July 28, 1931. H. S. BAIRD 1,816,461

SHORT WAVE RECEPTION

Filed April 30, 1929

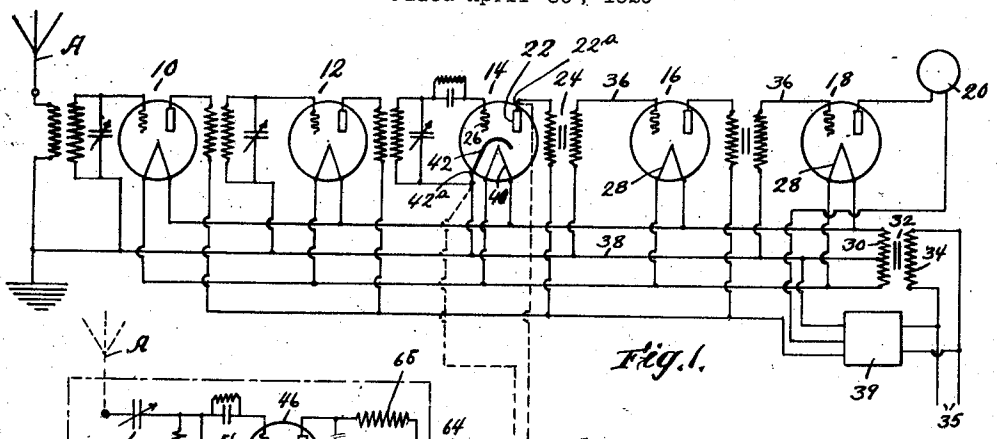
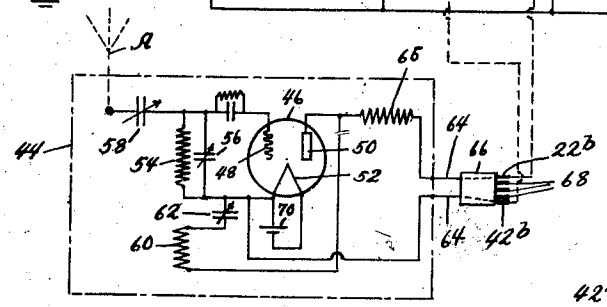


Fig. 1.



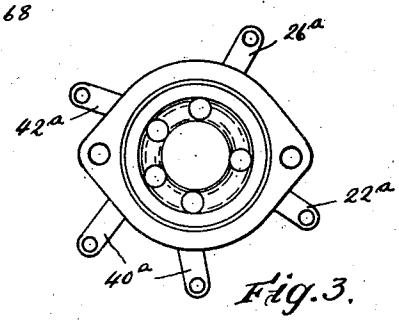


Fig. 3.

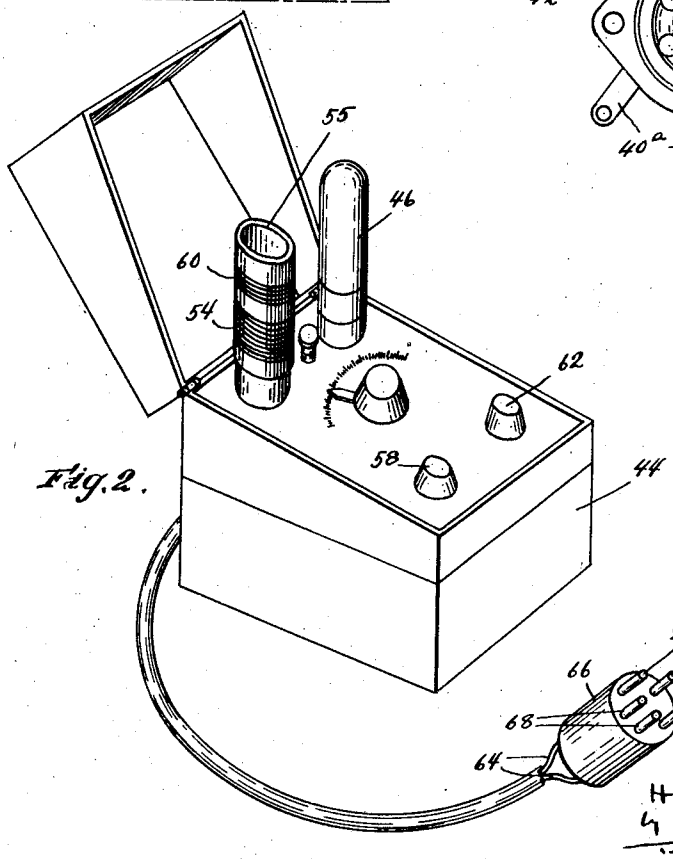


Fig. 2.

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UNITED STATES PATENT OFFICE

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SHORT WAVE RECEPTION

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This invention relates to apparatus and systems for the reception of radio signals and has particular relation to the reception of short wave signals.

It is well known that the tuning range of a radio receiving apparatus is limited to a certain band or range of wave lengths and can not effectively receive signals that are outside its band without a change of tuning apparatus, as inductances or condensers. A receiver designed to operate on the so-called broadcast band or on waves of between 200 and 550 meters cannot receive signals which are transmitted on much shorter wave lengths as, for instance, 20 or 40 meters. I have provided an arrangement whereby the usual receiver may be adapted for the reception of signals, and especially short wave signals that are outside its normal operating range. To this end, I provide a short wave adaptor set having a detector tube and tuning apparatus for the short waves, with a terminal plug adapted removably to enter the detector tube socket of the long wave receiver and connect the output of the adaptor set with the source of plate supply and the audio frequency amplyfying stage of the long wave set. In this manner, the broadcasting receiver may be arranged for the reception of signal transmitted on the shorter waves without any other changes than the removal of the detector tube of the long wave receiver and the insertion of the adapter plug in the detector tube socket.

It is common to heat the cathodes or filaments of the tubes of receiving apparatus by alternating current supplied directly from a step-down transformer energized from the alternating current lighting mains. This method is quite satisfactory for the reception of signals within or above the present broadcast band of wave lengths. I have found, however, that when it is attempted to heat the cathode of the detector tube of the short wave adaptor set from the same source of alternating current that supplies the broadcasting receiver, the alternating current produces such a loud audio frequency note as seriously to interfere with the intelligible reception of signals on the shorter waves. It is therefore an object of the present invention to provide a short wave adaptor set or converter for broadcast or long wave receivers wherein the anode circuit of the detector tube of the short wave adaptor set is supplied with power from the corresponding power source of the long wave set and wherein the cathode of the detector tube is energized by a direct current source of power as a battery that is an inherent part of the adaptor set and is entirely independent of the source of filament or cathode heating of the long wave receiver.

A further object of the invention is the combination of a multi-tube long wave receiver having its cathodes heated from a source of alternating current and a short wave receiver connected removably into a portion of the long wave receiver and having the cathode of its detector tube heated by a source of direct current and its anode circuit energized by the anode power for the long wave receiver.

A further object of the invention is generally to improve the construction and operation of apparatus adapted for the reception of signals on short waves.

Fig. 1 is a diagrammatic and simplified representation of a radio receiver adapted for operation on long waves combined with a short wave adaptor therefor arranged in accordance with the present invention.

Fig. 2 is a perspective view of the short wave adaptor set having the short wave circuit of Fig. 1.

Fig. 3 is a plan view of the detector tube socket of the long wave receiver of Fig. 1.

The long wave receiver illustrated diagrammatically in Fig. 1, which is adapted to receive over the broadcasting band of wave lengths, is of a more or less conventional type and includes the two radio frequency amplifying stages 10 and 12, the detector stage 14, and the two audio frequency amplifying steps 16 and 18, the output circuit of the last stage of which operates a load device 20 which may be a loud speaker or the like. A collection agency as the antenna A is coupled with the input circuit of the first stage. The anode or plate 22 of the detector tube is coupled through a suitable audio frequency translating device as the transformer 24 with

the grid of the next succeeding stage as is more or less usual practice. The grid 26 of the detector tube is energized from the plate or output circuit of the proceeding radio frequency stage as is also usual practice.

The filaments or cathodes 28 of the amplifying stages are supplied with alternating current by the low tension winding 30 of a step-down transformer 32 the primary 34 of which is connected to the higher tension alternating current mains 35. The grid circuits 36 of said amplifying tubes are connected by means of a conductor 38 with a mid-point of said low tension primary winding or a point of invariable potential, whereby to minimize the effect of the alternating current in the filaments in the output circuits of the tubes. The anodes of the tubes are supplied with a high tension direct current by a suitable source 39 which is energized from the high tension alternating current mains 35.

The detector tube is provided with a heater 40 which heats a cathode 42, the heat storage capacity of which is sufficient to maintain a reasonably uniform rate of ion emission so that the alternations of current in the heating circuit do not have an unduly pronounced effect in the output circuit when the receiver is operating on long waves. As has been stated above, however, this type of tube is unsatisfactory for the reception of shorter waves, because of the magnification of the effect of the fluctuations in temperature of the cathodes, when the tube is used as a detector for short wave signals.

The short wave adaptor, which is used to enable the long wave receiver above described to receive signals transmitted on shorter waves as on 20 and 40 meters, is separate from the long wave receiver and is contained in a separate case 44, see Fig. 2.

The short wave adaptor includes a detector tube 46 having the grid 48, the anode or plate 50 and the filaments 52, which, preferably, has a low power consumption. The grid circuit of the tube includes a fixed inductance 54 and a tuning condenser 56. The grid circuit is connected to the antenna A of the long wave receiver by a coupling condenser 58. The circuit here shown is of the regenerative type and includes a fixed feed back winding 60 which is in inductive relation with the inductance 54 and is carried on the same form 55 therewith and is provided with a regeneration control condenser 62 in series therewith to control regeneration and volume of the signal in the audio frequency output circuit 64 of the tube. The output circuit 64 includes two conductors, one extending from the plate 50 and the other from the filament 52. The plate condenser has a choke coil 65 therein by which to keep the high frequency current out of the audio frequency circuit. The type of tuning and regeneration circuits is of no particular consequence so far as this invention is concerned although the circuit herein shown works excellently in practice. The conductors of the output circuit 64 are flexible and terminate in a plug 66 where they are connected to prongs 22*b* and 42*b*, respectively. The plug is also provided with other prongs 68 which are not connected with any circuit but which are for the purpose of centering the plug and holding it in the socket of the detector tube of the long wave receiver.

The detector tube socket of the long wave receiver is illustrated in Fig. 4 and has the grid and plate terminals 26*a* and 22*a* respectively, the cathode terminal 42*a* and the heater terminals 40*a* with which the corresponding elements of the detector tube of the long wave receiver are adapted to be connected when the tube is in the socket. In the use of the short wave adaptor, the detector tube is adapted to be removed and replaced by the plug 66. The prongs 22*b* and 42*b* of the plug are adapted to engage the terminals 22*a* and 42*a* of the socket whereby to be connected with the plate and cathode circuits respectively of the detector, thereby to be energized from the anode power source 39 of the long wave receiver and to feed the audio frequency signals received by the detector set into the audio frequency stages of the long wave receiver.

In accordance with this invention, the short wave detector tube 46 has its filament supplied by a self-contained direct current source of power 70 that is located in a lower portion of the enclosing case 44 of Fig. 2. Thus, the filament 52 of the short wave detector tube is entirely independent from the alternating current source of energy for the tubes of the long wave receiver and consequently the signal from the adaptor is free from any alternating current hum. The long wave receiver can thus deliver a clear signal that is transmitted on a short wave.

I claim:

1. The combination of a long wave multistage radio receiver having a plurality of tubes and a source of alternating current power for heating the cathodes of said tubes, and a short wave adapter for said long wave receiver having a detector tube, an input circuit tuneable to the short waves, an output circuit having a detachable connection with an intermediate stage of said long wave receiver and having a direct current source of power for heating the cathode of said detector tube independently of the source of alternating current power.

2. The combination of a long wave radio receiver having a plurality of amplifying stages and a detector stage having plate and cathode circuits, each stage having a thermionic tube associated therewith, a source of alternating current power for heating the cathode of said tubes, a short wave adaptor

for said receiver having a detector tube, an input circuit tuneable to the short waves and an output circuit having detachable connections with the plate and cathode circuits of said detector stage, the cathode of said adaptor detector having a source of direct current power for heating it that is independent of the source of alternating current of said long wave receiver.

3. The combination of a long wave radio receiver having amplifying and detector stages including plate and cathode circuits, and thermionic tubes for said stages, said detector stage having a tube socket that has plate and cathode terminals engaged by the corresponding terminals of said detector tube and connected with the plate and cathode circuits of said stage, a source of alternating current power for heating the cathodes of said tubes, a short wave adaptor including a detector tube having an input circuit tuneable to the short waves and having output and cathode conductors connected respectively to the plate and to the cathode of said detector tube, a plug having prongs connected to said conductors adapted to be received in the detector tube socket of said long wave receiver and to engage respectively the plate and cathode terminals of said sockets, and a source of direct current power for heating the cathode of said adaptor detector tube, said source of direct current power being connected directly to the cathode of said detector tube and being independent of the source of alternating current of said long wave receiver and also independent of said output and cathode conductors.

4. In a long wave radio receiver having a thermionic detector tube the cathode of which is heated by alternating current, the method of adapting said receiver for the reception of short wave signals which consists in providing a separate detector tube, supplying the input circuit of said separate detector tube with a tuned short wave signal, heating the cathode of said tube by direct current, and feeding the output of said tube into the output of the detector tube of the long wave receiver.

5. The combination of a long wave multistage radio receiver having a plurality of amplifying and detector tubes, a source of alternating current for heating the cathodes of said tubes, a source of high tension direct current power for supplying the anodes of said tubes, and a short wave adaptor for said long wave receiver having a detector tube, an input circuit therefor tuneable to the short waves, means for connecting the cathode and anode of said short wave detector tube removably with the cathode and anode circuits of said long wave detector tube, whereby also to connect the anode of said short wave detector tube with said source of high tension direct current power, and a source of low tension direct current for heating the cathode of said short wave detector tube, which source is independent of said source of alternating current of said long wave receiver.

In testimony whereof, I have signed my name to this specification.

HOLLIS S. BAIRD.