

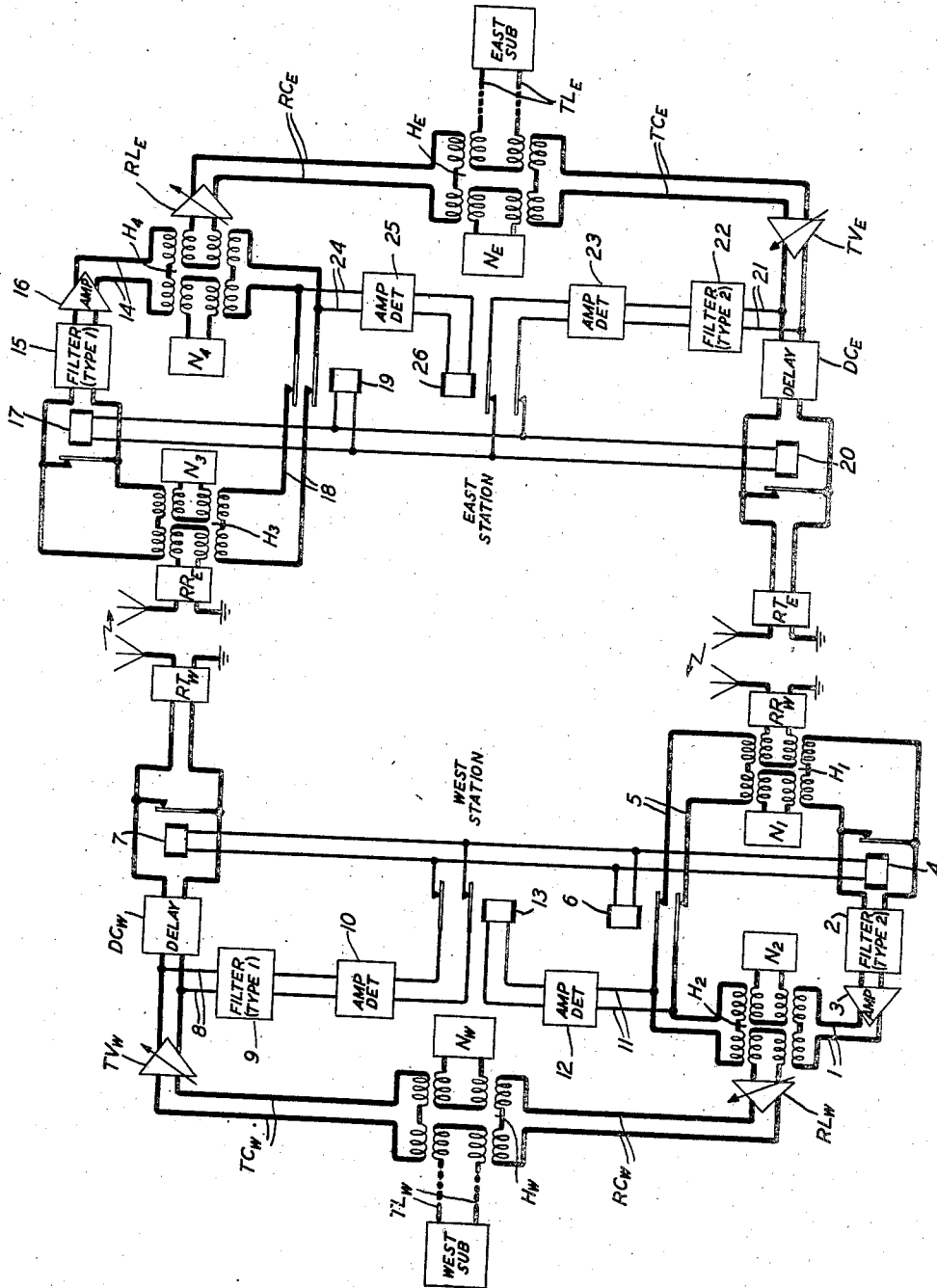
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TWO-WAY SIGNALING SYSTEM

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TWO-WAY SIGNALING SYSTEM

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The invention relates to two-way signal transmission systems and particularly to circuits for directionally controlling signal transmission in such systems.

The invention is specifically directed to two-way telephone systems employing voice-controlled switching circuits at the terminal stations to give exclusive directional control of transmission to the subscriber at one terminal who first starts to speak while at the same time minimizing signal transmission lock-out and clipping and facilitating break-in by the subscriber at the other terminal station. In one system of this type disclosed in the copending application of H. J. Fisher, Serial No. 338,884, filed June 5, 1940, which issued as Patent No. 2,251,276 on August 5, 1941, the control circuits at the terminals limit the transmission frequency range in both directions to only a portion, say one-half, of the signal frequency band in the idle condition of the system and when the two subscribers associated with the two terminal stations both start talking simultaneously or within a given time interval; and when one subscriber starts talking a definite time greater than that given time interval in advance of the other give the former complete control with full-frequency band transmission of his signal currents while allowing partial-frequency band transmission of the speech signals of the latter to the distant terminal to facilitate break-in during the pause by the former. This is accomplished by the use of mutually exclusive filters which are effectively switched in and out of the incoming and outgoing signal paths at the terminal stations by voice-operated switching circuits to properly vary the transmission frequency ranges over the system in both directions.

An object of the invention is to improve systems of the above-described general type so as to produce equivalent results from the standpoint of minimizing transmission lockout and facilitating break-in with economy of apparatus and improved quality of signal transmission.

The various objects and features of the invention will be better understood from the following detailed description when read in conjunction with the accompanying drawing, the single figure of which shows one modification of the invention embodied in a two-way radio telephone system.

The two-way radio telephone system of the drawing comprises a west terminal station and an east terminal station connected by a radio link which preferably employs different radio

frequencies for the opposite directions of transmission to reduce the possibility of singing difficulties. Each station includes a four-wire circuit connecting a two-way telephone line to a radio transmitter and a radio receiver.

The four-wire circuit at the west station comprises, as shown, a transmitting circuit TCw including an automatic volume control device TVw, which may be a variable-gain amplifier of the type known as a Vogad (volume-operated gain-adjusting device), for maintaining the transmitted signal volume substantially constant, and the delay circuit DCw leading to the radio transmitter RTw with an associated amplifier, and a receiving circuit RCw including the receiving loss control device RLw leading from the radio receiver RRw. The input of the circuit TCw and the output of the circuit RCw are coupled by the usual hybrid coil Hw and associated balancing network Nw to a two-way line section which may be connected directly or through a switchboard (not shown) to a two-way telephone circuit TLw leading to a west subscriber's telephone station indicated by a box.

The four-wire circuit at the east station comprises similar circuits and apparatus as described above for the west station as indicated by the use of similar identification characters for the corresponding elements with the subscript "E" instead of "W."

At the west station, the receiving circuit RCw includes at some point between the radio receiver RRw and the receiving loss control device RLw, two parallel, conjugate circuit branches coupled by the hybrid coil H₁ and associated balancing network N₁ and the hybrid coil H₂ and associated balancing network N₂, respectively, to the input and output portions of the circuit RCw. One of these circuit branches designated 1, which includes the filter 2 and the one-way amplifying device 3, is normally disabled in its input by a short-circuiting connection through the normally closed contacts of the unenergized switching relay 4, whereas the other branch 5 is normally operative due to the normally closed condition of the contacts of unenergized switching relay 6, in series with its conductors. The transmitting circuit TCw is normally disabled at a point between delay circuit DCw and the radio transmitter RTw by a short-circuiting connection across its conductors through the normally closed switching contacts of the unenergized switching relay 7.

Bridged across the transmitting circuit TCw of the west station, at a point between vogad

TVw and the delay circuit DCw, is the input of the transmitting voice-operated switching circuit 8 including in order, the filter 9, the amplifier-detector 10 and the switching relays 4, 6 and 7 having their operating windings connected in parallel across the output of the amplifier-detector 10. Bridged across the output of the circuit branch 5 of the receiving circuit RCw beyond the point of connection of the contacts of switching relay 6 therein, is the input of a voice-operated receiving switching circuit 11 including amplifier-detector 12 and the switching relay 13 having its operating winding connected across the output of the latter, the normally closed contacts of the latter relay being connected in series in the conductors of the transmitting switching circuit 8 at a point in the output of amplifier-detector 10.

Similarly, at the east station the receiving circuit RCe includes at some points between the radio receiver RRe and the receiving loss control device RLe, two parallel, conjugate circuit branches coupled by the hybrid coil H3 and associated balancing network N3 and hybrid coil H4 and associated balancing network N4, respectively, to the input and output portions of the receiving circuit RCe. One of these parallel circuit branches designated as 14, which includes the filter 15 and the one-way amplifying device 16, is normally disabled in its input by a short-circuiting connection through the normally closed contacts of unenergized switching relay 17, and the other circuit branch designated 18 is normally operative due to the normally closed condition of the contacts of unenergized switching relay 19, connected in series with its conductors. The transmitting circuit TCe is normally disabled at a point between the delay circuit DCe and the radio transmitter RTe by a short-circuiting connection through the normally closed contacts of unenergized switching relay 20.

Bridged across the transmitting circuit TCe of the east station at a point between vogad TVe and delay circuit DCe is the input of a voice-operated transmitting switching circuit 21 including in order, the filter 22, the amplifier-detector 23 and the operating windings of switching relays 17, 19 and 20 connected in parallel to the output of the latter. Bridged across the output of the circuit branch 18 of the receiving circuit RCe, beyond the point of connection of the contacts of switching relay 19, is the input of a voice-operated receiving switching circuit 24 including the amplifier-detector 25 and the operating winding of the switching relay 26 connected to the output of the latter, the normally closed switching contacts of the latter relay being connected in series with the conductors of the transmitting switching circuit 21 at a point in the output of amplifier-detector 23.

The filter 2 in branch 1 of the receiving circuit RCw at the west station and the filter 15 in the branch 14 of the receiving circuit RCe at the east station are mutually exclusive, each passing a different portion, which is preferably approximately one-half, of the voice signal frequency band. The filter 9 in front of the amplifier-detector 10 in the transmitting switching circuit 8 at the west station, passes the same frequencies as the filter 15 in the receiving circuit RCe at the east station, and the filter 22 in front of the amplifier-detector 23 in the transmitting switching circuit 21 at the east station passes the same frequencies as the filter 2 in the receiving circuit

RCw at the west station. Thus, the two filters used at each station, filters 2 and 9 at the west station and filters 15 and 22 at the east station, are also mutually exclusive.

In tests made to determine the best splitting up of the voice frequency band, 250 to 2800 cycles per second, by the filters in the signal transmission paths at the two stations from the standpoint of equal naturalness and articulation in each direction, the arrangement which proved to be most satisfactory was one in which the voice frequency band was split up into four subbands as follows:

250 to 500 cycles
500 to 1000 cycles
1000 to 2000 cycles
2000 to 2800 cycles

With this arrangement, the filter in the receiving transmission circuit at one station and the transmitting switching circuit filter at the other station would be designed to transmit the first and third subband specified, and the receiving transmission circuit filter at the other station and the transmitting switching circuit filter at the first station would be designed to pass the second and fourth subbands specified. For example, each of the filters 15 and 9 might be designed to transmit the frequency ranges 250 to 500 cycles and 1000 to 2000 cycles, and to suppress the other frequencies in the voice frequency band, and each of the filters 2 and 22 might be designed to transmit the frequency ranges 500 to 1000 cycles and 2000 to 2800 cycles and to suppress the other frequencies in the voice frequency band. For convenience in description, in the drawing the filters 15 and 9 transmitting the other frequency subbands specified above are designated as type No. 1 filters and the filters 2 and 22 transmitting the other frequency subbands specified above are designated as type No. 2 filters, it being understood that the type No. 1 filters transmit approximately one-half of the frequencies in the voice frequency band whereas the type No. 2 filters transmit the other half of the frequencies in the voice frequency band.

As in the usual vodas circuit, the relays operated by the transmitting switching branch at each station preferably should have a certain amount of hang-over in their operations to keep them operated during weak intermediate speech sounds between stronger syllables and during weak endings. This hang-over normally would be about 0.12 second for the singing suppressor relays 7, 20 and about 0.17 second for the echo suppressor relays 4, 6 and 17, 19. The receiving switching relays 13, 26 should also have a certain amount of hang-over, the amount of which depends on the length of the connected land line TLw or TLe. According to standard practice, this hang-over is kept as short as possible (usually about 0.020 second) to minimize the duration of false operations on received static. Due to the unequal hang-over a talker may keep control of his transmitting terminal a greater part of the time than he will control the corresponding receiving terminal. Occasionally in practice the sensitivity of the receiving amplifier-detector must be lowered due to static conditions, which further increases the inequality of control of the transmitting and receiving terminals. Under these conditions, with the usual vodas switching circuit, assuming west is speaking, it is quite easy for east to gain control of his transmitting terminal while west continues to control his own

transmitting terminal. Thus a lock-out will result with both west and east controlling only their respective transmitting terminals. This lock-out normally would continue until one talker stops and loses control of his terminal.

In the circuits of the invention as shown in the drawing, such lock-outs are eliminated and break-in facilitated with a relatively small amount of transmission control apparatus and with high quality of signal transmission in a manner which will be brought out in the following complete description of the operation of the system of the drawing.

In the absence of signal transmission over the system in either direction, with the transmitting and receiving switching circuits at the two stations unoperated, the transmitting speech circuit TCw at the west station and the transmitting speech circuit TCe at the east station are both blocked, as indicated in the drawing, so that neither can transmit to its radio transmitter. The receiving circuit RCw at the west station and the receiving circuit RCe at the east station are normally conditioned to pass the entire voice frequency range due to the normal operative condition of the receiving circuit branches 5 and 18, respectively, at the two stations, which do not contain any filters, and the normally blocked condition of the branches 1 and 14 containing filters, at the respective stations.

Now, let it be assumed that speech signals from a west telephone subscriber are received at the west station over the associated two-way telephone line TLw and are impressed by the hybrid coil Hw on the input of the transmitting circuit TCw, and at that time no speech signals are being received at the east station over the associated two-way telephone line TLe from the east subscriber. The west subscriber's speech currents in the circuit TCw will pass through the transmitting vogad TVw in which they will be regulated to the desired constant volume. The speech currents in the output of the vogad TVw will be divided between the delay circuit DCw in the speech transmission path and the input of the type No. 1 filter 9 in the transmitting switching circuit 8.

Of the speech signal waves diverted into the transmitting switching circuit 8, only part, approximately one-half, of the frequency components in the signal frequency band will be transmitted by the type No. 1 filter 9. The passed signal frequencies will be amplified and detected in the amplifier-detector 10 and cause the operation of the transmitting switching relays 4, 6 and 7 in its output. The operation of relay 4 will remove the normal short across the output of the filter branch 1 of the receiving circuit RCw and the simultaneous operation of relay 6 will disable the input of the non-filtering branch 5, thus effectively limiting the transmission frequency range of the receiving circuit RCw at the west station to the frequencies passed by the type No. 2 filter 2 in the circuit branch 1, and preventing transmission of the remaining frequencies in the signal frequency band corresponding to those passed by the type No. 1 filter 9 in the transmitting switching circuit 8.

The simultaneous operation of the switching relay 7 will remove the normal short across the transmitting circuit TCw in the output of delay circuit DCw, allowing transmission of west's speech currents, which meanwhile have been delayed in that delay circuit, out over the transmitting circuit TCw to the radio transmitter

RTw which will radiate them to the east station.

At the east station, west's speech signals will be picked up and detected by the radio receiver RRe, and the detected signals will pass through the hybrid coil H3 in circuit RCe. If the transmitting switching circuit 21 at the east station is in the unoperated condition, indicating that the east subscriber has not started to talk after west within a time interval equal to the over-all one-way transmission time between the west and east stations, the filter branch 14 of the receiving switching circuit RCe will be in its normally blocked condition and the non-filtering branch 13 will be operative, due to the unoperated condition of the transmitting switching relays 17 and 19, respectively at the east station. Thus, the entire frequency range of west's speech currents passing through the hybrid coil H3 will be transmitted over the receiving circuit branch 13 through hybrid coil H4 and the receiving loss control device RLe, and then through hybrid coil H5 to the two-way telephone line TLe over which it will be transmitted to the east subscriber.

Meanwhile, a portion of west's speech currents will be diverted from the receiving circuit branch 18 into the receiving switching circuit 24, will be amplified and detected by the amplifier-detector 25 therein and cause the operation of the receiving switching relay 26 to disable the energizing circuit for the transmitting switching relays 17, 19 and 20 at the station. West now has obtained exclusive control of the switching circuits at both stations of the systems. Thus, any subsequently received speech currents from the east subscriber entering the transmitting switching circuit 21 and operating the amplifier-detector 23, therein, cannot operate the transmitting switching relays to take directional control of the station away from west as long as west continues to talk without an appreciable pause. The blocked condition of the transmitting circuit TCe with the transmitting switching relay 20 deenergized will prevent any later received speech currents from east, or any echoes of west's speech currents entering the transmitting circuit TCe due to any unbalance of the hybrid coil set H5, N5, from being radiated by the radio transmitter RTE.

Now, let it be assumed that the east subscriber starts to talk about the same as the west subscriber or within a time interval thereafter within the over-all one-way transmission time between the west and east stations.

East's speech currents received at the east station over the line TLe will be impressed by the hybrid coil H5 on the input of the transmitting circuit TCe, and after regulation to constant volume in the transmitting vogad TVe, will be divided between the delay circuit DCE in the transmitting circuit proper and the input of the type No. 2 filter 22 in the transmitting switching circuit 21.

That part of the frequency band of east's speech currents passed by the type No. 2 filter 22 in circuit 21 will be amplified and detected by amplifier-detector 23 and, the receiving switching relay 24 being in its normally unoperated condition due to the fact that west's speech currents have not yet been received at the east station, will operatively energize the transmitting switching relays 17, 19 and 20. Relay 17 will operate to remove the normal short across the filtering branch 14 of the receiving switching circuit RCe, and the switching relay 19 will simultaneously operate to disable the non-filtering

branch 13 of that circuit, so that the frequency transmission range of the receiving circuit RC_E is thus effectively limited to that portion of the speech frequency range passed by the type No. 1 filter 15 in branch 14.

Transmitting switching relay 20 will simultaneously operate to remove the normal short across the transmitting switching circuit TC_E, thereby allowing the complete frequency band of east speech currents which have been meanwhile delayed in delay circuit DC_E to be transmitted to the radio transmitter RC_E and radiated thereby to the west station.

West's speech currents arriving at the east station will be picked up and detected in the radio receiver RR_E and will be transmitted through the hybrid coil H₃ of the receiving circuit RC_E. Because of the previous operation of the transmitting switching relays 17 and 19 in response to east's speech currents to disable branch 13 and enable branch 14, half of the frequency band of west's speech currents will be suppressed and the other half passed by the type No. 1 filter 15 in the operative branch 14. The part-band currents in the output of filter 15 in branch 14 will be amplified by the amplifying device 16 in that branch, provided for the purpose to be described later; and will be transmitted through the hybrid coil H₄, the receiving loss control device RL_E and hybrid coil H₅ to the associated two-way line TL_E over which it will be transmitted to and heard by the east subscriber.

Because of the connection of the receiving switching circuit 24 to the output of the now disabled branch 13 of the receiving circuit RC_E, which branch is in conjugate relation with the receiving branch 14, west's speech currents will not be able to cause false operation of the amplifier-detector 25 in that switching circuit to disable the output of the transmitting switching circuit 21. Thus east's speech waves (full-band) will continue to be transmitted from the east station.

At the west station, east's speech waves (full-band) will be picked up and detected by the radio receiver RR_W, and will be transmitted over the receiving circuit RC_W through the hybrid coil H₁. Because of the previous operation of the transmitting switching relays 4 and 6 at the west station in response to west's outgoing speech currents in the manner previously described, the filtering branch 1 of the receiving circuit RC_W is now operative and the non-filtering branch 5 is now disabled. Therefore, only that portion of east's speech currents passed by hybrid coil H₁, within the transmission frequency of the type No. 2 filter 2 in the branch 1 will be transmitted. East's speech currents (half-band) in the output of filter 2 will be amplified by the one-way amplifier 3 provided in the branch 1 for the purpose to be described later, and then will be transmitted through the hybrid coil H₂ and through the receiving loss control device RL_W. The waves in the output of RL_W will be transmitted through the hybrid coil H_W to the associated two-way line TL_W over which they will be transmitted to the west subscriber and will be heard by him.

Because of the connection of the receiving switching circuit 11 to the output of the disabled branch 5 of the receiving circuit RC_W and the conjugate connection of the output of the branch 5 with respect to the output of the branch 1, it will be apparent that east's half-band speech currents cannot get through to falsely operate the receiving amplifier-detector 12 and thus re-

ceiving switching relay 13 to reverse directional control at the west terminal station.

It will be apparent from the above description of operation that when either subscriber starts talking before the other subscriber by a time interval greater than the over-all one-way transmission time between the terminal stations, the first subscriber to talk gets exclusive control of the switching circuits at both terminal stations and is able to transmit his voice currents with full-frequency band transmission; that when both subscribers start talking at once or within a time interval equal to the over-all one-way transmission time between terminal stations, each subscriber will gain control of the transmitting circuit at his own terminal and will be able to transmit therefrom his complete signal frequency band, but will only partially block the receiving transmission circuit at his own terminal, so that the speech currents of each can get through and be heard by the other subscriber with part-band transmission.

The use of a filter in the transmitting switching circuit at each terminal which passes a different frequency range than the filter in the filtering branch of the receiving circuit at that terminal, serves to prevent false operation of the transmitting switching circuit at each terminal by echoes of incoming speech at the termination of periods of part-band transmission. The purpose of the amplifier 3 in the filtering branch 1 of the receiving circuit RC_W at the west station and of the amplifier 16 in the filtering branch 14 of the receiving circuit RC_E at the east station is to provide extra gain in the passed band during part-band transmission so as to provide about equal loudness of the received signal for whole or part-band transmission. This was found to provide better reception at the terminal and more naturalness in the conversation.

The system of the invention as described above is an improvement over the system disclosed in the aforementioned Fisher patent application in that it provides the same protection against transmission lock-out and substantially the same facility of break-in as in the latter system with the elimination of two filters at each terminal, which results, in addition to the economy of apparatus, in a substantial improvement in quality of transmission due to avoidance of transmission impairment due to changes in frequency characteristics and delay distortion in the filters eliminated, and also provides better reception than in the latter system during part-band transmission due to the additional gain present in the receiving circuit for that condition of operation.

Although in the above description of the system of the invention it is specified that each of the mutually exclusive filters in the transmission paths and switching circuit may be designed to transmit approximately half of the voice frequency band and particular frequency ranges are set forth, it is to be understood that these filters may be designed to transmit other different portions of the voice frequency band and other frequency ranges greater or less than the amounts specified. Various other modifications of the circuit illustrated and described which are within the spirit and the scope of the invention will appear to persons skilled in the art.

What is claimed is:

1. In a two-way telephone system including at each terminal station oppositely directed one-way transmission paths for the telephone signals transmitted in opposite directions, directional

control means comprising at each station means normally disabling the transmitting path while allowing the receiving path to transmit substantially all frequencies in the voice frequency range, a transmitting switching circuit responsive to outgoing signals in said transmitting path, in the absence of prior incoming signals in the receiving path, to render said transmitting path operative to transmit substantially all frequencies in the voice frequency range, and to reduce the transmission frequency range of said receiving path to only a part, different for each terminal station, of the voice frequency range, and a receiving switching circuit responsive to incoming signals in said receiving circuit only when said transmitting switching circuit is unoperated, to disable said transmitting switching circuit.

2. The system of claim 1, in which the transmitting switching circuit at each station is responsive only to frequencies in the voice frequency range outside the reduced frequency range of the receiving transmission path at the station when the transmitting switching circuit thereat is operated.

3. A control terminal for a radio telephone system comprising a voice frequency transmitting path leading to a radio transmitter and a voice frequency receiving path leading from a radio receiver, said transmitting path being normally disabled from transmitting to the radio transmitter, said receiving path being normally operative to transmit from said radio receiver to a telephone receiver substantially all frequencies in the voice frequency band, a transmitting switching circuit responsive to outgoing telephone signals in said transmitting path, in the absence of prior receiver telephone signals in said receiving path, to render the transmitting path operative to transmit substantially all frequencies in said outgoing signals, and to reduce the transmission frequency range of said receiving path to a portion of the voice frequency band, a receiving switching circuit responsive to incoming telephone signals in said receiving path, only when said transmitting switching circuit is unoperated, to disable said transmitting switching circuit, and means in said transmitting switching circuit for preventing its operation by frequencies in the voice frequency band, corresponding to those in the reduced transmission frequency range of said receiving path when said transmitting switching circuit is operated.

4. The control terminal of claim 3, in which said transmitting switching circuit is responsive to said outgoing telephone signals in said transmitting path to remove the normal disability therefrom and to effectively insert in said receiving path a filter passing only a part of the voice frequency band, and the last-mentioned means comprising a filter in the input of said transmitting switching circuit adapted to pass only frequencies in the voice frequency range suppressed by the first filter.

5. A two-way signal transmission system comprising two oppositely directed one-way transmission paths for transmitting signals in opposite directions between the terminals of the system, each of said paths except for a normal disability near the input thereof being operative to transmit substantially the entire signal frequency band, transmitting switching means connected to each path in front of the disabling point therein, responsive to signals impressed on the input of that path, in the absence of prior incoming signals in the output of the other path

at the same terminal, to cause the normal disability in the input of the first path to be removed, and the transmission frequency range of the output portion of the other path at the same terminal to be limited to only a portion of the signal frequency band, different for each terminal, receiving switching means responsive to incoming signals in the incoming path at each terminal only when the transmitting switching means at the same terminal is unoperated by prior outgoing signals thereat, to disable the transmitting switching means at that terminal, and means preventing operation of the transmitting switching means at each terminal by waves of frequencies corresponding to the signal frequencies within the limited frequency range of the incoming path at that terminal when the transmitting switching means thereat is operated.

6. A two-way telephone transmission system comprising at each terminal oppositely directed one-way transmission paths for the telephone signals transmitted in opposite directions, the transmitting path being normally disabled and the receiving path being normally operative to transmit substantially all frequencies in the telephone frequency range, a transmitting switching circuit responsive to outgoing telephone signals in the transmitting path, in the absence of prior incoming telephone signals in the receiving path, to remove the normal disability from the transmitting path so that it is operative to transmit substantially the whole frequency range of said outgoing signals, and to decrease the transmission frequency range of the receiving path to only a portion, different for each terminal, of the telephone signal frequency range, a receiving switching circuit responsive to incoming telephone signals in the receiving path in the absence of prior outgoing telephone signals in the transmitting path to disable the transmitting switching circuit, and means for preventing operation of the transmitting switching circuit by waves of frequencies corresponding to those transmitted by the receiving path when its transmission frequency range is reduced.

7. The system of claim 6, in which the receiving path at each terminal comprises two parallel conjugately connected branches one normally operative to transmit all frequencies in the signal frequency range and the other normally disabled and including a filter adapted to transmit only said reduced portion of the telephone frequency range allocated to that terminal, said transmitting switching circuit operating to reduce the transmission frequency range of said receiving path by disabling said one branch and removing the disability from the other branch, the receiving switching circuit at both terminals being controlled from a point in said one branch beyond the disabling point therein so as only to be operated by incoming signals when said one branch is operative, and the last-mentioned means comprising another filter in the input of the transmitting switching circuit adapted to transmit only those frequencies in the telephone signal frequency range suppressed by the other filter at the terminal.

8. The system of claim 6 in which the receiving path at each terminal comprises two parallel conjugately connected branches one normally operative to transmit substantially all frequencies in the telephone signal frequency range and the other normally disabled and including a filter adapted to transmit only said decreased por-

tion of the telephone frequency range, said transmitting switching circuit at each terminal operating to decrease the transmission frequency range of the receiving path at that terminal by disabling said one branch and enabling said other branch thereof, and said other of said conjugately connected branches of the receiving path at each terminal includes in the output of the filter therein amplifying means such as to give the telephone signals of decreased frequency range transmitted by that branch a degree of loudness substantially equal to that of the telephone waves of greater frequency range transmitted by said one branch at the terminal when it is operative.

9. A two-way telephone system comprising two oppositely directed one-way paths for respectively transmitting the voice signals of telephone subscribers at the two terminal stations to the telephone subscriber at the other station, each path except for a normal disability near its input being operative to transmit the entire voice frequency range, a filter at each terminal station respectively adapted to transmit a different limited portion of the voice frequency range, a

transmitting switching circuit connected to the outgoing path at each station in front of the disabling point therein, responsive to the outgoing voice signals of the subscriber at that station, in the absence of prior incoming signals in the incoming path at the station, to remove the normal disability from said outgoing path so as to allow transmission of the complete frequency range of the outgoing signals to the other station, and to effectively insert the filter at the first station into the incoming path thereat to limit its frequency transmission range, and a receiving switching circuit at each station responsive to incoming telephone signals in the incoming path thereat, only when the latter path is operative to transmit the entire voice frequency range, to disable the transmitting switching circuit at the same station.

10. The system of claim 9, in which the transmitting switching circuit at each station includes a second filter making it selectively operative only to the applied frequencies in the voice frequency range outside the pass frequency range of the other filter at the station.

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