United States Patent [19]

Sato

[11] **3,743,784**

[45] **July 3, 1973**

[54] **ELECTRICAL ATTACHMENT DEVICE**

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[73] Assignee: **Olympus Optical Co., Ltd.,** Shibuya-ku, Tokyo, Japan

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[21] Appl. No.: **200,366**

[52] **U.S. Cl.** ..... **179/1 PC**

[51] **Int. Cl.** **H01r 3/00**

[58] **Field of Search** ..... 179/1 SW, 1 PC, 1 A, 179/1 DD; 339/148, 154

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Primary Examiner—Kathleen H. Claffy
Assistant Examiner—Jon Bradford Leaheey
Attorney—Kelman & Berman

[57] **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

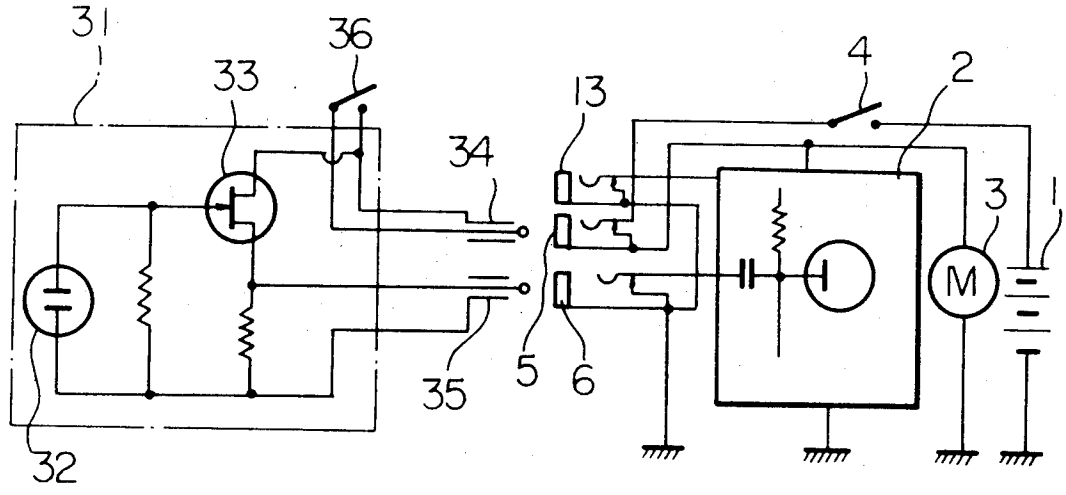


Fig. 1

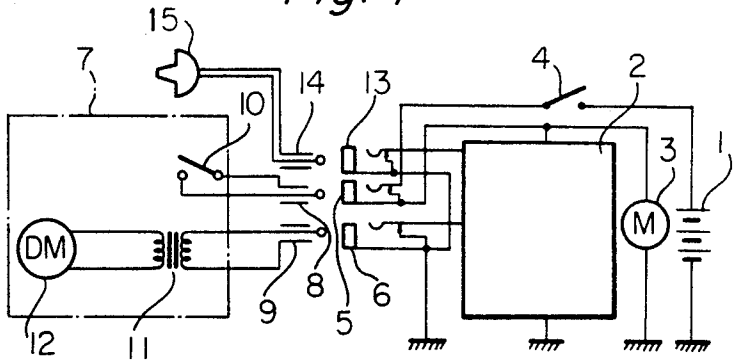


Fig. 2

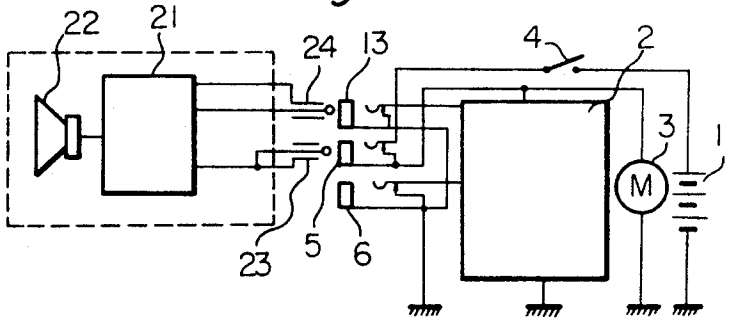
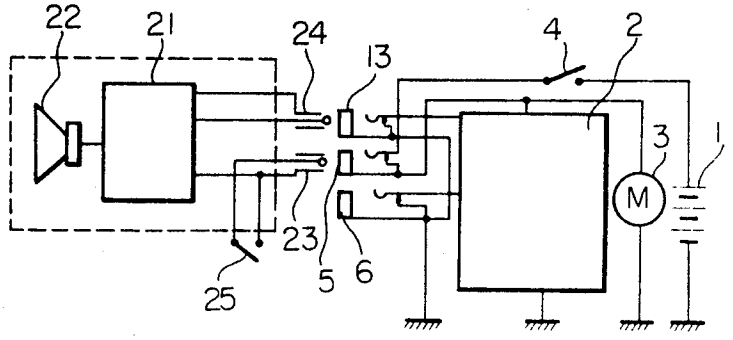


Fig. 3



INVENTOR
Masaaki Sato
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AGENTS

Fig. 4

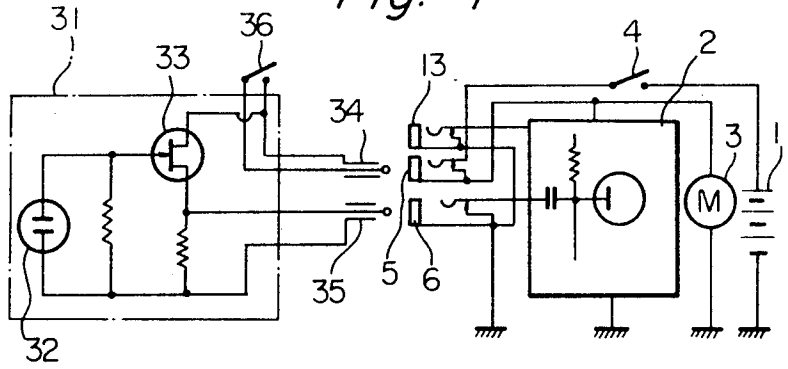


Fig. 5

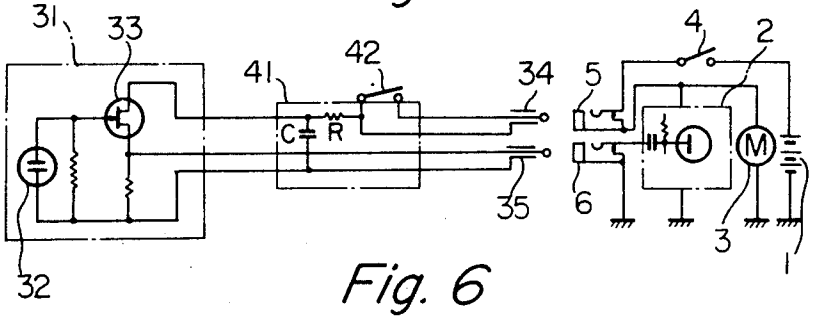


Fig. 6

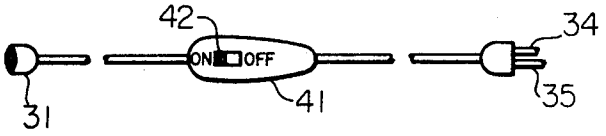
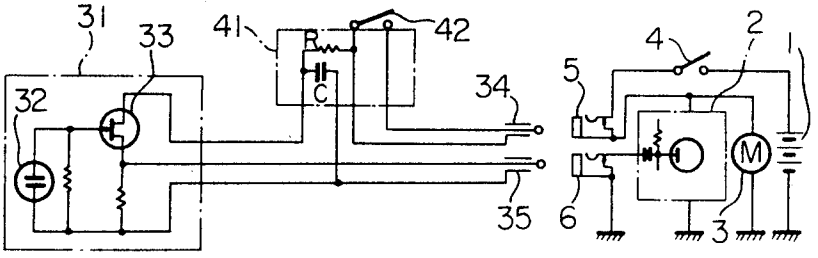


Fig. 7



INVENTOR
Masaaki Sato
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AGENTS

Fig. 8

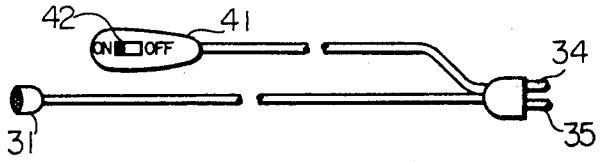


Fig. 9

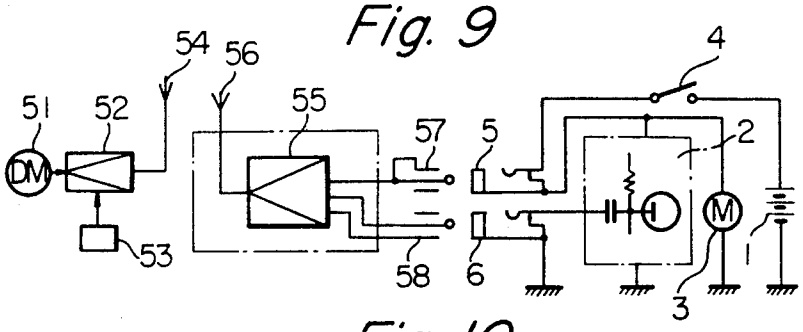


Fig. 10

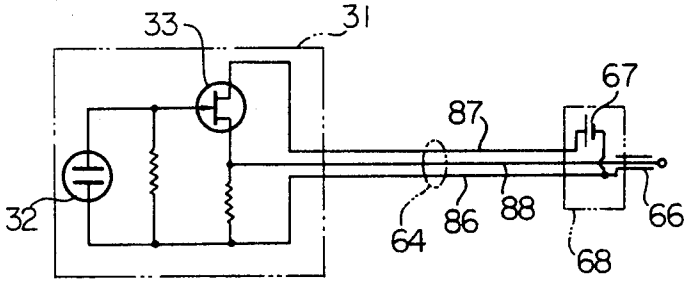


Fig. 11

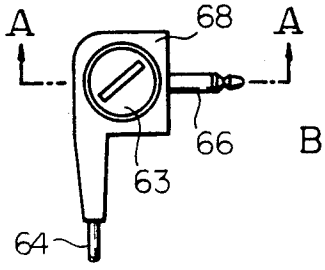
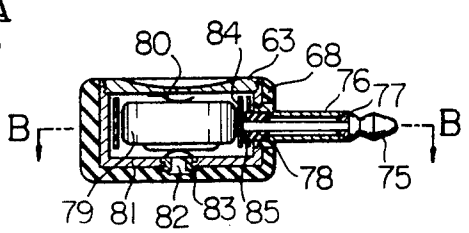


Fig. 12



INVENTOR
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AGENTS

Fig. 13

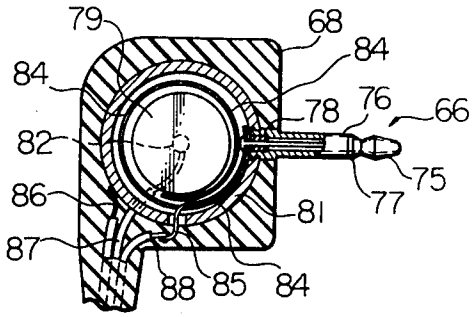


Fig. 14

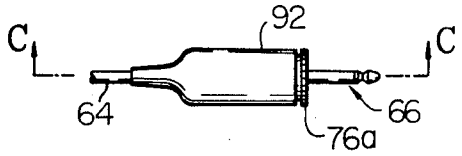


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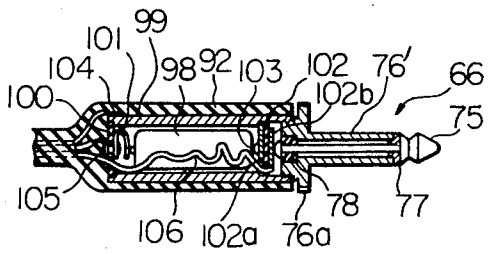
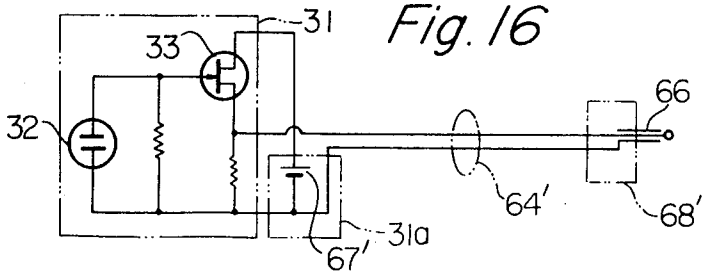


Fig. 16



INVENTOR
Masaaki Sato
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AGENTS

Fig. 17

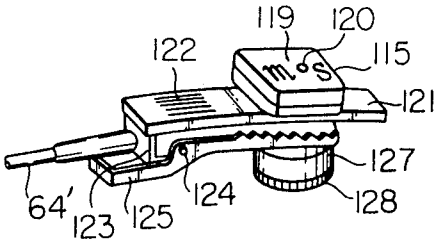


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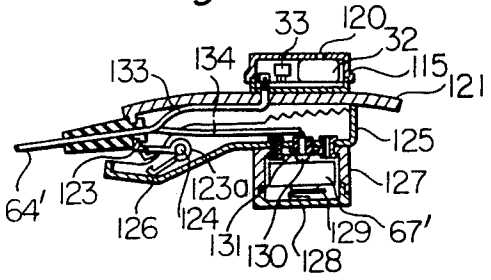


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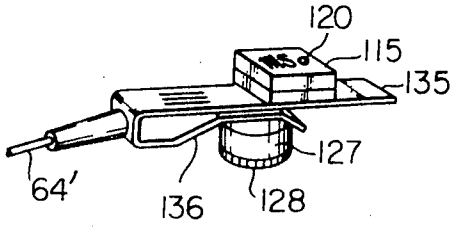
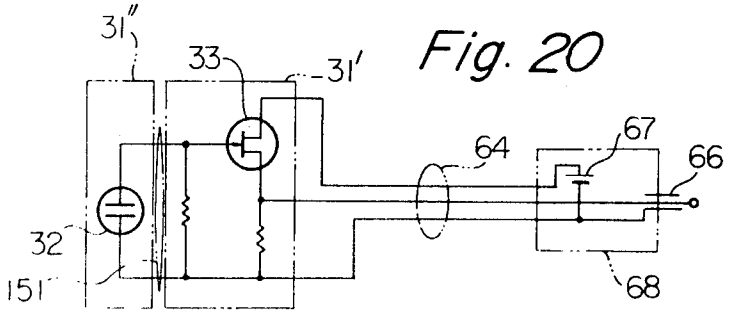


Fig. 20



INVENTOR
Masaaki Sato
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AGENTS

Fig. 21

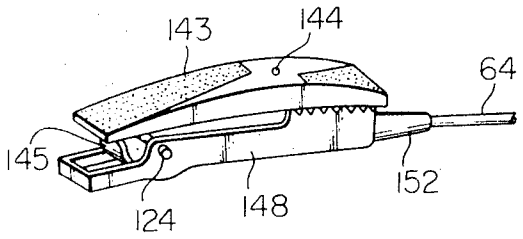


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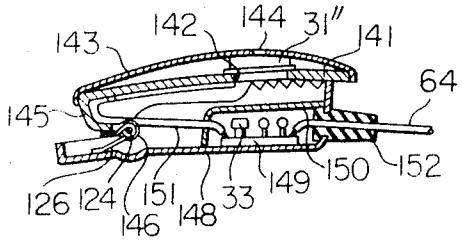


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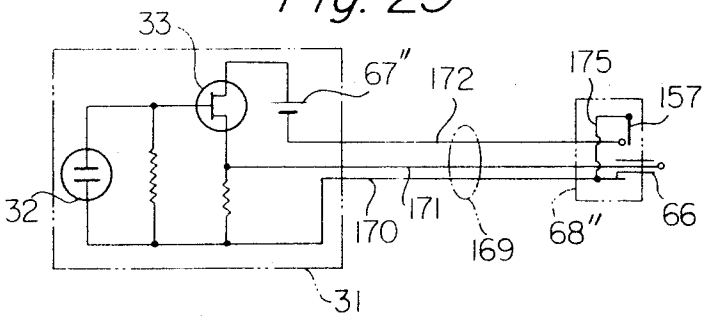
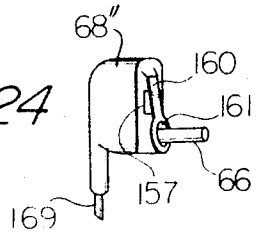


Fig. 24



INVENTOR
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Fig. 25

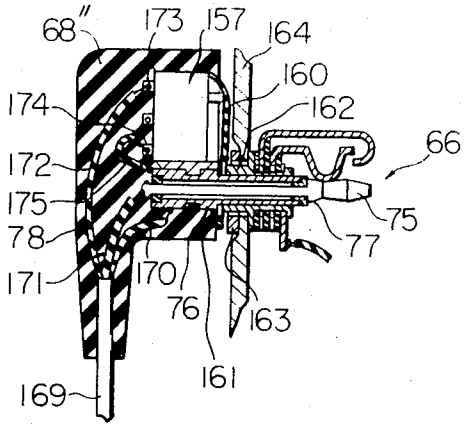


Fig. 26

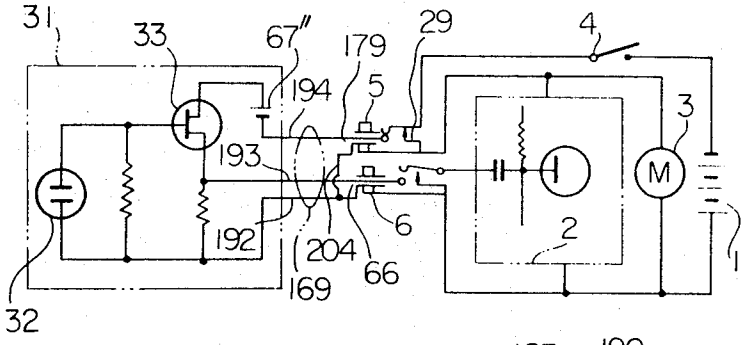


Fig. 28

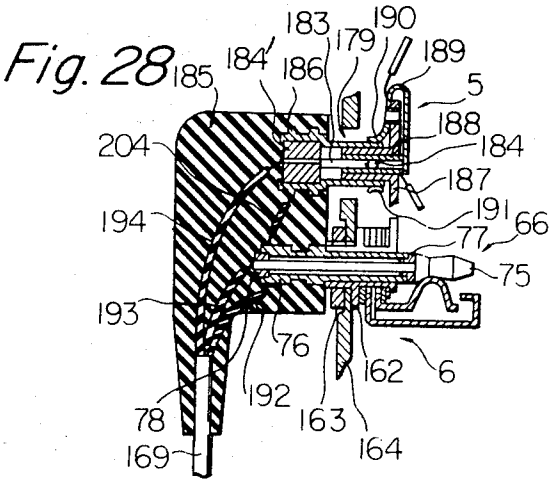
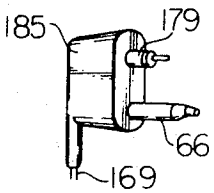


Fig. 27



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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 micropone 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 an 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 microphones 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 arrangment of the microphone plug of FIG. 12;

FIG. 14 is a general view showing the appearance of the other embodiment of th microphone plug of th 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 microhone 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 and 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 15 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 15 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 arrangment 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 with-out 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 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 – 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 76*a* 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 **102***a* **102***b* are provided on the respective side of the plate **102**, the layer **102***a* contacting with the casing **99** while the layer **102***b* 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 **102***b* and the layer **102***b* 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 casing **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 incorporated 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 **31''**. Thus, the electric source **67** is housed in the body **68** of the plug **66**.

As shown in FIG. **22**, the casing **31''** 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 **31''** within the opening **142** of the body **141** so as to reduce the height of the casing **31''**. A decoration plate **143** covers the outer surface of the body **141** as well as the casing **31''** with the voice transmitting hole **144** of the plate **143** being in alignment with the microphone **32** in the casing **32''**. 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 pivotably 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 **31'** 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. posi-tion

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'' 71** 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 micrphone **32.**

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** issecured 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 center terminal of said first plug being connected to the

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;

a first housing mounted to the other surface of said first member, said housing including a microphone and amplifying means, connected to said microphone, for amplifying the output thereof, said housing having an aperture in one wall thereof to admit acoustic waves to said microphone, and decorative indicia to disguise said aperture;

a second housing, mounted to the other surface of said second member, and including a source of d.c. power for said microphone and amplifying means; and

cable means connecting to said tie clip and invisible when the clip is fastened to a tie, for connecting said power source and said amplifying means one to the other and to an external tape recording device.

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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