

PATENT SPECIFICATION

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(54) ELECTRICAL DEVICE TO ENABLE THE HEATING ELEMENT OF AN ELECTRICALLY HEATED MOTOR VEHICLE WINDOW TO BE USED AS A RADIO AERIAL

(71) We, B.S.H. ELECTRONICS (MANCHESTER) LTD., a British Company, of Scottish Provident House, 52 Brown Street, Manchester M2 2LD, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a device to enable the heating element of an electrically heated motor vehicle window to be used as a radio aerial.

A device of this kind is disclosed in U.S. Patent No. 3,484,584. With this known device large air-cored chokes are interposed between electrical connections of the heating element of a motor car heated rear window and the motor car d.c. power supply. The chokes provide a low resistance path for the d.c. power supply with the aim of avoiding interference with heating of the window, and they provide a high impedance path for radio signals picked up by the heating element with the aim of avoiding undue reduction in strength of signals picked up by the heated rear window and fed to the aerial circuit due to earthing of same through the car power supply.

With this known arrangement to order to ensure a sufficiently high impedance to radio signals at the usual broadcast frequencies whilst at the same time presenting a sufficiently low d.c. resistance to avoid excessive voltage drop at the usual high current rating of the heater element, it is necessary to use chokes which are physically of large dimensions. Problems can therefore arise with regard to manufacturing costs, convenient installation in a motor car, screening of the coils to avoid interference, and loss of signal strength due to coil capacitance. In addition, with the known arrangement the radio aerial circuit can pick up interference

from the car ignition and other electrical circuits via the power supply.

An object of the present invention is to provide a device to enable the heating element of an electrically heated motor vehicle window to be used as a radio aerial and which is simple and inexpensive to manufacture and convenient to install in a motor vehicle.

According to the invention thereof, an electrical device to enable the heating element of an electrically heated motor vehicle window to be used as a radio aerial comprises input terminals for connection to a motor vehicle d.c. power supply, power output terminals for connection to the heating element, a radio signal output terminal for connection to the aerial circuit of a radio receiver for feeding radio signals picked up by the heating element to the receiver, and a blocking circuit for blocking passage of said radio signals to the power supply, the blocking circuit comprising two coils each interposed between a respective one of the said input terminals and a respective one of the power output terminals, and said coils being mutually inductively coupled and wound in a common direction so as to provide high impedance paths for in-phase fluctuating currents at said first output terminals but low resistance paths for currents flowing through said circuit from the d.c. power supply.

With this arrangement due to the use of coupled coils it is possible for the device to be simple and inexpensive to manufacture and to be of a small size, conducive to the convenient installation of same in a motor vehicle.

Preferably, said coils are together formed by a bifilar winding, that is, they constitute substantially identical inductors wound in a common direction formed by winding together two separate wires for example on a common core such as a pot core.

With the coupled coils of the invention it

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is also possible to achieve removal of noise, or other electrical fluctuations likely to cause interference with the radio signal, from the power supply circuit whereby good reception quality and sensitivity can be attained. If desired, however, to further improve interference elimination, the device of the invention may also incorporate an interference suppressing choke, which may have an air gapped winding, and possibly also a filter capacitor.

It is visualised that the device of the invention will have particular application in the context of motor cars having heated rear windows, the device being mounted at an appropriate position close to the rear window and being connected to the heating element of the heated rear window, to the car d.c. power supply, and to the aerial circuit of a radio in the car.

With regard to the nature of the heated window this may take any suitable form and thus for example may comprise an electrical resistance heating element applied to the surface of the window or alternatively and preferably an electrical resistance heating element which is incorporated in the glass of the window or sandwiched between sheets thereof during the manufacture of the window.

The invention will now be described further by way of example only and with reference to the accompanying drawings in which:—

Figure 1 is a circuit diagram of one form of device according to the present invention; and

Figure 2 is a circuit diagram showing a modification to the device.

The device is for use in a motor vehicle to enable the heating element of a heated rear window of the vehicle to be used simultaneously as a radio aerial.

The device comprises, in an earthed case 1, a pair of input terminals 2, a pair of power output terminals 3, and a radio signal output terminal 4.

In use, the input terminals 2 are connected to the vehicle earth and the vehicle d.c. power supply via the usual control switch for the heating element, the output terminals 3 are connected to the heating element 5, and the output terminal 4 is connected to a shielded aerial cable 6 connected to the radio in the vehicle.

Within the case 1, the input terminals 2 are connected to the power output terminals 3 via a suppressor arrangement, made up of a choke 7 and two filter capacitors 8, and two coils 9 interposed one before each output terminal 3.

The choke 7 is of the pot core type and has 20 turns of 18 swg wire on a pot core of 36 mm diameter and 23 mm high. The winding of the choke 7 is air gapped to give

an optimum inductance (say 60 to 100 μ H) at a current of 10 amps this being a usual current rating of a motor car heated rear window. The filter capacitors 8 may comprise 1 μ F ceramic capacitor for efficient high frequency filtering and 10 to 25 μ F tantalum electrolytic for general decoupling.

The coils 9 are provided by a bifilar winding of 18 turns of 19 swg wire on a pot core of 30 mm diameter and 19 mm high, with no air gaps, giving an inductance of the order of 2 mH.

If it is found to be necessary, the output terminals 3 may be interconnected by a capacitor (not shown) for equalisation purposes. In practice however equalisation is found to present no problems due to the fact, it is believed, that the heating element may act as a conductive sheet to radio signals, rather than a conductive loop. Also if desired a decoupling capacitor (also not shown) may be interposed in the lead connecting the output terminal 4 and the heating element 5.

In use, current can flow from the power supply through the heating element 5 and the coils 9 provide low impedance paths to such current. At the same time, radio signals picked up by the heating element 5 and which are in phase at the power output terminals 3, flow to the radio signal output terminal 4 and from there to the radio. The coils 9 provide high impedance paths for the radio signals and thus the power supply circuit has little effect with regard to reduction of signal strength.

The coils 9, and the suppressor circuit, also act to prevent background noise, and other interfering fluctuations, from reaching the output terminal 4.

With the embodiment described it is therefore possible to obtain good quality and sensitivity of radio reception.

It will be appreciated that the device can be provided in a motor vehicle as original equipment or may be installed subsequently, simply by interposition in the lead to the heating element. In either case, in order to minimise inductive pick-up of interference signals, the device should preferably be arranged as near as possible to the heater 5.

It is of course to be understood that the invention is not intended to be restricted to the details of the above embodiment which are described by way of example only.

Thus, for example, in a modification of the above embodiment and as shown in Figure 2, a number of tuned inductance/capacitance circuits 10, 11, 12 may be connected in series with each other between the output terminal 4 and earth, each circuit being tuned to a frequency in the middle of a different broadcast band.

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Thus there may be FM, AM medium wave and AM long wave circuits. On each band the respective circuit presents a high impedance corresponding to a desired aerial loading and the other circuits present low impedance.

Since the inductance/capacitance circuits are not connected in the power supply circuit it will be appreciated that heavy duty components are not required. Further, the series arrangement of same obviates switching arrangements to accommodate band changes.

With the above described embodiment and the modification thereof it will of course be appreciated that values of components would be selected in accordance with required current carrying capacity and radio frequency range. Also the various components may be constructed and arranged otherwise than as specifically described. Thus for example the coils 9 and/or the choke 7 may involve toroidal windings and/or ferrite cores with a view to increasing inductance and/or reducing coil size if this is believed to be advantageous in relation to the cost of manufacturing same.

With the above described embodiment and the modification thereof it will be appreciated that the inductive coupling of the similarly wound coil 9 gives rise to efficient blocking of passage of the in-phase radio signals to the d.c. power supply; and such inductive coupling also gives rise to cancellation of the equal but opposite magnetic fluxes generated in the coils when current from the power supply flows in opposite directions through the two coils whereby core saturation due to such current can be avoided.

WHAT WE CLAIM IS:—

1. An electrical device to enable the heating element of an electrically heated motor vehicle window to be used as a radio aerial comprising input terminals for connection to a motor vehicle d.c. power supply, power output terminals for connection to the heating element, a radio signal output terminal for connection to the aerial circuit of a radio receiver for feeding radio signals picked up by the heating element to the receiver, and a blocking circuit for blocking passage of said radio signals to the power supply, the blocking

circuit comprising two coils each interposed between a respective one of the said input terminals and a respective one of the power output terminals, and said coils being mutually inductively coupled and wound in a common direction so as to provide high impedance paths for in-phase fluctuating currents at said first output terminals but low resistance paths for currents flowing through said circuit from the d.c. power supply.

2. A device according to Claim 1 wherein the said coils are together formed by a bifilar winding.

3. A device according to Claim 2 wherein the bifilar winding is provided on a core without air gaps.

4. A device according to any one of Claims 1 to 3 further including an interference suppressing choke interposed between one input terminal and the associated power output terminal.

5. A device according to Claim 4 wherein the interference suppressing choke has an air-gapped winding.

6. A device according to Claim 4 or 5 further including a filter capacitor connected to the side of the interference suppressing choke remote from said one input terminal and to the other said input terminal.

7. A device according to any one of Claims 1 to 6 further including an aerial tuning circuit connected to the radio signal output terminal.

8. An electrical device to enable the heating element of an electrically heated motor vehicle window to be used as a radio aerial, substantially as hereinbefore described with reference to and as illustrated in Figure 1 or Figure 1 as modified by Figure 2 of the accompanying drawings.

9. A device according to any one of Claims 1 to 8 when used in a motor vehicle and connected to the heating element of an electrically heated rear window, to the vehicle d.c. power supply and to the aerial circuit of a radio in the vehicle.

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