

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMAZON.COM, INC. and AMAZON.COM SERVICES LLC,
Petitioner

v.

NOKIA TECHNOLOGIES OY,
Patent Owner.

IPR2024-00848

U.S. Patent No. 7,532,808

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 7,532,808**

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EXHIBIT LIST

Exhibit	Reference
1001	U.S. Patent No. 7,532,808 (“’808 Patent” or “’808Pat.”)
1002	File History of the ’808 Patent (“’808FH”)
1003	Declaration of Dr. Joseph P. Havlicek (“Havlicek”)
1004	Dr. Joseph P. Havlicek CV
1005	U.S. Patent Provisional Application No. 60/365,072
1006	International Patent Publication No. WO 01/11891 A1 (“Karczewicz”)
1007	U.S. Patent Publication No. 2003/0123738 (“Frojdh”)
1008	U.S. Patent Provisional Application No. 60/334,979 (“FrojdhProv”)
1009	ITU-T Recommendation H.263 (February 1998) (“H.263”)
1010	Martyn J. Riley and Iain E.G. Richardson, <i>Digital Video Communications</i> , Artech House, Inc. (1997) (“Riley”)
1011	Gary J. Sullivan and Thomas Wiegand, <i>Rate-Distortion Optimization for Video Compression</i> , IEEE Signal Processing Magazine, pp. 74-90 (November 1998) (“Sullivan”)
1012	JVT of ISO/IEC and ITU-T VCEG – JVT-A003r1, Joint Model Number 1, Revision 1 (JM-1r1), Pattaya, Thailand, 3-7 December 2001
1013	Ismaeil et al., “Efficient Motion Estimation Using Spatial and Temporal Motion Vector Prediction.” In <i>Proceedings 1999 International Conference on Image Processing</i> (Cat. 99CH36348), vol. 1, pp. 70-74. IEEE, 1999.
1014	Wang et al., <i>Video Processing and Communications</i> (Prentice Hall, 2002) (“Wang”)
1015	Bhaskaran, Vasudev, Konstantinides, Konstantinos, <i>Image and Video Compression Standards, Algorithms and Architectures</i> , (Kluwer Academic Publishers, 1995) (“Bhaskaran”)
1016	Respondents’ Opening Claim Construction Brief, Investigation No. 337-TA-1379 (ITC)

Exhibit	Reference
1017	Complainant's Opening Claim Construction Brief, Investigation No. 337-TA-1379 (ITC)
1018	Staff's Opening Claim Construction Brief, Investigation No. 337-TA-1379 (ITC)
1019	Respondents' Responsive Claim Construction Brief, Investigation No. 337-TA-1379 (ITC)
1020	Complainant's Responsive Claim Construction Brief, Investigation No. 337-TA-1379 (ITC)
1021	Staff's Responsive Claim Construction Brief, Investigation No. 337-TA-1379 (ITC)
1022	Order Construing Claims, Investigation No. 337-TA-1379 (ITC), Order No. 38
1023	Respondents' Final Invalidity Contentions, Investigation No. 337-TA-1379 (ITC)
1024	First Amended Complaint, <i>Nokia Corp. v. Amazon.com, Inc.</i> , No. 1:23-cv-01232 (D. Del.), ECF No. 5
1025	Complaint, <i>Nokia Techs. Oy v. HP Inc.</i> , No. 1:23-cv-01237 (D. Del.), ECF No. 1
1026	Declaration of June Ann Munford

LISTING OF CHALLENGED CLAIMS

Reference	Claim Limitation
Claim 10	
10[pre]	A video encoder for encoding a video sequence, the encoder comprises:
10[a]	a coding controller for assigning a skip coding mode to a first segment;
10[b]	a motion estimation block for assigning either a zero motion vector or a predicted non-zero motion vector for the skip coding mode for the first segment based at least in part on the motion information of a second segment neighboring the first segment; and
10[c]	forming a prediction for the first segment with respect to a reference frame based at least in part on the assigned motion vector for the skip coding mode, wherein the assigned motion vector is one of the zero motion vector and the predicted non-zero motion vector; and
10[d]	a multiplexer for providing in an encoded bitstream an indication of the skip coding mode, wherein no further motion vector information for the first segment is coded in the encoded bitstream.
Claim 11	
11	An encoder according to claim 10, wherein the second segment is a previously encoded segment neighboring the first segment.
Claim 15	
15	An encoder according to claim 10, wherein if a segment in a region surrounding the first segment has zero motion vector, the encoder is arranged to assign the zero motion vector for the skip coding mode of the first segment and the prediction for the first segment is formed with respect to a corresponding segment of the reference frame associated with the zero motion vector.

Reference	Claim Limitation
Claim 16	
16[pre]	A video decoder for decoding an encoded video sequence, the decoder comprising:
16[a]	a demultiplexer for receiving an indication of a skip coding mode assigned to a first segment;
16[b]	a motion compensated prediction block for assigning either a zero motion vector or a predicted non-zero motion vector for the skip coding mode for the first segment based at least in part on the motion information of a second segment neighboring the first segment; and
16[c]	forming a prediction for the first segment with respect to a reference frame based at least in part on the assigned motion vector for the skip coding mode, wherein the assigned motion vector is one of the zero motion vector and the predicted non-zero motion vector.
Claim 20	
20	A decoder according to claim 16, wherein if a segment in a region surrounding the first segment has zero motion vector, the zero motion vector is assigned for the skip coding mode of the first segment, and the prediction for the first segment is formed with respect to a corresponding segment of the reference frame associated with the zero motion vector.
Claim 21	
21	A multimedia terminal, comprising an encoder according to claim 10.
Claim 22	
22	A multimedia terminal comprising a decoder according to claim 16.

Reference	Claim Limitation
Claim 44	
44[pre]	An encoder according to claim 10, wherein if the second segment has a non-zero motion vector,
44[a]	the motion estimation block is further arranged to derive the predicted non-zero motion vector based at least in part on the motion vector of the second segment; and
44[b]	the predicted non-zero motion vector is assigned for the skip coding mode for the first segment; and
44[c]	the prediction for the first segment is formed by a motion compensated prediction with respect to the reference frame based at least in part on the predicted non-zero motion vector.
Claim 47	
47	An encoder according to claim 10, wherein the motion estimation block further arranged to derive the predicted non-zero motion vector based at least in part on the motion vector of the second segment.
Claim 48	
48	An encoder according to claim 10, wherein the motion estimation block further arranged to derive the predicted non-zero motion vector based at least in part on the motion vector of the second segment and motion vector of a third segment neighboring the first segment.
Claim 49	
49	An encoder according to claim 10, wherein no residual information is provided for the first segment in the encoded bitstream.
Claim 51	

Reference	Claim Limitation
51	An encoder according to claim 10, wherein if the second segment has a zero motion vector, the zero motion vector is assigned to the skip coding mode of the first segment and the prediction for the first segment is formed with respect to a corresponding segment of the reference frame associated with the zero motion vector.
Claim 52	
52	An encoder according to claim 10, wherein if the second segment has a zero motion vector and the second segment is predicted using motion-compensated prediction from the reference picture, the zero motion vector is assigned to the skip coding mode of the first segment and the prediction for the first segment is formed with respect to a corresponding segment of the reference frame associated with the zero motion vector.
Claim 53	
53	An encoder according to claim 10, wherein if the second segment has a zero motion vector and the second segment is predicted using motion-compensated prediction from a second reference picture immediately preceding the picture second segment belongs to, the zero motion vector is assigned to the skip coding mode of the first segment and the prediction for the first segment is formed with respect to a corresponding segment of the reference frame associated with the zero motion vector.
Claim 54	
54	A decoder according to claim 16, wherein if the second segment has a zero motion vector, the zero-motion vector is assigned to the skip coding mode for the first segment and the prediction for the first segment is formed with respect to a corresponding segment of the reference frame associated with the zero-motion vector.
Claim 58	

Reference	Claim Limitation
58	A decoder according to claim 16, wherein the motion estimation block further arranged to derive the predicted non-zero motion vector based at least in part on the motion vector of the second segment.
Claim 59	
59	A decoder according to claim 16, wherein the motion estimation block further arranged to derive the predicted non-zero motion vector based at least in part on the motion vector of the second segment and motion vector of a third segment neighboring the first segment.
Claim 60	
60	A decoder according to claim 16, wherein no residual information is provided for the first segment in an encoded bitstream.
Claim 62	
62	A decoder according to claim 16, wherein if the second segment has a zero motion vector and the second segment is predicted using motion-compensated prediction from the reference picture, the zero motion vector is assigned to the skip coding mode of the first segment and the prediction for the first segment is formed with respect to a corresponding segment of the reference frame associated with the zero motion vector.
Claim 63	
63	A decoder according to claim 16, wherein if the second segment has a zero motion vector and the second segment is predicted using motion-compensated prediction from a second reference picture immediately preceding the picture second segment belongs to, the zero motion vector is assigned to the skip coding mode of the first segment and the prediction for the first segment is formed with

Reference	Claim Limitation
	respect to a corresponding segment of the reference frame associated with the zero motion vector.
Claim 64	
64	A decoder according to claim 16, wherein no further motion vector information for the first segment is retrieved from an encoded bitstream.

I. INTRODUCTION

Amazon.com, Inc. and Amazon.com Services LLC (“Amazon” or “Petitioner”) request *inter partes* review (“IPR”) of claims 10-11, 15-16, 20-22, 44, 47-49, 51-54, 58-60, 62-64 (“Challenged Claims”) of U.S. Patent No. 7,532,808 (“the ’808 Patent” or “’808Pat.”; EX-1001).

II. GROUNDS FOR STANDING

Petitioner certifies the ’808 Patent is available for IPR, and Petitioner is not barred or estopped from requesting IPR on the grounds herein. Petitioner files this Petition within one year of service on Amazon of PO’s district court complaints (EX-1024, EX-1025).

III. IDENTIFICATION OF CHALLENGE

A. Prior Art

Petitioner respectfully requests cancellation of the Challenged Claims based on:

Prior Art
Karczewicz (WO 01/11891 A1), published February 15, 2001; prior art under at least 35 U.S.C. §102(b) ¹ (EX-1006).

¹ All references to §§102, 103 are to the pre-AIA statutory framework.

Frojdih (U.S. Patent Publication 2003/0123738); filed November 27, 2002, claims priority to U.S. Provisional Application 60/334,979, filed November 30, 2001; prior art under at least 35 U.S.C. §102(e)² (EX-1007).

H.263; ratified February 6, 1998 and publicly available no later than May 11, 2000³; prior art under at least 35 U.S.C. §102(b) (EX-1009).

B. Grounds for Challenge⁴

Ground		Claims	Prior Art
1A	§103	10-11, 15-16, 20-22, 44, 47-49, 51-54, 58-60, 62-64	Karczewicz
2A		10-11, 16, 21-22, 44, 47-49, 58-60, 64	Frojdih, AAPA
2B		15, 20, 51-54, 62-63	Frojdih, AAPA, H.263

² The '808 Challenged Claims are not entitled to the provisional date (§IV), whereas Frojdih is entitled to its provisional date (§VII.B.1.a), making Frojdih prior art under §102(e). Frojdih would still be §102(e) art if both Frojdih and the Challenged Claims are entitled to the priority dates of their respective provisionals or if neither Frojdih nor the Challenged Claims are entitled to the date of their respective provisionals.

³ EX-1026.

⁴ Petitioner reserves the right to raise invalidity grounds in other proceedings that cannot be raised in IPR.

IV. '808 PATENT OVERVIEW

The '808 Patent issued on May 12, 2009 from Application 10/390,549 (the “'549 Application”), filed March 14, 2003. The '808 Patent claims priority to Provisional Application 60/365,072 (“'808 Provisional”), filed March 15, 2002. The '808 Provisional lacks written description for at least the following claim limitations:

- “forming a prediction for the first segment with respect to a reference frame based at least in part on the assigned motion vector for the skip coding mode, wherein the assigned motion vector is one of the [ZMV]⁵ and the [PNZMV];”⁶ (claims 10, 16);
- “providing in an encoded bitstream an indication of the skip coding mode” (claim 10);
- “receiving an indication of a skip coding mode assigned to a first segment” (claim 16);
- “a video encoder...” (claim 10);

⁵ “ZMV” and “PNZMV” refer to “zero motion vector” and “predicted non-zero motion vector,” respectively.

⁶ N.5, *supra*.

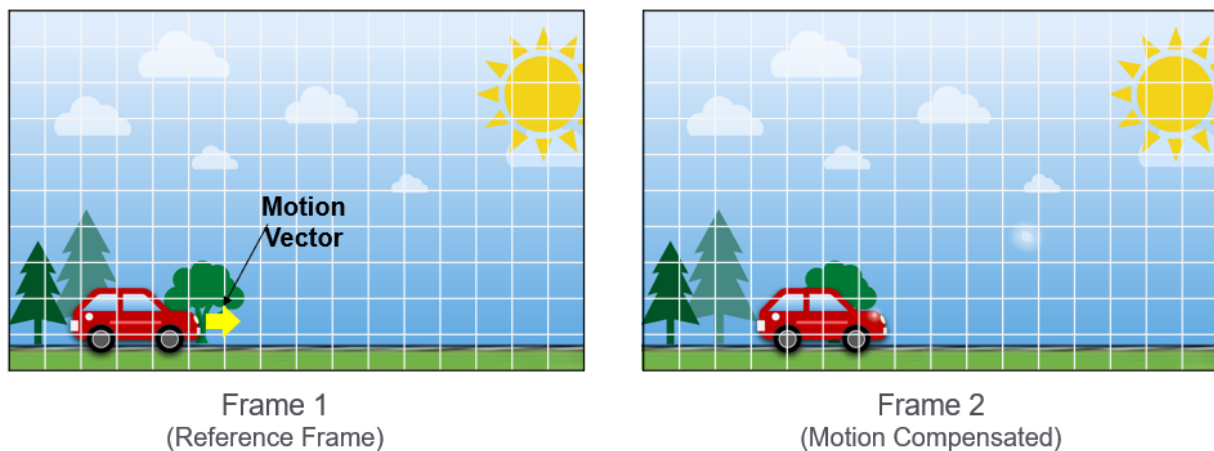
- “a coding controller for assigning a skip coding mode to a first segment” (claim 10);
- “a motion estimation block for assigning either a [ZMV] or a [PNZMV] for the skip coding mode for the first segment based at least in part on the motion information of a second segment neighboring the first segment” (claim 10);
- “a multiplexer for providing in an encoded bitstream an indication of the skip coding mode” (claim 10);
- “a video decoder...” (claim 16)
- “a demultiplexer for receiving an indication of a skip coding mode assigned to a first segment” (claim 16). Havlicek, ¶50.

The Challenged Claims are therefore entitled to a priority date no earlier than March 14, 2003 (’549 Application filing date).

The ’808 Patent is directed to video encoding. ’808Pat., Abstract. The Background explains a video sequence is formed of consecutive images (frames) displayed at a relatively fast rate, creating the illusion of motion. ’808Pat., 1:15-19. Because of the large amount of data required to transmit video data in uncompressed form (e.g., as uncompressed frames), video compression techniques are used to reduce redundancies in a sequence. ’808Pat., 2:7-20, 2:35-37.

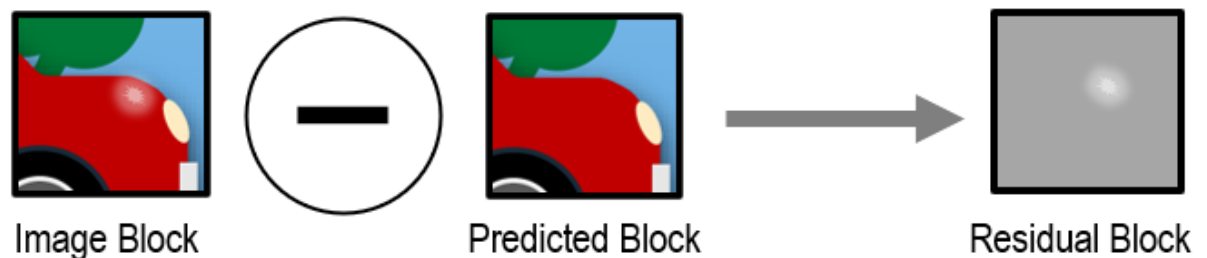
One technique is “‘motion compensated prediction’ to reduce the temporal redundancy in [a video] sequence” by predicting a frame using “motion vectors” that characterize the motion of objects in previously coded “reference” frames. ’808Pat., 3:11-21. Motion-compensated prediction may be performed on individual portions of a frame, known as “macroblocks.” ’808Pat., 1:58-62, 3:23-25. “Frames of a video sequence which are compressed using motion-compensated prediction are generally referred to as INTER-coded.” ’808Pat., 3:26-28. “Any frame encoded in INTER-coded format requires a reference frame for motion-compensated prediction.” ’808Pat., 7:5-6.

The figure below illustrates a macroblock in a current frame (“Frame 2”) predicted using a motion vector that characterizes macroblock motion in a reference frame (“Frame 1”). Havlicek, ¶46.



According to the Background, “[m]otion-compensated prediction alone rarely provides a sufficiently precise representation of the image content of a video frame

and therefore it is typically necessary to provide a so-called ‘prediction error’ (PE) frame with each INTER-coded frame. The prediction error frame represents the difference between a decoded version of the INTER-coded frame and the image content of the frame to be coded.” ’808Pat., 3:28-35; Havlicek, ¶47.

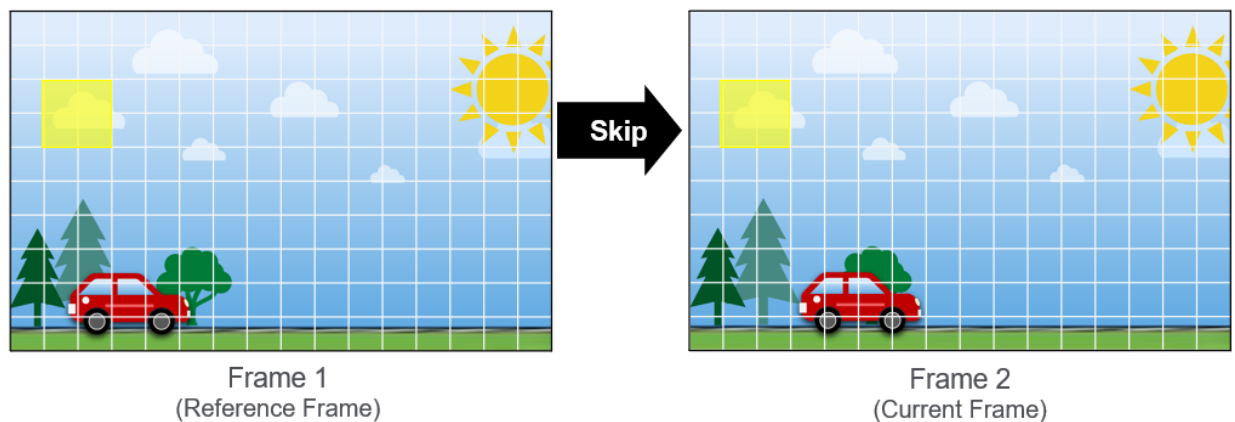


The Background explains generating a single bitstream that encodes information characterizing the prediction of frames and macroblocks therein (e.g., motion vector information, prediction error), and related control information. ’808Pat., 4:6-12, 6:37-44.

The Background next discusses Joint Model Number 1 (“JM1”) of the JVT codec. ’808Pat., 10:23-12:47. JM1 assigns a “skip mode” to a macroblock, indicating “the macroblock is to be copied from the reference video frame without using motion compensated prediction.” ’808Pat., 10:63-67. “The motion estimation for the skip mode is a very simple one [because] a constant zero valued vector is assigned for this mode.” ’808Pat., 11:8-11. For non-skip mode macroblocks, a “cost function” “typically combines the prediction error with number of estimated bits needed to code the macroblock and thus measures the relative efficiency of each

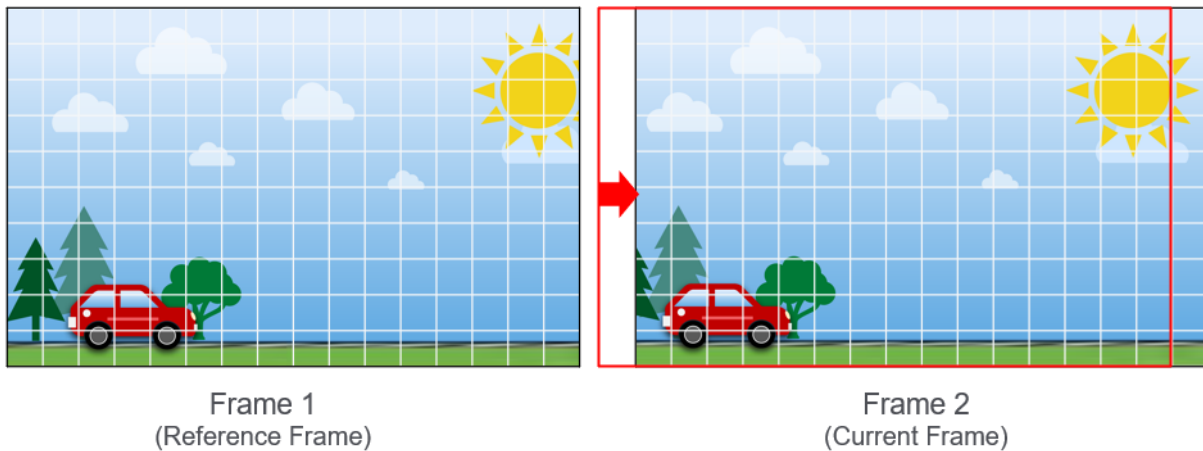
coding mode” to decide how the macroblock is divided into subblocks. ’808Pat., 11:11-18.

The figure below illustrates skip mode for macroblocks (highlighted yellow), copied from the reference frame (“Frame 1”) for use in the current frame (“Frame 2”) without motion-compensated prediction. Havlicek, ¶48.



The Background also discusses global motion compensation (“GMC”) and global motion vector coding (“GMVC”). ’808Pat., 12:48-14:10. “[T]he idea behind [GMC] is to generate a reference frame for motion compensation that cancels the effects of global motion,” but doing so requires “complex operations.” ’808Pat., 12:59-66. GMVC is a “simplified version of [GMC]” where “[t]he reference frame is used as it is, but additional information is transmitted to describe the global motion and additional macroblock modes are used to indicate when global motion vectors are used.” ’808Pat., 13:31-36.

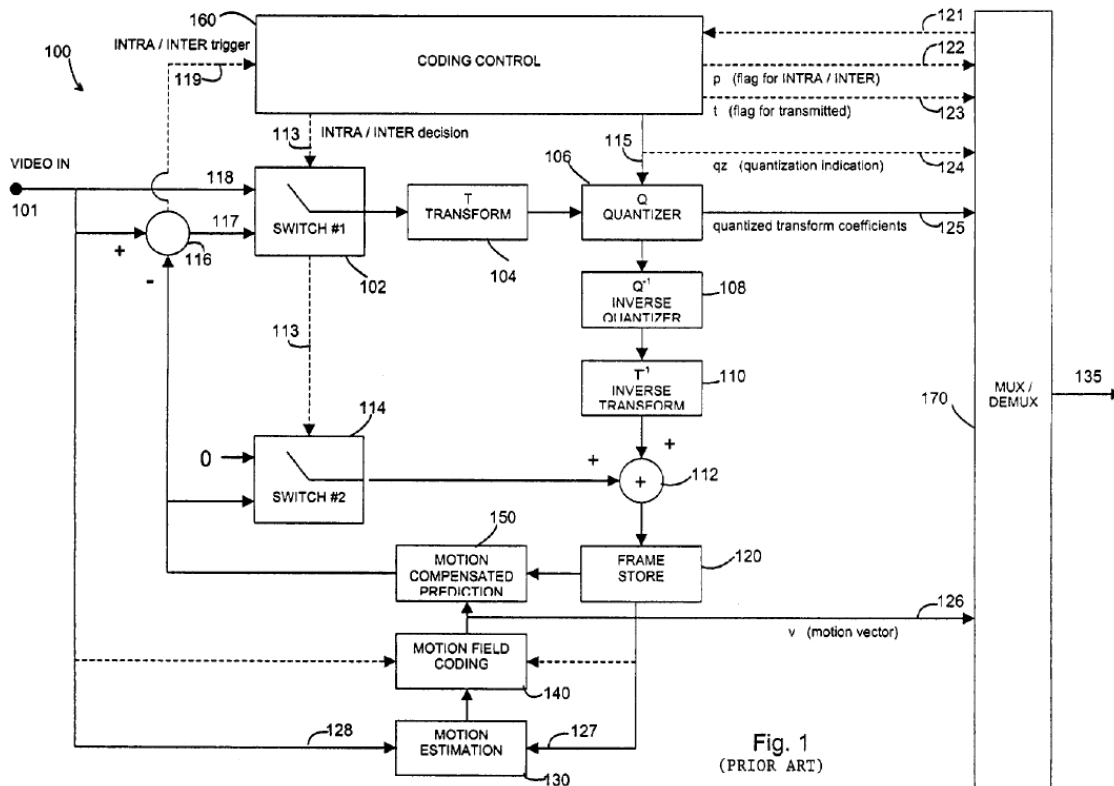
The figure below illustrates GMC, which can be used, e.g., to code camera panning, where a current frame (“Frame 2”) is predicted based on “global” motion of a reference frame (“Frame 1”). Havlicek, ¶49.

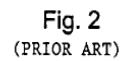


The '808 Patent purports to improve upon the prior art through “a redefinition of the skip mode concept used in JM1 of the JVT codec” such “that a macroblock assigned to skip mode is either associated with a zero (non-active) motion vector, in which case it is treated in the same way as a conventional skip mode macroblock and copied directly from the reference frame, or it is associated with a non-zero (active) motion vector.” '808Pat., 14:14-29; *id.*, 17:45-52, 19:28-51. Non-ZMVs are assigned based on the characteristics of the motion of previously coded neighboring macroblocks or sub-blocks. '808Pat., 14:29-37, 14:52-60, 17:58-64.

According to the '808 Patent, “minimal...modification is required to incorporate the method according to the invention into existing video coding systems that employ the concept of skip mode macroblocks,” and the '808's encoder and

decoder are “substantially identical” to the prior art encoder and decoder. ’808Pat., 15:11-14, 16:7-14, 20:29-32; *compare* Figs. 1-2 (prior art encoder and decoder, respectively), *with* Figs. 6-7 (encoder and decoder, respectively, of the purported invention) (all reproduced below).





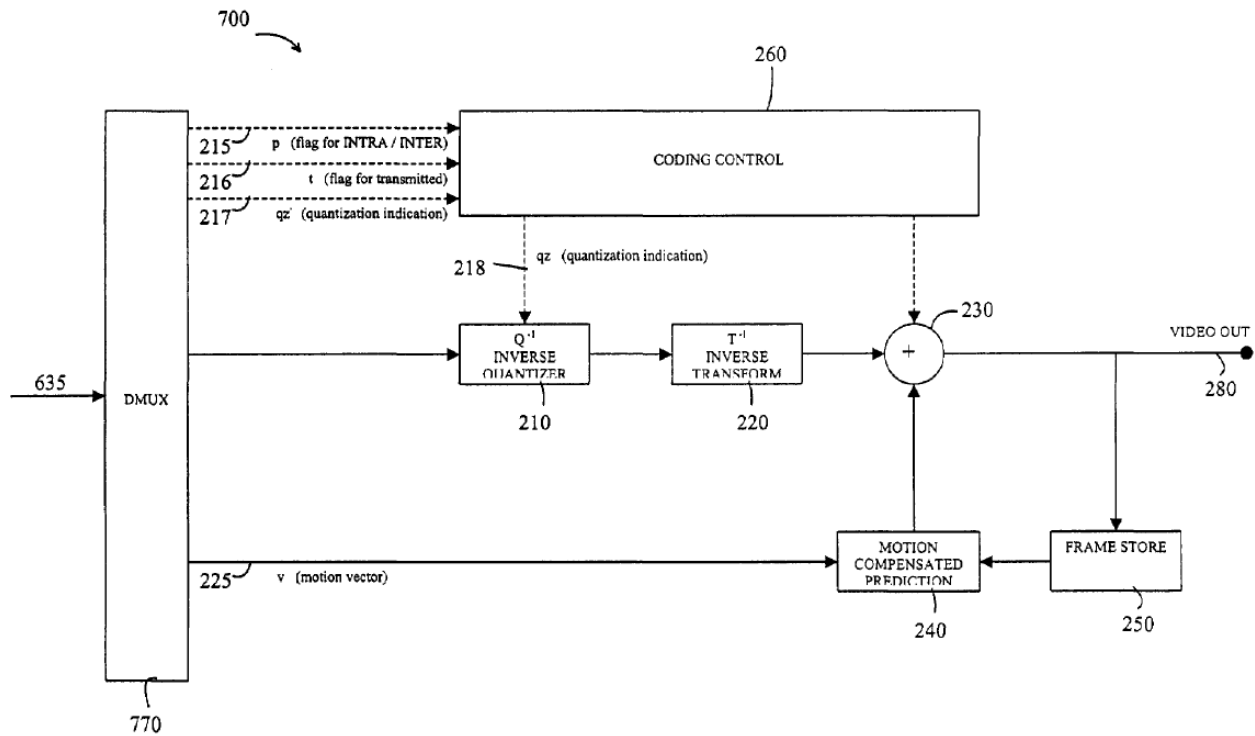


Fig. 7

V. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art (“POSITA”) at the time of the ’808 Patent would have had a (1) Bachelor’s degree in Electrical Engineering, Computer Engineering, Computer Science, or a comparable field of study such as Physics, and (2) approximately 2-3 years of practical experience with video and/or image processing or coding. More education could substitute for experience, and vice versa. Havlicek, ¶¶23-25.

VI. CLAIM CONSTRUCTION

Claims should be construed “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. §42.100(b).

In the co-pending ITC investigation, the parties disputed whether residual information (i.e., prediction error) can be included in “skip coding mode.” Havlicek, ¶70. Because the Challenged Claims are invalid regardless of the construction applied (i.e., regardless of whether “skip coding mode” allows for inclusion of residual information), Petitioner believes no construction is needed here. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). The table below summarizes the parties’ and Staff’s proposed constructions for “skip coding mode,” whether residual information can be included in the mode, and the construction applied by the ALJ:

	Construction⁷	Include “Residual Information”?
Respondent (Amazon)	A coding mode in which a zero (non-active) motion vector or a nonzero (active) motion vector is associated with each skip mode macroblock, depending on the characteristics of the motion in image segments surrounding the macroblock in question, <u>and residual information can be provided for each skip mode Macroblock</u>	Can be included.
ITC Staff	A coding mode in which a zero (non-active) motion vector or a non-zero (active) motion vector is associated with each skip mode macroblock, depending on the characteristics of the motion in image segments surrounding the macroblock in question.	“[T]he silence in the claim regarding residual information leaves open many different design choices”
Complainant (Nokia)		Precluded in skip coding mode.
ALJ		“In its silence, the definition in the ’808 patent allows for both possibilities.”

If the Board determines construction is required, it should adopt Amazon’s. Dependent claims 30, 41, 49, and 60 (which are substantively identical) recite “wherein no residual information is provided for the first segment in the encoded

⁷ EX-1016, 17; EX-1017, 17, 19-20; EX-1018, 9, EX-1022, 10.

bitstream.” Based on the doctrine of claim differentiation, “skip coding mode” should be construed with the additional language “and residual information can be provided for each skip mode Macroblock,” as proposed by Amazon. EX-1016, 17-19. This is consistent with the specification of the ’808 Patent, which discloses embodiments in which residual information is provided for the skip coding mode. ’808Pat., 16:51-55, 21:18-22, Figs. 6-7; Havlicek, ¶¶72-77.

Regardless, the prior art invalidates the Challenged Claims, as explained herein. Ground 1 demonstrates unpatentability under at least Amazon’s construction; Ground 2 demonstrates unpatentability under at least PO’s construction; and both grounds demonstrate unpatentability under the Staff’s/ALJ’s construction. Accordingly, the Board need not resolve this dispute to invalidate the Challenged Claims.

VII. DETAILED EXPLANATION OF GROUNDS

A. Ground 1: Obviousness over Karczewicz

1. Karczewicz

Karczewicz teaches an “apparatus, and an associated method, for encoding, and decoding, a video sequence utilizing motion compensated prediction.” Karczewicz, 1:7-8. Karczewicz teaches at least five different modes for coding a segment of a frame of a video sequence. Karczewicz, 31:14-25, claims 61, 64-65. In some modes, “[m]otion fields of a segment are predicted from adjacent segments

of a video frame and by using orthogonal affine motion vector field models.” Karczewicz, 1:9-10, 14:2-5. Thus, “motion vector fields are formed with a reduced number of bits while still maintaining a low prediction error.” Karczewicz, 1:11-13. Notably, motion vector fields can be thought of as the representation of “motion vectors actually identify[ing] the origin of pixels in the current frame by comparison with the reference frame,” so a POSITA would have understood when Karczewicz refers to coding “motion fields” of a segment, it is referring to coding motion vectors for said segment. Havlicek, ¶81; Karczewicz, 8:3-10, 20:11-13.

Two of Karczewicz’s coding modes exploit the similarity between motion vector fields of neighboring segments (typically macroblocks) by computing a motion vector field of a segment from its previously coded, neighboring segment. Karczewicz, 7:15-19, 11:1-8, 31:7-9, 14-25, claims 61, 64-65. Karczewicz teaches other modes where a small refinement field is also coded to account for differences between motion vectors of neighboring segments. *Id.* Specifically, after coding a first segment, Karczewicz determines whether it is “‘more efficient’ to model the second segment in terms of the affine motion model previously determined for the first segment, rather than according to the newly determined affine motion coefficients for the second segment itself.” Karczewicz, 14:27-15:1. “[I]n many cases, it is found that after projection of the motion field model from a neighboring segment, very little or even zero refinement information is required,” which “can

result in a significant reduction in the amount of data that must be transmitted from encoder to decoder.” Karczewicz, 15:27-16:1. If zero refinement is needed, “the motion vector field of the second segment can be predicted purely on the basis of motion coefficients [from the first segment] already stored in the decoder.” Karczewicz, 16:2-3. The second segment “can also be coded by using a [ZMV] field, e.g., a copy from the reference frame.” Karczewicz, 31:20-24.

Prediction error between the motion-compensated predicted version of the current frame and the current frame itself can be generated and sent to a decoder along with the motion vector information. Karczewicz, 20:21-29, 22:5-6, Fig. 1.

2. Claim 10 and Dependents

a. Claim 10

(i) 10[pre]

If the preamble is limiting, Karczewicz discloses or suggests 10[pre]. Karczewicz, 1:7-8 (“apparatus, and an associated method, for encoding...a video sequence utilizing motion compensated prediction”), Fig. 1 (annotated); Havlicek, ¶154.

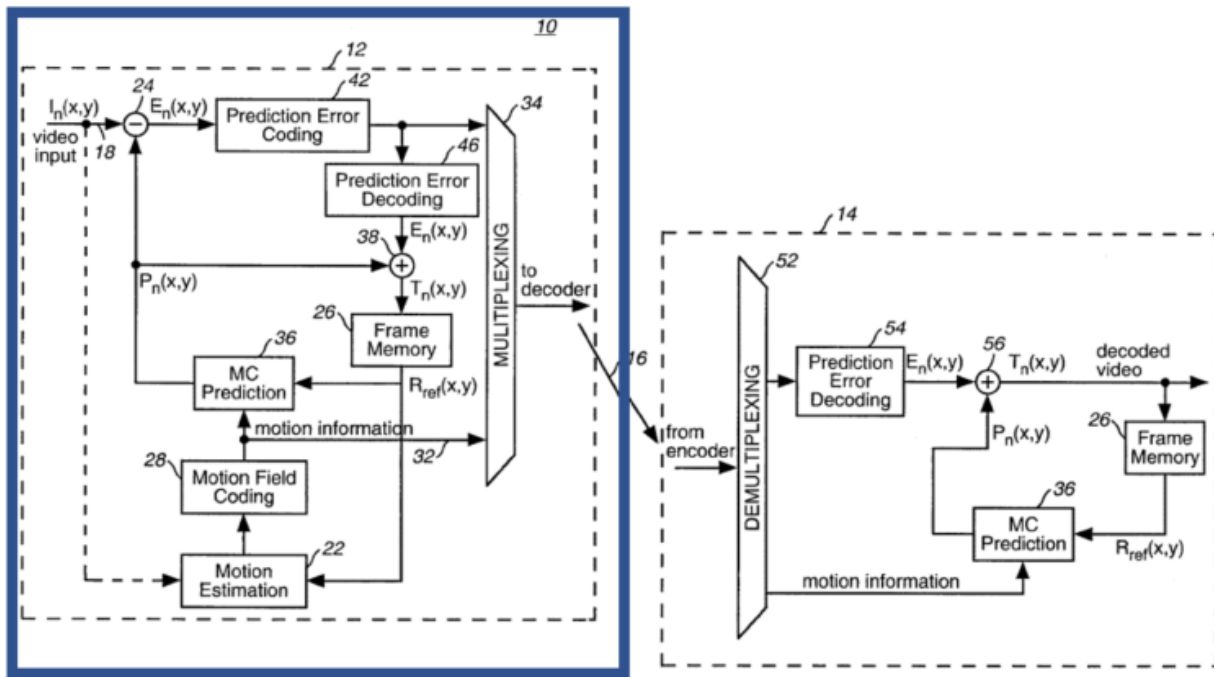


FIG. 1

(ii) 10[a]

Karczewicz discloses or suggests 10[a]. Havlicek, ¶¶155-74.

Karczewicz teaches a “prediction field” is “the motion field model predicted from the [previously coded] neighboring segment(s),” and a “refinement field” is “the difference between the prediction field and the motion field model determined specifically for the segment itself.” Karczewicz, 16:18-23. Furthermore, “[t]he sum of the prediction field and the refinement field should thus be equivalent to the motion field model determined by applying the affine motion model to the segment itself.” Karczewicz, 16:23-27; Havlicek, ¶¶156-57.

Karczewicz further explains “there are several different ways in which a given segment can be coded” (Karczewicz, 17:1-2), which Karczewicz characterizes as—and a POSITA would have understood to be—different coding modes. Karczewicz, 31:14-25, claims 61, 64-65; Havlicek, ¶¶158-60.

Karczewicz determines which mode to assign to a segment based on which is the most efficient. Specifically, when encoding a second segment of an inter frame (here, mapped to the claimed “first segment”), an encoder “considers whether it is ‘more efficient’ to model the second segment in terms of the affine motion model previously determined for [a] first segment, rather than according to the newly determined affine motion coefficients for the second segment itself.” Karczewicz, 14:27-15:1. “Efficiency” is based on “rate distortion,” which considers “both a measure of image distortion and a measure of the amount of data required to achieve that level of distortion.” Karczewicz, 14:12-17. In other words, Karczewicz balances the reduction in data coding against the potential quality loss of the coded video sequence. Havlicek, ¶159.

In the first mode, “[t]he segment may be represented as a prediction field only.” Karczewicz, 17:9-10, 31:16-17, claim 64. “This situation may arise when the segment can be adequately represented in terms of the motion field of one or more of its previously coded neighbors and no refinement information is necessary, or in a case where the encoder has found it efficient to reduce the refinement field to

zero.” Karczewicz, 17:10-14. In other words, Karczewicz teaches coding a second segment based on a neighboring segment (or segments) when efficient. Karczewicz, 14:12-17; Havlicek, ¶159.

In the second mode, “[t]he segment in question may be coded using a motion model determined specifically for the segment using the reference frame...the prediction field is set to zero and the refinement field is set equal to the motion field model determined from the reference frame.” Karczewicz, 17:14-18, 31:20-21, claim 64; Havlicek, ¶162.

In the third mode, “[a] given segment can be represented as a sum of a prediction field and a refinement field.” Karczewicz, 17:8-9, 31:17-20, claim 64; Havlicek, ¶163.

In the fourth mode, “[t]he segment can also be coded by using a [ZMV] field, e.g., a copy from the reference frame.” Karczewicz, 31:22-24, claim 65; Havlicek, ¶164.

Finally, in the fifth mode, “the segment can be coded using intra coding in which no motion vector field is utilized.” Karczewicz, 31:24-25, claim 65; Havlicek, ¶165.

Each of Karczewicz’s coding modes can send prediction error. Havlicek, ¶168. Regardless of the mode, the prediction error is the difference between the motion-compensated predicted frame, which uses the motion vector information

chosen, and the current input video frame. Karczewicz, 20:21-29; Havlicek, ¶168. If a non-zero prediction error for the second segment is calculated, it is encoded and sent to the decoder. Karczewicz, 20:22-26; Havlicek, ¶168.

Karczewicz does not discuss what happens if a prediction error of zero is calculated. Havlicek, ¶¶107-08. A POSITA would have found it obvious, based on both the teachings of Karczewicz and those of virtually all video coding standards at the time, not to send prediction error if it was calculated to be zero. *Id.*

Specifically, it would have been obvious to indicate no prediction error will be sent if it is calculated to be zero. *Id.* Karczewicz teaches efficiently coding segments, including by using a motion coefficient indication (MCI) bit to indicate all-zero refinement field coefficients, rather than coding the zeros themselves. Karczewicz, 14:12-17, 37:5-13; Havlicek, ¶107. A POSITA would have been motivated to apply the same principles to signal zero prediction error via a bit, rather than coding the zero-prediction error itself, because doing so would have taken fewer bits without degrading video quality, and thus would have been more efficient. Havlicek, ¶107. Doing so would have been no more than use of a known technique (using a single bit to indicate an all-zero field) to improve a similar method (sending an all-zero prediction error) in the same way (efficiently indicating all zero values). It also would have been obvious to use another bit or indicator, similar to the MCI bit, to code zero prediction error because it would have been one of a limited number

of choices (e.g., coding zero prediction error or indicating zero prediction error without coding it).

A POSITA would have found it obvious based on the teachings of the well-known video coding standards of the time not to provide prediction error for a segment if the prediction error was calculated to be zero. Havlicek, ¶108. Specifically, coding standards such as H.26L and H.263+ teach transforming and quantizing prediction error for a segment and coding only non-zero coefficients. Havlicek, ¶108 (citing EX-1006, 1009, 1012, 1014-1015). These standards also teach a code, EOB and LAST, respectively, for signaling the end of the code for a segment. Havlicek, ¶108; EX-1009, 41; EX-1012, 32. A POSITA would have understood where prediction error is calculated to be zero, these standards would simply send the code signaling the end of a segment (rather than the zero-prediction error) because only non-zero coefficients would be sent after transformation and quantization. Havlicek, ¶108.

Karczewicz thus assigns a “skip coding mode,” under Petitioner’s construction of the term (where residual information can be provided), to a second

segment of an inter frame⁸ (“first segment of a first frame of the sequence”) in instances where the second segment is either encoded using ZMV (Karczewicz, 31:22-24) or with just a prediction field—i.e., a non-zero motion vector associated with a neighboring segment. Karczewicz, 17:8-14, 31:22-24; Havlicek, ¶169. While Karczewicz lists these two functionalities as separate coding modes, a POSITA would have understood the functionality of these two modes together teaches the ’808 Patent’s “modified” “skip coding mode,” which groups these two independent functionalities and “redefines” them as the “skip coding mode.” Havlicek, ¶169; ’808Pat., 17:54-18:11. Karczewicz’s MCI has a zero value only in the two modes comprising the functionality of claim 1’s “skip coding mode” discussed above. Thus, a POSITA would have understood a zero MCI bit indicates a segment is assigned a “skip coding mode.” Havlicek, ¶169.

Specifically, “the presence of motion coefficients in the bitstream is signaled by one bit whenever refinement or nonrefinement motion coefficients can be expected. This bit is referred to as...(MCI).” Karczewicz, 37:5-8. “An all-zero pattern [of motion coefficients]...can be signaled by the MCI bit alone.”

⁸ Karczewicz transmits a sequence’s first frame in INTRA format, and a POSITA would have understood the recited “first frame in the sequence” refers to the sequence’s first inter-coded frame. Karczewicz, 13:17-23; Havlicek, ¶169.

Karczewicz, 37:12-13. Thus, a zero MCI bit indicates Karczewicz's two inter-coding modes corresponding to claim 1's "redefined" "skip coding mode." Specifically, when a segment is coded with ZMV, the MCI bit is zero because that indicates "[a]n all-zero pattern [of motion coefficients]." Karczewicz, 37:12-13; Havlicek, ¶169. When a segment is coded with just a prediction field, the MCI bit is also zero because it indicates there are no motion coefficients for the segment (i.e., no refinement field). Karczewicz, 37:5-8; Havlicek, ¶169. These are the only two modes in Karczewicz that include a zero MCI bit, so a POSITA would have understood if a segment is coded with a zero MCI bit, it is assigned a "skip coding mode." Havlicek, ¶169.

Motion Field Coder ("MFC") 28 determines which of its modes most efficiently codes a segment, and is thus a "coding controller" for assigning a skip coding mode. Havlicek, ¶172; Karczewicz, 11:19-23, 20:11-16, Figs. 1-2.

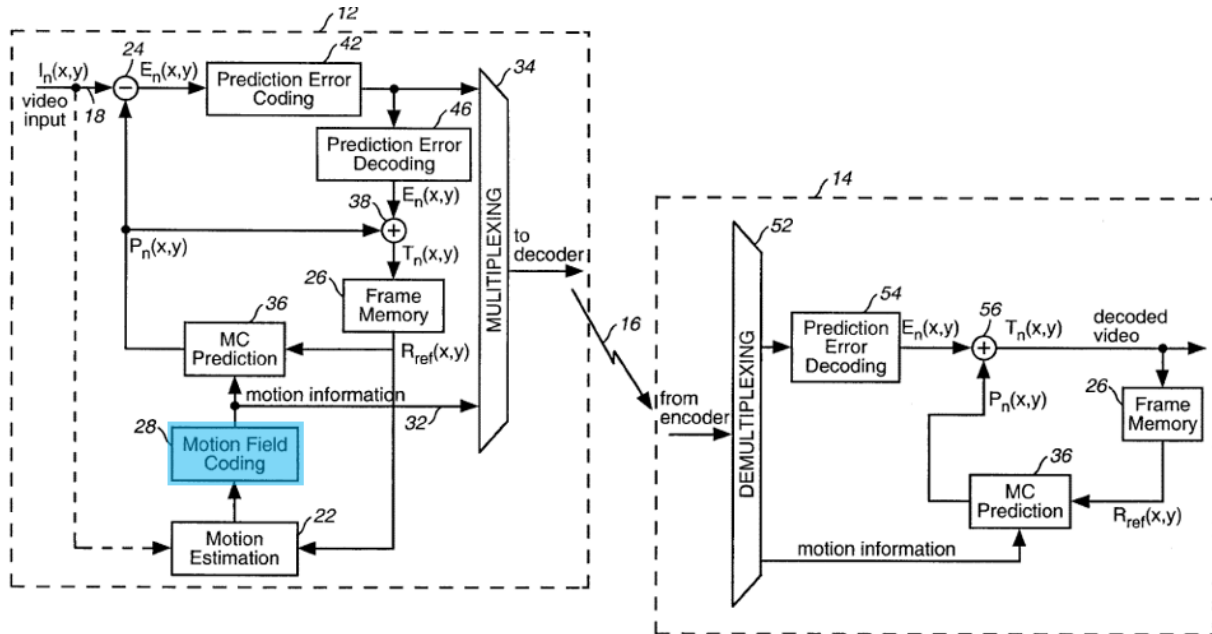


FIG. 1

Karczewicz, Fig. 1 (annotated).

Regardless of which coding mode is assigned to Karczewicz's second segment, Karczewicz calculates and, if it is non-zero, encodes prediction error. Karczewicz, 20:21-29. A POSITA would have understood prediction error information can be (but is not necessarily) sent with each of Karczewicz's coding modes, including the "skip coding mode" discussed above. Havlicek, ¶173. Karczewicz thus teaches residual information can be provided with the skip-coded macroblock in the form of prediction error information. *Id.*

Finally, a POSITA would have understood the decision to code a second segment with ZMV or PNZMV depends on the motion characteristics in the neighboring segment(s), consistent with all proposed constructions of "skip coding

mode,” because MFC 28 determines the efficient coding mode by balancing distortion due to coding the second segment with reference to a neighboring segment against the amount of data required to transmit the second segment’s motion vector information. Karczewicz, 15:15-20; Havlicek, ¶174. Karczewicz teaches a “skip coding mode” under Petitioner’s construction of the term. Havlicek, ¶174.

(iii) 10[b]

Karczewicz discloses or suggests 10[b]. Havlicek, ¶¶175-76. MFC 28 forms a motion vector field for a second segment with input from motion estimator 22. Karczewicz, 20:11-13, 21:18-21, Fig. 1; Havlicek, ¶175. Motion compensated predictor (“MCP”) 36 generates a prediction frame with input from MFC 28 and frame memory. §VII.A.2.a(iv); Karczewicz, 20:17-20, 21:16-21. A POSITA would have understood MFC 28 and MCP 36 together teach the recited “motion estimation block” performing the functions attributed to it in 10[b], 10[c]. Havlicek, ¶175.

MFC 28 determines “a previously-encoded segment of the current frame, or a combination of such segments, whose motion vector field, or fields, is best suitable for predicting the motion of a...current segment,” Karczewicz, 26:13-16, 26:9-20, and “a mathematically efficient representation” for a segment, *id.*, 26:21-25. MFC 28 forms the motion vector field for Karczewicz’s second segment. Karczewicz, 20:11-13. Thus, a POSITA would have understood MFC 28 “assigns” either ZMV or PNZMV for the skip coding mode of Karczewicz’s second segment when it forms

the motion vector field for the second segment. Havlicek, ¶176. This assignment is “based at least in part on the motion information of a second segment neighboring the first segment” because MFC 28 decides which previously coded, neighboring segment(s) have a motion field(s) best predicting the motion of its second segment. Karczewicz, 26:13-20. The PNZMV is “based at least in part on the motion information of a second segment neighboring the first segment” because Karczewicz’s prediction motion vector field is “extrapolated from a neighboring segment” or segments. Karczewicz, 31:16-17, 25:14-17, 25:19-23; Havlicek, ¶176.

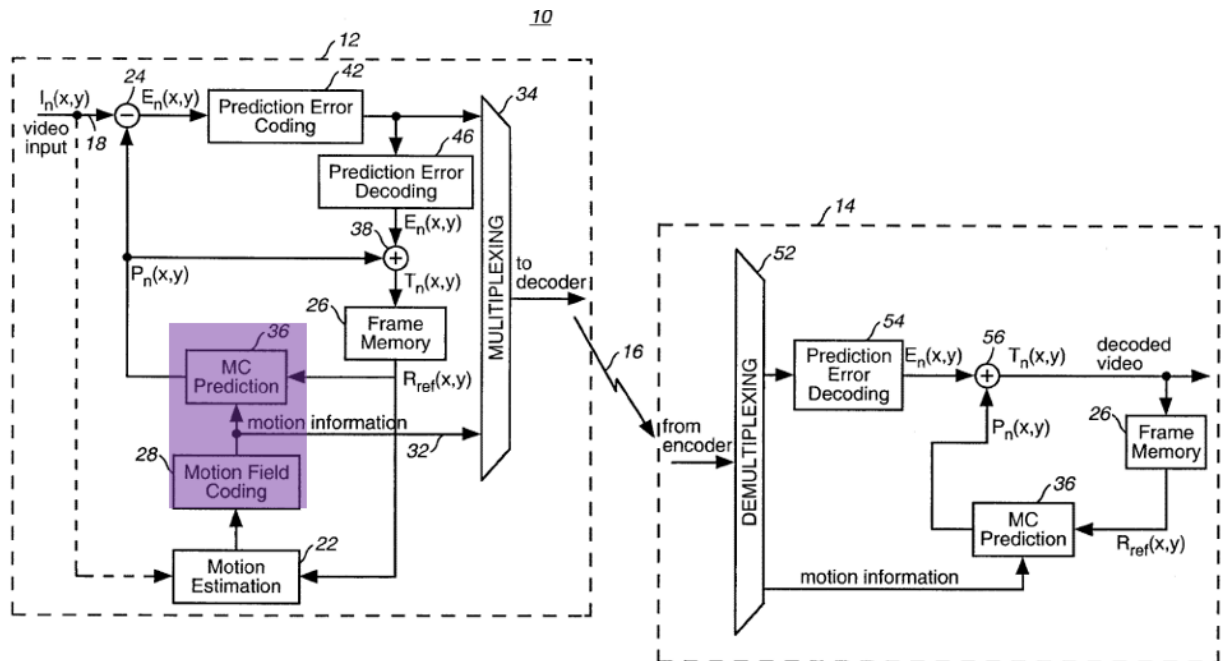


FIG. 1

Karczewicz, Fig. 1 (annotated).

(iv) 10[c]

Karczewicz discloses or suggests 10[c]. Havlicek, ¶177. MCP 36 uses the reference frame and the motion vector (either ZMV or PNZMV) assigned to Karczewicz's second segment ("first segment") to form a prediction for that segment. Karczewicz, 21:16-21, 21:3-5, 16:16-18, 20:17-20, 21:6-21, 23:6-9, 25:13-24, 26:13-20 27:15-30, 31:13-24; Havlicek, ¶177. Together, MCP 36 and MFC 28 form the recited "motion estimate block." §VII.A.2.a(iii); Havlicek, ¶177.

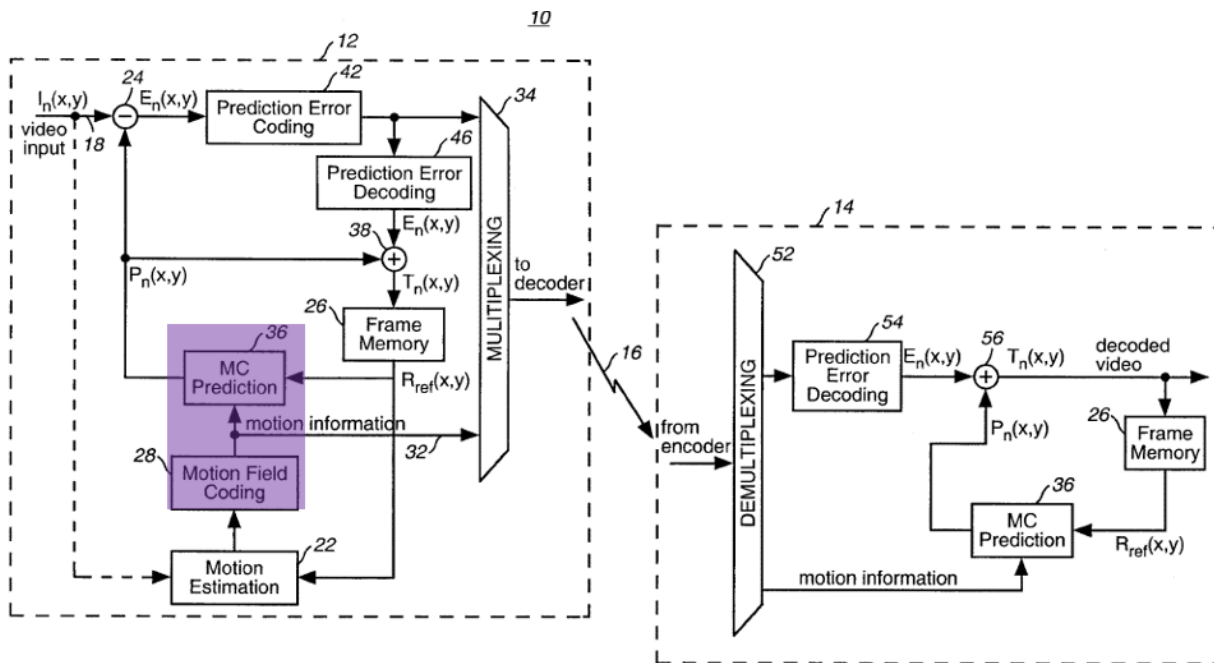


FIG. 1

Karczewicz, Fig. 1 (annotated).

(v) 10[d]

Karczewicz discloses or suggests 10[d]. Havlicek, ¶¶178-81. In Karczewicz, multiplexor 34 provides an encoded bitstream to the decoder. Karczewicz, 20:13-16, Fig. 1.

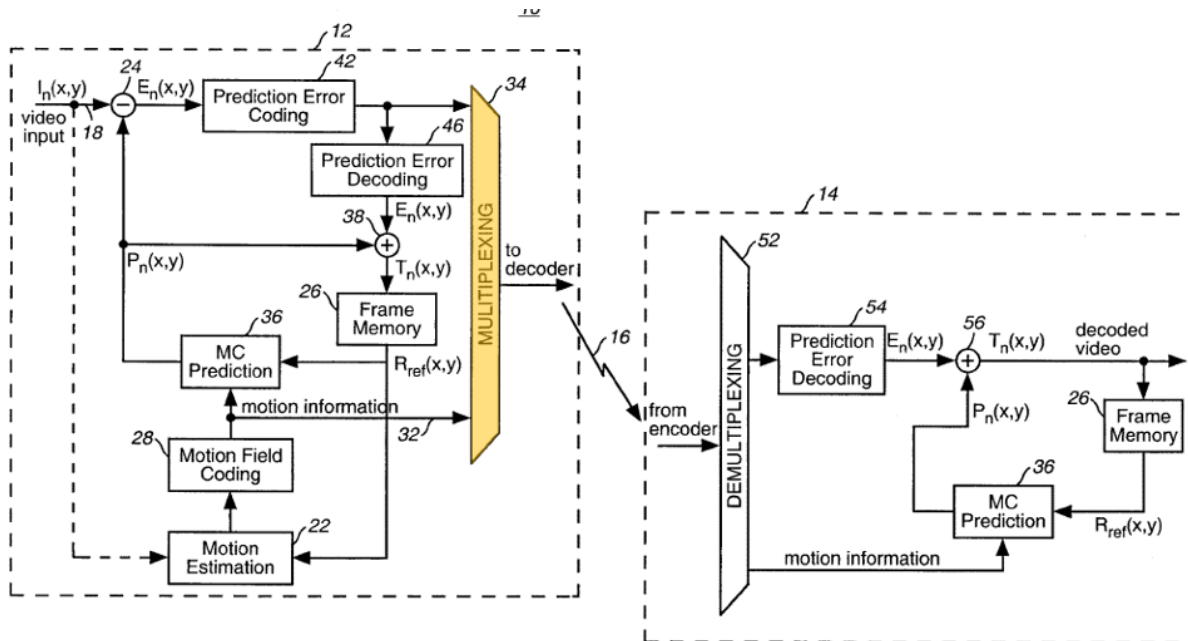


FIG. 1

Karczewicz, Fig. 1 (annotated).

Karczewicz teaches a zero MCI is coded only with a segment that is assigned a “skip coding mode.” §VII.A.2.a(ii). A POSITA would have understood coding a zero MCI bit for a segment to be “providing in an encoded bitstream an indication of the skip coding mode.” Havlicek, ¶179.

Karczewicz further discloses “one bit is sent to the decoder 14 to signal whether the prediction field of a neighbor is used or not, but only in the case when

there is at least one prediction neighbor candidate.” Karczewicz, 32:18-20. Karczewicz thus teaches that “no further motion vector information for the first segment is coded in the encoded bitstream” because neither the bit indicating whether a prediction motion vector field is used nor the information indicating which previously coded neighbor(s) to use for the prediction motion vector field is “motion vector information.” Havlicek, ¶180.

A POSITA would have understood Karczewicz’s multiplexor 34 encodes these two bits in the encoded bitstream because the multiplexor encodes the video for transmission. Karczewicz, 20:13-16; Havlicek, ¶181.

b. Claim 11

Karczewicz discloses or suggests claim 11’s additional limitation. Havlicek, ¶182. As discussed for claim 10, the prediction field for Karczewicz’s second segment (“first segment”) is “represented in terms of the motion field of one or more of its previously coded neighbors” (“second segment”). Karczewicz, 17:10-14, 14:27-15:6, 16:4-30; 17:23-28, 31:8-9.

c. Claim 15

Karczewicz discloses or suggests claim 15’s additional limitation. Havlicek, ¶¶183-86. Karczewicz codes a second segment (“first segment”) with reference to a previously coded neighboring segment (“second segment”) via a prediction motion vector field or with a ZMV. §§VII.A.2.a(ii), VII.A.2.a(iii); Karczewicz, 31:22-24.

A POSITA would have understood when a previously coded, neighboring segment has ZMV, Karczewicz codes its second segment with ZMV if it is efficient. Havlicek, ¶184. In that case, when ZMV is coded, the segment is copied from the reference frame—i.e., “formed with respect to a corresponding segment of the reference frame associated with the [ZMV].” Karczewicz, 31:22-24; Havlicek, ¶184.

If PO argues Karczewicz does not allow neighboring segments with ZMVs to be candidates for a prediction motion vector field (based on, *e.g.*, Karczewicz, 32:20-22), PO’s argument would be misplaced because Karczewicz renders this claim obvious regardless. Havlicek, ¶185. This disclosure in Karczewicz is related to the *decoder* side and is harmonized with Karczewicz’s encoder disclosures. Karczewicz, 32:18-20. Specifically, if a second segment is encoded with ZMV, which may be based on the motion vectors of its neighbors if it is efficient to do so in the rate-distortion sense, then the decoder would not receive a prediction motion vector field for that segment (because it is coded with ZMV), and there would not be any prediction neighbor candidates. Havlicek, ¶186. At the decoder, there are prediction motion vector field candidates and coefficients only if a segment is coded with a non-ZMV, but this does not affect Karczewicz’s teachings about how a segment may be encoded with a ZMV. *Id.*

d. Claim 21

Karczewicz discloses or suggests claim 21's additional limitation. Havlicek, ¶187. Karczewicz proposes implementing its teachings to "communication systems," including during video conferencing. Karczewicz, 1:19-22, 20:4-5. A POSITA would have understood communications systems used for video conferencing are "multimedia terminals" because they render at least video and sound media, and that each such terminal would comprise both an encoder and a decoder to allow for two-way communication. Havlicek, ¶187.

e. Claim 44

(i) 44[pre]

If the preamble is limiting, Karczewicz discloses that a previously coded neighboring segment ("second segment") may have a non-zero motion vector. Karczewicz, 32:20-22; Havlicek, ¶188.

(ii) 44[a]

Karczewicz discloses or suggests 44[a]. §§VII.A.2.a(ii), VII.A.2.a(iii); Havlicek, ¶¶189-90. Karczewicz's second segment "can be coded using only prediction motion vector fields extrapolated from a neighboring segment." Karczewicz, 31:16-20. Specifically, "[o]nce the neighboring segment has been selected for the prediction of the current segment, the prediction motion vector field

is simply the extrapolation of the motion vector field of the segment inside the pixel domain covered by the current segment as follows:

EQUATION 20

$$\Delta x_{prd}(x,y) = \beta_1^k + \beta_2^k \cdot (y - y_o^k) + \beta_3^k \cdot (x - x_o^k)$$

$$\Delta y_{prd}(x,y) = \beta_4^k + \beta_5^k \cdot (y - y_o^k) + \beta_6^k \cdot (x - x_o^k)$$

where x_o^k, y_o^k are coordinates of the upper left-most pixel in the neighboring segment S_k and $\beta_1^k, \dots, \beta_6^k$ are integer-valued coefficients corresponding to the motion field of segment S_k . In equation 20, the superscript ^{k} indicates that the coefficients are associated with the neighboring segment S_k .” Karczewicz 33:18-34:2. Where the one or several neighboring segments has a non-zero motion vector field, a POSITA would have understood Karczewicz “deriv[es] the [PNZMV] based at least in part on the motion vector of the second segment.” Havlicek, ¶190.

(iii) 44[b]

Karczewicz discloses or suggests 44[b]. Havlicek, ¶191. After the “skip coding mode” is assigned, Karczewicz’s second segment (“first segment”) is coded with a prediction motion vector field “extrapolated from a neighboring segment.” §VII.A.2.a(iii); Karczewicz, 31:16-17. Karczewicz thus codes (“assigns”) its second segment with a prediction motion vector field extrapolated from a neighboring segment (“[PNZMV]”). Havlicek, ¶191.

(iv) 44[c]

Karczewicz discloses or suggests 44[c]. Havlicek, ¶192. Karczewicz forms a motion vector prediction field for its second segment (“first segment”) with respect to a reference frame based on one or more previously coded segments (“second segment”). §VII.A.2.a(iv); Karczewicz, 13:29-14:2, 16:16-18, 21:6-21, 25:13-24, 26:13-20, 31:13-24. Where the “skip coding mode” is assigned to a prediction motion vector field (Karczewicz, 31:16-17), a POSITA would have understood “the prediction for the first segment is formed by motion compensated prediction with respect to the reference frame based at least in part on the [PNZMV].” Havlicek, ¶192.

f. Claim 47

Karczewicz discloses or suggests claim 47’s additional limitation. §VII.A.2.a(iii); Havlicek, ¶193. MFC 28, i.e., part of the “motion estimation block,” computes (“derives”) a motion vector for a second segment based upon the motion field of one or more of its previously coded neighbors. Karczewicz, 26:9-20; Havlicek, ¶193.

g. Claim 48

Karczewicz discloses or suggests claim 48’s additional limitation. §VII.A.2.a(iii); Havlicek, ¶194. MFC 28 (part of “motion estimation block”) computes (“derives”) a motion vector for the second segment based upon the motion

field of one or more of its previously coded neighbors. Karczewicz, 26:9-20; Havlicek, ¶194. For example, multiple previously coded neighbors (“second segment” and “third segment”) can be used to create a PNZMV by averaging or determining their median. Karczewicz, 25:19-24.

h. Claim 49

Karczewicz discloses or suggests claim 49’s additional limitation. §§VII.A.2.a(ii), VII.A.2.a(iii); Havlicek, ¶195. Karczewicz’s prediction error transmitted with the motion vector field is calculated as “the differences in pixel value between the current input video frame and the MC predicted version of the frame.” Karczewicz, 20:22-25. A POSITA would have understood where there is no difference between the motion-compensated predicted version of the frame and the actual version of the frame for the recited “first segment,” no residual, i.e., predicted error, would be provided. Havlicek, ¶195.

i. Claim 51

Karczewicz discloses or suggests claim 51’s additional limitation (§VII.A.2.c) because a POSITA would have understood Karczewicz’s previously coded, neighboring segment to be both a “segment in a region surrounding the first segment” (claim 15) and a “second segment” (claim 51). Havlicek, ¶196.

j. Claim 52

Karczewicz discloses or suggests claim 52's additional limitation. Havlicek, ¶197. Karczewicz does not discuss how previously coded, neighboring segments ("second segment") are predicted because Karczewicz's teachings only require that the neighboring segment be previously coded (and thus known to both the encoder and decoder). Havlicek, ¶197; Karczewicz 17:25-28 ("motion field model(s) of the previously coded neighboring segment(s) are already known to (i.e., stored in) the decoder"). Karczewicz discloses a segment assigned a ZMV is copied from the reference frame. Karczewicz, 13:29-30, 31:22-24. Therefore, if a previously coded, neighboring segment ("second segment") has ZMV, it is predicted using the reference picture. Havlicek, ¶197. When the previously coded, neighboring segment has ZMV, Karczewicz may decide that it is efficient for its second segment ("first segment") to have ZMV. §VII.A.2.a(ii). A segment coded with ZMV is copied from the reference frame, i.e., "formed with respect to a corresponding segment of the reference frame associated with the [ZMV]." Havlicek, ¶197.

k. Claim 53

Karczewicz discloses or suggests claim 53's additional limitation (§VII.A.2.i) because Karczewicz's reference frame may immediately precede the current frame. Havlicek, ¶198; Karczewicz, 5:30-6:2.

3. Claim 16 and Dependents

a. Claim 16

(i) 16[pre]

If the preamble is limiting, Karczewicz discloses or suggests 16[pre]. Havlicek, ¶199. Karczewicz discloses an “apparatus...for...decoding, a video sequence utilizing motion compensated prediction.” Karczewicz, 1:7-8, Fig. 1.

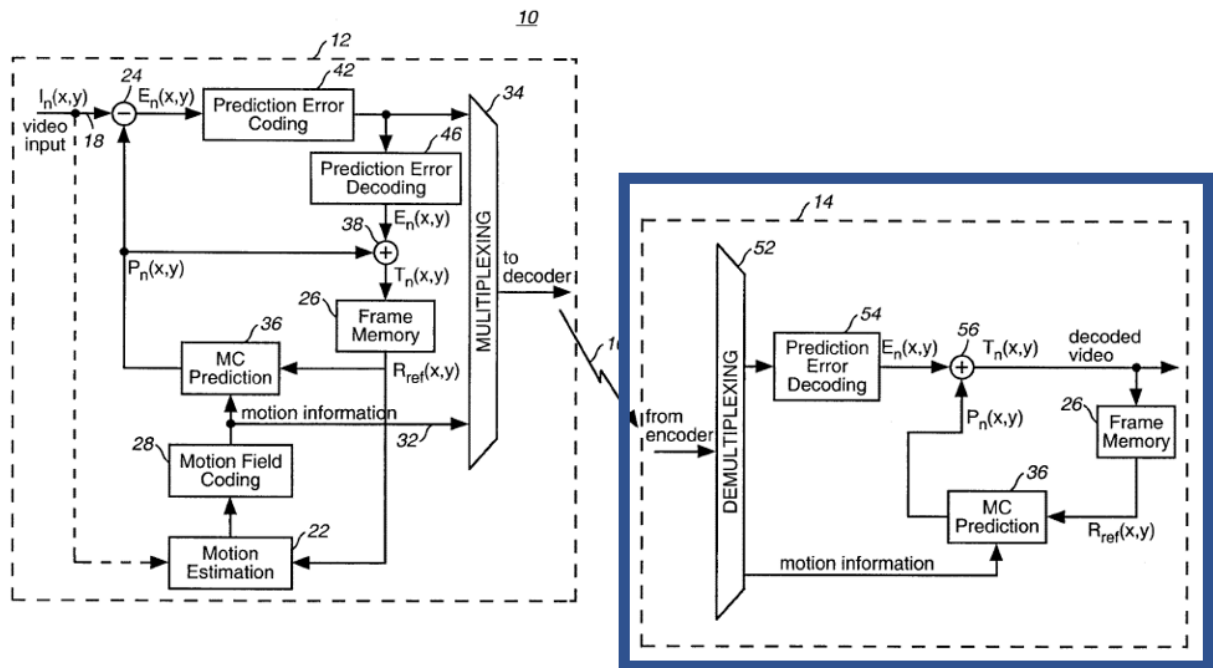


FIG. 1

Karczewicz, Fig. 1 (annotated).

(ii) 16[a]

Karczewicz discloses or suggests 16[a]. Havlicek, ¶200. Karczewicz’s decoder comprises demultiplexor 52 that receives the encoded bitstream (and thus

the recited “indication of a skip coding mode,” which is assigned to the “first segment”) (§VII.A.2.a(v)). Karczewicz, 21:1, Fig. 1; Havlicek, ¶200.

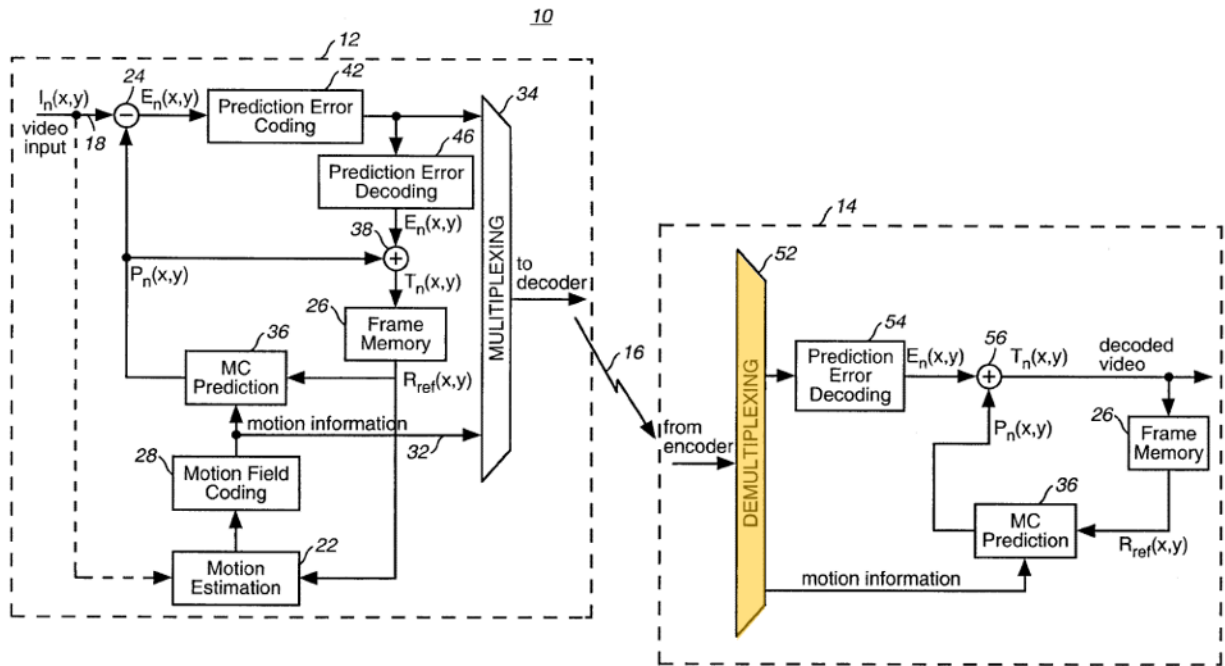


FIG. 1

Karczewicz, Fig. 1 (annotated).

(iii) 16[b]

Karczewicz discloses or suggests 16[b]. Havlicek, ¶201. Karczewicz’s decoder comprises MCP 36 utilizing the prediction and refinement motion vector fields for a segment received from the encoder to reconstruct said segment of the current frame. Karczewicz, 27:17-22 (MCP 36 reconstructs current frame in same way at both encoder and decoder), Figs. 1, 3. In Karczewicz’s “skip coding mode,” MCP 36 assigns ZMV or PNZMV to Karczewicz’s second segment based on the

values of the prediction motion vector field or ZMV is assigned and encoded for that segment (§VII.A.2.a(iii)). Havlicek, ¶201.

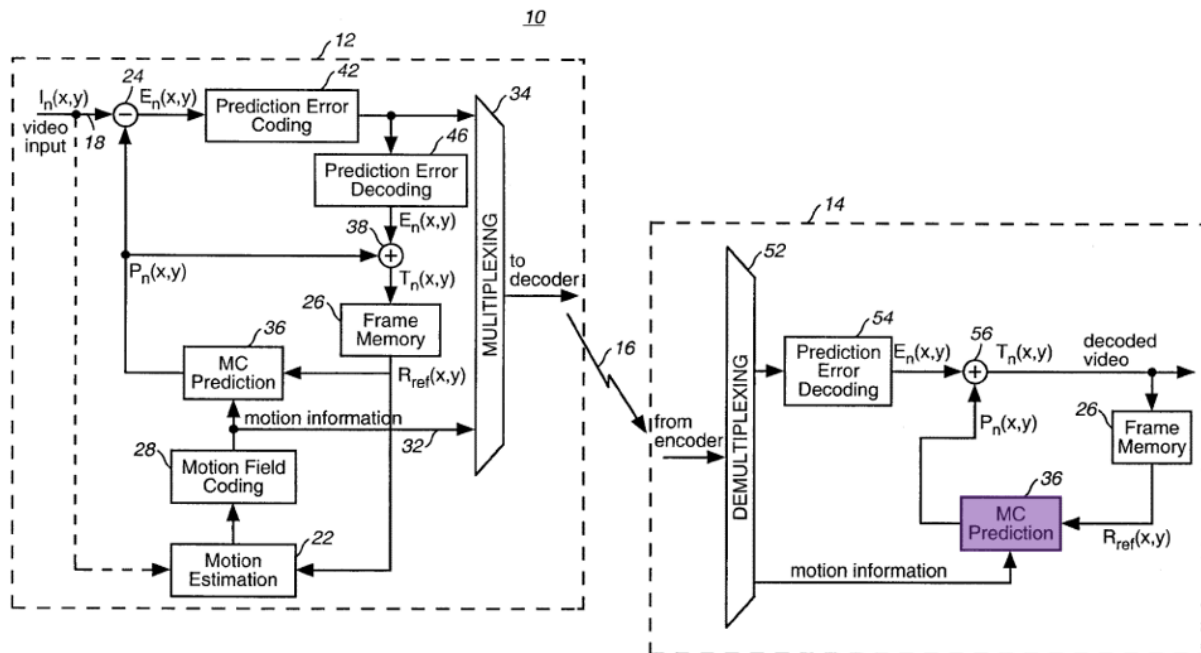


FIG. 1

Karczewicz, Fig. 1 (annotated).

(iv) 16[c]

Karczewicz discloses or suggests 16[c]. §VII.A.2.a(iv); Havlicek, ¶202. MCP 36 forms a prediction frame using the motion vector (“the assigned either [ZMV] or [PNZMV]”) and the reference frame. Karczewicz, 21:16-21, 27:17-22; Havlicek, ¶202.

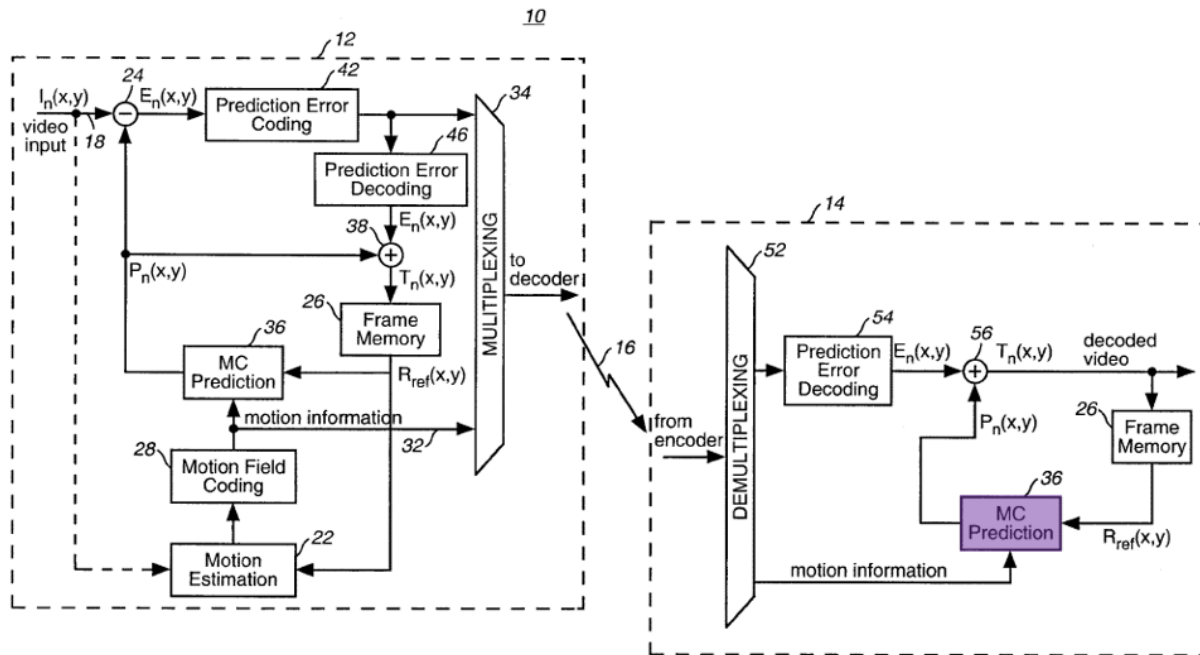


FIG. 1

Karczewicz, Fig. 1 (annotated).

b. Claim 20

Karczewicz discloses or suggests claim 20's additional limitation. §VII.A.2.c; Havlicek, ¶203. Where a second segment is assigned ZMV in the circumstances discussed in §VII.A.2.c, those same circumstances would be present for the second segment on the decoder side. *Id.* Further, when the decoder receives a zero MCI bit and no bit indicating a neighboring segment for a prediction neighbor candidate, §VII.A.2.a(v), the decoder assigns ZMV to Karczewicz's second segment, Havlicek, ¶203. The decoder's MCP 36 then forms a prediction for the second segment in the same way discussed in §VII.A.2.c. Havlicek, ¶203; Karczewicz, 27:17-22.

c. Claim 22

Karczewicz discloses or suggests claim 22's additional limitation. §VII.A.2.d; Havlicek, ¶204.

d. Claim 54

Karczewicz discloses or suggests claim 54's additional limitation (§VII.A.3.b) because a POSITA would have understood Karczewicz's previously-coded neighboring segment to be both a "segment in a region surrounding the first segment" (claim 20) and a "second segment" (claim 54). Havlicek, ¶205.

e. Claim 58

Karczewicz discloses or suggests claim 58's additional limitation (§VII.A.2.f) because MCP 36 in the decoder functions the same way as MCP 36 in the encoder. Karczewicz, 27:17-28:11, Havlicek, ¶¶206-07. MCP 36 assigns PNZMV to Karczewicz's second segment based on the values of the prediction motion vector field received from the encoder. §VII.A.3.a(iii); Havlicek, ¶206.

f. Claim 59

Karczewicz discloses or suggests claim 59's additional limitation (§VII.A.2.g) because MCP 36 in the decoder functions the same way as MCP 36 in the encoder. Karczewicz, 27:17-28:11, Havlicek, ¶¶208-09. MCP 36 assigns PNZMV to Karczewicz's second segment based on the values of the prediction motion vector field received from the encoder. §VII.A.3.a(iii); Havlicek, ¶208. The

prediction motion vector may be obtained “from a combination of affine motion vector fields of several neighboring segments,” i.e., “based at least in part on the motion vector of the second segment and the motion vector of a third segment neighboring the first segment.” Karczewicz 25:19-23; Havlicek, ¶208.

g. Claim 60

Karczewicz discloses or suggests claim 60’s additional limitation (§VII.A.2.h) because Karczewicz’s decoder would not receive prediction error information (“residual information”) about its second segment (“first segment”) from the encoder when the encoder does not send it. Havlicek, ¶210.

h. Claim 62

Karczewicz discloses or suggests claim 62’s additional limitation (§VII.A.2.j) because MCP 36 in the decoder functions the same way as MCP 36 in the encoder. Karczewicz, 27:17-28:11, Havlicek, ¶211.

i. Claim 63

Karczewicz discloses or suggests claim 63’s additional limitation (§VII.A.2.k) because MCP 36 in the decoder functions the same way as MCP 36 in the encoder. Karczewicz, 27:17-28:11, Havlicek, ¶212.

j. Claim 64

Karczewicz discloses or suggests claim 64’s additional limitation (§VII.A.2.a(v)) because Karczewicz’s “skip coding mode” does not provide a

refinement motion vector field (“further motion vector information for the first segment”). Havlicek, ¶213.

B. Ground 2A: Obviousness over Frojdh in view of AAPA

1. Frojdh

Frojdh discloses using motion prediction in digital video compression, including “employ[ing] global motion compensation” “wherein macroblocks are grouped into slices and global motion compensation information is transmitted with encoded slices.” Frojdh, [0002]; FrojdhProv, 5-6. In Frojdh, when making motion compensation determinations, parts of a frame containing little or no change can be “skipped or non-coded, in order to maximize compression efficiency.” Frojdh, [0004], [0047]; FrojdhProv, 5, 8-9. “[A]n embodiment referred to as Implicit global motion compensation (IGMC) [where] no explicit motion vector is sent with the encoded slice 40. Instead, the macroblock COPY (aka SKIP) mode is reinterpreted as an Inter macroblock mode without coefficients or explicitly coded motion vectors.” Frojdh, [0055]; FrojdhProv, 6, 12-13.

a. *Priority Analysis*

Frojdh claims the benefit of Provisional Application 60/334,979 (“FrojdhProv”), filed November 30, 2001. Frojdh is entitled to the benefit of FrojdhProv under §119(e) because Frojdh was filed less than 12 months after FrojdhProv and contains a specific reference to it. Frojdh, (60).

A nonprovisional patent application publication is prior art as of the earlier filing date of a provisional application if the disclosure of the provisional provides §112 support for at least one claim in the publication, and the provisional describes the subject matter relied upon as prior art. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1381-82 (Fed. Cir. 2015); *Medtronic, Inc. v. Niazi Licensing Corp.*, IPR2018-00609, Paper 8, 11 (Aug. 20, 2018).

FrojdProv supports at least Frojd claim 15. Havlicek, ¶¶219-21.

Frojd, Claim 15	
Limitation	FrojdProv Page Cite
A method...said method comprising the steps of:	11-12
identifying a signal...;	11
identifying GMC information ... and	11
decoding...	6, 13

FrojdProv further discloses the subject matter relied upon for prior art in Frojd, as shown using parallel citations in Grounds 2A, 2B. Havlicek, ¶¶222-23.

2. AAPA

AAPA describes a generic video coding system with exemplary video encoder and decoder. '808Pat., 3:44-52. The encoder includes a control manager, motion estimator, motion field coder, motion compensated predictor, and video multiplex coder. '808Pat., 4:1-12, Fig. 1. The decoder includes a control manager, video multiplex decoder, and motion compensated prediction block. '808Pat., 8:19-26,

Fig. 2. The AAPA encoder and decoder resemble well-known prior art encoders and decoders. Havlicek, ¶339.

3. Motivation to Combine

A POSITA would have been motivated to combine the AAPA encoder and decoder with Frojdh's video coding and decoding method, respectively. Havlicek, ¶340.

Frojdh discloses an encoder and decoder to compress and de-compress video data. Frojdh, [0002], [0011]; FrojdhProv, 5-7; Havlicek, ¶341. Frojdh does not disclose implementation details of the encoder and decoder. Havlicek, ¶341. A POSITA would have looked to AAPA teachings for those implementation details, as both Frojdh and AAPA describe performing motion compensation for video. Frojdh, [0002]; FrojdhProv, 5-6; '808Pat., 3:11-21; Havlicek, ¶341.

This combination amounts to using known techniques (AAPA's exemplary encoder and decoder) to improve a similar system (Frojdh's encoder and decoder, respectively) in the same way (to perform motion-compensated prediction). Havlicek, ¶342.

Further, this combination amounts to combining prior art elements (AAPA's video encoder and decoder) according to known methods (as evidenced by AAPA, showing a POSITA would have known how to use the disclosed video encoder and video decoder components in a similar video coding system). Havlicek, ¶343.

4. Claim 10 and Dependents

a. Claim 10

(i) 10[pre]

If the preamble is limiting, the Frojdh-AAPA combination teaches 10[pre].
Havlicek, ¶¶344-46.

Frojdh uses an encoder to encode video data. Frojdh, [0002], [0004], [0024], [0054]; FrojdhProv, 5-6, 11-12. AAPA provides implementation details of “an exemplary video encoder.” ’808Pat., 3:44-8:18, Fig. 1. A POSITA would have been motivated to combine these teachings for the reasons discussed in §VII.B.3.

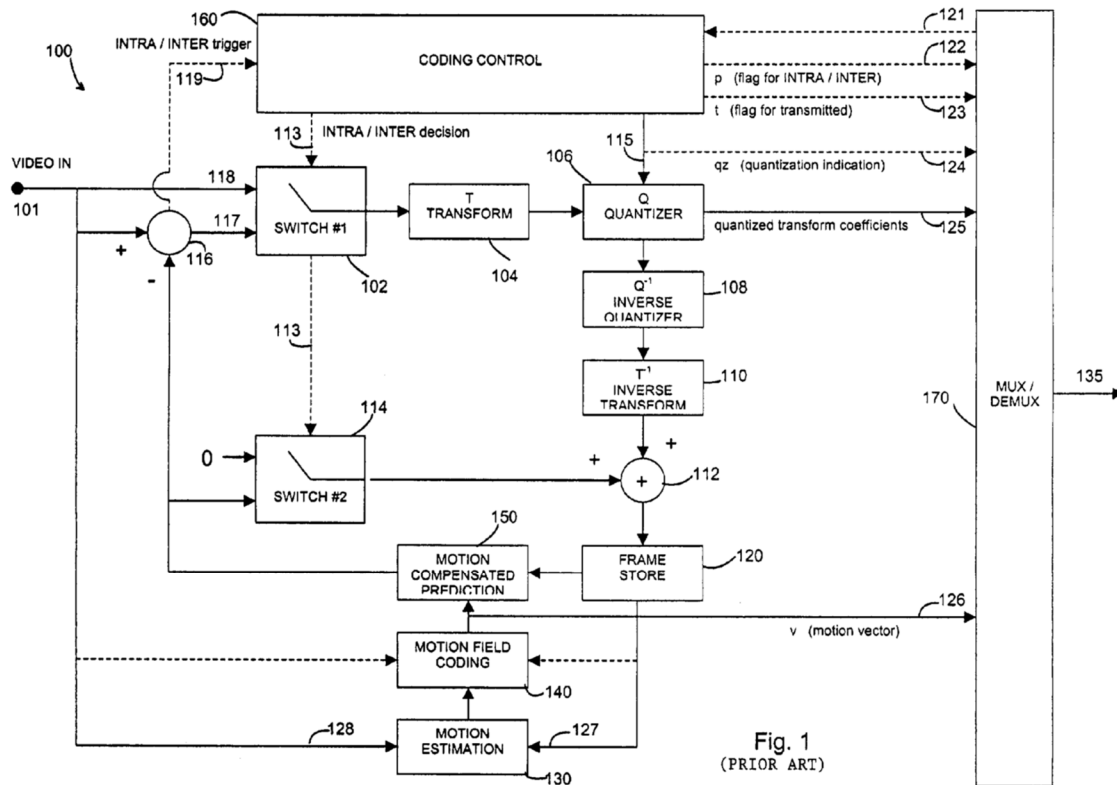


Fig. 1
(PRIOR ART)

(ii) 10[a]

The Frojdh-AAPA combination teaches 10[a]. Havlicek, ¶347.

AAPA teaches “coding control 160,” also referred to as “control manager 160.” ’808Pat., 3:61-4:6, Fig. 1. The control manager performs control functions, such as switching the video encoder between INTRA-mode and INTER-mode. ’808Pat., 4:29-56. A POSITA would have understood the described control manager teaches a “coding controller.” Havlicek, ¶348.

In the combination, the control manager (“coding controller”) “assign[s] a skip coding mode to a first segment.” Havlicek, ¶349. Specifically, Frojdh’s IGMC mode teaches a “skip coding mode” under at least PO’s claim construction. Havlicek, ¶¶227-29.

First, Frojdh’s IGMC mode is associated with both a zero (non-active) motion vector and a nonzero (active) motion vector. Havlicek, ¶230.

Frojdh discloses a technique “referred to as global motion compensation (GMC),” which uses predictions to “translate, or even scale or rotate, a previously coded region” to predict a region of a current frame. Frojdh, [0006]; FrojdhProv, 5-6. Frojdh describes when performing motion compensation, information about “how to spatially translate the corresponding regions of [a] reference frame [are used] in order to make a prediction for the macroblock under consideration” in the current frame. Frojdh, [0011]; FrojdhProv, 6-7. Frojdh additionally describes that not all

macroblocks need to be motion compensated, and “[i]f the change from the reference macroblock to the current macroblock is small, the macroblock can be coded in COPY mode, i.e. not coded per se but signaled to be copied.” Frojdth, [0011]; FrojdthProv, 6-7. “In COPY mode the motion vector is always zero.” Frojdth, [0022]; FrojdthProv, 12-13. Frojdth alternatively describes the copy operation performed during COPY mode as a skip, and also describes COPY mode as SKIP mode. Frojdth, [0047], [0055]; FrojdthProv, 6, 8-9, 12-13. Thus, Frojdth teaches a COPY or SKIP mode in which a macroblock is associated with a zero (non-active) vector. Havlicek, ¶¶231-33.

Frojdth further discloses “a new mode for global motion compensation, referred to as [IGMC].” Frojdth, [0022]; FrojdthProv, 12-13. Whereas in COPY mode the motion vector is always zero, “IGMC uses implicit motion vectors that are predicted.” Frojdth, [0022]; FrojdthProv, 12-13. When IGMC mode is used for “a particular image block in the current frame, a collocated block in a previous frame, dislocated by a motion vector is copied from the previous frame. The motion vector is predicted from neighboring blocks in the current frame, that is, from blocks which are adjacent to or proximate to the particular image block.” Frojdth, [0055]; FrojdthProv, 6, 12-13. In Frojdth, the predicted motion vector is based on “the

prediction from neighboring blocks.” FrojdhProv, 12.⁹ Because in IGMC mode the motion vector for a block is predicted from neighboring blocks’ motion vectors—unlike COPY mode, where the motion vector is always zero—the motion vector predicted using IGMC mode may be non-zero. Havlicek, ¶¶234-36. The motion vectors in IGMC mode may therefore be non-zero (active) motion vectors. Havlicek, ¶236. IGMC may be used as the coding mode for macroblocks. Frojdh, [0023]; FrojdhProv, 6, 12-13. Frojdh therefore teaches IGMC mode in which a macroblock is associated with a non-zero (active) motion vector. Havlicek, ¶236.

In IGMC mode, a macroblock may be associated with a zero (non-active) motion vector, based on Frojdh’s teachings of predicting a motion vector for a block (in IGMC) based on the motion vectors of neighboring blocks, and blocks may be associated with ZMV (e.g., in COPY mode). Havlicek, ¶237; Frojdh, [0022], [0055]; FrojdhProv, 6, 12-13. A POSITA would have understood when a macroblock has ZMV, a motion vector derived from that neighboring macroblock’s motion vector (as in IGMC mode) could be ZMV as well. Havlicek, ¶238. For example, calculating the motion vector for a macroblock based on the median of neighboring macroblocks’ motion vectors was one well-known technique for neighbor-based motion vector prediction. *Id.* Therefore, when Frojdh describes

⁹ Frojdh incorporates by reference its provisional application. Frojdh, [0001].

predicting a block's motion vector based on the neighboring macroblocks' motion vectors, it would have been obvious to calculate the predicted motion vector based on the median of the neighboring macroblocks' motion vectors. *Id.*

A POSITA would have further understood when macroblocks (e.g., neighboring macroblocks) have ZMVs, the median of those ZMVs results in a ZMV. Havlicek, ¶¶238-39. Accordingly, a POSITA would have understood the motion vector predicted for a macroblock using IGMC mode can be ZMV (e.g., when the neighboring macroblocks have ZMVs). Havlicek, ¶239. Further, the neighboring macroblocks could have ZMVs because they were coded using either COPY or IGMC mode. Havlicek, ¶239. Frojdh therefore teaches an IGMC mode in which a macroblock is associated with a zero (non-active) motion vector. Havlicek, ¶239. And Frojdh's IGMC mode teaches a coding mode in which a zero (non-active) motion vector or a nonzero (active) motion vector is associated with a macroblock. Havlicek, ¶239.

If IGMC mode alone does not teach the above-described feature of "skip coding mode" (e.g., a coding mode in which a zero (non-active) motion vector or a nonzero (active) motion vector is associated with a macroblock), Frojdh further discloses a coding mode (e.g., global motion compensation (GMC)) comprised of both the IGMC mode and COPY (aka SKIP) mode that teaches the recited "skip coding mode." Havlicek, ¶240.

Frojdth describes a COPY mode (with ZMV) and an IGMC mode (with a motion vector predicted based on neighboring motion vectors). Frojdth, [0022], [0023]; FrojdthProv, 6, 12-13. Further, either COPY or IGMC mode may be used when GMC is enabled. FrojdthProv, 12. GMC therefore allows either COPY (zero motion vector) or IGMC mode (predicted motion vector that can be non-zero or zero). Havlicek, ¶241. Further, GMC allowing either COPY or IGMC would have been obvious based on Frojdth's teaching of COPY mode's advantages, while describing how IGMC mode is a reinterpretation of COPY. Havlicek, ¶241; Frojdth, [0047], [0055]; FrojdthProv, 6, 8-9, 12-13. Therefore, when IGMC operates as a reinterpretation of COPY mode, a POSITA would have understood it was beneficial to be able to use COPY mode under GMC for the benefits it provides. Havlicek, ¶241. Frojdth teaches this feature of "skip coding mode" for this additional reason.

Whether to use ZMV or non-zero motion vector depends on the characteristics of the motion in image segments surrounding the macroblock in question. Havlicek, ¶242. Frojdth uses "neighboring image blocks of the current frame" to predict a motion vector in IGMC mode. Frojdth, [0023], [0055]; FrojdthProv, 6, 12-13. For example, the motion vector may be predicted from "the prediction from neighboring blocks." FrojdthProv, 12.

Frojdth thus teaches "skip coding mode" under at least PO's construction because in its IGMC mode a zero (non-active) motion vector or a nonzero (active)

motion vector is associated in an encoded bitstream with each IGMC (“skip mode”) macroblock, depending on the characteristics of the motion in image segments surrounding the macroblock in question. Havlicek, ¶¶242-44.

Frojdth “appl[ies] [IGMC mode] to a particular image block in the current frame,” and signals the use of COPY when GMC is enabled. Frojdth, [0054], [0055]; FrojdthProv, 6, 12-13. Frojdth thus additionally teaches assigning (applying) a skip coding mode (IGMC mode, alone or in combination with COPY) to a first segment (a particular image block in the current frame). Havlicek, ¶¶245-46. Further, since the combination’s control manager (“coding controller”) determines what coding mode to use (e.g., INTRA-mode or INTER-mode), a POSITA would have been motivated to use it to apply IGMC mode, alone or in combination with COPY, (“skip coding mode”) to a segment. Havlicek, ¶349.

(iii) 10[b]

The Frojdth-AAPA combination teaches 10[b]. Havlicek, ¶350.

AAPA includes “motion estimation block 130” within its video encoder, which “produce[s] a motion vector for [a] macroblock.” ’808Pat., 4:1-3, 7:30-60, Fig. 1. The combination therefore teaches “a motion estimation block for assigning” a motion vector. Havlicek, ¶¶351-52.

The combination teaches 10[b]’s additional elements. Havlicek, ¶352. Frojdth teaches assigning a “skip coding mode” for a particular image block (“first

segment”), where the skip coding mode utilizes ZMV or PNZMV based on characteristics of the motion in image segments surrounding the segment in question. §VII.B.4.a(ii). Specifically, Frojdh’s IGMC mode “uses implicit motion vectors that are predicted” based on the prediction of neighboring blocks. Frojdh, [0022]; FrojdhProv, 12-13. Frojdh further teaches IGMC mode can predict a motion vector that can be zero or non-zero (e.g., calculated from the median of neighboring blocks’ motion vectors, which can be zero or non-zero). §VII.B.4.a(ii). Accordingly, Frojdh teaches assigning either ZMV or PNZMV for the skip coding mode (IGMC mode alone or in combination with COPY (§VII.B.4.a(ii)) for the first segment (the particular image block). Havlicek, ¶¶247-48.

Frojdh “assign[s]” motion vectors in its IGMC mode “based at least in part on the motion information of a second segment neighboring the first segment.” Havlicek, ¶¶249-50. In IGMC mode, “[t]he motion vector is predicted from neighboring blocks in the current frame, that is, from blocks which are adjacent to or proximate to the particular image block.” Frojdh, [0055]; FrojdhProv, 6, 12-13. For example, the predicted motion vector may be based on “the prediction from neighboring blocks.” FrojdhProv, 12.¹⁰ Frojdh’s IGMC mode (and the associated predicted motion vector) “can be used as a tool in many coding scenarios which

¹⁰ N.7, *supra*.

require a more useful MB mode than COPY mode.” Frojdh, [0022]; FrojdhProv, 12-13. Frojdh explains COPY mode (and the associated ZMV) “is the cheapest mode to signal.” Frojdh, [0047]; FrojdhProv, 8-9. In other words, Frojdh discloses different advantages of ZMV and PNZMV, e.g., ZMV is cheapest to signal, but PNZMV may be “more useful.” Havlicek, ¶250. A POSITA would have understood whether to assign PNZMV or ZMV, to utilize which was “more useful,” would depend on the motion vectors (and how each performs coding a macroblock). Havlicek, ¶250. Thus, Frojdh teaches using motion information in a neighboring segment both to predict a motion vector, and assigning the predicted motion vector or alternative motion vector (e.g., ZMV) depending on which is associated with the “more useful MB mode” in a coding scenario. Havlicek, ¶¶251-52. Frojdh therefore teaches assigning the zero or PNZMV based at least in part on the motion information (prediction) of a second segment neighboring the first segment (neighboring block in the current frame, adjacent to or proximate to the particular image block). Havlicek, ¶¶251-52.

Frojdh also teaches “[PNZMV] for the skip coding mode” is “based at least in part on the motion information of a second segment neighboring the first segment.” Havlicek, ¶253. Frojdh predicts a motion vector based on the predictions of neighboring blocks. Frojdh, [0055]; FrojdhProv, 6, 12-13. A POSITA would have understood neighboring block predictions encompass motion information.

Havlicek, ¶253. Frojdh therefore teaches predicting a non-zero motion vector based at least in part on the motion information (prediction) of a second segment neighboring the first segment (neighboring block in the current frame, adjacent to or proximate to the particular image block). Havlicek, ¶253.

Since the combination's motion estimation block produces the macroblock's motion vector, a POSITA would have been motivated to use it to assign ZMV or PNZMV for the first segment. Havlicek, ¶352.

(iv) 10[c]

The Frojdh-AAPA combination teaches 10[c]. Havlicek, ¶353.

In Frojdh, when “making so-called motion-compensated predictions,...regions of a video frame are predicted from similar regions of a previous frame.” Frojdh, [0004]; FrojdhProv, 5. Frojdh teaches assigning an IGMC mode to a particular image block (“the first segment”). §VII.B.4.a(ii). When IGMC mode is used for the particular image block (“the first segment”), pixels are copied from a collocated image block, located in a previous frame, that is dislocated based on a predicted motion vector. Frojdh, [0023], [0055]; FrojdhProv, 6, 12-13. Thus, Frojdh teaches forming a prediction (copying pixels based on a predicted motion vector) for the first segment (the particular image block) with respect to a reference frame (the previous frame) based at least in part on the assigned motion vector for the skip coding mode (IGMC mode alone or in combination with COPY,

(§VII.B.4.a(ii)), wherein the assigned motion vector is one of ZMV and PNZMV. Havlicek, ¶¶254-57.

AAPA explains “[t]he first step in forming a prediction for a macroblock of the current frame is performed by motion estimation block 130.” ’808Pat., 7:30-32. A POSITA would have been motivated to use the combination’s motion estimation block to form the prediction because doing so was known and conventional. Havlicek, ¶354.

(v) 10[d]

The Frojdh-AAPA combination teaches 10[d]. Havlicek, ¶355.

AAPA describes “video multiplex coder 170,” “which forms a single bitstream from the various types of information produced by the encoder 100 for further transmission to a remote receiving terminal.” ’808Pat., 4:6-12, Fig. 1; Havlicek, ¶356.

The Frojdh-AAPA combination teaches the 10[d]’s additional elements. Havlicek, ¶¶356-57.

Frojdh teaches a method of video signal data compression, or encoding. §VII.B.4.a(i). Frojdh further discloses “a bitstream representing a coded image block can include a syntactic element which may be interpreted to indicate either the IGMC mode or the COPY mode.” Frojdh, [0056]; FrojdhProv, 11-12. Frojdh

therefore teaches “providing in an encoded bitstream an indication of the skip coding mode.” Havlicek, ¶¶258-60.

Frojdth’s IGMC mode operates “without coefficients or explicitly coded motion vectors,” and when IGMC is used, “no explicit motion vector is sent with the encoded slice 40.” Frojdth, [0055]; FrojdthProv, 6, 12-13. Similarly, Frojdth’s COPY mode “uses no MV and no coefficients.” Frojdth, [0047]; FrojdthProv, 8-9. Regardless of whether IGMC mode is used (to assign PNZMV or ZMV) or whether COPY mode is used (§VII.B.4.a(ii)), no explicit motion vector is included in the encoded bitstream. Havlicek, ¶261. Frojdth therefore teaches “no further motion vector information for the first segment is coded in the encoded bitstream.” *Id.*

b. Claim 11

The Frojdth-AAPA combination teaches claim 11’s additional limitation. Havlicek, ¶358-59.

Frojdth’s IGMC mode predicts the current macroblock’s motion vector using “neighboring blocks in the current frame, that is, from blocks which are adjacent to or proximate to the particular image block,” Frojdth, [0055]; FrojdthProv, 6, 12-13, based on “the prediction from neighboring blocks.” FrojdthProv, 12. At least one of these neighboring blocks in the current frame is the “second segment...neighboring the first segment.” §VII.B.4.a(iii).

In Frojdh, blocks of a frame are coded in raster-scan order. Frojdh, [0009]; FrojdhProv, 6; Havlicek, ¶264. Thus, all but the top-left block of a frame (“first segment”) include at least one previously-coded neighbor (“second segment”) on which to base the prediction for the particular image block. Havlicek, ¶¶263-64. In other words, the neighboring block in the current frame (“second segment”) was previously encoded so that there is a motion vector with which to predict the motion vector of the particular image block (“first segment”). Havlicek, ¶264.

c. Claim 21

The Frojdh-AAPA combination teaches this claim. Havlicek, ¶360.

The Frojdh-AAPA combination teaches “the encoder according to claim 10” (§VII.B.4.a), and AAPA further teaches claim 21’s additional limitations. Havlicek, ¶¶361-62. AAPA describes using video compression techniques, such as motion-compensated prediction to reduce temporal redundancy, in video telephony systems. ’808Pat., 2:25-46, 3:11-35; Havlicek, ¶¶362-63.

AAPA’s encoder “receiv[es] a digital video signal from a camera or other video source,” and “employs a combination of INTRA- and INTER-coding to produce a compressed (encoded) video bit-stream,” including performing motion-compensated prediction. ’808Pat., 3:47-50, 3:61-63, 7:3-4. In light of AAPA’s teachings, a POSITA would have found it obvious to use AAPA’s encoder in Frojdh in an environment with limited bandwidth, such as in a videotelephony system, to

perform motion-compensated prediction. Havlicek, ¶364. Further, a POSITA would have understood a videotelephony system is a “multimedia terminal” because it performs two-way reception/transmission of audio and video signals. *Id.*

d. Claim 44

(i) 44[pre]

If the preamble is limiting, the Frojdh-AAPA combination teaches an “encoder according to claim 10” (§VII.B.4.a) where a neighboring segment (“second segment”) can have a non-zero motion vector (§VII.B.4.a(iii)). Havlicek, ¶¶365-66.

(ii) 44[a]

The Frojdh-AAPA combination teaches 44[a]. Havlicek, ¶¶367-68.

Frojdh teaches assigning ZMV or PNZMV for the skip coding mode for the first segment based at least in part on the motion information of a second segment neighboring the first segment. §VII.B.4.a(iii). Frojdh describes the “motion vector is predicted from neighboring blocks in the current frame, that is, from blocks which are adjacent to or proximate to the particular image block.” Frojdh, [0055]; FrojdhProv, 6, 12-13. Frojdh thus teaches the predicted motion vector is “deriv[ed]...based at least in part on the motion vector of the second segment.” Havlicek, ¶¶266-67. Further, a POSITA would have understood if one of the neighboring blocks has a non-zero motion vector, then if a non-zero motion vector

is assigned to the skip coding mode for the first segment, it would be based at least in part on the neighboring non-zero motion vector. Havlicek, ¶268.

The motion estimation block of the Frojdh-AAPA combination assigns ZMV or PNZMV for the first segment. §VII.B.4.a(iii). A POSITA would have understood the combination's motion estimation block derives PNZMV as Frojdh teaches. Havlicek, ¶368.

(iii) 44[b]

The Frojdh-AAPA combination teaches 44[b]. Havlicek, ¶¶369-70.

Frojdh teaches “deriv[ing] [a PNZMV]” (§VII.B.4.d(ii)), “assigning either a [ZMV] or a [PNZMV] for the skip coding mode for the first segment” (§VII.B.4.a(iii)), and the PNZMV, as well as the assignment of the PNZMV or ZMV, is based on motion information of a neighboring second segment (§VII.B.4.a(iii)). Frojdh further teaches if the second segment has motion information (e.g., a non-zero motion vector), the motion vector predicted for and assigned to the neighboring first segment may be non-zero. Havlicek, ¶¶270-71. Frojdh describes using a motion vector predicted from neighboring blocks. Havlicek, ¶271; Frojdh, [0022]; FrojdhProv, 12-13. It was well-known to calculate the predicted motion vector for a block based on the median of neighboring blocks' motion vectors, which would result in a non-zero motion vector when neighbors' motion vectors are non-zero. Havlicek, ¶271. The Frojdh-AAPA combination

therefore teaches “the [PNZMV] is assigned for the skip coding mode for the first segment.” Havlicek, ¶370.

(iv) 44[c]

The Frojdh-AAPA combination teaches 44[c]. Havlicek, ¶¶371-72.

Frojdh teaches “forming a prediction for the first segment with respect to a reference frame” (§VII.B.4.a(iv)), and “the [PNZMV] is assigned for the skip coding mode for the first segment” (§VII.B.4.d(iii)). Further, a predicted motion vector is “used for motion compensating [a] macroblock.” Frojdh, [0055]; FrojdhProv, 6, 12-13. In other words, a motion vector assigned for the first segment (e.g., the PNZMV) is used for “a motion compensated prediction.” Havlicek, ¶¶274-75. The Frojdh-AAPA combination therefore teaches “the prediction for the first segment is formed by a motion compensated prediction with respect to the reference frame based at least in part on the [PNZMV].” Havlicek, ¶372.

e. Claim 47

The Frojdh-AAPA combination teaches claim 47’s additional limitation. Havlicek, ¶¶373-74.

Frojdh teaches assigning a motion vector based at least in part on motion information of a second segment (§VII.B.4.a(iii)) and deriving the PNZMV based at least in part on the motion vector of the second segment (§VII.B.4.d(ii)).

f. Claim 48

The Frojdh-AAPA combination teaches claim 48's additional limitation. Havlicek, ¶¶375-76.

Frojdh teaches assigning ZMV or PNZMV based at least in part on motion information of a second segment. §VII.B.4.a(iii). Frojdh discloses “[t]he motion vector is predicted from neighboring blocks in the current frame, that is, from blocks which are adjacent to or proximate to the particular image block.” Frojdh, [0055]; FrojdhProv, 6, 12-13. Thus, the prediction motion vector may be based on more than one neighboring block (e.g., a “second segment” and a “third segment”). Havlicek, ¶¶278-79. Frojdh teaches the prediction is based on “the prediction from neighboring blocks,” §VII.B.4.d(ii); FrojdhProv, 12, and therefore teaches deriving PNZMV based at least in part on the motion vector of the second segment. Accordingly, the Frojdh-AAPA combination additionally teaches deriving PNZMV based at least in part on the motion vector of the third segment. Havlicek, ¶376.

g. Claim 49

The Frojdh-AAPA combination teaches claim 49's additional limitation. Havlicek, ¶¶377-78.

Frojdh describes “[t]he difference between the prediction and the original is encoded in terms of transform coefficients.” Frojdh, [0011]; FrojdhProv, 6-7. Similarly, in the '808 Patent “the difference between a decoded version of the

INTER-coded frame and the image content of the frame to be coded” is represented as a prediction error. ’808Pat., 3:28-35. Frojdh’s “difference between the prediction and the original” is analogous to the ’808 “prediction error.” Havlicek, ¶¶281-83. A POSITA would have understood claim 49’s “residual information” encompasses “prediction error,” and so Frojdh’s “difference” teaches “residual information.” Havlicek, ¶283. When Frojdh’s IGMC mode (the recited “skip coding mode,” alone or in combination with COPY (§VII.B.4.a(ii))) is used, the macroblock is coded without coefficients encoding the difference between the prediction and the original (i.e., characterizing the prediction error). Havlicek, ¶284; Frojdh, [0055]; FrojdhProv, 6, 12-13. The Frojdh-AAPA combination therefore teaches “no residual information is provided for the first segment in the encoded bitstream.” Havlicek, ¶378.

5. Claim 16 and Dependents

a. Claim 16

(i) 16[pre]

If the preamble is limiting, the Frojdh-AAPA combination teaches or suggests it. Havlicek, ¶379.

Frojdh’s decoder is used during motion compensation. Frojdh, [0011]; FrojdhProv, 6-7.

AAPA shows “a generic video decoder.” ’808Pat., Fig. 2, 15:27-29, 8:19-10:22.

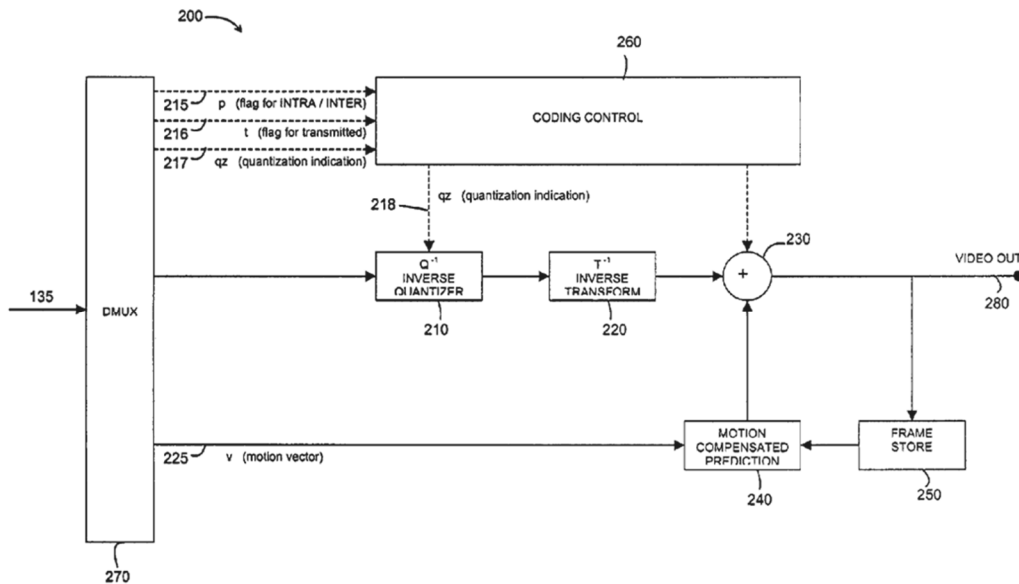


Fig. 2
(PRIOR ART)

Frojdth additionally teaches “[b]y using an already decoded frame (reconstructed frame) as reference,” the results of motion compensation (e.g., motion vectors) can “inform [a] decoder how to spatially translate the corresponding regions of the reference frame in order to make a prediction for [a] macroblock under consideration.” Frojdth, [0011]; FrojdthProv, 6-7. Frojdth further encodes a portion of a frame (e.g., a slice) with motion compensation information, and uses the motion compensation information to “reconstruct[]” the corresponding original portion of the frame. Frojdth, [0024]; FrojdthProv, 11-12. That is, Frojdth describes how the motion compensation information generated by its encoding process is used to decode encoded frame data. Havlicek, ¶¶286-87. Similarly, AAPA describes how

its decoder 200 is “arranged to receive and decode the video bit-stream produced by encoder 100 in order to produce a reconstructed video sequence.” ’808Pat., 3:47-52. The Frojdh-AAPA combination therefore teaches “[a] video decoder for decoding an encoded video sequence.” Havlicek, ¶¶380-82. Moreover, both Frojdh and AAPA teach the decoder “reconstructs” a video sequence using information generated by the combination’s encoder and encoding method. Havlicek, ¶383. To reconstruct a video sequence from the results of its encoding, the Frojdh-AAPA combination’s decoder performs decoding steps corresponding to those of the combination’s encoder and encoding steps. *Id.*

(ii) 16[a]

The Frojdh-AAPA combination teaches 16[a]. Havlicek, ¶384.

AAPA describes a “video multiplex decoder 270,” which “receives an encoded video bit-stream 135 from the encoder 100 and demultiplexes it into its constituent parts.” ’808Pat., 8:19-26, 8:40-43, Fig. 2.

The Frojdh-AAPA combination teaches 16[a]’s additional elements.

Frojdh teaches a video encoder assigning a skip coding mode to a first segment (§VII.B.4.a(ii)), and including an indication of the skip coding mode in the encoded video data (§VII.B.4.a(v)). The Frojdh-AAPA combination teaches the combination’s decoder performing steps corresponding to the combination’s encoder (§VII.B.5.a(i)). A POSITA would have understood the combination’s

decoder receives indication of the skip coding mode (i.e., the IGMCM mode alone or in combination with COPY (§VII.B.4.a(ii))) for a first segment. Havlicek, ¶386.

In AAPA, the video multiplex decoder “demultiplexes [an encoded video bit stream] into its constituent parts,” which includes “separat[ing] the encoded information for the blocks of the macroblock from possible control information relating to the macroblock in question.” ’808Pat., 8:19-26, 8:40-43. A POSITA therefore would have been motivated to use the video multiplex decoder (“demultiplexer”) to receive an indication of the skip coding mode. Havlicek, ¶¶385-86.

(iii) 16[b]

The Frojdh-AAPA combination teaches 16[b]. Havlicek, ¶387.

AAPA describes “motion compensated prediction block 240,” which “reconstructs a motion vector for the macroblock using the same motion model as that used to encode the INTER-coded macroblock in encoder 100.” ’808Pat., 8:19-26, 9:56-60, Fig. 2.

The Frojdh-AAPA combination teaches 16[b]’s additional limitations (§§VII.B.5.a(i), VII.B.4.a(iii)), because the combination’s decoder performs the same steps as the combination’s encoder for assigning a motion vector in skip coding mode. Havlicek, ¶388. The Frojdh-AAPA combination therefore teaches “assigning either a [ZMV] or a [PNZMV] for the skip coding mode for the first

segment based at least in part on the motion information of a second segment neighboring the first segment.” *Id.*

Since the combination’s motion-compensated prediction block reconstructs a motion vector for a macroblock, a POSITA would have been motivated to use the motion-compensated prediction block to assign ZMV or PNZMV for the first segment. Havlicek, ¶388.

(iv) 16[c]

The Frojdh-AAPA combination teaches 16[c] (§§VII.B.5.a(i), VII.B.4.a(iv)), because the combination’s decoder performs the same steps as the combination’s encoder for forming a prediction. Havlicek, ¶¶389-90. The Frojdh-AAPA combination therefore teaches “forming a prediction for the first segment with respect to a reference frame based at least in part on the assigned motion vector for the skip coding mode, wherein the assigned motion vector is one of the [ZMV] and the [PNZMV].” Havlicek, ¶390.

AAPA explains motion-compensated prediction block 240 forms a prediction based on a motion vector and reference frame. ’808Pat., 10:4-12. A POSITA therefore would have been motivated to use the combination’s motion-compensated prediction block to form the prediction. Havlicek, ¶390.

b. Claim 22

The Frojdh-AAPA combination teaches “the decoder according to claim 16,” and AAPA further teaches claim 22’s additional limitations. Havlicek, ¶¶391-95. The Frojdh-AAPA combination teaches using the encoder in a videotelephony system. §VII.B.4.c. AAPA additionally describes how its decoder, which includes a motion-compensated prediction block that “us[es] the same motion model” as the encoder, “is arranged to receive and decode the video bit-stream produced by encoder 100 in order to produce a reconstructed video sequence.” ’808Pat., 3:47-52, 8:20-26, 9:56-60.

A POSITA would have found it obvious to include AAPA’s decoder with Frojdh in a telephony system to, for example, decode video received from another telephony system that had been encoded by the encoder. Havlicek, ¶¶394. A POSITA would have understood a video telephone system is a “multimedia terminal.” §VII.B.4.c

c. Claim 58

The Frojdh-AAPA combination teaches claim 58’s additional limitation (§§VII.B.5.a(i), VII.B.4.e), because the combination’s decoder performs the same steps as its encoder. Havlicek, ¶¶396-98.

d. Claim 59

The Frojdh-AAPA combination teaches claim 59's additional limitation (§§VII.B.5.a(i), VII.B.4.f) because the combination's decoder performs the same steps as its encoder. Havlicek, ¶¶399-401.

e. Claim 60

The Frojdh-AAPA combination teaches claim 60's additional limitation (§§VII.B.5.a(i), VII.B.4.g) because Frojdh teaches no residual information is encoded, and thus none is provided to the decoder. Havlicek, ¶¶402-03.

f. Claim 64

The Frojdh-AAPA combination teaches claim 64's additional limitation (§§VII.B.5.a(i), VII.B.4.a(v)) because Frojdh teaches no further motion vector information is encoded, and thus none is retrieved from the encoded bitstream by the decoder. Havlicek, ¶¶404-05.

C. Ground 2B: Obviousness over Frojdh, AAPA and H.263

1. H.263

H.263 is titled "Video coding for low bit rate communication." The revision referenced herein (EX-1009) was ratified by the ITU-T in February 1998, and publicly available by May 11, 2000. H.263, i; Munford, 7-8.

H.263 is a standard that "specifies a coded representation that can be used for compressing the moving picture component" of video. H.263, 1; Havlicek, ¶¶297-

98. H.263 describes “a hierarchical structure with four primary layers” (picture; Group of Blocks (GOB), slice, or video picture segment; macroblock; and block). H.263, 13.

H.263 describes INTER coding, where a picture and/or macroblocks are predicted using a temporally previous reference picture, and INTRA coding, where no temporal prediction is applied. H.263, 11; Havlicek, ¶299. When INTER coding uses motion compensation, the decoder by default accepts one motion vector per macroblock.¹¹ H.263, 12; Havlicek, ¶299.

When using motion compensation, H.263 specifies how a macroblock’s motion vector “is obtained by adding predictors to the vector differences indicated by [Motion Vector Data or MVD].” H.263, 44. MVD “represents a pair of difference values” (e.g., a horizontal component difference and a vertical component difference) and is encoded in the macroblock data received by a decoder (e.g., from an encoder). H.263, 33-34, 38-40, 45, Fig. 10; Havlicek, ¶300. The other component used to obtain a macroblock’s motion vector, the predictor, “is the

¹¹ H.263 also uses the terms “vector” and “macroblock vector” when discussing motion compensation. A POSITA would have understood *vector* and *macroblock vector* generally mean *motion vector* unless otherwise specified. Havlicek, ¶299.

median value of the three candidate predictors,” where the three candidate predictors “are taken from three surrounding macroblocks” neighboring the macroblock being decoded. H.263, 44-45. Thus, H.263 forms a predictor for a macroblock based on the motion vector (candidate predictors) of neighboring macroblocks. Havlicek, ¶300. H.263 therefore teaches using motion vectors of neighboring macroblocks to determine the motion vector of a macroblock being decoded. *Id.* H.263 provides rules for specifying the candidate predictors, accounting for special cases, such as when a neighboring macroblock was INTRA coded and/or fell outside the boundaries of the current slice or picture. H.263, 44-45.

Although H.263 describes forming a macroblock’s motion vector using predictors, and the rules for calculating the predictors, in the context of H.263’s decoding process (H.263, 44), a POSITA would have found it obvious that an H.263 encoder calculates predictors based on candidate predictors, to form a macroblock’s motion vector, using the same rules. Havlicek, ¶301. H.263’s decoder obtains a macroblock vector “by adding predictors to the vector differences indicated by MVD,” where the MVD is part of the macroblock data (e.g., received from an encoder). H.263, 33-34, 38-40, 44, Fig. 10. Because the encoder provides the MVD to be used by the decoder to obtain a macroblock vector, both the encoder and decoder must perform the same steps for calculating the predictors to be used in combination with the MVD. Havlicek, ¶301. Otherwise, the decoder would obtain

a different macroblock vector than the one obtained and used by the encoder for encoding the macroblock, despite the MVD being the same at both the encoder and decoder. *Id.* H.263 indicates the same, when it describes how “[t]he video coder provides a self-contained digital bitstream...The video decoder performs the reverse process.” H.263, 2. Thus, H.263’s descriptions of calculating predictors from candidate predictors, and the handling of the special cases therein, apply equally to H.263 encoders. Havlicek, ¶301.

H.263 Annex P describes “a resampling process which can be applied to the previous decoded reference picture in order to generate a ‘warped’ picture for use in predicting the current picture,” which can be used to specify “global motion” (i.e., global motion compensation based on warping a reference frame). H.263, 116; Havlicek, ¶302.

2. Motivation to combine

A POSITA would have combined Frojdh’s teachings of an improved method of global motion compensation in the Frojdh-AAPA combination, and particularly its implicit GMC, with the H.263 video coding standard. Havlicek, ¶¶406-07.

Frojdh’s Background summarizes the shortcomings of the manner in which the video standards of the day (including H.263) provided GMC. Frojdh, [0012]-[0019]; Havlicek, ¶304. Frojdh’s IGMCM improved upon conventional GMC by improving error resilience while also minimizing the total number of bits needed for

motion vectors. Frojdh, [0021]-[0022]. But Frojdh did not define an entire video coding framework, instead describing IGMC as “a new mode for global motion compensation.” Frojdh, [0022]; Havlicek, ¶304. So IGMC in the Frojdh-AAPA combination would have been incorporated as “a new mode” into H.263 to provide the described improvements to GMC. Havlicek, ¶304.

At the relevant time, H.263 was a leading ratified video coding standard in use. Havlicek, ¶305. H.263 was developed as an improvement over its predecessors (e.g., H.262), and provided efficiency and video quality advantages. Havlicek, ¶305. H.263 saw widespread adoption and deployment, particularly in popular internet streaming applications of the day. Havlicek, ¶305. Similarly, both H.263 and Frojdh were intended for use in videoconferencing systems. H.263, 1; Frojdh, [0003]; Havlicek, ¶305.

A POSITA aware of H.263’s adoption would have been motivated to improve it. Havlicek, ¶306. Specifically, a POSITA would have been aware of H.263’s implementation of GMC (§VII.C.1) and its shortcomings (described by Frojdh), and as described below, would have been motivated to improve it by incorporating Frojdh’s IGMC as a “new mode” of H.263. Havlicek, ¶306. This would enhance the performance of base video coding standards by addressing global motion more effectively. Havlicek, ¶307; Frojdh, [0002]-[0022]. A POSITA would have recognized integrating Frojdh’s IGMC into H.263 would enhance motion

compensation (especially where global motion is present) without altering the core functionality of the existing framework. Havlicek, ¶307. Indeed, Frojdh explicitly mentions H.263's existing global motion technique and then proposes IGMC to address shortcomings of that technique. Frojdh, [0012]-[0015], [0021].

A POSITA would have recognized the benefits of adding Frojdh's IGMC (and the improved GMC capabilities it provides) to H.263. Havlicek, ¶308. For example, integrating Frojdh with H.263 would have allowed H.263 to leverage the enhanced Frojdh's GMC techniques (e.g., IGMC), which would further optimize video quality (particularly in streaming applications). *Id.* This would have expanded the use cases of the combined system, such as cases with more dynamic video applications, beyond those suitable for H.263 alone. *Id.*

Moreover, integration of Frojdh's IGMC into H.263 would have enabled the combined system to enjoy the benefits of IGMC—e.g., providing GMC without needing to transmit motion vector information. Havlicek, ¶309; Frojdh, [0022], [0055]. A POSITA would further have understood under the combined system, macroblocks encoded according to H.263 (i.e., not employing IGMC) may in contrast transmit motion vector information, such as MVD. Havlicek, ¶309. Incorporation of Frojdh's IGMC as a “new mode” of H.263, without altering other aspects of H.263, would have allowed the enhanced motion compensation of IGMC

to be applied where most useful without unnecessary complexity or redundancy. Havlicek, ¶309.

A POSITA would have had a reasonable expectation of success combining H.263 with the Frojdh-AAPA combination. Havlicek, ¶408. Frojdh's techniques would have been used as a "new mode," or enhancement, aimed at improving GMC within H.263. Havlicek, ¶310. A POSITA would have recognized Frojdh's techniques could be readily incorporated into H.263 without altering its core functionality, utilizing the exemplary video encoder and decoder of AAPA, and that the combination would yield predictable results. Havlicek, ¶408. Both H.263 and Frojdh would function as intended in the combination, each enhancing the other. Havlicek, ¶310. Further, Frojdh's IGMG is compatible with the H.263 framework, allowing the improvements to be realized without compromising the H.263 standard. *Id.* The combination would be well within a POSITA's capabilities, merely requiring modification of the H.263 encoder and decoder according to Frojdh's teachings to implement the AAPA exemplary video encoder and decoder. Havlicek, ¶408; Frojdh, [0055].

3. Claim 15

The Frojdh-AAPA-H.263 combination teaches claim 15's additional limitation. Havlicek, ¶¶409-12.

Frojd's IGMC, alone or in combination with COPY (described in §VII.B.4.a(ii)), teaches assigning either ZMV or PNZMV for a first segment based at least in part on the motion information of a second segment neighboring the first segment. §VII.B.4.a(iii). Thus, the second segment is “a segment in a region surrounding the first segment,” as recited. Havlicek, ¶¶312, 411.

Frojd describes how its IGMC mode is a “more useful” macroblock mode, using implicit motion vectors predicted from neighboring blocks. Frojd, [0022], [0055]; FrojdProv, 6, 12-13. Frojd, however, omits certain details of how to predict a motion vector from the motion vectors of neighboring blocks. Havlicek, ¶313. A POSITA would have looked to H.263 for those details. Havlicek, ¶313.

H.263 describes a motion vector predictor with two components (horizontal and vertical), where “[f]or each component, the predictor is the median value of the three candidate predictors for this component.” H.263, 44-45. In H.263, “the candidate predictors for the differential coding are taken from three surrounding macroblocks as indicated in Figure 12.” H.263, 44. Thus, in H.263's Figure 12, a motion vector predictor for a current macroblock (labeled MV) is calculated as the median of the motion vectors of the neighboring left, top, and top-right macroblocks (labeled MV1, MV2, MV3, respectively). Havlicek, ¶314. H.263's Figure 12 (reproduced and annotated below) highlights (in blue) the calculation described above, where a macroblock's motion vector (predictor) is calculated as the

component-wise median of its three neighboring macroblocks' motion vectors (candidate predictors). Havlicek, ¶314.

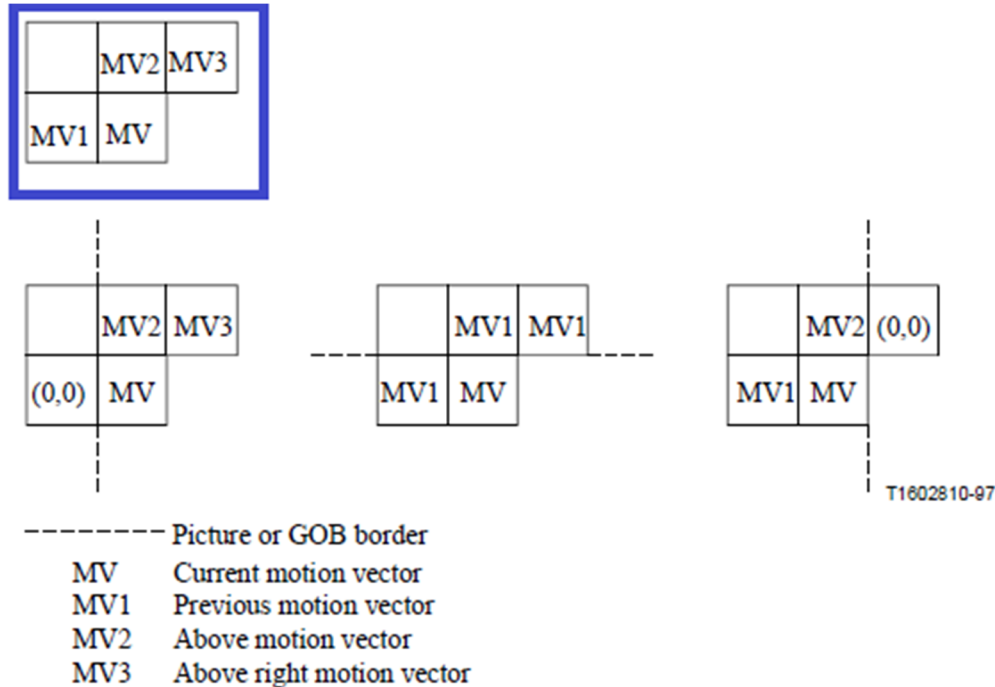


Figure 12/H.263 – Motion vector prediction

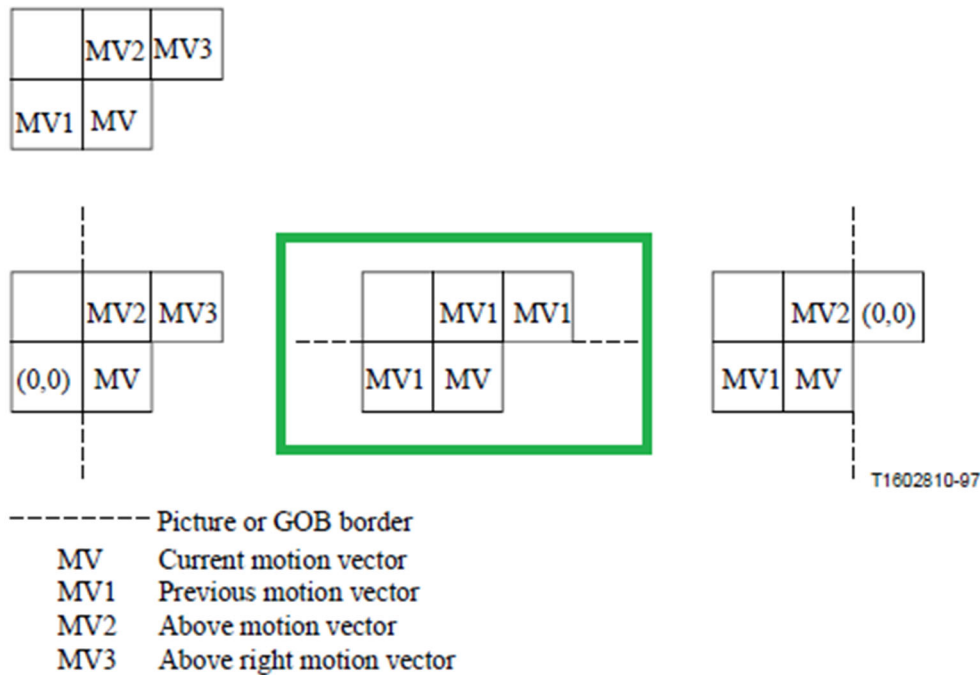
H.263, Fig. 12 (annotated).

H.263 also specifies “decision rules” applied for neighboring candidate predictors in the “special cases at the borders of the current GOB, slice, or picture.”

H.263, 44. The third decision rule specifies “candidate predictors MV2 and MV3 are set to MV1 if the corresponding macroblocks are outside the picture (at the top) or outside the GOB (at the top) if the GOB header of the current GOB is non-empty.”

H.263, 45. That is, in H.263, when a current macroblock is at the top border of a picture or GOB, by application of the third decision rule, the candidate predictors

provided by the motion vectors of the top and top-right neighboring macroblocks (MV2 and MV3, respectively) instead are set to be the motion vector of the left neighboring macroblock (MV1). Havlicek, ¶¶315-16. Thus, all three candidate predictors are set as the left neighboring macroblock's motion vector. Havlicek, ¶316. H.263's Figure 12 (reproduced and annotated below) highlights (in green) the application of the third decision rule. *Id.*



A POSITA would have known the median of three numbers, all of which have the same value, is equal to that value. Havlicek, ¶317. Thus, when the three candidate predictors are the motion vector of the left neighboring macroblock (MV1) due to application of the third decision rule, the predicted motion vector of the

current macroblock (MV), which is calculated as the median of the candidates, equals MV1 as well. Havlicek, ¶317.

H.263 thus teaches a motion vector predicted for a macroblock may equal the motion vector of a neighboring macroblock (e.g., of the left neighbor, when the macroblock is at a top boundary). Havlicek, ¶318. When that occurs, if the neighboring macroblock's motion vector (MV1) is a ZMV, the current macroblock's predicted motion vector (MV) will also be the ZMV. Havlicek, ¶318. The combination thus teaches “if a segment in a region surrounding the first segment has [ZMV],...assign[ing] the [ZMV] for the skip coding mode of the first segment.” Havlicek, ¶¶410-12.

Frojdth additionally discloses “copy[ing] pixels from a previous frame of a collocated block, dislocated by a motion vector.” Frojdth, [0023]; FrojdthProv, 6, 12-13. When the motion vector is zero (e.g., in COPY mode), no motion compensation is needed, and the reference frame can be used for the predicted macroblock without spatial translation. Frojdth, [0011]; FrojdthProv, 6-7. The Frojdth-AAPA-H.263 combination therefore teaches when ZMV is assigned for the first segment, “the prediction for the first segment is formed with respect to a corresponding segment of the reference frame associated with the [ZMV].” Havlicek, ¶319-20, 410-12.

4. Claim 51

The Frojdh-AAPA-H.263 combination teaches or suggests claim 51's additional limitation (§VII.C.3) because the “segment in a region surrounding the first segment (claim 15) is a “second segment” (claim 51). Havlicek, ¶¶413-15.

5. Claim 52

The Frojdh-AAPA-H.263 combination teaches claim 52's additional limitation. Havlicek, ¶415.

The Frojdh-AAPA-H.263 combination teaches “if the second segment has a [ZMV], the [ZMV] is assigned to the skip coding mode of the first segment and the prediction for the first segment is formed with respect to a corresponding segment of the reference frame associated with the [ZMV].” §VII.C.4

The Frojdh-AAPA-H.263 combination additionally teaches the “second segment is predicted using motion-compensated prediction from the reference picture.” Havlicek, ¶416. Frojdh teaches the second segment is a “previously encoded segment.” §VII.B.4.b. H.263 describes how the previously encoded second segment can be predicted, using motion-compensated prediction, to have ZMV. Havlicek, ¶323.

H.263 specifies “decision rules” to be applied for neighboring candidate predictors, describing how “[i]n the special cases at the borders of the current GOB,

slice, or picture, the following decision rules are applied in increasing order.”

§VII.C.1; H.263, 44. The first three are:

- 1) When the corresponding macroblock was coded in INTRA mode (if not in PB-frames mode with bidirectional prediction) or was not coded (COD = 1), the candidate predictor is set to zero.
- 2) The candidate predictor MV1 is set to zero if the corresponding macroblock is outside the picture or the slice (at the left side).
- 3) Then, the candidate predictors MV2 and MV3 are set to MV1 if the corresponding macroblocks are outside the picture (at the top) or outside the GOB (at the top) if the GOB header of the current GOB is non-empty; or outside the slice when in Slice Structured mode.

H.263, 44-45; Havlicek, ¶¶324-25. The rules illustrate how a motion compensated macroblock (the recited “second segment”) can be predicted to have ZMV. Havlicek, ¶325.

For example, the second and third rules apply to a current macroblock at the left border of a slice and the top border of a picture or GOB. Havlicek, ¶326. Then the candidate predictor from the left neighbor (MV1) is set to zero (rule 2), and the MV1 candidate predictor (zero per rule 2) used as the candidate predictor for the top and top-right neighbors (MV2 and MV3, respectively) (per rule 3). Havlicek, ¶326. Thus, all three candidate predictors are zero, resulting (due to the median calculation) in a predicted motion vector of the current macroblock of zero. Havlicek, ¶326. H.263’s Figure 12 (reproduced and annotated below) highlights (in

red) the application of the second rule, and (in green) the application of the third rule, illustrating how the three candidate predictors for a macroblock are set to zero.

Havlicek, ¶326.

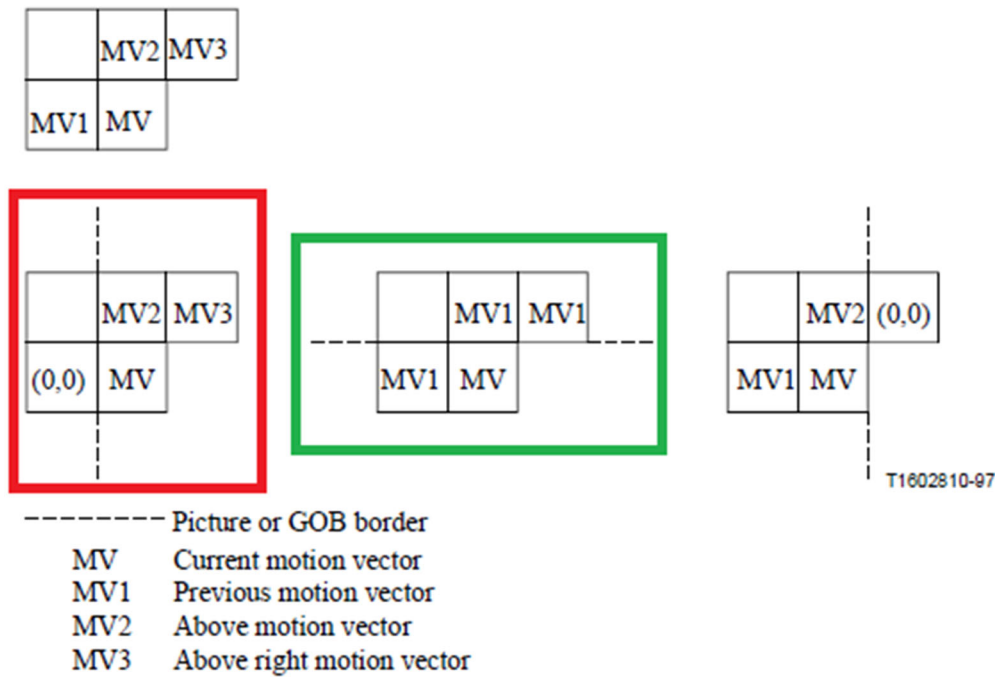


Figure 12/H.263 – Motion vector prediction

Other applications of H.263's rules result in a motion-compensated macroblock being predicted to have ZMV. Havlicek, ¶327. For example, per rule 1, the candidate predictor of a neighboring macroblock that was INTRA coded is set to zero. H.263, 44. If at least two of the three of the left, top, or top-right neighboring macroblocks were INTRA coded (with candidate predictors of zero, per rule 1), the predicted motion vector of the macroblock (calculated as the median) would also be zero. Havlicek, ¶327. As a further example, if a current macroblock is at the top

border of a picture or GOB, and the current macroblock's left neighbor is INTRA coded, then all three candidate predictors would be set to zero (per application of rule 1 and 3, in that order) (H.263, 44-45), resulting in a predicted motion vector for the current macroblock that is also zero. Havlicek, ¶327.

Thus, H.263 describes various ways a motion-compensated macroblock can be predicted to have ZMV, and therefore teaches “if the second segment has a [ZMV] and the second segment is predicted using motion-compensated prediction.” Havlicek, ¶¶328-29. H.263 teaches when “the second segment has a zero motion vector,” it can be “assigned to the skip coding mode of the first segment.” §VII.C.4.

6. Claim 53

The Frojdh-AAPA-H.263 combination teaches claim 53's additional limitations (§VII.C.5) and because Frojdh and H.263 teach a reference picture “immediately preceding” a current frame. Havlicek, ¶¶417-18.

Frojdh uses “a previous frame” as a reference frame and is agnostic as to whether the reference frame immediately precedes a current frame. Havlicek, ¶332; Frojdh, [0023]; FrojdhProv, 6, 12-13. H.263 describes using “the most recent temporally previous anchor picture,” which a POSITA would have understood is typically H.263's immediately-preceding frame (e.g., when optional B-pictures are not used). Havlicek, ¶332; H.263, 11-12, 30. Therefore, the Frojdh-AAPA-H.263

combination teaches the second reference picture may immediately precede the picture to which the claimed second segment belongs. Havlicek, ¶¶417-18.

7. Claim 20

The Frojdh-AAPA-H.263 combination teaches claim 20's additional limitation (§§VII.B.5.a(i), VII.C.3) because the combination's decoder performs the same steps as its encoder. Havlicek, ¶¶419-21.

8. Claim 54

The Frojdh-AAPA-H.263 combination teaches claim 54's additional limitation (§§VII.B.5.a(i), VII.C.4) because the combination's decoder performs the same steps as its encoder. Havlicek, ¶¶422-24.

9. Claim 62

The Frojdh-AAPA-H.263 combination teaches claim 62's additional limitation (§§VII.B.5.a(i), VII.C.5) because the combination's decoder performs the same steps as its encoder. Havlicek, ¶¶425-26.

10. Claim 63

The Frojdh-AAPA-H.263 combination teaches or suggests claim 63's additional limitation (§§VII.B.5.a(i), VII.C.6) because the combination's decoder performs the same steps as its encoder. Havlicek, ¶¶427-28.

VIII. CONCLUSION

IPR of the Challenged Claims is respectfully requested.¹²

IX. MANDATORY NOTICES

A. Real Party in Interest

Petitioner identifies themselves as real parties in interest. Out of an abundance of caution, Petitioner discloses Twitch Interactive, Inc., as a potential real party in interest.

B. Related Matters

To the best of Petitioner's knowledge, the '808 Patent has been involved in the following matters:

- *Nokia Technologies Oy v. Amazon.com, Inc., et al.*, 1-23-cv-01236 (D. Del. Oct. 31, 2023)
- *Nokia Technologies Oy v. HP Inc.*, 1-23-cv-01237 (D. Del. Oct. 31, 2023)
- *Nokia Corporation et al. v. Amazon.com, Inc. et al.*, Case No. 1:23-cv-01232 (D. Del. Oct. 27, 2023)
- *Nokia Technologies Oy v. Lenovo (Shanghai) Electronics Technology Co. Ltd. et al.*, Case No. 5:19-cv-00427 (E.D.N.C. Sept. 25, 2019)

¹² Petitioner does not anticipate that *Fintiv* will be raised because no schedule or trial date has been set in the district court.

- *Nokia Technologies Oy v. Apple Inc.*, Case No. 2:16-cv-01440 (E.D. Tex. Dec. 21, 2016)
- *Certain Electronic Devices, Including Computers, Tablet Computers, and Components and Modules Thereof*, Inv. No. 337-TA-1208 (ITC July 2, 2020)
- *Certain Video Capable Electronic Devices, Including Computers, Streaming Devices, Televisions, and Components and Modules Thereof*, Inv. No. 337-TA-1380 (ITC Oct. 31, 2023)

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CERTIFICATE OF WORD COUNT UNDER 37 CFR §42.24(d)

Pursuant to 37 C.F.R. §42.24(a), Petitioner hereby certifies that portions of the above-captioned Petition for *Inter Partes* Review of U.S. Patent 7,532,808, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is 13,990. Pursuant to 37 C.F.R. §42.24(a), this word count is in compliance and excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing. This word count was prepared using Microsoft Word.

Respectfully submitted,

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that true copies of the Petition for *Inter Partes* Review of U.S. Patent No. 7,532,808 and supporting materials (Exhibits and Power of Attorney) were served via overnight delivery on the Patent Owner at the correspondence address of record as listed on PAIR:

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