Aug. 12, 1924. 1,504,940

G. W. CARPENTER ET AL

TELEPHONE RECEIVER CIRCUITS

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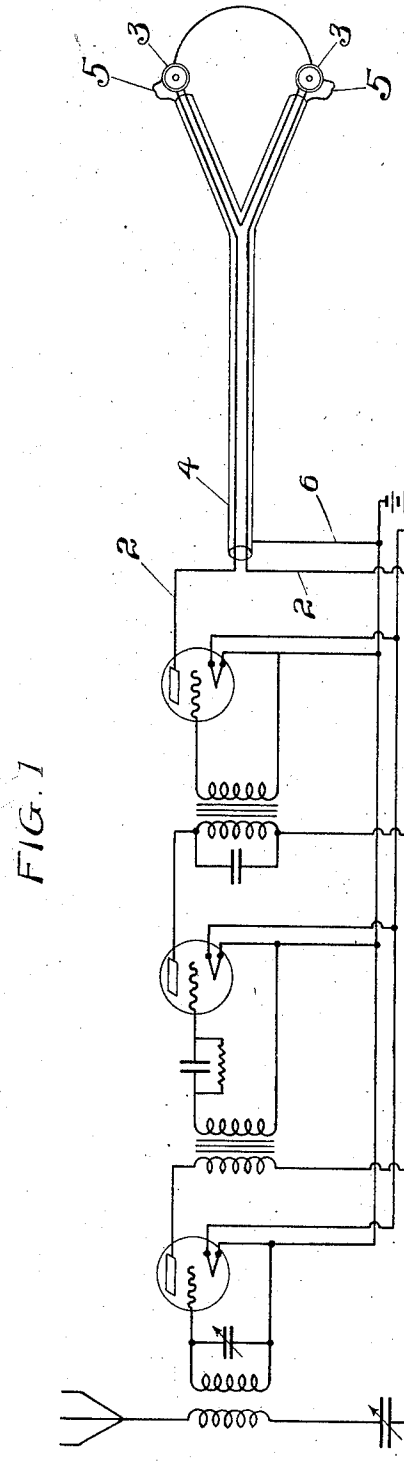

FIG. 1

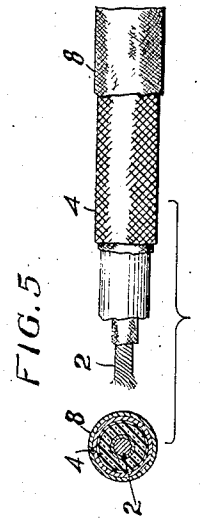

FIG. 5

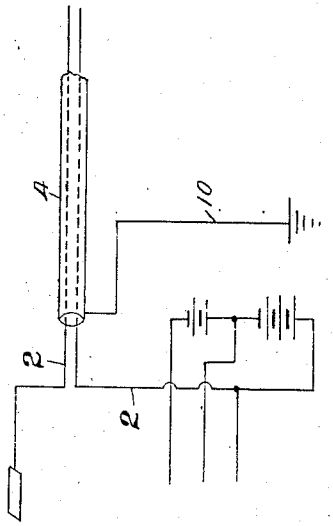

FIG. 4

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FIG. 2

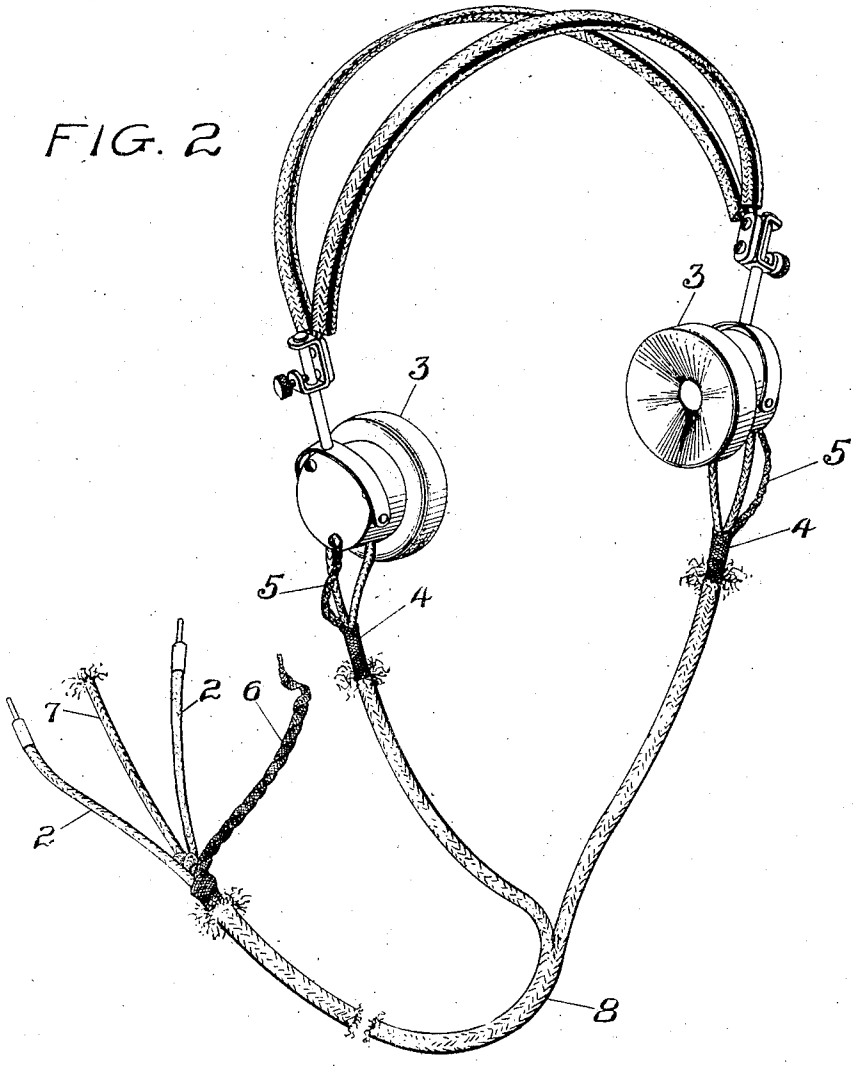
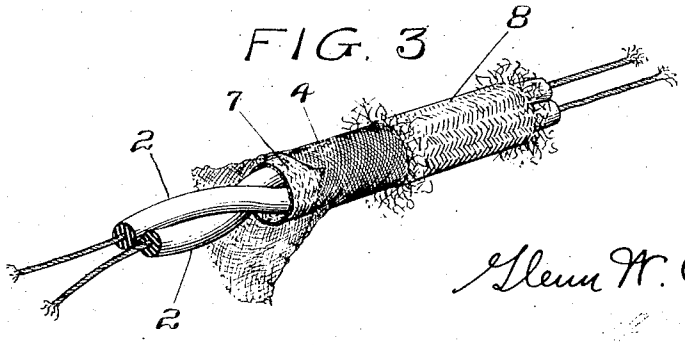


FIG. 3



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UNITED STATES PATENT OFFICE.

GLENN W. CARPENTER AND WENDELL L. CARLSON, OF WASHINGTON, DISTRICT OF COLUMBIA.

TELEPHONE-RECEIVER CIRCUITS.

Application filed January 29, 1921. Serial No. 440,992.

To all whom it may concern:

Be it known that we, GLENN W. CARPENTER and WENDELL L. CARLSON, citizens of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Telephone-Receiver Circuits, of which the following is a specification.

Our invention relates to telephone receiver circuits for radio-telegraphy and other uses and has for an object to prevent the deleterious effects caused by electrostatic, electromagnetic and direct coupling which now exists between the telephone receiving circuit and other circuits, particularly with circuits in high power radio receiving amplifiers.

A further object of our invention is to shield the telephone receiver circuit from strays or any other electrical disturbances from external sources.

Great difficulty has been encountered heretofore when telephone receivers were used in conjunction with high power vacuum tube apparatus, due to the fact that a coupling exists between the telephone receiver circuit and other circuits in the apparatus or external circuits. This coupling, in some instances, causes a detuning of the oscillatory circuit, while in other cases it produces oscillations in the telephone receiver circuit which is commonly known as "howling" when of an audio frequency.

We will now describe in detail our shielded telephone receiver circuit which prevents the above described coupling, reference being had to the accompanying drawings in which:

Figure 1 is a diagrammatic view of the shielded receiver combined with an ordinary high power receiving amplifier.

Figure 2 is a perspective view of the telephone receiver, parts being broken away to more clearly show the construction,

Figure 3 is a detail perspective view of a portion of the telephone cord, clearly showing one construction of the cords and arrangement of the conductors therein,

Fig. 4 is a modified wiring diagram of our shielded telephone circuit, and,

Fig. 5 shows a modified construction of our telephone cord.

With reference to the diagrammatic view shown in Figure 1, numeral 1 refers generally to any high power radio receiving amplifier, to which is connected in the usual manner the conductors 2, 2, leading to the ordinary telephone receivers 3, 3. Surrounding the conductors 2, 2, is arranged a metallic shield 4 which is preferably electrically connected with the receiver shells as indicated at 5, 5. At the amplifier end the shield is preferably electrically connected as indicated by numeral 6 with some point of low potential as with the low potential circuit of the amplifier or to ground 10 as indicated in the modified wiring diagram represented in Fig. 4. It will be understood that by a low potential point we mean a point in the circuit of practically the same potential as the filament.

While, of course, it is not our intention to be limited to the particular construction of the shielded cords or their connections, yet for the purpose of more clearly setting forth the invention we will now describe one of the many possible constructions of the cords and shield. It will be understood that the particular construction shown and described is to be considered in an illustrative rather than a limiting sense.

With reference to Figures 2 and 3, ordinary insulated conductors 2, 2, lead to conventional telephone receivers or head set 3, 3. These conductors may be covered with the usual insulating cotton cord covering 7 if desired. Surrounding the insulated conductors and the cotton covering, if the latter is used, is a metallic casing or shield 4, which is preferably flexible. The shield 4 may be constructed of flexible metallic conductors braided together as represented in Figs. 2, 3 and 5. As illustrated in the drawings the metallic strands of the shield 4 may be helically wound and interlaced forming a housing for conductor 2—2. This casing or shield is preferably directly connected with the telephone receiver shells and head band as indicated at 5, 5, or any other desired electrical connection may be substituted. That portion of the shield indicated by numeral 6 may lead to any low potential conductor associated with the apparatus. As shown in Figure 1, the shield connection 6 may be connected with the low potential circuit of the amplifier. Here also it will be obvious that any desired form of electrical connection between the shield and

the low potential conductor, may be used. Numeral 8 refers to the ordinary insulating cotton cord covering.

The particular construction of the shielded cords does not form an essential part of our invention as it will be apparent that many different forms, accomplishing the same purpose, might be used. For example, the cord might be constructed with one telephone conductor arranged within the other. As, for instance, making the outer conductor hollow to receive the inner one as would be accomplished in Fig. 3 if one of the conductors 2 is removed, the outer conductor in such a case having the same connections to the telephones and instruments with which used as the removed conductor 2 and being preferably electrically connected to the low potential side of the telephone circuit and to the receiver shells and head band. In such a construction the outer conductor would serve as a shield. Or to state it another way, the shield could be made to serve as one of the conductors. This alternative construction is represented in Fig. 5 wherein the inner conductor 2 covered with its usual insulation is shielded by the shield 4 which also serves as one conductor.

The operation is as follows:

When a metallic shield is not used any alternating current energy existing in the telephone receiver circuit may by electrostatic or electromagnetic coupling, existing between the conductors and other circuits in the apparatus, cause oscillations to be set up in the amplifier circuits. If these conductors are now enclosed in a metallic shield, which shield is preferably electrically connected with the telephone shells and with a low potential conductor, it is apparent that the shield will prevent the couplings referred to and therefore prevent an effective transfer of energy from the circuit formed by the telephone conductors, thus eliminating this well known annoying disturbance.

Our invention finds application in all multistage electron tube circuits connected to actuate a responsive device, in which the usual reaction must be eliminated, employed in connection with either line wire carrier wave systems or in radio systems. By use of the invention many additional stages of amplification may be employed and arranged to function without the inherent reaction of circuits which would occur under normal circumstances.

Having thus described our invention what we claim and desire to secure by Letters Patent of the United States is:

1. In a telephone receiver circuit the combination of telephone cords, an amplification circuit and means for shielding said cords from extraneous electrical influences comprising a metallic shield enclosing said cords substantially throughout their length and an electric connection between said shield and said amplification circuit.

2. The combination of telephone cords, a low potential circuit, means for shielding the cords from extraneous electrical influences, said means including a metallic shield, an electrical connection between the shield and the shell of the telephone receiver, and an electrical connection between the shield and low potential circuit.

3. In a system for amplifying feeble electrical currents, the combination with a signal amplifying device, a low potential circuit in said signal amplifying device, a signal responsive device, conductors connecting said devices, a shield surrounding said conductors substantially throughout their length, and a connection between said shield and said low potential circuit.

4. A high power radio receiving amplifier comprising an electron tube having grid, filament and plate electrodes, a telephone receiver actuated by said amplifier, and means for shielding the telephone receiver from extraneous electrical influences and reducing regenerative effects, said means including a metallic shield surrounding the telephone conductors substantially throughout their length and a connection between said shield and one of said electrodes.

5. A high power radio receiving amplifier, a telephone receiver associated therewith and means for shielding the telephone receiver from extraneous electrical influences, said means including a metallic shield surrounding the telephone conductors, and an electrical connection between the shield and the telephone receiver.

6. A high power radio receiving amplifier having a low potential circuit, a telephone receiver associated therewith, conductors connecting said receiver with said amplifier and means for shielding the telephone receiver from extraneous electrical influences, said means including a metallic shield surrounding the telephone conductors and an electrical connection between the shield and the low potential circuit.

7. A high power radio receiving amplifier having a low potential circuit, a telephone head set associated therewith, and means for shielding the telephone head set from extraneous electrical influences, said means including a metallic shield surrounding the telephone conductors, and electrical connection between the shield and the telephone head set, and an electrical connection between the shield and the low potential circuit.

8. In a radio receiving apparatus the combination of a thermionic vacuum tube amplifier, an input circuit, an output circuit, reproducing means in said output circuit

and means surrounding the conductors of said output circuit and extending substantially throughout the length thereof for shielding said reproducing means from extraneous electrical influences and regenerative effects.

9. In a radio receiving apparatus the combination of a plurality of thermionic vacuum tubes having grid, filament and plate electrodes, circuits interconnecting said electrodes, an output circuit including a plate electrode, telephone receivers and a source of potential and means surrounding the conductors of said circuit and extending substantially throughout the length thereof for shielding said telephone receivers from extraneous electrical influences and regenerative effects.

10. In a radio receiving apparatus the combination of a plurality of thermionic vacuum tubes having grid, filament and plate electrodes, circuits interconnecting said electrodes, a source of potential for heating said filament electrodes, an output circuit including a plate electrode, telephone receivers and a source of potential and means connected to said source of filament potential surrounding the conductors of said circuit substantially throughout their length for shielding said telephone receivers from extraneous electrical influences and regenerative effects.

11. In a radio receiving apparatus the combination of a thermionic vacuum tube amplifier, an input circuit, an output circuit, reproducing means in said output circuit and means maintained at ground potential surrounding the conductors of said output circuit and extending substantially throughout the length thereof for shielding said reproducing means from extraneous electrical influences and regenerative effects.

12. In a radio receiving apparatus the combination of a plurality of thermionic vacuum tubes having grid, filament and plate electrodes, an output circuit including a plate electrode, telephone receivers and a source of potential and means surrounding the conductors of said circuit and extending substantially throughout the length thereof and connected to said source of potential for shielding said telephone receivers from extraneous electrical influences and regenerative effects.

13. In a radio receiving apparatus, an electron tube amplifier comprising a plurality of electron tubes having grid, filament and plate electrodes, an input circuit, an output circuit, a responsive device connected in said output circuit, conductors for electrically connecting said device and said output circuit, and means for shielding said conductors from extraneous electrical influences and regenerative action with said input circuit comprising a flexible metallic shield surrounding the conductors and extending substantially throughout their length, and an electrical connection between the shield, the responsive device, and one of said electrodes.

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