

CASSETTE ADAPTER

BACKGROUND OF THE INVENTION

This invention relates to a cassette adapter onto which a semiconductor memory in which digital data are recorded can be removably mounted and which can be loaded into a radio cassette playback apparatus, a vehicle-carried tape playback apparatus or a like apparatus to reproduce the digital data of the semiconductor memory and besides can by itself reproduce data of the semiconductor memory.

Conventionally, a cassette adapter is known as means for allowing an audio source recorded on a CD (compact disk) or an MD (mini disc) to be enjoyed making use of a cassette deck playback apparatus of a car audio system or a radio cassette tape playback apparatus.

FIG. 1 shows a system wherein a conventional cassette adapter is used to allow an audio source of a CD or an MD to be enjoyed making use of such a cassette deck playback apparatus or a radio cassette tape playback apparatus as described above. Referring to FIG. 3, a cassette adapter 72 is formed with an outer profile substantially same as that of a tape cassette so that it can be loaded into a cassette deck section 741 of a radio

cassette tape playback apparatus 74 or a cassette deck section 761 of a car audio system 76.

A phone plug 80 is connected to the cassette adapter 72 by a cable 78. The phone plug 80 is adapted to be inserted into a headphone jack 821 of a CD player 82 or a headphone jack 841 of an MD player 84.

The phone plug 80 may otherwise be formed such that it can be inserted into a lineout jack not shown of the CD player 82 or a lineout jack not shown of the MD player 84.

An electromagnetic conversion section (not shown) for being contacted by a recording and reproduction head (not shown) of the cassette deck section 741 or the cassette deck section 761 is provided in the cassette adapter 72.

In order to enjoy an audio source recorded on a CD on the radio cassette tape playback apparatus 74 using such a cassette adapter 72 as described above, the cassette adapter 72 is loaded into the cassette deck section 741 of the radio cassette tape playback apparatus 74 and the phone plug 80 is inserted into the headphone jack 821 of the CD player 82, and then the CD player 82 and the radio cassette tape playback apparatus 74 are placed into a playback mode.

Consequently, an audio signal reproduced by the CD player 82 is signaled to the cassette adapter 72 through the headphone jack 821, phone plug 80 and cable 78 and applied through an internal circuit of the cassette adapter 72 to the electromagnetic conversion section, by which it is electromagnetically converted. The signal obtained by the electromagnetic conversion is supplied to the magnetic head of the cassette deck section 741.

The magnetic head converts the electromagnetic signal into an audio signal and outputs the audio signal through a reproduction circuit including an equalizer, an amplifier and so forth to a speaker of the radio cassette tape playback apparatus 74. Consequently, the user can enjoy the audio signal recorded on the CD on the radio cassette tape playback apparatus 74.

In order to enjoy an audio source recorded on an MD on the radio cassette tape playback apparatus 74, the phone plug 80 is inserted into the headphone jack 841 of the MD player 84, and the MD player 84 and the radio cassette tape playback apparatus 74 are placed into a playback mode. As a result, the audio signal recorded on the MD can be enjoyed on the radio cassette tape playback apparatus 74 similarly.

On the other hand, in order to enjoy an audio

source recorded on a CD on the car audio system 76, the cassette adapter 72 is loaded into the cassette deck, section 761 of the car audio system 76 and the phone plug 80 is inserted into the headphone jack 821 of the CD player 82, and then the CD player 82 and the car audio system 76 are placed into a playback mode. Consequently, the audio signal reproduced by the CD player 82 is signaled to the cassette adapter 72 through the headphone jack 821, phone plug 80 and cable 78 and is applied through the internal circuit of the cassette adapter 72 to the electromagnetic conversion section so that the audio signal is electromagnetically converted by the electromagnetic conversion section, and the electromagnetic signal is supplied to the magnetic head of the cassette deck section 761.

The magnetic head converts the electromagnetic signal into an audio signal and outputs the audio signal through a reproduction circuit including an equalizer, an amplifier and so forth to a speaker of the car audio system 76. As a result, the user can enjoy the audio signal recorded on the CD on the car audio system 76.

On the other hand, in order to enjoy an audio source recorded on an MD on the car audio system 76, the phone plug 80 is inserted into the headphone jack 841 of

the MD player 84, and the MD player 84 and the car audio system 76 are placed into a playback mode. As a result, the user can enjoy the audio signal recorded on the MD on the car audio system 76 in a similar manner as described above.

Such a cassette adapter as described above is disclosed, for example, in U.S. Patent No. 5,307,326 filed by the applicant of the present application and patented April 26, 1994.

Recently, a portable semiconductor memory recording and playback apparatus has been proposed into which a semiconductor memory formed from a flash memory can be removably loaded and which can store digital contents data downloaded over a communication line such as an analog line or an ISDN (Integrated Standard Digital Network) or a satellite line into the semiconductor memory and reproduce the digital contents data from the semiconductor memory.

Also it is possible to connect such a portable semiconductor memory recording and playback apparatus as described above similarly to the CD player 82 or the MD player 84 to a cassette adapter and enjoy digital contents data of the portable semiconductor memory recording and playback apparatus on the car audio system

76.

However, if the cassette adapter is constructed such that the semiconductor memory removed from the portable semiconductor memory recording and playback apparatus can be inserted into the cassette adapter and the cassette adapter in which the semiconductor memory is inserted is loaded into the cassette deck section of the radio cassette tape playback apparatus 74 or the cassette deck section of the car audio system 76 to play back the semiconductor memory, then the wiring line of a conductor between the cassette adapter and the portable semiconductor memory recording and playback apparatus can be eliminated.

Such a portable semiconductor memory recording and playback apparatus formed in a same profile as that of a cassette adapter as just described is disclosed, for example, in International Laid-Open No. WO99/38115 (laid open on July 29, 1999).

However, the cassette adapter itself disclosed in the document just mentioned has no such keys as a reproduction key, an AMS (Audio Music Sensor) key and a stop key, and the cassette adapter by itself does not have a playback function.

In particular, in outdoor use, it is necessary to

carry the portable semiconductor memory recording and playback apparatus, but in use on a car, it is necessary to remove the semiconductor memory from the portable semiconductor memory recording and playback apparatus and insert the semiconductor memory into the cassette adapter to perform playback of it. Therefore, the three apparatus including the portable semiconductor memory recording and playback apparatus, semiconductor memory and cassette adapter must be carried.

Further, even if an AMS (Auto Music Sensor) key for a program selection operation of the radio cassette tape playback apparatus 74 or the car audio system 76 or a stop key is operated, a program selection operation or a stopping operation of audio data stored in the semiconductor memory accommodated in the cassette adapter cannot be performed.

In particular, although control of the direction of driving rotation of a reel motor for a cassette, the scanning direction of a capstan motor and contacting of the magnetic head is performed in response to an operation of the AMS (Auto Music Sensor) key for a selection operation of the radio cassette tape playback apparatus 74 or the car audio system 76 or the stop key is performed, readout control of audio data stored in the

semiconductor memory accommodated in the cassette adapter cannot be performed.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a cassette adapter which can be controlled without using a radio cassette tape playback apparatus, a car audio system or the like.

In order to attain the object described above, according to the present invention, a cassette adapter is generally constructed such that a housing thereof is formed in a substantially same shape as that of a tape cassette which can be loaded into a cassette deck so that the cassette adapter can be loaded into a cassette deck section of a radio cassette tape playback apparatus or a cassette deck section of a car audio system so as to reproduce digital data recorded in a memory card accommodated in the cassette adapter, and the cassette adapter includes a signal reception section for receiving a control command from a remote control section.

More particularly, according to the present invention, there is provided a cassette adapter capable of being loaded into a cassette deck which includes a magnetic head and a reel shaft, comprising a housing

formed in a substantially same shape as that of a tape cassette which can be loaded into the cassette deck,, a memory card socket into which a memory card having digital data stored therein can be inserted, signal processing means for reading out the digital data stored in the memory card inserted in the memory card socket and performing predetermined signal processing for the digital data, electromagnetic conversion means provided in an opposing relationship to the magnetic head of the cassette deck in the housing for electromagnetically converting the signal for which the predetermined signal processing has been performed by the signal processing means and supplying the signal obtained by the electromagnetic conversion to the magnetic head, reception means for receiving a control command transmitted from a remote control section and regarding recording and/or reproduction of the digital data stored in the memory card, control means for controlling recording and/or reproduction operation of the digital data stored in the memory card based on the control command received by the reception means, and an external output terminal for externally outputting the signal for which the predetermined signal processing has been performed by the signal processing means.

In use, the cassette adapter is loaded into a cassette deck of a radio cassette tape playback apparatus or the like, and information of a semiconductor memory card inserted in the memory card socket is read out and reproduced by the signal processing means. Then, the reproduction signal is supplied to the magnetic head through the electromagnetic conversion means. Consequently, the user can enjoy an audio source or the like recorded in the semiconductor memory card on a radio cassette tape playback apparatus or the like.

On the other hand, if a headphone or an earphone is connected to the external output terminal of the cassette adapter and information of the memory card inserted in the memory card socket is read out and reproduced by the signal processing means and then the reproduction signal is supplied to the magnetic head through the electromagnetic conversion means, then the cassette adapter can be used as a portable playback machine.

With the cassette adapter, an audio source or the like recorded in a semiconductor memory card can be enjoyed readily on a cassette deck of a radio cassette tape playback apparatus or a car audio system without using a player of a separate structure, and besides can be enjoyed using the cassette adapter by itself as a

portable playback machine.

Further, since a key operation section is provided on a remote controller of a wireless/wired system, the cassette adapter can be utilized suitably in accordance with a manner of use or a used apparatus of the user, and there is no need of providing a key operation section on the cassette adapter body. Since no key is provided on a surface of the cassette adapter, the size of the cassette housing does not have an increased size and the tolerances prescribed in the specifications of the C cassette can be observed.

Preferably, the cassette adapter further comprises a generator provided in the housing for being rotated by the reel shaft of the cassette deck to generate power, the power generated by the generator being supplied to the electromagnetic conversion means and the signal processing means. Where the generator is provided in the cassette adapter, there is an advantage that, when the cassette adapter is loaded into and used with the cassette deck of a radio cassette tape playback apparatus or a car audio system, no battery is required.

The above and other objects, features and advantages of the present invention will become apparent from the following description and the appended claims,

taken in conjunction with the accompanying drawings in which like parts or elements denoted by like reference symbols.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagrammatic view showing a conventional system wherein an audio reproduction apparatus and a cassette adapter are combined to reproduce audio data using a cassette deck;

FIG. 2 is a schematic view showing an appearance of a cassette adapter to which the present invention is applied;

FIG. 3 is a block diagram of the cassette adapter of FIG. 2;

FIG. 4 is a schematic view showing an appearance of a radio cassette playback apparatus;

FIG. 5 is a schematic view illustrating a manner of connection between a cassette adapter and a remote controller;

FIG. 6A is a schematic view illustrating a wiring scheme of a waveguide when the cassette adapter of FIG. 2 is inserted in a first insertion direction into a cassette deck;

FIG. 6B is a similar view but illustrating another

wiring scheme of the waveguide when the cassette adapter of FIG. 2 is inserted in a second direction into the cassette deck;

FIG. 7A is a schematic view showing an appearance of a car audio body;

FIGS. 7B and 7C are schematic views illustrating wiring schemes of the waveguide when the cassette adapter is inserted in the first and second directions into the car audio body, respectively;

FIG. 7D is a sectional view of the car audio body in which the cassette adapter is inserted; and

FIG. 8 is a schematic view showing an appearance of a cassette adapter which includes a generator.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 2, there is shown a cassette adapter to which the present invention is applied together with a cassette deck section. The cassette adapter is generally denoted at 10 and adapted to be loaded into a cassette deck 16 of a car audio system or the like which includes a magnetic head 12 for a tape cassette and a pair of reel shafts 14 for a tape cassette. The cassette adapter 10 has a housing 101 formed with an outer profile substantially same as that of a tape

cassette.

The housing 101 has a memory card socket 18 which is open to a front end wall 101A thereof. A semiconductor memory card 20 in which information such as an audio source is stored is removably inserted into the memory card socket 18.

The semiconductor memory card 20 is formed from a nonvolatile memory represented by a flash memory.

A window 101B is formed at an intermediate portion in a longitudinal direction of a rear end wall 101F of the housing 101, and an electromagnetic conversion device 22 is located in the housing 101 in an opposing relationship to the window 101B. The electromagnetic conversion device 22 electromagnetically converts an audio signal or the like reproduced from a signal read out from the semiconductor memory card 20 and supplies the electromagnetic signal to the magnetic head 12 for a tape cassette.

The electromagnetic conversion device 22 and the magnetic head 12 are disposed such that they are opposed to each other when the cassette adapter 10 is loaded into the cassette deck 16.

An external output terminal 26 such as a phone jack to which a headphone 24 is to be connected is provided on

the front end wall 101A of the housing 101. Further, a battery 28 can be inserted into the housing 101 through a side end wall 101C of the housing 101.

A light reception section 30 for receiving a remote signal in the form of infrared rays or the like is provided at a central location of a surface portion 101D of the housing 101.

The light reception section 30 may alternatively be provided on the front end wall 101A or side end wall 101C or the like of the housing 101 so that it may receive a remote signal transmitted from a remote controller 32 even if the cassette adapter 10 is accommodated in the cassette deck 16, or otherwise, the housing of the cassette adapter itself may be formed translucent or transparent.

It is to be noted that a pair of holes 101E through which the reel shafts 14 project when the cassette adapter 10 is loaded in the cassette deck 16 is formed in a thicknesswise direction of the housing 101 through locations of the housing 101 which correspond to the reel shafts 14 of the cassette deck 16.

The remote controller 32 for signaling various remote signals to the cassette adapter 10 includes a transmission section 321 for signaling remote signals in

the form of infrared rays of codes which correspond to various operation keys 34A, 34B, ...

The operation keys 34A, 34B, ... for performing recording or reproduction of audio data, fast forward reproduction or fast backward reproduction of audio data, program selection (AMS) of audio data, stopping or the like are disposed in a concentrated manner on a surface portion of the remote controller 32.

For example, if the reproduction key 34A is operated, then a remote command signal for a reproduction is transmitted; if the AMS key 34B or 34D which indicates a program selection (AMS) operation of audio data is operated, then a remote command signal for a program selection operation is transmitted; if the recording key 34E is operated, then a remote command signal for a recording operation is transmitted; and if the stop key 34C is operated, then a remote command signal for a stopping operation is transmitted.

If the AMS key 34B or 34D is subject to a continuous depression operation, then a high speed reproduction mode is entered.

The remote signal signaled from the transmission section 321 is received by the light reception section 30 of the cassette adapter 10.

The system shown in FIG. 2 further includes a wired remote controller 46 which has the same control functions as the wireless remote controller 32 described above.

The wired remote controller 46 includes keys 46A to 46E corresponding to the keys 32A to 32E of the wireless remote controller 32, respectively.

The wired remote controller 46 is connected to the housing 101 of the cassette adapter 10 by a waveguide 48 so that a remote command signal is transmitted from a transmission section 461 of the wired remote controller 46 to the cassette adapter 10 over the waveguide 48.

Although it is otherwise possible to dispose various keys on the housing 101 of the cassette adapter body to allow various operations to be performed, if the cassette adapter 10 is accommodated fully in the cassette deck section, then the user cannot operate the keys of the housing 101. Therefore, the wired or wireless remote controller is used to control the cassette adapter 10.

Subsequently, a construction of an internal circuit of the cassette adapter 10 is described with reference to FIG. 3.

The internal circuit of the cassette adapter 10 provides a function for allowing an audio source or the like recorded in the semiconductor memory card 20 to be

enjoyed on the cassette deck 16 and another function for allowing the cassette adapter 10 by itself to serve as a portable playback machine (or portable recording and playback machine). The internal circuit of the cassette adapter 10 at least includes a signal processing circuit 36 which can perform reproduction processing of recorded information of the semiconductor memory card 20 loaded in the memory card socket 18. A battery (secondary battery or primary cell) 28 supplies power to the signal processing circuit 36, the electromagnetic conversion device 22 and so forth.

The signal processing circuit 36 includes a CPU 361 for controlling the entire signal processing circuit 36 in response to a remote signal from the remote controller 32, an interface 363 connected to the CPU 361 by a bus 362 for serially reading out recorded data of the semiconductor memory card 20 inserted in the memory card socket 18 (or serially writing data of an audio source or the like) under the control of the CPU 361, a code data processing section 364 connected to the CPU 361 by the bus 362 for discriminating based on code data regarding copyright read out from the semiconductor memory card 20 under the control of the CPU 361 whether or not reproduction of data of an audio source or the like

should be permitted and enabling reading out and reproduction only of data whose reproduction is permitted from the semiconductor memory card 20, a decoding section 365 for demodulating data of an audio source or the like outputted through the code data processing section 364, and a D/A conversion section 366 for converting the signal demodulated by the decoding section 365 into an analog audio signal.

If digital audio data stored in the semiconductor memory card 20 are compressed data, then the decoding section 365 may perform decompression processing corresponding to the compression processing. The compression system may be the ATRAC 3 (Adaptive Transform Acoustic Coding 3), the MP3 (MPEG Layer 3), the ACC (Advanced Audio Coding) or the like.

The electromagnetic conversion device 22 and the headphone 24 are connected to the D/A conversion section 366 through amplifiers 367 and 368, respectively.

A remote control signal transmitted from the transmission section 321 of the remote controller 32 is received by the light reception section 30 and converted by a demodulation section 369 into a command signal, which is supplied to the CPU 361.

Further, a remote control signal transmitted from

the transmission section 461 of the wired remote controller 46 is connected to the jack over the waveguide 48 and is converted by the demodulation section 369 into a command signal, which is supplied to the CPU 361.

In order to use the cassette adapter 10 having the construction described above to enjoy an audio source recorded in the semiconductor memory card 20, for example, on a radio cassette tape playback apparatus, the cassette adapter 10 having the semiconductor memory card 20 inserted in the memory card cassette 18 thereof is loaded into a cassette deck 16 of a radio cassette tape playback apparatus 40 shown in FIG. 2, and the radio cassette tape playback apparatus 40 is placed into a reproduction operation condition.

At this time, the magnetic head 12 (refer to FIG. 2) on the cassette deck 16 is placed into a state wherein it contacts with the electromagnetic conversion device 22 of the cassette adapter 10.

In this state, the reproduction operation key 34A of the remote controller 32 will be operated to signal a remote signal in the form of infrared rays from the transmission section 321 toward the light reception section 30 of the cassette adapter 10.

In this instance, since a lid member 421 of the

cassette deck 42 is transparent, the remote signal of infrared rays from the remote controller 32 passes through the lid member 421 and is received by the light reception section 30, demodulated by the demodulation section 369 and fetched into the CPU 361 to place the signal processing circuit 36 into a reproduction mode.

The CPU 361 thus reads out code data recorded in the semiconductor memory card 20 through the interface 363 in response to the remote signal for reproduction and outputs the code data to the code data processing section 364. The code data processing section 364 discriminates based on the code data whether or not the audio source is data whose reproduction is permitted. Then, only when the audio source is data whose reproduction is permitted, the code data processing section 364 successively reads out data of the audio source recorded in the semiconductor memory card 20 and outputs the data to the decoding section 365. The data are demodulated by the decoding section 365, converted into an analog audio signal by the D/A conversion section 366, amplified by the amplifiers 367 and outputted to the electromagnetic conversion device 22.

The electromagnetic conversion device 22 converts the audio signal into an electromagnetic signal and

supplies the electromagnetic signal to the magnetic head 12. The magnetic head 12 thus converts the electromagnetic signal into an audio signal and outputs an audio signal to a speaker 44 of the radio cassette tape playback apparatus 40 through the reproduction circuit including an equalizer, an amplifier and so forth in the radio cassette tape playback apparatus 40. Consequently, the user can enjoy the audio signal recorded in the semiconductor memory card 20 from the speaker 44.

On the other hand, in order to use a cassette deck of a car audio system to enjoy an audio source recorded in the semiconductor memory card 20, the cassette adapter 10 will be loaded into the cassette deck of the car audio system, and the car audio system will be put into a reproduction operation state.

If, in this state, the reproduction operation key 34A of the remote controller 32 is operated to signal a remote signal from the transmission section 321 toward the cassette adapter 10, then the signal processing circuit 36 is placed into a reproduction operation mode similarly as with the radio cassette tape playback apparatus described hereinabove. Consequently, audio source data read out from the semiconductor memory card

20 are outputted through the code data processing section 364, decoding section 365, D/A conversion section 366 and so forth to the element magnetic conversion device 22, by which they are converted into an electromagnetic signal. The electromagnetic signal is supplied to the magnetic head.

Accordingly, if an audio signal obtained from the magnetic head is outputted to speakers of the car audio system through the reproduction circuit of the car audio system, then the user can enjoy the audio data recorded in the semiconductor memory card 20 on the car audio system.

In this instance, the light reception section 30 of the cassette adapter 10 preferably is in a state similar to that of the radio cassette tape playback apparatus 40 shown in FIG. 3 so that it may receive a remote signal of infrared rays signaled from the remote controller 32.

Subsequently, use of the cassette adapter 10 as a portable playback machine is described. In this instance, the semiconductor memory card 20 is inserted into the memory card socket 18 and the headphone 24 is connected to the external output terminal 26.

If, in this state, the reproduction operation key 34A of the remote controller 32 is operated to signal a

remote signal from the transmission section 321 toward the light reception section 30 of the cassette adapter 10 similarly as described above, then the signal processing circuit 36 is placed into a reproduction mode, in which code data recorded in the semiconductor memory card 20 are read out through the interface 363 by the CPU 361 and outputted to the code data processing section 364.

The code data processing section 364 thus discriminates based on the code data whether or not the audio source is data whose reproduction is permitted. Only when it is discriminated that the audio source is data whose reproduction is permitted, the code data processing section 364 successively reads out data of the audio source recorded in the semiconductor memory card 20 and outputs the data to the decoding section 365. The data are demodulated by the decoding section 365 and converted into an analog audio signal by the D/A conversion section 366. The analog audio signal is amplified by the amplifier 368 and outputted to the headphone 24 from the external output terminal 26.

Consequently, the user can enjoy the audio source recorded in the semiconductor memory card 20 using the cassette adapter 10 itself as a portable playback machine.

It is to be noted that, though not shown in the

drawings, where the headphone 24 is connected to the external output terminal 26, signaling of an audio signal to the electromagnetic conversion device 22 is cut off.

With the cassette adapter 10 of the present embodiment having such a construction as described above, the user can enjoy an audio source or the like recorded in the semiconductor memory card 20 readily on the cassette deck of a radio cassette tape playback apparatus or a car audio system without using a player of a separate structure. Besides, the user can enjoy an audio source using the cassette adapter 10 by itself as a portable playback apparatus and hence as a reproduction machine for exclusive use for a semiconductor memory card.

Subsequently, remote control of the cassette adapter using not such a wireless system as described above but a wired lead system is described with reference to FIG. 3.

The wired remote controller 46 of the wired lead system is provided separately from the remote controller 32 and connected to the light reception section 30 of the cassette adapter 10 by the waveguide 48 for infrared rays which may be formed from an optical fiber, an analog line or the like.

Various operation keys 46A, 46B, ... for performing

recording or reproduction of audio data, fast forward reproduction or fast backward reproduction of audio data, program selection (AMS) of audio data, stopping or the like are disposed in a concentrated manner on a surface portion of the wired remote controller 46.

For example, if the reproduction key 46A is operated, then a remote command signal for a reproduction operation is transmitted; if the AMS key 46B or 46D which indicates a program selection (AMS) operation of audio data is operated, then a remote command signal for a program selection operation is transmitted; if the recording key 46E is operated, then a remote command signal for a recording operation is transmitted; and if the stopping key 46C is operated, then a remote command signal for a stopping operation is transmitted.

Further, if the AMS key 46B or 46D is subject to a continuous depression operation, then a high speed reproduction mode is entered.

Accordingly, remote control signals of infrared rays signaled from the transmission section 461 in response to operation of the operation keys are transmitted the light reception section 30 of the cassette adapter 10 over the waveguide 48.

Although the cassette adapter 10 of such a wired

lead remote control system as described above is different from the remote controller 32 of the wireless system described hereinabove in that the wired remote controller 46 is connected to the light reception section 30 of the cassette adapter 10 by the waveguide 48, operation of it when an audio source recorded on the semiconductor memory card 20 is to be enjoyed on a radio cassette tape playback apparatus or a car audio system or when the cassette adapter 10 is used so as to function as a playback machine is similar to that of the remote controller 32 of the wireless system described above.

Further, the cassette adapter 10 of the wired lead remote control system is preferable where the light reception section 30 is hidden completely when the cassette adapter 10 is loaded in a cassette deck of a car audio system.

Subsequently, another embodiment of the present invention is described with reference to FIG. 5. In the embodiment shown in FIG. 5, the waveguide 48 of the wired remote controller 46 of the wired lead system described hereinabove is constructed so as to be removably connected to the cassette adapter 10.

A mounting portion 50 to which the waveguide 48 is to be connected is provided on the cassette adapter 10.

The mounting portion 50 is formed by partly cutting away the housing of the cassette adapter 10 and allows connection of the waveguide 48 thereto.

A coupling portion 54 to which an end of the waveguide 48 is removably inserted is provided in the mounting portion 50. The coupling portion 54 and the light reception section 30 of the cassette adapter 10 are connected to each other by a waveguide not shown.

The waveguide 48 has a plug provided at the end thereof, and a jack into which the plug can be inserted is provided on the coupling portion 54. The mounting portion 50 may be covered with a removable lid member not shown.

Where the recess is provided at a corner portion of the cassette adapter to provide the mounting portion for connection to a wired remote controller as described above, the cassette adapter is ready for two different manners of use. In particular, in an ordinary cassette playback apparatus for a car use, the cassette adapter may possibly be inserted in its transverse direction or in its longitudinal direction as seen in FIGS. 6A and 6B. However, the mounting portion allows use of the cassette adapter in the two different directions.

With the cassette adapter 10 of the present

embodiment having the construction described above, the wired remote controller 46 can be attached to the , cassette adapter 10 or removed from the cassette adapter 10 in conformity with a situation of use of the cassette adapter 10.

Besides, where both of the wired remote controller 46 of the wired lead system and the remote controller 32 of the wireless system are provided, they can be selectively used arbitrarily in conformity with a situation of use of the cassette adapter 10.

FIGS. 7A, 7B, 7C and 7D show a further embodiment of the present invention. According to the embodiment shown in FIGS. 7A, 7B, 7C and 7D where the light reception section 30 of the cassette adapter 10 loaded in a cassette deck of a car audio system is hidden, the cassette adapter 10 can be remotely controlled by the remote controller 32 of the wireless type.

Referring first to FIG. 7A, a cassette insertion opening 561 is formed in a front wall of a car audio system body 56. Meanwhile, the cassette adapter 10 to be inserted into the cassette insertion opening 561 has a waveguide 58 for infrared rays removably adhered to an upper face portion thereof. The waveguide 58 is formed from an optical fiber of a flattened but narrow form and

extends in an insertion direction of the cassette adapter 10 as seen in FIG. 7B or 7C. An end of the waveguide 58 is opposed to the light reception section 30 of the cassette adapter 10, and the other end of the waveguide 58 projects outwardly from a top face portion of the cassette adapter 10.

Consequently, if the housing 101 having the waveguide 58 adhered thereto in such a manner as shown in FIG. 7B or 7C is loaded into the cassette deck of the car audio system body 56 through the cassette insertion opening 561 as shown in FIG. 7D, then the other end of the waveguide 58 projects outwardly from the cassette insertion opening 561.

Accordingly, if the transmission section 321 of the wireless remote controller 32 is directed to the other end of the waveguide 58 and a remote signal of infrared rays is signaled from the transmission section 321, then the remote signal is introduced into the light reception section 30 by the waveguide 58. Consequently, an operation corresponding to an operated key can be executed.

With the embodiment having such a construction as described above, when the light reception section 30 of the cassette adapter 10 loaded in the cassette deck of a

car audio system is hidden in the cassette deck, remote control of the cassette adapter 10 by means of the , wireless remote controller 32 is allowed.

A still further embodiment of the present invention is described with reference to FIG. 8. The cassette adapter 10 shown in FIG. 8 has a generator incorporated therein for supplying power to the internal circuit thereof.

A pair of generators 60 of a small size are provided at locations in the housing 101 of the cassette adapter 10 around the holes 101E into which the reel shafts 14 of the cassette deck are to be fitted, and are driven to rotate by the reel shafts 14.

The small size generators 60 supply power to the signal processing circuit 36, electromagnetic conversion device 22 and so forth which are internal circuits of the cassette adapter 10. Each of the small size generators 60 includes a rotor 601 formed from a permanent magnet for being rotated by a reel shaft 14, and a stator 602 provided in an opposing relationship to the rotor 601. A voltage induced in the stator 602 when the rotor 601 rotates is rectified and converted into a constant voltage, which is supplied to the internal circuits of the cassette adapter 10.

With the cassette adapter 10 of the embodiment having such a construction as described above, since the small size generators 60 which are driven to rotate by the reel shafts 14 are provided in the cassette adapter 10, there is an advantage that, when the cassette adapter 10 is loaded in and used together with the cassette deck of a radio cassette tape playback apparatus or a car audio system, no battery is required.

It is to be noted that, when the speeds of rotation of the reel shafts 14 are not sufficiently high for generation of the small generators 60, a speed increasing gear formed from a gear train or the like which transmits rotation of each reel shaft 14 in an increased speed to the rotor of the motor should be incorporated.

Further, it is also possible to charge power generated by the small generators 60 into a built-in battery so that, when the cassette adapter is used by itself after charging is performed for a predetermined time by a radio cassette tape playback apparatus or a car audio system, the power accumulated in the battery may be used for reproduction.

While, in the embodiments described above, infrared rays are used for remote control signals of the remote controllers 32 and 46, the present invention is not

limited to this, and radio waves or an electric signal may be used instead. Where radio waves are used for a remote control signal, the cassette adapter 10 can be used as it is even on a cassette deck by which the reception section of the cassette adapter 10 is hidden.

Further, while description of the signal processing circuit 36 shown in FIG. 3 is given hereinabove only in connection with reproduction of an audio source recorded in the semiconductor memory card 20, the present invention is not limited to this, and the signal processing circuit 36 may naturally be constructed such that it writes data of an audio source or the like into the semiconductor memory card 20.

The semiconductor memory card described above may naturally be not only a memory stick (trademark) presented by the assignee of the present application but also an SD card (trademark) presented by Sun Disk, Matsushita Electric Industrial Co., Ltd. and Toshiba Corporation, a multimedia card presented by Sun Disk and so forth.

While preferred embodiments of the present invention have been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made

without departing from the spirit or scope of the
following claims.

What Is Claimed Is:

1. A cassette adapter capable of being loaded into a cassette deck which includes a magnetic head and a reel shaft, comprising:

a housing formed in a substantially same shape as that of a tape cassette which can be loaded into said cassette deck;

a memory card socket into which a memory card having digital data stored therein can be inserted;

signal processing means for reading out the digital data stored in said memory card inserted in said memory card socket and performing predetermined signal processing for the digital data;

electromagnetic conversion means provided in an opposing relationship to said magnetic head of said cassette deck in said housing for electromagnetically converting the signal for which the predetermined signal processing has been performed by said signal processing means and supplying the signal obtained by the electromagnetic conversion to said magnetic head;

reception means for receiving a control command transmitted from a remote control section and regarding recording and/or reproduction of the digital data stored in said memory card;



control means for controlling recording and/or reproduction operation of the digital data stored in said memory card based on the control command received by said reception means; and

an external output terminal for externally outputting the signal for which the predetermined signal processing has been performed by said signal processing means.

2. A cassette adapter according to claim 1, wherein said memory card is formed from a nonvolatile memory.

3. A cassette adapter according to claim 1, wherein said remote control section is a wireless remote commander.

4. A cassette adapter according to claim 1, wherein said remote control section is a wired remote commander.

5. A cassette adapter according to claim 1, wherein said reception means includes a jack for connection to a waveguide of said remote control section, and said jack is provided at a recess formed at a corner portion of said housing.

6. A cassette adapter according to claim 5, wherein said recess is formed such that said waveguide



may be led out to the outside of said cassette deck without depending upon an insertion direction of said cassette adapter into said cassette deck.

7. A cassette adapter according to claim 1, further comprising a generator provided in said housing for being rotated by said reel shaft of said cassette deck to generate power, the power generated by said generator being supplied to said electromagnetic conversion means and said signal processing means.

8. A cassette adapter according to claim 7, further comprising a battery for accumulating the power generated by said generator.

9. A cassette adapter according to claim 7, wherein said generator includes a speed increasing section for increasing the speed of said reel shaft.

10. A cassette adapter according to claim 1, wherein said external output terminal allows connection of a headphone or an earphone thereto.

11. A cassette adapter according to claim 1, wherein said cassette adapter is translucent or transparent.

