Nov. 5, 1935. J. A. SULLER 2,019,939

AMPLIFICATION MEANS

Filed April 17, 1935

Fig. 1.

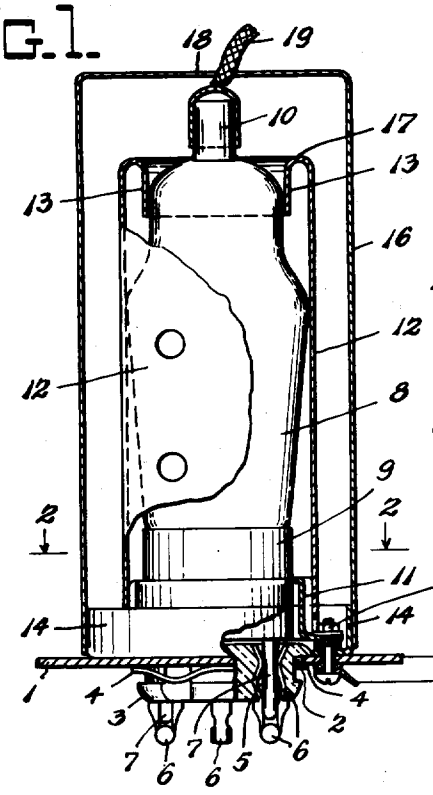


Fig. 2.

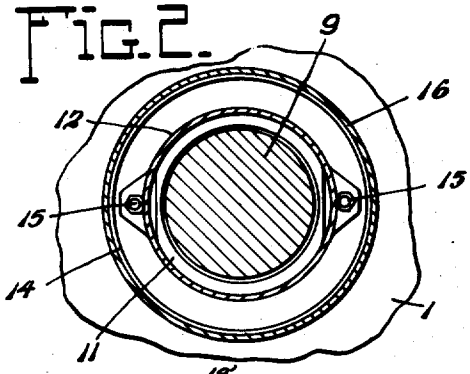


Fig. 4.

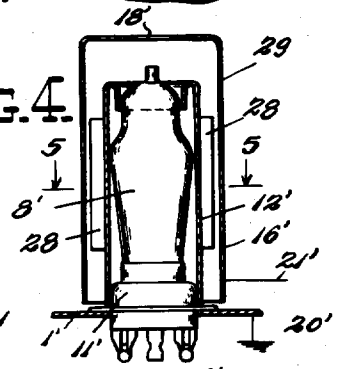
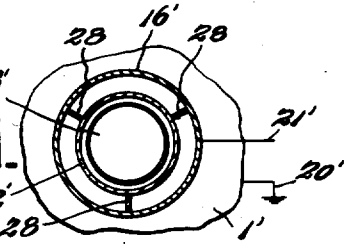


Fig. 5.



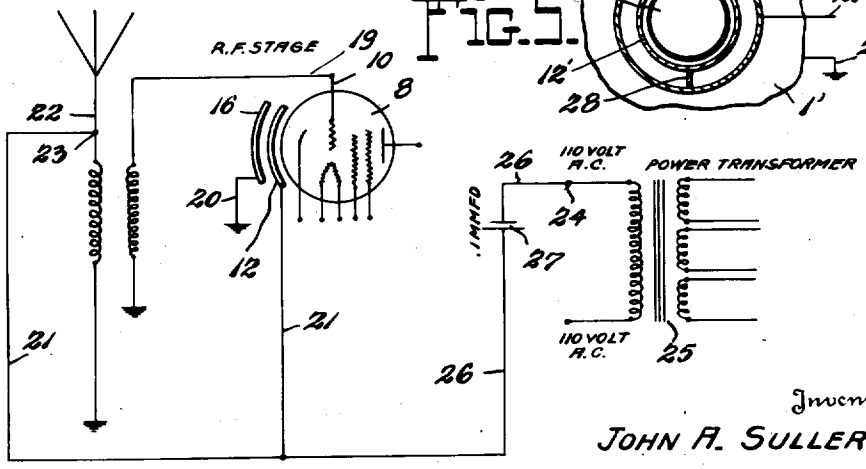


Fig. 3.

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Patented Nov. 5, 1935 2,019,939

UNITED STATES PATENT OFFICE

2,019,939

AMPLIFICATION MEANS

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Application April 17, 1935, Serial No. 16,865

16 Claims. (Cl. 250—20)

Under certain conditions the amplification of signals received by a radio receiver is not sufficient to permit a satisfactory tone reproduction of sufficient volume. Especially in the reception of distant broadcast or short-wave stations, conditions arise frequently where such stations can be heard although the volume with which they are received is not sufficient for satisfactory results. Usually in the reception of distant stations full use has already been made of the amplification available in the receiver, and further amplification of the signals is only possible by the use of additional radio frequency or audio frequency stages.

Such additional stages or units are expensive and quite often difficulties are encountered in interconnecting the same with a certain receiver circuit due to the particular arrangement of the latter.

The addition of such radio frequency or audio frequency stages increases the number of tubes, which, without the necessary precautions, reduce the tone quality of the rectified and amplified signal, in that interfering signals are also amplified in the same proportion. The possibility of tube noises presents another problem, which is increased when a large number of tubes are employed in a radio receiver.

The addition of radio frequency and audio frequency stages as above described increases also the number of circuits of which a receiver system is composed, and this may necessitate the frequent adjustment of trimmers or the like to balance the circuits with respect to each other. The upkeep of such multi-tube receiver systems as mentioned above is considerably expensive, and the current consumption is also a factor to be considered.

It is therefore the object of the present invention to provide a simple and efficient amplification means without the use of additional amplification stages and tubes.

It is known that the stable operation of a screen grid tube at a high gain requires a shielding by metal enclosures. However, the results obtained today may be considerably increased by the employment of a new shielding system for screen grid tubes to thereby step up the amplification of the received signal without the use of additional amplification stages. In carrying out my invention I have found that the gain of a screen grid tube may be considerably increased by the use of a plurality of shields arranged one within the other and by connecting one shield with the signal input of the receiver system and/or the negative A. C. input of the power transformer while the other shield is connected to the ground. By the use of an arrangement as set forth above the high gain capabilities and inter-electrode capacities of a screen grid tube may be used to best advantage, and results are obtained which have never heretofore been accomplished without the addition of further amplification stages.

Other and further objects and advantages of my invention will become apparent from the following description and the accompanying drawing, in which—

Figure 1 illustrates a view of my amplification arrangement, partially in section and partially in elevation.

Figure 2 shows a section of Figure 1 taken on the line 2—2.

Figure 3 illustrates a portion of a wiring diagram of a receiver system, showing more clearly how the amplification means, which are the subject of the present invention, are connected with the respective parts of a receiver system, portions of the system being omitted.

Figure 4 is an illustration of a modified construction.

Figure 5 shows a section taken on the line 5—5 of Figure 4.

Referring now to the drawing, and especially to Figure 1, 1 illustrates a chassis of a radio receiver which is provided with an opening 2 within which a tube socket 3 of the usual construction is mounted. The tube socket 3 is retained on said chassis by means of a resilient retaining means 4 and is also provided with openings 5 and contact members 6 for the reception of prongs 7 of a screen grid tube 8, which comprises the tube base 9 and the control grid terminal 10.

Mounted upon the chassis 1 and insulated therefrom is an inner shield socket 11 adapted to engage and support an inner metal shield or shield can 12 of cylindrical formation, surrounding the screen grid tube 8. The upper flange of the inner shield 12 is bent inwardly and downwardly as shown at 13. The shield can construction 12 may be of any commercial design.

An outer shield socket 14 is mounted upon the chassis 1 surrounding the tube socket 3 and in conductive contact with said chassis. Fastening means 15 are provided for securing the inner shield socket 11 and the outer shield socket 14 to the chassis 1 in the manner previously referred to. The outer shield socket 14 carries the outer shield 16 which surrounds the inner shield 12 and extends considerably above the upper edge 17 of

the inner shield 12 so as to also enclose the control grid terminal 10. The outer shield 16 is provided at its top with an opening 18 for the introduction of the control grid connection 19 for the screen grid tube 8.

The inner shield can 12 and the outer shield 16 are removably carried by their respective sockets so that they may be detached therefrom to permit the removal of the screen grid tube 8 for purposes of testing or replacing the same. The chassis 1 of the receiver is connected to the ground of the receiving system as indicated at 20, while the inner shield 12 is connected by means of the securing means 15 and conductor 21 to the signal input 22 of the radio frequency stage. In other words, the inner shield is connected with the aerial post 23 of the radio frequency stage. The inner shield 12 if desirable may be also connected to one of the A. C. input terminals 24 of a power transformer 25 of a receiving system by means of a conductor 26, clearly shown in Figure 3. If this connection is availed of it is desirable to place a fixed condenser between the A. C. input terminal of the power transformer above referred to and the inner shield at any convenient place, as shown at 27.

It should be understood that the inner shield or shield can may be connected either with the aerial post 23 or with one of the A. C. input terminals of the power transformer; or said shield may be connected to both. In practice it may be determined which connection will give the best results, or if greater amplification can be obtained by connecting the inner shield with the aerial post and the power transformer, this may preferably be done in such case.

Particular attention is called to the fact that the inner shield is in no way conductively connected with the chasis or any other ground connection of the receiving system, while only the outer shield is connected with the receiving system in the above outlined manner. A radio receiving system, of course, is usually provided with a plurality of screen grid tubes, and each of said tubes may be shielded in a manner as outlined above, the respective shields being connected to the signal input of the R. F. stage or one of the A. C. input terminals of the power transformer in the same manner as described in reference to shields 12 and 16. Preferably the tubes in the R. F. stage and in the intermediate frequency stage will be shielded in a manner as stated herein.

However, it has been found that if several tubes are shielded in the manner described, the amplification is so tremendous that it is not advisable to do so if the receiver is not to be used for outside performance or in large assembly halls.

It may be necessary to replace the usual potentiometer of the volume control of the receiving system by a potentiometer with a higher resistance so that better control of the amplification can be effected.

In arranging the shields as heretofore specifically stated in a capacitively spaced relation with respect to each other and the screen grid tube, it has been found that the high gain capabilities and inter-electrode capacities of the screen grid tube can be used to best advantage without destruction of the stable operation of such tubes, which is a result of proper shielding. The shielding for screen grid tubes availed of at the present time consists only of a shield can surrounding the tube and connecting over the chassis to the ground of the receiving system. This shielding, although it gives proper results and prevents oscillation of the tube, does not utilize entirely the high gain capabilities of such type of tubes, and it must be clearly understood that by providing a plurality of shields, one arranged within the other, surrounding the tube and capacitively inter-related to each other and said tube, the gain of a screen tube can be enormously increased, which in turn will produce an amplification of the received signals within the receiving system to an extent which has never heretofore been obtained.

In using the device heretofore described in connection with a regular broadcast receiver, it is possible to get a perfect reception of distant stations without the use of an aerial, and distant stations which could not heretofore be received without the addition of radio frequency or audio frequency stages can be received with sufficient volume.

The same is true with regard to the reception of distant short wave stations which may be brought in with greater volume by the employment of my shielding system, without any undesirable increase in atmospheric or man-made interference.

While the construction disclosed in Figures 1 and 2 is especially adaptable for incorporation into new radio receiving systems, it may be readily attached to present type receivers by using the structure disclosed in Figures 4 and 5. The construction disclosed in these figures is similar to the construction of Figure 1, and comprises an inner shield 12' and an outer shield 16' of substantially the same configurations as the shields 12 and 16 above referred to. However, spacing members 28 of insulating material are provided between the shields 12' and 16' for mounting the outer shield 16' directly upon the inner shield 12'. The spacing members 28 may be pressed between the walls of the respective shield members as clearly seen in Figures 4 and 5, so as to hold them in fixed relation with respect to each other. Any other securing or fastening means may of course be availed of, as will be obvious to those skilled in the art. The inner shield 12' is removably supported by the inner shield socket 11' customarily employed today for the attachment of the usual shield can surrounding screen grid tubes. This connects the inner shield 12' with the chassis 1' and ground 20' while the outer shield 16' is connected by means of a conductor 21' to the aerial post 23 or one of the A. C. input terminals of the power transformer 25, or to both, in the same manner as heretofore described with reference to shield 12 of Figure 1. The shields 12' and 16' which form a shield unit 29 may be readily removed from the tube, as clearly seen from Figure 4, so that the same can be replaced. The outer shield 16' is also provided with an opening 18' for the introduction of the control grid connection for the screen grid tube 8'. The operation of this modified construction is exactly the same as referred to above with respect to the construction shown in Figure 1, the only distinction being that the inner shield is in this instance connected to the ground while the outer shield is connected to the aerial or power transformer in a manner as specified above.

If the modified construction above described is used in connection with a radio receiving system which has not been especially constructed for the adaptation of the same, it may sometimes be necessary that the circuits of the receiving system be re-adjusted, as there is a possibility

that by the use of this adaptor-like shielding system the tuned circuits of the receiver may become out of balance.

It should be noted that the connection 26 is to be considered as a built-in aerial, as will be obvious to those skilled in the art.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is—

1. An amplifying circuit comprising, in combination, an input circuit, a screen grid tube in said input circuit, an aerial connection and a ground connection for said input circuit, a plurality of shield members surrounding said screen grid tube, means connecting one of said shields with the aerial connection, and instrumentalities for connecting the other shield with the ground connection of said input circuit.

2. An amplifying circuit, comprising, in combination, an input circuit, a screen grid tube in the input circuit, an aerial connection and a ground connection for said input circuit, a plurality of capacitively interconnected shield members surrounding said screen grid tube, a conductor for connecting one of said shields with the aerial connection, and a conductor for connecting the other shield with the ground connection of said input circuit.

3. A radio receiving system comprising, in combination, a radio frequency stage, a screen grid tube in said stage, an aerial connection and a ground connection for said stage, a conductive envelope for said screen grid tube conductively connected with said aerial connection, and another conductive envelope surrounding said first conductive envelope and conductively connected with said ground connection.

4. A radio receiving system comprising, in combination, a radio frequency circuit, an aerial and a ground connection for said radio frequency circuit, a screen grid tube in said circuit, a plurality of conductive envelopes capacitively interconnected with respect to each other and said tube, a conductor for connecting one of said envelopes to the aerial connection, and a conductor for connecting the other envelope to the ground connection of said radio frequency circuit.

5. A circuit for the reception of radio signals, comprising, in combination, a screen grid tube, a signal input connection, a ground connection, a plurality of capacitively interconnected shields surrounding said tube, one of said shields being conductively interconnected with said signal input while the other shield is conductively interconnected with said ground connection.

6. A radio receiving system, comprising, in combination, a plurality of inter-related circuits, a plurality of screen grid tubes in some of said circuits, an input connection and a ground connection for said circuits, a plurality of shields capacitively interconnected with at least one of said screen grid tubes and capacitively inter-related with respect to each other, conductive means for connecting at least one shield with the input connection, and a conductor for connecting another of said shields with the ground connection of said circuits.

7. A radio receiving circuit, comprising, in combination, a radio frequency circuit, a screen grid tube in said radio frequency circuit, a signal input and a ground connection for said radio frequency circuit, a plurality of cylindrical shield members arranged one within the other and capacitively spaced with respect to each other, said shield members surrounding said tube, and a conductor connecting one of said shield members with the signal input of said radio frequency circuit, the other of said shield members being conductively connected with the ground connection.

8. A radio receiving system comprising, in combination, a chassis, a plurality of inter-related circuits on said chassis, a plurality of screen grid tubes mounted on said chassis and connected with said circuits, a signal input for said circuits, a ground connection for said circuits and chassis, a shield surrounding at least one of said tubes and insulated from said chassis, a conductor connecting said shield with the signal input, and a shield surrounding said first named shield and mounted on said chassis in conductive contact therewith, said shields being capacitively spaced with respect to each other and said tube.

9. A radio receiving system comprising, in combination, a chassis, a plurality of inter-related circuits on said chassis, a screen grid tube mounted on said chassis and connected with said circuits, a signal input for said circuits, a ground connection for said circuits and chassis, a shield unit comprising an inner and outer shield, spaced with respect to each other, insulation means between said shields for securing the inner and outer shields in fixed relation to each other, a shield socket on the chassis adjacent said tube for supporting the inner shield and for conductively connecting the same to the chassis, and a conductor for connecting the outer shield with the signal input for said circuits.

10. A radio receiving system, comprising, in combination, a chassis, a plurality of inter-related circuits on said chassis, a screen grid tube mounted on said chassis and connected with said circuits, a power transformer for said circuits and tube, a signal input for said circuits, a ground connection for said circuits and chassis, a shield unit comprising an inner and outer shield spaced with respect to each other, insulation means between said shields for securing the inner and outer shields in fixed relation to each other, a shield socket on the chassis adjacent said tube for supporting the inner shield and for conductively connecting the same to the chassis, and a conductor for connecting the outer shield with the power transformer signal input for said circuits.

11. A radio receiving system comprising, in combination, a chassis, a plurality of inter-related circuits on said chassis, a screen grid tube mounted on said chassis and connected with said circuits, a power transformer having input connections, a signal input for said circuits, a ground connection for said circuits and chassis, a shield unit comprising an inner and outer shield spaced with respect to each other, insulation means between said shields for securing the inner and outer shields in fixed relation to each other, a shield socket on the chassis adjacent said tube for supporting the inner shield and for conductively connecting the same to the chassis, and a conductor for connecting the outer shield with one of the A. C. input connections of said power transformer.

12. A radio receiving system comprising, in combination, an input circuit, a screen grid tube in said input circuit, a power transformer in said system and provided with A. C. input connections, an aerial connection and a ground connection for said input circuit, a plurality of shield members surrounding said screen grid tube, means connecting one of said shields with one of the input connections of the power transformer, and

instrumentalities for connecting the other shield with the ground connection of said input circuit.

13. An amplifying system comprising, in combination, an input circuit, a screen grid tube in said input circuit, a power transformer in said system and provided with A. C. input connections, an aerial connection and a ground connection for said input circuit, a plurality of shield members surrounding said screen grid tube, means connecting one of said shields with the aerial connection and with one of the input connections of the power transformer, and instrumentalities for connecting the other shield with the ground connection of said input circuit.

14. A radio receiving system comprising, in combination, a radio frequency circuit, a screen grid tube in said radio frequency circuit, a power transformer in said system and provided with A. C. input connections, an aerial connection and a ground connection for said radio frequency circuit, a plurality of shield members surrounding said screen grid tube, means connecting one of said shields with the aerial connection and with one of the A. C. input connections of the power transformer, and instrumentalities for connecting the other shield with the ground connection of said circuit.

15. A radio receiving system comprising, in combination, a radio frequency circuit, a screen grid tube in said radio frequency circuit, a power transformer in said system provided with A. C. input connections, an aerial connection and a ground connection for said radio frequency circuit, a plurality of shield members surrounding said screen grid tube, means for connecting one of said shields with one of the A. C. input connections of the power transformer, and instrumentalities for connecting the other shield with the ground connection of said circuit.

16. In an amplifying circuit including a screen grid tube having an input circuit and an output circuit, a conductive shield surrounding said screen grid tube and conductively connected with said input circuit, and a second conductive shield disposed in spaced relation to the first mentioned shield and capacitively coupled therewith, said latter coupling including a conductive connection between the second shield and ground.

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