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2,111,397

HIGH FREQUENCY AMPLIFIER

Filed June 24, 1936

2 Sheets-Sheet 1

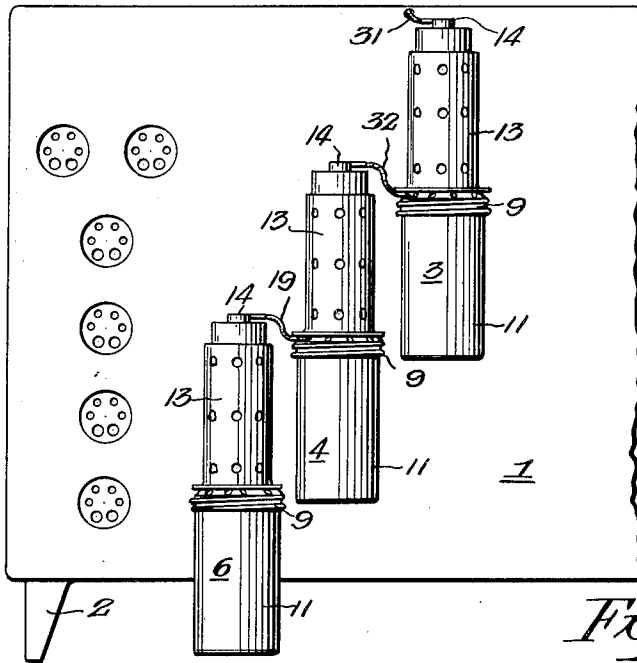


Fig. 1.

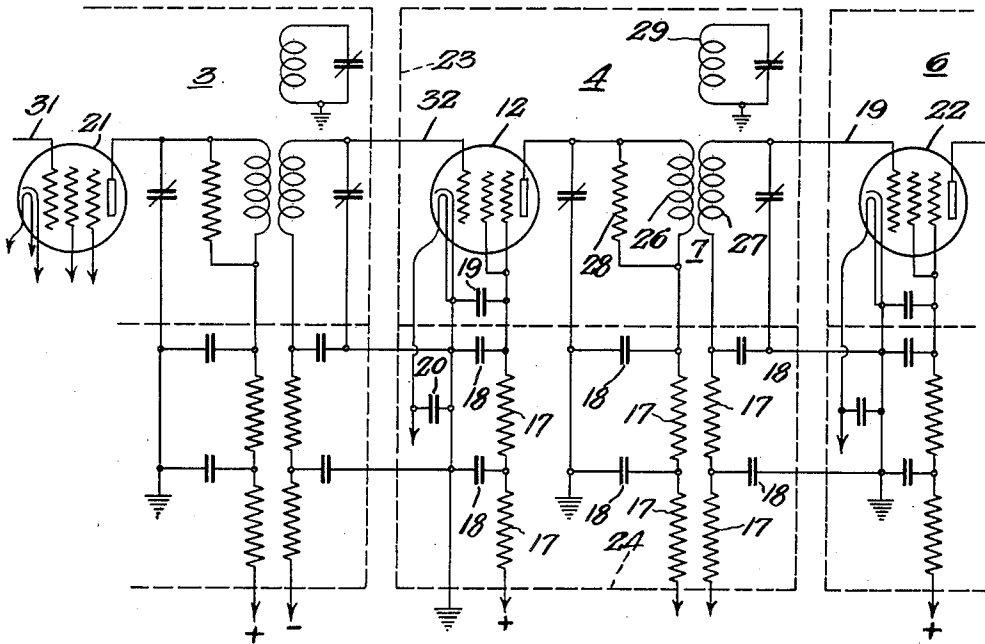


Fig. 2.

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*Fig. 3.*

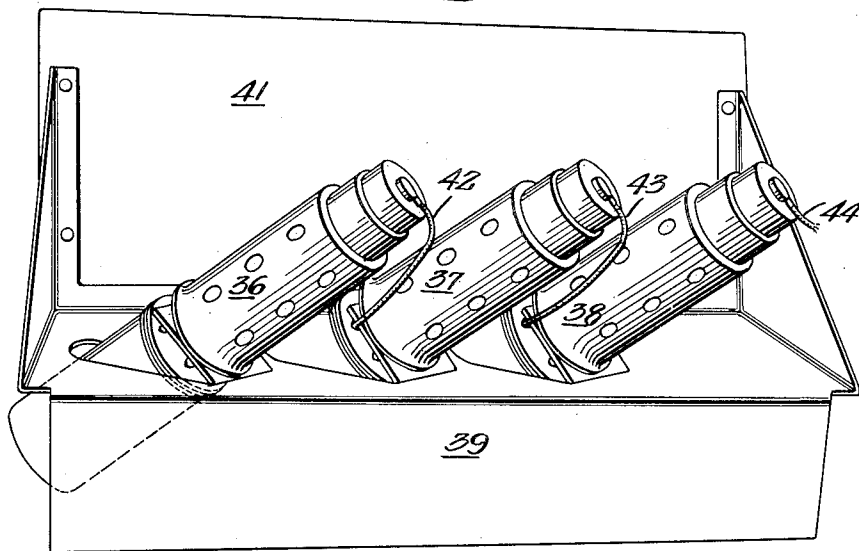
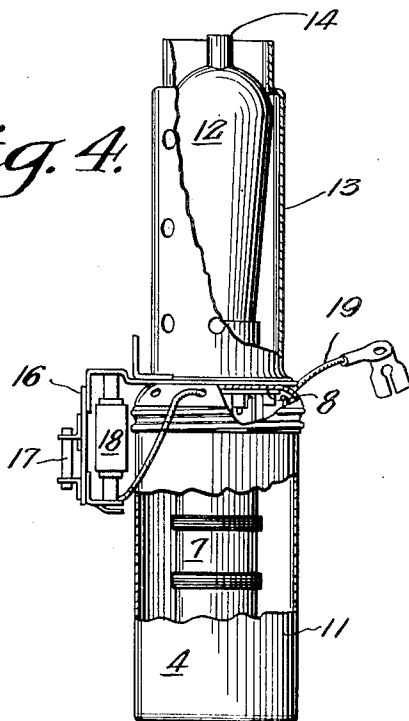


*Fig. 4.*



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## UNITED STATES PATENT OFFICE

2,111,397

## HIGH FREQUENCY AMPLIFIER

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Radio Corporation of America, a corporation  
of Delaware

Application June 24, 1936, Serial No. 86,906

6 Claims. (Cl. 179—171)

My invention relates to high frequency amplifiers and particularly to intermediate frequency amplifiers for short wave receivers such as television receivers.

5 An object of my invention is to provide an improved high frequency amplifier which is stable and efficient in operation.

A further object of my invention is to provide an improved multi-stage amplifier in which the unshielded signal leads are short.

10 In the preferred embodiment of my invention I employ amplifier units of the general type described and claimed in application Serial No. 76,338, filed April 25, 1936, in the name of Loy E. Barton, and assigned to the Radio Corporation of America. Each of these units is a complete unitary amplifier stage comprising a shielded intermediate frequency transformer and a shielded amplifier tube having an electrode terminal at the top of the tube. In accordance with the preferred embodiment of my invention, this electrode terminal is a grid terminal and successive amplifier units are mounted in staggered relationship whereby the grid terminal of the amplifier tube of one amplifier stage is positioned close to the point in the adjacent amplifier stage from which the grid lead extends. Thus the grid lead may be short, and feed-back difficulties and the like are avoided.

30 Other objects, features, an advantages of my invention will appear from the following description taken in connection with the accompanying drawings in which

35 Figure 1 is a view of a portion of a television receiver embodying my invention,

Fig. 2 is a circuit diagram of the amplifier shown in Fig. 1,

Fig. 3 is a view in perspective of a field strength receiver embodying my invention and

40 Fig. 4 is a view showing the construction of the amplifier units illustrated in Fig. 1.

Referring to Fig. 1, my invention is shown applied to an intermediate frequency amplifier in a television receiver in which the chassis is located in a vertical position. The chassis frame and one leg upon which it is supported are indicated at 1 and 2, respectively. Six tube sockets for a portion of the television receiver are shown on the left hand end of the chassis frame.

50 In the particular receiver illustrated, the intermediate frequency amplifier comprises three amplifier stages, these stages consisting of three units, 3, 4 and 5. Each of these units is similar to the amplifier unit described and claimed in the above identified Barton application. As will

be more fully explained later, the amplifier units are mounted on the chassis frame 1 in staggered relation in order to make possible the use of short grid leads.

As illustrated in Fig. 4, where the amplifier unit 4 is shown more in detail, each amplifier unit consists of an intermediate frequency transformer 7 supported from the under-side of a vacuum tube socket 8. The transformer 7 is shielded by means of a threaded shielding cap 9 which is attached to the socket 8 and by means of a shielding can 11 which is held in screw threaded relation with the shielding cap. The amplifier tube is inserted on the upper side of the tube socket as indicated at 12. Unless it is a metal tube or the like which does not require shielding, a suitable shield 13 is provided for shielding the tube.

In each amplifier stage the amplifier tube is of the type which has an electrode terminal at the top of the tube. In the embodiment of the invention which is illustrated, this being a preferred embodiment, this electrode terminal is the control grid terminal of the amplifier tube. In the amplifier stage 4 it is indicated by the reference numeral 14. As will be explained later, this terminal may be the plate terminal of the tube.

The amplifier unit 4 is provided with a resistor and condenser panel 16 upon which the filter resistors 17 and filter condensers 18 of the amplifier stage are mounted.

The grid lead for connecting the amplifier stage 4 to the succeeding amplifier stage 5 is indicated at 19. The circuit connections of the three stage amplifier will now be described with reference to Fig. 2.

Referring to Fig. 2, the three amplifier tubes included in the three amplifier stages 3, 4 and 6 shown in Fig. 1 are illustrated at 21, 12 and 22, respectively. Since all three amplifier stages are alike, only one complete amplifier stage has been shown, this being the stage including the amplifier tube 12. The portion of the amplifier which is shielded is enclosed by the upper dotted rectangle 23. The resistors 17 and condensers 18 which are mounted on the panel 16 are enclosed by the lower dotted rectangle 24. It will be understood that, of all the elements enclosed by the upper rectangle 23, the vacuum tube 12 is the only one which is positioned above the vacuum tube socket, the remaining elements being located underneath the socket and being shielded by the transformer shield 11. Each amplifier stage includes filter resistors 17 and filtering condensers 18 for preventing high frequency signals from feeding back to cause in-

stability of the amplifier. Additional by-pass condensers 19 and 20 are provided for the same purpose.

The intermediate frequency transformer 7 is of conventional design comprising a tuned primary 26 and a tuned secondary 27, the primary being shunted by a resistor 28 in order to broaden the tuning. In the particular amplifier illustrated, each amplifier stage is provided with a trip circuit 29 which is tuned to the intermediate frequency sound signal for the purpose of preventing it from being included in the picture output, this receiver being designed to receive pictures and sound simultaneously on two carrier waves having a suitable frequency spacing.

It will be seen from the circuit diagram that the grid lead of each amplifier stage is the connection from the high voltage end of the transformer secondary to the control grid of the succeeding amplifier tube as indicated at 31, 32 and 19.

Referring again to Fig. 1, each amplifier unit is mounted upon brackets (not shown) extending from the chassis frame. These brackets as well as the resistor and condenser panel 16 of each unit can not be seen on the drawings as they are on the back side of the units. The grid lead of each amplifier unit extends from the high potential end of the transformer secondary through the shielding cap 9. Therefore, it extends from a point positioned at approximately the middle of the unit. By staggering the several amplifier units as illustrated, the point in an amplifier unit from which the grid lead extends is brought close to the grid terminal of the succeeding amplifier whereby a very short grid lead may be employed. This is of great importance in amplifiers which operate at such high frequencies as those employed in television. Longer grid leads in such amplifiers cause instability and loss of gain.

It may be mentioned that in the television receiver from which the portion illustrated in Fig. 1 is taken, the first detector and superheterodyne oscillator (not shown) are mounted on the top of the chassis frame 1 close to the first amplifier 3 whereby the intermediate frequency output of the first detector may be supplied to the first amplifier stage through a short lead. The detector and oscillator have not been illustrated as they do not form part of the present invention.

In Fig. 3 there is illustrated a slightly different embodiment of my invention. In this figure my invention is shown applied to a superheterodyne receiver designed for taking field strength measurements. In order to simplify the drawings only the intermediate frequency amplifier portion of the receiver has been shown. In this receiver, three intermediate frequency amplifier stages 36, 37 and 38, each of the type previously described, are mounted in staggered relation to each other on a horizontal chassis frame 39. Each amplifier unit is supported from a bracket extending from the frame 39, the lower portion of the unit passing through an opening in the frame. Also each unit is mounted at an angle with respect to the horizontal frame and at an angle with respect to the vertical panel 41 of the receiver whereby there is a considerable saving in space. The main feature of this arrangement is that, as in the arrangement illustrated in Fig. 1, the grid leads of the amplifier units are shortened sufficiently to avoid difficulties in the amplifier operation, these grid leads being indicated at 42, 43 and 44.

By employing amplifier tubes in which the

plate terminal, instead of the grid terminal, is located at the top of each amplifier tube, the connections of each amplifier unit may be changed by making the intermediate frequency transformer of each unit the one which precedes the amplifier tube of the same unit. This arrangement, however, is not considered to be as satisfactory as the one illustrated for several reasons, one reason being that either at the beginning or at the end of the intermediate frequency amplifier there will be one transformer which is not contained in a complete amplifier unit.

From the foregoing description it will be apparent that various modifications may be made in my invention without departing from the spirit and scope thereof and I desire therefore that only such limitations shall be imposed thereon as are necessitated by the prior art and set forth in the appended claims.

I claim as my invention:

1. A high frequency amplifier comprising a plurality of amplifier units, each unit comprising an amplifier tube socket, an amplifier tube positioned therein, and a transformer mounted in unitary relation with said socket to form an integral amplifier stage, each of said units having means for shielding it from the other units, and a short signal lead from said transformer extending from a point near the base of said tube, said tube being of the type having an electrode terminal on the top thereof, said units including said shielding means being mounted in staggered relation with said point from which the short lead extends adjacent to the said electrode terminal of the tube in a next adjacent amplifier unit.

2. A high frequency amplifier comprising a plurality of amplifier units, each unit comprising an amplifier tube and a transformer mounted underneath said tube, each of said units having means for shielding it from the other units, and a short signal lead from said transformer extending from a point near the base of said tube, said tube being of the type having an electrode terminal on the top thereof, said units including said shielding means being mounted in staggered relation with said point from which the short lead extends adjacent to the said electrode terminal of the tube in a next adjacent amplifier unit.

3. A high frequency amplifier comprising a plurality of amplifier units, each unit comprising an amplifier tube and a transformer mounted underneath said tube, each of said units having means for shielding it from the other units, a short output lead from said transformer extending from a point near the base of said tube, said tube being of the type having a grid terminal on the top thereof, and means for mounting said units including said shielding means in staggered relation with said point from which the output lead extends adjacent to the grid terminal of the next succeeding amplifier unit whereby said short lead may be connected to said next adjacent grid terminal.

4. An amplifier comprising a plurality of amplifier units, each unit comprising an amplifier tube and an intermediate frequency transformer mounted underneath said tube to form a unitary structure, a shield for said transformer, a short signal lead from said transformer extending from a point near the base of said tube, said tube being of the type having an electrode terminal on the top thereof, said units including said shields being mounted in staggered relation with said point from which the short lead extends adjacent

to the said electrode terminal of the tube in a next adjacent amplifier unit.

5 5. An amplifier comprising a plurality of amplifier stages, each stage comprising a unitary structure including an amplifier tube socket for an amplifier tube of the type having a grid terminal at the top thereof and a transformer mounted underneath said socket and supported therefrom, said unitary structure including a shield for said transformer, said transformer having a primary connected to the output circuit of said tube and a secondary having output connections including a short grid lead, said amplifier stages being mounted in staggered relation with the grid terminal of one amplifier unit being positioned close to the tube socket of the next preceding amplifier unit.

10 6. A high frequency amplifier comprising a plurality of amplifier stages, each stage comprising

ing an amplifier tube socket, an amplifier tube in said socket, said tube being of the type having a control grid connected to a terminal on the top thereof, an intermediate frequency transformer mounted on the side of said socket opposite said tube, said transformer having a primary and a secondary, a shield for said transformer, said transformer primary being connected to the plate circuit of said tube, a short grid lead extending from said secondary through said transformer shield, said amplifier stages including said shields being mounted in staggered relation with respect to each other whereby the grid terminal of one tube is adjacent to the grid lead of an adjacent amplifier stage, the grid lead of each amplifier stage being connected to the grid terminal of the succeeding and next adjacent amplifier stage.

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