March 29, 1932. E. T. FLEWELLING 1,851,354

SHORT WAVE ADAPTER

Filed Oct. 15, 1928 2 Sheets-Sheet 1

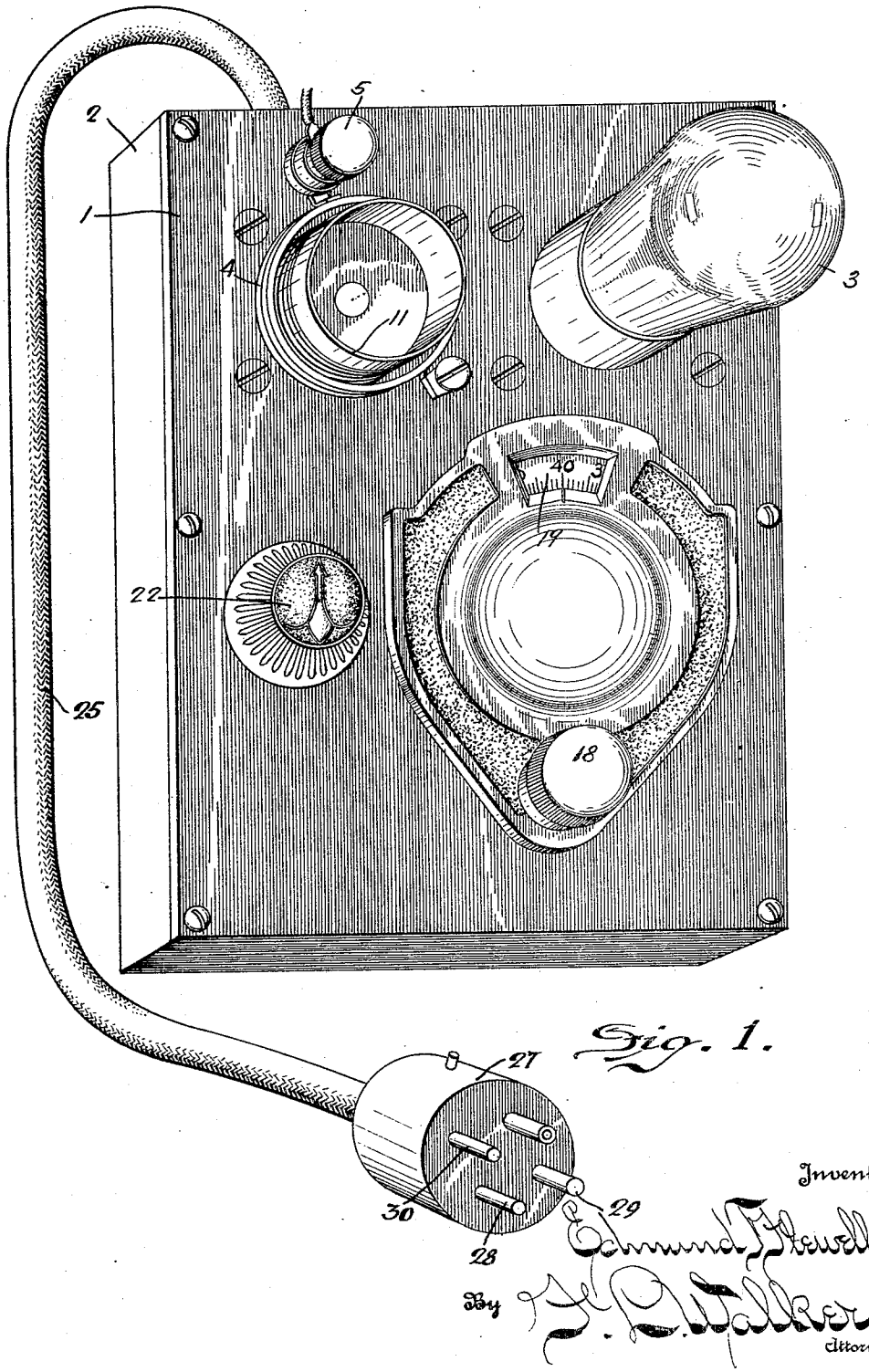


Fig. 1.

Inventor

Edmund T. Flewelling

By H. D. Walker

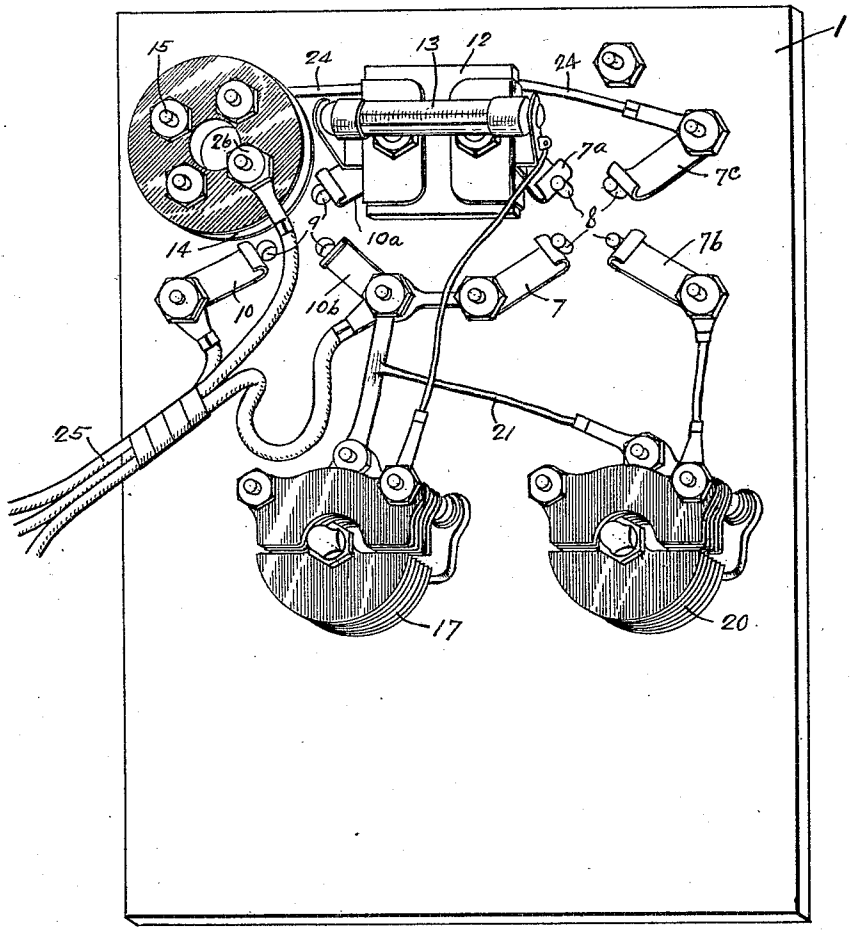
Attorney

March 29, 1932. E. T. FLEWELLING 1,851,354

SHORT WAVE ADAPTER

Filed Oct. 15, 1928 2 Sheets-Sheet 2

Fig. 2.



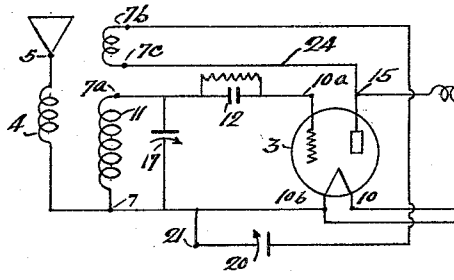


Fig. 3.

Inventor

Edmund T. Flewelling

By P. C. Wallace

Attorney

Patented Mar. 29, 1932 1,851,354

UNITED STATES PATENT OFFICE

EDMUND T. FLEWELLING, OF DAYTON, OHIO

SHORT WAVE ADAPTER

Application filed October 15, 1928. Serial No. 312,623.

My invention relates to radio receiving apparatus, and more particularly to an auxiliary short wave receiving apparatus for use with the usual broadcast receiving set, whereby short wave transmission may be received and amplified without unnecessary duplication of parts and apparatus.

Short wave or high frequency reception, that is impulses from three thousand to thirty thousand kilocycles, involves problems of operation and control which are not encountered in reception within the established broadcast band. Such short wave or high frequency receiving apparatus is subject to the influence of external masses and particularly body capacity of the operator to a much greater degree than receiver sets operating within the usual broadcast frequencies of from six hundred to fifteen hundred kilocycles.

The present apparatus is designed to overcome such difficulties without the necessity of metal shielding, by the relative disposition and methods of interconnection of the various parts, and by location of the control element in such position that the operator's hand will be outside the electrical field of super-sensitive elements or in such position as to minimize the effect of body capacity.

The short wave receiver, forming the subject matter hereof, comprises a one tube regenerative circuit fitted with a connecting cable enabling it to be "plugged" into a standard tube socket of an ordinary broadcast receiver from which current will be supplied at the necessary voltages for the operation of the short wave apparatus, known as an "adapter". When connected into the detector socket of a broadcast receiver, the audio amplifying circuits of such receiver are employed in conjunction with the short wave adapter to afford a complete short wave receiver of good operative characteristics. By connecting the short wave adapter into the first radio frequency tube socket of a radio frequency amplifying receiver and allowing the short wave adapter tube to oscillate at a frequency equal to that of the signal desired plus or minus the frequency to which the broadcast receiver is tuned, the broadcast receiver is converted into a short wave heterodyne type of receiver.

The object of the invention is to simplify the construction as well as the means and mode of operation of high frequency or short wave radio receiving sets whereby they will not only be cheapened in construction, but will be more efficient in operation, of good operating characteristics, uniform in action, easily controlled, and unlikely to get out of order.

A further and important object of the invention is to provide means by which an ordinary broadcast receiving set may be converted into a high frequency or short wave receiver at minimum cost and without disturbance or rearrangement of the circuit or other parts.

A further and quite important feature of the invention is to provide a simple and inexpensive form of high frequency or short wave receiver in which the undesirable influences of extraneous masses and body and hand capacity is minimized and wherein the component parts are disposed in a well balanced assembly which a novice is able to use with comparative ease of operation.

With the above primary and other incidental objects in view, as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof, and the mode of operation or their equivalents, as hereinafter described and set forth in the claims.

Referring to the accompanying drawings wherein is shown the preferred but obviously not necessarily the only form of embodiment of the invention, Fig. 1 is a perspective view of the assembled short wave radio receiver set. Fig. 2 is a perspective view of the under side of the panel upon which are mounted the operating parts. Fig. 3 is a diagrammatic view of the short wave adapter circuit, illustrating its association with a standard broadcast receiver set.

Like parts are indicated by similar characters of reference throughout the several views.

In the original drawings, the short wave adapter set has been illustrated substantially

full size. The operating parts are entirely supported upon a panel 1 with the inductances or coils and vacuum tube exposed on top of such panel, while the remaining parts are supported on the under side of the panel and are enclosed and protected within a shallow housing or box 2 of which the panel 1 forms the top. Located adjacent to the top margin of the panel 1 and positioned side by side, is the vacuum tube or thermionic valve 3 and the coils or inductances. These consist of a permanently mounted primary coil 4 consisting of a few turns of wire, usually three or four turns, one end of which is permanently connected with the aerial binding post 5, while the opposite end of such primary coil is connected with a contact arm 7 on the under side of the panel 1, which arm is common to both the secondary winding and tickler winding, being connected to the latter through a regeneration control condenser.

The secondary and tickler windings are of the "plug-in" type. For convenience and economy of manufacture, and interchangeability with other coils having different numbers of turns, the secondary and tickler inductances or coils are mounted upon a form having standard tube base prongs, for engagement in a standard tube mounting. In the present instance this mounting consists of a group of spaced holes through which the prongs 8 of the coil mounting may be projected into engagement with corresponding contact arms of which 7 is one. The mounting for the tube 3 is preferably of the same form, that is, it comprises a group of holes 9 in the panel 1 through which the tube base contact prongs are projected into engagement with correspondingly located arms 10 secured to the under side of the panel. The secondary and tickler inductance windings upon the coil mounting 11 have their number of turns proportioned in accordance with the wave band or frequency band to be received. In practice, a series of interchangeable inductance units, each having secondary and tickler windings of different capacities are interchangeably employed. Interposed between the inductance coil mounting and the tube mounting is a grid condenser 12 upon which is supported the usual grid leak 13. This grid condenser and grid leak 12—13 are directly connected with the grid contact arm 10*a* of the tube mounting at one side and correspondingly directly connected with the contact arm 7*a* of the inductance mounting at the opposite side. The inductance coil and tube are so located that the interconnection between the contact arms 7*a* and 10*a* may be made solely by the condenser and grid leak unit 12—13 without the necessity of intervening wire connection.

A choke coil 14 in the plate circuit of the tube 3 is located immediately below the tube mounting. One of the supporting studs 15 for such choke coil, may afford a direct connection with the plate contact arm of the tube mounting which is concealed beneath the choke coil 14. In practice, this choke coil consists of approximately one hundred and twenty-five turns of #30 wire wound "random" on an inch and a quarter form. These dimensions and number of turns, as well as those of the primary coil 4 are given merely for illustrative purposes and convenience of those who may have occasion to construct this device, and not with any intention of limiting the invention to any specific winding or relative proportion of inductances which obviously may be varied in accordance with the wave band or group of radio frequencies to be received. By the assembly thus far described, the super-sensitive elements of the set are closely connected in group relation adjacent to one end of the panel, and comparatively distantly located from the manually operable control devices.

The control of the set is effected by means of two variable condensers of approximately 50 m. m. f. capacity. The condenser 17 is the primary or tuning condenser, one side of which, preferably the rotor side, is connected with the A minus or negative contact arm 10*b* of the tube mounting, while the opposite side, preferably the stator side, is connected with the contact arm 7*a* pertaining to the secondary inductance, which is also common to one side of the condenser and grid leak unit 12—13. This condenser 17 is controlled by an adjusting knob 18 located on the exterior side of the panel 1 which simultaneously controls a dial 19 to indicate the relative adjustment of the condenser. It will be noted that the control knob 18 is located in proximate relation with the lower marginal edge of the panel 1 in distantly spaced relation with the group of super-sensitive elements assembled adjacent to the top margin of the panel and also in offset relation with the tuning condenser. By such arrangement the operator's hand is removed as far distant as possible from the elements subject to influence of body or hand capacity. The location of the adjusting knob 18 is such that the operator's hand is most conveniently positioned beyond the limit of the receiver set with only his fingers overhanging the panel. Further when grasping the knob 18 the operator's fingers are as distantly removed from the tuning condenser 17 and from the assembly at the opposite end of the panel, as is convenient or practicable.

Regeneration is controlled by a second condenser 20, one side, preferably the rotor side, of which is also connected with the negative or A minus contact arm 10*b* of the tube mounting by the connection 21 which also connects it with the primary or tuning condenser 17. The opposite side of the regeneration control condenser 20, which is preferably the

stator side, is connected with the contact arm 7b of the inductance mounting, which comprises one terminal of the tickler coil. The opposite terminal of the tickler winding with which the contact arm 7c makes engagement, is connected from such contact arm 7c through the connection 24 with the connection 15 of the choke coil 14 which is also directly connected with the plate terminal of the tube 3.

A three conductor cable 25 connects with the contact arms 10 and 10b comprising the filament plus and negative of the tube 3, while the third conductor leads to the terminal 26 of the choke coil 14 and forms a part of the plate circuit. The opposite end of the conductor cable 25 is connected with a plug 27 having contact prongs agreeing with those of a standard tube base, and adaptable to be plugged into any standard tube socket. The filament positive and negative conductors are connected with the corresponding prongs 28 and 29 of the plug 27, while the plate circuit conductor is connected with the usual plate contact prong 30 of such plug. By this arrangement, when the plug 27 is inserted in any standard tube socket of a broadcast receiving set, current is supplied through the contact prongs 28 and 29 to the filament of the tube 3 of the short wave adapter, while the plate of such tube is interconnected through the choke coil 14 with the plate circuit of such broadcast receiver set.

When the plug 27 is inserted into the detector socket of any standard broadcast radio receiver, the short wave adapter hereinbefore described will operate as a detector for receiving high frequency or short wave signals. It will utilize the audio frejuency amplification system of the broadcast receiver, and will afford a complete short wave radio receiver of very good operating characteristics. In such case, the radio frequency and detector portions of the broadcast receiver set being unused, such set is not tuned, but all tuning is effected by adjustment of the condenser 17 by means of the knob 18, the variations being indicated by the dial 19, of the short wave adapter set. Regeneration is controlled by the condenser 20, which upon the face of the panel 1 is provided with an adjusting knob 22. It is to be noted that the knob 22 for controlling the regeneration condenser 20, like the control knob 18, is located in proximate relation with the margin of the panel 1, so that in convenient operating position the operator's hand does not overhang the panel, but is rather offset to one side with only the operator's fingers positioned above the panel to grasp the knob 22. This arrangement of the knobs 18 and 22 keeps the operator's hand as far removed as practicable from the field of not only the condensers 17 and 20 but also the assembly near the top margin of the panel.

In lieu of connecting the adapter set into the detector socket of the broadcast receiver set, the short wave adapter connection plug 27 may be inserted into the socket of the first radio frequency tube of the broadcast receiver set. In such case the short wave adapter tube 3 is allowed to oscillate at a frequency equal to the signal desired plus or minus the frequency to which the broadcast receiver set is tuned. In such arrangement the short wave adapter acts as an autodyne detector, and the receiver set serves as an intermediate radio frequency amplifier, a second detector and audio amplifier, thus forming in combination a super-heterodyne type of receiver. In the event that a super-heterodyne broadcast receiver is employed in conjunction with this short wave adapter, the plug 27 is inserted into the first detector socket of such super-heterodyne receiver, and the operation is as before described. It is thus possible by use the short wave adapter set heretofore described to convert any type of receiver into a received for high frequency or short wave signals, utilizing the short wave adapter set heretofore described as the first tuned or detector tube, utilizing the broadcast receiver set for amplifying the short wave signals received.

The interconnection between the component parts of the short wave adapter set are either directly made as in the case of the condenser-grid leak unit 12—13 with the inductance and tube mounting, and the choke coil 14 with the plate connection of the tube mounting, or all such connections are made as short as possible with the use of wire as small as possible in order to reduce to a minimum the surface area. The component parts are designed to perform their various functions, but at the same time their surface areas are reduced to minimum, and likewise the "live side", that is the side at radio frequency potential, disposed as far away from the operating or control knobs as is possible, and also presenting such live or radio frequency potential side of the element as close as possible to the parts to which it is connected in order to reduce the length of connecting wire. The various parts including the coils are small and compact in order to reduce, so far as possible, their external field. While the circuit of the short wave receiver is not a new circuit per se, and while in construction standard commercial parts and accessories are employed, by careful and scientific design in the assembly and association of parts and their mountings, there has been produced a short wave receiver capable of operation in conjunction with a standard broadcast receiving set which will operate successfully under ordinary conditions and does not possess the peculiar, erratic and undesirable characteristics of an ordinary short wave receiver set operating under such conditions.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific details shown, but that the means and construction herein disclosed comprise the preferred form of several modes of putting the invention into effect and the invention is, therefore, claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. In a radio receiver, a short wave adapter for interconnection with a broadcast receiver, including a mounting panel, a vacuum detector tube mounted exteriorly adjacent to one end of said panel, a removable inductance unit containing secondary and tickler coils also mounted exteriorly of the panel in closely spaced relation with the vacuum tube, a condenser grid leak unit mounted upon the reverse side of the panel in closely connected relation intermediate the tube and inductance mountings, a choke coil located in intimate relation with the tube mounting, whereby said elements form a closely associated group, a tuning condenser and a regeneration control condenser located on the reverse side of the panel in distantly spaced relation with said group of elements, and control knobs for said condensers located on the face of the panel in closely spaced relation with the margin of the panel whereby the operator's hands, when operating such knobs, will be positioned beyond the limit of the set with only his fingers overhanging the panel.

2. In a radio receiver, a short wave adapter for detachable interconnection with a standard broadcast receiver set, including a mounting panel, a detachable inductance unit mounted thereon, a primary inductance coil permanently mounted on said panel surrounding the removable inductance unit, any one of a series of interchangeable inductance units being interchangeably engageable within the permanently positioned primary coil, a vacuum detector tube and a condenser grid leak unit, said parts being assembled in closely grouped relation, and control means therefor positioned in closely spaced relation with the margin of the panel whereby the operator's hand will be positioned beyond the limit of the adapter with only his fingers overhanging the adapter when operating such control.

3. In a radio receiver, a short wave adapter for detachable interconnection with a standard broadcast receiver set, a mounting panel, an inductance unit and a vacuum detector tube mounted side by side adjacent to one end of the panel, a pair of control condensers mounted side by side in spaced relation with the inductance unit and vacuum tube, a control knob for one condenser located in closely spaced relation with one margin of the panel, a control knob for the other condenser located in offset relation with the condenser, and in closely spaced relation with another margin of the panel.

4. A short wave radio receiver, including a mounting panel having two groups of spaced holes therein agreeing with the positions of the contact prongs of a standard vacuum tube base, contact arms secured to the reverse side of the panel in overlapping relation with the holes, a vacuum tube engageable in one set of holes the prongs of which contact with the corresponding arms, an interchangeable plug-in inductance unit having secondary and tickler windings and contact prongs corresponding with those of a standard vacuum tube engageable in the holes of the other group with its prongs contacting the corresponding contact arms, an intermediately positioned condenser grid leak unit having direct contact connection with the tube grid contact arm and with a secondary winding inductance contact arm, a primary inductance coil permanently mounted upon the panel in concentric relation with the interchangeable inductance unit and fixedly connected at one end with the contact arm pertaining to the secondary winding of the inductance unit and at its opposite end with an antenna connection, a circuit in which said inductance unit and vacuum tube contacts are included and tuning means for said circuit mounted on said panel.

5. In a short wave radio receiver, a panel, a tube mounting including contacts engageable with the contact prongs; of a vacuum tube base on the under side of said panel, an inductance mounting including contacts engageable with contact prongs upon a removable inductance unit on the under side of said panel in closely spaced relation with the tube mounting contacts, the panel having openings therein through which a vacuum tube and an inductance are detachably engageable with said contact prongs, a grid-leak condenser mounting directly connected with the grid contact of the tube mounting and likewise directly connected with one of the contacts of the inductance unit mounting, a tuning condenser bridging two of the inductance mounting contacts and simultaneously bridging two of the tube mounting contacts through the grid-leak condenser mounting, a regeneration control condenser bridging two of the inductance

mounting contacts including one of the contacts with which the tuning condenser is connected, a choke coil supported upon the tube mounting, and a plug-in multi-cable connection for supplying filament and plate current to the tube mounting contacts.

6. In a radio short wave adapter, the combination with tuning means and current supply means, of a vacuum tube mounting and a mounting for a detachable inductance unit, each including a plurality of contacts, and a choke coil directly connected to and supported by one of the vacuum tube contact connections.

7. In a radio short wave adapter, the combination with tuning means and current supply means, of a vacuum tube mounting and a mounting for a detachable inductance unit each including a group of contact elements, said mountings being located in closely spaced relation, and a grid-leak condenser unit interposed between said tube and inductance mountings and having direct bridging connection with a contact element of each mounting.

8. In a radio short wave adapter, the combination with tuning means and current supply means, of a vacuum tube mounting and a mounting for a detachable inductance unit, each including a group of contact elements engageable with contact prongs upon the tube base and inductance unit; a grid-leak condenser unit interconnecting a contact of each mounting, and a choke coil supported upon a contact of the vacuum tube mounting.

9. In a short wave radio receiver, the combination with tuning means and current supply means, of a vacuum tube mounting and a mounting for a detachable inductance unit; operative connections between the respective mountings and the tuning and current supply means; a removable inductance unit including secondary and tickler windings; and a primary coil permanently mounted concentrically with the inductance unit mounting, within which the removable inductance unit projects when connected with its mounting.

10. In a short wave radio reveiver, the combination with tuning means and current supply means; of a mounting panel having therein spaced groups of holes to receive contact prongs; of a vacuum tube base in the holes of one group and terminal contact prongs of a detachable inductance unit in the holes of the other group; independent spring contact arms secured to the under side of said panel and extending into overlapping relation with the different holes of said groups; a grid-leak condenser unit; attachment means common to a contact arm pertaining to a hole of each group and said unit for attaching said grid-leak condenser unit to said panel and simultaneously interconnecting said arms through the grid-leak condenser unit one to the other.

11. In a short wave radio receiver, the combination with tuning means and current supply means of a vacuum tube mounting, and a mounting for a detachable inductance unit, each including a group of contact elements engageable with contact prongs upon the vacuum tube base and inductance unit; a choke coil and a common connector element for said choke coil and a contact element engageable with a contact prong of the tube base.

In testimony whereof, I have hereunto set my hand this 11th day of October, A. D. 1928.

EDMUND T. FLEWELLING.