

WIRELESS RECEIVING APPARATUS

The present invention relates to a wireless receiving apparatus. More particularly, the present invention relates to a wireless receiving apparatus with a mounting portion for mounting on the head or over the ear.

Systems are known in which audio signals from audio equipment or microphones are modulated into infra-red signals and transmitted across space. A user wearing a headset which has an infra-red receiving unit or is connected to a demodulating unit which has an infra-red receiving unit can then listen to these audio signals.

Fig. 1 and Fig. 2 of the accompanying drawings are an external view and a block view, respectively, of an example of this system. The audio signals AU_L and AU_R outputted from the audio equipment 1 are supplied to the transmitter 2. The infra-red transmitter 2 has a modulating unit 4 which frequency modulates the audio signals AU_L and AU_R at a prescribed modulation frequency and outputs the modulated signal RF. This modulated signal RF is supplied to the infra-red output unit 3. A light emitting diode then carries out brightness modulation in accordance with the modulated signal RF so that the audio signal is transmitted across space as an infra-red signal.

The headset 10 then acts as the receiving apparatus for receiving the modulated infra-red signal. The headset 10 has an infra-red receiver 11 positioned, for example, at its vertex so that the transmitted infra-red signal can be received.

The infra-red waves received by the receiver 11 are converted to electrical signals, amplified, outputted and supplied to the demodulating circuit 13. The demodulating circuit 13 then demodulates the audio signals AU_L and AU_R using prescribed demodulation and sends them to the amplifier 14. This amplifier 14 then acts as a speaker



drive circuit and supplies drive signals to the speakers 12 so that sound is outputted from these speakers.

A reference numeral 15 indicates a battery section consisting of, for example, two three dry-cell batteries and a reference numeral 16 denotes the power supply circuit for supplying the power supply voltage for driving each of the circuit units.

The circuit construction which includes these batteries is within the headphone unit 10. For example, this may be within the housing for the speaker units 12 or somewhere in the vicinity.

In this kind of system, if a person places this headset 10 on their head, audio transmitted from the audio equipment 1 can be listened to.

However, this kind of infra-red broadcasting system has the following problems.

With the example shown in Fig. 1 and Fig. 2, the whole of the circuit construction which includes the battery 15 is built into the headset 10. This means that the headset 10 is heavy and feels very uncomfortable when worn. This is particularly tiresome for the wearer if the headset is worn over a long period of time. Also, it is not possible to have a large number of batteries or have larger batteries installed within the headset as the size and weight of the headset must be taken into consideration. It is therefore difficult to use this system for long periods of time.

It is, therefore, an object of the present invention to provide a wireless receiving apparatus which reduces or eliminates the above mentioned problems.

According to the present invention, there is provided a wireless receiving apparatus comprising:

an output device equipped with a receiving unit and at least one electro-acoustic transducing unit;



a signal processing unit equipped with a demodulating unit for demodulating a signal provided from said receiving unit, an amplifier unit for amplifying a demodulated signal from said demodulating unit and a power supply unit for supplying power to said demodulating unit and said amplifier unit; and

a connecting unit for supplying the signal outputted from said receiving unit to said demodulating unit and supplying the signal outputted from said amplifying unit to said electro- acoustic transducing unit.

The invention also provides a wireless receiving apparatus comprising:

an output device equipped with an infra-red receiving unit for receiving a signal transmitted from a transmission apparatus for converting to infra-red and transmitting an output signal from a signal source, and at least one electro-acoustic transducing unit, constructed in such a manner that, when mounted, said infra-red receiving unit is protruding;

a signal processing unit equipped with a demodulating unit for demodulating the output signal supplied from said infra-red receiving unit, an amplifier unit for amplifying the demodulated signal from said demodulating unit, a power supply unit for providing the operating voltage to said demodulating unit and said amplifier unit and a cabinet for housing said demodulating unit, said amplifier unit and said power supply unit, the signal processing unit being an item separate from said output device; and

a connecting unit for supplying the signal outputted from said receiving unit to said demodulating unit and supplying the signal outputted from said amplifying unit to said electro- acoustic transducing unit.

According to the present invention, the output device has a receiving unit and an electro-acoustic



transducing unit. The signal processing unit, which demodulates the receiving unit output signal, provides the demodulated signal to the electro- acoustic transducing unit after having amplified it and has a power supply built in, is then formed separately. In this way, the output circuit to be mounted on the ear or the head can be lightweight. As this makes it extremely comfortable to wear, it can be worn for long periods of time without causing duress to the wearer. Further, according to the present invention, the signal processing unit is formed separately from the output device and as such, does not in any way cause direct discomfort to the wearer. It is therefore possible to make the power supply larger to a certain extent, so that it becomes possible to use the apparatus over long periods of time.

The invention will be further described by way of non-limitative example with reference to the accompanying drawings, in which:-

Fig. 1 is an external view showing an outline of the structure of a usual infra-red transmitting/receiving system;

Fig. 2 is a block view of the system shown in Fig. 1;

Fig. 3 is an external view showing an outline of the structure of an infra-red receiving apparatus for a first embodiment of the present invention;

Fig. 4 is a block view of this first embodiment;

Fig. 5 is an external view showing an outline of the structure of an infra-red receiving apparatus for a second embodiment of the present invention;

Fig. 6 is a block diagram of a second embodiment.

A detailed description of an infra-red signal receiving apparatus for a first embodiment of the present invention will now be given using the diagrams. Fig. 3 and



Fig. 4 show an outline and a block view, respectively, of the infra-red signal receiving apparatus.

Here, A reference numeral 40 indicates a headset which has an infra red receiving unit 42 at its vertex and also has speakers indicated by the numerals 41. A flexible connecting cord 43 with a multi-connector 44 at its end also comes from the headset 40. Reference numeral 50 denotes a demodulating unit which is formed of a size and shape so as to be suitable for insertion into, for example, a breast pocket, or for wearing or carrying about the person in any other convenient way so as to leave the use unencumbered, and this has a jack 51 which acts as the input terminal for the multi-connector 44.

The inputs for the infra-red signal receiving signal and the speaker drive signal can therefore go between the headset 40 and the demodulating unit 50 via the signal lines of the cord 43 by connecting the multi-connector 44 to the jack 51 as is shown in Fig. 4.

The demodulating unit 50 has a demodulating circuit 52 and a amplifier unit 53, along with, for example, a built-in battery unit 54 which may use a dry or re-chargeable cell etc. and a power supply circuit 55.

The power supply circuit 55 uses one of the signal lines which goes along the multi-connector 44 and the cord 43 connected to the jack 51 in order to provide a reverse voltage VBIAS to the photodiode which functions as the photoelectric conversion circuit for the infra-red receiving unit 42.

The infra-red receiving unit 42, which is operated by the reverse bias voltage VBIAS from the demodulating unit, receives infra-red signals which are based on FM modulated audio signals AU_L and AU_R which are outputted from the infra-red transmitter 2, as shown in Fig. 1.

At the infra-red receiving unit 42, the infra-red is converted into an electrical signal (FM modulated signal

This Sheet Has Been Replaced



RF), amplified and outputted. This FM modulated signal is then supplied along one of the signal lines going along the cord 43 and the multi-connector 44 to the demodulating circuit 52 in the demodulating unit 50. The audio signals AU_L and AU_R are demodulated from the FM modulated signal RF at the demodulating circuit 52 before being supplied to the amplifier unit 53. This amplifier unit 53 then amplifies the audio signals AU_L and AU_R and supplies them to the speakers 41 as drive signals. Each of these drive signals L and R is supplied along its own individual signal line from the jack 51 to the multi-connector 44 and then along the cord 43. They are then supplied to the speakers 41 after having been inputted to the headset 40 and the sound L and R is outputted from the speakers 41.

Referring to parts of the demodulating unit 50 which are shown in Fig. 3, a reference numeral 56 indicates the power supply switch, a reference numeral 57, denotes the volume control and a reference numeral 58 indicates the frequency selection switch. These are not shown in Fig. 4 but they are for activating each of the operating means. For example, the power supply switch 56 turns the power supply to be supplied to the power supply circuit 55 on and off. Operation of the volume control 57 causes a corresponding change in a resistance within the amplification circuit 53 and this will in turn cause the volume of the sound being outputted from the speakers 41 for the headset 40 to be adjusted.

Also, the frequency selection switch 58 selects the demodulation frequency for the demodulation circuit 52. For example, in cases such as where various audio signals are being wirelessly transmitted within the same room at a number of frequencies, the frequency select switch 58 can be changed over to the frequency you want to hear. The FM modulation frequency setting can, of course, also be set accordingly on the infra-red transmitter side.



With a first embodiment having this kind of construction, at the lower limit, the headset may be composed of just the infra-red receiving unit 42 i.e. a light receiving element such as a photodiode etc., and a first stage amplification circuit element, along with the speakers 41. This will keep the overall weight down. Also, a large number of circuits going to the headset and the building in of batteries is not necessary, which gives a greater degree of freedom when designing the housing for the actual headphone body and means that the equipment may be compact. As a result of this, the headset feels good to wear so that little discomfort or fatigue results from the wearing of the headset. Also, as the infra-red receiving area is set up at the vertex of the headset 40, the infra-red light can be received in a stable manner and the efficiency of the wireless system may be increased.

Further, the battery unit 54 is built into the demodulation unit 50. This means that the battery may be made larger to a certain degree because its effect whilst the headphones are mounted, i.e. the weight of the headphones felt by the user, is no longer a consideration. This means that signal receiving apparatus which are capable of being driven for long periods of time are now a possibility.

Next, a detailed description will be given using the diagrams of an infra-red light receiving apparatus for a second embodiment of this invention. FIGS 5 and 6 show an outline view and a block view, respectively, of this second embodiment of the invention.

Here, a reference numeral 60 indicates an ear receiver and a reference numeral 61 indicates a speaker. An ear hanger 62, which is part of this ear receiver 60, loops around the ear so that the speaker 61 comes into contact with the users ear when it is mounted.

This Sheet Has Been Replaced



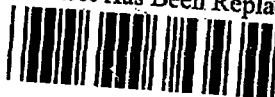
An antenna shaped protrusion 64 with an infra-red receiving unit 63 attached to its end then protrudes from the ear receiver 60.

5 There is also a cord 65 with a four electrode plug 66 at its end coming from the ear receiver 60.

Reference numeral 70 denotes a demodulating unit which is formed of a size and shape so as to be suitable for insertion into, for example, a breast pocket and this has a four electrode jack 71 which acts as the input terminal for
10 a four electrode plug 44. The construction of the demodulation unit 70 is almost the same as that of the demodulation unit 50 for the first embodiment, with numeral 72 indicating the demodulating unit, a reference numeral 73 indicating the amplifier unit, a reference numeral 74
15 indicating the battery unit and a reference numeral 75 indicating the power supply circuit. Numeral 76 then indicates the power supply switch, a reference numeral 77 the volume and a reference numeral 78 the frequency selection switch.

20 As can be seen from Fig. 6, the infra-red signal receiving signal and the speaker driver signal can pass between the ear receiver 60 and the de-modulating unit 50 using the four signal lines of the cord 65 coming from the four electrode plug 66.

25 The power supply circuit 75 uses one of the signal lines on the four electrode plug 66 and the cord 65 in order to provide a reverse voltage VBIAS to the photodiode for the infra-red receiving unit 63. Also, in the same way as the first embodiment, the infra-red light receiving unit 63 uses
30 its photodiode to receive infra-red light which has had its brightness adjusted and which is outputted from the infra-red transmitter as an FM modulated audio signal AU. The photodiode then photoelectrically converts this into an electrical signal which is taken as an FM modulation signal
35 RF, amplified and then outputted.



The FM modulation signal RF is supplied to the demodulating circuit 72 in the demodulating unit 70 via a signal line along the cord 65 and the four electrode plug 66, and the audio signal AU is demodulated. The demodulated audio signal AU is then supplied to the amplifier unit 73 where it is amplified. This amplified audio signal AU is supplied to the speaker 61 as a speaker drive signal. This drive signal is then supplied from the jack 71 along a signal line from the four pin plug 66 to the cord 65 so as to be inputted to the ear receiver 60 where it is supplied to the speaker 61. The drive signal then drives the speaker 61 so as to output sound.

In this second embodiment also, the ear receiver to be worn only comprising the speaker 61 and the infra-red receiver 63. This means that the ear receiver may be small, light in weight and comfortable to wear.

Also, by having the protrusion 64 coming from the infra-red receiving unit 63, as this is exposed at the top of the users head while the ear receiver is mounted, the infra-red signal can be easily received without the user's hair getting in the way. Further, as the infra-red signal receiving unit is positioned at the highest point on the receiving apparatus, hindrances to the receiving operation such as desks or people will have almost no effect.

In this second embodiment also, the battery unit 74 is installed in the demodulating unit 70. As this means that the battery can be made larger, so it is a simple process to make the receiving apparatus so that it can operate for long periods of time.

Although embodiments have been described above, the present invention is by no means limited to these embodiments, and variations are possible. In particular, items such as the connecting unit and the number of signal lines between the installed parts such as the headset and



ear receiver etc. may vary in accordance with the infra-red signal receiving system.

Also, the shape of the mounted part, in particular, the arrangement and shape of the infra-red receiving unit should be taken into consideration. With the
5 infra-red transmitting means, for example, the position and/or arrangement of the infra-red transmitter and the directionality of its output should be set up in an appropriate manner.

10 Further, the mounted part is not limited to the headset and ear receiver described in the embodiments.

This Sheet Has Been Replaced





CLAIMS

1. A wireless receiving apparatus comprising:
5 an output device equipped with a receiving unit
and at least one electro-acoustic transducing unit;
a signal processing unit equipped with a
demodulating unit for demodulating a signal provided from
said receiving unit, an amplifier unit for amplifying a
10 demodulated signal from said demodulating unit and a power
supply unit for supplying power to said demodulating unit
and said amplifier unit; and
a connecting unit for supplying the signal
outputted from said receiving unit to said demodulating unit
15 and supplying the signal outputted from said amplifying unit
to said electro- acoustic transducing unit.
2. A wireless receiving apparatus according to claim
1, wherein said output unit is equipped with an abbreviated
20 U-shaped headband having said receiving unit positioned at a
point corresponding to the vertex of said headband when said
headband is mounted, with said electro-acoustic transducing
unit being attached to one of the free ends of said
abbreviated U-shaped headband.
- 25 3. A wireless receiving apparatus according to claim
1, wherein said output device is equipped with a hanger and
a protrusion which protrudes from said hanger, with said
electro-acoustic transducing unit being set up at said
30 hanger and said receiving unit being set up at the end of
said protrusion.
4. A wireless receiving apparatus according to claim
1, 2 or 3, wherein one end of said connecting unit is

This Sheet Has Been Replaced





attached to said output device while the other end has a plug for connecting to said signal processing unit attached.

5. A wireless receiving apparatus comprising:
- 5 an output device equipped with an infra-red receiving unit for receiving a signal transmitted from a transmission apparatus for converting to infra-red and transmitting an output signal from a signal source, and at least one electro-acoustic transducing unit, constructed in
- 10 such a manner that, when mounted, said infra-red receiving unit is protruding;
- a signal processing unit equipped with a demodulating unit for demodulating the output signal supplied from said infra-red receiving unit, an amplifier
- 15 unit for amplifying the demodulated signal from said demodulating unit, a power supply unit for providing the operating voltage to said demodulating unit and said
- amplifier unit and a cabinet for housing said demodulating unit, said amplifier unit and said power supply unit, the
- 20 signal processing unit being an item separate from said output device; and
- a connecting unit for supplying the signal outputted from said receiving unit to said demodulating unit and supplying the signal outputted from said amplifying unit
- 25 to said electro- acoustic transducing unit.
6. A wireless receiving apparatus according to claim 5, wherein said output device is equipped with an abbreviated U- shaped headband having said receiving unit
- 30 positioned at a point corresponding to the vertex of said headband when said headband is mounted, with said electro-acoustic transducing unit being attached to one of the free ends of said abbreviated U-shaped headband.

This Sheet Has Been Replaced





has a
attached.

7. A wireless receiving apparatus according to claim 5, wherein said output device is equipped with a hanger and a protrusion which protrudes from said hanger, with said electro- acoustic transducing unit being set up at said hanger and said receiving unit being set up at the end of said protrusion.

8. A wireless receiving apparatus according to claim 5, 6 or 7, wherein said signal processing unit is equipped with a connector for providing an output signal from said infra-red receiving unit and an output signal from said amplifier unit, and one end of said connecting unit is attached to said output device while the other end has a plug for connecting to said signal processing unit attached.

9. A wireless receiving apparatus according to any one of the preceding claims wherein the connecting unit is, or comprises, a flexible cord interconnecting the output device and the signal processing unit.

10. A wireless receiving apparatus according to any one of the preceding claims in combination with a high-fidelity audio signal reproduction apparatus having an infra red transmitter for transmitting signals to said receiving unit.

11. A wireless receiving apparatus constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated by Figs. 3 and 4 or Figs. 5 and 6 of the accompanying drawings.

This Sheet Has Been Replaced

