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CALLING ARRANGEMENT FOR RADIOTELEPHONE CIRCUITS

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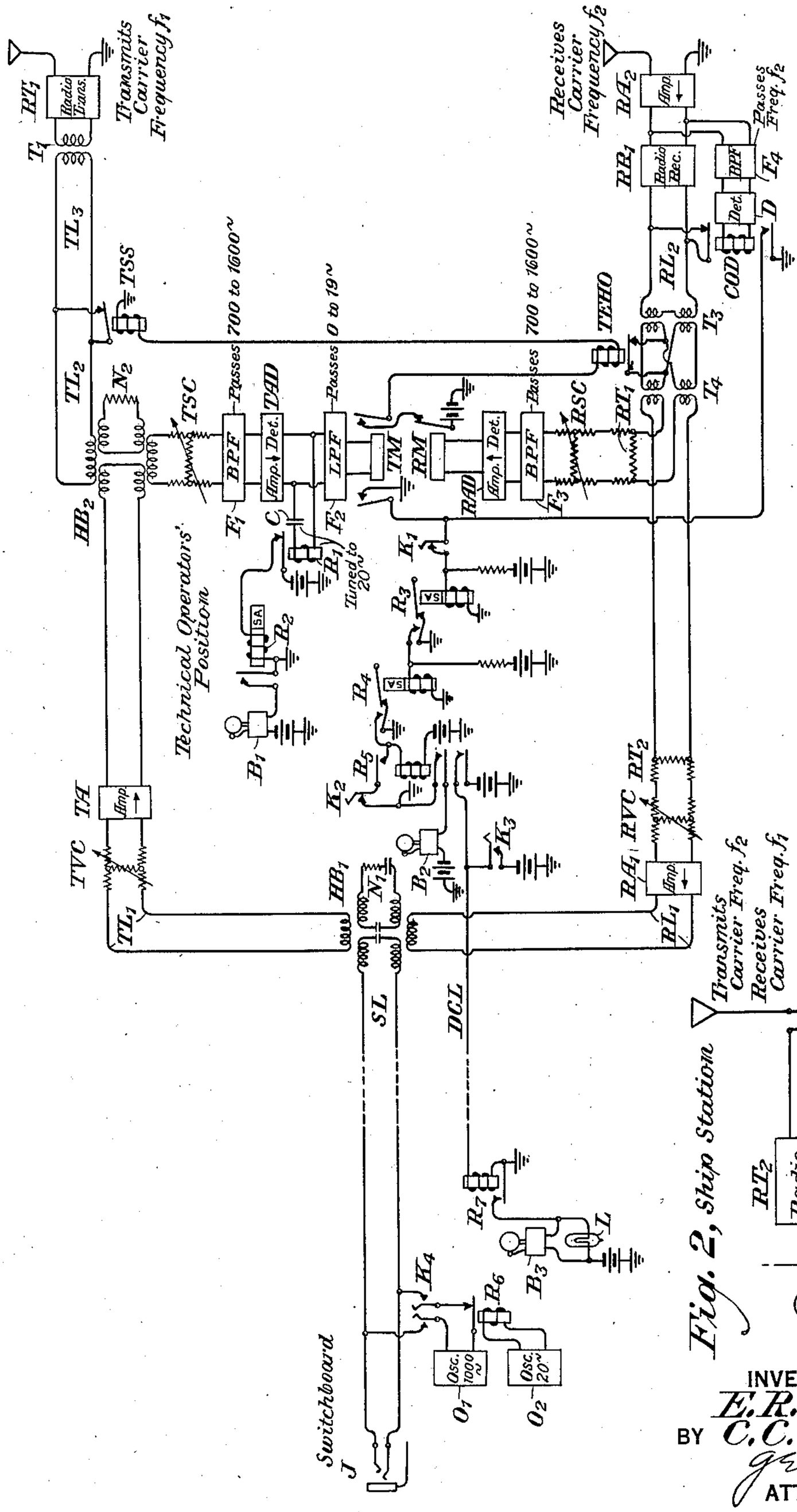

Fig. 1, Shore Terminal

Fig. 2, Ship Station

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CALLING ARRANGEMENT FOR RADIO-TELEPHONE CIRCUITS

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This invention relates to radio telephone systems and more particularly to arrangements for calling operators at stations equipped with echo or singing suppressing devices.

In operating a radio telephone circuit such for example as may be used in a ship harbor, it is essential that the technical operator in charge of the controls of the system be in attendance when communication is attempted but it is uneconomical and wasteful to require the undivided attention of the technical operator throughout the entire period that service is offered. This is particularly true during certain periods of the night and on holidays, when relatively little traffic is offered. It is also desirable in the interest of economy, ease of operation and freedom from maintenance to restrict the boat equipments to the simplest and most rugged apparatus capable of affording the desired operation.

As is well known, a radio transmitter and radio receiver may be connected by means of a combination of four-wire and two-wire circuits to a two-wire terminal at a switching point where connections may be established by a switching operator between the radio channel and various telephone circuits. It is also well known that terminal amplifiers, voice-operated devices and other apparatus under the control of a technical operator may be associated with the four-wire circuit in such a manner that echoes and singing, which might be caused by radio or wire line unbalances, are effectively eliminated, and radiation by the radio transmitter of signals received by the radio receiver is prevented.

In accordance with this invention, circuit arrangements are provided whereby an alarm is automatically operated at the control position when communication is attempted in either direction and whereby an alarm is operated at the switchboard or switching center when communication is desired between the radio stations and a land telephone station. These functions are obtained without requiring any apparatus peculiar to the alarm signal system at the outlying or boat radio stations and only a small amount of such apparatus at the other stations. Circuit arrangements are also provided whereby the switchboard operator may, at will, cause the operation of an alarm at the control terminal or technical operator's position, over the normal speech transmission path. In general the economy of apparatus and simplicity of operation is obtained by novel circuit arrangements whereby a part of the apparatus provided for the control of the speech circuit is also used to control the alarm arrangements.

The invention may now be more fully understood from the following description when read in connection with the accompanying drawing, Figure 1 of which shows the circuit arrangement for one terminal of a radio system embodying the invention, and Fig. 2 of which shows a circuit arrangement which may be used for one or more of the radio stations to be communicated with.

Referring to the drawing, Fig. 1 shows the circuit arrangement of one end of the radio telephone system which will be called the "shore terminal" for descriptive purposes. Fig. 2 shows the circuit arrangement of one of the radio stations to be communicated with, which is called a "ship station" for descriptive purposes. It will be understood, of course, that the invention is not to be limited to a ship-to-shore radio telephone system.

Referring to Fig. 1, SL designates the two-wire line connecting the control station to the switchboard. The two-wire line SL is connected through a hybrid coil HB_1 to a transmitting path TL_1 and a receiving path RL_1 being balanced by a suitable network N_1. The path TL_1 and the following parts of the transmitting circuit include the transmitting volume control variable attenuator TVC, amplifier TA, hybrid coil HB_2, transmitting path TL_2, transmitting path TL_3, transformer T_1, and radio transmitter RT_1. The receiving path includes receiving amplifier RA_2, radio receiver RR_1, receiving path RL_2, transformers T_3 and T_4, resistance termination RT_2, receiving volume control attenuator RVC, amplifier RA_1 and receiving path RL_1.

In order that when transmission is taking place over either the transmitting or receiving path the other path will be disabled, echo suppressor devices are associated with each path. The echo suppressor associated with the transmitting path TL_1 comprises an amplifier-detector unit TAD, of well known type, with its input connected through variable attenuator TSC and band-pass filter F_1 to hybrid coil HB_2 in conjugate relationship with transmitting path TL_2, the output of amplifier TA being balanced by a suitable network N_2. The output of the amplifier-detector unit TAD controls through master relay TM the relay TSS and TEHO for performing operations incident to the blocking or disabling operations whereby transmission is permitted in only one of the paths TL_2 and RL_1 at a time. Normally, transmission path TL_2 is disabled by the back

contacts of relay TSS, which short-circuit the conductors, and transmission from transmission path TL_1 to the radio transmitter cannot take place. Blocking means comprising transformer arrangements T_3 and T_4 are associated between receiving lines RL_1 and RL_2. These disabling means comprise transformer arrangements which are so connected as to be balanced when the contacts of relay TEHO are opened, thereby preventing transmission through the transformer arrangements. When the contacts of relay TEHO are closed, however, the transformer circuits instead of being balanced are, in effect, connected so as to be parallel-aiding, thereby permitting transmission to take place readily. Normally, relay TEHO (which is controlled by the amplifier-detector TAD) is de-energized so that the receiving path is unblocked to permit transmission to take place from receiving path RL_2 to the two-wire line SL.

The input of an amplifier-detector arrangement RAD is connected through band-pass filter F_3, receiving sensitivity control RSC and resistance termination RT_1 to the secondary windings of transformer T_4, so as to be effectively in series with the resistance termination RT_2 in the receiving path RL_1, and has in its output a relay RM, which when operated opens the control circuit from the amplifier-detector TAD to switching relays TSS and TEHO, thereby maintaining the transmitting path TL_2 blocked and receiving path RL_1 unblocked when signal currents are being received from the radio receiver. Static or other interference is prevented from causing operation of relay RM during idle periods by the action of relay COD which maintains a short circuit on receiving path RL_2 whenever receiving carrier f_2 is not present. As will be explained later in connection with Fig. 2, the distant or boat transmitters are so arranged that carrier frequency f_2 is radiated only when communication from a boat to the shore is desired. The control circuit of relay COD includes the following: The input band pass filter F_4 which passes substantially only carrier frequency f_2 is connected in multiple with the input of radio receiver RR_1 and the output of filter F_4 is connected to the input of detector D, the D. C. output of which controls the operation of relay COD.

The operation of the apparatus so far described for signal transmission is as follows: Signal currents incoming over the two-wire circuit SL pass through the hybrid coil HB_1 and through the amplifier TA. Some of the energy enters the amplifier-detector unit TAD and causes relays TM, TSS and TEHO to be energized. Relay TSS removes the short circuit from transmitting line TL_2, while relay TEHO, by opening its contact, causes the transformer arrangements T_3 and T_4 to block the receiving path. In the meantime a part of the energy passes from hybrid coil HB_2 through transmitting paths TL_2 and TL_3 to radio transmitter RT_1 and is transmitted on carrier frequency f_1. The receiving amplifier-detector RAD associated with the receiving path cannot be actuated to disturb the circuit condition now existing because the receiving path is disabled in the manner already described.

If in the normal condition of the circuit, carrier frequency f_2 modulated with signals is received through amplifier RA_2, a part of the received energy passes through band pass filter F_4 to detector D causing the operation of relay COD, which removes the short circuit from receiving path RL_2. In the meantime the remainder of the received energy passes into radio receiver RR_1 and is demodulated, the resultant signals pass through receiving path RL_2 and the transformer arrangements T_3 and T_4. A part of the energy passes through receiving amplifier RA_1 and hybrid coil HB_1 to the two-wire line SL. The remaining received energy passes through receiving sensitivity control RSC to the amplifier-detector RAD, to cause the operation of relay RM which opens the circuit controlled by the amplifier-detector unit TAD, thereby preventing energization of relays TSS and TEHO, so that the transmitting path is disabled and the receiving path remains unblocked so long as the signal currents are being received.

The apparatus and circuits employed at the ship station may be of several well known types, as, for example, those shown in Fig. 2 which shows an antenna normally connected to radio receiver RR_2 which is arranged to receive carrier frequency f_1 and the radio transmitter RT_2, arranged to transmit carrier frequency f_2. The antenna may be switched from the radio receiver RR_2 to radio transmitter RT_2 in a well known manner by relay AR which is controlled by key AK. The output of radio receiver RR_2 is connected to operator's receiver OR_2 and the input of radio transmitter RT_2 is connected to operator's transmitter OT_2. Accordingly, the operator at the ship station may normally receive signals transmitted on carrier frequency f_1 and may transmit signals on carrier frequency f_2 by operating key AK which enables radio transmitter RT_2 and disables radio receiver RR_2 and carrier frequency f_2 is radiated only when signals are to be transmitted from the boat.

The apparatus so far described relates to communication between the two-wire line SL and a distant radio station. The additional equipment and circuits which are associated with the shore terminal in order to afford signal alarm features will now be described. Referring to Fig. 1 and the operation of the echo and singing suppressing means described above, it will be seen that relay TM must be operated whenever signals are transmitted from the two-wire line SL to the radio transmitter RT_1 and that relay COD must be operated whenever signals are transmitted from the radio receiver RR_1 to the two-wire line SL and hence one or the other of these two relays TM and COD must be operated whenever communication is attempted in either direction of transmission. Contacts of these relays are connected to suitable circuits and apparatus for producing an alarm whenever either of them is operated. Accordingly the alarm circuit includes the following: The left-hand contacts of relay TM, the lower contacts of relay COD, key K_1, relays R_3, R_4 and R_5, key K_2 and bell or buzzer B_2, for giving an alarm at the technical operator's position and in addition key K_3, line DCL, relay R_7, bell B_3 and lamp L, for giving an alarm at the switchboard.

The operation of the circuit is as follows: the operation of either relay TM or relay COD connects ground to key K_1 and short-circuits the winding of relay R_3 which is normally operated as shown, if key K_1 is in its normal position, that is, with contacts closed. Key K_1 is provided so that the alarm arrangements may be disabled when alarm operation is not desired. Relays R_3 and R_4 are made slow acting in a well-known manner such as short-circuited windings or the addition of a copper slug to the core in order that intermittent, short duration operations of relays

TM and COD, such as might be caused by static, may not give an alarm. To continue the circuit operation, relay R_3 releases after a predetermined interval of time has elapsed and its contacts close, short-circuiting in turn the windings of relay R_4. After a second predetermined interval of time relay R_4 releases and its contacts close causing the operation of relay R_5. This causes the inner lower contacts of relay R_5 to complete the circuit of bell or buzzer B_2 giving an alarm. If key K_2 is in the normal position with its contacts closed relay R_5 will lock itself operated through its upper contacts and the alarm will continue until key K_2 is operated to break the locking circuit.

The remainder of the circuit operation required to operate the alarm at the switchboard is as follows: Relay R_5 operating as above closes its lower outer contacts connecting battery to line DCL and hence causing operation of relay R_7 at the switchboard. Relay R_7 closes its contact completing the circuit for bell B_3 and lamp L giving an audible and visual alarm at that point. Key K_3 is provided at the technical operator's position so that the lower outer contacts of relay R_5 may be short-circuited and an alarm given at the switchboard, if desired, when relay R_5 is unoperated.

Other apparatus and circuits are provided as mentioned earlier to afford means whereby the switchboard operator may signal the technical operator at will. These arrangements include the following: Oscillator O_1 which generates a frequency suitable for transmission through the system, a lower frequency oscillator O_2, relay R_6, key K_4, all at the switchboard end of two-wire line SL and condenser C and relay R_1 which are tuned to the frequency of oscillator O_2, relay R_2 and bell B_1 at the technical operator's position. The output of oscillator O_1 is modulated or periodically interrupted by relay R_6 whose operation and release are controlled by the output of oscillator O_2. When signaling is desired key K_4 is operated connecting the modulated output of oscillator O_1 to the two-wire line SL. This energy passes through line SL, hybrid coil HB_1, transmitting path TL_1, volume control TVC, amplifier TA, hybrid coil HB_2, sensitivity control TSC band pass filter F_1 to amplifier-detector TAD where it is demodulated to produce energy of the same frequency as oscillator O_2. This demodulated energy passes through condenser C and the windings of relay R_1 and since they are tuned to that frequency, causes the operation of relay R_1. When relay R_1 has been operated for a predetermined length of time relay R_2 releases completing the operating circuit of bell B_1 and giving an alarm. Relay R_2 is made slow acting in order to prevent static, or noise which might cause momentary operation of relay R_1, from giving an alarm. Band pass filter F_1 serves to exclude a large amount of noise and other interference from amplifier-detector TAD and hence reduces the number of false operations of relays TM and R_1. The alarm circuit is relatively immune to false operation by speech waves since relay R_1 is relatively insensitive to frequencies other than say 20 cycles on account of its tuning, and because the impedance of low pass filter F_2, shunted across it, is low for frequencies below 19 cycles and high for those above. Furthermore analysis of the relative strengths of the various frequencies produced by the detection of speech waves shows that those higher in frequency than 19 cycles are relatively weak and of short duration. Thus those that do cause operation of relay R_1 seldom last long enough to permit relay R_2 to release and energize the alarm bell. It will also be noticed that the shunting effect of condenser C and relay R_1 will not adversely affect operation of relay TM since the shunt impedance may be made high at all except the resonance frequency.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a radio telephone system a four-wire circuit comprising a transmitting path and a receiving path for connecting a radio transmitter and radio receiver, respectively, to a two-wire terminal, and means common to both paths and operative in response to the transmission of speech signals in either direction through the four-wire circuit to translate such speech signals into an audible signal having tonal characteristics unrelated to speech.

2. In a radio telephone system a four-wire circuit comprising a transmitting path and a receiving path for connecting a radio transmitter and radio receiver, respectively, to a two-wire terminal, and means common to both paths and operative in response to the transmission of signals in either direction through the four-wire circuit to produce an indication and continue the same after said signals cease.

3. In a radio telephone system a four-wire circuit comprising a transmitting path and a receiving path for connecting a radio transmitter and radio receiver, respectively, to a two-wire terminal, means common to both paths and operative in response to the transmission of speech signals in either direction through the four-wire circuit to produce an indication at the two-wire terminal and continue the same after said signals cease.

4. In a radio telephone system a four-wire circuit comprising a transmitting path and a receiving path for connecting a radio transmitter and radio receiver, respectively, to a two-wire terminal, switching devices one associated with one branch of the four-wire circuit and the other associated with the other branch of the four-wire circuit for preventing echoes and singing therein, and means common to both paths and operative by the switching devices to produce an indication at the two-wire terminal in response to the transmission of signals in either direction through the four-wire circuit.

5. In a radio telephone system a four-wire circuit comprising a transmitting path and a receiving path for connecting a radio transmitter and radio receiver, respectively, to a two-wire terminal, a control position with means for controlling transmission in the four-wire circuit located remote from the two-wire terminal, and means common to both paths and operative in response to the transmission of signals in either direction through the four-wire circuit to produce indications at the two-wire terminal and at the control position and continue the same after said signals cease.

6. In a signaling system a transmission circuit adapted to transmit telephone signals and terminating at a switching position, echo suppressing means associated with the transmission circuit and including devices, one responsive to transmission in one direction, and the other responsive to transmission in the other direction for pre-

venting echoes therein, and common means operative by either device of said echo suppressing means to produce the same indication at the switching position regardless of which device is operated.

7. In a signaling system a transmission circuit adapted to transmit telephone signals and terminating at a switching position, special signal generating devices associated with the transmission circuit at the switching position, echo suppressing means located remote from the switching position and associated with the transmission circuit, said echo suppressing means having associated therewith means operating to translate speech currents and special signaling currents into translated currents having non-speech characteristics, means controlled by currents translated from speech currents for preventing echoes in said transmission circuit, and signal receiving devices operated by currents translated from signal currents produced by said special signal generating devices at the switching point, said signal receiving devices being unresponsive to telephone signals.

8. In combination, a speech transmission circuit, an amplifier-detector with its input connected to said transmission circuit and its output connected to a plurality of devices each responsive to a different type of signal, one of which devices controls transmission conditions in said transmission circuit and another of which produces a signal having characteristics unrelated to speech.

9. In combination, a transmission circuit, an amplifier-detector with its input connected to said transmission circuit and its output connected to a plurality of signal responsive devices, one of which is responsive to one band of frequencies and controls transmission conditions in said transmission circuit and another of which is responsive to another band of frequencies to produce a signal having characteristics unrelated to speech.

10. In combination, a transmission circuit, an amplifier-detector responsive to a predetermined frequency band with its input connected to said transmission circuit and its output connected to a plurality of signal responsive devices, one of which is responsive to one band of frequencies and controls transmission conditions in said transmission circuit and another of which is responsive to another band of frequencies to produce a signal having characteristics unrelated to speech.

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