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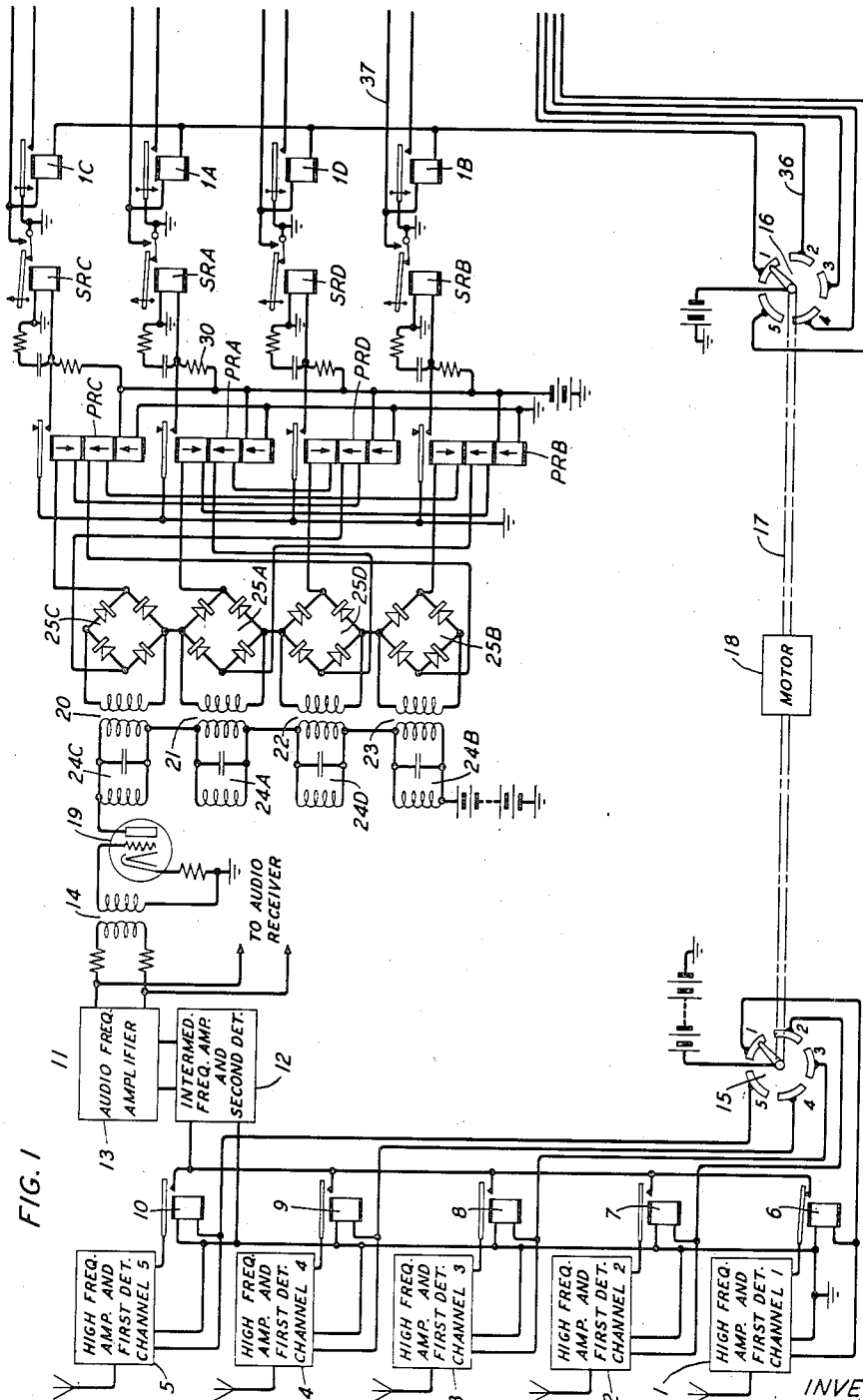
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2,093,855

RADIO TELEPHONE MONITORING SYSTEM

Filed May 19, 1936

3 Sheets-Sheet 1



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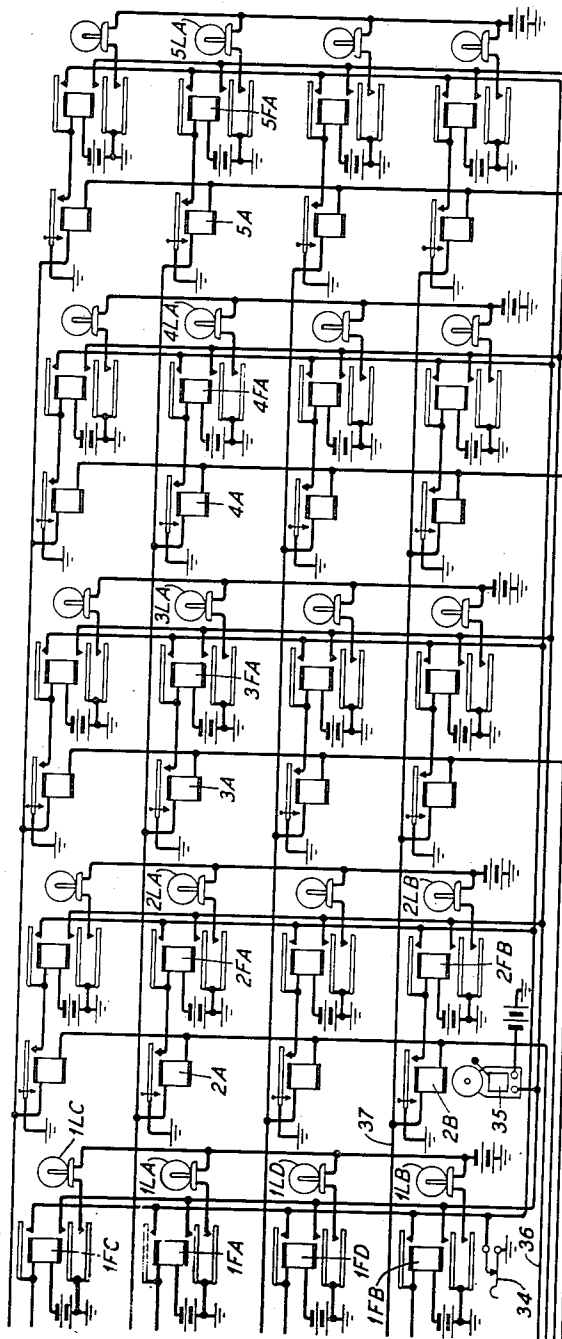


FIG. 2

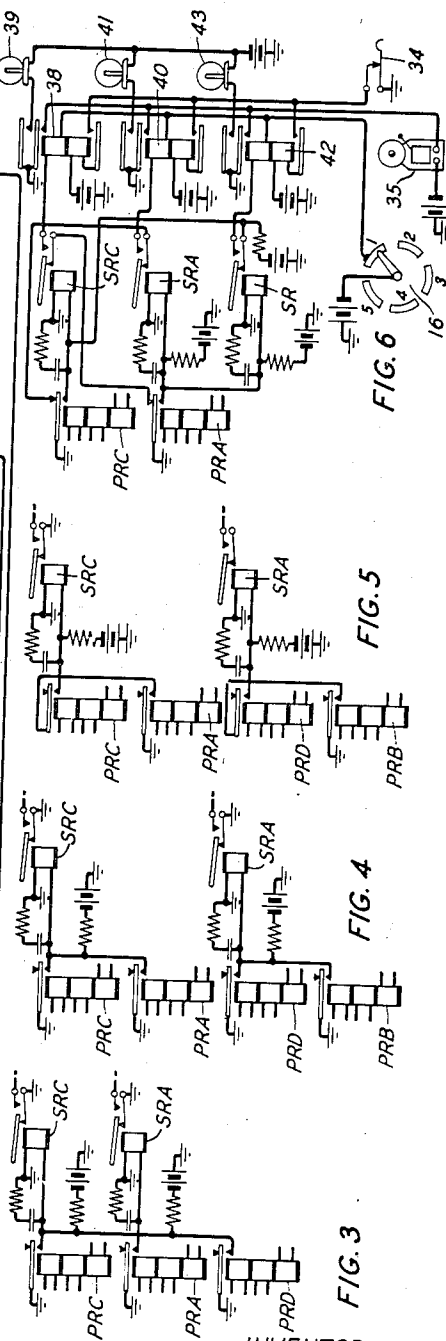


FIG. 3

FIG. 4

FIG. 5

FIG. 6

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FIG. 8

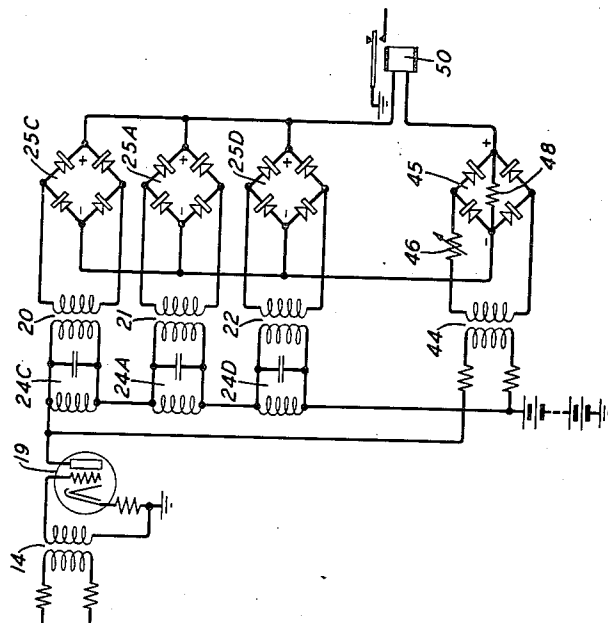
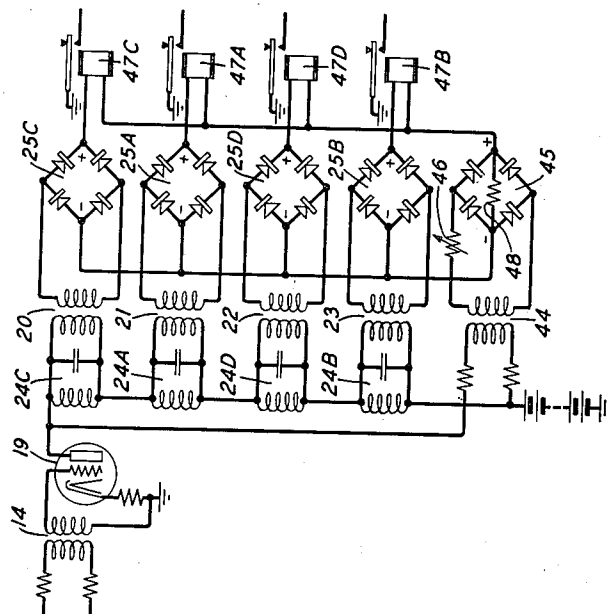


FIG. 7



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RADIO TELEPHONE MONITORING SYSTEM

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6 Claims. (Cl. 250—20)

This invention relates to radio telephone circuits and more particularly to facilities for enabling monitoring to be accomplished on a plurality of radio telephone receiving channels which are used on a shared time basis.

In some instances it is desirable to use one receiver for intercepting radio telephone reception from any one of a plurality of directive receiving antennae. One of these antennae may be arranged, for example, to receive at a frequency of 13345 kilocycles, a second to receive at a frequency of 14940 kilocycles, a third to receive at a frequency of 13345 kilocycles, a fourth to receive from two stations both operating on 14485 kilocycles and a fifth to receive from two stations both operating on 14485 kilocycles. Where the directivity of the antennae is sufficiently defined and the stations transmitting are operating on different frequencies, no great difficulty is encountered in determining which station is being received. However, when reception is required over several antennae as in the case assumed, from several transmitting stations operating on the same frequency, the antennae will not be sufficiently directive to determine definitely which of such stations is transmitting. It is therefore the object of the present invention to provide a monitoring and selective alarm system for enabling an accurate determination of the source of incoming radio transmission.

One manner in which this object may be attained is disclosed herein. It is to be understood, however, that this disclosure is only illustrative of one embodiment of the invention and that other equivalent circuits and apparatus might be employed without departing from the scope of the invention as defined in the appended claims.

In accordance with the present invention provision is made for monitoring by a single receiver on any one of a plurality of receiving channels, each associated with a receiving antenna. Each receiving channel comprises high frequency amplifier and first detector panels tuned to receive a particular high frequency carrier wave from one or more distant transmitting stations. The carrier waves transmitted from different stations are modulated by tone signals of relatively low frequency by means of which each transmitting station may be distinctively identified. The four stations transmitting on the same carrier frequency could be identified by four modulating tone frequencies, for example, 600, 1050, 1500 and 1950 cycles, respectively.

Provision is made for successively associating the common monitoring panel with each of the

receiving channels in rotation, for detecting the modulating tone frequency which may be present on the incoming carrier wave received by each channel while it is connected to the common monitoring channel, and for operating signaling devices indicative of the transmitting station from which the reception is being received and the particular receiving channel over which such reception may be intercepted. For this purpose a pair of constantly driven commutators is provided driven from a common driving means, one of which operates a plurality of switching relays in rotation to connect the outputs of the several receiving channels to the input of the common monitoring channel. The output of the monitoring channel is impressed upon the monitoring operator's audio receiving equipment, for example a loud-speaker, and also upon the input circuit of a selective detector and signal equipment.

The selective detector and signal equipment comprises a single tube amplifier, the input circuit of which is connected to the output circuit of the monitoring channel and the output circuit of which is connected to the primary windings of four output transformers tuned respectively to four different modulating tone or signal frequencies. The secondary of each of these transformers feeds into a full wave rectifier of the copper oxide type. The copper oxide rectifiers are connected to four polarized relays which are arranged to control any one of a plurality of groups of signaling devices including banks of lamps allocated respectively to the receiving channels and made effective in rotation by the second commutator.

By this arrangement each of the receiving channels and the allocated signaling devices are selected in rotation and during the monitoring on each channel any of four tone or signaling frequencies may be detected to operate the polarized relays and the lamps of the channel bank corresponding to those frequencies.

Several modifications of the selective signaling equipment have been disclosed illustrative of the flexibility of the system.

It is believed that a clearer understanding of the invention and its mode of operation may be obtained from a consideration of the following detailed description taken in connection with the accompanying drawings of which:

Figs. 1 and 2 taken together, with Fig. 2 placed at the right of Fig. 1, show schematically one embodiment of the monitoring system of the present invention. Fig. 1 discloses a plurality of receiving channels, the common monitoring chan-

nel, detector and tone signal responsive equipment and commutators by means of which the receiving channels are connected in rotation to the monitoring channel and the banks of signaling devices of Fig. 2 are successively made effective. Fig. 2 discloses banks of signaling equipment each bank being allocated to one of the receiving channels of Fig. 1;

Fig. 3 shows a modification of the tone signal response equipment of Fig. 1 for response to one signaling frequency when no inverter is used and for response to a second signaling frequency when an inverter is used;

Fig. 4 shows a further modification of the tone signal equipment for two tone operation providing for the detection of either one of two transmitting stations, reception of which may be intercepted upon the same high frequency receiving channel when there is selective fading.

Fig. 5 shows a further modification, also for two tone operation, arranged to prevent false operation from tone interference and to detect either one of two transmitting stations, reception from which may be intercepted upon the same high frequency receiving channel;

Fig. 6 shows a further modification enabling the detection of any one of six transmitting stations reception from which may be intercepted upon the same high frequency channel;

Fig. 7 shows a further modification of the tone signal responsive equipment of Fig. 1, wherein simple relays are used instead of polarized relays and provision is made for guarding against false operation by noise or static; and

Fig. 8 shows a further modification of the circuit disclosed in Fig. 7.

Reference will now be made to the main disclosure of the invention illustrated in Figs. 1 and 2. At the left of Fig. 1, the boxes 1 to 5, inclusive, diagrammatically illustrate five radio receiving channels, each tuned to receive a different high frequency carrier wave. Each channel comprises a receiving antenna, a high frequency amplifier and a first detector. The output circuits of these channels are each associable with the input circuit of a common monitoring channel 11 over contacts of the switching relays 6 to 10, inclusive, respectively. The common monitoring channel 11 comprises an intermediate frequency and second detector panel and an audio frequency amplifier schematically illustrated by the boxes 12 and 13. The output of the audio frequency panel 13 of the monitoring channel 11 is connected to any suitable receiving device (not shown) for example, a loudspeaker or telephone headset receiver and to the primary of input transformer 14.

Two commutators 15 and 16 are provided having their brush arms connected to a common driving shaft 17 driven by a motor 18 or other suitable source of power. The brush arms are continuously driven at a desirable speed in synchronism over correspondingly numbered segments of their respective arcs and are connected to the ungrounded terminal of a battery. The segments of commutator 15 are connected respectively with one terminal of the winding of each of the switching relays 6 to 10, inclusive, the other terminal of each relay being connected to ground. Thus as the brush arm of commutator 15 sweeps over the segments thereof, the switching relays are operated and released in succession thereby connecting the output circuits of the several receiving channels to the input circuit of the monitoring channel in rotation. In

the position of the brush arm of commutator 15 illustrated, the No. 1 receiving channel 1 is associated with the monitoring channel 11. The segments of commutator 16 are connected to the windings of groups of relays for a purpose to be later described.

It will be obvious to those skilled in the art that other well-known types of switching devices such as synchronously operated step-by-step switches might be employed in lieu of the commutators disclosed.

The secondary of input transformer 14 is connected to the input of amplifier tube 19, the output circuit of which extends serially through the primary windings of transformers 20 to 23 inclusive. Each of these primary transformer windings is tuned to be responsive to a particular signaling frequency by a filter circuit. It will be assumed that transformer 20 is tuned by filter 24C to a signaling frequency of 1950 cycles; that transformer 21 is tuned by filter 24A to a frequency of 1500 cycles; that transformer 22 is tuned by filter 24D to a frequency of 1050 cycles; and that transformer 23 is tuned by filter 24B to a frequency of 600 cycles. Hereinafter these frequencies 1950, 1500, 1050 and 600 will be referred to as frequencies C, A, D and B, respectively.

The secondary of each transformer is bridged across the two opposite input junctions of a full wave rectifier of the copper oxide type, the four rectifiers associated with the four transformer secondaries being designated 25A to 25D, inclusive. The output junctions of these rectifiers are connected to the windings of four polarized relays PRA, PRB, PRC and PRD. Each of the polarized relays is provided with three windings, the upper winding being an operating winding, the middle winding a biasing winding, and the lower winding a direct current biasing winding to normally hold the relay armature against its back contact. The upper operating winding of relay PRC and the middle biasing winding of relay PRD are connected in series across the output junctions of rectifier 25C; the upper operating winding of relay PRA and the middle biasing winding of relay PRB are connected in series across the output junctions of rectifier 25A; the upper operating winding of relay PRD and the middle biasing winding of relay PRA are connected in series across the output junctions of rectifier 25D and the upper operating winding of relay PRB and the middle biasing winding of relay PRC are connected in series across the output junctions of rectifier 25B.

With the polarized relays thus connected, signaling frequency A will operate polarized relay PRA and bias relay PRB against operation; frequency B will operate relay PRB and bias relay PRC against operation; frequency C will operate relay PRC and bias relay PRD against operation; and frequency D will operate relay PRD and bias relay PRA against operation. The presence of any one of the four frequencies in the output circuit of tube 19 will therefore operate the corresponding polarized relay and the presence of any two frequencies will operate at least one relay and in some cases two. With the operating and biasing circuits of the relays arranged in this manner, noise or static disturbances entering through the four tuned output transformers tend to be balanced out in each polarized relay, thus causing no relay operation. Likewise voice currents tend to balance out although the balance is not so perfect over the frequency band as it is in

the case of static currents. It is desirable to assign the 1500 cycle signaling frequency, designated A, first to all channels provided no inter-channel interference can result. This frequency has the advantage that inverters on the channel make no difference. The other frequencies may be assigned as desired.

Four slow-to-release relays SRA, SRB, SRC and SRD are provided, individual respectively to the polarized relays PRA, PRB, PRC and PRD and controlled thereby. These relays are normally operated, the circuit of each extending from ground through its winding and a resistance to grounded battery, the circuit of relay SRA extending for example from ground through its winding, resistance 30 to battery. These relays are arranged to control the operation of a plurality of groups of signaling devices allocated respectively to the high frequency receiving channels and made successively operable by the commutator 16, each group of signaling devices comprising two groups of control relays and a bank of signal lamps.

As disclosed, each group of signaling devices is arranged to identify the reception of transmission from any one of four transmitting stations which may be arranged to transmit on the same carrier frequency and may be received on the receiving channel to which the group of devices is allocated. However, when it is not necessary to identify reception from as many as four transmitting stations on any channel, the number of relays and lamps in the group of signaling devices allocated to that channel may be reduced. In the following description of the elements of each group of signaling devices, the prefix numeral of each identifying character has been employed to indicate the receiving channel to which it is allocated, the numeral 1 indicating channel 1, the numeral 2 indicating channel 2, etc., and the suffix letter of each identifying character has been employed to indicate the modulating tone or signaling frequency detected on the channel at the time being monitored and thus the particular transmitting station from which reception is being received. Thus the characters 1B, 1FB and 1LB indicate that these elements are allocated to receiving channel 1 and are responsive when reception is detected on that channel from a transmitting station modulated with signaling frequency B, similarly characters 5A, 5FA and 5LA indicate that these elements are allocated to receiving channel 5 and are responsive when reception is detected on that channel from a transmitting station modulated with signaling frequency A.

It will be assumed that it is necessary to identify any one of four transmitting stations, reception from which may be incoming over receiving channel 1, and that therefore the first group of signaling devices comprises a first group of four slow-to-operate relays 1A, 1B, 1C and 1D, a second group of four fast relays 1FA, 1FB, 1FC and 1FD and a bank of four lamps 1LA, 1LB, 1LC and 1LD. It will also be assumed that it is necessary to identify either of two transmitting stations, reception from which may be incoming over receiving channel 2, and that therefore the second group of signaling devices comprises a first group of two slow-to-operate relays 2A and 2B, a second group of two fast relays 2FA and 2FB and a bank of lamps 2LA and 2LB. It will be further assumed that it is necessary to identify only one transmitting station over each of the remaining channels 3, 4 and 5 each of which is

modulated by a signaling frequency A, reception of transmission over channel 3 being identified as modulated by signaling frequency A, by the relays 3A, 3FA and lamp 3LA, reception over channel 4 being identified as modulated by signaling frequency A, by relays 4A, 4FA and lamp 4LA and reception of transmission over channel 5 being identified as modulated by signaling frequency A, by relays 5A, 5FA and lamp 5LA. In the case assumed, the remaining relays and lamps of the groups of signaling devices may be omitted in the initial installation.

The apparatus having now been described, the manner in which it functions will be discussed. With the commutator brush arms in the position disclosed, switching relay 6 is operated and receiving channel 1 is connected to the common monitoring channel. It will now be assumed that a station is transmitting, reception from which is intercepted by the directive antenna associated with channel 1 and that this station is transmitting on a carrier frequency modulated by signaling frequency A, for example of 1500 cycles. This modulated carrier current will be detected and amplified by amplifier tube 19 and impressed on the output circuit of tube 19 through the serially connected primary windings of transformers 20, 21, 22 and 23. Since the primary windings of these transformers are tuned by the filter circuits connected therewith, only the primary winding of transformer 21 will pass energy of frequency A. Current will therefore be induced in the secondary winding of transformer 21, rectified by rectifier 25A and impressed upon the upper operating winding of polarized relay PRA and the middle biasing winding of polarized relay PRB. Relay PRB being biased by this current and the biasing current flowing through its lower winding will not operate. The current flowing through the operating winding of relay PRA will, however, be sufficient to overcome the effect of the lower biasing winding of this relay and relay PRA will therefore operate.

Relay PRA upon operating connects ground over its front contact to a point between resistance 30 and the winding of relay SRA whereupon the normally operated relay SRA releases after an interval of approximately .4 second. This delay is introduced to prevent any false operation which might occur should relay PRA be operated by speech currents or static. When relay SRA releases, with the brush arm of commutator 16 engaging its No. 1 segment, relay 1A operates over a circuit extending from battery, brush arm and the No. 1 segment of commutator 16, winding of relay 1A to ground at the back contacts of relay SRA. Relay 1A upon operating establishes an obvious circuit for relay 1FA which locks over its upper contact under the control of release key 34, closes an obvious circuit for lamp 1LA over its outer lower contact and over its inner lower contact establishes an obvious circuit for the alarm 35. The operator is now apprised by the sounding of the alarm 35 and the lighting of lamp 1LA that reception is being received over receiving channel 1 from a particular transmitting station identified by the signaling frequency A.

If instead of frequency A one of the other frequencies such as B had been received, polarized relay PRB would have operated releasing relay SRB which in turn would have caused the operation of relays 1B and 1FB, the lighting of lamp 1LB and the sounding of alarm 35, thus apprising the operator that reception was being re-

ceived over channel 1 from the particular transmitting station identified by signaling frequency B. It is thus possible to identify any one of four transmitting stations, reception from which may be received over channel 1.

As the commutators 15 and 16 continue in their rotation and their brush arms leave the No. 1 segments, switching relay 6 and the operated polarized relay, in the case assumed, relay PRA releases, thereby permitting relay SRA to again operate. Relay 1A also releases opening the operating circuit of relay 1FA but this relay being locked is not released until the operator desires to do so by operating the release key 34. When the brush arms of the commutators engage their No. 2 segments, switching relay 7 is operated to connect the No. 2 receiving channel 2 to the monitoring channel 11 and a circuit is prepared over conductor 36. It will now be assumed that a station is transmitting, reception from which is intercepted by the selective antenna associated with receiving channel 2 and that the station is transmitting on a carrier frequency modulated by signaling frequency B, which signaling frequency now causes the operation of polarized relay PRB and the release of relay SRB. With the brush arm of commutator 16 engaging its No. 2 segment, a circuit is now completed from battery over the brush arm and No. 2 segment of commutator 16, conductor 36, winding of relay 2B, conductor 37 to ground at the back contact of relay SRB. After a slight interval relay 2B operates and establishes an obvious circuit for relay 2FB which operates, locks under control of release key 34, closes the circuit of alarm device 35 and the circuit of lamp 2LB. The operator hearing the alarm and noting the illuminated lamp 2LB is apprised of the fact that reception is being received over receiving channel 2 from a particular transmitting station identified by the signaling frequency B. Had a station identified by signaling frequency A been transmitting, then in a similar manner polarized relay PRA would have operated releasing relay SRA, relays 2A and 2FA would have operated and lamp 2LA would have lighted to identify the particular transmitting station.

As the commutators continue to sweep over their segments, the remaining channels become successively associated with the monitoring channel and the identification of the transmitting stations is accomplished in the same manner by the selective lighting of lamps in the banks containing lamps 3LA, 4LA and 5LA allocated to the respective receiving channels.

The modification of Fig. 3 shows an arrangement of the polarized relays PRC, PRA and PRD responsive respectively to signaling frequencies C, A and D, with respect to relays SRC and SRA for controlling the identification of two stations reception from which may be received over one channel, the identification of one of such stations using the modulating frequency A being made in the manner previously described and the identification of the second of such stations being possible if it uses the modulating frequency D or the inversion of this frequency C. In this case the shunting down of relay SRC may be controlled either through the operation of polarized relay PRC in response to frequency C when the inverter is out at the transmitting station or through the operation of polarized relay PRD when the inverter is in.

The modification of Fig. 4 shows an arrangement of the polarized relays with respect to relays

SRC and SRA for controlling the identification of two transmitting stations reception from which may be received over the same receiving channel, when each station employs a combination of two signaling frequencies for protection from selective fading. In this case if one station is to be identified in the presence of selective fading between frequencies A and C, either polarized relay PRA or PRC or both will be operated. The operation of either one releases relay SRC which will cause the identification of such station. In a similar manner if the other station is to be identified in the presence of selective fading between frequencies D and B, polarized relay PRD or PRB or both will be operated. The operation of either one releases relay SRA which will cause the identification of the second station.

In accordance with the modification of Fig. 5, either one of two stations, reception from which may be received over the same receiving channel may be identified when each station employs a combination of two frequencies where transmission is not troubled by selective fading but tone interference or heterodyne may cause false operation on a single frequency basis. For example the first station may transmit on a carrier modulated with both signaling frequencies C and A thereby operating both polarized relays PRC and PRA and the other station may transmit on a carrier modulated with both signaling frequencies D and B, thereby operating polarized relays PRD and PRB. Relays PRC and PRA jointly control the release of relay SRC since the shunting circuit of relay SRC extends serially over front contacts of both of these relays. Similarly relays PRD and PRB jointly control the release of relay SRA. Relays SRC and SRA may then be employed as previously described to control the identification of two transmitting stations.

Fig. 6 shows in part a modification of Figs. 1 and 2 whereby more than four stations may be identified over a single receiving channel. In this case the same four polarized relays would be employed operated singly and in combination. To simplify the disclosure only two of the polarized relays and the relays controlled thereby have been disclosed, but it is to be understood that the other two polarized relays would control similar equipment. It will be assumed that it is desired to identify six stations. The first station would be identified by signaling frequency C, the second by frequency A, the third by combined frequencies A and B, the fourth by frequency D, the fifth by frequency B and the sixth by combined frequencies B and D. When frequency C is received alone, relay PRC operates releasing relay SRC whereupon a circuit is established for relay 38 when the brush arm of commutator 16 reaches the segment corresponding to the proper receiving channel, extending from battery over the brush arm and segment of the commutator, upper winding of relay 38, contacts of relay SRC to ground over the back contact of unoperated polarized relay PRA. Relay 38 upon operating locks over its lower winding and lower contact under the control of release key 34, operates the alarm 35 and lights the lamp 39 to identify the first station. Should signaling frequency A be received alone, polarized relay PRA would operate releasing relay SRA. With polarized relay PRC unoperated and relay SRA released, a circuit is now effective for relay 40 extending from battery as traced over the commutator 16, upper winding of relay 40, contacts of relay SRA to ground at the back contact of relay PRC. Relay 75

40 consequently operates, locks, causes the operation of alarm 35 and the lighting of lamp 41 to identify the second station. Should a combination of signaling frequencies C and A be received, both polarized relays PRC and PRA would operate releasing relays SRC and SRA and releasing relay SR. Since both relays PRC and PRA are operated there are no operating circuits for relays 38 and 40 but an operating circuit would be closed from battery as traced over the commutator 16, upper winding of relay 42, contacts of relay SR to ground at the front contact of relay PRC resulting in the operation of the alarm 35 and the lighting of lamp 43 to identify the third station. The other three stations would be identified in a similar manner.

In this modification, the two groups of relays such as 1A, 1B, etc. and 1FA, 1FB etc. of the signaling device of each channel disclosed in Figs. 1 and 2 have been replaced by a single group of double winding relays. It will of course be obvious that such double winding relays could with equal facility be employed in the circuit of Figs. 1 and 2.

In the modification of Fig. 7, provision is made for replacing the triple winding polarized relays PRA, PRB, etc. of Fig. 1 with simple non-polarized relays and for guarding the signaling circuit against false response to static disturbances or voice currents. In accordance with this modification, the output circuit of the amplifier tube 19 extends serially through the primary windings of output transformers 20, 21, 22, 23 tuned respectively to signaling frequencies C, A, D and B by the filters 24C, 24A, 24D and 24B and, in parallel therewith through the primary winding of the untuned guarding transformer 44. The secondary windings of these transformers feed into the full wave Rectox rectifiers 25C, 25A, 25D, 25B and 45 respectively. Signaling frequency C for example applied to transformer 20 to the full wave rectifier 25C produces a potential across the terminals of the rectifier marked + and - which tends to produce a flow of current from terminal + through the winding of relay 47C, resistance 48 to terminal - of rectifier 25C causing the operation of relay 47C. Similar circuits for relays 47A, 47B and 47D are effective in response to signaling frequencies A, B and D. Transformer 44 forms a relatively high impedance shunt for the output circuit of tube 19 and receives all of the frequency bands passed by the receiving channel associated with the tube 19, the signaling frequencies A, B, C and D being in this case somewhat enhanced compared to other frequencies, because of the high impedance of the tuned circuits 24A, 24B, 24C and 24D at those frequencies. If static disturbances are present, the potential produced across the output terminals of rectifier 45 and across resistance 48 is adjusted by rheostat 46 until it equals or is slightly greater than the potentials produced across the other rectifiers.

The operation of the circuit is then as follows: With no signaling frequency present, noise or static will produce a potential across resistance 48 of rectifier 45 which puts a bias across the output junctions of the other rectifiers so that no rectification occurs therein. This bias will follow static crashes so that no operation of relays 47A, 47B, 47C or 47D will occur. Similar action occurs with speech current applied to the amplifier tube 19, the total speech current frequency band producing a potential across resistance 48 sufficient

to prevent relay operation except in rare cases. If a signal of the C frequency is received, however, the potential across rectifier 25C becomes greater than the potential across resistance 48 and current flows through relay 47D causing it to operate. The ratio between the potential across rectifier 25C and that across resistance 48 produced by frequency C will be equal to or somewhat less than the ratio of the frequency band width received by the transformer 44 to that of the tuned transformer 20. While frequency C is present in sufficient volume compared to static, rectifiers 25A, 25B, 25D and 45 are biased so that no rectification occurs. As the potential across rectifier 25C due to frequency C approaches that produced across rectifier 25C and likewise across resistance 48 by static, a point is reached where failure to operate relay 47C occurs. The frequency C is then well down into the noise level, however.

Similar action occurs if signal frequency A, B or D is received, relay 47A, 47B or 47D being operated and other relays prevented from operating. The relays 47A, 47B, 47C and 47D may be employed to control groups of signaling devices in the same manner as illustrated in connection with polarized relays PRA, PRB, PRC and PRD of Figs. 1 and 2.

The modification of Fig. 8 is similar to that of Fig. 7 except that provision is made for the operation of relay 50 in response to three signaling frequencies. When no signaling frequencies are present the rectifiers 25C, 25A and 25D are biased by rectifier 45 so that no current flows through the winding of relay 50 from noise or static disturbances. When, however, signaling frequencies C, A, and D are received, the frequency of highest volume C, for example, will take control and cause the transmission of current through the winding of relay 50 to operate it. The potential across the rectifier 25C appears as a bias across rectifiers 25A and 25D and since frequency C is of higher volume than frequency A or D no rectification occurs at rectifier 25A or 25D. However, if frequency C fades down below frequency A, frequency A may take control and operate relay 50 until such time as one of the other frequencies becomes of higher volume. This circuit may therefore be used to respond to signaling through selective fading with an automatic switch to the frequency of highest volume.

The output of the amplifier tube 19 as disclosed in Figs. 7 and 8 is connected to transformers tuned with anti-resonant filters with the untuned transformer 44 in multiple with them. These tuned circuits may be secured with resonant tuned transformers having low impedance at the resonant frequencies or with band-pass filters. Likewise the untuned transformer 44 may be in series with the remainder of the output circuit of tube 19. It is not the intention here to limit the output circuit to that shown but it is expected that an optimum arrangement can be chosen for each application of the circuit dependent upon the particular problem encountered.

What is claimed is:

1. In a signaling system, a plurality of high frequency channels over which different signaling frequencies identifying different transmission stations may be received, an intermediate frequency channel, a plurality of responsive devices associated with said intermediate frequency channel, each of said devices being responsive to a different signaling frequency, a plurality of banks of signal lamps, said banks of lamps being

allotted respectively to said high frequency channels and selectively responsive to said responsive devices, and means for successively associating each of said high frequency channels with said intermediate frequency channel and for simultaneously rendering the allotted banks of lamps subject to the control of said responsive devices.

2. In a signaling system, a plurality of high frequency channels over which different signaling frequencies identifying different transmitting stations may be received, an intermediate frequency channel, a plurality of responsive devices associated with said intermediate frequency channel, each of said devices being responsive to a different signaling frequency, a plurality of indicators allotted respectively to said high frequency channels and each comprising a group of relays and lamps controlled thereby, the relays of each of said indicators being selectively responsive to said responsive devices, and means for successively associating each of said high frequency channels with said intermediate frequency channel and for simultaneously rendering the groups of relays of said indicators successively subject to the control of said responsive devices.

3. In a signaling system, a plurality of high frequency channels over which different signaling frequencies identifying different transmitting stations may be received, an intermediate frequency channel, a plurality of transformers associated with the output circuit of said intermediate frequency channel, each tuned to be responsive to a different signaling frequency, a rectifier in the output circuit of each of said transformers, a relay in the output circuit of each of said rectifiers and each rendered responsive only to a particular signaling frequency, a plurality of indicators allotted respectively to said high frequency channels and each comprising a group of relays and lamps controlled thereby, the relays of each of said indicators being selectively responsive to said first relays, and means for successively associating each of said high frequency channels with said intermediate frequency channel and for simultaneously rendering the groups of relays of said indicators successively subject to the control of said first relays.

4. In a signaling system, a high frequency channel over which different signaling frequencies identifying different transmitting stations may be received, an intermediate frequency channel associable therewith, a plurality of transformers associated with the output circuit of said intermediate frequency channel, one of said

transformers being untuned and the others of said transformers being tuned to be responsive respectively to different signaling frequencies, a responsive device associated with the output circuit of each of said tuned transformers, an operating circuit for each of said responsive devices controlled jointly by the associated tuned transformer and said untuned transformer whereby each responsive device is rendered responsive only to an incoming signal of a predetermined frequency and is rendered unresponsive to static disturbances or to voice frequency currents, and signal lamps selectively responsive to said devices for indicating the identity of the transmitting stations.

5. In a signaling system, a high frequency channel over which different signaling frequencies identifying different transmitting stations may be received, an intermediate frequency channel associable therewith, a plurality of transformers associated with the output circuit of said intermediate frequency channel, one of said transformers being untuned and the others of said transformers being tuned to be responsive respectively to different signaling frequencies, a rectifier in the output circuit of each of said tuned transformers, a relay associated with each of said rectifiers, a rectifier in the output circuit of said untuned transformer, an operating circuit for each of said relays controlled jointly by the associated rectifier and said latter rectifier whereby each relay is rendered responsive only to an incoming signal of a predetermined frequency and is rendered unresponsive to static disturbances or to voice frequency currents, and signal lamps selectively responsive to said relays for indicating the identity of the transmitting stations.

6. In a signaling system, a high frequency channel over which different signaling frequencies may be received singly or in combination to identify different transmitting stations, an intermediate frequency channel associable therewith, a plurality of responsive devices associated with said intermediate frequency channel, each of said devices being responsive to a different signaling frequency, a plurality of relays, a circuit for each of said relays, the circuit of each of certain of said relays being controlled by a single responsive device in response to a single signaling frequency, and the circuits of others of said relays being controlled jointly by a plurality of said responsive devices in response to combinations of signaling frequencies, and station identifying lamps controlled by said relays.

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