

Aug. 24, 1926.

1,597,420

L. W. AUSTIN

SIGNALING SYSTEM

Filed June 22, 1923 2 Sheets-Sheet 1

Fig. 1

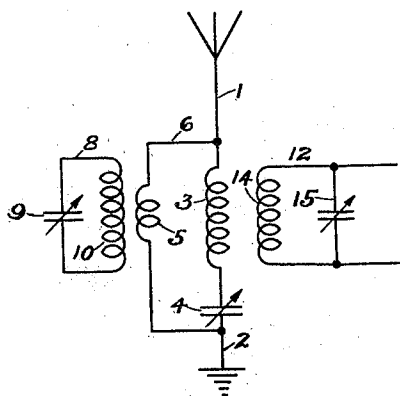


Fig. 2

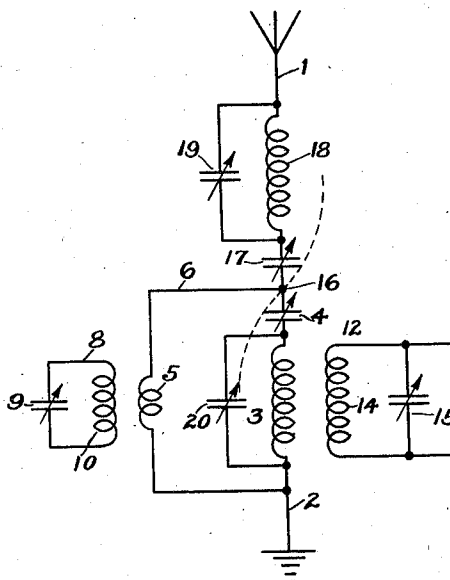
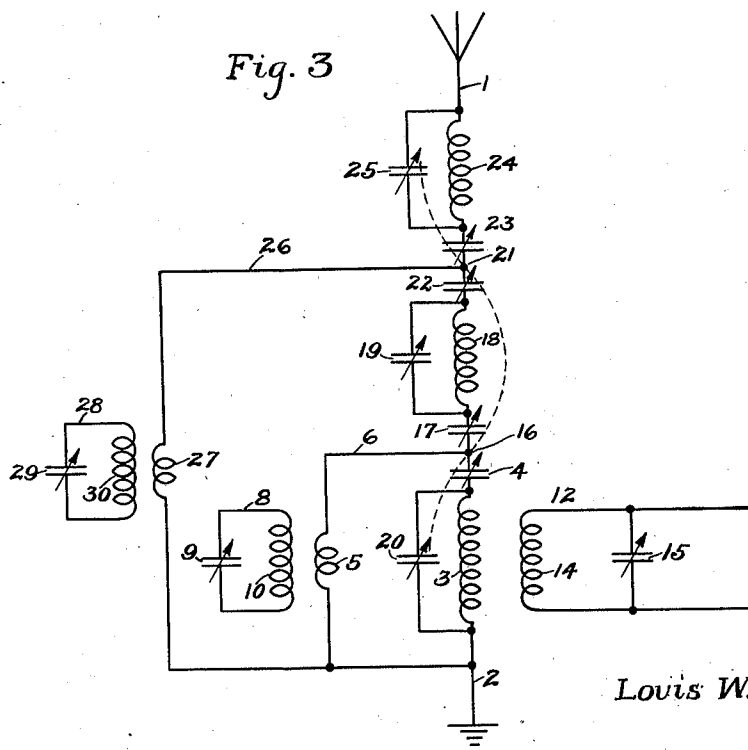


Fig. 3



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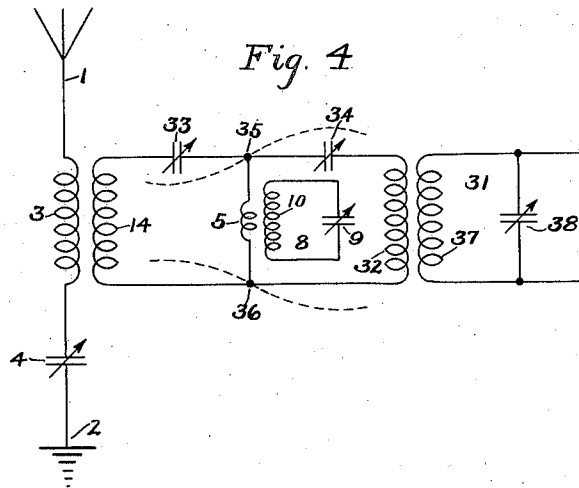
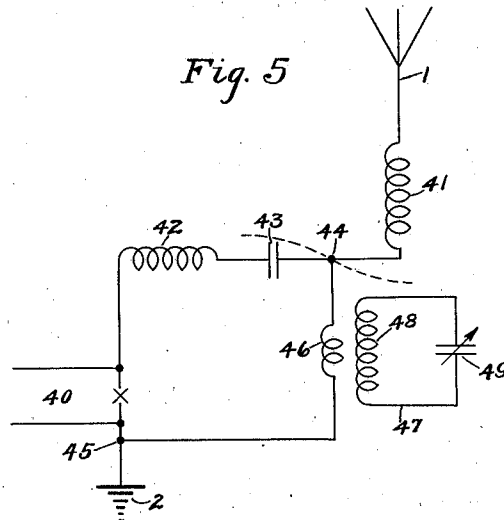
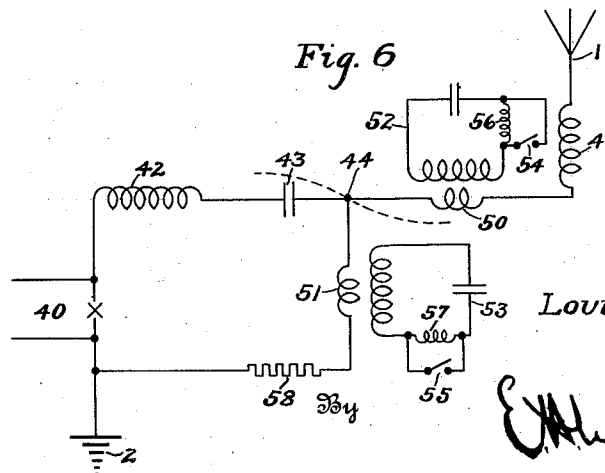
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UNITED STATES PATENT OFFICE.

LOUIS W. AUSTIN, OF WASHINGTON, DISTRICT OF COLUMBIA.

SIGNALING SYSTEM.

Application filed June 22, 1923. Serial No. 647,058.

My invention relates broadly to signaling systems, and more particularly to means for reducing undesired oscillations and interfering frequencies in signaling circuits.

One of the objects of my invention is to provide means for increasing the sharpness of tuning in signaling circuits and to decrease interference when utilizing a predetermined frequency due to simultaneous signaling at closely adjacent frequencies.

Another object of the invention is to provide a circuit arrangement by which rejector circuits may be coupled with a signaling system in such manner that inherent losses heretofore involved in rejector circuits are eliminated.

My invention finds particular application in radio signaling circuits both at the transmitter and at the receiver. The sharpness in tuning is increased and the tendency of the circuits to oscillate on harmonics or undesired frequencies is considerably reduced.

My invention accomplishes these results by providing means for controlling the radio frequency oscillations at either the transmitter or receiver so that those of the predetermined desired frequency shall be forced into the active portions of the circuits while those of other frequencies shall be by-passed and rendered harmless to act upon such portions of the circuits.

My invention comprises broadly a coupled circuit arrangement in which an inductive member of normally small impedance for a broad band of frequencies is made of high impedance for a particular frequency by being closely coupled to a closed circuit containing a relatively small capacity and a comparatively large inductance, tuned to the particular frequency while remaining low in its effective impedance for all other frequencies. When this particular frequency is chosen as the desired signaling frequency and the circuit associated with the signaling circuit the particular frequency will be forced back or rejected by the associated circuit to be actively employed in the signaling circuit, whereas all other frequencies may pass through the associated circuit.

My invention will be more clearly understood by reference to the accompanying drawings, in which:

Figure 1 is a wiring diagram showing a portion of the signaling circuit with the circuit of my invention associated therewith;

Figure 2 is a wiring diagram of an antenna ground circuit showing the circuit of my invention connected at a nodal point in the antenna ground circuit; Figure 3 is a wiring diagram showing a plurality of the circuits of my invention employed in connection with an antenna ground system; Figure 4 shows the application of my invention to a closed electrical circuit intermediate the radio frequency energy collecting circuit, which may be a coil antenna or an antenna ground system and detecting circuit in the case of reception, or the circuit containing the source of oscillations in the case of transmission; Figure 5 shows the application of my invention to a transmitting antenna system for eliminating harmonics and other undesired frequencies; and Figure 6 is a wiring diagram showing a plurality of the devices of my invention applied to a signaling circuit for a transmitter.

Referring more particularly to Figure 1 of the drawings, the invention is shown applied to an antenna ground system indicated by reference characters 1 and 2. Inductance 3 and capacity 4 are included in this circuit forming the usual tuned oscillatory system. An inductance 5 composed of a small number of turns with very small inductance as compared with inductance 3 is included in a circuit 6, which circuit is in parallel with the tuned circuit 3—4. The inductance 5 is of such value that ordinarily all frequencies pass through the circuit 6 in preference to passing through the circuit 3—4. A closed circuit represented by reference character 8 is employed, the circuit comprising an inductance 10 and a variable capacity 9. The inductance 10 is closely coupled to the small inductance 5. When the circuit 8 is tuned to any given frequency the effective impedance of the small inductance 5, which is extremely low for all frequencies, increases to a high value for the frequency to which the circuit 8 is tuned while remaining low for all other frequencies. When the circuit 8 is tuned to the same frequency as the circuit 3—4 then this particular frequency will be forced back or rejected by inductance 5 and circuit 6, and will flow practically entirely through 3—4 while other frequencies will be by-passed through the circuit 6. The antenna ground circuit 1—2 and circuit 3—4 is energized in the case of a transmitter by cir-

cuit 12 containing coupling coil 14 and condenser 15. In the case of a receiver this circuit leads to the detector or amplification circuit.

5 In Figure 2 the antenna ground circuit 1—2 is tuned so that the point 16 becomes a potential node for the desired frequency. The antenna ground circuit 1—2 comprises inductance 3, capacity 4, capacity 17, and inductance 18. Tuning condensers 19 and 20 are connected across inductances 18 and 3 respectively. The nodal point 16 is fixed by temporarily grounding the circuit at this point and tuning inductance 18 and condenser 19 when coupled directly to the system 12 including inductance 14 and capacity 15. Next the ground connection at 16 is removed and with the circuit arranged as represented in Fig. 2. Inductance 3 and capacity 20 are tuned, while coupled to the system 12 by means of inductances 14 and 3 without in any way changing the settings of inductance 18 and capacity 19. In this arrangement the desired frequency will be more completely rejected by circuit 5 and accepted by the circuit 3—4 while other frequencies are more completely by-passed through inductance 5.

Greater selectivity is obtainable by increasing the number of the rejectors as represented in Fig. 3. In this circuit the antenna system 1—2 contains nodal points 16 and 21 fixed by a method similar to that described in connection with Fig. 2. The antenna ground circuit 1—2 includes the additional tuning condensers 22, 23, and the inductance 24 and capacity 25. The additional circuit 26 is included between nodal points 21 and the ground 2, the circuit comprising small inductance 27 which normally passes a wide band of frequencies. A closed circuit 28 containing inductance 30 and capacity 29 is inductively associated with inductance 27. Greater selectivity is obtained by adjusting both circuits 8 and 28 to the signaling frequency, whereupon this frequency is forced back or rejected by circuits 6 and 26, causing the desired frequency to be confined to the antenna ground circuit while undesired frequencies are by-passed by the auxiliary circuits 6 and 26.

In Fig. 4 my invention is illustrated as applied to a closed circuit connected with inductance 14 which may be coupled with the antenna ground circuit 1—2—3—4. The circuit is positioned intermediate the antenna ground system and the circuit 31, which in the case of the transmitter is connected to a source of oscillations, or in the case of a receiver to a detection or amplification system. The intermediate circuit comprises coupling coils 14 and 32 and condensers 33 and 34. At nodal points 35 and 36 in the intermediate circuit I connect the small inductance coil 5 and the circuit 8 containing

inductance 10 and capacity 9. In this arrangement the coupled rejector by-passes the undesired frequencies and forces the desired frequency through the inductance 32 in the case of a receiver from whence it is passed through inductance 37 and condenser 38 to the amplification or detection circuit. In the case of a transmitter the desired frequency is forced into inductance 14 and undesired harmonics are substantially eliminated.

The principle of my invention is applicable to a transmitting antenna for eliminating harmonics generated by the source of oscillations as represented in Fig. 5. The system may comprise an arc generator 40 in the antenna ground circuit 1—2 in series with inductances 41—42 and capacity 43. At a nodal point 44 I connect a circuit around the oscillating arc circuit to a point 45 including the small inductance 46 which is coupled to the tuned circuit 47 including inductance 48 and capacity 49. By tuning the circuit 47 to the signaling frequency the inductance 46 becomes a high effective impedance for the signaling frequency while by-passing harmonics, and eliminating interference resulting from harmonic radiation.

Fig. 6 represents an application of my invention to the control of currents in a transmitting antenna so that the current may be made to flow either to the antenna or into an artificial antenna 58. The antenna ground circuit 1—2 is so tuned that 44 is a potential node and the small inductances 50 and 51 in the antenna and the artificial antenna circuit are coupled respectively to the closed circuits 52 and 53 which are normally tuned to the frequency being emitted by the station, and are respectively detuned by closing the keys 54—55 across a portion of the respective inductances 56 and 57. By alternately tuning one of the rejector circuits while the other is detuned, the current will be alternately forced into the antenna or into the artificial antenna. By this arrangement the keys 54 and 55 operate practically without sparking since when they are closed practically no current is flowing in their respective circuits 51 and 52. At the same time harmonics and other undesired frequencies will always flow by preference through the artificial antenna. If desired, delayed opening keys 54 and 55 can be used to open the respective circuits after the main current has been suppressed by the coupled rejectors.

The principle of operation of my invention has been already discussed, but it might be pointed out that the broad operating principle is that I provide a path or several paths in connection with a signaling circuit which are normally transparent to a broad band of frequencies. The effective impedance of the path or paths is then increased in value for the particular signaling frequency whereby the signaling frequency is

confined to the signaling circuit and the path or paths are rendered substantially opaque to the signaling frequency while all other frequencies may pass freely through the transparent path or paths. I am enabled to utilize a comparatively small capacity and a relatively large inductance by my coupled rejectors thereby reducing losses heretofore inherent in prior forms of rejectors.

While I have described my invention in certain specific embodiment, it will be understood that I intend no limitations other than are imposed by the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States is:

1. A signaling system, comprising in combination a signaling circuit, means for tuning said circuit to the signaling frequency, a second circuit containing a coil electrically connected with said signaling circuit and normally transparent to a broad band of frequencies, and means inductively associated with said last mentioned circuit whereby said second circuit is rendered opaque to the signaling frequency but transparent to other frequencies, causing said signaling frequency to be confined to said signaling circuit and all other frequencies to be by-passed by said second circuit, said means including a coil containing a greater number of turns than the first mentioned coil.

2. In a signaling system, the combination of a signaling circuit, means for tuning said signaling circuit to a particular signaling frequency, a plurality of paths each containing a coil electrically connected with said signaling circuit and arranged to be normally transparent to a broad band of frequencies, and independent means inductively connected to each of said paths whereby said paths are rendered opaque to the particular signaling frequency but transparent to all other frequencies, said means including a coil containing a greater number of turns than the first mentioned coil.

3. In a signaling system, the combination of a signaling circuit, a plurality of means for tuning said circuit to a particular signaling frequency, a plurality of circuits connected to said signaling circuit and separately connected to nodal points along said signaling circuit and between said first mentioned means, said circuits being normally transparent to a broad band of frequencies, and separate tuned circuits coupled therewith whereby said circuits are rendered substantially opaque to said signaling frequency, forcing said signaling frequency into said signaling circuit and by-passing all other frequencies.

4. A signaling system, comprising in combination a signaling circuit, inductive and capacitive means for tuning said circuit

to the signaling frequency, a second circuit electrically connected with said signaling circuit including an inductance small in value as compared with said inductive means and normally transparent to a broad band of frequencies, a tuned circuit including a relatively small capacity and a relatively large inductance coupled with said last mentioned inductance whereby said second circuit is rendered opaque to the signaling frequency but transparent to other frequencies, causing said signaling frequency to be confined to said signaling circuit and all other frequencies to be by-passed by said second circuit.

5. In a signaling system, the combination of a signaling circuit, inductive and capacitive means for tuning said signaling circuit to a particular signaling frequency, a plurality of paths electrically connected with said signaling circuit each containing an inductance small in value as compared with said inductive means and each arranged to be normally transparent to a broad band of frequencies, and independently tuned circuits coupled to each of said inductances comprising relatively small capacities and relatively large inductances arranged to be tuned to said signaling frequency whereby said paths are rendered opaque to the particular signaling frequency but transparent to all other frequencies.

6. The combination of a signaling circuit, means for tuning the said circuit to a particular signaling frequency, a path containing a coil responsive to a broad band of frequencies connected between a nodal point in said signaling circuit and another portion thereof, and means, including a coil in inductive relation to the first mentioned coil whereby said path may be rendered substantially opaque to said signaling frequency, the turn ratio between the coils being greater than unity.

7. A signaling system, comprising in combination a signaling circuit, means for tuning the circuit to the signaling frequency and means connected with the signaling circuit for confining the signal to said circuit, said last mentioned means including a transformer, the voltage transformation ratio of which is other than unity.

8. A signaling system comprising the combination of a signaling circuit, means for tuning said circuit to the signaling frequency, a second circuit containing a coil electrically connected with said signaling circuit and normally transparent to a broad band of frequencies, and means inductively associated with the last mentioned circuit whereby said second circuit is rendered opaque to the signaling frequency, said means including a condenser connected across a coil which contains a greater number of turns than the first-mentioned coil.

9. In a signaling system, the combination of a signaling circuit, means for tuning said signaling circuit to a particular signaling frequency, a plurality of paths each containing a coil electrically connected with said signaling circuit and arranged to be normally transparent to a broad band of frequencies and independent means inductively connected to each of said paths whereby said paths are rendered opaque to the particular signalling frequency but transparent to all other frequencies, said means including a condenser connected across a

coil which contains a greater number of turns than the first mentioned coil.

10. A signaling system comprising in combination a signaling circuit, means for tuning the circuit to the signaling frequency, a coil connected in parallel with said circuit, said coil comprising the primary of a transformer, the secondary of which consists of a coil containing a number of turns greater than that in the primary, and an adjustable condenser connected across the secondary.

LOUIS W. AUSTIN.