

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS, LLC

Petitioner

- v. -

VL COLLECTIVE IP LLC

Patent Owner

IPR2022-01086

U.S. Patent 8,605,794

DECLARATION OF DR. IMMANUEL FREEDMAN UNDER 37 C.F.R. § 1.68

IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW

OF U.S. PATENT NO. 8,605,794

TABLE OF CONTENTS

I.	Introduction.....	4
II.	Background and Qualifications	6
III.	Understanding of Patent Law	12
IV.	The '794 Patent.....	15
V.	Level of Ordinary Skill in the Pertinent Art.....	18
VI.	Claim Construction.....	20
VII.	Prior Art Invalidity Analysis	21
A.	Ground 1 and Ground 2: Claims 1, 3, 5, 9, 12, 13, 15, 20, and 21 are anticipated by <i>Abbott</i> or in the alternative, are rendered obvious by <i>Abbott</i> in view of the knowledge of a POSITA.....	23
1.	The Prior Art Reference.....	23
a)	Background on <i>Abbott</i>	23
2.	Analysis of Claims 1, 3, 5, 9, 12, 13, 15, 20, and 21.....	24
a)	Claim 1	24
b)	Claim 3.....	48
c)	Claim 5.....	49
d)	Claim 12.....	49
e)	Claim 13.....	49
f)	Claim 15.....	50
g)	Claim 20.....	50
h)	Claim 9.....	51
i)	Claim 21	53

Declaration of Dr. Immanuel Freedman Under 37 C.F.R. § 1.68 in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 8,605,794

B.	Ground 3 and Ground 4: Claims 1, 3, 5, 9, 12, 13, 15, 20, and 21 are anticipated by <i>Sonohara</i> or in the alternative, are rendered obvious by <i>Sonohara</i> in view of the knowledge of a POSITA	53
1.	The Prior Art Reference.....	54
a)	Background on <i>Sonohara</i>	54
2.	Analysis of Claims 1, 3, 5, 9, 12, 13, 15, 20, and 21	55
a)	Claim 1	55
b)	Claim 3	70
c)	Claim 5	71
d)	Claim 12	72
e)	Claim 13	72
f)	Claim 15	73
g)	Claim 20	73
h)	Claim 9	74
i)	Claim 21	76
VIII.	Availability for cross-examination	76
IX.	Conclusion	77

Declaration of Dr. Immanuel Freedman Under 37 C.F.R. § 1.68 in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 8,605,794

I, Dr. Immanuel Freedman, do hereby declare as follows:

I. INTRODUCTION

1. I have been retained by counsel for Unified Patents, LLC (“Unified”) as an independent expert witness for the above-captioned Petition for *Inter Partes* Review (“IPR”) of U.S. Patent No. 8,605,794 (“the ’794 Patent”). I am being compensated at my usual and customary rate for the time I spend in connection with this IPR. My compensation is not affected by the outcome of this IPR.

2. I have been asked to provide my opinions regarding claims 1, 3, 5, 9, 12, 13, 15, 20, and 21 (each a “Challenged Claim” and collectively the “Challenged Claims”) of the ’794 Patent. Specifically, I have been asked to provide my opinions regarding whether the claims would have been anticipated by the prior art, or whether the claims would have been obvious to a person having ordinary skill in the art (“POSITA”) as of the claims’ priority date. My opinions regarding these topics are set forth below.

3. In preparing this Declaration, I have reviewed:

- a) EX1001, the ’794 Patent;
- b) EX1002, the file history of the ’794 Patent;
- c) the prior art references discussed below:
 - EX1003, US Patent 5,627,656 to Sonohara (“*Sonohara*”)

Declaration of Dr. Immanuel Freedman Under 37 C.F.R. § 1.68 in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 8,605,794

- EX1004, U.S. Patent 6,654,933 to Abbott *et al.* (“Abbott”);
and

d) any other document cited below.

4. I understand that the ’794 Patent issued on December 10, 2013, from U.S. Patent Application Number 11/918,276, which was filed March 16, 2006. I understand that the ’794 Patent claims priority to German Application 10 2005 016 866, filed April 12, 2005. The face of the ’794 Patent lists Hermann Hellwagner, Jor Heufr, Andreas Hutter, and Michael Ransburg as the purported inventors. I understand that VL Collective IP LLC is the current assignee of the ’794 Patent.

5. In forming the opinions expressed in this Declaration, I relied upon my education and experience in the relevant field of art, and have considered the viewpoint of a Person of Ordinary Skill in the Art (POSITA), as of April 12, 2005. I have also considered:

- a) the documents listed above,
- b) any additional documents and references cited in the analysis below,
- c) the relevant legal standards, including the standards for anticipation and obviousness, and
- d) my knowledge and experience based upon my work in this area as described below.

II. BACKGROUND AND QUALIFICATIONS

6. My qualifications are set forth in my curriculum vitae, a copy of which is attached as an Appendix A to this Declaration. I have over 30 years of industry experience, including a substantial portion of which was spent working with image and video coding and developing models and simulations to analyze various video and imaging systems. I have summarized in this section my educational background, career history, and other qualifications relevant to this matter. As set forth in my curriculum vitae:

7. I earned a Bachelor of Science degree in Physics from the University of Durham, England, in 1979. I obtained a Doctorate in Physics from the University of Durham, England in 1986. Between obtaining my undergraduate and doctoral degree, I developed a microcomputer system for detecting coalmine fires and heatings as a scientist for the National Coal Board and worked as a software engineer for Laser-Scan Ltd. in Cambridge, England.

8. After obtaining my Doctorate, I served as a Research Assistant at University College London from September 1986 to June 1987, where I developed digital image processing algorithms to improve image and stereo-matching quality for a digital terrain modeling system, including software and algorithms for affine transformation, edge filtering, kriging interpolation, and image stereo-matching with sub-pixel acuity. I continued my work with digital image processing as a Research

Associate at the University of Maryland, from June 1987 to September 1988. During my time at the University of Maryland, I designed algorithms for filtering, segmenting, clustering, and path planning based on digital images organized by quad-tree data structures.

9. From September 1988 to June 1994, I worked as a Senior Systems Engineer for the Hughes STX Corporation. As part of my work, I developed methods for comparison of sky maps from the Cosmic Background Explorer (COBE) mission with sky maps from other missions based on scientific data stored in a spatially-referenced database using a quad-tree data structure. In this role, I led the Systems Engineering and end-to-end development of a novel system for compressing imaging and ancillary data that combined scientific modeling with statistical data compression. I was also charged with designing and developing evaluation tools to ensure user-transparent, system-wide compression of a 380-GB dynamic database at an image quality acceptable to end-user scientists. In public recognition of my work, I received National Aeronautics and Space Administration Group Achievement Awards in 1990 and 1992.

10. After June 1994, I began a six-month stint as a contract Software Engineer for the Federal National Mortgage Association in Washington D.C., for which I developed a graphical user interface to monitor and validate loan servicer input for a Loss Mitigation Project. I then served as an Independent Consultant to

Optivision, Inc. for the next six months, where I researched and developed rate control algorithms and software based on the MPEG-2 Test Model 5 for the OPTIVideo™ MPEG-2 video encoder, as well as adaptive quantization algorithms based on the then-JPEG-3 draft standard. In this role, I researched and developed algorithms to improve the quality of gray scale image compression for the medical imaging DICOM Standard by providing a lossless hybrid algorithm encoding image residuals with a diagonal Golomb code based an Enhanced Universal Trellis Coded Quantization algorithm.

11. Between December 1995 and March 1996, I served as a Senior Staff Engineer/Firmware Engineer for General Instrument Inc., Comstream Inc., and Armor Safe Technologies Inc. At Comstream, I worked on integrating an MPEG-2 set top box with OpenTV interactive television middleware programmed in the Microtec C language ported to a Motorola 68340 processor under the pSOS operating system.

12. From January 1996-97, I was the sole proprietor of Anugraha, where I researched and developed algorithms and processes to compress fine art photography at an image quality acceptable to artists based on the JPEG imaging standard implemented with image pre-processing and adaptive quantization. For the next year or so, I worked as an engineering contractor or consultant for various

companies, working primarily on image processing systems and digital interactive television set-top boxes.

13. In October 1998, I began a six-month engagement with Rockwell Collins Inc., where I worked as a Lead Systems Engineer tasked with harmonizing requirements for an MPEG-2 in-flight entertainment system. I then worked for Sun Microsystems Inc. as a Software Engineer until November 1999. During my time at Sun Microsystems Inc., I developed a Distributed Component Object Model (DCOM) software interface between a TV control graphical user interface and a Microsoft broadcast application programming interface (API) with the goal of improving the visual quality of interactive TV displays derived from UDP/IP datagrams synchronized with MPEG-2 audio/video packet data.

14. For the next 22 months, from January 2000 to October 2002, I worked as the Chief Systems Engineer for Media Logic Systems Ltd. During my time at Media Logic Systems, I designed and developed a live interactive television system (iSeeTV) in which customers communicate with human sales agents in video-enabled call centers. To create this system, I researched and developed tools and encoder systems to improve image quality at prescribed latency and bit rate for distributing live video and audio streams encoded via low latency methods. To perform the above, I was required to understand and implement video codec systems employing the MPEG-2 Simple Profile at Main Level (CATV), MPEG-4 Visual

Profile with background sprite coding, and the H.263+ Standard (now known as H.264).

15. Since November 2002, I have been an engineering contractor, and more recently an independent consultant in mathematical modeling, for several companies, such as Cyra Technologies Inc. and Amgen Inc. I also served as a senior research fellow at Merck & Co., Inc., a manager at GlaxoSmithKline Inc., a director at Daiichi Sankyo, Inc., a senior director at Praxis Precision Medicines, and currently serve as a director at Takeda Pharmaceuticals. During this time, I have developed mathematical models and simulations related to various systems, signals, and images. Specifically, I have focused on analyzing, processing, storing, and deriving information from biomedical imaging and other data. Using the information derived from these data, I have created a variety of models related to biology and the effects of drugs on the human body. In recognition of my work, I have received GlaxoSmithKline R&D Recognition Awards in 2012, 2013, and 2016 and a Daiichi Sankyo recognition award in 2021.

16. In addition to my over thirty years of relevant industry experience, I have authored many publications relating to video and imaging coding. In 2003, I authored a chapter entitled “Video Compression” for the *Internet Encyclopedia*. In 2004 I authored the chapter entitled “Video” for the *Berkshire Encyclopedia of*

Human-Computer Interaction. And in 2007 I authored a chapter titled “Video Compression” for the *Handbook of Computer Networks*.

17. I am also a Senior Member of the Institute of Electrical and Electronics Engineers (“IEEE”) and serve as the current Philadelphia Chapter Chair of the Communications & Information Theory Societies as well as the American Association of Pharmaceutical Scientists Pharmaco-Imaging Community. I also served as the 2019 Vice Chair of the IEEE P2673 Intelligence Augmentation for Medical Imaging Standards Working Group. I also have been registered to practice as a patent agent for the United States Patent and Trademark Office since 2002 (Reg. No. 51,704).

18. From 2017 I have also volunteered as a Voluntary Researcher with the State University of New York at Buffalo. In this role, I am providing senior authorship and mentorship for post-doctoral researchers in areas relating to computer modeling and estimation.

19. In view of the above and my curriculum vitae in Appendix A, I received a doctorate in physics and several years of work experience on image and video technologies, including image and video transmission, prior to the priority date of the ’794 Patent. Thus, as of both the priority date of the ’794 Patent (i.e., April 12, 2005), I was at least a person of ordinary skill in the art of the ’794 Patent (Section

V, *infra*), and I had direct personal knowledge of the technologies involved in the '794 Patent.

III. UNDERSTANDING OF PATENT LAW

20. I am not an attorney. For the purposes of this declaration, I have been informed about certain aspects of the law that are relevant to my opinions. My understanding of the law was provided to me by Petitioner's attorneys.

21. I understand that prior art to the '794 Patent includes patents and printed publications in the relevant art that predate the priority date of the '794 Patent. For purposes of this Declaration, and for the reasons set forth in more detail below, I have applied the date of April 12, 2005, the filing date of the German '866 Application, as the priority date.

22. I have been asked to provide my opinions regarding whether the claims of the '794 Patent would have been anticipated by the prior art or would have been obvious to a POSITA at the time of the alleged invention in light of the prior art.

23. It is my understanding that, to anticipate a claim under 35 U.S.C. § 102, a reference must disclose each and every element of the claim.

24. I understand that a claim is also unpatentable if it would have been obvious. Obviousness of a claim requires that the claim would have been obvious from the perspective of a POSITA at the time the alleged invention was made. I

understand that a claim could have been obvious from a single prior art reference or from a combination of two or more prior art references.

25. I understand that an obviousness analysis requires an understanding of the scope and content of the prior art, any differences between the alleged invention and the prior art, and the level of ordinary skill in evaluating the pertinent art.

26. I further understand that a claim would have been obvious if it unites old elements with no change to their respective functions, or alters prior art by mere substitution of one element for another known in the field and that combination yields predictable results. Also, I understand that obviousness does not require physical combination/bodily incorporation, but rather consideration of what the combined teachings would have suggested to POSITAs at the time of the alleged invention. I understand that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.

27. While it may be helpful to identify a reason for this combination, I understand that there is no rigid requirement of finding an express teaching, suggestion, or motivation to combine within the references. When a product is available, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a POSITA can implement a predictable variation, obviousness likely bars its patentability. For the same reason, if a

technique has been used to improve one device and a POSITA would recognize that it would improve similar devices in the same way, using the technique would have been obvious. I understand that a claim would have been obvious if common sense directs one to combine multiple prior art references or add missing features to reproduce the alleged invention recited in the claims.

28. I further understand that certain factors may support or rebut the obviousness of a claim. I understand that such secondary considerations include, among other things, commercial success of the patented invention, skepticism of those having ordinary skill in the art at the time of invention, unexpected results of the invention, any long-felt but unsolved need in the art that was satisfied by the alleged invention, the failure of others to make the alleged invention, praise of the alleged invention by those having ordinary skill in the art, and copying of the alleged invention by others in the field. I understand that there must be a nexus—a connection—between any such secondary considerations and the alleged invention. I also understand that contemporaneous and independent invention by others is a secondary consideration tending to show obviousness.

29. I am not aware of any allegations by the named inventor of the '794 Patent or any assignee of the '794 Patent that any secondary considerations tend to rebut the obviousness of any Challenged Claim of the '794 Patent.

30. I understand that in considering obviousness, it is important not to determine obviousness using the benefit of hindsight derived from the patent being considered.

31. I understand that Petitioner has the burden of proving unpatentability by a preponderance of evidence, which means that the claims are more likely than not unpatentable.

32. I understand that the claims are to be construed according to the same claim construction standard that district courts use wherein claim terms are given their ordinary and customary meaning from the perspective of a POSITA at the time of the invention.

33. The analysis in this declaration is in accordance with the above-stated legal principles.

IV. THE '794 PATENT

34. The '794 Patent relates to synchronization of multimedia data. The challenged claims of the '794 Patent relate to “synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file.” '794 Patent (EX1001), claim 1.

35. In one example of the '794 Patent, “a video data stream and an audio data stream are to be synchronized.” *Id.* at 3:67–4:1. Thus, in the challenged claims and specification, which use the phrases “first data” and “second data”, a POSITA

would have recognized references to “first data” as corresponding to video data, and references to “second data” as corresponding to audio data.

36. The '794 Patent explains that, in its method, “first and second data segments will be output in each case sequentially according to their chronological sequence in such a way that ... each second data segment will be output together with an associated first data segment.” '794 Patent (EX1001), 3:29–39. The '794 Patent explains that the “synchronization is controlled by way of the predefinable assignment rule” such that “content-related data segments can be output together according to their chronological sequence” which is advantageous “since the assignment is carried out without the use of timestamps.” *Id.* at 2:36–46. A POSITA would have recognized that, in the context of the '794 Patent, outputting a second data segment (audio segment) together with a corresponding first data segment (video segment) is done so that a given segment of video, e.g., video of an actor’s mouth speaking dialogue in a movie, is correspondingly matched with the correct audio that matches the script. In the '794 Patent, one example is a data segment that contains the word “Good” and a further data segment that includes the word “Morning” such that “Good” is output first, followed by “Morning.” *See id.* at 4:54–60.

37. Independent claim 1, which is reproduced below, recites aspects of the above disclosure.

1. A method for synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file, the method comprising:

sequentially outputting, by a device for synchronizing content-related data, the content-related first data segments and the content-related second data segments according to their chronological sequence

in such a way that each of the content-related second data segments is output together with an associated one of the content-related first data segments on the basis of an assignment rule for assigning each one of the content-related second data segments to one of the content-related first data segments.

'794 Patent (EX1001), claim 1.

38. However, prior to the '794 Patent, it was known to synchronize content-related segments, e.g., to synchronize segmented video and audio data. For example, in 1996, the IEEE Journal on Selected Areas in Communications published a paper titled "A Media Synchronization Survey: Reference Model, Specification, and Case Studies" by Gerold Blakowski and Ralf Steinmetz that stated that a "key issue" was "the synchronization of and between various kinds of media and data" and which described a "daily example of synchronization between continuous media" such as "the synchronization between the visual and acoustical information in television." EX1012, p. 1. Blakowski further stated that in "a multimedia system, the similar

synchronization must be provided for audio and moving pictures.” *Id.* The Blakowski paper also noted that, even in 1996, “in nearly every multimedia workshop and conference, many synchronization-related contributions have been provided.” *Id.* at 2. Thus, synchronization of multimedia content, such as audio and video, was an area of active research and development. *See also* EX1014, p. 1 (describing the problem of synchronizing time-ordered sequence of data elements as fundamental to multimedia data).

39. To this end, by the time of the ’794 Patent, it was known to synchronize data by assigning segments of one type of data (e.g., audio data) to segments of video data. For example, *Abbott*, one of the references applied herein, disclosed a synchronization method that mapped audio frames to groups of video data, so that media data delivered to a user was not presented out of sync. *Abbott* describes that its technique “enables the video to be synchronized with the audio.” *Abbott* (EX1004), 7:22–23. *Abbott*’s synchronization method, just like the ’794 Patent, does not rely on a timestamp to assign audio data to video data. Thus, as analyzed below, the prior art references presented in this Declaration disclose the limitations of the challenged claims, or at least render the challenged claims obvious.

V. LEVEL OF ORDINARY SKILL IN THE PERTINENT ART

40. I understand that the level of ordinary skill may be reflected by the prior art of record, and that a POSITA to which the claimed subject matter pertains would

have the capability of understanding the scientific and engineering principles applicable to the pertinent art. I understand that one of ordinary skill in the art has ordinary creativity, and is not a robot.

41. I understand there are multiple factors relevant to determining the level of ordinary skill in the pertinent art, including (1) the levels of education and experience of persons working in the field at the time of the invention; (2) the sophistication of the technology; (3) the types of problems encountered in the field; and (4) the prior art solutions to those problems. There is likely a wide range of educational backgrounds in the technology fields pertinent to the '794 Patent.

42. I am very familiar with the knowledge and capabilities that a person of ordinary skill in the art of streaming multimedia would have possessed in April 2005. Specifically, my experience in the industry and with engineers practicing in the industry during the relevant timeframe allowed me to become personally familiar with the knowledge and capabilities of a person of ordinary skill in the area of streaming multimedia. For example, as I detailed above, I gained work experience in this area while at Sun Microsystems by developing a software interface to improve the quality of interactive TV displays synchronized with MPEG-2 audio/video packet data. Unless otherwise stated, my testimony below refers to the knowledge of one of ordinary skill in the art in the field of streaming multimedia at the time of the priority date of the '794 Patent.

43. In my opinion, a person having ordinary skill in the art of the '794 Patent at the time of its filing would have been a person having: (1) at least an undergraduate degree in electrical or computer engineering or a closely related scientific field, such as physics or computer science, or similar advanced post-graduate education in this area; and (2) two or more years of experience with streaming multimedia. Such a person of ordinary skill in the art would have been capable of understanding the '794 Patent and the prior art references discussed herein.

44. Based on my education, training, and professional experience in the field of the claimed invention, I am familiar with the level and abilities of a person of ordinary skill in the art at the time of the claimed invention. Additionally, I met at least these minimum qualifications to be a POSITA at least as of April 2005. Further, although my qualifications may exceed those of the hypothetical person having ordinary skill in the art defined above, my analysis and opinions regarding the '794 Patent have been rendered from the perspective of a person having ordinary skill in the art at the time of the invention.

VI. CLAIM CONSTRUCTION

45. It is my understanding that in order to properly evaluate the '794 Patent, the terms of the claims must first be interpreted. It is my understanding that the claims are to be construed according to the same claim construction standard that

district courts use. Under the claim construction standard that district courts use, claim terms are given their ordinary and customary meaning from the perspective of a POSITA at the time of the invention.

46. In order to construe the claims, I have reviewed the entirety of the '794 Patent along the prosecution history of the '794 Patent (EX1002). Consistent with the '794 Patent disclosure, I have interpreted the terms in the Challenged Claims according to their plain and ordinary meaning as understood by a POSITA, and considered any explicit definitions provided by the specification of the '794 Patent, where applicable.

47. Based on my review of the '794 Patent, it is my opinion that a person of ordinary skill in the art would have understood each of the terms of the '794 Patent according to their ordinary and customary meaning.

VII. PRIOR ART INVALIDITY ANALYSIS

48. I have been asked to provide my opinion as to whether the Challenged Claims of the '794 Patent would have been anticipated by the prior art or would have been obvious in view of the prior art. The discussion below provides a detailed analysis of how the prior art references I reviewed disclose, teach, or suggest the limitations of the Challenged Claims of the '794 Patent.

49. As part of my analysis, I have considered the scope and content of the prior art and any potential differences between the claimed subject matter and the prior art. I conducted my analysis as of the priority date of the '794 Patent of April 12, 2005. I have also considered the level of ordinary skill in the pertinent art as of that date.

50. I describe in detail below the scope and content of the prior art, as well as any differences between the claimed subject matter and the prior art, on an element-by-element basis for each Challenged Claim of the '794 Patent. This analysis supports my finding that the limitations of the claims of the '794 Patent are disclosed in the prior art, or that the differences between the claims of the '794 Patent and the prior art discussed herein are such that the subject matter as a whole would have been obvious at the time of the filing of the '794 Patent to a POSITA to which the subject matter pertains.

51. As described in detail below, the claimed subject matter of the Challenged Claims would have been anticipated by the identified prior art references or obvious in view of the teachings of the identified prior art references as well as the knowledge of a POSITA.

52. I will now describe, in the grounds below, on an element-by-element basis how the prior art discloses or teaches all elements of claims 1, 3, 5, 9, 12, 13,

15, 20, and 21. Unless otherwise noted, all *italic*, and **bold italic** emphases in any quoted material have been added.

A. Ground 1 and Ground 2: Claims 1, 3, 5, 9, 12, 13, 15, 20, and 21 are anticipated by *Abbott* or in the alternative, are rendered obvious by *Abbott* in view of the knowledge of a POSITA

53. It is my opinion that *Abbott* discloses each and every limitation of claims 1, 3, 5, 9, 12, 13, 15, 20, and 21 (Ground 1). In the alternative, *Abbott* renders obvious, to a POSITA, the subject matter of each and every limitation of claims 1, 3, 5, 9, 12, 13, 15, 20, and 21 (Ground 2).

1. The Prior Art Reference

a) Background on *Abbott*

54. *Abbott* discloses an “indexing method for allowing a viewer to control the mode of delivery of program material.” *Abbott* (EX1004), Abstract. As pertinent to the analysis below, *Abbott* discloses a “synchronizing method ... to minimize a time offset between audio and video data.” *Id.* *Abbott*’s techniques are described in detail below in the substantive analysis of claim 1 and therefore are not repeated in this background portion.

55. *Abbott* is analogous art. According to the ’794 Patent, “[a]t least one embodiment of the invention specifies a method or, as the case may be, a device which enables content-related first and second data segments to be synchronized in a simple and standard-compliant manner.” ’794 Patent (EX1001), 2:24–26. *Abbott*

is within this field, as it likewise discloses a “synchronizing method...to minimize a time offset between audio and video data.” *Abbott* (EX1004), Abstract.

2. Analysis of Claims 1, 3, 5, 9, 12, 13, 15, 20, and 21

a) Claim 1

[1.0] A method for synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file, the method comprising:

56. *Abbott* discloses a *method for synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file* as set forth in the preamble of claim 1. Specifically, *Abbott* discloses a method for media stream synchronization (a *method for synchronizing*), and details that its method synchronizes between Groups of Pictures (*content-related first data segments*) of a video atom file (*of a first data file*) and audio frames (*content-related second data segments*) of an audio atom file (*of a second data file*).

57. First, *Abbott* discloses a *method for synchronizing content-related first data segments and content-related second data segments*. *Abbott* discloses a “system and **method for media stream indexing and synchronization.**” *Abbott* (EX1004), 1:11–13, *see also* Fig. 10, 4:36–38 (“process for synchronizing one or more auxiliary atoms containing media data with a base atom containing media data.”); 2:45–54 (“method is provided for synchronizing media data for delivery to

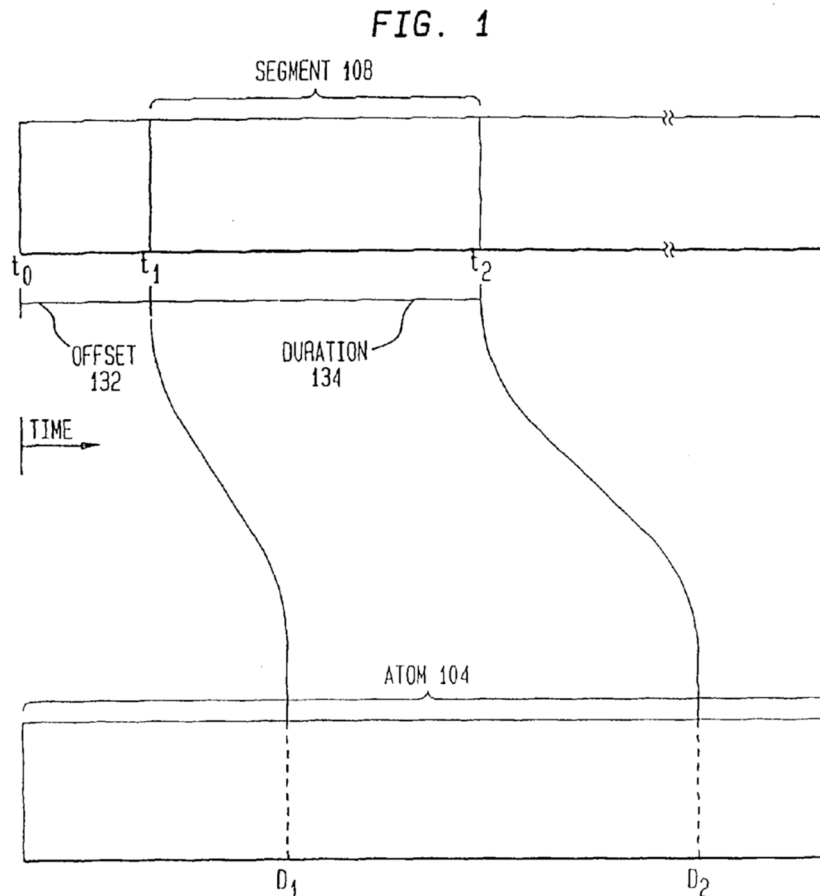
a viewer”); 15:50–54 (“better synchronization between audio and video data can be achieved”); 17:35–38 (“synchronize the data with each other”).

58. *Abbott* operates with reference to an “object hierarchy.” *Abbott* (EX1004), 5:46–55. In *Abbott*’s object hierarchy, “data representing the program material is contained in an atom” and it explains that, in one example, “a movie can be partitioned into two atoms, one atom for video, and another atom for audio.” *Id.* at 5:56–61; *see also* 3:32–34 (“video data in one atom and audio data in another atom.”); 3:37–39 (“audio data and video data can be encoded and contained in different atoms”).

59. *Abbott* further explains that an “atom may be stored in any suitable manner on a storage device or other suitable memory means. This may include, for example, **a file on a disk in a server....**” *Id.* at 6:3–8. Thus, a POSITA would have recognized that video data is contained in one atom, or *a first data file*, and likewise, audio data is contained in a second atom, or *a second data file*. Thus, each atom corresponds to a *data file*, and the atom for video is a *first data file* and the atom for audio is a *second data file*.

60. *Abbott* then explains that an “atom is thus the basic building block of the object hierarchy” and details a further division referred to as a segment, which “identifies a portion of one particular atom, i.e., program material data or ‘atom data’ between two points in time.” *Abbott* (EX1004), 6:24–42. *Abbott* further explains

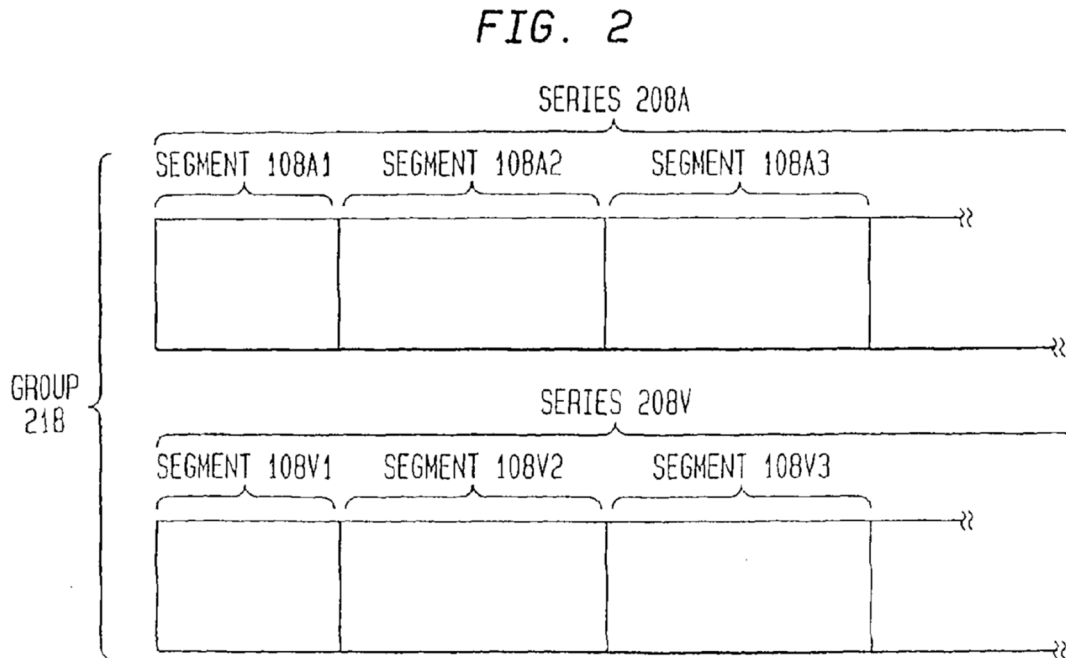
that a “segment may identify only a portion of the atom” including “atom data between two arbitrary times in the program material.” *Id.* This is depicted in Figure 1, which “illustrates the relationship between an atom and a segment.” *Id.* at 6:52–7:6.



Abbott (EX1004), Figure 1

61. *Abbott* further explains that a “series” may be formed by “sequentially ordering one or more segments” and further, that a “group is formed by joining or grouping series.” *Id.* at 7:7–8, 7:16–18. This is depicted in Figure 2, which is “a

diagram illustrating two series 208 (208A and 208V) and a group 218.” *Id.* at 7:36–37.



Abbott (EX1004), Figure 2

62. *Abbott* also discloses video data segmented into “Groups of Pictures” and audio data segmented into audio frames, which correspond to and are mapped to the recited *first data segments* and *second data segments* as is further detailed in the analysis of limitation [1.1], which I analyze in more detail below. *Abbott* (EX1004), 17:3–41. That is, in the analysis that follows, *first data segments* are disclosed by *Abbott*’s “Groups of Pictures,” while *second data segments* are disclosed by *Abbott*’s “audio frames.”

63. Thus, *Abbott* discloses *segments* of the atoms, and based on its disclosure of an atom stored in a file for video and an atom stored in a file for audio

detailed above, discloses *content-related first data segments of a first data file and content-related data segments of a second data file* as recited.

64. Finally, *Abbott* explains *synchronizing* these segments. As noted above, in *Abbott*, a “series is formed by sequentially ordering one or more segments” and a “group is formed by joining or grouping series in parallel for parallel, simultaneous delivery of the corresponding data.” *Id.* at 7:7–8, 7:16–18. *Abbott* also describes “synchronized delivery” of such data, and thus discloses *synchronizing* as recited. Specifically, *Abbott* explains: “synchronized delivery enables the video to be synchronized with the audio.” *Id.* at 7:16–26; *see also* 18:58–61 (“synchronization is done by correlating audio frames of the audio data with GOPs of the video data.”); 4:30–35 (“synchronization methods of the present invention using MPEG-1 encoded video and MPEG-1 encoded audio data”); 15:50–52 (“synchronization between audio and video data can be achieved”); 18:49–53 (“correlate the audio data with the corresponding video data to ensure that the audio and video remain synchronized.”)

65. Thus, by describing: atom data that includes video and audio; the division of atom data into segments (Groups of Pictures for video and audio frames for audio); and the synchronization of segments of atom data, *Abbott* discloses *synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file* as recited.

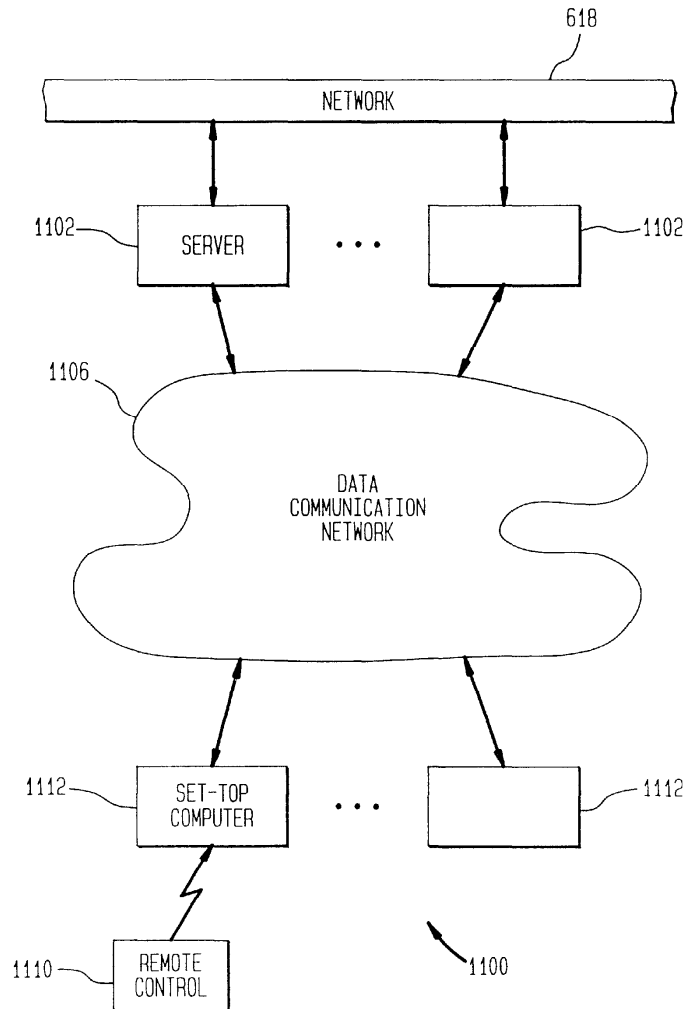
[1.1] sequentially outputting, by a device for synchronizing content-related data, the content-related first data segments and the content-related second data segments according to their chronological sequence;

66. *Abbott* discloses, or at least renders obvious, this limitation.

67. I will first address *Abbott*'s disclosure of *sequentially outputting, by a device for synchronizing content-related data*. I then address *sequentially outputting ... the content-related first data segments and the content-related second data segments according to their chronological sequence*.

68. With respect to *sequentially outputting, by a device for synchronizing content-related data*, *Abbott* discloses outputting *by a device for synchronizing content-related data* because it describes a “media delivery system using the object hierarchy of the present invention.” *Abbott* (EX1004), 7:57–59. *Abbott* further explains that “group 218 media data arranged in accordance with the viewer’s command is transmitted from remote servers 1102 via data communication network 1106 to set-top computer 1112.” *Id.* at 21:33–37.

FIG. 11



Abbott (EX1004), Figure 11

69. At the set-top computer 1112 “media data is then decoded, as necessary, by set-top computer 1112 for display on the viewer’s television.” *Id.*

70. This decoding operation by the set-top computer discloses *sequentially outputting, by a device for synchronizing content-related data* as recited, based on the '794 Patent’s examples of “output” as including passing data “to a processing unit” ('794 Patent (EX1001), 2:43–46), as a POSITA would have recognized

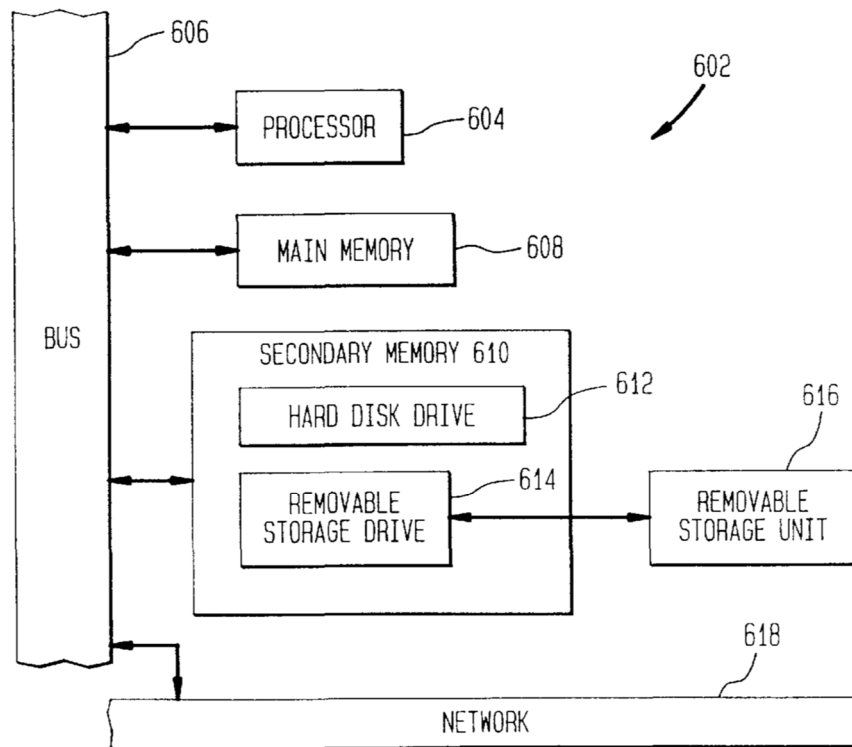
decoding media data by a set-top computer to include processing that data by a processor of the set-top computer. For example, to decode media data, as is disclosed by *Abbott*, a POSITA would have recognized that a processor in the set-top computer would decode MPEG-1 data in accordance with the MPEG-1 standard based on software instructions stored in a memory of the set-top computer such that the MPEG-1 data could be visually and audibly rendered on the viewer's television. Or, to decode media data, as is disclosed by *Abbott*, a POSITA would have recognized that a dedicated MPEG-1 decoder, implemented in hardware such as an application-specific integrated circuit (ASIC) or a field-programmable gate array (FPGA) controlled by firmware, would have decoded MPEG-1 data in accordance with the MPEG-1 standard based on the firmware such that the MPEG-1 data could be visually and audibly rendered on the viewer's television. This is consistent with my experience as an engineer working on set top boxes for television services detailed above. *See also* Microsoft Computer Dictionary (EX1011), p. 476 ("set-top box" definition pointing to "information appliance"); p. 271 ("information appliance" defined as "specialized computer").

71. Further, because the set-top computer 1112 is part of Figure 11's "system that uses the object hierarchy and indexing and synchronization methods of the present invention for interactive delivery of program material to a viewer," a POSITA would have recognized that the set-top computer decodes the media such

that “program material” is “delivered to the viewer in a synchronized manner” as disclosed throughout *Abbott*. See, e.g., *Abbott* (EX1004), 20:11–13. Thus, *Abbott* discloses *sequentially outputting, by a device for synchronizing content-related data* (the set-top computer 1112).

72. *Abbott* also describes a “computer system for storing and arranging media data for delivery to a viewer using the object hierarchy as described herein” which includes a connection to a network “so that program material may be retrieved and delivered to a viewer.” *Abbott* (EX1004), 11:59–65, 12:18–24. This “exemplary computer system 602 is shown in FIG. 6” and also corresponds to a *device for synchronizing content-related data* as it includes “control logic, when executed by processor 604” which “causes computer system 602 to store, arrange, format, and deliver media data to a viewer using the object hierarchy of the invention.” *Id.* at 12:34–40.

FIG. 6



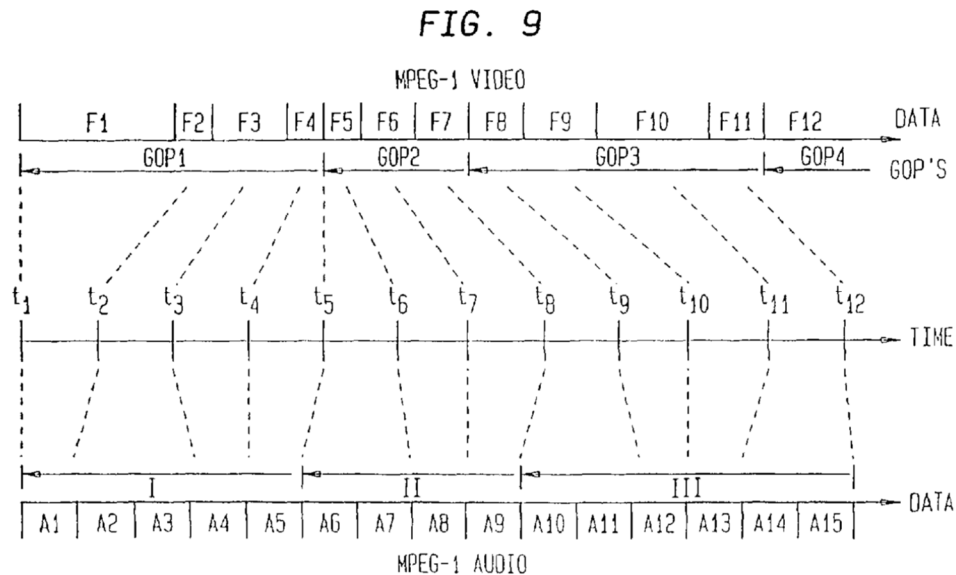
Abbott (EX1004), Figure 6

73. The arrangement and delivery of media data by the computer system 602 as described also discloses *sequentially outputting, by a device for synchronizing content-related data* as recited, based on the '794 Patent's examples of "output" as including transmission. See '794 Patent (EX1001), 2:43–46. For example, the computer system shown in Figure 6 would be understood to transmit, via network 618, media data arranged for synchronous output. Thus, *Abbott* discloses *outputting, by a device for synchronizing content-related data* (computer system 602).

74. With respect to *sequentially outputting ... the content-related first data segments and the content-related second data segments according to their chronological sequence*, *Abbott* also discloses this limitation of claim 1.

75. In a section titled Media Stream Synchronization, *Abbott* discloses that “it is necessary to correlate the audio data with the corresponding video data to ensure that the audio and video remain synchronized.” *Abbott* (EX1004), 18:48–57. *Abbott* further describes that the “media stream synchronization method of the present invention ensures that the data from every series in a group starts out in synchrony, and remains in synchrony after any repositioning of the viewpoint within the program material.” *Id.*

76. *Abbott* depicts *the content-related first data segments and the content-related second data segments according to their chronological sequence* in Figure 9.



Abbott (EX1004), Figure 9

77. *Abbott* explains Figure 9 with respect to video data, segmented as “Groups of Pictures” (i.e., *content-related first data segments*) as follows:

In some encoding protocols, such as MPEG-1, **video data frames** are **grouped together into units referred to herein as “Groups of Pictures” (GOPs)**. A GOP is comprised of one or more frames. In an environment using GOP, an index file is preferably constructed that allows a viewer to skip only to the beginning of a GOP, not simply to the beginning of a frame within the GOP. FIG. 9 illustrates the relationship between frames and a GOP. FIG. 9 shows MPEG-1 video data divided into twelve frames, shown as F1, F2, . . . F12. The twelve frames are further grouped into four GOPs, shown as GOP1, GOP2, GOP3, and GOP4. Particularly, frames F1, F2, F3, and F4 are in GOP1, frames F5, F6, and F7 are in [GOP2], frames F8, F9, F10, and F11 are in GOP3, and frame F12 is in GOP4. **The**

time axis shown in FIG. 9 is marked at regular intervals, i.e., the frame duration or time for which a particular [frame] is presented, generally approximately 1/30 sec. Dashed lines correlate the beginning of each frame with the corresponding time. **Frame F1 begins at time t1, frame F2 begins at time t2, frame F3 begins at time t3, etc.** The MPEG-1 video data of FIG. 9 has a fixed index duration, the index duration being the duration of each frame, or 1/30 sec. FIG. 9 illustrates that although frames F1-F12 all have the same duration, the frames have varying sizes. For example, frame F1 is larger than frame F2, i.e., frame F1 contains more data than frame 12.

Abbott (EX1004), 17:3–26.¹

78. *Abbott* then describes Figure 9 with respect to audio data, segmented as audio frames (i.e., *content-related second data segments*) as follows:

MPEG-1 audio has only one grouping level so that “audio frames” are not further grouped into “audio GOPS”. The **MPEG-1 audio data of FIG. 9 is broken down into fifteen audio frames A1, A23, . . . A15**. Each of the audio frames shown in FIG. 9 has a fixed [frame] size so that there is the same amount of data in each audio

¹ *Abbott*’s disclosure of an approximate frame duration of 1/30 seconds is consistent with a POSITA’s knowledge that the United States National Television System Committee (NTSC) standard broadcast frame rate is 30000/1001 frames per second.

frame. The duration of each audio frame is the same. **It can be seen from the time line in FIG. 9 that the index duration for the audio data is the same as the index duration of the video data.**

Id. at 17:27–41.

79. Thus, as shown in Figure 9, the *first data segments* (video Groups of Pictures) and *second data segments* (audio frames) are ordered *according to their chronological sequence* and Figure 9 explicitly shows the segments ordered according to time. For example, Figure 9 depicts the segments ordered in sequence from time t1 to time t2, t3, and so on. A POSITA would have thus recognized that the segments would be *output[]* in time order, or *according to their chronological sequence*. That is, a POSITA would have recognized that GOP1, spanning from time t1 to t5, would be output first, along with the audio frames that match GOP1 (e.g., A1 through A5). Then, GOP2, spanning from t5 through t8, would be output second, along with the audio frames that match GOP2.

80. Further, *Abbott* explains that the “object hierarchy of the present invention provides for **sequentially ordering data** (concatenating in an ordered sequence).” *Abbott* (EX1004), 5:46–55.

81. Thus, *Abbott* discloses *sequentially outputting ... the content-related first data segments and the content-related second data segments according to their chronological sequence* as recited.

[1.2] in such a way that each of the content-related second data segments is output together with an associated one of the content-related first data segments on the basis of an assignment rule for assigning each one of the content-related second data segments to one of the content-related first data segments.

82. *Abbott* discloses, or at least renders obvious, this claim limitation.

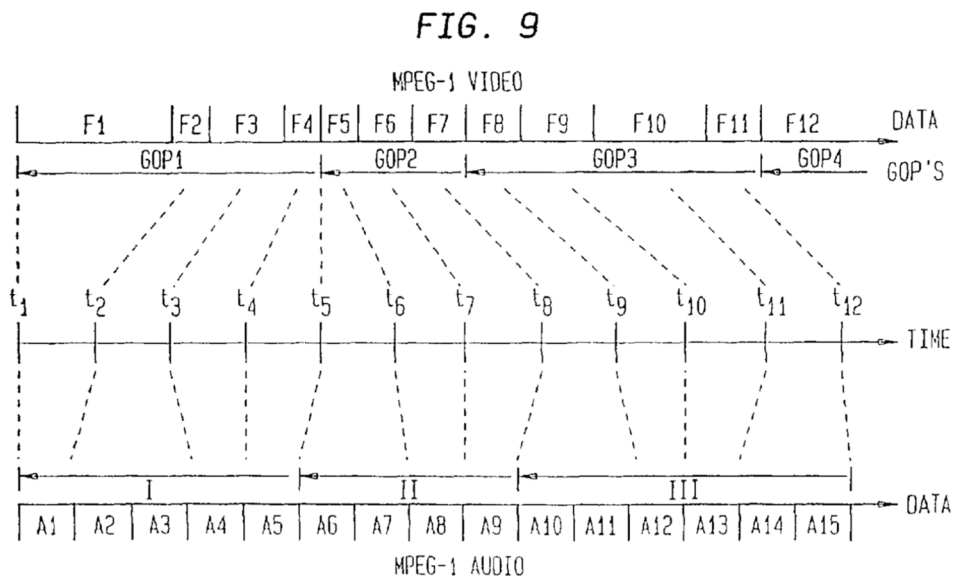
83. *Abbott* describes that “it is necessary to correlate the audio data with the corresponding video data to ensure that the audio and video remain synchronized.” *Abbott* (EX1004), 18:49–53. To do so, *Abbott* explains that “synchronization is done by correlating audio frames of the audio data with GOPs of the video data.” *Id.* at 18:58–63.

84. *Abbott* explains further how this is performed:

When jumping to various points in an item of program material, the indexing method of the present invention ensures that a jump is made to the beginning of a GOP. **To prevent audio data from being “out of sync”, it is necessary to correlate the corresponding audio data to each GOP.** To do so, an index file for the video data is constructed first. As discussed above with respect to FIG. 9, an index file for the video data would contain repeated atom-relative byte positions for the frames within GOP1, repeated atom-relative byte positions for the frames within [GOP2], repeated atom-relative byte positions for the frames within GOP3,

etc. Such a video data index file is then used to construct an index file for the corresponding audio data. An audio data index file is constructed so that, for the set of audio frames that most closely spans the time interval spanned by each GOP, each audio frame in that set is assigned the same atom-relative byte position. The assigned atom-relative byte position is the beginning of the set of audio frames. This synchronization method is illustrated in FIG. 9.

Abbott (EX1004), 18:66–19:17.



***Abbott* (EX1004), Figure 9**

85. *Abbott* then details Figure 9 in more detail, stating:

As shown in FIG. 9, **GOP1 spans the time interval from t1 to t5**. Audio frames A1, A2, A3, A4, and A5 (set I shown in FIG. 9) come closest to spanning this same time interval. In accordance with the

synchronization method of the present invention, **audio frames A1, A2, A3, A4, and A5 are assigned unique index numbers, but each of these index numbers points to the same atom-relative byte position that is the beginning of audio frame A1. Likewise, GOF2 spans the time interval from t5 to t8.** Audio frames A6, A7, A8, and A9 (set II shown in FIG. 9) come closest to spanning this same time interval. **In accordance with the synchronization method of the present invention, audio frames A6 through A9 are assigned unique index numbers, but each of these index numbers points to the same atom-relative byte position that is the beginning of audio frame A6.** The same methodology would apply so that unique index numbers are assigned to audio frames A10-A15 (set III shown in FIG. 9), but each of these index numbers points to the same atom-relative byte position that is the beginning of audio frame A10. The index numbers and corresponding atom-relative byte positions for the audio are thus selected to most closely match the GOP pattern in the corresponding video.

Id. at 19:18–39.

86. Based on the above discussion, *Abbott* discloses that *each of the content-related second data segments (audio frames) is output together with an associated one of the content-related first data segments (a group of pictures) and assigning each one of the content-related second data segments to one of the content-related first data segments (e.g., audio frame A1 is assigned to group of pictures GOP1, audio frame A6 is assigned to group of pictures GOP2, and so on).*

This is consistent with the disclosure of *Abbott* as matched with the detail provided by Figure 9 itself.

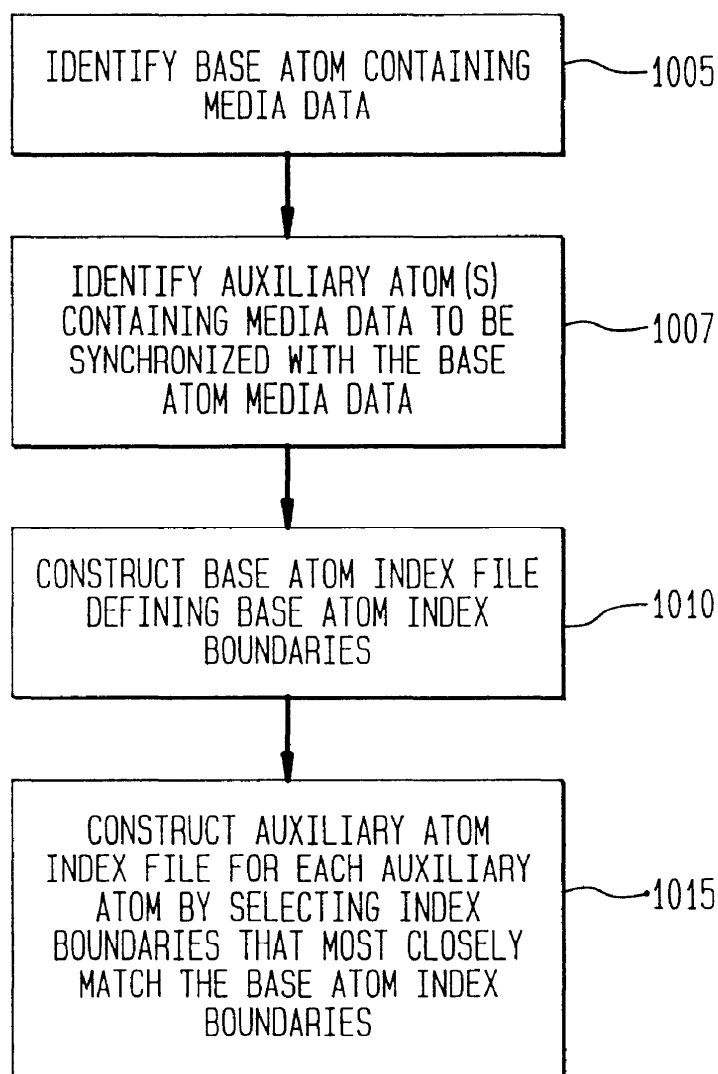
87. *Abbott* further discloses that the information assigning audio frames to a Group of Pictures is contained in an “index file for the video data” and an “audio data index file.” *Abbott* (EX1004), 18:66–19:17. *Abbott* describes that “an index file is used to correlate index number with a corresponding data position,” such as “the beginning of a frame of media data, or the beginning of a group of pictures of media data.” *Id.*, 2:39–44; *see also* 2:51–60 (“constructing a base atom index file that contains base atom index boundaries...the base atom index boundaries are Groups of Pictures boundaries...auxiliary atom index file is constructed by selecting the auxiliary atom index boundaries that most closely match the base atom index boundaries, thereby synchronizing media data...”); 20:6–24. *Compare with, e.g.*, ’794 Patent (EX1001), 2:55–59 (“the predefinable **assignment rule** is formed in such a way that for each second data segment a first data segment is assigned by specification of a number, the number representing a position of the first data segment within the chronological sequence of the first data segments.”).

88. As detailed above, the “audio index file” is constructed so that “each audio frame” in a particular set “is assigned the same atom-relative byte position.” *Abbott* (EX1004), 19:1–17. This is described further with reference to Figure 10, which is a “flow diagram illustrating a process for synchronizing one or more

auxiliary atoms containing media data with a base atom containing media data.” *Id.*

at 19:55–64.

FIG. 10



Abbott (EX1004), Figure 10

89. *Abbott* explains: “In the example illustrated in FIG. 9, the index boundaries for a base atom containing MPEG-1 video data are the boundaries defined by the GOPs. In a step 1015, an auxiliary atom index file is constructed for each auxiliary atom by selecting auxiliary atom index boundaries that most closely match the base atom index boundaries in the base atom index file. In this manner, the media data contained in the auxiliary atoms is synchronized with the media data contained in the base atom....For example, a base atom may contain video data with the index file constructed so that the base atom index boundaries are Groups of Pictures (GOP) boundaries as described above. In such a scenario, one of the auxiliary atoms may contain corresponding audio data....Index files are created for the audio data ... by selecting the index boundaries that most closely match the Groups of Pictures boundaries (index boundaries) of the base atom.” *Id.* at 19:60–20:24.

90. Thus, the index files, which map audio frames to Groups of Pictures using the index boundaries of the audio and video, correspond to *an assignment rule* which is for *assigning each one of the content-related second data segments* (audio frames) *to one of the content-related first data segments* (Groups of Pictures).

91. The '794 Patent does not specify the format of the *assignment rule*; however, a POSITA would have recognized that a file, such as *Abbott's* index file, to be within the scope of the term *rule*, because the '794 Patent provides an example

of an “assignment rule Z...in an XML-based document” (e.g., a file). ’794 Patent (EX1001), 5:19–21; *see also id.*, Figure 4. A POSITA would have recognized an XML-based document as a type of file (e.g., a file with a .xml extension), and thus, *Abbott’s* index files are consistent with the examples provided in the ’794 Patent itself.

92. Additionally, a POSITA would have recognized *Abbott’s* index files to correspond to an *assignment rule* as recited as both the index files and claimed *assignment rules* are implemented in computer instructions and cause a computer to perform actions in a specific way, i.e., to output audio and video in a synchronized manner. This is consistent with how a POSITA would have interpreted the word *rule* in the phrase *assignment rule*. *See* EX1013 (Webster’s Dictionary definition of “rule” as “a prescribed guide for conduct or action”). Thus, *Abbott’s* index files at least render obvious the recited *assignment rule*.

93. Thus, *Abbott* discloses *outputting ... in such a way that each of the content-related second data segments is output together with an associated one of the content-related first data segments on the basis of an assignment rule for assigning each one of the content-related second data segments to one of the content-related first data segments* as recited.

94. *Abbott* therefore discloses each and every limitation of claim 1. To the extent *Abbott* is considered to not anticipate claim 1, the differences between *Abbott*

and claim 1 are such that the invention as a whole would have been obvious before the priority date of the '794 Patent to a POSITA.

95. For example, it may be argued that *Abbott* does not explicitly disclose that the video data segments and audio data segments are output *sequentially*, but this would have been obvious to a POSITA at the time of the '794 Patent, based on the disclosure of *Abbott*. For example, *Abbott* refers throughout to video on demand, movies, and describes that “the terms ‘program’, ‘program material’, and ‘program content’ are used generally to refer to media provided to a viewer, such as audio, video, multi-media, or other types of material intended for listening and/or viewing by the viewer.” *Abbott* (EX1004), 1:57–63.

96. A POSITA would have recognized that such media data is intended to be output *sequentially* – for example, it would be logical to a POSITA that “the audio and video tracks of a movie” would be output in sequence, from the start of the movie to the end. Even if the viewer were “to skip to an arbitrary point in time in an item of program material,” (*Abbott* (EX1004), 15:55–57) after skipping to that time, the content at that point in time would be output and presented *sequentially*, in time order. Indeed, such *sequential[]* output would have been the case even with interactive movies which permit a user to select alternative paths and endings; upon selection of an alternative path, for example, the content of that alternative path would be presented *sequentially* as recited.

97. This would have been no more than common sense at the time of the '794 Patent, given a POSITA's background knowledge in delivery of multimedia content. Indeed, it would have been illogical for a movie to be output in a manner that was not sequential, as outputting a movie in this way would have been confusing to the viewer and lead to fewer movie views, for example. This is also supported by the Blakowski article, which describes that "[t]ime-dependent media objects are presented by a **sequence** of presentation units. An example is a motion picture sequence without audio (i.e., a video sequence) presented frame after frame." EX1012, p. 2. Thus, a POSITA would have appreciated that *Abbott's* multimedia content, i.e., a movie would be reproduced frame after frame, or *sequentially* as recited.

98. Patent Owner may also argue that *Abbott* does not explicitly disclose that *second data segments* are *output together* with *first data segments*. Again, this would have been obvious in view of *Abbott's* disclosure. For example, *Abbott* discloses that a workstation may "display a video portion of the program material" and "audibly output an audio portion of the program material for the workstation user." *Abbott* (EX1004), 21:55–65. *Abbott* also discloses that "[u]sing the synchronization method of the present invention, the offset or 'out of sync' time between audio and video is generally held to be within one frame duration." *Id.* at 19:40–43. Thus, *Abbott* teaches, or at least suggests to a POSITA, that audio data

(*second data segments*) are to be *output together* with video data (*first data segments*). Again, this is also supported by Blakowski, which describes a “daily example of synchronization” as “the synchronization between the visual and acoustical information in television” and which further describes that, “[i]n a multimedia system, the similar synchronization must be provided **for audio and moving pictures.**” EX1012, p. 1. Blakowski also describes synchronization of audio and video with respect to dialogue; for example, Blakowski describes a “temporal relationship between an audio and video stream for the particular case of humans speaking.” *Id.* at 8, *see also id.* at 15 (“[v]ideo and audio data are related by lip synchronization demands.”). Given *Abbott*’s reference to “English language audio” that is packaged with “the video for a movie”, a POSITA would have recognized that *Abbott* is intended to synchronize humans speaking with video of the humans speaking, and thus *Abbott* teaches *second data segments* that are *output together* with *first data segments*. *Abbott* (EX1004), 5:39–45.

99. Additionally, as detailed in the analysis of limitation [1.2], to the extent *Abbott* does not explicitly disclose an *assignment rule*, a POSITA would have recognized that *Abbott*’s index files render obvious an *assignment rule*, because the index file map audio frames to Groups of Pictures so that they are output together. Thus, the index files perform the same function as the recited *assignment rule*; specifically, the index files perform the function of *assigning each one of the*

content-related second data segments to one of the content-related first data segments just like the assignment rule.

100. Thus, *Abbott* also renders claim 1 obvious to a POSITA.

b) Claim 3

[3.1] The method as claimed in claim 1, wherein the assignment rule is formed in such a way that, for each of the content-related second data segments, the content-related first data segments are assigned by specification of a number, the number representing a position of the content-related first data segments within the order of content-related first data segments.

101. *Abbott* discloses, or at least renders obvious, this limitation.

102. Specifically, in *Abbott*, *for each of the content-related second data segments* (e.g., “[a]udio frames A1, A2, A3, A4, and A5”), *the content-related first data segments* (e.g., “GOP1”) *are assigned by specification of a number* (e.g., the number 1), *the number representing a position of the content-related first data segments within the order of content-related first data segments* (GOP1 is the first video segment within the order of video segments GOP2, GOP3, and so on). *Abbott* (EX1004), 19:18–39; Fig. 9.

103. Thus, *Abbott* discloses, or at least renders obvious, this limitation.

c) Claim 5

[5.1] The method as claimed in claim 1, wherein media data are represented by at least one of the first data file and the second data file.

104. *Abbott* discloses, or at least renders obvious, this limitation. As detailed above, *the first data file* is a video atom, and the *second data file* is an audio atom. See *Abbott* (EX1004), 5:56–61, 6:3–8.

105. Thus, *media data are represented by at least one of the first data file and the second data file.*

d) Claim 12

[12.1] The method as claimed in claim 5, wherein the media data include at least one of video and audio data.

106. *Abbott* discloses, or at least renders obvious, this limitation. As detailed in the analysis of claim 5, *Abbott* discloses *media data* including both *video and audio data*.

e) Claim 13

[13.1] The method as claimed in claim 1, wherein at least one of media data and metadata are represented by at least one of the first data file and the second data file.

107. *Abbott* discloses, or at least renders obvious, this limitation. As detailed above in the analysis of limitation [5.1], *media data ... are represented by at least one of the first data file and the second data file as the first data file is a video atom and the second data file is an audio atom.*

f) Claim 15

[15.1] The method as claimed in claim 13, wherein the media data include at least one of video and audio data.

108. *Abbott* discloses, or at least renders obvious, this limitation. As detailed in the analysis of claim 13, the atoms include video data and audio data, and thus, *the media data include at least one of video and audio data as recited.*

g) Claim 20

[20.1] The method of claim 1, wherein the assignment rule is not based on a timestamp.

109. *Abbott* discloses, or at least renders obvious, this limitation.

110. *Abbott* describes, for example, that “GOP1 spans the time interval from t1 to t5” and that “[a]udio frames A1, A2, A3, A4, and A5 are assigned unique index numbers, but each of these index numbers points to the same atom-relative byte position that is the beginning of audio frame.” *Abbott* (EX1004), 19:18–39. Thus,

Abbott's rule relies upon byte positions, not *a timestamp*, to assign *content-related second data segments* to a *content-related first segment* and thus discloses this limitation.

h) Claim 9

[9.0] A device for synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file, comprising:

111. *Abbott* discloses, or at least renders obvious, this limitation.

112. This limitation is substantively identical to limitation [1.0], except that claim 9 recites a *device* instead of a *method*.

113. *Abbott* discloses multiple examples of a *device for synchronizing* as recited. For example, *Abbott* discloses a “computer system for indexing media data for delivery to a viewer using the indexing method as described herein.” *Abbott* (EX1004), 20:42–44. As detailed in the analysis of limitation [1.0], *Abbott* discloses a “system and **method for media stream indexing and synchronization.**” *Abbott* (EX1004), 1:11–13. Thus, the computer system is a *device for synchronizing* as recited.

114. *Abbott* also discloses a “system that uses the object hierarchy and indexing and synchronization methods of the present invention for interactive delivery of program material to a viewer.” *Id.* at 20:55–59. Finally, *Abbott* discloses “a system that uses the object hierarchy and indexing and synchronization methods

of the present invention for interactive delivery of program material to a workstation” (*id.* at 21:38–42) which includes “computer means that enable the workstation to...display a video portion of the program material; and to audibly output an audio portion of the program material for the workstation user.” *Id.* at 21:55–64. As in the preceding paragraph, the methods described in *Abbott* are *for* synchronizing. Thus, *Abbott* discloses a *device for synchronizing* as recited.

115. Finally, as detailed in the analysis of limitation [1.0], *Abbott* also discloses *synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file* as recited.

116. Thus, *Abbott* discloses, or at least renders obvious, the preamble of claim 9.

[9.1] a synchronization device configured to output each of the content-related first data segments and the content-related second data segments, sequentially, according to their chronological sequence;

117. This limitation recites substantively the same subject matter as the subject matter recited in limitation [1.1], and thus, *Abbott* discloses, or at least renders obvious limitation [9.1] for the same reasons set forth with respect to limitation [1.1].

[9.2] each of the content-related second data segments being output together with an associated one of the content-related first data segments based upon an

assignment rule for assigning each one of the content-related second data segments to each one of the content-related first data segment.

118. This limitation recites substantively the same subject matter as the subject matter recited in limitation [1.2], and thus, *Abbott* discloses, or at least renders obvious limitation [9.2] for the same reasons set forth with respect to limitation [1.2].

119. Additionally, to the extent *Abbott* does not explicitly disclose each limitation of claim 9, in the alternative, *Abbott* renders obvious claim 9.

i) Claim 21

[21.1] The device of claim 9, wherein the assignment rule is not based on a timestamp.

120. *Abbott* discloses, or at least renders obvious, this limitation for the same reasons as provided above with respect to limitation [20.1].

B. Ground 3 and Ground 4: Claims 1, 3, 5, 9, 12, 13, 15, 20, and 21 are anticipated by *Sonohara* or in the alternative, are rendered obvious by *Sonohara* in view of the knowledge of a POSITA

121. It is my opinion that *Sonohara* discloses each and every limitation of claims 1, 3, 5, 9, 12, 13, 15, 20, and 21 (Ground 3). In the alternative, *Sonohara* renders obvious, to a POSITA, the subject matter of each and every limitation of claims 1, 3, 5, 9, 12, 13, 15, 20, and 21 (Ground 4).

1. The Prior Art Reference

a) Background on *Sonohara*

122. *Sonohara* discloses a “motion picture reproducing apparatus.” *Sonohara* (EX1003), Abstract. *Sonohara*’s apparatus reproduces “a file composed of a header[,], an image track on which image data have been recorded for a predetermined period of time and a sound track on which sound data have been recorded for the predetermined period of time.” *Id.* *Sonohara* further specifies that the “image and sound data of the file are provided with track and data identifying numbers by a track identifying section and a data identifying section” and this data is “outputted to a data synchronizing section.” *Id.*

123. The “data synchronizing section reads in order the Image data and the sound data on the basis of the control information of the header, synchronizes the image data and the sound data to which the same data identifying numbers have been imparted with reference to the track and data identifying numbers which have been given to the image and sound data, and outputs the image and sound data to reproduction units.” *Id.*

124. *Sonohara* is analogous art. According to the ’794 Patent, “[a]t least one embodiment of the invention specifies a method or, as the case may be, a device which enables content-related first and second data segments to be synchronized in a simple and standard-compliant manner.” ’794 Patent (EX1001), 2:24–26.

Sonohara is within this field, as it likewise discloses a “motion picture reproducing apparatus” that synchronizes audio and video data segments. *Sonohara* (EX1003), Abstract.

2. Analysis of Claims 1, 3, 5, 9, 12, 13, 15, 20, and 21

a) Claim 1

[1.0] A method for synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file, the method comprising:

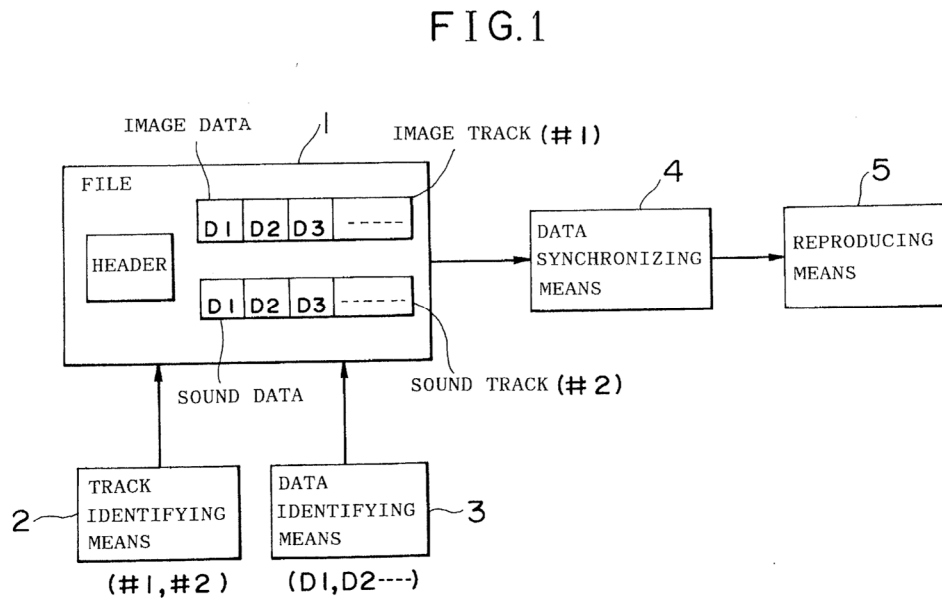
125. *Sonohara* discloses a *method for synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file* as set forth in the preamble of claim 1.

126. First, *Sonohara* discloses *synchronizing content-related first data segments and content-related second data segments*. *Sonohara* discloses “data synchronizing means for reading, in order, said image data and said sound data from said file in response to the control information of said header, and at the same time **for synchronously outputting said image data and said sound data...**” *Sonohara* (EX1003), cl. 1, 1:66–2:4.

127. *Sonohara* uses *segments* of the image data (*first data*) and sound data (*second data*) as recited, because *Sonohara* further describes that a “track identifying means 2 is included for imparting, to the image data and the sound data **for every unit time**, track identifying numbers for identifying either the image track or the

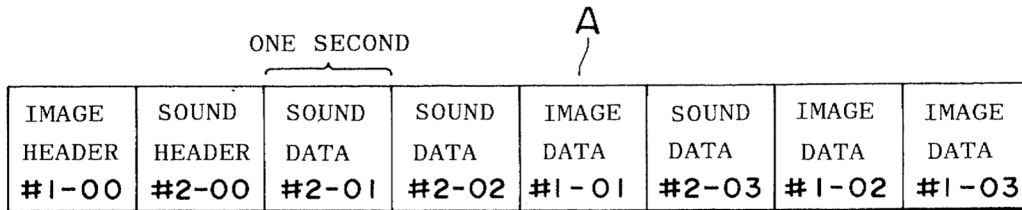
sound track.” *Sonohara* (EX1003), cl. 1; *see also* 5:57–65 (“the image data...are read by the image/sound data formation/renewal section 13 for a unit time (one second) to carry out the image data block formation process...”); 6:14–17 (“track identifying number #1 is given to the image data for every unit time....”); 6:44–46 (“track number #2 is given to the sound data for every unit time....”).

128. Each portion of data for a unit of time corresponds to a *segment* as recited. *Sonohara*’s use of *segments* of the image data and audio data is depicted in Figure 1 and Figure 7:



***Sonohara* (EX1003), Figure 1**

FIG. 7



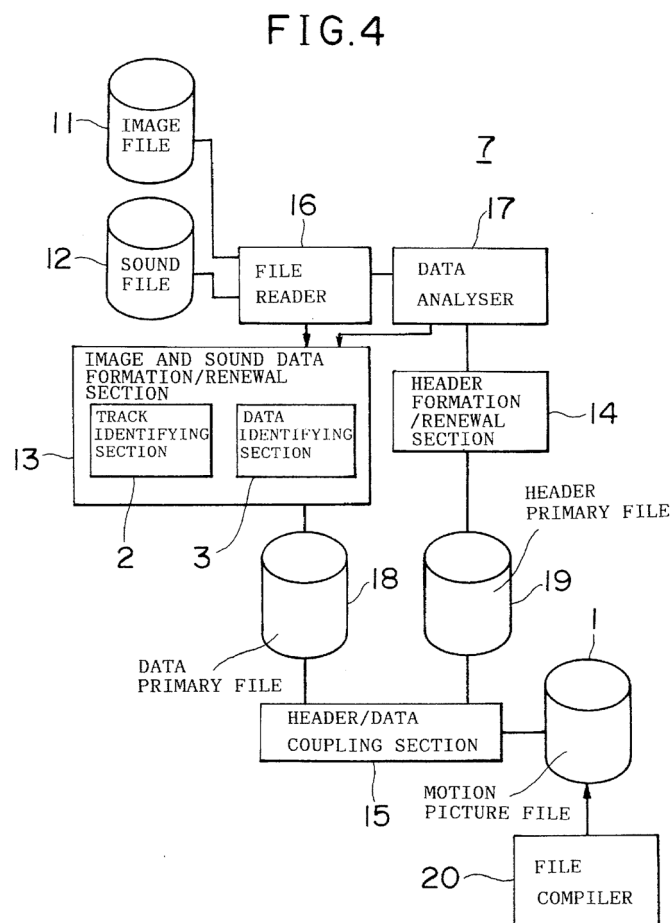
***Sonohara* (EX1003), Figure 7**

See also Sonohara (EX1003), 1:51–3:24 (explaining Figure 1); 5:41–6:67 (explaining Figure 7). For example, as described with reference to Figure 1, *Sonohara* describes that “the image and sound data of the file 1 are associated with the track and data identifying numbers for every unit time” (i.e., for each segment), and *Sonohara* then describes “synchronizing the image and sound data to which the same data identifying numbers.” *Id.* at 1:51–3:24.

129. Thus, by describing the synchronous output of image data and sound data, and by describing that image data and sound data are divided into unit time segments, *Sonohara* discloses *synchronizing content-related first data segments* and *content-related second data segments*.

130. *Sonohara* also discloses that the *content-related first data segments* are of a first data file and the *content-related second data segments* are of a second data

file. This is because, in *Sonohara*, the image data and sound data originate from an
“image file 11” and a “sound file 12” as depicted in Figure 4.



***Sonohara* (EX1003), Figure 4**

131. *Sonohara* further explains with respect to Figure 4 that the “file production processing device 7” is “**provided with an image file 11** onto which image data of motion picture having a plurality of frames per unit time have been recorded for a predetermined period of time, and **a sound file 12** onto which audio data have been recorded for a predetermined period of time corresponding to the image data. The image file 11 and the sound file 12 are formed on a magneto-optical

disc.” *Sonohara* (EX1003), 4:10–20. Thus, the *content-related first data segments* are from the “image file 11” (*a first data file*) and the *content-related second data segments* are from the “sound file 12” (*a second data file*).

132. Accordingly, by disclosing image data and audio data from an image file and sound file, and by describing the synchronization of units of the image and audio data, *Sonohara* discloses *synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file* as recited.

[1.1] sequentially outputting, by a device for synchronizing content-related data, the content-related first data segments and the content-related second data segments according to their chronological sequence;

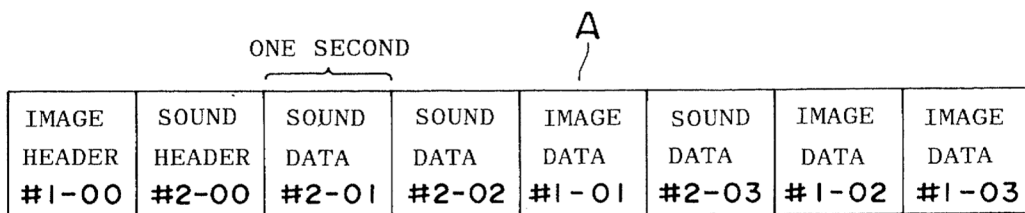
133. *Sonohara* discloses, or at least renders obvious, this limitation.

134. *Sonohara* discloses that the “data synchronizing means may **synchronously reproduce the image data and sound data** by using a controller 43 for outputting the data by reading synchronously the image and sound data to which the same data identifying numbers have been given with reference to the track identifying number and the data identifying number stored in the memory means 42.” *Sonohara* (EX1003), 2:40–51, *see also* 8:53–62.

135. *Sonohara* discloses that this output is *sequential* because, for example, the image data portion #1-02 and sound data portions #2-02 are shown as being output together after the output of image data portion #1-01 and sound data portion #2-01. *See Sonohara* (EX1003), Fig. 8. Further, *Sonohara* explains that, in the production of the file, “data identifying section 3 gives data identifying numbers 01, 02, 03, ... for representing **the order of the data** within the image track 22 or the sound track 23 to the image data and the sound data per unit time. In the apparatus, the same data identifying numbers are given to the image data and the sound data to be synchronized with the image data. Accordingly, in the file 1, the track identifying numbers and the data identifying numbers are imparted to the image data and the sound data per unit time by the track identifying section 2 and the data identifying section 3.” *Sonohara* (EX1003), 4:45–54; *see also* 1:59–65 (“data identifying means 3 is included for imparting, to the image data and the sound data for every unit time, data identifying numbers representative of **an order of data within the image track and the sound track.**”), 2:5–8 (“image and sound data of the file 1 are associated with the track and data identifying numbers for every unit time”), 2:9–16 (“synchronizing the image and sound data to which the same data identifying numbers have been imparted with reference to the track and data identifying numbers given to the image data and sound data”); 5:57–6:11 (describing imparting data identifying number 01 and 02 “in order of the data”). Thus, the data identifying

numbers are assigned based on how the image or sound data is ordered in the original image track or sound track, and a POSITA would have recognized that the order of an image track or sound track for a motion picture would be *chronological*. This is supported by Figure 7 of *Sonohara*, which depicts the data identifying numbers 01, 02, 03 for the image data and sound data; because these data identifying numbers represent “the order of the data” within the image track and sound track “per unit time”, the data identifying numbers are *sequential ... according to their chronological sequence*, consistent with a dictionary definition of *chronological*. See, e.g., Webster’s Dictionary (EX1013) (“chronological...arranged in the order of time.”). Further, because *Sonohara* explains that the output occurs in this sequence, the output of the segments is likewise *sequential ... according to their chronological sequence* as recited.

FIG.7



Sonohara (EX1003), Figure 7

136. The understanding that *Sonohara* provides output in a *chronological sequence* is also supported by other portions of *Sonohara*. For example, *Sonohara* details that image data is “obtained by picking up a moving object by a CCD (charge coupled device) and “[s]imultaneously with the recording operation of the image data, sounds generated in the object are input...and the audio data is converted into digital data and recorded in an audio file.” *Sonohara* (EX1003), 1:19–29. Logically, to reproduce the captured image data from the CCD and corresponding audio data, and in the context of a “motion picture reproducing apparatus” (i.e., a movie apparatus), such reproduction would be in a *chronological sequence*, i.e., reproduced in the same sequence as the data was captured. For example, a POSITA would have recognized that, in reproducing a motion picture, the order in which the motion picture is stored is in a *chronological sequence* so that the movie, when reproduced, is understandable to the viewer.

137. Thus, by describing an order of data within the image track and sound track, given the extensive disclosure in *Sonohara*, a POSITA would have recognized *Sonohara* to operate *sequentially* such that segments are output *according to their chronological sequence*. Outputting segments *according to their chronological sequence* would have also been the case with interactive movies which permit a user to select alternative paths and endings; upon selection of an alternative path, for example, the content segments corresponding to that alternative path would be

presented *according to their chronological sequence* as recited after jumping to that point in the data. *Sonohara* therefore discloses that the data identifying numbers of the image data and sound data segments, and thus the output of those segments, is *sequential ... according to their chronological sequence* as recited.

138. As detailed above, to the extent *Sonohara* is not considered to disclose output of segments *according to their chronological sequence* it would have been obvious to a POSITA to use *Sonohara* in this way. This is because *Sonohara* discloses a “motion picture reproducing apparatus” and a POSITA would have recognized the purpose of such an apparatus is to reproduce a movie, which would be unintelligible if the audio and video were not output in a *chronological sequence*. This is also supported by the Blakowski article, which describes that “[t]ime-dependent media objects are presented by a **sequence** of presentation units. An example is a motion picture sequence without audio (i.e., a video sequence) presented frame after frame.” EX1012, p. 2. Likewise, the Little article states that multimedia “data can be heavily time-dependent, such as audio and video in a motion picture, and require **time-ordered playout during presentation**” which confirms that *Sonohara*’s motion picture reproducing apparatus would output audio and image data *according to their chronological sequence*. EX1014, p. 1.

139. *Sonohara* also discloses that this is performed *by a device for synchronizing content-related data* as it discloses a “motion picture reproducing

apparatus in synchronism with the sound, which apparatus is capable of reproducing the video data and audio data contained in the file in synchronism.” *Sonohara* (EX1003), 1:44–48.

140. Thus, *Sonohara* discloses, or at least renders obvious to a POSITA, *sequentially outputting, by a device for synchronizing content-related data, the content-related first data segments and the content-related second data segments according to their chronological sequence.*

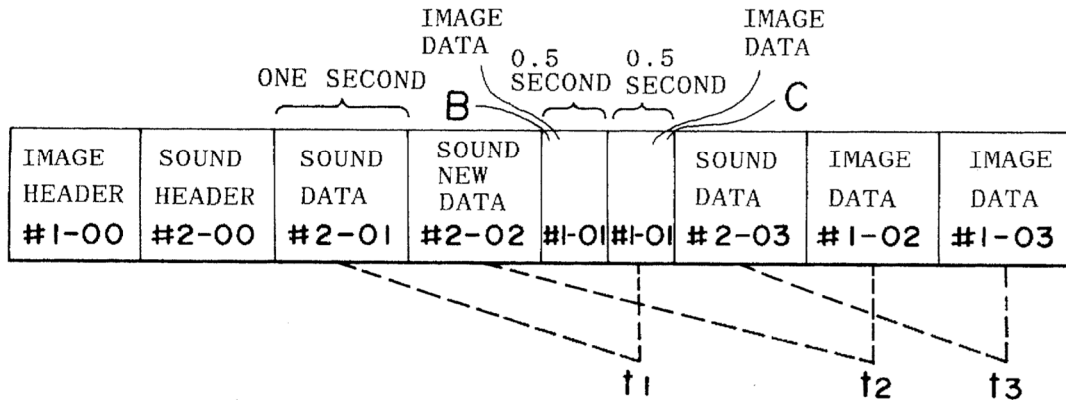
[1.2] in such a way that each of the content-related second data segments is output together with an associated one of the content-related first data segments on the basis of an assignment rule for assigning each one of the content-related second data segments to one of the content-related first data segments.

141. *Sonohara* discloses, or at least renders obvious, this claim limitation.

142. *Sonohara* details in Figure 9 “a flowchart showing a file reproduction process.” *Sonohara* (EX1003), 7:1–3. In this process, “the reproduction of the image data and sound data of the file 1a compiled by the file compiler 20 is now explained.” *Id.* at 7:3–6.

143. In describing Figure 9, *Sonohara* refers to the file of Figure 8, reproduced below.

FIG. 8



Sonohara (EX1003), Figure 8

144. *Sonohara* states:

[I]n the example shown in FIG. 8, at the time t1, the sound data #2-01 for one second and the new image data #1-01 for 0.5 seconds and the image data #1-01 for 0.5 seconds are read in synchronism. The image data display process is carried out by the image data processing section 52 to display the image data on the image display section 54. Also, the sound reproduction process is carried out in synchronism with the image reproduction process by the sound data processing section 53 to output the sound data to the speaker 55 (step 208).”

Sonohara (EX1003), 7:33–42. To summarize the above disclosure, *Sonohara* describes that its process includes outputting (or reproducing) the sound and image segments that have the same identifying number (“sound data #2-01” and “image data #1-01”) at the same time (“in synchronism”) and thus discloses *outputting* ...

content-related second data segments ... together with an associated one of the content-related first data segments.

145. *Sonohara* then explains that “the new image data #1-01, the image data #1-01 and the sound data #2-01 have been read out so that the reading region 42 has a blank in process of step 209.” *Sonohara* (EX1003), 7:43–48. Thus, “the process following the step 202 is repetitively carried out.” *Id.* *Sonohara* then explains that “in the example shown in FIG. 8, at time t2, the sound data #2-02 for one second and the image data #1-02 for one second are read in synchronism.” *Id.* at 7:49–51.

146. Thus, *Sonohara* discloses *outputting ... in such a way that each of the content-related second data segments (e.g., sound data segment #2-01) is output together with an associated one of the content-related first data segments (e.g., image data segment #1-01).*

147. As *Sonohara* discloses, this process continues after the segments with the “01” identifier, such that sound data segment #2-02 and image data segment #1-02 are subsequently output together.

148. *Sonohara* further discloses that this is done *on the basis of an assignment rule for assigning each one of the content-related second data segments to one of the content-related first data segments.* Specifically, the system of *Sonohara* outputs the data based on the control information in the header (*an assignment rule*), where the header “includ[es] control information for controlling

transfer of said image data and said sound data...said control information **indicating a relationship between said image data and said sound data...**” *Sonohara* (EX1003), claim 1.

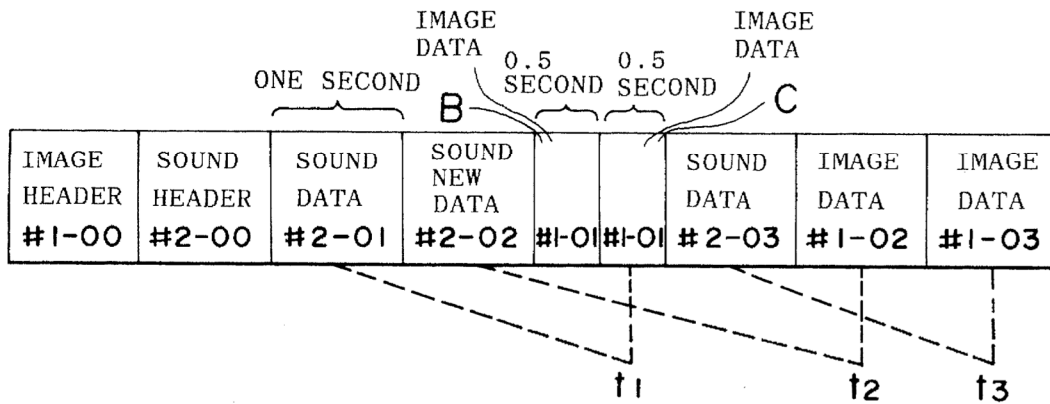
149. This process is described in more detail with respect to Figure 6, which shows “a formation process of the file.” *Sonohara* (EX1003), 5:41–46. The flowchart of Figure 6 starts with the file (element 1) shown in Figure 7 and results in the file (element 1a) shown in Figure 8. *See id.* at 5:41–6:67. In this process, for every unit time, “**the sound data and the image data are coupled** with each other (step 112).” *Id.* at 6:41–42.

150. Coupling the sound data with the image data *assign[s] each one of the content-related second data segments to one of the content-related first data segments*. Further, the information that represents the assignment is contained in the control information in the header, which discloses, or at least renders obvious, the recited *assignment rule*, as it controls the synchronization process such that *each one of the content-related second data segments* is assigned to *one of the content-related first data segments*. This is consistent with how a POSITA would have interpreted the word *rule* in the phrase *assignment rule*. *See* EX1013 (Webster’s Dictionary definition of “rule” as “a prescribed guide for conduct or action”).

151. For example, as shown in Figure 8 of *Sonohara*, the control information in the header assigns, sound data #2-01 to image data #1-01 so that the segments are

output synchronously at time t1. Likewise, the control information in the header assigns sound data #2-02 to image data #1-02 so that they are output synchronously at time t2. See *Sonohara* (EX1003), 7:33–50.

FIG. 8



Sonohara (EX1003), Figure 8

152. *Sonohara*'s control information in the header therefore discloses, or at least renders obvious to a POSITA, an assignment rule for assigning each one of the content-related second data segments to one of the content-related first data segments.

153. *Sonohara* therefore discloses outputting ... in such a way that each of the content-related second data segments is output together with an associated one of the content-related first data segments on the basis of an assignment rule for assigning each one of the content-related second data segments to one of the content-related first data segments as recited.

154. *Sonohara* thus discloses each and every limitation of claim 1.

155. In the alternative, *Sonohara* renders obvious claim 1, as the differences between *Sonohara* and claim 1 are such that the invention as a whole would have been obvious before the priority date of the '794 Patent to a POSITA. For example, as detailed in the analysis of limitation [1.1], to the extent *Sonohara* does not explicitly disclose outputting segments *according to their chronological sequence* it would have been obvious to a POSITA that *Sonohara* rendered such output obvious, because a POSITA would have recognized that chronological output of segments of a motion picture (i.e., a movie) would have been a logical sequence for doing so. As detailed above, this would have also been obvious when considering interactive movies.

156. Likewise, as detailed in the analysis of limitation [1.2], to the extent *Sonohara* does not explicitly disclose an *assignment rule*, a POSITA would have recognized that *Sonohara*'s control information in the header renders obvious an *assignment rule*, because the control information in the header couples together segments with the same identifying number so that they are output together (i.e., the control information in the header performs the same function of *assigning each one of the content-related second data segments to one of the content-related first data segments*). The analogy between *Sonohara*'s control information in the header and an *assignment rule* as recited would have been consistent with the knowledge of a POSITA, as supported by technical literature at the time of the '794 Patent. *See,*

e.g., EX1015, p. 3 (1995 paper discussing “**synchronization** attributes and **rules**” for multimedia presentations, showing that “temporal relations can be mapped,” and describing that a “user should express the temporal relationship of the various media data by **assigning the appropriate values to the synchronization attributes** within each media data before the presentation starts.”). Thus, a POSITA would have recognized *Sonohara*’s control information in the header to render obvious an *assignment rule*.

b) Claim 3

[3.1] The method as claimed in claim 1, wherein the assignment rule is formed in such a way that, for each of the content-related second data segments, the content-related first data segments are assigned by specification of a number, the number representing a position of the content-related first data segments within the order of content-related first data segments.

157. *Sonohara* discloses, or at least renders obvious, this limitation.

158. Specifically, *Sonohara*’s control information in the header shows that, *for each of the content-related second data segments* (e.g., sound data #2-01), *the content-related first data segments* (e.g., image data #1-01) *are assigned by specification of a number* (the **01** portion of the header information). *See* analysis of limitation [1.2], *see also Sonohara* (EX1003), 5:41–6:67 (“data identifying section 3 gives **01 in order of the data as the data identifying numbers**”), 7:33–

50, 5:17–23 (“at the same time reading, in synchronism, the image data and sound data to which the same data identifying numbers are given”).

159. *Sonohara* further describes this *number representing a position of the content-related first data segments within the order of content-related first data segments*: as shown in Figure 8, and as described by *Sonohara*, the “data identifying section 3 gives data identifying numbers 01, 02, 03, ... for representing **the order of the data** within the image track 22 or the sound track 23 to the image data and the sound data per unit time.” *Sonohara* (EX1003), 4:45–48, *see also* 7:33–59 (describing Figure 8 example: “at the time t1, the sound data #2-01 [and] image data #1-01...are read in synchronism....at time t2, the sound data #2-02 [and] image data #1-02...are read in synchronism.”).

160. Thus, the numbers represent *a position of the content-related first data segments within the order of content-related first data segments* as recited—image data #1-01 is in the first position within the collection of image data segments, image data #1-02 is in the second position within the collection of image data segments, and so on, and *Sonohara* therefore discloses this limitation.

c) Claim 5

[5.1] The method as claimed in claim 1, wherein media data are represented by at least one of the first data file and the second data file.

161. *Sonohara* discloses this limitation. In *Sonohara*, the *first data file* is video data contained in an image file (i.e., image file 11): “the apparatus is provided with an image file 11 onto which image data of motion picture having a plurality of frames per unit time have been recorded for a predetermined period of time.” Likewise, the *second data file* is audio data contained in a sound file (i.e., sound file 12): “a sound file 12 onto which audio data have been recorded for a predetermined period of time corresponding to the image data.”

162. Thus, *Sonohara* discloses that *media data are represented by at least one of the first data file and the second data file*.

d) Claim 12

[12.1] The method as claimed in claim 5, wherein the media data include at least one of video and audio data.

163. *Sonohara* discloses this limitation. As detailed in the analysis of claim 5, *Sonohara* discloses *media data* that includes both *video and audio data*.

e) Claim 13

[13.1] The method as claimed in claim 1, wherein at least one of media data and metadata are represented by at least one of the first data file and the second data file.

164. *Sonohara* discloses this limitation. As detailed in the analysis of claim 5, *Sonohara* discloses video data as *the first data file*.

f) Claim 15

[15.1] The method as claimed in claim 13, wherein the media data include at least one of video and audio data.

165. *Sonohara* discloses this limitation. As detailed in the analysis of claim 5, *Sonohara* discloses video and audio data.

g) Claim 20

[20.1] The method of claim 1, wherein the assignment rule is not based on a timestamp.

166. *Sonohara* discloses this limitation. *Sonohara's* assignment rule (i.e., the synchronization information in the header), uses “data identifying numbers,” and does not use *a timestamp*. *Sonohara* (EX1003), Abstract, Fig. 8.

167. In the context of the '794 Patent, a *timestamp* or “time code” (see '794 Patent (EX1001), 6:47) would be understood to be an absolute time or time range, e.g., 0:00.00–0:01.00. *Sonohara* does not use absolute times or time ranges, but instead uses the data identifying numbers, which are not limited to alignment with time units, and thus *Sonohara* discloses or at least renders obvious this limitation.

168. For example, a POSITA would have recognized that, although *Sonohara's* segments are one second each, *Sonohara* is not limited in this respect,

and thus, segments may be a different duration. In such an implementation, the “data identifying numbers” would not match with the segment time, e.g., an image data segment with data identifying number #1-02 would not correspond to a 2 second timestamp, but rather, a .5 second to 1 second time. Thus, the “data identifying numbers” would not be based on a timestamp, and the control information in the header (the *assignment rule*) that maps data identifying numbers would likewise not be based on a timestamp.

169. Thus, *Sonohara* discloses, or at least renders obvious, this limitation.

h) Claim 9

[9.0] A device for synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file, comprising:

170. *Sonohara* discloses this limitation.

171. This limitation is substantively identical to limitation [1.0], except that claim 9 recites a *device* instead of a *method*.

172. *Sonohara* discloses a *device for synchronizing* as recited, as it discloses a “file reproduction processing device 8 for reproducing the video data and audio data of the file 1.” *Sonohara* (EX1003), 3:54–58. This “device 8 has a reader 41 for reading, in order, the image data and the sound data from the file 1 on the basis of the control information of the header 21.” *Id.* at 5:9–13. The device also includes a “main controller 43...for controlling the file reader 41 and at the same time

reading, in synchronism, the image data and sound data to which the same data identifying numbers are given.” *Id.* at 5:17–24. Thus, *Sonohara* discloses a *device for synchronizing* as recited.

[9.1] a synchronization device configured to output each of the content-related first data segments and the content-related second data segments, sequentially, according to their chronological sequence;

173. *Sonohara* discloses, or at least renders obvious, this limitation.

174. This limitation recites substantively the same subject matter as the subject matter recited in limitation [1.1], and thus, *Sonohara* discloses, or at least renders obvious, limitation [9.1] for the same reasons set forth with respect to limitation [1.1].

[9.2] each of the content-related second data segments being output together with an associated one of the content-related first data segments based upon an assignment rule for assigning each one of the content-related second data segments to each one of the content-related first data segment.

175. *Sonohara* discloses, or at least renders obvious, this limitation.

176. This limitation recites substantively the same subject matter as the subject matter recited in limitation [1.2], and thus, *Sonohara* discloses, or at least renders obvious, limitation [9.2] for the same reasons set forth with respect to limitation [1.2].

177. Likewise, for the reasons set forth above in the analysis of claim 1, in the alternative, *Sonohara* renders obvious claim 9.

i) Claim 21

[21.1] The device of claim 9, wherein the assignment rule is not based on a timestamp.

178. *Sonohara* discloses this limitation for the same reasons as provided above with respect to limitation [20.1].

VIII. AVAILABILITY FOR CROSS-EXAMINATION

179. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross examination in the case and that cross examination will take place within the United States. If cross examination is required of me, I will appear for cross examination within the United States during the time allotted for cross examination.

IX. CONCLUSION

180. I hereby declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct, and that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I understand that willful false statements are punishable by fine or imprisonment or both. *See* 18 U.S.C. § 1001.

Date: June 6, 2022

Respectfully submitted,

I. Freedman

Dr. Immanuel Freedman

Appendix A

IMMANUEL FREEDMAN, Ph. D, SMIEEE, MInstP, CPhys

942 Clubhouse Drive
Harleysville, PA 19438
215-527-1779

SUMMARY OF EXPERIENCE

Systems, Signals and Algorithms Consultant with over 30 years experience of video, imaging, modeling, simulation, and systems analysis, design, development, and testing. He has served as expert consultant providing technical analysis related to patent infringement, patent validity, and the research tax credit.

EDUCATION

Ph. D., Physics, University of Durham, England, 1986
B.Sc. (Honors), Physics, University of Durham, England, 1979

LICENSES

Registered Patent Agent #51,704

EXPERIENCE

Takeda Pharmaceuticals	Cambridge, MA	Mar '22-present
Clinical Pharmacology Director		

Dr. Freedman provides mathematical modeling of systems, signals, and images.

Freedman Patent	Harleysville, PA	Oct '21-present
Sole Proprietor		

He provides consulting and expert witness services to industry and the legal profession.

State University of New York at Buffalo	Buffalo, NY	Jun '17-present
Volunteer Researcher		

Praxis Precision Medicines	Boston, MA	Aug '21-Sep '21
Senior Director, Pharmacometrics		

Dr. Freedman provided mathematical modeling of systems, signals, and images.

Daiichi Sankyo, Inc.	Basking Ridge, NJ	Nov '20-Aug '21
Director, Modeling and Simulation		

Dr. Freedman provided mathematical modeling of systems, signals, and images.

Freedman Patent	Harleysville, PA	Jun '16-Nov '20
Sole Proprietor		

He provided consulting and expert witness services to industry and the legal profession. In particular, he provided requirements analysis and design for a precision dosing system Graphical User Interface.

Aug '07-Jun '16

Jul '05-Aug '07

Nov '04-Jul '05

Apr '03-Mar '04

Nov '02-Apr '03

Jan '00-Oct '02

Dec'99-Jan '00

Dr. Freedman researched and developed a method of porting an application developed for a Digital Video Recorder in the embedded C software language to standard set top box (STB) middleware to eliminate high development and maintenance costs associated with developing

custom STBs. He optimized bit rate and encoder chip parameters to yield high-quality time-shifted MPEG-2 streams controlled by VCR-like consumer controls.

Sun Microsystems, Inc.**Cupertino, CA****Mar '99-Nov '99****Software Engineer (Contractor)**

Dr. Freedman researched and developed a Distributed Component Object Model (DCOM) software interface between a TV Control Graphical User Interface and the Microsoft Broadcast Application Programming Interface (API) to improve the visual quality of interactive TV displays derived from UDP/IP datagrams synchronized with MPEG-2 audio/video packet data.

The software interface additionally resolved discontinuities in Presentation Timestamp according to a Normal Play Time defined by a Digital Storage Media –Command and Control standard.

He designed and implemented an API written in the pJava and Visual C++ software languages under the Windows CE operating system for the Motorola DCT 5000+ DTV Set Top Box based on the Advanced Television Systems Committee digital television standard.

Rockwell Collins, Inc.**Pomona, CA****Oct '98-Mar '99****Lead Systems Engineer (Contractor)**

As Lead Systems Engineer with a two-engineer span of control, Dr. Freedman timely delivered harmonized requirements for an MPEG-2 in-flight entertainment system similar to a cable television system based on an advanced intranet implemented on an aircraft.

He trained his team to use a Rational Unified software development process based on a Spiral Development Model implemented in the Universal Modeling Language using the Rational/Rose 98i Computer Aided Software Engineering tool.

Stratagene, Inc.**La Jolla, CA****Aug '98-Oct '98****Engineer (Contractor to Permanent)**

Dr. Freedman evaluated frame grabber hardware for resolution and quality of time-integrated imagery and specified algorithms including cluster analysis and trending, further developing a user interface for a digital image processing system supporting gene-cloning science.

United Advanced Technologies, Inc.**Long Beach, CA****Feb '98-Aug '98****Firmware Engineer (Contractor)**

Dr. Freedman analyzed and developed a nine-camera remote surveillance system with a Graphical User Interface developed in the Visual C++ software language under a Microsoft Windows operating system host and firmware developed in the embedded C software language implemented on Analog Devices' ADV601 wavelet video hardware.

He researched and developed Video for Windows parameters and on-chip settings for video quality control to deliver full-frame video over Plain Old Telephone Service telephone lines at quality acceptable to retail store security services.

KeyInfo Services, Inc.**Spring Valley, CA****Mar '98-May '98****Database Consultant**

Dr. Freedman administered a database for providing web-based information developed in the Sybase SQL software language.

Aug '97-Jan '98

He researched and developed algorithms based on mathematical morphology implemented via neural nets to verify handwritten signatures on printed checks.

Principal Engineer (Temporary)

Dr. Freedman analyzed manpower estimates for design, development and testing of an MPEG-2 interactive television set-top box based on an OpenTV interactive television standard implemented for the "Open...." television commerce system deployed Spring 1999 in the United Kingdom.

Jan '97-Dec '97

Dr. Freedman reviewed, analyzed and developed proprietary disk layout software coded in the Visual C++ software language for a Near Video on Demand system delivering movies over telephone systems such as Asymmetric Digital Subscriber Lines (ADSL).

Mar '96-Jan '16

He provided technical consulting services to industry.

Jan '96-Jan '97

Dr. Freedman researched and developed algorithms and processes to compress fine art photography at image quality acceptable to artists based on the JPEG imaging standard implemented with image pre-processing and adaptive quantization.

Sep '95-Mar '96

Dr. Freedman developed an ARINC RS422/RS485 serial link communications software component written in the embedded C software language for a major confidential client specialized in retail store security. His timely software delivery enabled the client to capture a firm order with additional future potential.

Jul '96-Aug '96

Dr. Freedman integrated a MPEG-2 set top box with OpenTV interactive television middleware programmed in the Microtec C language ported to a Motorola 68340 processor under the pSOS operating system. He implemented native bindings of the middleware for the On-Screen Display (Graphical User Interface) and communications stack.

**General Instrument, Inc.
Senior Staff Engineer****San Diego, CA****Dec '95-May '96**

Dr. Freedman reviewed and evaluated methodologies, design and development and performance models for the DigiCipher 2 cable television conditional access system. He migrated a subscriber authorization system written in the C++ language from a DEC Alpha computing platform under the OpenVMS operating system to a Sun SPARCstation computing platform under the Solaris operating system.

**Optivision, Inc.
Consultant****Davis, CA****Mar '95-Sep '95**

Dr. Freedman researched and developed rate control algorithms and software based on MPEG -2 Test Model 5 for the OPTIVideo MPEG-2 video encoder written in the Visual C++ and C software languages.

He researched and developed adaptive quantization algorithms based on a JPEG-3 draft standard for possible inclusion in the draft National Imagery Transmission Format imaging standard.

He researched and developed algorithms to improve the quality of gray scale image compression for the medical imaging DICOM Standard by providing a lossless hybrid algorithm encoding image residuals with a diagonal Golomb code based on an Enhanced Universal Trellis Coded Quantization algorithm.

**Federal National Mortgage Association
Software Engineer (Contractor)****Washington, DC****Jul '94-Jan '95**

Dr. Freedman designed and developed a Graphical User Interface to monitor and validate loan servicer input for the Loss Mitigation Project. He developed the software in the C software language for a Sun SPARCstation 2 platform under a UNIX operating system.

**Hughes STX Corporation
Senior Systems Engineer****Greenbelt, MD****Sep '88-Jun '94**

As Spacecraft and Attitude Analyst for a mission to map the relict radiation from the Big Bang at near infrared, far infrared and microwave wavelengths, Dr. Freedman developed, simulated and calibrated the Cosmic Background Explorer (COBE) Attitude Determination System to yield a stable solution for the spacecraft orientation at a quality factor of 2 above customer's expectation. This solution included a quaternion estimator implemented via an Extended Kalman Filter.

He developed, calibrated and simulated the COBE spacecraft subsystem and provided graphical and statistical analysis of the spacecraft telemetry-word database. When a gyroscope failed during the Launch and Early orbit mission phase, he responded rapidly by plotting graphs of the thermal subsystem telemetry until he found a possible cause of failure.

Dr. Freedman developed a spatially referenced database based on a quad-tree data structure, which stored scientific data for comparison of sky maps from COBE with sky maps from other missions that served as a diagnostic user interface for the Diffuse Infrared Background Experiment.

For the COBE mission, he led the systems engineering and end-to-end development of a novel system for compressing data that combined scientific modeling with statistical data compression. He proposed the system concept and prepared the system level specification, design and project schedule. With a team of two engineers, Dr. Freedman tuned the compression system performance to yield a throughput greater than uncompressed data processing with a compression factor of 22-90%. He further designed and developed evaluation tools to ensure the

user- transparent system-wide compression of a 380GB dynamic data base at image quality acceptable to scientists.

**University of Maryland
Research Associate**

College Park, MD

Jun '87-Sep '88

Dr. Freedman researched and developed digital image methods to process terrain models for a combat information processor sponsored by Battelle. It was developed in the C software language on Sun Microsystems workstation for porting to a supercomputer under a UNIX operating system.

He designed low-complexity algorithms for filtering, segmenting, clustering, and path planning based on digital images organized by quad-tree data structures.

**University College London
Research Assistant**

London, England UK

Sep '86-Jun '87

Dr. Freedman developed digital image processing algorithms to improve image and stereo-matching quality for a digital terrain modeling system based on satellite data.

As part of a UK Government Fifth Generation computing project (Alvey MMI-237) in collaboration with Thorn EMI, Royal Signals and Radar Establishment, and Laser Scan Ltd., he developed software and algorithms for affine transformation, edge filtering, kriging interpolation and image stereo matching with sub-pixel acuity.

**Laser-Scan Ltd.
Software Engineer**

Cambridge, England UK

Sep '85-Sep '86

Dr. Freedman researched and developed algorithms based on the mathematics of tessellation for efficient manipulation of spatially referenced data on serial computers and transputer arrays for a UK Government Fifth Generation computing project (Alvey MMI-237) in collaboration with Thorn EMI, Royal Signals and Radar Establishment, and Laser Scan Ltd.

**National Coal Board
Scientist (Management Grade 7)**

Nuneaton, England UK

Nov '82-Sep '84

For a Health and Safety project, Dr. Freedman developed and validated a microcomputer system to detect coalmine fires and heatings. Based on stochastic and temporal analysis of infrared data obtained via a tube bundle system, and telemetry data from underground thermocouples, the system detected growing trends of carbon monoxide concentration in the presence of noise from underground events such as blasting, diesel engine fumes, ventilation changes, and seismic activity.

PUBLICATIONS

Freedman, I. (2021), "Modern Methods of Chaos and Babylonian Mathematical Astronomy," Ronin Institute Public Seminar, <https://www.youtube.com/watch?v=KIfNFzK8dyI>

Freedman, I. (2021), "On ^{mul} SAG.ME.GAR," NABU 2021-2, Nr. 52

Wilkins, J. et al. (2019), ISoP Position Statement on "Guidance Document: Population Pharmacokinetics: July 2019", Docket No. FDA 2019-D-2398

Freedman, I. (2019), "Chaos Synchronization: Identifying & Predicting Noisy Complex Systems," in AAPS Forum to Connect Predictive Modelers, May 6-7, 2019, Boston MA

Pillai, N. et al. (2019), "Estimating parameters of nonlinear dynamic systems in pharmacology using chaos synchronization and grid search," *Journal of Pharmacokinetics and Pharmacodynamics*, 46(2), 193-210

van Oordt, C. W. M. H et al. (2018), "ImmunoPET imaging to assess target engagement: Experience from 89Zr-anti-HER3 mAb (GSK2849330) in patients with solid tumors", *J Nucl Med jnumed.118.214726* published ahead of print February 7, 2019

Norris, D. et al. (2018), "Expansion Cohorts: Use in First-In-Human Clinical Trials To Expedite Development of Oncology," submitted to FDA, FDA-2018-D-2777-0001, DOI 10.17605/OSF.IO/NMGH8

Freedman, I. (2018), "IEEE Digital Health Standards," at FIS Global , November 27, 2018, Collegeville: PA

Freedman, I. (2018), "Chaos Synchronization: Estimating Parameters of Noisy Complex Systems," in IEEE Section Night, October 20, 2018, Philadelphia: PA

Schieke, M. & Freedman, I. (2018), "3D Topological Mapping of Macroanatomy and Microanatomy for Use in Big Data and Augmented Intelligence Systems," in IEEE-Standards Association Workshop on Digital Health Standards, September 11, 2018, Atlanta: GA

Freedman, I. (2018), "The Intellectual Heritage of Babylonian Astronomy: Music of the Spheres," in *Rencontre Assyriologique Internationale 64*, July 14-20, 2018, Innsbruck Austria

Pillai, N. et al. (2018), "Chaos synchronization and Nelder-Mead search for parameter estimation in nonlinear pharmacological systems: estimating tumor antigenicity in a model of immunotherapy," *PBMB Special Issue Volume 139*, November 2018, Pages 23-30

Pillai, N. et al. (2018), "Estimating parameters of chaotic systems: chaos synchronization combined with Nelder-Mead search, " in *PAGE 2018*: May 31, 2018, Montreux CH

O'Connor, M. A. et al. (2017), "Elucidating Exposure-Response (Safety and Efficacy) of Adct-402 (Loncastuximab Tesirine), a Novel Pyrrolobenzodiazepine-Containing Antibody Drug Conjugate, for Recommended Phase 2 Dose Determination in Patients with Relapsed or Refractory Non-Hodgkin Lymphoma," in *American Society of Hematology 59th Annual Meeting & Exposition*, Atlanta GA Dec 9-12, 2017

Freedman, I., Bies, R. R., Pillai, N., Schwartz, S., Ho, T. (2017), "Estimating parameters of chaotic systems in pharmacology", invited talk in *American Conference on Pharmacometrics 8*, Oct 14-19, 2017, Ft. Lauderdale: FL

Nguyen, T-H-H et al. (2016), Model evaluation of continuous data pharmacometric models: metrics and graphics, *CPT Pharmacometrics Syst Pharmacol.* 2017 Feb; 6(2): 87–109

Freedman, I., Bies, R. R., Pillai, N. (2016), "Estimating parameters of chaotic systems," in *American Association of Pharmaceutical Scientists Annual Meeting and Expositions*, November 13-17, 2016, Denver CO

Freedman, I. (2016), "Babylonian astronomers predicted lunar and planetary positions using iterated maps, forerunners of deterministic chaos," in Rencontre Assyriologique Internationale 62, July 11-15, 2016, Philadelphia PA

Cataloluk, O. & Freedman, I. (2016), "The meaning of *armannu*," in Rencontre Assyriologique Internationale 62, July 11-15, 2016, Philadelphia PA

Freedman, I., Bies, R. R., Ho, T. (2015), "Estimating parameters for chaotic systems," in GlaxoSmithKline Biostatistics Annual Conference, November 13, 2015, Upper Providence PA

Freedman, I. (2015), "A QSP model for cancer incorporating HER-3," in GlaxoSmithKline Quantitative Systems Pharmacology Day, October 29, 2015, Upper Merion PA

Freedman, I. (2015), "Imaging & Microdialysis: Complementary Modalities?" invited panelist, in American Association of Pharmaceutical Scientists Annual Meeting and Exposition, October 24-29, 2015, Orlando: FL

Freedman, I. (2015), "On MA.NA EN.NUN in ^{mul} APIN," NABU 2015-2 Nr. 50

Freedman, I. (2015), "The Marduk Star Nēbiru," Cuneiform Digital Library Bulletin 2015:3, retrieved from http://cdli.ucla.edu/files/publications/cdlb2015_003.pdf

Freedman, I. (2015), "Short Note: On an Assyriological Interpretation of the Book of Daniel 5:1–28," Journal of Translation 11(1), 74

Bies, R. R., Ho, T. & Freedman, I. (2015), "Nonlinear dynamic physiological systems: Chaos Synchronization as an approach to parameter estimation" in *Kinetic and Dynamic Complexity in Drug Transit-Response in the Human Body*, satellite meeting to Population Approach Group Europe 2015, June 2, 2015, Hersonissos: GR

Freedman, I. (2015), "On an Assyriological interpretation of Constantine's *labarum*" retrieved from <http://www.researchgate.edu>

Freedman, I. (2015), "Model Evaluation and Selection," invited talk to American Association of Pharmaceutical Sciences Pharmacometrics Focus Group, March 26, 2015

Freedman, I., Moyer, B.R & Cheruvu, N.P.S. (2014), "Pharmaco-Imaging", in American Association of Pharmaceutical Sciences Translational Sciences 101 e-learning course, retrieved from <http://www.aaps.org/TS101/>

Freedman, I. (2014), "Role of Pharmacology in Anti-Cancer Antibody Development," invited talk, in American Association of Pharmaceutical Scientists Annual Meeting and Exposition, Nov 2-6, San Diego: CA

Willis, S. et al. (2014), "Martha Meets Shakespeare," musical performance, retrieved from <http://www.youtube.com/>

Austin, D., Freedman, I., Grove, R, Tolson, J. & Vanmeter, S. (2014), "The Relationship Between Peripheral B-Cell Levels and MRI Disease Activity in Relapsing-Remitting Multiple

Sclerosis (RRMS)", dual presentation in American Academy of Neurology 66th Annual Meeting, Philadelphia: PA

Freedman, I. (2014), "On horses and bitumen in ^{mul}APIN," NABU 2014-1 Nr. 33

Freedman, I. (2014), "Pharmaco-Imaging in Translational Science and Research," in Pharmaco-Imaging in Drug and Biologics Development (Moyer, B.R., Cheruvu, N.P.S. & Hu, T. C.-C., eds.), Springer, Inc.

Freedman, I. & Bies, R. (2013), "Chaos Synchronization," invited talk, in 3rd Annual Indiana Clinical and Translational Sciences Institute Symposium on Disease and Therapeutic Response Modeling, Nov 5-6, 2013, Indianapolis, IN

Freedman, I. (2013), "Translational pharmacometric models of anti-cancer antibodies," invited talk, in 2nd International Conference on Translational & Personalized Medicine, Aug 5-7, 2013, Chicago IL

Freedman, I. (2013), "Writing on the Wall—Conspiracy in Babylon?" retrieved from <http://www.researchgate.edu>

Willis, S. et al. (2013), "Amy's Suite," musical performance, retrieved from <http://www.youtube.com/>

Freedman, I. (2012), "Case Studies in the Use of Imaging Agents in Proof-of-Concept and Early Proof-of-Efficacy Trials," invited talk, in National Biotechnology Conference, May 21-24, 2012, San Diego: CA

Freedman, I. (2012), "Regulatory Opportunities and Hurdles with Imaging Agents in the Era of Personalized Medicine," invited panelist, in National Biotechnology Conference, May 21-24, 2012, San Diego: CA

Freedman, I. (2012), "Translating Clinical and Pre-Clinical Information into Success," invited talk, in 3rd World PK/PD Summit, March 27-29, 2012, Boston: MA

Freedman, I. (2012), "Improving Integration of PK/PD Modeling into the Drug Development Process," invited panelist, in 3rd World PK/PD Summit, March 27-29, 2012, Boston: MA

Freedman, I. (2011), "The Impact of 3D Tissue Models on Drug Development and Predictive Safety," invited panelist, in Predictive Functional Tissue Models, November 17-18, 2011, Boston: MA

Derosier, F.J. et al. (2012), "Novel Uses," WIPO Publication WO2012096924 A1, priority date Jan 10, 2011

Freedman, I. (2011), "System for forecasting outcomes of clinical trials," United States Patent Application Publication 20110238317A1, priority date Aug 9, 2007.

Freedman, I. (2011), "Case Study—Optimizing Design of a Phase 2 Clinical Trial in Relapsing-Remitting Multiple Sclerosis," invited talk in Joint Statistical Meetings 2011, Miami FL July 30-August 4, 2011

- Freedman, I. (2011), "Case Study—Bridging from Western to East Asian Population in Accordance with ICH E5," in American Conference on Pharmacometrics 2011, San Diego CA April 3-6, 2011
- Larkin, J. et al. (2010), "Osteoarthritis Disease Modification Potential of GSK2394002" in GlaxoSmithKline Clinical Pharmacology Symposium, Philadelphia PA June 15, 2010
- Larkin, J. et al. (2010), "ADAMTS-5 Neutralizing Monoclonal Antibody: Translational Pharmacology Approach Provides Reason to Believe," in GlaxoSmithKline Clinical Pharmacology Symposium, Philadelphia PA June 15, 2010
- Freedman, I et al. (2009), "Bayesian Parametric Schild Analysis from a Whole Blood Stimulation Assay," in American Conference on Pharmacometrics 2009, Mystic CT October 4-7, 2009
- Freedman, I. (2009), "Feasibility of Immunogenicity Assessment based on Models of Polyclonal Anti-Drug Antibody Immunodynamics," in American Conference on Pharmacometrics 2009, Mystic CT October 4-7, 2009
- Austin, D. J., et al. (2008), "Translational Pharmacology from a Domain Antibody First Time in Human Study," in SciNovations Symposium, Verona IT, September 26, 2008
- Freedman, I. (2007), "Video Compression," in The Handbook of Computer Networks (Hossein Bidgoli, ed.), John Wiley & Sons, Inc.
- Freedman, I. (2006), "Examination on Challenge: A Proposal for Improving the Patent System", *Disclosure*, Jan 2006 retrieved from <http://www.napp.org>
- Freedman, I. (2005), "Erythropoietin Modeling & Simulation," retrieved from <http://www.freedmanpatent.com>
- Freedman, I. (2004), "Working with a Patent Agent," in PatentCafe Magazine, May 11, 2004
- Freedman, I. (2004), "Video," in Encyclopedia of Human-Computer Interaction (William Sims Bainbridge, ed.), Berkshire Publishing Group LLC
- Freedman, I. (2003), "Video Compression," in The Internet Encyclopedia (Hossein Bidgoli, ed.), John Wiley & Sons, Inc.
- Freedman, I. (2002), "Comparison of algorithms for efficient approximation of heterogeneous multidimensional scientific data," *Astronomical Data Analysis II*. (Starck, J-L; Murtagh, F D, ed.) in Proc. SPIE, Volume 4847, pp. 313-321
- Freedman, I. (1999), "Proposal for Preliminary Evaluation of an Approximate Data Compression Algorithm for the FITS Standard," *BAAS*, 194
- Freedman, I. and Farrelle, P. M. (1996), "Systems Aspects of COBE Science Data Compression," *ASP Conf. Ser. 101: Astronomical Data Analysis Software and Systems V*

Sodroski T. et al. (1995), "The Ratio of H₂ Column Density to ¹²CO Intensity in the Vicinity of the Galactic Center," Ap. J. 450

Freedman, I., Boggess, E. & Seiler, E. (1992), "COBE Science Data Compression," BAAS, 24

Freedman, I., Skard, J. A.J. & Kelsall, T. (1992), "COBE/DIRBE Sky Map Trending," in ASP Conf. Ser. 25: Astronomical Data Analysis Software and Systems I

Freedman, I., Rough, A. C. & Cheng, E. S. (1992), "COBE Astronomical Databases," in ASP Conf. Ser. 25: Astronomical Data Analysis Software and Systems I

Freedman, I. et al. (1991), "COBE ground segment gyro calibration," in NASA Flight Mechanics/Estimation Theory Symposium

Kumar, V.K. et al. (1991), "COBE ground segment attitude determination," in NASA Flight Mechanics/Estimation Theory Symposium

Wright, E.L. et al. (1991), "COBE attitude refinement," in AIP Conf. Proc. 222: After the first three minutes

Wright, E. L. et al. (1989), "The COBE Attitude Determination System," BAAS 21

Jackson M. J. et al. (1986), "Efficiency of tesseral arithmetic for 2.5D image manipulation on serial computers and transputer arrays," in S.B.M. Bell and B.M. Diaz (eds.) Spatial Data Processing using Tesseral Methods, pp. 353-364.

Dogiel V. et al. (1983), "Can Cosmic Rays be Accelerated in Collapsing Molecular Clouds?" Proc. 18th International Cosmic Ray Conference, 2

Giler, M. et al. (1980), "A limit to the velocity of convection of cosmic rays out of the Galaxy," Proc. 16th International Cosmic Ray Conference, 2

Freedman, I. et al. (1980), "Derivation of the age distributions of cosmic rays in a Galaxy with a convective halo," AAP, 82

PROFESSIONAL AWARDS

Daiichi Sankyo Recognition Award (2021)

Funaro Award (2015, 2018)

GlaxoSmithKline R&D Recognition Award (2012, 2013, 2016)

NASA Group Achievement Award (1990, 1992)

Hughes STX Achievement Award (1990)

IBM Fulcrum Award (1988)

PROFESSIONAL AFFILIATIONS

Institute of Electrical and Electronic Engineers (Senior Member; Chair, Communications & Information Theory Section, Philadelphia Chapter; 2018/2019 Vice-Chair, P2673 and Trusted Analytic Exchange Sub-Group Chair, P2795 Standards Working Group)

Institute of Physics (Chartered Physicist)

American Association of Pharmaceutical Scientists (Chair, Pharmaco-Imaging Community; 2017 Member, Predictive Modeling Task Force)

International Society of Pharmacometrics (Standards and Best Practices Committee Member–
Model Evaluation Group)

Regulatory Affairs Professionals Society

Drug Industry Information Association (Adaptive Designs Scientific Working Group Member)

International Association for Assyriology

National Coalition of Independent Scholars

Ronin Institute for Independent Scholarship

March 31, 2022