

Jan. 15, 1935.

L. A. GEBHARD

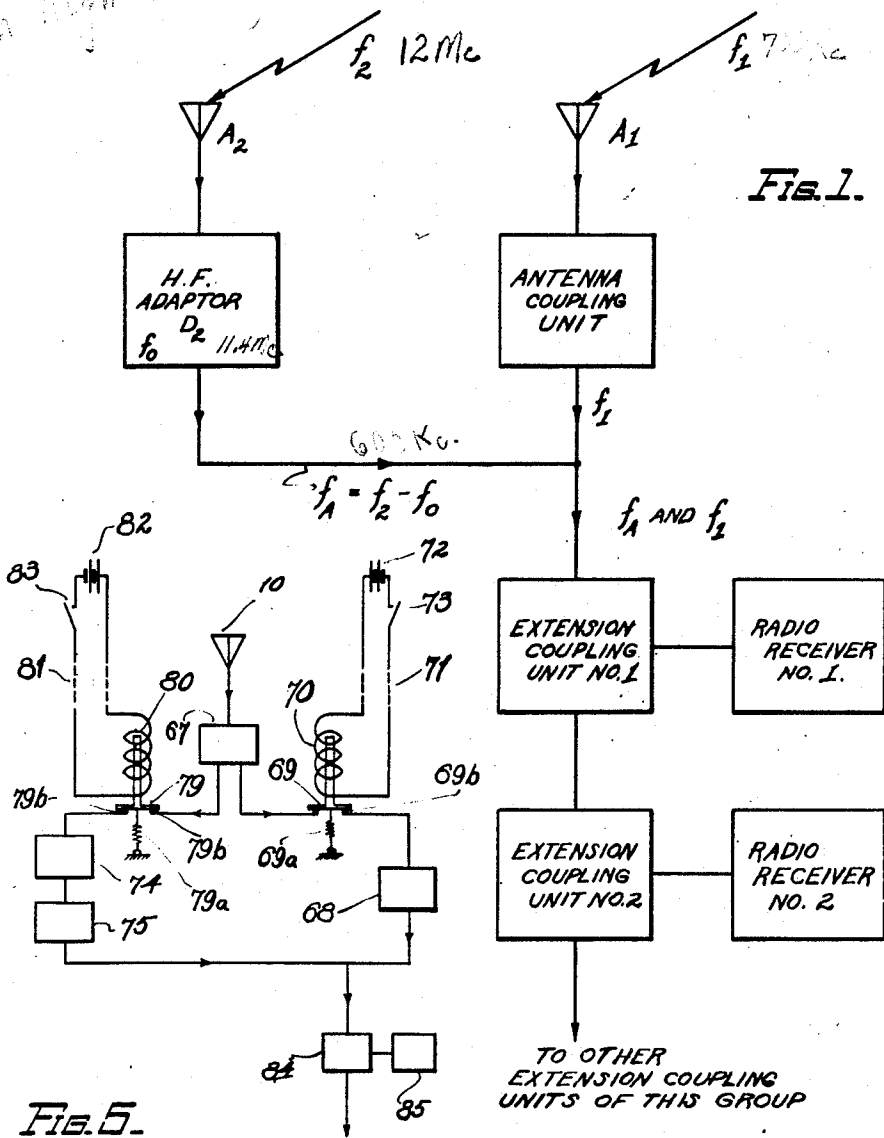
1,987,616

MULTIPLE RECEPTION SYSTEM.

Filed March 28, 1933

4 Sheets-Sheet 1

*Imagined to need
at both high & low freq.*



Inventor

L.A. GEBHARD

By

Robert A. Lavender

Attorney

Jan. 15, 1935.

L. A. GEBHARD

1,987,616

MULTIPLE RECEPTION SYSTEM

Filed March 28, 1933

4 Sheets-Sheet 2

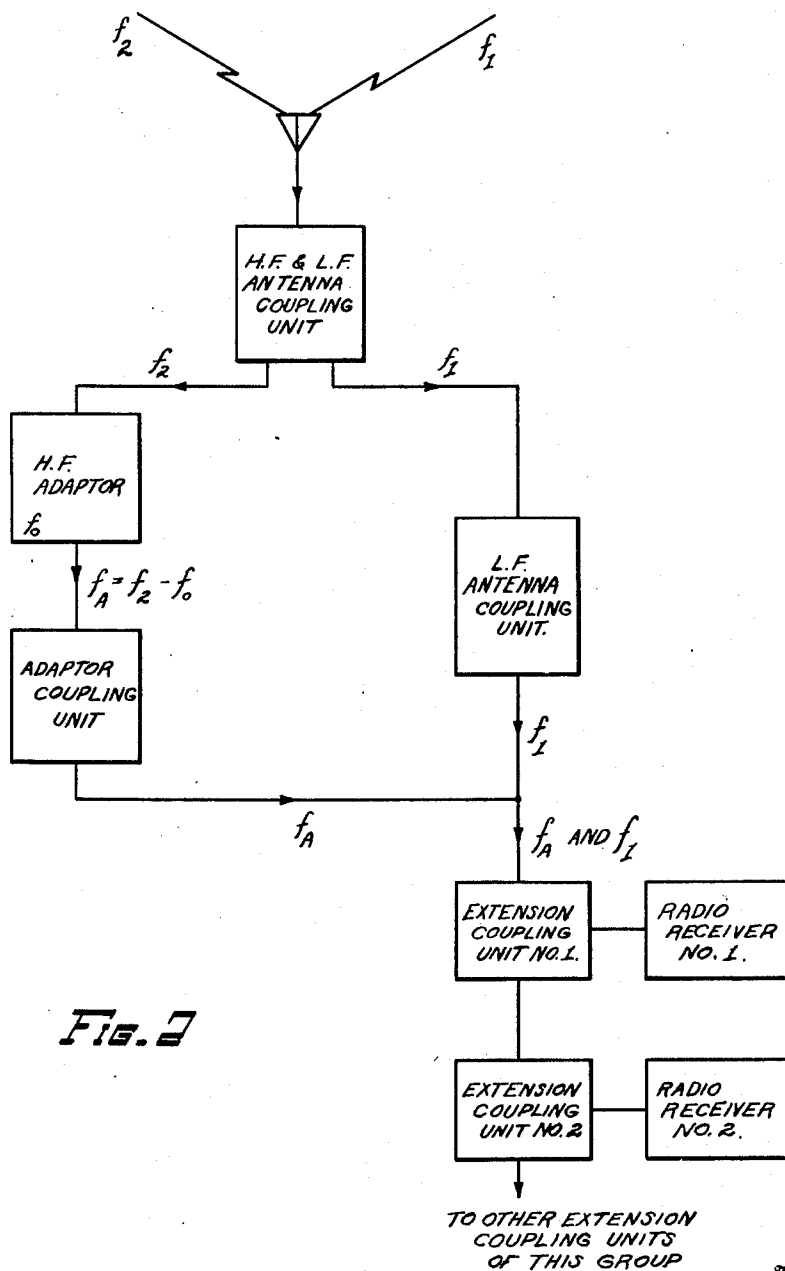


Fig. 2

Inventor

L.A. GEBHARD

By

Robert A. Fawcett
Attorney

250. RADIANT ENERGY
9

Examiner

Jan. 15, 1935.

L. A. GEBHARD

1,987,616

MULTIPLE RECEPTION SYSTEM

Filed March 28, 1933

4 Sheets-Sheet 3

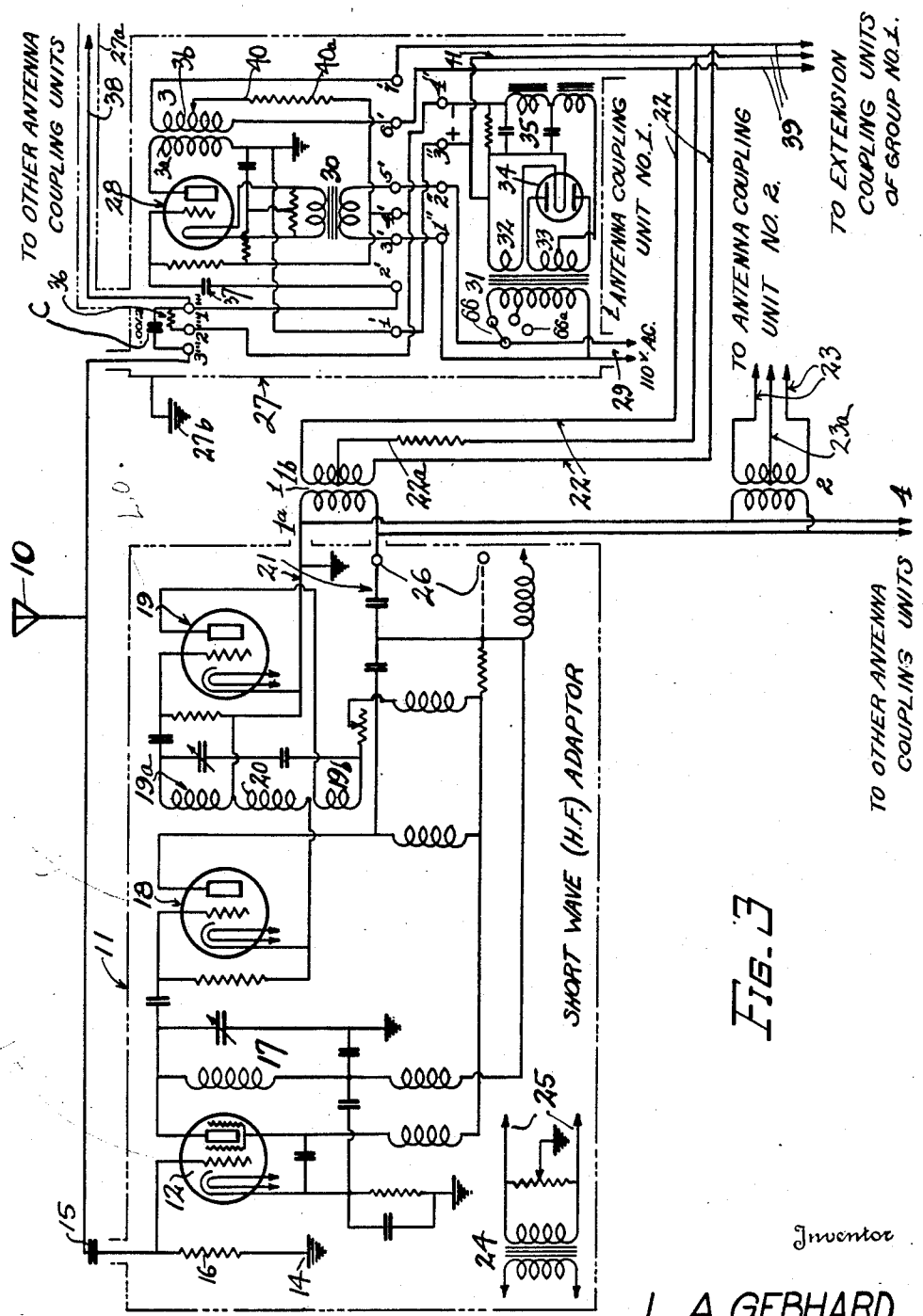


FIG. 3

Inventor

L. A. GEBHARD.

Robert A. Lammie
Attorney

By

Jan. 15, 1935.

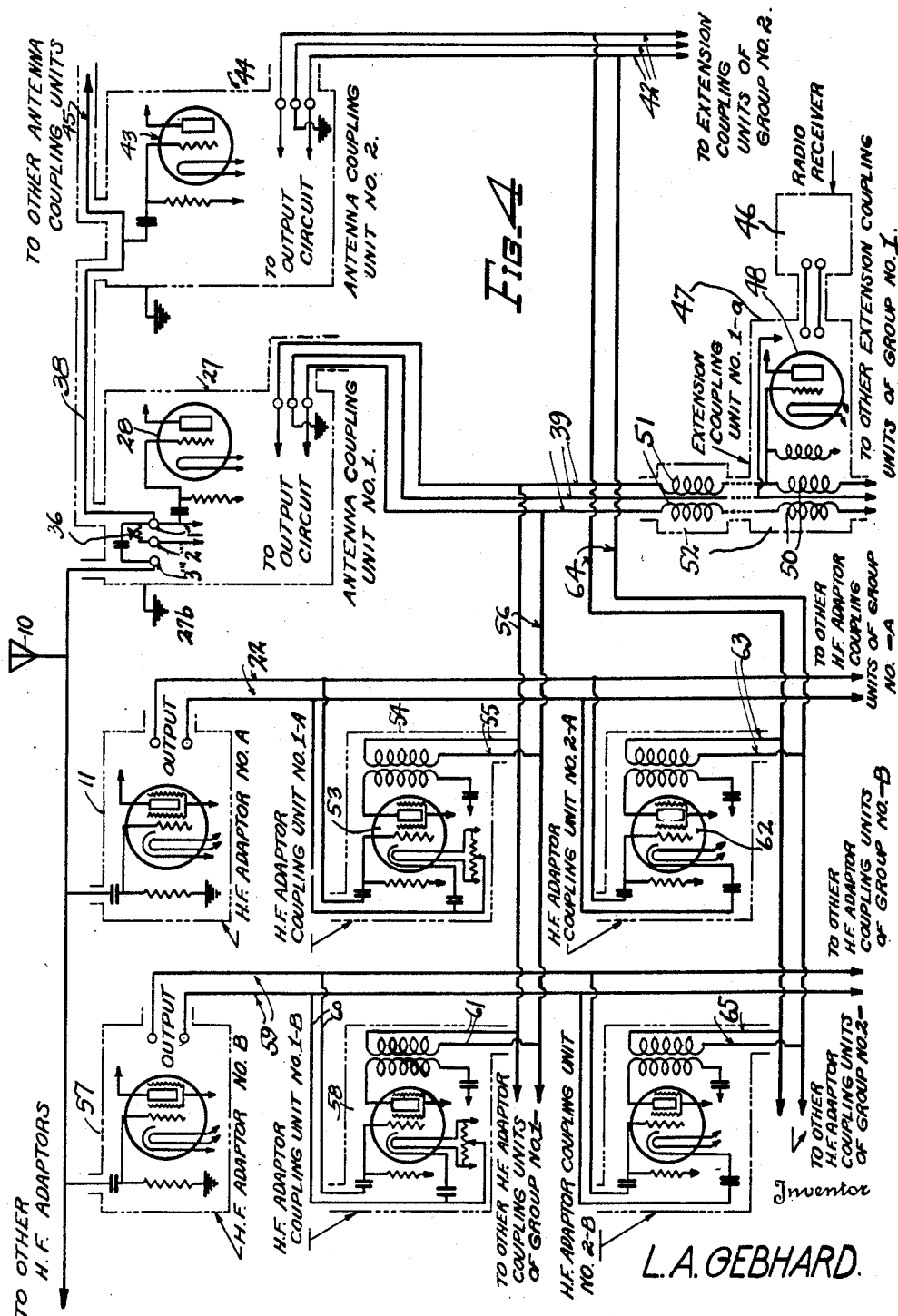
L. A. GEBHARD

1,987,616

MULTIPLE RECEPTION SYSTEM

Filed March 28, 1933

4 Sheets-Sheet 4



334

Robert A. Lawrence
Attorney

Patented Jan. 15, 1935

1,987,616

UNITED STATES PATENT OFFICE

1,987,616

MULTIPLE RECEPTION SYSTEM

Louis A. Gebhard, Washington, D. C.

Application March 28, 1933, Serial No. 663,213

10 Claims. (Cl. 250—9)

My invention relates broadly to multiple reception systems for use in the distribution of broadcast programs throughout a relatively large wire distribution system.

5 One of the objects of my invention is to provide a multiple reception system which will efficiently receive and reproduce broadcast programs transmitted at both high and low frequencies.

Another object of my invention is to provide 10 an arrangement of wire distribution system having a multiplicity of different signal receiving sets associated therewith with means for efficiently transmitting programs transmitted over both high and low frequency signaling channels.

15 Still another object of my invention is to provide a high frequency adaptor circuit for multiple reception systems in which radio frequency energy is intercepted by a central antenna, the lower range of carrier frequencies being transmitted to the multiplicity of radio receiving sets 20 connected with the distribution line while the higher range of signaling frequencies are converted to a lower frequency range and the converted signaling energy transmitted to the receiving sets.

A further object of my invention is to provide a multiple reception system employing a central antenna distribution circuit and a multiplicity of broadcast receivers with an adaptor unit associated with the central antenna for converting 30 the incoming high frequency signals to lower frequencies adapted to be readily conveyed over the wire distribution circuit to the radio broadcast receivers, where the operation of the adaptor is controlled so that the resulting beat frequency 35 falls within the band of frequencies transmitted over the wire distribution circuit but selectively different from any of the broadcast frequencies being transmitted over the distribution circuit.

40 A still further object of my invention is to provide a multiple reception system wherein the usual type of radio broadcast receiver may be installed in apartments, hotels, aboard ships, and in other multiple installations and signaling energy derived from the reception of both high and 45 low frequency radio signals received by a central antenna conveyed to the several broadcast receivers without mutual interference.

Another object of my invention is to provide 50 a practical form of program distribution system in which electromagnetically shielded distribution lines extend from a coupling unit adjacent a central antenna to the multiplicity of independent radio broadcast receivers with a high frequency adaptor connected between the central 55

antenna and the wire distribution circuit for converting high frequency signals to a frequency which can be readily transmitted over the wire distribution circuit without detrimental effects incident to large distributed capacities inherent with the electromagnetically shielded distribution circuit.

5 Still another object of my invention is to provide an arrangement of coupling unit adapted to be electrically connected with a central antenna 10 system for conveying broadcast signals over a wire distribution circuit for operation of a multiplicity of radio broadcast receivers connected at separate points to the wire distribution circuit in association with a short wave adaptor electrically connected between the central antenna 15 and the wire distribution circuit for converting short wave radio signals intercepted by the central antenna system to a frequency range which can be efficiently transmitted over the wire distribution circuit for enabling the radio broadcast receivers connected therewith to respond to the 20 programs received by the reception of both long and short waves at the central antenna system.

Other and further objects of my invention reside in the circuit arrangement for a high frequency adaptor and coupling unit in a multiple reception system as set forth more fully in the specification hereinafter following by reference 25 to the accompanying drawings, in which:

30 Figure 1 is a schematic view showing the arrangement of antenna coupling unit, high frequency adaptor in association with antenna systems and the manner of combining the operative effects thereof through extension coupling 35 units for operation of radio broadcast receivers over an extended frequency range; Fig. 2 shows the arrangement of my invention employing a central antenna system electrically connected with a high frequency and low frequency antenna coupling unit, which is in turn electrically connected with the high frequency adaptor and adaptor coupling unit and an independent low frequency antenna coupling unit to the wire distribution circuit which leads to the various extension coupling units to which the several radio broadcast receivers are connected; Fig. 3 is a diagrammatic view showing the circuit connections for the antenna coupling unit and the circuit arrangement for the high frequency adaptor and the manner in which the antenna coupling unit and high frequency adaptor are connected with the wire distribution circuit; Fig. 4 is a diagrammatic view illustrating the manner of electrically connecting a multiplicity of high fre- 55

quency adaptors to a central antenna system and to the wire distribution circuit in association with an adaptor coupling unit and independent of the antenna coupling units for distribution of programs resulting from the interception of both high and low frequency signals on the central antenna unit for a multiplicity of radio broadcast receivers; and Fig. 5 schematically illustrates one method of controlling the circuits of the antenna coupling unit for the short wave adaptor.

Various systems for the operation of a number of receivers from one antenna have been devised. One of the most general uses of such systems is in the case of apartment houses where it is desired to eliminate the maze of haphazard antennas necessary where one antenna is used for each broadcast receiving set. The system of my invention is particularly useful in hotel installations where guests may be provided with individual radio receiving sets for the selection of programs according to their choice without the limitations heretofore existing of listening to a few predetermined programs through an individual loud speaker supplied to the guest and controlled from a master receiving set under supervision of a master operator. Another application of such systems is on shipboard where space limitations make the use of a single, simple antenna imperative.

In most multiple systems the range of frequencies which can be received efficiently is limited to those covered by the ordinary "broadcast" receiver. The individual receivers are connected together and to the antenna by a transmission line and suitable coupling units. This transmission line is sometimes designed on the basis of a "low-pass" filter and is generally inefficient on the higher frequencies. This follows from the construction of the line since it must be shielded and that inherently means large distributed capacity which militates against the use of high frequencies.

In some installations it is desirable to have the feature of reception on high frequencies beyond the ability of the usual broadcast receivers. This is especially true of mobile installations such as those on shipboard where good reception from stations on the usual broadcast frequencies (550-1500 kcs.) is difficult or impossible on account of great distance. If it were possible however to adjust the system to high frequencies, good reception would result due to the wonderful transmission properties of these frequencies. My invention is directed to systems having this ability of frequency extension.

Referring to Fig. 1 of the drawings, the incoming high frequency energy from a high frequency broadcasting station having a frequency f_2 equal, let us say for convenience, to 12,000 kcs., is picked up by antenna A_2 and passed into a high frequency adaptor D_2 which contains an electron tube amplifier, preferably of the screen grid type, a detector and an oscillator. The oscillator is adjusted to a frequency f_0 equal to 11,400 kcs. These two frequencies "beating" together in the detector circuit give rise to a difference frequency f_A equal to: $f_A = f_2 - f_0 = 12,000 - 11,400 = 600$ kcs. This frequency f_A is then fed into the transmission line which passes it into the various extension coupling units and radio receivers. The ordinary reception function of the multiple receiver system is not disturbed by the addition of the adaptor and associated circuits or by the presence of the energy of frequency f_A . Energy of a frequency $f_1 = 700$ kcs. will be received on antenna system

A_1 and passed on to the receivers as usual. As long as f_A is chosen so as to fall on a frequency different from the frequencies received on antenna A_1 from broadcast stations in the usual frequency bands, no interference will result. The high frequency adaptor may be now coupled to the same antenna system supplying energy directly to the receivers without any change in frequency. This arrangement is shown in Fig. 2. For this purpose it is necessary to modify the high frequency adaptor or include a special coupling system in the usual low frequency antenna coupling unit. Details of this arrangement are shown in Fig. 3. Inductive coupling to the transmission line is shown at 1. If desired the coil $1a$ may be arranged to couple directly to coil 3. In this case coil $1a$ should be arranged symmetrically with respect to 3.

The general system described above may be broadened in certain respects without altering the general features. One extension is shown in Fig. 3 where an additional antenna coupling unit is shown at 2 and still more additional units may be connected at 4. Fig. 4 shows the system still further broadened by the use of several high frequency adaptors adjusted to receive from several high frequency broadcasting stations on different frequencies and feeding different resulting frequencies into the transmission line of several multiple unit groups. Obviously many modifications and ramifications of the general system are possible. For instance, capacity coupling may be used where inductive coupling is shown and vice versa. It will, for instance, be desirable to include a resistance shunt for capacity C of Fig. 3 to take off the static charge of the antenna.

It should be noted that one precaution must be taken; namely, to connect the high frequency adaptors to the antenna at a point above that where the latter becomes involved in large distributed capacities. Difficulty can be avoided by locating the high frequency and low frequency antenna coupling units as close as is possible to the antenna lead-in. In the systems described reception is possible on the usual frequency band covered by the ordinary "broadcast" receiver and on certain high frequencies to which the high frequency adaptors have been adjusted. However, in locations where static is quite heavy and reception on the usual frequency band covered by the ordinary broadcast receiver is poor, reception may be limited to the high frequencies through the adaptor system alone, thus avoiding the static received on the low frequencies. This may be accomplished by opening the antenna connection to the antenna coupling unit by means of a relay, the control circuit of which contains the usual three-way and four-way switches so as to provide controls at convenient points. These controls may be located at each receiver or any other convenient point.

In systems employing more than one antenna coupling unit, individual antenna relays may be employed to individually control the connections of the various antenna coupling units to the antenna. These individual relays may be operated by switches located convenient to the receivers of the particular group supplied by the particular antenna coupling unit. However, instead a single relay may be employed to control all antenna coupling units simultaneously.

The antenna coupling units may be rendered ineffective to accomplish the result described above by opening any of the supply circuits such as the plate, grid or filament circuits, or any other

1,987,616

3

circuit of the antenna coupling unit which will not disturb the system as far as the operation of the high frequency adaptor is concerned. By using a circuit not carrying radio frequency energy the leads may be run a considerable distance, the use of the relay avoided and control obtained with the use of the switching system alone. One of the best ways to accomplish the result is to have the switches control the alternating current supply circuit to the antenna coupling units either individually or by groups as described above. This then will control filament plate and grid supply sources simultaneously.

It should be noted that the antenna coupling units shown in the accompanying figures employ three element tubes. On account of the capacity between the grid and plate elements of these tubes the transmission line is coupled to the antenna circuit. Due to this coupling there may be some possibility of radiation from the antenna of the energy received by the transmission line from the high frequency adaptors. While this is probably of very low power level, should it become troublesome, it may be minimized by "balancing" the three element tube in the antenna coupling unit by the use of one of the conventional balance circuits. A more satisfactory way of suppressing radiation is to employ four-element tubes in place of the three-element tubes in the screen grid connection. In this case the input and output circuits are shielded from each other by the screening action of the additional grid. The parts of the input circuit must be properly isolated from those of the output circuit by additional shielding or location so as to reduce the coupling between these circuits to a negligible value.

In Figure 1 of the drawings, I have indicated for purposes of explaining my invention, separate antenna systems A_1 and A_2 where antenna system A_2 connects to the high frequency adaptor D_2 to the several extension coupling units as shown. Antenna A_1 connects through the antenna coupling unit to the several extension coupling units as shown.

In Figure 2, I have shown the manner of employing a single antenna system connected through a high and low frequency antenna coupling unit in divided paths to the extension coupling units, one of these paths containing the high frequency adaptor and the adaptor coupling unit while the other of the paths contains the low frequency antenna coupling unit connected to the several extension coupling units.

Figure 3 illustrates in detail the manner of connecting the antenna system 10 to the short wave high frequency adaptor contained in shielded compartment 11. The adaptor includes high frequency amplifier 12 connected to the antenna 10 and ground 14 through condenser 15 and coupling resistor 16. The output of the radio frequency amplifier, represented by amplifier stage 12, connects to the tuned input circuit 17 of the detector tube 18. The oscillator 19 has its input and output circuits connected through inductances 19a and 19b for the establishment of oscillations which are impressed upon detector 18 through coupling inductance 20. The beat frequency is supplied from leads 21 to the primary winding a of transformer 1 and to the primary winding of transformer 2. The secondary winding 1b of transformer 1 connects to the distribution circuit 22 leading to the antenna coupling unit No. 1 and to the extension coupling units of group No. 1. The secondary winding

of transformer 2 connects to distribution circuit 23 leading to antenna coupling unit No. 2 and to extension coupling units in group No. 2.

In order to facilitate illustration of the short wave adaptor, I have shown the power supply unit for the several cathodes of tubes 12, 18 and 19 as constituted by transformer 24 and leads 25 which, it will be understood, connect respectively to the several cathode heaters. The plate potential and potential for the screen grid electrode is supplied through terminals 26 represented schematically for connection to a source of rectified energy.

The antenna coupling unit No. 1 which is represented as enclosed in a shielded compartment 27 includes the radio frequency amplifier stage 28 constituted by an electron tube having its cathode energized from alternating current supplied to terminals 29 through terminal post 1'' 2'', terminal post 3' 5' and transformer 30. The alternating current supplied from line 29 is also supplied to primary winding of transformer 31, the secondary windings of which are shown at 32 and 33 connected to full wave rectifier tube 34 and filter circuit 35 to terminals 3'' and 4'' leading to terminals 1' and 2'' through resistor 36 to terminal post 1''' and terminal post 2' to parts of the power circuits of the amplifier tube 28 and through terminal post 4' to other parts of the power circuits of the amplifier tube 28. The connection from antenna 10 to the coupling unit in the shielded compartment 27 is made through terminal post 3''' and coupling condenser C, through terminal post 1'', terminal post 2', condenser 37 and to the grid of amplifier tube 28. The connection to the other antenna coupling units is taken from terminal post 1''' through the lead 38 shielded by the enclosing shield 27a constituting an electrical continuation of the shielded compartment 27. The compartment 27 is grounded as represented at 27b. The output from the coupling unit constituted by tube 28 passes through transformer 3 which includes primary winding 3a and secondary winding 3b. The terminals of the secondary winding connect to terminal posts 6' and 7' to which the distributing leads 39 connect, leading to extension coupling units of group #1. A midtap connection 40 which is taken from secondary winding 3b leads through resistor 40a to terminal post 4' which in turn connects to terminal post 4'' connecting to one side of the filter circuit. Lead 41 connects to the other side of the filter circuit and is carried adjacent the leads 39 to the extension coupling units of group #1. Lead 41 is connected in common with the center lead 22a of the leads 22 which extend from the secondary winding b of the output transformer connected with the short wave high frequency adaptor. This center lead is also shown at 23a connected to the secondary winding of transformer 2 which connects with leads 23 extending to the antenna coupling unit #2.

As illustrated in Fig. 4 a multiplicity of high frequency adaptors are connected to the antenna system 10 and the beat frequencies derived thereby so separated as to enable the individual radio receivers which are ultimately employed in the system for the reception of programs to receive any one of several high frequency broadcasting stations, according to the number of high frequency adaptors employed in the system.

I have illustrated two distribution circuits to extension coupling units, the circuits being shown at 39 and at 42, over which the programs within the broadcast range are transmitted through an-

tenna coupling units No. 1 and No. 2. I have not illustrated the antenna coupling units in detail in Fig. 4 as the circuit in each instance is similar to the circuit illustrated in Fig. 3. The connection from antenna 10 to coupling unit No. 2 is provided through conductor 38. The coupling tube in antenna coupling unit No. 2 is represented generally by reference character 43. The circuits of the coupling tube and associated apparatus are enclosed in the shield 44, which shield is co-extensive with the conductors 42, 38 and conductor 45 which leads to other antenna coupling units in the system. The radio receiver which is to be supplied with programs and which is located in the apartment, room, or point at which the programs are to be received and reproduced has been designated generally at 46. This receiver is representative of the ordinary radio broadcast receiver and has a normal tuning range of approximately 550-1500 kc. The extension coupling unit between the distribution circuit 39 and the radio receiver 46 is represented at 47. Extension coupling unit No. 1a comprises an amplifying valve 48 which is connected to the distribution circuit 39 across inductance elements 50 therein. The inductance elements 50 in the distribution circuit 39 are directly adjacent the inductance units 51 also included in the distribution circuit 39. The additional inductance 51, as well as the main inductance units 50 are electrostatically and electromagnetically shielded by shield 52 represented in dotted lines as extending wholly around the inductance units, the extension coupling unit, and the radio receiver 46. The shield 52 is coextensive with the shielded conduit through which the distribution leads 39 extend.

The signaling energy which is normally outside of the range of the radio receiver 46 is modified in frequency in such manner that it may be received by receiver 46 by means of the short wave adaptor or combinations of short wave adaptors as described in connection with Fig. 3. I have schematically shown the short wave adaptor of Fig. 3 as a high frequency adaptor No. A in Fig. 4, as enclosed in shield 11 and as delivering output energy to distribution circuit 22. In order to render the system practical, I interpose a high frequency coupling unit No. 1A between the output of the high frequency adaptor No. A and the distribution circuit 39. The high frequency coupling unit No. 1A comprises high frequency amplifier 53 enclosed within the shield 54 and having circuits which permit the amplification of energy at the frequency determined by the oscillator frequency in the high frequency adaptor as explained in connection with Fig. 3, which frequency is not one already occupied by a broadcast frequency normally impressed upon the receiver 46 through the antenna coupling units, as heretofore described. The output of the high frequency amplifier constituting the high frequency adaptor unit No. 1A is connected through leads 55 to the distributors 56 which in turn connect with the program distribution circuit 39 whereby there is impressed upon the program distribution circuit 39 a signaling frequency adapted to reproduce short wave signals incident upon the antenna system 10, but on such a frequency as will not interfere with broadcast signals impressed upon receiving apparatus 46 through the antenna coupling unit.

It will be understood that the short wave adaptor No. A and the short wave adaptor cou-

pling unit No. 1A are set to modify the incoming signaling energy to impress that selected frequency upon the receiving apparatus which will not interfere with the frequency being received by the radio receiver 46 through the antenna coupling unit. However when it is desired to receive more than one particular high frequency station which is normally beyond the range of the receiver 46, I provide a separate receiving channel in the form of high frequency adaptor No. B and high frequency adaptor coupling unit No. 1B. I have shown this apparatus at 57 and 58 connected similarly to the apparatus represented at 11 and 53. That is, the output leads 59 from high frequency adaptor No. B are connected to the input of the high frequency adaptor coupling unit No. 1B through leads 60. The output of the high frequency adaptor coupling unit No. 1B connects through leads 61 with the circuit 56 which conveys the converted signaling energy in the second channel to a frequency which may be transmitted over distribution circuit 39 and yet it will be so far removed from broadcast frequencies being received by receiving apparatus 46 that the second channel will successfully operate receiver 46 without interference.

Other high frequency adaptors, together with high frequency adaptor coupling units may be employed in carrying out the system of my invention in accordance with the number of signaling channels which are to be made available outside of the broadcast frequencies which will normally be transmitted to the receiver 46 through the antenna coupling unit. I have indicated that circuit 56 may be extended to other high frequency adaptor coupling units for group No. 1 for carrying out the principles of my invention and extending the range of the receiving apparatus represented at 46.

It may be desirable to receive the same extension programs on receiving sets which connect to extension coupling units of group No. 2. Additional high frequency adaptor coupling units are provided to serve as means for transferring energy from the high frequency adaptors to the second distribution circuit leading to the extension coupling units. For example, a high frequency coupling unit No. 2A has its input connected to leads 22 extending from the output of high frequency adaptor No. A. The high frequency adaptor coupling unit No. 2A includes a high frequency amplifier schematically represented at 62. The output of the high frequency coupling unit No. 2A passes through leads 63 to the distribution circuit 64 which in turn connects with the distribution circuit 42 leading to extension coupling units of group No. 2. The high frequency adaptor coupling unit No. 2A is responsive to the beat frequency derived from high frequency adaptor No. A and serves to impress the said beat frequency on circuit 64 leading to circuit 42, which in turn connects to the extension coupling units of group No. 2.

Where it is desired to impress signaling energy from the second channel through high frequency adaptor No. B, I provide a high frequency adaptor coupling unit No. 2B for serving as the transfer means between the output of high frequency adaptor No. B and the circuit 64. The high frequency adaptor coupling unit No. 2B has its input connected to leads 59 and its output connected through leads 65 and circuit 64 for transmitting energy from the second channel to the distribution circuit 42. I may provide other high frequency adaptor coupling units for group No. 2

1,987,616

5

for enlarging the pickup range of the radio receivers which connect with the extension coupling units. Inasmuch as there may be a number of additional distribution circuits in a large building or hotel, I may extend leads 22 and 59 to other high frequency coupling units in groups No. A or groups No. B, as schematically shown.

The distribution system of my invention provides for multiple reception on one antenna of signals on the same receiver which would normally not be responsive to signals beyond the frequency range of the receiver. On broadcast receivers normally responsive to 550-1500 kc. I am enabled through the system of my invention to receive other signals which are transmitted on frequencies below the normal range of the receiver. The high frequency adaptor circuits and high frequency coupling units are so designed however that in converting signal energy from a frequency outside of the normal range of the radio receiver to a frequency within the range of the radio receiver that such selected frequency does not fall upon one of the normally operating channels to which the receiving apparatus is responsive through its associated antenna coupling unit.

The system of my invention is particularly desirable for use under conditions of undesired static. Under conditions of static I may disconnect the low frequency antenna coupling devices, such as antenna coupling unit No. 1 and antenna coupling No. 2 and utilize the circuit which extends from the antenna system through the high frequency adaptor units and high frequency adaptor coupling units, as static is not so noticeable on the high frequency channels as it is upon the lower frequency channels. This may be accomplished by disconnecting the power supply unit to the antenna coupling unit or disconnecting the low frequency connection from antenna 10 to the antenna coupling units.

In the drawings I have illustrated the power switch 66 for controlling the circuit to the primary winding of the power transformer 31. When the movable arm of switch 66 is moved to contact 66a the power supply to the antenna coupling unit is cut off, thereby rendering the receiving apparatus effective only through the short wave adaptor circuits. Another way of disconnecting the circuit from the antenna to the antenna coupling unit is to interpose relays in the antenna circuit which can be remotely controlled from any desired point as represented in Fig. 5. For example the antenna 10 which connects through the high frequency and low frequency antenna coupling unit represented generally at 67 in Fig. 5 connects to the low frequency antenna coupling unit represented generally at 68 through the switching member 69. The switching member 69 is controlled by an armature which is electromagnetically controlled by relay winding 70. Relay winding 70 is connected in a remote control circuit represented at 71 which includes source of potential 72 and switching member 73. Armature 69 is normally closed by spring member 69a to complete a circuit through contact 69b to the low frequency antenna coupling unit 68. The high frequency adaptor represented generally at 74 connected in circuit with the adaptor coupling unit 75, may be disconnected from the circuit leading to the high frequency and low frequency antenna coupling unit by control of armature member 79. Armature member 79 carries a switching element establishing connection with contacts 79b. Contacts 79b are

normally closed under control of spring 79a. Actuating winding 80 operates to open the circuit through the high frequency adaptor 74 by movement of armature 79. The actuating winding 80 is controlled over control line 81 from any desired point at which switch 83 is located for controlling connection of source of potential 82 to the control line. The circuit to the extension coupling unit designated generally at 84 extends from the low frequency antenna coupling unit 68 and from the adaptor coupling unit 75 as shown. By this arrangement the radio receiver designated generally at 85 may be excited from antenna 10 through either the low frequency antenna coupling unit or the high frequency adaptor or combination thereof by selective actuation of the control circuits from any desired point.

One of the most important features of my invention is the arrangement of the high frequency adaptor circuits for connection to the antenna before the antenna lead becomes involved in high distributed capacities.

By use of the circuit of my invention, standard designs of radio broadcast receivers may be employed for the reception of both high and low frequency signals. The many combinations of insertable inductance coils and adjustable condensers now necessary to provide an extension in range of the usual broadcast receiver, become unnecessary and the added complication eliminated.

While I have described my invention in certain preferred embodiments, I desire that it be understood that modifications of the circuit of my invention may be made and that no limitations are intended other than are imposed by the scope of the appended claims.

The invention herein described may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalty thereon or therefor.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a radio signal receiving and distribution system, in combination, a single antenna system, an aperiodic low frequency coupling unit, a high frequency adapting unit composed of an amplifier and oscillator, a coupling unit for said high frequency adaptor unit, said high frequency adapting unit and said high frequency coupling unit being connected in parallel with said low frequency coupling unit, a combining circuit, and distribution lines connected with said combining circuit.

2. In a radio signal receiving and distribution system, in combination, a single antenna system, means for passing the ordinary broadcast frequencies directly to the distribution system, means for adapting the higher frequency signals for reception by the ordinary broadcast receiver by reducing the frequency of the incoming higher frequency signals, coupling means interconnecting the circuits containing the higher and lower frequencies, and means connected to said coupling means for distributing the lower frequencies and adapted high frequencies to a plurality of broadcast receivers, said combination making the higher and lower frequency signals simultaneously available.

3. In a radio signal receiving and distribution system, in combination, a signal antenna system, a plurality of broadcast receivers, and means interposed between said single antenna and said

receivers for adapting higher frequency signals to reception on said broadcast receivers simultaneously with lower frequency signal reception within the broadcast range.

4. In a radio signal receiving and distribution system, in combination, a single antenna system, an aperiodic low frequency coupling unit, a high frequency adapting unit comprising an amplifier and oscillator, a coupling unit for said high frequency adaptor unit, a combining circuit interconnecting said units, distribution lines connected with said combining circuit, and switching means for disconnecting said low frequency coupling unit for receiving only the adapted higher frequency through said high frequency adaptor unit.

5. In a radio signal receiving and distribution system, in combination, a single antenna system, an aperiodic low frequency coupling unit, a high frequency adapting unit comprising an amplifier and oscillator, means for combining the frequency of said oscillator circuit with that of the higher frequency signal received and obtaining a beat frequency of a value within the broadcast band, a coupling unit for said high frequency adaptor unit, a combining circuit interconnecting said units, and distribution lines connected therewith.

6. In a radio signal receiving and distribution system, in combination, a single antenna system, a plurality of aperiodic low frequency antenna coupling units, a plurality of high frequency adaptor units, the output frequencies of which are different, a multiple plurality of high frequency adaptor coupling units, connected between said high frequency adaptor units and said low frequency antenna coupling units by a plurality of combining circuits, and a distribution system individual to each of said combining circuits.

7. A radio receiving system comprising a radio frequency energy pick-up circuit, a radio receiver adjustable over a predetermined range, and a plurality of conductive paths permanently interposed between said radio frequency energy pick-up circuit and said radio receiver, one of said paths constituting means for impressing signaling energy from said radio frequency energy pick-up circuit without modification of the frequency thereof upon said radio receiver within the frequency range of said radio receiver, and others of said paths constituting means for modifying certain of the frequencies intercepted by said radio frequency energy pick-up circuit for impressing said frequencies upon said radio receiver at frequencies within the said predetermined

range of said radio receiver, all of said paths operating simultaneously.

8. A radio receiving system comprising a radio frequency energy pick-up circuit, a radio receiver adjustable over a predetermined frequency range, means coupling said radio frequency pick-up circuit with said radio receiver for impressing signaling energy without modifying the frequency thereof on said radio receiver within the frequency range of said radio receiver, and a multiplicity of separate means interposed between said radio frequency energy pick-up circuit and said radio receiver for selecting certain frequencies intercepted by said radio frequency energy pick-up circuit and modifying the said last mentioned frequencies to frequencies within the said predetermined range of said radio receiver, all of said paths operating simultaneously.

9. A radio receiving system comprising a radio frequency energy pick-up circuit, an aperiodic antenna coupling unit connected with said circuit, a distribution circuit connected with said antenna coupling unit, an extension coupling unit connected with said distribution circuit, a radio receiver connected with said extension coupling unit and adjustable over a predetermined frequency range, and a separate path connected between said radio frequency energy pick-up circuit and said distribution circuit for selectively modifying signaling energy intercepted by said radio frequency energy pick-up circuit at a frequency beyond the tuning range of said radio receiver and impressing the said signaling energy at a frequency within the range of said radio receiver upon said distribution circuit.

10. A radio receiving system comprising a multiplicity of distribution circuits, a plurality of radio receivers individual to each of said distribution circuits, each of said radio receivers being adjustable over a predetermined frequency range, a radio frequency energy pick-up circuit and separate paths interconnecting said radio frequency energy pick-up circuit with said distribution circuits, a number of said paths having aperiodic means for effecting the transfer of signaling energy from said radio frequency energy pick-up circuit without modifying the frequency thereof to said distribution circuits within the frequency range of said radio receivers, and others of said paths including means for selectively receiving signals intercepted by said radio frequency energy pick-up circuit at frequencies beyond the tuning range of said radio receivers and converting the carrier frequencies of said signals to frequencies within the range of the said radio receivers.

LOUIS A. GEBHARD.

Bruce jr.	1,737,407	250-20.29
Powell	1,375,140	" "
Clement	1,688,036	" 9e.
Heising	1,711,679	" 9
Benson	1,840,013	" 9xe
Radio Broadcast	Mar '29	pp295 250-9e
Fr. pat.	699,825	250-20.29
Clement	1,754,878	250-20.6s