Jan. 28, 1930. C. A. JAYNE 1,745,096

ANTENNA FOR RADIO RECEIVING SETS

Filed Dec. 12, 1927

Fig. 1.

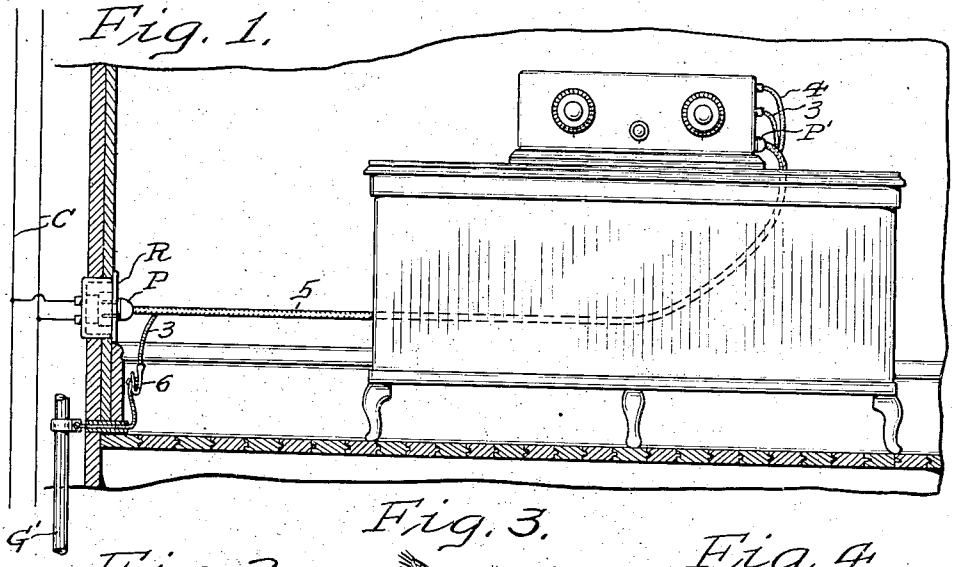


Fig. 2.

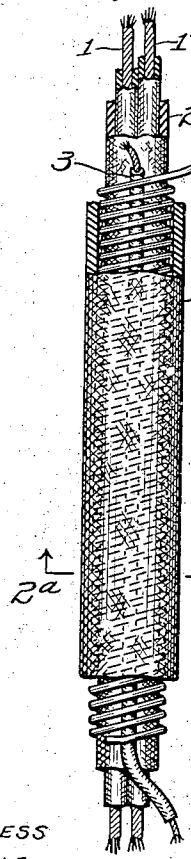


Fig. 2a.

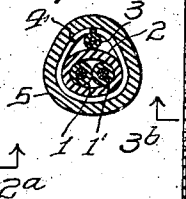


Fig. 3.

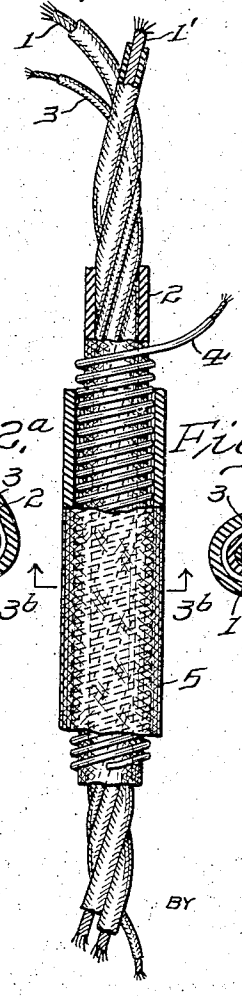


Fig. 3b

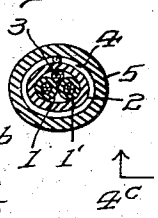


Fig. 4

Fig. 4c.

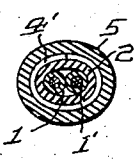


Fig. 5.



WITNESS

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ANTENNA FOR RADIO RECEIVING SETS

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My invention relates to antennæ for radio receiving sets, a principal object of the invention being to provide a novel form of antenna having certain advantages, features of convenience and novel characteristics as will hereinafter more fully appear.

It is generally recognized that the most efficient results in radio reception with the ordinary forms of receiving sets are attained by means of an outdoor aerial of suitable length and construction; but frequently an aerial of that character cannot be utilized for one reason or another while the cost of erecting the same even where it is feasible so to do is always a matter to be considered. In consequence, various forms of indoor aerials have been suggested and utilized with some success under certain conditions but the same are open to various disadvantages among which may be mentioned the fact that the most satisfactory types thereof require permanent or semi-permanent installation as, for example, around the picture molding or the like, thus substantially preventing the set from being moved from one room to another, while under all conditions they are far less efficient than the outside aerial.

Additionally, there is recently coming into extensive use a form of receiving set so designed that the entire current requisite for its operation is drawn directly from the house lighting circuit, the connection of the set to the latter being effected ordinarily by means of a flexible cord one end of which is connected to the set and the other end provided with a plug or other device adapted to be plugged into a receptacle or socket connected in the lighting circuit. Thus with this class of set, proper installation only requires the effecting of a suitable ground connection between the set and a water pipe or the like, the plugging in of the cable by which the current is carried from the lighting circuit to the set, and the connection of the set with a suitable antenna. These several results may be very readily and satisfactorily accomplished through the medium of my invention as will hereinafter more fully appear.

Broadly speaking, my invention contemplates the employment of the wires of the house lighting circuit as a substantial portion of a radio antenna through an inductive coupling between said circuit and an antenna lead directly connected with the radio set proper in such manner that the signals picked up by the house circuit are transmitted to the set to be reproduced thereby. I have found that this result may be desirably achieved by associating a wire or other conductor connected to the antenna binding post of the set with the wire or wires by means of which the lighting current is conveyed thereto or, more specifically, by winding said wire or conductor for a suitable distance about the said wire or wires which latter may be in the form of a flexible cable adapted to extend from a receptacle or socket disposed in the fixed house lighting circuit to the set for the purpose of conveying the current thereto as heretofore explained. In this manner I am enabled to provide a device in the nature of a flexible cable which may be used both to effect the requisite connection between the set and source of current supply and also as an antenna for the set while, moreover, as will hereinafter more fully appear, I may also and preferably incorporate in the device a ground wire adapted to afford a convenient connection between the ground terminal of the set and a water pipe, radiator or other like article disposed near the socket or receptacle or, in the absence of such an article disposed in a convenient position, between said terminal and a fixed wire terminating near the socket or receptacle and extending to a suitable ground remote therefrom.

To enable those skilled in the art to comprehend and practise the invention I have illustrated in the accompanying drawing and will now proceed to describe certain embodiments thereof as well as one manner of employing the invention. In said drawings Fig. 1 is a somewhat diagrammatic view showing the invention in use; Fig. 2 is an enlarged fragmentary view and Fig. 2^a is a transverse section on line a—a thereof illustrating one form of the invention; Figs. 3 and 3^b are similar views illustrating another form of the invention, and Figs. 4 and 4^c are similar views illustrating still another form,

while Fig. 5 is a transverse section similar to Fig. 4c but showing still another form.

In the preferred practice of my invention I provide one or more current conductors of suitable length, generally taking the form of a pair of flexible wires, adapted to convey the house lighting current from the fixed portion of the house lighting circuit to the radio receiving set, a suitable conductor which I term the "antenna lead" which is associated with and preferably wound about the aforesaid current conductors and adapted to be connected at one end to the set as in the case of an ordinary aerial lead-in wire, and a third conductor which I term the "ground wire" adapted to extend between the set and the grounding point such as a cold water pipe or a connection extending therefrom, and arrange these several conductors so as to form in effect a single self-contained cable for the major portion of their length, the two last mentioned conductors being both brought out of the body of the cable near one end thereof to facilitate their connection to the set and the ground wire being brought out near the other end thereof to facilitate its connection to the grounding point; desirably also the current conductors are attached at the ends of the composite cable to suitable plugs or other devices of standard construction to enable them to be readily connected with the fixed house lighting circuit and with the set.

Thus, as shown in Figs. 2 and 2a I may employ as the core of my composite cable an ordinary flexible lamp cord comprising a pair of suitably insulated flexible wires 1, 1′ extending in parallel relation with each other and enclosed by an insulating sheath 2. On the outside of this cord I may then dispose a ground wire 3 desirably comprising an insulated flexible wire and may then wind about the cord and ground wire a suitable conductor forming the antenna lead 4 and comprising in this form of the invention a continuous wire. This antenna lead may be either insulated or non-insulated and is preferably wound spirally about the ground wire and cord and the whole then covered with a suitable sheath 5 which may desirably be of insulated material. The composite cable thus formed may be of any suitable length but I have found in practice that a cable about eight feet long and about which the antenna lead is wound for substantially its entire length gives good results under most conditions, the turns of the antenna lead being desirably but no necessarily slightly spaced apart. As clearly shown in Fig. 1 the composite cable may be provided at one end with a plug or the like P to which the conductors 1, 1′ are connected in the ordinary way, this plug being desirably of such character as to enable it to be readily inserted in a receptacle R to thereby connect the conductors 1, 1′ with the fixed house lighting circuit, generally designated as C. To facilitate its connection to the grounding point the ground wire 3 may be brought out of the cable as shown in Fig. 1 at a point adjacent the plug P and, if desired, provided at its free end with a clip or other means 6 for conveniently attaching it to a fixed ground wire G extending to a water pipe G′ or other suitable ground. In a substantially similar manner a plug or other standard device P′ may be provided at the other end of the composite cable and there connected to the conductors 1, 1′ to enable the latter to be plugged into the set. Or, if desired, the plug P′ may be omitted and the ends of the current conductors 1, 1′ simply allowed to extend from the end of the cable so they may be directly attached to the internal wiring of the set. It will thus be understood that the method of connecting the current conductors 1, 1′ to the set will necessarily vary with the design of the latter and that a plug may be provided when the invention is to be used with sets having a receptacle or socket for the reception of a plug or the plug may be omitted and the ends of the conductors attached directly to the terminals of the set if the latter is not provided with a socket or receptacle.

Near that end of the cable which is intended for attachment to the set, both the ground wire 3 and the antenna lead 4 may be brought through the outer sheath 5 as shown in Fig. 1 to facilitate their connection to the terminals of the set designed for their respective reception, a sufficient length of each being permitted to extend beyond the sheath for this purpose, it being, of course, understood that the opposite end of the antenna lead is simply terminated, as shown, near the other end of the cable beneath the sheath 5.

It will thus be apparent that in using my invention it is only necessary to insert the plug P′ in the set, to connect the ground wire and antenna lead to their proper terminals, to then insert the plug P in a conveniently located receptacle R which may be disposed in the baseboard of the room or other suitable point and to then connect the opposite end of the ground wire by the clip 6 or other device directly with the ground G′ or with a fixed wire extending therefrom to the vicinity of the receptacle as clearly shown in Fig. 1.

In those cases where the invention is installed by the manufacturer of the set and thus sold as a unit therewith, the current conductors, ground wire and antenna are ordinarily permanently soldered or otherwise connected to the internal wiring of the set, so that to properly arrange the set for operation all that is required is to insert the plug P in a suitable receptacle and connect the free end of a ground wire 3 to a suitable ground.

In Figs. 3 and 3b I have shown a slightly

modified form of the invention in which the conductors 1, 1′ instead of being arranged in parallel relation are twisted upon each other and the ground wire 3 is disposed in the V-shaped opening or groove formed by the twisted wires. In other respects this form of the invention is substantially similar to that shown in Fig. 1.

In Figs. 4 and 4ᶜ, however, another form of the invention is disclosed in which instead of employing a wire for the antenna lead I utilize a flexible material which comprises interwoven strands of metal and fibre. As materials of this general character are well known and sold in large quantities for the construction of inside aerials and the like, further description thereof would be superfluous. In winding this material, designated as 4′ in said figures, about the central core formed by the lamp cord or the like, the edges of the tape may be slightly overlapped as shown or may be spaced slightly apart, practical tests having shown that substantially similar results are obtained in either case.

While under most conditions I prefer to include a ground wire in the composite cable, under certain conditions it may be deemed desirable to omit the same, as shown in Fig. 5, which illustrates a cable otherwise similar to that shown in Figs. 4 and 4ᶜ.

It will thus be understood that the inclusion or omission of the ground wire is a matter of choice although, as stated, I prefer under ordinary conditions to include it, for the reason that by so doing I am enabled to provide a substantially self-contained unit comprising all the necessary wiring for the receiving set and adapted to be interposed between the set and that point at which the connection is effected with the fixed house lighting circuit, thereby obviating the necessity of running a separate ground wire from the set to the grounding point. I have found, moreover, that in so far as the quality and strength of reception is concerned it is apparently immaterial whether or not the ground wire be incorporated in the composite cable, no undesirable effects being noticeable by reason of its inclusion therein and consequently necessarily close association with the antenna lead and the conductors by which the operating current is conveyed to the set.

It might be imagined, moreover, that the quality of the reception would be effected and undesirable hummings or other noises produced from the close association of the antenna lead 4 with the conductors 1, 1′ through which the operating current, usually of an alternating character, is passing to the set when the latter is in use, but such is not in fact the case as has been demonstrated under practical conditions of operation. In fact, it appears immaterial in so far as the quality of the reception is concerned whether current is flowing through the conductors 1, 1′ or not as can be readily shown by disconnecting the latter from the set and conveying the operating current thereto by some other means.

It is, moreover, equally demonstratable that the efficiency of my improved antenna is very largely derived from the inductive connection of the antenna lead with the fixed house lighting circuit C, for the moment this connection is severed as by removing the plug P′ from the receptacle R, the volume obtainable from the set is very greatly diminished from that obtainable under the same conditions when the antenna lead is inductively coupled with the house lighting circuit C through the medium of the conductors 1, 1′ and is only substantially equal to that which can be obtained by using as an antenna a piece of wire or the like of substantially the same length as that employed as the antenna lead in the composite cable constructed in accordance with my invention.

Under practical conditions of operation I have found that surprisingly good results are obtained by the use of antennæ constructed in accordance with my invention both as to volume and quality of reception and which, while not in most cases equal to the results which can be obtained by the use of a properly constructed outdoor aerial under similar conditions, are ordinarily superior to those obtained by the use of inside aerials or by those devices now upon the market by means of which a house lighting circuit is attempted to be utilized as an antenna by connection thereto either directly or indirectly through the medium of condensers or otherwise.

The terms "fixed house lighting circuit" or the like as used herein have been used as a matter of convenience to designate, and are to be understood as meaning, the fixed, relatively permanent wiring by means of which current for lighting or other purposes is directly conveyed to and distributed throughout the building in or near which the receiving set is to be employed and which are ordinarily in direct connection with the street power lines; these latter, therefore, may properly be considered as a part of the said circuit as the broadcasted signals are undoubtedly picked up by them as well as by the wires in or adjacent the walls of the building itself.

It is also to be understood that while I have herein referred more particularly to the use of wire and of tape embodying metal strands as suitable for the antenna lead, I do not thereby desire or intend to restrict myself solely to the use of such materials for this purpose, as excellent results have been obtained by the use of other forms of conductors such as continuous ribbons of metal or other conductive material, and the employment thereof is therefore to be deemed

as well within the scope of my invention. Moreover, while my invention particularly lends itself to use with receiving sets adapted to draw their current from the house lighting circuit, its employment is not confined or restricted thereto as the conductors 1, 1′ forming part of the said circuit may, instead of being connected to a receiving set, be connected to a lamp or other electrical appliance or, in fact, not connected to anything at all at their free ends, namely, their ends opposite to those which are interconnected with the lighting circuit.

Nor, because I have described certain forms of my invention with considerable particularity, do I thereby desire or intend to limit myself to any specific details of construction or arrangement as the same may be modified or varied from the precise embodiments to which I have referred without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim and desire to protect by Letters Patent of the United States:

1. The combination with a fixed house lighting circuit and a radio receiving set, of a composite cable comprising a pair of conductors connected at one end into said lighting circuit, a conductor attached at one end to the ground terminal of the set and at its other end to a ground, a third conductor wound about said first mentioned conductors and attached at one end to the antenna terminal of the set and a sheath enclosing all of said conductors for the major portion of their respective lengths.

2. In combination with a radio receiving set and a fixed house lighting circuit, a composite cable comprising a pair of conductors respectively connected between the set and said circuit, a second conductor extending adjacent said first mentioned conductors and connected between the ground terminal of the set and a ground and a third conductor wound spirally about the other conductors and connected at one end to the antenna terminal of the set.

3. In combination with a radio receiving set and a fixed house lighting circuit, a composite flexible cable having a core formed of a pair of separate conductors respectively connected between the set and said lighting circuit, a second conductor extending adjacent the first mentioned conductors and connected between the ground terminal of the set and a ground, a third conductor wound spirally about the other conductors and connected at one end to the antenna terminal of the set and a sheath enclosing all of said conductors for the major portion of their respective lengths.

4. In combination with a radio receiving set and a fixed house lighting circuit, a composite flexible cable having a core formed of a pair of separate conductors respectively connected to the set and to said lighting circuit, a second conductor extending adjacent the first mentioned conductors and connected at one end to the ground terminal of the set and at the other to a ground, a third conductor wound about the other conductors and connected at one end to the antenna terminal of the set and a sheath enclosing all of said conductors, the last mentioned conductor being brought through the sheath adjacent one end of the cable.

5. A composite cable adapted for interposition between a radio receiving set and the fixed house lighting circuit and comprising a pair of separate conductors respectively adapted to convey current from said circuit to said set, a conductor separate from the first mentioned conductors adapted for effecting a connection between the ground terminal of the set and a ground, and a third conductor wound spirally about the other conductors and adapted to serve as an antenna for the set when connected with the antenna binding post thereof at one end and a sheath enclosing all of said conductors, the ground conductor being brought through said sheath near that end thereof designed for remote disposition from the set.

In witness whereof I have hereunto set my hand this 10th day of December, 1927.

CHARLES A. JAYNE.