

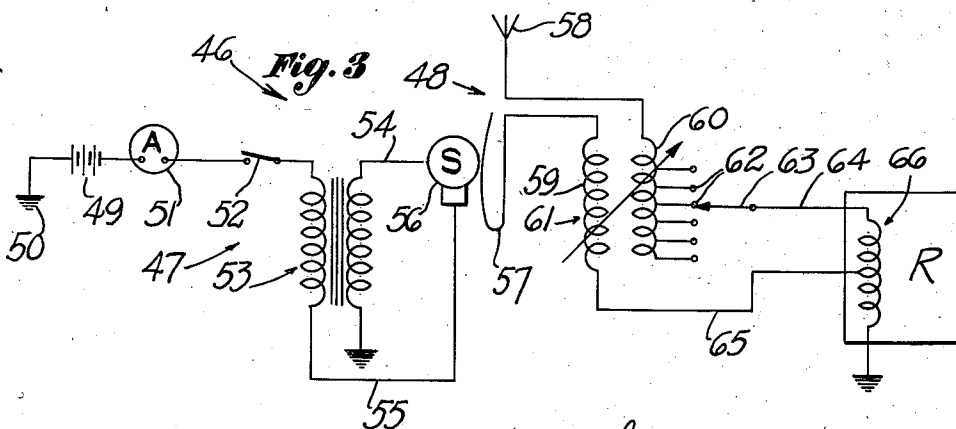
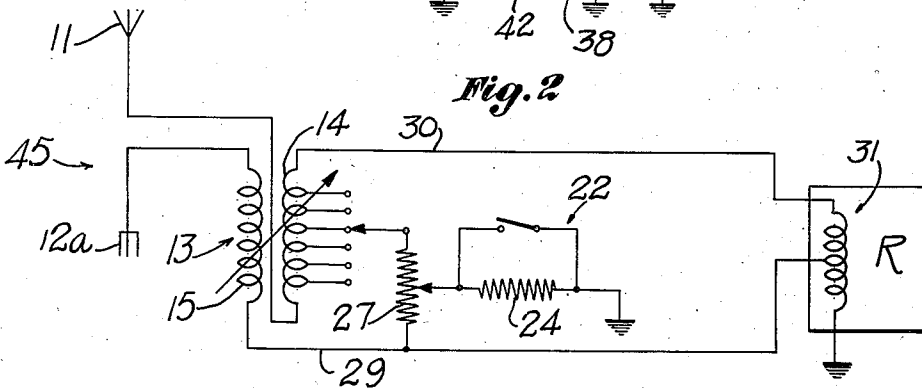
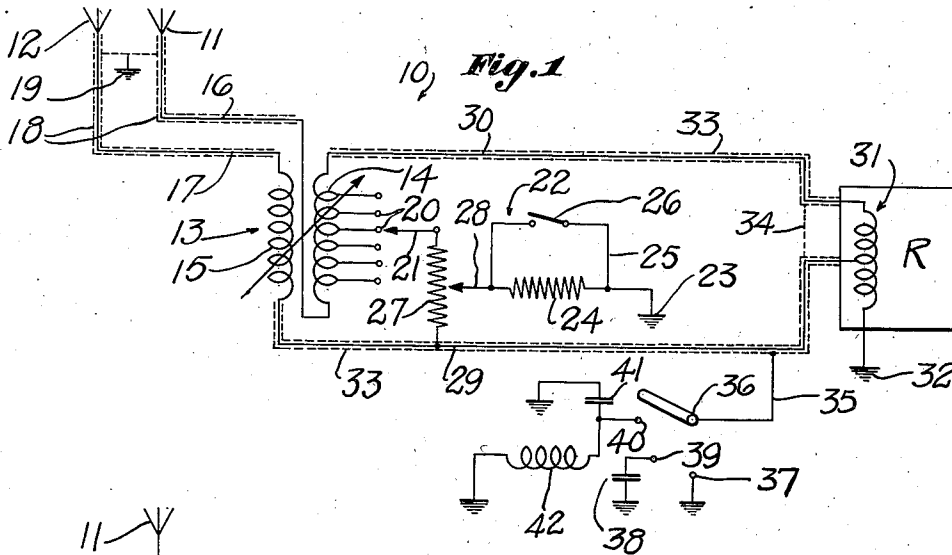
April 21, 1942.

S. WHISK

2,280,461

ELIMINATION OF ATMOSPHERIC RADIO DISTURBANCES

Filed Oct. 6, 1941



INVENTOR.
Samuel Whisk
BY
Miss Shumacher
ATTORNEY.

UNITED STATES PATENT OFFICE

2,280,461

ELIMINATION OF ATMOSPHERIC RADIO DISTURBANCES

Samuel Whisk, Brooklyn, N. Y., assignor of one-half to Morris Abrams and Morris Zippert, both of Brooklyn, N. Y., jointly

Application October 6, 1941, Serial No. 413,743

8 Claims. (Cl. 250-20)

This invention relates to apparatus for suppressing electrical disturbances caused by long distance radio or local magnetic waves or both, in order to thus obtain the maximum energy in the transmission of signals at high and low radio frequencies.

One object of the invention is the provision of relatively simple and inexpensive apparatus adapted for the transmission of different radio frequencies with the maximum suppression of interfering frequencies or sources of electrical disturbances, as by simple and easy adjustment.

Another object of the invention is to provide apparatus for relatively large thoroughly shielded apparatus wherein capacitive shielding disturbances as well as distant and local antenna affecting disturbances can be conjointly eliminated in a simple manner.

Another object of the invention is to furnish improved electrical apparatus as for small or cheap installations wherein shielding is eliminated to save expense, with variable inductive and variable resistive effects combined in an improved manner to efficiently suppress noises caused by distant and local sources.

Another object of the invention is to construct apparatus of the nature set forth having improved easily adjustable means independent of the receiver for suppressing noises at high or low radio frequency.

Another object of the invention is to furnish apparatus for efficient noise suppression at different radio frequencies without the employment of a radiation discharge tube as was heretofore required.

The present invention embodies an improvement over the disclosure of my Patent No. 2,139,533 issued December 6, 1938, and the obtaining of substantially greater noise suppression by practically infinitely adjustable means, free of the limitations which heretofore occurred, is another object of the invention.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention consists in the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated in the annexed drawing, wherein like parts are designated by the same reference characters throughout the several views.

In the drawing:

Figure 1 is a diagrammatic view of an embodi-

ment of the invention, showing a shielded transmission line.

Fig. 2 is a similar view showing a modification with the shielding omitted.

Fig. 3 is a similar view of another modification showing a typical installation with relation to the power plant of a vehicle having a wooden body.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined in one and the same structure, but, useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which the invention appertains, that the same may be incorporated in several different constructions. The accompanying drawing, therefore, is submitted merely as showing the preferred exemplification of the invention.

Referring in detail to the drawing, 10 denotes an apparatus embodying the invention, and being adapted to function as an efficient local and long distance suppressor at different radio frequencies.

This apparatus 10 preferably includes two antennas 11, 12, which are desirably arranged to be individually responsive to different frequencies; or, one of the antennas such as 12 may be arranged as a counterpoise for the other. The antenna system is in general adapted to pick up radio signals of widely varying frequencies and may be adapted to cooperate for the efficient suppression of local and distant disturbances of different frequencies or characteristics as herein-after described.

Coacting with the antenna system 11, 12, is a variable radio frequency transformer 13; thus the respective primary and secondary inductance coils 14, 15 thereof may be connected directly to the respective aerials 11, 12 as by conductors 16, 17. The latter may be shielded as at 18, to thus provide coaxial cable transmission lines, the shielding 18 being grounded as at 19. If preferred, the so-called twisted pair transmission lines may be substituted for the different coaxial cables.

It is preferred that the coils 14, 15 be wound in opposite directions and that each of them be connected so that signal currents coming in from the antenna flow in like direction through the coils, for instance, clockwise.

The coil 14 is constructed as an antenna frequency selector coil, while the coil 15 is arranged as an antenna current phase shifting coil. Accordingly, the coil 14 is provided with a series of taps such as 20, any one of which may be engaged at 21 by an adjustable resistance means

22 leading to ground 23. The purposes of the invention are best realized by constructing the means 22 as a bridge forming different paths to ground, and it may include a high resistance 24 and a shunt 25 therefor comprising a switch 26. At high radio frequencies, the switch 26 is open, but it is closed for eliminating disturbances at low radio frequencies. Cooperating with the bridge 22, is a potentiometer 27, adjustable at 28. It will be understood that the specific nature of the resistances at 24 and 27 are such as are best capable of high efficiency operation of the invention. The potentiometer resistance is connected to 21 and to a conductor 29 extending from the phase shifting coil 15. The transmission line includes a companion conductor 30, thus providing a circuit for a radio receiver R having an input transformer 31 that may be grounded at 32. The transmission line elements 29, 30 may each be shielded as at 33 in the manner described with reference to the shielding at 18.

While the coaxial cable represents the best form of shielded transmission line, it has considerable distributed capacity, and moreover, the shield itself acts as an antenna. I therefore ground the main part of the transmission line by an interconnection at 34, and by a conductor 35 connected to a switch 36 adapted for a variable connection to ground. Thus a most direct ground connection is afforded at 37; a ground through a capacity 38 at 39, and at 40 a ground may be obtained through a capacitance 41 and an inductance coil 42. Since the quality or nature of a ground varies infinitely with the installation, it will be seen that by means of the switch 36 different conditions are easily available to suit. It will be noted that satisfactory results for the device 10 may also be obtained without the employment of shielding.

In Fig. 2 is shown a modification 45 which may be exactly like the apparatus 10 except that the shielding for the transmission line has been omitted. A twisted pair may be substituted for each of the individual branches of the transmission line and a very great saving in costs is effected. In this device 45, the aerial 12 is more specifically shown as a counterpoise 12a. This change is not absolutely necessary, but better results are thus obtainable.

With the apparatus shown at 10 and 45, elimination is obtained by a balancing action with the aid of the potentiometer bridge 27 and 22. As shown this potentiometer is on the input side of both antennas; it may also be connected across the phase shifting coil 15, or across both of the coils 14 and 15. In general, the problem is to reduce interference energy in relation to signal strength. This is done by placing the switch 21 at the proper tap, and the coil 15 at the required angle. The resistor 24 is used to prevent high frequency signals from passing to ground in obtaining a balance in the circuit, but by closing the switch 26, disturbances at low frequencies pass to ground while the desired incoming low frequency signals are preserved. The apparatus shown is designed to receive different frequency bands, but if only one frequency is to be received, the phase shifting coil may be set at a particular angle and left undisturbed, and the variable bridge 23 may be omitted with the potentiometer 27 being optional.

In Fig. 3 is shown an apparatus 46 representing another embodiment of the invention. Here likewise the transmission line is unshielded, except that a twisted pair may be used in each part

of the transmission. Thus the cost of shielding material and installation is avoided which in the aggregate may be very great. It will be understood that the apparatus 46 is intended particularly for vehicles having wooden bodies, such as boats. My apparatus 46 has been installed and tested in various wooden hull boats of the U. S. Coast Guard and has been found highly satisfactory; where formerly magnetic interference was so great that it was impossible to hear many radio signals and very difficult to hear others, satisfactory and clear reception for all high frequency ranges is now available. Also the life of this installation is greater, because shielding was subject to corrosion by salt water sprays with eventual overheating of rubber insulation and short circuiting or arcing. Thus the power plant may stop, because of defective sparking of the motor ignition system. Moreover, in rough seas it was necessary to stop the engine in order to reduce the noise sufficiently to permit operation of the radio receiver with the weak signal current that was available.

In the apparatus 46, is shown the electrical part of the power plant 47, to indicate its relation to my device which embodies the principles of the invention. Thus a source of current 49, grounded at 50 is connected through an ammeter 51 and a switch 52 to an iron core transformer 53 in a grounded circuit 54, 55 that comprises an interrupter or timing switch 56 for the ignition system of an internal combustion engine. The apparatus 47 creates a powerful magnetic field which constitutes a source of disturbance against which the most modern radio receivers have been impotent.

Disposed in suitable relation or adjacent to the apparatus 47 is a counterpoise 57 for an antenna 58, respectively connected to the coils 59, 60 of variable transformer 61. The coil 59 may constitute the phase shifting coil, while the coil 60 is a selector coil having a series of taps 62 for a switch 63. A circuit 64, 65 is connected to the switch 63 and to the coil 59 and includes the grounded input transformer 66 of a radio receiver.

The counterpoise 57 is preferably arranged in U or loop form and is wound in the same direction so as to be in phase with the secondary coil 59. This arrangement is very useful where sparking or magnetos constitute a source of disturbance. The counterpoise is relied upon to pick up the maximum portion of the disturbance, and causing it to be balanced out in the transformer 61 by adjustment of phase shifting and selector coils thereof. In the case of wooden boats the antenna 58, which is usually of the well known telescopic type, thus picks up the signal energy, and the transmission line efficiently conducts it to the radio receiver. In general the counterpoise may be placed anywhere on a wooden boat, as distinguished from a metallic craft or airplane, on which it should be externally located. In an installation on a wooden boat, according to the invention, the operation of only one motor at half speed resulted in drowning out the most powerful signals, and when this invention was installed, all of the boat's four motors could be operated at full speed with satisfactory reception of signal energy at high frequency. While in many respects the apparatus 48 is like that at 45, it is different in that it is adapted only for operation at high frequencies, whereas the apparatus 45 is operative with efficiency at both high and low frequencies.

With the present invention the use of the discharge tube 12 shown in my Patent No. 2,139,533 is rendered unnecessary, resulting in a saving of cost and increased compactness. Moreover, while setting the phase shifting coil at an angle of 180° out of phase should suffice to substantially aid in the elimination of noises, yet in practice this does not occur, because the interfering frequencies vary. Thus suppression may best occur at 45 degrees or at some other angle. Thus the apparatus of this invention is much more flexible and efficient than that of my prior patent. Moreover, with the tap connections for the antenna transformer, the proper impedance match and signal balance is obtained to maintain signal energy while suppressing interferences.

I claim:

1. An apparatus for the elimination of radio frequency disturbances while maintaining desired signal energy, including an antenna system comprising an antenna and a counterpoise therefor, a relatively fixed coil connected to the antenna, a movable phase shifting coil connected to the counterpoise, said coils being responsive to each other solely for the selective reception of a desired frequency, a transmission line having connections for the respective coils, a variable tap means connected to the relatively fixed coil, and means for connecting the tap means to ground, including a resistance.

2. An apparatus for the elimination of radio frequency disturbances while maintaining desired signal energy, including an antenna system comprising an antenna and a counterpoise therefor, a relatively fixed coil connected to the antenna, a movable phase shifting coil connected to the counterpoise, said coils being responsive to each other solely for the selective reception of a desired frequency, a transmission line having connections for the respective coils, a variable tap means connected to the relatively fixed coil, and a potentiometer having a resistance connected at one end to the variable tap means and at its other end to one side of the transmission line, said potentiometer being adjustably connected to ground at a selected point thereof.

3. An apparatus for the elimination of radio frequency disturbances while maintaining desired signal energy, including an antenna system comprising an antenna and a counterpoise therefor, a relatively fixed coil connected to the antenna, a movable phase shifting coil connected to the counterpoise, said coils being responsive to each other solely for the selective reception of a desired frequency, a transmission line having connections for the respective coils, a variable tap means connected to the relatively fixed coil, and a potentiometer having a resistance connected at one end to the variable tap means and at its other end to one side of the transmission line, said potentiometer having a movable tap connected to ground and the potentiometer so cooperating with the transmission line that as the ground resistance for the counterpoise is decreased that for the antenna is increased, and vice versa, whereby a maximum signal energy is transmitted.

4. An apparatus for the elimination of radio frequency disturbances while maintaining desired signal energy, including an antenna system comprising an antenna and a counterpoise there-

for, a relatively fixed coil connected to the antenna, a movable phase shifting coil connected to the counterpoise, said coils being responsive to each other solely for the selective reception of a desired frequency, a transmission line having connections for the respective coils, a variable tap means connected to the relatively fixed coil, and a potentiometer having a resistance connected at one end to the variable tap means and at its other end to one side of the transmission line, said potentiometer being adjustably connected to ground at a selected point thereof, and means for so connecting the potentiometer to ground comprising a resistance and an openable shunt therefor.

5. An apparatus for the efficient reception of signal energy free of interference at different radio frequencies including an antenna system comprising a plurality of sections, a transformer having its coils respectively connected to said different sections, said transformer being variable so that one coil is a phase shifting coil, a variable tap for a coil of said transformer to constitute the same a frequency selector, a transmission line connected to said transformer, a potentiometer connected to said variable tap and said transmission line, and a ground connection for said potentiometer to interpose a variable ground resistance for varying sections of the tapped coil.

6. An apparatus for the efficient reception of signal energy free of interference at different radio frequencies including an antenna system comprising a plurality of sections, a transformer having its coils respectively connected to said different sections, said transformer being variable so that one coil is a phase shifting coil, a variable tap for a coil of said transformer to constitute the same a frequency selector, a transmission line connected to said transformer, a potentiometer connected to said variable tap and said transmission line, and a ground connection for said potentiometer to interpose a variable ground resistance for varying sections of the tapped coil, said ground connection including a circuit having a high resistance and a shunting switch therefor which is closed for the elimination of low frequency disturbances.

7. An apparatus according to claim 6, including shielding for said transmission line, and grounding connections for the shielding directly to ground, or through a capacitance or an inductance to ground at will, and a switch for the selective control of said grounding connections.

8. An apparatus for reducing interference energy while maintaining desired signal strength at high and low radio frequencies, including a main antenna and a secondary antenna, a variable transformer having its primary coil connected to the main antenna and its secondary coil to the other antenna, a variable tap for the primary coil to afford a frequency selector, the secondary coil being movable for phase shifting, a transmission line having a pair of leads respectively connected to the different coils, and an adjustable bridging device to ground connected to said tap and adapted to interpose a high or low resistance at will, said phase shifting, variable tapping and variable grounding being adapted to conjointly cause balancing out of the interfering frequencies.

SAMUEL WHISK.