tially 20 Hz to essentially 120 Hz, particularly in the range between 40 Hz and 120 Hz, more particularly in the range between 80 Hz and 120 Hz.

[0057] More generally, the haptic excitation generating unit may be adapted for generating the haptic excitation of the specific body part of the user by generating the air flow through the vent in accordance with the audio signal in an audio frequency dependent manner. In other words, the haptic excitation may be different for different audio frequencies. By taking this measure, frequency specific audio playback capabilities of an audio playback system may be equilibrated for a better experience of a user. For instance, strong haptic excitations may be generated in frequency domains in which audio play back quality is relatively poor (for instance a bass regime in small playback devices), and weaker or no haptic excitations may be generated in frequency domains in which audio play back quality is better. In some applications the haptic excitation generating unit may be adapted or may also be adapted for generating the haptic excitation of the specific body part of the user by generating the air flow through the vent in accordance with a video signal.

[0058] The device may be designed in such a manner that, in an operation state, in which the device is used/carried by the user (for instance mounted on the body of a user), a distance between an outlet of the vent and the specific body part of the user does not exceed a threshold value. Spacers may be provided which may define a minimum distance. Particularly, the distance between an outlet of the vent and the specific body part may be smaller or equal to five times of a diameter of an audio reproduction device, for instance of a loudspeaker. With such a geometrical configuration, a very efficient audio reproduction and combined excitation may be made possible.

[0059] The device may further comprise an auditory excitation generating unit adapted for generating a auditory perception of the user by generating acoustic waves in accordance with the audio signal to be reproduced. In other words, the audio excitation generating unit may generate acoustic waves and may therefore be a loudspeaker, a headset, an earpiece or the like. The generation of the acoustic waves and the generation of the airflow may be synchronized or coordinated, particularly by using the same signal, namely the audio signal, as a basis for generating the tactile and the acoustic stimulus. By taking this measure, the haptic excitation may be perceived as an improvement or strengthening of the acoustic performance.

[0060] Particularly, the device may be adapted as portable device. Portable devices are in many cases relatively small and may have shortcomings with regard to reproducing bass in a sufficient quality. By adding the tactile stimulus, such a shortcoming in the bass regime may be compensated and thus at least partially overcome.

[0061] The device for processing audio and/or visual data may be realized as a handheld sound reproduction system, a wearable device, a near-field sound reproduction system, headphones, earphones, a keyboard of a personal computer, a portable audio player, a loudspeaker, an audio surround system, a mobile phone, a headset, a hearing aid, a handsfree system, a television device, a TV set audio player, a video recorder, a monitor, a gaming device, a laptop, an audio player, a DVD player, a CD player, a harddisk-based media player, an internet radio device, a public entertainment device, an MP3 player, a hi-fi system, a vehicle entertainment device, a car entertainment device, a solarium system, such as Philips Innergize system, a medical communication system, a speech communication device, a home cinema system, a home theater system, an audio server, an audio client, a flat television apparatus, an ambiance creation device, or a music hall system.

[0062] Although the system according to an embodiment of the invention primarily intends to improve the quality of sound or audio data, it also intends to improve the quality of video and visual data. Moreover the system is favourably applicable for a combination of audio data and visual data. For instance, an embodiment of the invention may be implemented in audiovisual applications, like a video player or a home cinema system in which one or more speakers are used.

[0063] The aspects defined above and further aspects of the invention are apparent from the examples of embodiment to be described hereinafter and are explained with reference to these examples of embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0064] The invention will be described in more detail hereinafter with reference to examples of embodiment but to which the invention is not limited.

[0065] FIG. **1**, FIG. **3** to FIG. **12** illustrate devices for processing an audio signal according to exemplary embodiments of the invention.

[0066] FIG. **2** illustrates a diagram describing a functional principle of a device for processing an audio signal according to an exemplary embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

[0067] The illustration in the drawing is schematically. In different drawings, similar or identical elements are provided with the same reference signs.

[0068] In the following, referring to FIG. **1**, a device **100** for processing an audio signal **101** according to an exemplary embodiment of the invention will be explained.

[0069] The device **100** comprises an audio data source **111**, for instance a CD, a harddisk or even a wired or wireless connection to a remote source, for instance in the context of digital television.

[0070] Audio data **101** to be reproduced by the device **100** are transmitted to a control unit **109**, which may be a CPU (central processing unit). The CPU **109** has processing capabilities and is capable of processing the audio signal **101** to prepare it for reproduction.

[0071] The CPU **109** is in bidirectional communication with an input/output device **110** that allows a user to control the entire system **100**. The input/output unit **110** may comprise a display unit like a liquid crystal display, a plasma device or even a cathode ray tube. Furthermore, input elements may be provided at the input/output device **110**, like a keypad, a trackball, a mouse, a joystick or even a microphone of a voice recognition system. A user may initiate playback of an audio piece stored on the CD **111** by providing the CPU **109** with corresponding control commands.

[0072] Based on these control commands, the audio data **101** are transmitted from the CD **111** to the CPU **109** for processing. The selected audio data **101** is then reproduced by a loudspeaker **107**, thereby generating acoustic waves **108** that can be perceived by an ear **106** of a human listener shown schematically in FIG. **1**.

[0073] Beyond this, the audio signals **101** are also transmitted to a haptic excitation generation unit **102**. Component **102**