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Declarations under Rule 4.17:

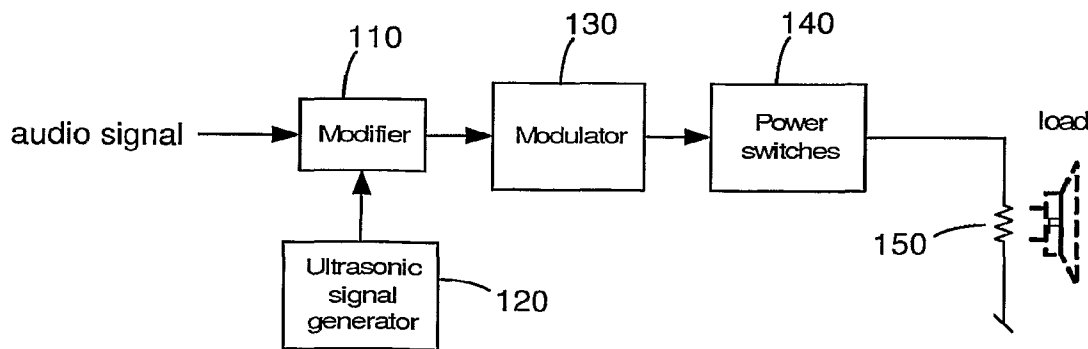
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

- (88) Date of publication of the international search report:
6 March 2008

(54) Title: SYSTEMS AND METHODS FOR IMPROVING PERFORMANCE IN A DIGITAL AMPLIFIER BY ADDING AN ULTRASONIC SIGNAL TO AN INPUT AUDIO SIGNAL



Switching amplifier with modifier

(57) Abstract: Systems and methods in which an ultrasonic signal is introduced into an audio signal before the audio signal is amplified by a switching amplifier. The added ultrasonic signal (e.g., a tone at half the amplifier's switching frequency) shifts the signals input to a set of power switches so that they do not switch nearly simultaneously. The ultrasonic signal causes the output current to be well defined to eliminate dead time distortion at low signal levels. Adding the tone ultrasonic signal causes the distortion to shift to an amplitude greater than zero. Signals that exceed this amplitude will experience the distortion, but the distortion will be less noticeable than in lower-amplitude signals. Signals that do not exceed this amplitude will not experience the distortion at all. Adding an ultrasonic signal may also draw energy away from the switch frequency and its harmonics to interference with AM radio reception.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US07/60984

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(8) - H03F 3/38 (2007.10)
 USPC - 330/10
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
 IPC(8) - H03F 3/38 (2007.10)
 USPC - 330/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 Databases: Patabase, Google Patent

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,594,386 A (DHUYVETTER) 14 January 1997 (14.01.1997) entire document	1, 2, 5 ----- 3, 4, 6-17
Y	US 5,548,286 A (CRAVEN) 20 August 1996 (20.08.1996) entire document	3, 4, 6-10
Y	US 5,551,067 A (HULKKO et al) 27 August 1996 (27.08.1996) entire document	11-17

Further documents are listed in the continuation of Box C.

- * Special categories of cited documents:
- "A" document defining the general state of the art which is not considered to be of particular relevance
 - "E" earlier application or patent but published on or after the international filing date
 - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
 - "O" document referring to an oral disclosure, use, exhibition or other means
 - "P" document published prior to the international filing date but later than the priority date claimed
 - "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
 - "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
 - "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
 - "&" document member of the same patent family

Date of the actual completion of the international search 20 November 2007	Date of mailing of the international search report 15 JAN 2008
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Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/60984

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See Extra Sheet (page 10)

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-17

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/60984

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-17, drawn to a switching amplifier.

Group II, claims 18-20, drawn to an apparatus that uses a switching waveform having a fundamental frequency.

Group III, claims 21-30, drawn to a method of improving performance of a switching amplifier.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention is a modifier that modifies an audio signal in dependence on an ultrasonic signal as claimed therein is not present in the invention of Groups II and III; the special technical feature of the Group II invention is a controller configured to adjust an operating parameter to reduce an amplitude of signals at a fundamental frequency or at a harmonic of the fundamental frequency in response to a network receiver receiving a message indicating that an amplifier is potentially creating interference with a radio receiver as claimed therein is not present in the invention of Group I and III; and the special technical feature of the Group III invention is adding an ultrasonic signal to an audio signal as claimed therein is not present in the invention of Groups I and II.

Since none of the special technical features of the Group I, II and III inventions is found in more than one of the inventions, unity of invention is lacking.