UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Microsoft Corporation
Petitioner

v.

Mobile Telecommunications Technologies, LLC
Patent Owner

Patent No. 5,754,946

DECLARATION OF DONALD GAYTON IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 5,754,946

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I. INTRODUCTION

1. My name is Donald Gayton. I am the Vice President of Engineering and Product Development at Acuva Technology Inc. in Vancouver British Columbia.

2. I have been engaged by Microsoft Corporation ("Microsoft") as a consultant in connection with Microsoft's Petition for *Inter Partes* Review ("Microsoft IPR Petition") of U.S. Patent No. 5,754,946 (the "'946 Patent").

3. I understand that the '946 Patent has been assigned to Mobile Telecommunications Technologies, LLC ("MTel"). MTel is also referred to as the "Patent Owner" in this declaration.

4. This declaration is based on the information currently available to me. To the extent that additional information becomes available, I reserve the right to continue my investigation and study, which may include a review of documents and information that may be produced, as well as testimony from depositions that not yet been taken.

II. SUMMARY OF OPINIONS

5. The '946 Patent relates to a "two-way communication system for communication between a system network and a mobile unit," with the mobile unit allowing a user "to request the network to retransmit a received message that contains errors." Ex. 1001 at Abstract. The Microsoft IPR Petition challenges

claims 1, 2, 4 and 7-9 of the '946 Patent. Independent claims 1 and 8 are directed toward the mobile unit, with claim 8 representing the method performed by the mobile device of claim 1. Claims 1 and 8 are depicted side-by-side in the table below to show the similarity of the claims.

'946 Patent Claim 1	**'946 Patent Claim 8**
1(P) A mobile unit for transmitting and receiving radio frequency signals to and from a communications network comprising:	8(P) A method for receiving and transmitting messages at a mobile unit, comprising the steps of:
1(A) means for receiving a radio frequency message from the network;	8(A) receiving at the mobile unit a radio frequency message;
1(B) a display for displaying said message;	8(B) displaying said message on the mobile unit;
1(C) a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network;	8(C) receiving an indication of a portion of the displayed message for which a user desires retransmission;
1(D) means for transmitting, only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message; and	8(D) transmitting, only upon receipt of the indication, a signal requesting retransmission of said indicated portion of said message;
1(E) means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display.	8(E) receiving a retransmission of said indicated portion; and 8(F) displaying the received retransmission of said indicated portion on the mobile unit.

6. Independent claim 7 is directed toward a mobile network that supports the retransmission requests of the mobile unit.

’946 Patent Claim 7
7(P) A communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network, the network comprising:
7(A) means for transmitting radio frequency signals containing a message to the mobile unit;
7(B) means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission;
7(C) means for retransmitting radio frequency signals containing the portion of the message to the mobile unit.

7. Dependent claims 2 and 9 are similar in claim scope to each other, with these claims depending from claims 1 and 8, respectively. Claims 2 and 9 add the limitations that the mobile unit be able to detect errors in the received messages, and that it be able to display an indication of errors in the displayed message.

’946 Patent Claim 2	**’946 Patent Claim 9**
2(A) The mobile unit of claim 1, further comprising: means for detecting errors in the received message,	9(A) The method according to claim 8, further comprising the step of: detecting errors in the received message; and
2(B) said display including means for highlighting said errors when the message is displayed on said display.	9(B) wherein the step of displaying comprises the substep of: highlighting said errors in the message on the mobile unit.

8. Dependent claim 4 adds to claim 1 the limitation that the signal transmitted to request retransmission indicate to the network that the user of the mobile unit has read the message.

’946 Patent Claim 4
The mobile unit of claim 1, wherein the signal transmitted by the transmitting means indicates to the network that the user has read the message.

9. The elements recited in the challenged claims of the ‘946 Patent are basic communications concepts that were well known long before the earliest priority date of the ‘946 Patent. Further, transmission and reception of messages over RF signals, detection of errors in a received message, and requests for retransmission of a message that contained errors were well-known concepts to people having ordinary skill in the art at the time the ’946 Patent was filed. None

of the features described in claims 1, 2, 4 and 7-9 of the ‘946 Patent was novel as of the earliest claimed priority date, nor does the ‘946 Patent teach a novel and non-obvious way of combining the known features.

10. It is therefore my opinion that claims 1, 2, 4 and 7-9 of the ‘946 Patent are invalid for being anticipated or were obvious under the patentability standards of pre-AIA 35 U.S.C. §§ 102 and 103 explained to me by Microsoft’s counsel as stated below.

11. The subsequent sections of this declaration will first provide my qualifications and experience and then describe the details of my analysis and observations.

III. QUALIFICATIONS AND EXPERIENCE

A. Education and Experience

12. I graduated from the University of British Columbia with a Bachelors of Applied Science in Electrical Engineering in 1983. I joined Glenayre Electronics Limited of Vancouver BC, Canada, immediately upon graduation.

13. During my career, I was a top designer and leader at Glenayre Electronics from 1983 to 2001. My career at Glenayre was focused around paging; first one-way, and then two-way. My work involved all aspects of paging, from central system hardware and software design, RF control systems, RF transmitters and receivers, miniature mobile terminal design and manufacture as well as user

interface design. I was central to many paging product developments, innovations and industry standards development during my tenure. I developed a deep understanding of all things paging during my 16-year career working in the field.

14. Glenayre Electronics was considered the world leader in paging systems since roughly 1985. In 1983 it was a leader in mobile telephones, both central systems and the mobile units. Cellular was in its infancy, so systems using Improved Mobile Telephone System (IMTS) protocol were the main systems in use at the time. I gained experience writing software for the Glenayre central switching system that used that protocol. Later, I was a design engineer, both hardware and software on a more advanced system, AutoTel. I developed radio modems, and other devices that used RF transmissions to move digital messages.

15. In 1985, Glenayre entered the paging market with its newly developed GL3000 model paging system. At that time, I was an intermediate hardware and software designer on the new system. In 1988 I was promoted to Manager of Hardware Development for the GL3000 product line. In 1990 I was promoted to Director of Development for GL3000, and as such I was involved with all aspects of paging technology and development. The GL3000 became the leading paging switch in North America and also enjoyed good international sales. During this time I gained intimate knowledge of paging technology, protocols, system design and system operation.

16. In 1992, I was promoted to Vice President, Engineering, where I continued my leadership in all things paging, I directed development of Glenayre's high speed, GPS based paging control system. This dual site development resulted in a product that captured 70% of the high speed paging market and had total sales exceeding $200M USD. I directed developments that kept the GL3000 paging switch at the front of the market capturing 80% market share in a field of five competitors.

17. In 1995, I was promoted to Senior Vice President, Research and Development at Glenayre, giving me responsibility for both the Vancouver BC and Quincy Illinois Engineering centers.

18. At that point, I oversaw architecture, design, testing, and introduction of Glenayre's complete two-way paging system for data and voice utilizing high speed, linear ReFLEX-25 and Inflexion protocols. This involved a staff of 200 engineers working in two locations. It required development in networking, hardware, embedded and system software, DSP, FM and linear modulation, low and high power RF.

19. I was responsible for the entire group's intellectual property program and successfully doubled Glenayre's patent portfolio during that period. I was also responsible for managing Glenayre's relationship with Motorola, Inc., the world leader in paging mobile terminals. This relationship and associated licenses

resulted in Glenayre's exclusive access to and influence over Motorola's next generation paging protocols.

20. In 1998, I stepped into the role of Chief Technology Officer to provide guidance on how Glenayre was going to navigate the coming changes in mobile data technology. During this time I led a team of six technical and marketing experts in the development of the Advanced Services Strategy for the infrastructure and device groups.

21. I integrated the device and infrastructure product roadmaps, directed development and release of Glenayre's first Internet centric product, the GL3200 Internet Gateway. I oversaw completion of research on an extremely bandwidth-efficient, next generation radio communications protocol and the patent protection of the basic technology. I also chaired the 1999 Glenayre/Motorola ReFLEX Solutions Development Conference in San Francisco that was attended by over 200 third-party developers working on two-way paging applications.

22. In 1999 I moved to California to head up Glenayre's two-way pager development as Vice President of Product Development at Glenayre Consumer Products Group, Santa Clara, CA, USA. There I led the launch of three models of two-way data pagers and one PDA two-way data module with combined sales in excess of 150,000 units. I directed all stages of product development, including specification, hardware and software development, plastics design, pilot runs, FCC

and customer certification and production ramp.

23. In summary, I have over 16 years of experience in wireless, one-way paging, and two-way paging systems including system design, protocols, software and hardware on both the central controller side and the mobile side. I was deeply involved with the development of two-way paging with all the major players including Motorola, Skytel and PageNet, to name a few.

24. Since 2001 I have continued to be a leader in high technology. I have led development of mission critical fault detection software for semi-conductor manufacturing, consulted with other companies on innovation and IP development until 2010 when I refocused my career from high tech to clean tech. In 2010 I returned to the University of British Columbia to earn my Masters in Engineering in Clean Energy Engineering with a 4.1 GPA. Since then I have worked exclusively in clean technology innovation from high energy efficiency compressors to advanced water disinfection systems. I am currently VP of Engineering and Product Development at Acuva Technologies Inc., and we are developing the world's first practical commercial UV-LED water disinfection system.

25. I am the primary inventor on three patents, and named as an inventor on two more patents. Four of these five patents relate to paging technology.

26. In summary, I have substantial experience in the design and

development of communications devices and systems, including two-way paging systems like those described in the ’946 Patent. My experience is directly relevant to the technology described the ‘946 Patent.

27. A copy of my curriculum vitae is attached to this declaration as Appendix A.

B. Compensation

28. I am being compensated by Microsoft for my work in connection with this declaration. The compensation is not contingent upon my performance, the outcome of this inter partes review or any other proceeding, or any issues involved in or related to the inter partes review.

C. Documents and Other Materials Relied Upon

29. My opinions expressed in this declaration are based on documents and materials identified in this declaration, including the ‘946 Patent and its prosecution history, the prior art references and background materials discussed in this declaration, and any other references specifically identified in this declaration. I have considered these materials in their entirety, even if only portions are discussed here.

30. I have also relied on my own experience and expertise in electrical engineering and product design. In doing so, I have kept in mind that the ‘946

Patent claims priority to an application filed on September 21, 1993 and a different application filed on November 12, 1992.

31. All exhibit numbers used in this declaration refer to Exhibits to Microsoft's IPR Petition for the '946 Patent.

IV. STATEMENT OF LEGAL PRINCIPLES

A. Claim Construction

32. Microsoft's counsel has advised that, when construing claim terms in an expired patent, the claim construction principles set forth by the Federal Circuit in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir.2005) (en banc) apply. Microsoft's counsel has further informed me that the terms should be interpreted as understood by one of ordinary skill in the art at the time of the invention. I understand that the context of the term within the claim and in view of other claims is instructive in interpreting the claim. I further understand from Microsoft's counsel that the claim terms must be read in view of the patent specification, of which they are a part. Microsoft's counsel has also informed me that the prosecution history of the '946 Patent can be useful for claim construction purposes.

B. Anticipation

33. Microsoft's counsel has advised that in order for a patent claim to be valid, the claimed invention must be novel. Microsoft's counsel has further

advised that if each and every element of a claim is disclosed in a single prior art reference, then the claimed invention is anticipated, and the invention is not patentable according to pre-AIA 35 U.S.C. § 102 effective before March 16, 2013. In order for the invention to be anticipated, all of the elements and limitations of the claim must be shown in a single prior art reference, arranged as in the claim. A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. In order for a reference to inherently disclose a limitation, that claim limitation must necessarily be present in the reference.

C. Obviousness

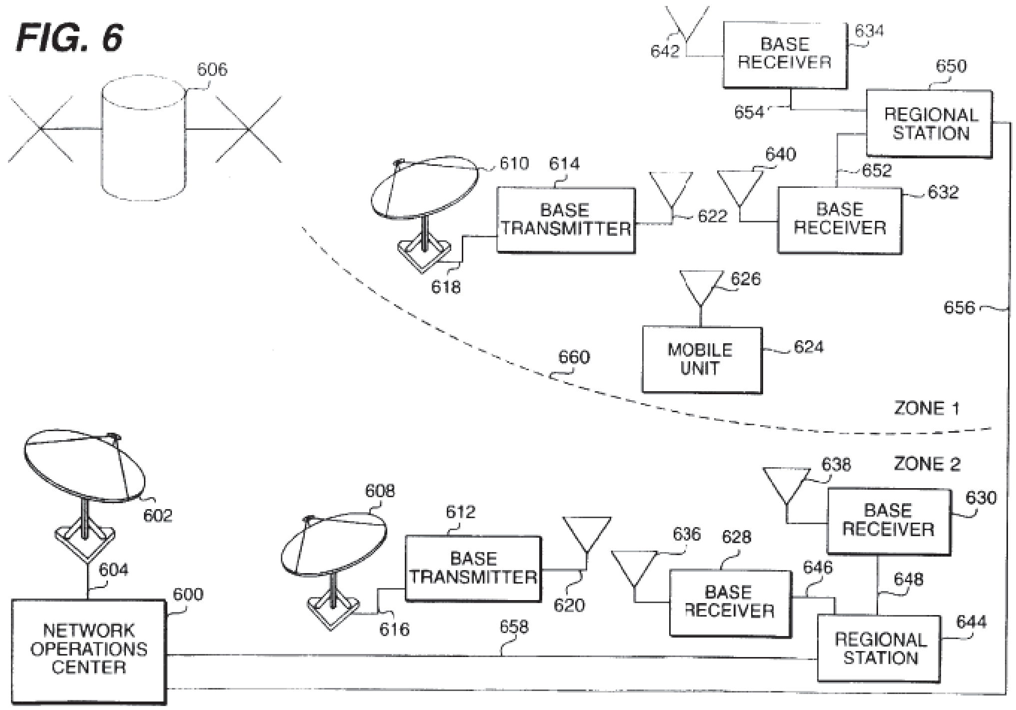
34. Microsoft's counsel has also advised me that obviousness under pre-AIA 35 U.S.C. § 103 effective before March 16, 2013 is a basis for invalidity. I understand that where a prior art reference does not disclose all of the limitations of a given patent claim, that patent claim is invalid if the differences between the claimed subject matter and the prior art reference are such that the claimed subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art. Obviousness can be based on a single prior art reference or a combination of references that either expressly or inherently disclose all limitations of the claimed invention.

V. OVERVIEW OF THE '946 PATENT

A. Summary of the '946 Patent

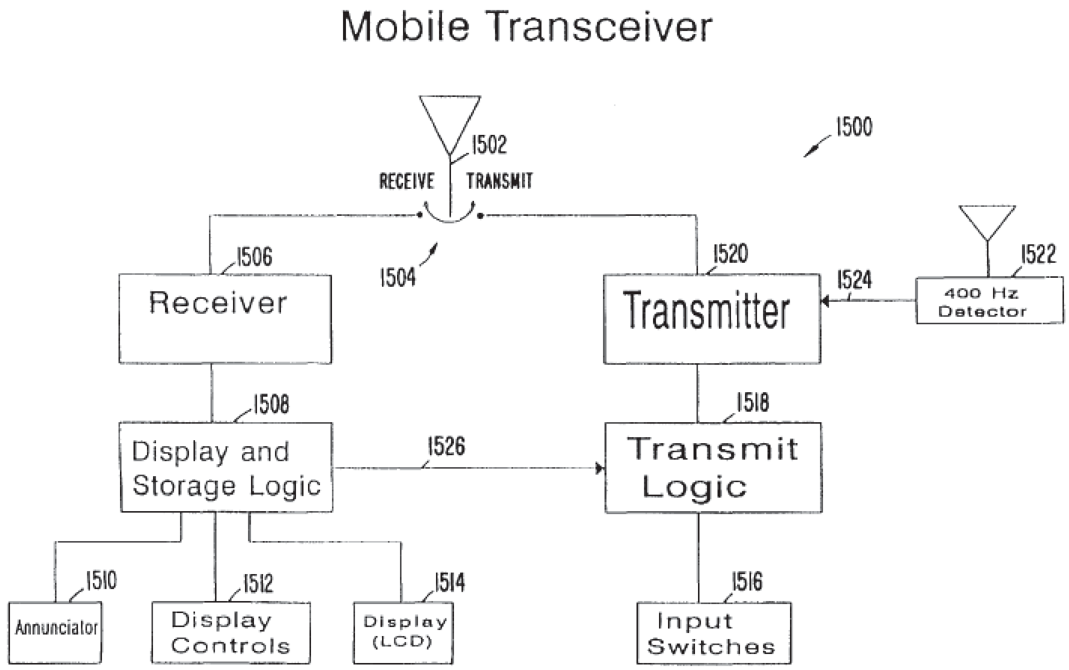
35. The '946 Patent is titled Nationwide Communication System, and it describes a "two-way communication system for communication between a system network and a mobile unit." Ex. 1001 at Abstract. The system network is made up of a group of base station transmitters that are divided into zones and that transmit messages to the mobile units within the zone. Ex. 1001 at Abstract. The network also includes base station receivers that receive messages from the mobile units. Ex. 1001 at 7:29-46. Messages are transmitted to and from the mobile units by the system network via radio frequency ("RF") signals. Ex. 1001 at 5:29-40. Figure 6 of the '946 Patent gives an example of the mobile communications system, including Base Transmitters 612 and 614, Base Receivers 628, 630, 632, and 634, and mobile unit 624.

FIG. 6



36. The mobile units described in the '946 Patent include both transmitter and receiver circuits that enable the mobile unit to receive messages from the network as well as transmit messages back to the network. Ex. 1001 at 14:45-51. Figure 15 of the '946 Patent depicts the mobile unit with its transmitter unit 1520 and receiver unit 1506 connected to a shared antenna 1502 through an antenna switch 1504. Ex. 1001 at 14:52-55, 15:41-45. Figure 15 also shows the display and storage logic 1508 and display controls at 1512 that support displaying received messages on the LCD display 1514. Ex. 1001 at 15:6-10.

FIG. 15



37. The mobile unit described in the '946 Patent sends a negative acknowledgement to the network if a message is not properly received, which results in the network retransmitting the message to the mobile unit without requiring a user request for retransmission. Ex. 1001 at 15:15-22. Figure 16 of the '946 Patent depicts an example of the mobile unit. As shown in Figure 16, the mobile unit includes display control buttons 1604 that allow the user to scroll text up or down on the display 1606. Ex. 1001 at 16:38-45. The mobile unit also includes reply buttons 1608-1618 that allow the user to generate reply messages to received messages. Ex. 1001 at 16:49-58. Finally, the mobile unit includes retransmission button 1622 that allows the user to request that the network retransmit whole messages or a part of the received messages that had errors. Ex.

1001 at 17:8-23. By allowing the user to decide if a message needs to be retransmitted, the system can save bandwidth by not always automatically retransmitting the messages where the user was able to understand the message without retransmission. Ex. 1001 at 17:24-27.

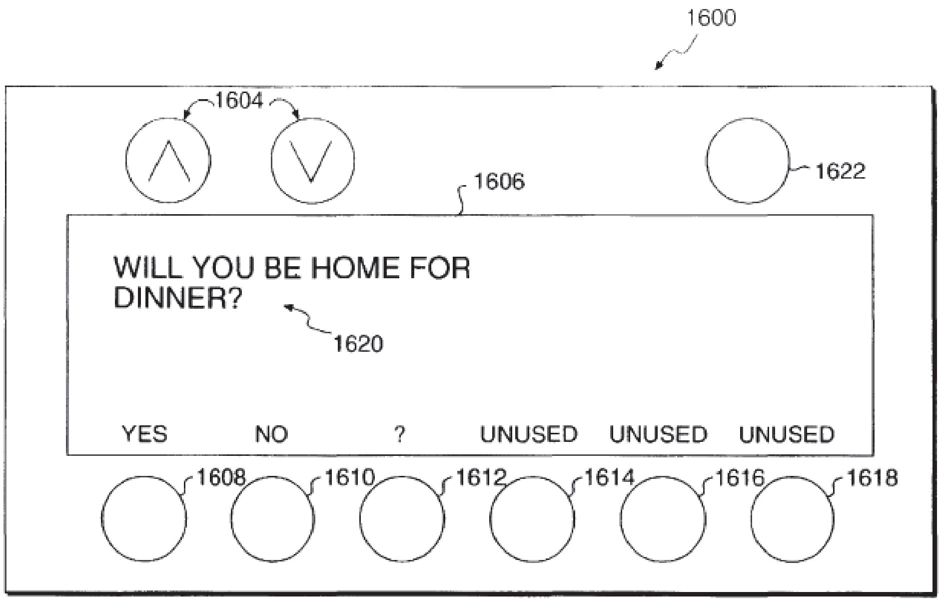


FIG. 16

38. The received messages are checked for errors, and if errors are detected, the errors will be highlighted on the display. Ex. 1001 at 17:8-15. The ’946 Patent indicates that the errors in the received messages may be highlighted in various ways, including underlining, placing the errors in brackets, or printing the errors in reverse video. Ex. 1001 at 17:10-14. Given that the user must read the message and decide if at least part of the message should be retransmitted, the

manual retransmission request is an indication to the network that the user has read the message. Ex. 1001 17:14-18, 17:28-33.

39. The ’946 Patent describes the well-known feature of detecting errors in received messages using error correcting codes, and it identifies the potential negative impact on the network if the system automatically requests retransmission for every message that the receiver detects has an error in a part of the message. Ex. 1001 at 4:41-57. The ’946 Patent claims to improve network efficiency by allowing the user to decide when the errors are bad enough that the message, or at least a part of the message, should be retransmitted. Ex. 1001 at 17:8-27.

40. As discussed in Section II above, claims 1, 2, 4 and 7-9 of the ‘946 Patent cover the ability of both the system network and the mobile unit to transmit and receive messages via RF signals, including the ability of the mobile unit to transmit a request for retransmission of a portion of the message that was received with errors. Independent claims 1 and 8 cover the mobile unit, while independent claim 7 covers the system network. Claims 2 and 9 depend from claims 1 and 8 respectively and add the limitations that the mobile unit be able to detect errors in the received data, and that the mobile unit also highlight the received errors on the display. Claim 4 covers the fact that the request for retransmission of certain portions of the received message is an indication to the system network that the user has read the message.

B. Priority Date for the ’946 Patent

41. I understand that a patent may claim priority to the date on which an earlier patent application was filed if the claim to priority is included within the patent and the earlier application meets the statutory requirements for an adequate disclosure of the claimed invention. I understand that this includes at least two requirements: the earlier application must include a written description of the claimed subject matter, and the description must be sufficient to enable a POSITA to make and use the claimed invention.

42. The ’946 patent issued lists a filing date of September 21, 1993. The patent further lists a related patent application, serial number 973,918, which later issued as U.S. Patent No. 5,590,403 (the ’403 Patent). I have reviewed the application filed for the ’403 patent (Ex. 1010). I have reviewed the application to determine whether the limitations of claims 1, 2, 4 and 7-9 were described and enabled in the November 1992 application.

43. The November 1992 application does not include any disclosure of an action by the user of the mobile unit to request retransmission of a message or any feature of that mobile unit to receive any such indication that the user desires retransmission of a message. The November 1992 application describes an autonomous negative acknowledgement of an incorrectly or partially received message but no disclosure of an indication that a user desires retransmission. Ex.

1010 at 23-24. The November 1992 disclosure does not describe or enable at least claim elements 1(C), 1(D), 7(B), 8(C), or 8(D).

44. In addition, the November 1992 application describes various buttons for an embodiment of the mobile unit. But the application does not explain that any of those buttons could allow a user to indicate a request for retransmission of a message. Ex. 1010 at 40-41. Specifically, the retransmit button 1622 of Figure 16 in the ’946 Patent does not appear in the same figure in the November 1992 application. The November 1992 application does not describe or enable at least claim elements 1(C), 1(D), 7(P), 8(C), or 8(D).

45. I have also compared the November 1992 application to the ’946 Patent and determined that the applicants added descriptions of a user requesting retransmission through a button on the mobile unit. Ex. 1001 17:8-34; Ex. 1010 at 41.

46. Because none of the challenged claims of the ’946 patent are fully described or enabled by the November 1992 application, I understand that the earliest application priority date for those claims is the first application in which they appeared - September 21, 1993 - and not the November 1992 application.

47. Although I am applying a priority date of September 21, 1993, I have also considered whether there was any meaningful difference between November 1992 and September 1993 that would affect the analysis in this declaration. Other

than the legal question of whether certain references qualify as prior art the analysis in this declaration are unaffected by the difference in priority dates between November 1992 and September 1993.

VI. STATE OF THE ART PRIOR TO THE '946 PATENT

A. Radio Communications

48. Radio communications, being subject to fades and static, has historically required the ability to retransmit messages under the direction of the receiver. Even voice radio protocols have methods of retransmitting messages when they are not understood.

49. In army voice radio protocol, if the listener doesn't understand a message, they say "Say again" rather than "Roger" to get the sender to repeat the last message. If the message being sent is a long message (over 20 seconds) one follows the "Long Message Procedure" where the message is broken up into segments, after each segment the listener replies either "Roger so far" if they understood the last segment or "Say again" if they did not understand it.

50. I have attached a copy of an IEEE article from 1983, "ARQ Schemes for Data Transmission in Mobile Radio Systems" as Appendix B, which provides a good overview of the state of the art for over-the-air RQ ("repeat request") in mobile systems. In Section III. ARQ Techniques, Subsection D. Selective

Retransmission, it clearly explains the technique and advantages of retransmitting only errored parts of a message, rather than the whole message.

B. Early Paging Systems

51. Radio paging, or paging for short, has been around since the 1970's. At the start, the portable part of the paging system, called "beepers" at the time, could only emit a tone when a call was received, and the user would have to call a central telephone answering service to get the message. Later, pagers got more sophisticated and protocols improved and became digital so the phone numbers of those who called could be displayed on the pager. Then the ability to transmit full text messages, called alphanumeric paging was added. Around the point of the patent of interest, work was underway to develop two-way pagers and paging systems. Motorola was the leader in pager technology at the time and was pushing hard to make it commercial. Much of the IP around two-way paging originated with Motorola. Having a two-way pager added many useful features on top of the traditional one-way service.

C. One-Way Paging Systems

52. One-way paging systems, in general, are composed of a central controller which receives messages that need to be sent to mobile terminals, also known as pagers. The controller adds control and address information to the messages and sends the messages out to one or more radio transmitters to be

broadcast. A small town could be covered using only one transmitter, but a large city may require 10's of transmitters. Normally all transmitters transmit the exact same information, so no matter where the pager is it can receive the message and alert the user. Having many transmitters sending out the exact same radio signal results in one of the unique strengths of paging—the ability for the radio signals to penetrate deep inside buildings. This allows messages to be received almost anywhere in the coverage area. Once the message is received, the user could hear or read the message and decide to take action or not, but it was always one-way communication from the central controller out to the pagers. If the user wanted to respond in some fashion they would have to call on a telephone.

53. Messages can be in many forms, from a simple alert, to a phone number, to a full text message or a binary data message. Many one-way protocols for sending the information via radio were developed in the United States and elsewhere. Designers where always striving to get the most capacity into the radio channels available. As technology improved, bit rates increased from 600 bits per second (bps) to 6400 bps. Paging controllers often had to support many protocols on the same radio channel to support older pagers and newer pagers at the same time.

D. Two-Way Paging Networks

54. In the early 1990's, technology had improved enough that it became possible to fit a small radio transmitter into the pager while maintaining good battery life, thus two-way paging was born. With two-way paging, receivers were added at the paging transmitter sites, as well as fill in receivers as needed (because the small mobile transmitter was much weaker than the strong base transmitter, more receivers were needed to pick up the signals). With two-way, many more features became possible, including having the pager acknowledge the message had been received correctly, notifying that a message had been read by the user, sending back short messages like Yes/No, selecting common messages from a short list to send back (for example "I'm running late") and full responses, very similar to what we do today with text messages on cell phones. Note, at the time, texting capability for cellular phones was not widely available.

55. It is important to keep in mind other two-way radio data systems were well established at the time, with Mobitex, first launched in Sweden in 1986, being a prime example. These systems offered much higher data rates than paging, but needed more transmitters and receivers to cover a city and the mobile terminals were much larger than pagers. However, they did offer all the same "paging" type features, be it at higher cost. The Gutman, Zabarsky, and Schwendeman references discussed in detail below are each directed to two-way paging systems,

and are further evidence that two-way paging systems were understood prior to the filing date of the ’946 patent.

56. Two-way paging systems took advantage of the many radio data technologies developed to date. These include protocols that used error detection and error corrections codes. Error detection is a technique of adding some information to a message that allows the receiver to detect if a message was received correctly or not, like adding a check sum to a string of numbers. Error correction codes are techniques that add extra information to a message that allows a message to be corrected even though it was received incorrectly. These codes can normally correct a message that is slightly incorrect, but not if it is totally wrong. One popular error correction algorithm was proposed by Andrew Viterbi in 1967. With improvements in microcomputer computing power, these techniques became widespread in all radio communications. Other important techniques were added to paging protocols lifted from other technology areas, including message fragmentation (breaking long messages up into smaller pieces for transmission and then reassembling them in the receiver), time and channel diversity, where data fragments are sent to a receiver at different times or channels so if there is a brief problem at a single point in time or channel, the whole message is not lost.

57. And, of course, with two-way came the ability for the pager receiver to acknowledge back to the controller if a message had been received correctly or not. This "ACK" (short for acknowledge, message received) and "NACK" (short for negative acknowledge, please repeat) function has been a cornerstone of radio communication since it began. Even face to face human voice communication includes ACK/NACK ("uh-huh" for ACK, "Pardon me? or "What?" for NACK).

E. The Level of Ordinary Skill in the Art

58. I understand from Microsoft's counsel that the claims and specification must be read and construed though the eyes of a person of ordinary skill in the art ("POSITA") at the time of the priority date of the claims. I have also been advised that to determine the appropriate level of ordinary skill in the art, the following factors may be considered: (a) the types of problems encountered by those working in the field and prior art solutions thereto; (b) the sophistication of the technology in question and the rapidity with which innovations occur in the field; (c) the educational level of active workers in the field; and (d) the educational level of the inventor.

59. The '946 Patent relates to transmission, reception, and retransmission of messages using radio frequency signals.

60. Based on the above considerations and factors, it is my opinion that a person of ordinary skill in the art at the time of the alleged invention would have

had at least a bachelor's degree in electrical engineering and three to five years of experience in wireless communication system design. A recipient of other science or engineering degrees may qualify as a POSITA if they have taken relevant coursework or have sufficient experience in the field of wireless communications. This description is approximate and additional educational experience could make up for less work experience and vice versa.

VII. IDENTIFICATION OF THE PRIOR ART AND SUMMARY OF OPINIONS

61. It is my opinion that the following prior art references cited in the Microsoft IPR Petition disclose all technical features in claims 1, 2, 4 and 7-9 of the '946 Patent, rendering those claims unpatentable: Japanese Unexamined Patent Application No. H2-213237 ("Akiyama") (Ex. 1003); U.S. Patent No. 4,940,963 to Gutman ("Gutman") (Ex. 1004); U.S. Patent No. 4,644,351 to Zabarsky ("Zabarsky") (Ex. 1005); U.S. Patent No. 5,311,516 to Kuznicki ("Kuznicki") (Ex. 1006); U.S. Patent No. 5,448,759 to Krebs ("Krebs") (Ex. 1007); U.S. Patent No. 5,396,537 to Schwendeman ("Schwendeman") (Ex. 1008); and U.S. Patent No. 5,031,179 ("Yoshida") (Ex. 1009).

62. Claims 1, 2, 4 and 7-9 are obvious over Akiyama and Gutman (Ground 1).

63. Claims 1, 2 and 7-9 are obvious over Zabarsky and Kuznicki (Ground 2).

64. Claims 1, 4, and 7-8 are anticipated or obvious in light of Krebs (Ground 3).

65. Claims 1, 2, 4, and 7-9 are obvious in light of Krebs, Schwendeman, and Yoshida (Ground 4).

VIII. CLAIM CONSTRUCTION

66. In conducting my analysis of the challenged claims of the '946 Patent, I have applied the legal understandings I set out below regarding claim construction consistent with the *Phillips* standard described above in § IV(A).

67. I understand that, under the *Phillips* standard, a claim in an expired patent shall be given its ordinary and customary meaning as would be understood by a person of ordinary skill in the art at the time of the invention in the context of the entire disclosure. An inventor may rebut that presumption by providing a definition of the term in the specification with reasonable clarity, deliberateness, and precision. In the absence of such a definition, limitations are not to be read from the specification into the claims.

68. I understand that patent claims may be written in a "means-plus-function" format which requires identification of the function that is performed by the required "means" and the structure or structures described in the patent's

specification that are clearly linked to performing the required function. I understand that for a prior art reference to disclose a means-plus-function limitation it must disclose the same or an equivalent structure to a structure disclosed in the ’946 patent, where the prior art structure can perform the required function.

A. “means for receiving a radio frequency message from the network”

69. The function to be performed by this “means” is explicitly stated within the claim language. Specifically, the means must “receiv[e] a radio frequency message from the network.” This limitation appears in claim 1, and is part of a mobile unit that transmits and receives messages from the network. I have reviewed the ’946 Patent specification for any parts of the mobile unit that are described as receiving radio frequency messages from the network and are capable of doing so. Figures 15 and 17 of the ’946 Patent each depict a mobile unit that contains an antenna and a receiver that are used to receive radio frequency communications from the network. Ex. 1001 Figs. 15, 17 & 14:45-57, 17:64-18:10.

B. “means for transmitting, only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message”

70. The function to be performed by this “means” is explicitly stated

within the claim language. Specifically, the means must "transmit[], only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message." This limitation appears in claim 1, and is part of a mobile unit that transmits and receives messages from the network. I have reviewed the '946 Patent specification for any parts of the mobile unit that are described and capable of transmitting, only upon actuation of a switch, a signal to the communications network requesting retransmission of a specified portion of a message.

71. Figure 15 of the '946 patent discloses part of the structure required to perform this function. In order to transmit a signal to the communications network, the mobile unit uses an antenna, labeled 1502, and a transmitter, labeled 1520. Some connection is required between the transmitter and antenna. In figure 15, the connection includes a transmit/receive switch, labeled 1504, because the antenna is shared between the transmitter and receiver in a half-duplex arrangement. This switch is not essential to performing the transmit function because more than one antenna can be used, permitting the transmitter and receiver to each be directly attached to separate antennas.

72. In order to form the retransmission request upon activation of a switch, the '946 patent discloses the use of a switch that can be manipulated by the user (labeled 1622 in Fig. 16), which causes transmit logic (labeled 1518) to create

the retransmission request that is sent to the transmitter and antenna. The '946 Patent does not state how the transmit logic is implemented, but a POSITA would conclude that it could be some form of programming or instructions implemented in hardware, software, firmware, discrete logic gates, integrated circuits, programmable memory, read-only memory, or some combination of these or similar components.

73. The essential structure for this "means" limitation, therefore, is an antenna, transmitter, a switch for the user to use in requesting retransmission, and transmit logic to form the retransmission request. Ex. 1001 Fig. 15 & 14:45-55, 15:11-22, 15:39-45, 17:8-23.

C. "means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display"

74. The function to be performed by this "means" is explicitly stated within the claim language. Specifically, the means must "receiv[e] a specified portion retransmitted from the communications network and displaying the received specified portion on the display." This limitation appears in claim 1, and is part of a mobile unit that transmits and receives messages from the network. I have reviewed the '946 Patent specification for any parts of the mobile unit that are described and capable of receiving a specified portion retransmitted from the communications network and displaying the received specified portion on the

display. Figures 15 and 17 each disclose an antenna and receiver capable of receiving messages from the network. Ex. 1001 Figs. 15, 17 & 14:45-57. In order to display the received portion on a display, the '946 patent discloses display logic and a display. Ex. 1001 Figs. 15-16 & 14:66-15:11. The '946 Patent does not state how the display logic is implemented, but a POSITA would conclude that it could be some form of programming or instructions implemented in hardware, software, firmware, discrete logic gates, integrated circuits, programmable memory, read-only memory, or some combination of these or similar components.

D. "means for detecting errors in the received message"

75. The function to be performed by this "means" is explicitly stated within the claim language. Specifically, the means must "detect[] errors in a received message." This limitation appears in claim 2, and is part of a mobile unit that transmits and receives messages from the network. I have reviewed the '946 Patent specification for any parts of the mobile unit that are described and capable of detecting errors in a received message. Although the '946 Patent explains that conventional prior art error correction codes are used to detect errors, Ex. 1001 at 3:23-25, 4:43-46, 26:2-19, it does not expressly state which component of the mobile unit is responsible for detecting errors, but the closest possible structure includes a receiver capable of decoding error correcting codes contained in the message. Ex. 1001 Fig. 15 & 4:43-46, 15:24-30.

E. "means for highlighting said errors when the message is displayed on said display"

76. The function to be performed by this "means" is explicitly stated within the claim language. Specifically, the means must "highlight[] errors when a message is displayed on said display." This limitation appears in claim 2, and is part of a mobile unit that transmits and receives messages from the network. I have reviewed the '946 Patent specification for any parts of the mobile unit that are described and capable of highlighting errors when a message is displayed on said display. The '946 Patent describes an ordinary display that is capable of highlighting errors in the message by underlining errors, placing errors in brackets, or printing errors in reverse video. Ex. 1001 at 17:10-14.

F. "means for transmitting radio frequency signals containing a message to the mobile unit"

77. The function to be performed by this "means" is explicitly stated within the claim language. Specifically, the means must "transmitting radio frequency signals containing a message to a mobile unit." This limitation appears in claim 7, and is part of a communications network that transmits and receives messages from a mobile unit. I have reviewed the '946 Patent specification for any parts of the communications network that are described and capable of transmitting radio frequency signals containing a message to the mobile unit. Figures 6, 13, and 14 depict base stations with transmitters and antenna used to transmit radio

frequency messages to the mobile units. Ex. 1001 Figs. 6, 13-14 & 7:13-22, 8:54-63, 13:60-14:42.

G. "means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission"

78. The function to be performed by this "means" is explicitly stated within the claim language. Specifically, the means must "receiv[e], from a mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission." This limitation appears in claim 7, and is part of a communications network that transmits and receives messages from a mobile unit. I have reviewed the '946 Patent specification for any parts of the communications network that are described and capable of receiving, from a mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission. Figures 6, 18(a) and 18(b) depict base stations with receivers and antenna used to receive messages from the mobile unit. Ex. 1001 Figs. 6, 18(a), 18(b) & 7:30-46 9:14-17, 14:47-51, 17:18-21.

H. "means for retransmitting radio frequency signals containing the portion of the message to the mobile unit"

79. The function to be performed by this "means" is explicitly stated within the claim language. Specifically, the means must "retransmit[] radio frequency signals containing a portion of the message to the mobile unit." This

limitation appears in claim 7, and is part of a communications network that transmits and receives messages from a mobile unit. I have reviewed the '946 Patent specification for any parts of the communications network that are described and capable of retransmitting radio frequency signals containing a portion of the message to the mobile unit. Figures 6, 13, and 14 depict a transmitter and antenna that is used to transmit messages to the mobile unit. Ex. 1001 Figs. 6, 13-14 & 7:13-22, 8:54-63, 13:60-14:42.

I. Limitations regarding a portion of a message for which the user desires retransmission

80. Claim elements 1(C), 7(P), 7(B), and 8(C) refer to a mechanism to create or the receipt of some message or indication that a user desires retransmission of a portion of a displayed message. The user-requested retransmission features of the '946 Patent were added to the original disclosure of the '403 Patent, including the addition of the paragraph at column 4 lines 41-57 of the '946 Patent. That passage explains a problem the user-requested retransmission feature is intended to address. Specifically, a message block that was received with errors may result in retransmissions of that message block until the whole message is correctly received. Ex. 1001 at 4:41-57. The '946 patent seeks to reduce these subsequent transmissions of a previously received message block by permitting the user to determine if retransmission of an erroneously

received message is necessary. Ex. 1001 at 4:41-57, 15:39-41, 17:8-27.

81. Viewing the claim language regarding manual retransmission requests in view of the '946 Patent specification, as a person of skill in the art would have viewed it in the 1992-93 timeframe, the manual retransmission claim elements would have been understood to require a user request to have part of the message actually displayed (presumably with errors) to be transmitted again to the mobile unit. Retransmission of other information that was not previously transmitted (with or without errors) to the mobile unit and thereafter displayed by the mobile unit does not match the claim language.

82. I understand, however, that the Patent Owner has asserted that no prior transmission and display of the retransmitted portion of the message needs to precede the request for retransmission. I also understand that the Patent Owner obtained a judgment based on that broader understanding of the patent, and that in those circumstances the Patent Owner may be prevented from taking a different position on the meaning of this term. My analysis of the prior art applies the narrower, correct, understanding of these limitations. But where applicable, I note where the prior art satisfies the broader understanding asserted by the Patent Owner in earlier litigation.

83. In my analysis, I have interpreted all other claim terms according to their plain and ordinary meaning as required by the *Phillips* standard.

IX. UNPATENTABILITY OF THE CHALLENGED CLAIMS OF THE '946 PATENT

A. Ground 1: Akiyama Combined With Gutman

1. Akiyama

84. Akiyama is titled "Message Transmission System" and was published August 24, 1990, which is more than a year before the earliest claimed priority date of the '946 Patent. Akiyama was developed by individuals at Nippon Telephone and Telegraph ("NTT"). Akiyama discloses a one-way paging system that solves the problem of excessive network congestion caused by retransmission by only retransmitting a portion of a message (a frame or frames) rather than retransmitting entire messages each time an error is detected, and only if the user requests the retransmission. Ex. 1003 at 1-2. Like the '946 Patent, Akiyama discloses a paging network control station and at least one base station that transmit messages to the mobile units via RF signals. Ex. 1003 at 2-3, Fig. 1. Although the paging network of Akiyama is discussed in terms of a single base station, a POSITA would have understood the benefit of using multiple base stations to increase coverage area or handle a larger number of mobile units. The paging network is shown in Figure 1 below with mobile terminal 101 receiving RF signals from base station 102.

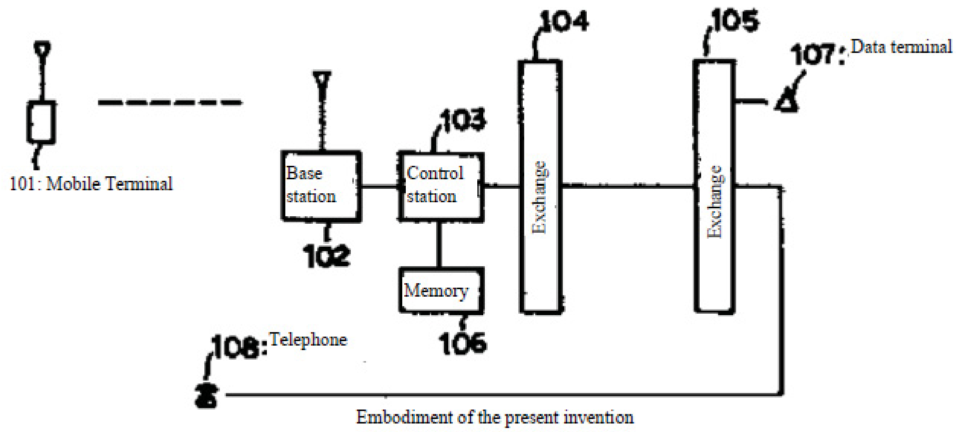
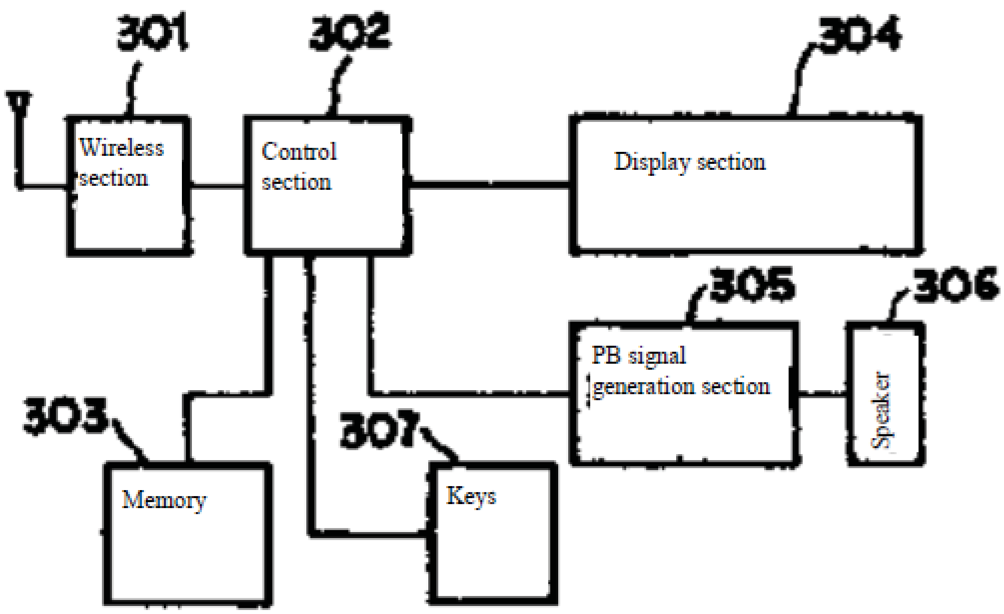


FIG. 1

85. Figure 3 of Akiyama shows the block diagram of the mobile terminal, which includes an antenna and wireless section 301 to receive messages via RF signals from the base station. The mobile terminal includes a control section 302 that, among other things, detects errors in the received messages using error correction detection codes and stores an indication of which frames have errors in memory 303, and it also includes a display section 304 for displaying the received messages and for highlighting any errors in the received messages by causing frames with errors to blink. Ex. 1003 at 2-3. The mobile terminal includes keys 307 that allow a user to initiate a request for retransmission of the portions of a message (frames) that were received with errors. Ex. 1003 at 3. The PB signal generation section 305 and speaker 306 are used to transmit wireless acoustic or electromagnetic signals to a telephone receiver, which are transmitted to the network control station and result in a retransmission of the frames with errors.

Ex. 1003 at 3. As discussed in detail below, it is my opinion that a person of ordinary skill in the art would have readily understood the advantages of using an RF transmitter in the mobile terminal for the retransmission request in place of the acoustic or electromagnetic transmitter that requires a telephone line.

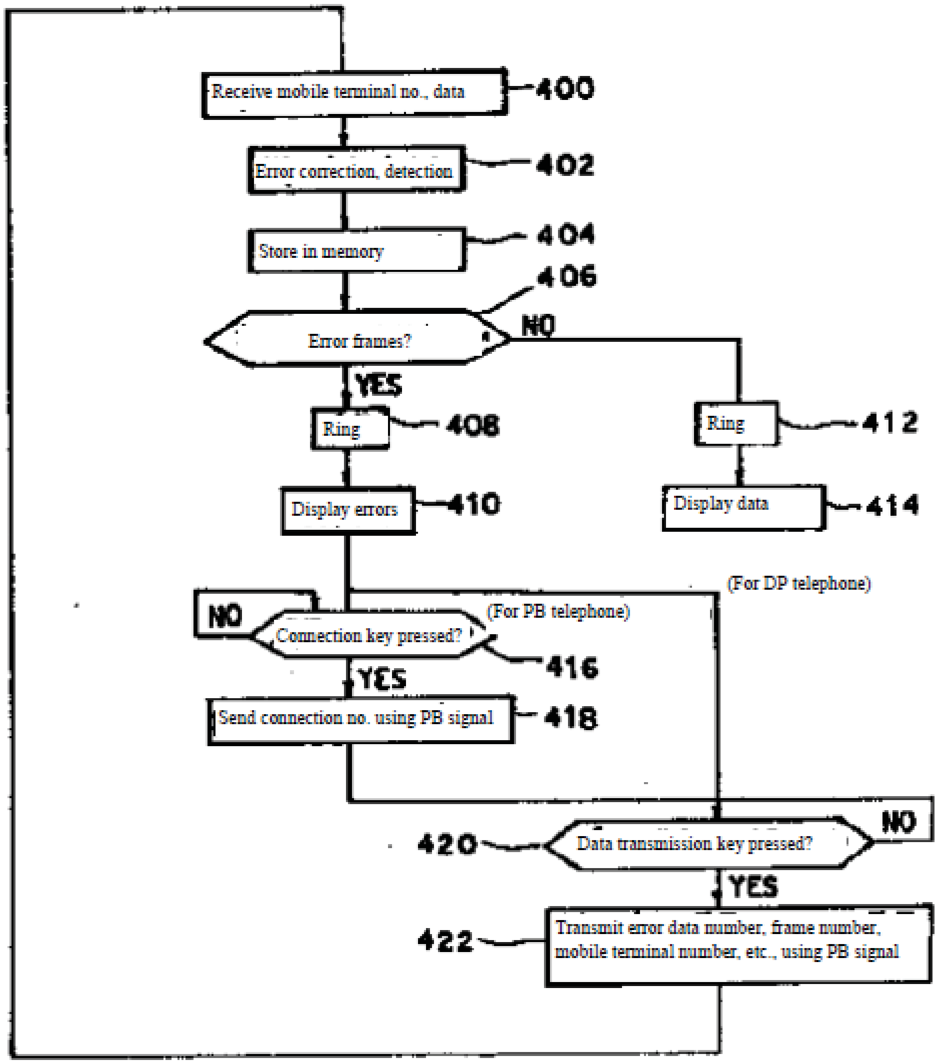


Block diagram of mobile terminal

FIG. 3

86. Akiyama accomplishes its goal of efficient network usage by breaking larger messages into frames and allowing the user to determine if one or more frames of the displayed message should be retransmitted due to errors that have been highlighted on the display. Ex. 1003 at 2-3, Fig. 4. The general flow of the retransmission request of Akiyama is depicted in Figure 4, which is described on page 3 of Akiyama. Beginning at step 400, a message is received at the mobile

terminal, and the message is checked for errors at step 402. If errors were detected in any of the frames of the message at step 406, the user is alerted by a ring at step 408 and then the message and errors are displayed to the user at step 410. If the user desires retransmission of the frames of the message that have errors, the user then makes the connection with the phone service and presses the data transmission key at step 420. If the data transmission key is pressed, then the mobile terminal will transmit to the network control station the data necessary for the control station to determine which frames need to be retransmitted and to which mobile terminal.



Operation flow of mobile terminal

FIG. 4

87. Once the paging network control station has received the retransmission request, it retransmits the frames of the message that had errors to the requesting mobile terminal. Ex. 1003 at 3. The mobile terminal checks the received retransmitted message frames for errors, and then displays the corrected

message if the frames are now error-free. Ex. 1003 at 3. As shown in Figure 2 below, the messages in Akiyama are transmitted with error correction detection codes 206 that allow the control section of the mobile terminal to determine if there are errors in the transmitted or retransmitted messages. Ex. 1003 at 2-3.

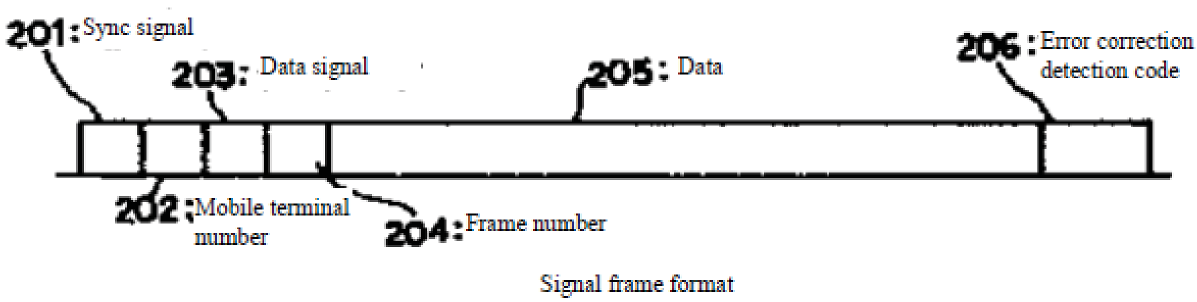


FIG. 2

2. Gutman

88. Gutman is titled "Paging System With Improved Acknowledge-Back Capabilities" and issued July 10, 1990, which is more than a year before the earliest claimed priority date of the '946 Patent. Gutman was originally assigned to Motorola, Inc., which was the industry leader in paging mobile terminals. Gutman discloses a paging system that includes two-way RF transmissions between the mobile units and the network base stations, including support for transmitting automatic and manual acknowledgement messages to the network. Ex. 1004 Figs. 1, 4, 3:34-57, 4:56-68. Figure 1 of Gutman illustrates the two-way paging network with the paging transceiver 22 (transmitter and receiver) in communication with various paging mobile terminals, including alphanumeric

pager 24c. Ex. 1004 at 3:47-50. The ability of the paging system to transmit and receive messages is shown in Figure 1 of Gutman by the arrows traveling in both directions between the network and the paging mobile terminals.

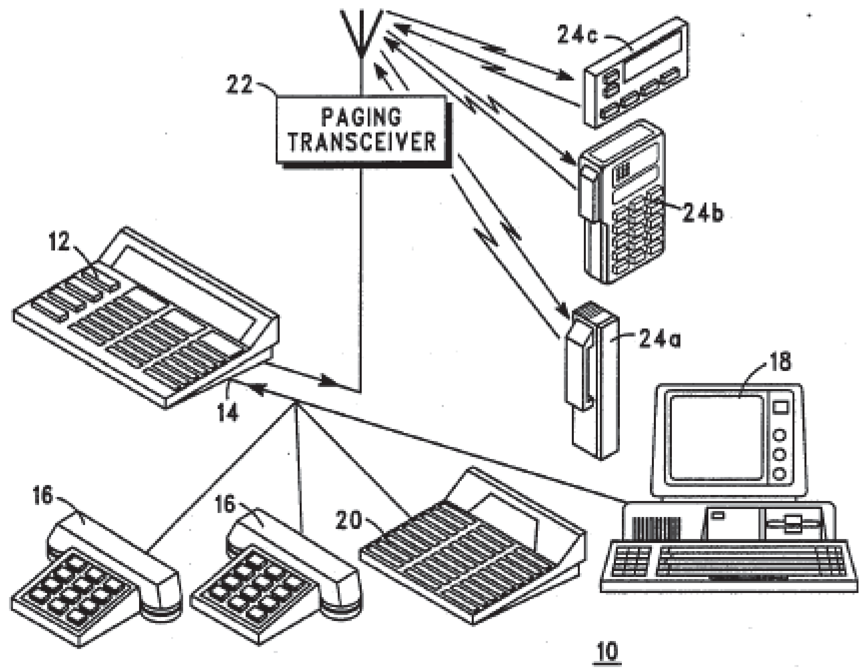


FIG.1

89. Figure 4 of Gutman shows the block diagram of the paging mobile terminal that includes both a receiver 50 and a transmitter 52 connected to a shared antenna 54 through an antenna switch 56, which is the same configuration disclosed in Figure 15 of the ’946 Patent. Ex. 1004 at 4:25-38. The mobile terminal of Gutman also includes a display 62, and a switch 66 for manually acknowledging that a paging message has been read and understood. Ex. 1004 at 4:28-34, 4:56-68.

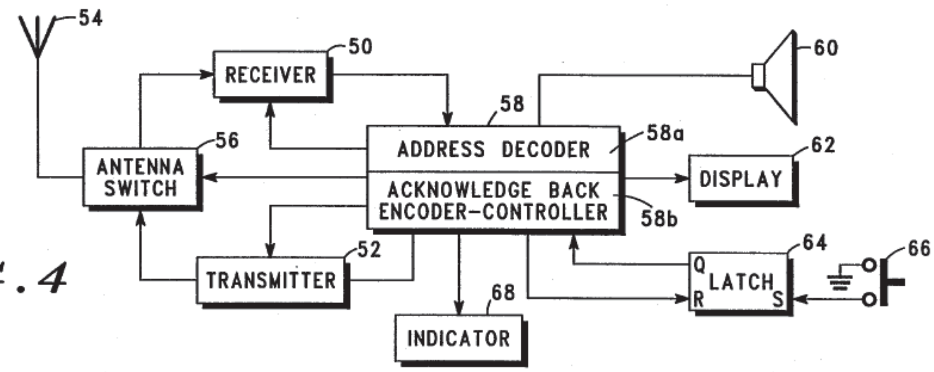


FIG. 4

90. It is my opinion that it would have been obvious to a person of ordinary skill in the art to combine the RF transmitter of Gutman with the paging mobile terminal of Akiyama. One of ordinary skill in the art would have easily understood the advantages of using an RF transmitter to send the retransmission requests back to the paging network rather than having to find a telephone line. The decision between using the wireless acoustic or electromagnetic transmitter of Akiyama or the RF transmitter described in Gutman is a simple design choice, and the advantages and costs of both would have been apparent to the designer. The transmitter of Akiyama makes sense if the pager was being designed for a one-way paging system because the paging network would not have been capable of receiving the RF messages even if the mobile unit had an RF transmitter. Adding RF transmission equipment introduces additional components, cost, and weight to the device, but these could be partially offset by the elimination of the acoustic and electromagnetic coupling equipment in Akiyama. The RF transmitter of Gutman is the reasonable choice if the pager is being designed for a network that has RF

receivers at the base stations as was the case in two-way paging systems. The RF transmission approach also frees the user from having to find a landline phone in order to request retransmission and permits some level of automatic acknowledgement, which can reduce the number of times a page needs to be transmitted on the network to ensure delivery. Akiyama recognized that there was a potential benefit from using an electromagnetic rather than acoustic coupler to send the retransmission requests, and it would have been obvious to a POSITA to go the additional step of transmitting the request using an RF transmitter. Ex. 1003 at 3. The paging industry at the time the '946 Patent was filed was moving rapidly toward the two-way paging technology described in Gutman and designers at that time would have understood the advantages of using the RF transmitter of Gutman with the retransmission request feature of Akiyama, providing additional mobility by removing the need to find a telephone.

91. Schwendeman, described in greater detail in Ground 4 below, is a prior art patent that includes discussion of the well-known idea that a wired telephone interface, or a wireless RF interface could be included in a paging device to send messages from the mobile unit to the paging network. Ex. 1008 at 4:59-65, 5:3-9.

> Hence, although the telephone line interface communication tends to be more reliable than the paging channel communication, it can significantly limit the

> number of subscribing remote units 130 in the communication system, and it tends to inconvenience users by requiring them to connect their remote units 130 to a telephone line interface 152 for communication with the central terminal 102.

Ex. 1008 at 5:46-52.

> Optionally, as mentioned earlier, path A 152 can be configured as a one-way or two-way radio frequency communication channel between the central terminal 102 and the remote units 130. In this case, the message reconciliation can be performed while the users carry the remote selective call receivers 130 such that [sic]. Hence, the users are minimally inconvenienced.

Ex. 1008 at 6:38-45. As disclosed in Schwendeman, a POSITA was aware of the tradeoffs between the more reliable but less portable wired connection through a telephone line and the more mobile and portable connection using a wireless RF interface. Ex. 1008 at 5:19-53, 6:38-45. By the time the ’946 Patent was filed, a POSITA was aware of the design tradeoffs related to the various communications interfaces that were available at that time for use in a mobile paging device to enable communications back to the paging network.

92. The combination of Akiyama and Gutman would yield the expected and obvious result of a mobile paging unit that could make user retransmission requests over the RF transmitter rather than being tied to a telephone line. Although the two-way RF system in Gutman had additional requirements and components absent from the one-way RF system in Akiyama, the trend at the time

was moving from one-way to two-way paging networks for increased mobility, to reduce blind retransmission, and to permit mobile users to respond to pages. There would not be any surprises or unexpected results from such a combination.

93. Also, both of these references are focused on improving paging systems by adding capabilities for the user to manually request retransmission of errored frames or manually acknowledge that a message had been received and read. In both instances, the reference teaches that the user can send information back to the paging network at the user's discretion. Whether that information is transmitted over acoustic or RF signals is a mere design choice between two known options that was well within the capabilities of a POSITA at the time the '946 Patent was filed.

94. The fact that Gutman is a Motorola patent is also relevant to my opinion that a POSITA would have been motivated to combine these references. Motorola was the worldwide industry leader in mobile paging devices, and a POSITA would have been more likely to look to Motorola for ideas on the latest developments in mobile paging. A POSITA at the time that the '946 Patent was filed would have already been aware that Motorola was developing two-way pagers and that two-way paging systems would soon be launched. A POSITA would also have understood that two-way paging required that the mobile unit include an RF transmitter and that the network include RF receivers. Similarly,

NTT, the applicant for Akiyama, was a reputable and innovative company in the telecommunications industry and a POSITA would have considered the teachings in NTT's patents.

95. I have reviewed Akiyama and Gutman and have not found any significant technical hurdle that a POSITA could not have overcome in combining the identified aspects of these two references together. The addition of radio frequency transmit capability from Gutman into Akiyama does not eliminate the usefulness or basis to include a manual retransmission request in the device. With paging technology at the time, guaranteed error-free message transmission using only automatic ACK/NACK would have consumed a lot of bandwidth for retransmissions that were typically unnecessary. Pagers could only have much lower power transmitters than the base stations, and often could not successfully send the acknowledgements that indicate whether the message was entirely received. But the higher base station transmit power often meant that the message was received prior to the retransmission. This power differential could be made up somewhat by using lower data rates for pager transmissions and/or adding more fill-in base receivers, but these actions would lower capacity and raise costs. Guaranteed message delivery in that situation would result in an unacceptable number of retransmissions until the system receives an acknowledgement. Because guaranteed error-free delivery is not always practical,

the more natural approach at the time was to deliver messages with errors and allow the user assess the need for a retransmission. As a result, manual retransmission requests remained useful even when automatic retransmission requests were possible.

96. It is my opinion that claims 1, 2, 4 and 7-9 of the '946 Patent do not present any novel or non-obvious features over those in Akiyama when combined with Gutman. The following sections provide a detailed account of the specific sections of Akiyama and Gutman that describe all the limitations in claims 1, 2, 4 and 7-9, and show why those claims are obvious. I have also included an element-by-element analysis of Akiyama and Gutman against claims 1, 2, 4 and 7-9 in Appendix C.

3. Claim 1 is Invalid in View of Akiyama Combined with Gutman

97. **1(P)**: <u>"A mobile unit for transmitting and receiving radio frequency signals to and from a communications network comprising [the elements below]"</u> Akiyama in combination with Gutman discloses this limitation. Akiyama discloses the transmission of RF signals to a mobile unit and the transmission of acoustic or electromagnetic signals from the mobile unit to the paging network. Ex. 1003 at 2, Fig. 1. Specifically, Akiyama discloses:

> [A] message transmission system comprising a mobile terminal, a wireless base station, and a control station,

> using one-way wireless communication lines that transmit data from the control station to the mobile terminal via the wireless base station, wherein the data transmitted from the control station is divided into a plurality of frames,…a mobile terminal holder electrically or acoustically couples the mobile terminal to a general telephone network to transmit to the control station the mobile terminal number, the data number, and the number of the frame where the error occurred, the control terminal retransmits only the mobile terminal number, the data number, and the error frame number, and the mobile terminal visibly displays the data of the frames which were initially correctly received and of the retransmitted frame in frame number order.

Ex. 1003 at 2. Figure 1 illustrates the mobile paging network of Akiyama, with the mobile terminal 101 receiving messages from base station 102 and transmitting retransmission requests through telephone line 108.

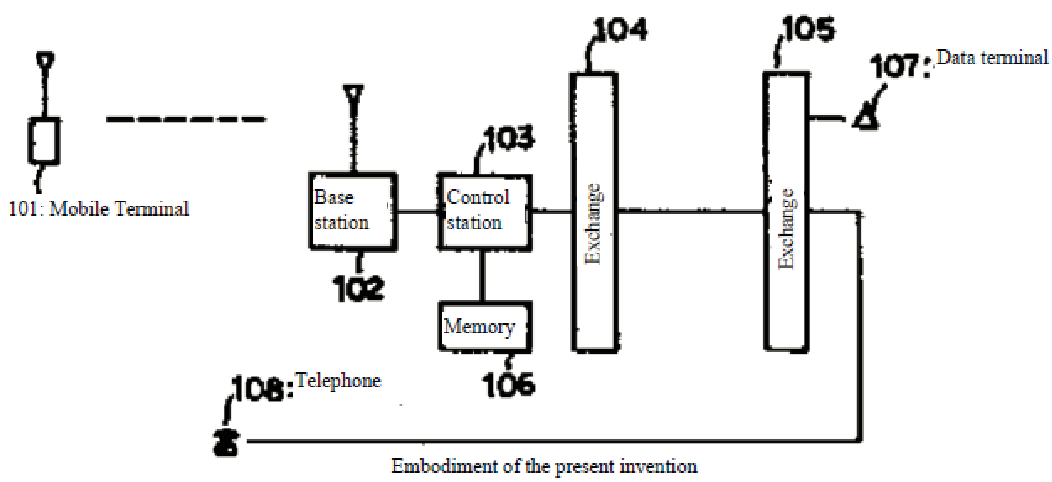


FIG. 1

98. Gutman discloses a two-way paging system where the mobile terminal both receives and transmits messages from/to the paging network using

RF signals. Ex. 1004 Figs. 1, 4 & 3:29-33, 3:41-46. The paging mobile terminal of Gutman includes hardware to allow the user to manually acknowledgement that a received message has been read. Ex. 1004 at 3:29-33. Figure 4 of Gutman illustrates the receiver 50 and transmitter 52 within the mobile unit, and it shows the connection to a shared antenna 54 through an antenna switch 56.

12

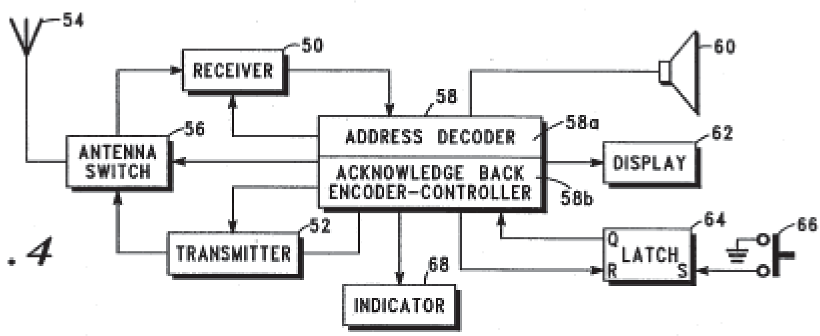


FIG.4

99. It would have been obvious to a POSITA to combine the RF transmitter of Gutman with the paging device of Akiyama, enabling the paging device of Akiyama to transmit requests for retransmission using RF signals rather than the less portable method of transmitting the request using a telephone line.

100. **1(A)**: <u>"means for receiving a radio frequency message from the network"</u> Akiyama discloses an antenna and wireless section for receiving paging messages from the base station of the paging network using RF signals. Ex. 1003 at 2-3, Figs. 1, 3. Specifically, Akiyama discloses:

> The transmission data is sent from the base station 102 to the mobile station 101 over the wireless communication line. In the mobile station 101, the wireless section 301 in FIG. 3 performs reception and demodulation (400 in FIG.

> 4), and the control section 302 corrects any errors using the error correction detection code 206 (402).

Ex. 1003 at 2-3.

101. Figure 3 depicts the antenna and wireless section 301 of Akiyama, which is used to receive paging messages from the base station of the paging network.

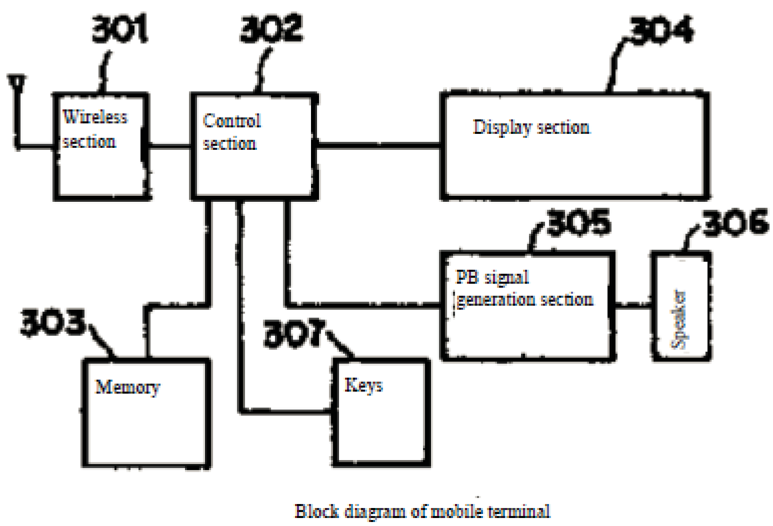


FIG. 3

102. **1(B)**: "<u>a display for displaying said message</u>" As depicted in Figure 3 of Akiyama above, Akiyama discloses a display section 304 for displaying received messages. Ex. 1003 at 3, Fig. 3.

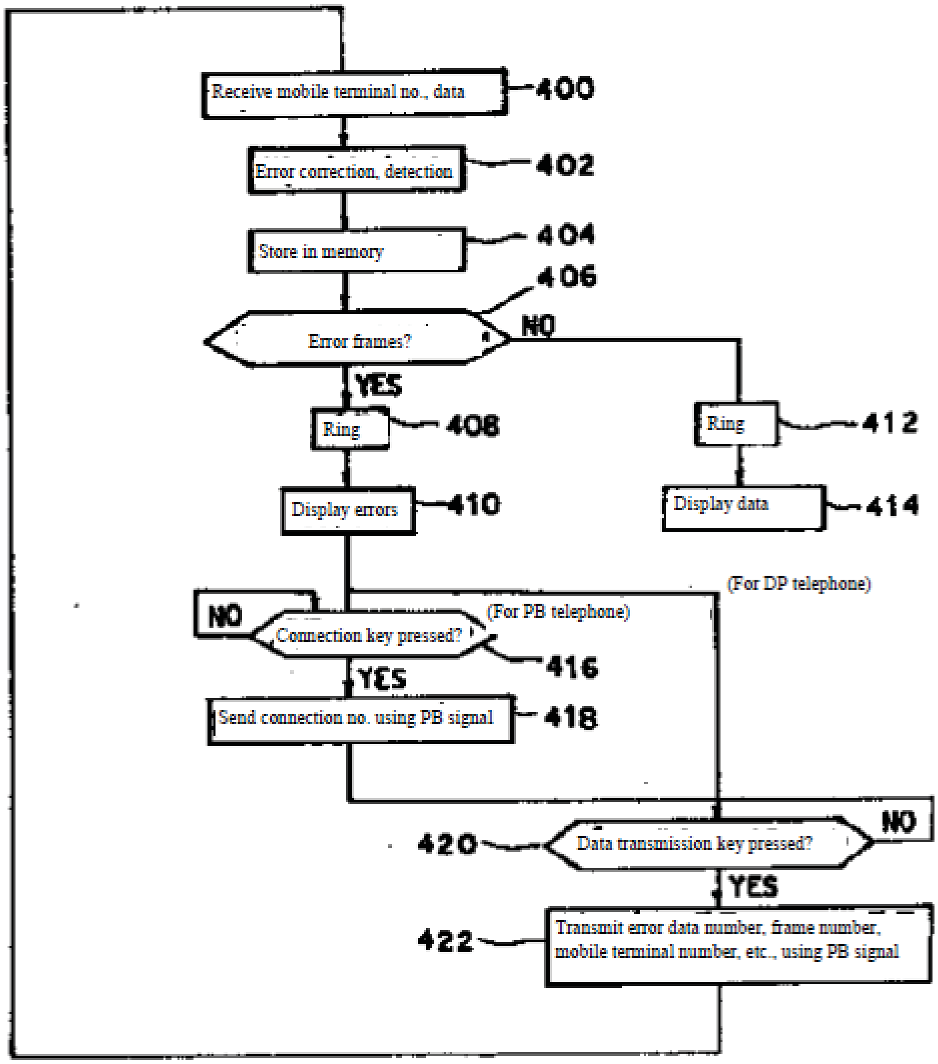
103. **1(C)**: <u>"a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network"</u> Akiyama discloses the use of keys on the mobile unit by the user to

indicate that a portion of the message should be retransmitted. Ex. 1003 at 3, Fig. 3. The received message is made up of multiple frames of data, and the system of Akiyama identifies which frames within the message have errors. Ex. 1003 at 2-3. Specifically, Akiyama discloses:

> Upon hearing this, the mobile terminal owner presses the data transmission key in the keys 307 (420), upon which the control section 302 reads the data number, the frame number, and its own mobile terminal number for the data that is experiencing the error from the memory 303, drives the PB signal generation section 305, and transmits the data through the speaker 306 (422). If there are a plurality of frames with errors, a plurality of frame numbers are transmitted.

Ex. 1003 at 3.

104. **1(D)**: <u>"means for transmitting, only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message</u>" Akiyama combined with Gutman discloses this limitation. Akiyama discloses a mobile terminal that waits for a user to press the designated transmission key before the control section (*i.e.* transmit logic) transmits a signal to the paging network control station requesting that a specified portion of the received message be retransmitted. Ex. 1003 at 3, Figs. 3-4. Figure 4 shows the flow diagram of the retransmission request feature of Akiyama, which includes waiting for the data transmission key to be pressed at step 420 and then transmits the retransmission signal with corresponding frame numbers at step 422.



Operation flow of mobile terminal

FIG. 4

105. Gutman discloses transmitter 52, antenna switch 56, and antenna 54 for transmitting RF signals back to the paging network after a user manually presses the designated switch. Ex. 1004 Figs. 1, 4 & 2:35-43, 4:28-34. Switch 66

of Figure 4 is used in Gutman by the user to manually transmit an acknowledgement message to the paging network. Ex. 1004 at 2:35-43, 4:28-34.

106. It would have been obvious to a POSITA to combine the RF transmitter of Gutman with the mobile paging unit of Akiyama, enabling the mobile unit to transmit the retransmission request using RF signals rather than the less portable method of transmitting the request over a telephone line.

107. **1(E)**: "means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display" Akiyama discloses an antenna and wireless section 301 for receiving the retransmitted portions of the message, and it discloses display section 304 for displaying the received retransmitted portion on the display. Ex. 1003 at 3, Fig. 3. Specifically, Akiyama discloses:

> The mobile terminal 101 sees from the data number that this data is a retransmission of previously received data, and stores the newly received data in a memory area for already-stored data numbers. If there are frames with errors after error correction and detection, the display indicates that there are errors, as during the first reception, and requests retransmission again through the telephone if needed. If it is seen that all the frames were able to be received without errors after error correction, then this is displayed to the display section 304 to notify the mobile terminal owner.

Ex. 1003 at 3.

4. Claim 2 is Invalid in View of Akiyama Combined with Gutman

108. **2(A)**: "The mobile unit of claim 1, further comprising: means for detecting errors in the received message" Akiyama discloses detection of errors in the received message by control section 302 using the error correction detection code 206. Ex. 1003 at 2-3, Figs. 2-4. Specifically, Akiyama discloses:

> The transmission data is sent from the base station 102 to the mobile station 101 over the wireless communication line. In the mobile station 101, the wireless section 301 in FIG. 3 performs reception and demodulation (400 in FIG. 4), and the control section 302 corrects any errors using the error correction detection code 206 (402). If it is found that there are no errors, the data number 203, the frame number 204, and the data 205 are stored in the memory 303 (404). If there are errors, a symbol is attached indicating that there is an error, and this is similarly stored in the memory 303.

Ex. 1003 at 2-3.

109. Figure 2 illustrates the error correction detection code 206 that is used to detect errors in Akiyama.

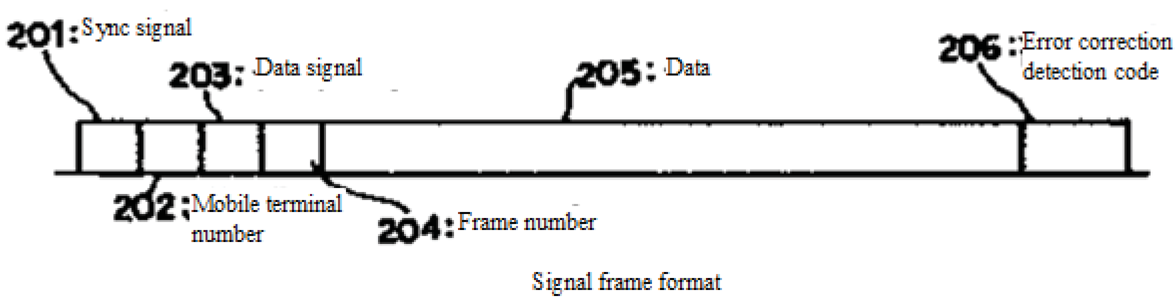


FIG. 2

110. **2(B)**: “said display including means for highlighting said errors when the message is displayed on said display” Akiyama discloses display section 304 that highlights frames within the message that have errors by, among other things, causing the frames with errors to blink. Ex. 1003 at 3, Figs. 3-4. Specifically, Akiyama discloses:

> If there are any frames that contain errors in the display data, the fact that there is an error is also displayed. For the error display, several methods are conceivable, including displaying everything including the incorrect data, and causing the frames with incorrect data to blink, indicating through writing or the like that there are incorrect frames without displaying the data, and so on.

Ex. 1003 at 3.

5. Claim 4 is Invalid in View of Akiyama Combined with Gutman

111. **4**: “The mobile unit of claim 1, wherein the signal transmitted by the transmitting means indicates to the network that the user has read the message” Akiyama combined with Gutman discloses this limitation. Akiyama discloses that the message is displayed with errored frames highlighted and then the user determines if a request for retransmission should be made after reviewing the received message. Ex. 1003 at 3, Fig. 4. Because the user must view the message to determine if he or she desires retransmission of the errored frames, the

retransmission request is an indication to the paging network that the user has read the message.

112. Gutman discloses that the manual acknowledgment signal is an indication to the paging network that the user has read and understood the message. Ex. 1004 at 4:56-68. Specifically, Gutman discloses:

> During the time for processing the message, and for a predetermined period thereafter, which constitutes a response interval, the pager wearer may activate manual pushbutton 66 to generate a further and manual ack-back response. When received and processed at the base-central site, it is indicative of the condition that the page message was duly received and understood by the intended pager wearer.

Ex. 1004 at 4:56-68.

6. Claim 7 is Invalid in View of Akiyama Combined with Gutman

113. **7(P)**: <u>"A communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network, the network comprising [the elements below]"</u> Akiyama in combination with Gutman discloses this limitation. Akiyama discloses a paging network base station that transmits RF signals to a mobile unit and a paging network control station that receives

retransmission requests from the mobile unit, where the mobile unit includes a display and keys that enable a user to specify a portion of a displayed message that the user desires to have retransmitted after viewing the displayed message that was transmitted from the paging network. Ex. 1003 at 2-3, Figs. 1, 3. Specifically, Akiyama discloses:

> Upon hearing this, the mobile terminal owner presses the data transmission key in the keys 307 (420), upon which the control section 302 reads the data number, the frame number, and its own mobile terminal number for the data that is experiencing the error from the memory 303, drives the PB signal generation section 305, and transmits the data through the speaker 306 (422). If there are a plurality of frames with errors, a plurality of frame numbers are transmitted.

Ex. 1003 at 3. Akiyama further discloses:

> Upon receiving this signal, the control station 103 searches the content of the memory 106 on the basis of the mobile terminal number, the data number, and the frame number that have been received, and then retransmits the incorrect frame to the mobile terminal 101 via the base station 102 and the wireless communication line. The mobile terminal 101 sees from the data number that this data is a retransmission of previously received data, and stores the newly received data in a memory area for already-stored data numbers. If there are frames with errors after error correction and detection, the display indicates that there are errors, as during the first reception, and requests retransmission again through the telephone if needed. If it is seen that all the frames were able to be received without errors after error correction, then this is displayed to the display section 304 to notify the mobile terminal owner.

Ex. 1003 at 3.

114. Gutman discloses a two-way paging system where the paging network includes a paging transceiver 22 (transmitter and receiver) that enables the network to transmit messages to a mobile unit and receive messages from the mobile unit. Ex. 1004 Figs. 1, 4 & 2:35-43, 3:29-33. Also, the mobile unit of Gutman includes both transmitter 52 and receiver 50 connected to shared antenna 54 along with a display 62 and manual acknowledgment function that is transmitted only upon user request by pressing switch 66. Ex. 1004 Fig. 4 & 2:35-43, 3:29-33.

115. It would have been obvious to a POSITA to combine the RF transceiver of the paging network in Gutman with the paging control station and base station of Akiyama to allow for the retransmission requests to be received over the RF wireless interface rather than requiring the messages to be transmitted over a telephone line.

116. **7(A)**: <u>"means for transmitting radio frequency signals containing a message to the mobile unit"</u> Akiyama discloses a base station 102 with antenna for transmitting RF signals containing paging messages to mobile terminal 101. Ex. 1003 at 2-3, Figs. 1, 3. Specifically, Akiyama discloses:

> A feature of the present invention for attaining this object is a message transmission system comprising a mobile terminal, a wireless base station, and a control station, using one-way wireless communication lines that

> transmit data from the control station to the mobile terminal via the wireless base station….

Ex. 1003 at 2.

117. **7(B)**: "means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission" Akiyama combined with Gutman discloses this limitation. Akiyama discloses receiving at the paging network control station signals from the mobile unit representing a portion of the message that the user desires to have retransmitted. Ex. 1003 at 3, Figs. 1, 3.

118. Gutman discloses an antenna and transceiver 22 (transmitter and receiver) at the paging network that supports receiving RF signals from the mobile terminals, including manual acknowledgement messages from the user. Ex. 1004 Figs. 1, 3 & 2:35-43.

119. It would have been obvious to a POSITA to combine the RF transceiver of the paging network in Gutman with the paging control station and base station of Akiyama to allow for the retransmission requests to be received over the RF wireless interface rather than requiring the messages to be transmitted over a telephone line.

120. **7(C)**: "means for retransmitting radio frequency signals containing the portion of the message to the mobile unit" Akiyama discloses a base station 102

and antenna for retransmitting RF signals containing the portion of the message to the mobile unit that was requested by the user. Ex. 1003 at 3, Fig. 1. Specifically, Akiyama discloses:

> Upon receiving this signal, the control station 103 searches the content of the memory 106 on the basis of the mobile terminal number, the data number, and the frame number that have been received, and then retransmits the incorrect frame to the mobile terminal 101 via the base station 102 and the wireless communication line. The mobile terminal 101 sees from the data number that this data is a retransmission of previously received data, and stores the newly received data in a memory area for already-stored data numbers. If there are frames with errors after error correction and detection, the display indicates that there are errors, as during the first reception, and requests retransmission again through the telephone if needed. If it is seen that all the frames were able to be received without errors after error correction, then this is displayed to the display section 304 to notify the mobile terminal owner.

Ex. 1003 at 3.

7. Claim 8 is Invalid in View of Akiyama Combined with Gutman

121. **8(P)**: <u>"A method for receiving and transmitting messages at a mobile unit, comprising the steps [below]"</u> Akiyama discloses receiving messages at a mobile unit from a paging network and transmitting retransmission request messages from the mobile unit to the paging network. Ex. 1003 at 2, Fig. 1. Specifically, Akiyama discloses:

> [A] message transmission system comprising a mobile terminal, a wireless base station, and a control station, using one-way wireless communication lines that transmit data from the control station to the mobile terminal via the wireless base station, wherein the data transmitted from the control station is divided into a plurality of frames…a mobile terminal holder electrically or acoustically couples the mobile terminal to a general telephone network to transmit to the control station the mobile terminal number, the data number, and the number of the frame where the error occurred, the control terminal retransmits only the mobile terminal number, the data number, and the error frame number, and the mobile terminal visibly displays the data of the frames which were initially correctly received and of the retransmitted frame in frame number order.

Ex. 1003 at 2. Figure 1 illustrates the mobile paging network of Akiyama, with the mobile terminal 101 receiving messages from base station 102 and transmitting retransmission requests through telephone line 108.

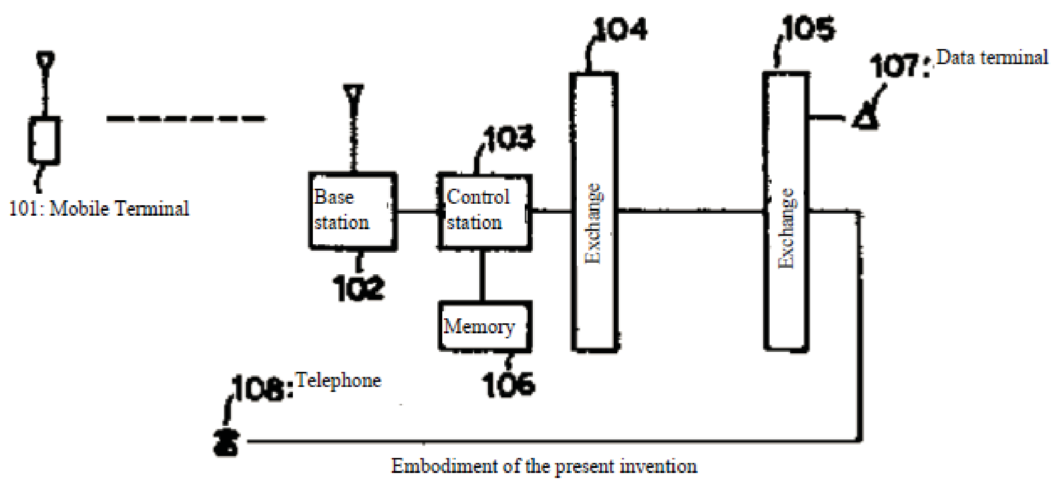


FIG. 1

122. Gutman discloses a two-way paging system where the mobile terminal both receives and transmits messages from/to the paging network using RF signals. Ex. 1004 Figs. 1, 4 & 3:29-33, 3:41-46. The paging mobile terminal of Gutman includes hardware to allow the user to manually acknowledge that a received message has been read. Ex. 1004 at 3:29-33. Figure 4 of Gutman illustrates the receiver 50 and transmitter 52 within the mobile unit, and it shows the connection to a shared antenna 54 through an antenna switch 56.

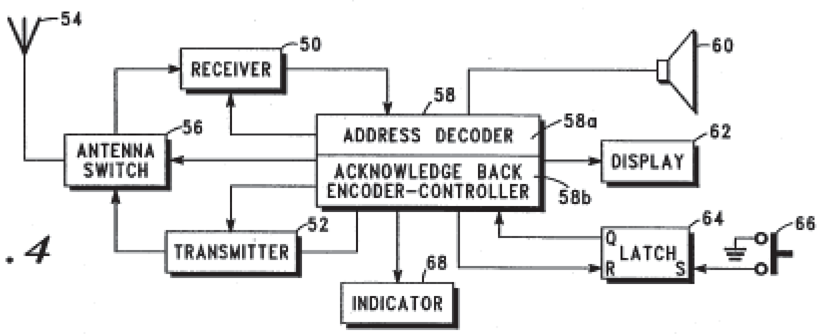


FIG. 4

123. It would have been obvious to a POSITA to combine the RF transmitter of Gutman with the mobile paging unit of Akiyama, enabling the mobile unit to transmit the retransmission request using RF signals rather than the less portable method of transmitting the request over a telephone line.

124. **8(A)**: <u>"receiving at the mobile unit a radio frequency message"</u> Akiyama discloses receiving paging messages from the network base station via RF signals. Ex. 1003 at 2-3, Figs. 1, 3. Specifically, Akiyama discloses:

> The transmission data is sent from the base station 102 to the mobile station 101 over the wireless communication

> line. In the mobile station 101, the wireless section 301 in FIG. 3 performs reception and demodulation (400 in FIG. 4), and the control section 302 corrects any errors using the error correction detection code 206 (402).

Ex. 1003 at 2-3.

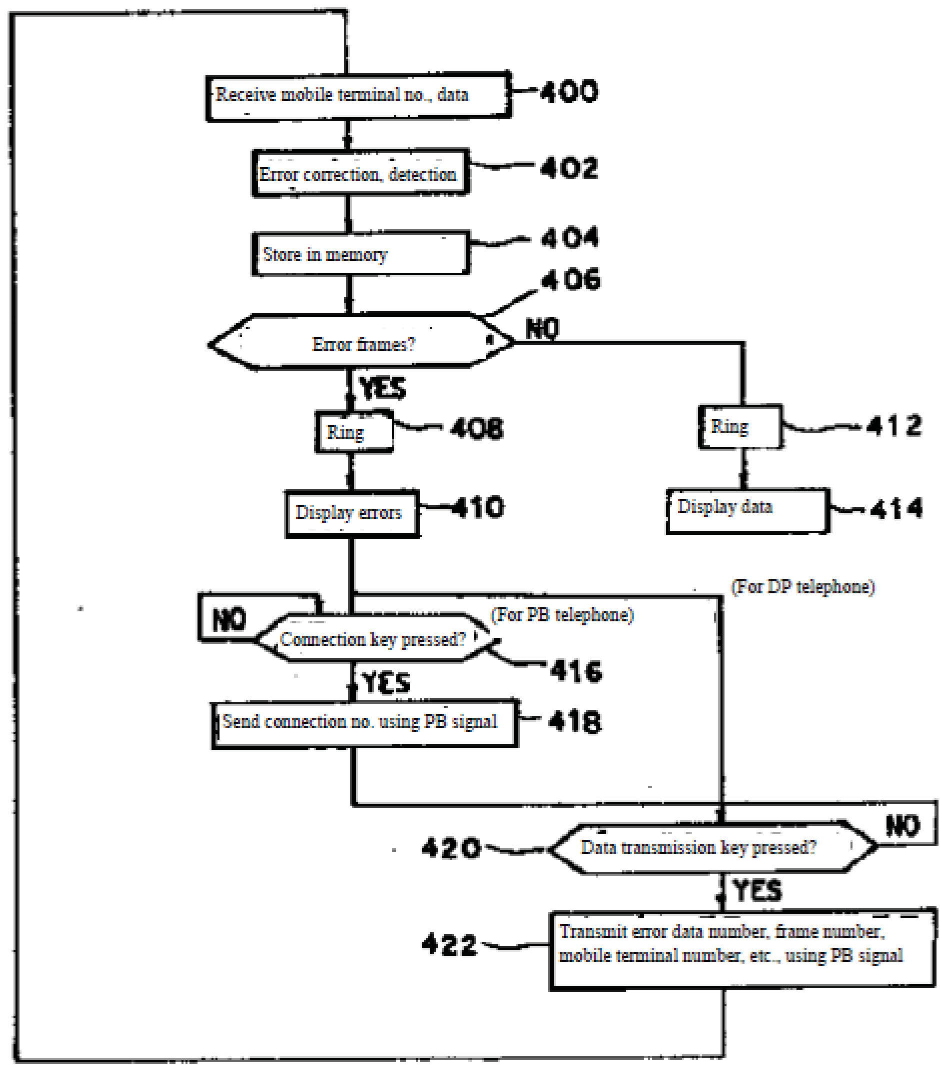
125. **8(B)**: <u>"displaying said message on the mobile unit"</u> Akiyama discloses a display section 304 for displaying received messages. Ex. 1003 at 3, Fig. 3.

126. **8(C)**: <u>"receiving an indication of a portion of the displayed message for which a user desires retransmission"</u> Akiyama discloses the use of keys on the mobile unit by the user to indicate that a portion of the message should be retransmitted. Ex. 1003 at 3, Fig. 3. The received message is made up of multiple frames of data, and the system of Akiyama identifies which frames within the message have errors. Ex. 1003 at 2-3. Specifically, Akiyama discloses:

> Upon hearing this, the mobile terminal owner presses the data transmission key in the keys 307 (420), upon which the control section 302 reads the data number, the frame number, and its own mobile terminal number for the data that is experiencing the error from the memory 303, drives the PB signal generation section 305, and transmits the data through the speaker 306 (422). If there are a plurality of frames with errors, a plurality of frame numbers are transmitted.

Ex. 1003 at 3.

127. **8(D)**: "transmitting, only upon receipt of the indication, a signal requesting retransmission of said indicated portion of said message" Akiyama combined with Gutman discloses this limitation. Akiyama discloses a mobile terminal that waits for a user to press the designated transmission key before transmitting a signal to the paging network control station requesting that a specified portion of the received message be retransmitted. Ex. 1003 at 3, Figs. 3, 4. Figure 4 shows the flow diagram of the retransmission request feature of Akiyama, which includes waiting for the data transmission key to be pressed at step 420 and then transmits the retransmission signal with corresponding frame numbers at step 422.



Operation flow of mobile terminal

FIG. 4

128. Gutman discloses transmitter 52, antenna switch 56, and antenna 54 for transmitting RF signals back to the paging network after a user manually presses the designated switch. Ex. 1004 Figs. 1, 4 & 2:35-43, 4:28-34. Switch 66

of Figure 4 is used in Gutman by the user to manually transmit an acknowledgement message to the paging network. Ex. 1004 at 2:35-43, 4:28-34.

129. It would have been obvious to a POSITA to combine the RF transmitter of Gutman with the mobile paging unit of Akiyama, enabling the mobile unit to transmit the retransmission request using RF signals rather than the less portable method of transmitting the request over a telephone line.

130. **8(E)**: <u>"receiving a retransmission of said indicated portion"</u> Akiyama discloses an antenna and wireless section 301 for receiving the retransmitted portions of the message. Ex. 1003 at 3, Fig. 3. Specifically, Akiyama discloses:

> "The mobile terminal 101 sees from the data number that this data is a retransmission of previously received data, and stores the newly received data in a memory area for already-stored data numbers. If there are frames with errors after error correction and detection, the display indicates that there are errors, as during the first reception, and requests retransmission again through the telephone if needed. If it is seen that all the frames were able to be received without errors after error correction, then this is displayed to the display section 304 to notify the mobile terminal owner."

Ex. 1003 at 3.

131. **8(F)**: <u>"displaying the received retransmission of said indicated portion on the mobile unit"</u> Akiyama discloses displaying the received retransmission of the message frames using the display section 304 of the mobile terminal. Ex. 1003 at 3, Fig. 3.

8. Claim 9 is Invalid in View of Akiyama Combined with Gutman

132. **9(A)**: "The method according to claim 8, further comprising the step of: detecting errors in the received message" Akiyama discloses detecting errors in the received message by control section 302 using the error correction detection code 206. Ex. 1003 at 2-3, Figs. 2-4. Specifically, Akiyama discloses:

> The transmission data is sent from the base station 102 to the mobile station 101 over the wireless communication line. In the mobile station 101, the wireless section 301 in FIG. 3 performs reception and demodulation (400 in FIG. 4), and the control section 302 corrects any errors using the error correction detection code 206 (402). If it is found that there are no errors, the data number 203, the frame number 204, and the data 205 are stored in the memory 303 (404). If there are errors, a symbol is attached indicating that there is an error, and this is similarly stored in the memory 303.

Ex. 1003 at 2-3.

133. Figure 2 illustrates the error correction detection code 206 that is used to detect errors in Akiyama.

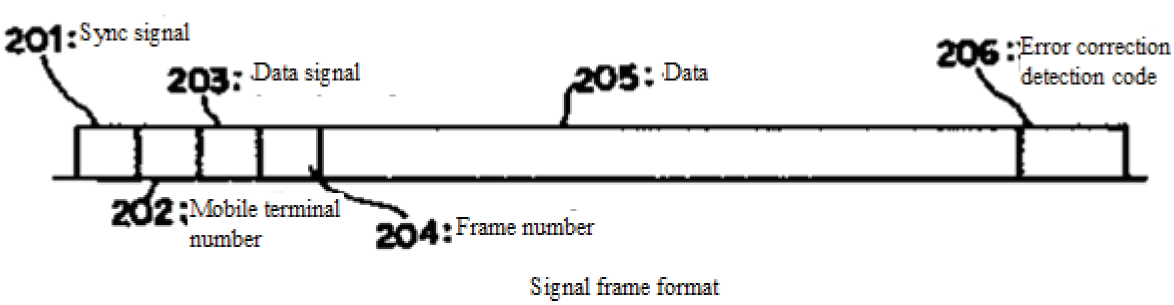


FIG. 2

134. **9(B)**: "wherein the step of displaying comprises the substep of: highlighting said errors in the message on the mobile unit" Akiyama discloses display section 304 that highlights on the display frames within the message that have errors by, among other things, causing the frames with errors to blink. Ex. 1003 at 3, Figs. 3-4. Specifically, Akiyama discloses:

> If there are any frames that contain errors in the display data, the fact that there is an error is also displayed. For the error display, several methods are conceivable, including displaying everything including the incorrect data, and causing the frames with incorrect data to blink, indicating through writing or the like that there are incorrect frames without displaying the data, and so on.

Ex. 1003 at 3.

B. Ground 2: Zabarsky Combined With Kuznicki

1. Zabarsky

135. Zabarsky is titled "Two Way Personal Message System With Extended Coverage" and issued more than a year before the earliest claimed priority date of the '946 Patent. In general, Zabarsky describes a paging network and mobile pager that could be carried at all times and provide wide coverage in contrast to the mobile telephones available at the time. Ex. 1005 Figs. 1-3, 5, 9. Zabarsky issued to Motorola, which was a leader in mobile communications and paging technologies at the time. Ex. 1005 Cover.

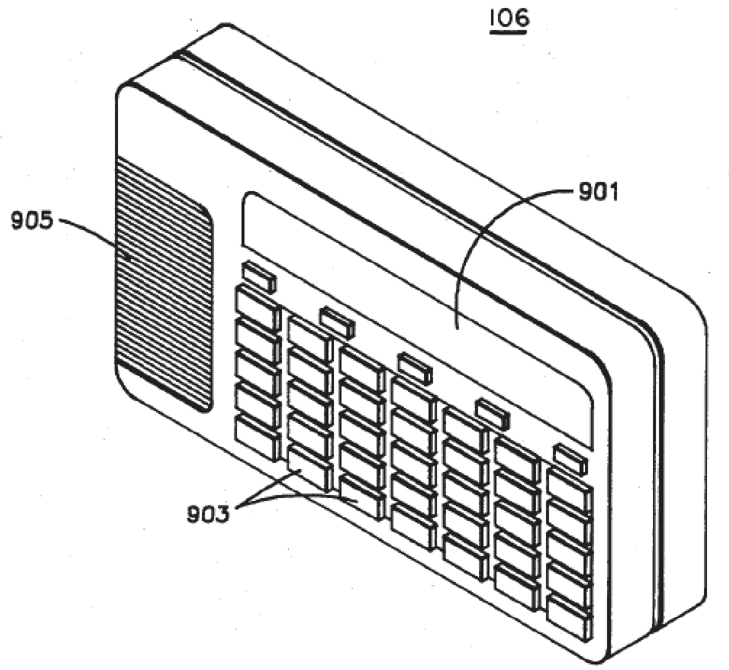


Fig. 9

136. The primary focus of Zabarsky is to provide a communications system that would allow mobile individuals to remain in contact without experiencing some of the drawbacks present in mobile telephones and pagers at the time. In 1984, portable telephones were larger and much more cumbersome devices than we have today. Real-time two way voice traffic (i.e. a telephone call) also took up a lot of airtime and was therefore quite expensive. However, Zabarsky explains that paging systems at the time were limited to relatively small geographic areas, limiting user mobility. Ex. 1005 Figs. 1-3, 6 & 1:37-2:26, 3:10-25. Zabarsky describes a two-way paging system in which the pager reports its location to the network so that the network can direct pages to the appropriate transmitters that

can reach that pager. Ex. 1005 Figs. 1-6, & 3:41-67, 5:13-6:3. This is accomplished with multiple techniques. In order to identify the mobile device's location among multiple antennas that receive signals from the mobile device, the signal strengths are compared. Ex. 1005 at 6:4-58. When a user travels to a new location, the user can command the mobile unit to request roaming service, which causes the system to update the user's location. Ex. 1005 at 15:34-47.

137. In order to ensure that messages are successfully delivered, messages intended for a user are stored at the user's home central paging site. Ex. 1005 at 3:46-50. The system may attempt to reach the mobile device at more than one location. Ex. 1005 at 6:59-7:10. If a message is successfully delivered, the mobile unit may or may not successfully transmit an acknowledgement message. Ex. 1005 at 3:61-65, 6:67-7:10, 14:4-9. Of course, the mobile unit may also attempt, unsuccessfully, to transmit an acknowledgement message. This is more likely to occur when the mobile device is in a poor coverage area. In that situation, messages with errors caused by the poor coverage area are likely to coincide to some degree with messages that are not successfully acknowledged by the mobile device if an acknowledgement is even attempted. In addition, Zabarsky used commonly known error detection techniques to identify if messages are received with errors. Ex. 1005 at 7:54-8:20. Because transmitting an acknowledgement will result in deletion of the acknowledged message at the central station, a

POSITA would have understood that the Zabarsky system would not have sent acknowledgements for messages received with errors. Ex. 1005 at 3:61-65.

138. Although Zabarsky does not go into detail about displaying even those messages that contain errors on the pager, a POSITA at the time would have understood that messages received with errors would have been displayed. At a minimum it would have been obvious to display those messages. For example, Zabarsky emphasizes the desirability of notifying a user that he or she has a message. Ex. 1005 at 2:50-54. It would run contrary to that goal to receive a message intended for a particular pager, but withhold any indication of the message from the user. The obvious approach that a POSITA would have expected in Zabarsky would be to display the message even though it contained errors, and possibly to indicate that it may contain errors. It was the standard practice at the time to display even those messages with errors. This approach is explicitly taught in Kuznicki, which I address below. But at least until a retransmission can occur, there are only two alternative actions when receiving a message with errors. Silently ignore and delete the message, or store it and treat it as a received message. It would have been obvious to consider either of these approaches, and storing/displaying the message supports the general goal of alerting the user to messages as soon as possible during normal turned-on operation of the pager.

139. Zabarsky recognizes that the user may have some preference regarding when or whether to request that unacknowledged messages be retransmitted to the mobile unit. Ex. 1005 at 14:67-15:4. The user may enter a sequence of keypad commands to request that unacknowledged messages are transmitted to the pager again. Ex. 1005 at 14:67-15:4. As I explained above, one source of unacknowledged messages are those messages that were received with errors. An obvious and likely scenario, therefore, is that a user would receive a message containing errors, perhaps due to being located in a poor coverage like the center of a building. The user would recognize that errors are present in the message (whether or not the pager indicates there was an error), move to a better coverage area and enter the key sequence requesting retransmission of unacknowledged messages. The network then retransmits the message originally received with errors, this time successfully. Even though the request may, in some cases, result in other unacknowledged messages does not detract from the fact that the user can request a message that was in fact received with errors.

140. Claim limitations 1(C), 7(B), and 8(D) refer to a user request for retransmission of *a portion* of a displayed message. Although the operation of Zabarsky that I've just described certainly includes retransmitting the portions of unacknowledged messages that are received with errors (and therefore that the user

desires to have resent), it does so by resending the entire page over again including those parts that were received without errors.

141. I have reviewed the file history that corresponds to the ’946 Patent and I understand from that review that the original applicants distinguished between retransmitting the entire message and requesting “*only* a portion of a message.” Ex. 1017 (1996-11-2 Amendment) at 3-4 (emphasis added). Although the ’946 Patent claims do not explicitly qualify that *only* a portion is to be retransmitted, I have analyzed the prior art under this narrower understanding of the claims.

142. Zabarsky’s approach to retransmitting the entire page was appropriate because the messages in Zabarsky were short alphanumeric messages similar to a text message or text-only tweet today. Ex. 1005 at 11:46-49, 15:5-16. The trade-off between the data saved by avoiding retransmission of the entire message and the complexity of retransmitting only a portion of a message tipped in favor of whole-page retransmission in Zabarsky, but as messages got larger those larger messages were fragmented into multiple pages. The trend toward larger messages preceded from alerts, to numeric pages, to alphanumeric, to larger messages. This was partially recognized by Kuznicki, as I discuss below. Fragmenting messages across multiple pages has the added benefit of permitting page-level retransmission requests (as is already the case in Zabarsky) but because the individual pages are

only part of the total message, retransmission of those pages represents retransmission of only a portion of the message.

2. Kuznicki

143. Kuznicki is titled “Paging System Using Message Fragmentation To Redistribute Traffic” and was filed ten months before the filing date of the ‘946 Patent. Kuznicki claims priority to a continuation-in-part application filed on May 29, 1992. Either of these dates precedes the priority date for the ’946 Patent. Like Zabarsky, Kuznicki was originally assigned to Motorola.

144. Kuznicki describes a paging system that comes about 7-8 years after Zabarsky. As Kuznicki explains “Communication systems, such as paging systems, have been increasing the length of their transmitted messages. Further, the trend in the marketplace is toward transmitting very long messages in certain applications, such as information distribution services.” This statement accurately reflects one of the trends that was taking place at the time.

145. Kuznicki describes some undesirable conditions that could occur due to longer message lengths in a paging system. These included monopolization of the transmission medium, decreased likelihood that the entire message will be received without errors, and the longer time required for complete transmission (and the potential for repeated messages that may result). Ex. 1006 at 1:24-51.

146. Kuznicki's general approach to this problem is to fragment longer messages into multiple shorter messages, and then to reassemble these messages at the receiver. Ex. 1006 at 1:52-2:12. The focus of most of the specification in Kuznicki involves techniques for how to efficiently fragment, schedule, and transmit the message. Kuznicki describes how a message may be fragmented, transmitted, received, and recombined. Kuznicki discloses that errors in the messages may be corrected with error correcting codes, but errors may persist in the displayed messages. Ex. 1006 at 17:57-18:22, 30:24-31. Kuznicki does not address performing a manual retransmission request for messages containing errors.

147. Zabarsky and Kuznicki are complementary references describing similar systems. Kuznicki accurately explains the trend of larger message sizes that occurred in intervening time since Zabarsky was written. And Kuznicki goes on to explain various benefits that accrue from fragmenting messages into multiple smaller messages for transmission. Combining message fragmenting features from Kuznicki into Zabarsky was obvious, in part, because it would allow Zabarsky to handle larger messages, as was the trend at the time, while ameliorating the problems with larger messages. Incorporating message fragmentation into Zabarsky provides the benefits of allowing larger messages while avoiding long delays to other messages on the transmission medium, reducing the impact of

fading. Ex. 1006 at 1:32-51. Incorporating Kuznicki, therefore, provides the obvious benefits sought by Kuznicki to achieve the predictable, and predicted, results described in Kuznicki.

148. Kuznicki recognizes that errors may occur during transmission that prevent some messages from being received. Ex. 1006 at 12:48-56. Other messages may be received with errors. Ex. 1006 at 30:21-30. But Kuznicki does not explain that a user can receive a retransmission of a message that was received with errors. The benefit of obtaining a corrected retransmission is apparent. If, for example, the sender's reply telephone number was garbled during transmission, the recipient may be unable to respond effectively. A similar scenario is described in the Schwendeman reference (Ex. 1008). Schwendeman describes a scenario in which a user receives a message with errors, and upon recognizing the existence of errors that were flagged by the receiver, connects the device to the network for reconciliation and receives the corrected message. Ex. 1008 at 18:21-31. Obtaining the benefit of correcting messages with errors, provides a reason to combine Kuznicki with Zabarsky.

149. While Kuznicki comes later than Zabarsky and addressed the trend in larger message sizes, Zabarsky's approach to retransmission is not supplanted or otherwise solved by Kuznicki, and it would have been obvious to combine their teachings. For example, the mobile paging device in Kuznicki lacks transmission

capability, and in order to obtain corrected messages it is necessary to combine it with another reference that can communicate back to the network, such as Zabarsky. Because Kuznicki lacks any acknowledgement capability, the obvious approach in combining Zabarsky with Kuznicki is to retain the per-transmission acknowledgement of Zabarsky in which each individual page or transmission is acknowledged. As a general rule, reducing the amount of retransmitted data tends to improve efficiency. U.S. Patent No. 5,031,179, Yoshida, issued in July 1991 and discusses some of these general principles. For example, the abstract suggests "to minimize the number of incidents of error retransmission" to improve efficiency. Ex. 1009 Abstract. Various approaches to retransmission are described, including selective retransmission, which retransmits "only an error block." Ex. 1009 at 1:50-66. The techniques in Yoshida for different types of retransmission would have been understood by a POSITA, which is confirmed by Yoshida's discussion of the retransmission techniques as part of its background section. Applying the goal of minimizing the amount of retransmitted data and the technique of selective retransmission, the obvious manner of combining Zabarsky and Kuznicki is to fragment large messages as taught by Kuznicki and to perform Zabarsky's acknowledgements on a per-fragment basis so that a later request for unacknowledged messages results in only erroneous blocks being retransmitted.

150. Other aspects of the Kuznicki approach were likewise obvious to import. For example, the use of error correction codes was an ordinary engineering choice at the time. Zabarsky, in fact, cited a patent that focused on the use of error correction codes as one of the known, ordinary transmission techniques. Ex. 1005 at 8:21-27 (citing U.S. Patent No. 4,156,867, which relies on error correction (Hamming) codes at 5:25-33). In fact, the '946 Patent recognizes that error correction codes were a known prior art technique. Ex. 1001 at 3:23-25. Both error correction codes and error detection codes add redundant information to a transmission that results in more bits transmitted to convey the same information. Error correction codes carry a higher bandwidth cost than error detection codes. That higher cost is justified if the likelihood of errors that can be corrected by the codes results in an expected reduction in the number of bits that need to be retransmitted that exceeds the cost of the addition correction bits. The probabilities involved are based on the expected error rate which usually depends on the transmission techniques and medium. As a result, both error detection codes and error correction codes were known interchangeable techniques whose selection was an ordinary design choice based on expected conditions for the transmissions in question. Moreover, Kuznicki points out that when messages are fragmented, certain types of errors may lead to "orphan" message packets. Ex. 1006 at 17:28-32. Kuznicki makes this point as part of its discussion of error correcting codes

because the ability to correct these errors prevents misinterpreting more than one transmission. Incorporating the message fragmentation techniques in Kuznicki, therefore, also provides a reason to include error correction circuitry within the mobile unit. The known interchangeability of error correcting codes and error detection codes is also confirmed in Schwendeman's treatment of the error correcting and error detecting codes as equivalent alternatives. Ex. 1008 at 8:8-15. Yoshida, similarly treats error detection and correction codes as roughly interchangeable when used for the common purpose of detecting errors. Ex. 1009 at 1:26-36. Of course, error correction codes serves the additional purpose of correcting errors in the transmission. Ex. 1009 at 1:37-49.

151. In addition, Kuznicki's explicit teaching to highlight errors in a received message was obvious to incorporate in Zabarsky. As I previously explained, displaying messages, even those with errors, was a known alternative that supported Zabarsky's goal of promptly notifying users of messages. Zabarsky included error detection codes inserted in the message and it would have been obvious to incorporate error correction codes. With either of these, the presence of errors would have been detected in most instances. Because the device is aware of the presence of errors, it was a trivial and obvious benefit to flag those errors in the message itself, as taught by Kuznicki because then the user is made aware of the

possibility of errors in the message. A failure to identify errors in a message can mislead the recipient. Ex. 1009 at 2:30-38.

152. At the same time, it would have been obvious to incorporate the manual retransmission request operation in Zabarsky into Kuznicki. Although Kuznicki may need to be modified to include per-fragment acknowledgements which are not explicitly disclosed or ruled out in Kuznicki, the obvious benefit of allowing the user to select whether retransmission is necessary with its resulting reduction in retransmission requests, is an expected benefit of manual retransmission requests. Ex. 1005 at 14:67-15:4. Further, the benefit of manual retransmission approaches was not eliminated by the passage of time from 1984 to the filing of Kuznicki. For example, another Motorola publication in 1991 continued to support the known benefit of using a manual retransmission request. Ex. 1015 at 114-15.

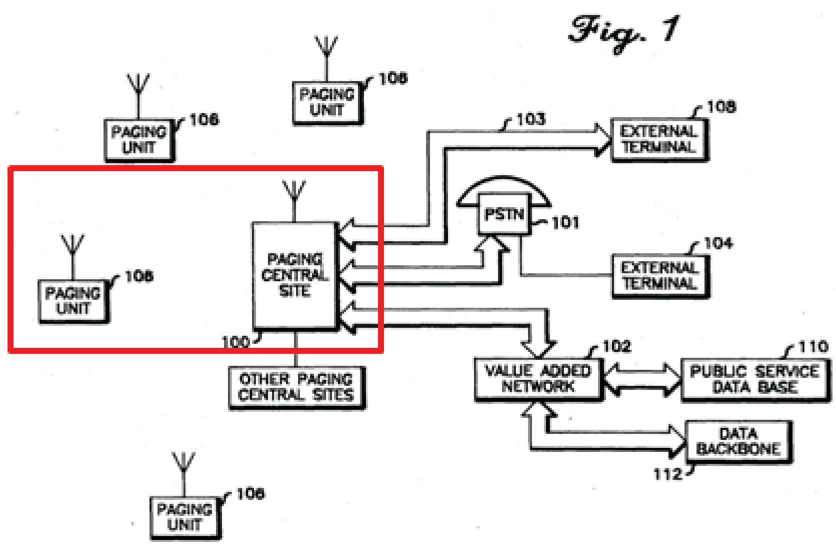
153. I have reviewed the Zabarsky and Kuznicki patents and have not found any substantial hurdle that a POSITA could not have overcome at the time to incorporate the identified aspects of these two references together.

154. It is my opinion that claims 1, 2 and 7-9 of the ‘946 Patent do not present any novel or non-obvious features over those in Zabarsky when combined with Kuznicki. The following sections provide a detailed account of the specific sections of Zabarsky and Kuznicki that describe all the limitations in claims 1, 2

and 7-9, and show why those claims are obvious. I have also included an element-by-element analysis of Zabarsky and Kuznicki against claims 1, 2 and 7-9 in Appendix D.

3. Claim 1 is Invalid in View of Zabarsky Combined with Kuznicki

155. **1(P)**: "A mobile unit for transmitting and receiving radio frequency signals to and from a communications network comprising [the elements below]" Zabarsky discloses a mobile unit that sends and receives RF signals to a communications network. Ex. 1005 Fig. 1 & 1:6-12. The diagram below is annotated to show a mobile unit (the paging unit) that is communicating with the paging network.



156. That the communications medium comprises radio frequency transmissions is also explicitly disclosed. "A communications system for carrying

messages via a radio channel between one central site of a plurality of central sites and a plurality of two-way remote data units is disclosed." Ex. 1005 Abstract.

157. **1(A)**: "means for receiving a radio frequency message from the network" Zabarsky discloses an antenna and a receiver configured to receive a radio frequency message from the network. As noted for element 1(P), the Zabarsky mobile unit communicates with the base station via radio frequency messages. Zabarsky discloses an antenna and receiver used to receive the RF messages.

> It is desirable that the pager of the preferred embodiment include **two antennas** of dissimilar receiving characteristics such as that described by Kneisel et al. in U.S. patent application Ser. No. 511,430 (Homotropic Antenna System for Portable Radio) filed on July 6, 1983 and assigned to the assignee of the present application. **A single antenna pager may be used**, however, without departing from the spirit and scope of the present invention. A duplexer 1021 of commercial availability couples the transceiver transmitter 1023 and **receiver 1025** to one antenna with minimal interaction and a second antenna is coupled directly to the receiver 1025. The receiver output signal is filtered (in conventional bandpass filter 1027) and limited (in conventional limiter 1029) before being passed to the MPU 1001 bus via I/O 1017.

Ex. 1005 at 13:2-18 (emphasis added).

1(B): "a display for displaying said message" Zabarsky discloses a display used to display the messages. ""The pager unit 106 of the preferred embodiment is shown in FIG. 9. Preferably it has a back-lit LCD alphanumeric display 901 with two lines of 16 characters per line for message display." Ex. 1005 Fig. 9 & 12:9-12, 13:21-27.

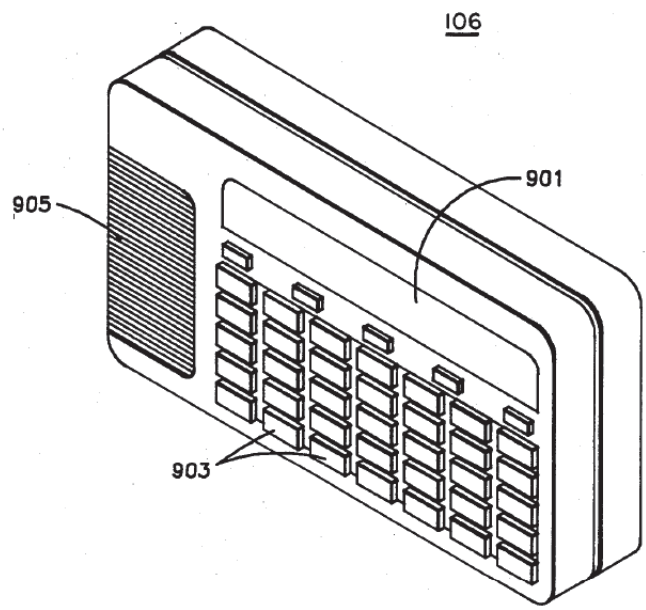


Fig. 9

158. **1(C)**: <u>"a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network"</u> Zabarsky discloses a key sequence entered using the buttons present on the mobile device that causes unacknowledged messages to be retransmitted to the mobile device. Ex. 1005 Fig. 9 & 10:42-48, 12:12-15, 14:67-15:4. Although Zabarsky relies on the retransmission of entire pages, Zabarsky in combination with Kuznicki discloses that larger messages will be fragmented into multiple

individual transmissions. Ex. 1006 Abstract, 19:41-63. Zabarsky acknowledges each individual transmission, and continuing this approach in the combined Zabarsky-Kuznicki system, individual fragments of a larger message are acknowledged. Ex. 1005 at 16:17-21. Applying the fragmentation teachings of Kuznicki within Zabarsky, therefore, discloses the retransmission of just those fragments which were unacknowledged. In a typical use case, the combined Zabarsky-Kuznicki request for retransmission would result in only a portion of the fragmented message to be retransmitted in response to a users' request for unacknowledged messages to be sent again. Kuznicki recognizes that messages may be received with errors, ex. 1006 fig. 31 & 30:25-31, and an obvious and common result of receiving messages with errors would be for the user to request retransmission (in a system that allows that) in an attempt to correct the errors.

159. **1(D)**: "means for transmitting, only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message" Zabarsky discloses an antenna, transmitter, a switch for the user to use in requesting retransmission, and transmit logic to form and send the retransmission request only upon actuation of a switch requesting retransmission of the unacknowledged portion of the received message. Ex. 1005 Figs. 1, 9 & 10:42-48, 12:12-15, 13:2-18, 14:67-15:4. Incidentally, Zabarsky also

discloses a duplexer for combining the transmitter and the antenna in a similar manner to the ’946 Patent. Ex. 1005 at 13:11-14.

160. As I’ve described for limitation 1(C), the user in the combined Zabarsky-Kuznicki system can enter a key sequence to request retransmission of unacknowledged messages. That operation is performed by programming incorporated in the pager. Ex. 1005 at 12:29-37. This transmit logic causes the retransmission request to occur only upon the user entering the key sequence that causes the unacknowledged messages to be retransmitted. Ex. 1005 at 14:67-15:4.

161. **1(E)**: “means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display” Zabarsky discloses an antenna, receiver, display logic, and a display that combine to receive the specified portion retransmitted from the network and to display that portion on the display. Ex. 1005 Figs. 1, 9 & 12:9-12, 13:2-8, 13:21-27.

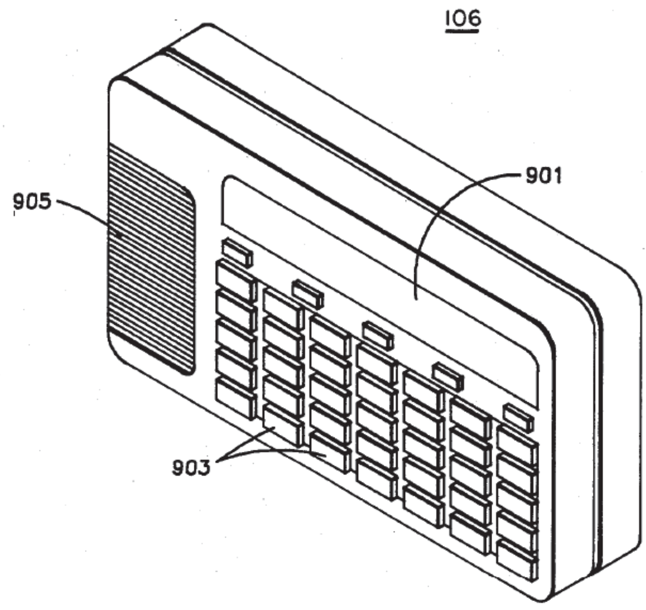
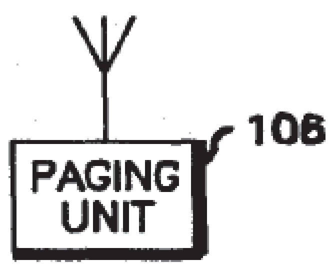


Fig. 9



4. Claim 2 is Invalid in View of Zabarsky Combined with Kuznicki

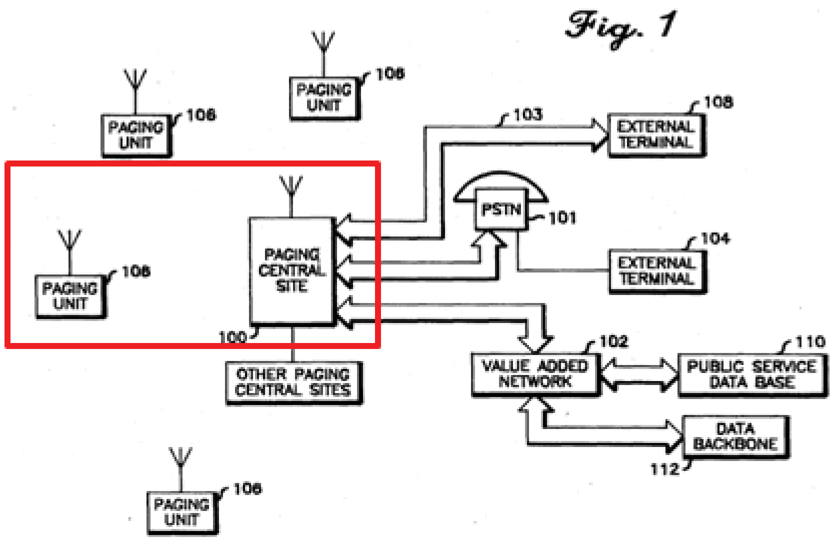
162. **2(A)**: <u>"The mobile unit of claim 1, further comprising: means for detecting errors in the received message"</u> Zabarsky in combination with Kuznicki discloses a receiver capable of decoding error correcting codes. As I've noted above regarding the combination of Zabarsky and Kuznicki, it would have been obvious to combine the error correction codes in Kuznicki, ex. 1006 Fig. 19 &

17:6-14, in place of the error detection codes (i.e. CRC codes) used in Zabarsky. Ex. 1005 at 7:66-8:9. The relative benefits and costs of error detection and correction codes were well known and the substitution of error correction codes for detection codes yielded predictable results. There is an increase in bits transmitted to permit error correction, but a decrease in the likelihood that an uncorrected error will result in an error or desire for retransmission. This ordinary design choice was well within the skill set of a POSITA. Zabarsky recognized the relevance of using error correcting codes when it cited to another patent focusing on error correcting codes as disclosing "similar signaling schemes" to the disclosed CRC error detection codes. Ex. 1005 at 8:21-27 (citing U.S. Patent No. 4,156,867).

163. **2(B)**: <u>"said display including means for highlighting said errors when the message is displayed on said display"</u> Zabarsky in combination with Kuznicki discloses an ordinary display that is capable of highlighting errors in the message by flagging errors with a special character like putting putting errors in brackets. Ex. 1006 at 30:25-31. Incorporating this feature of Kuznicki is obvious to combine with Zabarsky because it informs the user of possible errors in the message. This is particularly useful in combination with Zabarsky because it can prompt the user to request retransmission of unacknowledged messages including the erroneously delivered portion.

5. Claim 7 is Invalid in View of Zabarsky Combined with Kuznicki

164. **7(P)**: "A communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network, the network comprising [the elements below]" While claim 7 is directed to a communications network, 7(P) identifies the mobile unit that network communicates with, and limitation 7(A) requires sending and receiving signals to "the mobile unit" identified in this preamble. Claim 1 is directed to the mobile unit, and Zabarsky in combination with Kuznicki discloses a "mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network" as I've described for 1(P), 1(B), 1(C), above. Zabarsky discloses a communications network that communicates via radio frequency signals. Ex. 1005 Fig. 1 & 1:6-12. The diagram below is annotated to show a mobile unit (the paging unit) that is communicating with the paging network.



165. **7(A)**: <u>"means for transmitting radio frequency signals containing a message to the mobile unit"</u> Zabarsky discloses base stations that each use a transmitter and an antenna for transmitting radio frequency signals containing a message to the mobile unit. Ex. 1005 Figs. 1-2 & 1:6-12, 5:39-51.

> The RF communications channel between the base transceiver and a pager is preferably comprised of first and second carrier signals which may be modulated with the message signals. The **transmitters of the base transceivers** 200, 201, 202 may each operate on unique first carrier signals in discrete radio coverage zones while the receivers of the transceivers may each operate on unique second but associated carrier signals in associated zones. The **transmitters and receivers of the base transceivers** 206, 207, 208 also utilize the unique but associated carrier signals which comprise a set of duplex radio channels enabling simultaneous **transmission and reception of messages**.

Ex. 1005 at 5:39-51 (emphasis added).

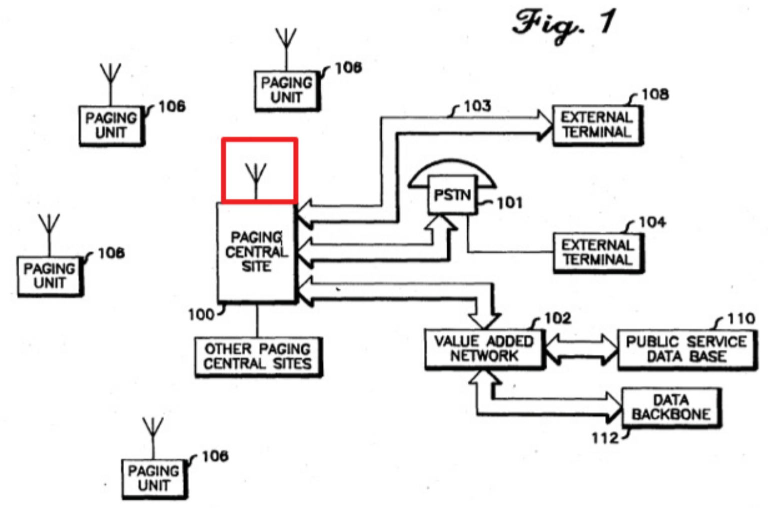


Fig. 1
PAGING UNIT
106
PAGING CENTRAL SITE
100
OTHER PAGING CENTRAL SITES
103
EXTERNAL TERMINAL
108
PSTN
101
EXTERNAL TERMINAL
104
VALUE ADDED NETWORK
102
PUBLIC SERVICE DATA BASE
110
DATA BACKBONE
112

Ex. 1005 Fig. 1.

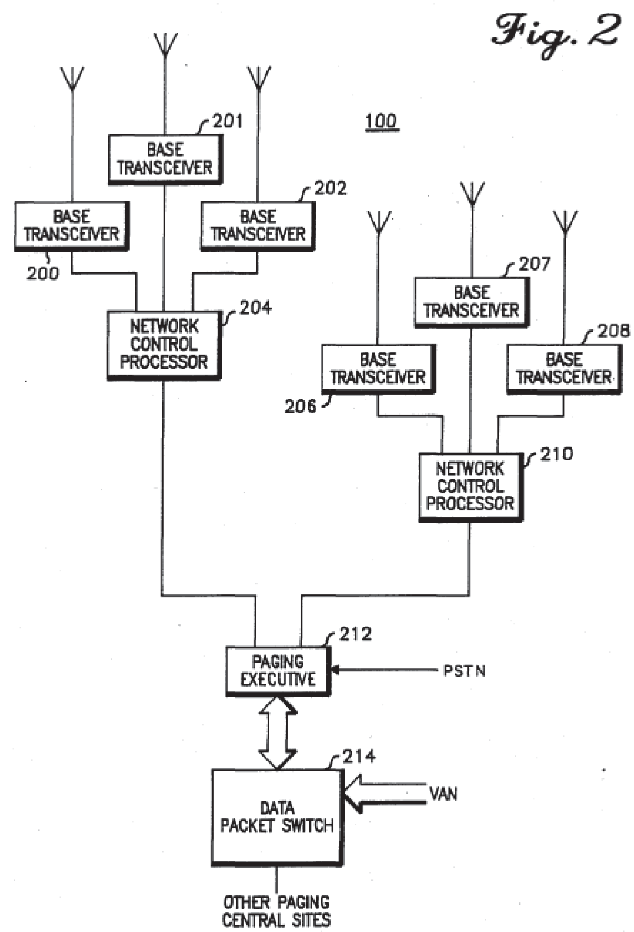


Fig. 2
100
BASE TRANSCEIVER
200
201
202
NETWORK CONTROL PROCESSOR
204
206
207
208
210
PAGING EXECUTIVE
212
PSTN
DATA PACKET SWITCH
214
VAN
OTHER PAGING CENTRAL SITES

Ex. 1005 Fig. 2.

166. **7(B):** "means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission" Zabarsky discloses base stations that each use a receiver and an antenna for receiving radio frequency signals containing a message from the mobile unit. Ex. 1005 Figs. 1-2 & 1:6-12, 5:39-51.

> The RF communications channel between the base transceiver and a pager is preferably comprised of first and second carrier signals which may be modulated with the message signals. The transmitters of the base transceivers 200, 201, 202 may each operate on unique first carrier signals in discrete radio coverage zones **while the receivers of the transceivers** may each operate on unique second but associated carrier signals in associated zones. The **transmitters and receivers of the base transceivers** 206, 207, 208 also utilize the unique but associated carrier signals which comprise a set of duplex radio channels enabling simultaneous **transmission and reception of messages**.

Ex. 1005 at 5:39-51 (emphasis added).

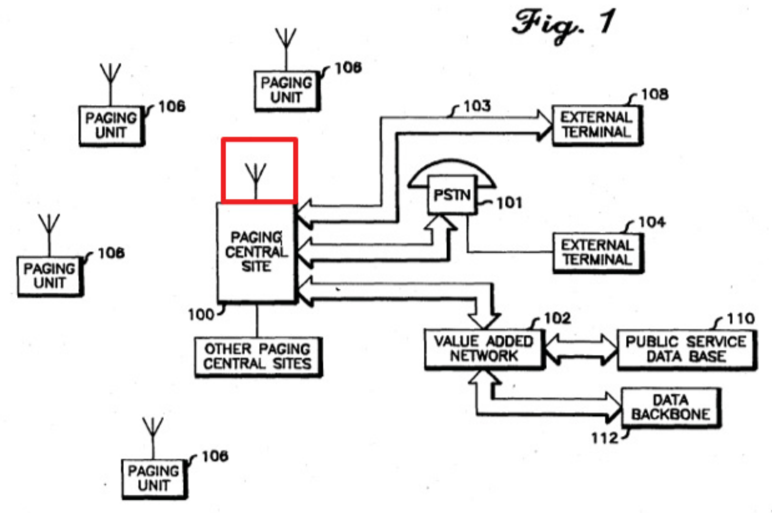


Fig. 1
PAGING UNIT
106
PAGING CENTRAL SITE
100
OTHER PAGING CENTRAL SITES
103
EXTERNAL TERMINAL
108
PSTN
101
EXTERNAL TERMINAL
104
VALUE ADDED NETWORK
102
PUBLIC SERVICE DATA BASE
110
DATA BACKBONE
112

Ex. 1005 Fig. 1.

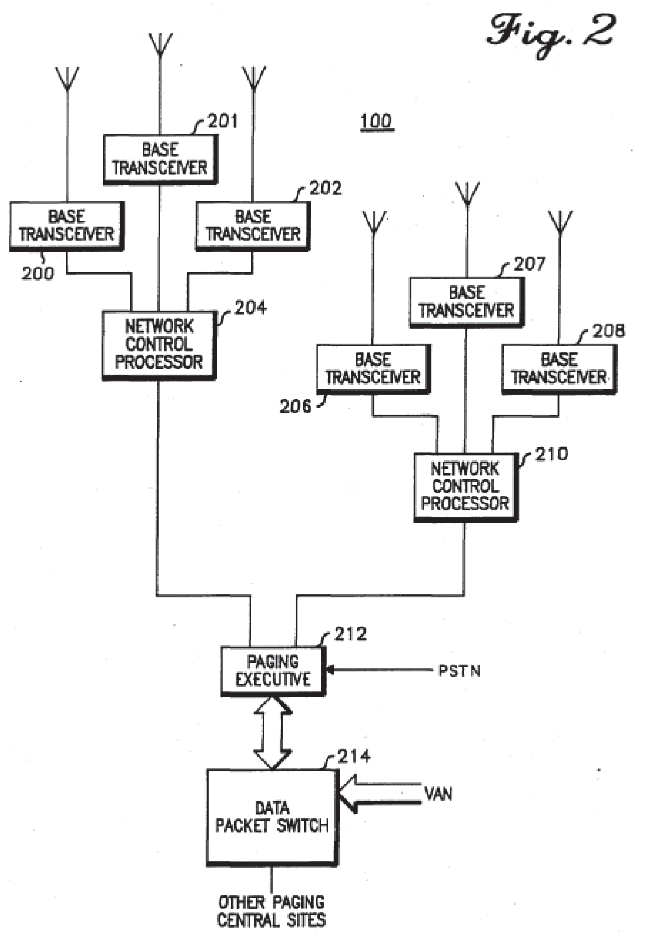


Fig. 2
100
BASE TRANSCEIVER
200
201
202
NETWORK CONTROL PROCESSOR
204
206
207
208
210
PAGING EXECUTIVE
212
PSTN
DATA PACKET SWITCH
214
VAN
OTHER PAGING CENTRAL SITES

Ex. 1005 Fig. 2.

167. The receiver in Zabarsky in combination with Kuznicki is capable of processing a retransmission request. The user request for retransmission of unacknowledged messages is sent from the mobile unit to the network, and in response, the network retransmits unacknowledged messages including, when applicable, the fragment or portion of a message that the user desired to have retransmitted.

> **There is**, of course, **the possibility of the automatic acknowledgement not being received** for a number of reasons, for example the pager being out of range of central site or missing the message address because of a radio channel fade. **A pager may retrieve these messages by inquiring into whether any "missed" messages exist for it.**

Ex. 1005 at 10:42-48 (emphasis added).

> **In order to recall a message stored at the home central site, the user may enter a request for the unacknowledged messages to be sent to the pager.** This request in the preferred embodiment consists of a unique series of keypad entries and the **pushing of the transmit** function key.

Ex. 1005 at 14:67-15:4 (emphasis added). The transmission of a fragment of the message is obvious through the incorporation of message fragmentation in Kuznicki, as I've discussed previously. Ex. 1006 Abstract, 19:41-63

168. **7(C)**: "means for retransmitting radio frequency signals containing the portion of the message to the mobile unit" Zabarsky in combination with Kuznicki discloses that the base stations include a transmitter and antenna, which I've identified for limitation 7(A). The operation of Zabarsky's manual retransmission operation in combination with the fragmentation aspects of Kuznicki (which I have explained in the first parts of my discussion of Ground 2) cause the antenna and transmitter to retransmit RF signals containing the portion of a message to the mobile unit. Ex. 1005 Figs. 1-2 & 1:6-12, 5:39-51, 10:42-48, 14:67-15:4; Ex. 1006 Abstract, 19:41-63.

6. Claim 8 is Invalid in View of Zabarsky Combined with Kuznicki

169. **8(P)**: "A method for receiving and transmitting messages at a mobile unit, comprising the steps [below]" Zabarsky discloses each of these steps as I explain in turn. Zabarsky discloses a mobile unit that sends and receives RF signals to a communications network. Ex. 1005 Fig. 1 & 1:6-12, 1:64-65.

170. **8(A)**: "receiving at the mobile unit a radio frequency message" Zabarsky discloses that the mobile unit receives radio frequency messages. Ex. 1005 Abstract, 1:6-12, 3:62-65, 13:2-18; *see also* claim 1(A).

8(B): "displaying said message on the mobile unit" Zabarsky discloses displaying the messages. "The pager unit 106 of the preferred embodiment is shown in FIG. 9. Preferably it has a back-lit LCD alphanumeric display 901 with two lines of 16 characters per line for message display." Ex. 1005 Fig. 9 & 12:9-12, 13:21-27.

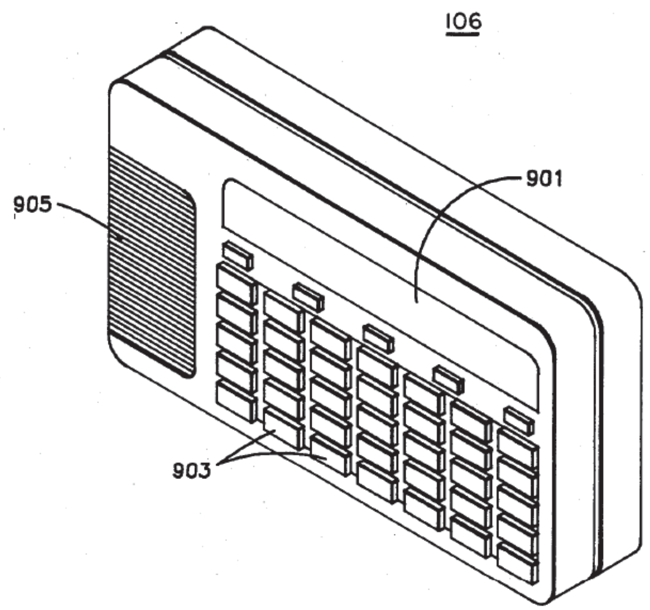


Fig. 9

171. **8(C)**: <u>"receiving an indication of a portion of the displayed message for which a user desires retransmission"</u> For limitation 1(C), I have addressed the operation of Zabarsky in combination with Kuznicki by which the user can enter a key sequence that indicates that unacknowledged messages need to be retransmitted, including portions of a message that were received with errors and were not acknowledged. Ex. 1005 at 10:42-48, 14:67-15:4; Ex. 1006 at 19:41-63. That discussion applies to this limitation as well. Although the request to receive unacknowledged messages may, in some cases, result in additional

unacknowledged fragments or whole pages being retransmitted, in some fraction of instances, only a portion of an message received with errors would have been retransmitted in a system embodying the combined teachings of Zabarsky and Kuznicki. As a result, a user attempting to receive retransmission of a part of a message received in error would, on some instances, obtain only that portion in response to a retransmission request.

172. **8(D)**: <u>"transmitting, only upon receipt of the indication, a signal requesting retransmission of said indicated portion of said message"</u> I have previously addressed the disclosures of Zabarsky and Kuznicki operating to transmit, only upon receipt of an indication, a signal requesting retransmission of an indicated portion of a message for limitation 1(D). That discussion applies here as well. A transmission is sent by the mobile to the network requesting retransmission of unacknowledged message, and that transmission is sent only if the user enters a command sequence requesting that retransmission. Ex. 1005 at 10:42-48, 14:67-15:4.

173. **8(E)**: <u>"receiving a retransmission of said indicated portion"</u> I have previously addressed the disclosures of Zabarsky and Kuznicki operating to receive a retransmission of an indicated portion of a message for limitation 1(E), and that discussion applies here as well. Ex. 1005 at 14:67-15:4. In summary, the

purpose of requesting unacknowledged messages be retransmitted is for those retransmissions to be received by the mobile unit.

174. **8(F)**: "displaying the received retransmission of said indicated portion on the mobile unit" The purpose of receiving a retransmission of the unacknowledged messages is to then display those messages to the user to satisfy the user's request to have them retransmitted. Zabarsky in combination with Kuznicki therefore discloses the step of displaying the received retransmission of an indicated portion on the mobile unit. Ex. 1005 Figs. 1, 9 & 12:9-12, 13:2-8, 13:21-27.

7. Claim 9 is Invalid in View of Zabarsky Combined with Kuznicki

175. **9(A)**: "The method according to claim 8, further comprising the step of: detecting errors in the received message" For limitation 2(A), I have addressed that Zabarsky in combination with Kuznicki discloses a receiver configured to detect errors, through the use of error correction codes, in received messages. Ex. 1005 at 7:66-8:9; Ex. 1006 Fig. 19 & 17:6-14. That discussion applies for this limitation as well. In addition, Zabarsky further discusses the use of CRC codes for simple error detection. Ex. 1005 at 7:66-8:20.

176. **9(B)**: "wherein the step of displaying comprises the substep of: highlighting said errors in the message on the mobile unit" For limitation 2(B), I

have addressed Zabarsky in combination with Kuznicki discloses that part of the display includes flagging those portions of messages that contain errors. Ex. 1006 at 30:21-31. That discussion applies to this limitation as well.

C. Ground 3: Krebs

1. Krebs

177. Krebs is titled "Method For Efficient Bandwidth Utilization When Transceiving Varying Bandwidth Messages" and was filed approximately one month before the filing date of the '946 Patent. Krebs, like Zabarsky and Kuznicki, was originally assigned to Motorola. And like Kuznicki, Krebs addresses issues raised by users' desires to transmit larger messages using a mobile device. Ex. 1007 Fig 1 & 1:31-67.

178. Krebs differentiates messages by their sizes, with first bandwidth messages being the shortest, second are longer than first, and third are the longest messages. Ex. 1007 at 2:11-14, 3:60-66, 4:1-3. Krebs describes short pages as an example of a short message. Ex. 1007 at 1:35-37. Longer messages may include a file transfer or a fax. Ex. 1007 at 1:35-37. For the three enumerated types of message, first were short, like 140 character text messages; second could be considerably larger like a single page fax transmission or a data file; and third included multiple data files or a multiple page fax. Ex. 1007 at 3:67-4:8.

179. Krebs recognizes difficulties with sending large messages in terms of the amount of transmission capacity (called bandwidth) that would be taken up by the large message on a small-message transmission system and corresponding inefficiencies of sending small messages on a large-message transmission system. Ex. 1007 at 1:31-49. Krebs recognizes that some people used different systems for long and short messages or that transmitting a long message could delay the ability to receive a short message on the same system. Ex. 1007 at 1:50-55. It is important to Krebs that a large message is not automatically received which prevents shorter messages from getting through. Ex. 1007 at 1:50-59. Krebs describes a method of simultaneously delivering large and small messages in one device. Ex. 1007 at 1:64-67.

180. Krebs achieves its aim of sending large and small messages simultaneously by allowing the user to determine whether and when to receive the bulk of the second or third bandwidth message. Krebs Figure 2 depicts the general operation of Krebs' technique. When a short first bandwidth message is received, the system can immediately transmit the message to the communications device because it is a short message. But second and third bandwidth messages are long enough to potentially cause unacceptable delay if they are immediately sent in their entirety. Instead, parts of the second or third bandwidth messages are included in a short (first bandwidth) message, which is sent to the user. Ex. 1007 Fig. 2 & 4:61-

65. Along with information copied from the second or third bandwidth message, the notification message adds the cost of retrieving the full message and options for responding to the notification message. The notification message serves two purposes. It is displayed to the user, notifying him or her of the full message and the cost to retrieve it, and it provides the user with options for responding, including to delete, forward, save, or receive the second or third bandwidth message. Ex. 1007 at 5:24-27.

181. If the user selects to receive the second or third bandwidth message, that message is transmitted to the user. Ex. 1007 at 5:52-57. Those parts that were included in the notification message, for example the sender and subject, will be retransmitted in the full second or third bandwidth message. Any additional information added to the notification message, for example the cost of receiving the second or third bandwidth message, is not part of the second or third bandwidth message and is not retransmitted. As a result, only a portion of the notification message will be retransmitted in the second or third bandwidth message. Alternatively, it would have been obvious to include only the parts of the second or third bandwidth message that were not transmitted previously in order to reduce the amount of data transmitted.

182. The underlying purpose of Krebs is not the same as that described by the '946 Patent. The only disclosed purpose of retransmission in the '946 Patent is

to attempt to send those parts received in error a second time. In Krebs, the parts that are sent a second time were not necessarily received in error, and other parts are newly transmitted (including the bulk of the second or third bandwidth message). If the notification message was received without errors the user is likely indifferent about whether the transmission of the second or third bandwidth message repeated the parts of the second or third bandwidth message that were included in the notification message. The user's indication that the second or third bandwidth message should be sent is primarily an indication that the part of the second or third bandwidth message that was not previously sent should be transmitted.

183. The transmission of the notification message, followed by an indication that the second or third bandwidth message should be sent, and including parts of the notification message in that second transmission from the base station to the mobile device teaches claims 1, 4, 7, and 8 if the user's indifference about whether information is retransmitted is not material to the limitations addressing involving "a portion of the displayed message *for which a user desires retransmission*." If it is enough that the user's request, for whatever personal reason to request the second transmission, results in the retransmission of some information, this operation anticipates or renders obvious the claims.

184. If the user's intent matters, then it is likely that in some instances the additional reception of a full second or third bandwidth message will result in correcting errors received in the notification message and retransmitted in the full message. But the primary purpose of selecting to receive the remainder of the message is to receive information that was not transmitted previously. Based on trial documents I have reviewed from a patent infringement case involving Apple and the Patent Owner, Exs. 1011-1013, I understand that the Patent Owner has successfully argued that the transmission of information to the mobile unit for the first time nevertheless satisfied the limitations requiring retransmission of a portion of a displayed message if the message is relayed so that it involves more than one transmission.

185. Under that understanding of the claims, the user's request to receive the previously untransmitted parts of the second or third bandwidth message anticipates or renders obvious claims 1, 4, 7, and 8. Although Krebs discloses that the full second or third bandwidth message is transmitted without any explicit indication that the previously transmitted parts are not retransmitted, either approach is obvious in view of Krebs alone. For simplicity and to allow for the correction of any errors in the notification message, the full second or third bandwidth message can be sent, as suggested by Krebs. Ex. 1007 at 5:42-47. But in most cases, some transmission bandwidth can be saved by transmitting only the

previously untransmitted parts of the second or third bandwidth message and combining the complete message on the receiver. Reducing transmission costs is a goal recognized in Krebs. Ex. 1007 at 3:24-30. Sending either the full second or third bandwidth message, or just a part of them, was either anticipated or obvious in to a POSITA reviewing Krebs.

186. The following sections provide a detailed account of the specific sections of Krebs that describe all the limitations in claims 1, 4, 7, and 8, and show why those claims are anticipated or rendered obvious. I have also included an element-by-element analysis of Krebs against claims 1, 4, 7, and 8 in Appendix E, which describes anticipation and obviousness because of Krebs alone and Krebs in combination with Schwendeman, which I address further below.

187. In my view, claims 1, 4, 7, and 8 are disclosed by Krebs, but to the extent any differences exist between the disclosure in Krebs and the requirements of claims 1, 4, 7, and 8, those differences were obvious. Benefits of user-controlled transmission or retransmission requests were known, Ex. 1007 at 2:28-40, and the claimed techniques in the ’946 Patent present an ordinary and predictable implementation of user-initiated retransmission.

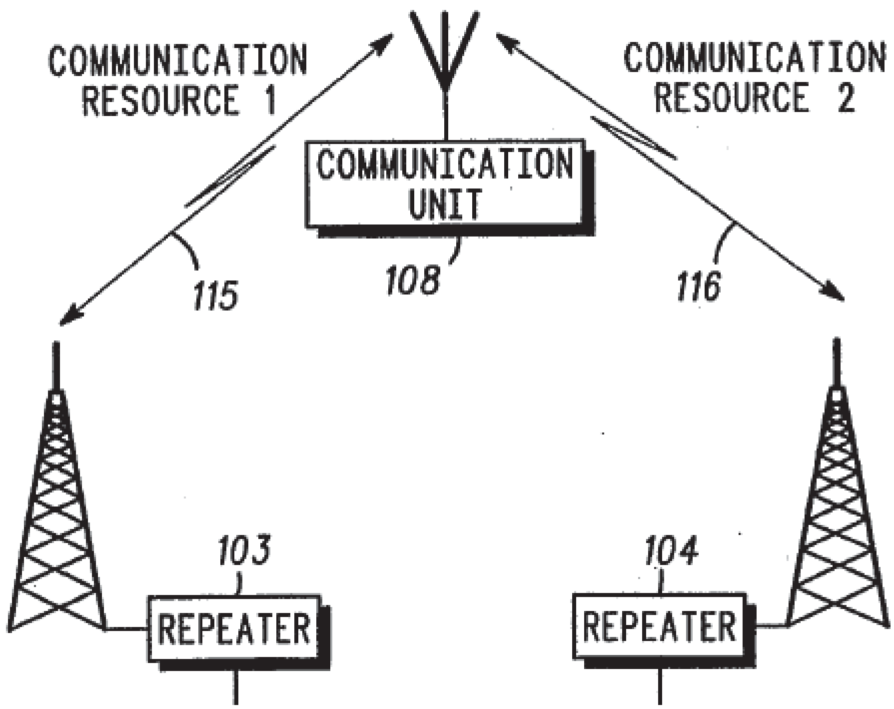
2. Claim 1 is Invalid in View of Krebs

188. **1(P)**: “A mobile unit for transmitting and receiving radio frequency signals to and from a communications network comprising [the elements below]”

Krebs discloses a mobile unit that transmits and receives RF signals to and from a communications network. Ex. 1007 Fig. 1 & 1:8-11, 3:51-59.

> This invention relates generally to radio communication systems and, in particular, to a radio communication system that utilizes communication resources to transceive varying bandwidth messages.

Ex. 1007 at 1:8-11.



189. **1(A)**: <u>"means for receiving a radio frequency message from the network"</u> Krebs discloses an antenna and a receiver configured to receive radio frequency messages from the network. Ex. 1007 Fig. 1 & 1:8-11.

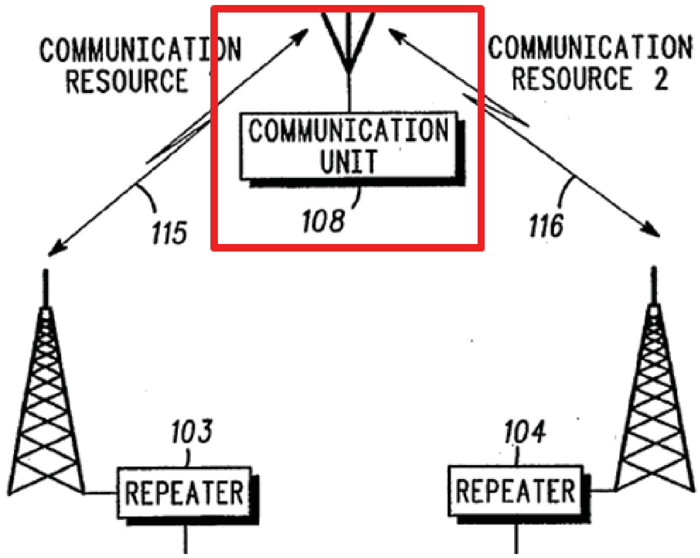
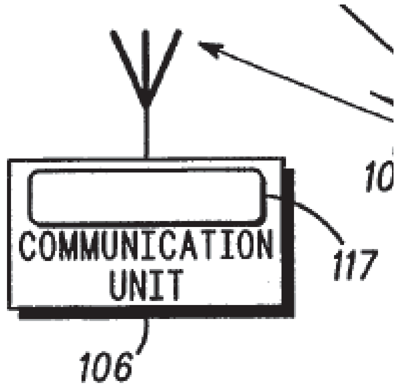


Fig. 1 (cropped and annotated). Krebs does not explicitly describe the internal components of the communication unit shown in Figure 1 above, but a receiver is inherently disclosed because the communication unit would not be able to operate as described in Krebs to receive RF signals unless it included both an RF receiver and an antenna. The ordinary purpose of an RF receiver is to receive RF signals from an antenna, and to demodulate or process the received signals and extract the transmitted information or data. It would have been obvious to a POSITA to include an RF receiver in the communication device disclosed in Krebs so it would be enabled to receive the RF signals as disclosed in Krebs.

190. **1(B)**: "<u>a display for displaying said message</u>" Krebs discloses that the mobile units include a display that displays received messages. Ex. 1007 Fig. 1 & 2:46-47, 5:3-7.



Ex. 1007 Fig. 1 (cropped).

> a plurality of communication units 106-108 each having a display 117

Ex. 1007 at 2:46-47.

191. **1(C)**: "a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network" Krebs discloses that the user can enter commands using the mobile communications unit. Ex. 1007 at 5:22-27. As I've described above, a second or third bandwidth message directed to a pager causes a first bandwidth notification message to be sent to the pager. Ex. 1007 Fig. 2.

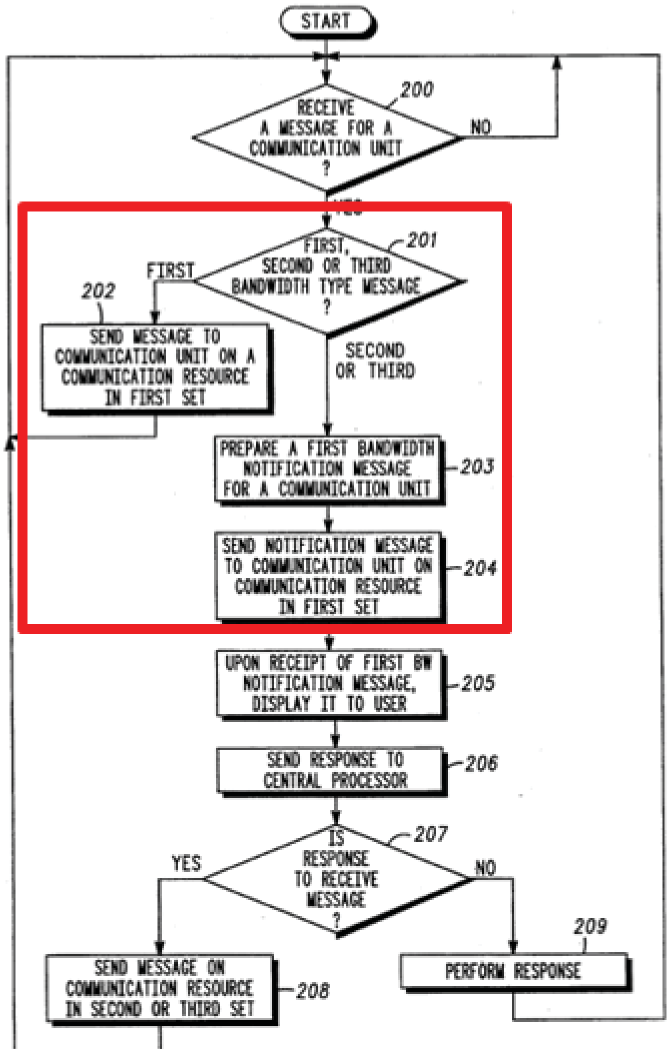


FIG. 2

Ex. 1007 Fig. 2 (annotated).

192. The notification message includes some of the information from the original second or third bandwidth message, including the originator, a summary, and the date sent. Ex. 1007 at 4:61-63. Other information is added to the notification message, including the cost to retrieve the full message and the full length of the second or third bandwidth message. Ex. 1007 at 4:64-65.

193. The user can respond to the notification message by, among other things, requesting to receive the full second or third bandwidth message, which will result in the retransmission of the information copied from the second or third bandwidth message to the notification message. Ex. 1007 Fig. 2 & 5:22-37. In order for the user to manually enter a command on the Krebs communication unit, the communications unit necessarily requires buttons or switches for the user to manipulate. The user's selection of the "receive" command, therefore identifies that the portion of the first or second bandwidth message previously transmitted should be retransmitted through the manipulation of switches or buttons. The use of switches, buttons, or keys on a pager device as a mechanism for the user to input commands and control the device was known, commonly implemented, and obvious.

194. Alternatively, viewing the displayed message as a fraction of the second or third bandwidth message and applying the understanding of "retransmission" applied by the Patent Owner, selecting to receive the second or third bandwidth message causes that message to be relayed from the central processor to a repeater and then to the mobile. Ex. 1007 Fig. 1. This meets the definition of "retransmission" that the Patent Owners obtained in the Apple litigation. The user's selection is an indication that the portion of the second or

third bandwidth message that had not been sent previously should be transmitted via relays resulting in more than one transmission.

195. **1(D)**: "means for transmitting, only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message" Krebs discloses an antenna, a transmitter, a switch for the user to use in requesting retransmission, and transmit logic to form the retransmission request. Ex. 1007 Fig. 1 & 1:8-11, 5:22-37. These components then signal the retransmission request to the communications network. The "receive" signal will only be sent to the communications network if the receive request command is selected. Ex. 1007 at 5:22-27. Krebs does not explicitly disclose the internal components of the communication device shown in Figure 1, but use of an RF transmitter in the two-way pager device was inherent to support the disclosed transmission of RF signals from the communication device to the central network. The ordinary purpose of an RF transmitter is to generate, amplify, or otherwise transmit RF signals to a local antenna resulting in an RF signal radiated to the receiver's antenna.

196. **1(E)**: "means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display" Krebs discloses an antenna, receiver, display logic, and a display that receives the retransmitted portion and displays it on the display. Ex. 1007

Abstract, Fig. 1 & 2:32-36, 2:46-47, 5:40-47, 5:65-68. The purpose of retransmitting the second or third bandwidth message is to display it.

197. As I described for limitation 1(C), only a portion of the information in the notification message is part of the first or second bandwidth message, and as a result, only that portion is received and subsequently can be displayed as part of the second or third bandwidth message.

198. And as I noted for limitation 1(C), under the patent owner's broader interpretation of the retransmission limitations, the user can indicate the desire to have the second or third bandwidth message transmitted. The full second or third bandwidth message still represents a portion of the notification message that was actually displayed, but not a portion of the original second or third bandwidth message. But as I explained in my summary of Krebs, above, it would have been obvious to modify Krebs to transmit only the previously untransmitted portions of the second or third bandwidth message in order to achieve the goal in Krebs of reducing the bandwidth costs associated with the messages. Ex. 1007 at 3:24-30.

3. Claim 4 is Invalid in View of Krebs

199. **4**: <u>"The mobile unit of claim 1, wherein the signal transmitted by the transmitting means indicates to the network that the user has read the message"</u> Krebs discloses that the user makes the decision whether to receive, delete, or

forward a second or third bandwidth message in response to observing a notification message. Ex. 1007 Fig. 2 & 5:22-31, 4:65-5:11.

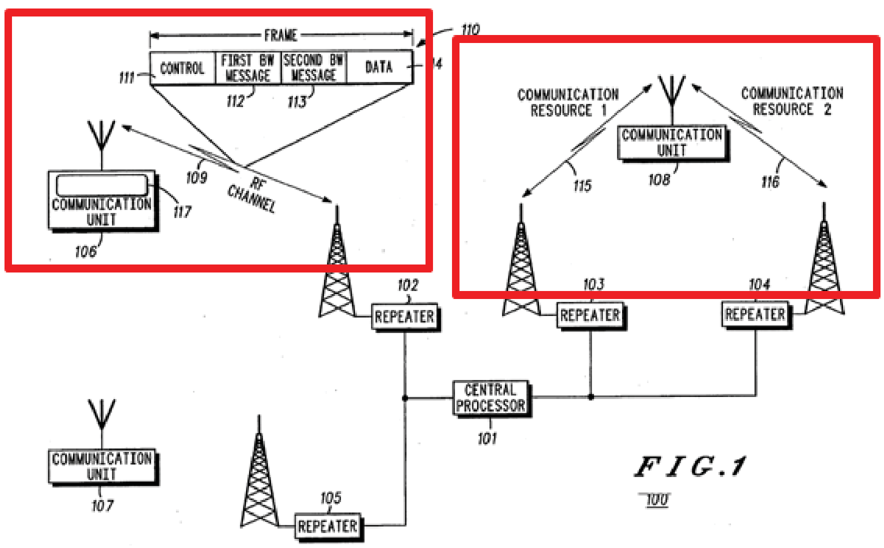
> **Upon observing the first bandwidth notification message**, the user sends a response to the central processor via the operable communication unit 206. **The response may comprise a receive message request**, a delete message request, a forward message request, or a save message request. The response is generally sent to the central processor immediately following the display of the first bandwidth notification message, but it may also be delayed, in which case, the central processor continues to store the message in its memory.

Ex. 1007 at 5:22-31 (emphasis added).

4. Claim 7 is Invalid in View of Krebs

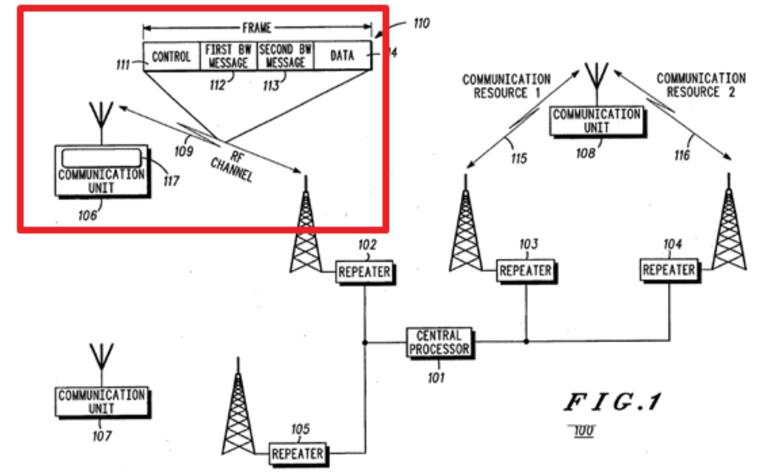
200. **7(P)**: <u>"A communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network, the network comprising [the elements below]</u>" While claim 7 is directed to a communications network, 7(P) identifies the mobile unit that network communicates with, and limitation 7(A) requires sending and receiving signals to "the mobile unit" identified in this preamble. Claim 1 is directed to the mobile unit, and Krebs discloses a "mobile unit having a display and a switch actuatable to specify a

portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network" as I've described for 1(P), 1(B), 1(C), above. Krebs discloses a communications network that communicates via radio frequency signals. Ex. 1007 Fig. 1 & 1:8-11. The diagram below is annotated to show a mobile unit (the communications unit) that is communicating with the paging network.



201. **7(A)**: <u>"means for transmitting radio frequency signals containing a message to the mobile unit"</u> Krebs discloses base stations with a transmitter and antenna that transmits RF signals with messages to the mobile unit. Ex. 1007 Fig. 1 & 2:42-55. Figure 1 of Krebs depicts a repeater connected to an antenna that is used to transmit RF signals to the communication unit. Use of an RF transmitter at

the repeater is inherent because the system would not be able to perform the disclosed functions in Krebs without the transmitter. And if that were not the case, it would have been obvious to a POSITA that an RF transmitter is included in the repeater to transmit RF signals to the communication unit via the antenna.



202. **7(B)**: <u>"means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission"</u> Krebs discloses base stations with receivers and antenna capable of receiving and processing a request for retransmission of messages, as I've described for limitations 1(C) and 1(D), above. Ex. 1007 at 2:32-36, 2:41-55, 5:22-27, 5:40-47. Krebs does not explicitly disclose the internal components of the base stations or repeaters depicted in Figure 1, but inclusion of RF receivers would have been inherent because without them the system would not be able to receive the disclosed RF signals, including the user's request to have the larger messages transmitted. If not, it would have been obvious to a POSITA to include RF

receivers at the base stations to perform the ordinary purpose of receiving the RF signals from the mobile communication units.

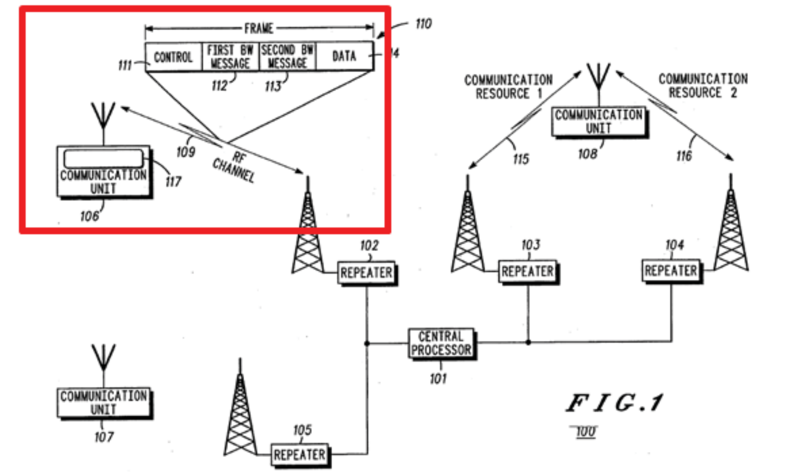
203. The network in Krebs is configured to process a "receive" message response to a notification message resulting in a retransmission. Ex. 1007 at 2:32-36, 5:22-27. The notification message includes some of the information from the original second or third bandwidth message, including the originator, a summary, and the date sent. Ex. 1007 at 4:61-63. Other information is added to the notification message, including the cost to retrieve the full message and the full length of the second or third bandwidth message. Ex. 1007 at 4:64-65.

204. The user can respond to the notification message by, among other things, requesting to receive the full second or third bandwidth message, which will result in the retransmission of the information copied from the second or third bandwidth message to the notification message. Ex. 1007 Fig. 2 & 5:22-27. The user's selection of the "receive" command, therefore identifies that the portion of the first or second bandwidth message previously transmitted should be retransmitted.

205. Alternatively, viewing the displayed message as a fraction of the second or third bandwidth message and applying the understanding of "retransmission" applied by the Patent Owner, selecting to receive the second or third bandwidth message causes the that message to be relayed from the central

processor to a repeater and then to the mobile. Ex. 1007 Fig. 1. This meets the definition of "retransmission" that the Patent Owners obtained in the Apple litigation. The user's selection is an indication that the portion of the second or third bandwidth message that had not been sent previously should be transmitted via relays resulting in more than one transmission.

206. **7(C)**: <u>"means for retransmitting radio frequency signals containing the portion of the message to the mobile unit"</u> Krebs discloses a transmitter and antenna configured to transmit the second or third bandwidth message containing the portion of the message being retransmitted to the mobile unit. *See* limitation 7(B); Ex. 1007 Fig. 1 & 2:42-45, 5:22-27, 5:40-47. Figure 1 of Krebs depicts a repeater connected to an antenna that is used to transmit RF signals to the communication unit. Use of an RF transmitter at the repeater is inherent because the system would not be able to perform the disclosed functions in Krebs without the transmitter. If not, it would have been obvious to a POSITA that an RF transmitter is included in the repeater to transmit RF signals to the communication unit via the antenna, including retransmission of the second or third bandwidth message.



207. As I described for limitations 1(C) and 7(B), only a portion of the information in the notification message is part of the first or second bandwidth message, and as a result, only that portion is received and subsequently can be displayed as part of the second or third bandwidth message.

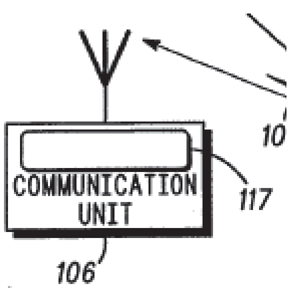
208. And as I noted for limitations 1(C) and 7(B), under the patent owner's broader interpretation of the retransmission limitations, the user can indicate the desire to have the second or third bandwidth message transmitted. The full second or third bandwidth message still represents a portion of the notification message that was actually displayed, but not a portion of the original second or third bandwidth message. But as I explained in my summary of Krebs, above, it would have been obvious to modify Krebs to transmit only the previously untransmitted portions of the second or third bandwidth message in order to achieve the goal in Krebs of reducing the bandwidth costs associated with the messages. Ex. 1007 at 3:24-30.

5. Claim 8 is Invalid in View of Krebs

209. **8(P)**: <u>"A method for receiving and transmitting messages at a mobile unit, comprising the steps [below]"</u> Krebs discloses each of these steps as I explain in turn. Krebs discloses a mobile unit that sends and receives RF signals to a communications network. Ex. 1007 Fig. 1 & 1:8-11, 3:51-59,

210. **8(A)**: <u>"receiving at the mobile unit a radio frequency message"</u> Krebs discloses that the mobile unit receives radio frequency messages. Ex. 1007 at 1:8-11, 2:14-32; *see also* claim 1(A).

8(B): <u>"displaying said message on the mobile unit"</u> Krebs discloses displaying the messages. For example, it describes "a plurality of communication units 108-108 each having a display 117." Ex. 1007 at 2:46-47, 5:3-7.



Ex. 1007 Fig. 1 (cropped).

211. **8(C)**: <u>"receiving an indication of a portion of the displayed message for which a user desires retransmission"</u> Krebs discloses that the user can enter commands using the mobile communications unit. Ex. 1007 at 5:22-37. As I've

described above, a second or third bandwidth message directed to a pager causes a first bandwidth notification message to be sent to the pager. Ex. 1007 Fig. 2.

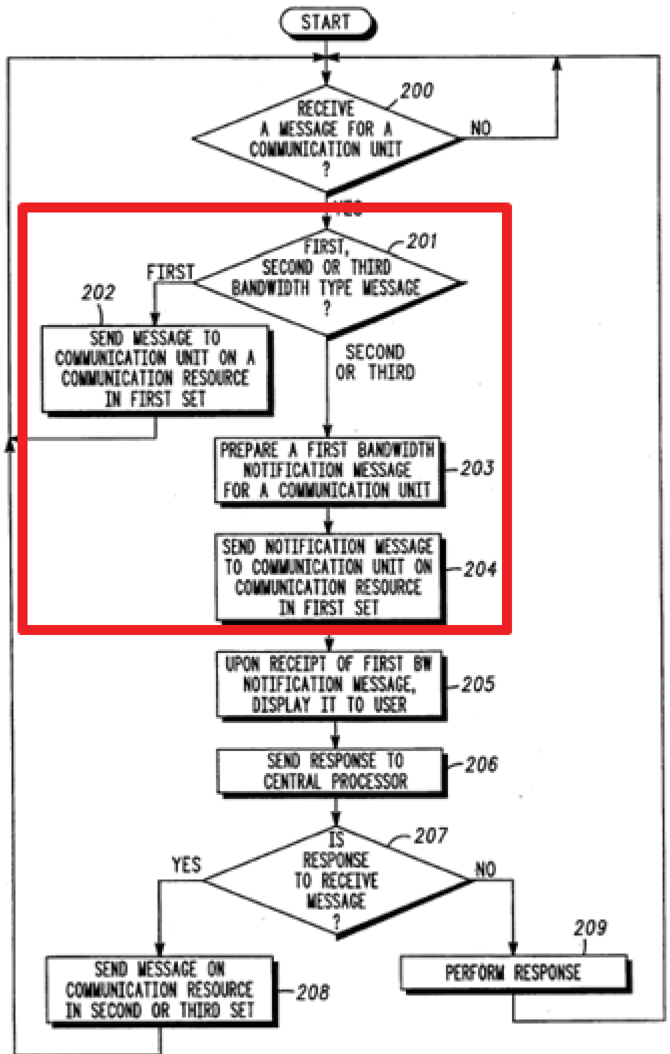


FIG.2

Ex. 1007 Fig. 2 (annotated).

212. The notification message includes some of the information from the original second or third bandwidth message, including the originator, a summary, and the date sent. Ex. 1007 at 4:61-63. Other information is added to the

notification message, including the cost to retrieve the full message and the full length of the second or third bandwidth message. Ex. 1007 at 4:64-65.

213. The user can respond to the notification message by, among other things, requesting to receive the full second or third bandwidth message, which will result in the retransmission of the information copied from the second or third bandwidth message to the notification message. Ex. 1007 Fig. 2 & 5:22-27. The user's selection of the "receive" command, therefore identifies that the portion of the first or second bandwidth message previously transmitted should be retransmitted.

214. Alternatively, viewing the displayed message as a fraction of the second or third bandwidth message and applying the understanding of "retransmission" applied by the Patent Owner, selecting to receive the second or third bandwidth message causes the that message to be relayed from the central processor to a repeater and then to the mobile. Ex. 1007 Fig. 1. This meets the definition of "retransmission" that the Patent Owners obtained in the Apple litigation. The user's selection is an indication that the portion of the second or third bandwidth message that had not been sent previously should be transmitted via relays resulting in more than one transmission.

215. **8(D)**: <u>"transmitting, only upon receipt of the indication, a signal requesting retransmission of said indicated portion of said message"</u> Krebs

discloses requesting retransmission as I've explained for limitation 8(C). Ex. 1007 Fig. 1 & 1:8-11, 5:22-37; 5:40-47. These components then signal the retransmission request to the communications network. The "receive" signal will only be sent to the communications network if the receive request command is selected. Ex. 1007 at 5:22-27.

216. **8(E)**: "receiving a retransmission of said indicated portion" Krebs discloses retransmitting a portion of a message through the transmission of a second or third bandwidth message. Ex. 1007 Fig. 1 & 5:22-37, 5:40-47, 5:65-68.

217. As I described for limitations 1(C), 7(B), and 8(C), only a portion of the information in the notification message is part of the first or second bandwidth message, and as a result, only that portion is received and subsequently can be displayed as part of the second or third bandwidth message.

218. And as I noted for limitations 1(C), 7(B), and 8(C), under the patent owner's broader interpretation of the retransmission limitations, the user can indicate the desire to have the second or third bandwidth message transmitted. The full second or third bandwidth message still represents a portion of the notification message that was actually displayed, but not a portion of the original second or third bandwidth message. But as I explained in my summary of Krebs, above, it would have been obvious to modify Krebs to transmit only the previously untransmitted portions of the second or third bandwidth message in order to

achieve the goal in Krebs of reducing the bandwidth costs associated with the messages. Ex. 1007 at 3:24-30.

219. **8(F)**: "displaying the received retransmission of said indicated portion on the mobile unit" The purpose of receiving a retransmission of the unacknowledged messages is to then display those messages to the user to satisfy the user's request to have them retransmitted. Krebs, therefore, discloses displaying the retransmission messages. Ex. 1007 Abstract, Fig. 1 & 2:32-36, 2:46-47. As I explained for limitation 8(E), the transmitted message contains either a portion of the earlier notification message it was obvious to modify Krebs to transmit only a portion of the original second or third bandwidth message. In either case, that portion is included within the newly displayed message.

D. Ground 4: Krebs, Schwendeman, and Yoshida

220. Krebs describes a process by which a user can receive part of a larger message, along with some other information, in a "notification message" and then decide whether to receive the full larger message. This results in the retransmission of some part of the originally displayed message. But the request by the user in Krebs for the full message does not imply that the user necessarily needed parts of the previously displayed notification message to be retransmitted. In most cases the notification message would have been successfully transmitted, and an obvious modification of Krebs would be to transmit only the previously

untransmitted parts of the original message in the subsequent transmission. This operation does not serve the same purpose as the retransmissions in the ’946 patent, which instead are focused on resending a part of the message that contained errors.

221. If the claims require that the user command that results in a retransmission be based on some need or specific desire by the user to have something transmitted prior to the user command be transmitted again, then Krebs does not disclose this feature. The parts of the notification message that are sent to the mobile twice were likely successfully received the first time. The request for transmission of the full message does not necessarily indicate the user’s desire to have an erroneously received portion retransmitted. Krebs does not address retransmission of messages to correct for errors in the original transmission.

222. Schwendeman describes manually requesting retransmission of erroneous messages in a manner that would be obvious to combine with Krebs to allow for retransmission of erroneous messages. A POSITA would have found it obvious to combine the error detection feature of Schwendeman with the manual request by a user for transmission of a larger message based on a smaller notification message in Krebs, which would save network bandwidth and allow for error correction of only a portion of the larger message. Schwendeman and Krebs are similar and complementary references. Both were assigned to Motorola, a

leading paging manufacturer at the time, and each describes a two-way paging system intended to reliably deliver longer messages. Ex. 1007 at Cover & Fig. 1, & 2:41-47; Ex. 1008 at Cover & 1:32-40. And each discloses that one approach to deliver larger messages is to use a second communications channel for the larger message and the second channel can be a radio link. Ex. 1007 at 2:60-68, 5:42-51; Ex. 1008 at 4:59-65, 5:7-9. Krebs does not address the retransmission of messages received with errors, and through a combination with Schwendeman could gain the benefit of correcting received transmissions. Some error rate is inevitable in any transmission scheme and receiving the correct message is usually preferable to receiving only an incorrect one. In some instances, of course, the errors in the message are not so severe as to require retransmission. Retransmission in Schwendeman can result in long messages occupying a lot of bandwidth in the communications channel without first allowing the user to decide whether the full message transmission (or retransmission) is necessary. Ex. 1007 at 1:31-63. The combination of Krebs and Schwendeman addresses both of these issues. Messages can still be corrected, but whether to send large messages the first time or by retransmission is under manual control. This allows the user to determine whether the cost of the transmission is justified.

223. Combining Krebs with Schwendeman results in some instances in which the retransmissions contain only a portion of the larger message, but there is

no explicit statement in Schwendeman that the retransmission of a large message (like the full second or third bandwidth message) requires only a retransmission of the erroneous parts. A person of ordinary skill would have known that a large message could have been retransmitted in part or in whole as those are the only two options, and it would have been obvious to retransmit only part of the large messages to save bandwidth. One of the primary purposes in Krebs is to efficiently use bandwidth. Ex. 1007 Title & 2:36-40. Yoshida demonstrates that a person of ordinary skill would have known and preferred partial retransmission to reduce the total amount of transmitted data. Ex. 1009 at 1:50-66. Yoshida deals primarily with fax or facsimile transmission, which is also a type of data transmission attempted in Krebs. Ex. 1007 at 3:67-4:8. And the benefit of partial retransmission, particularly of larger messages like faxes, provides the same benefit to Krebs as it would in Yoshida - a reduction in the amount of data transmitted. The assignee in Yoshida was Canon, which was a significant manufacturer of office equipment, like fax machines, and a POSITA addressing fax transmissions, as Krebs does, would have considered Canon's technology. But Yoshida is really just applying basic retransmission approaches that were known to a POSITA at the time. In fact, Appendix B subsection D describes similar repeat request techniques to those in Yoshida. In combining Krebs and Schwendeman, a POSITA would have found it obvious to use the repeat request techniques in

Yoshida to retransmit only erroneous blocks. There is no technical difficulty in doing so because, as I explain for claims 2 and 9, Schwendeman discloses the identification of those erroneous parts of the message, which permits distinguishing between the erroneous and the correctly received parts. Incorporating the limited teaching of selective retransmission from Yoshida does not present a significant technological hurdle that would have been beyond the ability of a POSITA. Although Yoshida provides a particular transmission and retransmission protocol for its wireline-based system, incorporating that entire technique is not necessary or desirable when considering how to perform retransmission over a wireless RF interface. Yet the limited teaching of selectively retransmitting only parts with errors would have been sufficiently straight-forward for a POSITA to implement by using a similar linked-list of subparts of the message along with individual CRC or error correction checks of the individual subparts that Schwendeman describes for tracking whether entire messages were successfully received. Ex. 1008 Fig. 4, 8:64-9:9. This linked-list structure only needs to be maintained for messages received with some errors, and the CRCs of the overall message and the subparts can be used to identify those parts that require retransmission. This modest increase in memory requirements would have been justified to reduce retransmission costs, which is a benefit specifically sought in Krebs. Ex. 1007 Title & 2:36-40.

224. In my view, claims 1, 2, 4, and 7-9 are disclosed by Krebs in combination with Schwendeman and Yoshida. The following sections provide a detailed account of the specific sections of Krebs, Schwendeman, and Yoshida that describe all the limitations in claims 1, 2, 4 and 7-9, and show why those claims are obvious. I have also included an element-by-element analysis of Krebs, Schwendeman, and Yoshida against claims 1, 2, 4 and 7-9 in Appendix F.

1. Claim 1 is Invalid in View of Krebs, Schwendeman, and Yoshida

225. **1(P)**: "A mobile unit for transmitting and receiving radio frequency signals to and from a communications network comprising [the elements below]" Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses a mobile unit that transmits and receives RF signals to and from a communications network. Ex. 1008 Fig. 1 & 1:10-15, 4:59-5:9, 5:16-18.

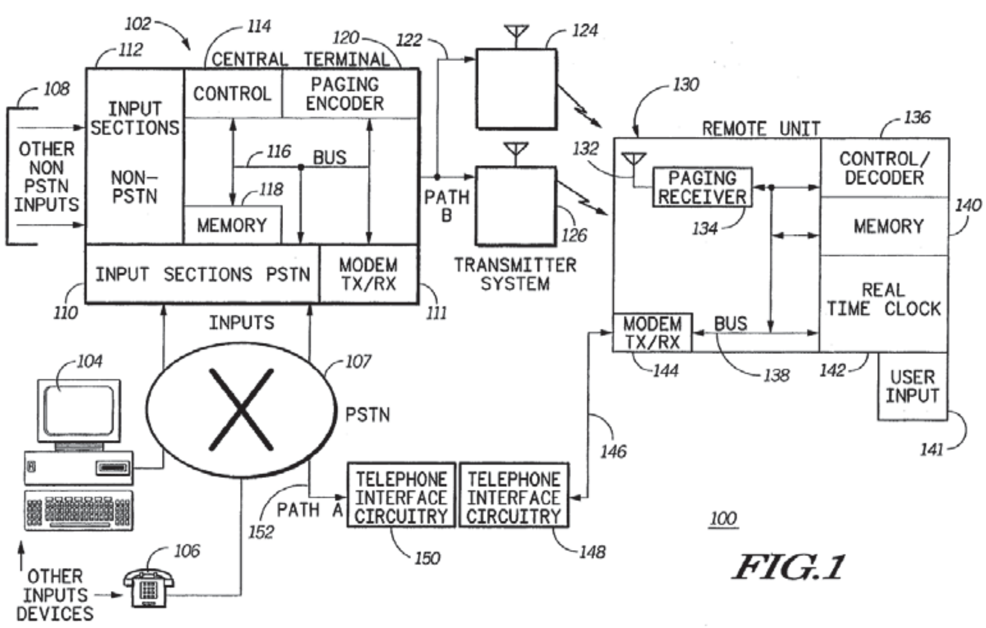


FIG.1

Fig. 1.

226. **1(A)**: "means for receiving a radio frequency message from the network" Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses an antenna and a receiver configured to receive radio frequency messages from the network. Ex. 1008 Fig. 1 & 1:10-15, 3:65-4:6 4:59-5:9, 5:16-18.

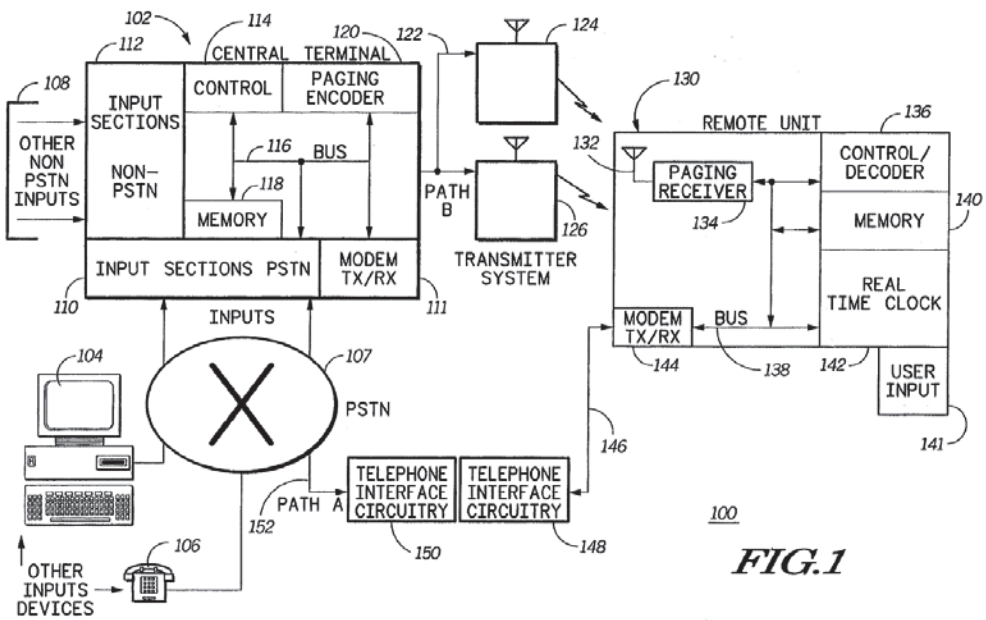


Fig. 1.

227. **1(B)**: "a display for displaying said message" Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses that the mobile units include a display that displays received messages. Ex. 1008 at 1:18-25, 4:16-21, 7:12-16, 15:15-18, 18:24-27.

228. **1(C)**: "a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network" Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses that the user can enter commands using the mobile communications unit. Ex. 1008 at 4:16-20. Schwendeman also describes that the user can enter a manual command to cause retransmission of previously received messages. Ex. 1008 Figs. 12, 15-16 & 14:50-15:3, 20:15-32.

> [T]he remote unit 130 can initiate a reconciliation sequence 1202 with the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, in a response to a manual entry, e.g., in response to user input, at the remote unit 130 such as by buttons, or switches 141.

Ex. 1008 at 14:52-58.

229. Schwendeman describes that the user would have been expected to request retransmission of messages received in error. Ex. 1008 at 18:21-31. Schwendeman prefers to use a telephone network for retransmissions, but explains that a radio communication can also be used for retransmission. Ex. 1008 at 4:59-5:9.

230. Through the combination of Krebs and Schwendeman, the notification message in Krebs includes just a portion of the second or third bandwidth message that it is meant to notify. The notification part of the second or third bandwidth

message may have errors that affect the user's ability to determine whether to download the full second or third bandwidth message. Through the retransmission technique in Schwendeman, errors in that notification can be corrected by requesting its retransmission. That retransmission, like the original notification message, represents just a part of the full second or third bandwidth message. Also, the full second or third bandwidth message may be received with errors which the user may seek retransmission of using the techniques in Schwendeman. Retransmission in Schwendeman is typically of the entire message, but it would have been obvious to retransmit only the erroneous part of the message, as taught in Yoshida. Ex. 1009 Abstract & 1:50-66 (describing the preference for retransmitting only parts with errors). Retransmission in part is particularly beneficial for the larger messages described in Krebs and the increased cost of transmitting larger messages. Ex. 1007 at 5:22-37.

231. **1(D)**: <u>"means for transmitting, only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message</u>" Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses an antenna, a transmitter, a switch for the user to use in requesting retransmission, and transmit logic to form the retransmission request. Ex. 1008 Fig. 1 & 4:66-5:9, 5:16-18. These components then signal the retransmission request to the communications network.

Schwendeman discloses two alternative embodiments, automatically requesting an update, or doing so manually. Ex. 1008 Figs. 1, 12, 15-16, 4:66-5:9, 5:16-18, 14:50-15:3, 20:15-32. For the manual embodiment, the retransmission will only occur if the user requests retransmission. And in a combined automatic and manual embodiment, the automatic update request may eventually fail enough times to prevent any further automatic transmission. At that point, only a manual request will cause any further update requests. Ex. 1008 Figs. 12, 15-16 & 14:50-15:3, 20:15-32. In either scenario, the manual retransmission request is one that would not have occurred without the user's manual input.

232. **1(E)**: "means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display" Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses an antenna, receiver, display logic, and a display that receives the retransmitted portion and displays it on the display. Ex. 1008 Fig. 1, 1:18-25, 3:65-4:6, 4:16-21, 4:66-5:9, 7:12-16.

2. Claim 2 is Invalid in View of Krebs, Schwendeman, and Yoshida

233. **2(A)**: "The mobile unit of claim 1, further comprising: means for detecting errors in the received message" Schwendeman discloses a receiver capable of decoding error detecting and/or correcting codes in order to discern

messages containing errors that may require retransmission from those that were received correctly. Ex. 1008 Fig. 13 & 8:8-19 ("Other information can be transmitted with a transmitted message 200, such as error detecting and/or correcting code."). It would have been obvious to combine the error detection and/or correction codes in Schwendeman as part of incorporating its retransmission request techniques into Krebs in order to permit the combined system to identify messages with errors.

234. **2(B)**: "said display including means for highlighting said errors when the message is displayed on said display" Schwendeman discloses highlighting errors in a received message in order to inform the user of an error and therefore request retransmission. Ex. 1008 at 18:21-31. Schwendeman mentions the inclusion of a "message" on the display to inform the user of an error. This message could be an inserted character, like brackets, reverse video, or underlining as the choice of how to display that message was an ordinary design choice that could be made by a person of skill in the art.

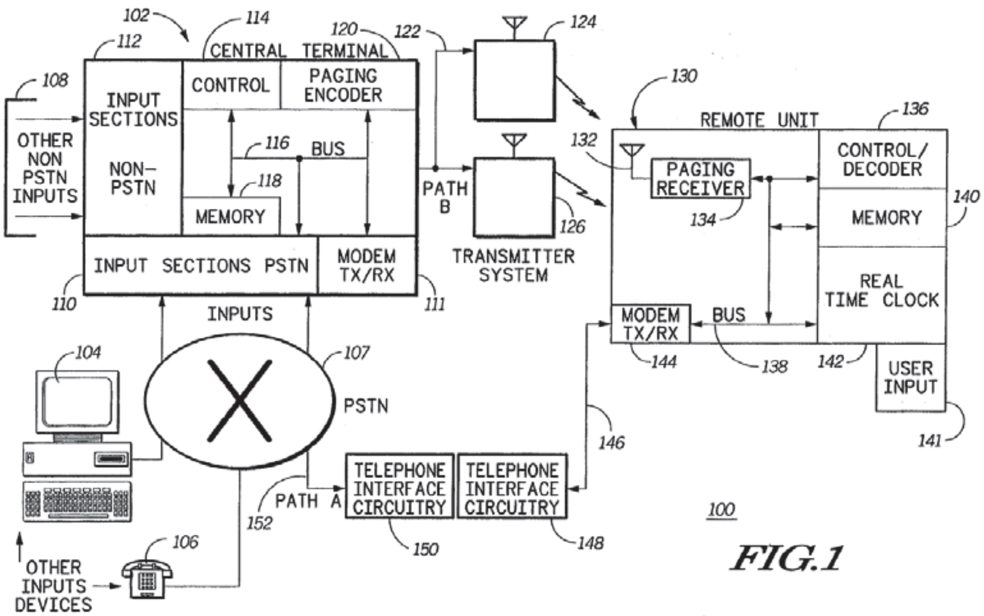
3. Claim 4 is Invalid in View of Krebs, Schwendeman, and Yoshida

235. **4**: "The mobile unit of claim 1, wherein the signal transmitted by the transmitting means indicates to the network that the user has read the message" Krebs discloses this limitation as described for the previous ground. The messages

transmitted manually by the user in response to a message also indicate that the original message was read.

4. Claim 7 is Invalid in View of Krebs, Schwendeman, and Yoshida

236. **7(P)**: "A communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network, the network comprising [the elements below]" While claim 7 is directed to a communications network, 7(P) identifies the mobile unit that network communicates with, and limitation 7(A) requires sending and receiving signals to "the mobile unit" identified in this preamble. Claim 1 is directed to the mobile unit, and Krebs in combination with Schwendeman and Yoshida discloses a "mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network" as I've described for 1(P), 1(B), 1(C), above. Krebs in combination with Schwendeman and Yoshida discloses a communications network that communicates via radio frequency signals. Ex. 1007 Fig. 1 & 1:8-11; Ex. 1008 Fig. 1 & 3:65-4:6, 4:66-5:9.



Ex. 1008 Fig. 1.

237. **7(A)**: <u>"means for transmitting radio frequency signals containing a message to the mobile unit"</u> Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses base stations with a transmitter and antenna that transmits RF signals with messages to the mobile unit. Ex. 1008 Fig. 1 & 1:10-15, 2:62-67.

238. **7(B)**: <u>"means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission"</u> Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses base stations with receivers and antenna capable of receiving and processing a request for retransmission of messages, as I've described for limitations 1(C) and 1(D), above for this and the previous ground.

Ex. 1007 at Figs. 1-2& 2:32-36, 2:41-55, 5:22-27, 5:40-47; Ex. 1008 Fig. 1 & 1:10-15, 2:62-67; Ex. 1009 at 1:50-66. Requests for retransmission of notification messages through the combination of Krebs, Schwendeman, and Yoshida will result in the retransmission of a part of the second or third bandwidth message. And, as I previously explained, it would have been obvious also to retransmit only erroneous parts of the full second or third bandwidth message. Ex. 1009 at 1:50-66.

239. **7(C)**: <u>"means for retransmitting radio frequency signals containing the portion of the message to the mobile unit"</u> Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman and Yoshida disclose a transmitter and antenna configured to transmit the second or third bandwidth message containing the portion of the message being retransmitted to the mobile unit. *See* limitation 7(B); Ex. 1007 Fig. 1 & 2:42-47, 5:22-27, 5:40-47; Ex. 1008 Fig. 1 & 1:10-15, 2:62-67; Ex. 1009 at 1:50-66.

240. As I explained for limitations 1(C) and 7(B) of this and the prior ground, the retransmissions resulting from the combination of Krebs and Schwendeman results in a portion of the second or third bandwidth message being retransmitted, or, at a minimum, it was obvious to retransmit only a portion of the second or third bandwidth message, by applying the selective retransmission technique disclosed in Yoshida.

5. Claim 8 is Invalid in View of Krebs, Schwendeman, and Yoshida

241. **8(P)**: <u>"A method for receiving and transmitting messages at a mobile unit, comprising the steps [below]"</u> Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses each of these steps as I explain in turn. Schwendeman discloses a mobile unit that sends and receives RF signals to a communications network. Ex. 1008 Fig. 1 & 1:10-15, 4:59-5:9, 5:16-18.

242. **8(A)**: <u>"receiving at the mobile unit a radio frequency message"</u> Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses that the mobile unit receives radio frequency messages. Ex. 1008 Fig. 1 & 1:10-15, 3:65-4:6 4:59-5:9, 5:16-18; *see also* claim 1(A).

243. **8(B)**: <u>"displaying said message on the mobile unit"</u> Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses displaying the messages. For example, it describes mobile devices with displays. Ex. 1008 at 1:18-25, 4:16-21, 7:12-16, 15:15-18, 18:24-27.

244. **8(C)**: <u>"receiving an indication of a portion of the displayed message for which a user desires retransmission"</u> Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses that the user can enter commands using the mobile communications unit. Ex. 1008 at 4:16-

20. Schwendeman also describes that the user can enter a manual command to cause retransmission of previously received messages. Ex. 1008 Figs. 12, 15-16 & 14:50-15:3, 20:15-32.

> [T]he remote unit 130 can initiate a reconciliation sequence 1202 with the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, in a response to a manual entry, e.g., in response to user input, at the remote unit 130 such as by buttons, or switches 141.

Ex. 1008 at 14:52-58.

245. Schwendeman describes that the user would have been expected to request retransmission of messages received in error. Ex. 1008 at 18:21-31. Schwendeman prefers to use a telephone network for retransmissions, but explains that a radio communication can also be used for retransmission. Ex. 1008 at 4:59-5:9.

246. Through the combination of Krebs and Schwendeman, the notification message in Krebs includes just a portion of the second or third bandwidth message that it is meant to notify. The notification part of the second or third bandwidth message may have errors that affect the user's ability to determine whether to download the full second or third bandwidth message. Through the retransmission technique in Schwendeman, errors in that notification can be corrected by requesting its retransmission. The retransmission, like the original notification

message, represents just a part of the full second or third bandwidth message. Also, the full second or third bandwidth message may be received with errors which the user may seek retransmission of using the techniques in Schwendeman. Retransmission in Schwendeman is typically of the entire message, but it would have been obvious to retransmit only the erroneous part of the message, as taught in Yoshida. Ex. 1009 Abstract & 1:50-66 (describing the preference for retransmitting only parts with errors). Retransmission in part is particularly beneficial for the larger messages described in Krebs and the increased cost of transmitting larger messages. Ex. 1007 at 5:22-37.

247. **8(D)**: <u>"transmitting, only upon receipt of the indication, a signal requesting retransmission of said indicated portion of said message"</u> Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses requesting retransmission as I've explained for limitation 8(C) and 1(D). Ex. 1008 Figs. 12, 15-16 & 14:50-15:3, 20:15-32. The user in Schwendeman can manually invoke an update request that causes a transmission to be sent requesting retransmission. That request could occur for the notification message in Krebs, which contains a portion of the second or third bandwidth message, or it could involve the larger message, in which case it would have been obvious to retransmit only those portions with errors.

248. **8(E)**: “receiving a retransmission of said indicated portion” Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses retransmitting a portion of a message through the transmission of a second or third bandwidth message. Ex. 1008 Fig. 1 & 4:66-5:9, 5:16-18. These components then signal the retransmission request to the communications network. Schwendeman discloses two alternative embodiments, automatically requesting an update, or doing so manually. Ex. 1008 Figs. 1, 12, 15-16 & 4:66-5:9, 5:16-18, 14:50-15:3, 20:15-32. For the manual embodiment, the retransmission will only occur if the user requests retransmission. And in a combined automatic and manual embodiment, the automatic update request may eventually fail enough times to prevent any further automatic transmission. At that point, only a manual request will cause any further update requests. Ex. 1008 Figs. 12, 15-16 & 14:50-15:3, 20:15-32.

249. **8(F)**: “displaying the received retransmission of said indicated portion on the mobile unit” Krebs discloses this limitation as described for the previous ground. In addition, Schwendeman discloses displaying the retransmission messages. Ex. 1008 at 1:18-25, 4:16-21, 7:12-16, 15:15-18, 18:24-27. As I explained for limitation 8(E), the transmitted message contains either a portion of the earlier notification message or it was obvious to modify Krebs to transmit only

a portion of the original second or third bandwidth message. In either case, that portion is included within the newly displayed message.

6. Claim 9 is Invalid in View of Krebs, Schwendeman, and Yoshida

250. **9(A)**: "The method according to claim 8, further comprising the step of: detecting errors in the received message" Schwendeman discloses a receiver capable of decoding error detecting and/or correcting codes in order to discern messages containing errors that may require retransmission from those that were received correctly. Ex. 1008 Fig. 13 & 8:8-19 ("Other information can be transmitted with a transmitted message 200, such as error detecting and/or correcting code."). It would have been obvious to combine the error detecting and/or correction codes in Schwendeman as part of incorporating its retransmission request techniques into Krebs.

251. **9(B)**: "wherein the step of displaying comprises the substep of: highlighting said errors in the message on the mobile unit" Schwendeman discloses highlighting errors in a received message in order to inform the user of an error and therefore request retransmission. Ex. 1008 at 18:21-31. Schwendeman mentions the inclusion of a "message" on the display to inform the user of an error.

252. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001; and further that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

253. I declare under the penalty of perjury that the foregoing is true and correct.

Executed on 8 day of August 2016 in Seabeck, Washington.

Donald Gayton

APPENDIX A

Don Gayton, M. Eng.

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dgayton@shaw.ca 604-220-9642

PROFESSIONAL PROFILE

High Technology • Clean Energy • Leadership • Analysis • Engagement

I am a hands-on clean technology/high technology expert with a broad background in executive leadership, high technology and a proven track record for making things happen. After achieving considerable success in the high technology sector in Vancouver and Silicon Valley, I decided to pursue my passion for renewable energy and energy efficiency applications and went back to school. I received my Masters of Engineering in Clean Energy Engineering from the University of British Columbia in 2011.

My ongoing goal is to continue to be a leader who turns ideas into action, now focusing on transforming our energy systems away from fossil fuels towards renewable energy and, ultimately, the mitigation of climate change.

Core Competences

- Leadership in Engineering and Business
- Building High Performance Teams
- Technical Analysis
- Business Analysis
- Creative Thinking
- Customer/Stakeholder Engagement
- Design – Systems, Electronics, Software
- Thermodynamics, Chemistry and Statistics
- Presentations, Public Speaking
- Intellectual Property Management
- Quick Study, Flexibility

PROFESSIONAL EXPERIENCE

Jan 2016 – Present Acuva Technology Inc, Vancouver BC
VP Engineering and Product Development

Overseeing all aspects of development of the world's first commercial UV-LED point-of-use water disinfection system. Includes directing requirements, mechanical design, optical design, electrical design, testing, certification and production.

2015 – Jan 2016 LRH Technology, Nanaimo, BC
Consultant

I consulted for investors, providing them with analyses of clean tech startup's technology and, if applicable, engineering plans. Work involved researching the area concerned, interviewing technical teams, reviewing reports and documents and then coming up an assessment of the technology and recommendations for action. I completed two such major analyses, one in the oil and gas sector, one in the energy storage space.

2012-2015 Kairama Inc., Vancouver, BC
Co-founder & CTO

I co-founded Kairama in 2012 to develop a novel, high efficiency gas compressor of my invention. As CTO I led all technical developments as well as contributing heavily to investor engagement and market assessments using the Lean Startup methodology. I did all original thermodynamic modeling, mechanical design and testing of the first prototype. I led the second prototype design, build, testing and modeling, working closely with UBC's Clean Energy Research Centre.

- Secured over $200K in project funding through NSERC and IRAP.
- Acquired many new skills related investor/stakeholder engagement and investment practices, and what it takes to run a startup company.
- Developed successful patent application for the invention, US patent issued in 2016.

2010-2011 UBC Masters of Clean Energy Engineering Program, Vancouver, BC
Student

In 2010 I went back to University to obtain my Masters of Engineering in Clean Energy Engineering, earning a GPA of 4.1. My final project was a original study entitled "Yield, Cost, Energy Balance and GHG emission estimation of Hydrogen Enhanced Production of Liquid Renewable Hydrocarbon Fuels".

- Acquired a broad range of energy related skills and knowledge, including energy systems, thermodynamics, demand-side-management, energy audits and pollution mitigation.
- While at UBC I researched and wrote a number of highly regarded papers on a range of clean energy topics including, among others: Fuel Cell Micro-CHP Technology & Potential in BC; Assessment of Battery Electric Vehicles, past, present and future; Critique of "Microalgae as biodiesel & biomass feedstocks: Review & analysis of the biochemistry, energetic & economics".

2007 – 2010 LRH Technology, Vancouver, BC
Consultant

Using my extensive Intellectual Property (IP) management experience I consulted with small companies helping them set up their IP programs from idea generation and capture to preliminary patent searching and maximizing the value of lawyer time. I also did some Scientific Research and Experimental Development (SR&ED) program work for larger companies.

2002 – 2007 Triant Technologies Inc, Vancouver/Nanaimo, BC
Vice President of Engineering
Officer of the Company

- Directed re-architecture of Triant Technologies Advanced Real Time Fault Detection product for Semiconductor Manufacturing
- Oversaw development of Triant's Vancouver engineering office from the ground up and hiring 15 staff, including managers, developers, testers and a project manager.
- Participated in joint sales team approach while at Triant securing multimillion dollar sales to top tier international customers including Hynix, Samsung, AMD, Sony, Panasonic and Toshiba.
- Was the principal technical representative on the joint sales team while at Triant securing multimillion dollar sales to top tier international customers including Hynix, Samsung, AMD, Sony, Panasonic and Toshiba. Have assisted sales teams with presentations and executive support in Canada, USA, UK, Spain Japan, Korea, China and Singapore.

1999-2001 Glenayre Consumer Products Group, Santa Clara, CA, USA
Vice President of Product Development

Accomplishments:

Launched three models of two-way data pagers and one PDA two-way data module with combined sales in excess of 150,0000 units. Directed all stages of product development, including specification, hardware and software development, plastics design, pilot runs, FCC and customer certification and production ramp.

Saved over $500,000 in development costs by discovering a method of software based fast RF carrier detection that allowed next version protocol compliant devices to be implemented without changing a custom VLSI circuit.

Improved software quality 50% by establishing basic software development methodology and requirements control, improving testing, hiring more staff and initiating a formal bug tracking system.

Negotiated partnership agreement with Locate Networks and Snaptrack to develop a GPS based personal location device. This location device development was the first multi-site development for the Santa Clara group, with most of the development being done in Vancouver, Canada.

Initiated Glenayre's CDMA 2000 smart phone module development and negotiated Glenayre's CDMA license with Qualcomm.

1998 – 1999 Glenayre Wireless Messaging Group, Vancouver BC
Chief Technology Officer

Accomplishments:
Led a team of six technical and marketing experts in the development of the Advanced Services Strategy for the infrastructure and device groups. Forecast the rise of the email pager 6 months before its appearance.
Integrated device and infrastructure product roadmaps.
Directed development and release of Glenayre's first Internet centric product, the GL3200 Internet Gateway.
Oversaw completion of research on an extremely bandwidth-efficient, next generation radio communications protocol and the patent protection of the basic technology.
Chaired the 1999 Glenayre/Motorola ReFLEX Solutions Development Conference in San Francisco that was attended by over 200 third party developers.

1995 – 1998 Glenayre Wireless Messaging Group, Vancouver BC & Quincy IL
Senior Vice President, Research and Development

Accomplishments:
Oversaw architecture, design, testing, and introduction of Glenayre's complete two-way paging system for data and voice utilizing high speed, linear ReFLEX-25 and Inflexion protocols. Involved a staff of 200 engineers working in two locations. Required development in networking, hardware, embedded and system software, DSP, FM and linear modulation, low and high power RF.
Given the special task of focusing on the China business and was able to grow market share in China from 10% to over 50% and get Glenayre's interswitch protocol accepted as the China national standard.
Responsible for all of group's intellectual property program. Doubled Glenayre's patent portfolio during period.
Kept R&D staff turnover less than 10% and grew R&D organization from 150 to 250 engineers.
Managed Motorola relationship and licenses resulting in Glenayre's exclusive access to and influence over Motorola's next generation paging protocols.

1992 – 1995 Glenayre Electronics, Vancouver BC
Vice President, Engineering,

Accomplishments:
Directed development of Glenayre's high speed, GPS based paging control system. This dual site development resulted in a product that captured 70% of the high speed paging market and had total sales exceeding US$200M.
Architected the GL3000's PCM system to quadruple capacity. Directed developments that kept the GL3000 paging switch at the front of the market capturing 80% market share in a field of five competitors.
Led team in the development and implementation of Glenayre's first structured design process.

1990 – 1992 Glenayre Electronics, Vancouver BC
Director of Development for GL3000,
Accomplishments:
Directed development of multiple projects relating to the GL3000 paging switch that caused product sales to more than double due to superior features, capacity and reliability during period. Designed program to ensure quality of designs and testing procedures. Managed second-line customer service support. Architected the GL3000 redundancy solution and digital trunk T1/E1 board.

1988 – 1990 Glenayre Electronics, Vancouver BC
Manager of Hardware Development,

1983 – 1988 Glenayre Electronics, Vancouver BC
Hardware and Software Design Engineer,

General Skills

- Electronics hardware and software design.
- Systems engineering
- Public speaking, liaison with customers in good times and bad, managing third party developer relations.
- Software Applications: MS Excel, MS Word, MS Project, MS PowerPoint
- Working knowledge of CAD tools, Software simulation, VHDL
- Computer languages: C, C++, Assembler, Visual Basic, HTML
- Operating systems: Unix, Windows
- Protocols: TCP/IP, FLEX, ReFLEX, CDMA One, CDMA 2000
- Deep experience in the supporting processes of engineering development and getting buy in thereof. Personally introduced processes including product development processes, IP cultivation and protection, as well as SR&ED claims writing and management.

Education

M. Eng in Clean Energy Engineering, UBC, 2011
BASc in Electrical Engineering, UBC, 1983
Accounting for Non-Financial Managers – UBC
Managing High Technology Employees – UBC
Dale Carnegie Management Training
Quality *Rapid* Product Development

Memberships

IEEE
BC Sustainable Energy Association
Green Tech Exchange
Serve on two non-profit boards

APPENDIX B

techniques, multiplexing, signaling and control technology, system design, and simulation. This work has contributed to the trunked mobile radio and cellular mobile radio-telephone systems being implemented today. He is now a Senior Member of the Technical Staff, and Manager of the Systems Research Laboratory, Corporate Research and Development Center, Motorola, Incorporated, with responsibilities for modulation techniques, signal processing, and communications systems.

Dr. Mikulski has been named a Dan Noble Fellow of Motorola and is a member of Tau Beta Pi and Sigma Xi.

Philip T. Porter (M'59) received the B.A. and M.A. degrees in physics from Vanderbilt University, Nashville, TN, in 1952 and 1953, respectively.

In 1953, he joined AT&T Bell Laboratories, Holmdel, NJ, where he initially participated in early development planning for electronic station sets and Picturephone visual telephone service; he also did systems engineering work on AUTOSEVOCOM. In the mobile radio field, he has been involved in development of Bellboy paging, the improved mobile telephone system, the Metroliner system, and others (including early planning studies leading to AMPS). From 1971 to 1977, he supervised a group involved in systems planning of network and mobile control logic for AMPS. Later, he was responsible for long-range mobile radio studies and for analysis of other systems proposals. Since January 1, 1984, he has been with Bell Communications Research, Incorporated, where he is District Research Manager of a group studying intrasystem frequency reuse and other efficiency improving techniques for future systems to provide untethered communications.

Mr. Porter is a member of Phi Beta Kappa.

ARQ Schemes for Data Transmission in Mobile Radio Systems

RICHARD A. COMROE, MEMBER, IEEE, AND DANIEL J. COSTELLO, JR., SENIOR MEMBER, IEEE

***Abstract*—An important problem in land mobile radio communications is how to provide reliable data communications to the largest number of users. To explore this problem, several existing ARQ protocols are examined which have application to the land mobile radio channel, as well as some new protocol combinations. All protocols are analyzed for several key system performance measures which are verified by experimental means for static as well as fading channels. Finally, a conclusion is reached regarding a new protocol combination which is found to offer significant advantages over all other protocols explored.**

I. Introduction

The problem of providing data communications over a land mobile radio channel has received considerable attention. Error detection combined with retransmission on request has been used for over two decades as a means of obtaining reliability in digital data transmission [1], [2]. Such systems are referred to as automatic RQ or ARQ, where RQ is the repeat–request symbol, attributed to a printing telegraph system patent dated 1943 [3]. When forward error correction (FEC) is used in conjunction with an ARQ protocol, it is called hybrid error control or hybrid ARQ. Over the years, a multitude of variations on the basic ARQ theme has been examined [4]–[21].

The distinguishing features of a land mobile radio (LMR) system, as far as the ARQ protocol is concerned, are a frequency or pair of frequencies shared by a large population of half-duplex users which cannot transmit and receive simultaneously, a wide range in signal conditions for users, and a signal condition which can fluctuate quickly in time due to multipath. The following sections will describe those variations of ARQ which are adaptable to an LMR system.

Section II will develop a new channel model for a fading land mobile radio channel. Section III will describe several ARQ protocols as well as some new protocol combinations. In Section IV the relationships will be developed to describe the various protocols in terms of channel failure probabilities, which will be examined in Section V. In

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R. A. Comroe is with Motorola Incorporated, Schaumburg, IL 60196.
D. J. Costello is with the Department of Electrical Engineering, Illinois Institute of Technology, Chicago, IL 60616.

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Section VI the performance of the various protocols will be predicted and compared. Finally, in Section VII the undetected error probabilities will be developed and compared.

II. Multipath Fading Model

The characteristics of multipath are known in sufficient detail that accurate simulation is possible. For one well-known fading model programmed simulations exist which produce a random function resembling the strength of a multipath fading signal [22]. Hardware simulators also exist which can take a signal and vary its amplitude and phase to resemble multipath according to the same model [23]. The experimental results within this paper make extensive use of such a hardware fading simulator.

Another type of model, called a threshold model, will also be used. In this model a data system is assumed to have a sensitivity threshold. This assumption means that at signal strengths above this threshold communication is successful. Likewise, at signals below threshold, it is assumed to be unsuccessful. Thus, the probability of successful communication can be identified as the probability that the signal is above threshold [24]

$$P_{\text{success}} = 1 - F(r) = e^{-0.693r^2} \tag{1}$$

where r is the threshold to median signal ratio and $F(r)$ is the probability distribution of r. Since the signal amplitude pdf is Rayleigh, $F(r)$ is a Rayleigh distribution function. This can be interpreted as the success probability for a single transmitted bit, or a bound for short messages or very slow fading.

A more useful notion is the probability of success or failure for a data block of some measurable length. Define the block error probability P_f as the probability of the signal being below threshold somewhere during the message interval. By defining a gap as the interval between fades, a message lying entirely in a gap is assumed to be received error free with probability $1-P_f$.

To evaluate this probability the statistics of the gaps must be known; however, without knowing the gap length distribution the expected value can be calculated as the average time between fade occurrences $\bar{T}$ minus the average fade length $\bar{t}$ (see Fig. 1). For the threshold model, $\bar{T}$ has been found to be [24]

$$\bar{T} = 1/f_r \tag{2}$$

where

$$f_r = 2re^{-0.693r^2} f_e \tag{3}$$

is the fading rate across levels other than the median, and

$$f_e = V/\lambda \tag{4}$$

is the Doppler frequency for a vehicle speed V and carrier wavelength λ. Knowing only $\bar{T}$, the distribution function

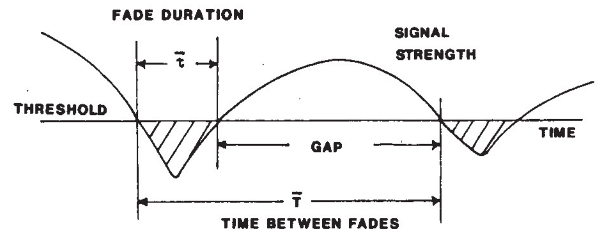


Fig. 1. Fades below a threshold.

for the time between fade occurrences can be approximated as an exponential [25], where

$$P(T \leqslant t) = 1 - e^{-t/\bar{T}} = 1 - e^{-f_r t}. \tag{5}$$

The probability that the message lies within a gap can be expressed as the probability that the message starts in a gap times the probability that the next fade is further away than the message length L, and

$$P_f = 1 - P(\text{starts in gap}) \cdot P(T > L). \tag{6}$$

The probability of starting in a gap is just the probability that the starting moment is above threshold. Thus,

$$P_f = 1 - e^{-0.693r^2} e^{-f_r L} \tag{7}$$

which can be put in the convenient form

$$P_f = 1 - k_1 (k_2)^{VL} \tag{8}$$

where

$$k_1 = e^{-0.693r^2} \tag{9}$$

and

$$k_2 = e^{-(2r/\lambda)e^{-0.693r^2}} \tag{10}$$

This relationship is illustrated in Fig. 2 for $r = 0.1$. When L or V goes to zero the fading process is stationary during the message. For this case P_f goes to $1 - k_1$, which is the probability of the message being in a gap. When LV goes to infinity the message becomes very long compared to the fading process, and consequently P_f goes to unity. This is similar to, but slightly different in form from, a recent model by Hafez [8]. Both these models are improvements over previous models where the probability of error goes to zero as the length approaches zero [25], [26].

Another interesting characteristic of this model is that P_f remains constant for vehicle speeds inversely related to message duration. For example, a 1 s message at 1 mi/h would have the same P_f as a 1/2 s message at 2 mi/h. This is an intuitively satisfying result since the probability of error depends on the message duration relative to the fading process. This model is used in later sections, and is also compared to experimental results.

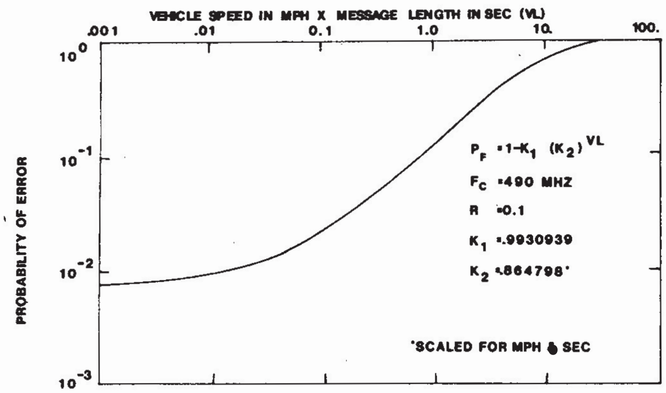


Fig. 2. Probability of error versus VL scaled in mi/h and s for 490 MHz carrier frequency.

III. ARQ Techniques

The ARQ techniques include the coding and retransmission request strategy used to deliver a message. The message itself is contained within a packet, with the source and destination addresses, as well as other useful routing information preceding the message in a header. The header is usually encoded separately from the message so that the header may be read before making a decision as to whether to read the following message section. This is desirable in a land mobile radio system where all users must read the header of every message in order to find messages with their destination address.

A. *SAW ARQ*

SAW is the notation for stop-and-wait ARQ. As the name implies, the message originator stops at the end of each transmission to await a reply from the receiver. The transmission may be followed by one of three possible events. The receiver may respond with an acknowledgment, or ACK, indicating that the message was correctly received; an NAK if it was not correctly received; or no response if the message header was not received. Anything other than an ACK will result in the message originator repeating the message. Theoretically, a message might be repeated forever while awaiting an ACK. Usually, a system implementation will contain a retransmission limit beyond which the message is returned as undeliverable.

When SAW ARQ is used on a single-frequency system, the time lost when waiting for an ACK is important because it represents wasted air time; however, the typical land mobile radio system uses two frequencies with duplex base stations. In this configuration the time is not wasted when awaiting an ACK. For example, after the base transmits a message to a mobile, it may immediately follow with a message to any other mobile without interfering with the first mobile's ACK on the return channel. The same is true of messages from mobile to base. Thus, SAW ARQ is well suited to land mobile radio channels. All the following ARQ variations will assume an SAW format.

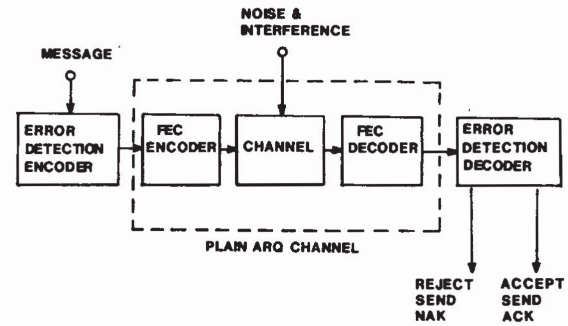


Fig. 3. Type I hybrid ARQ forward channel.

B. *Type I Hybrid ARQ*

Hybrid ARQ and hybrid error control are techniques that use forward error correction (FEC) AND error detection coding. In a Type I hybrid ARQ system the message and error detecting parity bits are further encoded with an FEC code. The bits added by the error correction code can be called error correction parity bits to distinguish them from the error detection parity bits. At the receiver, the error correction parity bits are used to correct channel errors. The FEC decoder then outputs an estimate of the message and the error detection parity bits. The FEC decoder output is then tested by the error detection decoder to determine if the message should be accepted as error free, or rejected as containing errors (see Fig. 3).

If the message is long, or if the channel signal strength is poor (high bit error rate), the probability of error-free transmission may approach zero, as shown in the previous section. Under these conditions the efficiency may be improved by using a Type I hybrid ARQ protocol rather than a simple ARQ protocol. This scheme lengthens each transmission with extra FEC parity bits to increase the success probability of each transmission. A coding gain can result if the reduction in the number of transmissions necessary to deliver a message compensates for the increased message length.

In strong signal, the Type I hybrid ARQ does not result in an efficiency improvement. When the signal is strong enough to deliver messages error free, then the extra FEC parity bits are wasted. Thus, a crossover point in signal strength exists between plain ARQ and Type I hybrid ARQ as far as efficiency is concerned.

C. *Type II Hybrid ARQ*

In a Type II hybrid ARQ scheme the FEC parity bits are not sent with the message and error detecting parity bits. Instead, the message originator alternates between message bits along with error detecting parity bits on one transmission, and only FEC parity bits on the next. The first point to observe is that when the first transmission is received error free, the FEC parity bits are never sent. Secondly, any error-free copy of the message and the error detecting parity bits delivers the message. Also note that if the code

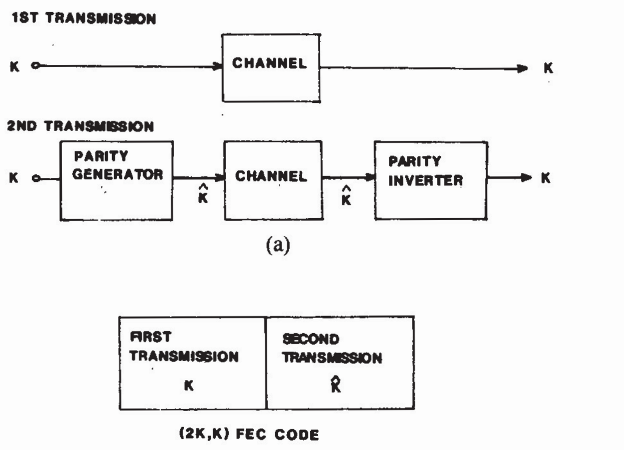


Fig. 4. Type II hybrid ARQ. (a) Data and parity transmissions. (b) Code formed by combining two consecutive transmissions.

is invertible [27] any error-free copy of the FEC parity bits delivers the message [see Fig. 4(a)]. Finally, any two consecutive transmissions, if neither is error free, can be combined for error correction, which may successfully deliver the message [see Fig. 4(b)]. The intent of Type II hybrid ARQ is to operate with the efficiency of plain ARQ in good quality signal and obtain the improvement of Type I hybrid ARQ in poor quality signal.

D. Selective Retransmission

When many blocks are transmitted at once, it can be useful to apply error detection to each block individually rather than to the message as a whole. The error detection on each block can then be used advantageously in an ARQ system by the receiver accepting individually any block received error free, and NAKing only those blocks found to contain detected errors. To do this the receiver must send back a request selecting the blocks to be retransmitted. This is called selective retransmission or SRT.

Either of the hybrid ARQ schemes may be combined with SRT ARQ. For a Type I hybrid SRT ARQ, each block in the SRT ARQ would be further encoded with an FEC code. This would lengthen each block while improving its success probability in poor signal conditions. A combination of SRT ARQ and Type II hybrid ARQ would imply that each block in the packet would be composed of message and error detecting parity bits, or FEC parity bits on alternate transmissions.

Fig. 5 illustrates typical channel transactions for these basic ARQ techniques. Both forward and reverse channel packets are shown on the same line for simplicity. The basic SAW ARQ transaction is illustrated in Fig. 5(a) showing all possible responses from the receiver (NAK, no response, ACK). In all ARQ variations the final ACK terminates the transaction. The SRT ARQ scheme is illustrated in Fig. 5(b) for a ten-block message. In this scheme the NAK returns the identity of the missed blocks

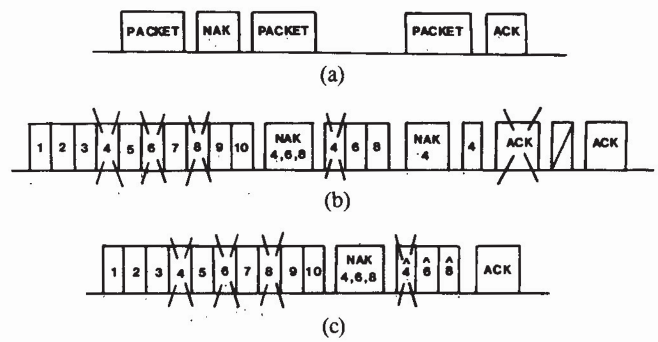


Fig. 5. ARQ transactions. (a) SAW ARQ. (b) SRT ARQ. (c) Type II hybrid SRT ARQ.

to the message originator. Also shown in this figure is an error on the reverse channel. The scheme illustrates a simple rule of repeating the last transmission for no-response or return channel errors. A Type II hybrid SRT ARQ combination protocol is illustrated in Fig. 5(c) for a ten-block message. The example shows three blocks recovered on the second transmission, which consisted of FEC parity bits on the blocks missed from the first transmission. The error-free FEC parity blocks can recover the missing message blocks by parity inversion. The remaining block containing detected errors is combined with the previously transmitted block for error correction to recover the missing message block (see Fig. 6).

IV. Throughput Analysis

The development begins with calculations for the expected number of transmissions for the simpler schemes and then proceeds to the more complex ones. Real failure mechanisms such as message header or return channel failure probabilities are included in the analysis.

Let $F(i)$ be the probability of delivering a message in fewer than i transmissions. Then $1-F(i)$ is the probability that an ith transmission occurs. The expected number of transmissions necessary to deliver a message will be denoted $E(H)$, and is given by

$$E(H)=\sum_{i=1}^{\infty}[1-F(i)]. \tag{11}$$

The distribution function can be computed from

$$1-F(i)=\prod_{j=1}^{i-1}P(j) \tag{12}$$

where $P(j)$ is the probability of failure on the jth transmission. This assumes only that the failure probabilities are independent. An important special case is when the per transmission failure probabilities are identical, or $P(j)=P_f$ for all j. Then

$$E(H)=\sum_{i=1}^{\infty}[1-F(i)]=\sum_{i=1}^{\infty}P_f^{i-1}=\frac{1}{1-P_f}. \tag{13}$$

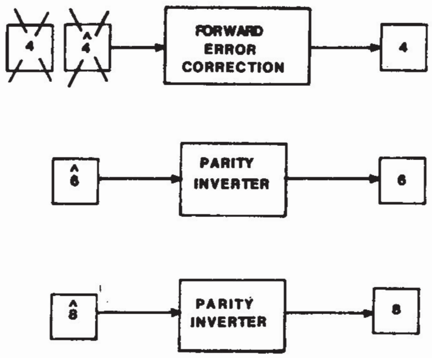


Fig. 6. Recovery of blocks from parity retransmission in a Type II hybrid SRT ARQ.

A. Non-SRT ARQ

$E(H)$ is a function of message length to the extent that P_f is a function of message length as was shown in Section II. To make meaningful comparisons between SRT and non-SRT techniques, P_f is defined as the block failure rate. Then a message is defined as a concatenation of N blocks. Now success on the ith transmission depends on all N blocks being successful, and this probability is

$$1-P_N(i)=[1-P(i)]^N \tag{14}$$

which assumes independence between blocks. For the equal probability case, the expected number of transmissions is given by

$$E_N(H)=\frac{1}{1-P_N}=\frac{1}{(1-P_f)^N}. \tag{15}$$

The function $E_N(H)$ is displayed in Fig. 7 versus block failure probability P_f for various values of message length. Note that the $E_N(H)$ increases more quickly with increasing message length.

B. SRT ARQ

In a selective retransmission scheme independence between blocks implies that the number of transmissions of each block is independent of the number of transmissions of any other block. Then the probability of requiring fewer than i transmissions for an N block message $F_N(i)$ is the same as N single-block messages *all* requiring fewer than i transmissions. Thus, it follows that

$$E_N(H)=\sum_{i=1}^{\infty}[1-F_N(i)]=\sum_{i=1}^{\infty}\{1-[F(i)]^N\}. \tag{16}$$

For the equal failure probability case

$$E_N(H)=\sum_{i=1}^{\infty}\left[1-\left(1-P_f^{i-1}\right)^N\right]. \tag{17}$$

This function is displayed in Fig. 8 for several message lengths versus block failure probability P_f. By comparison to the previous figure it can be seen that SRT requires fewer transmissions to deliver a message than a non-SRT scheme for messages of two or more blocks.

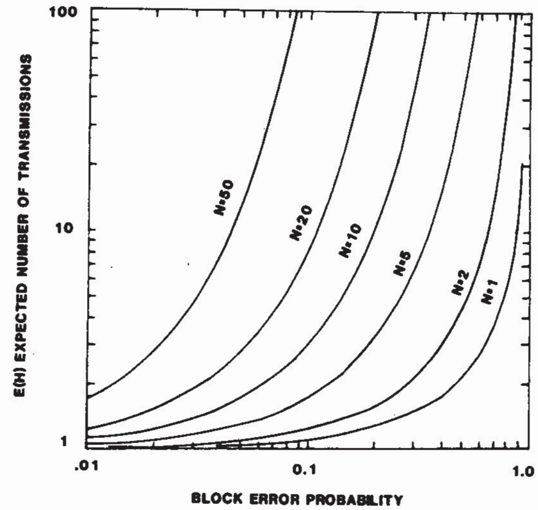


Fig. 7. $E(H)$, expected number of transmissions to deliver an N block message for ARQ.

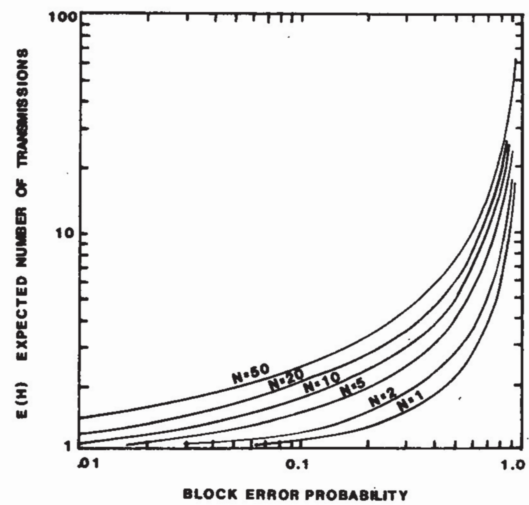


Fig. 8. $E(H)$, expected number of transmissions to deliver an N block message for SRT ARQ.

C. Type II Hybrid ARQ

In the Type II hybrid scheme the failure probabilities are not identical on each transmission. Two probabilities are sufficient for a Type II scheme: a first-transmission probability P_1, and a retransmission probability P_2. Therefore,

$$\begin{aligned} E_N(H) &= [1-F(1)]+\sum_{i=2}^{\infty}[1-F(i)] \\ &= 1+\sum_{i=2}\left[1-\left(1-P_1P_2^{i-2}\right)^N\right]. \end{aligned} \tag{18}$$

In practice P_2 is at least as small as P_1; however, since the Type II system allows for more powerful forward error correction by combining the retransmissions with previously stored transmissions, P_2 would be expected to be smaller than P_1. To represent this concept, P_2 will be represented as a positive integer power of P_1. The higher the power, the greater the error correction capability of the FEC code. The resulting relationship for $E_N(H)$ is displayed in Fig. 9 for $N=10$, and for various FEC code powers.

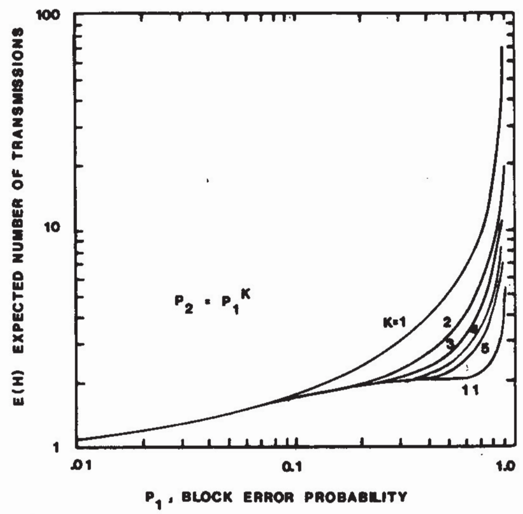


Fig. 9. $E(H)$, expected number of transmissions to deliver a 10 block message for Type II hybrid SRT ARQ for various retransmission failure probabilities.

D. Transmission Efficiency

In this section the transmission efficiency will be computed as the ratio of the number of information bits to the total number of transmitted bits. Since ACK's and NAK's are sent on a return channel, a separate efficiency is computed for each channel. The efficiency R of a non-SRT ARQ is given by

$$R = \frac{NL}{(H+NB)E_N(H)} \tag{19}$$

for an N block message where B is the number of bits per block, each containing L information bits, with an H bit long message header.

In an SRT scheme each block is transmitted $E_1(H)$, or $E(H)$ times, while $E_N(H)$ transmissions are necessary for the whole message. Then the efficiency is

$$R = \frac{L}{\frac{H}{N}E_N(H) + BE(H)}. \tag{20}$$

E. Header Sensitivity

When a header is missed, the transmission is wasted. If we let h represent the header failure probability, then h is the fraction of messages wasted. If $E_N(H)$ transmissions must be received to deliver a message, then $E_N(H)/(1-h)$ transmissions must be sent. The effect on efficiency is to decrease R by the same factor. In the non-SRT schemes

$$R = \frac{L(1-h)}{\left(\frac{H}{N}+B\right)E_N(H)} \tag{21}$$

and in the SRT case

$$R = \frac{L(1-h)}{\frac{H}{N}E_N(H) + BE(H)}. \tag{22}$$

F. ACK Sensitivity

When an ACK or NAK is missed the previous transmission is repeated. In a non-SRT scheme a missed NAK has no effect and may even be eliminated. The missed ACK, however, causes an extra transmission. Its effect is to increase $E_N(H)$ by the factor $a/(1-a)$ for an ACK failure probability of a. For the SRT scheme each NAK may be thought of as an ACK for any blocks accepted on that transmission. Therefore, both $E(H)$ and $E_N(H)$ are increased by the same factor. Then the resulting efficiencies, taking into account both header and ACK sensitivities, are, for the non-SRT schemes

$$R = \frac{L(1-h)}{\left(\frac{H}{N}+B\right)\left[E_N(H)+\frac{a}{1-a}\right]} \tag{23}$$

and for the SRT schemes

$$R = \frac{L(1-h)}{\frac{H}{N}\left[E_N(H)+\frac{a}{1-a}\right] + B\left[E(H)+\frac{a}{1-a}\right]}. \tag{24}$$

The feedback channel efficiency R_f is defined as the ratio of the total feedback channel bits to total forward channel bits. This is written in terms of the forward channel efficiency R and the ACK or NAK length in bits A. For non-SRT schemes where NAK's are not sent

$$R_f = \frac{R}{NL}\frac{A}{1-a} \tag{25}$$

and for SRT schemes

$$R_f = \frac{R}{NL}A\left[E_N(H)+\frac{a}{1-a}\right]. \tag{26}$$

V. Failure Probability Analysis

The expressions derived in the previous section all use failure probabilities. To compare particular schemes for land mobile radio channel, values will be needed for these failure probabilities. These will be derived in terms of the error weight distribution function $F_w(i)$. Then in turn, $F_w(i)$ will be obtained for a specific set of typical land mobile radio channel conditions.

$F_w(i)$, or the probability of fewer than i bit errors in a block, directly yields the failure probabilities for detection or correction codes. For error detection codes, P_f is $1-F_w(1)$. For an FEC code with error correction capability t, P_f is $1-F_w(t+1)$. Useful bounds exist for predicting the maximum error correcting capability t, for a given L and B [27].

In turn, $F_w(i)$ must be obtained for a given set of channel conditions. For static channels, independence between bits has been experimentally observed at data rates over 4800 bits/s on a standard land mobile radio set operating at 494 MHz. When independence holds, $F_w(i)$ can be computed by the binomial distribution function

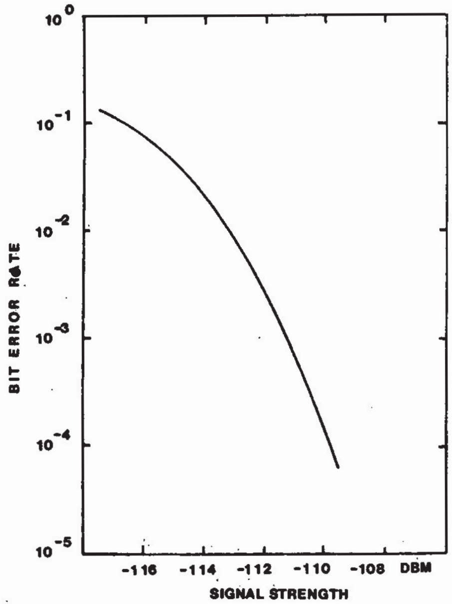


Fig. 10. Bit error rate versus static signal strength.

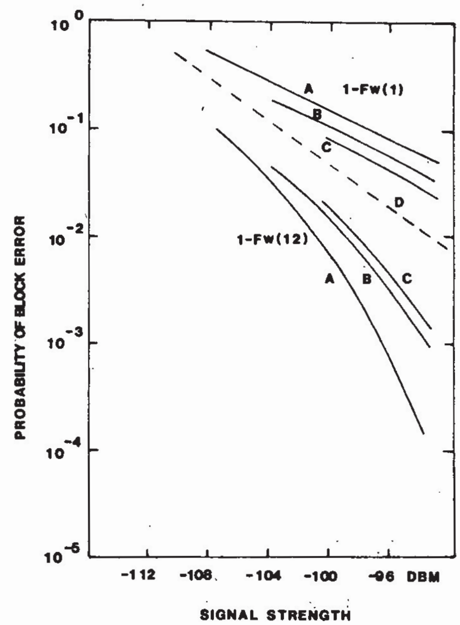


Fig. 11. Probability of block error versus signal strength in fading. A: 20 mi/h. B: 10 mi/h. C: 6 mi/h. D: Rayleigh distribution.

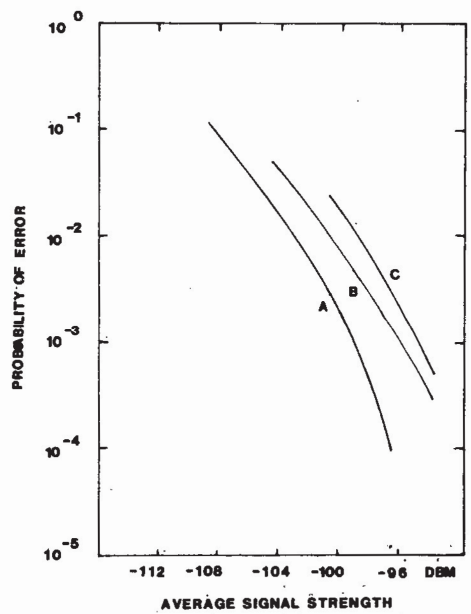


Fig. 12. Retransmission failure probability P_2 for a Type II hybrid SRT ARQ in fading. A: 20 mi/h. B: 10 mi/h. C: 6 mi/h.

with the bit error rate (BER) as the distribution parameter for any size block. The experimentally measured BER is shown in Fig. 10.

For fading channels the distribution cannot be obtained in this fashion. In Section II a model was presented which can predict $1-F_w(1)$, or the error detection failure probability. Unfortunately, no model is known which can predict the rest of the distribution function. Experimental measurements were used to produce the distribution for 100 bit blocks at several fading rates. From these measurements the function $1-F_w(i)$ was seen to follow a log-linear relationship. This suggested an approximation to this function of the form

$$1-F_w(i) \approx e^{m(i-1)+b} \tag{27}$$

where the constants m and b are experimentally derived for each particular set of fading conditions.

From these measurements, models, and approximations, some conclusions can be reached as to the performance of error detection and correction coding in fading. For FEC coding, a block code was assumed with an error correction capability equal to the Hamming bound for 100 bit blocks with a rate of 1/2. The error detection and correction failure probabilities are shown for several different fading rates in Fig. 11. This shows that the FEC code yields a lower failure probability than the error detection code; however, as fading rates decrease, the failure probabilities move toward one another.

For the Type II scheme the first transmission failure probability is that of the error detection code just described. The retransmission failure probability was calculated using moment generating functions which yield the probability that the sum of the error weights in two blocks exceeds the correction capability of a two-block, rate 1/2, FEC code. Again, the Hamming bound was used and the resulting retransmission failure probabilities are shown in Fig. 12.

VI. Predicted and Measured System Performance

For the channel conditions where the failure probabilities have been evaluated, the various ARQ protocols can be compared. The schemes will all share some basic choices to facilitate the comparison. The messages will be assumed to be 256 characters of 7 bits each. Each scheme will contain an additional message cyclic redundancy check (CRC) of 16 bits. Message headers will be 40 bits of preamble followed by two 100 bit blocks, each of a rate 1/2 FEC code. ACK's will be one block for non-SRT schemes and two blocks for SRT schemes to reflect the greater amount of information which must be returned in an SRT NAK.

The Type I hybrid coding will be assumed to be of a rate 1/2. Finally, SRT error detection will be assumed to be a 16 bit CRC per block.

For each protocol, a different packet length will result. For example, the 256 7 bit characters plus a 16 bit message CRC come to 1808 bits. At 100 bits per block, this is 18.08 blocks with a plain ARQ protocol. With a rate 1/2 FEC code per block, this is 36.16 blocks with a Type I hybrid ARQ scheme. If an additional 16 bits per block are used for error detection rather than for information, this becomes 53.17 blocks in a Type I hybrid SRT ARQ combination protocol. For error detection only per block, 21.52 blocks result in an SRT ARQ format. This is the same length for a Type II hybrid SRT ARQ combination format.

Fig. 13 illustrates the inverse of the efficiency (channel bits per data bit) in a fading environment, calculated with the expressions derived in the previous sections. Fig. 14 shows the same information for four of the five protocols, measured on a simulated system composed of a laboratory setup of an RF generator, fading simulator, radio, and special purpose microprocessor hardware.

Notice that at lower signal strengths the schemes require more channel bits per data bit due to increased retransmission activity. In strong signal conditions, each protocol achieves its asymptotic efficiency, based on its overall rate, when the channel becomes essentially error free. Other conclusions reached from this and from other data taken were that the SRT schemes continue to deliver messages at reasonable efficiency at lower faded signal strengths than the non-SRT schemes. Also, the plain ARQ, SRT ARQ, and Type II hybrid SRT ARQ perform the job of delivering messages with better efficiency in strong signal conditions than the Type I hybrid ARQ schemes. Finally, the best overall efficiency and sensitivity is offered by the Type II hybrid SRT ARQ.

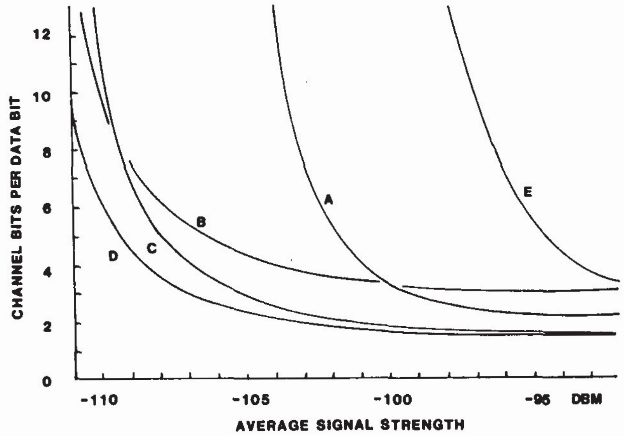


Fig. 13. Inverse of the transmission efficiency, 20 mi/h faded predictions. *A*: Type I hybrid ARQ. *B*: Type I hybrid SRT ARQ. *C*: SRT ARQ. *D*: Type II hybrid SRT ARQ. *E*: Plain ARQ.

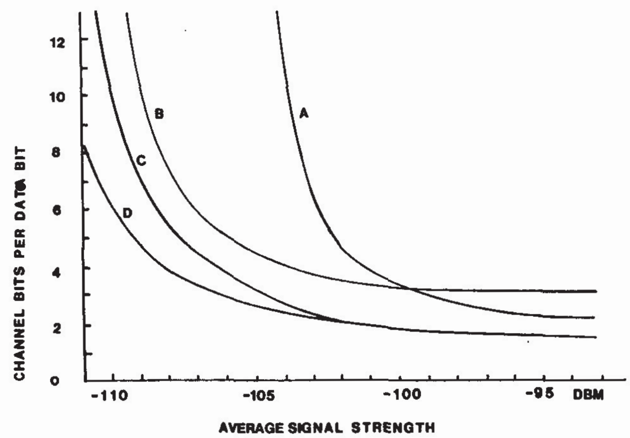


Fig. 14. Inverse of the transmission efficiency in 20 mi/h fading, experimentally measured. *A*: Type I hybrid ARQ. *B*: Type I hybrid SRT ARQ. *C*: SRT ARQ. *D*: Type II hybrid SRT ARQ.

VII. Undetected Error Rates

In the previous sections it has been assumed that each transmission results in one of two outcomes, i.e., success or failure. Actually, three outcomes are possible: success, detected error, or undetected error. These three probabilities per transmission are denoted P_c, P_d, and P_e. When these probabilities are identical for each transmission, the non-SRT undetected error probability per message has been found to be [27]

$$P(E)=\frac{P_e}{P_c+P_e}. \tag{28}$$

P_c can be expressed in terms of the failure probabilities previously defined, while P_e can be bounded based on the number of error detection parity bits m [28]

$$P_c=1-P_f \tag{29}$$

$$P_e \leqslant P_f 2^{-m}. \tag{30}$$

For an N block ARQ define P_{Nc}, P_{Nd}, and P_{Ne} as the N block counterparts of P_c, P_d, and P_e. For the non-SRT scheme, the undetected error probability is given by

$$P_N(E)=\frac{P_{Ne}}{P_{Nc}+P_{Ne}}=\frac{1-(1-P_f)^N}{1+(1-P_f)^N(2^m-1)}. \tag{31}$$

For the SRT schemes, first consider b parity bits per block instead of m parity bits for the whole message. The probability of undetected error for each block as a single message would be

$$P(E)=\frac{P_f}{P_f(1-2^b)+2^b}. \tag{32}$$

For all N blocks to be received correctly, none can contain detected errors, and therefore

$$P_N(E)=1-\left[1-\frac{P_f}{P_f(1-2^b)+2^b}\right]^N \tag{33}$$

If b bits per block and m bits per message are assumed for error detection, then

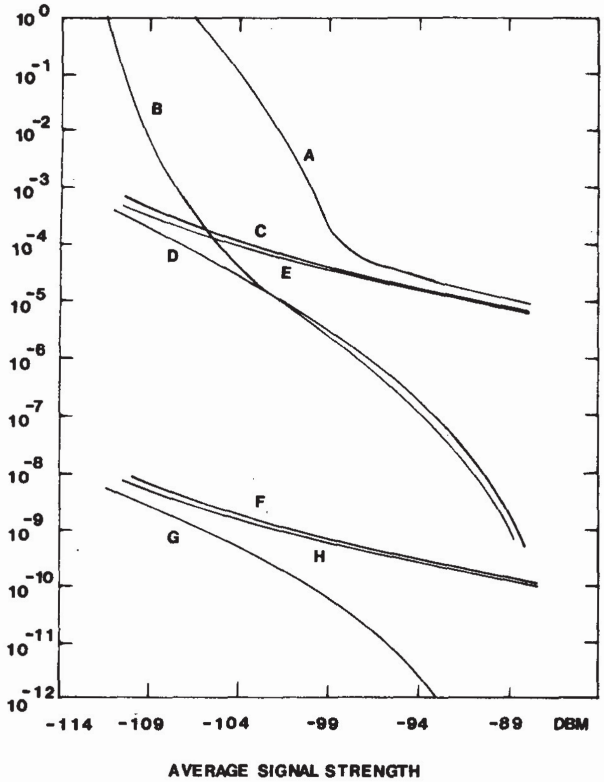


Fig. 15. Undetected error rates for 20 mi/h fading. *A*: Plain ARQ. *B*: Type I hybrid ARQ with whole message CRC. *C*: SRT ARQ. *D*: Type I hybrid SRT ARQ. *E*: Type II hybrid SRT ARQ with per block CRC. *F*: SRT ARQ. *G*: Type I hybrid SRT ARQ. *H*: Type II hybrid SRT ARQ with per block and whole message CRC.

$$P_N(E) = \frac{1-[1-P(E)]^N}{1+[1-P(E)]^N(2^m-1)} \tag{34}$$

which can be evaluated by substituting in (32) for $P(E)$ as the failure probability per block.

For the Type II hybrid scheme two sets of probabilities are needed: one set for the first transmission P_{c1}, P_{d1}, and P_{e1}, and another for the retransmissions P_{c2}, P_{d2}, and P_{e2}. Then $P(E)$ is equal to

$$P(E) = P_{e1} + P_{d1}\left(\frac{P_{e2}}{P_{e2}+P_{c2}}\right) \tag{35}$$

which can be calculated in terms of the per transmission failure probabilities P_1 and P_2, and the number of error detection parity bits. Fig. 15 illustrates an overall comparison of the resulting undetected error probabilities for all the analyzed schemes for 256 character message lengths. The SRT schemes are shown two ways: with per block only, and with whole message in addition to per block CRC's.

VIII. Conclusions

The land mobile radio channel exhibits a wide range of signal quality. This results in variations in time and space from low error rates to very high error rates. Because of this, the coding applied to the message and the retransmission request strategy has been found to have a dramatic influence on the overall system performance. It has also been found that the longer the message, the more important the coding and protocol become. Regarding the fading rate, an important characteristic was noted: that at slower fading rates, the success probability advantage of FEC coding over error detection coding is diminished.

Regarding the protocols examined, it was found that the best efficiency is exhibited by plain ARQ in strong signal; however, it also degrades the most in marginal signal conditions. Type I hybrid ARQ improves the poor signal sensitivity at the expense of the strong signal efficiency. SRT ARQ gives a much more dramatic improvement in sensitivity in fading signals with much less impact on efficiency than the Type I hybrid ARQ. A Type I hybrid SRT ARQ combination gains a little more sensitivity; however, it has the worst efficiency in strong signals. Finally, a new protocol combination, Type II hybrid SRT ARQ, was found to offer the best sensitivity and efficiency overall, and when both per block and whole message CRC's are used, also exhibits as low an undetected error rate as any other protocol tested.

References

[1] R. J. Benice and A. H. Frey, "Comparison of error control techniques," *IEEE Trans. Commun. Technol.*, vol. COM-12, pp. 146–154, Dec. 1964.

[2] ——, "An analysis of retransmission systems," *IEEE Trans. Commun. Technol.*, vol. COM-12, pp. 135–145, Dec. 1964.

[3] H. C. A. Van Duuren, "Printing telegraph systems," U.S. Patent 2 313 980, Mar. 1943.

[4] P. F. Turney, "An improved stop-and-wait ARQ logic for data transmission in mobile radio systems," *IEEE Trans. Commun.*, vol. COM-29, pp. 68–71, Jan. 1981.

[5] ——, "Control of protocol for mobile radios," *Microprocessors and Microsystems*, vol. 3, no. 5, pp. 203–209, June 1979.

[6] L. Kleinrock and F. Tobagi, "Random access techniques for data transmission over packet-switched radio channels," in *Proc. AFIPS*, 1975, pp. 187–201.

[7] B. H. Saeki and I. Rubin, "An analysis of a TDMA channel using stop-and-wait, block, and select-and-repeat ARQ error control," *IEEE Trans. Commun.*, vol. COM-30, pp. 1162–1173, May 1982.

[8] S. A. Mahmoud, J. S. DaSilva, and H. M. Hafez, "Optimal packet length for fading land mobile data channels," in *Proc. Int. Conf. Commun.*, June 1980, p. 61.3.

[9] W. W. Chu, "Optimal message size for computer communications with error detection and retransmission strategies," *IEEE Trans. Commun.*, vol. COM-22, pp. 1516–1525, Oct. 1974.

[10] J. M. Morris, "Optimal block lengths for ARQ error control schemes," *IEEE Trans. Commun.* vol. COM-27, pp. 488–493, Feb. 1979.

[11] B. Arizi, "Improving the throughput of an ARQ stop and wait scheme for burst noise channels," *IEEE Trans. Commun.*, vol. COM-24, pp. 661–663, June 1976.

[12] C. S. K. Leung and A. Lam, "Forward error correction for an ARQ scheme," *IEEE Trans. Commun.*, vol. COM-29, pp. 1514–1519, Oct. 1981.

[13] P. J. Mabey, "Mobile radio data transmission-coding for error control," *IEEE Trans. Veh. Technol.*, vol. VT-27, no. 3, pp. 99–109, Aug. 1978.

[14] P. S. Sindhu, "Retransmission error control with memory," *IEEE Trans. Commun.*, vol. COM-25, pp. 473–479, May 1977.

[15] G. Dallos and L. Gyorfi, "An error correcting rule using memory for simple ALOHA channels," *IEEE Trans. Commun.*, vol. COM-30, pp. 1208–1212, May 1982.

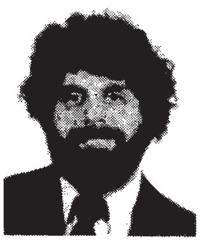
[16] J. J. Metzner, "Improvements in block-retransmission schemes," *IEEE Trans. Commun.*, vol. COM-27, pp. 524–532, Feb. 1979.

[17] Y.-M. Wang and S. Lin, "A modified selective-repeat Type II hybrid ARQ system and its performance analysis," *IEEE Trans. Commun.*, vol. COM-31, pp. 593–608, May 1983.

[18] R. A. Comroe and D. J. Costello, Jr., "An analysis of ARQ schemes for data transmission in mobile radio systems," in *Proc. Int. Conf. Commun.*, June 1982, p. 5B.5.

[19] T. A. Freeburg, "The effect of redundant coding on throughput in a

mobile data terminal system," in *Proc. Veh. Technol. Conf.*, Mar. 1979, pp. 79–82.
[20] R. E. Kahn, S. A. Gronemeyer, J. Burchfiel, and R. C. Kunzelman, "Advances in packet radio technology," *Proc. IEEE*, vol. 66, pp. 1468–1496, Nov. 1978.
[21] N. Abramson, "The ALOHA system—Another alternative for computer communications," in *Proc. AFIPS*, 1970, pp. 281–285.
[22] R. A. Comroe, "Simulate multipath fading in basic," *EDN*, Oct. 1979, pp. 120–122.
[23] —, "All-digital Rayleigh fading simulator," in *Proc. Nat. Electron. Conf.*, Oct. 1978, vol. 32, pp. 136–139.
[24] S. O. Rice, "Statistical properties of a sine wave plus random noise," *Bell Syst. Tech. J.*, no. 27, pp. 109–157, Jan. 1948.
[25] T. A. Freeburg, "An accurate simulation of multi-path fading," in *Proc. Nat. Electron. Conf.*, Oct. 1978, vol. 32, pp. 140–142.
[26] P. F. Turney, "A simple procedure for modeling mobile-radio block error probabilities," Dep. Electron., Chelsea College, London, England, Internal Rep., May 1979.
[27] S. Lin and D. J. Costello, Jr., *Error Control Coding: Fundamentals and Applications.* Englewood Cliffs, NJ: Prentice-Hall, 1983.
[28] J. K. Wolf, A. M. Michelson, and A. H. Levesque, "On the probability of undetected error for linear block codes," *IEEE Trans. Commun.*, vol. COM-30, pp. 317–324, Feb. 1982.



Richard A. Comroe (S'76–M'76) was born in Fairbanks, AK, on July 1, 1952. He received the B.S. degree in electronics technology from Northern Illinois University, Dekalb, the M.S.E.E. degree from the University of Illinois, Urbana, and the Ph.D.E.E. degree from the Illinois Institute of Technology, Chicago, in 1973, 1976, and 1982, respectively.

He first worked at C.T.S. Knights, Sandwich, IL, in Xtal filter design. Since 1974 he has worked for Motorola, Franklin Park and Schaumburg, IL. He is now working on land mobile radio trunking systems. He is a Senior Staff Engineer with Motorola, Schaumburg. He has worked primarily in research on vehicle location, multipath fading, digital signal processing, error detecting and correcting codes, data modulations, computer protocols, and microprocessor systems.

Daniel J. Costello, Jr. (S'62–S'67–M'69–SM'78) was born in Seattle, WA, on August 9, 1942. He received the B.S.E.E. degree from Seattle University, Seattle, WA, in 1964, and the M.S and Ph.D. degrees in electrical engineering from the University of Notre Dame, Notre Dame, IN, in 1966 and 1969, respectively.

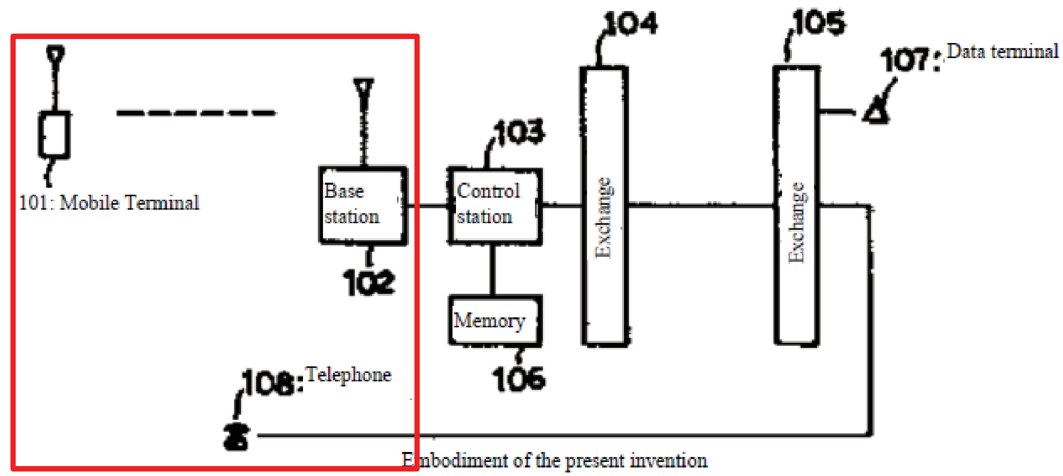
In the summer of 1966 he served as an Associate Research Engineer at the Boeing Aerospace Division, Seattle. In 1969 he joined the faculty of the Illinois Institute of Technology, Chicago, as an Assistant Professor of Electrical Engineering. He was promoted to Associate Professor in 1973, and to Full Professor in 1980. He spent the summer of 1971 as a Research Associate at Cornell University, Ithaca, NY, and was a Visiting Professor at the University of Notre Dame during the 1983–1984 academic year. In addition, he has served as a professional consultant for Western Electric, the Illinois Institute of Technology Research Institute, and Motorola Communications. His research interests are in the area of digital communications, with special emphasis on coding theory, information theory, multiuser systems, communication networks, error control, and spread-spectrum communications. He has over 50 technical publications in his field, and in 1983 coauthored a textbook entitled *Error Control Coding: Fundamentals and Applications.* He has served as Principal Investigator on ten research grants, and as an Associate Investigator on two others. He has also supervised ten Ph.D. dissertations at the Illinois Institute of Technology.

Dr. Costello belongs to the Information Theory Group and the Communications Society. Since 1983, he has been a member of the Information Theory Group Board of Governors, to which he was elected Second Vice-President in 1984. He has served as an Associate Editor for Communication Theory for the IEEE TRANSACTIONS ON COMMUNICATIONS, and since 1984 has been an Associate Editor for Coding Techniques for the IEEE TRANSACTIONS ON INFORMATION THEORY.

APPENDIX C

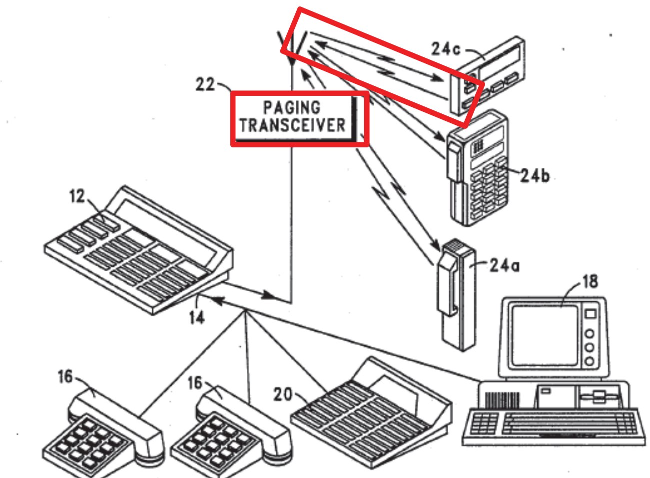
Appendix C
U.S. Patent No. 5,754,946 in view of Japanese Unexamined Patent Application H2-213237 ("Akiyama") in combination with U.S. Patent No. 4,940,963 ("Gutman")

Claim 1	Akiyama combined with Gutman
1(P) A mobile unit for transmitting and receiving radio frequency signals to and from a communications network comprising:	Akiyama discloses a pager system with a mobile unit that receives wireless signals from a base station of a paging network. Akiyama also discloses transmitting signals to the paging network control station through a phone line by the mobile unit transmitting wireless acoustic or electromagnetic signals to the telephone receiver. *See, e.g.*, "*A feature of the present invention for attaining this object is* ***a message transmission system comprising a mobile terminal, a wireless base station, and a control station, using one-way wireless communication lines that transmit data from the control station to the mobile terminal via the wireless base station****, wherein the data transmitted from the control station is divided into a plurality of frames, a mobile terminal number, a data number, and a frame number are attached to each frame before being transmitted, and transmitted frames are held by the control station for a fixed amount of time, the mobile terminal checks whether or not the frames were able to be received without error, and, if a frame with an error is identified, stores the data number and the frame number thereof, and visibly displays the data number and the frame number in the mobile terminal,* ***a mobile terminal holder electrically or acoustically couples the mobile terminal to a general telephone network to transmit to the control station the mobile terminal number, the data number, and the number of the frame where the error occurred****, the control terminal retransmits only the mobile terminal number, the data number, and the error frame number, and the mobile terminal visibly displays the data of the frames which were initially correctly received and of the retransmitted frame in frame number order.*" Akiyama at 2

	 FIG. 1 Akiyama Fig.1. Additionally, Gutman discloses this limitation. Gutman discloses a two-way paging system where the pagers have an ability to receive paging messages and transmit acknowledgements back to the base station using radio frequency signals. It would have been obvious to one of ordinary skill in the art to combine the wireless transmit circuitry of Gutman with the retransmit request transmitter in Akiyama such that the retransmit request could be transmitted wirelessly rather than over a phone line. *See, e.g.*, "*Referring now to the drawings **a paging system** is shown in FIG. 8, which system has been here constructed in accordance with the present, invention and includes the capability of automatic as well as **manual acknowledge back (ACK-BACK) signal response**.*" Gutman 3:29-33 "*Console terminal 12 will process the paging request, extract the appropriate address from internal memory and activate t**he paging transmitter 22 to broadcast the intended paging call**,*

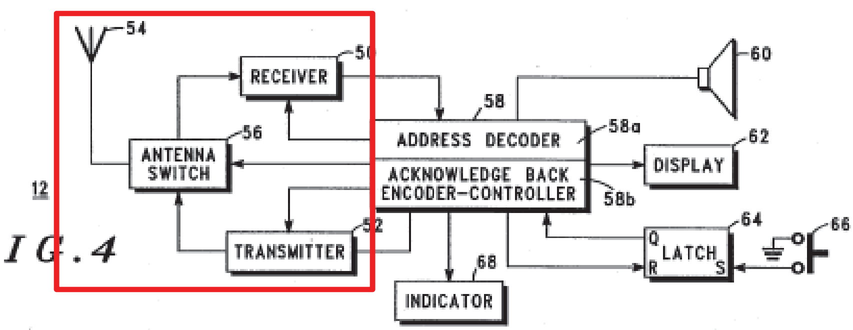
	*and **which in turn is received by the appropriate system pager** for processing the information and alerting the paging receiver wearer or user.*"

Gutman 3:41-46



10
F I G. 1

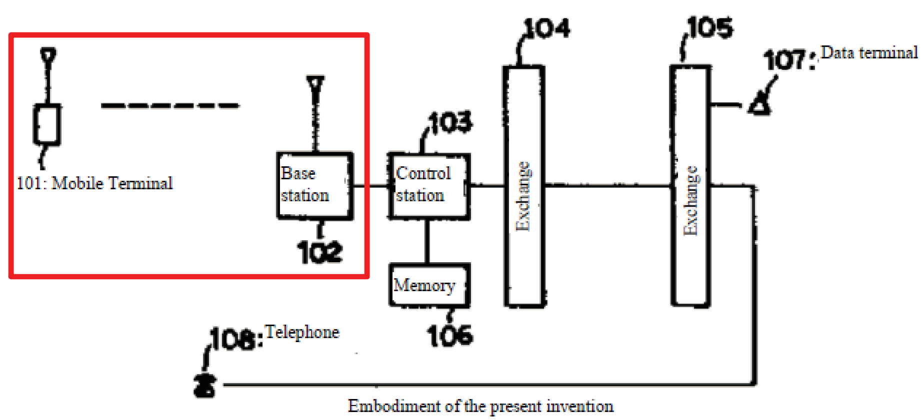
Gutman Fig. 1

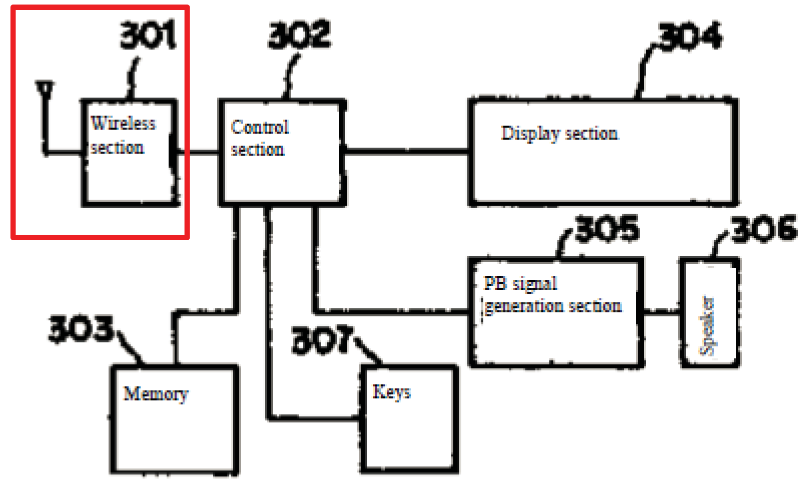


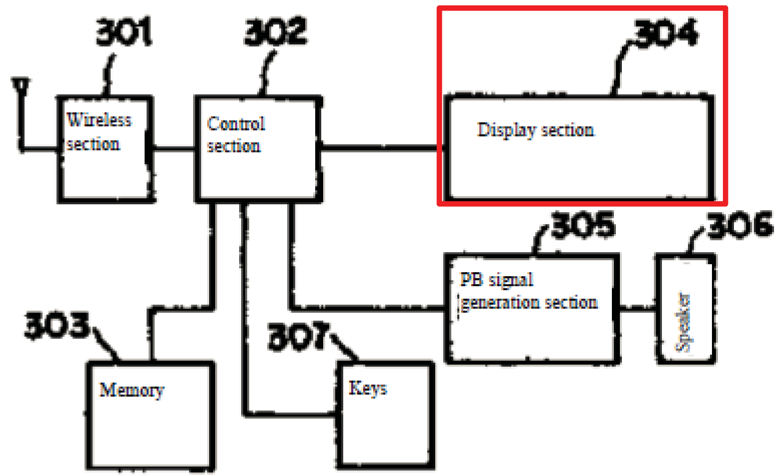
F I G. 4

Gutman Fig. 4

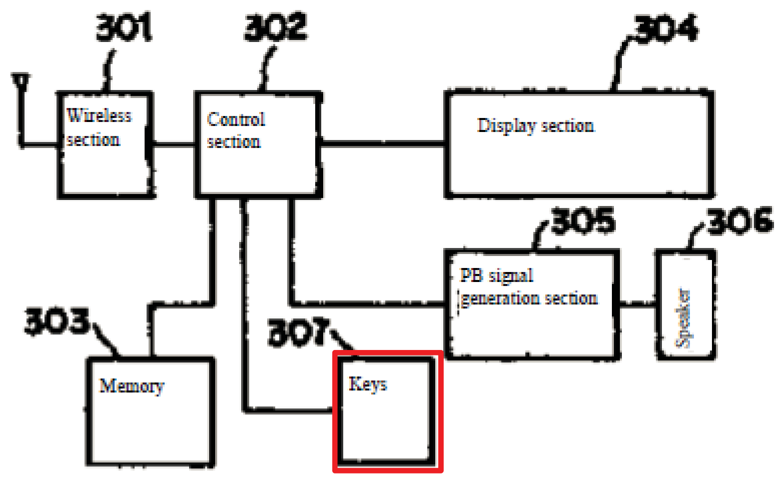
Appendix C
U.S. Patent No. 5,754,946 in view of Japanese Unexamined Patent Application H2-213237 ("Akiyama") in combination with U.S. Patent No. 4,940,963 ("Gutman")

1(A) means for receiving a radio frequency message from the network;	Akiyama discloses a pager system with a mobile unit that receives wireless signals from a paging network base station. Akiyama discloses wireless section and an antenna that are used to receive the wireless message from the base station of the paging network. *See, e.g.*, "*A feature of the present invention for attaining this object is **a message transmission system comprising a mobile terminal, a wireless base station, and a control station, using one-way wireless communication lines that transmit data from the control station to the mobile terminal via the wireless base station**…*" Akiyama at 2 "***The transmission data is sent from the base station 102 to the mobile station 101 over the wireless communication line. In the mobile station 101, the wireless section 301 in FIG. 3 performs reception and demodulation** (400 in FIG. 4), and the control section 302 corrects any errors using the error correction detection code 206 (402).*" Akiyama at 2-3  FIG. 1 Akiyama Fig. 1

	Block diagram of mobile terminal FIG. 3 Akiyama Fig. 3
1(B) a display for displaying said message;	Akiyama discloses a pager system with a mobile unit includes a display for displaying the received page messages. *See, e.g.*, "*Once all the frames in one data number have been received, the control section 302 emits a ring tone (408) as needed,* ***and displays the data to the display section 304 (410)****. Whether all the frames have been received or not can easily be established by including a number indicating an order of frames and how many frames have been transmitted in the frame number.* ***If there are any frames that contain errors in the display data, the fact that there is an error is also displayed****.* ***For the error display****, several methods are conceivable, including* ***displaying everything including the incorrect data****, and causing the frames with incorrect data to blink, indicating through writing or the like that there are incorrect frames without displaying the data, and so on.*"

	Akiyama at 3  Block diagram of mobile terminal FIG. 3 Akiyama Fig. 3
1(C) a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network;	Akiyama discloses a pager system where the pager displays an indicator for portions of a message with errors and includes keys that can be pressed to transmit a request for retransmission of only the portion of the displayed message with errors from the network control station. *See, e.g.*, “*A feature of the present invention for attaining this object is a message transmission system comprising a mobile terminal, a wireless base station, and a control station, using one-way wireless communication lines that transmit data from the control station to the mobile terminal via the wireless base station,* ***wherein the data transmitted from the control station is divided into a plurality of frames,*** *a mobile terminal number, a data number, and a frame number are attached to each frame before being transmitted, and transmitted frames are held by the control*

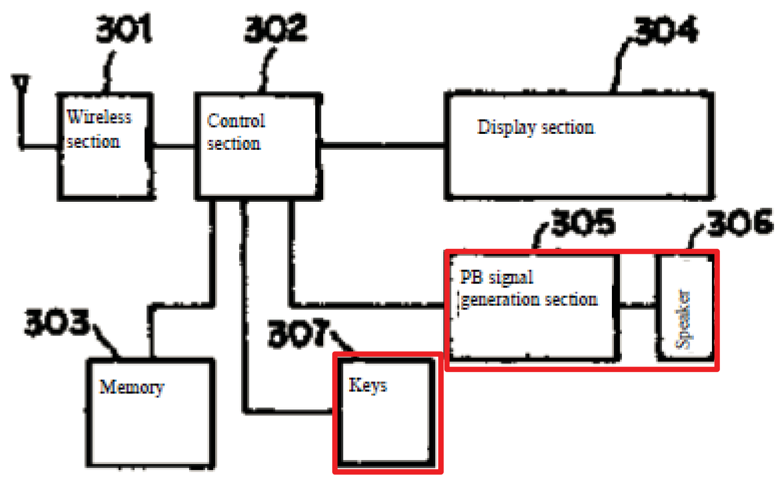
	station for a fixed amount of time, the mobile terminal checks whether or not the frames were able to be received without error, and, ***if a frame with an error is identified, stores the data number and the frame number thereof, and visibly displays the data number and the frame number in the mobile terminal, a mobile terminal holder electrically or acoustically couples the mobile terminal to a general telephone network to transmit to the control station the mobile terminal number, the data number, and the number of the frame where the error occurred,*** *the control terminal retransmits only the mobile terminal number, the data number, and the error frame number, and the mobile terminal visibly displays the data of the frames which were initially correctly received* ***and of the retransmitted frame*** *in frame number order*." Akiyama at 2 "*If there are any frames that contain errors in the display data, the fact that there is an error is also displayed. For the error display, several methods are conceivable, including displaying everything including the incorrect data, and* ***causing the frames with incorrect data to blink****, indicating through writing or the like that there are incorrect frames without displaying the data, and so on.*" Akiyama at 3 "*Upon hearing this,* ***the mobile terminal owner presses the data transmission key in the keys 307 (420), upon which the control section 302 reads the data number, the frame number, and its own mobile terminal number for the data that is experiencing the error from the memory 303****, drives the PB signal generation section 305, and transmits the data through the speaker 306 (422).* ***If there are a plurality of frames with errors, a plurality of frame numbers are transmitted****.*" Akiyama at 3 "*Upon receiving this signal, the control station 103 searches the content of the memory 106 on the basis of the mobile terminal number, the data number, and the frame number that have been received,* ***and then retransmits the incorrect frame to the mobile terminal 101 via the base station 102 and the wireless communication line****.*"

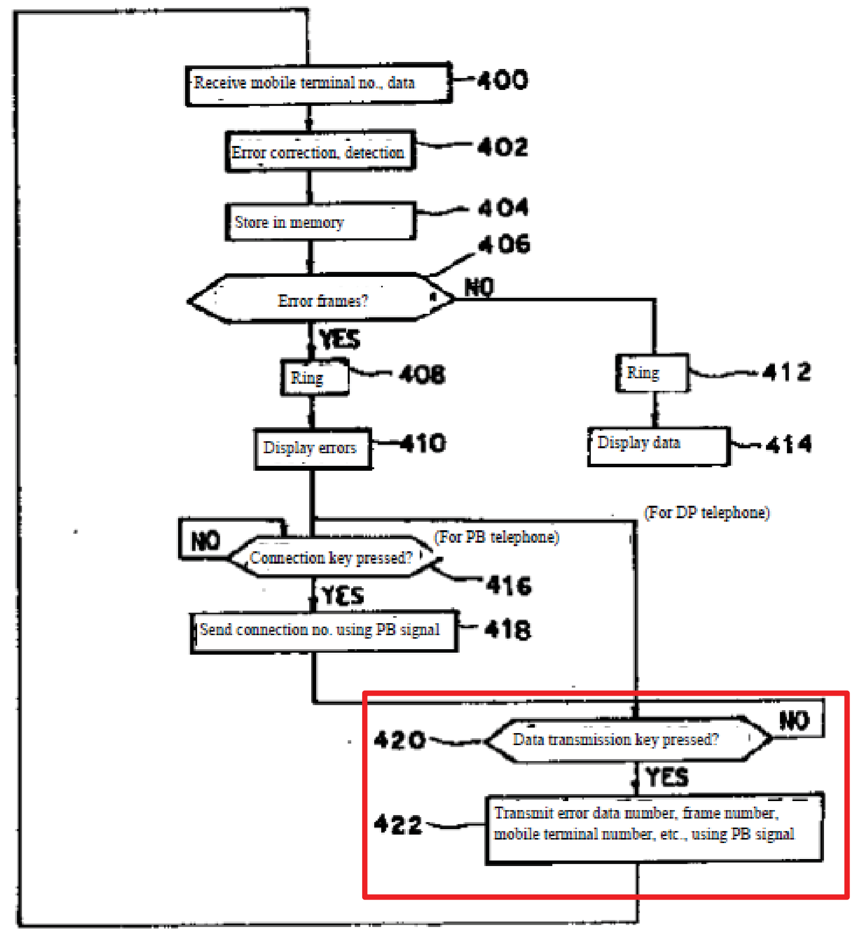
<table>
<tr><td></td><td>Akiyama at 3


Block diagram of mobile terminal
FIG. 3

Akiyama Fig. 3</td></tr>
<tr><td>1(D) means for transmitting, only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message; and</td><td>Akiyama discloses a pager system where the pager includes transmitting a signal to the paging network control station requesting retransmission of a portion of a message only after a user presses the transmission button. See, e.g.,

“Upon hearing this, the mobile terminal owner presses the data transmission key in the keys 307 (420), upon which the control section 302 reads the data number, the frame number, and its own mobile terminal number for the data that is experiencing the error from the memory 303, drives the PB signal generation section 305, and transmits the data through the speaker 306 (422). If there are a plurality of frames with errors, a plurality of frame numbers are transmitted.”</td></tr>
</table>

	Akiyama at 3 "*In the above description, a method was described in which a mobile terminal owner acoustically couples a mobile terminal to a telephone and automatically transmits a data number, frame number, and a mobile terminal number with an error,* ***but it is also possible to provide a special terminal to the telephone and transmit the data electromagnetically****, instead of using acoustic coupling.*" Akiyama at 3  Block diagram of mobile terminal FIG. 3 Akiyama Fig. 3

	 Operation flow of mobile terminal FIG. 4 Akiyama Fig. 4

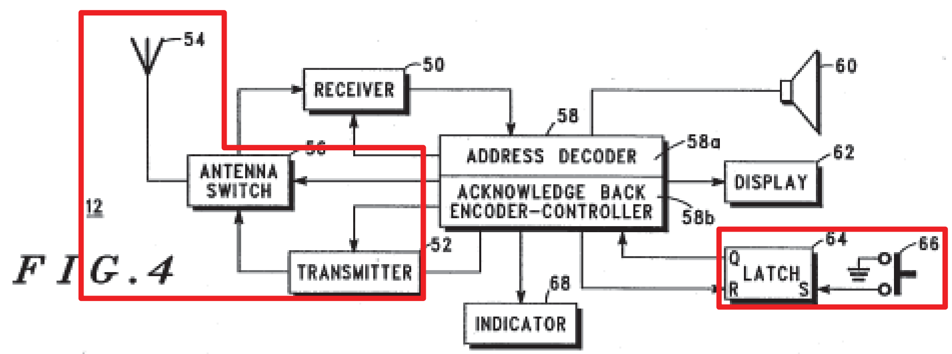
Additionally, Gutman discloses a wireless transmitter unit that is used to transmit acknowledgments back to the communications network if the user activates a switch or button on the paging device. It would have been obvious to one of ordinary skill in the art to combine the wireless transmitter of Gutman with the retransmission request function of Akiyama *See, e.g.*,

"*In practicing the invention, a paging system is provided wherein a plurality of associated paging receivers have the capability of automatic acknowledging-back and wherein such pagers are further provided with visual and audible indicator means,* ***along with a manual operating button for a further manual acknowledge back response****.*"

Gutman 2:35-42

"*The pager-side 15 of system 10 comprises the paging receiver portion 50, the included ack-back encoder 58 and* ***associated antenna 54****. A more detailed representation of a system pager is shown in FIG. 4. In addition to the foregoing, the overall pager unit 24 further includes* ***an antenna switch 56****,* ***a transmitter portion 52****, a speaker 60, a display 62, if of the numeric or alphanumeric type, and a latch 64* ***and manual button 66 coupled to the ack-back encoder-controller 58b*** *and a manual response indicator 68.*"

Gutman 4:28-34

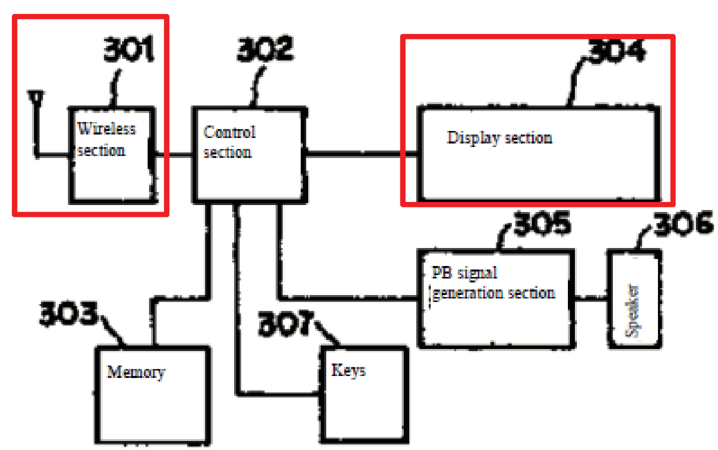


Gutman Fig. 4.

<table>
<tr>
<td>1(E) means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display.</td>
<td>Akiyama discloses a pager system where the mobile pager unit includes an antenna and wireless section for receiving retransmitted portions of a message from the communications network. The pager also includes a display section, which displays the received retransmitted portion of a message. See, e.g.,

“The mobile terminal 101 sees from the data number that this data is a retransmission of previously received data, and stores the newly received data in a memory area for already-stored data numbers. If there are frames with errors after error correction and detection, the display indicates that there are errors, as during the first reception, and requests retransmission again through the telephone if needed. If it is seen that all the frames were able to be received without errors after error correction, then this is displayed to the display section 304 to notify the mobile terminal owner.”

Akiyama at 3



Block diagram of mobile terminal
FIG. 3

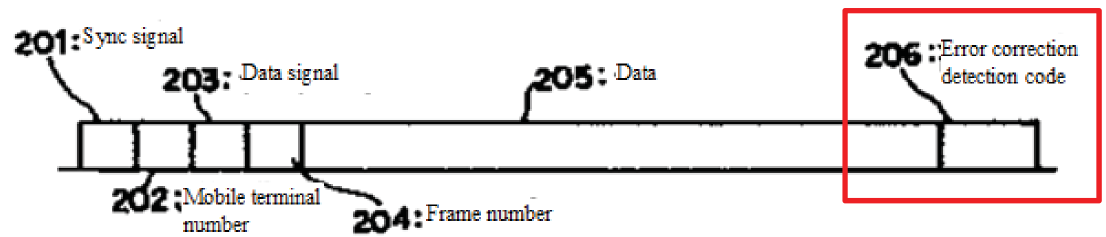
Akiyama Fig.3.</td>
</tr>
</table>

<table>
<tr><th>Claim 2</th><th>Akiyama combined with Gutman</th></tr>
<tr><td>2(A) The mobile unit of claim 1, further comprising:

means for detecting errors in the received message,</td><td>Akiyama discloses a paging system where the pager device includes a control section that detects errors in the received message. See, e.g.,

"The transmission data is sent from the base station 102 to the mobile station 101 over the wireless communication line. In the mobile station 101, the wireless section 301 in FIG. 3 performs reception and demodulation (400 in FIG. 4), and the control section 302 corrects any errors using the error correction detection code 206 (402). If it is found that there are no errors, the data number 203, the frame number 204, and the data 205 are stored in the memory 303 (404). If there are errors, a symbol is attached indicating that there is an error, and this is similarly stored in the memory 303."

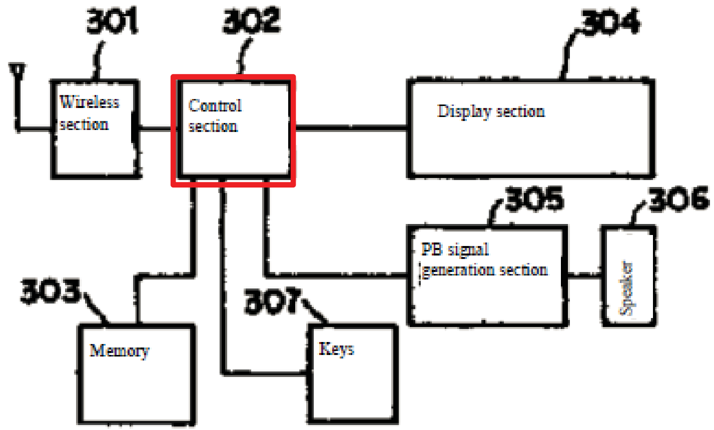
Akiyama at 2-3

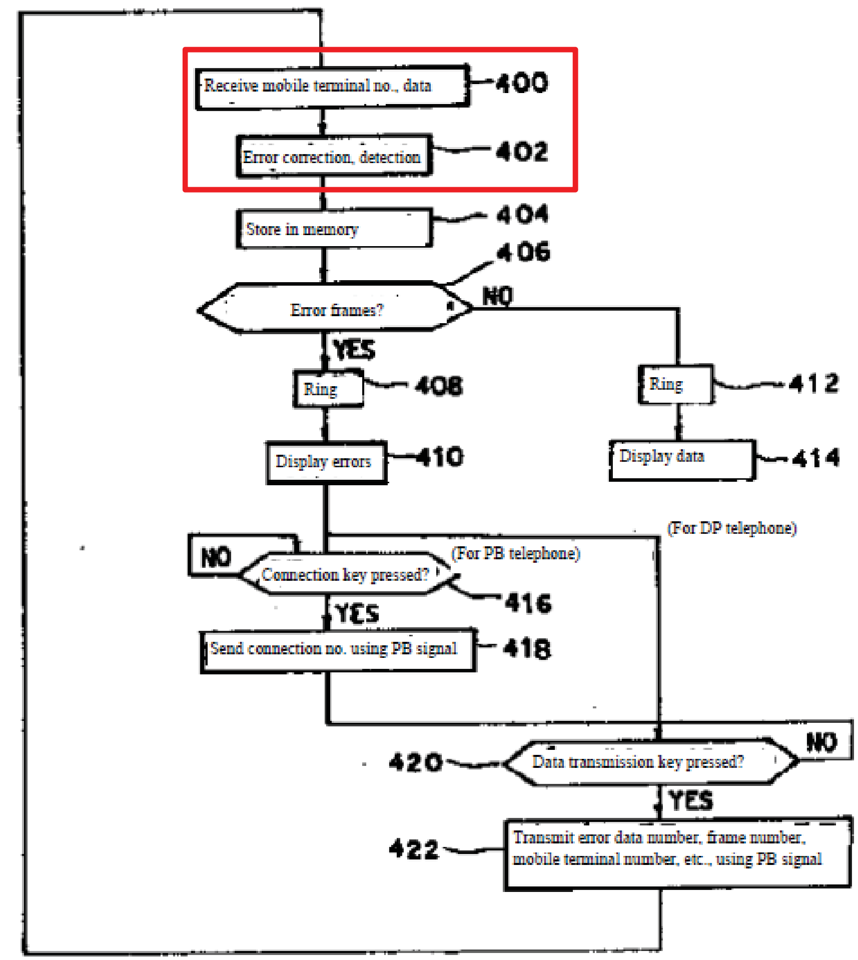


Signal frame format

FIG. 2

Akiyama Fig. 2</td></tr>
</table>

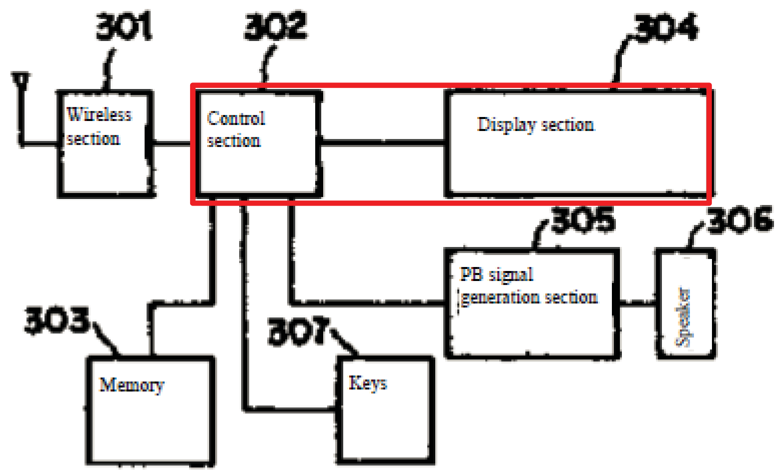
	 Block diagram of mobile terminal FIG. 3 Akiyama Fig. 3

	 Operation flow of mobile terminal FIG. 4 Akiyama Fig. 4

<table>
<tr>
<td>2(B) said display including means for highlighting said errors when the message is displayed on said display.</td>
<td>Akiyama discloses a pager system where the pager display includes an indicator that a portion or portions of a message have errors. The portions with an error will be highlighted by causing that section of the message to blink, or indicating in writing that there are errors. See, e.g.,

“If there are any frames that contain errors in the display data, the fact that there is an error is also displayed. For the error display, several methods are conceivable, including displaying everything including the incorrect data, and causing the frames with incorrect data to blink, indicating through writing or the like that there are incorrect frames without displaying the data, and so on.”

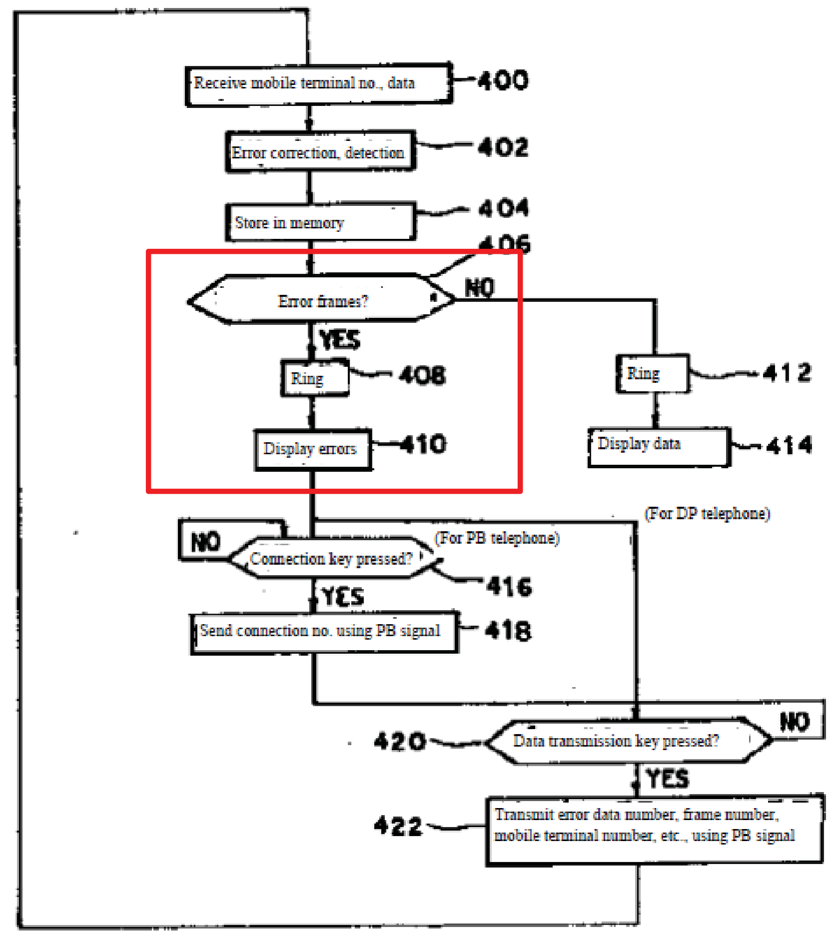
Akiyama at 3



Block diagram of mobile terminal

FIG. 3

Akiyama Fig. 3</td>
</tr>
</table>



Operation flow of mobile terminal

FIG. 4

Akiyama Fig. 4

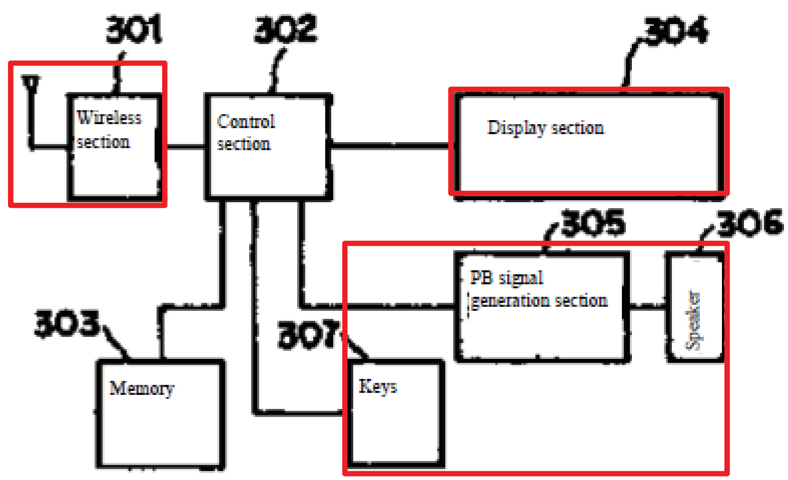
Claim 4	Akiyama combined with Gutman
The mobile unit of claim 1, wherein the signal transmitted by the transmitting means indicates to the network that the user has read the message.	Akiyama discloses a paging system where the paging unit displays the message and errors, allowing the user to decide whether to request a retransmission of the portions of the message with errors. Because a user will have viewed the message on the display before making the request for retransmission, this transmission of the request indicates to the paging network that the message has been read. *See, e.g.*, "*For the error display, several methods are conceivable, **including displaying everything including the incorrect data, and causing the frames with incorrect data to blink**, indicating through writing or the like that there are incorrect frames without displaying the data, and so on. **The mobile terminal owner sees these displays and if he or she desires to receive correct data, he or she goes to a nearby telephone 108 as in FIG. 1,** and if the telephone is a PB telephone, the mobile terminal owner picks up the handset and checks for a dial tone, and then places the speaker section 306 of the mobile terminal 101 against a mouthpiece of the telephone and presses a connection key of the keys 307 (416).*" Akiyama at 3; *See also* Akiyama Fig. 4. Additionally, Gutman discloses transmitting a signal to the communication network indicating that the user has read the message. It would have been obvious to one of ordinary skill in the art to combine the manual transmitting of an acknowledgement of having read a message with the retransmission request of Akiyama. *See, e.g.*, "*During the time for processing the message, and for a predetermined period thereafter, which constitutes a response interval, **the pager wearer may activate manual pushbutton 66 to generate a further and manual ack-back response**. When received and processed at the base-central site, **it is indicative of the condition that the page message was duly received and understood by the intended pager wearer.***" Gutman at 4:56-68; *See also* Figs. 1, 4.

Appendix C
U.S. Patent No. 5,754,946 in view of Japanese Unexamined Patent Application H2-213237 ("Akiyama") in combination with U.S. Patent No. 4,940,963 ("Gutman")

Claim 7	Akiyama combined with Gutman
7(P) A communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network, the network comprising:	Akiyama discloses a pager system where the network base station transmits messages to the mobile pager unit over wireless signals. The pager unit includes a display and an indicator for portions of a message with errors. It also includes a button that can be pressed to transmit a request for retransmission of only the portion of the message with errors to the network control station. *See, e.g.*, "***The transmission data is sent from the base station 102 to the mobile station 101 over the wireless communication line.*** *In the mobile station 101, the wireless section 301 in FIG. 3 performs reception and demodulation (400 in FIG. 4), and the control section 302 corrects any errors using the error correction detection code 206 (402). If it is found that there are no errors, the data number 203, the frame number 204, and the data 205 are stored in the memory 303 (404).* ***If there are errors, a symbol is attached indicating that there is an error, and this is similarly stored in the memory 303.***" Akiyama at 2-3 "***If there are any frames that contain errors in the display data, the fact that there is an error is also displayed****. For the error display, several methods are conceivable, including displaying everything including the incorrect data, and causing the frames with incorrect data to blink, indicating through writing or the like that there are incorrect frames without displaying the data, and so on.*" Akiyama at 3 "*Upon hearing this,* ***the mobile terminal owner presses the data transmission key in the keys 307 (420), upon which the control section 302 reads the data number, the frame number, and its own mobile terminal number for the data that is experiencing the error from the memory 303****, drives the PB signal generation section 305, and transmits the data through the speaker 306 (422). If there are a plurality of frames with errors, a plurality of frame numbers are transmitted.*" Akiyama at 3

"*Upon receiving this signal, the control station 103 searches the content of the memory 106 on the basis of the mobile terminal number, the data number, and the frame number that have been received,* ***and then retransmits the incorrect frame to the mobile terminal 101 via the base station 102 and the wireless communication line. The mobile terminal 101 sees from the data number that this data is a retransmission of previously received data****, and stores the newly received data in a memory area for already-stored data numbers. If there are frames with errors after error correction and detection, the display indicates that there are errors,* ***as during the first reception, and requests retransmission again through the telephone if needed. If it is seen that all the frames were able to be received without errors after error correction, then this is displayed to the display section 304 to notify the mobile terminal owner.***"

Akiyama at 3

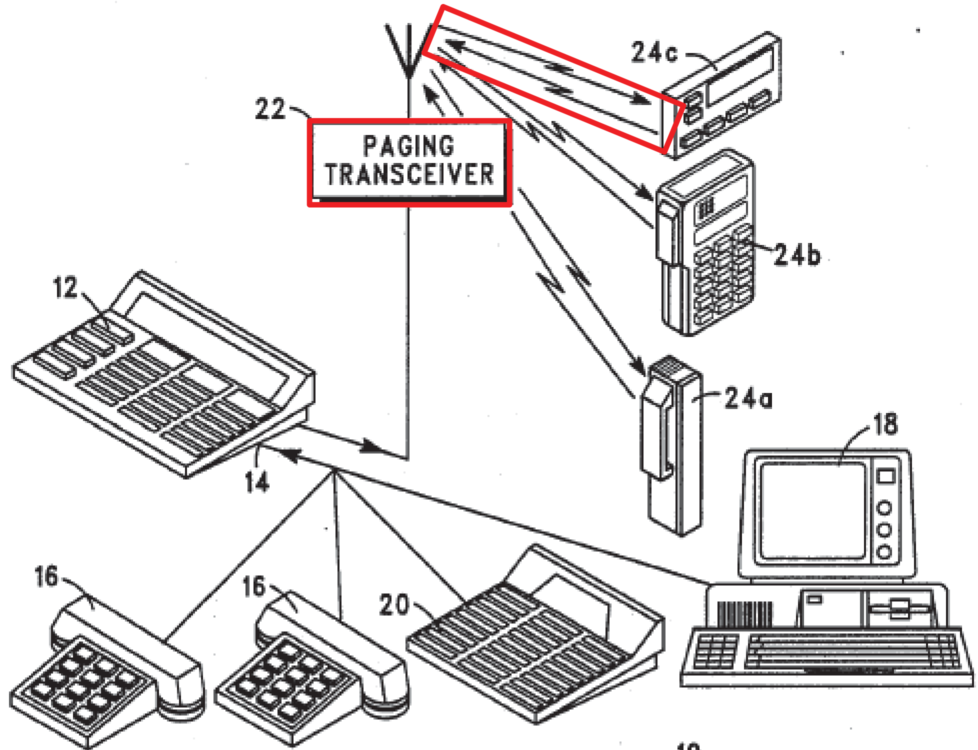


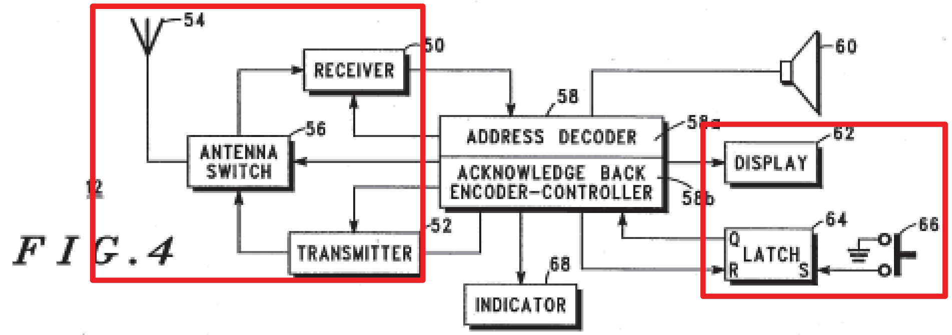
Block diagram of mobile terminal

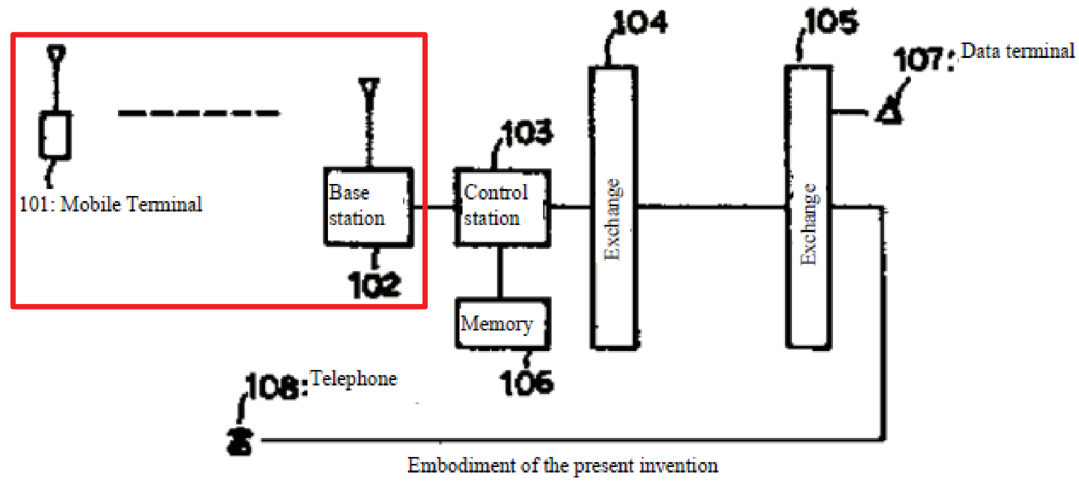
FIG. 3

Akiyama Fig. 3

	Additionally, Gutman discloses a two-way paging communication network where the mobile pager units include a wireless transmitter in addition to a wireless receiver. The paging messages in both directions between the network and the mobile unit are transmitted wirelessly using radio frequency signals. It would have been obvious to one of skill in the art to combine the wireless transmitter unit of Gutman with the retransmission request function of Akiyama *See, e.g.*, "*Referring now to the drawings a paging system is shown in FIG. 8, which system has been here constructed in accordance with the present, invention and includes the capability of automatic as well* ***as manual acknowledge back (ACK-BACK) signal response***." Gutman 3:29-33

	 10 FIG.1 Gutman Fig. 1

	 Gutman Fig. 4 Gutman also discloses the use of a switch or button that allows the user to manually transmit an acknowledgment back to the pager communication network. *See, e.g.*, "*In practicing the invention, a paging system is provided wherein a plurality of associated* ***paging receivers*** *have the capability of automatic acknowledging-back and wherein such pagers are further* ***provided with visual*** *and audible indicator means, along with* ***a manual operating button for a further manual acknowledge back response***." Gutman 2:35-42
7(A) means for transmitting radio frequency signals containing a message to the mobile unit;	Akiyama discloses a pager system that includes a network base station transmitting messages to mobile pager units using wireless signals. Akiyama discloses a wireless base station and antenna that transmit messages to the antenna and wireless section of the mobile pager unit. *See, e.g.*, "*A feature of the present invention for attaining this object is* ***a message transmission system comprising a mobile terminal, a wireless base station, and a control station, using one-way wireless communication lines that transmit data from the control station to the mobile terminal via the wireless base station****...*" Akiyama at 2

	"***The transmission data is sent from the base station 102 to the mobile station 101 over the wireless communication line. In the mobile station 101, the wireless section 301 in FIG. 3 performs reception and demodulation*** *(400 in FIG. 4), and the control section 302 corrects any errors using the error correction detection code 206 (402).*" Akiyama at 2-3  FIG. 1 Akiyama Fig. 1

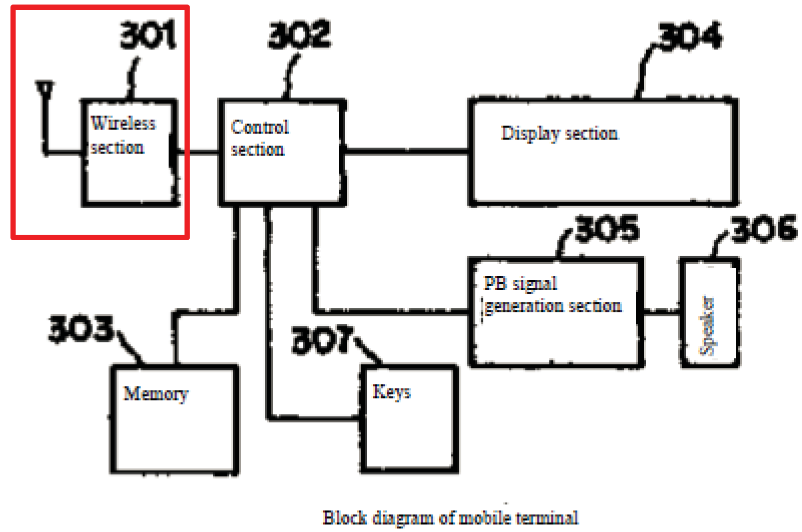
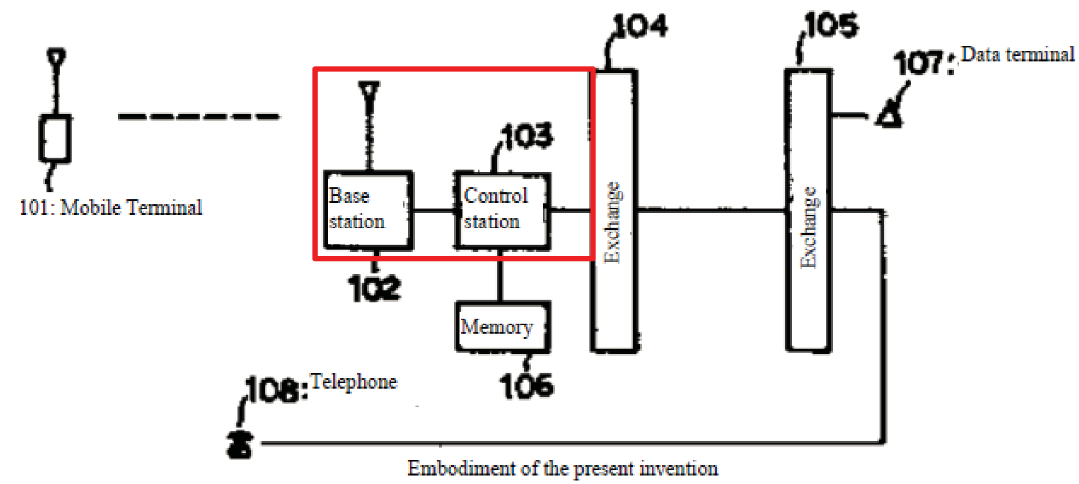
<table>
<tr><td></td><td>

FIG. 3

Akiyama Fig. 3</td></tr>
<tr><td>7(B) means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission;</td><td>Akiyama discloses a pager system where the paging network control station receives requests from the mobile pager unit requesting retransmission of only the portion of the message with errors. See, e.g.,

“Upon hearing this, the mobile terminal owner presses the data transmission key in the keys 307 (420), upon which the control section 302 reads the data number, the frame number, and its own mobile terminal number for the data that is experiencing the error from the memory 303, drives the PB signal generation section 305, and transmits the data through the speaker 306 (422). If there are a plurality of frames with errors, a plurality of frame numbers are transmitted.”

Akiyama at 3</td></tr>
</table>

	“***If there are frames with errors after error correction and detection****, the display indicates that there are errors, as during the first reception,* ***and requests retransmission again*** *through the telephone if needed.*”
	Akiyama at 3
	“*In the above description, a method was described in which a mobile terminal owner acoustically couples a mobile terminal to a telephone and automatically transmits a data number, frame number, and a mobile terminal number with an error, but it is also possible to provide a special terminal to the telephone and* ***transmit the data electromagnetically****, instead of using acoustic coupling.*”
	Akiyama at 3
	
	FIG. 1
	Akiyama Fig. 1
	Additionally, Gutman discloses an antenna and a paging transceiver (transmitter and receiver) in

	the communication network that receives radio frequency signals from the paging unit, including an acknowledgment signal, transmitted from the mobile pager unit. It would have been obvious to one of skill in the art to combine the radio frequency transmitter of the mobile unit in Gutman with the request for retransmission function of Akiyama *See, e.g.*, "*In practicing the invention, a paging system is provided wherein a plurality of associated paging receivers have the capability of automatic acknowledging-back and wherein such pagers are further provided with visual and audible indicator means, along with* ***a manual operating button for a further manual acknowledge back response***." Gutman 2:35-42

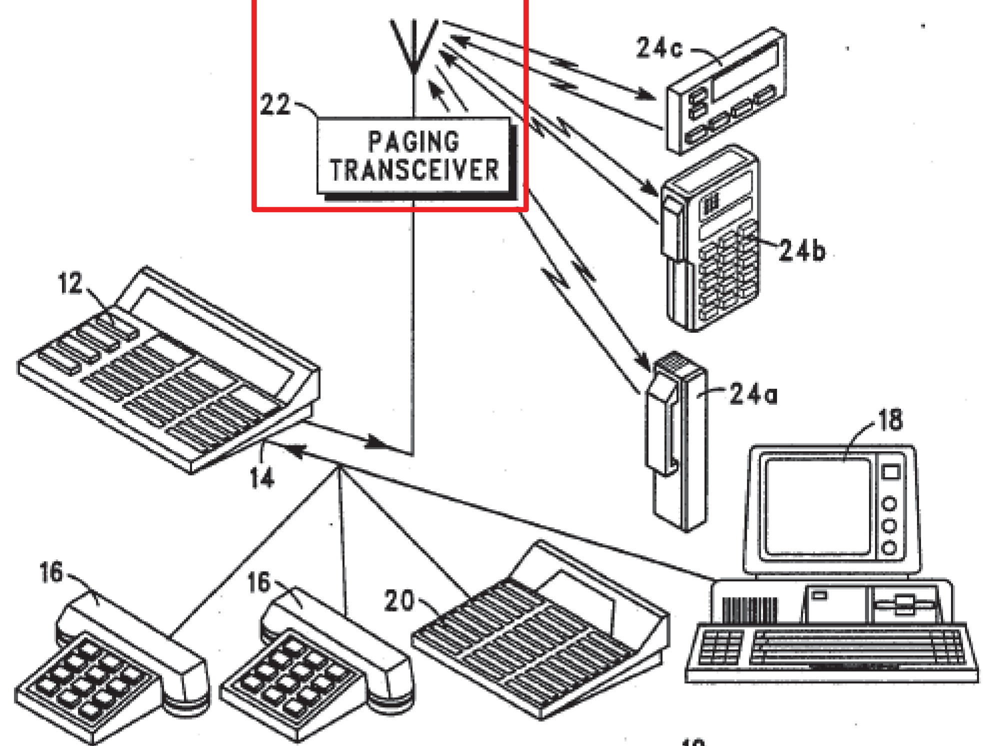
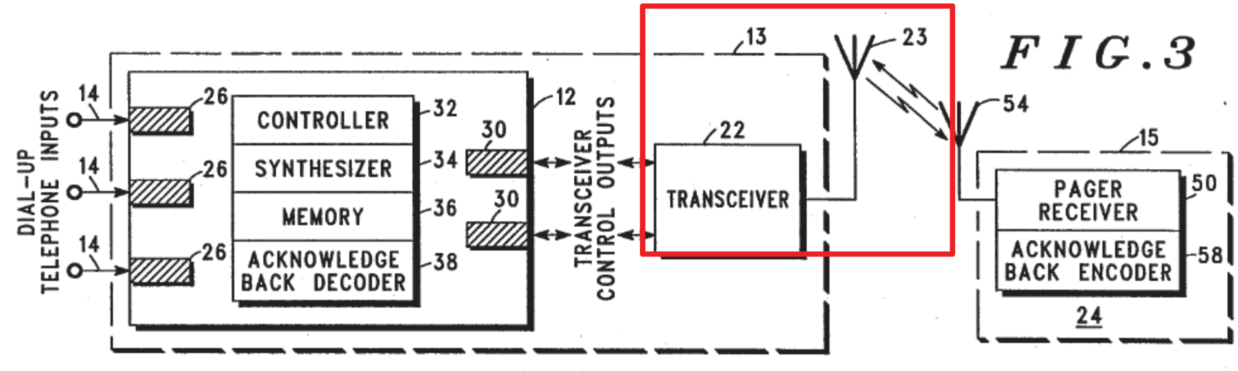
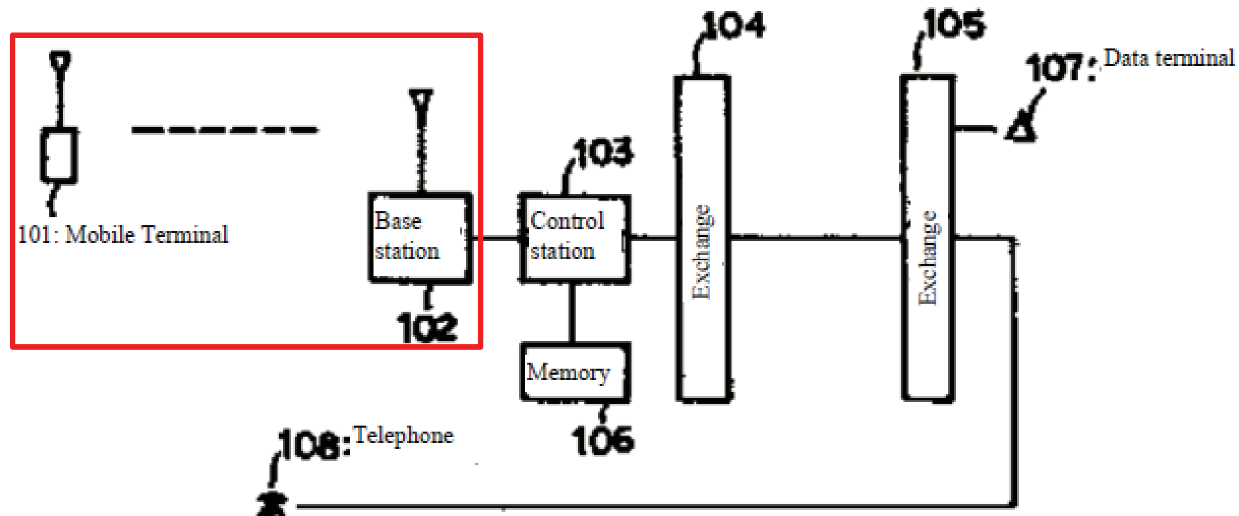


FIG.1

Gutman Fig. 1

	 Gutman Fig. 3
7(C) means for retransmitting radio frequency signals containing the portion of the message to the mobile unit.	Akiyama discloses a pager system where the paging network retransmits a portion of a message from the wireless base station transmitter and antenna to the mobile pager unit. *See, e.g.*, "*Upon receiving this signal, the control station 103 searches the content of the memory 106 on the basis of the mobile terminal number, the data number, and the frame number that have been received,* ***and then retransmits the incorrect frame to the mobile terminal 101 via the base station 102 and the wireless communication line. The mobile terminal 101 sees from the data number that this data is a retransmission of previously received data****, and stores the newly received data in a memory area for already-stored data numbers. If there are frames with errors after error correction and detection, the display indicates that there are errors, as during the first reception, and requests retransmission again through the telephone if needed.* ***If it is seen that all the frames were able to be received without errors after error correction, then this is displayed to the display section 304 to notify the mobile terminal owner****.*" Akiyama at 3

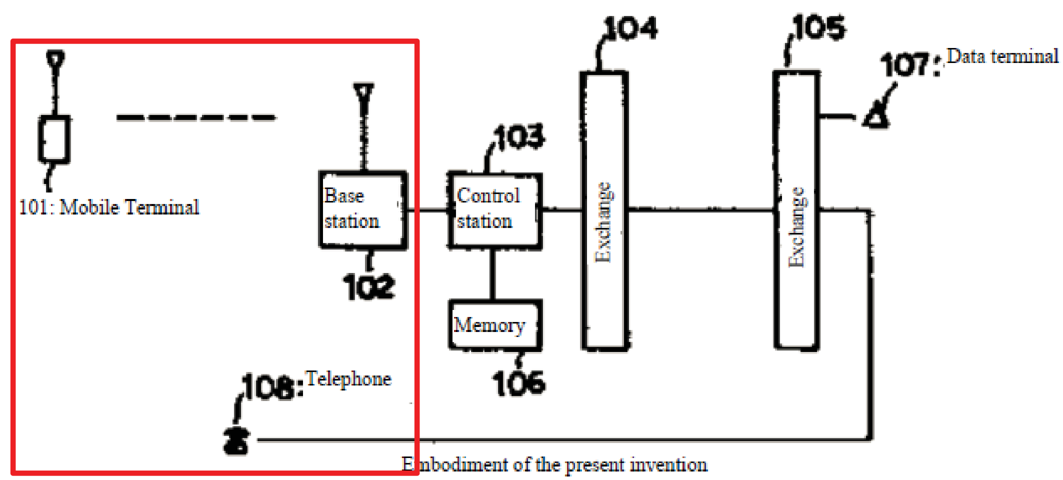


Embodiment of the present invention

FIG. 1

Akiyama Fig. 1

Claim 8	Akiyama combined with Gutman
8(P) A method for receiving and transmitting messages at a mobile unit, comprising the steps of:	Akiyama discloses a pager system with a mobile unit that receives wireless signals from a network base station. Akiyama also discloses transmitting messages to the paging network control station through a phone line. *See, e.g.*, “*A feature of the present invention for attaining this object is* ***a message transmission system comprising a mobile terminal, a wireless base station, and a control station, using one-way wireless communication lines that transmit data from the control station to the mobile terminal via the wireless base station****, wherein the data transmitted from the control station is divided into a plurality of frames, a mobile terminal number, a data number, and a frame number are attached to each frame before being transmitted, and transmitted frames are held by*

	the control station for a fixed amount of time, the mobile terminal checks whether or not the frames were able to be received without error, and, if a frame with an error is identified, stores the data number and the frame number thereof, and visibly displays the data number and the frame number in the mobile terminal, ***a mobile terminal holder electrically or acoustically couples the mobile terminal to a general telephone network to transmit to the control station the mobile terminal number, the data number, and the number of the frame where the error occurred****, the control terminal retransmits only the mobile terminal number, the data number, and the error frame number, and the mobile terminal visibly displays the data of the frames which were initially correctly received and of the retransmitted frame in frame number order.*" Akiyama at 2.  FIG. 1 Akiyama Fig.1 Additionally, Gutman discloses this limitation. Gutman discloses a two-way paging system where the pagers have an ability to receive paging messages and transmit acknowledgements back to the base station using radio frequency signals. It would have been obvious to one of

ordinary skill in the art to combine the wireless transmit circuitry of Gutman with the retransmit request transmitter in Akiyama such that the retransmit request could be transmitted wirelessly rather than over a phone line. *See, e.g.*,

“*Referring now to the drawings **a paging system** is shown in FIG. 8, which system has been here constructed in accordance with the present, invention and includes the capability of automatic as well as **manual acknowledge back (ACK-BACK) signal response**.*”

Gutman 3:29-33

“*Console terminal 12 will process the paging request, extract the appropriate address from internal memory and activate t**he paging transmitter 22 to broadcast the intended paging call**, and **which in turn is received by the appropriate system pager** for processing the information and alerting the paging receiver wearer or user.*”

Gutman 3:41-46

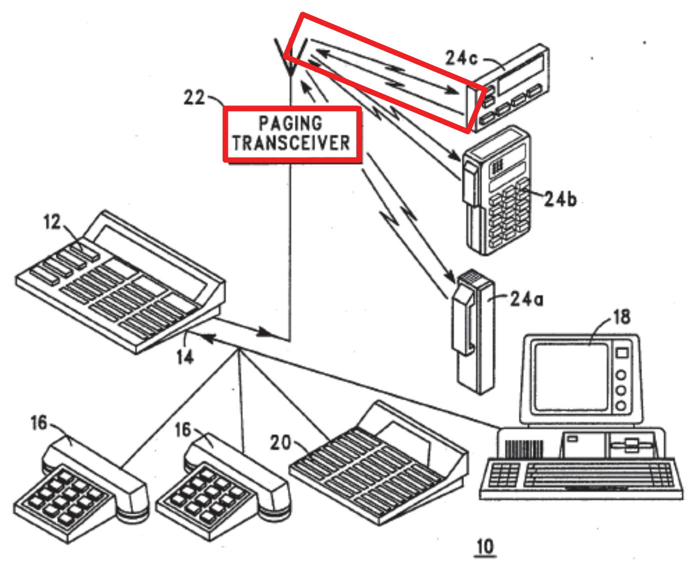
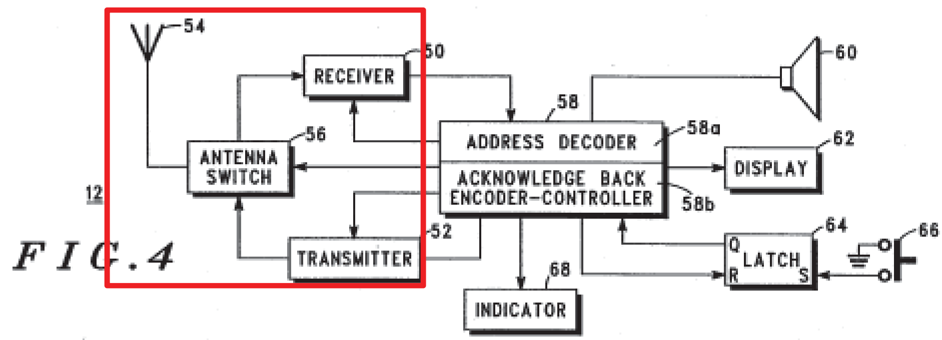


FIG.1

	Gutman Fig. 1  Gutman Fig. 4
8(A) receiving at the mobile unit a radio frequency message;	Akiyama discloses a pager system with a mobile unit that receives wireless signals from a network base station. Akiyama discloses a wireless section and an antenna that are used to receive the wireless message from the paging network. *See, e.g.*, "*A feature of the present invention for attaining this object is* ***a message transmission system comprising a mobile terminal, a wireless base station, and a control station, using one-way wireless communication lines that transmit data from the control station to the mobile terminal via the wireless base station****…*" Akiyama at 2 "***The transmission data is sent from the base station 102 to the mobile station 101 over the wireless communication line. In the mobile station 101, the wireless section 301 in FIG. 3 performs reception and demodulation*** *(400 in FIG. 4), and the control section 302 corrects any errors using the error correction detection code 206 (402).*" Akiyama at 2-3

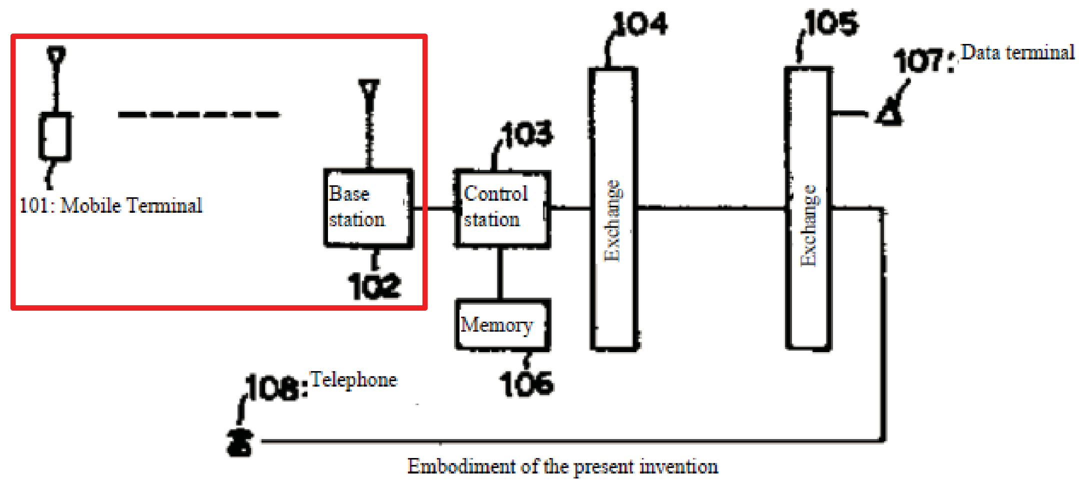
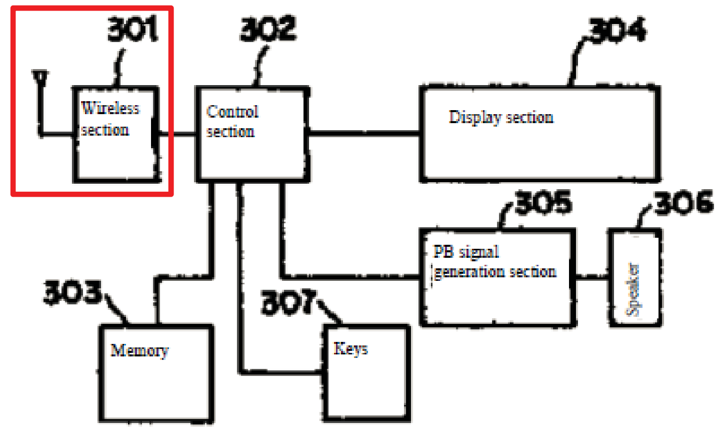
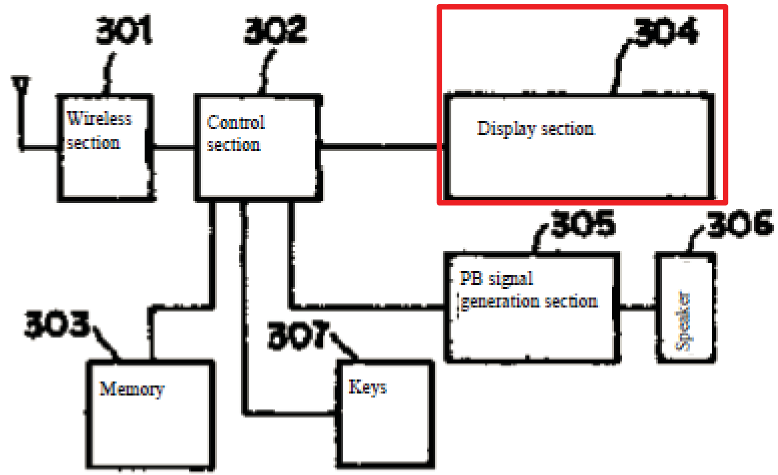


FIG. 1

Akiyama Fig. 1

	 Block diagram of mobile terminal FIG. 3 Akiyama Fig 3
8(B) displaying said message on the mobile unit;	Akiyama discloses a pager system with a mobile unit includes a display for displaying the received page messages. *See, e.g.*, "*Once all the frames in one data number have been received, the control section 302 emits a ring tone (408) as needed,* ***and displays the data to the display section 304 (410)****. Whether all the frames have been received or not can easily be established by including a number indicating an order of frames and how many frames have been transmitted in the frame number.* ***If there are any frames that contain errors in the display data, the fact that there is an error is also displayed****.* ***For the error display****, several methods are conceivable, including* ***displaying everything including the incorrect data****, and causing the frames with incorrect data to blink, indicating through writing or the like that there are incorrect frames without displaying the data, and so on.*" Akiyama at 3

<table>
<tr><td></td><td>

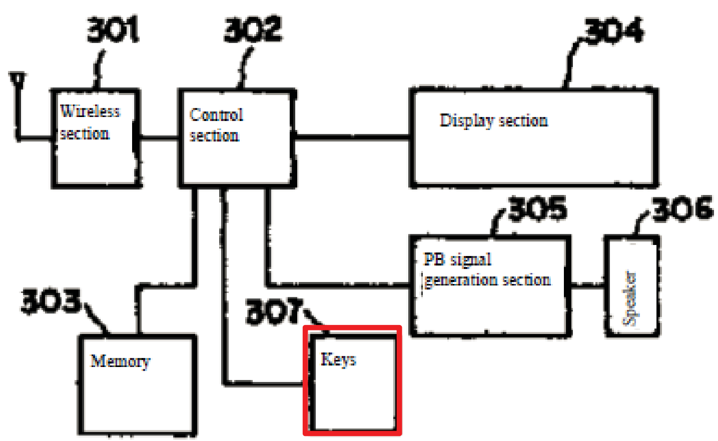
Block diagram of mobile terminal
FIG. 3

Akiyama Fig. 3</td></tr>
<tr><td>8(C) receiving an indication of a portion of the displayed message for which a user desires retransmission;</td><td>Akiyama discloses a pager system where the pager displays an indicator for portions of a message with errors and includes a button that can be pressed by a user to transmit a request for retransmission of only the portion of the message with errors. See, e.g.,

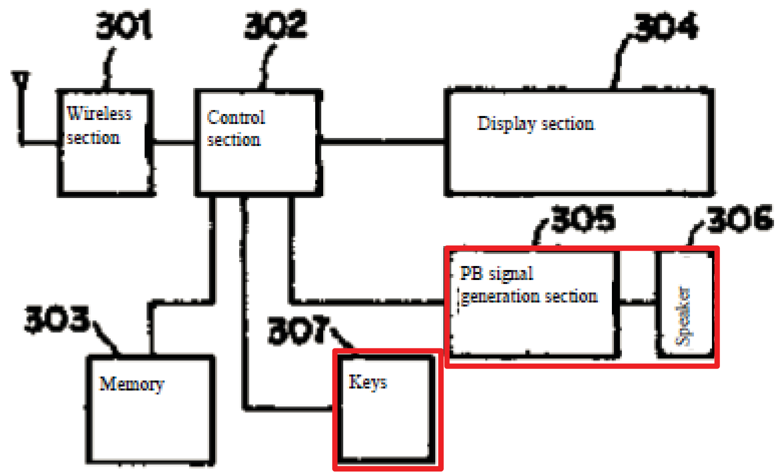
"If there are any frames that contain errors in the display data, the fact that there is an error is also displayed. For the error display, several methods are conceivable, including displaying everything including the incorrect data, and causing the frames with incorrect data to blink, indicating through writing or the like that there are incorrect frames without displaying the data, and so on."

Akiyama at 3

"The mobile terminal owner sees these displays and if he or she desires to receive correct data,</td></tr>
</table>

	he or she goes to a nearby telephone 108 as in FIG. 1, and…Upon hearing this, ***the mobile terminal owner presses the data transmission key in the keys 307*** *(420), upon which the control section 302 reads the data number, the frame number, and its own mobile terminal number for the data that is experiencing the error from the memory 303, drives the PB signal generation section 305, and transmits the data through the speaker 306 (422). If there are a plurality of frames with errors, a plurality of frame numbers are transmitted."* Akiyama at 3 "***Upon receiving this signal****, the control station 103 searches the content of the memory 106 on the basis of the mobile terminal number, the data number, and the frame number that have been received,* ***and then retransmits the incorrect frame to the mobile terminal 101 via the base station 102 and the wireless communication line****.*" Akiyama at 3  Block diagram of mobile terminal FIG. 3 Akiyama Fig. 3

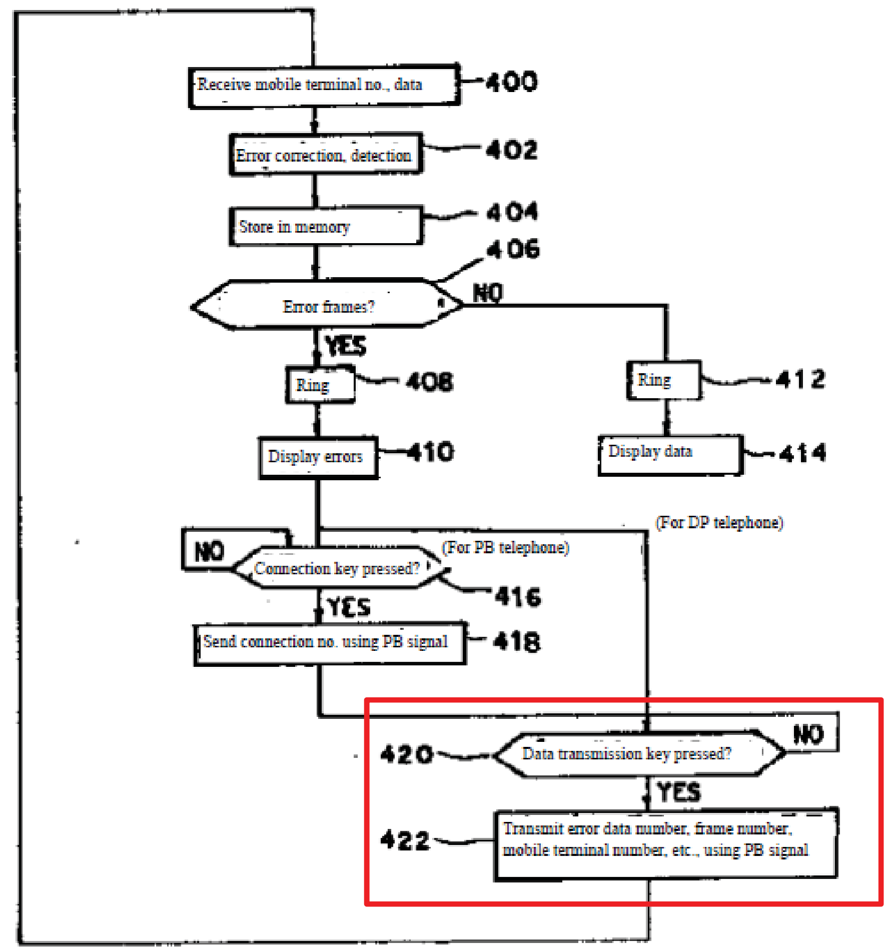
8(D) transmitting, only upon receipt of the indication, a signal requesting retransmission of said indicated portion of said message;	Akiyama discloses a pager system where the pager includes transmitting a signal to the paging network control station requesting retransmission of a portion of a message only after a user presses the transmission key. *See, e.g.*, "*Upon hearing this,* ***the mobile terminal owner presses the data transmission key in the keys 307 (420), upon which the control section 302 reads the data number, the frame number, and its own mobile terminal number for the data that is experiencing the error from the memory 303****, drives the PB signal generation section 305,* ***and transmits the data through the speaker*** *306 (422). If there are a plurality of frames with errors, a plurality of frame numbers are transmitted.*" Akiyama at 3 "*In the above description, a method was described in which a mobile terminal owner acoustically couples a mobile terminal to a telephone and automatically transmits a data number, frame number, and a mobile terminal number with an error,* ***but it is also possible to provide a special terminal to the telephone and transmit the data electromagnetically****, instead of using acoustic coupling.*" Akiyama at 3



Block diagram of mobile terminal

FIG. 3

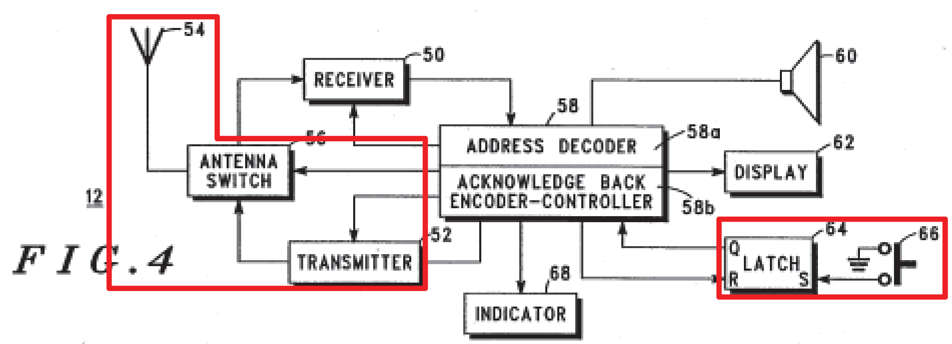
Akiyama Fig. 3



Operation flow of mobile terminal

FIG. 4

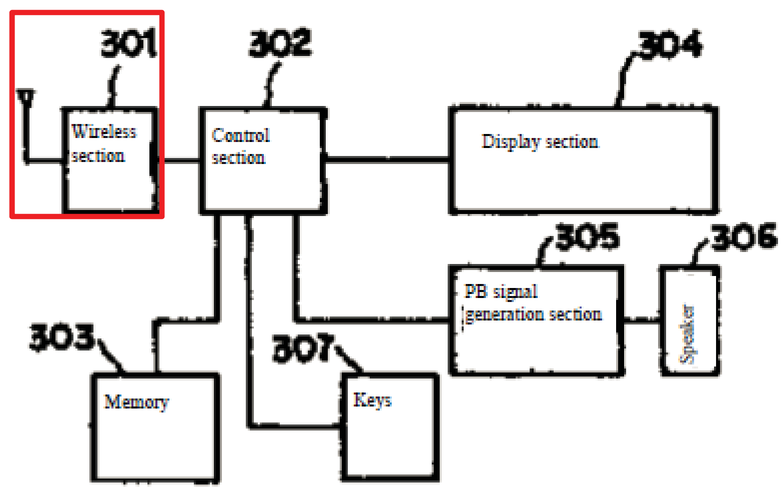
Akiyama Fig. 4

	Additionally, Gutman discloses a wireless transmitter unit that is used to transmit acknowledgments back to the communications network if the user activates a switch or button on the paging device. It would have been obvious to one of ordinary skill in the art to combine the wireless transmitter of Gutman with the retransmission request function of Akiyama *See, e.g.*, "*In practicing the invention, a paging system is provided wherein a plurality of associated paging receivers have the capability of automatic acknowledging-back and wherein such pagers are further provided with visual and audible indicator means,* ***along with a manual operating button for a further manual acknowledge back response***." Gutman 2:35-42 "*The pager-side 15 of system 10 comprises the paging receiver portion 50, the included ack-back encoder 58 and* ***associated antenna 54****. A more detailed representation of a system pager is shown in FIG. 4. In addition to the foregoing, the overall pager unit 24 further includes* ***an antenna switch 56****,* ***a transmitter portion 52****, a speaker 60, a display 62, if of the numeric or alphanumeric type, and a latch 64* ***and manual button 66 coupled to the ack-back encoder-controller 58b*** *and a manual response indicator 68.*" Gutman 4:28-34  Gutman Fig. 4

<table>
<tr>
<td>8(E) receiving a retransmission of said indicated portion; and</td>
<td>Akiyama discloses a pager system where the mobile pager unit receives a retransmission of a portion of a message. See, e.g.,

"The mobile terminal 101 sees from the data number that this data is a retransmission of previously received data, and stores the newly received data in a memory area for already-stored data numbers. If there are frames with errors after error correction and detection, the display indicates that there are errors, as during the first reception, and requests retransmission again through the telephone if needed. If it is seen that all the frames were able to be received without errors after error correction, then this is displayed to the display section 304 to notify the mobile terminal owner."

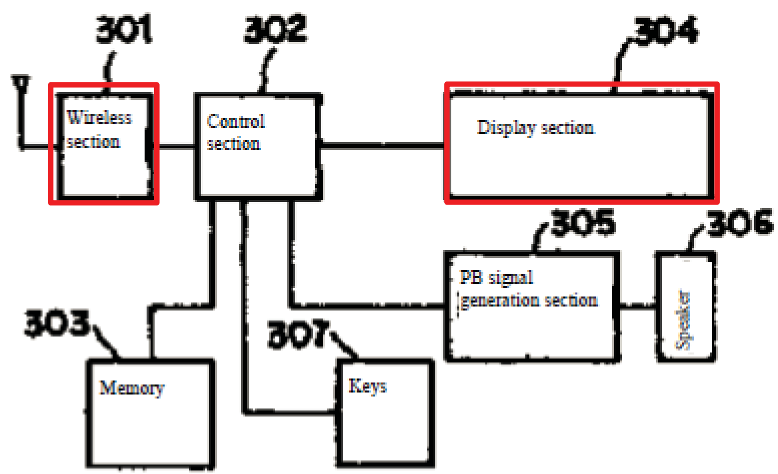
Akiyama at 3



Block diagram of mobile terminal

FIG. 3

Akiyama Fig. 3</td>
</tr>
</table>

8(F) displaying the received retransmission of said indicated portion on the mobile unit.	Akiyama discloses a pager system where the mobile pager unit displays the received retransmission of a portion of a message. *See, e.g.*, "***The mobile terminal 101 sees from the data number that this data is a retransmission of previously received data, and stores the newly received data*** *in a memory area for already-stored data numbers. If there are frames with errors after error correction and detection, the display indicates that there are errors, as during the first reception, and requests retransmission again through the telephone if needed.* ***If it is seen that all the frames were able to be received without errors after error correction, then this is displayed to the display section 304 to notify the mobile terminal owner***." Akiyama at 3  Block diagram of mobile terminal FIG. 3 Akiyama Fig. 3

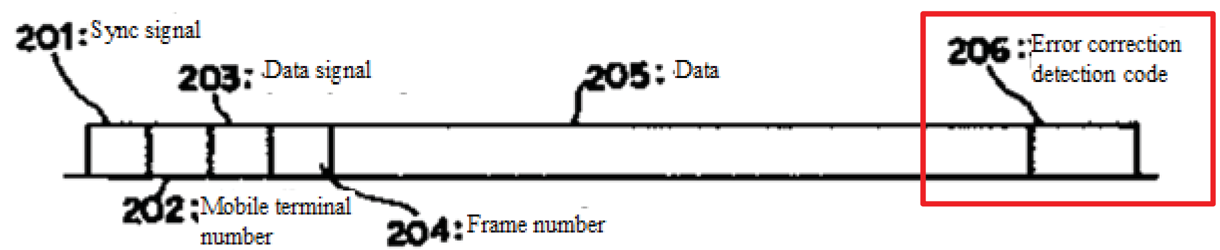
Appendix C
U.S. Patent No. 5,754,946 in view of Japanese Unexamined Patent Application H2-213237 (“Akiyama”) in combination with U.S. Patent No. 4,940,963 (“Gutman”)

<table>
<tr><th>Claim 9</th><th>Gutman combined with Akiyama</th></tr>
<tr><td>9(A) The method according to claim 8, further comprising the step of:

detecting errors in the received message; and</td><td>Akiyama discloses a paging system where the pager device includes a control section that detects errors in the received message. See, e.g.,

“The transmission data is sent from the base station 102 to the mobile station 101 over the wireless communication line. In the mobile station 101, the wireless section 301 in FIG. 3 performs reception and demodulation (400 in FIG. 4), and the control section 302 corrects any errors using the error correction detection code 206 (402). If it is found that there are no errors, the data number 203, the frame number 204, and the data 205 are stored in the memory 303 (404). If there are errors, a symbol is attached indicating that there is an error, and this is similarly stored in the memory 303.”

Akiyama at 2-3



Signal frame format

FIG. 2

Akiyama Fig. 2</td></tr>
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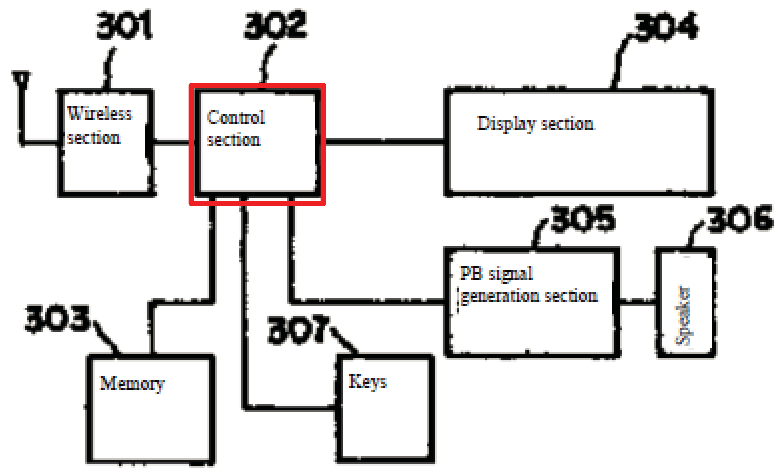
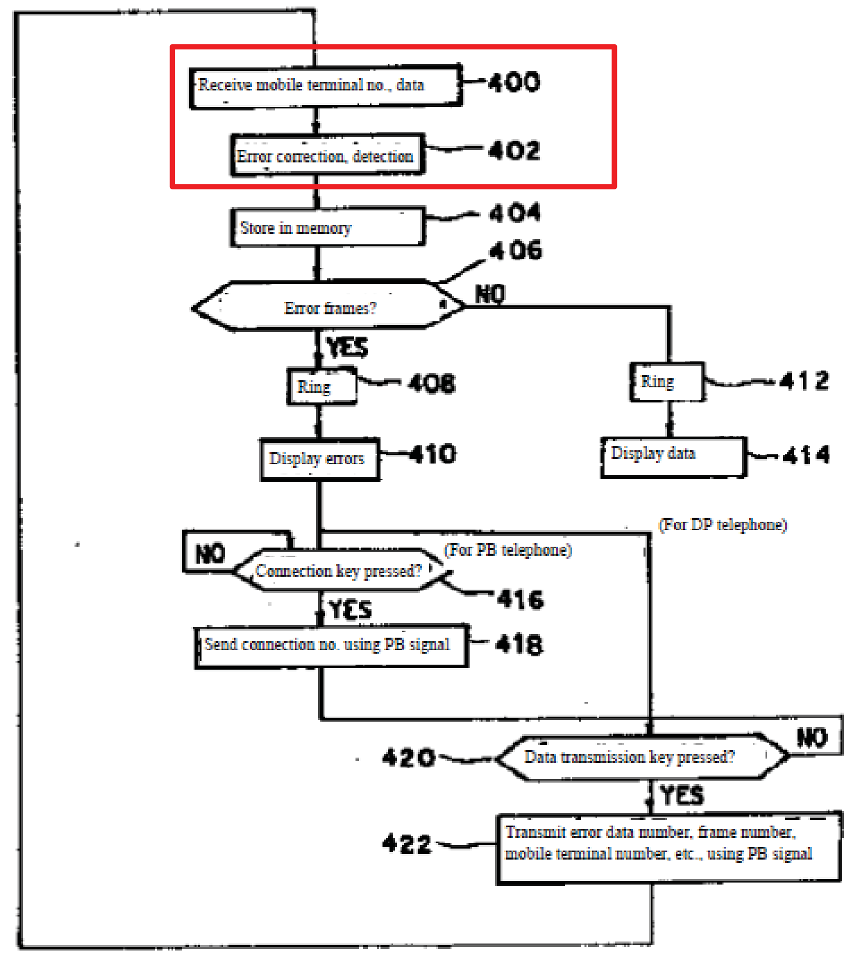
<tr><td></td><td>

Block diagram of mobile terminal

FIG. 3

Akiyama Fig. 3</td></tr>
</table>

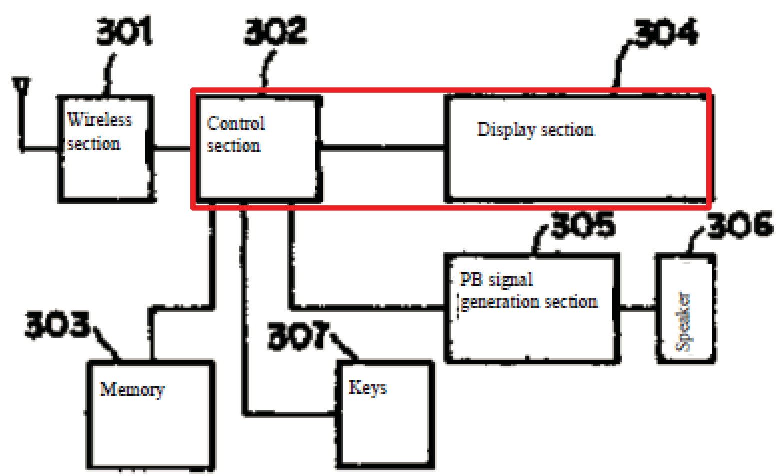
	 Operation flow of mobile terminal FIG. 4 Akiyama Fig. 4

<table>
<tr><td>9(B) wherein the step of displaying comprises the substep of:

highlighting said errors in the message on the mobile unit.</td><td>Akiyama discloses a pager system where the pager display includes an indicator that a portion or portions of a message have errors. The portions with an error will be highlighted by causing that section of the message to blink, or indicating in writing that there are errors. See, e.g.,

"If there are any frames that contain errors in the display data, the fact that there is an error is also displayed. For the error display, several methods are conceivable, including displaying everything including the incorrect data, and causing the frames with incorrect data to blink, indicating through writing or the like that there are incorrect frames without displaying the data, and so on."

Akiyama at 3



Block diagram of mobile terminal

FIG. 3

Akiyama Fig. 3</td></tr>
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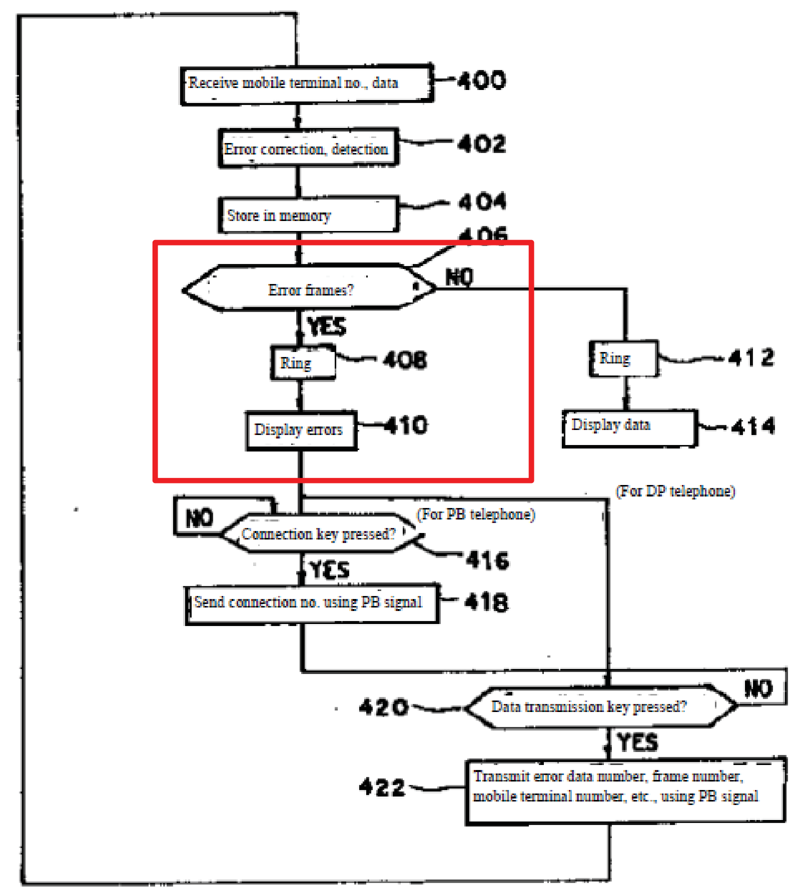
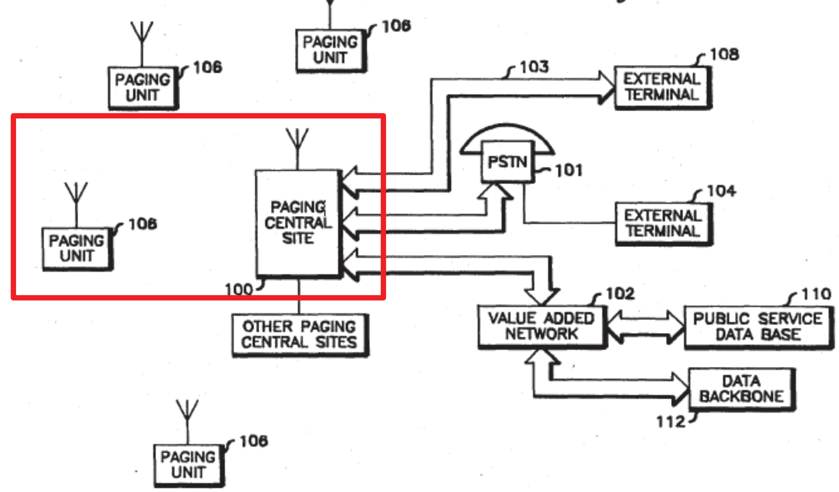


Operation flow of mobile terminal

FIG. 4

Akiyama Fig. 4

APPENDIX D

Claim 1	U.S. Patent 4,644,351 (“Zabarsky”) in view of U.S. Patent No. 5,311,516 (“Kuznicki”)
1(P) A mobile unit for transmitting and receiving radio frequency signals to and from a communications network comprising:	Zabarsky in view of Kuznicki discloses a mobile unit for transmitting and receiving radio frequency signals to and from a communications network. *See, e.g.*, Fig. 1  Zabarsky Fig. 1. “This invention relates generally to radio paging systems and more particularly to a two-way radio personal data message system in which a miniature transceiver is carried by an individual for presentation of messages to that individual and for transmission of messages to a central site for relay to another individual or to a data base.” Zabarsky 1:6-12. “A communications system for carrying messages via a radio channel between one central site of a plurality of central sites and a plurality of two-way remote data units is disclosed.”

	Zabarsky Abstract.
1(A) means for receiving a radio frequency message from the network;	Zabarsky in view of Kuznicki discloses a means for receiving a radio frequency message from the network. *See, e.g.*, "It is desirable that the pager of the preferred embodiment include two antennas of dissimilar receiving characteristics such as that described by Kneisel et al. in U.S. patent application Ser. No. 511,430 (Homotropic Antenna System for Portable Radio) filed on July 6, 1983 and assigned to the assignee of the present application. A single antenna pager may be used, however, without departing from the spirit and scope of the present invention. A duplexer 1021 of commercial availability couples the transceiver transmitter 1023 and receiver 1025 to one antenna with minimal interaction and a second antenna is coupled directly to the receiver 1025. The receiver output signal is filtered (in conventional bandpass filter 1027) and limited (in conventional limiter 1029) before being passed to the MPU 1001 bus via I/O 1017." Zabarsky 13:2-18.
1(B) a display for displaying said message;	Zabarsky in view of Kuznicki discloses a display for displaying said message. *See, e.g.*,

<table>
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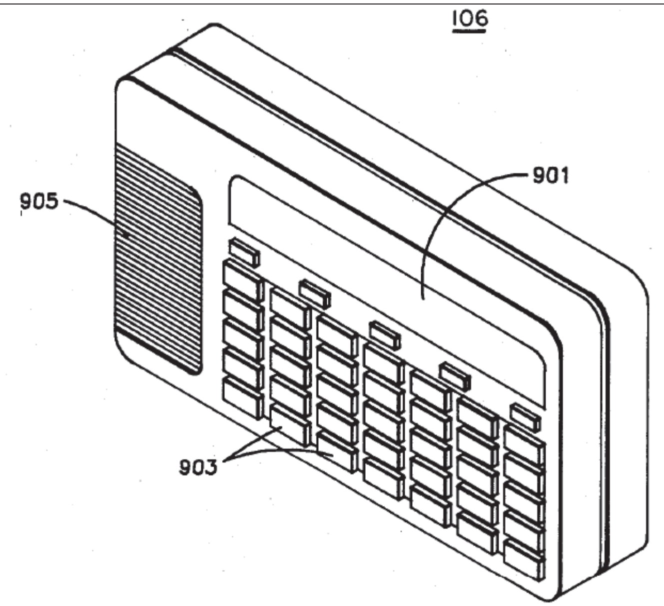


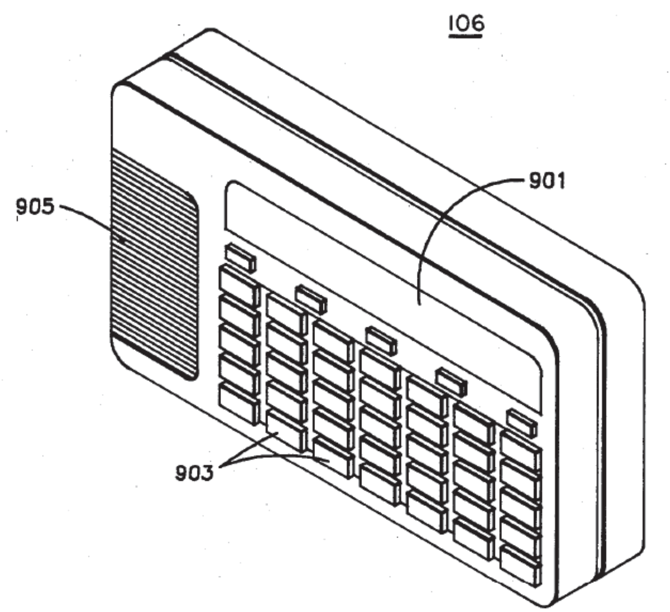
Fig. 9

Zabarsky Fig. 9.

“The pager unit 106 of the preferred embodiment is shown in FIG. 9. Preferrably it has a back-lit LCD alphanumeric display 901 with two lines of 16 characters per line for message display.”

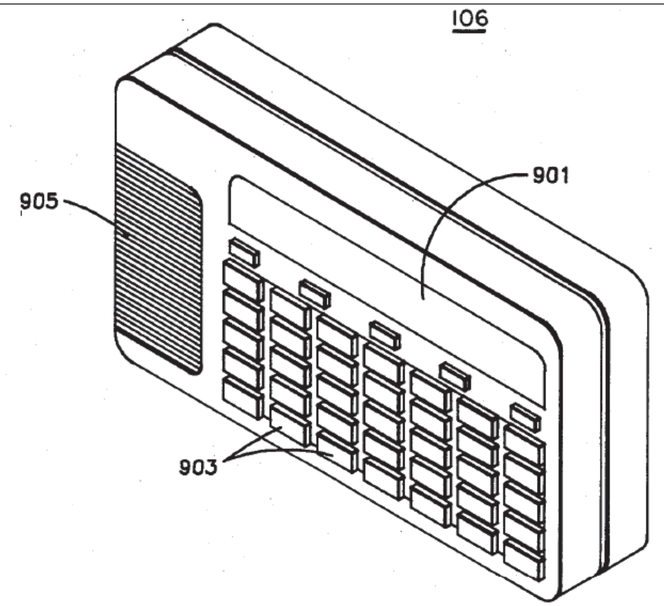
Zabarsky 12:9-12.

“Message readout is accomplished via the alphanumeric display 901 either at the time of message reception or upon activation of the appropriate function key thereby causing the MPU 1001 to retrieve the message from the RAM memory 1005 and place it on the display 901 sixteen characters at a time. Additional characters may be shifted into the
</td>
</tr>
</table>

	display replacing those already displayed as desired." Zabarsky 13:21-27.
1(C) a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network;	Zabarsky in view of Kuznicki discloses a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network. *See, e.g.*,  *Fig. 9* Zabarsky Fig. 9. "A 5×7 matrix of elastomeric switches and keys corresponding to alphanumeric symbols form the keypad 903, and 5 additional function keys are located above keypad 903."

	Zabarsky 12:12-15. “There is, of course, the possibility of the automatic acknowledgement not being received for a number of reasons, for example the pager being out of range of central site or missing the message address because of a radio channel fade. A pager may retrieve these messages by inquiring into whether any "missed" messages exist for it.” Zabarsky 10:42-48. “In order to recall a message stored at the home central site, the user may enter a request for the unacknowledged messages to be sent to the pager. This request in the preferred embodiment consists of a unique series of keypad entries and the pushing of the transmit function key.” Zabarsky 14:67-15:4. Zabarsky discloses the pager requesting retransmission of entire pages without regard to whether any one of those pages constitutes all or less than all of a message. It would have been obvious to combine Zabarsky with U.S. Patent No. 5,311,516 (“Kuznicki”), which discloses that it is advantageous to deliver larger messages by fragmenting them into multiple smaller communications so that the page retransmissions in Zabarsky may constitute a part of a larger message. “This message packet decoding protocol allows the terminal 102 in the communication system to redistribute traffic of long messages over a combination of multiple frames, or multiple phases, or multiple communication channels, as will be more fully discussed below. By creating smaller packets 1610 of message information and distributing these over one or more frames as needed, the terminal 102 can better manage the message traffic to the communication receivers 106. For example, if an emergency message needs to be transmitted over a communication channel the terminal 102 can packetize a long message into smaller message packets and fit the emergency message into the current frame along with one or more of the smaller packets of the fragmented message. Hence, long messages can be reduced to a number of short message packets and transmitted over one or more frames to distribute the traffic over the communication

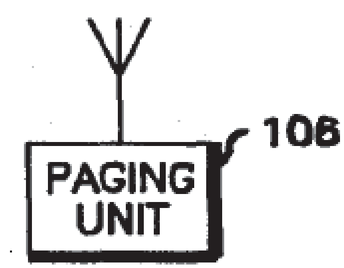
	channel. In this way, other messages can also at least partially be transmitted during the current frame as necessary. Additionally, by sending shorter message packets the probability of fading errors corrupting a portion of the message can be reduced." Kuznicki 19:41-63. "A selective call receiver (106) receives one or more message packets of a transmitted fragmented message, where each of the one or more message packets includes an address (1605) and message data (1610), and the message data (1610) includes an indication (1702) of whether more message packets are to be received for the fragmented message." Kuznicki Abstract.
1(D) means for transmitting, only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message; and	Zabarsky in view of Kuznicki discloses a means for transmitting, only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message. *See, e.g.*,

	 *Fig. 9* Zabarsky Fig. 9. “A 5×7 matrix of elastomeric switches and keys corresponding to alphanumeric symbols form the keypad 903, and 5 additional function keys are located above keypad 903.” Zabarsky 12:12-15. “There is, of course, the possibility of the automatic acknowledgement not being received for a number of reasons, for example the pager being out of range of central site or missing the message address because of a radio channel fade. A pager may retrieve these messages by inquiring into whether any "missed" messages exist for it.”

Zabarsky 10:42-48.

“In order to recall a message stored at the home central site, the user may enter a request for the unacknowledged messages to be sent to the pager. This request in the preferred embodiment consists of a unique series of keypad entries and the pushing of the transmit function key.”

Zabarsky 14:67-15:4.



Zabarsky Fig. 1.

“It is desirable that the pager of the preferred embodiment include two antennas of dissimilar receiving characteristics such as that described by Kneisel et al. in U.S. patent application Ser. No. 511,430 (Homotropic Antenna System for Portable Radio) filed on July 6, 1983 and assigned to the assignee of the present application. A single antenna pager may be used, however, without departing from the spirit and scope of the present invention. A duplexer 1021 of commercial availability couples the transceiver transmitter 1023 and receiver 1025 to one antenna with minimal interaction and a second antenna is coupled directly to the receiver 1025. The receiver output signal is filtered (in conventional bandpass filter 1027) and limited (in conventional limiter 1029) before being passed to the MPU 1001 bus via I/O 1017.”

<table>
<tr><td></td><td>Zabarsky 13:2-18.</td></tr>
<tr><td>1(E) means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display.</td><td>

Zabarsky in view of Kuznicki discloses a means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display. *See, e.g.*,

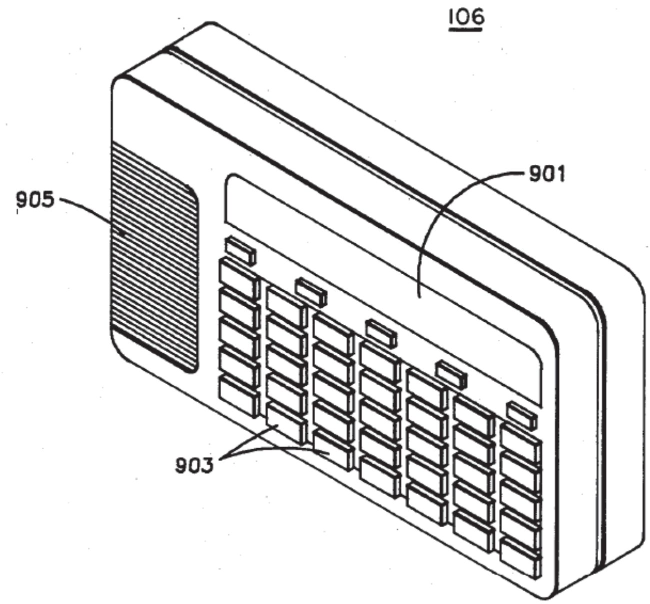


Fig. 9

Zabarsky Fig. 9.

“The pager unit 106 of the preferred embodiment is shown in FIG. 9. Preferrably it has a back-lit LCD alphanumeric display 901 with two lines of 16 characters per line for message display.”

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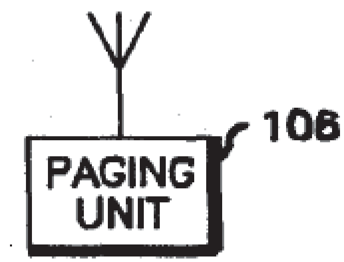
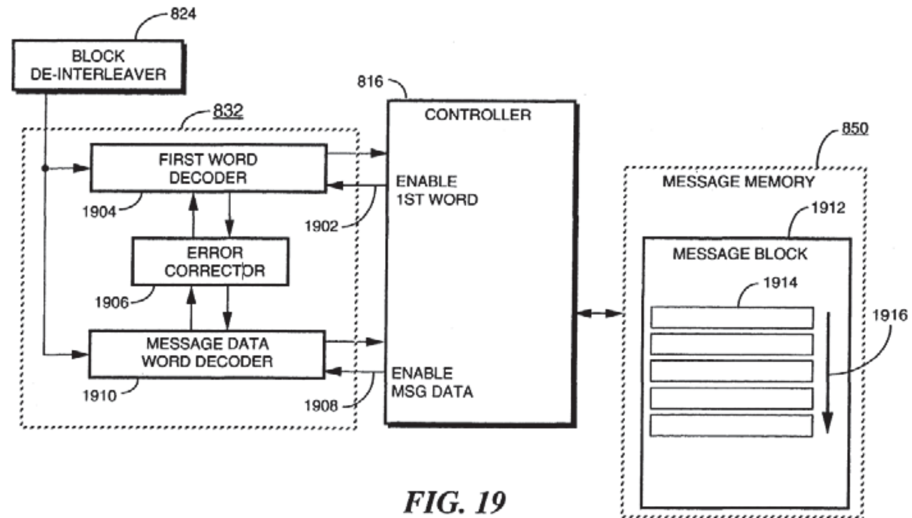
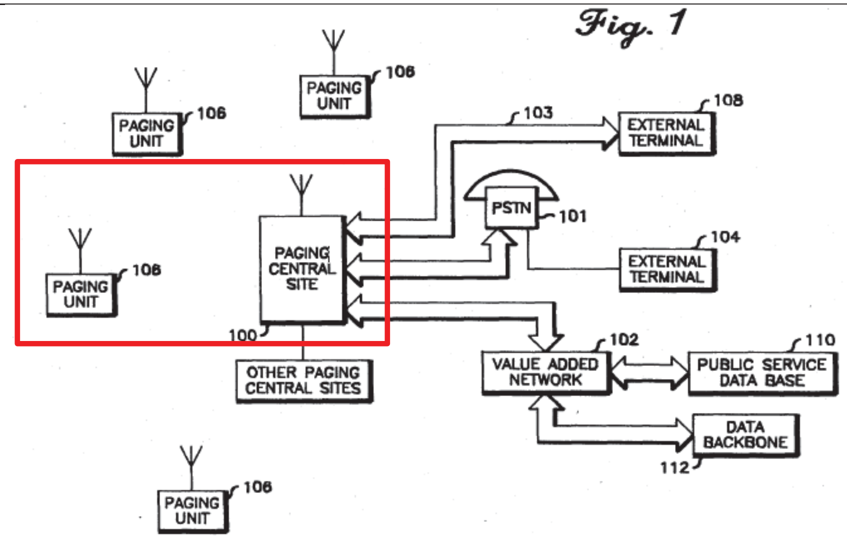
	Zabarsky 12:9-12. “Message readout is accomplished via the alphanumeric display 901 either at the time of message reception or upon activation of the appropriate function key thereby causing the MPU 1001 to retrieve the message from the RAM memory 1005 and place it on the display 901 sixteen characters at a time. Additional characters may be shifted into the display replacing those already displayed as desired.” Zabarsky 13:21-27.  Zabarsky Fig. 1. “It is desirable that the pager of the preferred embodiment include two antennas of dissimilar receiving characteristics such as that described by Kneisel et al. in U.S. patent application Ser. No. 511,430 (Homotropic Antenna System for Portable Radio) filed on July 6, 1983 and assigned to the assignee of the present application. A single antenna pager may be used, however, without departing from the spirit and scope of the present invention. A duplexer 1021 of commercial availability couples the transceiver transmitter 1023 and receiver 1025 to one antenna with minimal interaction and a second antenna is coupled directly to the receiver 1025. The receiver output signal is filtered (in conventional bandpass filter 1027) and limited (in conventional limiter 1029) before being passed to the MPU 1001 bus via I/O 1017.”

	Zabarsky 13:2-18.
Claim 2	**4,644,351 (“Zabarsky”) in view of U.S. Patent No. 5,311,516 (“Kuznicki”)**
2(A) The mobile unit of claim 1, further comprising: means for detecting errors in the received message,	Zabarsky in view of Kuznicki discloses a means for detecting errors in the received message. “To properly perform control functions, error detection is required to prevent any uncorrected bit errors from inadvertently causing an undesired function. This error protection is provided by dividing the 48-bit basic information unit 406 into two fields: a 32-bit command field and a 16-bit cyclic redundancy check (CRC) field. The cyclic redundancy check field is computed from the command field prior to transmission and later checked upon reception. The error detection code defined here is commonly used in the data communications industry, and is known as CRC-CCITT.” Zabarsky 7:66-8:9. “The controller 816 couples an enable first word output signal 1902 to an input of the data decoder 832 to indicate to a first word decoder 1904 that the data code word 1612 is present in the incoming data stream. The first word decoder 1904 captures the 32 bit data code 10 word 1612 and couples it to an error corrector 1906. The error corrector 1906 can correct up to a predetermined number of error bits, such as two error bits, in a data code word 1612.” Kuznicki 17:6-14.

	 *FIG. 19* Kuznicki Fig. 19. "Optionally, the communication receiver 106 can calculate a checksum 2914 over the range of decodes data codewords and compared to a transmitted checksum value 2916 to determine a transmission error. The communication receiver 106 can then flag errors in messages which can then be processed accordingly in presentation to a user of the communication receiver." Kuznicki 30:21-31. In addition, it would have been obvious to a person of ordinary skill to employ the admitted prior art of error correcting codes from the '946 patent. *See, e.g.*, "The slight offset of the carrier frequencies between the first and second transmitters causes a slow drift of the relative phase of the two signals, as shown in FIG. 3(D). When the signals are ±180° out of phase, the temporary dip in the amplitude signal may cause the loss of a few bits in the composite signal, at worst. These errors can be counteracted with a conventional error correcting code, such as is commonly known." Cameron '946 3:18-

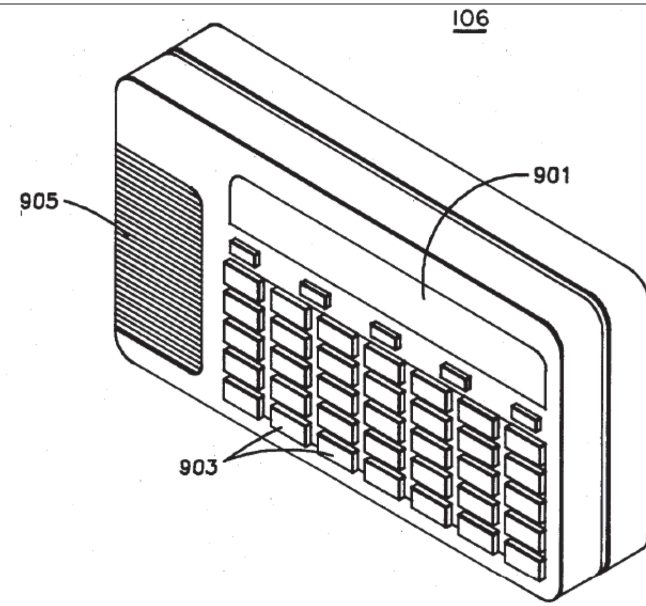
	25.
2(B) said display including means for highlighting said errors when the message is displayed on said display.	Zabarsky in view of Kuznicki discloses a means for highlighting said errors when the message is displayed on the display. "Optionally, the communication receiver 106 can calculate a checksum 2914 over the range of decodes data codewords and compared to a transmitted checksum value 2916 to determine a transmission error. The communication receiver 106 can then flag errors in messages which can then be processed accordingly in presentation to a user of the communication receiver." Kuznicki 30:21-31.
Claim 7	**4,644,351 ("Zabarsky") in view of U.S. Patent No. 5,311,516 ("Kuznicki")**
7(P) A communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network, the network comprising:	Zabarsky in view of Kuznicki discloses a communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network. *See, e.g.*,

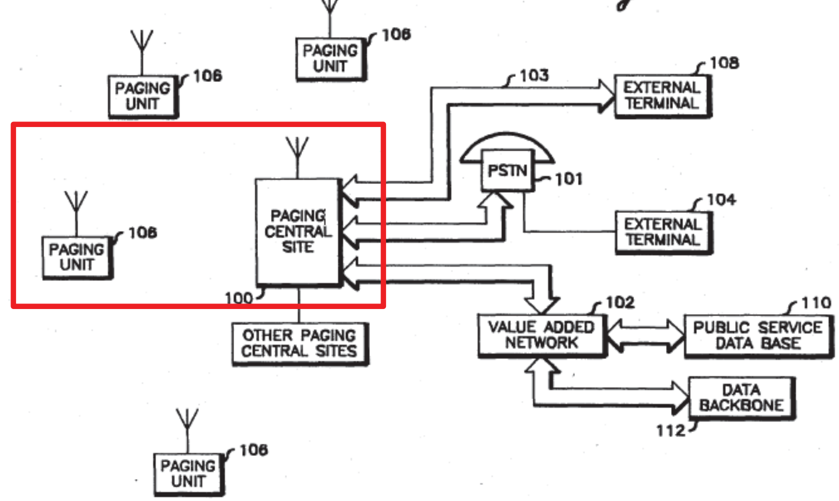


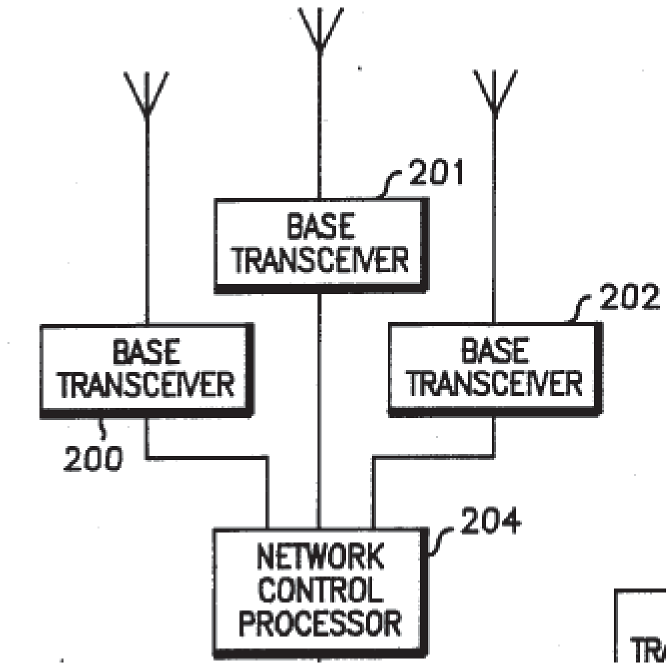
Zabarsky Fig. 1.

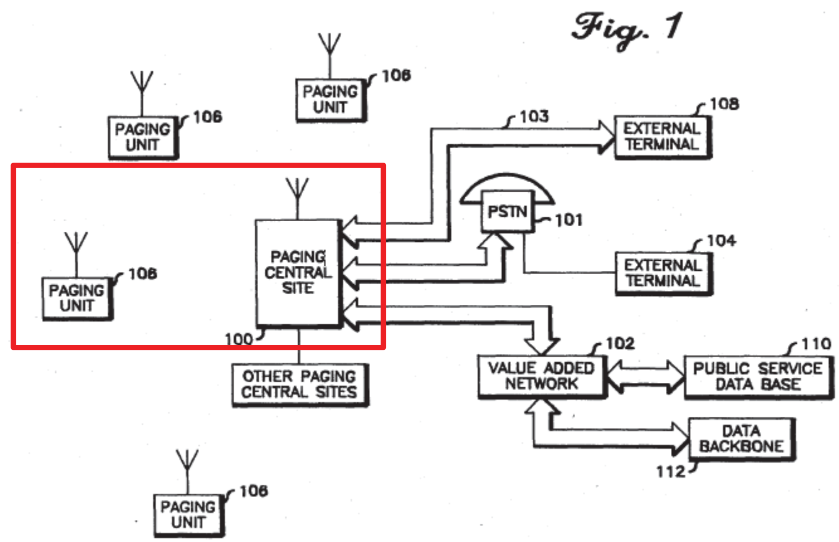
“This invention relates generally to radio paging systems and more particularly to a two-way radio personal data message system in which a miniature transceiver is carried by an individual for presentation of messages to that individual and for transmission of messages to a central site for relay to another individual or to a data base.”

Zabarsky 1:6-12.

	 *Fig. 9* Zabarsky Fig. 9. “The pager unit 106 of the preferred embodiment is shown in FIG. 9. Preferrably it has a back-lit LCD alphanumeric display 901 with two lines of 16 characters per line for message display.” Zabarsky 12:9-12. “Message readout is accomplished via the alphanumeric display 901 either at the time of message reception or upon activation of the appropriate function key thereby causing the MPU 1001 to retrieve the message from the RAM memory 1005 and place it on the display 901 sixteen characters at a time. Additional characters may be shifted into the display replacing those already displayed as desired.”

	Zabarsky 13:21-27. “There is, of course, the possibility of the automatic acknowledgement not being received for a number of reasons, for example the pager being out of range of central site or missing the message address because of a radio channel fade. A pager may retrieve these messages by inquiring into whether any "missed" messages exist for it.” Zabarsky 10:42-48. “In order to recall a message stored at the home central site, the user may enter a request for the unacknowledged messages to be sent to the pager. This request in the preferred embodiment consists of a unique series of keypad entries and the pushing of the transmit function key.” Zabarsky 14:67-15:4.
7(A) means for transmitting radio frequency signals containing a message to the mobile unit;	Zabarsky in view of Kuznicki discloses a means for transmitting radio frequency signals containing a message to the mobile unit. *See, e.g.*, *Fig. 1* 

	Zabarsky Fig. 1. “This invention relates generally to radio paging systems and more particularly to a two-way radio personal data message system in which a miniature transceiver is carried by an individual for presentation of messages to that individual and for transmission of messages to a central site for relay to another individual or to a data base.” Zabarsky 1:6-12.  Zabarsky Fig. 2. “The RF communications channel between the base transceiver and a pager is preferably comprised of first and second carrier signals which may be modulated with the message signals. The transmitters of the base transceivers 200, 201, 202 may each operate on

	unique first carrier signals in discrete radio coverage zones while the receivers of the transceivers may each operate on unique second but associated carrier signals in associated zones. The transmitters and receivers of the base transceivers 206, 207, 208 also utilize the unique but associated carrier signals which comprise a set of duplex radio channels enabling simultaneous transmission and reception of messages.” Zabarsky 5:39-51.
7(B) means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission;	Zabarsky in view of Kuznicki discloses a means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission. *See, e.g.*,  Zabarsky Fig. 1. “This invention relates generally to radio paging systems and more particularly to a two-way radio personal data message system in which a miniature transceiver is carried by an individual for presentation of messages to that individual and for transmission of messages to a central site for relay to another individual or to a data base.”

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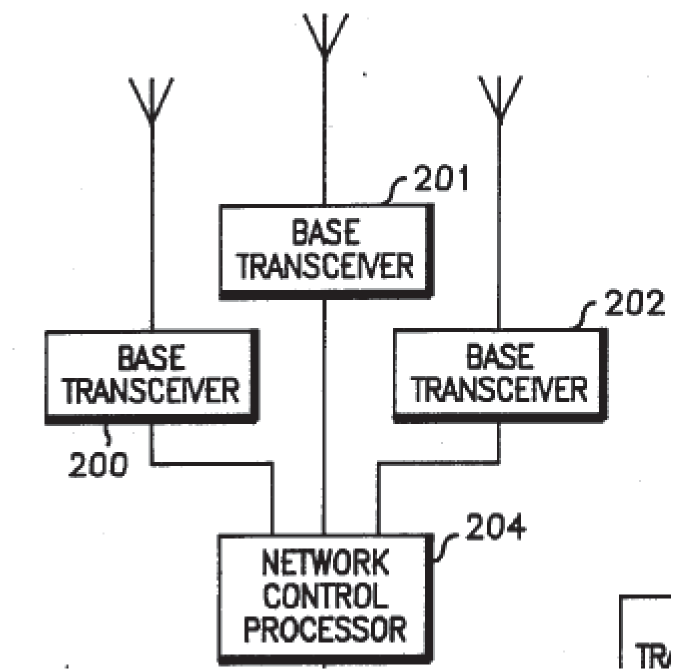
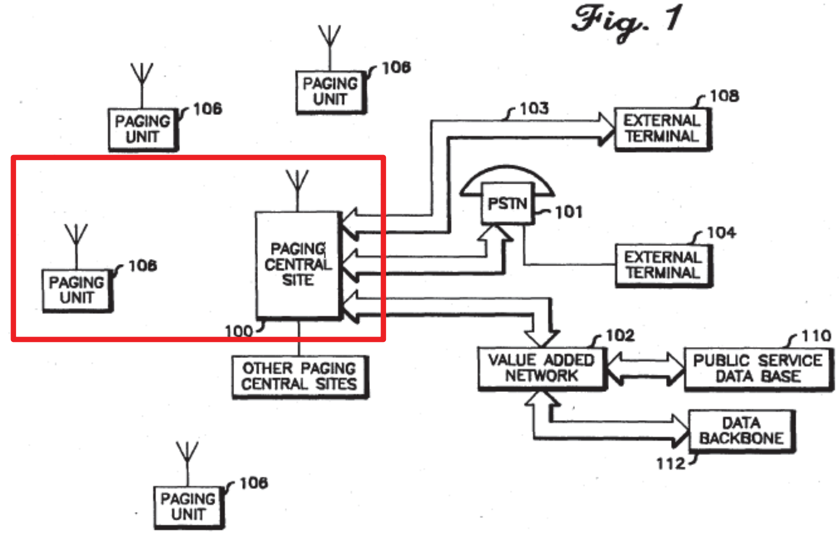
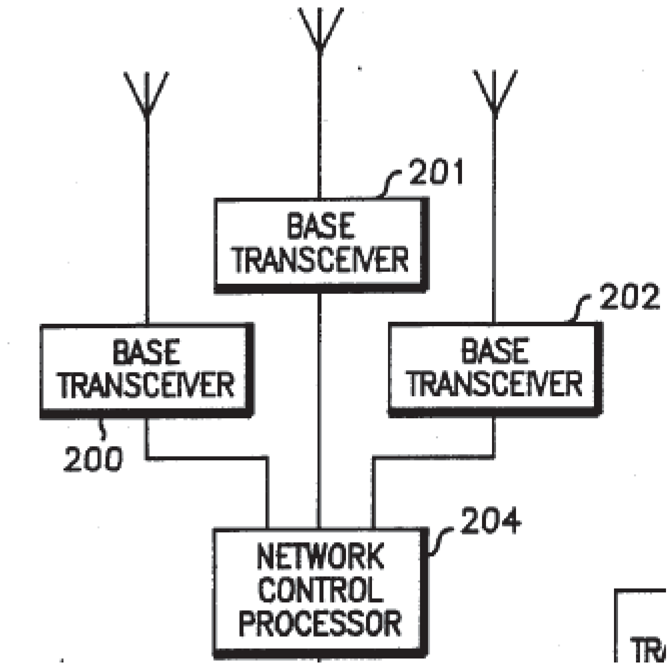
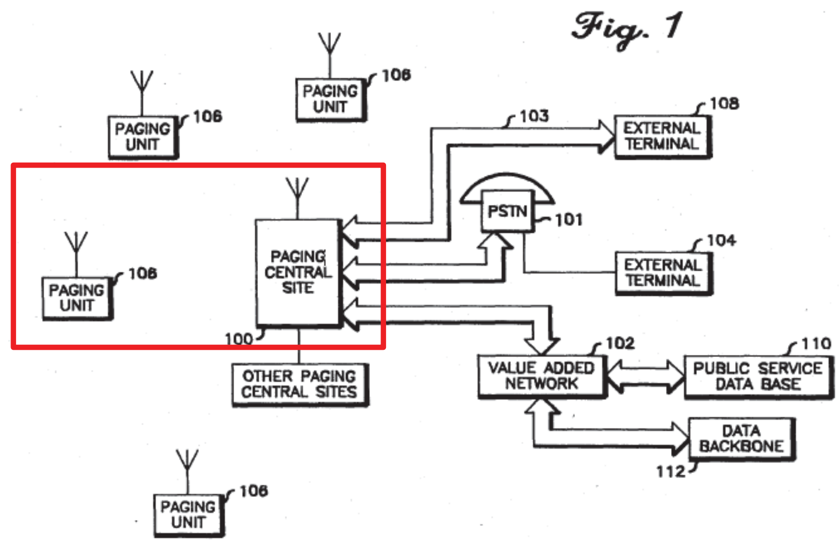
	
	Zabarsky Fig. 2.
	"The RF communications channel between the base transceiver and a pager is preferably comprised of first and second carrier signals which may be modulated with the message signals. The transmitters of the base transceivers 200, 201, 202 may each operate on unique first carrier signals in discrete radio coverage zones while the receivers of the transceivers may each operate on unique second but associated carrier signals in associated zones. The transmitters and receivers of the base transceivers 206, 207, 208 also utilize the unique but associated carrier signals which comprise a set of duplex radio channels enabling simultaneous transmission and reception of messages."
	Zabarsky 5:39-51.

	“There is, of course, the possibility of the automatic acknowledgement not being received for a number of reasons, for example the pager being out of range of central site or missing the message address because of a radio channel fade. A pager may retrieve these messages by inquiring into whether any "missed" messages exist for it.” Zabarsky 10:42-48. “In order to recall a message stored at the home central site, the user may enter a request for the unacknowledged messages to be sent to the pager. This request in the preferred embodiment consists of a unique series of keypad entries and the pushing of the transmit function key.” Zabarsky 14:67-15:4. Zabarsky discloses the pager requesting retransmission of entire pages without regard to whether any one of those pages constitutes all or less than all of a message. It would have been obvious to combine Zabarsky with U.S. Patent No. 5,311,516 (“Kuznicki”), which discloses that it is advantageous to deliver larger messages by fragmenting them into multiple smaller communications so that the page retransmissions in Zabarsky may constitute a part of a larger message. “This message packet decoding protocol allows the terminal 102 in the communication system to redistribute traffic of long messages over a combination of multiple frames, or multiple phases, or multiple communication channels, as will be more fully discussed below. By creating smaller packets 1610 of message information and distributing these over one or more frames as needed, the terminal 102 can better manage the message traffic to the communication receivers 106. For example, if an emergency message needs to be transmitted over a communication channel the terminal 102 can packetize a long message into smaller message packets and fit the emergency message into the current frame along with one or more of the smaller packets of the fragmented message. Hence, long messages can be reduced to a number of short message packets and transmitted over one or more frames to distribute the traffic over the communication channel. In this way, other messages can also at least partially be transmitted during the current frame as necessary. Additionally, by sending shorter message packets the

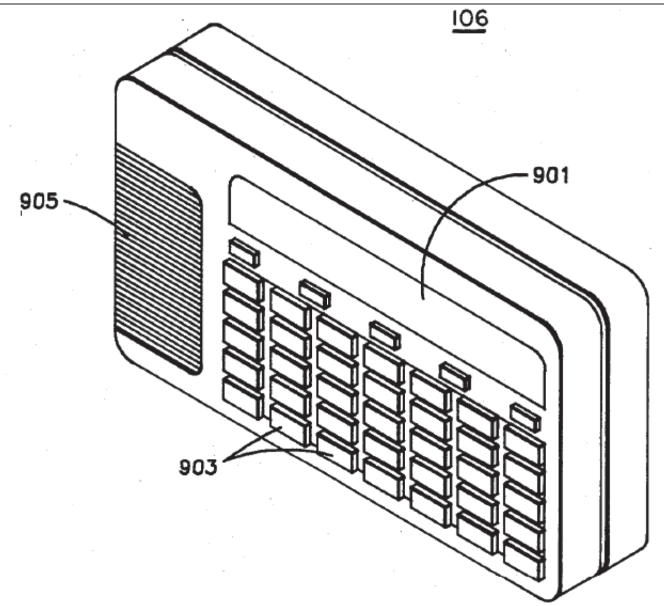
	probability of fading errors corrupting a portion of the message can be reduced.” Kuznicki 19:41-63. “A selective call receiver (106) receives one or more message packets of a transmitted fragmented message, where each of the one or more message packets includes an address (1605) and message data (1610), and the message data (1610) includes an indication (1702) of whether more message packets are to be received for the fragmented message.” Kuznicki Abstract.
7(C) means for retransmitting radio frequency signals containing the portion of the message to the mobile unit.	Zabarsky in view of Kuznicki discloses a means for retransmitting radio frequency signals containing the portion of the message to the mobile unit. *See, e.g.*, *Fig. 1*  Zabarsky Fig. 1. “This invention relates generally to radio paging systems and more particularly to a two-

	way radio personal data message system in which a miniature transceiver is carried by an individual for presentation of messages to that individual and for transmission of messages to a central site for relay to another individual or to a data base.” Zabarsky 1:6-12.  Zabarsky Fig. 2. “The RF communications channel between the base transceiver and a pager is preferably comprised of first and second carrier signals which may be modulated with the message signals. The transmitters of the base transceivers 200, 201, 202 may each operate on unique first carrier signals in discrete radio coverage zones while the receivers of the transceivers may each operate on unique second but associated carrier signals in associated zones. The transmitters and receivers of the base transceivers 206, 207, 208

	also utilize the unique but associated carrier signals which comprise a set of duplex radio channels enabling simultaneous transmission and reception of messages.” Zabarsky 5:39-51. Zabarsky discloses the pager requesting retransmission of entire pages without regard to whether any one of those pages constitutes all or less than all of a message. It would have been obvious to combine Zabarsky with U.S. Patent No. 5,311,516 (“Kuznicki”), which discloses that it is advantageous to deliver larger messages by fragmenting them into multiple smaller communications so that the page retransmissions in Zabarsky may constitute a part of a larger message. “This message packet decoding protocol allows the terminal 102 in the communication system to redistribute traffic of long messages over a combination of multiple frames, or multiple phases, or multiple communication channels, as will be more fully discussed below. By creating smaller packets 1610 of message information and distributing these over one or more frames as needed, the terminal 102 can better manage the message traffic to the communication receivers 106. For example, if an emergency message needs to be transmitted over a communication channel the terminal 102 can packetize a long message into smaller message packets and fit the emergency message into the current frame along with one or more of the smaller packets of the fragmented message. Hence, long messages can be reduced to a number of short message packets and transmitted over one or more frames to distribute the traffic over the communication channel. In this way, other messages can also at least partially be transmitted during the current frame as necessary. Additionally, by sending shorter message packets the probability of fading errors corrupting a portion of the message can be reduced.” Kuznicki 19:41-63. “A selective call receiver (106) receives one or more message packets of a transmitted fragmented message, where each of the one or more message packets includes an address (1605) and message data (1610), and the message data (1610) includes an indication (1702) of whether more message packets are to be received for the fragmented message.”

	Kuznicki Abstract.
Claim 8	**4,644,351 ("Zabarsky") in view of U.S. Patent No. 5,311,516 ("Kuznicki")**
8(P) A method for receiving and transmitting messages at a mobile unit, comprising the steps of:	Zabarsky in view of Kuznicki discloses a method for receiving and transmitting messages at a mobile unit. *See, e.g.*,  Zabarsky Fig. 1. "This invention relates generally to radio paging systems and more particularly to a two-way radio personal data message system in which a miniature transceiver is carried by an individual for presentation of messages to that individual and for transmission of messages to a central site for relay to another individual or to a data base." Zabarsky 1:6-12. "Pagers have also evolved into devices which can transmit in addition to receiving."

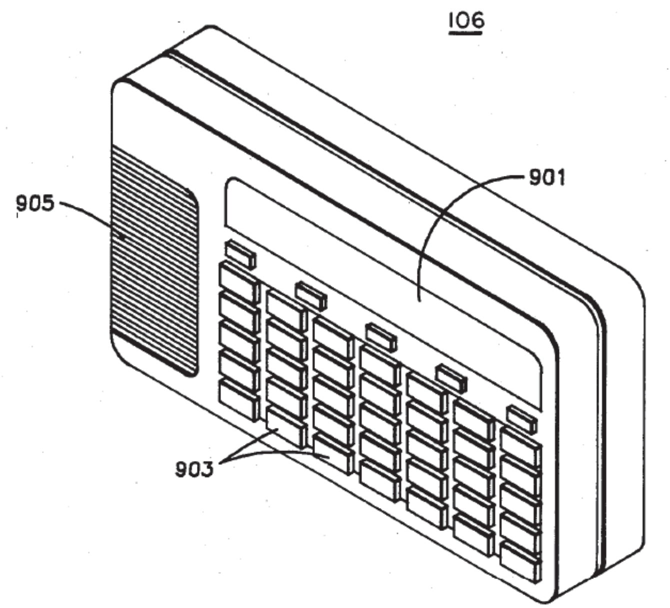
	Zabarsky 1:64-65.
8(A) receiving at the mobile unit a radio frequency message;	Zabarsky in view of Kuznicki discloses receiving at the mobile unit a radio frequency message. *See, e.g.*, "It is desirable that the pager of the preferred embodiment include two antennas of dissimilar receiving characteristics such as that described by Kneisel et al. in U.S. patent application Ser. No. 511,430 (Homotropic Antenna System for Portable Radio) filed on July 6, 1983 and assigned to the assignee of the present application. A single antenna pager may be used, however, without departing from the spirit and scope of the present invention. A duplexer 1021 of commercial availability couples the transceiver transmitter 1023 and receiver 1025 to one antenna with minimal interaction and a second antenna is coupled directly to the receiver 1025. The receiver output signal is filtered (in conventional bandpass filter 1027) and limited (in conventional limiter 1029) before being passed to the MPU 1001 bus via I/O 1017." Zabarsky 13:2-18. "When the selected remote unit receives the message it stores the message and returns a message received acknowledgement to the central site which subsequently deletes the message from its storage." Zabarsky 3:62-65.
8(B) displaying said message on the mobile unit;	Zabarsky in view of Kuznicki discloses displaying said message on the mobile unit. *See, e.g.*,

	 *Fig. 9* Zabarsky Fig. 9. “The pager unit 106 of the preferred embodiment is shown in FIG. 9. Preferrably it has a back-lit LCD alphanumeric display 901 with two lines of 16 characters per line for message display.” Zabarsky 12:9-12. “Message readout is accomplished via the alphanumeric display 901 either at the time of message reception or upon activation of the appropriate function key thereby causing the MPU 1001 to retrieve the message from the RAM memory 1005 and place it on the display 901 sixteen characters at a time. Additional characters may be shifted into the

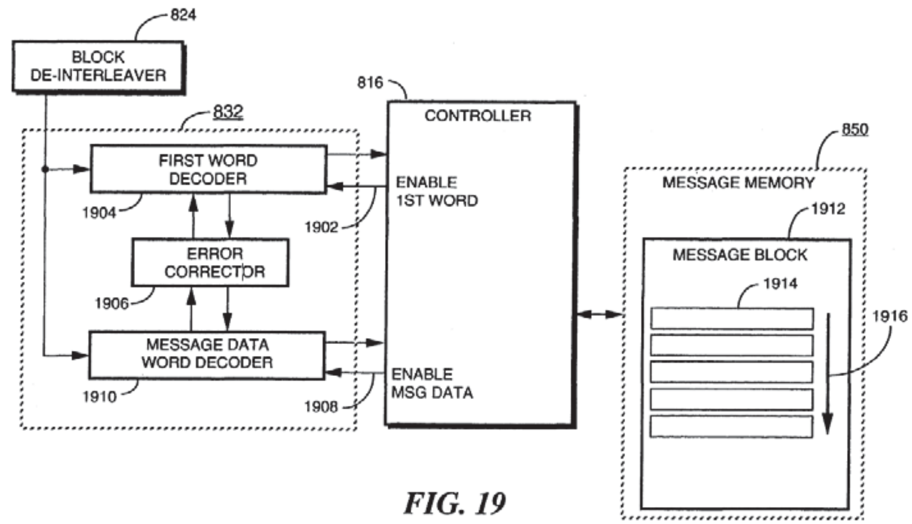
	display replacing those already displayed as desired.” Zabarsky 13:21-27.
8(C) receiving an indication of a portion of the displayed message for which a user desires retransmission;	Zabarsky in view of Kuznicki discloses receiving an indication of a portion of the displayed message for which a user desires retransmission. *See, e.g.*, “A 5×7 matrix of elastomeric switches and keys corresponding to alphanumeric symbols form the keypad 903, and 5 additional function keys are located above keypad 903.” Zabarsky 12:12-15. “There is, of course, the possibility of the automatic acknowledgement not being received for a number of reasons, for example the pager being out of range of central site or missing the message address because of a radio channel fade. A pager may retrieve these messages by inquiring into whether any "missed" messages exist for it.” Zabarsky 10:42-48. “In order to recall a message stored at the home central site, the user may enter a request for the unacknowledged messages to be sent to the pager. This request in the preferred embodiment consists of a unique series of keypad entries and the pushing of the transmit function key.” Zabarsky 14:67-15:4. Zabarsky discloses the pager requesting retransmission of entire pages without regard to whether any one of those pages constitutes all or less than all of a message. It would have been obvious to combine Zabarsky with U.S. Patent No. 5,311,516 (“Kuznicki”), which discloses that it is advantageous to deliver larger messages by fragmenting them into multiple smaller communications so that the page retransmissions in Zabarsky may constitute a part of a larger message. “This message packet decoding protocol allows the terminal 102 in the communication

	system to redistribute traffic of long messages over a combination of multiple frames, or multiple phases, or multiple communication channels, as will be more fully discussed below. By creating smaller packets 1610 of message information and distributing these over one or more frames as needed, the terminal 102 can better manage the message traffic to the communication receivers 106. For example, if an emergency message needs to be transmitted over a communication channel the terminal 102 can packetize a long message into smaller message packets and fit the emergency message into the current frame along with one or more of the smaller packets of the fragmented message. Hence, long messages can be reduced to a number of short message packets and transmitted over one or more frames to distribute the traffic over the communication channel. In this way, other messages can also at least partially be transmitted during the current frame as necessary. Additionally, by sending shorter message packets the probability of fading errors corrupting a portion of the message can be reduced." Kuznicki 19:41-63.
8(D) transmitting, only upon receipt of the indication, a signal requesting retransmission of said indicated portion of said message;	Zabarsky in view of Kuznicki discloses transmitting, only upon receipt of the indication, a signal requesting retransmission of said indicated portion of said message. *See, e.g.*, "If no acknowledge is received, the message is stored as will be described later." Zabarsky 7:22-23. "There is, of course, the possibility of the automatic acknowledgement not being received for a number of reasons, for example the pager being out of range of central site or missing the message address because of a radio channel fade. A pager may retrieve these messages by inquiring into whether any "missed" messages exist for it." Zabarsky 10:42-48. "In order to recall a message stored at the home central site, the user may enter a request for the unacknowledged messages to be sent to the pager. This request in the preferred embodiment consists of a unique series of keypad entries and the pushing of the transmit

	function key." Zabarsky 14:67-15:4. Zabarsky discloses the pager requesting retransmission of entire pages without regard to whether any one of those pages constitutes all or less than all of a message. It would have been obvious to combine Zabarsky with U.S. Patent No. 5,311,516 ("Kuznicki"), which discloses that it is advantageous to deliver larger messages by fragmenting them into multiple smaller communications so that the page retransmissions in Zabarsky may constitute a part of a larger message. "This message packet decoding protocol allows the terminal 102 in the communication system to redistribute traffic of long messages over a combination of multiple frames, or multiple phases, or multiple communication channels, as will be more fully discussed below. By creating smaller packets 1610 of message information and distributing these over one or more frames as needed, the terminal 102 can better manage the message traffic to the communication receivers 106. For example, if an emergency message needs to be transmitted over a communication channel the terminal 102 can packetize a long message into smaller message packets and fit the emergency message into the current frame along with one or more of the smaller packets of the fragmented message. Hence, long messages can be reduced to a number of short message packets and transmitted over one or more frames to distribute the traffic over the communication channel. In this way, other messages can also at least partially be transmitted during the current frame as necessary. Additionally, by sending shorter message packets the probability of fading errors corrupting a portion of the message can be reduced." Kuznicki 19:41-63.
8(E) receiving a retransmission of said indicated portion; and	Zabarsky in view of Kuznicki discloses receiving a retransmission of said indicated portion. *See, e.g.*, "In order to recall a message stored at the home central site, the user may enter a request for the unacknowledged messages to be sent to the pager. This request in the preferred embodiment consists of a unique series of keypad entries and the pushing of the transmit

	function key." Zabarsky 14:67-15:4.
8(F) displaying the received retransmission of said indicated portion on the mobile unit.	Zabarsky in view of Kuznicki discloses displaying the received retransmission of said indicated portion on the mobile unit. *See, e.g.*,  *Fig. 9* Zabarsky Fig. 9. "The pager unit 106 of the preferred embodiment is shown in FIG. 9. Preferrably it has a back-lit LCD alphanumeric display 901 with two lines of 16 characters per line for message display."

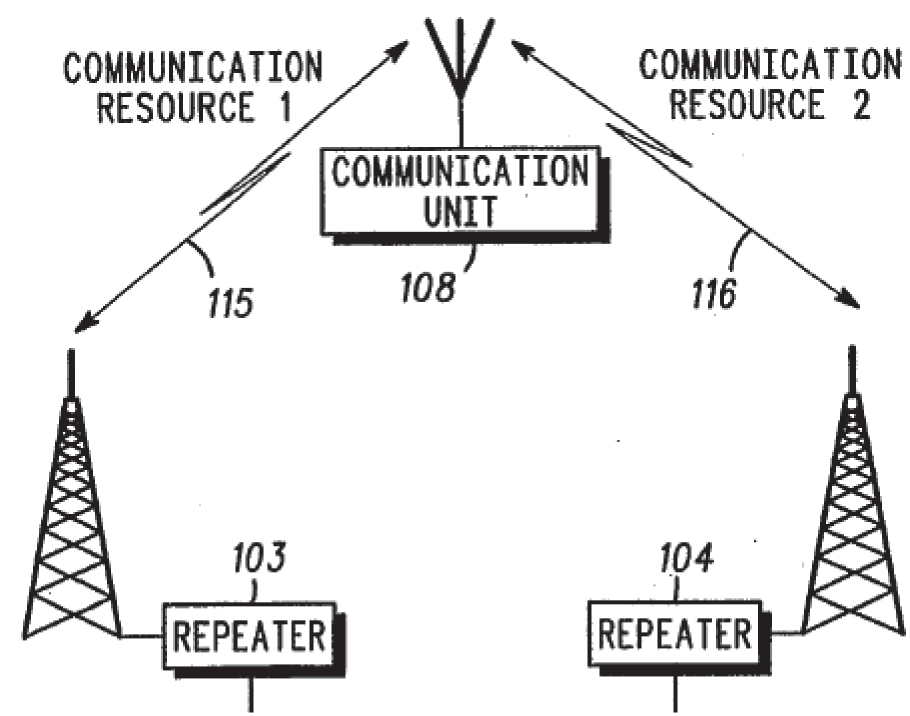
	Zabarsky 12:9-12. “Message readout is accomplished via the alphanumeric display 901 either at the time of message reception or upon activation of the appropriate function key thereby causing the MPU 1001 to retrieve the message from the RAM memory 1005 and place it on the display 901 sixteen characters at a time. Additional characters may be shifted into the display replacing those already displayed as desired.” Zabarsky 13:21-27.
Claim 9	**4,644,351 (“Zabarsky”) in view of U.S. Patent No. 5,311,516 (“Kuznicki”)**
9(A) The method according to claim 8, further comprising the step of: detecting errors in the received message; and	Zabarsky in view of Kuznicki discloses detecting errors in the received message. *See, e.g.*, “To properly perform control functions, error detection is required to prevent any uncorrected bit errors from inadvertently causing an undesired function. This error protection is provided by dividing the 48-bit basic information unit 406 into two fields: a 32-bit command field and a 16-bit cyclic redundancy check (CRC) field. The cyclic redundancy check field is computed from the command field prior to transmission and later checked upon reception. The error detection code defined here is commonly used in the data communications industry, and is known as CRC-CCITT.” Zabarsky 7:66-8:9. “The controller 816 couples an enable first word output signal 1902 to an input of the data decoder 832 to indicate to a first word decoder 1904 that the data code word 1612 is present in the incoming data stream. The first word decoder 1904 captures the 32 bit data code 10 word 1612 and couples it to an error corrector 1906. The error corrector 1906 can correct up to a predetermined number of error bits, such as two error bits, in a data code word 1612.”

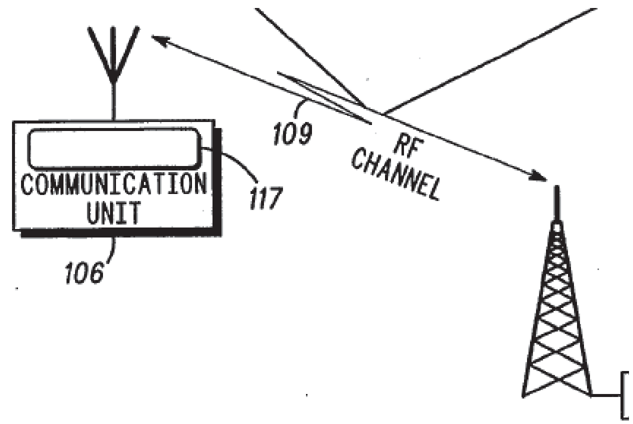
	Kuznicki 17:6-14.  *FIG. 19* Kuznicki Fig. 19. “Optionally, the communication receiver 106 can calculate a checksum 2914 over the range of decodes data codewords and compared to a transmitted checksum value 2916 to determine a transmission error. The communication receiver 106 can then flag errors in messages which can then be processed accordingly in presentation to a user of the communication receiver.” Kuznicki 30:21-31. In addition, it would have been obvious to a person of ordinary skill to employ the admitted prior art of error correcting codes from the ’946 patent. *See, e.g.*, “The slight offset of the carrier frequencies between the first and second transmitters causes a slow drift of the relative phase of the two signals, as shown in FIG. 3(D). When the signals are ±180° out of phase, the temporary dip in the amplitude signal may cause the loss of

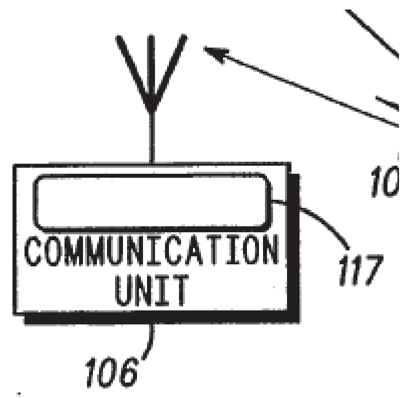
	a few bits in the composite signal, at worst. These errors can be counteracted with a conventional error correcting code, such as is commonly known." Cameron '946 3:18-25.
9(B) wherein the step of displaying comprises the substep of: highlighting said errors in the message on the mobile unit.	Zabarsky in view of Kuznicki discloses highlighting said errors in the message on the mobile unit. *See, e.g.*, "Optionally, the communication receiver 106 can calculate a checksum 2914 over the range of decodes data codewords and compared to a transmitted checksum value 2916 to determine a transmission error. The communication receiver 106 can then flag errors in messages which can then be processed accordingly in presentation to a user of the communication receiver." Kuznicki 30:21-31.

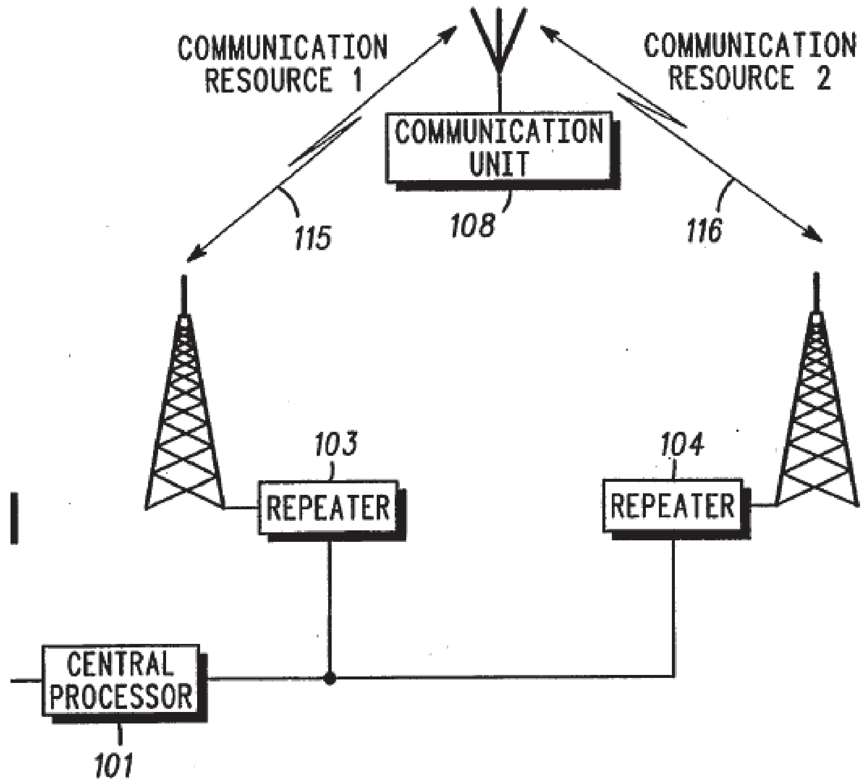
APPENDIX E

Appendix E
U.S. Patent No. 5,754,946 in view of U.S. Patent No. 5,448,759 ("Krebs")

Claim 1	5,448,759 ("Krebs")
1(P) A mobile unit for transmitting and receiving radio frequency signals to and from a communications network comprising:	Krebs discloses a mobile unit for transmitting and receiving radio frequency signals to and from a communications network. *See, e.g.*,  Krebs Fig. 1. "This invention relates generally to radio communication systems and, in particular, to a radio communication system that utilizes communication resources to transceive varying bandwidth messages." Krebs 1:8-11.

	“Upon registering, the central processor authorizes the communication unit to be on the communication network and communicates, via control information, with the communication unit while the communication unit is within the network's coverage area. The central processor continuously monitors the communication unit's operational status, such as attachment or detachment from the network, location updates, authentication, and service requests.” Krebs 3:51-59.
1(A) means for receiving a radio frequency message from the network;	Krebs discloses a means for receiving a radio frequency message from the network. Krebs discloses mobile units with at least an antenna and transceiver. *See, e.g.*,  Krebs Fig. 1. “This invention relates generally to radio communication systems and, in particular, to a radio communication system that utilizes communication resources to transceive varying bandwidth messages.” Krebs 1:8-11.
1(B) a display for displaying said	Krebs discloses a display for displaying said message. *See, e.g.*,

message;	“a plurality of communication units 106-108 each having a display 117” Krebs 2:46-47.  Krebs Fig. 1. “When the operable communication unit receives the first bandwidth notification message, the notification message is displayed to the user 205. The operable communication unit displays the notification message to the user via its display screen.” Krebs 5:3-7.
1(C) a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network;	Krebs discloses a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network. *See, e.g.*, “Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request. The response is generally sent to the central processor immediately following the display of the first bandwidth notification message, but it may also be delayed, in which case, the central processor continues to store the message in its memory. Depending on system configuration, delaying the response to a later time of the day, when system traffic

	is lighter, may reduce service costs for receiving the message. If a response is not received within a predetermined period of time (e.g. 3 weeks), the central processor deletes the stored message.” Krebs 5:22-37.  *FIG.1* Krebs Fig. 1.
1(D) means for transmitting, only	Krebs discloses a means for transmitting, only upon actuation of the switch, a signal to the

upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message; and	communications network requesting retransmission of said specified portion of said message. *See, e.g.*, “Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request. The response is generally sent to the central processor immediately following the display of the first bandwidth notification message, but it may also be delayed, in which case, the central processor continues to store the message in its memory. Depending on system configuration, delaying the response to a later time of the day, when system traffic is lighter, may reduce service costs for receiving the message. If a response is not received within a predetermined period of time (e.g. 3 weeks), the central processor deletes the stored message.” Krebs 5:22-37.

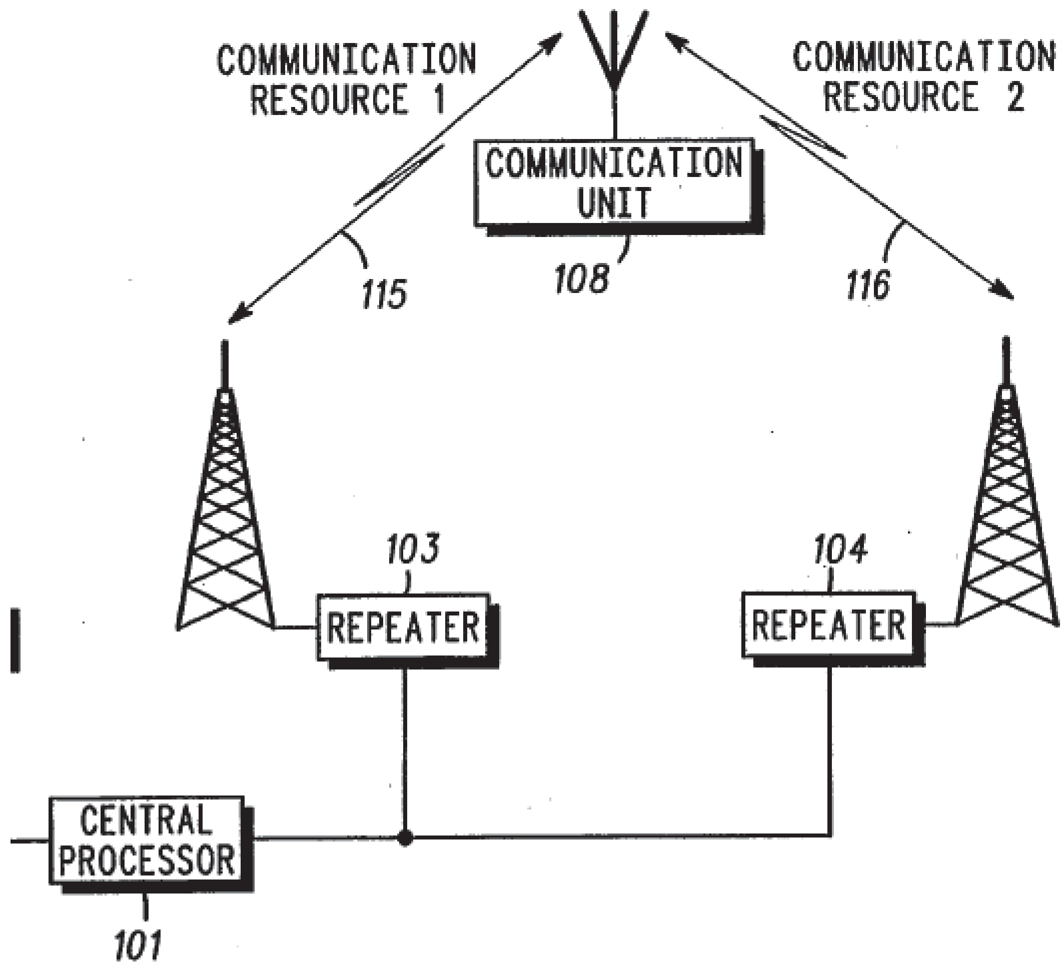
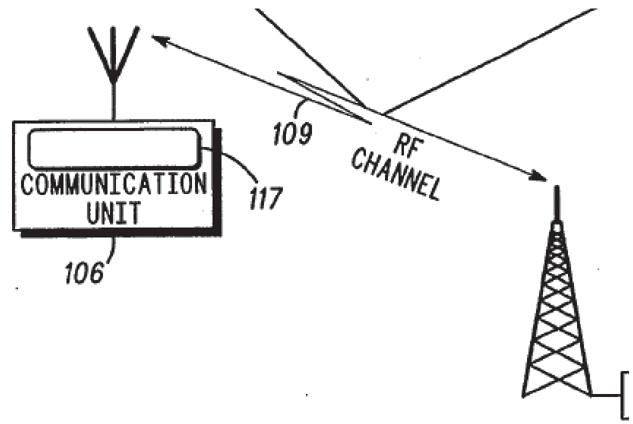


FIG.1

Krebs Fig. 1.

<table>
<tr><td></td><td>Krebs discloses at least an antenna and transceiver. See, e.g.,


Krebs Fig. 1.

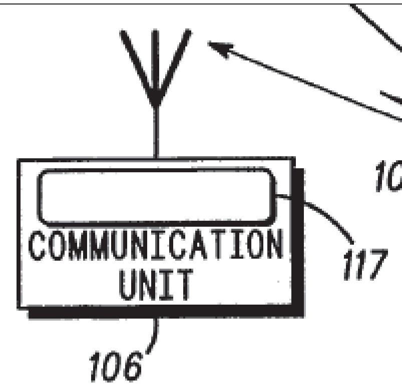
"This invention relates generally to radio communication systems and, in particular, to a radio communication system that utilizes communication resources to transceive varying bandwidth messages."

Krebs 1:8-11.</td></tr>
<tr><td>1(E) means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display.</td><td>Krebs discloses a means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display. See, e.g.,

"Upon receipt of the response, the central processor determines whether the response is the receive message request 207. When the response is to receive the message, the central processor transmits the message to the operable communication unit, via the repeater, on a communication resource in either a second or third set of communication resources, depending on the type of message 208."

Krebs 5:40-47.</td></tr>
</table>

	"While receiving second or third bandwidth type messages, the operable communication unit may receive additional first bandwidth type messages from the central processor." Krebs 5:65-68. "When the message is of the second bandwidth message type, the central processor prepares a first bandwidth notification message and transmits it to the communication unit via the communication resource. The first bandwidth notification message informs a user of the communication unit that the central processor has the second bandwidth type message for it. When the user desires to receive the message, a request is sent to the central processor, which subsequently transmits the message on a communication resource that is primarily used for transceiving second bandwidth type messages." Krebs Abstract. "When the user desires to receive the message, a request is sent to the central processor, which subsequently transmits the message on a communication resource that is primarily used for transceiving second bandwidth type messages." Krebs 2:32-36. "a plurality of communication units 106-108 each having a display 117" Krebs 2:46-47.

	 Krebs Fig. 1.
Claim 4	**5,448,759 ("Krebs")**
The mobile unit of claim 1, wherein the signal transmitted by the transmitting means indicates to the network that the user has read the message.	Krebs discloses that the signal transmitted by the transmitting means indicates to the network that the user has read the message. *See, e.g.*,

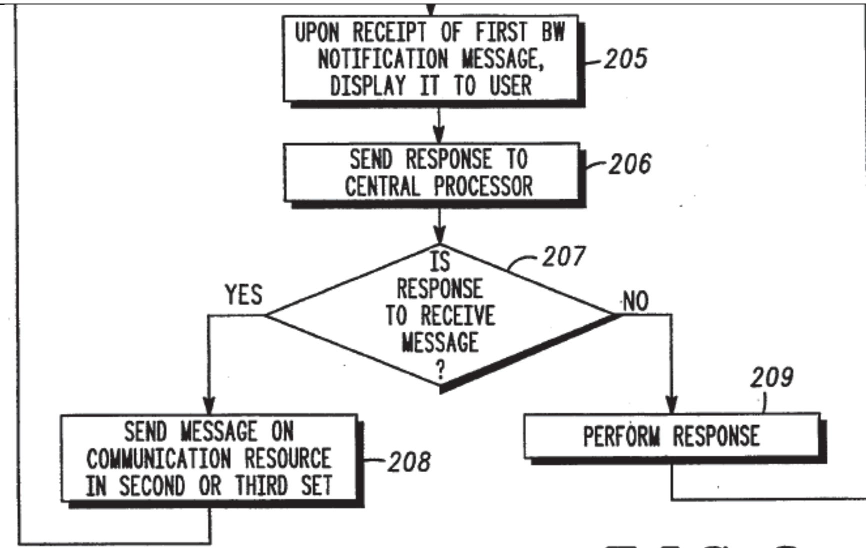


FIG. 2

Krebs Fig. 2.

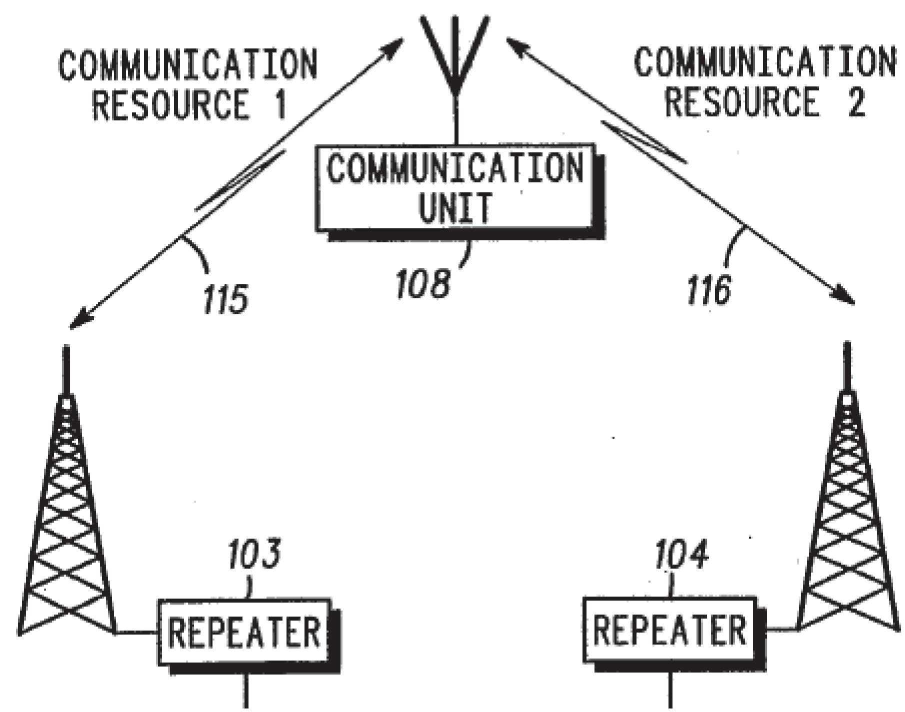
"Upon preparing the first bandwidth notification message, the central processor transmits, or sends, the first bandwidth notification message to the operable communication unit, via the repeater, on the communication resource in the first set 204.

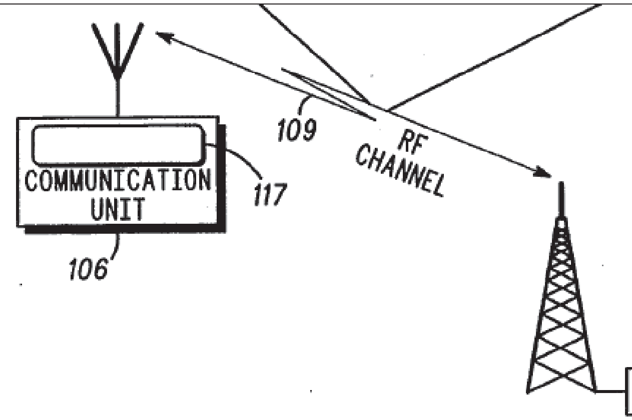
When the operable communication unit receives the first bandwidth notification message, the notification message is displayed to the user 205. The operable communication unit displays the notification message to the user via its display screen. Since a typical display screen can only display about 36 characters of the message at a time, the user may need to utilize a message scrolling function to read messages incorporating more than 36 characters."

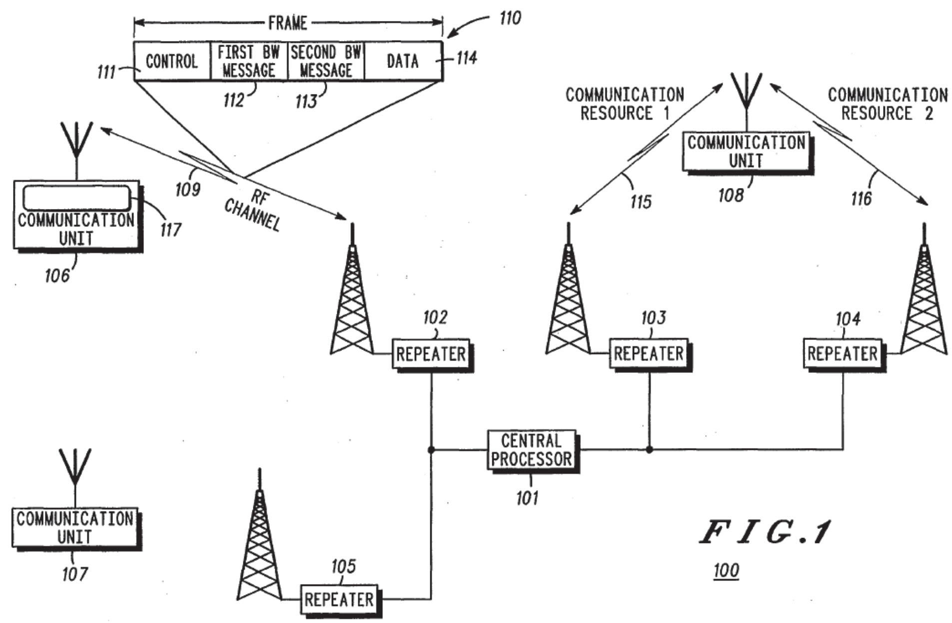
Krebs 4:65-5:11.

"Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save

	message request. The response is generally sent to the central processor immediately following the display of the first bandwidth notification message, but it may also be delayed, in which case, the central processor continues to store the message in its memory." Krebs 5:22-31.
Claim 7	**5,448,759 ("Krebs")**
7(P) A communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network, the network comprising:	Krebs discloses a communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network. *See, e.g.*,

	 Krebs Fig. 1. "Upon registering, the central processor authorizes the communication unit to be on the communication network and communicates, via control information, with the communication unit while the communication unit is within the network's coverage area. The central processor continuously monitors the communication unit's operational status, such as attachment or detachment from the network, location updates, authentication, and service requests." Krebs 3:51-59.

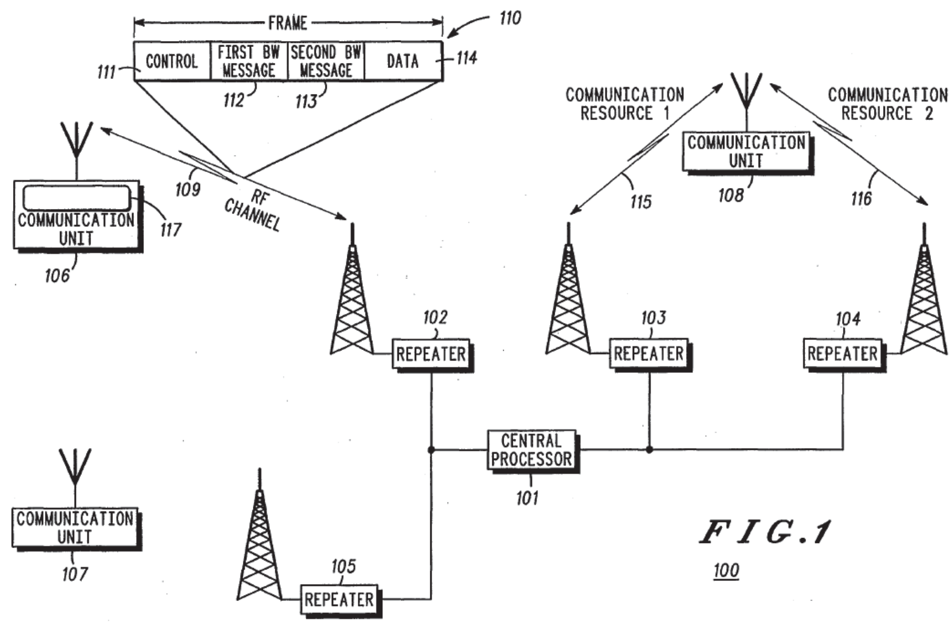
	 Krebs Fig. 1. “a plurality of communication units 106-108 each having a display 117” Krebs 2:46-47. “When the operable communication unit receives the first bandwidth notification message, the notification message is displayed to the user 205. The operable communication unit displays the notification message to the user via its display screen.” Krebs 5:3-7.
7(A) means for transmitting radio frequency signals containing a message to the mobile unit;	Krebs discloses a means for transmitting radio frequency signals containing a message to the mobile unit. For example, Krebs discloses the use of a network of base stations for transmitting radio frequency signals and messages to mobile units. *See, e.g.*,

<table>
<tr><td></td><td>


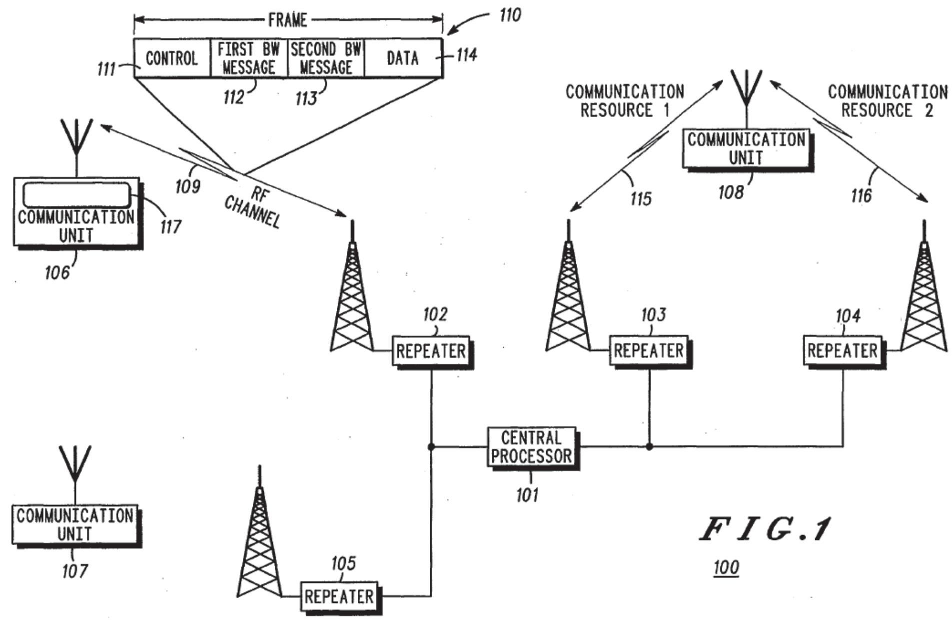
Krebs Fig. 1.

“FIG. 1 illustrates a communication system 100 that includes a central processor 101, a plurality of repeaters or paging broadcast units 102-105 that transceive a limited number of communication resources 111-116, and a plurality of communication units 106-108 each having a display 117. The central processor may comprise a central controller and a data processing element that includes communication protocols, data storage (memory), queuing means, a communication unit data base, and message scheduling algorithms. Alternatively, the data processing element may comprise multiple processing elements which may be centrally located or distributed on a computer network.”

Krebs 2:42-55.
</td></tr>
<tr><td>7(B) means for receiving, from the mobile unit, radio frequency signals</td><td>Krebs discloses a means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission. For example,</td></tr>
</table>

representing a portion of the message that the user desires retransmission;	Krebs discloses the use of a network of base stations for receiving radio frequency signals and messages from mobile units. *See, e.g.*,  Krebs Fig. 1. “FIG. 1 illustrates a communication system 100 that includes a central processor 101, a plurality of repeaters or paging broadcast units 102-105 that transceive a limited number of communication resources 111-116, and a plurality of communication units 106-108 each having a display 117. The central processor may comprise a central controller and a data processing element that includes communication protocols, data storage (memory), queuing means, a communication unit data base, and message scheduling algorithms. Alternatively, the data processing element may comprise multiple processing elements which may be centrally located or distributed on a computer network.”

	Krebs 2:42-55. "When the user desires to receive the message, a request is sent to the central processor, which subsequently transmits the message on a communication resource that is primarily used for transceiving second bandwidth type messages." Krebs 2:32-36. "Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request." Krebs 5:22-27. "Upon receipt of the response, the central processor determines whether the response is the receive message request 207. When the response is to receive the message, the central processor transmits the message to the operable communication unit, via the repeater, on a communication resource in either a second or third set of communication resources, depending on the type of message 208." Krebs 5:40-47.
7(C) means for retransmitting radio frequency signals containing the portion of the message to the mobile unit.	Krebs discloses a means for retransmitting radio frequency signals containing the portion of the message to the mobile unit. *See, e.g.*,



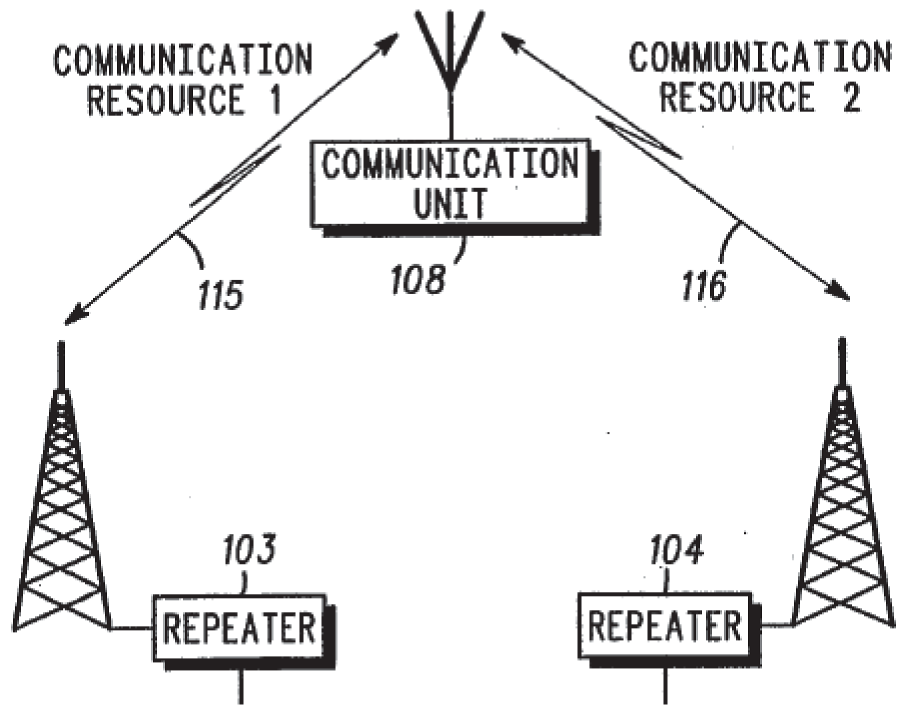
Krebs Fig. 1.

"FIG. 1 illustrates a communication system 100 that includes a central processor 101, a plurality of repeaters or paging broadcast units 102-105 that transceive a limited number of communication resources 111-116, and a plurality of communication units 106-108 each having a display 117. The central processor may comprise a central controller and a data processing element that includes communication protocols, data storage (memory), queuing means, a communication unit data base, and message scheduling algorithms. Alternatively, the data processing element may comprise multiple processing elements which may be centrally located or distributed on a computer network."

Krebs 2:42-55.

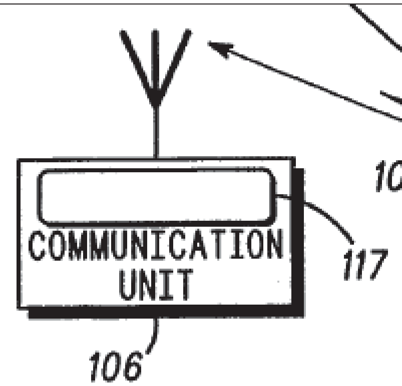
"Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a

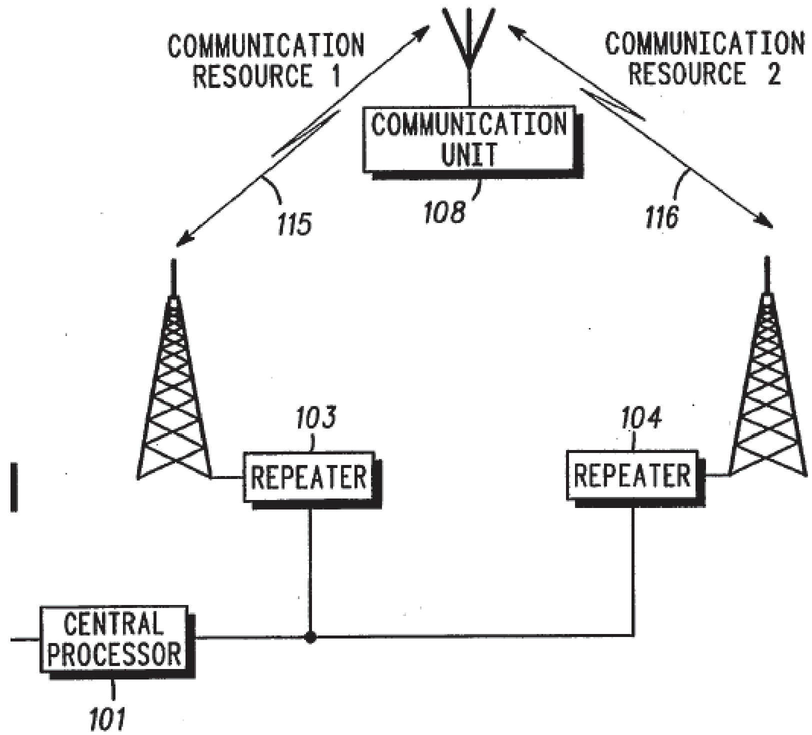
	receive message request, a delete message request, a forward message request, or a save message request." Krebs 5:22-27. "Upon receipt of the response, the central processor determines whether the response is the receive message request 207. When the response is to receive the message, the central processor transmits the message to the operable communication unit, via the repeater, on a communication resource in either a second or third set of communication resources, depending on the type of message 208." Krebs 5:40-47.
Claim 8	**5,448,759 ("Krebs")**
8(P) A method for receiving and transmitting messages at a mobile unit, comprising the steps of:	Krebs discloses a method for receiving and transmitting messages at a mobile unit. *See, e.g.*,

<table>
<tr><td></td><td>

Krebs Fig. 1.
“Upon registering, the central processor authorizes the communication unit to be on the communication network and communicates, via control information, with the communication unit while the communication unit is within the network's coverage area. The central processor continuously monitors the communication unit's operational status, such as attachment or detachment from the network, location updates, authentication, and service requests.”
Krebs 3:51-59. </td></tr>
<tr><td>8(A) receiving at the mobile unit a</td><td>Krebs discloses receiving at the mobile unit a radio frequency message. See, e.g.,</td></tr>
</table>

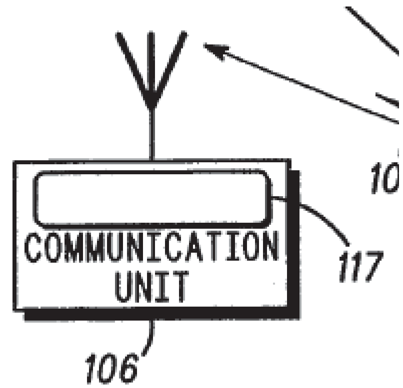
radio frequency message;	"This invention relates generally to radio communication systems and, in particular, to a radio communication system that utilizes communication resources to transceive varying bandwidth messages." Krebs 1:8-11. "This is accomplished when a central processor receives a message for the communication unit and determines whether the message is of a first bandwidth message type or a second bandwidth message type. When the message is of the first bandwidth message type, the central processor transmits the message to the communication unit via a communication resource that is used primarily for transceiving first bandwidth type messages. When the message is of the second bandwidth message type, the central processor prepares a first bandwidth notification message and transmits it to the communication unit via the communication resource, which can be done without interruption of current services. The first bandwidth notification message informs a user of the communication unit that the central processor has the second bandwidth type message for it, which the user can access at the user's convenience." Krebs 2:14-31.
8(B) displaying said message on the mobile unit;	Krebs discloses displaying said message on the mobile unit. *See, e.g.*, "a plurality of communication units 106-108 each having a display 117" Krebs 2:46-47.

	 Krebs Fig. 1. “When the operable communication unit receives the first bandwidth notification message, the notification message is displayed to the user 205. The operable communication unit displays the notification message to the user via its display screen.” Krebs 5:3-7.
8(C) receiving an indication of a portion of the displayed message for which a user desires retransmission;	Krebs discloses receiving an indication of a portion of the displayed message for which a user desires retransmission. *See, e.g.*, “Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request. The response is generally sent to the central processor immediately following the display of the first bandwidth notification message, but it may also be delayed, in which case, the central processor continues to store the message in its memory. Depending on system configuration, delaying the response to a later time of the day, when system traffic is lighter, may reduce service costs for receiving the message. If a response is not received within a predetermined period of time (e.g. 3 weeks), the central processor deletes the stored message.”

	Krebs 5:22-37.  *FIG.1* Krebs Fig. 1. "When the message is either of the second bandwidth message type or the third bandwidth message type, the central processor prepares a first bandwidth notification message for the operable communication unit 203. The first bandwidth notification message is a first bandwidth message that notifies the operable communication unit of the second or third bandwidth message resident for it in the central processor's memory. The first bandwidth notification message typically contains the originator of the message, a summary of the

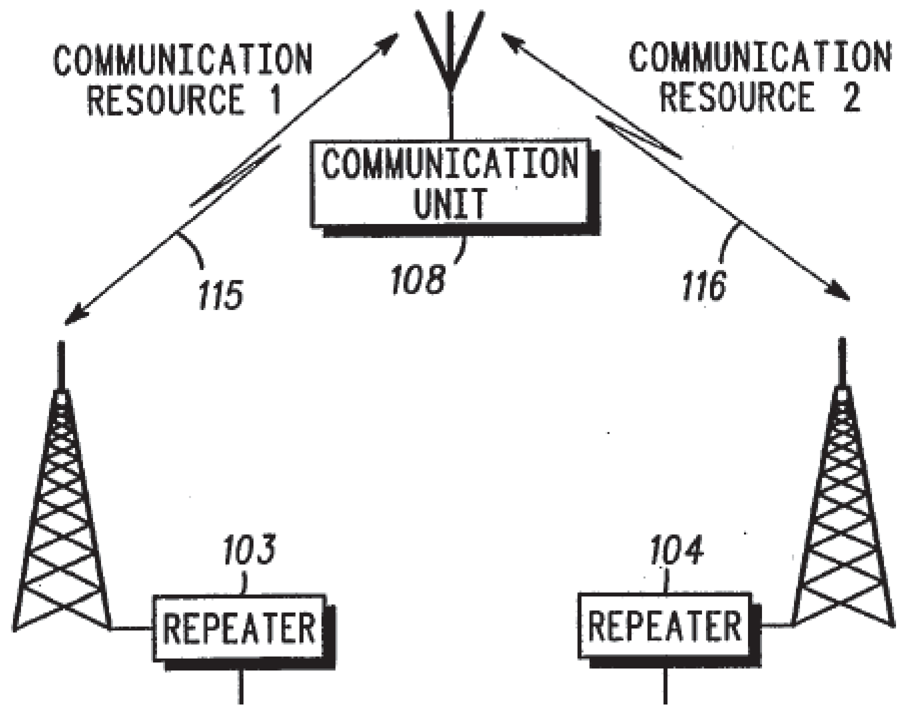
	message, the date sent, the length of the message, priority, and cost to retrieve the entire message over the network." Krebs 4:54-65. "Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request." Krebs 5:22-27.
8(D) transmitting, only upon receipt of the indication, a signal requesting retransmission of said indicated portion of said message;	Krebs discloses transmitting, only upon receipt of the indication, a signal requesting retransmission of said indicated portion of said message. *See, e.g.*, "Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request. The response is generally sent to the central processor immediately following the display of the first bandwidth notification message, but it may also be delayed, in which case, the central processor continues to store the message in its memory. Depending on system configuration, delaying the response to a later time of the day, when system traffic is lighter, may reduce service costs for receiving the message. If a response is not received within a predetermined period of time (e.g. 3 weeks), the central processor deletes the stored message." Krebs 5:22-37. "Upon receipt of the response, the central processor determines whether the response is the receive message request 207. When the response is to receive the message, the central processor transmits the message to the operable communication unit, via the repeater, on a communication resource in either a second or third set of communication resources, depending on the type of message 208."

	Krebs 5:40-47.
8(E) receiving a retransmission of said indicated portion; and	Krebs discloses receiving a retransmission of said indicated portion. *See, e.g.*, "Upon receipt of the response, the central processor determines whether the response is the receive message request 207. When the response is to receive the message, the central processor transmits the message to the operable communication unit, via the repeater, on a communication resource in either a second or third set of communication resources, depending on the type of message 208." Krebs 5:40-47. "While receiving second or third bandwidth type messages, the operable communication unit may receive additional first bandwidth type messages from the central processor." Krebs 5:65-68.
8(F) displaying the received retransmission of said indicated portion on the mobile unit.	Krebs discloses displaying the received retransmission of said indicated portion on the mobile unit. *See, e.g.*, "When the message is of the second bandwidth message type, the central processor prepares a first bandwidth notification message and transmits it to the communication unit via the communication resource. The first bandwidth notification message informs a user of the communication unit that the central processor has the second bandwidth type message for it. When the user desires to receive the message, a request is sent to the central processor, which subsequently transmits the message on a communication resource that is primarily used for transceiving second bandwidth type messages." Krebs Abstract. "When the user desires to receive the message, a request is sent to the central processor, which subsequently transmits the message on a communication resource that is primarily used for transceiving second bandwidth type messages."

	Krebs 2:32-36. "a plurality of communication units 106-108 each having a display 117" Krebs 2:46-47.  Krebs Fig. 1.

APPENDIX F

Appendix F
U.S. Patent No. 5,754,946 in view of U.S. Patent No. 5,448,759 ("Krebs") in Combination with U.S. Patent No. 5,396,537 ("Schwendeman") and U.S. Patent No. 5,031,179 ("Yoshida")

Claim 1	5,448,759 ("Krebs") in Combination with U.S. Patent No. 5,396,537 ("Schwendeman") and U.S. Patent No. 5,031,179 ("Yoshida")
1(P) A mobile unit for transmitting and receiving radio frequency signals to and from a communications network comprising:	Krebs in combination with Schwendeman and Yoshida discloses a mobile unit for transmitting and receiving radio frequency signals to and from a communications network. *See, e.g.*,  Krebs Fig. 1. "This invention relates generally to radio communication systems and, in particular, to a radio communication system that utilizes communication resources to transceive varying bandwidth messages."

<table>
<tr>
<td></td>
<td>

Krebs 1:8-11.

“Upon registering, the central processor authorizes the communication unit to be on the communication network and communicates, via control information, with the communication unit while the communication unit is within the network's coverage area. The central processor continuously monitors the communication unit's operational status, such as attachment or detachment from the network, location updates, authentication, and service requests.”

Krebs 3:51-59.

Schwendeman discloses a mobile unit for transmitting and receiving radio frequency signals to and from a communications network. *See, e.g.*,

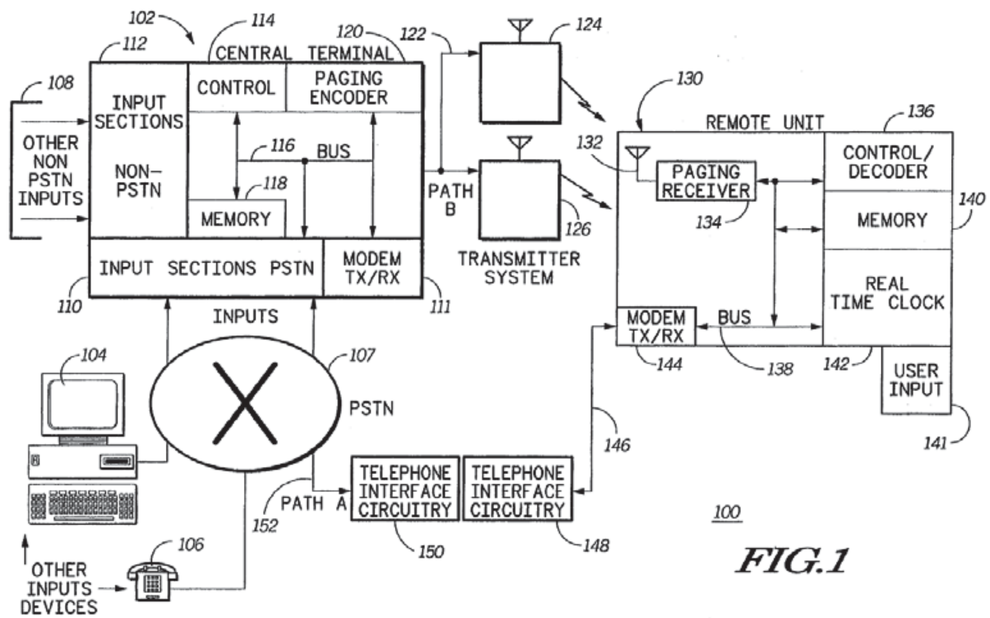


FIG.1

</td>
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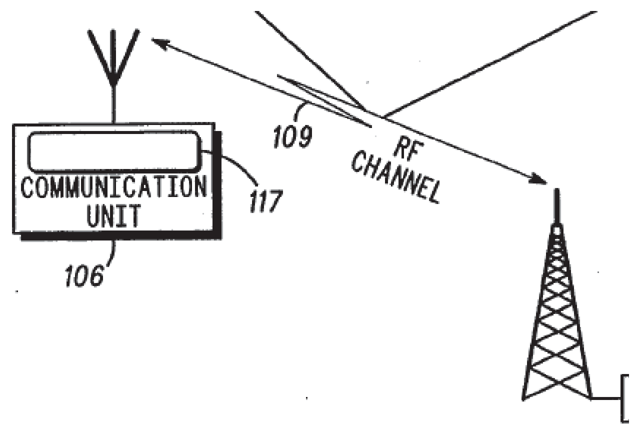
</table>

	Schwendeman Fig. 1. "This invention relates generally to message delivery systems, such as for electronic mail systems, and more specifically to specifically to a method and apparatus for reliably delivering messages to one or more remote units from a central communication system utilizing a paging transmitter system." Schwendeman 1:10-15. "The path A 152 communication medium and the path B 122 communication medium can comprise any communication paths, such as direct wired line path, telephone line path, or wireless communication path including at least one radio communication channel preferably path A 152 is different than path B 122." Schwendeman 4:59-65. "In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels." Schwendeman 4:66-5:9. "However, using two-way radio frequency communication channels for both path A and path B may be perfectly acceptable in some systems." Schwendeman 5:16-18.
1(A) means for receiving a radio	Krebs in combination with Schwendeman and Yoshida discloses a means for receiving a radio frequency message from the network. Krebs discloses mobile units with at least an

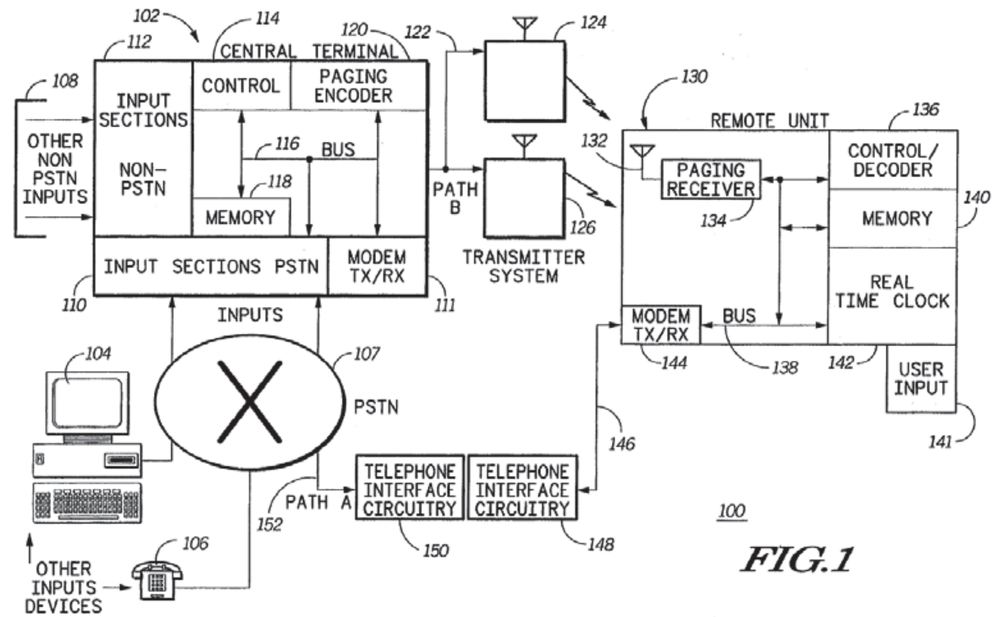
<table>
<tr><td>frequency message from the network;</td><td>antenna and transceiver. See, e.g.,


Krebs Fig. 1.

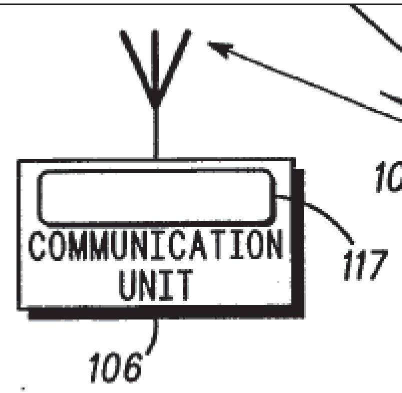
“This invention relates generally to radio communication systems and, in particular, to a radio communication system that utilizes communication resources to transceive varying bandwidth messages.”

Krebs 1:8-11.

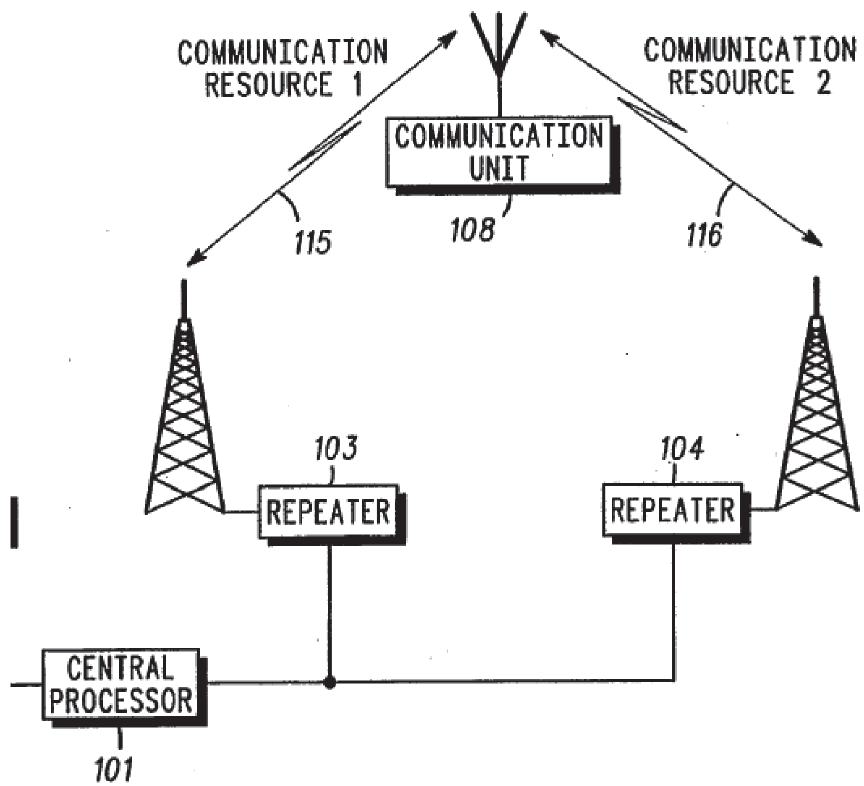
Schwendeman discloses a means for receiving a radio frequency message from the network. Schwendeman discloses mobile units with at least an antenna and transceiver. See, e.g.,</td></tr>
</table>

	 FIG.1 Schwendeman Fig. 1. “This invention relates generally to message delivery systems, such as for electronic mail systems, and more specifically to specifically to a method and apparatus for reliably delivering messages to one or more remote units from a central communication system utilizing a paging transmitter system.” Schwendeman 1:10-15. “The selective call receiver 130 preferably incorporates a paging receiver 134 that operates to receive messages transmitted over the paging communication channel through the antenna 132. The operation of a paging receiver 134 of the general type shown in FIG. 1 is well known and is more fully described in U.S. Pat. No. 4,518,961 issued May 21, 1985, entitled, "Universal Paging Device With Power Conservation", which is assigned to the same assignee

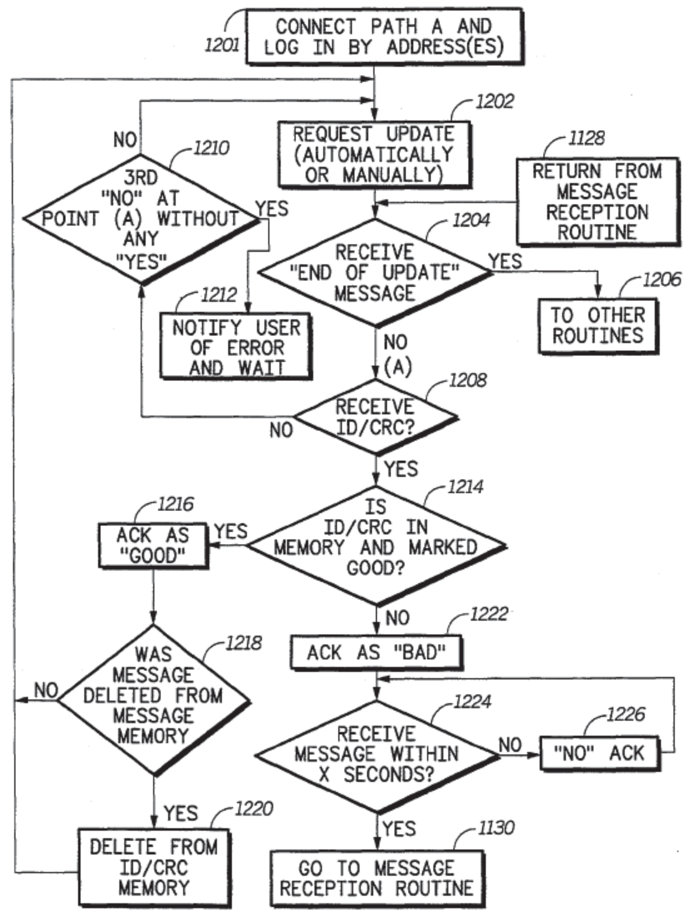
	as the present invention and is incorporated herein by reference.” Schwendeman 3:65-4:6. “The path A 152 communication medium and the path B 122 communication medium can comprise any communication paths, such as direct wired line path, telephone line path, or wireless communication path including at least one radio communication channel preferably path A 152 is different than path B 122.” Schwendeman 4:59-65. “In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels.” Schwendeman 4:66-5:9. “However, using two-way radio frequency communication channels for both path A and path B may be perfectly acceptable in some systems.” Schwendeman 5:16-18.
1(B) a display for displaying said message;	Krebs in combination with Schwendeman and Yoshida discloses a display for displaying said message. *See, e.g.*, “a plurality of communication units 106-108 each having a display 117” Krebs 2:46-47.

	 Krebs Fig. 1. "When the operable communication unit receives the first bandwidth notification message, the notification message is displayed to the user 205. The operable communication unit displays the notification message to the user via its display screen." Krebs 5:3-7. Schwendeman discloses a display for displaying said message. *See, e.g.*, "Communication systems, such as paging systems, typically communicate messages from an originating device to one or more destination devices. These messages can include numeric and alphanumeric information for a user of the destination device. The destination device, e.g., a selective call receiver or pager, typically presents the information received to the user by displaying the information on a display." Schwendeman 1:18-25. "A user can access user input means 141, such as buttons or switches, at the remote unit 130 to cause the message data of a received message to be displayed on a display, e.g., a liquid crystal display (not shown). The user can then read the message that is visible on the

	display.” Schwendeman 4:16-21. “Typically, the user reviews the message on a display on the remote unit 130. That is, for example, the user can read the message on a display screen such as commonly available on portable personal computers and portable selective call display receivers.” Schwendeman 7:12-16. “Additionally, the remote unit 130 can determine 1280 if the message data was previously deleted from memory 140, such as after a user has read the message from a display.” Schwendeman 15:15-18. “That is for example, when the message data 1304 is determined to be corrupted by the receiving remote unit 130, the remote unit 130 can automatically alert the user via a message on a visual display.” Schwendeman 18:24-27.
1(C) a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network;	Krebs in combination with Schwendeman and Yoshida discloses a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network. *See, e.g.*, “Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request. The response is generally sent to the central processor immediately following the display of the first bandwidth notification message, but it may also be delayed, in which case, the central processor continues to store the message in its memory. Depending on system configuration, delaying the response to a later time of the day, when system traffic is lighter, may reduce service costs for receiving the message. If a response is not received

	within a predetermined period of time (e.g. 3 weeks), the central processor deletes the stored message." Krebs 5:22-37.  FIG.1 Krebs Fig. 1. It would have been obvious to one of ordinary skill in the art to combine the teachings of

	Krebs with the retransmission request systems of Schwendeman and Yoshida, resulting in a system that allows the user to request retransmission of only the errored portions of a received message. Schwendeman discloses a switch actuatable to specify a portion of the displayed message for which a user desires retransmission from the communications network. *See, e.g.*,

	 *FIG.12* Schwendeman Fig. 12. "Referring to FIG. 12, once the remote unit 130 is connected 1201 and communicating with the central terminal 102 over path A 152, the remote unit 130 can initiate a reconciliation

	sequence 1202 with the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, in a response to a manual entry, e.g., in response to user input, at the remote unit 130 such as by buttons, or switches 141. While in the reconciliation handling routine 102, if the remote unit 130 receives a request from the central terminal 102 to terminate 1204 the reconciliation sequence, the remote unit 130 can exit the reconciliation handling routine and perform 1206 other functions. While in the reconciliation routine, the remote unit 130 waits to receive 1208 a transmission over path A from the central terminal. If the received message information 1208 is not correctly received by the remote unit 130, the remote unit 130 can request reconciliation again 1210, 1202. If the remove unit 130 requests reconciliation for a third time 1210 then it notifies 1212 the user that there is an error in communication with the central terminal 102." Schwendeman 14:50-15:3.

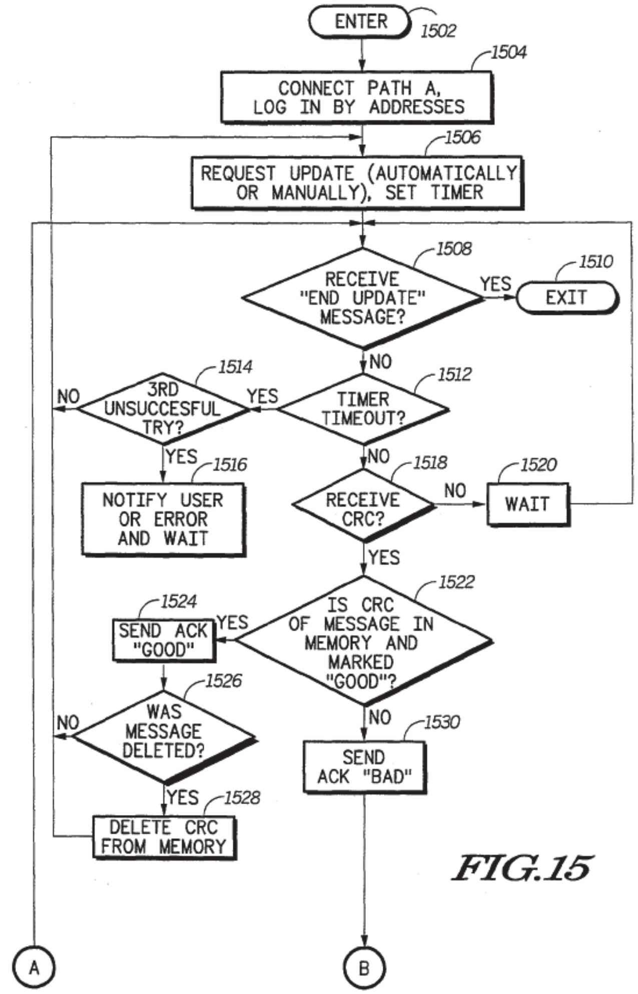

ENTER
1502
CONNECT PATH A, LOG IN BY ADDRESSES
1504
REQUEST UPDATE (AUTOMATICALLY OR MANUALLY), SET TIMER
1506
RECEIVE "END UPDATE" MESSAGE?
1508
YES
EXIT
1510
NO
TIMER TIMEOUT?
1512
YES
3RD UNSUCCESFUL TRY?
1514
NO
YES
NOTIFY USER OR ERROR AND WAIT
1516
NO
RECEIVE CRC?
1518
NO
WAIT
1520
YES
IS CRC OF MESSAGE IN MEMORY AND MARKED "GOOD"?
1522
YES
SEND ACK "GOOD"
1524
WAS MESSAGE DELETED?
1526
NO
YES
DELETE CRC FROM MEMORY
1528
NO
SEND ACK "BAD"
1530
A
B

FIG.15

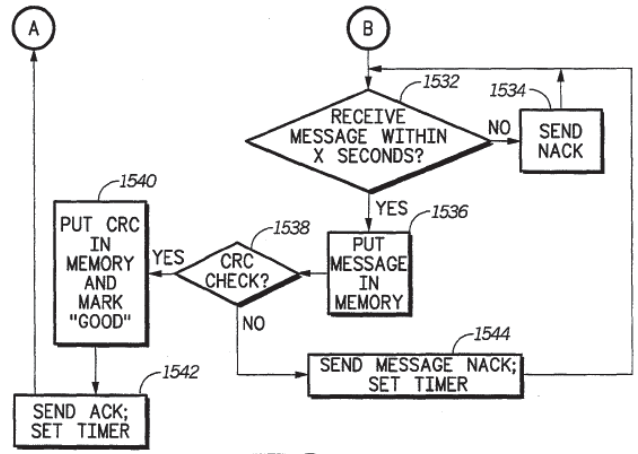


FIG.16

Schwendeman Figs 15-16.

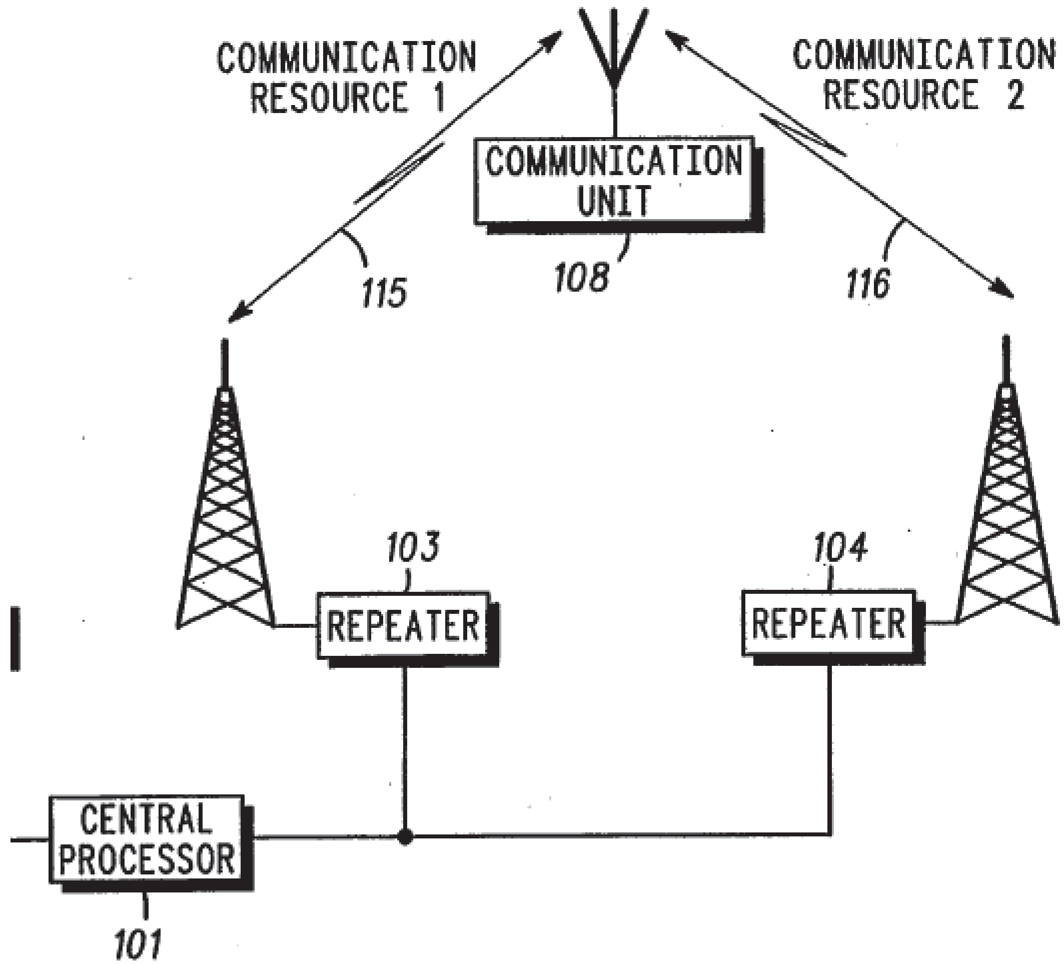
“Referring to FIGS. 15 and 16, once the remote unit 130 is connected 1502, 1504 and communicating with the central terminal 102 over path A 152, the remote unit 130 can initiate a reconciliation sequence 1506 by sending a reconciliation request to the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, as a response to a manually entry, e.g., in response to user input, at the remote unit 130 by buttons or switches 141. While in the reconciliation sequence, if the remote unit 1130 receives a request from the central terminal 102 to terminate 1508 the reconciliation sequence, the remote unit 130 can exit 1510 and perform other functions as necessary. When the remote unit 130 initiates 1506 a reconciliation sequence, it can also set a timer to a predetermined value to provide a maximum time interval for the central terminal 102 to respond to the reconciliation request.”

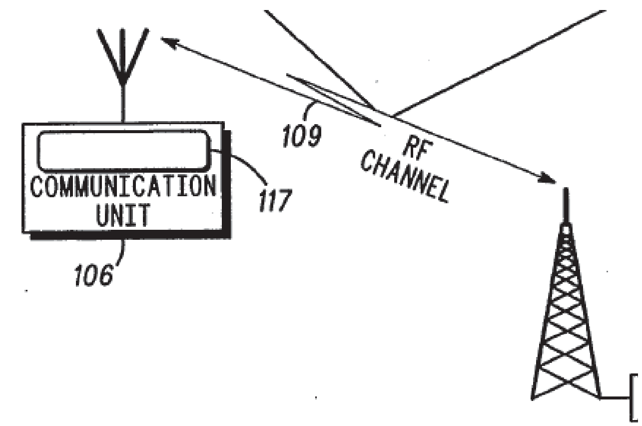
Schwendeman 20:15-32.

Yoshida discloses retransmission of only the erroneous part of the message. *See, e.g.*,

	"A data communication apparatus having an error retransmission mode allows the operator to ascertain an amount of error data when an error is contained in data and when the error is not corrected despite retransmission of the error a predetermined number of times, or makes it possible to reproduce data with respect to correctly received data by discriminating correct data contained in error data, thereby preventing error data from becoming wasted as practically as possible. In addition, at the time of error retransmission, a transmission mode for retransmitting the error data is changed so as to minimize the number of incidents of error retransmission, thereby to enable efficient data transmission." Yoshida Abstract. "In the ARQ system, the following three systems are used depending on a method of retransmission: (1) Basic ARQ (Stop-and-Wait, Idle-RQ) This is a system wherein a confirmed response is returned each time one data block is received, and an ensuing data block is sent after confirmation. (2) Continuous block transmission ARQ (Go-back-N) This is a system wherein data blocks are transmitted continuously, and when a response for request for retransmission is given, the process returns to the block in which the error occurred, and an ensuing block N is retransmitted without disturbing the order of the blocks. (3) Selective retransmission ARQ (Selective Repeat) This system is a modification of the continuous block transmission ARQ, and is designed to retransmit only an error block." Yoshida 1:50-66.
1(D) means for transmitting, only	Krebs in combination with Schwendeman and Yoshida discloses a means for transmitting,

upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message; and	only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message. *See, e.g.*, “Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request. The response is generally sent to the central processor immediately following the display of the first bandwidth notification message, but it may also be delayed, in which case, the central processor continues to store the message in its memory. Depending on system configuration, delaying the response to a later time of the day, when system traffic is lighter, may reduce service costs for receiving the message. If a response is not received within a predetermined period of time (e.g. 3 weeks), the central processor deletes the stored message.” Krebs 5:22-37.

	 FIG.1 Krebs Fig. 1.

	Krebs in combination with Schwendeman and Yoshida discloses at least an antenna and transceiver. *See, e.g.*,  Krebs Fig. 1. “This invention relates generally to radio communication systems and, in particular, to a radio communication system that utilizes communication resources to transceive varying bandwidth messages.” Krebs 1:8-11. It would have been obvious to one of ordinary skill in the art to combine the teachings of Krebs with the retransmission request system of Schwendeman, resulting in a system that transmits a request signal for retransmission of a portion of a received message only after a user activates the designated button on the paging device. Schwendeman discloses a means for transmitting, only upon actuation of the switch, a signal to the communications network requesting retransmission of said specified portion of said message. *See, e.g.*,

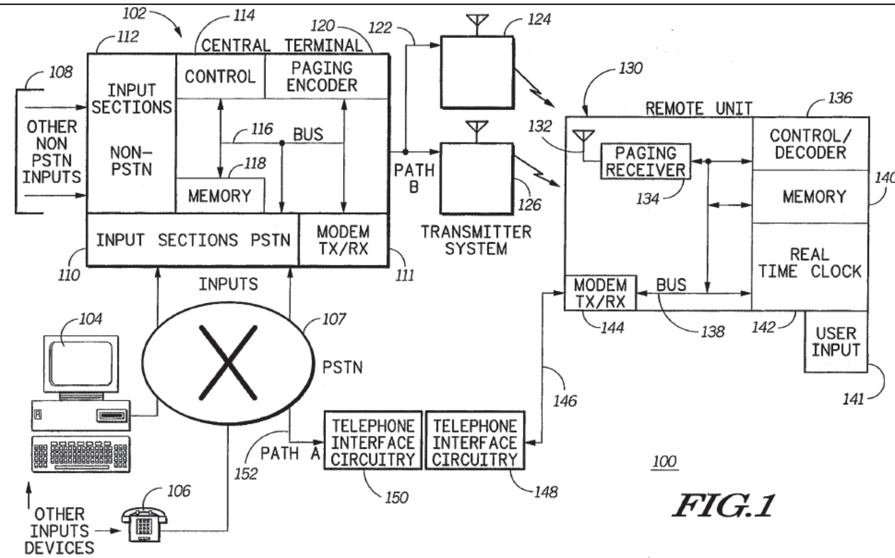


FIG.1

Schwendeman Fig. 1.

"In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels."

Schwendeman 4:66-5:9.

"However, using two-way radio frequency communication channels for both path A and path B may be perfectly acceptable in some systems."

	Schwendeman 5:16-18.

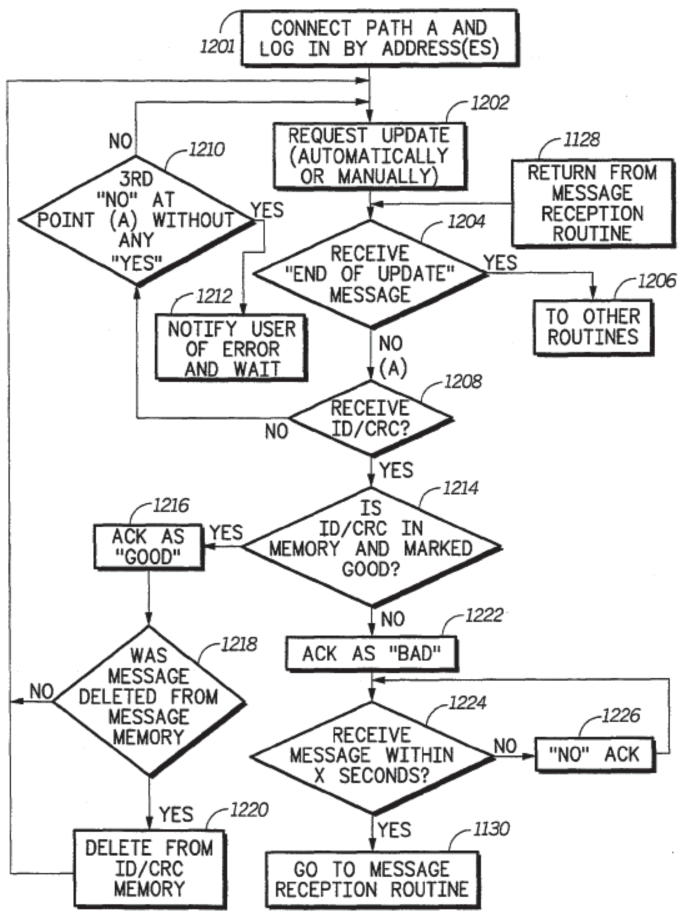
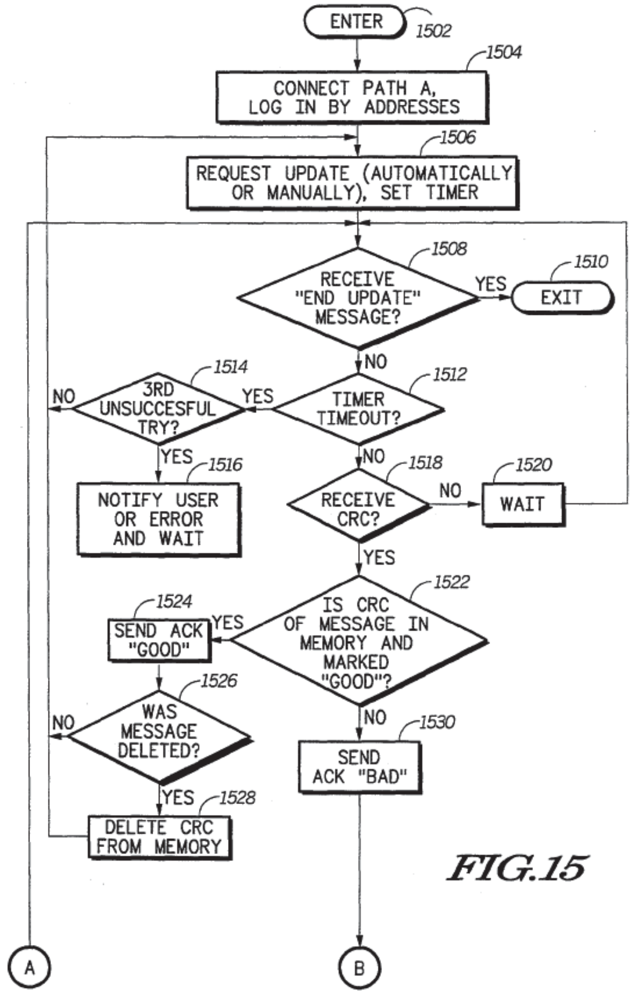
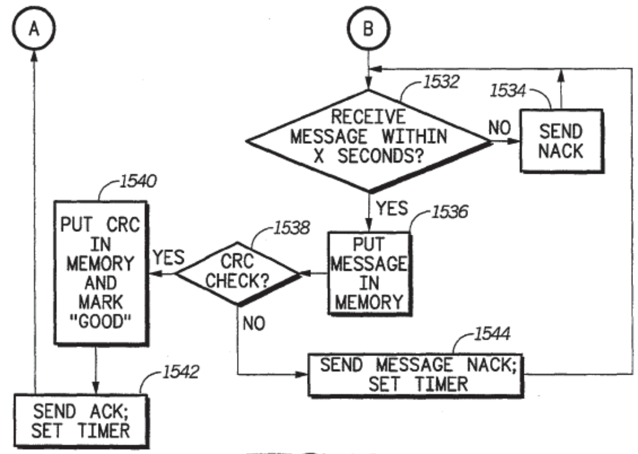


FIG.12

Schwendeman Fig. 12.

	"Referring to FIG. 12, once the remote unit 130 is connected 1201 and communicating with the central terminal 102 over path A 152, the remote unit 130 can initiate a reconciliation sequence 1202 with the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, in a response to a manual entry, e.g., in response to user input, at the remote unit 130 such as by buttons, or switches 141. While in the reconciliation handling routine 102, if the remote unit 130 receives a request from the central terminal 102 to terminate 1204 the reconciliation sequence, the remote unit 130 can exit the reconciliation handling routine and perform 1206 other functions. While in the reconciliation routine, the remote unit 130 waits to receive 1208 a transmission over path A from the central terminal. If the received message information 1208 is not correctly received by the remote unit 130, the remote unit 130 can request reconciliation again 1210, 1202. If the remove unit 130 requests reconciliation for a third time 1210 then it notifies 1212 the user that there is an error in communication with the central terminal 102." Schwendeman 14:50-15:3.

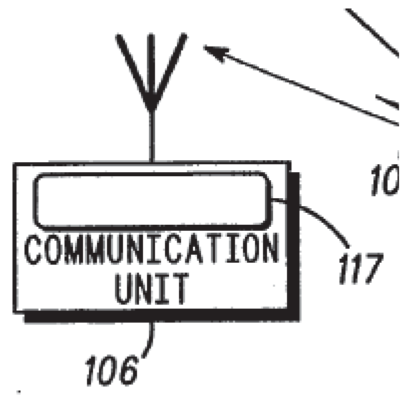
	 ENTER 1502 CONNECT PATH A, LOG IN BY ADDRESSES 1504 REQUEST UPDATE (AUTOMATICALLY OR MANUALLY), SET TIMER 1506 RECEIVE "END UPDATE" MESSAGE? 1508 YES EXIT 1510 NO TIMER TIMEOUT? 1512 YES 3RD UNSUCCESFUL TRY? 1514 NO YES NOTIFY USER OR ERROR AND WAIT 1516 NO RECEIVE CRC? 1518 NO WAIT 1520 YES IS CRC OF MESSAGE IN MEMORY AND MARKED "GOOD"? 1522 YES SEND ACK "GOOD" 1524 WAS MESSAGE DELETED? 1526 NO YES DELETE CRC FROM MEMORY 1528 NO SEND ACK "BAD" 1530 A B FIG.15

	 FIG.16 Schwendeman Figs 15-16. “Referring to FIGS. 15 and 16, once the remote unit 130 is connected 1502, 1504 and communicating with the central terminal 102 over path A 152, the remote unit 130 can initiate a reconciliation sequence 1506 by sending a reconciliation request to the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, as a response to a manually entry, e.g., in response to user input, at the remote unit 130 by buttons or switches 141. While in the reconciliation sequence, if the remote unit 1130 receives a request from the central terminal 102 to terminate 1508 the reconciliation sequence, the remote unit 130 can exit 1510 and perform other functions as necessary. When the remote unit 130 initiates 1506 a reconciliation sequence, it can also set a timer to a predetermined value to provide a maximum time interval for the central terminal 102 to respond to the reconciliation request.” Schwendeman 20:15-32.
1(E) means for receiving said	Krebs in combination with Schwendeman and Yoshida discloses a means for receiving said

specified portion retransmitted from the communications network and for displaying the received specified portion on the display.	specified portion retransmitted from the communications network and for displaying the received specified portion on the display. *See, e.g.*, "Upon receipt of the response, the central processor determines whether the response is the receive message request 207. When the response is to receive the message, the central processor transmits the message to the operable communication unit, via the repeater, on a communication resource in either a second or third set of communication resources, depending on the type of message 208." Krebs 5:40-47. "While receiving second or third bandwidth type messages, the operable communication unit may receive additional first bandwidth type messages from the central processor." Krebs 5:65-68. "When the message is of the second bandwidth message type, the central processor prepares a first bandwidth notification message and transmits it to the communication unit via the communication resource. The first bandwidth notification message informs a user of the communication unit that the central processor has the second bandwidth type message for it. When the user desires to receive the message, a request is sent to the central processor, which subsequently transmits the message on a communication resource that is primarily used for transceiving second bandwidth type messages." Krebs Abstract. "When the user desires to receive the message, a request is sent to the central processor, which subsequently transmits the message on a communication resource that is primarily used for transceiving second bandwidth type messages." Krebs 2:32-36.

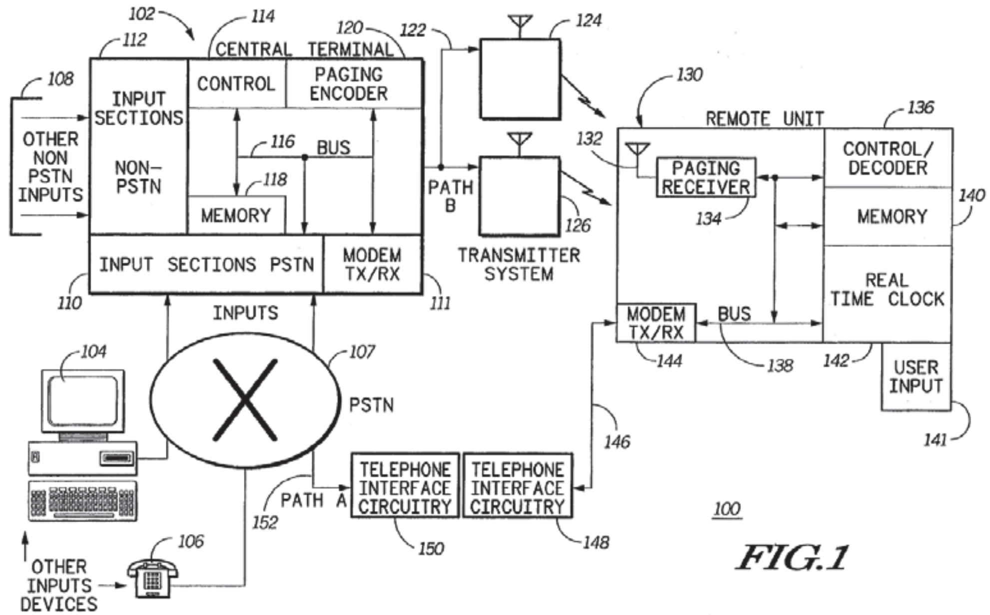
"a plurality of communication units 106-108 each having a display 117"

Krebs 2:46-47.



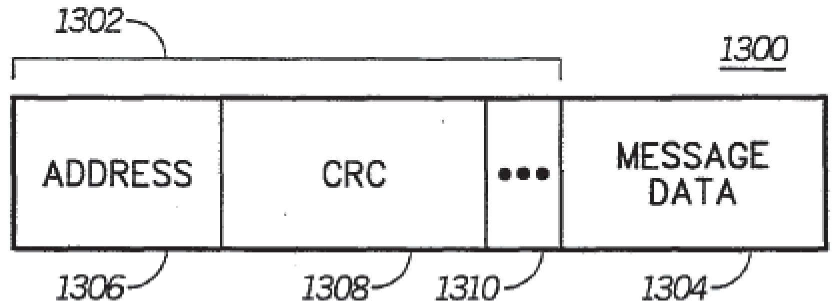
Krebs Fig. 1.

Schwendeman discloses a means for receiving said specified portion retransmitted from the communications network and for displaying the received specified portion on the display. *See, e.g.*,

	 Schwendeman Fig. 1. “This invention relates generally to message delivery systems, such as for electronic mail systems, and more specifically to specifically to a method and apparatus for reliably delivering messages to one or more remote units from a central communication system utilizing a paging transmitter system.” Schwendeman 1:10-15. “Communication systems, such as paging systems, typically communicate messages from an originating device to one or more destination devices. These messages can include numeric and alphanumeric information for a user of the destination device. The destination device, e.g., a selective call receiver or pager, typically presents the information received to the user by displaying the information on a display.”

	Schwendeman 1:18-25. "The selective call receiver 130 preferably incorporates a paging receiver 134 that operates to receive messages transmitted over the paging communication channel through the antenna 132. The operation of a paging receiver 134 of the general type shown in FIG. 1 is well known and is more fully described in U.S. Pat. No. 4,518,961 issued May 21, 1985, entitled, "Universal Paging Device With Power Conservation", which is assigned to the same assignee as the present invention and is incorporated herein by reference." Schwendeman 3:65-4:6. "A user can access user input means 141, such as buttons or switches, at the remote unit 130 to cause the message data of a received message to be displayed on a display, e.g., a liquid crystal display (not shown). The user can then read the message that is visible on the display." Schwendeman 4:16-21. "The path A 152 communication medium and the path B 122 communication medium can comprise any communication paths, such as direct wired line path, telephone line path, or wireless communication path including at least one radio communication channel preferably path A 152 is different than path B 122." Schwendeman 4:59-65. "In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels."

	Schwendeman 4:66-5:9. "However, using two-way radio frequency communication channels for both path A and path B may be perfectly acceptable in some systems." Schwendeman 5:16-18. "Typically, the user reviews the message on a display on the remote unit 130. That is, for example, the user can read the message on a display screen such as commonly available on portable personal computers and portable selective call display receivers." Schwendeman 7:12-16. "Additionally, the remote unit 130 can determine 1280 if the message data was previously deleted from memory 140, such as after a user has read the message from a display." Schwendeman 15:15-18. "That is for example, when the message data 1304 is determined to be corrupted by the receiving remote unit 130, the remote unit 130 can automatically alert the user via a message on a visual display." Schwendeman 18:24-27.
Claim 2	**5,448,759 ("Krebs") in Combination with U.S. Patent No. 5,396,537 ("Schwendeman") and U.S. Patent No. 5,031,179 ("Yoshida")**
2(A) The mobile unit of claim 1, further comprising: means for detecting errors in the received message,	Schwendeman, when combined with Krebs and Yoshida, discloses a means for detecting errors in the received message. It would have been obvious to one of ordinary skill in the art to combine the teachings of Krebs with error detection function of Schwendeman, resulting in a system that detects errors in the received message that can be displayed to a user. *See, e.g.*,

	 FIG.13 Schwendeman Fig. 13. “Other information can be transmitted with a transmitted message 200, such as error detecting and/or correcting code. For example, a cyclic redundancy code (CRC) 212 can be included with each transmitted message 200 to help identify at the receiving remote unit 130 when received message data 204 has been erroneously received, e.g., when the message data 204 has been received with errors included therein. In this cage, [sic] although the message 200 has been received by the remote unit 130, the message data 204 may not ba completely and correctly communicated to the user of the remote unit 130.” Schwendeman 8:8-19.
2(B) said display including means for highlighting said errors when the message is displayed on said display.	Schwendeman, when combined with Krebs and Yoshida, discloses a display including a means for highlighting said errors when the message is displayed on said display . It would have been obvious to one of ordinary skill in the art to combine the teachings of Krebs with the error detection function of Schwendeman, resulting in a system that notifies the user when the received message includes errors and displays that indication. *See, e.g.*, “That is for example, when the message data 1304 is determined to be corrupted by the receiving remote unit 130, the remote unit 130 can automatically alert the user via a message on a visual display.”

<table>
<tr><td></td><td>Schwendeman 18:24-27.</td></tr>
<tr><th>Claim 4</th><th>5,448,759 (“Krebs”) in Combination with U.S. Patent No. 5,396,537 (“Schwendeman”) and U.S. Patent No. 5,031,179 (“Yoshida”)</th></tr>
<tr><td>The mobile unit of claim 1, wherein the signal transmitted by the transmitting means indicates to the network that the user has read the message.</td><td>Krebs in combination with Schwendeman and Yoshida discloses that the signal transmitted by the transmitting means indicates to the network that the user has read the message. See, e.g.,

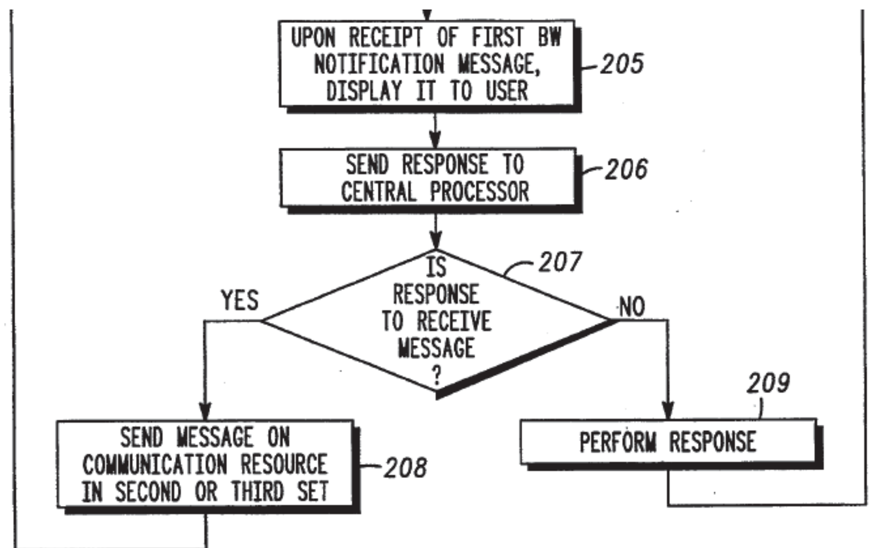


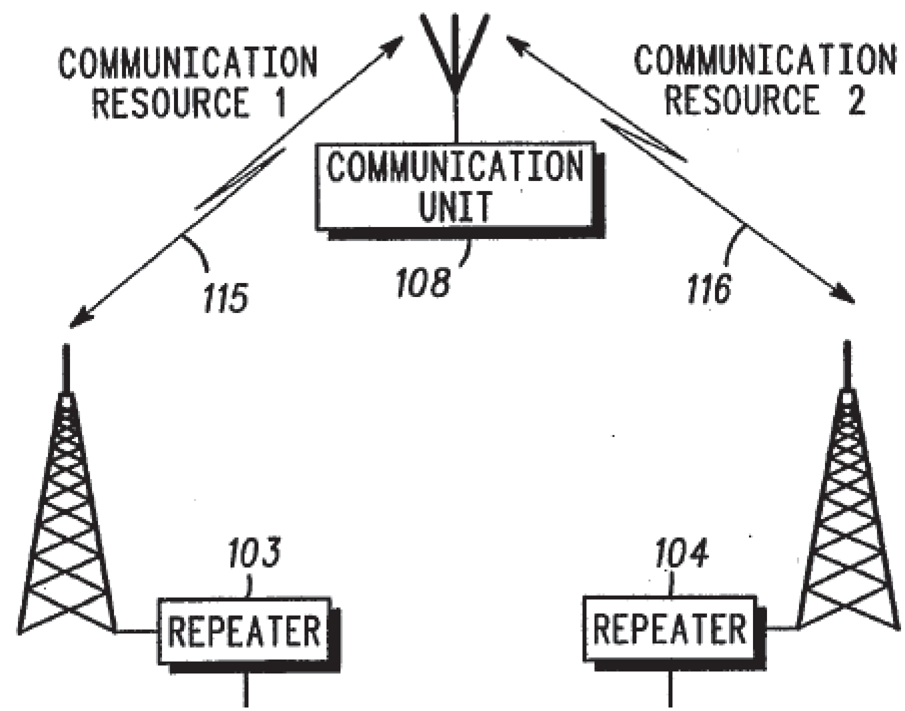
FIG. 2

Krebs Fig. 2.

“Upon preparing the first bandwidth notification message, the central processor transmits, or sends, the first bandwidth notification message to the operable communication unit, via the repeater, on the communication resource in the first set 204.

When the operable communication unit receives the first bandwidth notification message, the</td></tr>
</table>

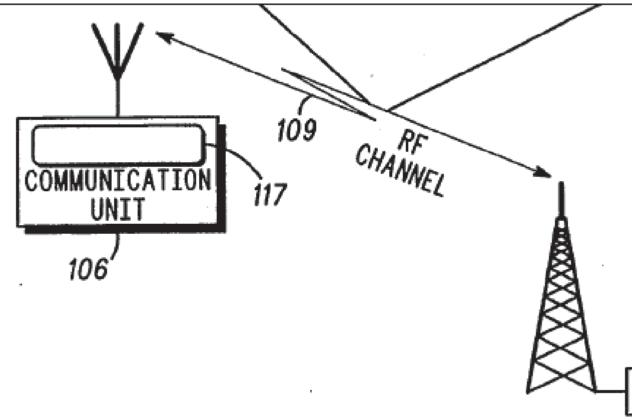
	notification message is displayed to the user 205. The operable communication unit displays the notification message to the user via its display screen. Since a typical display screen can only display about 36 characters of the message at a time, the user may need to utilize a message scrolling function to read messages incorporating more than 36 characters." Krebs 4:65-5:11. "Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request. The response is generally sent to the central processor immediately following the display of the first bandwidth notification message, but it may also be delayed, in which case, the central processor continues to store the message in its memory." Krebs 5:22-31.
Claim 7	**5,448,759 ("Krebs") in Combination with U.S. Patent No. 5,396,537 ("Schwendeman") and U.S. Patent No. 5,031,179 ("Yoshida")**
7(P) A communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network, the network comprising:	Krebs in combination with Schwendeman and Yoshida discloses a communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the communications network. *See, e.g.*,

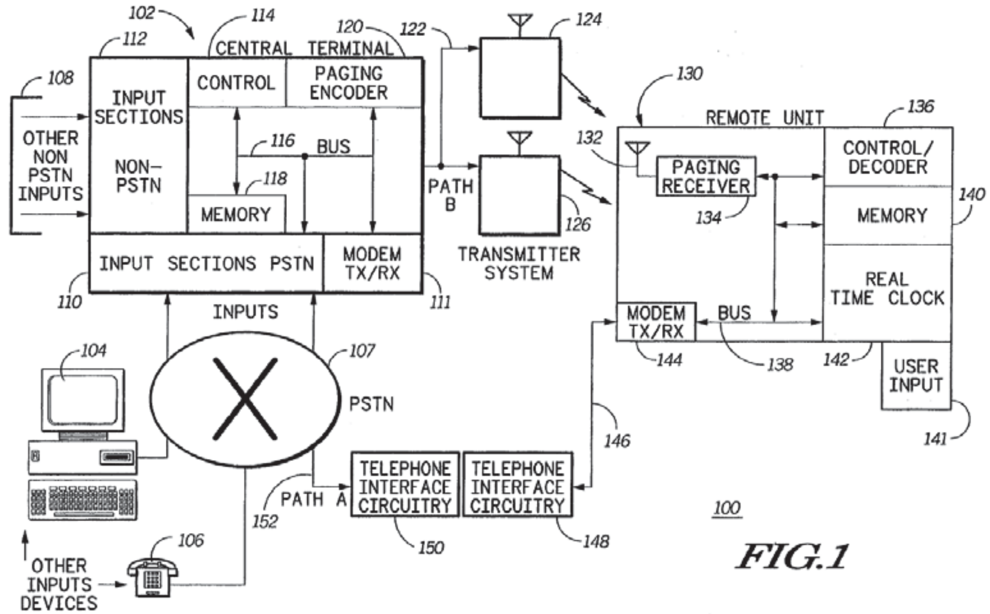


Krebs Fig. 1.

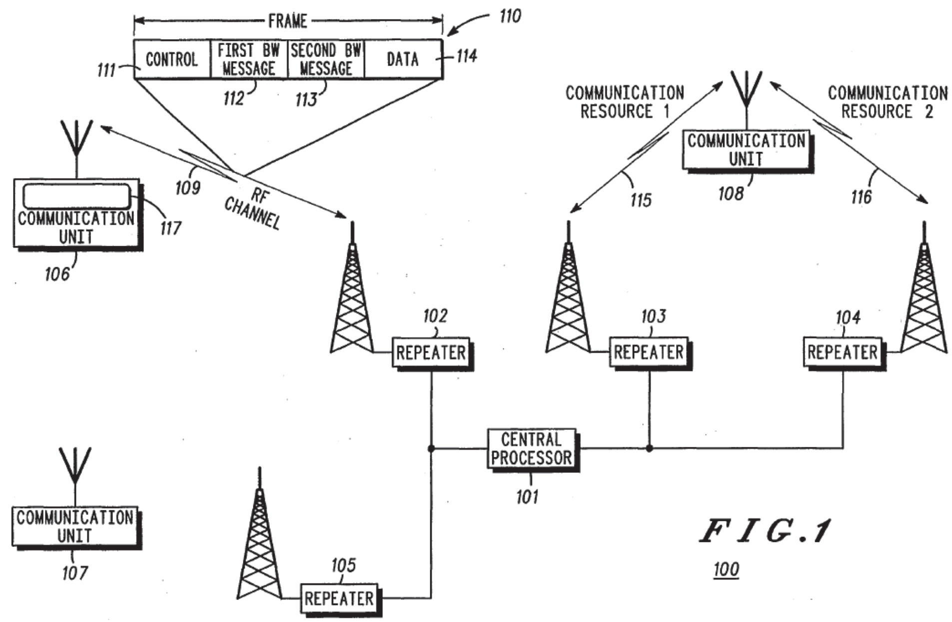
“Upon registering, the central processor authorizes the communication unit to be on the communication network and communicates, via control information, with the communication unit while the communication unit is within the network's coverage area. The central processor continuously monitors the communication unit's operational status, such as attachment or detachment from the network, location updates, authentication, and service requests.”

Krebs 3:51-59.

	 Krebs Fig. 1. "a plurality of communication units 106-108 each having a display 117" Krebs 2:46-47. "When the operable communication unit receives the first bandwidth notification message, the notification message is displayed to the user 205. The operable communication unit displays the notification message to the user via its display screen." Krebs 5:3-7. It would have been obvious to one of ordinary skill in the art to combine the teachings of Krebs with the retransmission request system of Schwendeman, resulting in a system that allows the user to request retransmission of only the errored portions of a received message. Schwendeman discloses a communications network for transmitting radio frequency signals to a mobile unit and for receiving radio frequency signals from the mobile unit, the mobile unit having a display and a switch actuatable to specify a portion of a displayed message for which a user desires retransmission after viewing the displayed message transmitted from the

	communications network. *See, e.g.*,  FIG.1 Schwendeman Fig. 1. "This invention relates generally to message delivery systems, such as for electronic mail systems, and more specifically to specifically to a method and apparatus for reliably delivering messages to one or more remote units from a central communication system utilizing a paging transmitter system." Schwendeman 1:10-15. "FIG. 1 shows a communication system 100 utilizing a paging transmitter system 120, 122, 124, 126, for delivering messages to at least one portable remote unit, e.g., a portable selective call receiver 130, in accordance with the preferred embodiment of the present

	invention." Schwendeman 2:62-67. "The path A 152 communication medium and the path B 122 communication medium can comprise any communication paths, such as direct wired line path, telephone line path, or wireless communication path including at least one radio communication channel preferably path A 152 is different than path B 122." Schwendeman 4:59-65. "In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels." Schwendeman 4:66-5:9. "However, using two-way radio frequency communication channels for both path A and path B may be perfectly acceptable in some systems." Schwendeman 5:16-18.
7(A) means for transmitting radio frequency signals containing a message to the mobile unit;	Krebs in combination with Schwendeman and Yoshida discloses a means for transmitting radio frequency signals containing a message to the mobile unit. For example, Krebs discloses the use of a network of base stations for transmitting radio frequency signals and messages to mobile units. *See, e.g.*,

	 FIG. 1 100 Krebs Fig. 1. “FIG. 1 illustrates a communication system 100 that includes a central processor 101, a plurality of repeaters or paging broadcast units 102-105 that transceive a limited number of communication resources 111-116, and a plurality of communication units 106-108 each having a display 117. The central processor may comprise a central controller and a data processing element that includes communication protocols, data storage (memory), queuing means, a communication unit data base, and message scheduling algorithms. Alternatively, the data processing element may comprise multiple processing elements which may be centrally located or distributed on a computer network.” Krebs 2:42-55. Schwendeman discloses a means for transmitting radio frequency signals containing a

message to the mobile unit. For example, Schwendeman discloses the use of base stations for transmitting radio frequency signals and messages to mobile units. *See, e.g.*,

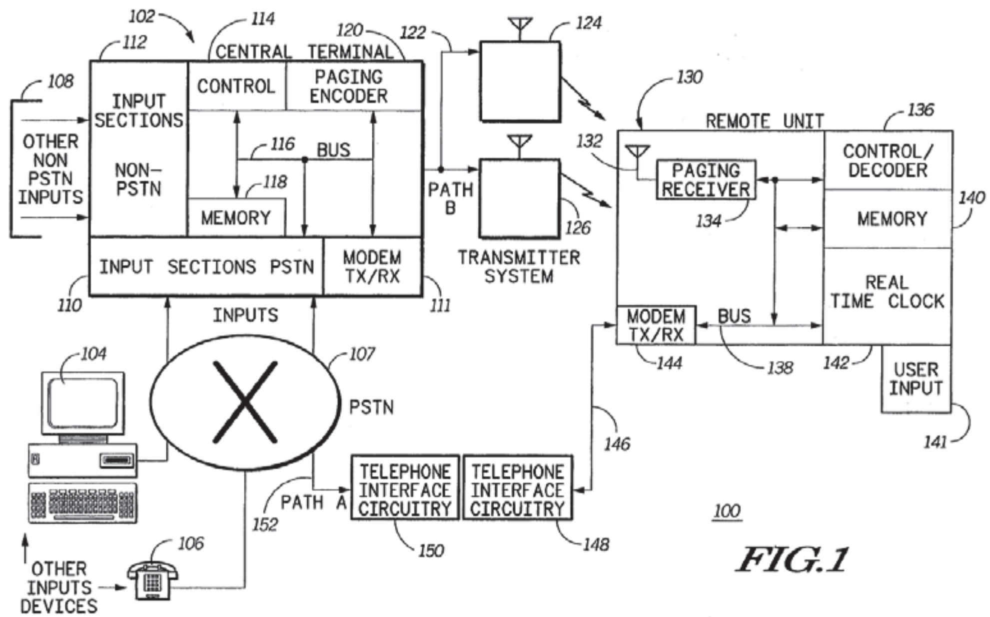


FIG.1

Schwendeman Fig. 1.

"This invention relates generally to message delivery systems, such as for electronic mail systems, and more specifically to specifically to a method and apparatus for reliably delivering messages to one or more remote units from a central communication system utilizing a paging transmitter system."

Schwendeman 1:10-15.

"FIG. 1 shows a communication system 100 utilizing a paging transmitter system 120, 122, 124, 126, for delivering messages to at least one portable remote unit, e.g., a portable selective call receiver 130, in accordance with the preferred embodiment of the present

	invention." Schwendeman 2:62-67. "The path A 152 communication medium and the path B 122 communication medium can comprise any communication paths, such as direct wired line path, telephone line path, or wireless communication path including at least one radio communication channel preferably path A 152 is different than path B 122." Schwendeman 4:59-65. "In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels." Schwendeman 4:66-5:9. "However, using two-way radio frequency communication channels for both path A and path B may be perfectly acceptable in some systems." Schwendeman 5:16-18.
7(B) means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission;	Krebs in combination with Schwendeman and Yoshida discloses a means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission. For example, Krebs discloses the use of a network of base stations for receiving radio frequency signals and messages from mobile units. *See, e.g.*,

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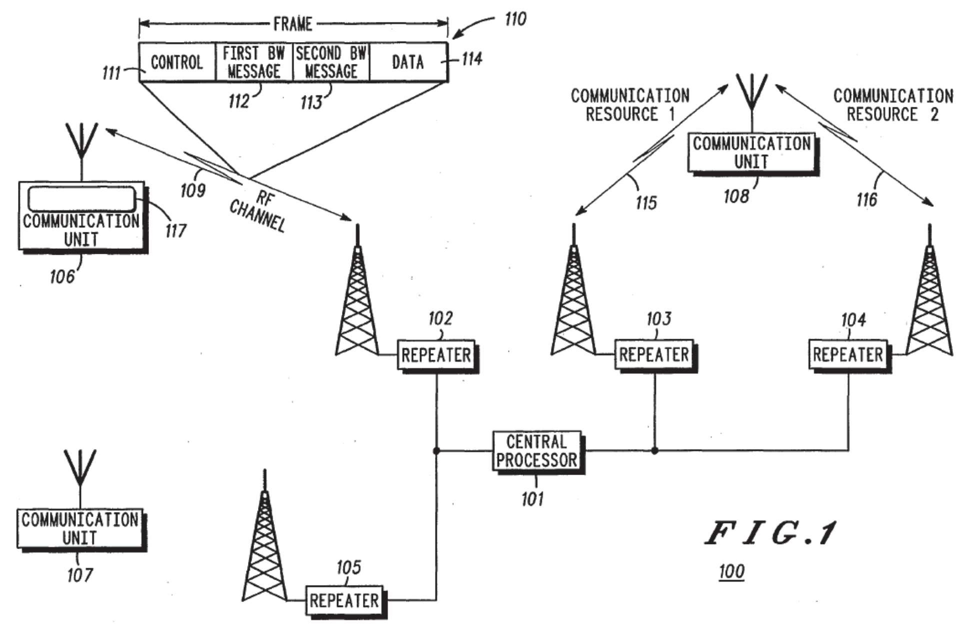

Krebs Fig. 1.

“FIG. 1 illustrates a communication system 100 that includes a central processor 101, a plurality of repeaters or paging broadcast units 102-105 that transceive a limited number of communication resources 111-116, and a plurality of communication units 106-108 each having a display 117. The central processor may comprise a central controller and a data processing element that includes communication protocols, data storage (memory), queuing means, a communication unit data base, and message scheduling algorithms. Alternatively, the data processing element may comprise multiple processing elements which may be centrally located or distributed on a computer network.”

Krebs 2:42-55.

“When the user desires to receive the message, a request is sent to the central processor,
</td>
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<table>
<tr><td></td><td>which subsequently transmits the message on a communication resource that is primarily used for transceiving second bandwidth type messages."

Krebs 2:32-36.

"Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request."

Krebs 5:22-27.

"Upon receipt of the response, the central processor determines whether the response is the receive message request 207. When the response is to receive the message, the central processor transmits the message to the operable communication unit, via the repeater, on a communication resource in either a second or third set of communication resources, depending on the type of message 208."

Krebs 5:40-47.

It would have been obvious to one of ordinary skill in the art to combine the teachings of Krebs with the retransmission request systems of Schwendeman and Yoshida, resulting in a system that allows the user to request retransmission of only the errored portions of a received message.

Schwendeman discloses a means for receiving, from the mobile unit, radio frequency signals representing a portion of the message that the user desires retransmission. For example, Krebs discloses the use of a network of base stations for receiving radio frequency signals and messages from mobile units. See, e.g.,</td></tr>
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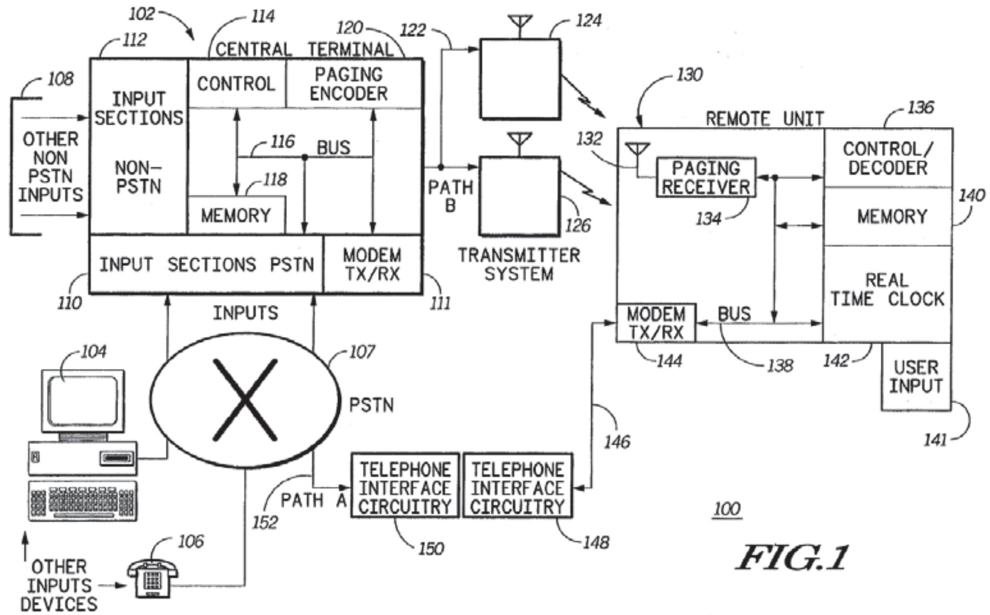

Schwendeman Fig. 1.
“This invention relates generally to message delivery systems, such as for electronic mail systems, and more specifically to specifically to a method and apparatus for reliably delivering messages to one or more remote units from a central communication system utilizing a paging transmitter system.”
Schwendeman 1:10-15.
“FIG. 1 shows a communication system 100 utilizing a paging transmitter system 120, 122, 124, 126, for delivering messages to at least one portable remote unit, e.g., a portable selective call receiver 130, in accordance with the preferred embodiment of the present invention.”
</td>
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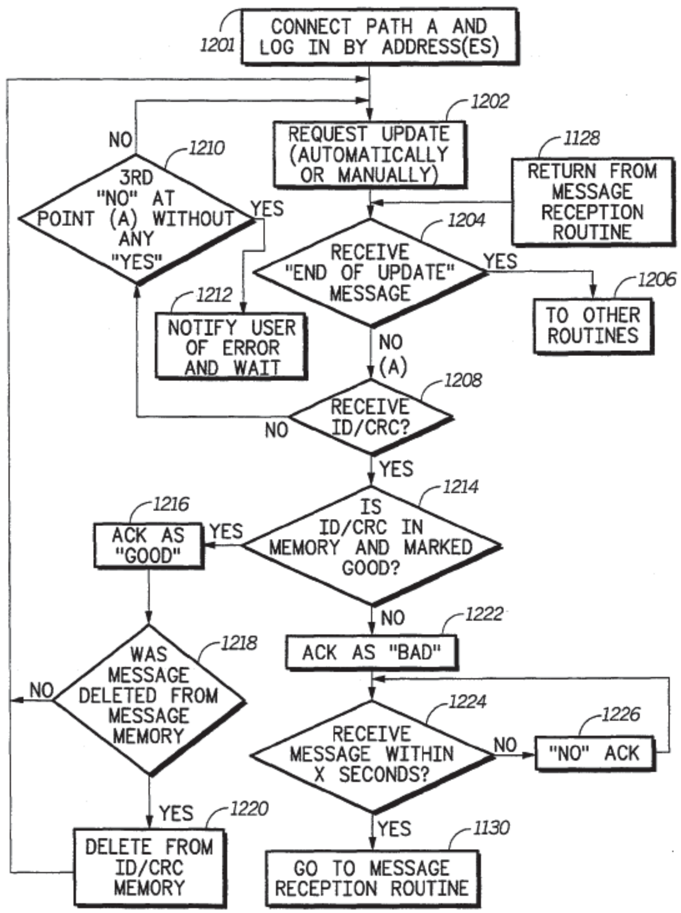
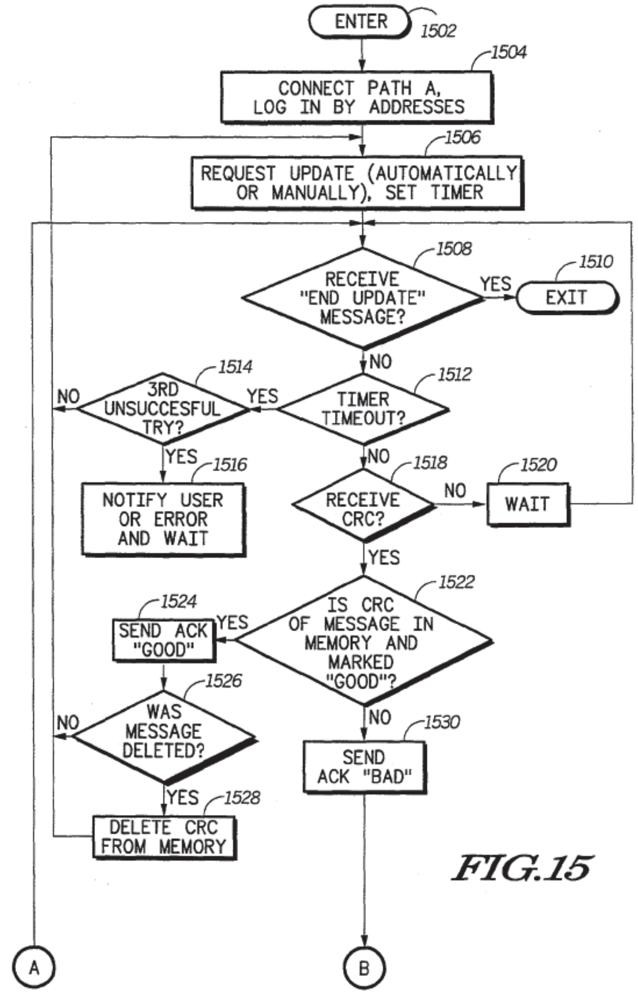
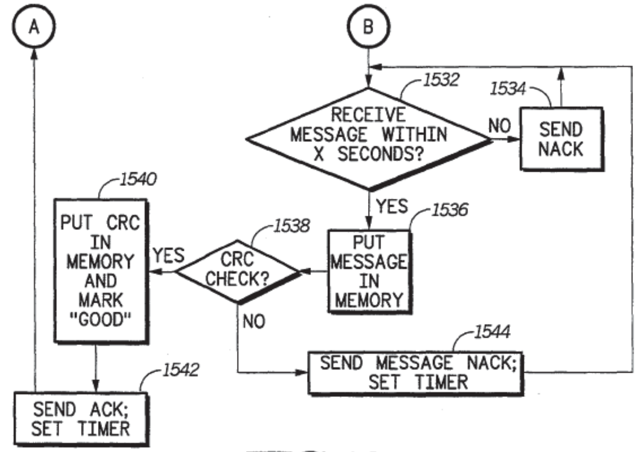
</table>

	Schwendeman 2:62-67. "The path A 152 communication medium and the path B 122 communication medium can comprise any communication paths, such as direct wired line path, telephone line path, or wireless communication path including at least one radio communication channel preferably path A 152 is different than path B 122." Schwendeman 4:59-65. "In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels." Schwendeman 4:66-5:9. "However, using two-way radio frequency communication channels for both path A and path B may be perfectly acceptable in some systems." Schwendeman 5:16-18.

	 *FIG.12* Schwendeman Fig. 12. “Referring to FIG. 12, once the remote unit 130 is connected 1201 and communicating with the central terminal 102 over path A 152, the remote unit 130 can initiate a reconciliation

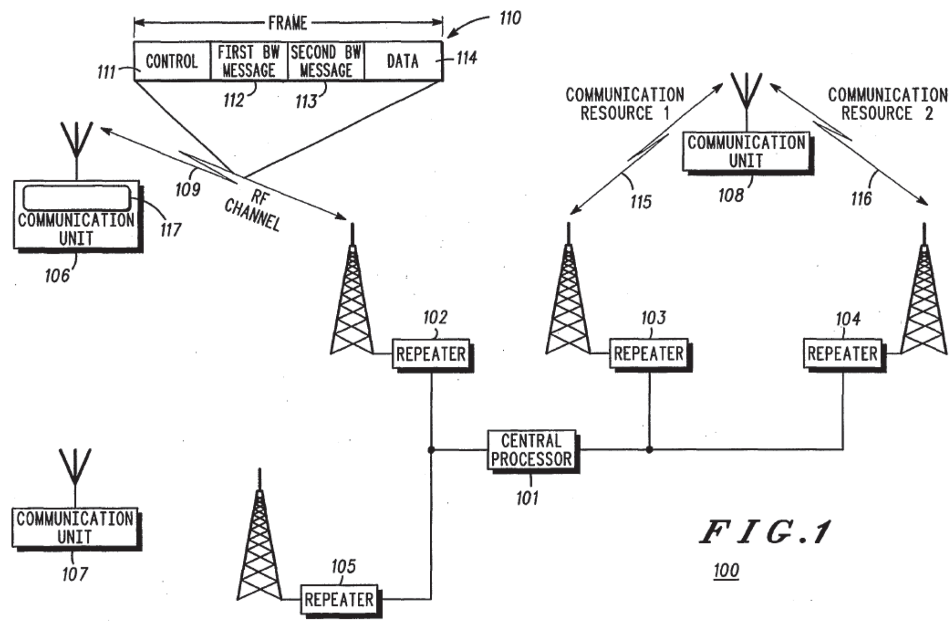
	sequence 1202 with the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, in a response to a manual entry, e.g., in response to user input, at the remote unit 130 such as by buttons, or switches 141. While in the reconciliation handling routine 102, if the remote unit 130 receives a request from the central terminal 102 to terminate 1204 the reconciliation sequence, the remote unit 130 can exit the reconciliation handling routine and perform 1206 other functions. While in the reconciliation routine, the remote unit 130 waits to receive 1208 a transmission over path A from the central terminal. If the received message information 1208 is not correctly received by the remote unit 130, the remote unit 130 can request reconciliation again 1210, 1202. If the remove unit 130 requests reconciliation for a third time 1210 then it notifies 1212 the user that there is an error in communication with the central terminal 102.” Schwendeman 14:50-15:3.


ENTER
1502
1504
CONNECT PATH A, LOG IN BY ADDRESSES
1506
REQUEST UPDATE (AUTOMATICALLY OR MANUALLY), SET TIMER
1508
RECEIVE "END UPDATE" MESSAGE?
YES
1510
EXIT
NO
1512
TIMER TIMEOUT?
YES
1514
3RD UNSUCCESFUL TRY?
NO
YES
1516
NOTIFY USER OR ERROR AND WAIT
NO
1518
RECEIVE CRC?
NO
1520
WAIT
YES
1522
IS CRC OF MESSAGE IN MEMORY AND MARKED "GOOD"?
YES
1524
SEND ACK "GOOD"
1526
WAS MESSAGE DELETED?
NO
YES
1528
DELETE CRC FROM MEMORY
NO
1530
SEND ACK "BAD"
A
B
FIG.15

	 *FIG.16* Schwendeman Figs 15-16. “Referring to FIGS. 15 and 16, once the remote unit 130 is connected 1502, 1504 and communicating with the central terminal 102 over path A 152, the remote unit 130 can initiate a reconciliation sequence 1506 by sending a reconciliation request to the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, as a response to a manually entry, e.g., in response to user input, at the remote unit 130 by buttons or switches 141. While in the reconciliation sequence, if the remote unit 1130 receives a request from the central terminal 102 to terminate 1508 the reconciliation sequence, the remote unit 130 can exit 1510 and perform other functions as necessary. When the remote unit 130 initiates 1506 a reconciliation sequence, it can also set a timer to a predetermined value to provide a maximum time interval for the central terminal 102 to respond to the reconciliation request.” Schwendeman 20:15-32. “A data communication apparatus having an error retransmission mode allows the operator to

	ascertain an amount of error data when an error is contained in data and when the error is not corrected despite retransmission of the error a predetermined number of times, or makes it possible to reproduce data with respect to correctly received data by discriminating correct data contained in error data, thereby preventing error data from becoming wasted as practically as possible. In addition, at the time of error retransmission, a transmission mode for retransmitting the error data is changed so as to minimize the number of incidents of error retransmission, thereby to enable efficient data transmission.” Yoshida Abstract. “In the ARQ system, the following three systems are used depending on a method of retransmission: (1) Basic ARQ (Stop-and-Wait, Idle-RQ) This is a system wherein a confirmed response is returned each time one data block is received, and an ensuing data block is sent after confirmation. (2) Continuous block transmission ARQ (Go-back-N) This is a system wherein data blocks are transmitted continuously, and when a response for request for retransmission is given, the process returns to the block in which the error occurred, and an ensuing block N is retransmitted without disturbing the order of the blocks. (3) Selective retransmission ARQ (Selective Repeat) This system is a modification of the continuous block transmission ARQ, and is designed to retransmit only an error block.” Yoshida 1:50-66.
7(C) means for retransmitting radio frequency signals containing the	Krebs in combination with Schwendeman and Yoshida discloses a means for retransmitting

<table>
<tr>
<td>portion of the message to the mobile unit.</td>
<td>radio frequency signals containing the portion of the message to the mobile unit. See, e.g.,



Krebs Fig. 1.

“FIG. 1 illustrates a communication system 100 that includes a central processor 101, a plurality of repeaters or paging broadcast units 102-105 that transceive a limited number of communication resources 111-116, and a plurality of communication units 106-108 each having a display 117. The central processor may comprise a central controller and a data processing element that includes communication protocols, data storage (memory), queuing means, a communication unit data base, and message scheduling algorithms. Alternatively, the data processing element may comprise multiple processing elements which may be centrally located or distributed on a computer network.”</td>
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	Krebs 2:42-55. “Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request.” Krebs 5:22-27. “Upon receipt of the response, the central processor determines whether the response is the receive message request 207. When the response is to receive the message, the central processor transmits the message to the operable communication unit, via the repeater, on a communication resource in either a second or third set of communication resources, depending on the type of message 208.” Krebs 5:40-47. It would have been obvious to one of ordinary skill in the art to combine the teachings of Krebs with the retransmission request systems of Schwendeman and Yoshida, resulting in a system that allows the user to request retransmission of only the errored portions of a received message. Schwendeman discloses a means for retransmitting radio frequency signals containing the portion of the message to the mobile unit. *See, e.g.*,

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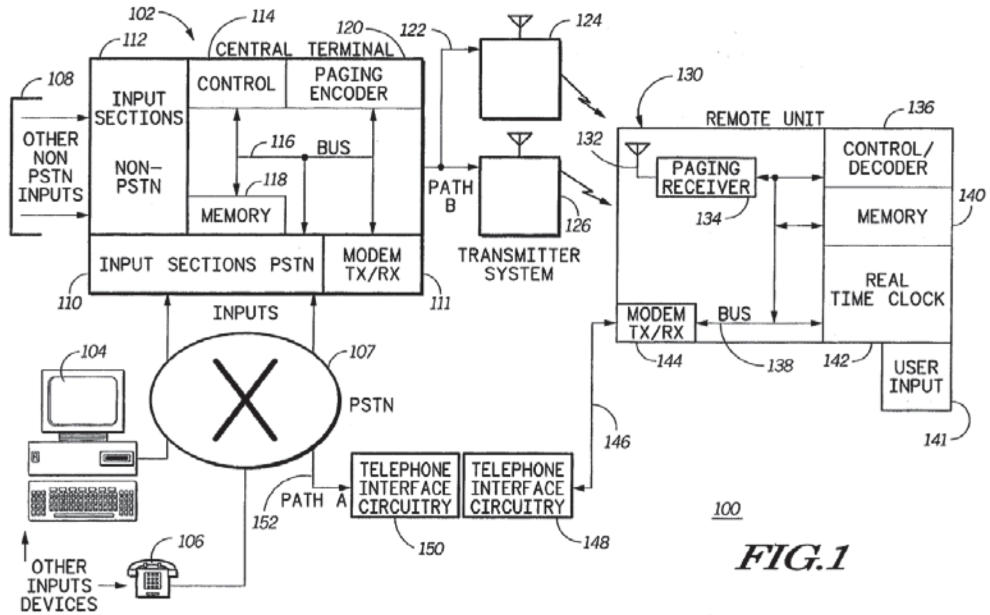

FIG.1

Schwendeman Fig. 1.

“This invention relates generally to message delivery systems, such as for electronic mail systems, and more specifically to specifically to a method and apparatus for reliably delivering messages to one or more remote units from a central communication system utilizing a paging transmitter system.”

Schwendeman 1:10-15.

“FIG. 1 shows a communication system 100 utilizing a paging transmitter system 120, 122, 124, 126, for delivering messages to at least one portable remote unit, e.g., a portable selective call receiver 130, in accordance with the preferred embodiment of the present invention.”
</td>
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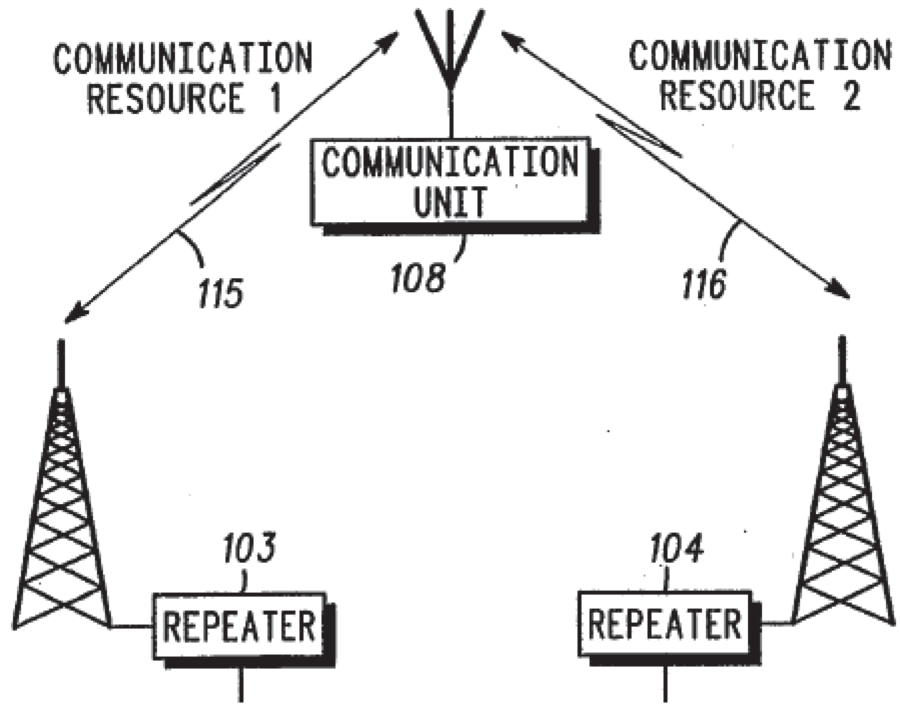
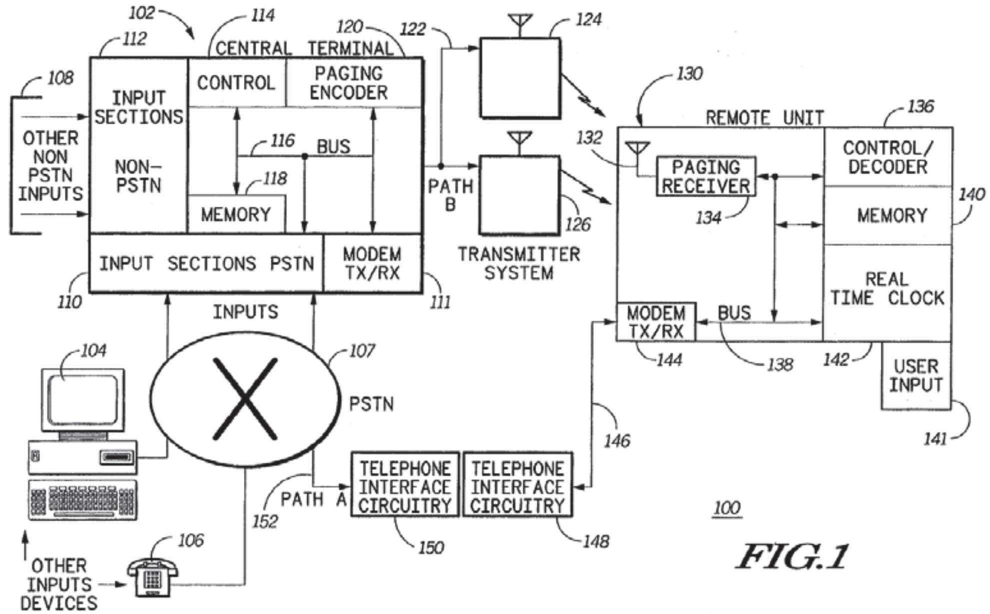
</table>

	Schwendeman 2:62-67. "The path A 152 communication medium and the path B 122 communication medium can comprise any communication paths, such as direct wired line path, telephone line path, or wireless communication path including at least one radio communication channel preferably path A 152 is different than path B 122." Schwendeman 4:59-65. "In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels." Schwendeman 4:66-5:9. "However, using two-way radio frequency communication channels for both path A and path B may be perfectly acceptable in some systems." Schwendeman 5:16-18. "A data communication apparatus having an error retransmission mode allows the operator to ascertain an amount of error data when an error is contained in data and when the error is not corrected despite retransmission of the error a predetermined number of times, or makes it possible to reproduce data with respect to correctly received data by discriminating correct data contained in error data, thereby preventing error data from becoming wasted as practically as possible. In addition, at the time of error retransmission, a transmission mode for retransmitting the error data is changed so as to minimize the number of incidents of error retransmission, thereby to enable efficient data transmission."

	Yoshida Abstract. "In the ARQ system, the following three systems are used depending on a method of retransmission: (1) Basic ARQ (Stop-and-Wait, Idle-RQ) This is a system wherein a confirmed response is returned each time one data block is received, and an ensuing data block is sent after confirmation. (2) Continuous block transmission ARQ (Go-back-N) This is a system wherein data blocks are transmitted continuously, and when a response for request for retransmission is given, the process returns to the block in which the error occurred, and an ensuing block N is retransmitted without disturbing the order of the blocks. (3) Selective retransmission ARQ (Selective Repeat) This system is a modification of the continuous block transmission ARQ, and is designed to retransmit only an error block." Yoshida 1:50-66.
Claim 8	**5,448,759 ("Krebs") in Combination with U.S. Patent No. 5,396,537 ("Schwendeman") and U.S. Patent No. 5,031,179 ("Yoshida")**
8(P) A method for receiving and transmitting messages at a mobile unit, comprising the steps of:	Krebs in combination with Schwendeman and Yoshida discloses a method for receiving and transmitting messages at a mobile unit. *See, e.g.*,

	 Krebs Fig. 1. “Upon registering, the central processor authorizes the communication unit to be on the communication network and communicates, via control information, with the communication unit while the communication unit is within the network's coverage area. The central processor continuously monitors the communication unit's operational status, such as attachment or detachment from the network, location updates, authentication, and service requests.” Krebs 3:51-59. Schwendeman discloses a method for receiving and transmitting messages at a mobile unit.

	See, e.g.,  *FIG.1* Schwendeman Fig. 1. “This invention relates generally to message delivery systems, such as for electronic mail systems, and more specifically to specifically to a method and apparatus for reliably delivering messages to one or more remote units from a central communication system utilizing a paging transmitter system.” Schwendeman 1:10-15. “The path A 152 communication medium and the path B 122 communication medium can comprise any communication paths, such as direct wired line path, telephone line path, or wireless communication path including at least one radio communication channel preferably

	path A 152 is different than path B 122." Schwendeman 4:59-65. "In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels." Schwendeman 4:66-5:9. "However, using two-way radio frequency communication channels for both path A and path B may be perfectly acceptable in some systems." Schwendeman 5:16-18.
8(A) receiving at the mobile unit a radio frequency message;	Krebs in combination with Schwendeman and Yoshida discloses receiving at the mobile unit a radio frequency message. *See, e.g.*, "This invention relates generally to radio communication systems and, in particular, to a radio communication system that utilizes communication resources to transceive varying bandwidth messages." Krebs 1:8-11. "This is accomplished when a central processor receives a message for the communication unit and determines whether the message is of a first bandwidth message type or a second bandwidth message type. When the message is of the first bandwidth message type, the central processor transmits the message to the communication unit via a communication resource that is used primarily for transceiving first bandwidth type messages. When the

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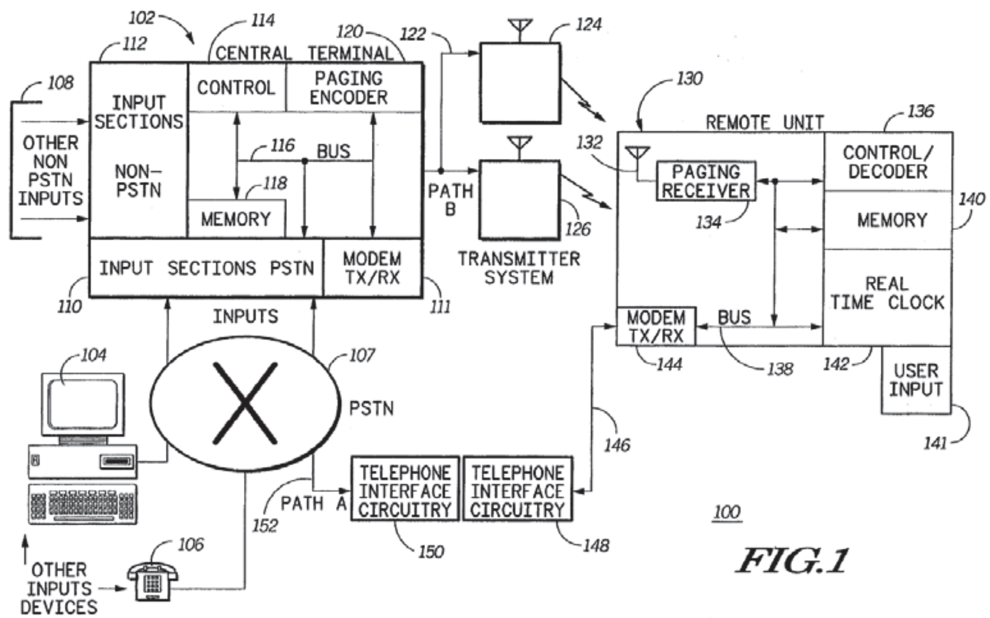
message is of the second bandwidth message type, the central processor prepares a first bandwidth notification message and transmits it to the communication unit via the communication resource, which can be done without interruption of current services. The first bandwidth notification message informs a user of the communication unit that the central processor has the second bandwidth type message for it, which the user can access at the user's convenience."

Krebs 2:14-31.

Schwendeman discloses receiving at the mobile unit a radio frequency message. *See, e.g.*,



Schwendeman Fig. 1.

"This invention relates generally to message delivery systems, such as for electronic mail systems, and more specifically to specifically to a method and apparatus for reliably

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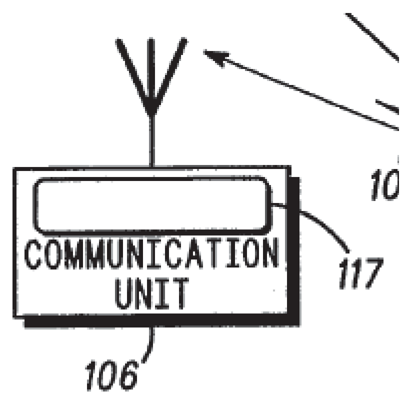
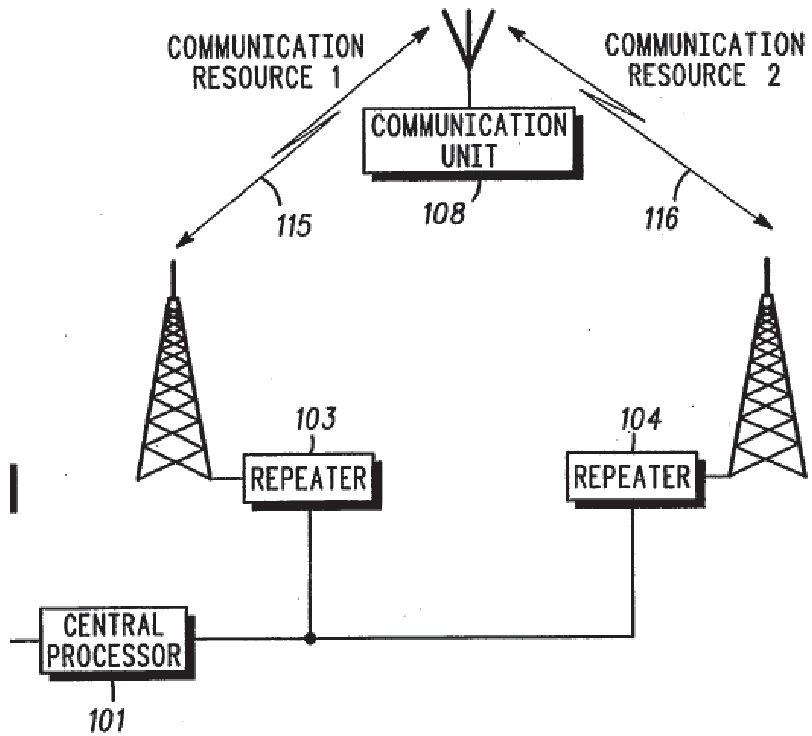
</table>

	delivering messages to one or more remote units from a central communication system utilizing a paging transmitter system.” Schwendeman 1:10-15. “The selective call receiver 130 preferably incorporates a paging receiver 134 that operates to receive messages transmitted over the paging communication channel through the antenna 132. The operation of a paging receiver 134 of the general type shown in FIG. 1 is well known and is more fully described in U.S. Pat. No. 4,518,961 issued May 21, 1985, entitled, "Universal Paging Device With Power Conservation", which is assigned to the same assignee as the present invention and is incorporated herein by reference.” Schwendeman 3:65-4:6. “The path A 152 communication medium and the path B 122 communication medium can comprise any communication paths, such as direct wired line path, telephone line path, or wireless communication path including at least one radio communication channel preferably path A 152 is different than path B 122.” Schwendeman 4:59-65. “In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels.” Schwendeman 4:66-5:9. “However, using two-way radio frequency communication channels for both path A and path

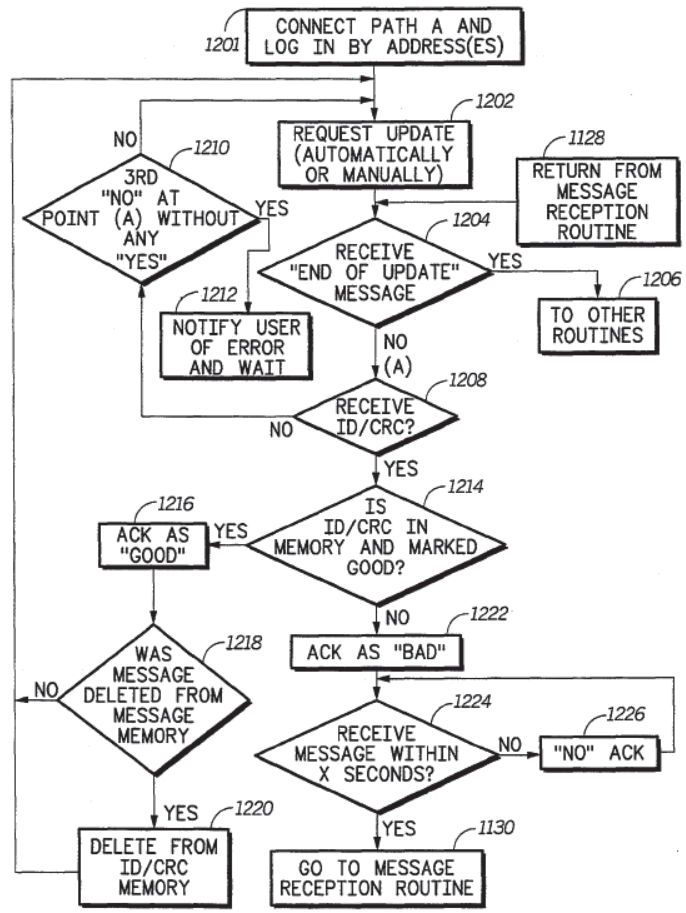
	B may be perfectly acceptable in some systems.” Schwendeman 5:16-18.
8(B) displaying said message on the mobile unit;	Krebs in combination with Schwendeman and Yoshida discloses displaying said message on the mobile unit. *See, e.g.*, “a plurality of communication units 106-108 each having a display 117” Krebs 2:46-47.  Krebs Fig. 1. “When the operable communication unit receives the first bandwidth notification message, the notification message is displayed to the user 205. The operable communication unit displays the notification message to the user via its display screen.” Krebs 5:3-7. Schwendeman discloses displaying said message on the mobile unit. *See, e.g.*,

	"Communication systems, such as paging systems, typically communicate messages from an originating device to one or more destination devices. These messages can include numeric and alphanumeric information for a user of the destination device. The destination device, e.g., a selective call receiver or pager, typically presents the information received to the user by displaying the information on a display." Schwendeman 1:18-25. "A user can access user input means 141, such as buttons or switches, at the remote unit 130 to cause the message data of a received message to be displayed on a display, e.g., a liquid crystal display (not shown). The user can then read the message that is visible on the display." Schwendeman 4:16-21. "Typically, the user reviews the message on a display on the remote unit 130. That is, for example, the user can read the message on a display screen such as commonly available on portable personal computers and portable selective call display receivers." Schwendeman 7:12-16. "Additionally, the remote unit 130 can determine 1280 if the message data was previously deleted from memory 140, such as after a user has read the message from a display." Schwendeman 15:15-18. "That is for example, when the message data 1304 is determined to be corrupted by the receiving remote unit 130, the remote unit 130 can automatically alert the user via a message on a visual display." Schwendeman 18:24-27.
8(C) receiving an indication of a	Krebs in combination with Schwendeman and Yoshida discloses receiving an indication of a

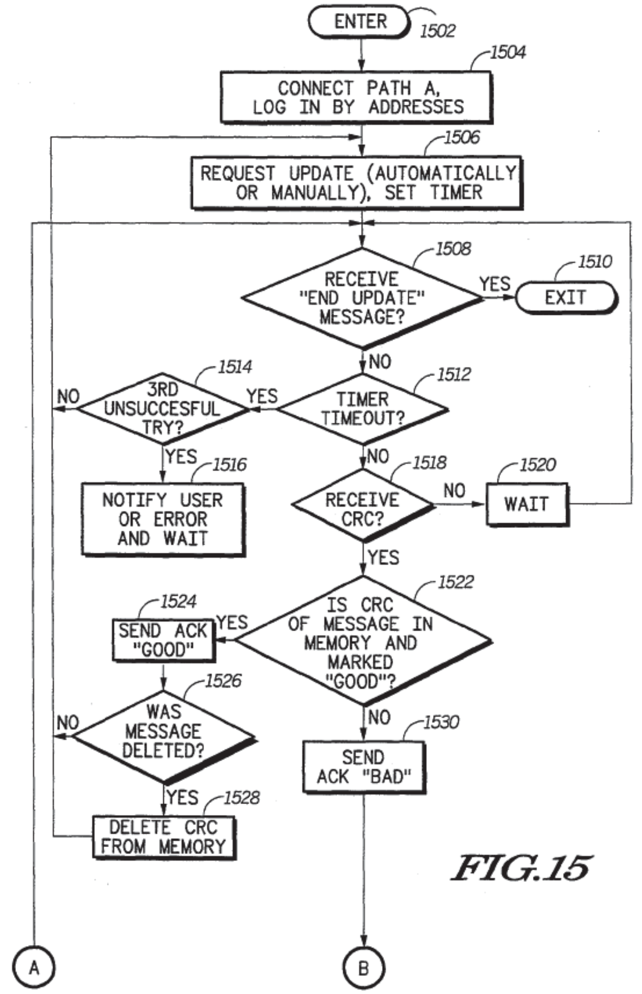
portion of the displayed message for which a user desires retransmission;	portion of the displayed message for which a user desires retransmission. *See, e.g.*, “Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request. The response is generally sent to the central processor immediately following the display of the first bandwidth notification message, but it may also be delayed, in which case, the central processor continues to store the message in its memory. Depending on system configuration, delaying the response to a later time of the day, when system traffic is lighter, may reduce service costs for receiving the message. If a response is not received within a predetermined period of time (e.g. 3 weeks), the central processor deletes the stored message.” Krebs 5:22-37.

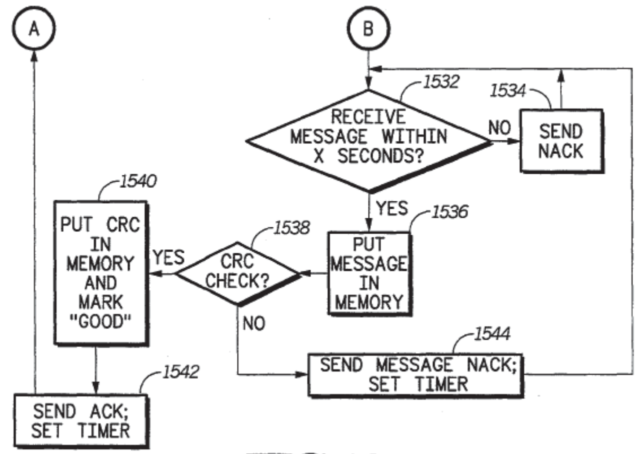
	 *FIG.1* Krebs Fig. 1. "When the message is either of the second bandwidth message type or the third bandwidth message type, the central processor prepares a first bandwidth notification message for the operable communication unit 203. The first bandwidth notification message is a first bandwidth message that notifies the operable communication unit of the second or third bandwidth message resident for it in the central processor's memory. The first bandwidth notification message typically contains the originator of the message, a summary of the message, the date sent, the length of the message, priority, and cost to retrieve the entire

	message over the network.” Krebs 4:54-65. “Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request.” Krebs 5:22-27. It would have been obvious to one of ordinary skill in the art to combine the teachings of Krebs with the retransmission request systems of Schwendeman and Yoshida, resulting in a system that allows the user to request retransmission of only the errored portions of a received message. Schwendeman discloses receiving an indication of a portion of the displayed message for which a user desires retransmission. *See, e.g.*,

	 *FIG.12* Schwendeman Fig. 12. “Referring to FIG. 12, once the remote unit 130 is connected 1201 and communicating with the central terminal 102 over path A 152, the remote unit 130 can initiate a reconciliation

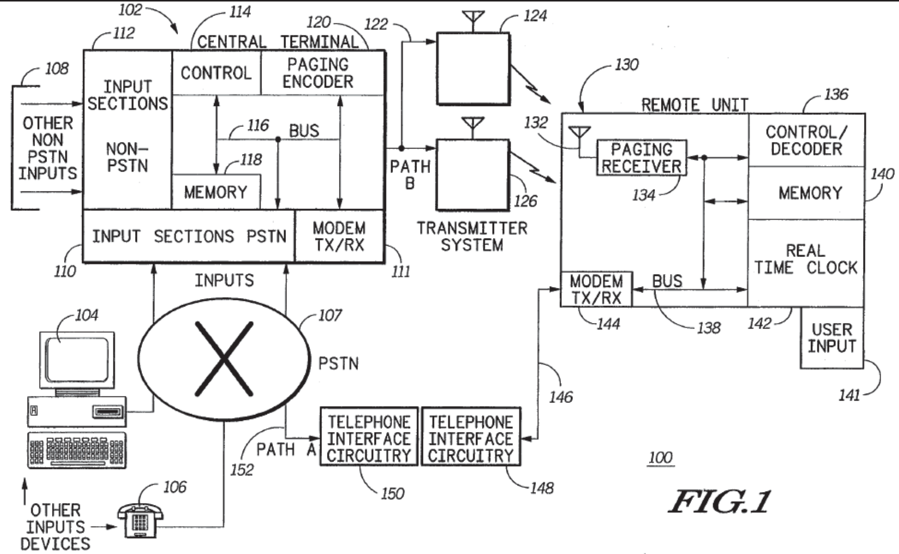
	sequence 1202 with the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, in a response to a manual entry, e.g., in response to user input, at the remote unit 130 such as by buttons, or switches 141. While in the reconciliation handling routine 102, if the remote unit 130 receives a request from the central terminal 102 to terminate 1204 the reconciliation sequence, the remote unit 130 can exit the reconciliation handling routine and perform 1206 other functions. While in the reconciliation routine, the remote unit 130 waits to receive 1208 a transmission over path A from the central terminal. If the received message information 1208 is not correctly received by the remote unit 130, the remote unit 130 can request reconciliation again 1210, 1202. If the remove unit 130 requests reconciliation for a third time 1210 then it notifies 1212 the user that there is an error in communication with the central terminal 102." Schwendeman 14:50-15:3.

	 ENTER 1502 CONNECT PATH A, LOG IN BY ADDRESSES 1504 REQUEST UPDATE (AUTOMATICALLY OR MANUALLY), SET TIMER 1506 RECEIVE "END UPDATE" MESSAGE? 1508 YES EXIT 1510 NO TIMER TIMEOUT? 1512 YES 3RD UNSUCCESFUL TRY? 1514 NO YES NOTIFY USER OR ERROR AND WAIT 1516 NO RECEIVE CRC? 1518 NO WAIT 1520 YES IS CRC OF MESSAGE IN MEMORY AND MARKED "GOOD"? 1522 YES SEND ACK "GOOD" 1524 WAS MESSAGE DELETED? 1526 NO YES DELETE CRC FROM MEMORY 1528 NO SEND ACK "BAD" 1530 A B FIG.15

	 *FIG.16* Schwendeman Figs 15-16. "Referring to FIGS. 15 and 16, once the remote unit 130 is connected 1502, 1504 and communicating with the central terminal 102 over path A 152, the remote unit 130 can initiate a reconciliation sequence 1506 by sending a reconciliation request to the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, as a response to a manually entry, e.g., in response to user input, at the remote unit 130 by buttons or switches 141. While in the reconciliation sequence, if the remote unit 1130 receives a request from the central terminal 102 to terminate 1508 the reconciliation sequence, the remote unit 130 can exit 1510 and perform other functions as necessary. When the remote unit 130 initiates 1506 a reconciliation sequence, it can also set a timer to a predetermined value to provide a maximum time interval for the central terminal 102 to respond to the reconciliation request." Schwendeman 20:15-32. Yoshida discloses retransmission of only the erroneous part of the message. *See, e.g.*,

	"A data communication apparatus having an error retransmission mode allows the operator to ascertain an amount of error data when an error is contained in data and when the error is not corrected despite retransmission of the error a predetermined number of times, or makes it possible to reproduce data with respect to correctly received data by discriminating correct data contained in error data, thereby preventing error data from becoming wasted as practically as possible. In addition, at the time of error retransmission, a transmission mode for retransmitting the error data is changed so as to minimize the number of incidents of error retransmission, thereby to enable efficient data transmission." Yoshida Abstract. "In the ARQ system, the following three systems are used depending on a method of retransmission: (1) Basic ARQ (Stop-and-Wait, Idle-RQ) This is a system wherein a confirmed response is returned each time one data block is received, and an ensuing data block is sent after confirmation. (2) Continuous block transmission ARQ (Go-back-N) This is a system wherein data blocks are transmitted continuously, and when a response for request for retransmission is given, the process returns to the block in which the error occurred, and an ensuing block N is retransmitted without disturbing the order of the blocks. (3) Selective retransmission ARQ (Selective Repeat) This system is a modification of the continuous block transmission ARQ, and is designed to retransmit only an error block." Yoshida 1:50-66.
8(D) transmitting, only upon receipt of	Krebs in combination with Schwendeman and Yoshida discloses transmitting, only upon

the indication, a signal requesting retransmission of said indicated portion of said message;	receipt of the indication, a signal requesting retransmission of said indicated portion of said message. *See, e.g.*, “Upon observing the first bandwidth notification message, the user sends a response to the central processor via the operable communication unit 206. The response may comprise a receive message request, a delete message request, a forward message request, or a save message request. The response is generally sent to the central processor immediately following the display of the first bandwidth notification message, but it may also be delayed, in which case, the central processor continues to store the message in its memory. Depending on system configuration, delaying the response to a later time of the day, when system traffic is lighter, may reduce service costs for receiving the message. If a response is not received within a predetermined period of time (e.g. 3 weeks), the central processor deletes the stored message.” Krebs 5:22-37. “Upon receipt of the response, the central processor determines whether the response is the receive message request 207. When the response is to receive the message, the central processor transmits the message to the operable communication unit, via the repeater, on a communication resource in either a second or third set of communication resources, depending on the type of message 208.” Krebs 5:40-47. It would have been obvious to one of ordinary skill in the art to combine the teachings of Krebs with the retransmission request system of Schwendeman, resulting in a system that transmits a request signal for retransmission of a portion of a received message only after a user activates the designated button on the paging device. Schwendeman discloses transmitting, only upon receipt of the indication, a signal requesting retransmission of said indicated portion of said message. *See, e.g.*,

	 FIG.1 Schwendeman Fig. 1. “In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels.” Schwendeman 4:66-5:9. “However, using two-way radio frequency communication channels for both path A and path B may be perfectly acceptable in some systems.”

<table>
<tr><td></td><td>Schwendeman 5:16-18.

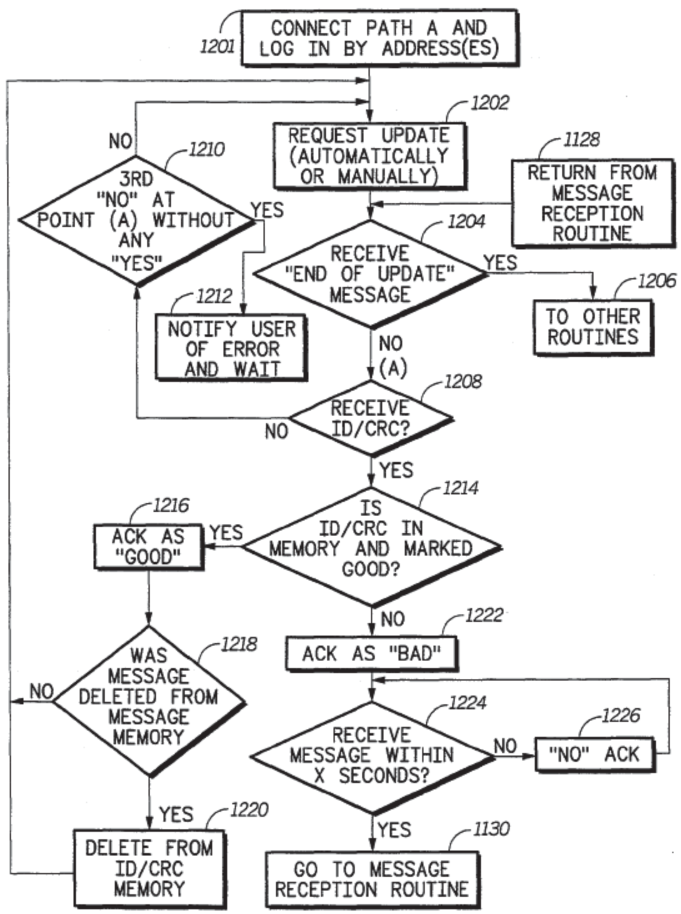


FIG.12

Schwendeman Fig. 12.</td></tr>
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	“Referring to FIG. 12, once the remote unit 130 is connected 1201 and communicating with the central terminal 102 over path A 152, the remote unit 130 can initiate a reconciliation sequence 1202 with the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, in a response to a manual entry, e.g., in response to user input, at the remote unit 130 such as by buttons, or switches 141. While in the reconciliation handling routine 102, if the remote unit 130 receives a request from the central terminal 102 to terminate 1204 the reconciliation sequence, the remote unit 130 can exit the reconciliation handling routine and perform 1206 other functions. While in the reconciliation routine, the remote unit 130 waits to receive 1208 a transmission over path A from the central terminal. If the received message information 1208 is not correctly received by the remote unit 130, the remote unit 130 can request reconciliation again 1210, 1202. If the remove unit 130 requests reconciliation for a third time 1210 then it notifies 1212 the user that there is an error in communication with the central terminal 102.” Schwendeman 14:50-15:3.

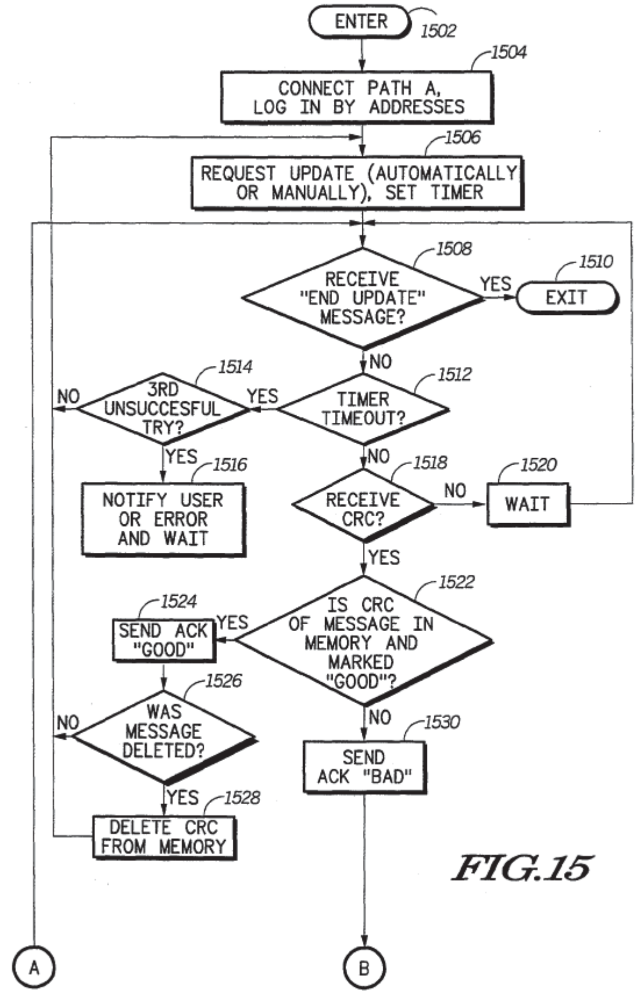

ENTER
1502
CONNECT PATH A, LOG IN BY ADDRESSES
1504
REQUEST UPDATE (AUTOMATICALLY OR MANUALLY), SET TIMER
1506
RECEIVE "END UPDATE" MESSAGE?
1508
YES
EXIT
1510
NO
TIMER TIMEOUT?
1512
YES
3RD UNSUCCESFUL TRY?
1514
NO
YES
NOTIFY USER OR ERROR AND WAIT
1516
NO
RECEIVE CRC?
1518
NO
WAIT
1520
YES
IS CRC OF MESSAGE IN MEMORY AND MARKED "GOOD"?
1522
YES
SEND ACK "GOOD"
1524
WAS MESSAGE DELETED?
1526
NO
YES
DELETE CRC FROM MEMORY
1528
NO
SEND ACK "BAD"
1530
A
B

FIG.15

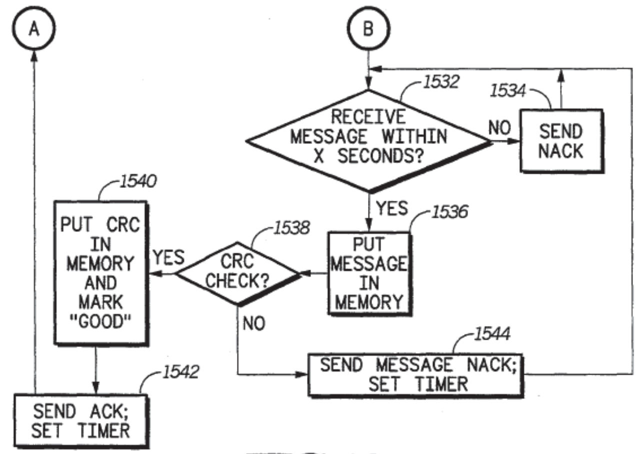
<table>
<tr><td></td><td>

FIG.16

Schwendeman Figs 15-16.

"Referring to FIGS. 15 and 16, once the remote unit 130 is connected 1502, 1504 and communicating with the central terminal 102 over path A 152, the remote unit 130 can initiate a reconciliation sequence 1506 by sending a reconciliation request to the central terminal 102. This can be done automatically between the remote unit 130 and the central terminal 102, or, optionally, as a response to a manually entry, e.g., in response to user input, at the remote unit 130 by buttons or switches 141. While in the reconciliation sequence, if the remote unit 1130 receives a request from the central terminal 102 to terminate 1508 the reconciliation sequence, the remote unit 130 can exit 1510 and perform other functions as necessary. When the remote unit 130 initiates 1506 a reconciliation sequence, it can also set a timer to a predetermined value to provide a maximum time interval for the central terminal 102 to respond to the reconciliation request."

Schwendeman 20:15-32.</td></tr>
<tr><td>8(E) receiving a retransmission of said</td><td>Krebs in combination with Schwendeman and Yoshida discloses receiving a retransmission</td></tr>
</table>

indicated portion; and	of said indicated portion. *See, e.g.*, “Upon receipt of the response, the central processor determines whether the response is the receive message request 207. When the response is to receive the message, the central processor transmits the message to the operable communication unit, via the repeater, on a communication resource in either a second or third set of communication resources, depending on the type of message 208.” Krebs 5:40-47. “While receiving second or third bandwidth type messages, the operable communication unit may receive additional first bandwidth type messages from the central processor.” Krebs 5:65-68. Schwendeman discloses receiving a retransmission of said indicated portion. *See, e.g.*,

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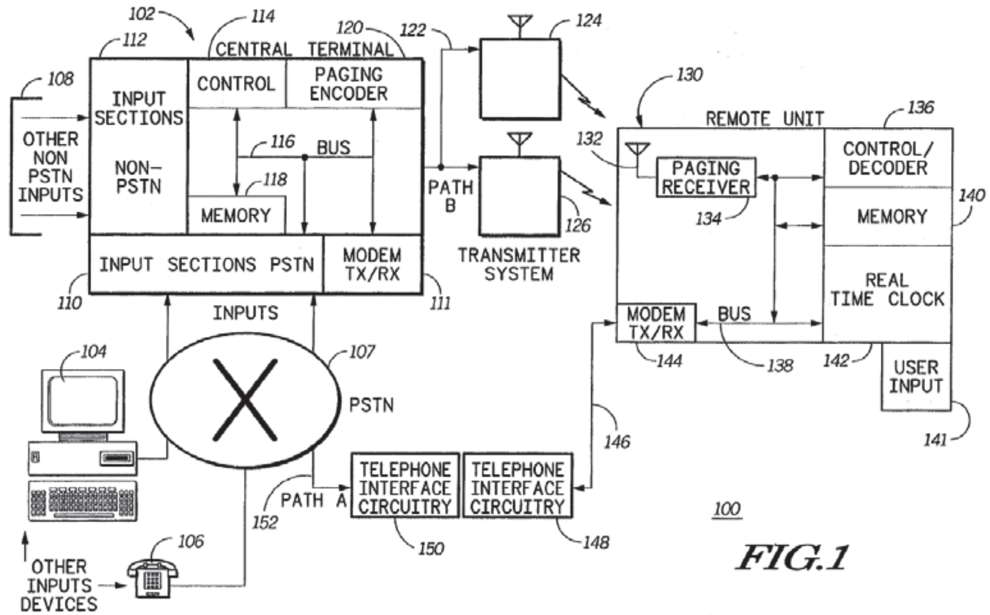

Schwendeman Fig. 1.

“This invention relates generally to message delivery systems, such as for electronic mail systems, and more specifically to specifically to a method and apparatus for reliably delivering messages to one or more remote units from a central communication system utilizing a paging transmitter system.”

Schwendeman 1:10-15.

“Communication systems, such as paging systems, typically communicate messages from an originating device to one or more destination devices. These messages can include numeric and alphanumeric information for a user of the destination device. The destination device, e.g., a selective call receiver or pager, typically presents the information received to the user by displaying the information on a display.”

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	Schwendeman 1:18-25. “The selective call receiver 130 preferably incorporates a paging receiver 134 that operates to receive messages transmitted over the paging communication channel through the antenna 132. The operation of a paging receiver 134 of the general type shown in FIG. 1 is well known and is more fully described in U.S. Pat. No. 4,518,961 issued May 21, 1985, entitled, "Universal Paging Device With Power Conservation", which is assigned to the same assignee as the present invention and is incorporated herein by reference.” Schwendeman 3:65-4:6. “A user can access user input means 141, such as buttons or switches, at the remote unit 130 to cause the message data of a received message to be displayed on a display, e.g., a liquid crystal display (not shown). The user can then read the message that is visible on the display.” Schwendeman 4:16-21. “The path A 152 communication medium and the path B 122 communication medium can comprise any communication paths, such as direct wired line path, telephone line path, or wireless communication path including at least one radio communication channel preferably path A 152 is different than path B 122.” Schwendeman 4:59-65. “In the preferred embodiment, path A 152 is a dial-up telephone line using modem communication between the central terminal 102 and the remote unit 130. Also, preferably path B includes a paging communication channel for transmitting messages to the selective call receiver 130. Alternatively, path A may be a one-way or two-way radio frequency communication channel between the remote unit 130 and the central terminal 102, and path B can be a paging communication channel. Additionally, in another alternative, path A and path B can be one-way or two-way radio frequency communication channels.”

	Schwendeman 4:66-5:9. "However, using two-way radio frequency communication channels for both path A and path B may be perfectly acceptable in some systems." Schwendeman 5:16-18. "Typically, the user reviews the message on a display on the remote unit 130. That is, for example, the user can read the message on a display screen such as commonly available on portable personal computers and portable selective call display receivers." Schwendeman 7:12-16. "Additionally, the remote unit 130 can determine 1280 if the message data was previously deleted from memory 140, such as after a user has read the message from a display." Schwendeman 15:15-18. "That is for example, when the message data 1304 is determined to be corrupted by the receiving remote unit 130, the remote unit 130 can automatically alert the user via a message on a visual display." Schwendeman 18:24-27.
8(F) displaying the received retransmission of said indicated portion on the mobile unit.	Krebs in combination with Schwendeman and Yoshida discloses displaying the received retransmission of said indicated portion on the mobile unit. *See, e.g.*, "When the message is of the second bandwidth message type, the central processor prepares a first bandwidth notification message and transmits it to the communication unit via the communication resource. The first bandwidth notification message informs a user of the communication unit that the central processor has the second bandwidth type message for it. When the user desires to receive the message, a request is sent to the central processor, which subsequently transmits the message on a communication resource that is primarily used for

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transceiving second bandwidth type messages."

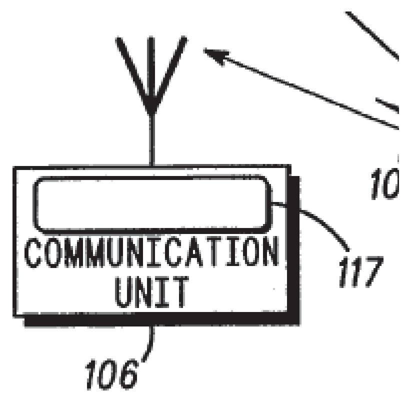
Krebs Abstract.

"When the user desires to receive the message, a request is sent to the central processor, which subsequently transmits the message on a communication resource that is primarily used for transceiving second bandwidth type messages."

Krebs 2:32-36.

"a plurality of communication units 106-108 each having a display 117"

Krebs 2:46-47.



Krebs Fig. 1.

Schwendeman discloses displaying the received retransmission of said indicated portion on the mobile unit. *See, e.g.*,

"This invention relates generally to message delivery systems, such as for electronic mail systems, and more specifically to specifically to a method and apparatus for reliably
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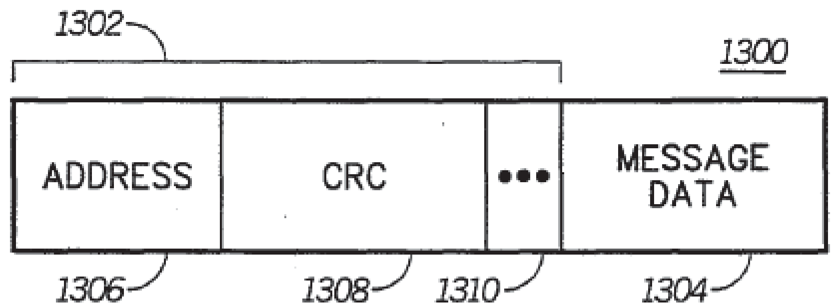
</table>

	delivering messages to one or more remote units from a central communication system utilizing a paging transmitter system.” Schwendeman 1:10-15. “Communication systems, such as paging systems, typically communicate messages from an originating device to one or more destination devices. These messages can include numeric and alphanumeric information for a user of the destination device. The destination device, e.g., a selective call receiver or pager, typically presents the information received to the user by displaying the information on a display.” Schwendeman 1:18-25. “A user can access user input means 141, such as buttons or switches, at the remote unit 130 to cause the message data of a received message to be displayed on a display, e.g., a liquid crystal display (not shown). The user can then read the message that is visible on the display.” Schwendeman 4:16-21. “Typically, the user reviews the message on a display on the remote unit 130. That is, for example, the user can read the message on a display screen such as commonly available on portable personal computers and portable selective call display receivers.” Schwendeman 7:12-16. “Additionally, the remote unit 130 can determine 1280 if the message data was previously deleted from memory 140, such as after a user has read the message from a display.” Schwendeman 15:15-18. “That is for example, when the message data 1304 is determined to be corrupted by the receiving remote unit 130, the remote unit 130 can automatically alert the user via a message

	on a visual display."
Claim 9	**5,448,759 ("Krebs") in Combination with U.S. Patent No. 5,396,537 ("Schwendeman") and U.S. Patent No. 5,031,179 ("Yoshida")**
9(A) The method according to claim 8, further comprising the step of: detecting errors in the received message; and	Schwendeman, when combined with Krebs and Yoshida, discloses detecting errors in the received message. It would have been obvious to one of ordinary skill in the art to combine the teachings of Krebs with error detection function of Schwendeman, resulting in a system that detects errors in the received message that can be displayed to a user. *See, e.g.*,  FIG.13 Schwendeman Fig. 13. "Other information can be transmitted with a transmitted message 200, such as error detecting and/or correcting code. For example, a cyclic redundancy code (CRC) 212 can be included with each transmitted message 200 to help identify at the receiving remote unit 130 when received message data 204 has been erroneously received, e.g., when the message data 204 has been received with errors included therein. In this cage, [sic] although the message 200 has been received by the remote unit 130, the message data 204 may not ba completely and correctly communicated to the user of the remote unit 130."

	Schwendeman 8:8-19.
9(B) wherein the step of displaying comprises the substep of: highlighting said errors in the message on the mobile unit.	Schwendeman, when combined with Krebs and Yoshida, discloses that displaying includes highlighting said errors in the message on the mobile unit. It would have been obvious to one of ordinary skill in the art to combine the teachings of Krebs with the error detection function of Schwendeman, resulting in a system that notifies the user when the received message includes errors and displays that indication. *See, e.g.*, “That is for example, when the message data 1304 is determined to be corrupted by the receiving remote unit 130, the remote unit 130 can automatically alert the user via a message on a visual display.” Schwendeman 18:24-27.