

The invention relates to an electronic storage device for a magnetic tape cassette and a recording and/or reproduction equipment which is suitable therefor, in particular, a video recorder which includes digital processing means for digitally coded video/audio signals. The magnetic tape cassette includes a housing and it contains, within the housing, one or more magnetic tape spools and also the electronic storage device, which device can be connected via connecting means to the recording and/or reproduction equipment and can be controlled thereby in the sense of an evaluation of the stored information, and the device containing items of information for preventing and/or enabling certain operational states of the recording and/or reproduction equipment.

A magnetic tape cassette, which comprises an electronic storage device, electrical connecting means and also an arrangement which can be controlled in the sense of an evaluation of the stored information by means of a recording and/or reproduction equipment, is known from DE-A-2943409. Herein, provision is made for storing the currently occurring position of the tape and, possibly also, auxiliary, characteristic items of data which relate to the magnetic tape cassette itself and/or just to the magnetic tape within the cassette, such as for example, the type of cassette or the favoured level of pre-magnetisation. As for the first items of data, these relate to alterable items of data in the sense of a tape counter which merely serves for determining the instantaneous position of the tape. In respect of the auxiliary items of data, these relate to fixed items of data which are written once and for all and reflect tape or cassette parameters such as the unalterable mechanical or magnetic properties of the cassette for example. The possibility of altering these items of data, or, of directly affecting or blocking the recording and/or reproduction functions thereby, is not envisaged.

WO-A-89/10615 depicts a magnetic tape cassette including an electronic storage device which contains a list of contents

regarding the recorded items of information and enables a more rapid access to wanted items of information.

The object of the invention is to definitively block unwanted or impermissible operational states of the recording and/or reproduction equipment in the context of a specific recording medium or a specific magnetic tape cassette and to permit only wanted or permissible operational states when this magnetic tape cassette is placed in the recording and/or reproduction equipment.

An unwanted operational state may, for example, be the recording function when the cassette already contains recordings and it is not intended that these should be overwritten or erased. Furthermore, the user should be able to specify the cassette type on one subsequent occasion.

Impermissible operational states may occur in connection with the reproduction function. For example, a private user may be interested in allowing items of information, which he himself has recorded, to be able to be reproduced only by those authorised to do so e.g. by entering a password or a code-number, rather than by anybody. A child lock could thus be implemented in this way for example. Other impermissible operational states occur in the field of commercial usage, e.g. when selling or hiring out pre-recorded, magnetic tape video cassettes (video hire shops). The seller or the lender of such cassettes may be interested in ensuring that stolen cassettes cannot be reproduced at all for example, or, in only allowing a particular number of reproductions to occur for cassettes which have been offered at a certain rental, or, in ensuring that only certain parts of the recorded information can be reproduced.

In accordance with the invention, the object is achieved by a storage device having the features according to claim 1. Advantageous developments and embodiments are specified in the appendant claims 2 - 4. Claims 5 - 7 relate to a recording

and/or reproduction equipment including a magnetic tape cassette,

The invention will be explained in more detail hereinafter by means of embodiments taken with reference to the drawing, Fig. 1 to Fig. 3. In the drawings:

Fig. 1 illustrates an exemplary implementation of the contents of the store that are recorded in the electronic storage device, in the case of a blank cassette.

Fig. 2 illustrates an exemplary implementation of the contents of the store that are recorded in the electronic storage device, in the case of a cassette used for the first time by a private user.

Fig. 3 illustrates an exemplary implementation of the contents of the store that are recorded in the electronic storage device, in the case of a cassette intended for hire or for sale.

Fig. 4 illustrates a magnetic tape cassette having a storage device included therein.

The electronic store illustrated in Fig. 1 to Fig. 3 is partitioned into continuous units of different length e.g. into bytes each having a length of 8 bits or into groups of bytes.

Items of information regarding the cassette itself, the type of cassette, the length of magnetic tape it contains or the type of magnetic tape, here for example, x3f (x being a hexadecimal) are located in the first byte in known manner. These items of information are unalterable.

An item of information regarding the utilisation of the cassette is stored in the second byte. This item of information may be altered just once when the cassette is first used, whereafter this item of information is also unalterable.

Here, as illustrated in Fig. 1 for example, 00 is entered as the content of the store of a blank cassette, whereby this characterisation simultaneously permits a once only alteration of the entry. The remainder of the stored content, in the case of a blank cassette, is irrelevant and therefore quite arbitrary e.g. constantly, also 00.

The content of the store illustrated in Fig. 2 of a cassette used in a camcorder for the first time by a private user is characterised for example by the entry 01 in the second position. A cassette used for the first time in a video recorder could then be characterised by 02 for example, a cassette used for the first time in a sound recorder could be characterised by 03.

The following storage region in Fig. 1 and Fig. 2 serves for identifying a combination of the starting point, the end point and the duration of each recording. Here for example, there is illustrated a set of data consisting of a start time in minutes and seconds, an end time in minutes and seconds and a plurality of bytes for auxiliary information. Such a data set is provided for each recording on the magnetic tape. Over and above this, a pre-recorded cassette intended for hire or sale for example may be identified by xff in the second place. The content of the store illustrated in Fig. 3 in the case of a pre-recorded cassette differs insofar as further locations for items of information are inserted between the first two bytes and the subsequent data sets. These contain a serial number for example, with which a cassette that has been recorded with a certain program can be uniquely identified, and, in a further storage location for example, items of information regarding the type of authorisation required for reproduction of this program.

The various manners of operation, which lead to the prevention of undesired or impermissible operational states, will now be described hereinafter.

1. Blank cassette

The content of the store in the case of an unused blank cassette is illustrated in Fig. 1. The identification "00" in the second region of the store permits this to be altered once during the first recording on the cassette.

2. Self recorded cassette

If the identifying mark in the second storage region indicates that it relates to a cassette for private use, then the partitioning of the subsequent storage region is also determined thereby.

2.1 Protection of the recording

Protection against unwanted overwriting or erasure of existing recordings is achieved by having a recording apparatus continually carry out a comparison between the instantaneous position of the tape and the entries in the store. The recording function is only made available for use if this comparison indicates that there will be no chance of overwriting anything. If, however, it is discovered that there is a chance of overwriting, then the recording function can be fully blocked or only made available for use after a process of checking back and receiving confirmation. In addition to this, a complete blocking of the recording function can also be effected for each individual recording by means of a corresponding entry in the storage location provided for the auxiliary items of data. This entry can be made, and also removed again, by the user with the help of an appropriated function in the recorder or camcorder. This thus recorded function thereby replaces, in a substantially more flexible manner, the previously conventional, mechanical

erasure prevention means in a magnetic tape cassette which took the form of a rupturable tongue or a slider.

2.2 Child lock

One further possible function is the intentional enablement or blocking of reproduction for each individual recording. This may be effected likewise by means of an entry in the location provided for the auxiliary items of data. Reproduction for unauthorised persons, in the form of a child lock for example, can thus be prevented in this manner. A password or code number may be agreed upon in order to prevent this entry from being easily changed. This may be likewise stored in the storage device together with the other items of data.

3. Pre-recorded cassette

Basically for example, only the reproduction function can be made available for use in the case of a cassette that is identified as being pre-recorded, whence unwanted erasure will be positively prevented.

In order to reduce the risk of theft of such cassettes, a special entry may be necessary in the location provided for authorisations of use in order for the reproduction function of a play-back equipment to be enabled at all. This entry might not be present in a cassette which is on display on the shelf of a video hire shop for example, it only being made once one is at the till. Since, however, such an entry can be manipulated with the help of a suitable device, it is still more expedient to erase all of the data sets concerning the contents in the case of cassettes displayed on a shelf. Such a cassette is practically worthless. It is not until one is at the till that the cassette is identified with the aid of the serial number and

the data sets are loaded-in from the memory of a computer for example.

It is not only possible to authorise reproduction in a general sense from a cassette by means of a suitable entry. In addition to this, only certain ones of the functions related to the reproduction may also be authorised. For example, in the case of compatible HDTV/TV recordings, it is possible to permit just TV reproduction with lower resolution, in the case of recordings having stereo-sound and surround-sound, the reproduction of the surround-sound may be blocked. Furthermore, it is also possible to form a storage location in the storage device as a counter for counting the number of permitted play-backs.

Moreover, individual blocks on the reproduction may be activated by the user, as for a self-recorded cassette, in addition to the entries typical of a pre-recorded cassette. Following the return of the cassette, such blocking entries, possibly together with a secret code number, could be left in the storage device. However, it is equally possible to entirely remove these from the storage device in favour of a total block after the cassette has been returned or when there is a fresh authorisation at the till.

4. Pre-recorded cassettes having increased protection (comparison with a sub-code)

It is conceivable that the content of the storage device might be altered on the part of unauthorised persons using appropriate means i.e. in particular, the content of the storage locations identifying the authorisations. Increased security can be produced in the case of a pre-recorded cassette in that the total content of the storage device, or parts thereof, is recorded continually together with the recording of the useful signal as a so-called subcode. If one makes it possible for reproduction to be effected only when the content of the storage device is in agreement with the recorded subcode, then it is

sufficient, for the purpose of blocking reproduction, to deliberately alter the content of the storage device at one or just a few locations.

Such a cassette is then likewise worthless until such time as the person responsible for the authorisations corrects the stored items of information at the locations known only to himself. It is advantageous that it is not necessary to encode the content of the storage device or to associate an encoding unit with the storage device.

Fig. 4 shows a magnetic tape cassette 7 having a housing. The magnetic tape cassette contains two magnetic tape spools 8 and 9 on which a magnetic tape 10 is coiled. In addition, the magnetic tape cassette contains a storage device 11 as previously described which can be connected or coupled to a write and/or read device provided in a magnetic tape equipment on the side 12 facing the outer wall of the magnetic tape cassette. The write and/or read device thereby serves as an interface or means for transmitting signals from the storage device to the magnetic tape equipment or vice versa. The signals received from the storage device are processed or evaluated in a data processing and/or control unit in the magnetic tape equipment (not shown). This data processing and/or control unit controls an operational mode blocking means as previously described.

However, yet further forms of blocking or enabling the magnetic tape equipment and the cassette can be carried out using memory by means of the invention.

For example, a general block on recording can be brought about by means of a special (blocking) bit in the memory whereby this bit replaces the mechanical sliders/rupturable-flaps. The bit may be set or enabled by the user. Basically, the making of an undesired recording can be blocked by means of a characterising bit for the cassette e.g. as a cassette for hire/sale, the bit being stored in the memory.

Yet again, specific blocking modes can be envisaged which trigger off a block on recording using an enquiry function when there is a conflict between the position of the tape and the entries already present in the UTOC (User Table Of Content). This blocking mode may also be referred to as a Safe-Record function.

A specific block on recording may also be set or enabled by the user by means of a new entry in the UTOC.

A general block on reproduction only occurs when an entry is present in the UTOC and if additional blockages have not been set.

The user may generally block the whole cassette (adult video) with/without a password or trigger off specific blockages for each entry in the UTOC with/without a password.

A block which is typical of the cassette is just the thing for cassettes for sale/hire. Here, any reproduction in the reproduction equipment can only occur if utilisation of the cassette is allowed i.e. if the "video shop paid" bit is set.

The comparison of the content of the memory with the subcode stored on the magnetic tape offers a further way for effecting the blocking action.

For example, a reproduction can only occur if a certain part of the subcode is in agreement with a certain entry in the memory. Naturally, it is advantageous, when every cassette is numbered, that this number should on the one hand be in the memory and, on the other hand, that it be simultaneously recorded in the subcode during each recording. The cassette housing (= memory) and the recorded tape then belong together.

Blocking / enabling processes using encoding are to be described hereinafter.

Basically, a cassette number and some further item of information e.g. "video shop paid bit", and this using 64 bits i.e. $2 * 10 \exp 19$ variations, should be available. Moreover, an encoding procedure using trapdoor and/or avalanche functions is to be assumed and each recorder should contain a chip which can execute the necessary encoding. Trapdoor means that the coded text $f(x)$ can be easily calculated from the clear text x . By contrast however, x cannot be calculated from $F8x$) at an acceptable cost. Avalanche means that small changes in the clear text lead to large changes in the coded text.

Reproduction is only enabled when the coded text $f'(x)$ read from the subcode is in agreement with the currently occurring coded items ($f(x)$) that have been encoded from the clear text in the memory. Even small changes at the relevant locations in the memory thus immediately render any reproduction impossible.

For the purposes of blocking a recording, the encoding process signifies a clear improvement over the known serial copy management. The clear text x from the memory and the coded text $f'(x)$ from the subcode in the cassette being reproduced are transmitted via the digital interface to the recorder effecting the recording e.g. 2 times 64 bits.

The recorder effecting the recording will only switch to the recording mode if the coded text $f(x)$ calculated from the transmitted items x is in agreement with the likewise transmitted coded text $f'(x)$.

Any simple intrusion into the transmission of x and $f'(x)$ e.g. the reversal of a bit, cannot lead to a recording, which actually is not allowed, nevertheless becoming possible. The recorder effecting the recording now records in the subcode a

new code text which appertains to the current cassette number and to the current, and possibly altered, blocking bits.

Thus, an original cassette may contain the item of information "One copy allowed" in the memory and coded/uncoded [error in original text] in the subcode. After evaluating this, the recorder effecting the recording then writes into the memory and into the subcode the item of information "a copy already exists". Any further copying process is then impossible.



Claims

1. Magnetic tape cassette (7) including a housing, at least one magnetic tape spool (8, 9) and an electronic storage device (11), wherein, when the magnetic tape cassette is arranged in a recording and/or reproduction equipment, the storage device is connectible thereto and can be controlled by means of a data processing and control circuit for evaluating the stored items of information and wherein unalterable items of data, which characterise the cassette and the magnetic tape (10) contained therein themselves or the parameters thereof, are written into a first subsection of the storage device and a second subsection of the storage device contains items of data which are dependent on the items of information stored on the magnetic tape, characterised by:

- in the case of a blank magnetic tape cassette (7) and during a first recording on the magnetic tape (10), items of data can be written once into the second subsection of the storage device whereby the partitioning and utilisation of a further recordable subsection of the storage device is defined and wherein the further subsection is provided for the storage of items of information regarding the starting and end points of the recordings and also contains items of control data with which a selective blocking of the operational modes of the recording and/or reproduction equipment can be controlled;

- in the case of a prerecorded magnetic tape cassette (7), the second subsection of the storage device contains items of information regarding the identity of, and/or an authorisation for reproduction from, the magnetic tape cassette whereby the further subsection contains items of information regarding the starting and end points of the recordings.

2. Magnetic tape cassette in accordance with Claim 1, characterised in that, the items of control data can be altered in such a way that a selective blocking of the operational modes of the recording and/or reproduction equipment can also be



controlled in the case of a prerecorded magnetic tape cassette (7).

3. Magnetic tape cassette in accordance with Claim 1 or 2, characterised in that, for a prerecorded magnetic tape cassette, the entire content of the storage device (11) or parts thereof is continually recorded on the magnetic tape (10) as part of a subcode together with the recording of a useful signal and a respective subcode is assigned to each recorded item.

4. Magnetic tape cassette in accordance with any one or more of Claims 1 to 3, characterised in that, the items of control data are encoded by means of a trapdoor and/or avalanche function.

5. Recording and/or reproduction equipment which includes a recording device for a magnetic tape cassette and a magnetic tape cassette (7) including an electronic storage device (11) in accordance with any one or more of the Claims 1 to 4, wherein the equipment contains means for transmitting signals from and/or to the storage device and a data processing and/or control device for processing the items of information stored in the storage device and also contains blocking means for blocking the operational modes of the recording and/or reproduction equipment, whereby the blocking means can be controlled by the data processing and/or control device.

6. Recording and/or reproduction equipment in accordance with Claim 5, characterised in that, there are provided means for encoding and/or decoding the items of control data.

7. Recording and/or reproduction equipment in accordance with Claim 5, characterised in that, when effecting reproduction from a magnetic tape cassette in accordance with Claim 3, the content of the storage device can be checked for agreement with the recorded subcode by means of a comparator circuit in the recording and/or reproduction equipment whereby the right to reproduce a recording is blocked by deliberately altering the



subcode recorded on the magnetic tape at at least one location
whose spatial position cannot be predetermined.