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(71) Applicant: **P&DA Enterprise Support S.R.L.**
00195 Roma (IT)

(72) Inventor: **The designation of the inventor has not yet been filed**

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(54) **System for audiovisual signals based on controlled identification data**

(57) System to mark audio visual signals using controlled identification data, and implemented by a coder and a decoder using a PC, able to perform an electronic processing of audio frequency signals to code and to decode text messages in the audio playing of speech

and musical files. The system is based on a SW program specifically developed.

This system is a typical electronic product and properly an audiovisual electronic device utilised in the multimedia electronic devices.

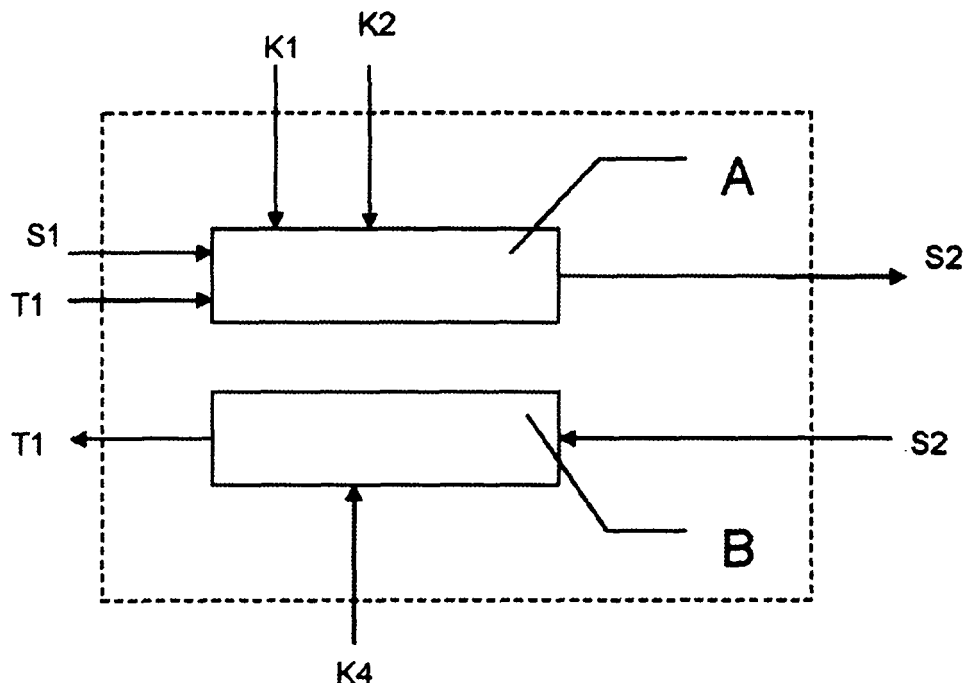


FIGURE 3

Description

[0001] The invention relates an electronic system device able to generate sound signals, of audio frequency range, to insert, by means of a coding unit, both text messages and digital signatures, into musical and speech files, besides it is able to decode them and check their authenticity using a decoder unit.

[0002] In the case the system presented is utilized order to play a vocal or musical file, the coder inserts in real time the text containing the data identifying the file and the user's digital signature on line. For this purpose it uses a pseudo random coding in the audio frequency range.

[0003] The process performed by the coder on the audio frequency signals doesn't alter the sound quality since the changing introduced is imperceptible and unchangeable. Besides this process allows identifying the file and the user through his digital signature.

[0004] The decoder is the relevant part of the system presented and is able to detect, also in critical conditions, the text and the digital signatures, inserted by the coder in the elaborated files. Critical condition is every situation in which the files, managed in the initial phase by the coder, have had distortions, elaborations and different types of treatments able to modify the audio frequency characteristics. Regarding the capability of characterizing sound files in an imperceptible and unchangeable way, the invention is a solution able to fight the counterfeiting of CD musical, video films and other recordings in the multimedia area of illegal reproduction.

[0005] Some different procedures are known to delete and to modify codes of the audio recording devices.

[0006] At present, different techniques are available, on the market, to attack audio recorded files in digital format on CD-Rom and other devices. Different systems known as "watermarking" have been used for some years. These systems are able to insert into the audio multimedia files, auxiliary data which do not affect the hosting signal but these files cannot avoid the illegal reproduction.

[0007] The invention uses the "watermarking" in the situations where it is required to know with certainness the producer of the multimedia files in order to allow the identification of the source and to stop the illegal diffusion.

[0008] The aim of this invention is fighting the hackers of the recording duplication and the illegal diffusion of audio and audiovisual files, including those concerning telephone traces authorized by legal Authority. The main advantage of this invention, associated to its innovative architecture, is the relevant protection against every type of attack performed by means of well known solutions to delete the source identity.

[0009] The invention is a typical electronic product and properly an audiovisual electronic device utilised in the multimedia electronic devices. It basically consists of:

- a coding device, termed "coder", able to insert the

text messages in the recording of sound, music or speech files without affecting the audio perception and the sound quality;

- a decoding device, termed "decoder", able to extract text messages from audio records previously managed by the "coder" and to transfer them, without mistakes, to the controller reading the message in order to identify the sources.

[0010] The controller is a unit that uses the decoder to extract the hidden message and identify the source. The "source" is considered the unit responsible for the multimedia production process including the place where the recording has been done.

[0011] The insertion of the algorithm does not allow the cancellation of inserted hidden message in the multimedia signal.

[0012] The hidden message will remain unaltered in spite of the attempt of erasing it because it is inserted so that it cannot be modified or destroyed without making the basic audiovisual not understandable. Its strength is obtained by working in the frequency range and "spreading" the identification data message in redundant way and mistake correction using the whole frequency range available.

[0013] When the watermarking is applied to musical signals the absence of any perception of marking signals is the most relevant requirement, in the invention the most relevant aspect is the absence of the deletion capability. The watermarking algorithm is programmed in order to provide the no deletion feature of marking signals instead of the no perception feature.

[0014] The invention is below described according to a scheme, preferred by the inventor, based on the following annexed figures:

Fig. 1 - Coder blocks diagram

Fig. 2 - Decoder blocks diagram

Fig. 3 - System blocks diagram

[0015] The system, **Fig.3**, is mainly based on the coder unit, **Fig.1**, and on the decoder unit, **Fig.2**.

[0016] The coder system consists of, **Fig.1**, a cipher unit **1** using a private authentication key **k2** of the text message **T1**, a decipher unit **2** of the audiovisual digital signal **S1** using a decipher key **k1**, a sequence generator **3** using a key **k3** controlling the pseudo random sequences, a large range modem **4**, a signal audiovisual characteristics analyzer/detector **5**, a signal processor **6** which makes a conversion from time to frequency, a signal processor **7** which performs a "watermarking" procedure, a signal processor **8** which makes a reverse conversion from frequency to time, a processor **9** and a storage buffer **10**.

[0017] The digital signal **S1** musical sound or speech is received as a ciphered signal and forwarded to the input of the deciphered unit **2** using the **K1** key.

[0018] The multimedia signal will not be reproduced

so far as the marker is not applied. As long as the signal is out of the marker device it is transmitted in a ciphered way. The marker device deciphers the signal, makes ready the message consisting of the certified message containing the identification data and it inserts a protected support in the audio (visual) file. When the marker is applied, the audio message is deciphered and it is again understandable. The message **T1** is provided to the cipher unit **1** digital input, using **K2** key and it is transmitted to the extended range modem **4** to process in computer **7** the watermarking of signal **S1**, previously processed and transferred in the frequency field by analyser **5** and computer **6**. The codex system process ends by the reversing change from the frequency to the time performed by computer **8** which produces on line the audiovisual signal **S2** marked in unchangeable and imperceptible way.

[0019] The decoder, **Fig 2**, consists of signal elaborator **1** which processes, according to a mathematic algorithm, the **S2** signal from the time field to the frequency field, a correlator **3**, a pseudo random sequences generator **2** based on the **K3** key, a decipher unit for the message based on **K4** key, of an analyser-detector **5** of the audiovisual signal parameters, a processor **6** and a buffer device **7**. The **S2** signal, after the treatment **1** in the frequency field, is provided to the correlator **3**, working on the pseudorandom sequence generated by source **2**, using **K3** key and the parameters of the sound signals from analyser **5**. The signal originated from the correlation, the hidden message, is deciphered in the unit **4** which defines on the public **k4** key the text message **T1**.

[0020] Unlike the coder is working on real time basis, the decoder can be working off-line, due to the controller need to verify the "ad hoc" message **T1** previously inserted and coded. The system presented is implemented by means of a component available on the consumer market. The invention allows coding and decoding phases for audio recorders and it is used mainly in the treatment and in the protection of confidential and private owned. The system is managed by SW program specifically developed, being user interface with coder and decoder and performing the following functions:

- User interface during the sound audio playing;
- Sound file **S1** tracing and coding;
- **T1** message content automatic management;
- Sound file **S2** audio playing automatic management;
- User interface during the coding phase;
- Input to the checking device to the **T1** message selected and certified by the decoder.

Claims

1. System to mark audio visual signals **characterised by** the fact to use controlled identification data, and mainly implemented by coder (A) and a decoder (B); the coder (A) consists of a cipher unit (1) using an

authentication private key (K2) of the text message (T1), by a digital audio visual signal (S1) decipher unit (2) using a decipher key (K1), by a sequences generator (3) using a controlling key (K3) of the pseudo random sequences, by a large range modem (4), by an analyzer detector (5), of the audio visual characteristics, by a signal computer (6), by a signal computer (7), by a signal computer (8), by a processing unit (9) and by buffer device (10); the decoder (B) consists of a signal computer (1), of a correlator (3), of a pseudo random sequences generator (2), of a key (K3), of a message (T1) decipher unit (4) using a public key (K4), of an analyzer detector (5), of a processing unit (6) and of a buffer device (7).

2. System to mark audio visual signals **characterised by** the fact to use controlled identification data according to claim 1, being the hidden data transmitted into the multimedia signal certified by a cipher unit; the authentication of data source takes place inside of the marking/coding unit.
3. System to mark audio visual signals **characterised by** the fact to use controlled identification data according to claim 1, being decoder (A) working in real time while the decoder (B) is working both on line and off line.
4. System to mark audio visual signals using controlled identification data according to the previous claims, **characterised by** the fact that the components are available on the consumer market.
5. System to mark audio visual signals using controlled identification data according to the previous claims, **characterised by** the fact to be based on a SW program specifically developed.

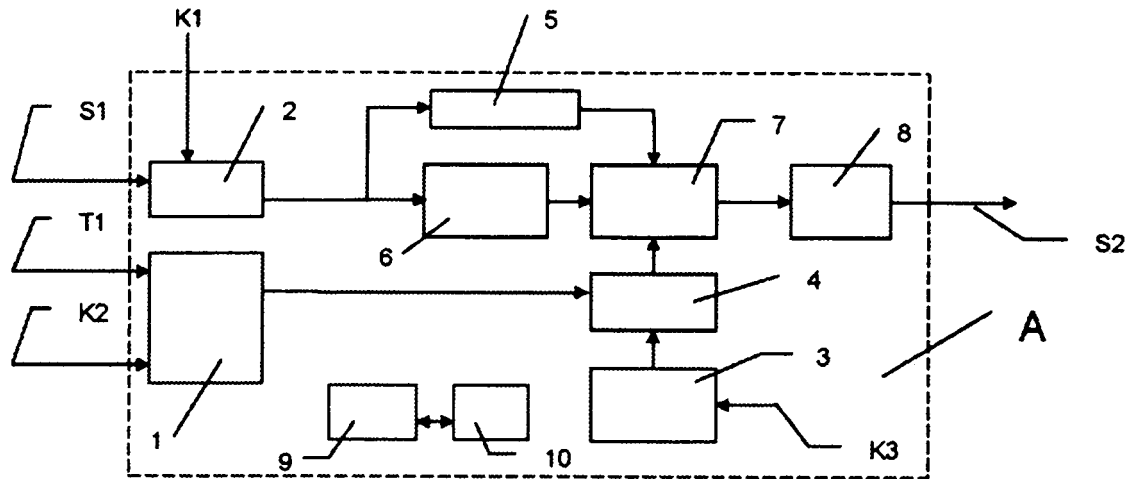


FIGURE 1

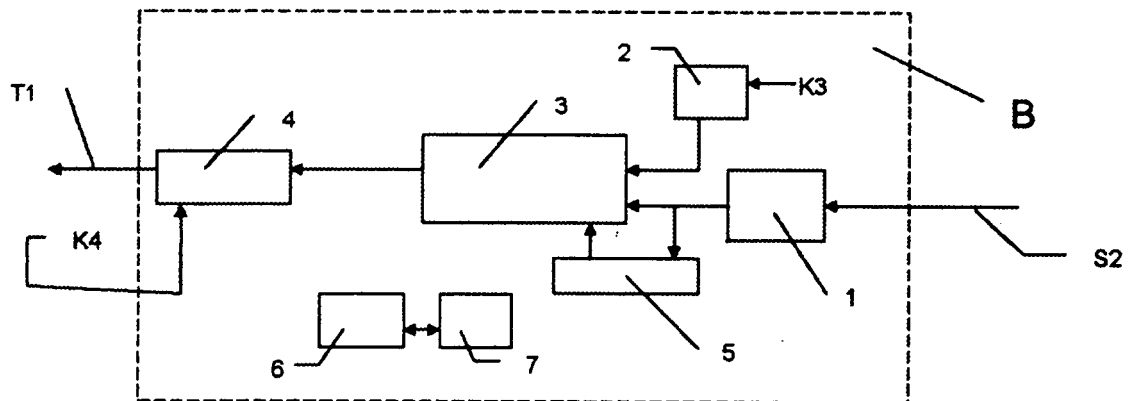


FIGURE 2

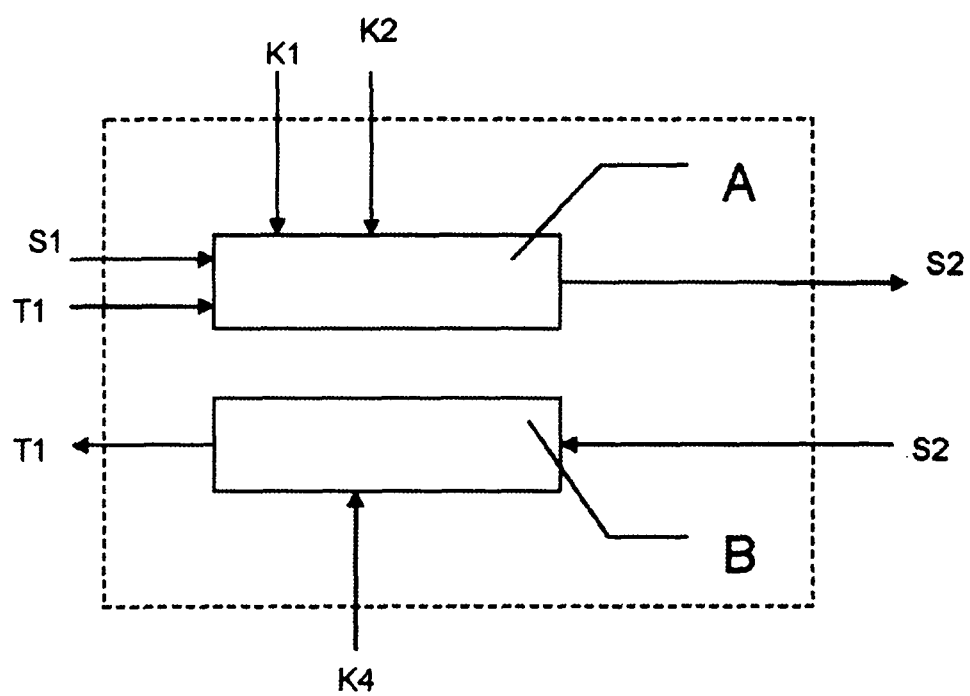


FIGURE 3