ELECTRICAL ATTACHMENT DEVICE

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ABSTRACT

Electrical attachment device such as a speaker device and a microphone device requiring an electric power for use with a tape recorder having an earphone jack, a remote switch jack and a microphone jack for extension connection of the electrical attachment device. The electrical attachment device has plugs mating with the jacks of the tape recorder, the polarity of the connection of the center terminal and the shield terminal of the plug for connection to the remote switch jack is reversed with respect to that of the center terminal and the shield terminal of the plug for connection to the earphone jack or the microphone jack so that the electric power is supplied to the attachment device from the tape recorder when the plugs are coupled with the respective jacks thereby dispensing with an additional electric source for the attachment device.

12 Claims, 28 Drawing Figures
Fig. 21

Fig. 22

Fig. 23

Fig. 24

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ELECTRICAL ATTACHMENT DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to an electric attachment device such as a speaker, a microphone, a frequency-modulated tuner which itself requires an electric power for the operation thereof and is adapted to be detachably attached to an electric appliance such as a tape recorder which is provided with an electric source so that the electric power is supplied to the attachment device from the electric appliance when the former is attached to the latter.

A miniature tape recorder has been made very small in size and a speaker and an output circuit of the amplifier thereof have been eliminated from the main body of the tape recorder, and an earphone adapted to be connected to the tape recorder through an earphone jack has been used for minimizing the size of the tape recorder. Thus, when it is desired to use a speaker, an output circuit and a speaker are connected to the tape recorder through the earphone jack so that the output signal of the tape recorder is supplied to the speaker through the output circuit to amplify the output signal. In this case, an electric source is required for the output circuit thereby necessitating the casing of the output circuit to be enlarged for housing a battery therein. Further, it is necessary to cut off the electric source from the output circuit each time the operation of the output circuit is terminated so that manipulation of the tape recorder is made troublesome. Alternatively, the electric power for the output circuit may be supplied from the tape recorder. To this end, however, it is necessary to provide separate terminals in the tape recorder for supplying the electric power to the output circuit so that the construction and the manipulation of the tape recorder are made complicated and troublesome.

The input impedance of a microphone circuit of a tape recorder having an amplifier incorporating a transistor is several kiloohms at the highest. Therefore, a dynamic type or a magnetic type microphone having an impedance of the value near that of the input impedance of the microphone circuit of the tape recorder has been used with the tape recorder of the type described above.

Recently, a condenser microphone or a ceramic microphone which is very small in size and inexpensive in price has been developed. The condenser microphone has characteristics that the lower region in frequency is cut off when the impedance thereof is made low. Therefore, it is desirable to connect an active element such as a field effect transistor (referred to hereinafter as FET) having a high input impedance and a low output impedance between the condenser microphone and the amplifier of the tape recorder so as to achieve a low input impedance of about several kiloohms to be supplied to the amplifier of the tape recorder while the condenser microphone is actuated at a high performance without cutting off the lower region in frequency caused by the low impedance thereof.

When a condenser microphone is used with the microphone circuit of the tape recorder of the type described above, no serious problems arise if the condenser microphone is housed in the main body of the tape recorder. However, when the condenser microphone is used as a remote microphone for a tape recorder by connecting it to the tape recorder through a microphone jack thereof, the tape recorder must be designed to have a special construction so that the condenser microphone can be connected to the tape recorder without deteriorating the performance thereof, thereby making it impossible to use the condenser microphone with a conventional tape recorder as a remote microphone, so that the use of the condenser microphone is made inconvenient.

It is, therefore, desirable to permit the condenser microphone to be used commonly with any conventional tape recorder by the provision of an FET so that the output impedance of the condenser microphone is reduced by the FET to one to several kiloohms suitable for supplying to the amplifier of the tape recorder having the input impedance of several kiloohms. Further, it is desirable to locate the FET adjacent to the microphone so as to prevent the oscillation thereof.

To this end, it is advantageous to arrange the condenser microphone and the FET in a common casing so that the low output impedance of the FET is supplied to the amplifier of the tape recorder while the condenser microphone is actuated at a high performance and the oscillation is positively prevented.

In this case, an electric source is required for the FET. To this end, a small size silver or mercury cell may be incorporated in the casing of the microphone. However, this requires an extra electric source although it can be of very little capacity. Further, it is desirable to cut off the electric source each time the operation of the microphone is terminated thereby making the manipulation of the tape recorder troublesome. Alternatively, the electric power for the FET may be supplied from the electric source of the tape recorder. In this case, however, it is necessary to provide separate terminals in the tape recorder for connecting the FET to the tape recorder so as to supply the electric power to the FET from the tape recorder, thereby resulting in a complicated construction of the tape recorder while the manipulation of the tape recorder is made troublesome.

In case the electric power for the FET arranged in the casing of the condenser microphone is supplied from the main body of the tape recorder, electric noise of the electric source of the tape recorder might cause oscillation of the microphone circuit. It is, therefore, necessary to provide a decoupling circuit including a capacitor and a resistor which is connected to the electric source so that the oscillation is positively prevented. It is, however, disadvantageous to locate such a decoupling circuit in the main body of the tape recorder, because the resistor of the decoupling circuit is connected at all times in series to the load of the tape recorder.

On the other hand, if the capacitor and the resistor forming the decoupling circuit are arranged in the casing of the microphone, an extra space is required thereby resulting in increase in the size of the casing. This is a fatal defect for a miniature microphone.

Further, in order to carry out a secret recording, it is necessary to remotely operate the tape recorder while it is held in a pocket, for example, of the clothes of the operator, thus requiring a remote switch for operating the tape recorder.

In the recording operation of a tape recorder, a microphone is usually used. In this case, the recording necessarily contains not only the necessary sound desired to be recorded but also unwanted sound existing
in the ambient atmosphere thereby deteriorating the quality of the recording.

Therefore, when the recording is to be carried out in a lecture meeting, for example, where the electric signal generated by the microphone of a lecturer is transmitted by a frequency-modulated transmitter (referred to hereinafter as FM transmitter) through an antenna, it is desirable to effect the recording by connecting a frequency-modulated tuner (referred to hereinafter as FM tuner) to the microphone jack of the tape recorder so as to receive by the FM tuner the electric signal transmitted from the FM transmitter so that the lecture is recorded without accompanying any unwanted noise existing in the ambient atmosphere in the lecture meeting. In this case, however, an electric source is required for the FM tuner. No serious problems arise if a battery is arranged in the casing of the FM tuner, except that an extra space is required in the casing for locating the battery therein while the manipulation of the tape recorder is made troublesome, because the electric source must be cut off each time the operation of the tape recorder is terminated.

Alternatively, the electric power may be supplied to the FM tuner from the main body of the tape recorder. In this case, however, separate terminals are required in the tape recorder so that the electric power is supplied from the tape recorder to the FM tuner. This makes the construction of the tape recorder complicated and the FM tuner can not be used with a conventional tape recorder having no such terminals.

In carrying out a secret recording, the size of various attachment device to be connected to the main body of the tape recorder which is kept in a pocket, for example, of the clothes of the operator must be minimized so as to conveniently arranged in the clothes of the operator for operation of the tape recorder without being noticed by other persons.

The present invention aims at solving the above described problems of the prior art electric appliances.

**SUMMARY OF THE INVENTION**

An object of the present invention is to provide a novel and useful electrical attachment device requiring an electric power for the operation thereof and adapted to be detachably connected to an electric appliance such as a tape recorder having an electric source, wherein the electric power is supplied to the attachment device from the electric appliance by merely connecting the former to the latter for the operation thereof without requiring any further connecting means for supplying the electric power from the electric appliance to the attachment device.

Another object is to provide a novel and useful speaker device connectable to a tape recorder having an electric source, wherein the electric power required for the operation of the speaker device is supplied thereto from the tape recorder by merely connecting the speaker device to the tape recorder for the operation thereof without requiring any additional connecting means in the tape recorder for supplying the electric power from the tape recorder to the speaker device.

A further object of the present invention is to provide a novel and useful microphone device connectable to a tape recorder having an electric source, wherein the electric power required for the operation of the microphone device is supplied thereto from the tape recorder by merely connecting the microphone device to the tape recorder for the operation thereof without requiring any additional connecting means in the tape recorder for supplying the electric power from the tape recorder to the microphone device.

A still further object of the present invention is to provide a novel and useful microphone device of the type described above, wherein the oscillation of the microphone device due to possible electric noise of the electric source of the tape recorder is positively prevented while the remote control of the operation of the tape recorder is effected by the microphone device thereby facilitating the operation of the tape recorder.

Another object is to provide a novel and useful FM tuner device connectable to a tape recorder having an electric source, wherein the electric power required for the operation of the FM tuner is supplied thereto from the tape recorder by merely connecting the FM tuner to the tape recorder for the operation of the FM tuner without requiring any additional connecting means in the tape recorder while the required recording of an information transmitted from an FM transmitter is effecting without containing any unwanted noise existing in the ambient atmosphere around the tape recorder.

A further object is to provide a novel and useful microphone device connectable to a tape recorder, which is small in size for facilitating the operation thereof while the oscillation of the microphone device due to possible electric noise of the electric source of the tape recorder is positively prevented.

Another object of the present invention is to provide a novel and useful ultraminiature microphone device for use with a tape recorder, which is arranged in a necktie pin so that it is advantageously used in a secret recording.

A still further object is to provide a novel and useful microphone device for use with a tape recorder, wherein the electric source of the microphone device is connected in the circuit thereof only when the microphone device is connected to the tape recorder thereby minimizing the consumption of the electric source.

In accordance with the present invention, the above object is achieved by the provision of a speaker device comprising a loudspeaker connected to an output circuit for amplifying the electric signal supplied from a tape recorder connected thereto, the tape recorder having an electric source, an earphone jack and a remote switch jack, the speaker device being provided with a pair of plugs adapted to be connected to the remote switch jack and the earphone jack of the tape recorder, respectively, for cooperation of the speaker device with the tape recorder, thereby permitting the electric power required for the operation of the speaker device to be supplied thereto from the tape recorder by the mere connection of the pair of plugs of the speaker device to the jacks of the tape recorder for the operation of the speaker device.

In accordance with another feature of the present invention, the microphone device is adapted to be connected to a tape recorder having an electric source, an amplifier incorporating a transistor, a remote switch jack and a microphone jack, the microphone device being provided with a condenser microphone, an active element such as an FET for accommodating the output impedance of the microphone device to the input impedance of the amplifier of the tape recorder and a pair of plugs adapted to be connected to the remote switch.
jack and the microphone jack of the tape recorder, respectively, for the cooperating of the microphone device with the tape recorder, thereby permitting the electric power required for the operation of the FET of the microphone device to be supplied thereto from the tape recorder by the mere connection of the pair of plugs of the microphone device to the jacks of the tape recorder for the operation of the microphone device.

In accordance with the other feature of the present invention, the microphone device is provided with a decoupling circuit and a remote switch so that the oscillation of the microphone device due to the possible electric noise of the electric source of the tape recorder is positively prevented while the remote control of the operation of the tape recorder is made possible by the remote switch of the microphone device thereby facilitating the operation of the tape recorder.

In accordance with a still further feature of the present invention, the FM tuner is adapted to be connected to a tape recorder having an electric source, an amplifier, a remote switch jack and a microphone jack, the FM tuner being provided with a pair of plugs adapted to be connected to the remote switch jack and the microphone jack of the tape recorder, respectively, for cooperation of the FM tuner with the tape recorder while the electric power required for the operation of the FM tuner is supplied thereto from the tape recorder by the mere connection of the pair of plugs to the jacks of the tape recorder for the operation of the FM tuner, thereby permitting the required recording of information transmitted from an FM transmitter to be carried out by the tape recorder without accompanying any unwanted noise existing in the ambient atmosphere around the tape recorder.

In accordance with the other feature of the present invention, the microphone device is provided with a condenser microphone, a mating FET arranged in the same casing as that of the condenser microphone, for accommodating the output impedance of the microphone device to the input impedance of a tape recorder to be used with the microphone device while preventing the oscillation thereof, and an electric source for the FET, the tape recorder being provided with a microphone jack while the microphone device is provided with a plug engageable with the microphone jack for the connection thereof with the tape recorder, the electric source for the FET being arranged in the plug thereby minimizing the size of the microphone device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing the arrangement of the microphone with a remote switch and an earphone connectable to a conventional tape recorder;

FIG. 2 is a block diagram similar to that of FIG. 1 but showing the electric circuit of the speaker in the tape recorder constructed in accordance with the present invention, in which the electric power for the speaker is supplied from the tape recorder through the remote switch jack thereof;

FIG. 3 is a block diagram similar to FIG. 2 but showing the modification of the electric circuit of FIG. 2;

FIG. 4 is a block diagram showing the electric circuit of the microphone in the tape recorder of the present invention in which the electric power for the microphone is supplied from the tape recorder through the remote switch jack thereof as in the case of the speaker shown in FIG. 2 or 3;

FIG. 5 is a block diagram showing the modified circuit of the microphone having a remote switch of the tape recorder constructed in accordance with the present invention;

FIG. 6 is a schematic general view showing the appearance of the microphone of FIG. 5;

FIG. 7 is a block diagram showing another form of the circuit of the microphone having a remote switch of the tape recorder of the present invention;

FIG. 8 is a schematic general view showing the appearance of the microphone of FIG. 7;

FIG. 9 is a block diagram showing the circuit of the FM tuner for use with the tape recorder constructed in accordance with the present invention;

FIG. 10 is a wiring diagram showing another form of the microphone of the present invention;

FIG. 11 is a schematic general view showing the appearance of the microphone plug constructed in accordance with the present invention;

FIG. 12 is a sectional view taken along line A—A in FIG. 11 showing the internal arrangement of the microphone plug of FIG. 11;

FIG. 13 is a sectional view taken along line B—B in FIG. 12 showing the internal arrangement of the microphone plug of FIG. 12;

FIG. 14 is a general view showing the appearance of the other embodiment of the microphone plug of the present invention;

FIG. 15 is a sectional view taken along line C—C in FIG. 14 showing the interior of the microphone plug of FIG. 14;

FIG. 16 is a wiring diagram showing the electric circuit of a further embodiment of the microphone of the present invention;

FIG. 17 is a perspective view showing the necktie pin in which the microphone of FIG. 16 is incorporated;

FIG. 18 is a longitudinal sectional view showing the internal arrangement of the necktie pin of FIG. 17;

FIG. 19 is a perspective view showing a modified form of the microphone of FIG. 17 which is incorporated in a necktie pin;

FIG. 20 is a wiring diagram showing the electric circuit of the other form of the microphone of the present invention;

FIG. 21 is a perspective view showing a necktie pin in which the microphone of FIG. 20 is incorporated;

FIG. 22 is a longitudinal sectional view showing the interior of the necktie pin of FIG. 21;

FIG. 23 is a wiring diagram showing a further modification of the electric circuit of the microphone of the present invention;

FIG. 24 is a perspective view showing the appearance of the microphone plug used in the microphone of FIG. 23;

FIG. 25 is an enlarged sectional view showing the interior of the microphone plug of FIG. 24;

FIG. 26 is a wiring diagram showing the switching circuit of the tape recorder constructed in accordance with the present invention;

FIG. 27 is a perspective view showing the modified form of the microphone plug used in the switching circuit of FIG. 26; and

FIG. 28 is a sectional view showing the interior of the microphone plug of FIG. 27.
DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 showing a conventional tape recorder, the tape recorder comprises electric source 1, amplifier unit 2, motor 3 and main switch 4 connected to the plus terminal of the electric source 1. As shown, remote switch jack 5 is connected between the main switch 4, the amplifier unit 2 and the motor 3. Microphone jack 6 is connected between the input terminal of the amplifier unit 2 and the earth. Microphone unit 7 is provided with a remote switch 10 connected to the remote switch plug 8 adapted to be connected to the remote switch jack 5, the remote switch 10 being connected between the shield terminal and the center terminal of the remote switch plug 8. The microphone unit 7 incorporates therein a microphone 12 and a matching transformer 11 having the primary winding connected to the microphone 12 as shown. The terminals of the secondary winding of the matching transformer 11 are connected to the shield terminal and the center terminal of microphone plug 9 mating with the microphone jack 6, respectively. Earphone jack 13 is connected to the shield terminal and the center terminal of earphone plug 14, respectively, which is adapted to be connected to the earphone jack 13 of the tape recorder.

In such a tape recorder of the conventional type, when plug 9 of the microphone unit 7 is connected to the microphone jack 6 of the tape recorder and the remote switch plug 8 is connected to the remote switch jack 5, the input circuit of the microphone is connected to the electric circuit of the remote switch so that, when the main switch 4 is closed, the tape recorder can be switched to ON or OFF by operating the remote switch 10. Earphone jack 13 can be operated by connecting the plug 14 thereof to the earphone jack 13. If it is desired to actuate a speaker, an output circuit and the speaker are connected to the earphone jack 13 so as to supply the output to the speaker after amplified by the output circuit. In this case, a separate electric source is required to energize the output circuit.

FIG. 2 shows the electric circuit of the present invention, in which the output circuit and the speaker can be operated without requiring any separate electric source by utilizing the remote switch jack 5 and the earphone jack 13 of the tape recorder.

In FIG. 2, the speaker comprises an output circuit 21 for amplifying the output signal from the amplifier unit 2 of the tape recorder and a speaker 22 adapted to be energized by the output circuit 21. The plus lead wire of the output circuit 21 is connected to the shield terminal of the plug 23 mating with the remote switch jack 5 and the shield terminal of the plug 23 is connected to the center terminal of the plug 23, while the earth lead wire of the output circuit 21 is connected to the shield terminal of the plug 24 mating with the earphone jack 13 and the center terminal of the plug 24 is connected to the input terminal of the output circuit 21.

By the arrangement shown in FIG. 2, when the plug 23 is connected to the remote switch jack 5 and the plug 24 is connected to the earphone jack 13, the plus side of the electric power for the output circuit 21 is applied thereto from the tape recorder through the plug 23, jack 5, while the earth side of the electric power is supplied to the output circuit 21 through the plug 24, jack 13.

A switch 25 may be provided between the center terminal and the shield terminal of the plug 23 as shown in FIG. 3 instead of directly short-circuiting the center terminal and the shield terminal of the plug 23. In this case, the switch 25 serves as the remote switch of the speaker circuit.

FIG. 4 shows a microphone circuit in which a condenser microphone having an FET is used by utilizing the remote switch jack 5 and the microphone jack 6 as shown in FIG. 1.

In FIG. 4, the condenser microphone unit 31 has a condenser microphone 32 and an FET 33. The gate of the FET 33 is connected to the condenser microphone 32, while the drain of the FET 33 is connected to the shield terminal of plug 34 similar to the plug 8 in FIG. 1 and the source of the FET 33 is connected through a resistor to the shield terminal of plug 35 which is similar to the plug 9 in FIG. 1. Remote switch 36 is connected between the shield terminal and the center terminal of the plug 34.

By the arrangement shown in FIG. 4, when the plug 34 is connected to the remote switch jack 5 and the plug 35 is connected to the microphone jack 6 of the conventional tape recorder, the plus side of the electric power for the FET 33 is applied thereto from the tape recorder through the plug 34, jack 5 while the earth side of the electric power is applied to the FET 33 through the plug 35, jack 6. The remote switch 36 may be dispensed with and the shield terminal and the center terminal of the plug 34 may be short-circuited in order to make the device compact.

FIG. 5 shows a microphone circuit having a decoupling circuit incorporated in the remote switch in accordance with the present invention for preventing the oscillation of the microphone circuit, in which the earphone circuit is omitted although it may be incorporated, and FIG. 6 shows the appearance of the microphone of FIG. 5.

In FIG. 5, the tape recorder is similar to that shown in FIG. 4 except that the earphone circuit is omitted, and the condenser microphone circuit is substantially similar to that shown in FIG. 4 except that the remote switch 36 is dispensed with. A remote switch housing 41 is provided between the microphone unit 31 and the plugs 34 and 35 which incorporates therein a remote switch 42 connected between the shield terminal and the center terminal of the plug 34. A capacitor C and a resistor R are provided in the remote switch housing 41, and the capacitor C is connected between the drain of the FET 33 and the condenser microphone 32 as shown while the resistor R is connected between the drain of the FET 33 and the remote switch 42, so that the capacitor C and the resistor R form the decoupling circuit.

By the arrangement of FIG. 5, the microphone unit can be made compact, because the decoupling circuit is arranged in the remote switch housing instead of the microphone unit.

FIG. 7 shows a modification of the microphone unit of FIG. 5 while FIG. 8 shows the appearance of the microphone unit of FIG. 7.

As is clear from the drawings, lead wires extend separately from the plugs 34 and 35, the lead wires from the plug 35 being connected to the microphone unit 31 while the remote switch housing 41 is connected to the lead wires from the plug 34, so that the remote switch
housing 41 is arranged separately of the microphone unit 31.

FIG. 9 shows the electric circuit of the present invention in which the FM tuner is coupled with the tape recorder without requiring any separate electric source for the FM tuner by utilizing the remote switch jack and the microphone jack of the tape recorder.

In FIG. 9, the tape recorder per se is similar to that shown in FIG. 5. The FM transmitter unit for use with the FM tuner shown in FIG. 9 comprises a microphone 51 for a lecturer in a lecture meeting, for example, a transmitter 52 connected to the microphone 51, an electric source 53 connected to the transmitter 52 for the energization thereof. An antenna 54 is connected to the transmitter 52 so that the aural signal received by the microphone 51 is amplified and frequency modulated so as to be transmitted from the antenna 54. FM tuner unit comprises a FM tuner 55 and an antenna 56 connected thereto. The FM tuner 55 has plugs 57 and 58 which are adapted to be connected to the remote switch jack 5 and the microphone jack 6 of the tape recorder. The plug side of the output of the FM tuner 55 is connected to the center terminal of the plug 57 and the center terminal is connected to the shield terminal of the plug 57 while the earth side is connected to the shield terminal of the plug 58, the center terminal thereof being connected to the output terminal of the FM tuner 55. Thus, the FM tuner unit receives the frequency modulated aural signal through the antenna 56 and demodulates the same by the FM tuner 55.

In operation, when the plug 57 is connected to the remote switch jack 5 and the plug 58 is connected to the microphone jack 6 of the tape recorder, the plus side of the electric power for the FM tuner 55 is applied from the electric source 1 of the tape recorder through the plug 57, jack 5 and the earth side is applied through the plug 58 and the jack 6, while the motor 3 and the amplifier unit 2 of the tape recorder are energized by the electric source 1 through the jack 5 and the plug 57.

If it can be seen when the antenna 56 of the FM tuner 55 receives the input signal from the antenna 54 of the transmitter unit as in the case of the recording in a lecture meeting, it suffices to merely connect the plugs 57, 58 of the FM tuner 55 to the respective jacks 5 and 6 of the tape recorder in order to carry out the recording by the tape recorder.

In case, however, when it can not be noticed when the input signal is applied to the antenna 56 of the FM tuner 55, it is necessary to maintain the tuner 55 to be connected to the tape recorder so as to keep them in operative position, thereby consuming the electric power as well as the tape in the tape recorder. In such a case, it is preferred to provide in the tape recorder a switching circuit or a voice starting circuit which is adapted to commence the operation of the electric circuit for the motor 3 when an aural signal is applied thereto. In this case, the motor 3 will not be driven even though the main switch 4 is kept closed, unless the aural signal is applied to the switching circuit, the electric power to be consumed being reduced to that for the FM tuner 55 and the amplifier unit 2, while the tape recorder is kept in inoperative position. When an aural input signal is applied to the FM tuner 55, then the motor 3 commences its rotation by the switching circuit provided in the tape recorder for the recording operation of the tape recorder so that the waste of the tape is kept to the minimum.

FIG. 10 shows the alternative form of the electric circuit of the microphone device of the present invention for use with the conventional tape recorder, in which a condenser microphone and an FET are in the same casing and the FET is energized by an electric source housed in the microphone plug of the microphone device thereby making it possible to minimize the size of the microphone device so as to be suitable for a secret recording while the high impedance output of the FET is supplied to the microphone and the low impedance output of the tape recorder is accommodated for the supply to the microphone by the provision of the FET.

In FIG. 10, the circuit of the microphone device is substantially similar to that of FIG. 4 except that the remote switch 36 of FIG. 4 is omitted and the drain of the FET 33 is connected to the shield terminal of the microphone plug 66 through lead wire 87 and an electric source 67 such as a mercury cell or a silver cell or the like having a relatively low capacity and one terminal of the microphone plug 32 opposite to that connected to the gate of the FET 33 is connected to the shield terminal of the plug 66 through lead wire 86 while the source of the FET 33 is connected to the center terminal of the plug 66 through lead wire 88, the lead wires 86, 87, 88 forming together an electric cord 64.

The electric source 67 is housed in the body 68 of the plug 66 made of non-conductive plastic material.

The detailed construction of the body 68 of the microphone plug 66 is shown in FIGS. 11 to 13. In the drawings, the plug 66 and the cord 64 extend from the body 68 to one side of which a cover 63 for the electric source 67 is detachably secured. The plug 66 consists of an inner shaft 75 and an outer tube 76 surrounding the inner shaft 75, isolating rings 77, 78 being interposed between the shaft 75 and the tube 76 at the respective ends thereof so as to electrically isolate the shaft 75 from the tube 76. A leaf spring 80 serving as a negative pole of the electric cell 79 housed in the recess of the body 68 is secured to the inner surface of the cover 63 so as to contact with the negative pole of the cell 79. Casing 81 of electrically conducting material is provided in the recess of the body 68 and the positive pole of the cell 79 contacts with an electrically conducting pin 82 serving as a positive pole which is secured to the casing 81. The casing 81 is electrically connected to the outer tube 76 while the inner shaft 75 is connected to a terminal plate 85 which is electrically isolated from the casing 81 as well as the cell 79 by a spirally wound isolating strip 84.

The pin 82 is electrically connected to the lead wire 87 and the casing 81 is connected to the lead wire 86 while the terminal plate 85 is connected to the lead wire 88, the lead wires 86, 87, 88 extending in the cord 64.

The microphone device shown in FIGS. 11 to 13 can be made very small in size thereby permitting it to be conveniently used in a secret recording when used with a miniature tape recorder.

FIGS. 14 and 15 show another form of the microphone plug of the present invention in which a standard type cylindrical electric cell is housed. As shown, the body 92 of the plug is made by the molding of electrically non-conductive plastic material electrically conductive cylindrical casing 99 is located in the body 92 and the flange 76a formed in the outer tube 76' of the
plug is threadedly secured to the casing 99 which is electrically connected to the lead wire 104 similar to lead wire 86 in FIG. 10. An electrically non-conductive plate 102 is secured to the open end of the casing 99 adjacent to the plug and electrically conducting layers 102a 102b are provided on the respective side of the plate 102, the layer 102a contacting with the casing 99 while the layer 102b is electrically isolated therefrom. The layer 102 has a contact 103 secured thereto which contacts with the negative pole of the cell 98. The inner shaft 75 of the plug is in contact with the layer 102b and the layer 102b is connected to the lead wire 106 similar to lead wire 88 in FIG. 10. An insulating plate 100 is secured to the other end of the casing 99 and an electrically conductive leaf spring 101 is secured to the plate 100 which is connected to the lead wire 105 similar to the lead wire 87 in FIG. 10. The leaf spring 101 contacts with the positive pole of the cell 98.

The cell 79 or the cell 98 shown in FIG. 12 or FIG. 15 can be exchanged by removing the cover 63 in FIG. 12 or detaching the outer tube 76 in FIG. 15 together with the inner shaft 75.

In the embodiments shown in FIGS. 10 to 15, since the microphone 32 and the FET 33 are arranged in the same casing closely to each other, the possible oscillation is positively prevented, and, further, the size of the microphone per se can be made to the minimum, because the electric source is housed in the body of the microphone plug.

FIGS. 16 to 18 show another form of a microphone device of the present invention which is extremely compact so as to be conveniently used in a secret recording.

The electric circuit shown in FIG. 16 is substantially similar to that shown in FIG. 10 except that the electric cell 67 is arranged separately from the body of the plug 68.

In FIGS. 17 and 18, the microphone housing 115 housing therein the microphone 32 and the FET 33 is provided with a decoration pattern 119 and a voice transmitting opening 120, and the casing 115 is fixedly secured to the front side of the body 121 of a necktie pin having a decoration 122 in its front side with the pattern 119 and the opening 120 being faced outwardly.

An L-shaped lug 123 is provided in the rear side of the necktie pin and a circularly wound portion 123a is formed in the free end of the lug 123 in which a pivot shaft 124 is located. The clipper portion 125 of the necktie pin is pivotally mounted on the shaft 124 and a spring 126 is arranged about the shaft 124 so as to urge the clipper portion 125 against the body 121 of the necktie pin.

The cell 67 is housed in a case 127 (indicated schematically as 31a in FIG. 16) and the case 127 is fixedly secured to the rear side of the clipper portion 125. A leaf spring 129 contacting with the negative pole of the cell 67 is fixed to the inner surface of the cover 128.

A contact 130 contacting with the positive pole of the cell 67 is provided in the case 127, an insulating ring 131 being interposed between the contact 130 and the clipper portion 125 and the case 127. Lead wires 133, 134 of the cord 64 and a lead wire (not shown) are connected to the microphone 32, the FET 33 and the cell 67, respectively, so as to make the electrical connection as shown in FIG. 16.

FIG. 19 shows a modification of FIG. 17, in which the microphone casing 115 and the case 127 are incorpo-

rated in a necktie pin having the body 135 and the clipper portion 136 integral with the body 135. In this embodiment, the electrical connection between the cord 64 and the microphone, the FET and the electric cell is made by lead wires (not shown) in accordance with FIG. 16.

The necktie pin per se may be made of a metal so as to be used as an electric conductor for the minus side of the electric current, thereby making the construction simple.

In the embodiments shown in FIGS. 16 – 19, the size of the microphone device is made to the minimum to facilitate the secret recording by simply attaching the necktie pin to the necktie of the operator while the oscillation is positively prevented as described previously.

FIGS. 20 – 22 show a further embodiment of the microphone device of the present invention.

The electric circuit of FIG. 20 is substantially similar to that shown in FIG. 10 except that the microphone 32 is housed in a separate casing 311. Thus, the electric source 67 is housed in the body 68 of the plug 66.

As shown in FIG. 22, the casing 311 of the condenser microphone 32 is attached to the outer surface of the body 141 of the necktie pin by fitting a portion of the casing 311 within the opening 142 of the body 141 so as to reduce the height of the casing 311. A decoration plate 143 covers the outer surface of the body 141 as well as the casing 311 with the voice transmitting hole 144 of the plate 143 being in alignment with the microphone 32 in the casing 311. A circularly wound portion 146 is formed in the tip of U-shaped extension 145 of the body 141, in which the pivot shaft 124 is secured. The clipper portion 148 is pivotally mounted on the shaft 124 and a spring 126 is located around the shaft 124 so as to urge the clipper portion 148 toward the body 141.

The clipper portion 148 is in the U-form in the cross-section so as to provide a space therein, in which a base plate 149 mounting thereon the FET 33 and other elements is secured, a cover 150 being provided to cover the elements on the base plate 149. Thus, the casing 311 in FIG. 20 is formed by the clipper portion 148 and the cover 150.

The microphone 32 and the FET 33 and other elements are electrically connected by high quality shielding wires 151 so as to make the electrical connection shown in FIG. 20, thereby preventing the electric oscillation of the microphone device. It is preferred to form the clipper portion 148 and the cover 150 by a metal having a high shielding effect.

The cord 64 is elastically held to the clipper portion 148 by an elastic holder 152 made of rubber or plastic material. Position

The FET 33 and other elements may be arranged in a separate shielding case which is secured in the rear side of the clipper portion 148.

Since the microphone device can be used without being covered by any portion of the clothes of the operator, a high quality recording is insured during the secret recording operation of the tape recorder.

FIGS. 23 – 25 show a still further embodiment of the microphone device of the present invention. The circuit shown in FIG. 23 is substantially similar to that shown in FIG. 10 except that the electric cell 67 is housed in the same casing as that in which the microphone 32 and the FET 33 are housed and a microswitch 157 is arranged between the shield terminal of
the plug 66 and the minus terminal of the electric cell 67 through lead wire 175, the lead wires 170, 171 and 172 extending in the cord 169 corresponding to the lead wires 86, 88 and 87 of FIG. 10.

FIGS. 24 and 25 show the construction of the body 68 of the plug 66 in which the switch 157 is arranged.

In the figures, the switch 157 has an elastically movable actuating member 160 at the tip of which an annular portion 161 is formed through which the plug 66 loosely extends.

In FIG. 25, the chassis 164 of the tape recorder is provided with a jack 162 which is secured to the chassis 164 by means of a nut 163. The inner shaft 75 and the outer tube 76 serving as the center terminal and the shield terminal, respectively, are electrically insulated by insulating rings 77, 78 as in the previous examples. The microswitch 157 is embedded in the body 68 of the plug so that the actuating member 160 thereof extends downwardly from the body 68 as shown. The plug 66 per se is embedded at its one end beneath the switch 157.

The lead wire 170 from the cord 169 is connected to the outer tube 76 of the plug 66 and the lead wire 171 is connected to the inner shaft 75, while the lead wire 172 is connected to one terminal 173 of the switch 157, the other terminal 174 of the switch 157 being connected to the outer tube 76 being connected by the lead wire 175, so that the electrical connection makes the electric circuit of FIG. 23.

In operation, when the plug 66 is inserted into the jack 162, the actuating member 160 of the switch 157 is engaged with the exposed end surface of the jack 162 so as to be moved to close the switch 157. When the plug 66 is withdrawn from the jack 162, the actuating member 160 returns to its natural position by its resiliency, so that the switch 157 is automatically opened, thereby saving the consumption of the electric power.

FIGS. 26 to 28 show the other embodiment of the microphone device of the present invention.

The electric circuit of FIG. 26 is like that shown in FIG. 4 but the switch 36 of FIG. 4 is omitted and, instead, the drain of the FET 33 is connected to the center terminal of the plug 179 mating with the remote switch jack 5 through an electric cell 67 while the shield terminal of the plug 179 is connected to the shield terminal of the plug 66 mating with the microphone jack 6 of the tape recorder, the earphone jack 13 of FIG. 4 being omitted in FIG. 26. The lead wires 192, 193 and 194 extend together to form the cord 169. The electric cell 67 is of a relatively small capacity such as a silver cell or a mercury cell, because it is used only for energizing the FET 33 which serves to impedance change for the microphone.

FIG. 28 shows the construction of the body 185 of the plug 66 shown in FIG. 27 in which the remote switch plug 179 is incorporated and which is coupled with the tape recorder.

In FIG. 28, the microphone plug 66 is similar to that shown in FIG. 25. A jack 162 mating with the plug 66 is secured to the chassis 164 of the tape recorder by a nut 163 while a remote switch jack 5 is located in the chassis 164 of the tape recorder.

The remote switch plug 179 comprises an inner shaft 183 having an insulating piece 184 attached to its outer end while an insulating tube 184 surrounds the other end of the shaft 183 and an electrically conductive outer tube 186 is provided around the insulating tube 184.

The jack 5 has an insulating base plate 187 fixed to the chassis 164. An electrically conductive tube 188 for engaging with the inner shaft 183 of the plug 179 is secured to the base plate 187. An elastically movable switching piece 189 is secured to the base plate 187. The embracing portions 190, 191 of the switching piece 189 are adapted to be fitted with the outer tube 186 while the other end of the piece 189 is resiliently urged toward the base plate 187 so that the tube 188 contacts with the other end of the piece 189.

The lead wire 192 is connected to the outer tube 76 and the lead wire 193 is connected to the inner shaft 75 while the lead wire 194 is connected to the inner shaft 183, the outer tube 76 of the plug 66 being connected to the outer tube 186 of the plug 179 by the lead wire 204. Thus, when the plug body 185 is coupled with the tape recorder, electrical connection is made between the inner shaft 183, the tube 188, the switching piece 189, the embracing portions 190, 191 and the outer tube 186 so that the electric cell 67 is made operable, i.e., the electric power is supplied from the cell 67 to the FET 33 by utilizing the remote switch jack 5 only when the plug body 185 is coupled with the tape recorder.

In case a low impedance microphone other than a condenser microphone is used, the electric source for the FET is not required, thus making it possible to use the conventional remote control system. In this case, the length of the inner shaft 183 or the insulating tube 184 is enlarged so that it urges the switching piece 189 so as to disengage it from the tube 188 to open the circuit of the electric cell 67.

The construction of the jack 5 is not limited to the above described arrangement but may be modified variously. It is preferred to mold the portion of each of the plugs 66 and 179 and the lead wires integral with the body 185.

The above described construction may be utilized when an extension speaker device having a speaker, an amplifier and an electric source is used with a miniature tape recorder having no speaker and an output amplifier incorporated therein and adapted to use an earphone connectable thereto so as to save the consumption of the electric power.

I claim:

1. In a speaker device for use with a tape recorder having an earphone jack and a remote switch jack for extension connection to an earphone and a remote switch, respectively, said speaker device including a speaker connected to an output circuit therefor, the improvement wherein said speaker device comprises a first and a second plug adapted to be coupled with said remote switch jack and said earphone jack, respectively, the shield terminal of said first plug being connected to the plus side of said output circuit as well as to the center terminal of said first plug, while the earth side of said output circuit is connected to the shield terminal of said second plug, the center terminal thereof being connected to the input terminal of said output circuit, thereby permitting electric power for said output circuit to be supplied from a power source in the tape recorder when said first and said second plug are coupled with the respective jacks for the operation of the tape recorder.
2. In a speaker device for use with a tape recorder having an earphone jack and a remote switch jack for extension connection to an earphone and a remote switch, respectively, said speaker device including a speaker connected to an output circuit therefor, the improvement wherein said speaker device comprises a first and a second plug adapted to be coupled with said remote switch jack and said earphone jack, respectively, the shield terminal of said first plug being connected to the plus side of said output circuit, while the earth side of said output circuit is connected to the shield terminal of said second plug, the center terminal thereof being connected to the input terminal of said output circuit, a remote switch being connected between the center terminal and the shield terminal of said first plug, thereby permitting electric power for said output circuit to be supplied from a power source in the tape recorder when said first and said second plug are coupled with respective jacks for the operation of the tape recorder while remote control is effected by said remote switch.

3. In a microphone device for use with a tape recorder having a remote switch jack and a microphone switch jack, said microphone device including a high impedance microphone and a field effect transistor for matching the impedance with the tape recorder, the improvement wherein said microphone device comprises a first and a second plug adapted to be coupled with said remote switch jack and said microphone jack, respectively, the gate of said field effect transistor being connected to said microphone while the drain is connected to the shield terminal of said first plug and the source is connected to the center terminal of said second plug, the shield terminal thereof being connected to said microphone, a remote switch being connected between the center terminal and the shield terminal of said first plug, thereby permitting electric power for said field effect transistor to be supplied from a power source in the tape recorder when said first and said second plug are coupled with the respective jacks for the operation of the tape recorder while remote control is effected by said remote switch.

4. Microphone device according to claim 3, further comprising a decoupling circuit arranged in the lead wires connecting said plugs to said microphone and said field effect transistor, said remote switch being physically located in a common housing with said decoupling circuit.

5. Microphone device according to claim 3, further comprising a decoupling circuit arranged integral with said remote switch, said decoupling circuit and said remote switch being connected between the lead wires lead from said microphone and said field effect transistor and from said plugs separately from the lead wires connecting directly said second plug to said microphone as well as said field effect transistor.

6. In an FM tuner device for use with a tape recorder having remote switch jack and a microphone jack for recording the signal transmitted from a FM transmitter, said FM tuner device including an FM tuner and an antenna connected to said FM tuner, the improvement wherein said FM tuner device comprises a first and a second plug adapted to be coupled with said remote switch jack and said microphone jack, respectively, the plus side of said FM tuner being connected to the center terminal of said first plug which is connected to the shield terminal thereof, while the earth side of said FM tuner is connected to the shield terminal of said second plug, the center terminal thereof being connected to the output terminal of said FM tuner, thereby permitting the electric power for said FM tuner to be supplied from the tape recorder when said first and second plugs are coupled with the respective jacks of the tape recorder operation thereof.

7. FM tuner device according to claim 6, wherein the tape recorder has a switching circuit and is operable only when said FM tuner receives the signal from the FM transmitter, while said FM tuner is kept in operable position by coupling said first and second plugs with the respective jacks.

8. In a microphone device for use with a tape recorder having a microphone jack, said microphone device including a condenser microphone, a field effect transistor for accommodating the impedance of the tape recorder with said microphone and an electric source for said field effect transistor, the improvement wherein said microphone device comprises a plug adapted to be coupled with said microphone jack and said electric source is housed in the body of said plug, the center terminal of said plug being connected to the source of said field effect transistor the shield terminal of which is connected to one terminal of said microphone, the other terminal thereof being connected to the gate of said field effect transistor, the plus terminal of said electric source being connected to the drain of said field effect transistor while the minus terminal of said electric source is connected to the shield terminal of said plug, thereby minimizing the size of said microphone device while oscillation thereof is positively prevented.

9. In a microphone device for use with a tape recorder having a microphone jack, said microphone device including a condenser microphone, a field effect transistor for accommodating the impedance of the tape recorder with said microphone and an electric source for said field effect transistor, the improvement wherein said microphone device comprises a normally opened micro-switch and a plug adapted to be coupled with said microphone device, the center terminal of said plug being connected to the source of said field effect transistor the gate of which is connected to one terminal of said microphone, the other terminal thereof being connected to the shield terminal of said plug, the plug terminal of said electric source being connected to the drain of said field effect transistor, while the minus terminal of said electric source is connected to one contact of said switch, the other contact of said switch being connected to the shield terminal of said plug, said switch being located in the body of said plug, a resilient actuating member being provided on said body so as to be urged to close said switch when said plug is coupled with said jack thereby permitting said electric source to be connected to said field effect transistor only when said plug is coupled with said jack for the operation of the tape recorder.

10. In a microphone device for use with a tape recorder having a remote switch jack and a microphone jack, said microphone device including a condenser microphone, a field effect transistor and an electric source for said field effect transistor, the improvement wherein said microphone device comprises a first and a second plug adapted to be coupled with said remote switch jack and said microphone jack, respectively, the plus side of said FM tuner being connected to the center terminal of said first plug which is connected to the shield terminal thereof, while the earth side of said FM
minus terminal of said electric source the plug terminal of which is connected to the drain of said field effect transistor while the gate thereof is connected to one terminal of said microphone the other terminal of which is connected to the shield terminal of said second plug, the center terminal thereof being connected to the source of said field effect transistor, the shield terminal of said first plug being connected to the shield terminal of said second plug, thereby permitting said electric source to be connected to said field effect transistor only when said first and second plugs are coupled with the respective jacks of the tape recorder.

11. An espionage device, which comprises:
 a tie clip including a first elongated member having a serrated surface, a second elongated member having a serrated surface for mating engagement with the serrated surface of the first member, spring means for biasing said first and second members towards each other, the serrated surfaces thereof gripping the tie to which the tie clip is fastened, the other surface of said first member having at least a portion thereof decoratively embellished;

12. The espionage device according to claim 11 wherein said first and second elongated members are formed from a unitary hair-pin shaped member and said spring means is omitted.

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