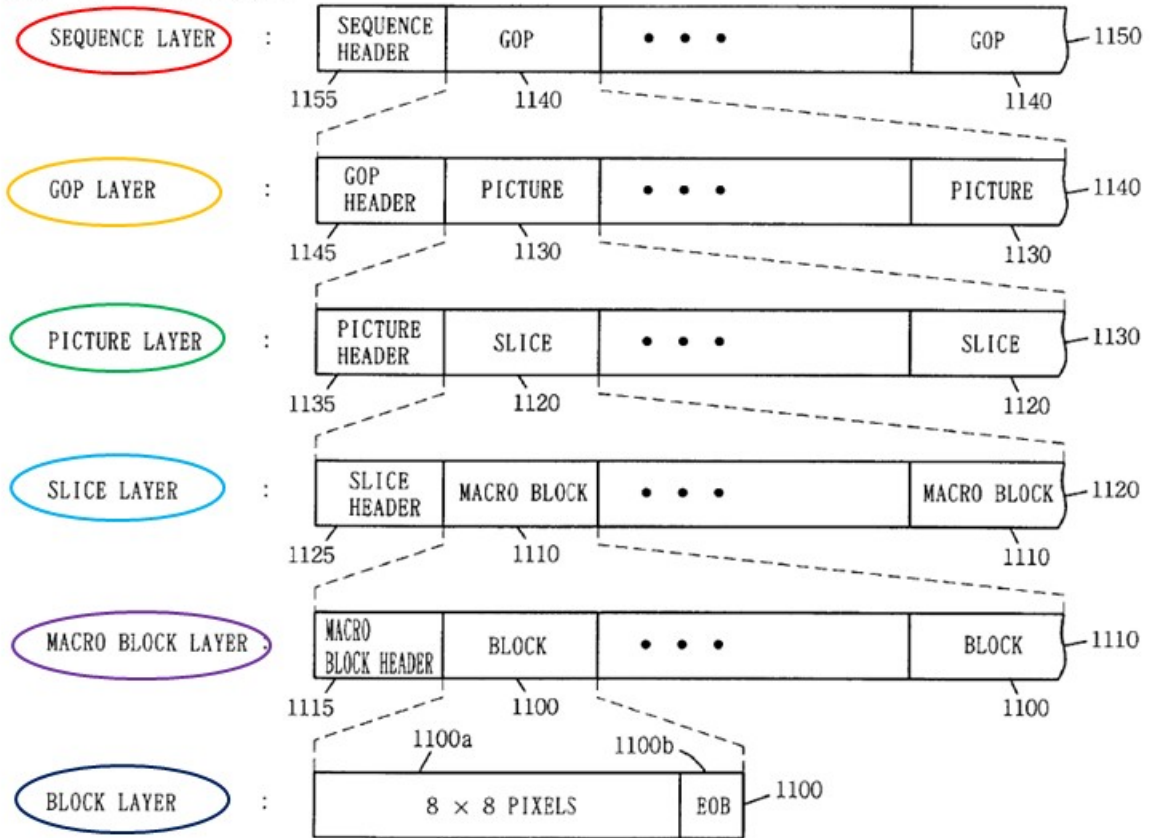
- a) The method as set forth in claim 1, wherein the first and second pixel arrays each have a size and structure defined by an MPEG standard.

Hanami discloses this claim. (Ex. 1002 at ¶¶134-143.)

For example, *Hanami* discloses that the template block TB1 (FIGS. 8A-8B) (“first pixel array”) and the candidate reference blocks (e.g., MB1-MB3) (FIGS. 10-11) included in the search area (“second pixel arrays”) each have a size and structure defined by an MPEG standard. (Ex. 1002 at ¶135.)

In particular, *Hanami* discloses the format of its image signals (including the template block in a current frame and candidate reference blocks within a search area in a reference frame) by way of its background with respect to Figure 87.

FIG. 87 PRIOR ART



(Ex. 1005 at FIG. 87 (annotated); Ex. 1002 at ¶136.)

Hanami discloses that “FIG. 87 schematically illustrates *the structure (syntax)* of image data coded by the video multiplex coding circuit 914 shown in FIG. 83.”¹³ (Ex. 1005 at 4:1-3 (emphasis added), FIG. 87.) Specifically, with

¹³ A POSITA would have understood that *Hanami* does not propose to change the “overall structure of an encoder for coding image data” as shown in Figure 83. (Ex. 1005 at 1:44-47, FIG. 83.) (See *supra* Section IX.A.1.a.)

reference to annotated Figure 87 above, *Hanami* discloses that “the bit stream is split into a plurality of layers, i.e., a sequence layer [annotated in red], a GOP (group of picture) layer [annotated in orange], a picture layer [annotated in green], a slice layer [annotated in light blue], a macro block layer [annotated in purple] and a block layer [annotated in dark blue] in order from the uppermost layer.” (Ex. 1005 at 4:7-10.) And *Hanami* discloses with respect to its macro block 1110 (e.g., template block TB1 and reference blocks such as MB1-MB3 included in the search area) that it “includes a prescribed number of (six) blocks 1100” and “a macro block header 1115.”¹⁴ (*Id.* at 4:17-23; Ex. 1002 at ¶137.)

This is the exact same structure of MPEG, as confirmed by contemporaneous MPEG-related literature at the time. For instance, an authoritative and well-known MPEG textbook at the time of the alleged invention entitled “MPEG Video Compression Standard” by *Mitchell et al.* (Ex. 1006) (“*Mitchell*”)¹⁵ discloses that the **MPEG-1** bit stream syntax layers include the same six layers as reflected in Figure 8.1 below: sequence layer (annotated in red), GOP

¹⁴ *Hanami*’s template block TB1 and reference candidate blocks (e.g., MB1-MB3) are all macroblocks. (Ex. 1005 at 15:39-41, 15:64-66; Ex. 1002 at ¶137 n.23.)

¹⁵ Dr. Rabbani also refers to the *Mitchell* textbook in the technology background section. (See, e.g., Ex. 1002 at ¶¶20-22.)

layer (annotated in orange), picture layer (annotated in green), slice layer (annotated in light blue), macroblock layer (annotated in purple), and block layer (annotated in dark blue).¹⁶ (*Id.* at 166-168, FIG. 8.1.) And just like *Hanami*, *Mitchell* discloses that “[t]he macroblock is a group of six 8x8 DCT blocks” and “starts with a macroblock header.” (*Id.* at 167-169.)

¹⁶ Petitioner relies on the teachings of *Hanami* for the features of claim 2. The *Mitchell* textbook demonstrates what a POSITA would have known at the time of the alleged invention regarding the size and structure of pixel arrays (being coded) as defined by an MPEG standard. This knowledge would have confirmed a POSITA’s understanding that *Hanami*’s template block TB1 (FIGS. 8A-8B) and candidate reference blocks (e.g., MB1-MB3) (FIGS. 10-11) in the search area each have a size and structure defined by an MPEG standard. *Int’l Bus. Machines Corp. v. Intellectual Ventures II, LLC*, IPR2015-00089, Paper No. 44 at 15 (Apr. 25, 2016).

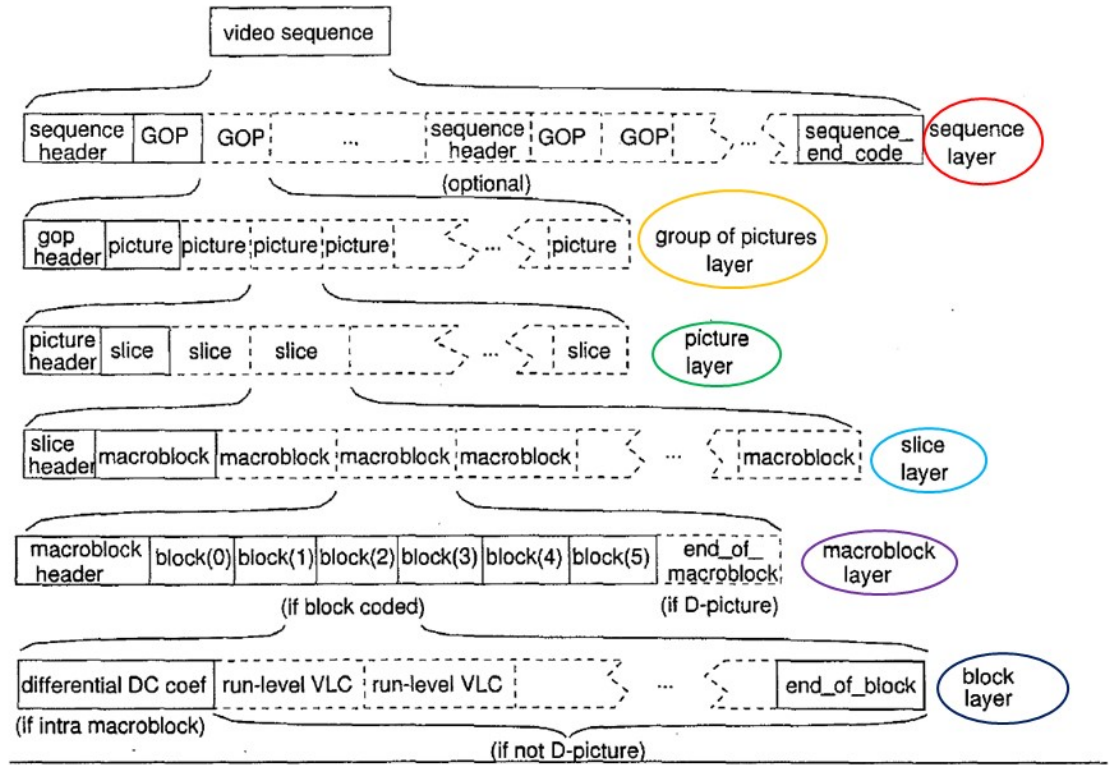


Figure 8.1: The layers of a video stream.

(Ex. 1006 at 168 (Figure 8.1) (annotated); *see also id.* at 167 (“Figure 8.1 gives an overview of the six layers in MPEG-1 video sequences.”); Ex. 1002 at ¶138.)

Indeed, a side-by-side comparison of the known MPEG structure of video sequences and that disclosed in *Hanami*, as shown below, readily confirms that the video sequence structure in *Hanami* is defined by an MPEG Standard.

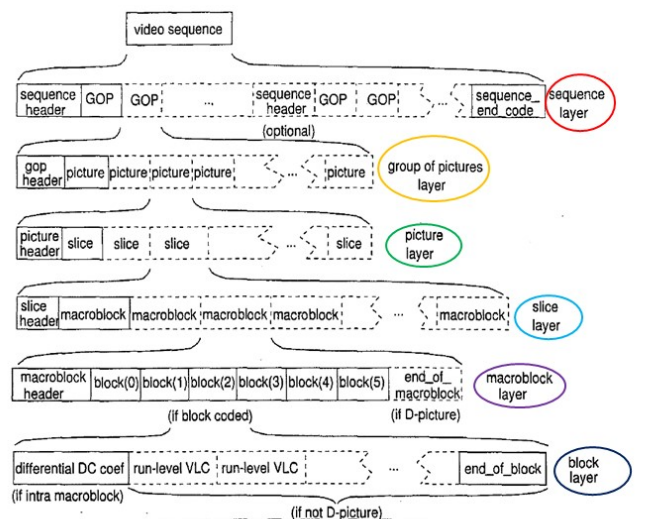
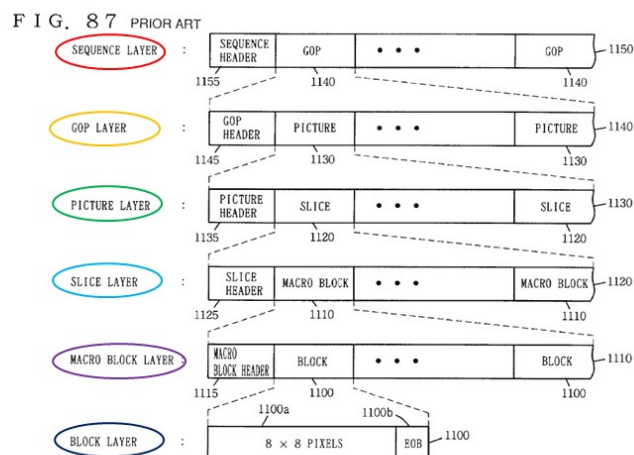


Figure 8.1: The layers of a video stream.



(Ex. 1006 at 167 (Figure 8.1) (annotated) (left); Ex. 1001 at FIG. 87 (annotated) (right); Ex. 1002 at ¶139.)

Coming to the “size” of *Hanami*’s template and reference candidate blocks (e.g., the first pixel array or the second pixel arrays), *Hanami* discloses that its template block TB1 (FIGS. 8A-8B) (“first pixel array”) and reference image blocks such as macroblocks MB1-MB3 (FIGS. 10-11) (“second pixel arrays”) in the search area are of size 16x16, as discussed above with respect to claim element 1(b). (See *supra* Section IX.A.1.b); Ex. 1002 at ¶140, citing Ex. 1005 at 15:39-47, 16:53-55, FIGS. 8A-8B, 15.)

Again, this is the same exact size of blocks in MPEG, as confirmed by the *Mitchell* textbook. In particular, *Mitchell* discloses that “[t]he basic building block of an MPEG picture is the macroblock, sketched in Figure 2.6. ***The macroblock***

consists of a 16 x 16 sample array.” (Ex. 1006 at 58 (section 2.3.3) (emphasis added).)

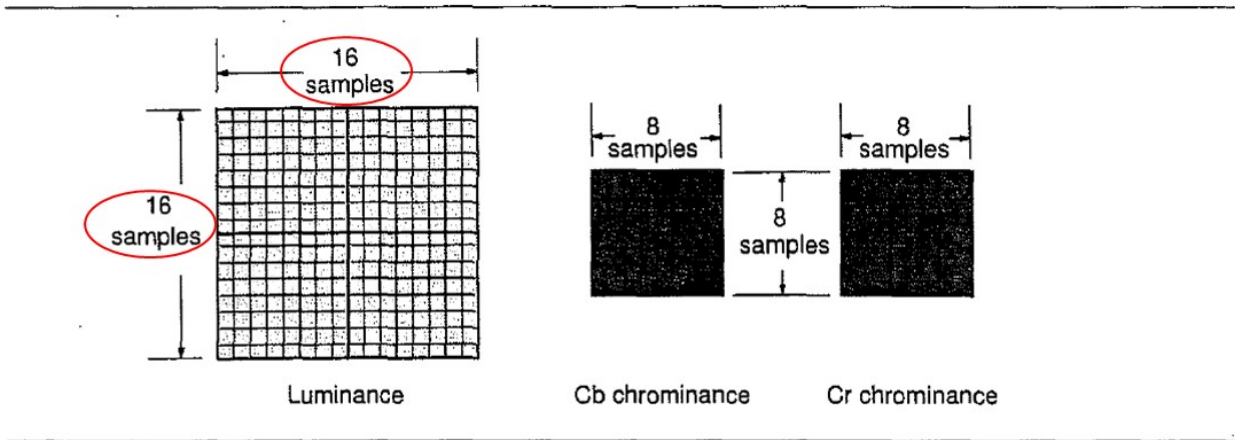


Figure 2.6: The MPEG macroblock.

(Ex. 1006 at 59 (Figure 2.6) (annotated); Ex. 1002 at ¶141.)

This understanding of the size and structure of the template block TB1 and the candidate reference blocks (e.g., MB1-MB3) in the search area is consistent with the '005 patent, which also discloses a 16x16 macroblock just like *Hanami*'s macroblock. (Ex. 1002 at ¶142 (citing Ex. 1001 at 2:26-27), FIG. 1).

Thus, a POSITA would have readily understood that the template block TB1 (“first pixel array”) and the candidate reference blocks (e.g., MB1-MB3) in the search area (“second pixel arrays”) in *Hanami* each have a size and structure defined by an MPEG standard, as claimed. (Ex. 1002 at ¶143.)

3. Claim 3

- a) The method as set forth in claim 1, wherein the method is implemented using a motion estimation search engine of a digital video encoder.

Hanami discloses this claim. (Ex. 1002 at ¶¶144-148.)

As an initial matter, the '005 patent discloses in relation to this feature that “[f]or all MPEG-2 prediction modes, the fundamental technique of *motion estimation consists of comparing the current macroblock with a given 16-by-16 pixel array in the anchor picture*, estimating the quality of the match according to the specified metric, and repeating this procedure for every such 16-by-16 pixel array located within the search range. *The hardware or software apparatus that performs this search is usually termed the ‘search engine.’*” (Ex. 1001 at 2:49-56 (emphasis added).) Thus, any hardware or software in *Hanami* that performs the method set forth in claim 1 discloses the claimed motion estimation search engine of a digital video encoder. (Ex. 1002 at ¶145.)

Hanami discloses that its method is implemented using a source coding circuit 912 (“motion estimation search engine”) of a digital video encoder shown in Figure 83, as discussed above with respect to claim element 1(a) and further discussed below. (*See supra* Section IX.A.1.a); Ex. 1002 at ¶146.)

For example, *Hanami* discloses an “overall structure of an encoder for coding image data” as shown in Figure 83.¹⁷ (Ex. 1005 at 1:44-47; FIG. 83.) The encoder includes a “source coding circuit 912 [which] performs an orthogonal transformation such as discrete cosine transformation (DCT), for example, on the supplied signal, *performs motion compensation on the input signal*, and quantizes orthogonal-transformed image data.” (*Id.* at 1:61-65 (emphasis added); *see also id.* at 2:13-67 (describing additional details of the source coding circuit 912 with reference to Figure 84), FIGS. 83-84.)

FIG. 83 PRIOR ART

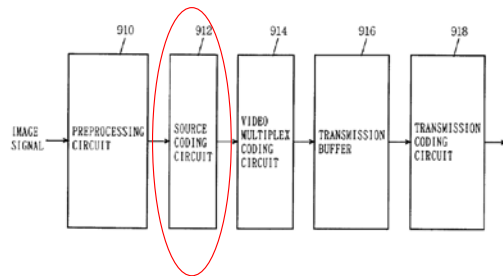
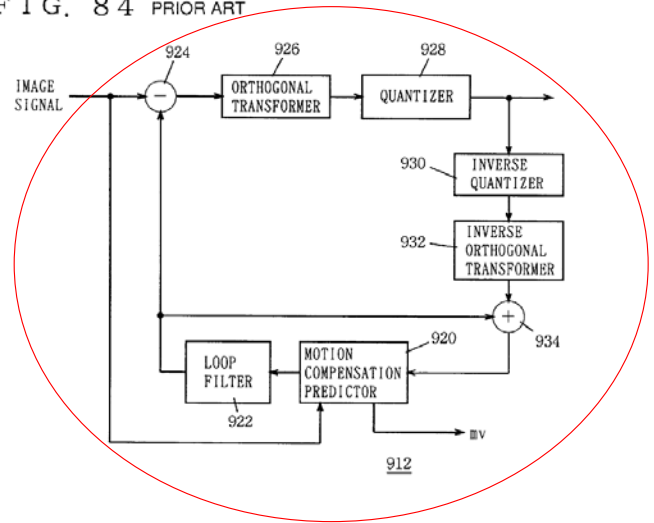


FIG. 84 PRIOR ART



(Ex. 1005 at FIG. 83 (left) (annotated), FIG. 84 (right) (annotated); Ex. 1002 at ¶147.)

¹⁷ See also *supra* n.13.

Specifically, the source coding circuit 912 includes a motion compensation predictor 920 which, among other things, detects motion vectors. (Ex. 1005 at 2:27-33.) As discussed above, *Hanami* explains that the generation of motion vectors involves block matching. (*Id.* at 2:65-67; *see also supra* Section IX.A.1.b.) In other words, the source coding circuit 912 is the hardware or software that performs the search (block-matching) and thus is a “motion estimation search engine,” as claimed. (Ex. 1001 at 2:49-56.) (Ex. 1002 at ¶148.)

4. Claim 5

- a) The method as set forth in claim 1, wherein the motion coding is performed in accordance with an MPEG standard.

Hanami discloses this claim for at least reasons similar to those discussed above with respect to claim 2. (*See supra* Section IX.A.2.) For example, as discussed above with respect to claim 2, *Hanami* discloses a video sequence structure that is defined by the MPEG Standard. (Ex. 1002 at ¶149.) Thus, a POSITA would have understood that the motion coding in *Hanami* is in accordance with an MPEG standard since its video sequence structure is compliant with the MPEG Standard. (*Id.*)

This understanding is confirmed by *Hanami*’s disclosure related to motion coding of motion vectors which is identical to the requirements imposed by MPEG-2 for motion coding of motion vectors. (*Id.* at ¶150.) For example,

Hanami discloses that Figure 3 shows “a list of variable-length codes of the variable-length motion vector components MHC [horizontal component] and MVC [vertical component].” (Ex. 1005 at 12:22-23, FIG. 3; *see also id.* at 11:66-12:5.) The MPEG-2 Part 2 standard (Ex. 1010) discloses Table B.10 which includes variable length codes for motion coding the motion vectors. (Ex. 1010 at 141 (Table B.10).)¹⁸ Table B.10 in the MPEG-2 standard is identical to Figure 3 of *Hanami*. (Ex. 1002 at ¶¶150-151 (showing comparison between *Hanami*’s FIG. 3 and the MPEG-2 standard’s Table B.10).)

¹⁸ Exhibit 1010 is a copy of the MPEG-2 Part 2 standard published in 1996, which is officially known as the ISO/IEC 13818-2 International Standard. (Ex. 1002 at ¶150 n.26.) The MPEG-2 Part 2 standard was made widely available to the public at the time of its release in 1996, and there were no confidentiality restrictions regarding further distribution and dissemination of the standard. (*Id.*) *Mitchell* further confirms that the MPEG-2 Part 2 standard (ISO/IEC 13818-2) was published in 1996. (*Id.*)

5. Claim 6

- a) The method as set forth in claim 5, further comprising the initial step of providing information identifying a picture type of the first pixel array and using this information in the comparing step.

Hanami discloses this claim. (Ex. 1002 at ¶¶152-155.)

For example, *Hanami* discloses that its picture layer 1130 in Figure 87 includes a picture header 1135 which stores “information indicating the type (I picture, P picture or the like) of the picture 1130.” (Ex. 1005 at 4:32-36; FIG. 87; *see also id.* at 4:38-63 (explaining the different picture types).) As explained by *Hanami*, the picture type (e.g., I picture, P picture, or B picture) dictates how the image is coded (e.g., an I picture is coded with only information coded in the image, a P picture is coded based on an already coded I or P picture temporally preceding the current P picture, and a B picture is coded based on an already coded I or P picture temporally preceding the current P picture, an already coded I or P picture temporally subsequent to the current P picture, or an interpolated image produced by the temporally preceding I/P picture and the temporally subsequent I/P picture.) (*Id.* at 4:38-63.) Thus, *Hanami* discloses the initial step of providing information identifying a picture type of the template block (e.g., the picture type of the current frame 36 within which the template block TB1 resides in Figure 8A), and using this information during the block-matching (“comparing step”). For example, the block-matching will depend on whether the current picture is coded

based on only temporally preceding I/P picture(s) or only temporally sequential I/P picture(s), or both. (Ex. 1002 at ¶¶153-155.)

6. Claim 8

- a) The method as set forth in claim 1, wherein the different prediction modes are: frame prediction mode for frame pictures; and, field prediction mode for frame pictures.

Hanami discloses this claim. (Ex. 1002 at ¶¶156-158.)

For example, *Hanami* discloses that the different prediction modes are frame predictive mode (“frame prediction mode”) for frame pictures and even/odd-field prediction modes (“field prediction mode”) for frame pictures. (*Id.* at ¶157.)

In particular, *Hanami* discloses with respect to the motion vector detector illustrated in Figure 4 that it is “adapted to code pixel data in *units of frames*.” (Ex. 1005 at 12:54-55 (emphasis added), FIG. 4.) Thus, the predictive modes described with reference to *Hanami*’s Figure 4 are for frame pictures. Moreover, as discussed above with respect to claim element 1(b)[2], the motion vector detector of Figure 4 calculates evaluation values $\Sigma|a-b|$, $\Sigma_o|a-b|$ and $\Sigma_e|a-b|$, where “[t]he evaluation value $\Sigma|a-b|$ corresponds to that of a *frame predictive mode*,” “[t]he evaluation value $\Sigma_o|a-b|$ corresponds to that in accordance with an *odd field predictive mode*,” and “[t]he evaluation value $\Sigma_e|a-b|$ is that computed in accordance with an *even field predictive mode*.” (*Id.* at 13:4-14 (emphasis added), FIG. 4.) That is, the different prediction modes in *Hanami*’s relied upon

disclosures are a frame predictive mode and odd/even field predictive modes for frame pictures, as claimed, since Figure 4's motion vector detector is configured to code pixel data in units of frames. (Ex. 1002 at ¶158.)

7. Claim 39

- a) A motion estimation search system that concurrently performs motion estimation using each of a plurality of different motion estimation prediction modes and then selects the prediction mode that produces the optimum result.

Hanami discloses the elements of claim 39. (Ex. 1002 at ¶¶159-160.)

For example, as discussed above with respect to claim elements 1(b) and 1(c), *Hanami* discloses a motion estimation search system that performs motion estimation in parallel (“concurrently”) using a frame predictive mode, an even field predictive mode, and an odd field predictive mode (“a plurality of different motion estimation prediction modes”) and then selects the prediction mode that produces the optimum result (e.g., based on which evaluation value corresponding to the different predictive modes is the minimum value). (*See supra* Sections IX.A.1.b)-IX.A.1.c).)

8. Claim 41

- a) A method, including the steps of:

To the extent the preamble of claim 41 is limiting, *Hanami* discloses this element for at least the reasons given above with respect to claim element 1(a). (*See supra* Section IX.A.1.a.) (Ex. 1002 at ¶161.)

- b) concurrently performing motion estimation using each of a plurality of different motion estimation prediction modes;

Hanami discloses this element for at least the reasons given above with respect to claim element 1(b). (*See supra* Section IX.A.1.b.) (Ex. 1002 at ¶162.)

- c) comparing the results produced using each different prediction mode; and,

Hanami discloses this element for at least the reasons given above with respect to claim element 1(b). (*See supra* Section IX.A.1.b.) (Ex. 1002 at ¶163.)

- d) selecting the prediction mode that produced an optimum result; and,

Hanami discloses this element for at least the reasons given above with respect to claim elements 1(b)-1(c). (*See supra* Sections IX.A.1.b)-IX.A.1.c.) (Ex. 1002 at ¶164.)

- e) generating one or more motion vectors using the selected prediction mode.

Hanami discloses this element for at least the reasons given above with respect to claim element 1(d). (*See supra* Section IX.A.1.d.) (Ex. 1002 at ¶165.)

B. Ground 2: *Hanami* and *Mitchell* Render Obvious Claims 2 and 5

1. Claim 2

As discussed above, *Hanami* discloses that the first and second pixel arrays (e.g., *Hanami*'s template block TB1 and candidate reference blocks such as MB1-MB3 included in the search area) each have a size and structure defined by an MPEG standard, as required by claim 2. (*See supra* Section IX.A.2; Ex. 1002 at ¶¶166-172.)

To the extent PO argues or the Board finds that *Hanami* does not necessarily disclose this feature, a POSITA would have found it obvious to modify *Hanami* such that its disclosed video encoding techniques would be compliant with, and therefore defined by, the MPEG standard.¹⁹ (Ex. 1002 at ¶167.) A POSITA would have found it obvious to do so in light of the knowledge of a POSITA at the time of the alleged invention and the teachings of *Mitchell* (Ex. 1006). (*Id.*)

For example, the *Mitchell* textbook includes, as part of its Introduction chapter, a section entitled “Why standardize video compression?” (Ex. 1006 at 38-39.) In it, *Mitchell* explains that “the MPEG standardization effort was initiated in 1988” as a result of the “several different industries [] converging on digital video technology.” (*Id.* at 38.) As *Mitchell* explains, “[w]ith the sharing of technology

¹⁹ Petitioner does not concede that *Hanami* does not anticipate claim 2.

among these diverse industrial interests, ***standardization was a natural development***” as “the cost reduction implicit in having a common digital video technology ***for all*** has been a key driving force for standardization.” (*Id.* (emphasis added).) *Mitchell* also explains that the interests of different industries converging which resulted in a common standard “lower[ed] the barriers that are usually present to the deployment of new technology.” (*Id.*; Ex. 1002 at ¶168; *see also id.* at ¶¶84-89 (providing relevant overview of *Mitchell*).)

Indeed, *Mitchell*’s description of the need and desire to standardize video coding via MPEG is confirmed by the ’005 patent itself, which states that “[t]he ***most widely accepted international standards have been proposed by the Moving Pictures Expert Group (MPEG)***, and are generally referred to as the ***MPEG-1 and MPEG-2 standards***.” (Ex. 1001 at 1:20-23 (emphasis added); Ex. 1006 at 38-39 (standardization with respect to MPEG-1 and MPEG-2).) Other contemporaneous documents such as *Lam* (Ex. 1007) also confirm that the MPEG standard was a “commonly used video compression standard” at the time of the alleged invention. (Ex. 1007 at 1:37-40.) As one IEEE article noted, the development of MPEG-1 and MPEG-2 “resulted in an explosion of products and services that created consumer video technology as we know it today.” (Ex. 1011 at 3; Ex. 1002 at ¶169.)

In view of the foregoing, a POSITA would have been motivated to modify *Hanami* such that its video coding techniques would be compliant with, and therefore defined by, the MPEG standard. Such a POSITA would have been motivated to modify *Hanami* this way for several reasons. (Ex. 1002 at ¶170.)

For example, as discussed above, there was a need and desire to standardize video coding techniques so the different industries converging on digital video technology could share their technologies. (Ex. 1006 at 38-39.) Indeed, there was an apparent benefit for such standardization because as *Mitchell* explains, “[i]f standardization of digital video could be achieved, the potentially large sales volumes in the consumer market would lower the cost of VLSI chips for all of the industries” and indeed this “cost reduction” was “a key driving force for standardization.” (*Id.*) Moreover, a POSITA would have known at the time of the alleged invention that MPEG was the most widely acceptable video coding standardization body at the time of the alleged invention. (Ex. 1002 at ¶171.) Thus, a POSITA would have been motivated to ensure that any video coding techniques (including those disclosed by *Hanami*) would be compliant with, and therefore defined by, MPEG. (*Id.*) Accordingly, *Hanami*’s template block TB1 and reference candidate blocks (e.g., MB1-MB3) included in the search area would have a structure and size defined by an MPEG standard. (*Id.*)

A POSITA would have had the capability and knowledge to implement the above modification to *Hanami* while ensuring that *Hanami*'s video coding techniques performed properly and would have expected the combined *Hanami-Mitchell* process to perform efficient and effective video coding without detracting from the processes disclosed by *Hanami*. (*Id.* at ¶172.) Thus, implementing the above-discussed modification would have been a predictable application of known techniques (e.g., the video coding techniques disclosed by *Hanami* and the standardization of such techniques via MPEG as disclosed by *Mitchell*) to achieve the foreseeable result of providing video coding techniques standardized and defined by MPEG such that the techniques would be widely applicable. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007).

2. Claim 5

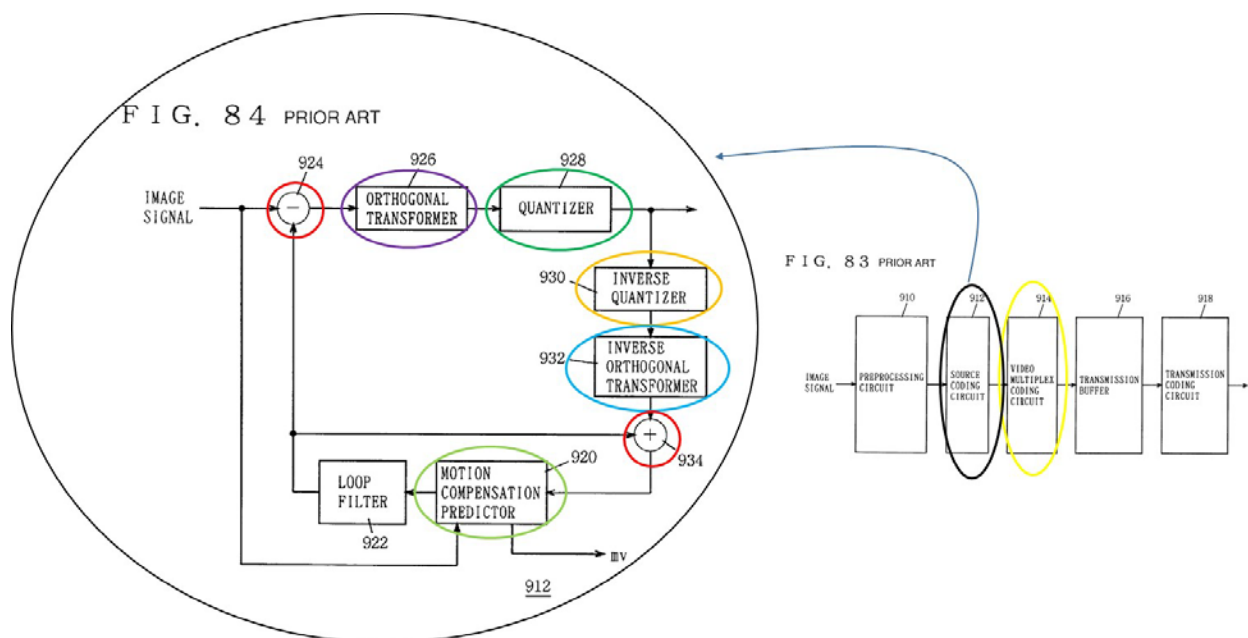
As discussed above, *Hanami* discloses that the motion coding in *Hanami* is in accordance with an MPEG standard, as required by claim 5. (*See supra* Section IX.A.4.) (Ex. 1002 at ¶¶173-185.)

To the extent PO argues or the Board finds that *Hanami* does not necessarily disclose this feature, a POSITA would have found it obvious to modify *Hanami* such that its disclosed video encoding techniques would be compliant with, and

therefore defined by, an MPEG standard.²⁰ (Ex. 1002 at ¶174.) In other words, for all the reasons discussed above with respect to claim 2, a POSITA would have found it obvious to modify *Hanami* such that its motion coding would have been in accordance with the MPEG standard in light of the knowledge of a POSITA at the time of the alleged invention and the teachings of *Mitchell* (Ex. 1006). (*See supra* Section IX.B.1.)

This is further confirmed by *Hanami* for at least two additional reasons. First, as discussed above with respect to claim 5, the variable length coding list for motion vectors in *Hanami* and the MPEG-2 Part standard is identical. (*See supra* Section IX.A.4.) Second, as discussed below, *Hanami*'s video encoder already includes all the functionality necessary to implement motion coding in accordance with an MPEG standard. (Ex. 1002 at ¶175.) In particular, *Hanami* shows by way of its Figures 83-84 that its source coding circuit 912 and video multiplex coding circuit 914 include all the functionality necessary to implement motion coding in accordance with an MPEG standard.

²⁰ Petitioner does not concede that *Hanami* does not anticipate claim 5.



(Ex. 1005 at FIG. 84 (left) (annotated), FIG. 83 (right) (annotated); Ex. 1002 at ¶176.)

A POSITA at the time of the alleged invention would have known that to perform motion encoding in accordance with an MPEG standard, the encoder would need to include components such as those shown above in Figures 83-84 of *Hanami*, namely a motion compensation predictor 920, subtracter 924, orthogonal transformer 926, quantizer 928, inverse quantizer 930, inverse orthogonal transformer 932, adder 934, and video multiplex coding circuit 914. (Ex. 1002 at ¶¶177-180.) Contemporaneous MPEG-related documentation at the time of the alleged invention such as U.S. Patent No. 6,035,069 to Nagai *et al.* (“*Nagai*”) (Ex. 1013) confirm such understanding of a POSITA. For instance, with reference to Figure 1, *Nagai* discloses an example of a conventional moving-picture coding

system using the motion-compensated adaptive prediction and discrete cosine transform implemented by international standardized methods such as MPEG-1 and MPEG-2.²¹ (Ex. 1013 at 1:21-43.)

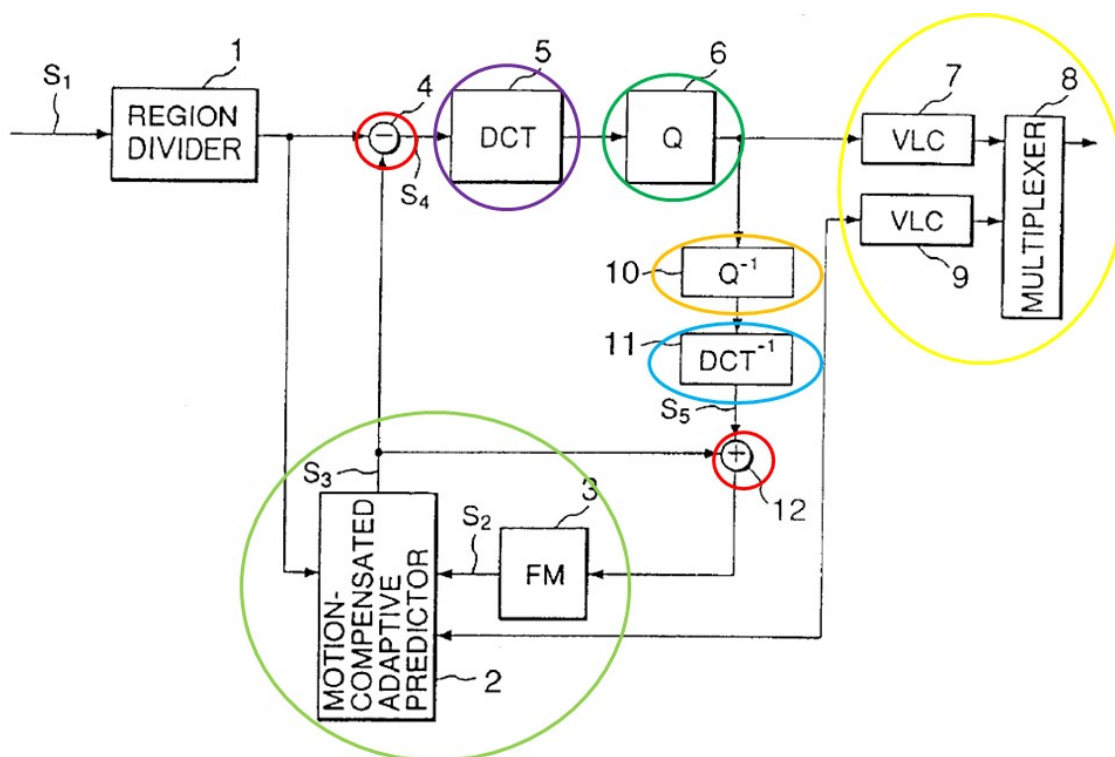
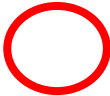
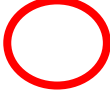
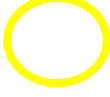


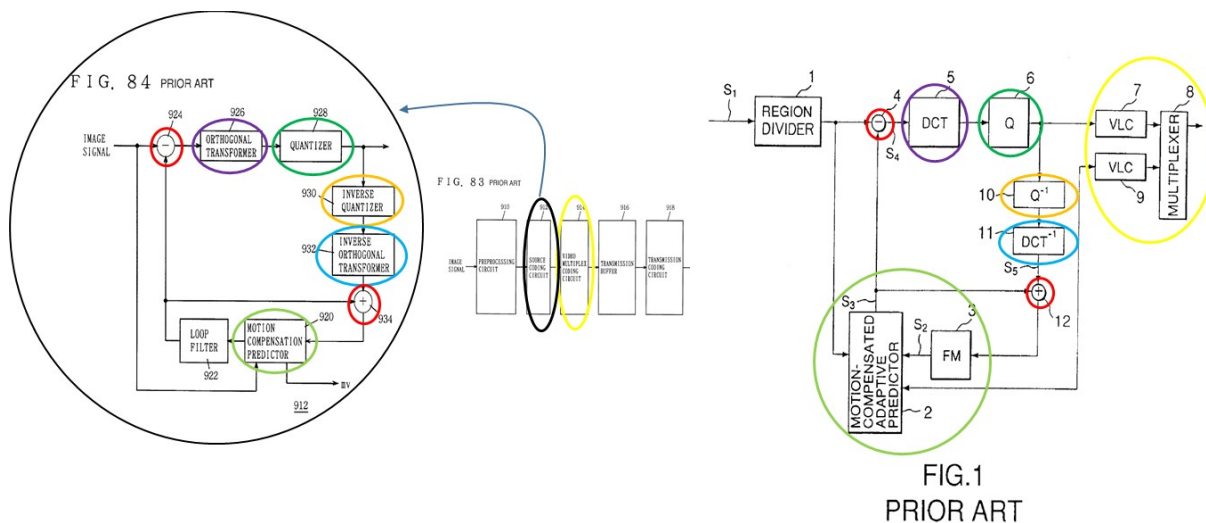
FIG.1
PRIOR ART

²¹ Petitioner relies on the teachings of *Hanami* and *Mitchell* for disclosing the features of claim 2. *Nagai* is cited to and discussed herein to demonstrate the knowledge of a POSITA at the time of the alleged invention regarding the conventional configuration and layout of an MPEG encoder. (Ex. 1002 at ¶181 n.29.) *Int'l Bus. Machines Corp.*, IPR2015-00089, Paper No. 44 at 15.

(*Id.* at FIG. 1 (annotated); Ex. 1002 at ¶181.)

As shown above in *Nagai*'s annotated Figure 1, a conventional MPEG-1/MPEG-2 moving-picture coding system would have included components that are already included in *Hanami*'s overall encoder configuration. The table below shows the correspondence between these components:

Annotation color	<i>Nagai</i>	<i>Hanami</i>
	motion-compensated adaptive predictor 2	motion compensation predictor 920
	subtractor 4	subtractor 924
	discrete cosine transformer 5	orthogonal transformer 926
	quantizer 6	quantizer 928
	inverse quantizer 10	inverse quantizer 930
	inverse discrete-cosine transformer 11	inverse orthogonal transformer 932
	adder 12	adder 924
	variable-length encoders 7, 9, and multiplexer 8	video multiplex coding circuit 914



(Ex. 1005 at FIG. 84 (left) (annotated), FIG. 83 (center) (annotated); Ex. 1013 at FIG. 1 (right) (annotated); Ex. 1002 at ¶182.)

As can be seen above based on a side-by-side comparison, *Hanami* includes all the required components in its encoder to perform motion coding in accordance with an MPEG standard and further includes a loop filter 22. (Ex. 1002 at ¶183.) To the extent that the loop filter 22 would not have been part of an MPEG standard for motion coding, a POSITA would have understood that this would have been a design choice and that the trade-off between having a loop filter as opposed to making the overall encoder compliant with the MPEG standard (e.g., by excluding the loop filter 22) would have weighed in favor of excluding the loop filter 22 for all the reasons discussed above with respect to claim 2 relating to the benefits of making a video coding technique compliant with the MPEG standard. (*See supra* Section IX.B.1.) (Ex. 1002 at ¶184.)

A POSITA would have had the capability and knowledge to implement the above modification to *Hanami* while ensuring that *Hanami*'s video coding techniques performed properly and would have expected the combined *Hanami-Mitchell* process to perform efficient and effective video coding without detracting from the processes disclosed by *Hanami*. Thus, implementing the above-discussed modification would have been a predictable application of known techniques (e.g., the video coding techniques disclosed by *Hanami* and the well-known motion coding technique defined by an MPEG standard) to achieve the foreseeable result of providing video coding techniques (including motion coding) to be performed in accordance with an MPEG standard. (*Id.* at ¶185.) *KSR Int'l Co.*, 550 U.S. at 421.

X. THE BOARD SHOULD CONSIDER THE MERITS AND INSTITUTE REVIEW

Before the Board are two pending petitions challenging claims of the '005 patent, namely the Unified IPR and Sling TV IPR.²² (*See supra* Section II.) The Board should nevertheless institute review here as well.

This petition does not present any of the factors that led the Board in other cases to decline institution of multiple petitions. Petitioner is not attempting to correct deficiencies or change prior art grounds from any previous petition—this is

²² The Unified IPR was filed on May 28, 2019, and the Sling TV IPR was filed on June 25, 2019.

Petitioner's first challenge to claims of the '005 patent and it is filed well before the one-year statutory deadline. Nor is Petitioner trying to gain advantage based on positions raised by PO or the Board in the Sling TV and Unified IPRs. The early stage of the parallel litigation, particularly given the possibility of a stay, also weights in favor of institution. For these and other reasons discussed below, Petitioner respectfully requests that the Board consider the merits of this Petition and institute review.

The Board considers seven factors in determining whether to exercise its discretion to allow or deny a follow-on petition. *Gen. Plastic Indus. Co., v. Canon Kabushiki Kaisha*, IPR2016-01357, Paper 19 at 15-19 (Sept. 6, 2017) (precedential as to § II.B.4.i). Each of these factors favors institution.

Under the first *General Plastic* factor, the Board considers "whether the same petitioner previously filed a petition directed to the same claims of the same patent." *Id.* at 16. Petitioner has not previously done so. Indeed, this is Petitioner's first IPR petition directed to any claims of the '005 patent. Petitioner has not coordinated in any way with Sling TV or Unified in relation to challenging claims of the '005 patent. Since Petitioner did not file any previous petition, the second factor (which inquires about petitioner's knowledge of the asserted prior art at the time of the prior filing, *Gen. Plastic*, IPR2016-01357, Paper 19 at 16) is inapplicable. In any event, the prior art asserted in the instant Petition is different

than the prior art asserted in the Unified IPR and Sling TV IPR. (*See supra* Section V.B.) Unified IPR, Paper 1 at 16; Sling TV IPR, Paper 2 at 2.

The third factor calls for “whether at the time of filing of the second petition the petitioner already received the patent owner’s preliminary response to the first petition or received the Board’s decision on whether to institute review in the first petition.” *Gen. Plastic*, IPR2016-01357, Paper 19 at 16. Both the Unified and Sling TV IPRs are at an early stage, with no PO’s preliminary responses filed or institution decisions rendered. Thus, there was no tactical advantage Petitioner could have gained from positions taken by the PO or the Board regarding the claims or the prior art asserted in those petitions, and using them as a roadmap to draft its own petition. Indeed, the Board has repeatedly weighed this factor heavily in favor of instituting an IPR in similar circumstances. *See, e.g., Unified Patents Inc. v. Speakware, Inc.*, IPR2019-00495, Paper 9 at 14-15 (July 1, 2019) (instituting IPR filed after two other IPRs because petitioner did not receive any preliminary response or institution decision from the prior IPRs and thus “there is no indication that Petitioner strategically staged its prior art and arguments in order to use PO’s preliminary response or the Board’s decision on institution as a roadmap”); *Livanova, Inc. et al. v. Neuro and Cardiac Tech., LLC*, IPR2019-00264, Paper 7 at 30-31 (May 20, 2019) (instituting review of a second IPR and finding that a two-month gap between the first and second IPRs does not favor

denial because the first petition was “timely[] and, importantly, was filed prior to the filing of the Patent Owner Preliminary Response in [the first IPR]” and thus petitioner did not gain “any tactical advantage” from the first IPR); *Cook Inc. et al. v. Medtronic, Inc.*, IPR2019-00123, Paper 11 at 35-36, 41-42 (June 11, 2019) (instituting IPR where, even though patent owner’s preliminary responses were filed in the previously filed IPRs, no institution decisions were yet rendered).

Under the fourth and fifth *General Plastic* factors, the Board considers “the length of time that elapsed between the time the petitioner learned of the prior art asserted in the second petition and the filing of the second petition” and “whether the petitioner provides adequate explanation for the time elapsed between the filings of multiple petitions directed to the same claims of the same patent.” *Gen. Plastic*, IPR2016-01357, Paper 19 at 16. These factors are inapplicable since this is Petitioner’s first petition challenging any claims of the ’005 patent and because there is no overlap between the grounds of this petition and the grounds in the Unified IPR and Sling TV IPR. (*See supra* Section V.B.) Unified IPR, Paper 1 at 16; Sling TV IPR, Paper 2 at 2.

Finally, under the sixth and seventh *General Plastic* factors, the Board considers “the finite resources of the Board” and “the requirement under 35 U.S.C. § 316(a)(11) to issue a final determination not later than 1 year after the date on which the Director notices institution of review.” *Gen. Plastic*, IPR2016-01357,

Paper 19 at 16. Notably, PO has asserted the '005 patent against *at least* fourteen other entities in separate litigations (*see supra* Section II) involving various claims, and thus cannot argue it could not have expected separate challenges to the '005 patent based on each party's litigation positions (e.g., comparison of accused products to asserted claims, claim construction issues, etc.).

This petition focuses on only the claims PO asserts against Petitioner in the parallel litigation, and the challenged claims are a subset of those challenged in the Unified and Sling TV IPRs. Also, the grounds for unpatentability rely on a single primary reference. Thus, Petitioner has strived to simplify and narrow the issues in its petition. *See also, e.g., Unified Patents*, IPR2019-00495, Paper 9 at 16 (finding that the case does not “implicate[] the efficiency concerns of the sixth and seventh *General Plastic* factors” given petitioner filed a single petition despite eight petitions challenging overlapping claims of the same patent), *Cooler Master Co. Ltd. v. Aavid Thermalloy LLC*, IPR2019-00337, Paper 7 at 44-45 (June 12, 2019) (instituting review and noting that “considerations of patent quality and merits of the challenges outweigh concerns about duplication of resources and potential for harassment”). Thus, this petition would not burden the Board's resources or interfere with its duty to issue a final determination within one year of institution.

The Board takes into consideration the stage of any parallel district court proceeding, especially where the court will analyze the same issues as the *inter*

partes review and the verdict will issue before the Board renders a final written decision. See *NHK Spring Co., Ltd. v. Intri-Plex Techs., Inc.*, IPR2018-00752, Paper 8 (PTAB Sept. 12, 2018) (precedential). As the Board has explained, *NHK Spring* certainly does not prevent institution any time there is a parallel district court proceeding, for doing so would be contrary to the design and purpose of the America Invents Act (“the AIA”):

In creating *inter partes* reviews, Congress clearly recognized that there would be some degree of parallel proceedings between the Board and the district courts. The fact that 35 U.S.C. § 315(b) bars petitions brought more than one year after the service of an infringement complaint necessarily implies that petitions brought within the one-year period will proceed in parallel with the infringement complaint. Quite often, these cases have ‘intertwined issues.’ That is not, by itself, sufficient reason for us to attempt to resolve the discrete set of issues Congress gave us authority to decide.

Hormel Foods Corp. v. HIP, Inc., IPR2019-00469, Paper 9 at 50 (July 15, 2019).

Here, since being served the complaint on January 28, 2019, Petitioner diligently worked to meet deadlines in the litigation and file this IPR petition well within the one-year statutory bar. Moreover, the district court may stay the case upon this IPR’s institution (or institution of any other IPRs involving the ’005

patent). Indeed, several other litigations involving the ‘005 patent before the same district court hearing Petitioner’s case have already been stayed: (Exs. 1014-1015.)²³ Furthermore, that is what the same district court did in another dispute between the Petitioner and Uniloc USA Inc. involving different patents. (Ex. 1017.) And while Petitioner may pursue invalidity in the district court litigation based on prior art relied upon in this petition, Petitioner has at its disposal several other bases for invalidity challenges in the district court litigation. Thus, while there may be some intertwined issues between this IPR and the related litigation (which is to be expected), that overlap does not rise to the level warranting denial of review. Indeed, as another Board panel has recently noted, “[w]hen compared to other *inter partes* mechanisms for assessing the validity of issued claims, such as district court litigation, our time constrained proceedings with streamlined discovery are generally viewed as efficient.” *Unified Patents Inc. v. Velos Media, LLC*, IPR2019-00635, Paper 8 at 22 (August 20, 2019) (citing *Regents of the U. of Minn. v. LSI Corp.*, 926 F.3d 1327, 1336–37 (Fed. Cir. 2019) (“The procedure for

²³ Those cases were stayed pending the conclusion of any appeal of the United States District Court for the Central District of California’s decision in another case finding that the ‘005 patent is not directed to patentable-eligible subject matter. (Ex. 1016.)

reexamining the earlier decision to issue the patent by design is abbreviated compared to district court proceedings.”).)

Accordingly, Petitioner requests the Board consider and institute review of the challenged claims of the '005 patent.

XI. CONCLUSION

For the reasons given above, Petitioner requests institution of IPR for claims 1-3, 5, 6, 8, 39 and 41 of the '005 patent based on each of the grounds specified in this petition.

Respectfully submitted,

Dated: September 9, 2019

By: /Naveen Modi/
Naveen Modi (Reg. No. 46,224)
Counsel for Petitioner

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 6,519,005 contains, as measured by the word-processing system used to prepare this paper, 13,953 words. This word count does not include the items excluded by 37 C.F.R. § 42.24 as not counting towards the word limit.

Respectfully submitted,

Dated: September 9, 2019

By: /Naveen Modi/
Naveen Modi (Reg. No. 46,224)
Counsel for Petitioner

CERTIFICATE OF SERVICE

I hereby certify that on September 9, 2019, I caused a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 6,519,005 and supporting exhibits to be served via express mail on the Patent Owner at the following correspondence address of record as listed on PAIR:

PHILIPS INTELLECTUAL PROPERTY & STANDARDS
465 Columbus Avenue
Suite 340
Valhalla NY 10595

A courtesy copy was also sent via electronic mail to the Patent Owner's litigation counsel at the following addresses:

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