

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ELEMENT TV COMPANY, LP, AND
ELEMENT TELEVISION COMPANY, LLC,

Petitioner

v.

NOKIA CORPORATION AND NOKIA TECHNOLOGIES OY,
Patent Owner.

IPR2025-01108, IPR2025-01109

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

**DECLARATION OF DR. ELI SABER IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT NO. 7,532,808**

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I, **Eli Saber**, hereby declare as follows:

I. INTRODUCTION AND COMPENSATION

1. I have been retained by Amazon.com, Inc., as an independent expert consultant in this inter partes review (“IPR”) proceeding before the United States Patent and Trademark Office (“PTO”).

2. I have been asked by Counsel for Petitioner to consider whether certain references teach or suggest the features cited in claims 1-2, 6-7, 9-11, 15-16, 20-25, 28-30, 32, 34, 36, 39-41, 43-44, 47-49, 51-54, 58-60, and 62-65 (“Challenged Claims”) of U.S. Patent No. 7,532,808 (“the ’808 Patent”) (EX1001). My opinions and the bases for those opinions are set forth below.

3. I am being compensated for my time at my standard consulting rate. I am also being reimbursed for expenses that I incur during the course of this work. My compensation in no way depends on the outcome of this matter. I have no other financial interest in this proceeding.

4. My analysis here is based on my years of education, research and experience, as well as my investigation and study of relevant materials, including those cited herein. I may rely upon these materials, my knowledge and experience, and/or additional materials to rebut arguments raised by the Patent Owner. Further, I may also consider additional documents and information in forming any necessary opinions, including documents that may not yet have been provided to me.

5. My analysis of the materials in this proceeding is ongoing, and I will continue to review any new material as it is provided. This Declaration represents only those opinions I have formed to date. I reserve the right to revise, supplement, and/or amend my opinions stated herein based on new information and on my continuing analysis of the materials already provided.

II. BACKGROUND AND QUALIFICATIONS

6. I am over the age of 18 and am competent to write this declaration. I have personal knowledge, or have developed knowledge of these technologies, based upon education, training, or experience, of the matters set forth herein.

7. My qualifications are set forth in my curriculum vitae, a copy of which is filed as Exhibit EX-1004. The following is a brief summary of my relevant qualifications and professional experience.

8. I am a Professor in the Department of Electrical and Microelectronic Engineering (EME) and the Chester F. Carlson Center for Imaging Science at the Rochester Institute of Technology (RIT) in Rochester, New York. I also serve as the Director of the Image, Video and Computer Vision Laboratory. I joined RIT's full-time faculty in 2004. I have over thirty-four (34) years of industry and academic experience, thirty (30) of which are in the fields of Computer Vision, Digital Image/Video Processing, Pattern Recognition, and Machine Learning.

9. I received a Ph.D. in Electrical Engineering from the University of Rochester in 1996. My concentration was in Signal/Image/Video Processing, Pattern

Recognition, and Computer Vision. I received a Master of Science Degree in Electrical Engineering from the University of Rochester in 1992 in the same concentration as listed above, and I received a Bachelor of Science Degree in Electrical and Computer Engineering, Summa Cum Laude, from the State University of New York at Buffalo in 1988.

10. Before becoming a full-time professor, I worked for Xerox Corporation for 16 years, from 1988 to 2004. During my years at Xerox, I was responsible for delivering color management, image processing innovations, architectures, and algorithms; xerographic sub-systems for a variety of color products; and control systems for toner production facilities. One of several roles I held at Xerox was Advanced Development Scientist and Manager. In that capacity, I established the Advanced Design Laboratory—an Imaging/Xerographics lab—and provided technical and managerial leadership for the Electrical, Imaging and Xerographics Department. In another role, as Product Development Scientist and Manager, I led the research and development of image quality metrics for various product platforms. I also led the Image Science, Analysis, and Evaluation area, with 12 to 15 direct reports and a budget of approximately \$2 million.

11. From 1997 until 2004, I was an adjunct faculty member at the Electrical Engineering Department of the Rochester Institute of Technology and at the Electrical & Computer Engineering Department of the University of Rochester. I was responsible

for teaching undergraduate and graduate coursework such as Digital Signal Processing, Digital Image Processing, Digital Video Processing, Pattern Recognition, Detection and Estimation Theory and Communication Systems; and performing research in multimedia applications, pattern recognition, image understanding and color engineering.

12. Since joining RIT full time, I have been responsible for teaching several undergraduate and graduate courses in Digital Signal Processing, Digital Image Processing, Digital Video Processing, Pattern Recognition, Engineering Analysis, Random Signal & Noise, Advanced Engineering Mathematics, Matrix Methods, Communications, Modern Control Theory, and Linear Systems.

13. I proposed, developed, and introduced the Digital Video Processing and the Advanced Neural Network and Deep Learning courses; and I reestablished the Pattern Recognition course at the Electrical Engineering Department at RIT. These graduate courses are instrumental in providing MS/PhD students with the proper foundation and knowledge in all aspects of the subject areas in order to perform in-depth research in the field and continue to advance the state of the art.

14. The Digital Video Processing course is designed to provide a thorough and comprehensive coverage of the field. Topics covered include the mathematical representation of digital video including motion and time-varying image formation models, spatio-temporal sampling/reconstruction, sampling structure conversions,

motion estimation using optical flow, block-based, pel-recursive, Bayesian and point correspondence type methodologies, segmentation, motion tracking, filtering, restoration, super-resolution and image/video compression.

15. The Pattern Recognition course, on the other hand, covers pertinent concepts in Bayes decision theory, linear and nonlinear classifiers, artificial neural networks, feature selection/generation/extraction and various types of clustering algorithms and techniques.

16. The “Advanced Neural Networks and Deep Learning: Theory, Mathematics and Algorithms” course is intended to provide an in-depth comprehensive study of the theory, mathematics and algorithms for advanced neural networks and their usage in deep learning. It is primarily targeted for upper graduate students that are planning to pursue advanced studies/research in the field. The course begins with an in-depth study of the mathematical methodologies for neural networks and optimization (zero-, first- and second-order) techniques. It then progresses to provide a thorough study of shallow and deep neural networks architectures and algorithms, activation functions, regression, two- and multi-class classification, unsupervised learning, feature engineering/selection, backpropagation along with applications to a variety of engineering problems.

17. I am currently working to develop a follow-on course (part 2) to the Advanced Neural Networks and Deep Learning course described above. This course is

intended to cover convolutional and recurrent style neural networks, principles of feature engineering, kernel methods, tree-based learners, attention mechanisms/transformers, reinforcement learning and generative adversarial networks. This course is being targeted for the first time in Fall 2025.

18. I am also currently working to revamp the graduate course titled: “Image and Video Compression.” The updated version of this course will start by providing a brief history of video coding and video coding standards and then progress to discussing video basics, formats and fundamentals of video compression. It will then progress to cover JPEG, JPEG 2000, H.261, MPEG-1, MPEG-2, H.263, MPEG-4 visual, H.264 and H.265 and if time permits, AV-1 and H.266. The course is intended to debut in Fall 2027.

19. My current research focuses on machine learning for object tracking/remote sensing applications; image/video processing for multimedia, military & biomedical applications; and computer vision and three-dimensional scene reconstruction. As a principal investigator (PI) or co-principal investigator, I have acquired almost \$6 million in research funding since joining RIT and have managed multiple government grants from the Department of Defense as well as several corporate grants from Hewlett-Packard, Lenel, and Data Physics. I am currently managing (as PI) a multiyear government grant from the Department of Defense titled “Target Detection/Tracking and Activity Recognition from Multimodal Data.” In this project,

we propose to develop operational target detection/tracking techniques and activity recognition/understanding methods that can leverage multimodal data in a fusion framework using deep learning algorithms while providing accurate and near real-time performance.

20. In 2012, I was awarded the prestigious Trustees Scholarship Award, the highest award at RIT with regard to research recognition.

21. I am the author or co-author of thirty-eight (38) peer-reviewed journal publications.

22. I have also authored or co-authored 102 conference and workshop publications and a book entitled Advanced Linear Algebra for Engineers with MATLAB, published by CRC Press in February 2009, and am a named inventor on multiple U.S. and foreign patents.

23. I am a senior member of the Institute of Electrical and Electronic Engineers and a member of the IEEE Signal Processing Society, the Electrical Engineering Honor Society, Eta Kappa Nu.

III. LEVEL OF ORDINARY SKILL IN THE ART

24. I understand that a person of ordinary skill in the art (“POSITA”) is a hypothetical person who is presumed to have known the relevant art at the time of the invention. To determine the level of skill held by a person of ordinary skill in the art, I understand that a number of factors may be considered, including the following:

- The type of problems encountered in the art;
- Prior art solutions to those problems;
- Rapidity with which innovations are made;
- Sophistication of the technology; and
- Educational level of active workers in the field.

25. I understand that not all of the above factors will be present in every case and that one or more factors may predominate.

26. In view of the above factors, it is my opinion that a POSITA at the time of the alleged invention 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.

27. As of the March 15, 2002, I met and exceeded the qualifications of a POSITA. My opinions are offered from this perspective, even if they do not specifically refer to the perspective of a POSITA.

IV. MATERIALS REVIEWED

28. My opinions contained in this Declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge.

29. In forming my opinions expressed in this Declaration, I have reviewed and considered the following materials:

Exhibit	Reference
1001	U.S. Patent No. 7,532,808 (“’808 Patent” or “’808Pat.”)
1002	File History of the ’808 Patent (“’808FH”)
1004	Curriculum Vitae of Dr. Eli Saber
1005	Provisional Application No. 60/365,072
1006	International Patent Publication No. WO 01/11891 A1 (“Karczewicz”)
1007	ISO/IEC 11172-2:1993, Information technology—Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s—Part 2: Video (“MPEG-1”)
1008	RESERVED
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	Iain E. G. Richardson, <i>H.264 and MPEG-4 Video Compression</i>
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	Declaration of June Ann Munford

Exhibit	Reference
1017	Complaint for Declaratory Judgment, U.S. District Court for the District of Minnesota, <i>Element Television Company, LLC v. Nokia Corporation</i> , November 25, 2024
1018	M. Ghanbari, “Video Coding: an introduction to Standards codecs”, IEEE, 1999, Chapter 3

30. I have also considered any materials cited in this Declaration, even if not included in the list above.

31. My opinions have also been guided by my appreciation of how a POSITA would have understood the claims and the specification of the '808 patent at the time of the alleged invention. I am told that Patent Owner may assert that this date is March 15, 2002 (the filing date of Provisional Application No. 60/365,072), rather than March 14, 2003 (the filing date of the application that issued as the '808 Patent). My opinions reflect how one of ordinary skill in the art would have understood the '808 patent, the prior art to the patent, and the state of the art at the time of the alleged invention. My opinions would remain the same regardless of whether the '808 patent is entitled to the March 15, 2002 priority date.

V. LEGAL STANDARDS

32. I am not an attorney and offer no legal opinions, but in the course of my work, I have had experience studying and analyzing patents and patent claims from the perspective of a POSITA.

33. For the purposes of this Declaration, I have been informed about certain aspects of the law that are relevant to my analysis, as summarized below.

A. Claim Interpretation

34. I understand from Counsel that during an IPR proceeding, claims are to be construed in light of the specification as would be read by a POSITA at the time the application was filed. I understand that claim terms are given their ordinary and customary meaning as would be understood by a POSITA in the context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if the patentee acted as his or her own lexicographer and clearly set forth a definition of the claim term in the specification. In that case, the claim term will receive the definition set forth in the patent.

B. Prior Art

35. I understand from Counsel that certain patents and printed publications can be considered prior art in an IPR proceeding. I understand that prior art must predate the effective filing date of the claims of the patent-at-issue.

C. Obviousness

36. I understand that a claim is unpatentable if the claim limitations, as arranged in a claim, would have been obvious to a person of ordinary skill in the art as of the date of invention. For example, a combination of familiar elements according to known methods is likely to be obvious if the combination does no more than produce predictable results.

37. In determining obviousness, I understand that the analysis may take into account multiple prior art references, as well as the common knowledge possessed by a POSITA (as discussed above). I further understand that the POSITA is not an automaton but one having common sense and ordinary creativity. I also understand that a claim is not obvious simply because a combination of prior art references discloses each claim element collectively.

38. In determining obviousness, I understand that one should consider the following.

- The scope and content of the prior art;
- The differences between the claimed invention and the prior art;
- The level of ordinary skill in the pertinent art; and
- Secondary considerations of obviousness.

39. I understand that a POSITA is assumed to have knowledge of all prior art references. I also understand that when considering the obviousness of a patent claim, one should consider whether a teaching, suggestion, or motivation to combine the references exists so as to avoid impermissibly applying hindsight when considering the prior art. I understand this test should not be rigidly applied, but that the test can be important to avoiding such hindsight.

40. I understand that a POSITA can combine various prior art references based on the teachings of those prior art references, the general knowledge present in the art,

or common sense. I understand that a motivation to combine the references may be implicit in the prior art, and there is no requirement that there be an actual or explicit teaching to combine two references. Thus, one may take into account the inferences and creative steps that a POSITA would employ to combine the known elements in the prior art in the manner claimed by the patent-at-issue. I understand that one should avoid “hindsight bias” and ex post reasoning in performing an obviousness analysis. This does not mean, however, that a POSITA, for purposes of the obviousness inquiry, does not have recourse to common sense.

41. I understand that the following are examples of approaches and rationales that may be considered in determining whether a prior art reference could have been combined with other prior art or with other information within the knowledge of a POSITA:

- Combining prior art elements according to known methods to yield predictable results;
- Simple substitution of one known element for another to obtain predictable results;
- Use of known techniques to improve similar devices, methods, or products in the same way;
- Applying a known technique to a known device, method, or product ready for improvement to yield predictable results;

- That it was “obvious to try”—i.e., that it was one choice from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; and
- Some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify the prior art reference or to combine multiple prior art reference teachings to arrive at the claimed invention.

42. I also understand that obviousness is a legal conclusion based on the underlying factual issues of the scope and content of the prior art, the differences between the claimed invention and the prior art, the level of ordinary skill in the art, and any objective indicia of non-obviousness. For that reason, I am not rendering a legal opinion on the ultimate legal question of obviousness. Rather, my testimony addresses the underlying facts and factual analysis that would support a legal conclusion of obviousness, and when I use the term obvious, I am referring to the perspective of a POSITA at the time of invention.

VI. SUMMARY OF OPINIONS

43. For the reasons I discuss below, it is my opinion that claims 1-2, 6-7, 9-11, 15-16, 20-25, 28-30, 32, 34, 36, 39-41, 43-44, 47-49, 51-54, 58-60, and 62-65 of the

'808 patent would have been obvious to a POSITA in view of the prior art, and if asked to do so, I can identify disclosures in the references that correspond to each limitation of each Challenged Claim. In the interest of keeping my declaration focused, however, I only specifically address claim elements/limitations or key points that may not be readily apparent on the face of the prior art but would nevertheless have been understood by a POSITA reading that art. For avoidance of doubt, however, I have reviewed and I agree with the full limitation-by-limitation analyses presented in the Petition.

VII. OVERVIEW OF THE '808 PATENT

A. Technology Overview

44. Digital video, like analog video (and film) comprises a rapid, time-ordered sequence of image frames. Sullivan, 74. It is a representation of a visual scene, sampled spatially and temporally and represented in the form of a series of frames. Each video frame comprises a rectangular array of pixels. Digital video in its raw format typically exhibits a high degree of redundancy both in the spatial and temporal domain given that frames are usually acquired at a frame rate of 30 frames per second. Transmission and/or storage of raw digital video data requires huge volumes of data and very fast data rates. Sullivan, 74-76. Compression and decompression refer to techniques to take one form of data and convert it into another form that takes up less space, i.e., a fewer number of bits, in a memory. Compression is the process of taking data and making it

occupy less space in memory, and decompression is the process of restoring the data to its original form. An encoder compresses data, and a decoder reverses the process for display. Riley, 15, 18-19 (“[D]igital video information must be compressed (encoded) prior to transmission and decompressed (decoded) before displaying it at the receiver.”).

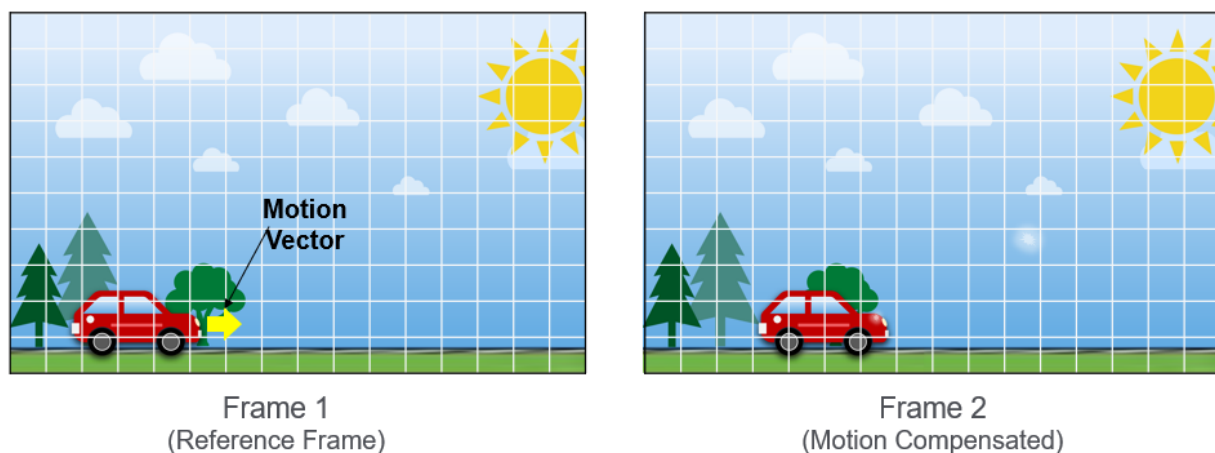
45. Statistical analysis of video frames indicates that there is a strong correlation both within frames (spatial correlation) and between successive picture frames (temporal correlation). For coding still images, only the spatial correlation is exploited yielding a technique known as intraframe coding which forms the basis for Joint Picture Expert Group (JPEG) coding and the resulting JPEG coding standard that was made available in the late 1980s.

46. On the other hand, image frames in a video sequence typically depend on information from other frames – a concept known as temporal correlation. This dependency arises from the use of a compression technique called “temporal prediction,” which takes advantage of “temporal redundancy” across image frames. “The term ‘temporal redundancy’ expresses the fact that objects appearing in one frame of a sequence are likely to appear in subsequent frames” ’808 Patent, 2:42-44. Because image frames in a video sequence are typically captured in rapid succession (typically frames are captured at the frame rate of 30 frames per second), many aspects of the scene being captured do not change, or change in predictable ways, from one image frame to the next. These aspects are considered to be temporally redundant if

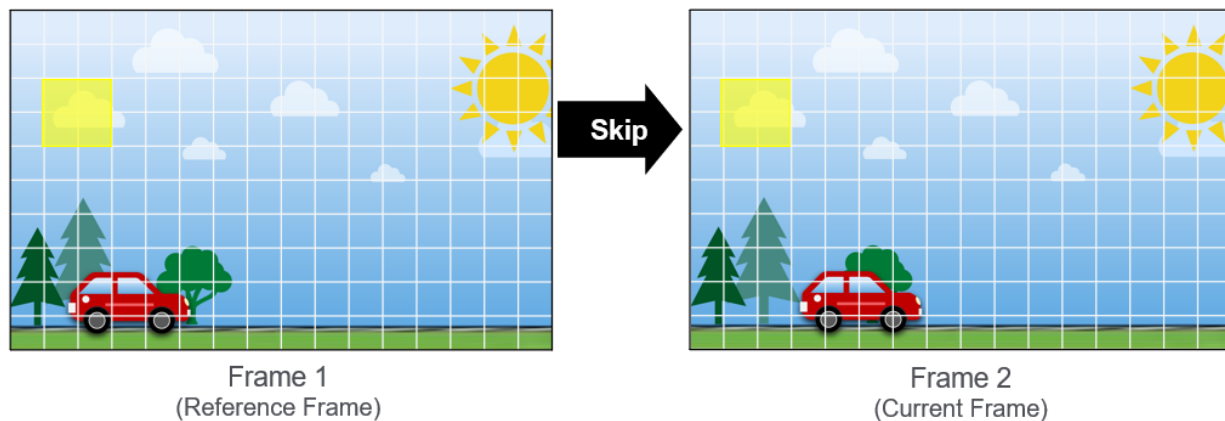
this temporal correlation is exploited, then it is typically referred to as interframe coding.

47. A technique called motion compensated prediction is often used “to reduce the temporal redundancy in [a] sequence [of frames].” ’808 Patent, 3:11-15. Using motion compensated prediction, image content of frames, typically on a macroblock by macroblock basis, is “‘predicted’ from one or more frames in the sequence, known as ‘reference’ frames ... by tracking the motion of objects or regions of an image between the frame to be coded [] and the reference frame(s) using ‘motion vectors.’” *Id.*, 3:15-21. Interframe predictive coding is the main coding principle that is adopted in all the standard video codecs, such as H.261, H.263, H.264, etc. and Motion Picture Experts Group (MPEG)-1, -2 and -4, etc. EX-1018, Ch. 3.

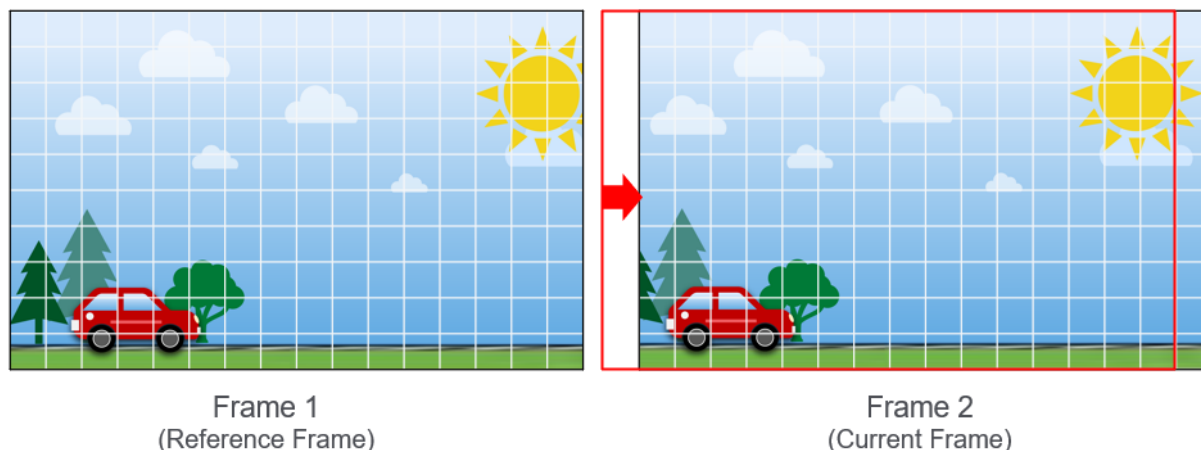
48. The figure below illustrates the concept of motion compensated prediction, where a macroblock in a current frame (“Frame 2”) is predicted using a motion vector that characterizes the motion of a macroblock in a reference frame (“Frame 1”):



49. Aspects of an image that do not change from frame to frame do not need to be motion compensated, and are instead “skipped” i.e., “copied” from the reference frame. ’808 Patent, 10:63-67; EX1007, 54-55. For example, the figure below illustrates how a block, highlighted in yellow, is copied, i.e., “skipped” from the reference frame to the current frame:



50. Finally, a technique called global motion (i.e. motion affecting the entire area of a video frame due to camera panning or zooming) compensation may be used to generate predicted macroblocks from a reference frame in instances where, for example, the camera pans or a large portion of the frame is displaced by the same motion vector. *See, e.g.,* ’808 Patent, 12:48-14:10. The figure below illustrates predicting a current frame based on global motion of a reference frame:



B. '808 Subject Matter Overview

51. The '808 Patent issued on May 12, 2009, from U.S. Patent Application No. 10/390,549 (the "'549 Application"), which was filed on March 14, 2003. The '808 Patent claims priority to U.S. Provisional Application No. 60/365,072, filed on March 15, 2002.

52. Much of the '808 Patent's specification describes the "Background of the Invention," which provides an overview of video coding and discusses purported shortcomings of the prior art. '808 Patent, 1:15-14:10. For example, the Background section describes the structure and function of prior art video encoders and decoders, including how inter-coded and intra-coded video frames are encoded and decoded. '808 Patent, 3:44-10:22. The Background additionally provides an overview of certain prior art video coding solutions. '808 Patent, 10:23-14:5.

53. The Background of the '808 Patent further explains that "motion-compensated prediction' [is used] to reduce the temporal redundancy in [a] sequence,"

and that “[f]rames of a video sequence which are compressed using motion-compensated prediction are generally referred to as INTER-coded or P-frames.” ’808 Patent, 3:13-15, 3:26-28. Moreover, “[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.” ’808 Patent, 3:28-35. And “[a]ny frame encoded in the INTER-coded format requires a reference frame for motion-compensated prediction.” ’808 Patent, 7:5-6.

54. The Background of the ’808 Patent then discusses prior art solutions for coding INTER-coded frames. One is T. Wiegand’s “Joint Model Number 1” Doc. JVT-A003, Joint Video Team of ISO/IEC MPEG and ITU-TVCEG, January 2002 (“JM1” or “JM1 of the JVT codec”). ’808 Patent, 10:23-12:47. JM1 teaches dividing macroblocks to be inter coded into multiple subblocks and associating motion information with each of the subblocks. ’808 Patent, 10:47-54.

55. The Background of the ’808 Patent also describes JM1 assigning a “skip mode” to a macroblock to indicate “that the macroblock is to be copied from the reference video frame without using motion compensated prediction.” ’808 Patent, 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.” ’808 Patent, 11:8-11. The Background next explains that for non-skip mode macroblocks, JM1 codes a macroblock based on a “cost function” that “combines the prediction error with number of estimated bits needed to code the macroblock and thus measures the relative efficiency of each coding mode.” ’808 Patent, 11:11-18.

56. According to the Background, JM1 “has no special provision for taking account of global motion in video sequences,” nor do other video coding standards. ’808 Patent, 13:51-53. The Background section reviews global motion compensation (used in ISO MPEG-4 and ITU-T H.263+ video coding standards) and global motion vector coding (described in Doc. VCEG-020, ITU-T Video Coding Experts Group (VCEG) Meeting, Pattaya, Thailand 4-7 Dec. 2001). ’808 Patent, 12:48-14:10. The Background states “the idea behind global motion compensation is to generate a reference frame for motion compensation that cancels the effects of global motion,” but that doing so requires “complex operations.” ’808 Patent, 12:59-66, 13:36-44 (discussing “additional complexity” related to other prior art approach). And the Background further says that global motion vector coding is a “simplified version of global motion compensation” 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.” ’808 Patent, 13:31-36. The Background of the ’808 Patent thus identifies alleged shortcomings in the prior

art. '808 Patent, 13:45-14:5.

57. To address the alleged shortcomings of the prior art, the '808 Patent purports to “redefin[e] [] the skip mode concept used in JM1 of the JVT codec.” '808 Patent, 14:14-18. The patent describes its “redefined” skip mode—in which a macroblock may be associated with a zero or non-zero motion vector—as follows:

According to the invention, the skip mode concept is redefined in such a way 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.

'808 Patent, 14:23-29, *see also, id.*, 17:47-52, 19:28-51.

58. In the redefined skip mode, assigning a zero or non-zero motion vector to a macroblock is based on the motion of surrounding macroblocks:

The decision as to whether a macroblock should be associated with a zero or non-zero motion vector is made by analysing the motion of other macroblocks or sub-blocks in a region surrounding the macroblock to be coded. If it is found that the surrounding region exhibits a certain type of

motion, a non-zero motion vector representative of that motion is generated and associated with the current macroblock. In particular, the continuity, velocity or deviation of motion in the surrounding macroblocks or sub-blocks can be analyzed. For example, if the motion in the surrounding region exhibits a certain level of continuity, a certain common velocity, or a particular form of divergence, a motion vector representative of that motion can be assigned to the current macroblock to be coded. On the other hand, if the region surrounding the current macroblock does not exhibit such continuity, common velocity or divergence and has an insignificant level of motion, the macroblock to be coded is assigned a zero motion vector, causing it to be copied directly from the reference frame, just as if it were a conventional SKIP mode macroblock. In this way, according to the invention, SKIP mode macroblocks can adapt to the motion in the region surrounding them, enabling global or regional motion to taken account of in an efficient manner.

'808 Patent, 14:29-51.

59. The surrounding macroblocks used may be previously encoded

macroblocks:

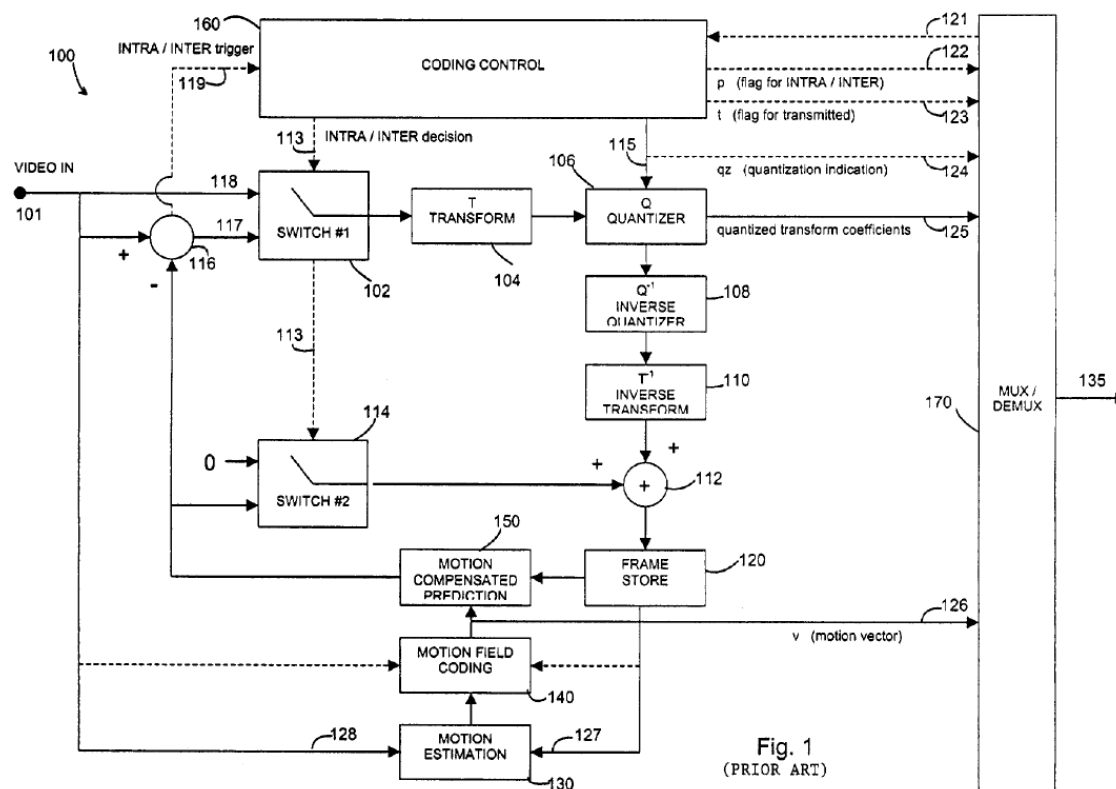
In an advantageous embodiment of the invention, the surrounding macroblocks or sub-blocks whose motion is analysed are previously encoded macroblocks neighboring the macroblock to be coded. This ensures that motion information relating to the region the surrounding a macroblock is available in the encoder (decoder) when a current macroblock is being encoded (decoded) and can be used directly to determine the motion vector to be assigned to the current macroblock. This approach enables the motion analysis of the surrounding region performed in the encoder to be duplicated exactly in the decoder. This, in turn, means that according to the invention, no additional information must be sent to the decoder in order to model global or regional motion.

'808 Patent, 14:52-64.

60. More specifically, according to the '808 Patent, an encoder analyzes the motion of image segments surrounding the macroblock to be coded, and "[i]f it determines that the surrounding region exhibits a certain type of motion, for example it has characteristics indicative of global or regional motion, it generates a non-zero

valued skip mode motion vector representative of the motion.” ’808 Patent, 17:58-64.

61. The ’808 Patent further explains that “a minimal amount of modification is required to incorporate the method according to the invention into existing video coding systems that employ the concept of skip mode macroblocks.” ’808 Patent, 15:11-14. For example, Figure 6 (below) which shows an encoder according to the purported invention that “is substantially identical to that of the prior art video encoder shown in FIG. 1, with appropriate modifications to the motion estimation part necessary to implement the video encoding method according to the invention.” ’808 Patent, 16:7-14. The figures are indeed substantively identical and are reproduced below for reference:



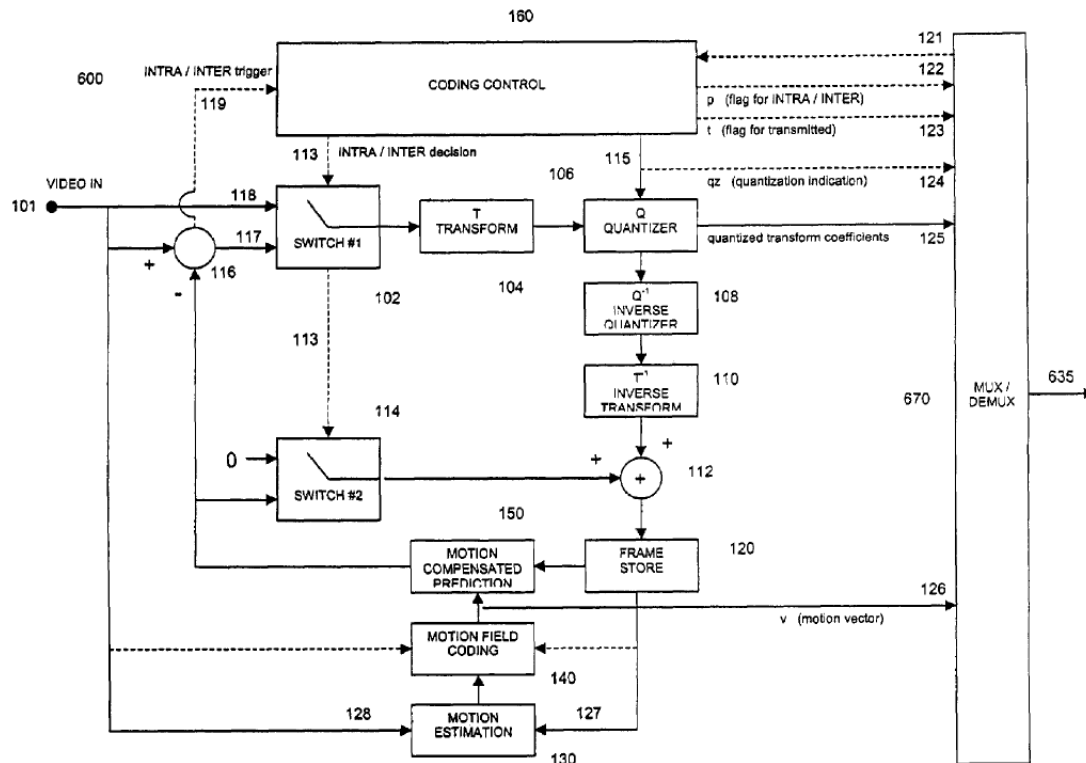
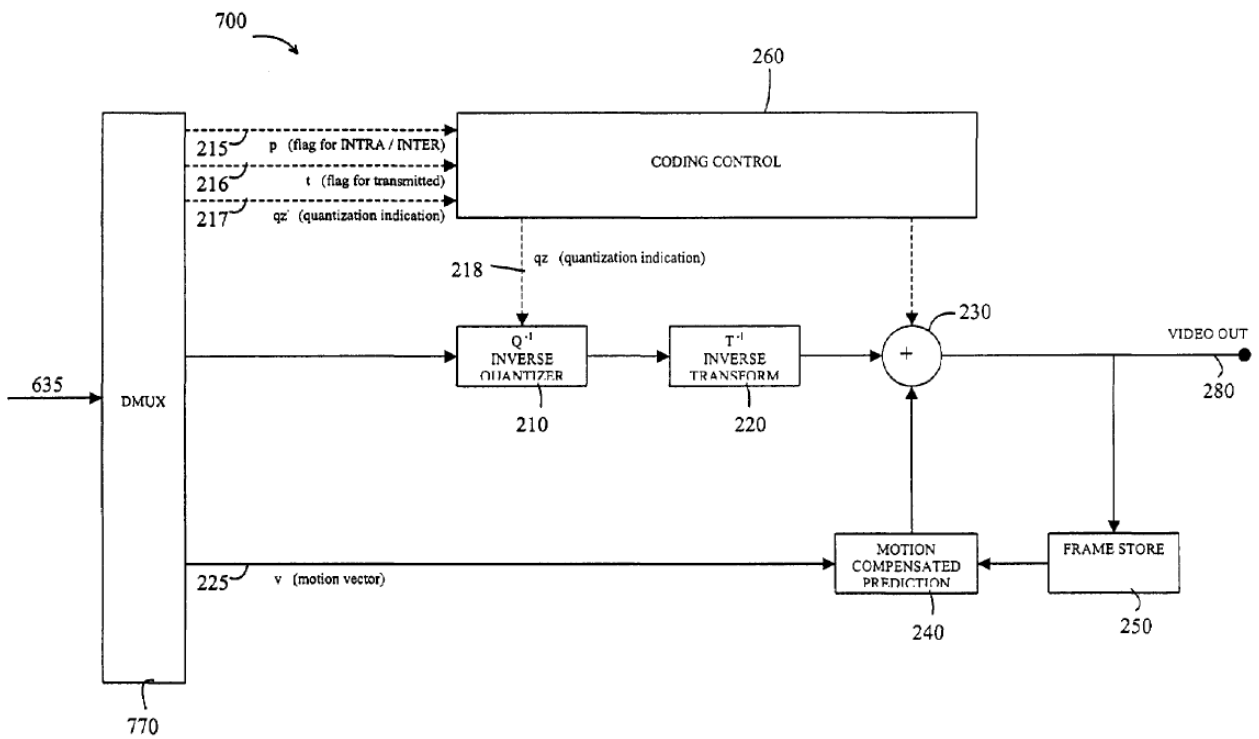
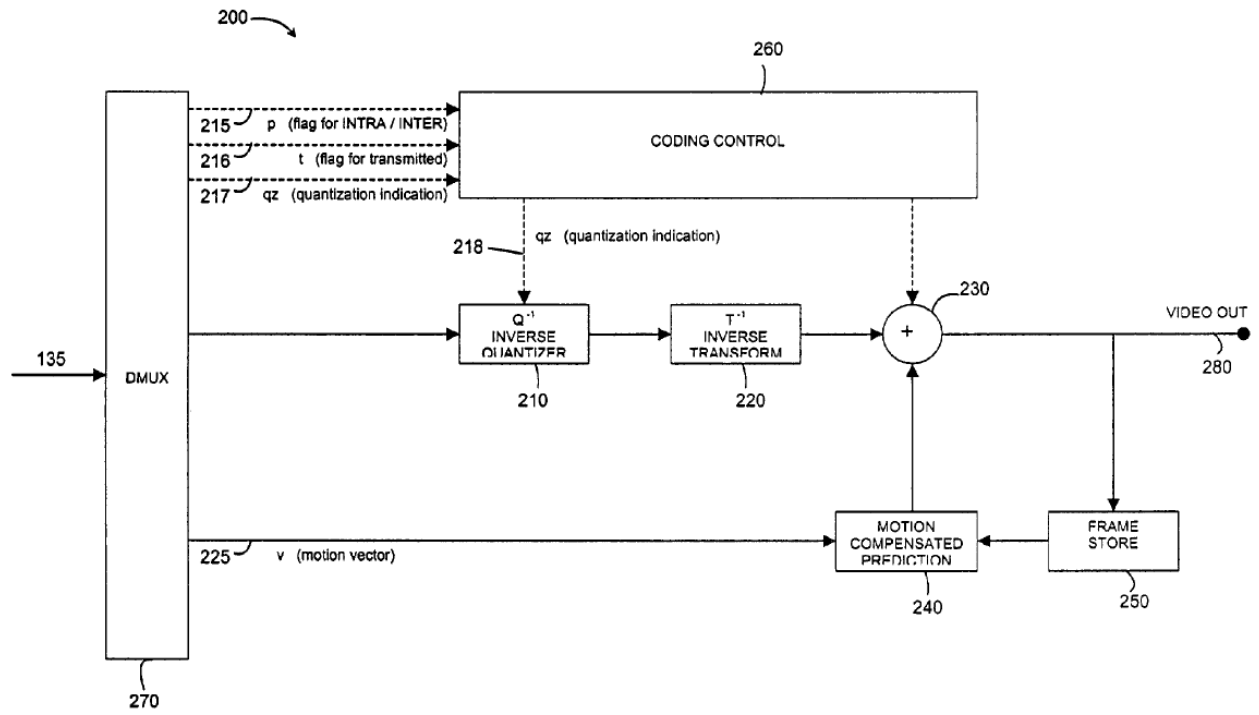


FIG. 6

62. Similarly, Figure 7 shows a decoder according to the alleged invention that is “substantially identical to that of the prior art video decoder shown in FIG. 2, with appropriate modifications to those parts of the decoder that perform motion estimation operations.” ’808 Patent, 20:29-32. The figures are substantively identical and are reproduced below:



C. The Challenged Claims

63. In this Declaration, I address Challenged Claims 1-2, 6-7, 9, 23-25, 28-30, 32, 34, 36, 39-41, 43, 65 of the '808 patent. Claims 1, 7, 10, and 16 are independent.

64. The Challenged Claims generally recite an encoding and decoding method (and an encoder and decoder) that assigns a *skip coding mode*¹ to a segment. The patent says “the present invention is based on a redefinition of the skip mode concept used in JM1 of the JVT codec.” '808 Patent, 14:16-18. Specifically, the '808 patent purports to “redefine[]” “skip coding mode” to refer to 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.” '808 Patent, 17:47-52.

D. '808 Patent Prosecution History

65. The provisional application to which the '808 Patent claims priority was filed on March 15, 2002.

66. The '549 Application was originally filed with 27 claims. '808FH, 54-61. Independent claims 1 and 8 generally related to methods of motion compensated prediction in encoding and decoding a digital video sequence, respectively, and claims 12 and 19 generally related to a video encoder and video decoder using motion compensated prediction, respectively. *Id.* Each independent claim recited a “skip

¹ Italicized text is claim language unless otherwise indicated.

coding mode” that, when assigned to a first segment of a frame, indicated one of two things:

- (i) that the segment has an insignificant level of motion, in which case, forming a prediction for the segment by copying directly from a corresponding region of the second frame, or
- (ii) that the segment has a motion characteristic of global or regional motion in the video sequence, in which case, forming a prediction for the segment by motion compensated prediction with respect to the second frame using motion information representative of said global or regional motion.

’808FH, 54, pending claim 1, *see also* pending claims 8, 12, 19. The Examiner rejected these pending independent claims and their dependents based on a combination of U.S. Patent No. 5,701,164 to Kato and U.S. Patent No. 5,442,400 to Sun, with Kato disclosing everything except the recited “skip coding mode.” ’808FH, 97-100.

67. In response, Applicant amended pending independent claims 1, 8, 12, and 19; added new dependent claims 28-70; and canceled or amended previous claims so that all claims ultimately depended from claims 1, 8, 12, or 19. ’808FH, 106-44. The amended independent claims shifted focus to “assigning a skip coding mode to a first segment of a first frame of the sequence” and “assigning either a zero motion vector or

a predicted non-zero motion vector for the skip coding mode” ’808FH, 106, pending claim 1; *see also* pending claims 8, 12, 19. Applicant distinguished the amended independent claims from Sun based on the recited “skip coding mode,” arguing that Sun taught “skip coding mode” as acknowledged in the AAPA, where the skip coding mode “indicates that [a] macroblock is to be copied from the reference video frame,” while the “skip coding mode” of the pending claims “can be a zero motion vector, or a predicted non-zero motion vector at least partially based on the motion information of a neighboring segment.” ’808FH, 145-46.

68. Without further comment, the Examiner issued another obviousness rejection based on the combination of U.S. Patent No. 7,200,275 to Srinivasan and U.S. Patent No. 6,6893,987 to Sugahara. ’808FH, 158-77. And in response, the Applicant argued that the portions of Srinivasan upon which the Examiner relies were not prior art. ’808FH, 183-84. The Examiner thereafter allowed the claims without further substantive comment (after some minor, clarifying amendments from the Applicant). ’808FH, 217, 239, 244.

69. A Certificate of Correction subsequently changed the dependency of claim 43 from claim 1 to claim 7. ’808FH, 277.

VIII. CLAIM CONSTRUCTION

70. I understand that the term “skip coding mode” was construed in a previous IPR challenge to the ’808 patent to mean “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 motion in image segments surrounding the macroblock in question.” I have been asked to apply this construction in my analysis below. I have given all other claim terms of the Challenged Claims their plain and ordinary meaning, as would have been understood by a POSITA, at the time of the alleged invention.

IX. DETAILED EXPLANATION OF GROUNDS

A. Karczewicz Renders Obvious the Challenged Claims

1. Karczewicz

71. Karczewicz describes an “apparatus, and an associated method, for encoding, and decoding, a video sequence utilizing motion compensation prediction.” Karczewicz, 1:7-8. In particular, Karczewicz teaches at least five ways, or modes, of coding a segment of a frame in a video sequence:

Therefore, with respect to motion vector fields, a given segment S_i can be coded in any of various manners. For instance, the segment can be coded using only prediction motion vector fields extrapolated from a neighboring segment. Or, the segment can be coded by using a prediction motion vector field extrapolated from a neighboring segment together with a compressed refinement motion vector field. Alternately, the segment can be coded using only a compressed motion vector field without utilization of a

prediction field. If the prediction field is set to zero, however, refinement information is sent. The segment can also be coded by using a zero motion vector field, e.g., a copy from the reference frame $R_{ref}(x,y)$. And, for example, the segment can be coded using intra coding in which no motion vector field is utilized.

Karczewicz, 31:14-25, claim 61 (“In a method of encoding a video sequence ... defining a set of coding modes”), claim 64 (“A method according to claim 61 wherein said set of coding modes comprises: a first coding mode ... a second coding mode ... a third coding mode”), claim 65.

72. Karczewicz teaches some of these coding modes. For example:

Motion fields of a segment are predicted from adjacent segments of a video frame and by using orthogonal affine motion vector field models. Through operation of an embodiment of the present invention, motion vector fields are formed with a reduced number of bits while still maintaining a low prediction error.

Karczewicz, 1:09-13.

73. As Karczewicz explains, a motion vector field “is a set of motion vectors of all pixels of the current frame.” Karczewicz 20:11-13, *see also*, 8:3-10 (“motion

vectors actually identify the origin of pixels in the current frame by comparison with the reference frame. Coding continues until the origin of each segment in the current frame has been identified. The resulting representation can be thought of as a ‘motion vector field’ describing the overall correspondence between the two frames.”). In addition, Karczewicz further teaches using an affine motion model² to approximate a motion vector and to generate a set of motion coefficients to allow for more efficient transmission of motion vectors given that the basis functions for the affine motion model are known to both encoder and decoder, meaning only the coefficients need to be transmitted. Karczewicz, 13:29-14:9. Motion vectors of an image segment are calculated from the motion vector fields assigned to the segment. *E.g.*, Karczewicz, 23:10-26. A POSITA would therefore have understood that each of Karczewicz’s modes assigns motion vectors to a segment and represents those motion vectors through motion vector fields.

74. Karczewicz provides an overview of known video coding techniques, explaining that coding every pixel in a video sequence would take a very large amount of data and would be impractical to transmit over low bit-rate communications channels.

² An affine motion vector field model is “a special class of motion model whose mathematical form is such as to allow translational, rotational, and skewing movements between frames.” Karczewicz, 14:2-5.

Karczewicz, 1:23-3:15. Karczewicz then describes motion compensated prediction—a technique widely used to reduce temporal redundancy in successive frames of a video:

Video coding schemes are utilized to reduce the amount of data required to represent such video sequences. A key of many video coding schemes is a manner by which to provide motion compensated prediction. Motion compensated prediction, generally, provides a manner by which to improve frame compression by removing temporal redundancies between frames. Operation is predicated upon the fact that, within a short sequence of the same general image, most objects remain in the same location whereas others move only short distances. Such motion is described as a two- dimensional motion vector.

Karczewicz, 3:16-24.

75. Because “a typical video sequence [is] recorded at a comparatively rapid frame rate ... there are only small changes from one frame to the next. Usually the background is stationary and only some parts of the image undergo some form of movement. Alternatively, if the camera itself is moving, all elements undergo some consistent movement.” Karczewicz, 5:22-27. Motion compensated prediction uses these assumptions by coding and transmitting only the differences between a previously

coded frame and a current frame. Karczewicz, 5:30-6:5.

76. Karczewicz further explains that in motion predictive coding, the encoder and decoder both “maintain a record of a reference frame [previously coded frame] and the current frame is coded with reference to that stored frame.” Karczewicz, 7:7-9. The decoder reconstructs the current frame using the stored reference frame and the transmitted difference information. Karczewicz, 7:9-11. This is accomplished by examining a current frame “on a segment-by-segment basis in order to determine the correspondence between itself and the reference frame.” Karczewicz, 7:12-14. Practically, this requires that: 1) both the encoder and decoder have a copy of the reference frame, which means the encoder must also have a decoder for decoding an encoded frame and using it as a reference frame for future frames, and 2) the segmentation scheme between the encoder and decoder is predefined. Karczewicz provides examples of common segmentation schemes:

Frequently, the current image is simply divided into regular blocks of pixels e.g. the comparison may be done macroblock by macroblock. Alternatively, the frame may be divided on some other basis; perhaps in an attempt to better identify the different elements of the image contained therein and thus enable a more accurate determination of the motion within the frame.

Karczewicz, 7:15-19. Segments are typically macroblocks, but Karczewicz leaves open the possibility of other segmentation schemes. Karczewicz, 7:15-20 (“Frequently, the current image is simply divided into regular block of pixels e.g. the comparison may be done macroblock by macroblock.”), Karczewicz, 31:7-9.

77. In the next step, a best match for a given segment in the current frame is determined in the reference frame, and “the correspondence between the segment and the reference frame is coded using ‘motion vectors.’” Karczewicz, 8:1-3. “A motion vector can be considered as a displacement vector with x and y (horizontal and vertical) components, which actually points back from the segment of the current frame to pixel locations in the reference frame.” Karczewicz, 8:3-6. Further, to provide for even more efficient coding, a motion field model known to both the encoder and decoder can be used, such that only motion field model coefficients (rather than entire functions) need to be transmitted to code motion vectors with sufficient accuracy. Karczewicz, 8:24-9:7.

78. Karczewicz recognizes that motion field model accuracy is limited by the functions chosen for the model, and this problem can be addressed by constructing a “‘prediction error frame,’ containing the difference between the coded current frame and the original current frame” at the encoder and then transmitting the prediction error frame information along with the motion field model coefficients to the decoder:

Finally, and in order to compensate for the errors introduced by the motion field coding process, typical motion predictive encoders include an error estimation function. Information about the prediction error is transmitted to the decoder, together with the motion field model coefficients. In order to estimate the error introduced in the motion field coding process, a motion predictive encoder typically also includes a decoding section, identical to that found in the receiver. Once the current frame has been encoded using the motion predictive methods described above, the decoding section of the encoder reconstructs the current frame and compares it with the original version of the current frame. It is then possible to construct an "prediction error frame," containing the difference between the coded current frame and the original current frame. This information, together with the motion field model coefficients and perhaps some information about the segmentation of the current frame, is transmitted to the decoder.

Karczewicz, 9:14-27.

79. Notwithstanding these known methods for coding video sequences,

Karczewicz notes that “significant amounts of data are still required to represent a video sequence.” Karczewicz, 9:28-29.

80. Karczewicz improves upon the prior art to reduce the amount of data required to represent a video sequence while preserving low prediction error. Karczewicz, 10:18-21. For example, as noted above, Karczewicz describes (at least) five coding modes. Karczewicz, 31:14-25. Two of those coding modes exploit (where present) the similarity between motion vector fields of neighboring segments by computing a motion vector field of a segment from its previously coded neighboring segment. Karczewicz, 11:1-8, 31:14-25 (“For instance, the segment can be coded using only prediction motion vector fields extrapolated from a neighboring segment”), claims 61, 64, 65. This calculation may use a small refinement field to account for differences between motion vectors of neighboring segments, though in some circumstances, the refinement field may be zero:

The similarity of affine motion vector fields of neighboring segments of a video frame is exploited by utilizing affine prediction motion vector fields. If, for instance, two neighboring segments have similar motion vector fields, one of the motion vector fields can be computed from the other merely with the addition of a small, or even negligible, i.e., zero, refinement field. For each segment of a video frame,

an affine motion model is selected which achieves satisfactorily low prediction error with as few non-zero coefficients as possible.

Karczewicz, 11:1-8.

81. 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. This technique can enhance coding efficiency:

The benefit of this approach to motion predictive coding may not be immediately apparent. However, in 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. This can result in a significant reduction in the amount of data that must be transmitted from encoder to decoder. In the case where zero refinement information is required, the motion vector field of the second segment can be predicted purely on the basis of motion coefficients already stored in the decoder.

Karczewicz, 15:26-16:3.

82. Karczewicz further explains that the second segment “can also be coded by using a zero motion vector field, e.g., a copy from the reference frame.” Karczewicz, 31:20-24.

83. And Karczewicz acknowledges that a prediction error determined in the customary way (i.e., as the difference between the motion compensated predicted version of the current frame and the current frame itself) can be transmitted to the decoder with motion vector information:

Difference values formed by the subtractor 24 are provided to a prediction error coder 42. The prediction error coder determines the differences in pixel value between the current input video frame and the MC predicted version of the frame in order to produce an indication of the prediction error. And, in turn, the prediction error coder 42 is coupled to the multiplexor 34 and to a prediction error decoder 46. The prediction error decoding block decodes the prediction error which is added to the MC predicted current frame by the adder 38 and the result is stored in the frame memory 26. The decoder 14 is here shown to include a demultiplexer 52, a prediction error decoder 54, a motion compensated predictor 36, a summer 56, and a frame memory 26. The

predictor 36 of the encoder and of the decoder are commonly numbered as are the frame memories 26 of the respective devices.

Karczewicz, 20:21-21:5, *see also* Karczewicz, 22:5-6, Fig. 1.

2. Claim 1 and Dependents (Encoding Method Claims)

a. Claim 1

i. 1[a]: *assigning a skip coding mode to a first segment of a first frame of the sequence;*

84. Karczewicz describes coding modes using a “prediction field”—i.e., “the motion field model predicted from the neighboring segment(s)” that are previously coded (EX1006, 16:18-21, 17:10-14)—and a “refinement field”—i.e., “the difference between the prediction field and the motion field model determined specifically for the segment itself.” *Id.*, 16:21-23. Both fields may be affine motion fields, and “[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.” *Id.*, 16:25-27. A POSITA would understand these disclosures to mean at least the following:

- The motion field model for a segment is the sum of the prediction field and the refinement field;
- the prediction field predicts the motion of a segment based on the motion predictions for neighboring segments;

- the refinement field accounts for differences between that neighbor-based prediction and a prediction based on the segment itself;
- A motion predicted segment is obtained by applying the motion field model to a reference segment (i.e., from a segment from a previously coded frame);
- Prediction error is the difference between an actual segment and the motion predicted segment; and
- Prediction error is therefore also the difference between the actual segment and the application of the sum of the prediction field and the refinement field to a reference segment.

85. According to Karczewicz “there are several different ways in which a given segment can be coded.” *Id.*, 17:1-2. As described above in Section IX.A.1 (overview of Karczewicz), Karczewicz teaches five different “modes” or ways in which a segment can be coded. *Id.*, 31:14-25. Claim 61 of Karczewicz says there are “a set of coding modes” for coding a segment, and claims 64 and 65 describe a “first coding mode” through a “fifth coding mode.” *Id.*, cls. 61, 64, 65. A POSITA would have related Karczewicz’s coding modes to its teachings of a prediction and a refinement field.

86. **First coding mode:** “The segment may be represented as a prediction field only.” *Id.*, 17:9-10, 31:16-17, claim 64 (“a first coding mode wherein ... said second neighboring segment is represented by said prediction motion field model”).

Karczewicz explains that “[t]his 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.” *Id.*, 17:10-14. A POSITA would understand this to mean that the first coding mode codes a second segment based on neighboring segment(s) when doing so adequately represents the segment or when it is efficient to do so (e.g., considering rate distortion).

87. **Second coding mode:** “The segment in question may be coded using a motion model determined specifically for the segment using the reference frame. In this case, as described above, the prediction field is set to zero and the refinement field is set equal to the motion field model determined from the reference frame.” *Id.*, 17:14-18, 31:20-21, claim 64 (“a second coding mode wherein said second neighboring segment is represented by a motion field model derived from said reference frame”). A POSITA would understand this to mean that in the second coding mode, the motion field model for a segment may be coded without using motion information of neighboring segment(s).

88. **Third coding mode:** “A given segment can be represented as a sum of a prediction field and a refinement field.” *Id.*, 17:8-9, 31:17-20, claim 64 (“a third coding mode wherein ... said second neighboring segment is represented by said prediction motion field model and a refinement field model.”). A POSITA would understand this

to mean that the third coding mode codes a second segment based on a motion field model predicted from neighboring segment(s) (the prediction field) as well as additional motion information used to achieve acceptable distortion (the refinement field).

89. **Fourth coding mode:** “The segment can also be coded by using a zero motion vector field, e.g., a copy from the reference frame” *Id.*, 31:22-24, claim 65 (“a fourth coding mode wherein said second neighboring segment is encoded using pixel values from said reference frame”).

90. **Fifth coding mode:** “the segment can be coded using intra coding in which no motion vector field is utilized.” *Id.*, 31:24-25, claim 65 (“a fifth coding mode wherein said second neighboring segment is encoded using pixel values from said current frame.”).

91. Karczewicz determines which mode to assign to a given segment based on which is the most efficient (considering rate distortion). When encoding a second segment of an inter frame (the *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.” *Id.*, 14:27-15:1. The “efficiency” is based on “rate distortion,” which considers “both a measure of [the] image distortion and a measure of the amount of data required to achieve that level of distortion.” *Id.*, 14:12-17. A POSITA would understand this to mean balancing the reduction in data

coding against the potential quality loss of the coded video sequence.

92. Furthermore, a POSITA would have understood Karczewicz's first and fourth coding modes collectively disclose or suggest the *skip coding mode* of the '808 Patent. Even though Karczewicz refers to them as separate "modes," a POSITA would have understood that they provide the *skip coding mode* defined in the '808 patent because Karczewicz's first and fourth coding "modes"— and **only** its first and fourth coding "modes"— are indicated using a motion coefficient indicator ("MCI") bit set to zero. *See id.*, 37:5-8 ("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 a motion coefficient indicator (MCI)."), 37:12-13 ("An all-zero pattern [of motion coefficients] ... can be signaled by the MCI bit alone.").

93. A zero MCI bit thus indicates one of Karczewicz's two inter coding modes that collectively correspond to the "redefined" *skip coding mode*. When MCI bit is zero for a segment, it indicates a zero motion vector with "[a]n all-zero pattern [of motion coefficients]." Karczewicz, 37:12-13. And when a segment is coded with just a prediction field, the MCI bit is also zero because it indicates that there are no motion coefficients for the segment (i.e., there is no refinement field). Karczewicz, 37:5-8. These are the only two modes in Karczewicz that include a zero MCI bit, so a POSITA would have understood that if a segment is coded with a zero MCI bit, it is assigned a *skip coding mode*.

94. Alternatively, a POSITA would have found it obvious to combine the first coding mode from Karczewicz (where a segment is coded solely with a prediction motion vector field) with the fourth coding mode (where a segment is coded by a zero motion vector) because the combination would minimize the number of bits needed to encode the segment (e.g., utilizing the zero motion vector when appropriate, otherwise utilizing the prediction motion vector field, without refinement, when encoding motion information for the segment). Karczewicz already teaches a single indicator for such a combined mode (i.e., an MCI bit of 0), so a POSITA would have had a reasonable expectation of success because they would not have needed to make any modifications to Karczewicz's teachings beyond simply redefining its first and fourth coding modes to be a single coding mode. And as I explain below for claim 6 (Section IX.A.2.c), a POSITA would have understood that there are situations in Karczewicz when a segment—coded based on the neighboring segments that have already been coded—is coded with a zero motion vector. It would therefore have been obvious to a POSITA to treat the two coding modes (one associated with a zero motion vector, the other associated with a non-zero motion vector) as one mode.

95. I understand that in a previous proceeding, patent owner (PO) has argued that it would have been impossible for a POSITA to combine Karczewicz's teachings of coding a segment with either a zero motion vector or with just a prediction field because those teachings are somehow "mutually exclusive." This argument fails for

two reasons. First, a POSITA would have understood Karczewicz's teachings of coding a segment with either a zero motion vector or just a prediction field when the MCI bit is set to 0 to already be a *skip coding mode* as "redefined" in the '808 Patent – i.e., without a combination being required. Second, even if a combination between the two modes were necessary, PO's argument does not have any technical merit. Karczewicz's teachings of coding a segment with a zero motion vector or coding a segment with just a prediction field are not mutually exclusive because Karczewicz already teaches the mechanism for distinguishing the two. Simply speaking, a POSITA would have understood that an MCI bit set to 0 indicates a *skip coding mode* where either a zero motion vector or a non-zero motion vector, based on a prediction field alone, is assigned to a segment. Once the *skip coding mode* is assigned, Karczewicz teaches that an additional bit signals whether the prediction field of a neighbor is used. Karczewicz, 32:18-20. Thus, a POSITA would have understood that Karczewicz's teachings of coding a segment with either a zero motion vector or a prediction field alone are not mutually exclusive (as argued by PO) within a single mode because Karczewicz already teaches the mechanism for combining the two ways of coding a segment into a single mode. And as I explain further below in Section IX.A.2.a.iv (limitation 1[d]), a POSITA would have understood that neither the bit indicating that a prediction field should be used nor any indication regarding which surrounding segments should be used to calculate the prediction field would have been understood by a POSITA to be

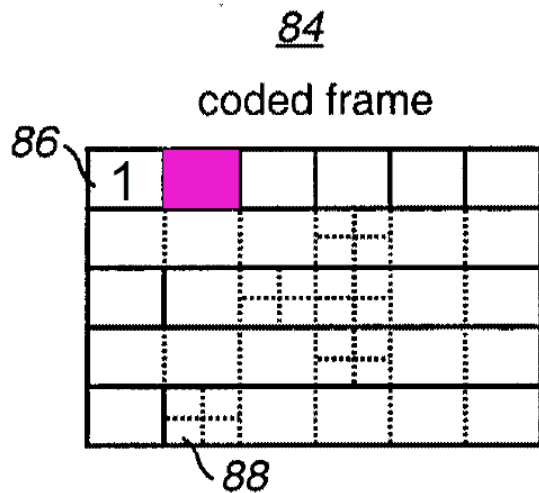
motion vector information for the first segment, so this additional signaling taught by Karczewicz is not contrary to the claims.

96. Regardless of whether a segment is coded using a prediction field or a zero motion vector, the decision of how to code the segment *depend[s] on the motion in image segments surrounding the macroblock in question*. Specifically, the efficient coding mode is chosen by balancing distortion due to coding the second segment with reference to a neighboring segment against the amount of data required to transmit the motion vector information of the second segment. *Id.*, 15:16-20.

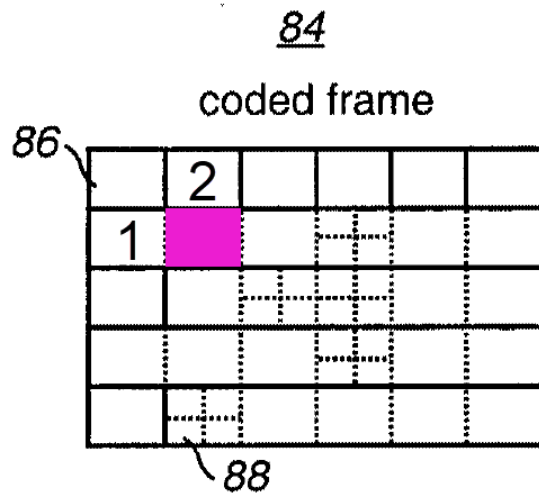
97. If a segment is coded using only a prediction field, it “depend[s] on the characteristics of the motion in image segments surrounding the macroblock in question” such that one, two, or four neighboring segments may be used to determine the motion vector field of that segment. *Id.*, 16:4-10 (explaining a situation in which “the second segment has only one neighbor that can be used to predict its motion), 16:10-20 (“segments in subsequent rows have [two] neighbors[,] to the left and above” that the encoder can use to predict the motion coefficients for a macroblock, “using the motion field model for both neighbors.”), 18:17-28 (“In this case, a general 16x16 pixel segment has four immediately neighboring 8x8 pixel sub-segments that may be considered”). A POSITA would have understood that these, described as “neighboring” by Karczewicz, correspond to previously coded segments *surrounding* the macroblock being coded because they are to the left and above of said macroblock, as described in

the '808 Patent. E.g., EX1001, Fig. 9, 15:47-51, 18:47-51. To illustrate how Karczewicz teaches considering one, two, or four previously coded segments, I have annotated Karczewicz's Figure 4 below to enumerate each of the previously coded surrounding segments that could be used to form the prediction field of a macroblock currently being coded (pink):

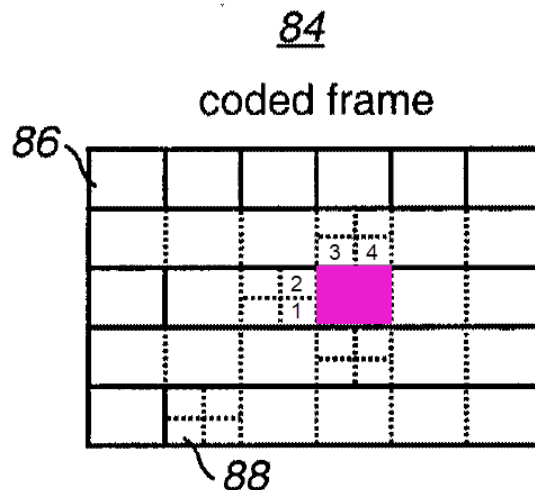
One Segment



Two Segments



Four Segments:



98. I understand that in a previous preceding, PO also argues that Karczewicz does not disclose that *skip coding mode* “considers surrounding motion to determine whether to treat the skip coding mode as active (and generate a predicted motion vector) or non-active (and then signal a zero-motion vector) to best predict a given image block from a reference frame.” In my opinion, the prior art would not need to disclose a *skip coding mode* as was posited by PO. As I explain below in Section IX.B.4.a.ii (Ground 2, limitation 1[a]), PO’s arguments related to “generating” a zero motion vector based on some form of analysis are simply not claimed – and indeed the ’808 Patent contains claims reciting “analysis” that have not been challenged. Nonetheless, Karczewicz discloses or suggests a *skip coding mode* even the incorrect interpretation that PO previously advocated for.

99. As I explained above, Karczewicz considers, i.e., analyzes, the actual motion of a segment being coded as well as the motion of previously coded segments surrounding that segment in order to determine the most efficient way to code said segment. Karczewicz, 14:27-15:6, 19:2-5. Karczewicz may determine that it is most efficient to code a segment using just a prediction field, which a POSITA would have understood to be “determin[ing] to treat the skip coding mode as active” as PO argued. Karczewicz, 15:27-16:3. Karczewicz may also determine that it is most efficient to set the entire refinement field to zero based on its efficiency analysis. Karczewicz 19:2-9. Because Karczewicz states that “[i]t should be emphasized here that an aim of this

method is ... to find the affine motion field model that yields the best match for a segment in a ‘rate-distortion’ sense,” a POSITA would have understood that Karczewicz teaches setting the entire refinement field to zero and coding a segment with a zero motion segment if it decides that it is more efficient to do so than to code it with a prediction field. A case such as this may occur, for example, if a segment has zero or close to zero motion, but previously coded surrounding segments have non-zero motion.

100. Karczewicz thus *assigns a skip coding mode to a first segment of a first frame of a sequence*³ by indicating with a zero MCI bit that the segment is not coded with a refinement field. The *skip coding mode* is “a coding mode in which a zero (non-active) motion vector” is associated with the segment (corresponding to Karczewicz coding a segment with a zero motion vector) “or a non-zero (active) motion vector is associated with each skip mode macroblock” (corresponding to Karczewicz coding a segment with a prediction field only). Whether to code the segment with a zero motion vector or only a prediction field “depend[s] on the motion in image segments surrounding the macroblock in question” based on an efficiency analysis that weighs

³ Karczewicz’s first frame in a sequence is transmitted in INTRA format, and a POSITA would have understood that the *first frame of the sequence* is the first inter-coded frame of the sequence. Karczewicz, 13:17-23.

coding a segment with a prediction field (based on the motion in image segments surrounding the macroblock in question) against coding it according to one of Karczewicz's other "modes." Furthermore, if a segment is coded with a prediction field only ("a non-zero (active) motion vector is associated with [the] skip mode macroblock"), the "non-zero (active) motion vector" also "depend[s] on the motion in image segments surrounding the macroblock in question" because the prediction field can be obtained from one, two, or four surrounding macroblocks.

- ii. **1[b]: 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**

101. As explained above, Karczewicz assigns a *skip coding mode* to a second segment (the claimed *first segment*) based on efficiency (considering rate distortion), and the skip coding mode can be used with a zero motion vector or a non-zero motion vector. The second segment is thus assigned either a prediction motion vector field "extrapolated from a neighboring segment" or a "zero motion vector field, e.g., a copy from the reference frame." Karczewicz, 15:16-20, 31:16-24. In other words, a POSITA would understand that "assigning" the zero motion or predicted non-zero motion vector for the second segment is based (at least in part) on motion information of a neighboring segment because Karczewicz calculates rate-distortion efficiency using motion coefficients from a neighboring, previously coded segment. For example, Karczewicz describes calculating the most efficient coding for rate-distortion by minimizing the

Lagrangian criterion shown in Equation 7 where “[t]he factor λ is a constant referred to as the Lagrangian parameter” (see equations 7 through 10). Karczewicz 24:18-27:11.

102. Karczewicz’s *predicted non-zero motion vector for the skip coding mode* is further *based at least in part on the motion information of a second segment neighboring the first segment* because the prediction motion vector field is “extrapolated from a neighboring segment.” Karczewicz, 31:16-17, 25:14-17 (“the prediction motion vector field is obtained by extrapolating the affine motion vector field of a neighboring, e.g., adjacent segment”), 25:19-23 (“the prediction motion vector field is obtained from a combination of affine motion vector fields of several neighboring segments”).

- iii. **1[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**

103. As explained above, Karczewicz forms a prediction frame for its second segment (*the first segment*) based on a *reference frame*, assigning to the second segment either a *zero motion vector* or a *non-zero motion vector* based on one or more previously coded segments (*the second segment*). E.g., Karczewicz, 21:17-21 (“the compressed motion vectors and the reference frame are used to construct a prediction frame The prediction frame is a coded version of the current frame ..., calculated using the motion vector field ... and the pixel values of the reference frame.”), 20:17-20 (“The encoder

is further shown to include a motion compensated (MC) predictor 36. The predictor 36 is also coupled to the frame memory 26. The predictor 36 is operable to generate a prediction frame which is supplied to the subtractor 24 and also to a summer 38.”), 21:18-21 (“The prediction frame is a coded version of the current frame $I_n(x, y)$ calculated using the motion vector field determined by the motion estimator 22 and the motion field coder 28 and the pixel values of the reference frame $R_{ref}(x, y)$.”); *see also*, *id.*, 16:16-18 (“In a general case, the encoder can try to predict the motion coefficients for a given segment using the motion field model for the segment above it or to the left”), 20:17-20, 21:6-21, 25:13-24, 26:13-20, 27:15-30, 31:13-24 (“For instance, the segment can be coded using only prediction motion vector fields extrapolated from a neighboring segment The segment can also be coded by using a zero motion vector field, e.g., a copy from the reference frame”).

iv. 1[d]: *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.*

104. As explained above, Karczewicz codes a zero MCI bit only if a segment is coded with either a zero motion vector or a prediction field alone, so a POSITA would have understood a zero MCI bit to be *providing in an encoded bitstream an indication of the skip coding mode*.

105. To distinguish between coding a segment with a zero motion vector or with a prediction field, Karczewicz’s encoder must provide more information to the decoder

than just a zero MCI bit. Accordingly, “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. If a segment is coded with a prediction field (as indicated by the unnamed bit signaling that a prediction field is used), “it is necessary to provide information about the neighboring segment(s) used in the prediction. It is not necessary to transmit any motion coefficient data because the motion field model(s) of the previously coded neighboring segment(s) are already known to (i.e., stored in) the decoder.” *Id.*, 17:23-28. However, a POSITA would have understood that neither the bit indicating a prediction field is used, nor the information about which neighboring segment(s) are used for the prediction field is *motion vector information* because no motion vectors are sent (*no further motion vector information for the first segment is coded in the encoded bitstream*).

106. I understand that PO may argue that the claim additionally requires that no residual information is provided for a macroblock assigned a *skip coding mode*. A POSITA would not have understood this to be the case because claim 30, which I discuss in Section IX.A.2.i (claim 30), below, recites this additional limitation. Limitation 1[d] merely requires that *no further motion vector information for the first segment is coded*...which Karczewicz discloses or suggests as explained above. However, to the extent that this claim is found to also require that no residual

information is coded for the *first segment*, Karczewicz discloses or suggests this additional limitation for the reasons I discuss in Section IX.A.2.i (claim 30) below.

b. Claim 2: *A method according to claim 1, wherein the second segment is a previously encoded segment neighboring the first segment.*

107. As discussed above, Karczewicz’s prediction field for the second segment (*the first segment*) is “represented in terms of the motion field of one or more of its previously coded neighbors”⁴ (*the second segment*). Karczewicz, 17:10-14 (“The segment may be represented as a prediction field only. 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.”), *see also, id.*, 14:27-15:6 (“The second segment has one previously coded neighboring segment (i.e. the first segment). The encoder now considers 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. The rationale is as follows: Since the motion coefficients for the first segment have already been determined and transmitted to the decoder, it may be possible to reduce the amount of information that must be

⁴ Karczewicz’s coding and decoding are performed in raster scan order. Karczewicz, 31:8-10.

transmitted to the decoder while encoding the second segment. Hence an improvement in coding efficiency may be obtained.”), 16:4-30; 17:23-28 (“Whenever a segment is coded using a prediction field, whether there is an associated refinement field or not, it is necessary to provide information about the neighboring segment(s) used in the prediction. It is not necessary to transmit any motion coefficient data because the motion field model(s) of the previously coded neighboring segment(s) are already known to (i.e., stored in) the decoder.”).

- c. **Claim 6: *A method according to claim 1, wherein if the second segment has zero motion vector, the zero motion vector is assigned for 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.***

108. As explained in Sections IX.A.2.a.i (limitation 1[a]) and IX.A.2.a.ii (limitation 1[b]), Karczewicz codes a second segment (*the first segment*) with reference to a previously coded neighboring segment (*the second segment*) using a prediction motion vector field. That second segment may be coded with a zero motion vector. Karczewicz, 31:22-24. A POSITA would therefore have understood that when a previously coded neighboring segment *has a zero motion vector*, the second segment is likewise assigned a zero motion vector because Karczewicz does not treat neighboring segments with zero motion any differently from non-zero motion neighboring segments when encoding a second segment. As long as it is efficient to do so (considering rate distortion), Karczewicz codes a second segment with a zero motion vector if its

neighboring segment has a zero motion vector. In such a case, when a zero motion vector is coded, the segment is copied from the reference frame (*formed with respect to a corresponding segment of the reference frame associated with the zero motion vector*). Karczewicz, 31:22-24 (“The segment can also be coded by using a zero motion vector field, e.g., a copy from the reference frame $R_{ref}(x,y)$.”).

109. To the extent Patent Owner argues that Karczewicz does not allow neighboring segments with zero motion vectors to be candidates for a prediction motion vector field (e.g., based on Karczewicz’s disclosure at 32:20-22), I disagree. A POSITA reading Karczewicz would have understood its disclosure to relate to prediction neighbor candidates at the decoder, which is entirely consistent with Karczewicz’s statements about encoding:

In the exemplary implementation, 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. A neighboring segment S_K is a candidate for prediction of motion vector field of a segment S_i only if it has a nonzero motion vector field.

Karczewicz, 32:18-22.

110. So if a second segment is encoded using a zero motion vector—which may

be based on the motion vectors of its neighbors (if that is efficient for rate distortion)—the decoder would not receive a prediction motion vector field for that segment (coded with a zero motion vector), and there would be no prediction neighbor candidates. This is consistent with Karczewicz’s exemplary implementation that sets a MCI bit to indicate the presence of motion coefficients in the bitstream. Karczewicz, 37:5-8 (“In the exemplary implementation, 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 a motion coefficient indicator (MCI).”). And “when motion coefficients are transmitted ... a motion coefficient pattern (MCP) is first sent to indicate which coefficients have nonzero values. An all-zero pattern is the only non-valid pattern, as this possibility can be signaled by the MCI bit alone.” Karczewicz, 37:9-13. Therefore, a POSITA would have understood that the decoder only receives prediction motion vector field candidates and coefficients if a segment is coded with a non-zero motion vector field. This does not affect how a segment may be encoded with a zero motion vector.

d. Claim 23

- i. 23[a]: *the method further comprising deriving the predicted non-zero motion vector based at least in part on the motion vector of the second segment; and***

111. Karczewicz discloses or suggests this limitation for the same reasons discussed in Sections IX.A.2.a.i (limitation 1[a]) and IX.A.2.a.ii (limitation 1[b]) above.

112. To provide additional detail, Karczewicz explains that a second segment “can be coded using only prediction motion vector fields extrapolated from a neighboring segment.” Karczewicz, 31:16-20. “Once 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.

113. Where the one or several neighboring segments has a non-zero motion vector field, a POSITA would have understood that *the predicted non-zero motion vector is derived based at least in part on the motion vector of the second segment.*

ii. 23[b]: *the predicted non-zero motion vector is assigned for the skip coding mode of the first segment; and*

114. As discussed in Section IX.A.2.a.ii (limitation 1[b]), after assigning the *skip coding mode* based on an efficiency determination (considering rate distortion),

Karczewicz's second segment (*the first segment*) is coded using a prediction motion vector field "extrapolated from a neighboring segment." Karczewicz, 31:16-17. Because Karczewicz already discloses coding a second segment with a non-zero motion vector, a POSITA would have understood that coding the second segment with a prediction motion vector field extrapolated from a neighboring vector means that the second segment is coded with a non-zero motion vector (*assign[ing] the predicted non-zero motion vector [] for the skip coding mode of the first segment*).

iii. 23[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.*

115. As discussed in Section IX.A.2.a.iii (limitation 1[c]), Karczewicz forms a motion vector prediction field for its second segment (*the first segment*) with respect to a reference frame based on one or more previously coded segments (*the second segment*). *E.g.*, Karczewicz, 13:29-30, 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 extrapolated from a neighboring segment (Karczewicz, 31:16-17), a POSITA would have understood that *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 predicted non-zero motion vector* because the non-zero motion vector of the neighboring segment would be used to predict the second segment.

- e. **Claim 24:** *A method according to claim 1, 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.*

116. Karczewicz does not explain how previously coded neighboring segments (*the second segment*) are predicted because, to describe its invention, Karczewicz only requires that the neighboring segment be previously coded (and thus known to both the encoder and decoder). *E.g.*, 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.”). Nevertheless, Karczewicz does disclose that a segment may be assigned a zero motion vector, meaning it is copied from the reference frame. Karczewicz, 31:22-24 (“The segment can also be coded by using a zero motion vector field, e.g., a copy from the reference frame ...”), 13:29-30 (“[a] motion vector field that describes the mapping of pixel values between the reference frame and the first segment of the current frame ...”). So if a previously coded neighboring segment (*the second segment*) has a zero motion vector, it would be predicted using the reference picture. And if the previously coded neighboring segment has a zero motion vector, Karczewicz’s second segment (*the first segment*) would likewise have a zero motion vector after applying a prediction based on the reference frame (*see supra* Section IX.A.2.c (claim 6)).

- f. **Claim 25:** *A method according to claim 1, 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.*

117. Karczewicz discloses or suggests claim 25 for the reasons discussed in Sections IX.A.2.c (claim 6) and IX.A.2.e (claim 24) because Karczewicz is agnostic as to whether the reference frame *immediately preced[es]* the current frame. Karczewicz, 5:30-6:2 (“[a] so-called reference frame ... is usually, but not necessarily, the frame immediately preceding that currently being coded.”).

- g. **Claim 28:** *A method according to claim 1, further comprising: deriving the predicted non-zero motion vector based at least in part on the motion vector of the second segment.*

118. Karczewicz discloses claim 28 for the reasons discussed in Section IX.A.2.a.ii (limitation 1[b]). As an example, Karczewicz derives a motion vector for a second segment (*the first segment*) based on the motion field of one or more previously coded neighbors (*the second segment*). E.g., Karczewicz, 17:8-14 (“The segment may be represented as a prediction field only. 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 . . .”).

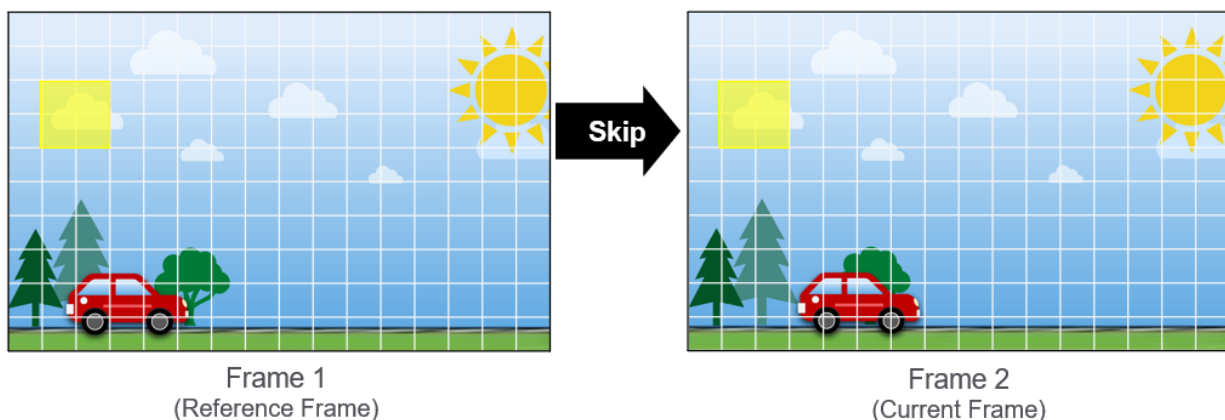
- h. Claim 29: *A method according to claim 1, further comprising: deriving the predicted non-zero motion vector based at least in part on the motion vector of the second segment and motion vector of a third segment neighboring the first segment.***

119. Karczewicz discloses or suggests claim 29 for the reasons as discussed in Section IX.A.2.a.ii (limitation 1[b]). For example, the motion vector for Karczewicz's second segment (*the first segment*) is derived from "one or more of its previously coded neighbors" (*the second segment* and *third segment*) Karczewicz, 17:10-14, 16:16-19 ("the encoder can try to predict the motion coefficients for a given segment using the motion field model for the segment above it or to the left. Alternatively, it can form some kind of average, using the motion field model for both neighbors.").

- i. Claim 30: *A method according to claim 1, wherein no residual information is provided for the first segment in the encoded bitstream.***

120. Karczewicz's "prediction error coder determines the differences in pixel value between the current input video frame and the MC predicted version of the frame in order to produce an indication of the prediction error." Karczewicz, 20:22-25. Karczewicz does not discuss how to handle instances where prediction error is calculated to be zero. Such instances may occur, for example, where zero motion occurs at a macroblock between two frames, and the macroblock is coded with a zero motion vector. In this case, the motion predicted macroblock and the actual macroblock would have the same pixel values, and prediction error would be zero. Such a scenario is illustrated through for instance, the example that I earlier provided in the Technology

Overview, Section VII.A, wherein there is zero motion for the pixels within the yellow box:



121. In such instances, it would have been obvious to a POSITA, based on the teachings of Karczewicz and the coding standards at the time, not to encode (and thus not to send) prediction error for a segment if prediction error is calculated to be zero. Karczewicz teaches efficiently coding segments in the rate-distortion sense, Karczewicz, 14:12-17, so a POSITA would have found it obvious that instead of coding numerous zeros for the prediction error of pixels in a segment, no prediction error would be sent. Doing so would have been obvious based on Karczewicz's teachings, which include, for example, the MCI bit that is used to indicate a set of all-zero motion field coefficients. Karczewicz, 37:5-13. Furthermore, applying the same principle with regard to prediction error, a POSITA would have found it obvious to use an indicator similar to the MCI bit to code zero prediction error for a segment. Doing so would have been no more than making 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).

122. Omitting prediction error where it is calculated to be zero would have also been obvious to a POSITA based on the contemporary coding standards, such as H.262, H.263 (and variants such as H.263+ and H.263++), as well as the emerging H.26L standard. In each of these standards, a block-based transform such as the discrete cosine transform (DCT) or an integer approximation thereto was applied to each block of prediction error values to obtain a corresponding block of “transform coefficients.” E.g., Karczewicz, 24:12-14; Wang, 294, Fig. 9.12; Bhaskaran, 168; H.263 (EX-1009) at Section 5.4.2, Table 16, Table 17, pp. 41-44, Section 6.2, pp. 46-47; JM-1r1 (EX-1012) at Section 4.3, pp. 30-32. The transform coefficients are then quantized and scanned in a zig-zag order to obtain a sequence of quantized transform coefficients. This sequence is run-length coded, meaning that each run of consecutive zero values is represented by a count of the number of consecutive zero values paired with an encoding of the non-zero value that terminates the run. A special flag called “LAST” in H.263 (“this is the last non-zero coefficient in this block,” H.263 at Section 5.4.2 on p. 41) and “EOB” in H.26L (“End Of Block”, see JM-1r1 (EX-1012) at 32) was used to signal that all remaining values in the 1D sequence of quantized transform

coefficients were equal to zero. A POSITA would have understood, or at the very least found it obvious that where zero prediction error is calculated, the prediction error is not coded. Instead, a “LAST” or “EOB” flag is encoded to represent the entire block of zero-valued quantized coefficients. See, e.g., JM-1r1 (EX-1012), Section 4.3.3.2 on p. 31 (“remember that a lot of 4x4 blocks only have EOB”).

123. Accordingly, a POSITA would have understood or found it obvious that when the difference between the current input video and the MC-predicted version of Karczewicz’s second segment (*the first segment*) is zero, the prediction error for that segment would also be zero. Therefore it would have been obvious not to send the prediction error when it is calculated to be zero (*no residual information is provided*).

3. Claim 7 and Dependents (Decoding Method Claims)

These claims would have been obvious to a POSITA based on the above analyses of Karczewicz and because Karczewicz’s decoding method performs the same steps as the encoding method in forming a segment prediction. Karczewicz, 27:17-22.

a. Claim 7

i. 7[a]: *receiving an indication of a skip coding mode for a first segment;*

124. As I explained in Section IX.A.2.a.iv (limitation 1[d]), Karczewicz’s encoder sends to the decoder—and the decoder receives—a zero MCI bit signaling no motion coefficients for a segment. Karczewicz, 37:12-13 (“An all-zero pattern [for motion coefficients] ... can be signaled by the MCI bit alone”). And as I further

explained in Section IX.A.2.a.i (limitation 1[a]), a POSITA would have understood a zero MCI bit to be *an indication of a skip coding mode* for Karczewicz's second segment because it indicates that there are no motion coefficients coded in the segment. The decoder therefore receives the zero MCI bit (*an indication of a skip coding mode*) for the *first segment*.

- ii. **7[b]: 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**

125. Karczewicz discloses or suggests this limitation for the reasons discussed in Section IX.A.2.a.ii (limitation 1[b]) because a POSITA would have understood that Karczewicz's decoding method performs the same steps as the encoding method for forming a segment prediction. Karczewicz, 27:17-22 ("The functional elements of the MC predictor 36 are similar for both the encoder and the decoder and the MC predictor is operable, at both the encoder and decoder to reconstruct the pixels of a current frame by calculating the motion vector fields of each segment within the frame. The motion vector field is computed based upon a prediction motion vector field ($\Delta x_{prd}(x, y), \Delta y_{prd}(x, y)$) and the refinement motion vector field coefficients.").

126. I understand that PO may argue that Karczewicz does not disclose limitation 7[b] because a decoder cannot perform an efficiency determination as taught with regard to Karczewicz's encoder because the decoder does not have access to the

uncoded image. Such an argument would be incorrect. As I explained in Section IX.A.2.a.ii (limitation 1[b]), Karczewicz teaches making an efficiency determination that may result in the encoder *assigning a skip coding mode*.... Unlike the encoding claims, the decoding claims require only *receiving an indication of a skip coding mode*..., which Karczewicz discloses or suggests as discussed in Section IX.A.3.a.i (limitation 7[a]). The *assigning either a zero motion vector*... in 7[b] is performed at the decoder if, after receiving a zero MCI bit, the decoder does not receive a bit indicating that a prediction field is used, meaning that the segment is coded with an all-zero motion field and without a prediction field. And the *assigning... a predicted non-zero motion vector* in 7[b] is performed at the decoder if it receives a bit indicating a prediction motion vector field is used. Karczewicz, 32:18-20.

127. In either case, the decision whether to code a segment based on a prediction field (and thus send a bit indicating the use of a prediction field) is provided by the encoder *based at least in part on the motion information of a second segment*... as explain in Section IX.A.2.a.ii (limitation 1[b]). A POSITA would have therefore understood that the assigning recited in 7[b] is also therefore based at least in part on the motion information of a second segment neighboring the first segment because this motion information is used by the encoder to determine whether to code the segment with a prediction field (and thus instruct the decoder to decode the segment using a prediction field). And further, for the reasons explained in Section IX.A.2.a.ii

(limitation 1[b]), *the predicted non-zero motion vector... is based at least in part on the motion of a second segment neighboring the first segment.*

- iii. **7[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.***

128. Karczewicz discloses or suggests this limitation for the reasons discussed in Section IX.A.2.a.iii (limitation 1[c]).

- b. **Claim 9: *A method according to claim 7, wherein if a segment in a previously decoded region surrounding the first segment has 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.***

129. Karczewicz discloses or suggests claim 9 for the reasons discussed in Section IX.A.2.c (claim 6) because a POSITA would have understood that Karczewicz's decoding method performs the same steps as the encoding method for forming a segment prediction, and that prediction field is based on a previously decoded region or "second segment" (*see claim 6*). A POSITA would have understood that the previously decoded neighboring first segment (*a segment in a previously decoded region surrounding the first segment*) could be "above or to the left of the segment currently being predicted," which a POSITA would have understood to *surround* the segment being predicted. Karczewicz, 33:7-9.

- c. **Claim 32:** *A method according to claim 7, 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.*

130. A POSITA would have understood Karczewicz to disclose or suggest this claim for the same reasons discussed in Section IX.A.2.c (claim 6).

- d. **Claim 34:** *A method according to claim 7, wherein if the second segment has a non-zero motion vector, the method further comprising deriving the predicted non-zero motion vector based at least in part on the motion vector of the second segment; and the predicted non-zero motion vector is assigned for the skip coding mode of the first segment; and 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.*

131. A POSITA would have understood Karczewicz to disclose or suggest this claim for the reasons discussed in Section IX.A.2.d (claim 23).

- e. **Claim 36:** *A method according to claim 7, 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.*

132. A POSITA would have understood Karczewicz to disclose or suggest this claim for the reasons discussed in Section IX.A.2.e (claim 24).

- f. **Claim 39:** *A method according to claim 7, further comprising: deriving the predicted non-zero motion vector based at least in part on the motion vector of the second segment.*

133. A POSITA would have understood Karczewicz to disclose or suggest this claim for the reasons discussed in Section IX.A.2.g (claim 28).

- g. **Claim 40:** *A method according to claim 7, further comprising: deriving 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.*

134. A POSITA would have understood Karczewicz to disclose or suggest this claim for the reasons discussed in Section IX.A.2.h (claim 29).

- h. **Claim 41:** *A method according to claim 7, wherein no residual information is provided for the first segment in the encoded bitstream.*

135. A POSITA would have understood Karczewicz to disclose or suggest this claim for the reasons discussed in Section IX.A.2.i (claim 30).

- i. **Claim 43:** *A method according to claim 7, 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.*

136. A POSITA would have understood Karczewicz to disclose or suggest this claim for the reasons discussed in Section IX.A.2.f (claim 25).

- j. **Claim 65:** *A method according to claim 7, wherein no further motion vector information for the first segment is retrieved from the encoded bitstream.*

137. A POSITA would have understood Karczewicz to disclose or suggest this claim for the reasons discussed in Section IX.A.2.a.iv (limitation 1[d]). Furthermore, Karczewicz's *skip coding mode* does not send a refinement field, so a POSITA would have understood that *no further motion vector information for the first segment is retrieved from the encoded bitstream* when decoding a segment assigned a *skip coding mode*.

4. **Claim 10 and Dependents (Encoder Claims)**

a. **Claim 10**

- i. **10[pre]:** *A video encoder for encoding a video sequence, the encoder comprises:*

138. Karczewicz discloses *a video encoder for encoding a video sequence*.

Karczewicz, 1:7-8, Figure 1 (annotated):

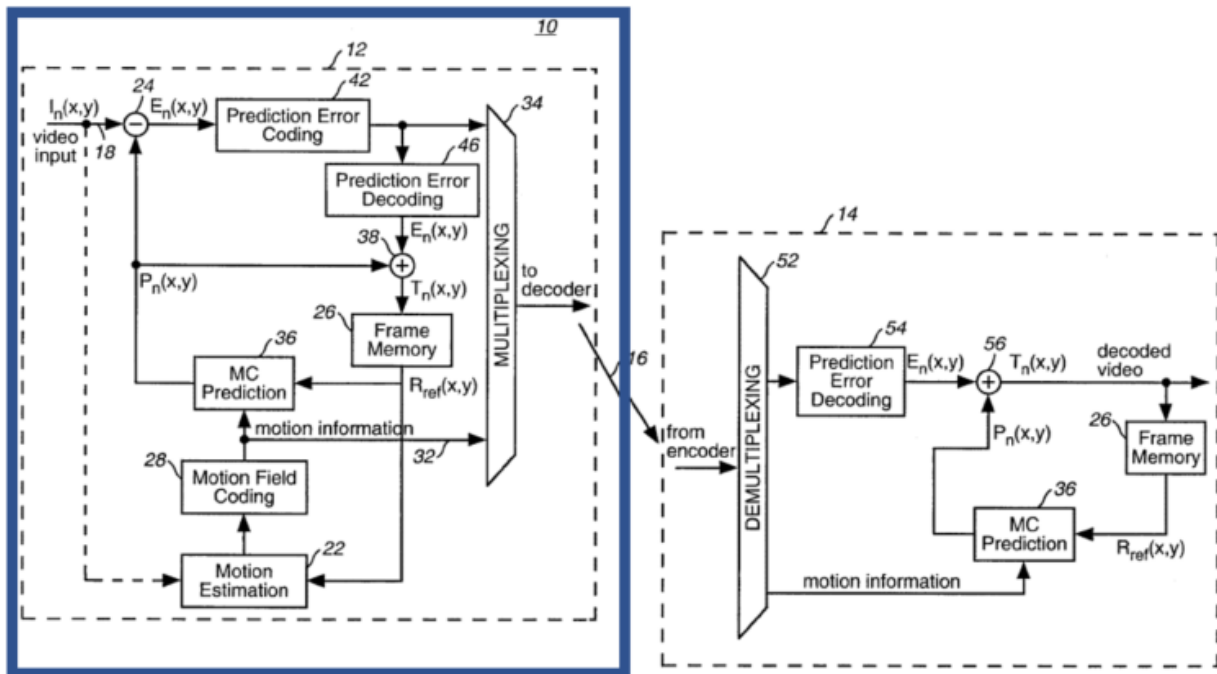


FIG. 1

ii. **10[a]: a coding controller for assigning a skip coding mode to a first segment;**

139. Karczewicz discloses or suggests *assigning a skip coding mode to a first segment* for the reasons discussed in Section IX.A.2.a.i (limitation 1[a]).

140. Karczewicz discloses a motion field coder 28, which determines which of Karczewicz's modes most efficiently codes a segment. Karczewicz, 11:19-23 ("The motion field coder is operable to form a compressed motion vector field which is formed of a set of motion vectors of all pixels of a current frame."), 26:9-27:14 (describing components and functions of motion field coder 28), Fig. 1 (annotated), Fig. 2. A POSITA would have understood Karczewicz's motion field coder 28 is a *coding controller for assigning a skip coding mode to a first segment* because it selects a

prediction field, Karczewicz 26:13-20, a refinement field, *id.*, 26:21-29, and determines an efficient way of coding a segment, *id.*, 26:22-25.

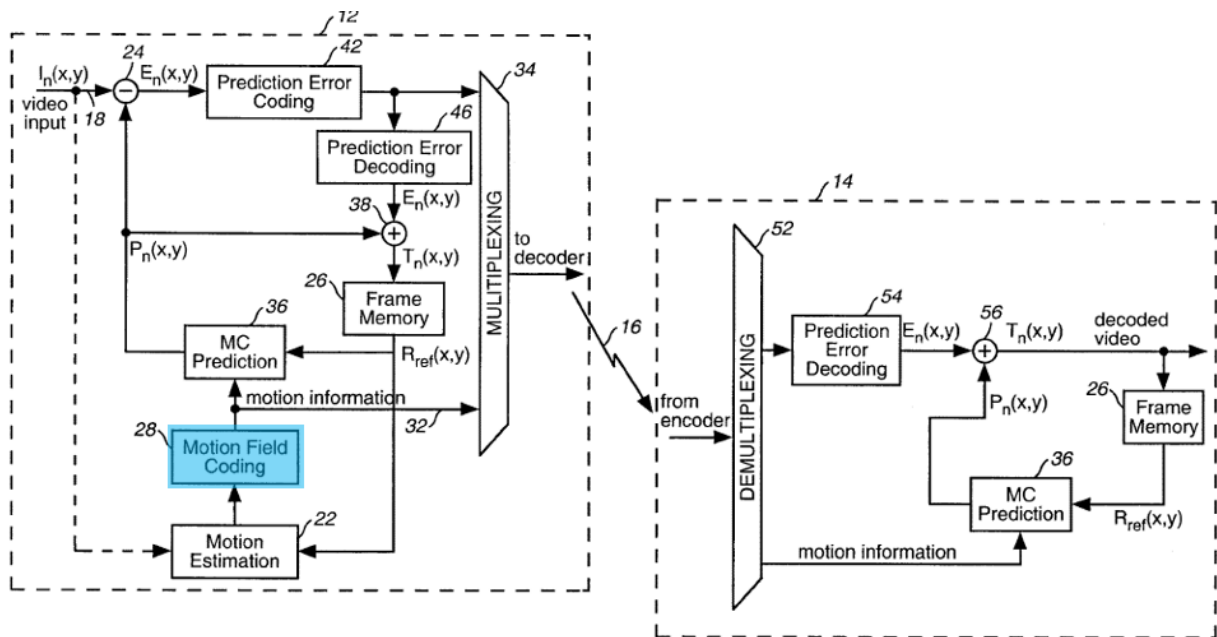


FIG. 1

- iii. 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

141. Karczewicz discloses or suggests *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* for the reasons discussed in Section IX.A.2.a.ii (limitation 1[b]).

142. Karczewicz further discloses its motion field coder 28 performing the *assigning* recited in this claim. Along with Karczewicz's motion compensated predictor 36, which as explained below in IX.A.4.a.iv, *form[s] a prediction for the first*

segment..., the motion field coder and the motion compensated predictor comprise a motion estimation block as recited in 10[b] and 10[c]. Karczewicz, Fig. 1 (annotated).

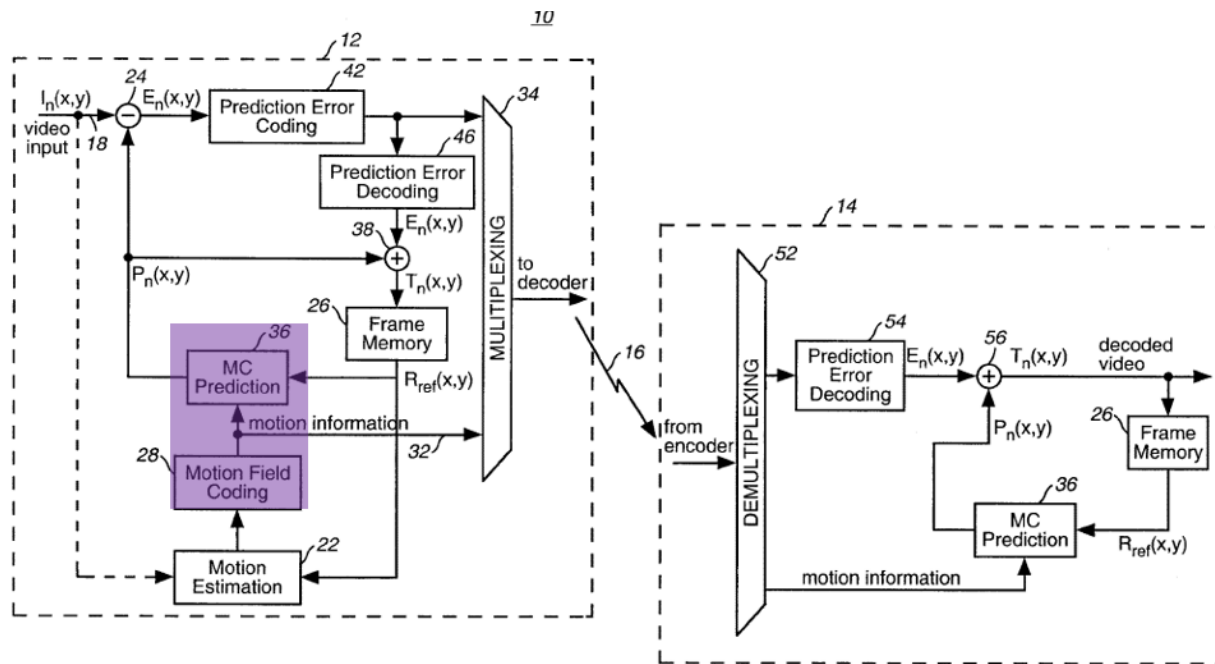


FIG. 1

143. Motion field coder 28 “determine[s] 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 field of a ... current segment.” Karczewicz, 26:13-16, *see also, id.*, 26:9-20. The motion field coder also determines “a mathematically efficient representation” for a segment, Karczewicz, 26:21-25, and forms the motion vector field for said second segment, *id.*, 20:11-13. Thus, the motion field coder 28 *assign[s] either a zero motion vector or a predicted non-zero motion vector for the skip coding mode* for the segment being coded (*first segment*) when it forms the motion vector field for the second segment. And this is *based at least in part*

on the motion information of a second segment neighboring the first segment because the motion field coder 28 considers which previously coded neighboring segment or segments have a motion field(s) that is best suitable for predicting the motion of its second segment. Karczewicz, 26:13-20.

- iv. **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***

144. Karczewicz discloses or suggests this limitation for the reasons discussed in Section IX.A.2.a.iii (limitation 1[c]). Karczewicz discloses that its motion compensated (MC) predictor 36, located at both the encoder and decoder, “reconstruct the pixels of a current frame by calculating the motion vector fields of each segment within the frame.” Karczewicz, 27:15-20, 27:20-30, Figs. 1 (annotated), 2. As explained above in Section IX.A.4.a.iii (limitation 1[c]), Karczewicz’s motion field coder 28 and MC predictor 36 together form the *motion estimation block*.

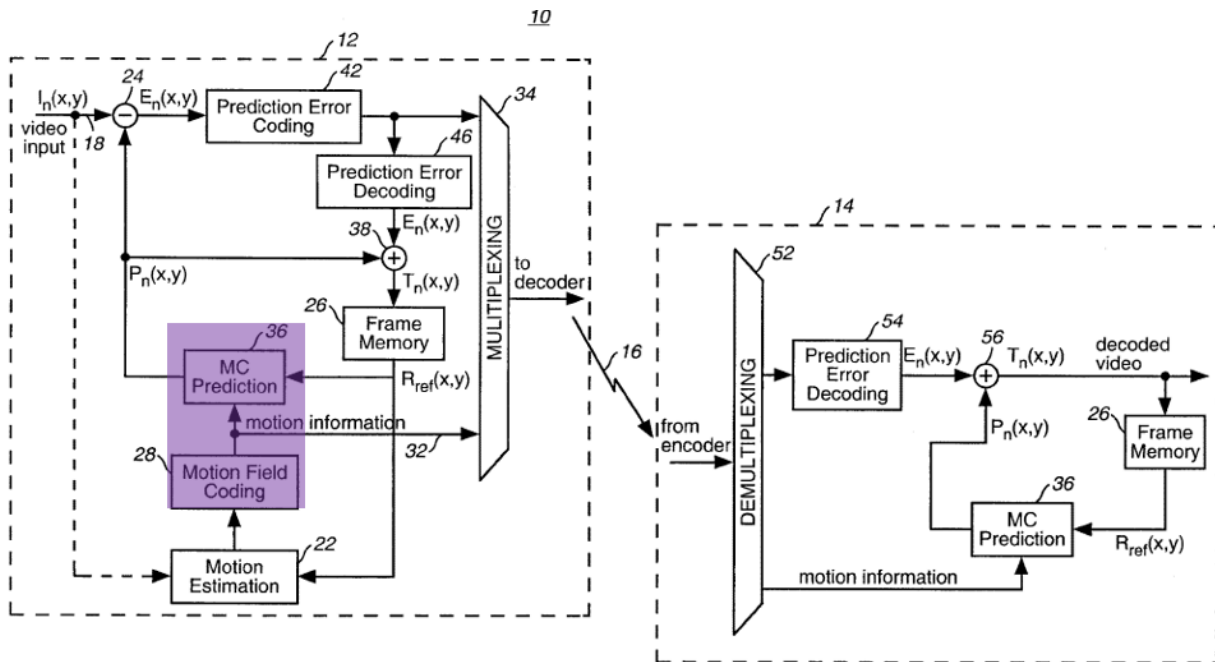


FIG. 1

- v. **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.**

145. Karczewicz discloses or suggests *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* for the reasons discussed in Section IX.A.2.a.iv (limitation 1[d]).

146. Karczewicz further discloses a multiplexor 34 that provides an encoded bitstream to the decoder. Karczewicz, 20:13-16, Fig. 1 (annotated).

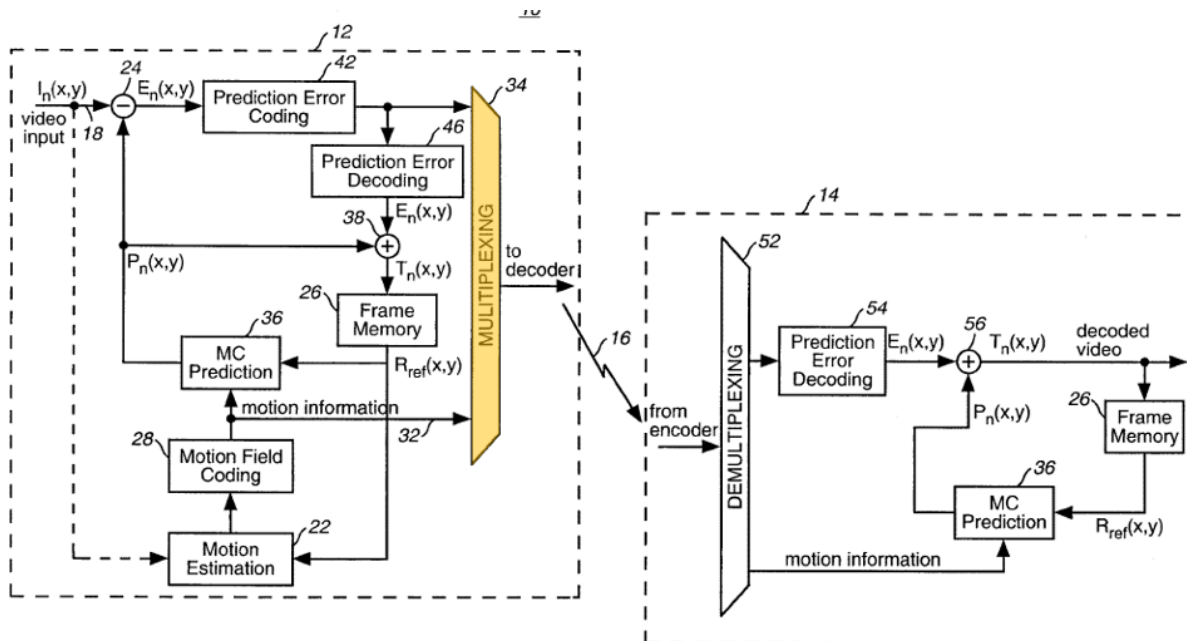


FIG. 1

- b. **Claim 11:** *An encoder according to claim 10, wherein the second segment is a previously encoded segment neighboring the first segment.*

147. Karczewicz discloses or suggests the additional limitations of claim 11 for the reasons discussed in Section IX.A.2.b (claim 2).

- c. **Claim 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.*

148. Karczewicz discloses or suggests the additional limitations of claim 15 for the reasons discussed in Section IX.A.2.c (claim 6). I note that claim 6 recites *the second segment has a zero motion vector...* while claim 15 recites *a segment in a region surrounding the first segment has a zero motion vector....* A POSITA would have

understood any one of the previously coded segments surrounding the segment being coded, which Karczewicz teaches may be used in a prediction field to be both *a second segment* and *a segment in a region surrounding the first segment*.

d. Claim 21: *A multimedia terminal, comprising an encoder according to claim 10.*

149. Karczewicz discloses implementing its teachings in communications systems and video conferencing. Karczewicz, 1:19-22. A POSITA would have understood that 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.

e. Claim 44

i. 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*

150. Karczewicz discloses or suggests this limitation for the reasons discussed in Section IX.A.2.d.i (limitation 23[a]). As further discussed in Sections IX.A.4.a.iii-IX.A.4.a.iv (limitations 10[b]-10[c]), Karczewicz's MC predictor 36 together with motion field coder 28 comprise the recited *motion estimate block* and *forms* (and a POSITA would have understood it to also *derive*) predicted motion vectors.

- ii. **44[b]: *the predicted non-zero motion vector is assigned for the skip coding mode for the first segment; and***

151. Karczewicz discloses or suggests this limitation for the reasons discussed in Section IX.A.2.d.ii (limitation 23[b]).

- iii. **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.***

152. Karczewicz discloses or suggests this limitation for the reasons discussed in Section IX.A.2.d.iii (limitation 23[c]).

- f. **Claim 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.***

153. Karczewicz discloses or suggests the additional limitations of claim 47 for the reasons discussed in Section IX.A.2.g (claim 28). As further discussed in Sections IX.A.4.a.iii-IX.A.4.a.iv (limitations 10[b]-10[c]), Karczewicz's MC predictor 36 together with motion field coder 28 comprise the recited *motion estimate block* and *forms* (and a POSITA would have understood it to also *derive*) predicted motion vectors.

- g. Claim 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.*

154. Karczewicz discloses or suggests the additional limitations of claim 48 for the reasons discussed in Section IX.A.2.h (claim 29). As further discussed in Sections IX.A.4.a.iii-IX.A.4.a.iv (limitations 10[b]-10[c]), Karczewicz's MC predictor 36 together with motion field coder 28 comprise the recited *motion estimate block* and *forms* (and a POSITA would have understood it to also *derive*) predicted motion vectors.

- h. Claim 49:** *An encoder according to claim 10, wherein no residual information is provided for the first segment in the encoded bitstream.*

155. Karczewicz discloses or suggests the additional limitations of claim 49 for the reasons discussed in Section IX.A.2.i (claim 30).

- i. Claim 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.*

156. Karczewicz discloses or suggests the additional limitations of claim 51 for the reasons discussed in Section IX.A.2.c (claim 6).

- j. **Claim 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.*

157. Karczewicz discloses or suggests the additional limitations of claim 52 for the reasons discussed in Section IX.A.2.e (claim 24).

- k. **Claim 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.*

158. Karczewicz discloses or suggests the additional limitations of claim 53 for the reasons discussed in Section IX.A.2.f (claim 25).

5. Claim 16 and Dependents (Decoder Claims)

a. Claim 16

- i. **16[pre]:** *A video decoder for decoding an encoded video sequence, the decoder comprising:*

159. Karczewicz discloses *a video decoder for decoding an encoded video sequence*. Karczewicz, 1:7-8, Fig. 1 (annotated):

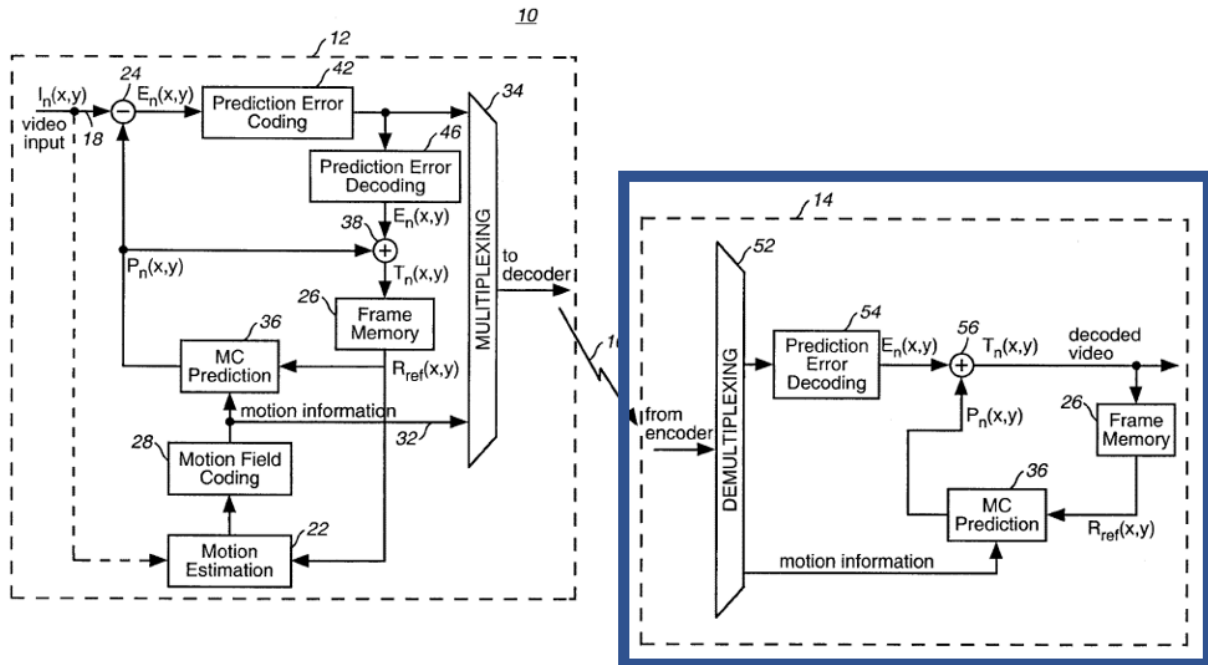


FIG. 1

ii. 16[a]: a demultiplexer for receiving an indication of a skip coding mode assigned to a first segment;

160. Karczewicz discloses or suggests *receiving an indication of a skip coding mode assigned to a first segment* for the reasons discussed in Section IX.A.3.a.i (limitation 7[a]).

161. Karczewicz further discloses a demultiplexer 52 that receives the encoded bitstream (and thus the recited *indication of a skip coding mode assigned to a first segment*). Karczewicz, 21:1 (“The decoder 14 is here shown to include a demultiplexor 52 ...”), Fig. 1 (annotated).

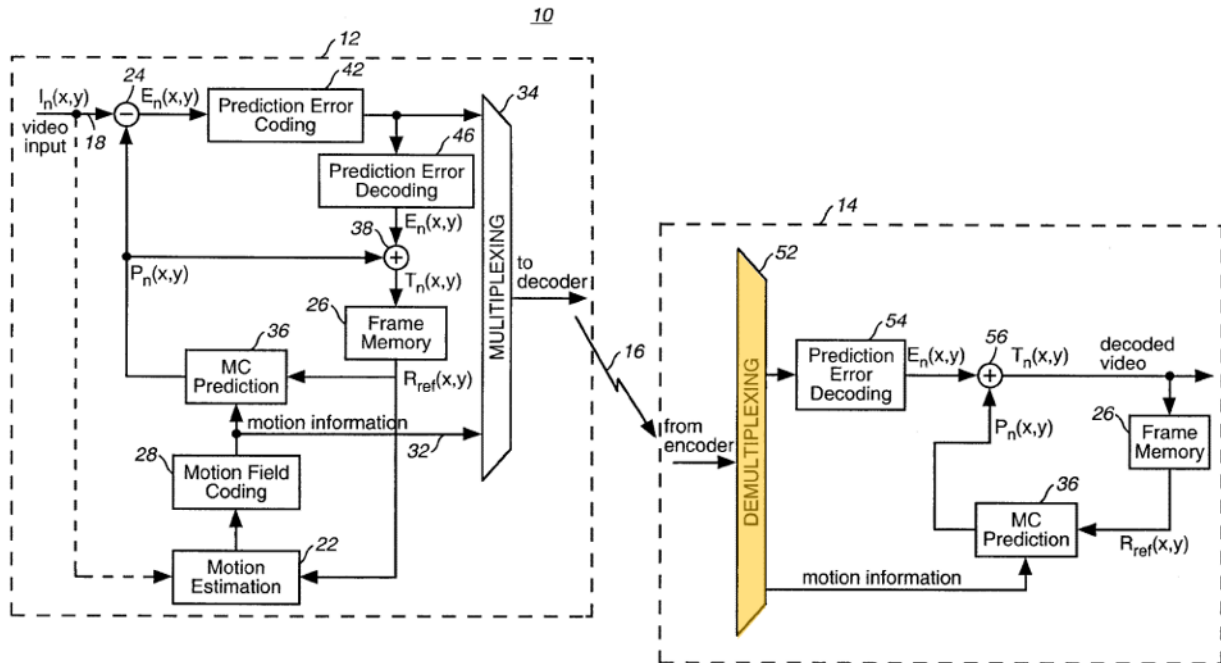


FIG. 1

- iii. 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

162. Karczewicz discloses or suggests *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* for the reasons discussed in Section IX.A.3.a.ii (limitation 7[b]).

163. Karczewicz further discloses that the decoder comprises a motion compensated predictor 36 that calculates the motion vector fields of each segment in the frame and forms a predicted frame. Karczewicz, 27:17-23, Figs. 1, 3. A POSITA would have understood that as part of calculating the motion vector fields and forming

a prediction, the motion compensated predictor 36 performs that *assigning...* recited in 16[b].

- iv. **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.***

164. Karczewicz discloses or suggests this limitation for the reasons discussed in Section IX.A.3.a.iii (limitation 7[c]).

- b. **Claim 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.***

165. Karczewicz discloses or suggests the additional limitations of claim 20 for the reasons discussed in Section IX.A.3.b (claim 9). The only difference between the language in claims 20 and 9 is that claim 9 recites the additional limitation that the *region surrounding the first segment* also be *previously decoded*, so a POSITA would have understood that Karczewicz discloses or suggests claim 20 by virtue of disclosing or suggesting the narrower claim 9.

- c. **Claim 22: *A multimedia terminal comprising a decoder according to claim 16.***

166. Karczewicz discloses implementing its teachings in communications systems and video conferencing. Karczewicz, 1:19-22. A POSITA would have

understood that 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.

- d. **Claim 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.*

167. Karczewicz discloses or suggests the additional limitations of claim 54 for the reasons discussed in Section IX.A.3.c (claim 32).

- e. **Claim 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.*

168. Karczewicz discloses or suggests the additional limitations of claim 58 for the reasons discussed in Section IX.A.3.f (claim 39).

169. The term *motion estimation block* in claim 58 has no antecedent basis in claim 16. I have been asked to consider what structure recited in claim 16 could have performed the additional limitations attributed to the *motion estimation block* in claim 58. Between the two decoder components recited in claim 16, a *motion compensated prediction block* and a *demultiplexer*, a POSITA would have understood that the *motion compensated prediction block*, Section IX.A.5.a.iii (limitation 16[b]), *derive[s] []*

predicted non-zero motion vector[s] based on the prediction field received from the encoder.

- f. **Claim 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.*

170. Karczewicz discloses or suggests the additional limitations of claim 59 for the reasons discussed in Section IX.A.3.g (claim 40).

171. Like in claim 58, the term *motion estimation block* in claim 59 has no antecedent basis in claim 16. A POSITA would have understood that claim 16's *motion compensated prediction block derive[s] [] predicted non-zero motion vector[s]* based on the prediction field received from the encoder for the reasons discussed in Section IX.A.5.e (claim 58).

- g. **Claim 60:** *A decoder according to claim 16, wherein no residual information is provided for the first segment in an encoded bitstream.*

172. Karczewicz discloses or suggests the additional limitations of claim 60 for the reasons discussed in Section IX.A.3.h (claim 41).

- h. **Claim 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.*

173. Karczewicz discloses or suggests the additional limitations of claim 62 for the reasons discussed in Section IX.A.3.e (claim 36).

- i. **Claim 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 respect to a corresponding segment of the reference frame associated with the zero motion vector.*

174. Karczewicz discloses or suggests the additional limitations of claim 63 for the reasons discussed in Section IX.A.3.i (claim 43).

- j. **Claim 64:** *A decoder according to claim 16, wherein no further motion vector information for the first segment is retrieved from an encoded bitstream.*

175. Karczewicz discloses or suggests the additional limitations of claim 64 for the reasons discussed in Section IX.A.3.j (claim 65).

B. Ground 2: MPEG-1 and H.263 Render Obvious the Challenged Claims

1. MPEG-1

176. International Standard ISO/IEC 11172 (“the Standard”) is titled “Information Technology – Coding of Moving Pictures and Associated Audio for Digital Storage Media at Up to About 1,5 Mbit/s.” EX1007, 1. When the Standard was approved in 1993, it consisted of four parts: Systems, Video, Audio, and Compliance Testing. EX1007, 11. ISO/IEC later published a fifth part, which consisted of a software simulation. (*See* ISO/IEC TR 11172-5:1998: Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s Part 5: Software simulation, <https://www.iso.org/standard/25029.html>.)

177. Historically, the term “MPEG-1” referred to all parts of the Standard. But I understand that Petitioner’s Petition uses the term “MPEG-1” to specifically refer to the second part of the Standard (ISO/IEC 11172-2), which concerns video. (*See* EX100X, 11.) I adopt the Petition’s naming convention and refer to the second part of the Standard as MPEG-1.

178. MPEG-1 was developed by the Moving Pictures Expert Group in response to “the growing need for a common format for representing compressed video on various digital storage media such as CDs, DATs, Winchester disks and optical drives.” EX1007, 12, 68. It “specifies a syntax for a coded video bitstream,” (EX1007, 16) and defines the process for decoding that bitstream (EX1007, 15). *See also* EX1007, 18

(“This part of ISO/IEC 11172 specifies the coded representation of video for digital storage media and specifies the decoding process.”).

179. In MPEG-1, “[a] picture corresponds to a single frame of motion video, or to a movie frame.” EX1007, 71. MPEG-1 describes three picture types: I-pictures, P-pictures, and B-pictures. *See* EX1007, 33, 71.

180. First, an “I-picture” (intra coded picture) is “[a] picture coded using information only from itself” (EX1007, 23) and therefore “without reference to any other pictures” EX1007, 71.

181. Second, a “P-picture” (predictive coded picture) is “[a] picture that is coded using motion compensated prediction from the past reference picture.” EX1007, 25. “[T]he past reference picture” is defined to be the nearest adjacent I- or P- picture that occurs at an earlier time in display order. (*See* EX1007, 25 (defining “past reference picture”), 26 (defining “reference picture”); *see also* EX1007, 71 (“P-pictures ... are coded using motion compensation from a previous I or P-picture.”).)

182. Third, a “B-picture” (bidirectionally predictive coded picture) is “[a] picture that is coded using motion compensated prediction from a past and/or future reference picture.” EX1007, 20; *see also* EX1007, 71. MPEG-1’s Figure 1 illustrates how these three picture types relate to one another:

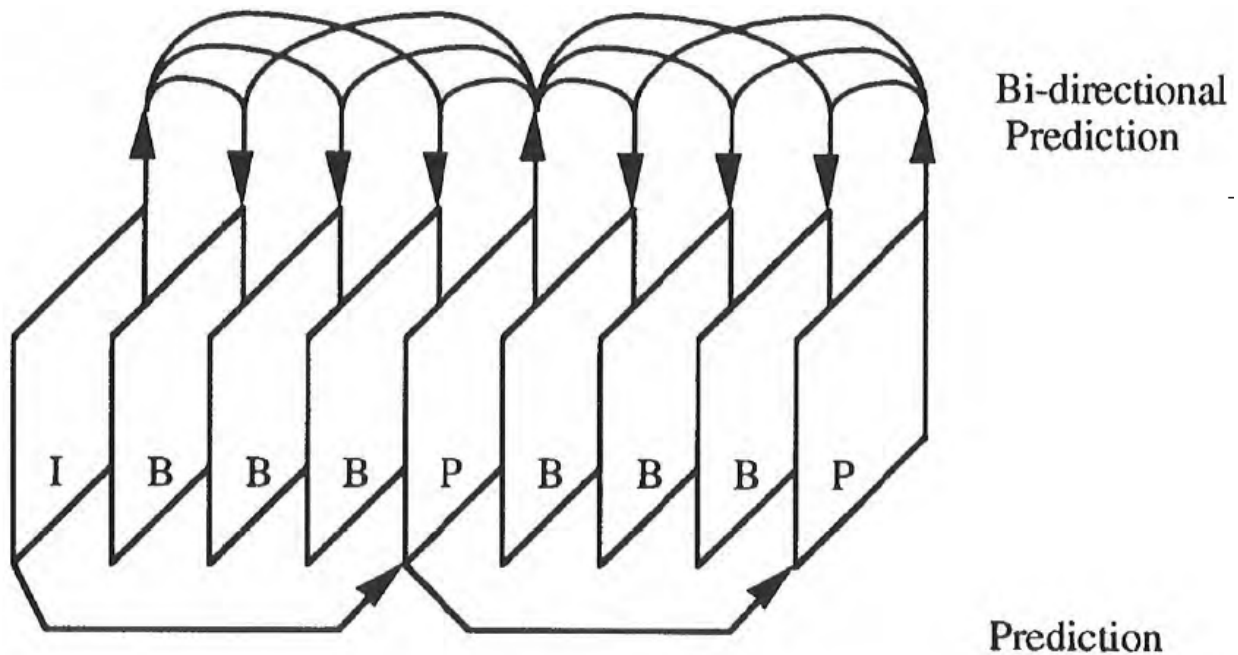
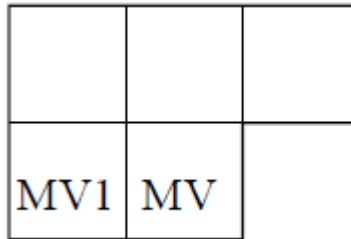


Figure 1 -- Example of temporal picture structure

183. MPEG-1 further teaches “skipped macroblocks,” which are “macroblock[s] for which no data [is] stored.” E.g., EX1007, 26, *see also*, EX1007, 54-55 (“for [skipped macroblocks] there are no coded data, that is neither motion vector information nor DCT information is available to the decoder ... skipped macroblocks ... are indicated when the macroblock_address_increment is greater than 1.”

184. MPEG-1 recognizes that “[t]he motion vector of a macroblock tends to be well correlated with the vector of previous macroblock. For example, in a pan all vectors would be roughly the same.” *Id.*, 100. MPEG-1 takes advantage of this observation and teaches that, “[i]n B-pictures, the skipped macroblock is defined to have the same macroblock_type (forward, backward, or both motion vectors) as the prior macroblock, differential motion vectors equal to zero, and not DCT coefficients.”

Id., 54. This means that skipped macroblocks in B-pictures have the same motion vector(s) as the immediately preceding macroblock. To illustrate this, I have created the figure below, wherein MV1 represents the motion vector of the prior macroblock, and MV represents the motion vector currently being coded:



2. H.263

185. The version of International Telecommunication Union (ITU) recommendation H.263 used by Petitioner is titled “Audiovisual and Multimedia Systems, Infrastructure of audiovisual services – Coding of moving video, Video coding for low bit rate communication,” and was ratified in February, 1998. EX1009, 1. H.263 was a widely adopted video compression standard and was well known to POSITAs at the time.

186. H.263 teaches that INTER prediction is the “primary form” of prediction and may be augmented by motion compensation. EX1009, 11. Inter prediction may also be referred to as a P-picture. *Id.* When INTER coding, a picture and/or macroblocks of a picture are predicted from a previous reference picture by taking advantage of temporal redundancy between the current picture and a previously coded reference picture. *Id.*

187. When INTER coding is augmented by motion compensation, by default the “decoder will accept one vector per macroblock.” *Id.*, 12. H.263 motion compensation uses differential motion vectors, wherein the “macroblock vector is obtained by adding predictors to the vector differences indicated by MVD [motion vector data].” *Id.*, 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). *Id.*, 33-34, 38-40, 45, Fig. 10.

188. The other component of obtaining a macroblock vector when employing motion compensation, a predictor, is obtained as “the median value of the three candidate predictors” that are “taken from three surrounding macroblocks” that were previously coded and neighbor the macroblock being coded. *Id.*, 44-45. I have annotated H.263’s Figure 12 below to illustrate the arrangement of the three previously coded macroblocks (MV1-MV3) relative to the macroblock currently being coded (MV):

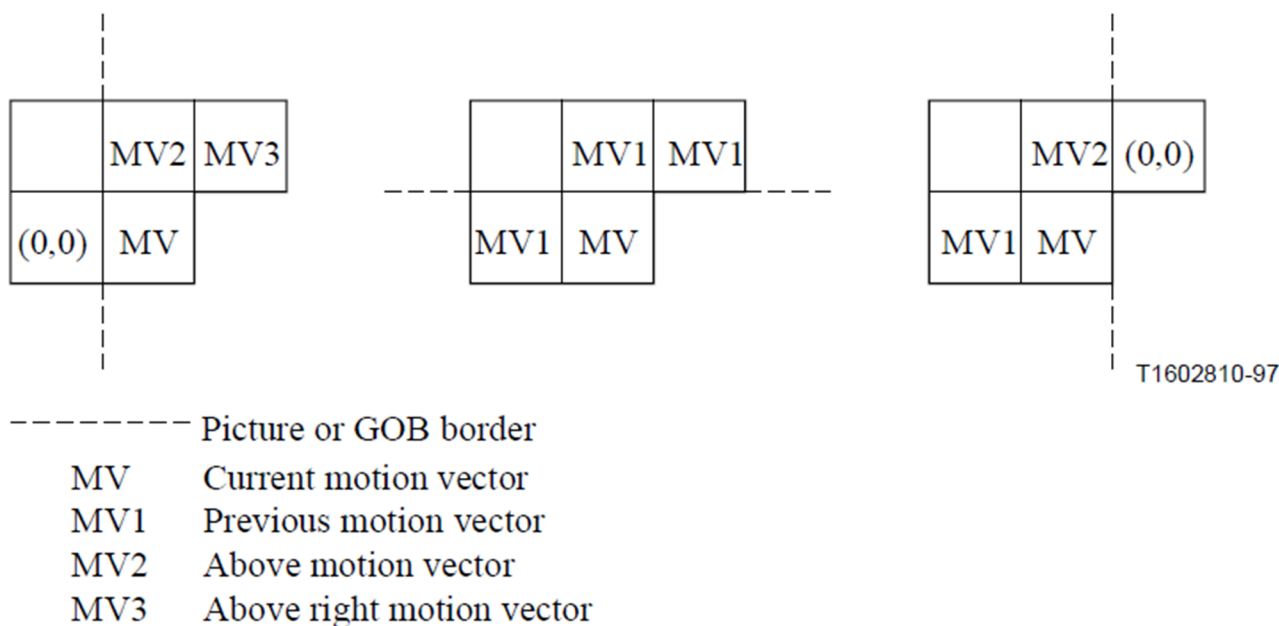
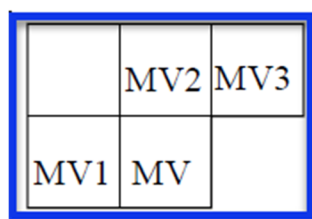


Figure 12/H.263 – Motion vector prediction

189. H.263 thus teaches calculating the median of motion vectors for three previously coded macroblocks to determine the motion vector of a macroblock being coded. *Id.*, 44. H.263 further provides rules for specifying the candidate predictors for calculating the median predictor in certain special cases, discussed below as relevant to the grounds. *Id.*, 44-45.

190. I note that while H.263 discusses its motion vector prediction in the context of a decoder, a POSITA would have understood that an H.263 encoder must follow the

same median prediction rule so that both the encoder and decoder obtain the same motion vectors when forming a prediction.

3. Motivation to Combine

191. In my opinion, by the time of the alleged invention of the '808 patent, a POSITA would have been motivated to improve MPEG-1's skipped macroblocks for B-pictures by implementing H.263's median predictor teaching to assign a motion vector to a skipped macroblock based on the median of three surrounding, previously coded, macroblocks, rather than just the immediately preceding macroblock as MPEG-1 teaches. Median filtering, as has been utilized extensively in the enhancement of digital images, is a nonlinear process targeted to achieve noise reduction without blurring the image as is typically the case with lowpass filtering type techniques. In essence, the gray level of the pixel is replaced by the median of the gray levels in a neighborhood of the pixel (which is typically accomplished by sorting the pixels within a kernel (i.e. a 3x3 block of pixels) and selecting the median), instead of lowpass filtering the image using convolution style methods. The use of median filtering is popular because of its effectiveness in reducing random noise thereby smoothing the image without blurring it. Hence, unlike lowpass filtering, median filtering can preserve discontinuities by smoothing pixels whose values differ significantly from their surroundings (neighborhood) without affecting the other pixels. However, it is known to be a somewhat slower process than convolution due to the need to sort all of the pixels within the given kernel by the gray level in order to select the median.

192. Between MPEG-1's approval in 1993 and H.263's ratification in 1998, significant improvements in processing hardware were made which would have allowed for the implementation of more robust and calculation intensive motion predictions than that taught in MPEG-1, without significantly sacrificing coding speed. Recognizing that more computing power was available to them, a POSITA would have looked to a more recent video coding standard such as H.263 for teachings on utilizing the additional computing power to improve MPEG-1's skipped macroblock coding in B-pictures, which merely predicts the skipped macroblock by copying the motion vector from the immediately preceding macroblock.

193. A POSITA would have recognized that H.263's median prediction technique would have improved MPEG-1's prediction for skipped macroblocks in B-pictures because it uses three data points for obtaining a prediction instead of a single data point as disclosed in MPEG-1. Accordingly, H.263's median prediction would be less likely to inaccurately represent the motion of a skipped macroblock because for the same reasons outlined above (i.e. reducing noise, preserving discontinuities instead of averaging them) for median filtering in imagery.

194. In addition, using H.263's median prediction rather than MPEG-1's single macroblock prediction would have been obvious to a POSITA because it would have made the skip coding mode available in more scenarios. Specifically, MPEG-1 prevents a skipped macroblock from following an intra-coded macroblock. EX1009, 55. On the

other hand, H.263's special case rule 1, explicitly contemplates that a previously coded macroblock that can be used to determine the median prediction may have been intra-coded. EX1007, 44 (“1) When the corresponding macroblock was coded in INTRA mode (if not in PB-frames mode with bidirectional prediction)⁵ or was not coded (COD = 1), the candidate predictor is set to zero.”. Because skipped macroblocks are a very efficient way of coding a macroblock, a POSITA would have been motivated to improve MPEG-1's skipped macroblock with H.263's teaching because it would allow one to code skipped macroblocks in more cases, thereby improving overall coding efficiency.

195. I am informed that Patent Owner may argue that a POSITA would not have been motivated to employ H.263's median prediction for skipped macroblocks in B-pictures of MPEG-1 because subsequent coding standards did not in fact do so. Such an argument would be flawed because coding standards are usually the result of cooperation among multiple stakeholders representing broad, and sometimes competing, interests. In fact, H.264 adopted the idea of the use of the median and re-customized it in computing motion vector predictions for certain types of partitions.

⁵ I note here that this exclusion does not apply to B-pictures in H.263, and thus would not have taught away from the combination, to the extent that PO may argue as much. EX1007, 11-12 (listing PB and B pictures as separate picture types).

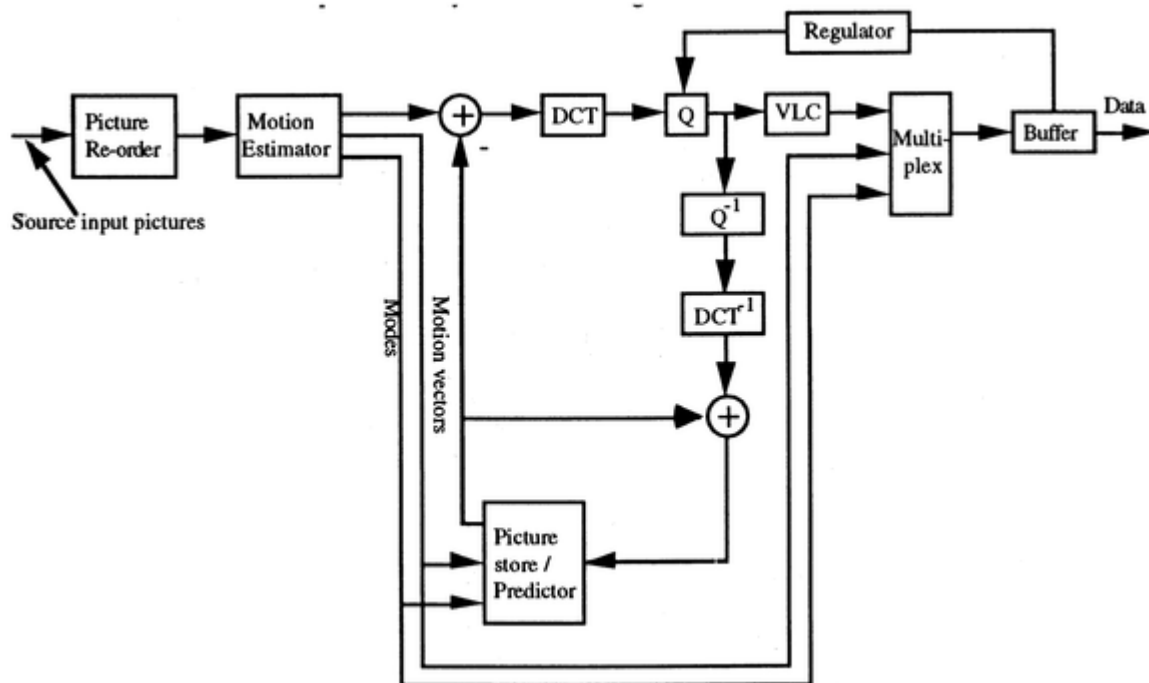
EX1013 (Richardson 1st Ed.), 176. A POSITA would have understood that merely because a particular possible improvement was not entirely adopted as part of a standard, one would not necessarily be dissuaded from making such an improvement if it offered some benefit, such as those explained above. Put another way, standards are often the result of compromises made between multiple competing solutions to a problem, and just because a particular solution was adopted, it does not mean that another, which was not adopted, would not have been made by a POSITA.

4. Claim 1 and Dependents (Encoding Method Claims)

a. Claim 1

i. (i) 1[pre]: *A method of encoding a video sequence, the method comprising:*

196. MPEG-1 does not specify an encoding process, thereby leaving options for encoders to “trade-off cost and speed against picture quality and coding efficiency.” EX1007, 14. MPEG-1 does disclose the “functions that need to be performed by an [MPEG-1 compliant] encoder” and provides a simplified video encoder block diagram. *Id.*, 14, Figure 2.



MPEG-1 at Figure 2 — Simplified video encoder block diagram

197. These functions include digitizing a video input signal, preprocessing, format conversion, motion vector estimation, picture reordering, and coding of macroblocks sequentially within a picture. *Id.* Relevant to the grounds, MPEG-1 further teaches choosing a picture type to use for a picture and estimating motion vectors for each macroblock within the picture. *Id.*, 14-15. MPEG-1 further describes the steps of choosing a coding mode, motion-compensated prediction, forming an error signal, DCT, quantization, and variable length coding, concluding with the regeneration of I-Pictures and P-Pictures for further encoding. *Id.* Thus, MPEG-1 discloses or suggests “a method for encoding a video sequence” as claimed.

ii. (ii) 1[a]: *assigning a skip coding mode to a first segment of a first frame of the sequence;*

198. A POSITA would have understood that MPEG-1 combined with H.263's teaching for forming a median predictor discloses or suggests "assigning a skip coding mode to a first segment of a first frame of the sequence."

199. MPEG-1 teaches using "skipped macroblock[s]" for which there is "no coded data, that is neither motion vector information nor DCT information is available to the decoder." EX1007, 54. MPEG-1 further teaches that for B-pictures "the skipped macroblock is defined to have the same macroblock_type (forward, backward, or both motion vectors) as the prior macroblock, differential motion vectors equal to zero, and no DCT coefficients." *Id.*, 55. Thus, an MPEG-1 skipped macroblock uses the same reference picture(s) and has the same motion vectors as the immediately preceding, previously coded macroblock. Put differently, for B-pictures, MPEG-1 teaches using the immediately preceding macroblock as a motion vector predictor.

200. By the time of the alleged invention, a POSITA would have been motivated to improve MPEG-1's skipped macroblocks in B-pictures by using a median predictor calculated from three previously coded surrounding macroblocks, as taught by H.263, for the reasons I discussed in Section IX.B.3 (motivation to combine MPEG-1 and H.263). Specifically, rather than using the motion vector(s) from the single preceding previously coded macroblock, a POSITA would have taken a median of the motion vectors from three previously coded macroblocks surrounding the current

macroblock as taught by H.263 to obtain the motion vector for a skipped macroblock.

(EX1009, 44-45, Figure 12):

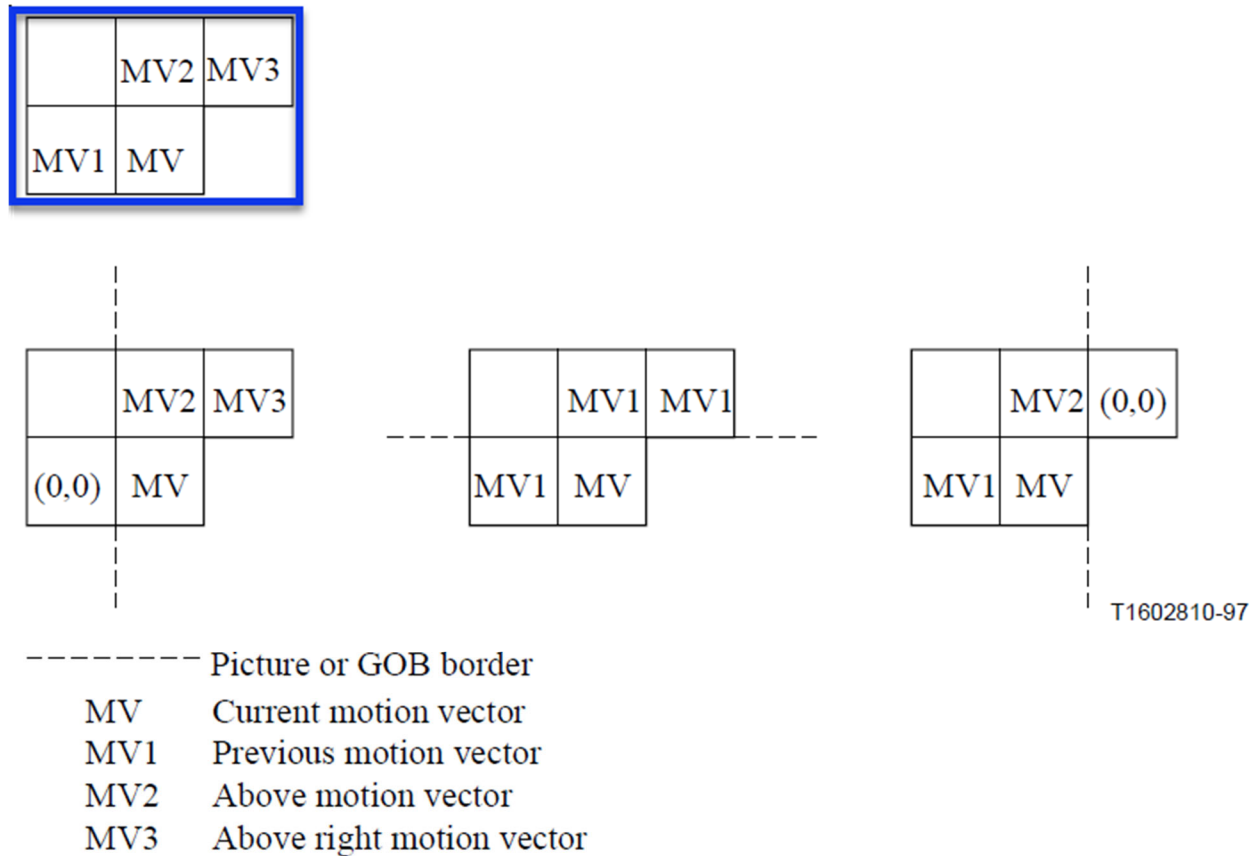


Figure 12/H.263 – Motion vector prediction

201. H.263’s median prediction calculates the median value of each of the horizontal and vertical components of the motion vectors of three candidate predictors, MV1, MV2, and MV3 surrounding the macroblock currently being coded, MV. *Id.*, 44-45. Thus, when MPEG-1’s skipped macroblock assigns a motion vector using H.263’s median predictor, the motion vector is “depending on the motion in image segments” (i.e., MV1, MV2, and MV3) “surrounding the macroblock in question” (MV), as recited in the claim construction of “skip coding mode.”

202. Further, a POSITA would have understood that depending on the result of the median calculation, either “a zero (non-active) motion vector or a non-zero (active) motion vector is associated with each skip mode macroblock.” In other words, if the median of MV1, MV2, and MV3 is equal to zero, then the skipped macroblock would be assigned a zero (non-active) motion vector. Conversely, if the median of MV1, MV2, and MV3 is not equal to zero, then the skipped macroblock would be assigned a non-zero (active) motion vector.

203. I am told that Patent Owner may argue that my analysis above regarding associating either a “zero (non-active) motion vector or a non-zero (active) motion vector) with a skipped macroblock in MPEG-1 by using H.263’s median prediction teachings conflates the results (associating a zero or non-zero motion vector with the skipped macroblock) with the claimed process, which Patent Owner may argue requires “automatically generating,” rather than predicting, a zero motion vector in response to a classification of “non-active” motion after surrounding motion analysis. In my opinion, such an argument would be incorrect.

204. First, neither the claim nor the construction for “skip coding mode” requires that a zero (non-active) motion vector be “automatically generated” or indeed “generated.”

205. Second, the claim recites “assigning a skip coding mode,” and the claim construction for “skip coding mode” requires that the zero (non-active) or non-zero

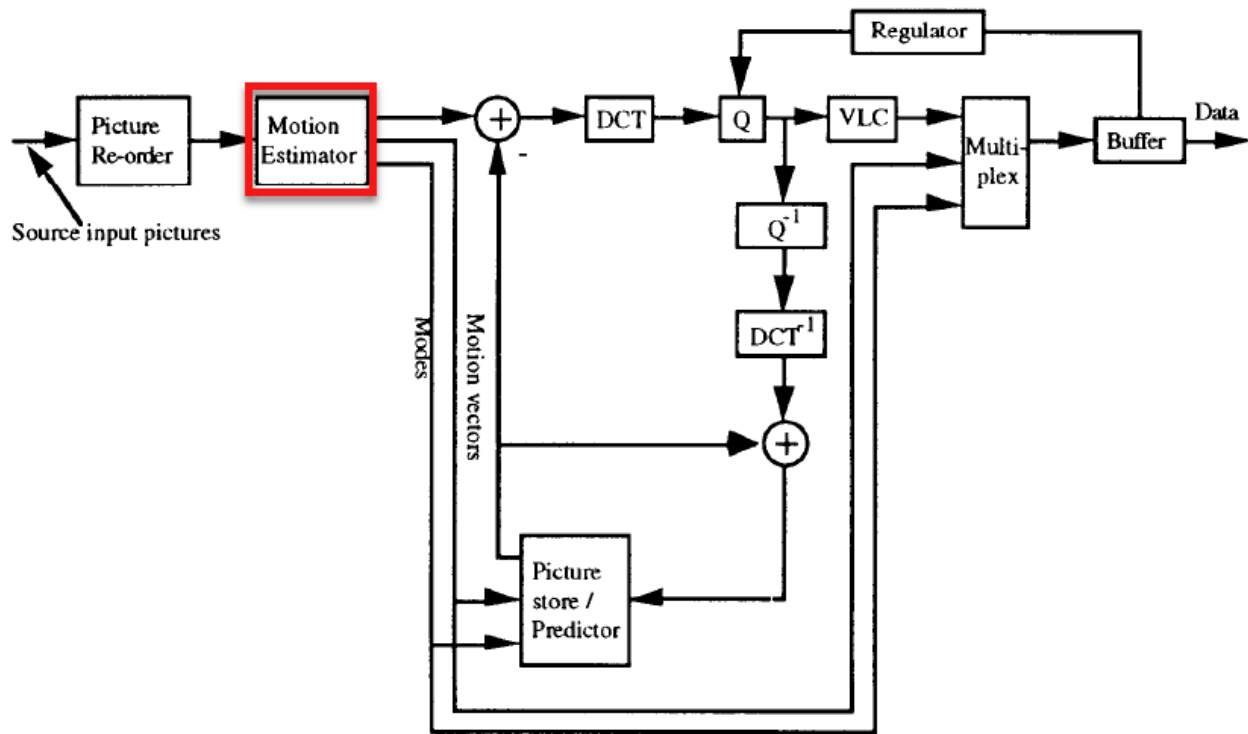
(active) motion vector “is associated with each skip mode macroblock, depending on the motion in image segments surrounding the macroblock in question,” which the combination of MPEG-1 and H.263 renders obvious as explained above. Neither the claim nor the construction for “skip coding mode” requires “analysis” of motion of a region surrounding the “first segment,” as I am told Patent Owner may argue. Indeed, performing “analysis” is recited in claims that are not challenged in this IPR, such as claims 5, 8, 14, 19, 26, 37, 45, and 56. A POSITA would have recognized the difference in language used in these claims and the Challenged Claims and understood that “analysis” is not required by the Challenged Claims. This is further consistent with an embodiment described in the ’808 patent’s specification wherein surrounding motion analysis does not occur at all. EX1001, 24:42-45.

206. A POSITA would have therefore understood that the combination of MPEG-1 and H.263 discloses or suggests *assigning a skip coding mode to a first segment of a first frame of the sequence* (coding a “skipped macroblock” in a B-picture), wherein the encoding method uses H.263’s median prediction teachings to determine the motion vector for the skipped macroblock by calculating the median of three previously coded macroblocks surrounding the skipped macroblock. Using H.263’s median prediction teachings, MPEG-1’s “skip coding mode” is “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 motion in image

segments surrounding the macroblock in question,” i.e., depending on the result of the median calculation of MV1, MV2 and MV3, which represent “the motion in image segments surrounding” MV, as taught by H.263.

- iii. ***1[b]: 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***

207. The combination of MPEG-1 and H.263 discloses or suggests this limitation. MPEG-1 teaches that its encoder includes a “Motion Estimator,” which I have annotated red in Figure 2 below. EX1007, 14-15.



where

DCT is discrete cosine transform

DCT⁻¹ is inverse discrete cosine transform

Q is quantization

Q⁻¹ is dequantization

VLC is variable length coding

Figure 2 -- Simplified video encoder block diagram

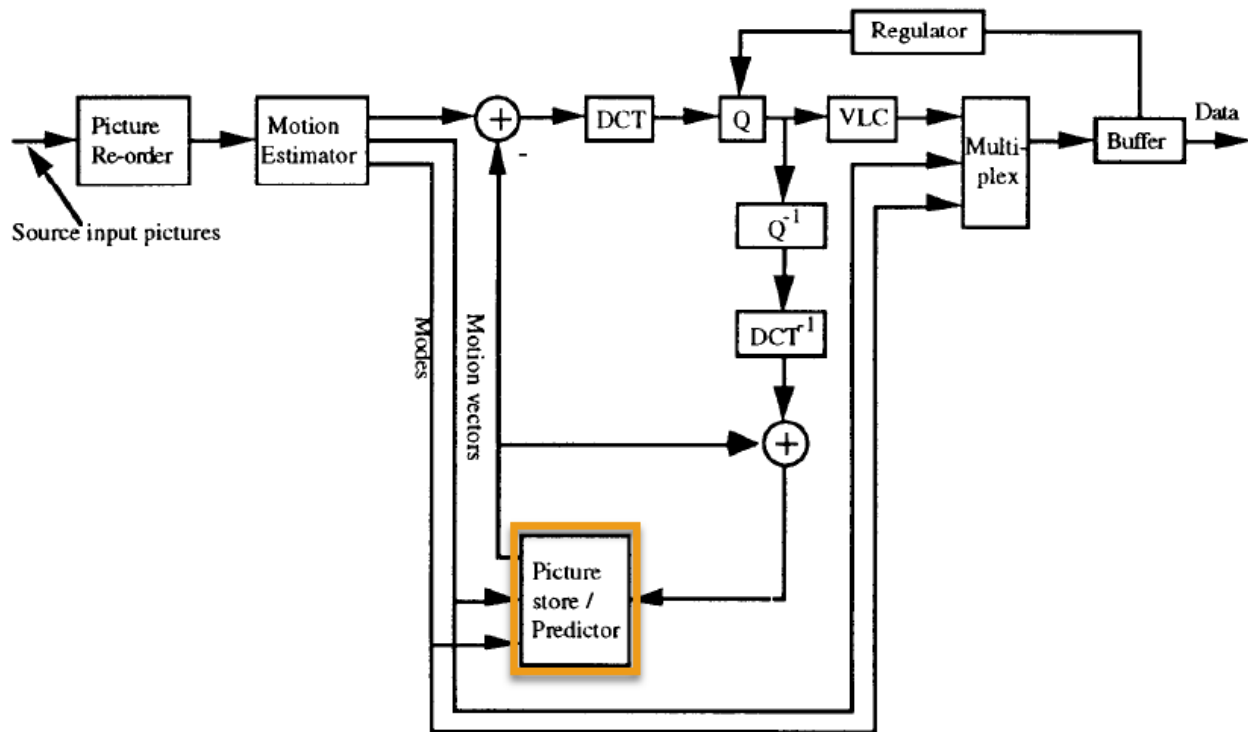
208. The motion estimator chooses the coding mode for a given macroblock, and the mode and motion vectors associated with the macroblock are then sent to the Picture store/Predictor, as indicated by the lines labeled “Modes” and “Motion vectors” in Figure 2 above.

209. As I explained above in Section IX.B.4.a.ii (limitation 1[a]), modifying MPEG-1 to use H.263’s median prediction for skipped macroblocks assigns *either a zero motion vector or a predicted non-zero motion vector for the skip coding mode* depending on the result of the median calculation of MV1, MV2, and MV3. This

motion vector is assigned to the *skip mode* for the macroblock by MPEG-1's motion estimator, as explained above. Further, the assigned motion vector is "based at least in part on the motion information of a second segment neighboring the first segment," e.g., any one of MV1, MV2, or MV3, because those are the motion vectors used in the H.263's median calculation.

- iv. ***1[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***

210. The combination of MPEG-1 and H.263 discloses or suggests this limitation. MPEG-1 discloses a Picture store/Predictor, which I have annotated orange in Figure 2 below. As I explained in Section IX.B.4.a.iii (limitation 1[b]), the Picture store/Predictor receives mode and/or motion vector information from the Motion estimator.



where

DCT is discrete cosine transform

DCT^{-1} is inverse discrete cosine transform

Q is quantization

Q^{-1} is dequantization

VLC is variable length coding

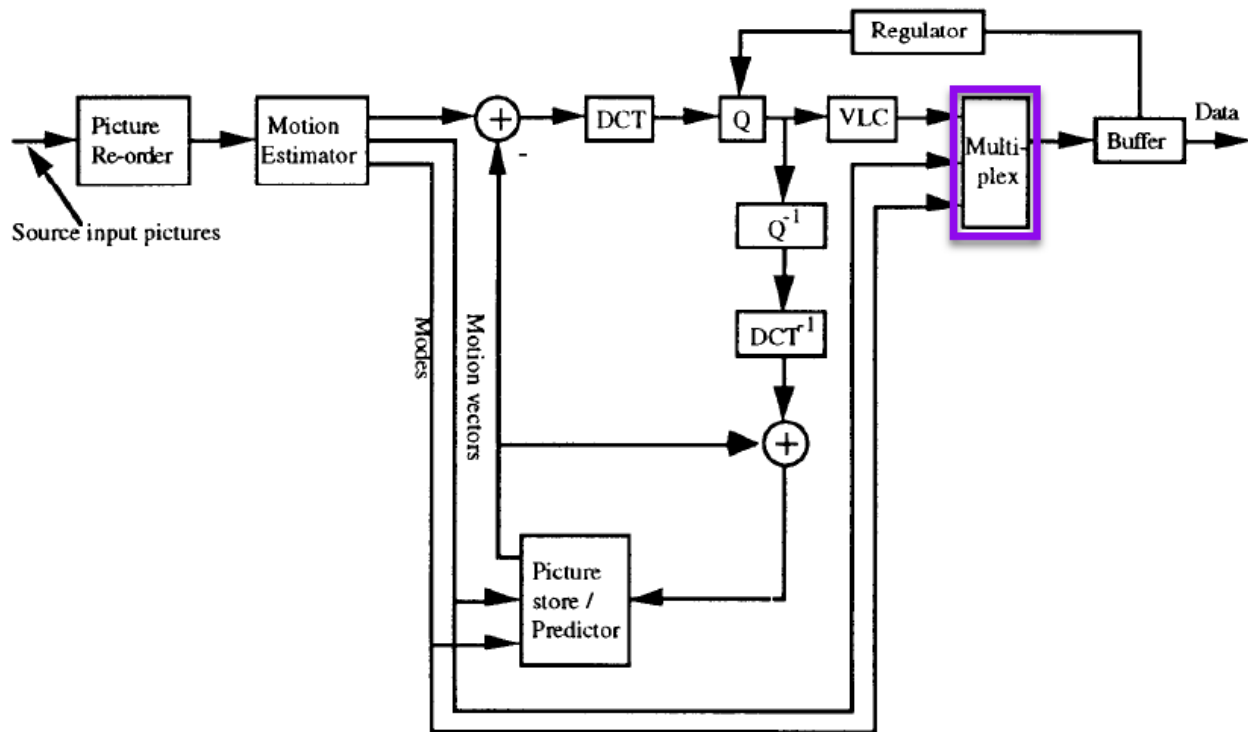
Figure 2 -- Simplified video encoder block diagram

211. Then, “a motion compensated prediction of the contents of the block based on past and/or future reference pictures is formed.” EX1007, 15. A POSITA would have understood that the prediction based on past and/or future reference pictures is “based at least in part on the assigned motion vector for the skip coding mode” because this information is communicated to the Predictor from the Motion estimator and used to form the prediction by exploiting the temporal redundancy from said past and/or future reference pictures. And as explained in Section IX.B.4.a.iii (limitation 1[b]), “the assigned motion vector is one of the zero motion vector and the predicted non-zero

motion vector” assigned to MPEG-1’s skipped macroblock using H.263’s median prediction.

- v. **1[d]: *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.***

212. The combination of MPEG-1 and H.263 discloses or suggests this limitation. MPEG-1 explains that skipped macroblocks “are indicated when the macroblock_address_increment is greater than 1.” EX1007, 54. This “indication” of MPEG-1’s skip mode is encoded into a bitstream by the multiplex, which I have annotated purple in MPEG-1’s Figure 2 below. *Id.*, 15 (“Fourthly, the side-information for the macroblock (mode, motion vectors etc.) and the quantized coefficient data are encoded.”).



where

DCT is discrete cosine transform

DCT⁻¹ is inverse discrete cosine transform

Q is quantization

Q⁻¹ is dequantization

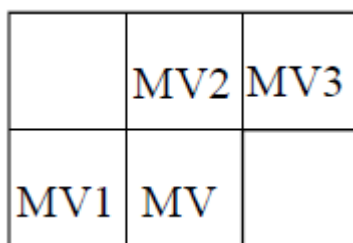
VLC is variable length coding

Figure 2 -- Simplified video encoder block diagram

213. Further, for skipped macroblocks, “there is no coded data, that is neither motion vector information nor DCT information is available to the decoder.” *Id.*, 54. Thus, *no further motion vector information for the first segment is coded in the encoded bitstream* besides the mode information (indicated a by macroblock_address_increment greater than 1).

- b. **Claim 2:** *A method according to claim 1, wherein the second segment is a previously encoded segment neighboring the first segment.*

214. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 2. As I explained in Section IX.B.4.a.ii (limitation 1[a]), H.263's median prediction calculates the median of motion vectors for three previously coded surrounding macroblocks, MV1, MV2, and MV3. As seen in the excerpt from H.263's Figure 12, each of MV1, MV2, and MV3 is "neighboring" MV ("the first segment.").



- c. **Claim 6:** *A method according to claim 1, wherein if the second segment has zero motion vector, the zero motion vector is assigned for 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.*

215. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 6. H.263 provides a set of rules, applied in increasing order, for "special cases at the borders of the current GOB, slice, or picture. EX1009, 44-45. I have reproduced the rules below:

- 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.
- 4) Then, the candidate predictor MV3 is set to zero if the corresponding macroblock is outside the picture (at the right side).

216. The third rule indicates that if MV2 and MV3 are outside the picture, GOB, or slice, their candidate predictors are set to MV1. *Id.*, 45. I have annotated Figure 12 in green to illustrate this scenario:

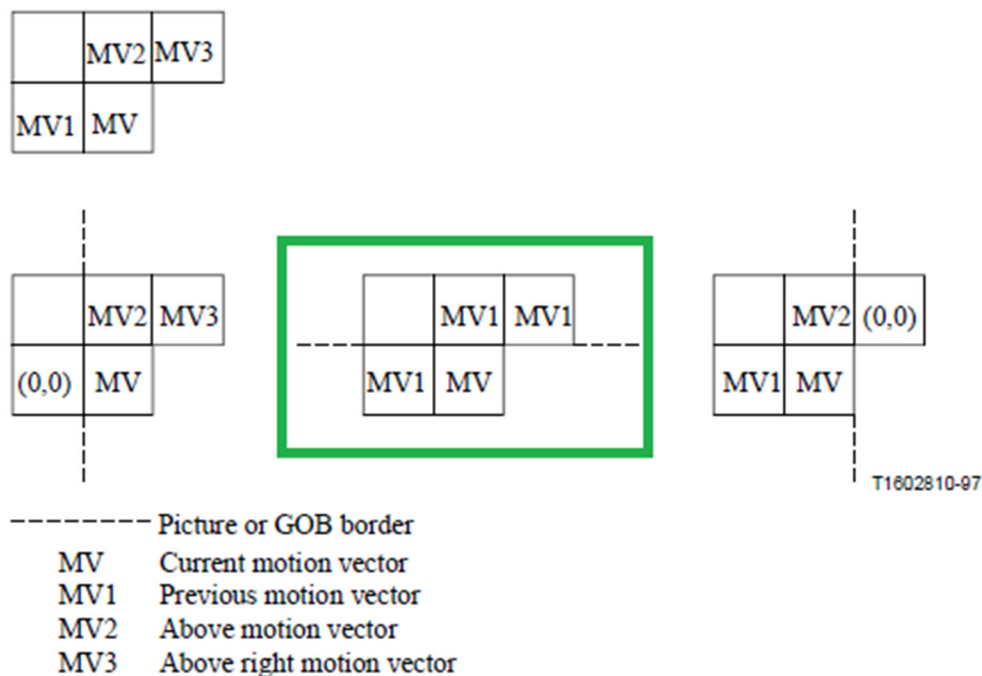


Figure 12/H.263 – Motion vector prediction

217. In this scenario, if MV1 is zero, then all three candidate predictors used in H.263's median prediction would equal to zero, and the median would also be zero. Mapping the recited "second segment" to MV1 would therefore result in "the zero

motion vector [being] assigned for skip coding mode of the first segment.” Furthermore, where a zero motion vector is assigned to the skipped macroblock, a POSITA would have understood that MPEG-1 forms a prediction for the skipped macroblock (“first segment”) “with respect to the corresponding segment of the reference frame associated with the zero motion vector” because it copies the macroblock from the reference frame with a motion vector equal to zero and no DCT coefficients. EX1007, 54-55.

d. Claim 23

i. 23[pre]: *A method according to claim 1, wherein if the second segment has a non-zero motion vector,*

218. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of this element. A POSITA would have understood, and indeed H.263 contemplates, instances where MV1, MV2, and/or MV3 have a non-zero motion vector when calculating the median prediction. EX1009, 44-45, Figure 12.

ii. 23[a]: *the method further comprising deriving the predicted non-zero motion vector based at least in part on the motion vector of the second segment; and*

219. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of this element. A POSITA would have understood that if one of the candidate predictors, MV1, MV2, or MV3 has a non-zero motion vector, as required by limitation 23[pre], scenarios could exist where, e.g., the other two candidate

predictors would also have non-zero motion vectors, which would result in deriving a predicted non-zero motion vector.

220. Indeed under the third H.263 median prediction decision rule discussed in Section IX.B.4.c (claim 6), if MV1 is a non-zero motion vector and MV2 and MV3 are set equal to MV1, the median prediction would also equal to MV1, a non-zero motion vector. EX1009, 44-45, Figure 12.

iii. 23[b]: *the predicted non-zero motion vector is assigned for the skip coding mode of the first segment; and*

221. As I explained in Section IX.B.4.a.iii (limitation 1[b]), in the MPEG-1 and H.263 combination, the predicted non-zero motion vector derived by H.263's median prediction is assigned to MPEG-1's skipped macroblock in a B-picture ("assigned for the skip coding mode of the first segment").

iv. 23[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.*

222. As I explained in Section IX.B.4.a.iv (limitation 1[c]), MPEG-1 teaches that after a mode and/or motion vector is assigned to a macroblock, "a motion compensated prediction of the contents of the block based on past and/or future reference pictures is formed" using said assigned information for the macroblock. EX1009, 15. In this instance, the MPEG-1's predictor forms a prediction for the

skipped macroblock using the motion vector derived from H.263's median prediction, i.e., "based at least in part on the predicted non-zero motion vector."

- e. **Claim 24:** *A method according to claim 1, 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.*

223. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 24. As I explained in Section IX.B.4.c (claim 6), the combination of MPEG-1 and H.263 teaches *if the second segment has zero motion vector, the zero motion vector is assigned for 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*. The MPEG-1 and H.263 combination teaches the substantially similar portion of claim 24 (*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*).

224. The combination of MPEG-1 and H.263 further discloses or suggests the additional limitation of claim 24: *second segment is predicted using motion-compensated prediction from the reference picture*. The candidate predictors MV1, MV2, and MV3 in H.263 are previously coded. E.g., EX1009, 44-45. A POSITA

would have understood that any one of the candidate predictors, e.g., MV1, could also have been “predicted using motion-compensated prediction from the reference picture” if it was coded as a skipped macroblock assigned a zero motion vector, as described in Sections IX.B.4.a.iv (limitation 1[c]) and IX.B.4.d.iv (limitation 23[c]) with regard to forming a prediction.

- f. **Claim 25:** *A method according to claim 1, 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.*

225. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 25 for the reasons discussed in Section IX.B.4.e (claim 24). The additional limitation of claim 25, which recites that the second reference picture is *immediately preceding the picture second segment belongs to*, is also taught by the MPEG-1 and H.263 combination. Both MPEG-1 and H.263 teach that a reference picture may be (and in many cases is) “immediately preceding” the picture being coded (i.e., “the picture second segment belongs to”). EX1007, 117 (“If only a backward motion vector is present, then the motion-compensated macroblock is constructed from a future picture”); EX1009, 11-12 (describing using temporally previous reference pictures for coding various picture types).

- g. Claim 28: *A method according to claim 1, further comprising: deriving the predicted non-zero motion vector based at least in part on the motion vector of the second segment.***

226. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 28. As I explained in Section IX.B.4.a.ii (limitation 1[a]), H.263's median predictor derives a motion vector as the median of previously coded surrounding macroblocks. The predicted non-zero motion vector is therefore derived "based at least in part on the motion vector of the second segment."

- h. Claim 29: *A method according to claim 1, further comprising: deriving 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.***

227. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 29. As I explained in Section IX.B.4.a.ii (limitation 1[a]), H.263's median predictor derives a motion vector as the median of the motion vectors of three previously coded surrounding macroblocks, MV1, MV2, and MV3. The predicted non-zero motion vector is therefore derived "based at least in part on the motion vector of the second segment and motion vector of a third segment neighboring the first segment."

- i. **Claim 30:** *A method according to claim 1, wherein no residual information is provided for the first segment in the encoded bitstream.*

228. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 30. MPEG-1 explicitly states that skipped macroblocks have “differential motion vectors equal to zero, and no DCT coefficients.” A POSITA would have understood that sending no DCT coefficients means that “no residual information is provided” for the skipped macroblock (“first segment”). EX1007, 15 (describing the encoding processes wherein the prediction is subtracted from the actual data in the current macroblock and a discrete cosine transform is performed on each block to create DCT coefficients, which represent residual information).

5. Claim 7 and Dependents (Decoding Method Claims)

229. MPEG-1 discloses that after a coded representation of a picture is generated by the encoder, the encoder “decod[es] the data so that [the decoded pictures] can be used as reference pictures for subsequent encoding.” EX1007, 15. MPEG-1 further discloses that “[d]ecoding is the inverse of the encoding operation.” *Id.* Accordingly, both an MPEG-1 encoder and decoder perform a method of decoding...which is the inverse of the encoding method I discuss with regard to claim 1 and its dependents.

a. **Claim 7**

i. **7[pre]: A method of decoding an encoded video sequence, the method comprising:**

230. MPEG-1 teaches a decoding method, which “is the inverse of the encoding operation.” EX1007, 15-16. I have reproduced MPEG-1’s basic video decoder block diagram in Figure 4 below:

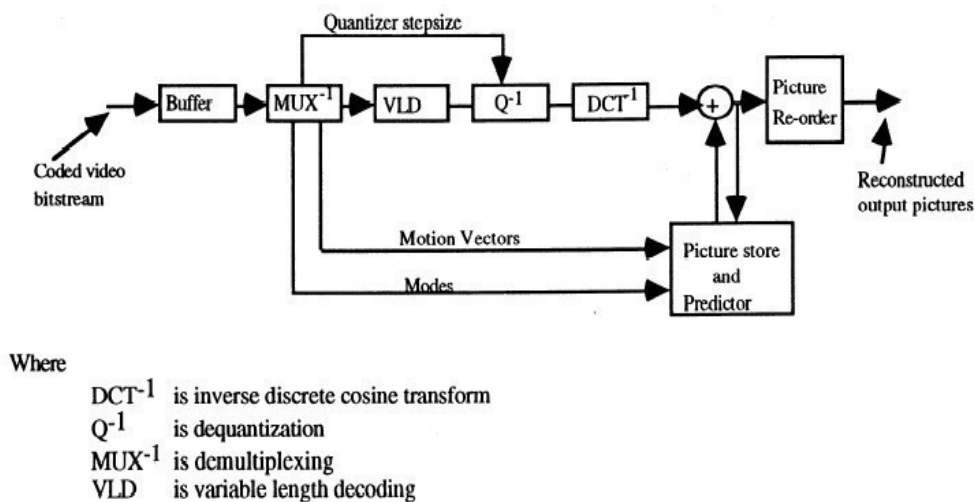


Figure 4 -- Basic video decoder block diagram

231. MPEG-1 explains that “[t]he decoder reads the bitstream, identifies the start of a coded picture and then the type of the picture in turn. The macroblock type and motion vectors, if present, are used to construct a prediction of the current macroblock based on past and future reference pictures that have been stored in the decoder. The coefficient data are decoded and dequantized. Each 8x8 block of coefficient data is transformed by an inverse DCT (specified in annex A), and the result is added to the prediction signal and limited to the defined range.” *Id.*, 16. A POSITA

would have understood these steps to be a “method of decoding an encoded video sequence.”

232. MPEG-1’s Figure D.7, as shown below, provides an additional example of a decoder, which a POSITA would have understood to be used to effectuate MPEG-1’s “method of decoding an encoded video sequence.”

A simplified block diagram of a possible decoder implementation is shown below:

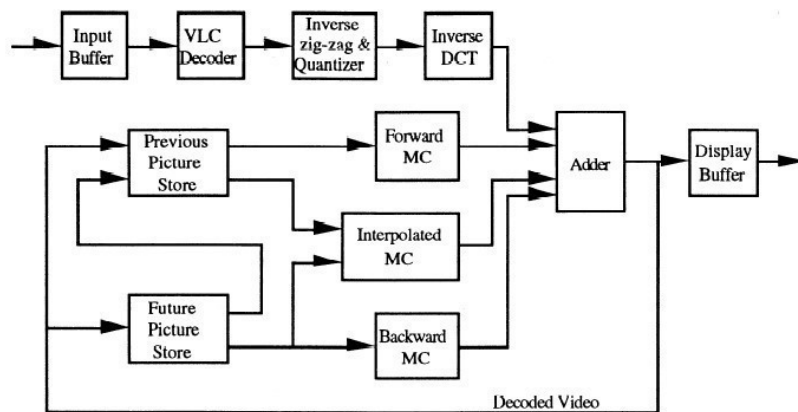


Figure D.7 -- Simplified decoder block diagram

ii. ***7[a]: receiving an indication of a skip coding mode for a first segment;***

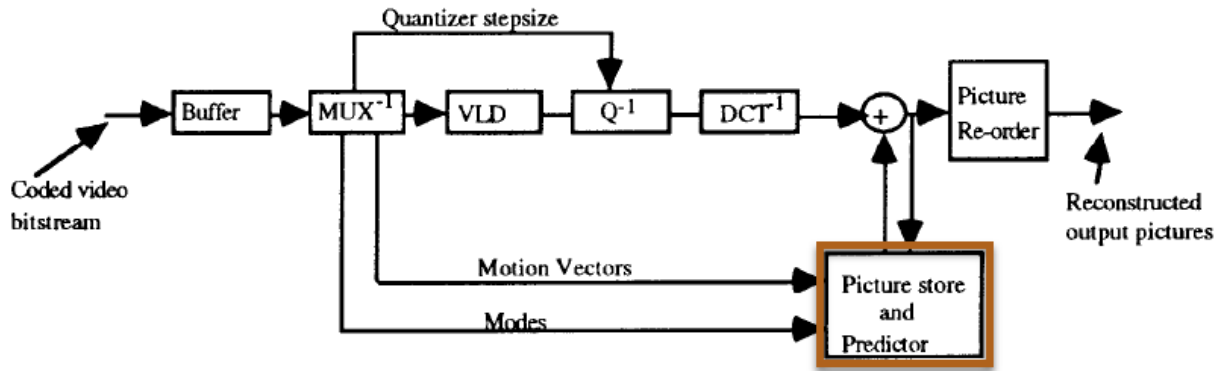
233. As I explained in Section IX.B.4.a.v (limitation 1[d]), MPEG-1 teaches encoding “an indication of the skip coding mode” by encoding a macroblock_address_increment is greater than 1. EX1007, 54. This indication of a skipped macroblock is decoded when received from the encoder via a bitstream. *Id.*, 16.

- iii. ***7[b]: 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***

234. MPEG-1 and H.263 render 7[b] obvious for the reasons discussed in Section IX.B.4.a.iii (limitation 1[b]) because MPEG-1's decoding method performs the same steps as the encoding method for assigning either a zero motion vector or a predicted non-zero motion vector for the skip coding mode. A POSITA would have understood this to necessarily be the case in order for skipped macroblocks to be accurately decoded when, e.g., for B-pictures, differential motion vectors are equal to zero, and no DCT coefficients are encoded.

- iv. ***7[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.***

235. MPEG-1 and H.263 render 7[c] obvious for the reasons discussed in Section IX.B.4.a.iv (limitation 1[c]) because the encoder and decoder must form a prediction in the same way. Further, MPEG-1 explicitly teaches its decoder forming a prediction based macroblock type and motion vectors based on past and future reference pictures stored in the decoder. EX1007, 16. I have also annotated MPEG-1's decoder to highlight its Picture store and Predictor, which has a corresponding structure in the encoder as discussed in Section IX.B.4.a.iv (limitation 1[c]).



Where

DCT⁻¹ is inverse discrete cosine transform
 Q⁻¹ is dequantization
 MUX⁻¹ is demultiplexing
 VLD is variable length decoding

Figure 4 -- Basic video decoder block diagram

- b. **Claim 9:** *A method according to claim 7, wherein if a segment in a previously decoded region surrounding the first segment has 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.*

236. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 9. As explained in Section IX.B.4.c (claim 6), the combination discloses or suggests *wherein if the second segment has zero motion vector, the zero motion vector is assigned for 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.* As explained in Section IX.B.4.a.iii (limitation 1[b]), the combination discloses or suggests *a second segment neighboring the first segment.* And as explained in Section IX.B.4.b (claim 2), the combination discloses or suggests *the second segment is a previously encoded segment*

neighboring the first segment. The second segment neighboring the first segment is in a previously encoded *region surrounding the first segment.* A POSITA would have understood that a decoding method decodes blocks or segments in a bitstream in the same order they were encoded and placed in the bitstream, and therefore the MPEG-1/H.263 combination additionally teaches the claimed second segment is *in a previously decoded region surrounding the first segment.*

- c. **Claim 32:** *A method according to claim 7, 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.*

237. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 32 for the reasons discussed in Section IX.B.4.c (claim 6) because the combined decoding method performs the same steps as the encoding method for forming a prediction of a segment. *See also, EX1009, 15-16.*

- d. **Claim 34:** *A method according to claim 7, wherein if the second segment has a non-zero motion vector, the method further comprising deriving the predicted non-zero motion vector based at least in part on the motion vector of the second segment; and the predicted non-zero motion vector is assigned for the skip coding mode of the first segment; and 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.*

238. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 34 for the reasons discussed in Section IX.B.4.d (claim

23) because the combined decoding method performs the same steps as the encoding method for forming a prediction of a segment.

- e. **Claim 36:** *A method according to claim 7, 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.*

239. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 36 for the reasons discussed in Section IX.B.4.e (claim 24) because the combined decoding method performs the same steps as the encoding method for forming a prediction of a segment.

- f. **Claim 39:** *A method according to claim 7, further comprising: deriving the predicted non-zero motion vector based at least in part on the motion vector of the second segment.*

240. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 39 for the reasons discussed in Section IX.B.4.g (claim 28) because the combined decoding method performs the same steps as the encoding method for forming a prediction of a segment.

- g. Claim 40: *A method according to claim 7, further comprising: deriving 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.***

241. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 40 for the reasons discussed in Section IX.B.4.h (claim 29) because the combined decoding method performs the same steps as the encoding method for forming a prediction of a segment.

- h. Claim 41: *A method according to claim 7, wherein no residual information is provided for the first segment in the encoded bitstream.***

242. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 41 for the reasons discussed in Section IX.B.4.i (claim 30) because no residual information is provided for the first segment in the encoded bitstream from the encoder for MPEG-1 skipped macroblocks.

- i. Claim 43: *A method according to claim 7, 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.***

243. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 43 for the reasons discussed in Section IX.B.4.f (claim

25) because the combined decoding method performs the same steps as the encoding method for forming a prediction of a segment.

- j. **Claim 65:** *A method according to claim 7, wherein no further motion vector information for the first segment is retrieved from the encoded bitstream.*

244. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 65 for the reasons discussed in Section IX.B.4.a.v (limitation 1[d]) because MPEG-1 does not include any further motion vector information with skipped macroblocks.

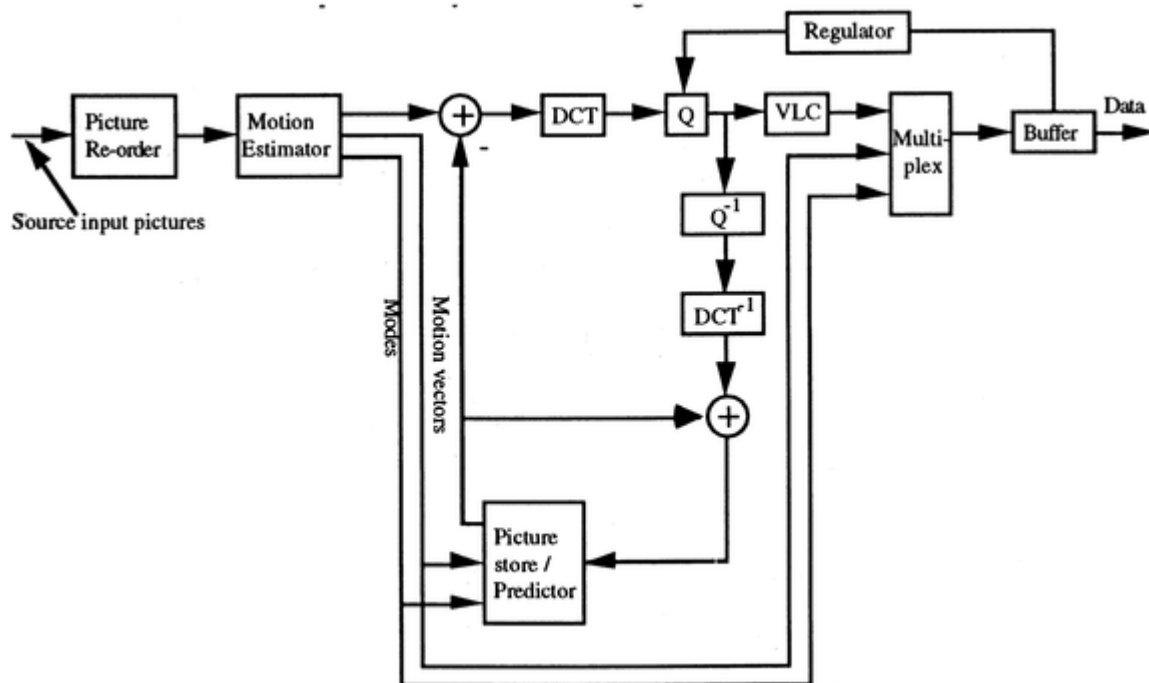
6. Claim 10 and Dependents (Encoder Claims)

a. Claim 10

- i. **10[pre]:** *A video encoder for encoding a video sequence, the encoder comprises:*

245. MPEG-1 discloses or suggests *encoding a video sequence* for the reasons discussed in Section IX.B.4.a.i (limitation 1[pre]).

246. MPEG-1 further discloses a simplified video encoder block diagram and the “functions that need to be performed by an [MPEG-1 compliant] encoder.” EX1007, 14, Fig. 2.

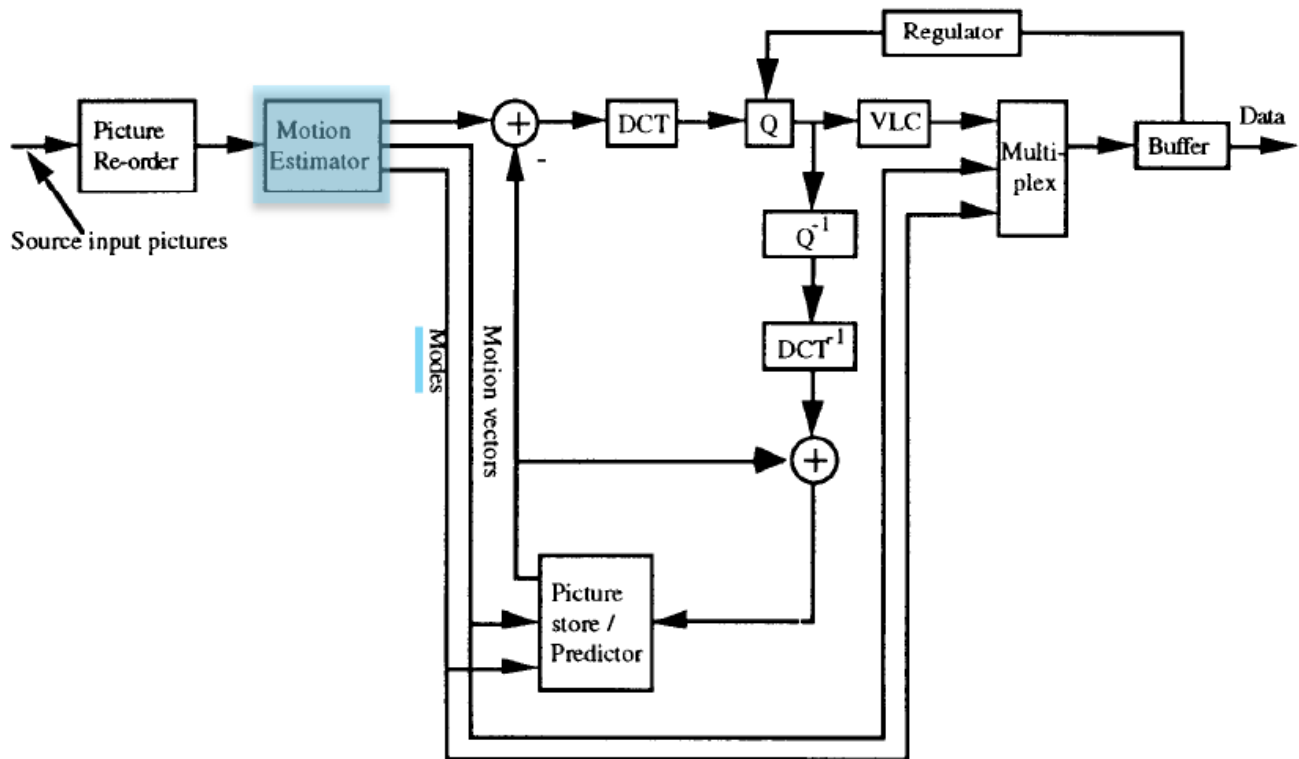


MPEG-1 at Figure 2 — Simplified video encoder block diagram

ii. **10[a]: a coding controller for assigning a skip coding mode to a first segment;**

247. MPEG-1 combined with H.263 discloses or suggests *assigning a skip coding mode to a first segment* for the reasons discussed in Section IX.B.4.a.ii (limitation 1[a]).

248. MPEG-1 further discloses that “for a given macroblock, a coding mode is chosen.” EX1007, 15. Figure 2 depicts that “modes” (underlined cyan) are sent out from the motion estimator (cyan) to the picture store/predictor and multiplex. A POSITA would have therefore understood that MPEG-1’s motion estimator is a *coding controller that assign[s] a skip coding mode to a first segment*.



where

DCT is discrete cosine transform

DCT^{-1} is inverse discrete cosine transform

Q is quantization

Q^{-1} is dequantization

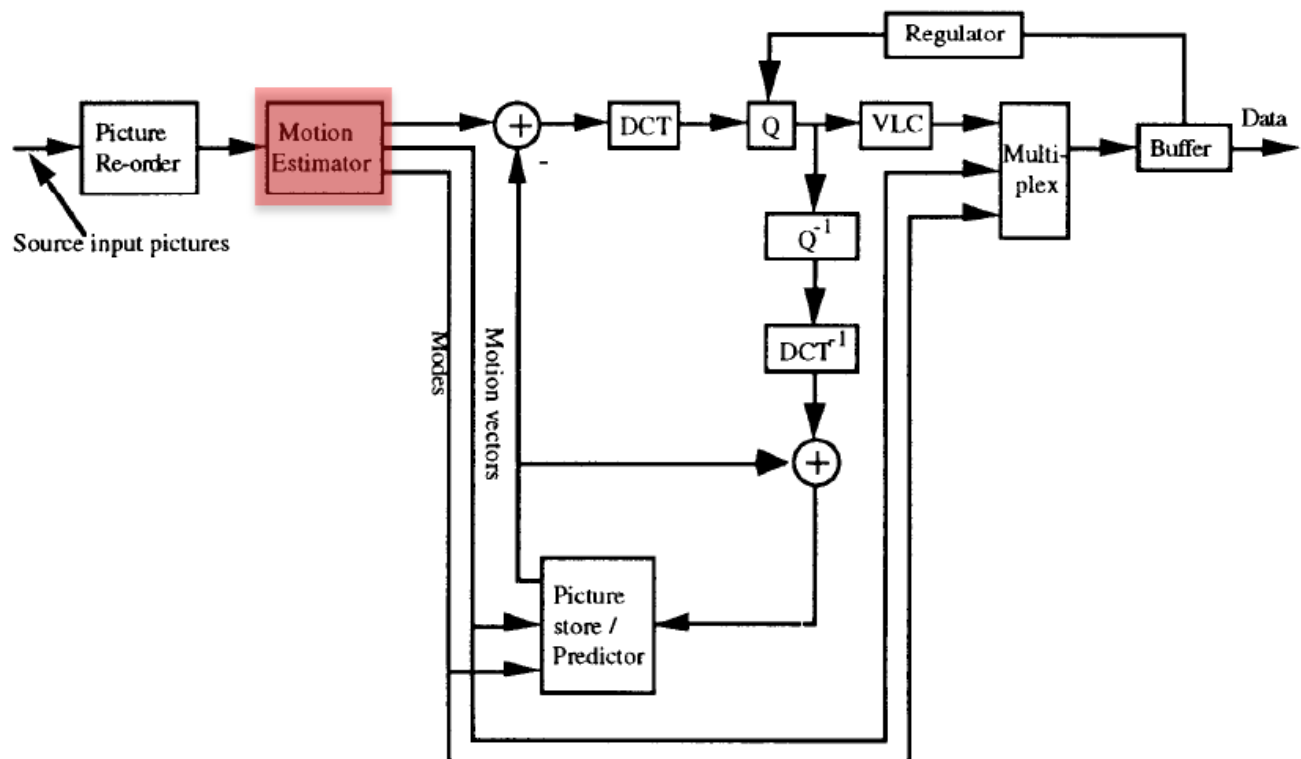
VLC is variable length coding

Figure 2 -- Simplified video encoder block diagram

- iii. 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

249. MPEG-1 combined with H.263 discloses or suggests *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* for the reasons discussed in Section IX.B.4.a.iii (limitation 1[b]).

250. As I explained in Section IX.B.4.a.iii (limitation 1[b]), MPEG-1's motion estimator (red) performs the *assigning...* recited in 1[b], and thus 10[b], so a POSITA would have understood it to be part of the recited *motion estimation block*. As I explain below in Section IX.B.6.a.iv (limitation 10[c]), MPEG-1's Picture store/Predictor performs the *forming a prediction...* recited in 10[c], so a POSITA would have understood MPEG-1's Motion Estimator and Picture store/Predictor together to comprise the recited *motion estimation block*.



where

DCT is discrete cosine transform

DCT⁻¹ is inverse discrete cosine transform

Q is quantization

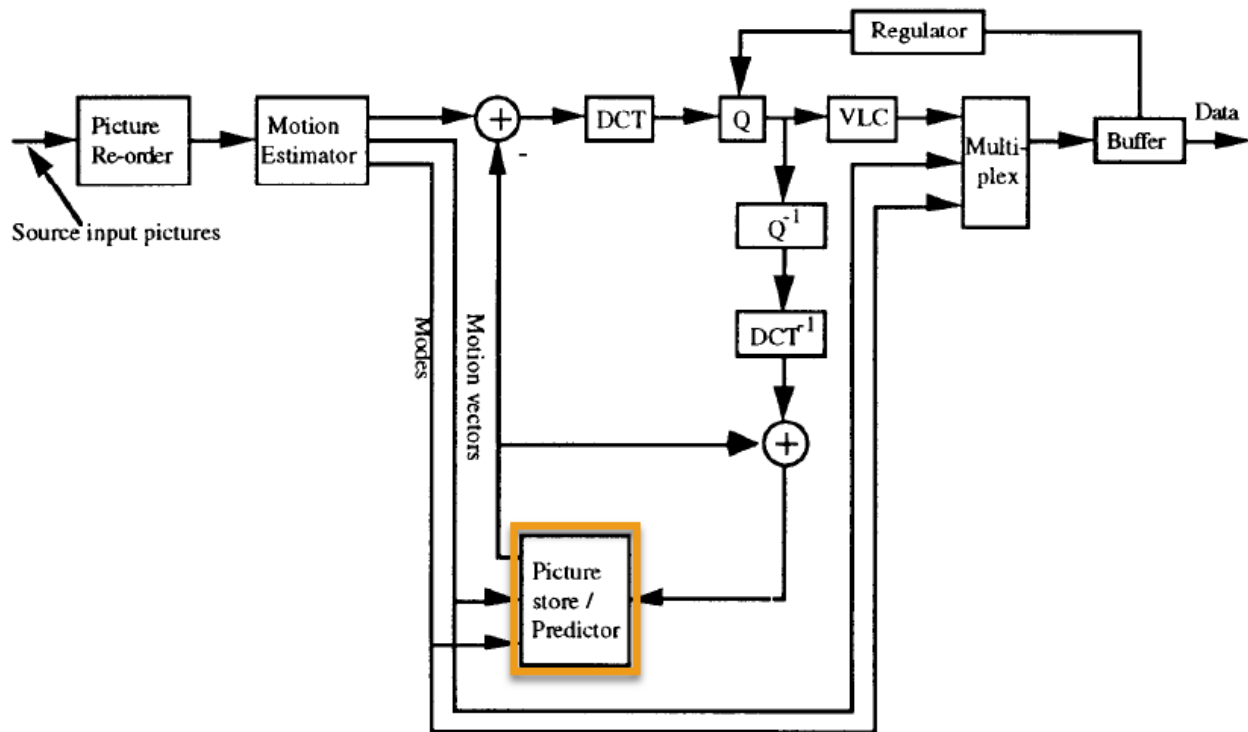
Q⁻¹ is dequantization

VLC is variable length coding

Figure 2 -- Simplified video encoder block diagram

- iv. **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***

251. The combination of MPEG-1 and H.263 discloses or suggests this limitation for the reasons discussed in Section IX.B.4.a.iv (limitation 1[c]). As I explained in Section IX.B.4.a.iv (limitation 1[c]), MPEG-1's Picture store/Predictor (orange) performs the *forming a prediction...* recited in 10[c], so a POSITA would have understood it, together with MPEG-1's Motion estimator, to be *a motion estimation block*. See Section IX.B.6.a.iii (limitation 10[b]).



where

DCT is discrete cosine transform

DCT⁻¹ is inverse discrete cosine transform

Q is quantization

Q⁻¹ is dequantization

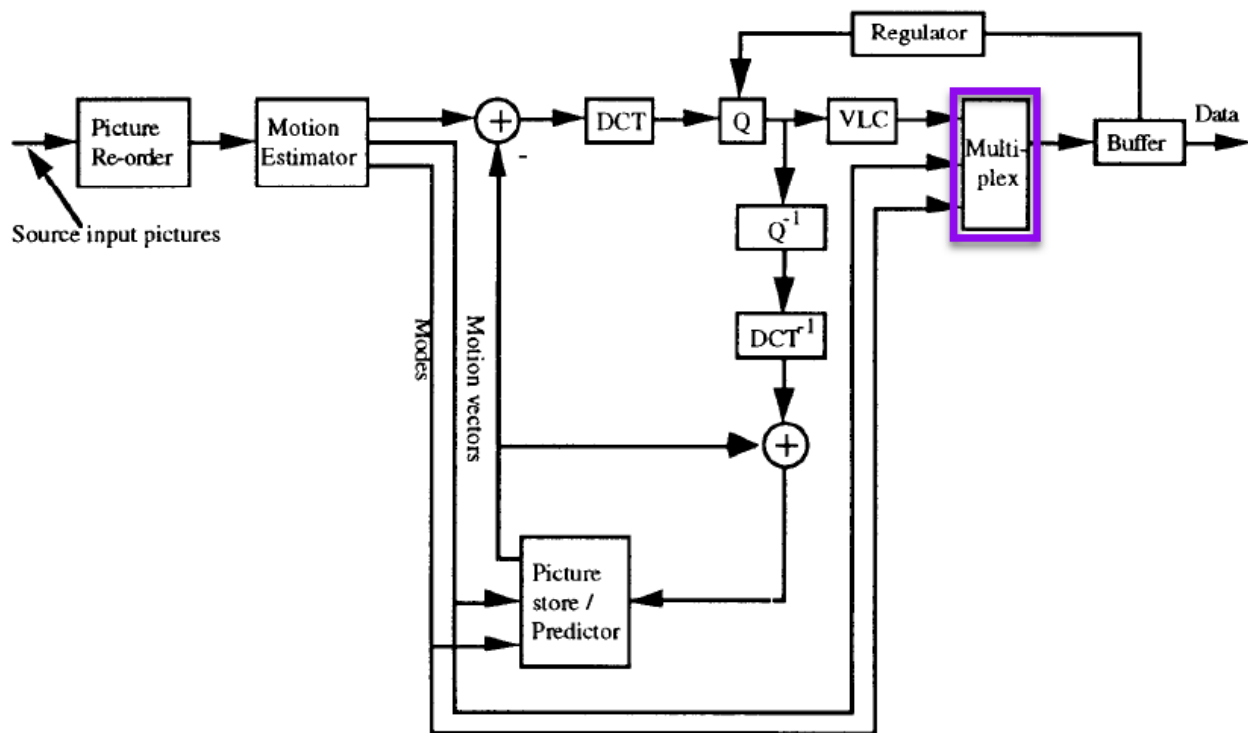
VLC is variable length coding

Figure 2 -- Simplified video encoder block diagram

- v. 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.*

252. The combination of MPEG-1 and H.263 discloses or suggests *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* for the reasons discussed in Section IX.B.4.a.v (limitation 1[d]). As I explained in Section IX.B.4.a.v

(limitation 1[d]), MPEG-1's Multiplex (purple) performs the *providing...*, and is therefore a *multiplexer* are recited.



where

DCT is discrete cosine transform

DCT^{-1} is inverse discrete cosine transform

Q is quantization

Q^{-1} is dequantization

VLC is variable length coding

Figure 2 -- Simplified video encoder block diagram

- b. **Claim 11:** *An encoder according to claim 10, wherein the second segment is a previously encoded segment neighboring the first segment.*

253. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 11 for the reasons discussed in Section IX.B.4.b (claim 2)

- c. **Claim 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.*

254. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 15 for the reasons discussed in Section IX.B.4.c (claim 6). I note that claim 6 recites *the second segment has a zero motion vector...* while claim 15 recites *a segment in a region surrounding the first segment has a zero motion vector....* A POSITA would have understood any one of the previously coded segments surrounding the segment being coded, as taught by H.263's median prediction may be both *a second segment* and *a segment in a region surrounding the first segment*.

- d. **Claim 21:** *A multimedia terminal, comprising an encoder according to claim 10.*

255. The combination of MPEG-1 and H.263 discloses or suggests that its encoder is used in a *multimedia terminal* because MPEG-1 was developed in a committee for “coded representation of audio, picture, multimedia and hypermedia information.” EX1007, 11.

- e. **Claim 44**

- i. **44[pre]:** *An encoder according to claim 10, wherein if the second segment has a non-zero motion vector,*

256. The combination of MPEG-1 and H.263 discloses or suggests this limitation for the reasons discussed in Section IX.B.4.d.i (limitation 23[pre]).

- ii. **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***

257. The combination of MPEG-1 and H.263 discloses or suggests this limitation for the reasons discussed in Section IX.B.4.d.ii (limitation 23[a]). As further discussed in Section IX.B.6.a.iii-IX.B.6.a.iv (limitations 10[b]-10[c]), MPEG-1's Motion Estimator and Picture store/Predictor comprise the recited *motion estimation block* and *forms* (and a POSITA would have understood it to also *derive*) predicted motion vectors.

- iii. **44[b]: *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***

258. The combination of MPEG-1 and H.263 discloses or suggests this limitation for the reasons discussed in Section IX.B.4.d.iii (limitation 23[b]).

- iv. **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.***

259. The combination of MPEG-1 and H.263 discloses or suggests this limitation for the reasons discussed in Section IX.B.4.d.iv (limitation 23[c]).

- f. **Claim 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.*

260. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 47 for the reasons discussed in Section IX.B.4.g (claim 28). As further discussed in Section IX.B.6.a.iii-IX.B.6.a.iv (limitations 10[b]-10[c]), MPEG-1's Motion Estimator and Picture store/Predictor comprise the recited *motion estimation block* and *forms* (and a POSITA would have understood it to also *derive*) predicted motion vectors.

- g. **Claim 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.*

261. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 48 for the reasons discussed in Section IX.B.4.h (claim 29). As further discussed in Section IX.B.6.a.iii-IX.B.6.a.iv (limitations 10[b]-10[c]), MPEG-1's Motion Estimator and Picture store/Predictor comprise the recited *motion estimation block* and *forms* (and a POSITA would have understood it to also *derive*) predicted motion vectors.

- h. **Claim 49:** *An encoder according to claim 10, wherein no residual information is provided for the first segment in the encoded bitstream.*

262. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 49 for the reasons discussed in Section IX.B.4.i (claim 30).

- i. **Claim 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.*

263. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 51 for the reasons discussed in Section IX.B.4.c (claim 6).

- j. **Claim 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.*

264. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 52 for the reasons discussed in Section IX.B.4.e (claim 24).

- k. **Claim 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.*

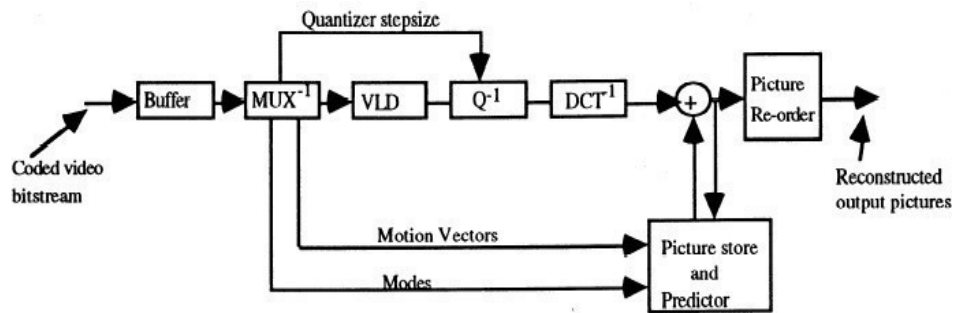
265. The combination of MPEG-1 and H.263 discloses or suggests the additional limitations of claim 53 for the reasons discussed in Section IX.B.4.f (claim 25).

7. Claim 16 and Dependents (Decoder Claims)

a. Claim 16

- i. **16[pre]:** *A video decoder for decoding an encoded video sequence, the decoder comprising:*

266. MPEG-1 discloses or suggests *a video decoder for decoding an encoded video sequence*. For example, MPEG-1's Figure 4 discloses a basic video decoder block diagram:



Where

DCT^{-1} is inverse discrete cosine transform
 Q^{-1} is dequantization
 MUX^{-1} is demultiplexing
 VLD is variable length decoding

Figure 4 -- Basic video decoder block diagram

267. MPEG-1 explains that “[t]he decoder reads the bitstream, identifies the start of a coded picture and then the type of the picture in turn. The macroblock type and motion vectors, if present, are used to construct a prediction of the current macroblock based on past and future reference pictures that have been stored in the decoder. The coefficient data are decoded and dequantized. Each 8x8 block of coefficient data is transformed by an inverse DCT (specified in annex A), and the result is added to the prediction signal and limited to the defined range.” *Id.*, 16. A POSITA would have understood these steps to comprise *decoding an encoded video sequence*.

268. MPEG-1’s Figure D.7, shown below, provides an additional example of a decoder, which a POSITA would have understood to also be used in *decoding an encoded video sequence*.

A simplified block diagram of a possible decoder implementation is shown below:

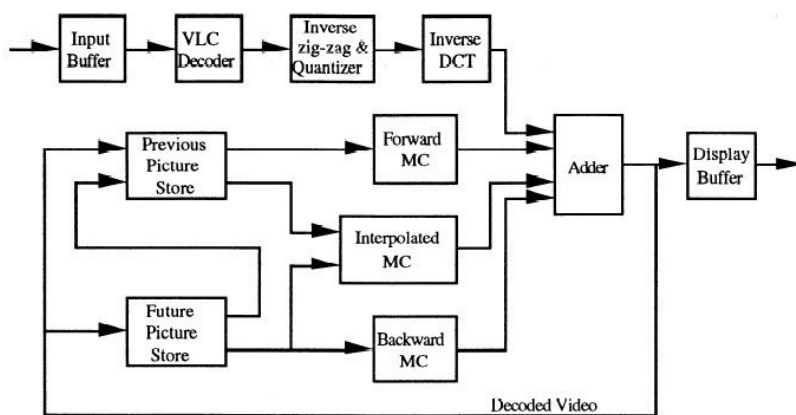
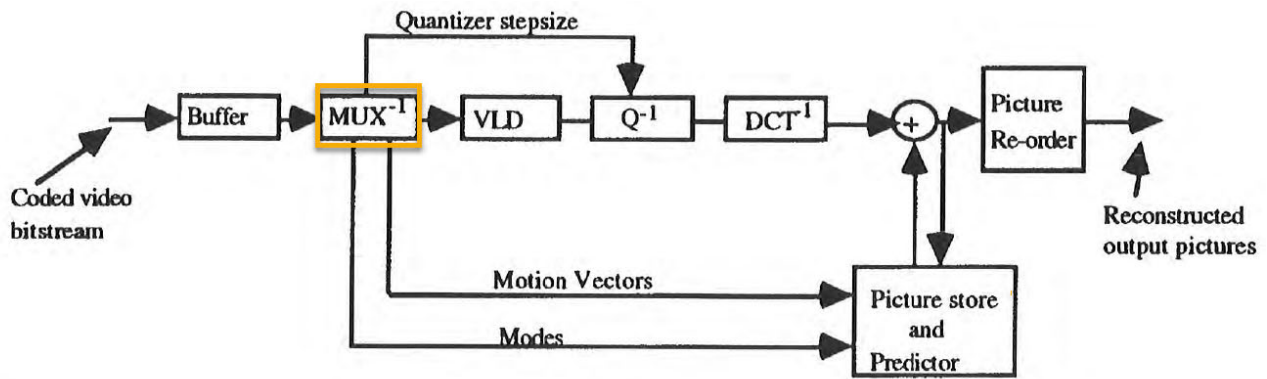


Figure D.7 -- Simplified decoder block diagram

ii. 16[a]: *a demultiplexer for receiving an indication of a skip coding mode assigned to a first segment;*

269. MPEG-1 combined with H.263 discloses or suggests *receiving an indication of a skip coding mode assigned to a first segment* for the reasons discussed in Section IX.B.5.a.ii (limitation 7[a]).

270. MPEG-1 further discloses MUX⁻¹ (orange) for demultiplexing. EX1007, Figure 4:



Where

DCT⁻¹ is inverse discrete cosine transform

Q⁻¹ is dequantization

MUX⁻¹ is demultiplexing

VLD is variable length decoding

Figure 4 -- Basic video decoder block diagram

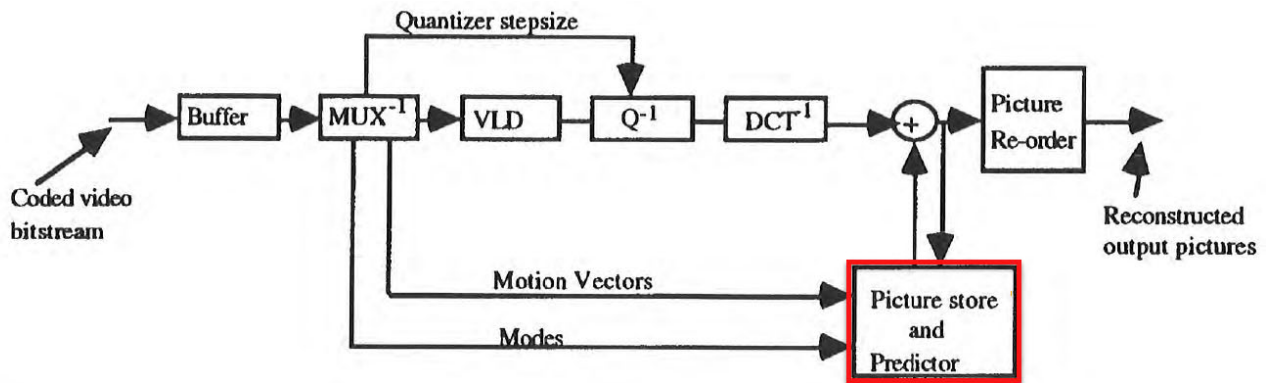
271. Figure 4 illustrates that a coded video bitstream enters the decoder, passes through a buffer, and goes into the MUX⁻¹ where it is read. *Id.*, Fig. 4, 16 (“For fixed-rate applications, the channel fills a FIFO buffer at a constant rate with the coded bitstream. The decoder reads this buffer and decodes the data elements in the bitstream according to the defined syntax”). A POSITA would have thus understood that the MUX⁻¹ *receiv[es] an indication of a skip coding mode assigned to a first segment by the encoder.*

- iii. **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**

272. MPEG-1 combined with H.263 discloses or suggests *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 for the reasons discussed in Section IX.B.5.a.iii (limitation 7[b]).

273. MPEG-1 further discloses that the decoder comprises a Picture store and Predictor (red). EX1007, Figure 4.



Where

DCT⁻¹ is inverse discrete cosine transform
 Q⁻¹ is dequantization
 MUX⁻¹ is demultiplexing
 VLD is variable length decoding

Figure 4 -- Basic video decoder block diagram

274. MPEG-1 discloses that “[t]he macroblock type and the motion vectors, if present, are used to construct a prediction of the current macroblock based on past and future reference pictures that have been stored in the decoder. *Id.*, 16. Figure 4 depicts that modes and motion vectors are sent from the MUX⁻¹ to the Picture store and Predictor, so a POSITA would have understood that the Picture store and Predictor performs the *assigning...*based on the mode (here, the *skip coding mode*).

- iv. **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.***

275. MPEG-1 combined with H.263 discloses or suggests this limitation for the reasons discussed in Section IX.B.5.a.iv (limitation 7[c]).

- b. **Claim 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.***

276. MPEG-1 combined with H.263 discloses or suggests the additional limitations of claim 20 for the reasons discussed in Section IX.B.5.b (claim 9). The only difference between the language in claims 20 and 9 is that claim 9 recites the additional limitation that the *region surrounding the first segment* also be *previously decoded*, so a POSITA would have understood that MPEG-1 combined with H.263 discloses or suggests claim 20 by virtue of disclosing or suggesting the narrower claim 9.

- c. **Claim 22: *A multimedia terminal comprising a decoder according to claim 16.***

277. The combination of MPEG-1 and H.263 discloses or suggests that its decoder is used in a *multimedia terminal* because MPEG-1 was developed in a

committee for “coded representation of audio, picture, multimedia and hypermedia information.” EX1007, 11.

- d. **Claim 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.*

278. MPEG-1 combined with H.263 discloses or suggests the additional limitations of claim 54 for the reasons discussed in Section IX.B.5.c (claim 32).

- e. **Claim 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.*

279. MPEG-1 combined with H.263 discloses or suggests the additional limitations of claim 58 for the reasons discussed in Section IX.B.5.f (claim 39).

280. The term *motion estimation block* in claim 58 has no antecedent basis in claim 16. I have been asked to consider what structure recited in claim 16 could have performed the additional limitations attributed to the *motion estimation block* in claim 58. Between the two decoder components recited in claim 16, a *motion compensated prediction block* and a *demultiplexer*, a POSITA would have understood that the *motion compensated prediction block*, Section IX.B.7.a.iii (limitation 16[b]), *derive[s] [] predicted non-zero motion vector[s]* based on the prediction field received from the encoder.

- f. **Claim 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.*

281. MPEG-1 combined with H.263 discloses or suggests the additional limitations of claim 59 for the reasons discussed in Section IX.B.5.g (claim 40).

282. Like in claim 58, the term *motion estimation block* in claim 59 has no antecedent basis in claim 16. A POSITA would have understood that claim 16's *motion compensated prediction block derive[s] [] predicted non-zero motion vector[s]* based on the prediction field received from the encoder for the reasons discussed in Section IX.B.7.e (claim 58).

- g. **Claim 60:** *A decoder according to claim 16, wherein no residual information is provided for the first segment in an encoded bitstream.*

283. MPEG-1 combined with H.263 discloses or suggests the additional limitations of claim 60 for the reasons discussed in Section IX.B.5.h (claim 41).

- h. **Claim 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.*

284. MPEG-1 combined with H.263 discloses or suggests the additional limitations of claim 62 for the reasons discussed in Section IX.B.5.e (claim 36).

- i. **Claim 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 respect to a corresponding segment of the reference frame associated with the zero motion vector.*

285. MPEG-1 combined with H.263 discloses or suggests the additional limitations of claim 63 for the reasons discussed in Section IX.B.5.i (claim 43).

- j. **Claim 64:** *A decoder according to claim 16, wherein no further motion vector information for the first segment is retrieved from an encoded bitstream.*

286. MPEG-1 combined with H.263 discloses or suggests the additional limitations of claim 64 for the reasons discussed in Section IX.B.5.j (claim 65).

X. CONCLUSION

287. I currently hold the opinions expressed in this Declaration. However, my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

288. I hereby declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge. I understand that willful false statements are punishable by fine or imprisonment or both. *See* 18 U.S.C. § 1001.

Date: June 13, 2025

By:

A handwritten signature in blue ink, appearing to read 'Eli Saber', written over a horizontal line.

Dr. Eli Saber, PhD