H04S

STEREOPHONIC SYSTEMS

Definition statement

This place covers:

Signal processing or circuitry for two or more channel sound reproduction, using loudspeakers or headphones, or for two or more channel sound capture, using microphones.

Relationships with other classification places

Concerning G10L 19/008, this group covers in principle coding, processing in the coded state, and decoding of stereophonic audio signals for redundancy reduction, whereas processing of stereophonic audio signals in the decoded stated, i.e. before coding (e.g. sound capturing) or after decoding (e.g. sound rendering) is covered by H04S.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Multi-channel audio coding and decoding using interchannel correlation to reduce redundancies	G10L 19/008
Circuits or components specially adapted for stereophonic broadcast systems	H04H 20/47
Broadcast systems for the distribution of stereophonic information	H04H 20/88
Circuits or components specially adapted for stereophonic broadcast receiving	H04H 40/36

Informative references

Attention is drawn to the following places, which may be of interest for search:

Speech or audio signal analysis-synthesis techniques for redundancy reduction, e.g. in vocoders; Coding or decoding of speech or audio signals, e.g. for compression or expansion, source-filter models or psychoacoustic analysis	G10L 19/00
Information storage on discs or tapes	G11B
Low frequency amplifiers, e.g. audio preamplifiers	H03F 3/181
Power amplifiers using a combination of several semiconductor amplifiers	H03F 3/211
Combinations of amplifiers using coupling networks with distributed constants	H03F 3/602
Combinations of amplifiers, e.g. multi-channel amplifiers for stereophonics	H03F 3/68
Remote control of amplification, tone, or bandwidth	H03G 1/02
Gain control	H03G 3/00
Tone control and equalizers	H03G 5/00
Compression or expansion	H03G 7/00
Combination of types of control	H03G 9/00

| Multiplex systems in general | H04J |
| Stereophonic arrangements of loudspeakers, microphones or headphones | H04R 5/00 |

Special rules of classification

- Classification of invention information and additional information is obligatory.
- The subgroups of Indexing Code groups H04S 2400/00 and H04S 2420/00 should be used to classify information relevant for the invention, although it need not be invention information. Indexing Code symbols H04S 2400/00 and H04S 2420/00 themselves should not be used for classification.
- Further detail not provided for in any of the main groups is provided for in Indexing Code groups H04S 2400/09, H04S 2400/15, H04S 2420/01, H04S 2420/03, H04S 2420/05, H04S 2420/07 and H04R 2499/13. Classification is obligatory.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

| Stereophonic system | two or more channel system, e.g. quadraphonic, ambisonic or similar systems |
| Multi-channel system | three- or more channel system |

H04S 1/00

Two-channel systems (H04S 5/00, H04S 7/00 take precedence)

Definition statement

This place covers:

Electronic sound processing in two-channel systems wherein the processing itself is independent on the input signal or its properties.

References

Limiting references

This place does not cover:

| Pseudo-stereophonic systems | H04S 5/00 |
| Indicating arrangements of stereophonic systems; Control arrangements, e.g. balance control of stereophonic systems | H04S 7/00 |

Special rules of classification

Multi-channel, i.e. more than two input channels, sound reproduction with two speakers wherein the multi-channel information is substantially preserved is not to be classified under H04S 1/00 but under H04S 3/00, H04S 5/00 or H04S 7/00 using the Indexing Code H04S 2400/01.
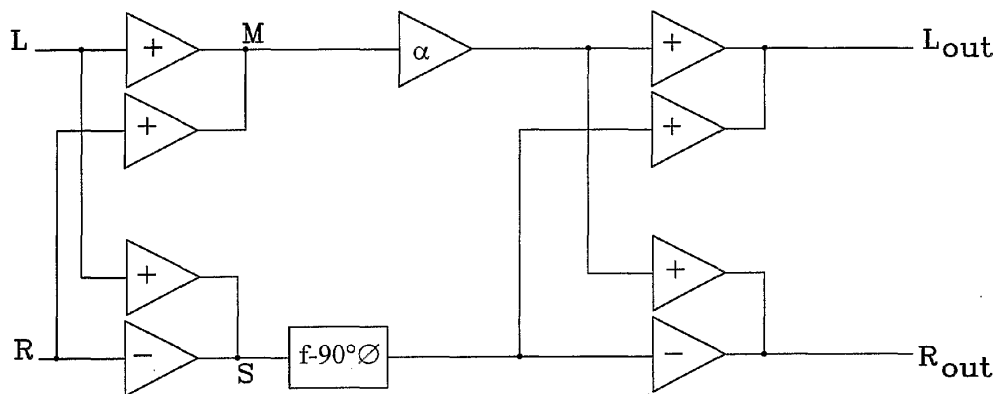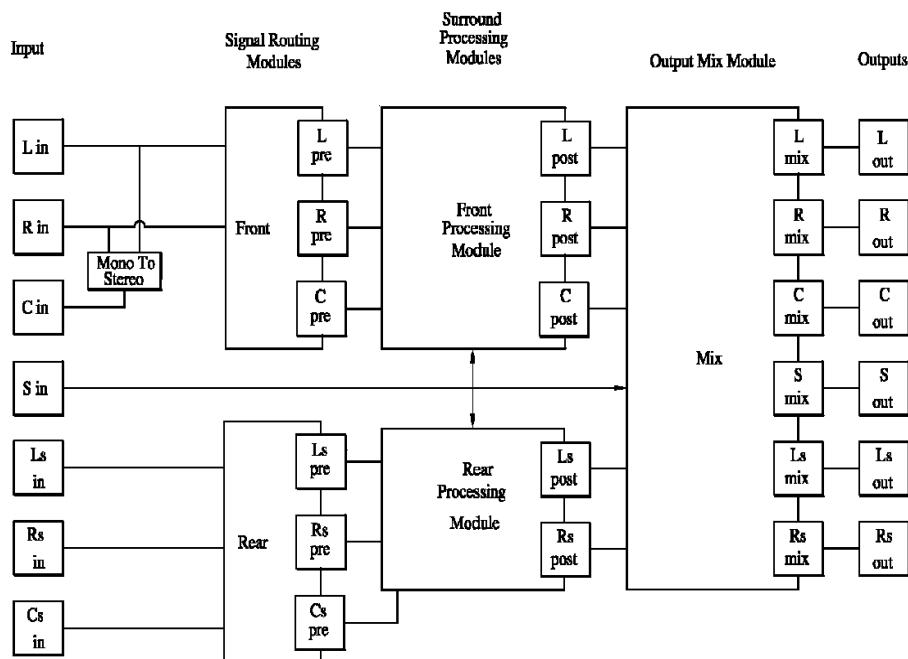
Classification is obligatory.

H04S 1/002

{Non-adaptive circuits, e.g. manually adjustable or static, for enhancing the sound image or the spatial distribution (control circuits for electronic adaptation of the sound field <u>H04S 7/30</u>)}

Definition statement

This place covers:

Electronic sound processing for enhancing the sound image or the spatial distribution, wherein the processing itself is static or manually adjustable (e.g. Figure below).

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References

Limiting references

This place does not cover:

Control circuits for electronic adaptation of the sound field, i.e. electronic sound processing adaptable in dependence of calibration signals, sensor signals or parameters for sound field or sound object description, e.g. by using an adaptive circuit, a look-up table or orientation sensors, for changing the sound field, e.g. the spatial distribution	H04S 7/30

H04S 1/007

{in which the audio signals are in digital form (data reduction aspects thereof based on psychoacoustics <u>G10L 19/02</u>)}

References

Limiting references

This place does not cover:

Data reduction aspects of digital stereo signals based on psychoacoustics	G10L 19/02

H04S 3/00

Systems employing more than two channels, e.g. quadraphonic (H04S 5/00, H04S 7/00 take precedence)

Definition statement

This place covers:

Electronic sound processing in systems employing more than two channels wherein the processing itself is independent on the input signal or its properties.

References

Limiting references

This place does not cover:

Pseudo-stereophonic systems	H04S 5/00
Indicating arrangements of stereophonic systems; Control arrangements, e.g. balance control of stereophonic systems	H04S 7/00

Special rules of classification

Further detail is covered by Indexing Code groups H04R 2203/12, H04S 2400/01, H04S 2400/03, H04S 2400/05, H04S 2420/11 and H04S 2420/13. Classification is obligatory.

H04S 3/002

{Non-adaptive circuits, e.g. manually adjustable or static, for enhancing the sound image or the spatial distribution (control circuits for electronic adaptation of the sound field H04S 7/30)}

Definition statement

This place covers:

Electronic sound processing for enhancing the sound image or the spatial distribution, wherein the processing itself is static or manually adjustable (e.g. Figure below).

References

Limiting references

This place does not cover:

Control circuits for electronic adaptation of the sound field, i.e. electronic sound processing adaptable in dependence of calibration signals, sensor signals or parameters for sound field or sound object description, e.g. by using an adaptive circuit, a look-up table or orientation sensors, for changing the sound field, e.g. the spatial distribution	H04S 7/30

H04S 3/006

{in which a plurality of audio signals are transformed in a combination of audio signals and modulated signals, e.g. CD-4 systems}

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

For broadcasting	H04B 1/1646 , H04H 20/89

H04S 3/008

{in which the audio signals are in digital form, i.e. employing more than two discrete digital channels (data reduction aspects thereof based on psychoacoustics G10L 19/02)}

Definition statement

This place covers:

Spatial sound processing employing more than two discrete digital channels.

References

Limiting references

This place does not cover:

Data reduction aspects of digital stereo signals based on psychoacoustics	G10L 19/02

H04S 3/02

of the matrix type, i.e. in which input signals are combined algebraically, e.g. after having been phase shifted with respect to each other

Definition statement

This place covers:

Using a matrix arrangement that routes multiple input audio signals to multiple outputs.

Typical example:
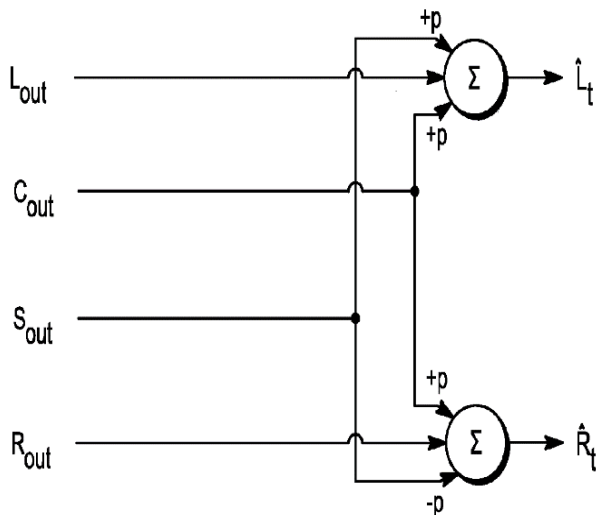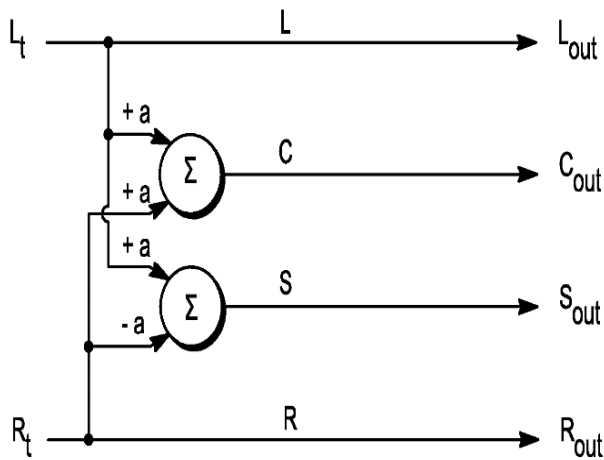
H04S 5/00

Pseudo-stereo systems, e.g. in which additional channel signals are derived from monophonic signals by means of phase shifting, time delay or reverberation

Definition statement

This place covers:

Systems wherein one or more additional channels are generated from one or more of the existing channels to improve the spatial sound reproduction, e.g. wave field synthesis or virtual surround sound, or the spatial sound capture, e.g. 4-channel ambisonic capture to 7.1-channel.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Directing or focusing sound using electrical steering of transducer arrays, e.g. beam steering	G10K 11/34

| Arrangements for producing a reverberation or echo sound | G10K 15/08 |

Special rules of classification

Further detail is covered by Indexing Code groups H04R 2203/12, H04S 2400/01, H04S 2400/03, H04S 2400/05, H04S 2420/11, and H04S 2420/13.

Classification is obligatory.

H04S 5/005

{of the pseudo five- or more-channel type, e.g. virtual surround}
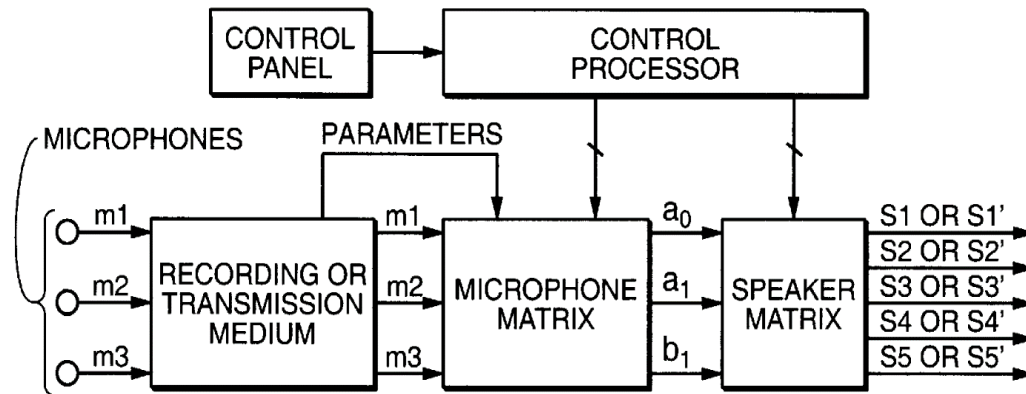
Definition statement

This place covers:

Systems wherein more than four additional channels are generated from the existing channels. Example for sound reproduction with two channel stereophonic source signal reproduced over five loudspeaker channels.
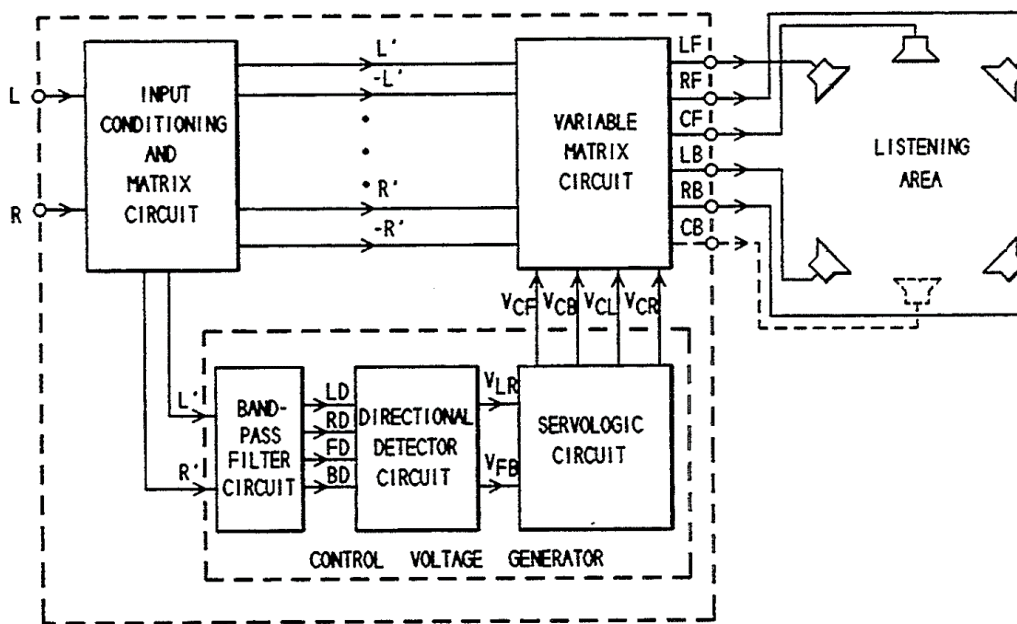
Example for sound capture with input three microphone channels, output five loudspeaker channels, see figure below:

H04S 7/00

Indicating arrangements; Control arrangements, e.g. balance control

Definition statement

This place covers:

- Sound field processing, i.e. electronic adaptation of the sound field, e.g. automatic set-up, adaptation with respect to listener position, frequency adjustment, reverberation adaptation, sound object positioning.
- Automatic audio format change, e.g. dependent on the input signal.
- Indicating the sound field.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Non-adaptive circuits, i.e. manually adjustable or static, for signal processing, e.g. enhancing the sound image or thespatial distribution, of for sound capture in stereophonic systems	H04S 1/00, H04S 3/00
Arrangements for producing a reverberation or an echo sound	G10K 15/08
Tone control circuits in amplifiers per se	H03G 5/00
Circuits for coupling gramophone pick-up, recorder output, or microphone to receiver, e.g. for Hi-Fi systems or audio/video combinations by remote control	H04B 1/202
Circuits for correcting the frequency response of transducers	H04R 3/04
Adaptation of reverberation in public address systems	H04R 27/00
Monitoring or testing arrangements for transducers, loudspeakers, microphones or public address systems; Visual indication of acoustic signal levels	H04R 29/00

Special rules of classification

Further detail is covered by Indexing Code groups H04R 2203/12, H04S 2400/01, H04S 2400/03, H04S 2400/05, H04S 2400/07, H04S 2400/11, H04S 2400/13 and H04S 2420/13.

Classification is obligatory.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Control systems	encompasses adaptive systems

H04S 7/30

{Control circuits for electronic adaptation of the sound field}

Definition statement

This place covers:

Electronic sound processing adaptable in dependence of
- calibration signals
- sensor signals,
- parameters for sound field or sound object description, e.g. by using an adaptive circuit, a look-up table or orientation sensors, for changing the sound field, e.g. the spatial distribution (as show in the example), for automatic set-up, adaptation with respect to listener position, frequency adjustment, reverberation adaptation, sound object positioning
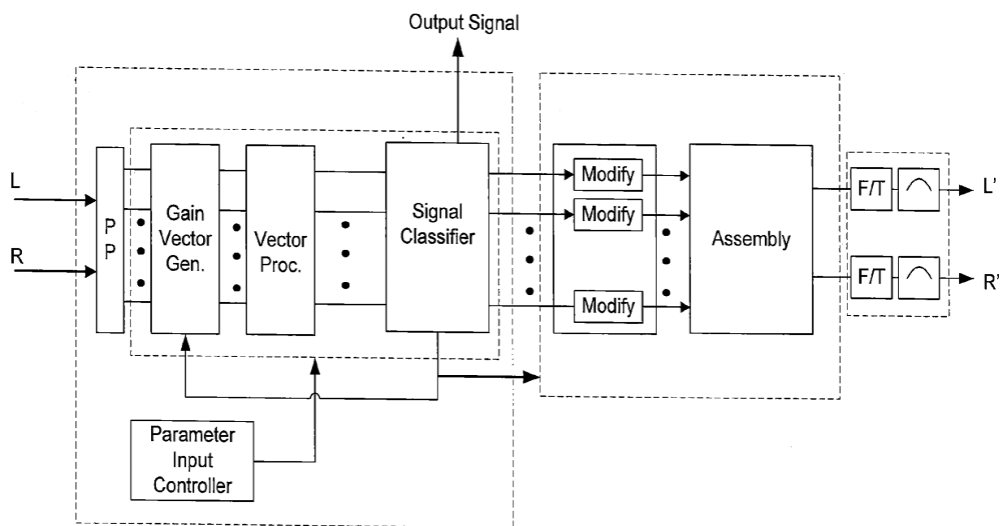
Example for adaptation of the sound field (e.g. shading effects) in dependence of the number and position of passengers in the vehicle. Directionally deviations due to shading is measured. Once measured the sound field is adapted accordingly (see figure).
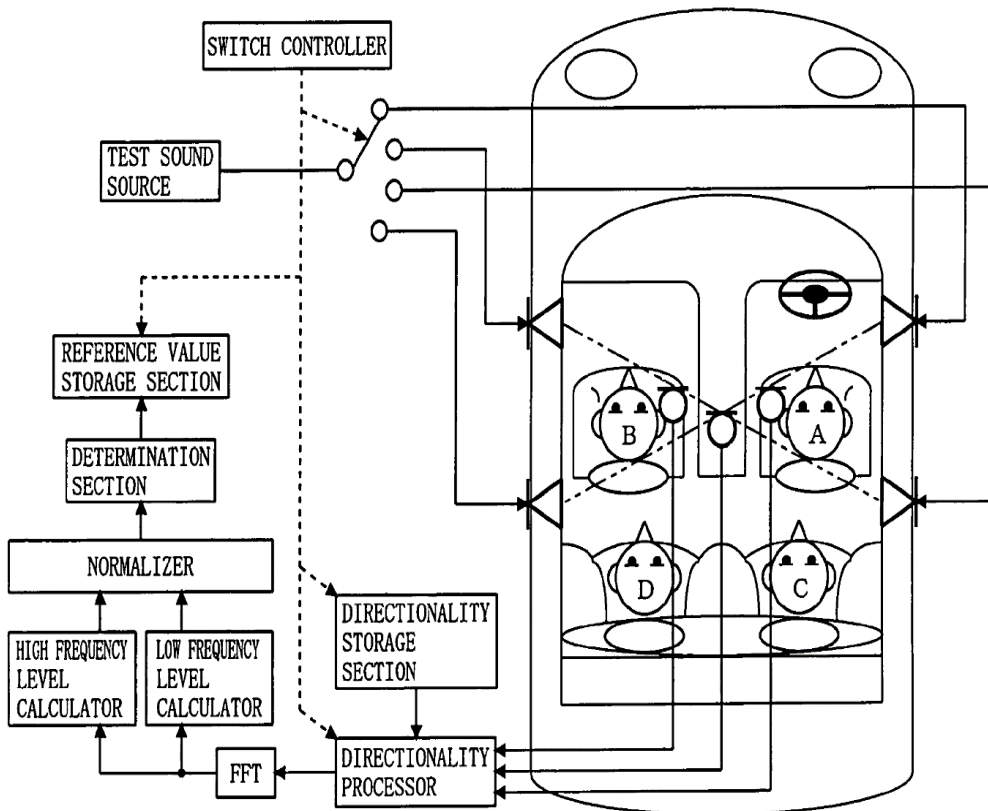
References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Telephonic conference arrangements	H04M 3/56
Video conference systems	H04N 7/15

Informative references

Attention is drawn to the following places, which may be of interest for search:

Non-adaptive circuits, i.e. manually adjustable or static, for enhancing the sound image or the spatial distribution	H04S 1/002, H04S 3/002

H04S 7/301

{Automatic calibration of stereophonic sound system, e.g. with test microphone}

Definition statement

This place covers:

Automatic set-up. In the example below calibration is carried out with respect to the relative gains in the listener position by using a test microphone and a noise generator.
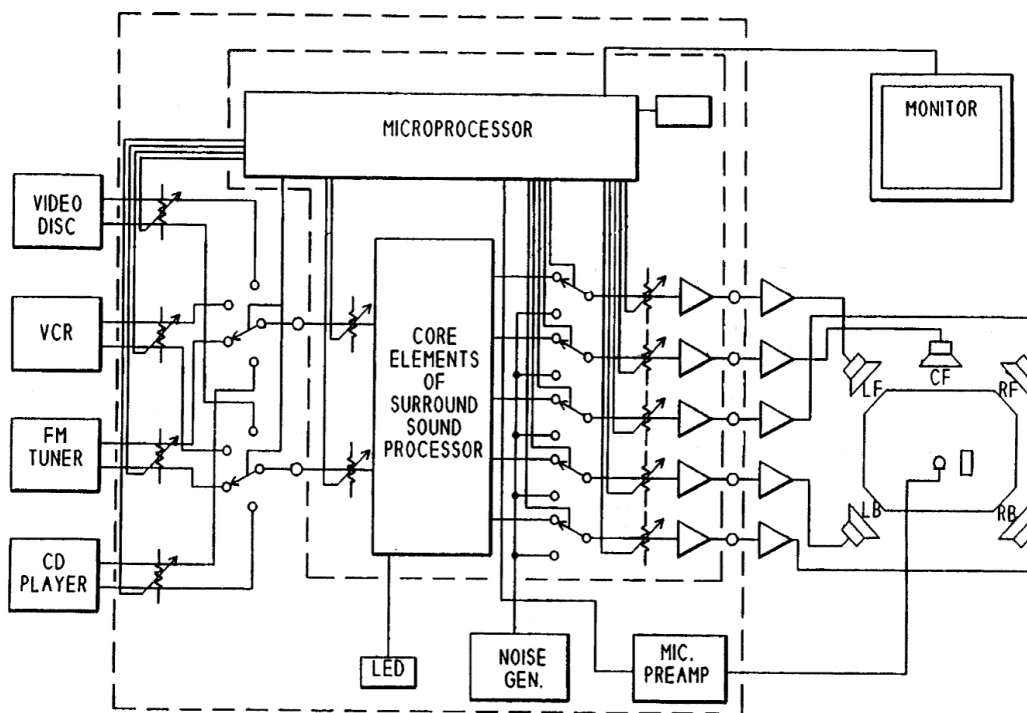
In the example below calibration is carried out with respect to the signal delays in the listener position (12) by a determining the distance between the remote control (14,16) and each loudspeaker using

low frequency pulses sent by the control and received by pulse counter (22a-22e) provided with each speaker (20a-20e).
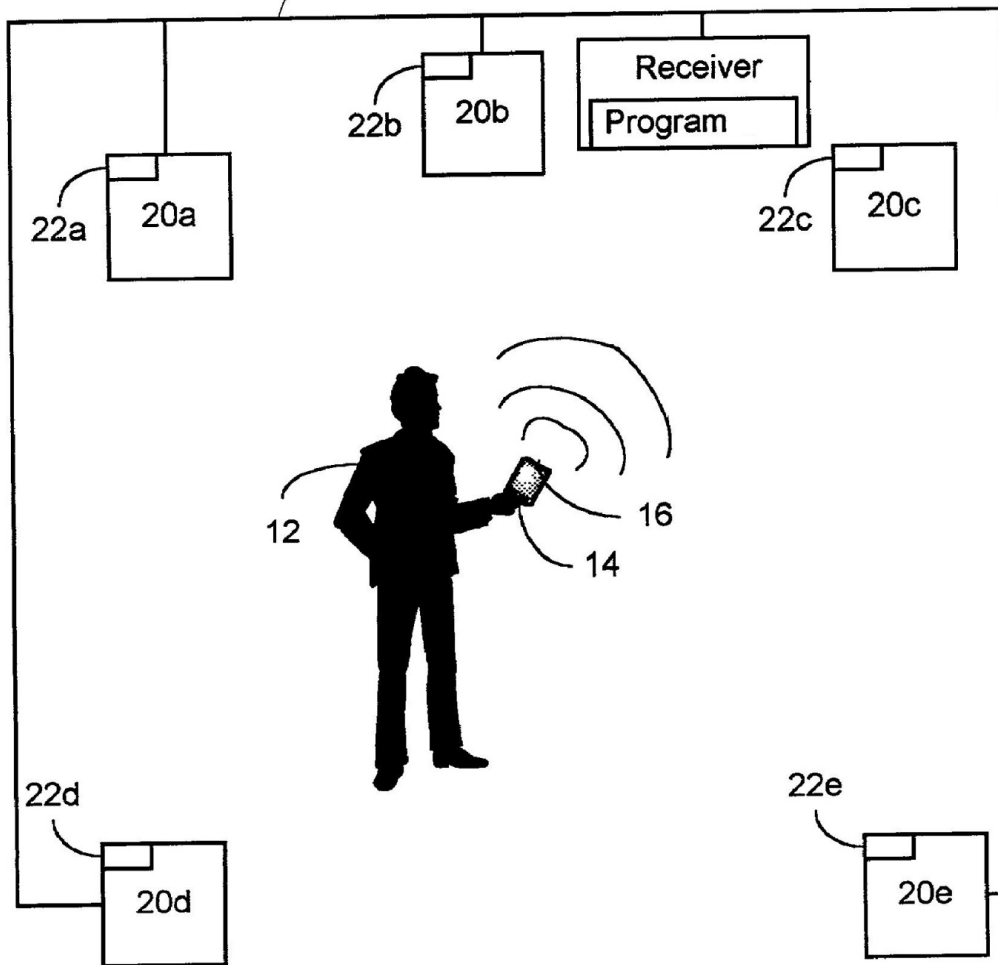
References

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Automatic gain control | H03G 3/20 |
| Automatic tone control or bandwidth control in amplifiers | H03G 5/16 |

H04S 7/302

{Electronic adaptation of stereophonic sound system to listener position or orientation (H04S 7/301 takes precedence)}

Definition statement

This place covers:

Aspects of adaptation of a sound system with respect to listener position (see figures) or orientation relative to the loudspeakers or virtual sound sources. The calibration can be automatic.
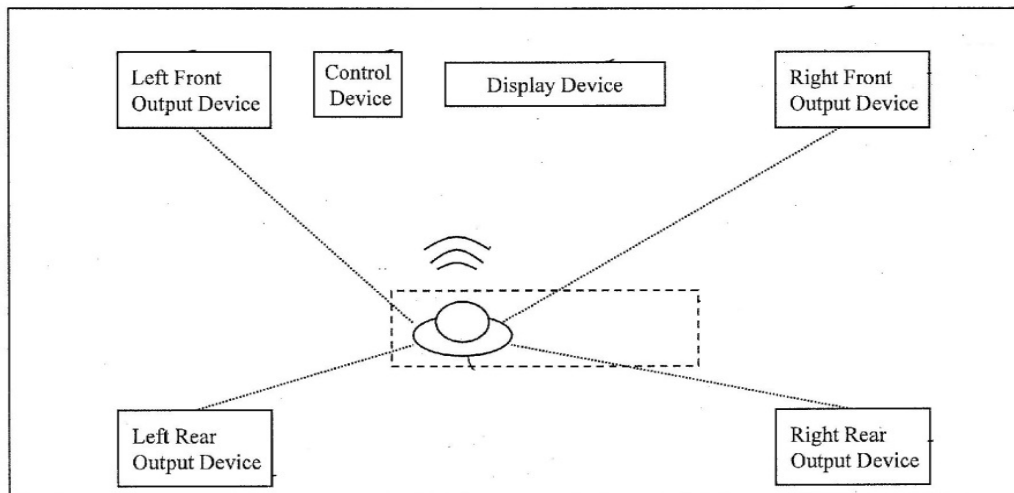
References

Limiting references

This place does not cover:

Automatic calibration of stereophonic sound system, e.g. with test microphone	H04S 7/301

H04S 7/303

{Tracking of listener position or orientation}

Definition statement

This place covers:

System in which the listener position or orientation (P) is tracked, e.g. with a camera (26a, 26b) (see Figure) and the sound field is adapted accordingly.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Head tracking input arrangements for transferring data to be processed into a form capable of being handled by the computer	G06F 3/012

H04S 7/304

{For headphones}

Definition statement

This place covers:

System adapted for headphones (61) in which the orientation of the listener head is tracked, e.g. with a rotation angle sensor (71) and the sound delivered to the headphone (6R, 6L) is adapted accordingly (see figure).

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Head tracking input arrangements for transferring data to be processed into a form capable of being handled by the computer	G06F 3/012

H04S 7/305

{Electronic adaptation of stereophonic audio signals to reverberation of the listening space (H04S 7/301 takes precedence)}

Definition statement

This place covers:

Reverberation adaption to the sound field. Example for adaptation of reverberation in a room (see figure).
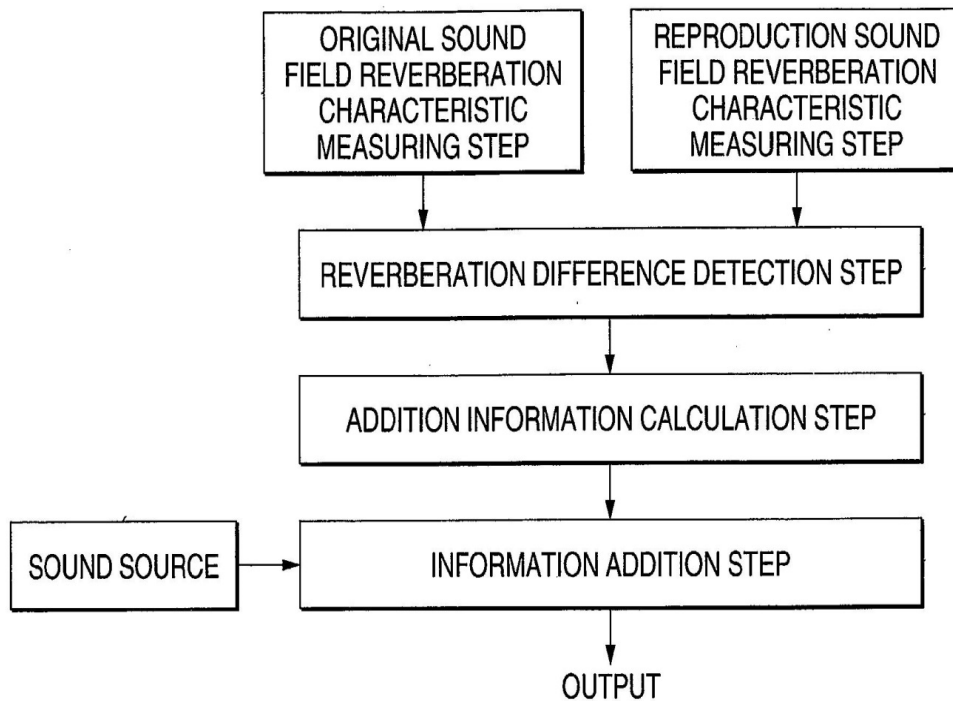
Example for adaptation of reverberation in dependence of the number and position of passengers (A,B,C,D) in the vehicle (201). Variations in reverberation due to the passengers are measured. Once measured, reverberation is adapted accordingly (see figure).

References

Limiting references

This place does not cover:

Automatic calibration of stereophonic sound system, e.g. with test microphone	H04S 7/301

Informative references

Attention is drawn to the following places, which may be of interest for search:

Measuring reverberation time, i.e. room acoustic measurements	G01H 7/00
Arrangements for producing a reverberation or echo sound	G10K 15/08
For public address systems	H04R 27/00

H04S 7/307

{Frequency adjustment, e.g. tone control (H04S 7/301 takes precedence)}

Definition statement

This place covers:

Frequency adaption to the sound field. Example for adaptation of frequency in dependence of the number and position of passengers in the vehicle. Variations in frequency due to the passengers are measured. Once measured, the frequency response is adapted accordingly (see figure).

References

Limiting references

This place does not cover:

Automatic calibration of stereophonic sound system, e.g. with test microphone	H04S 7/301

Informative references

Attention is drawn to the following places, which may be of interest for search:

Tone control in general	H03G 5/00
Circuits for correcting the frequency response of transducers	H04R 3/04

H04S 7/308

{Electronic adaptation dependent on speaker or headphone connection}

Definition statement

This place covers:

Adaptation of the stereophonic signal processing in dependence of the state of electrical connection of loudspeakers/headphones to respective output channels of stereophonic amplifiers.

For example, a multichannel system wherein the low frequency signals are treated differently depending on the presence of a subwoofer (see figure).
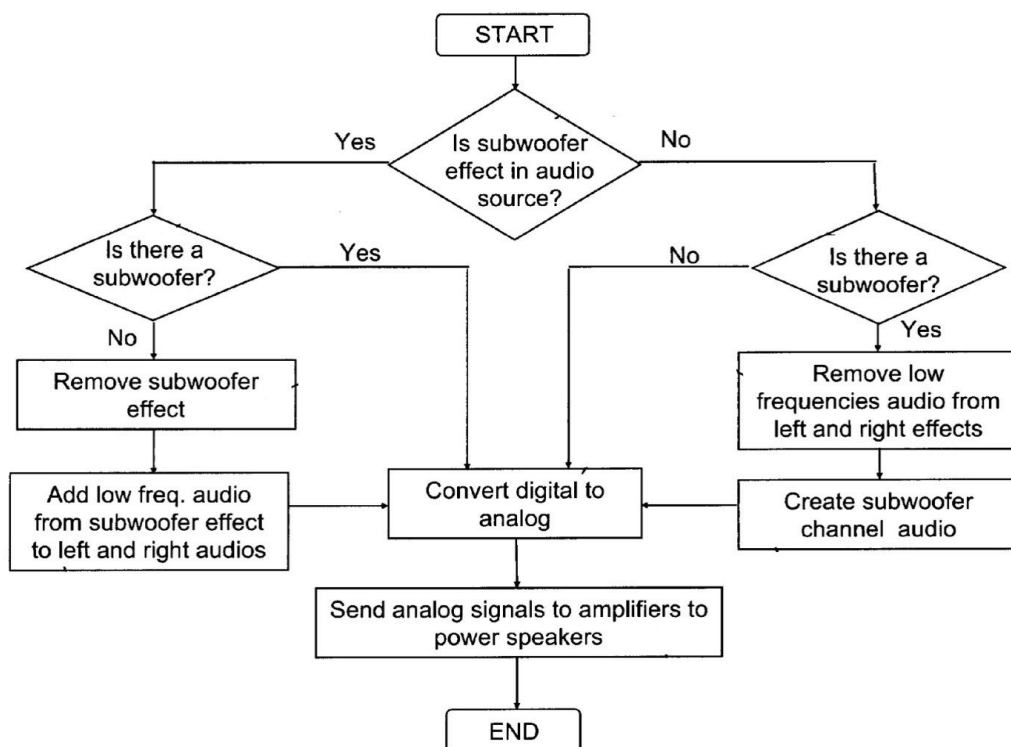
For example, a multi-room system with different loudspeaker configuration in the respective sound zones (see figure (Z1-Z4)). Audio signal processing of the multichannel sound signal is depending on the zone (room) the sound signal is outputted to.
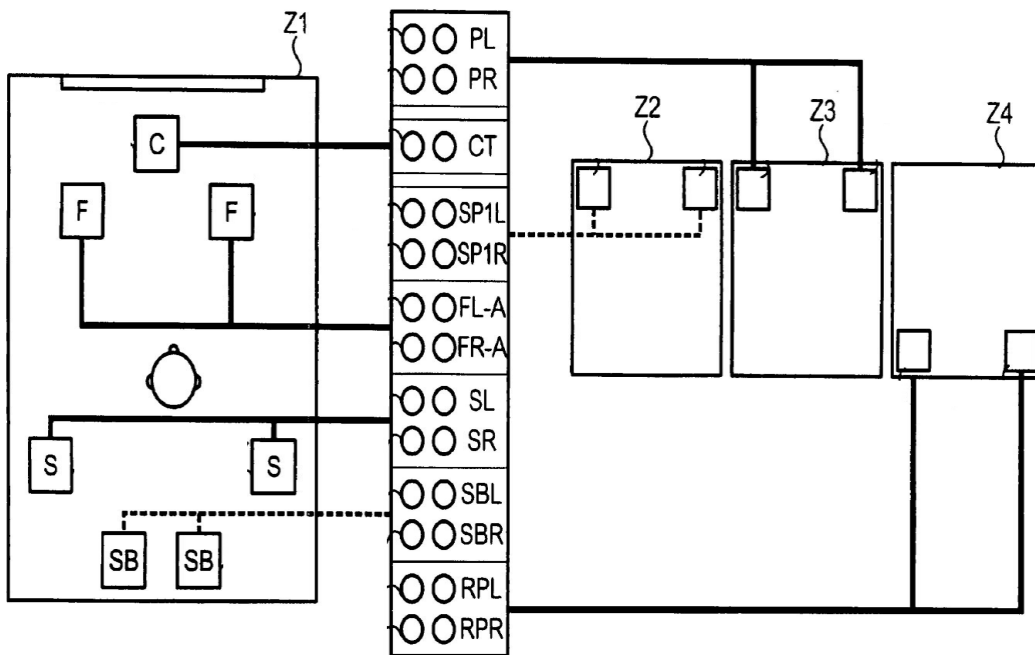
H04S 7/40

{Visual indication of stereophonic sound image}

Definition statement

This place covers:

Display showing stereophonic sound image. For example, indicating power and the frequency of the channels (X1-X5) as shown in the figure. The shading indicates the frequency characteristics and the radius of the shaded area the power of the signal for the channels.
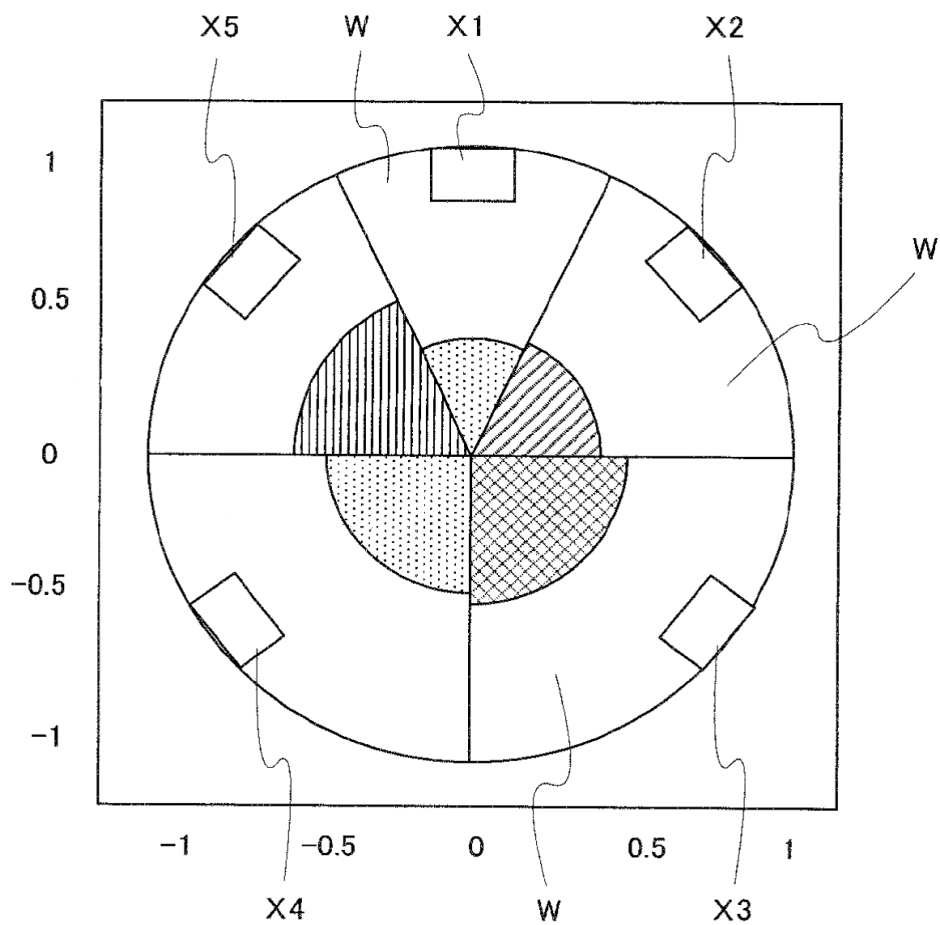
Channels are displayed and by sliding one of the controls one can rotate, change the width and the amplitude of the source channels which is visualised in the display.
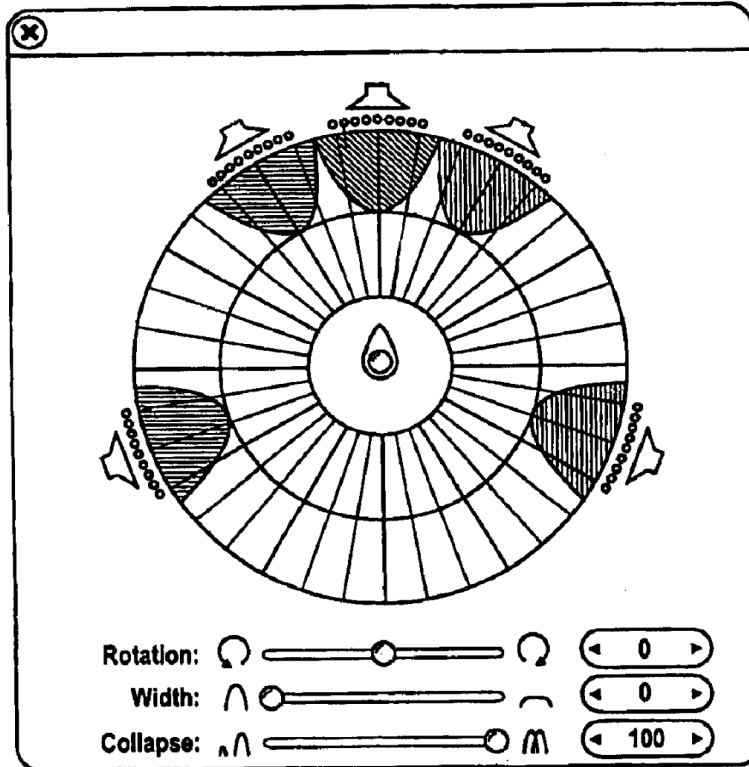
References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Indicating measured values	G01D 7/00
Arrangements for displaying electric variables or waveforms	G01R 13/00
Visual indication of individual audio signal levels	H04R 29/008

H04S 2400/01

Multi-channel, i.e. more than two input channels, sound reproduction with two speakers wherein the multi-channel information is substantially preserved

Definition statement

This place covers:

Preservation of the multi-channel information is essential when reducing the number (more than two) of channels to two.
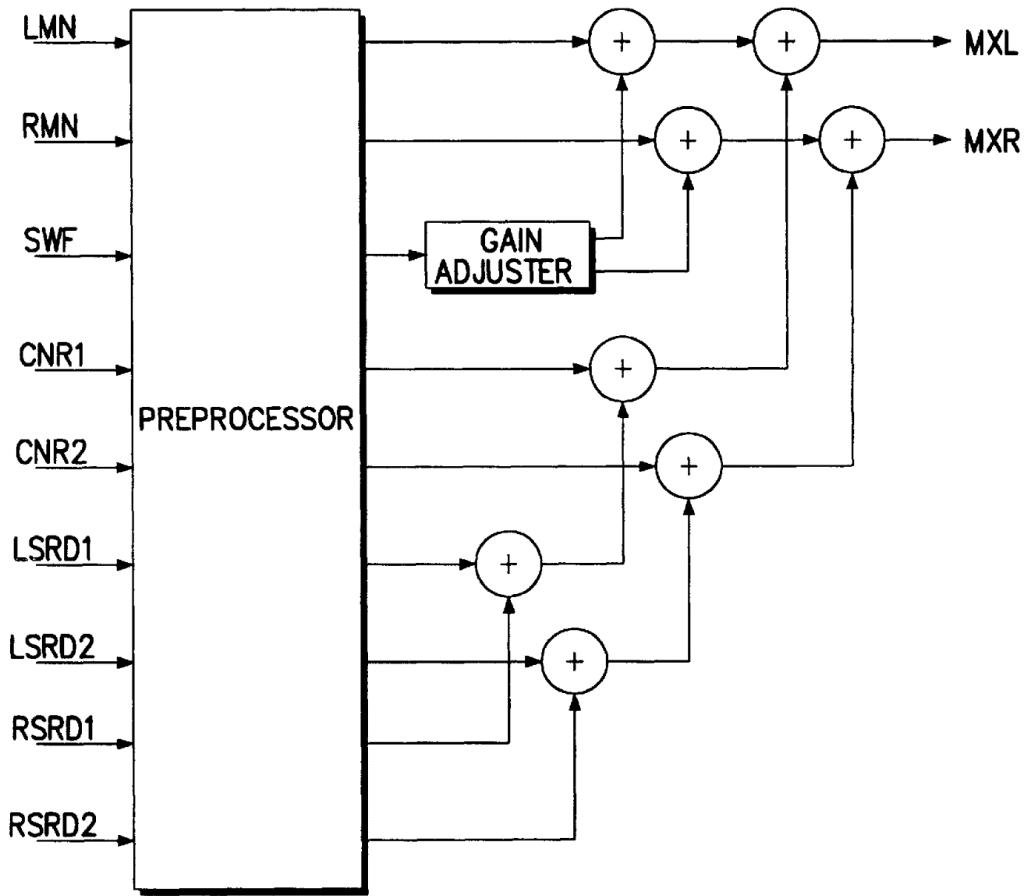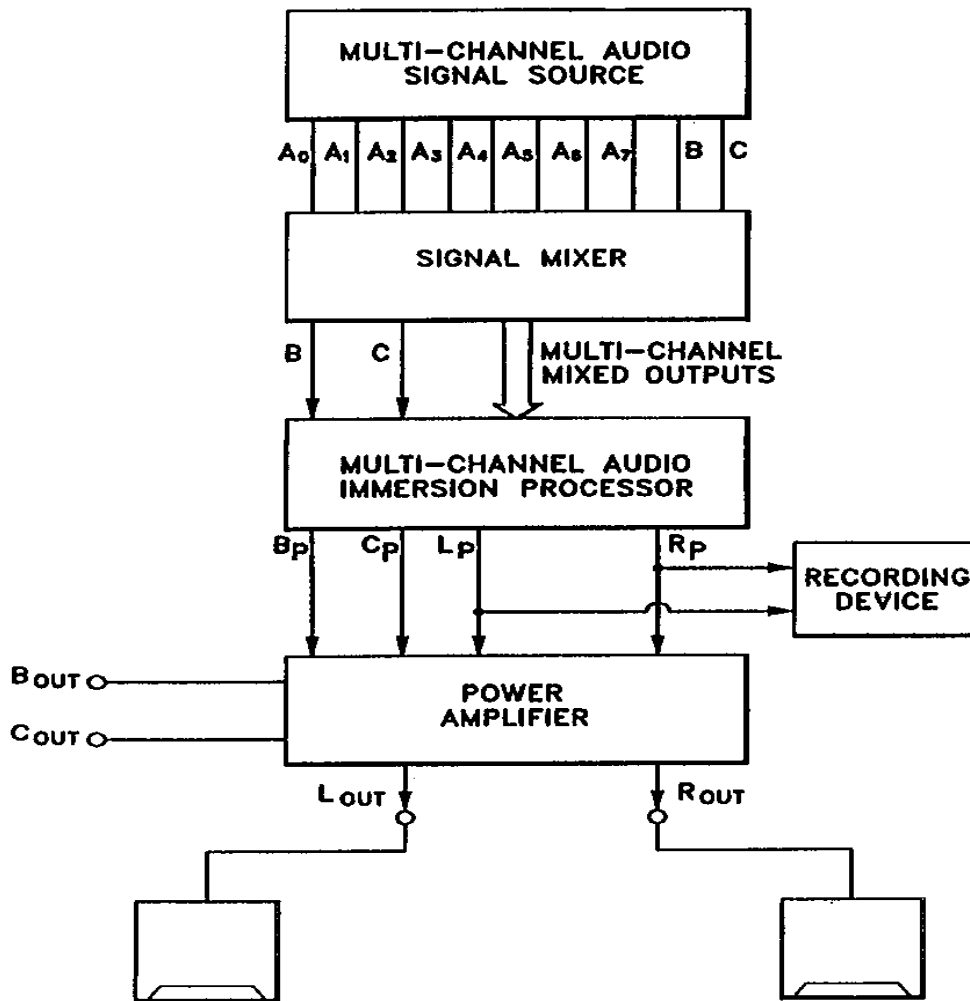
Definition statement

For example:

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Aspects of down-mixing multi-channel audio to configurations with lower numbers of playback channels, e.g. 7.1 -> 5.1	H04S 2400/03

Special rules of classification

NOT to be given for H04S 1/00 since no multi-channel sound information is present according to H04S 1/00.
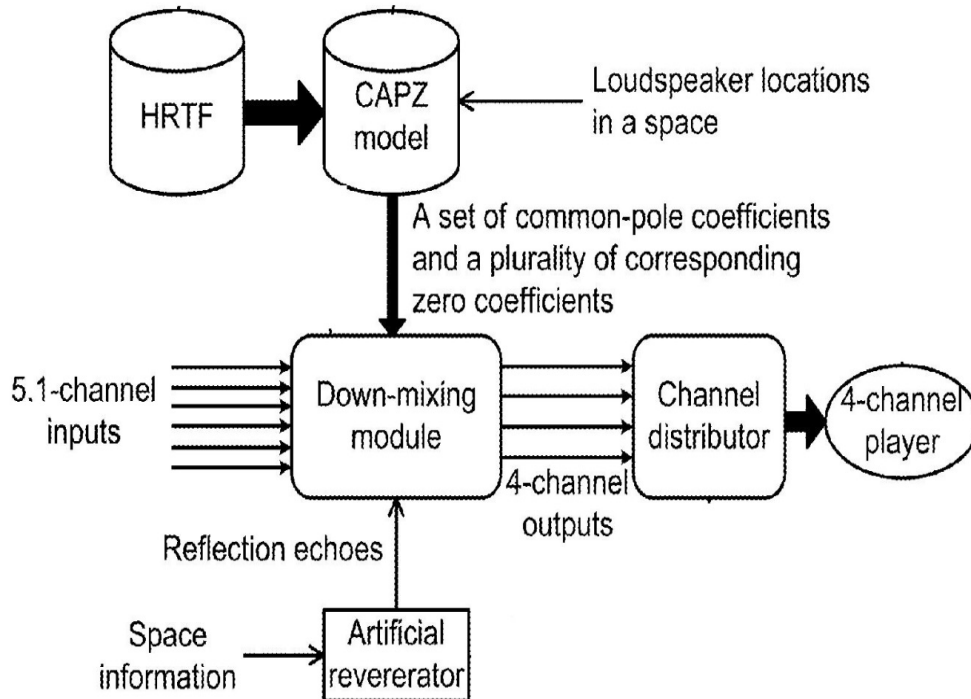
H04S 2400/03

Aspects of down-mixing multi-channel audio to configurations with lower numbers of playback channels, e.g. 7.1 -> 5.1 (H04S 2400/01 takes precedence)

Definition statement

This place covers:

The multi-channel information should be preserved as much as possible when reducing the number (more than two) of channels.

For example a reduction from five input channels to four.

References

Limiting references

This place does not cover:

Multi-channel, i.e. more than two input channels, sound reproduction with two speakers wherein the multi-channel information is substantially preserved	H04S 2400/01

Special rules of classification

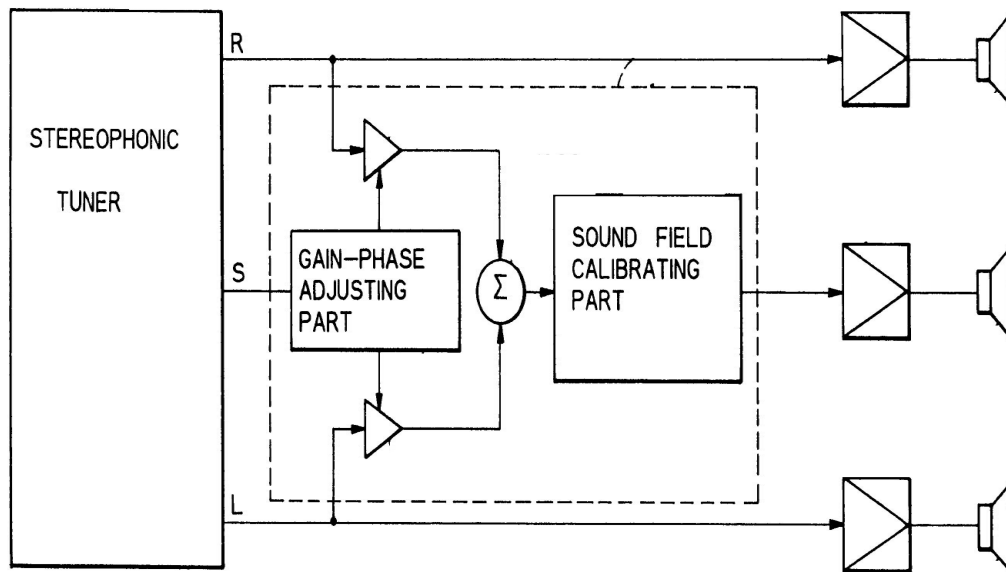The mere presence of downward compatibility is not to be classified.

H04S 2400/05

Generation or adaptation of centre channel in multi-channel audio systems

Definition statement

This place covers:

Signal processing with respect to the centre channel, e.g. generation, redistribution or adaptation.

Example for adaptation of centre channel (S):

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Generation of additional channels in pseudo stereo system per se	H04S 5/00
Control circuits for electronic adaptation of the sound field	H04S 7/30

H04S 2400/07

Generation or adaptation of the Low Frequency Effect [LFE] channel, e.g. distribution or signal processing

Definition statement

This place covers:

Signal processing with respect to the LFE channel, e.g. generation, redistribution. Figure 1. Example for of LFE channel of a 5.1 system to the other five channel (5.0 system).
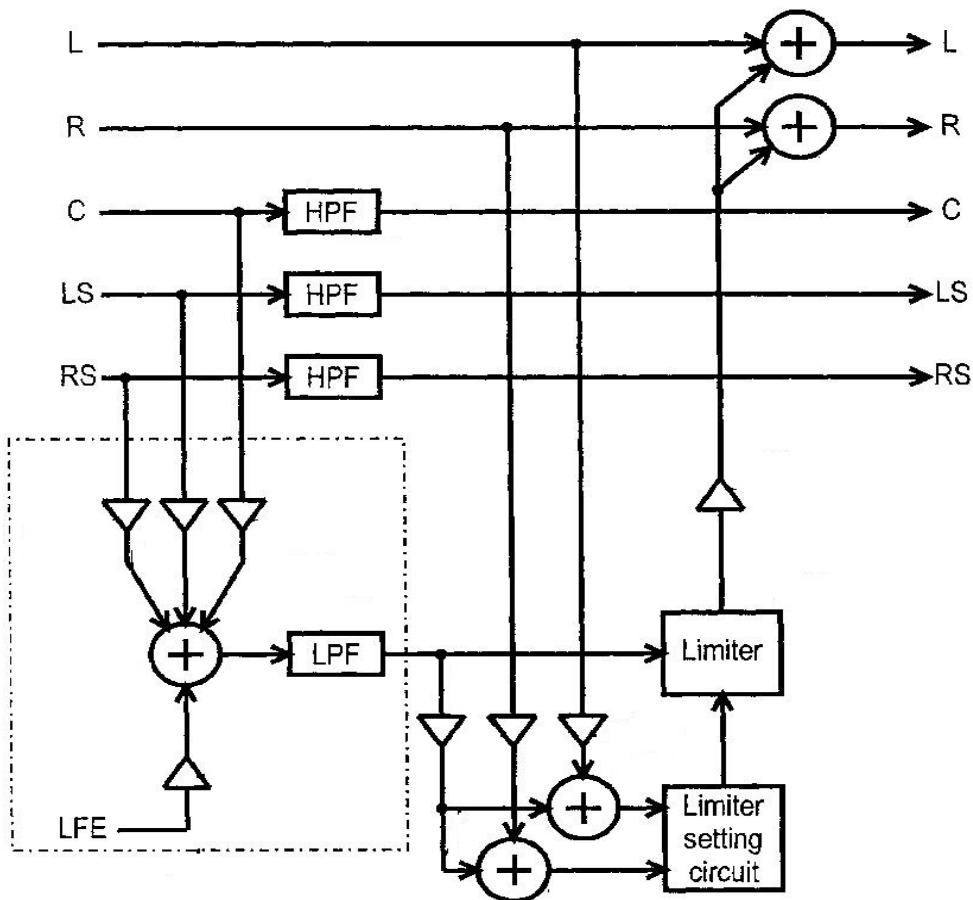
Figure 2. Example of redistribution of low frequency components of the 5 channels of a 5.1 system to the LFE channel.
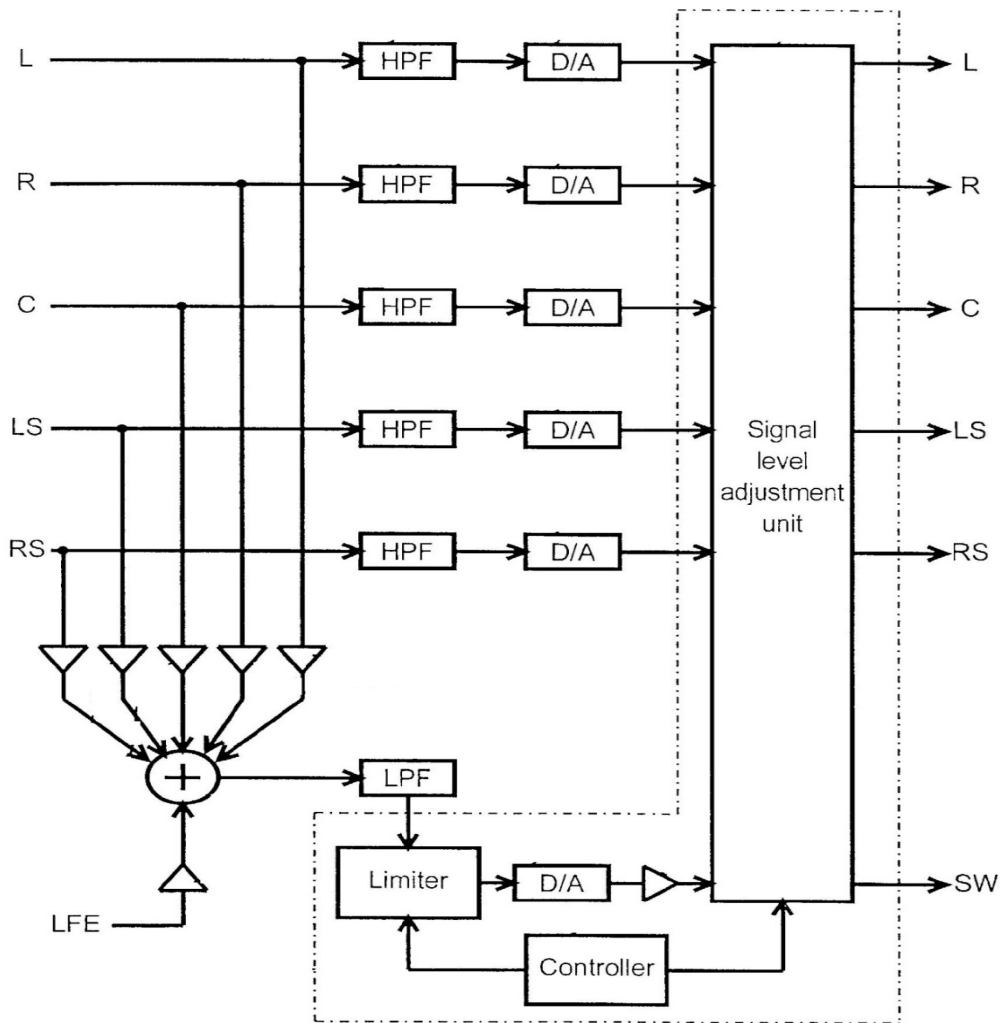
H04S 2400/09

Electronic reduction of distortion of stereophonic sound systems

Definition statement

This place covers:

Distortion can be caused by the reproduction components (speakers, signal processing). In the example below the phase distortion is reduced.
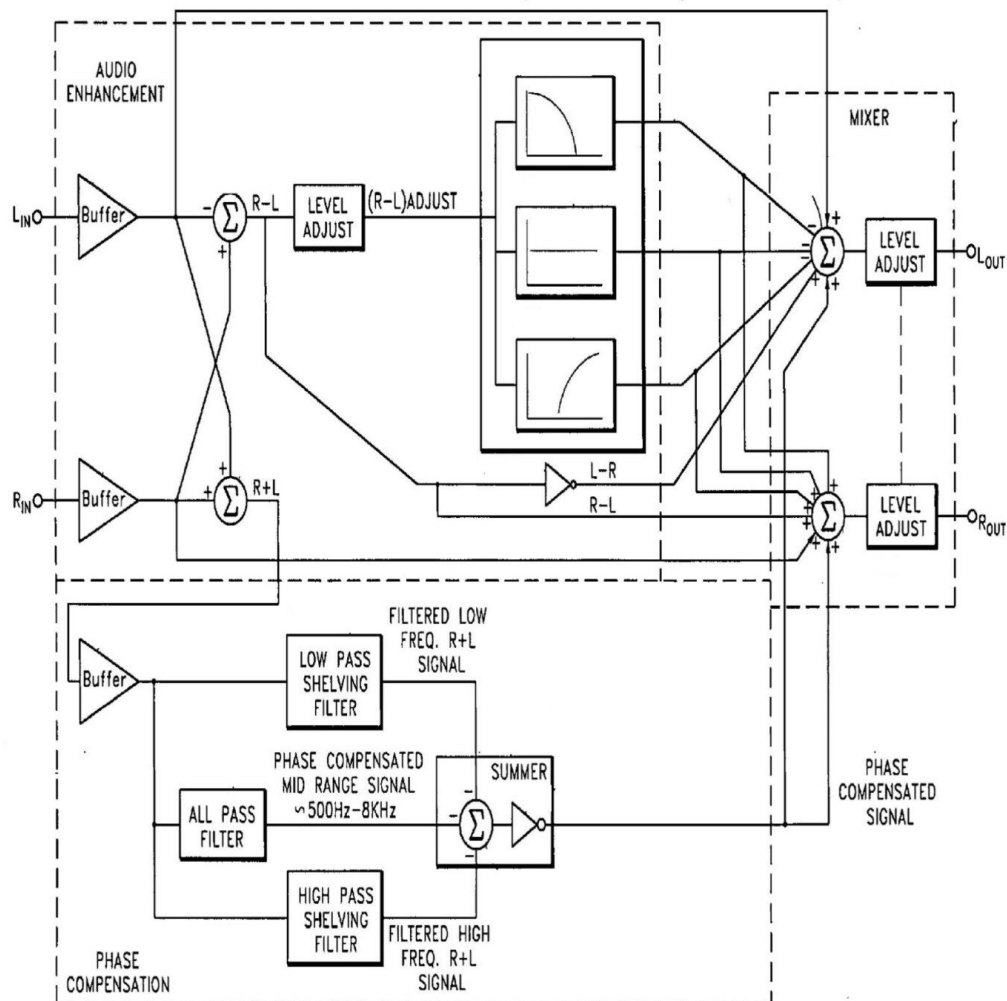
Distortion can be due to standing waves, which are in the example below suppressed by compensating loudspeaker 5.
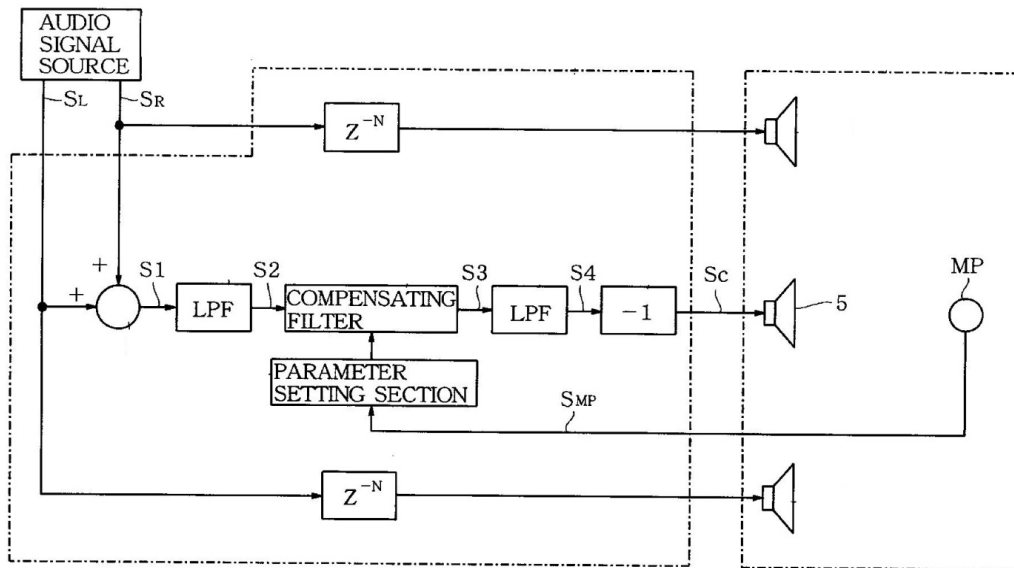
References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Reduction of non-linear distortion in audio amplifiers	H03F 1/3264

H04S 2400/11

Positioning of individual sound objects, e.g. moving airplane, within a sound field (H04S 2420/13 takes precedence)

Definition statement

This place covers:

Figure 1. Sound objects are first extracted during recording and combined reproduction.
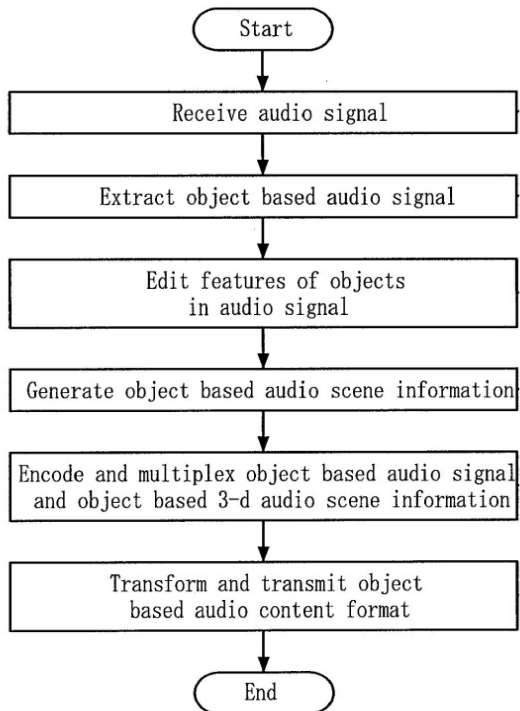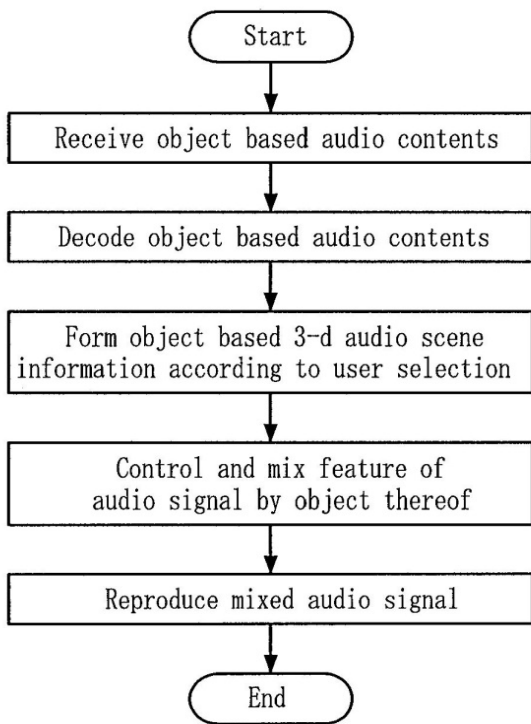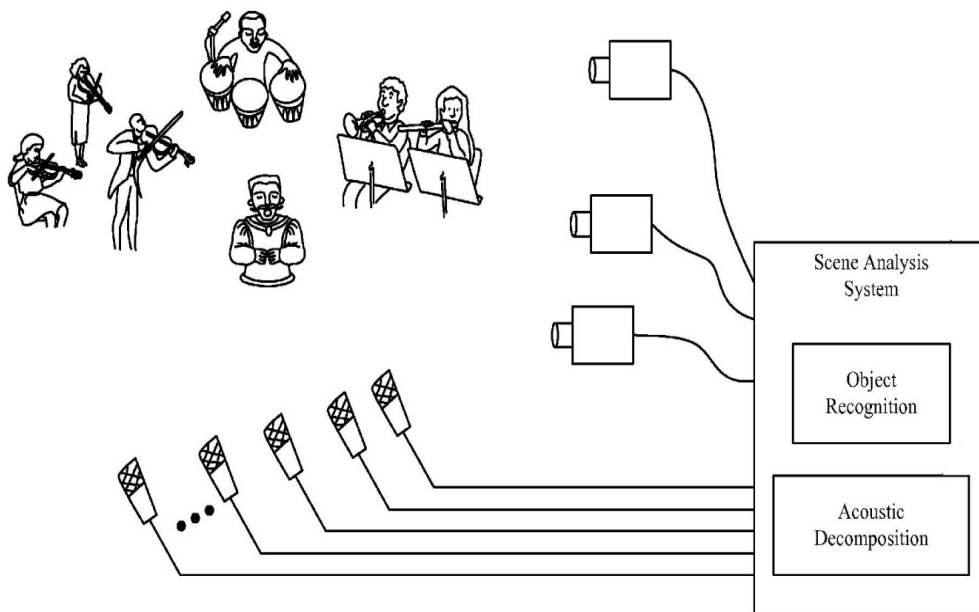
Figure 2. Extraction can be done with the help of a camera.

References

Limiting references

This place does not cover:

Application of wave-field synthesis in stereophonic audio systems	H04S 2420/13

Informative references

Attention is drawn to the following places, which may be of interest for search:

Positioning of sound field itself, e.g. balance and fading of the loudspeaker signals	H04S 7/302
Aspects of volume control, not necessarily automatic, in two and multi-channel sound systems	H04S 2400/13

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Sound object	audio object, i.e. acoustic representation of a sound producing entity in a sound field
Sound source	real or virtual loudspeaker

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:
- "virtual sound sources", "virtual sound objects" and "virtual loudspeakers"
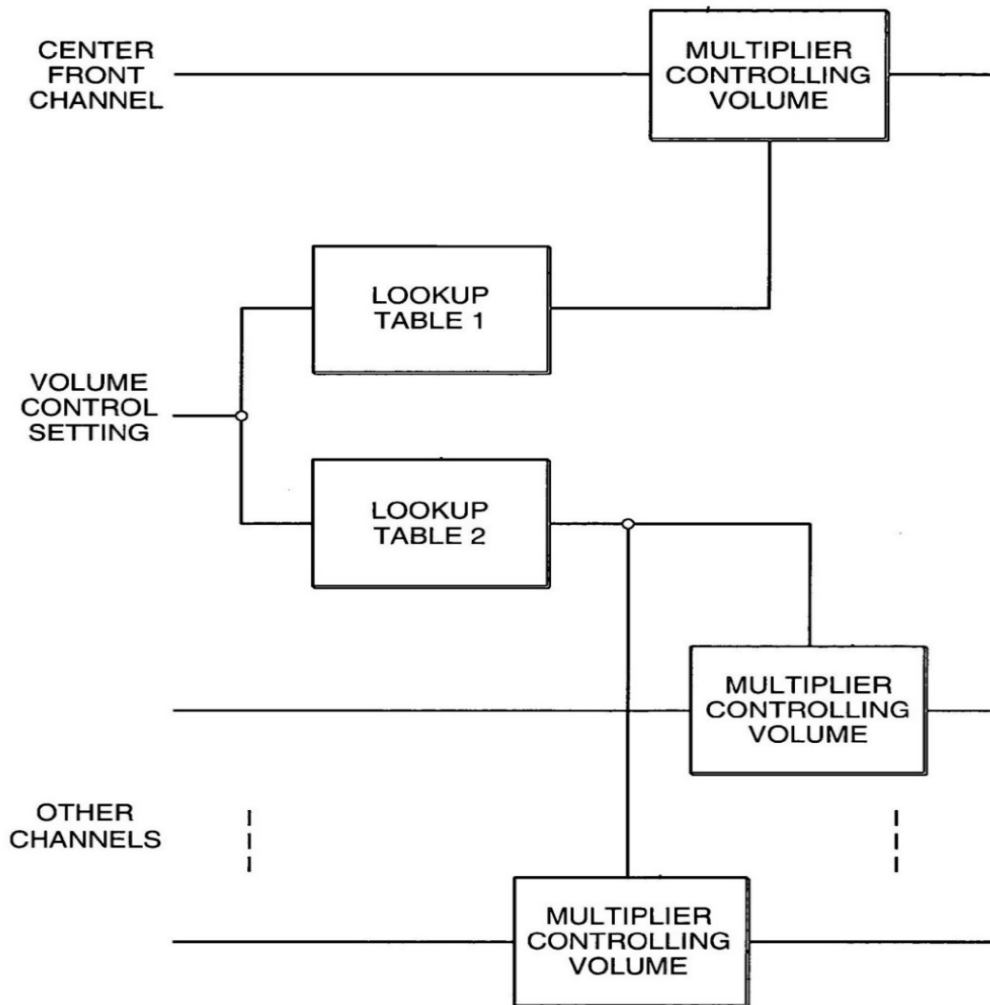
H04S 2400/13

Aspects of volume control, not necessarily automatic, in stereophonic sound systems

Definition statement

This place covers:
Control of volume.

Figure 1. Volume Control

For example, note the following figure showing aspects of volume control.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

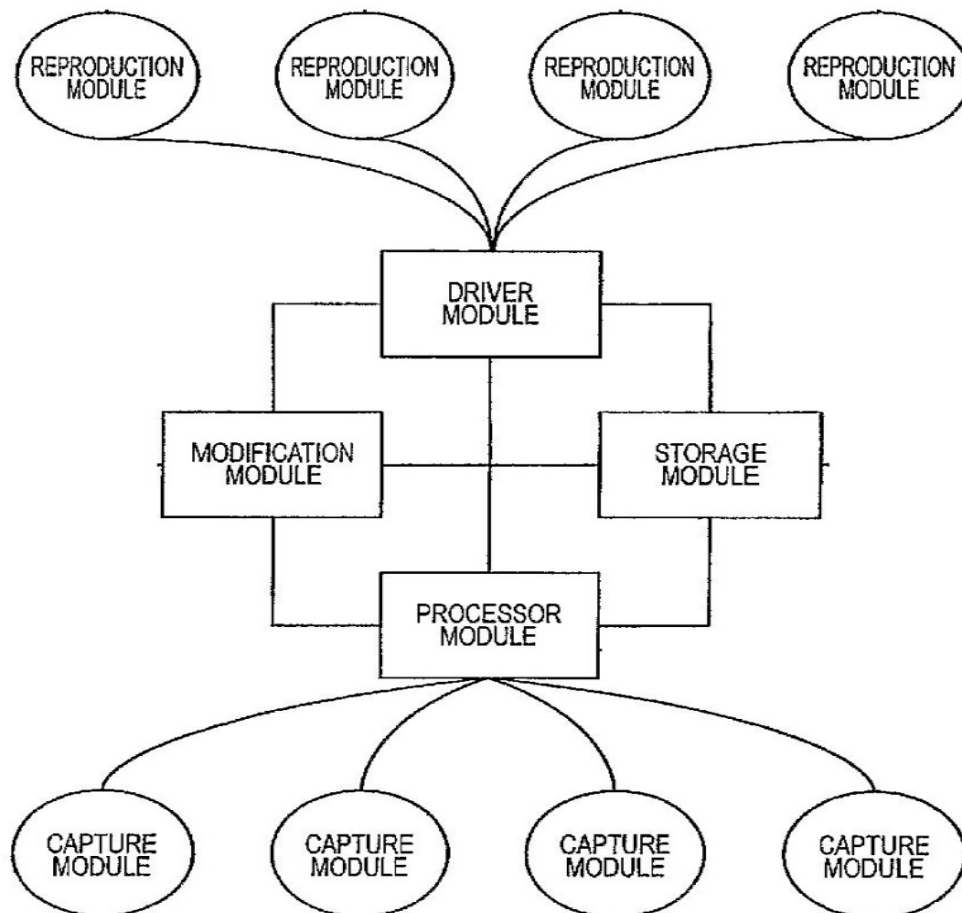| Control of amplification per se	H03G
Automatic control of amplifiers dependent upon ambient noise level or sound level	H03G 3/24; H03G 3/32

H04S 2400/15

Aspects of sound capture and related signal processing for recording or reproduction

Definition statement

This place covers:

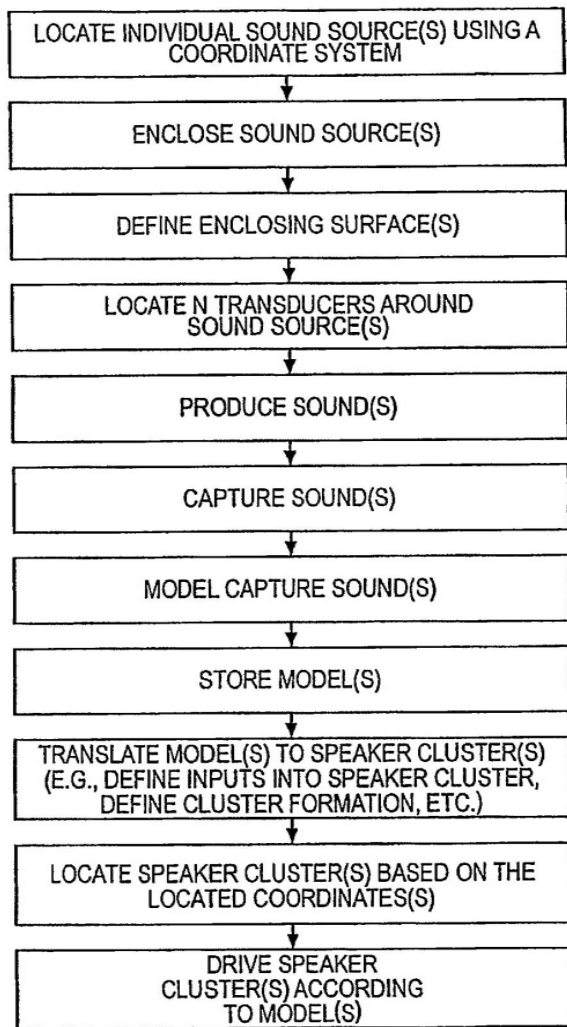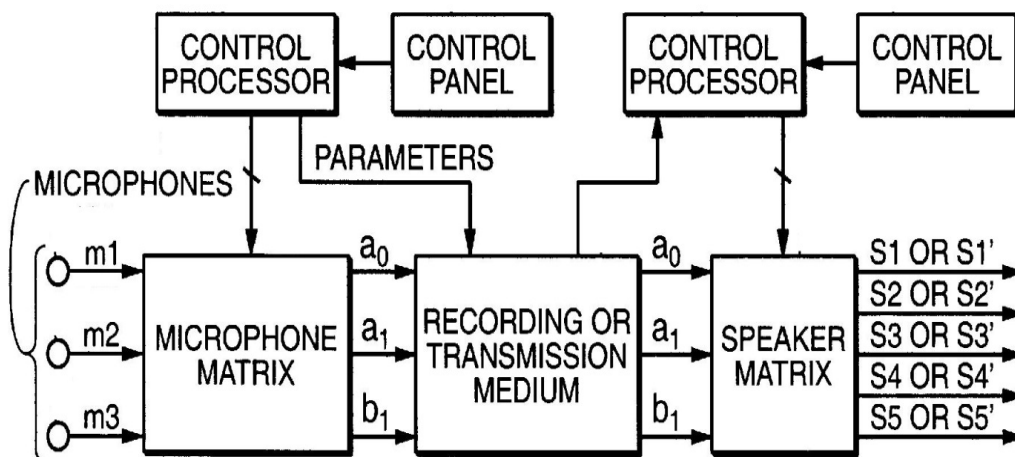Figure 1. Capture and reproduction of sound objects.

Figure 2. Capture and reproduction of sound field.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Spatial or constructional arrangements of microphones	H04R 5/027

Special rules of classification

Documents only relating to spatial or constructional arrangements of microphones should not receive this Indexing Code group.

H04S 2420/01

Enhancing the perception of the sound image or of the spatial distribution using head related transfer functions [HRTF's] or equivalents thereof, e.g. interaural time difference [ITD] or interaural level difference [ILD]

Definition statement

This place covers:

Improvement of the sound field taking transfer functions between ears and sound sources into account.

Examples:

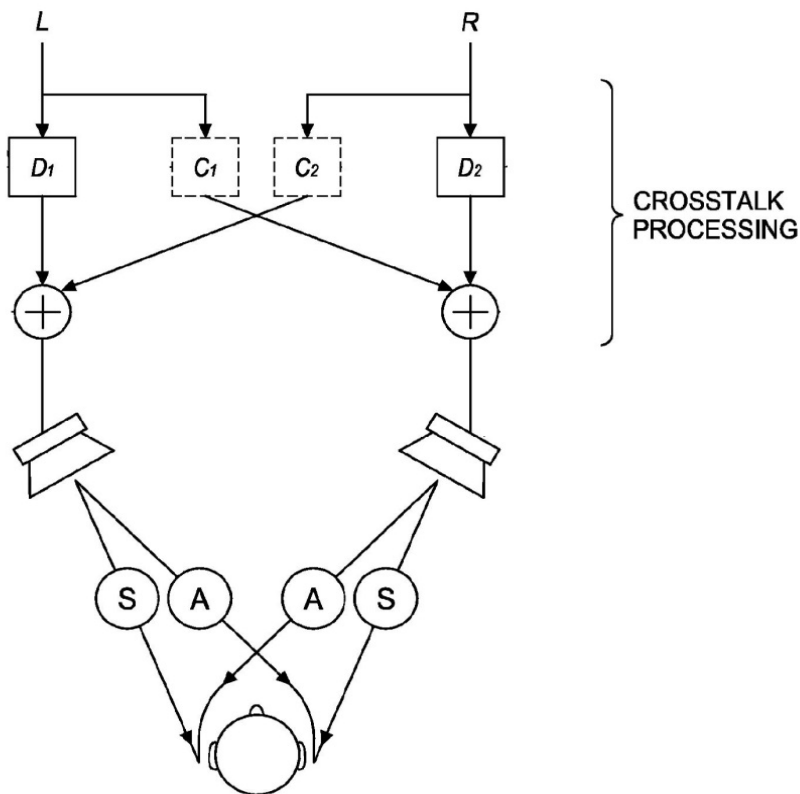Figure 1. 2-channel stereophonic reproduction on binaural headphones.

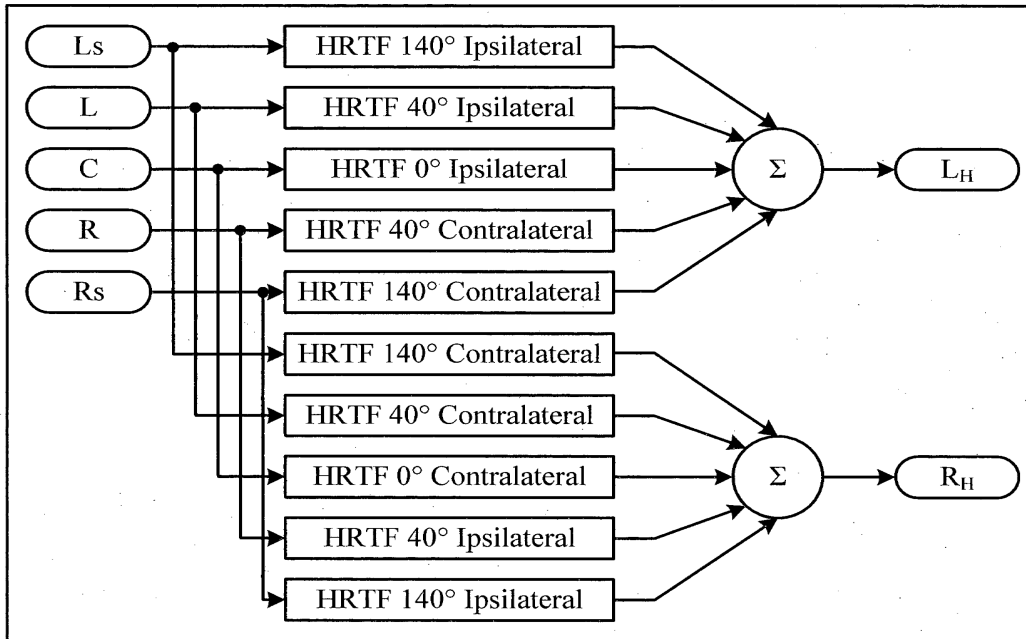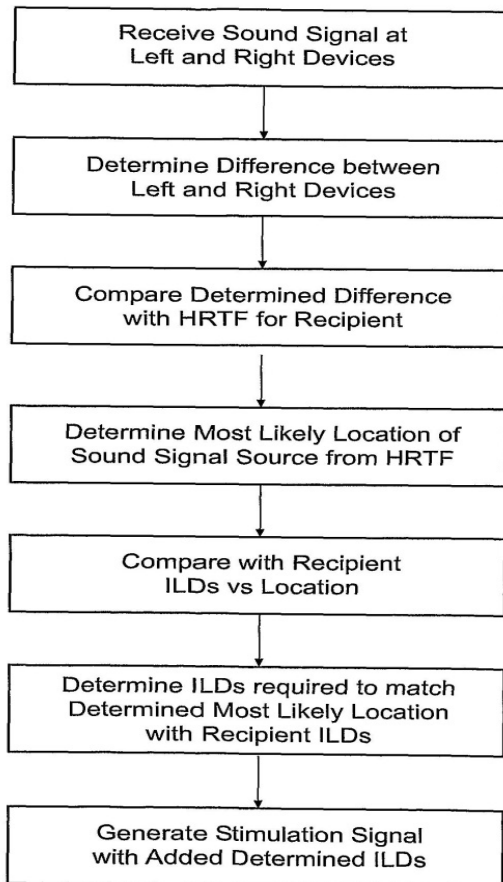Figure 2. 5.1 reproduction on binaural headphones.

Figure 3. using HRTF to improve localisation for a binaural hearing aid system.

H04S 2420/03

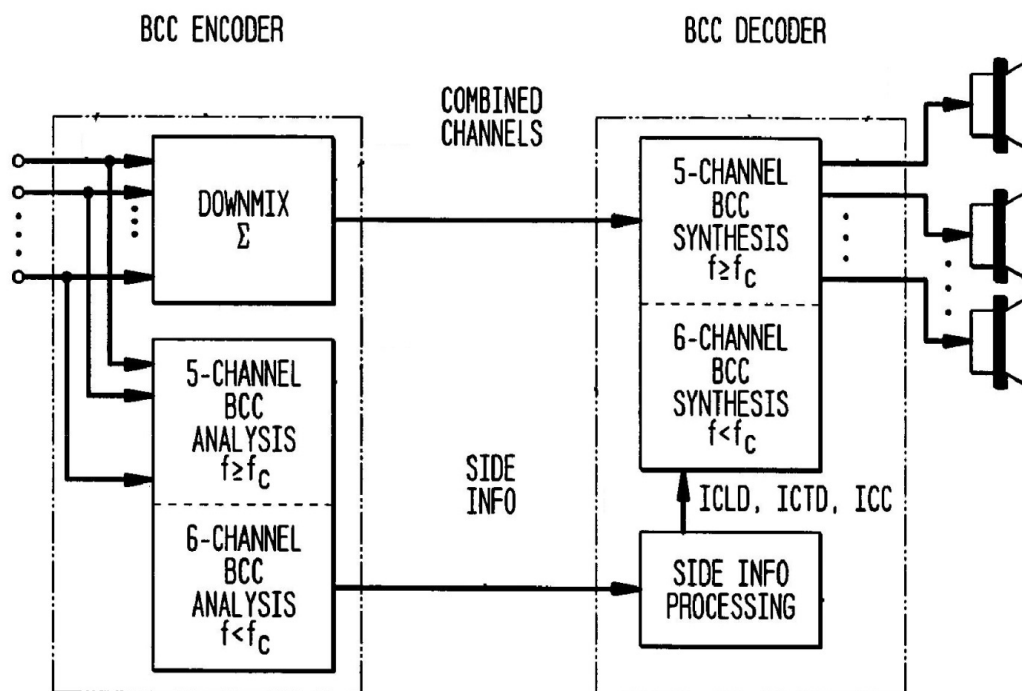## Application of parametric coding in stereophonic audio systems

Definition statement

This place covers:

Aspects regarding parametric coding affecting the rendering in a stereophonic audio system.

For example:

Reduced computational load due to frequency dependent Binaural Cue Coding (BCC) analysis and synthesis.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Parametric coding as such	G10L 19/008

H04S 2420/05

Application of the precedence or Haas effect, i.e. the effect of first wavefront, in order to improve sound-source localisation

Definition statement

This place covers:

The use of the Haas effect to control the sound localisation from loudspeakers in a stereophonic sound sytem.

For example in the figure below: low frequency components of the centre output signal is routed to the main loudspeakers and is thus heard if coming from small centre channel loudspeaker.
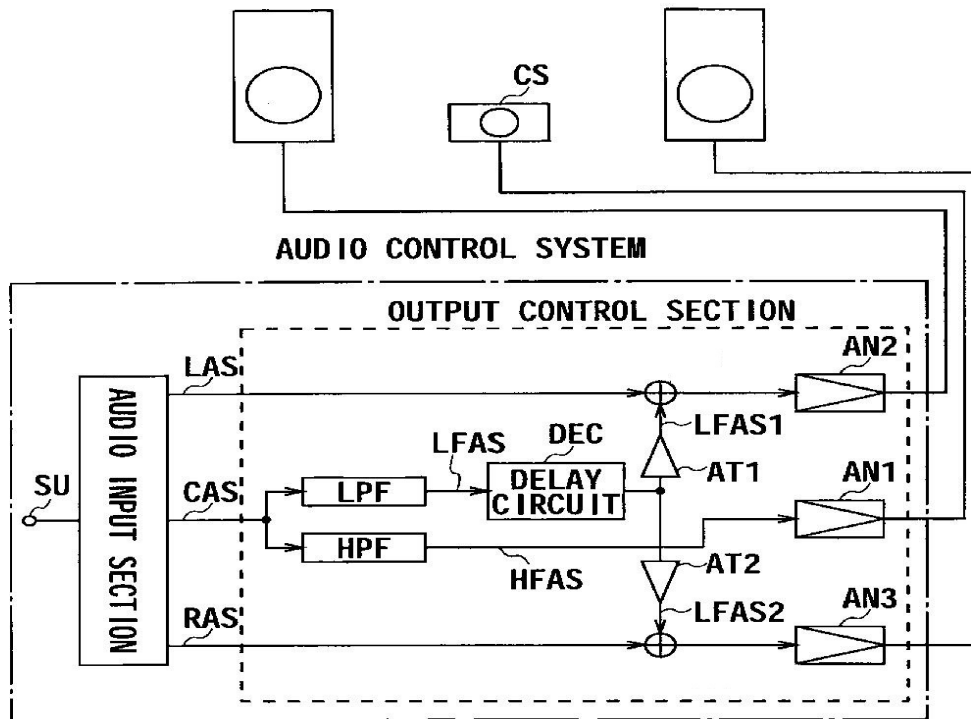

H04S 2420/07

Synergistic effects of band splitting and sub-band processing

Definition statement

This place covers:

For example: Improved pseudo stereo generation by splitting the mono signal in different frequency bands ($H_1(z)$, $H_2(z)$) and applying for band a different type of pseudo-stereo splitting filter ($H_{11}(z)$,

$H_{12}(z)$, $H_{21}(z)$, $H_{22}(z)$; e.g. according to H. Lauridsen). Thus, the high frequency contribution to the pseudo stereo can be improved.
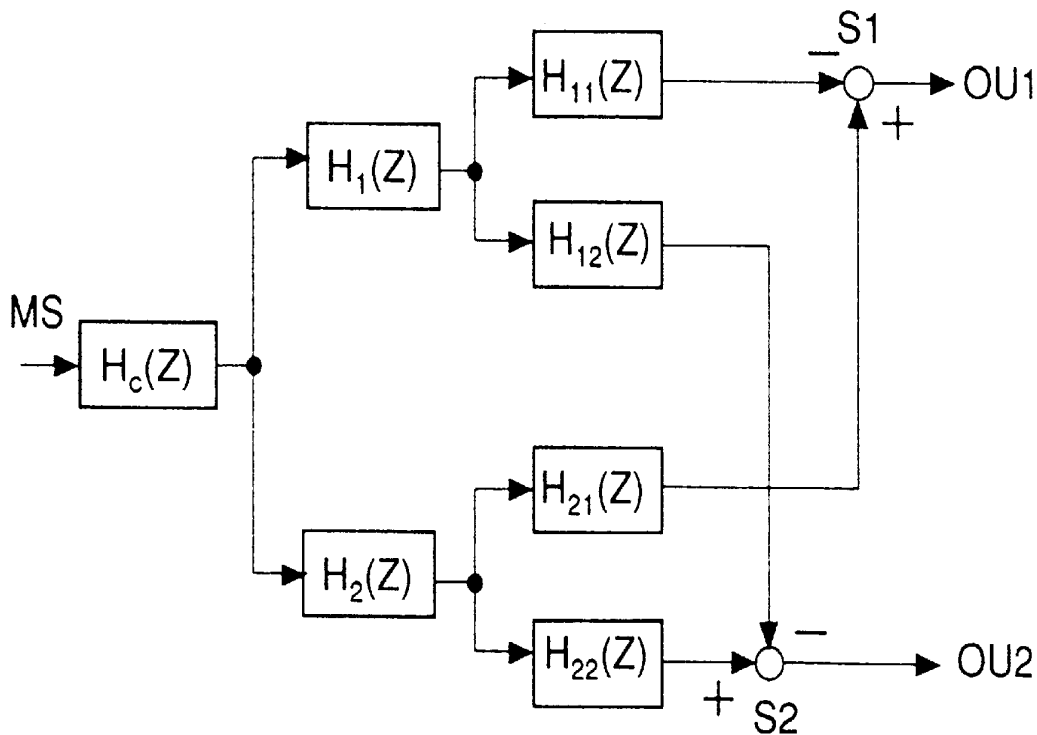
References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Digital filter banks	H03H 17/0266
Crossover filters for loudspeakers	H04R 3/14

Special rules of classification

The mere indication of band splitting or presence of a filter bank (e.g. fast Fourier transform (FFT); or finite impulse response (FIR)) is not sufficient to mandate classification into this Indexing Code group.

H04S 2420/11

Application of ambisonics in stereophonic audio systems

Definition statement

This place covers:

The ambisonic B-format system is a high quality sound positioning system which operates by breaking down the directionality of the sound into spherical harmonic components termed W, X, Y and Z
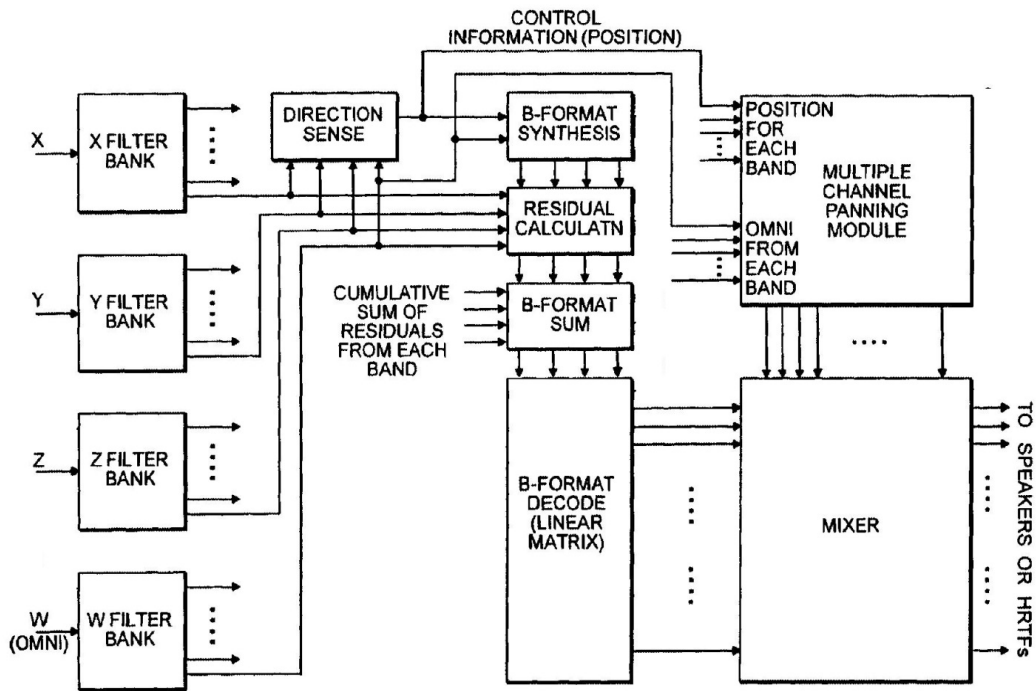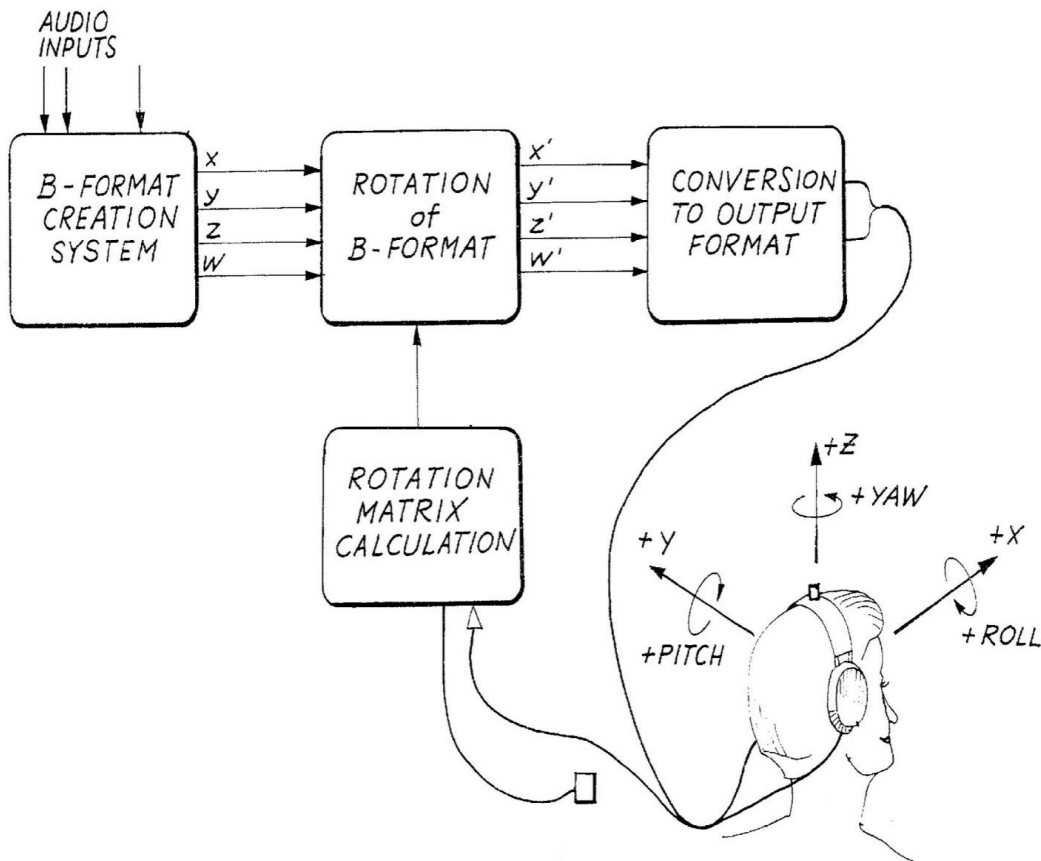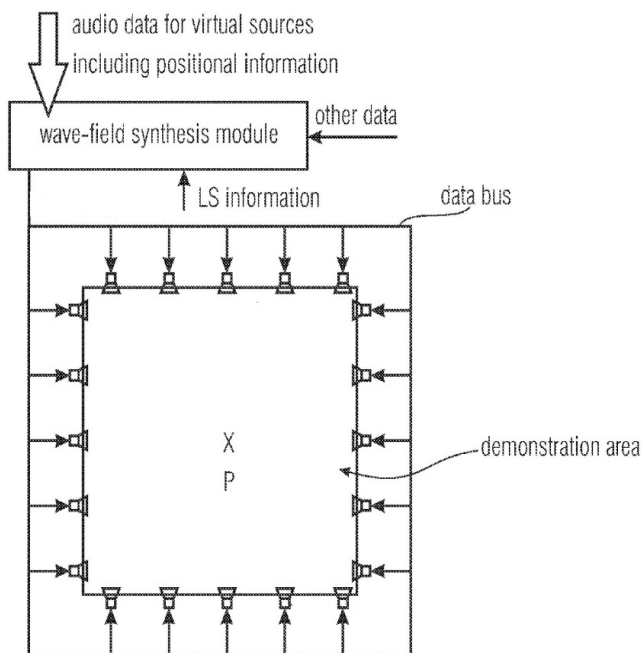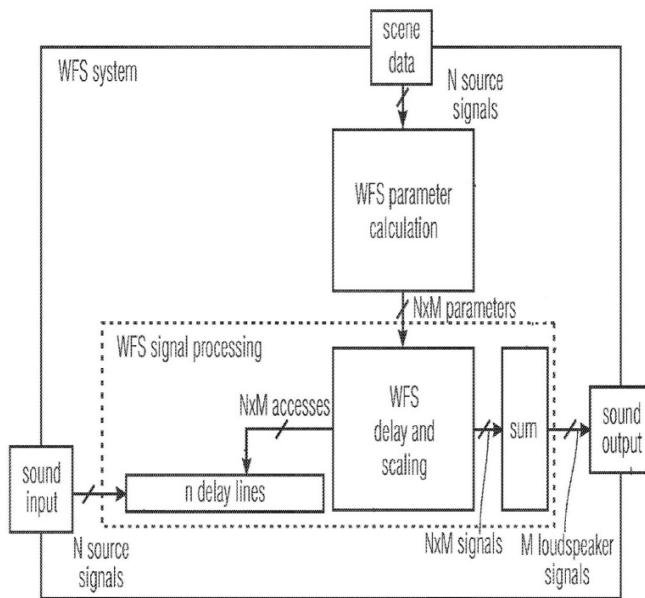
For example:

Figure 1.

Figure 2.

H04S 2420/13

Application of wave-field synthesis in stereophonic audio systems

Definition statement

This place covers:

Wave-field synthesis is a spatial audio rendering technique based on the Huygens–Fresnel principle, which states that any wave front can be regarded as a superposition of elementary spherical waves.

For example:

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Control systems	encompasses adaptive systems

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated: