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CONTROL OF TWO-WAY SIGNAL TRANSMISSION SYSTEMS

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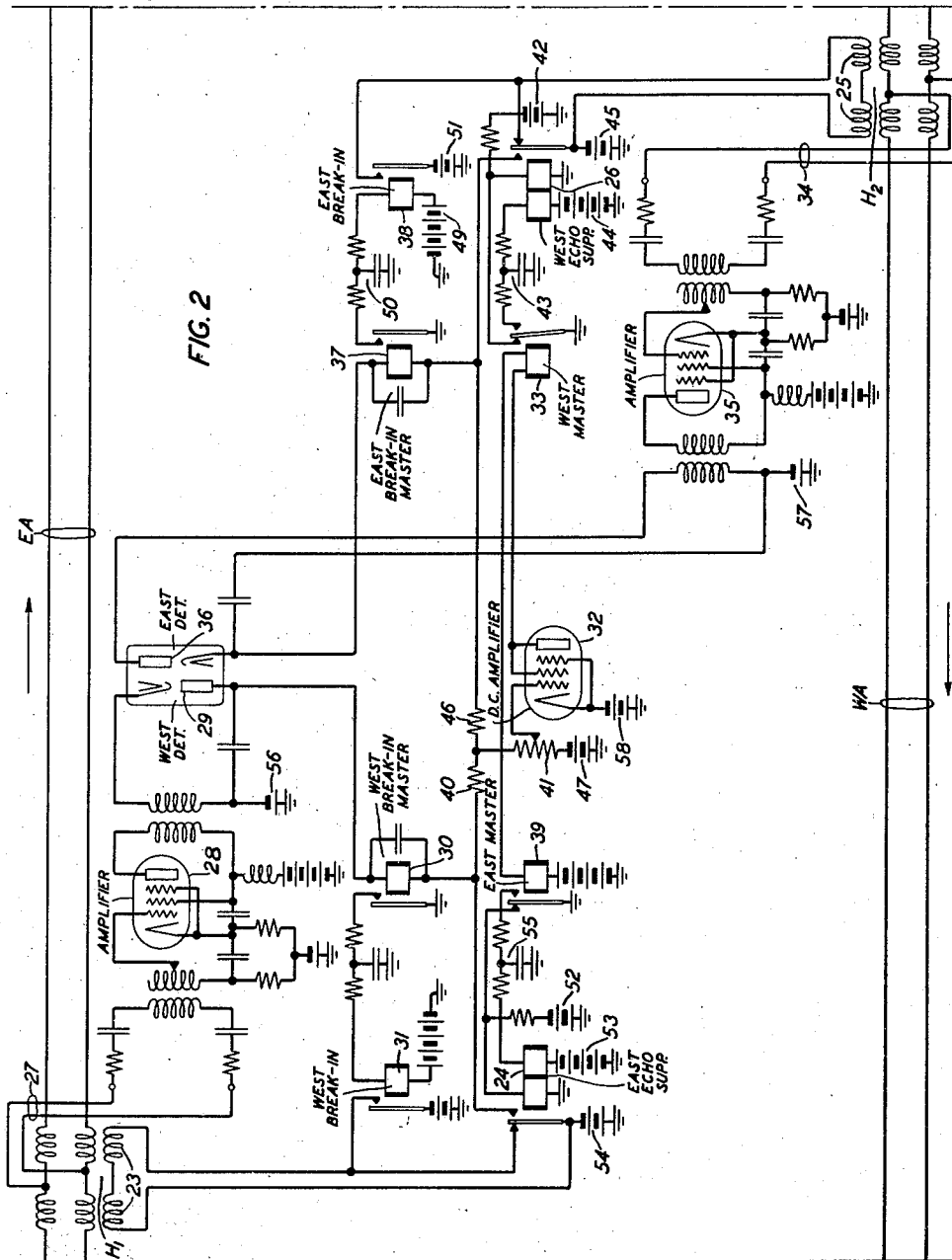
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CONTROL OF TWO-WAY SIGNAL
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The invention relates to two-way signal transmission systems and particularly to the signal-controlled switching circuits used with such systems to directionally control signal transmission therein while suppressing echoes and preventing singing.

Such signal-controlled switching circuits, commonly called echo suppressors, usually employ two switching branches respectively connected to each of two oppositely directed one-way signal transmission paths at a terminal or intermediate point in the two-way system, each including a rectifier for rectifying a portion of the signals diverted into the switching branch and electromagnetic relays or other switching devices operated by the rectified signals to suitably control the transmission efficiency of the signal transmission paths and to disable the other switching branch so as to provide the desired directional control of signal transmission while suppressing echoes and preventing singing.

The copending patent application of K. H. Davis and A. C. Norwine, Serial No. 421,704, filed December 3, 1941, which issued as Patent No. 2,306,689 on December 29, 1942, discloses such an echo suppressor applied to a four-wire telephone circuit, modified so as to enable one subscriber by talking loudly to break in on another who is talking and has obtained directional control of the system, while the latter continues to talk and regardless of how loudly the latter party is talking. This is accomplished by the use of relatively insensitive auxiliary switching controls, properly located with respect to the echo suppressor controls, operating on an amplitude basis to disable the echo suppressor controls of the talking party when the breaking party talks with the required loudness.

An object of the invention is to improve break-in echo suppressors of the above-described type.

A more specific object is to provide echo suppression and to enable break-in in systems of the above-described type with economy of apparatus.

These objects are attained in accordance with the invention by arrangements for automatically transforming the echo suppressing equipment associated with each side of a four-wire circuit into break-in equipment during periods in which it is not needed for performing its echo suppressing function.

The various objects and features of the invention will be better understood from the following detailed description when read in conjunction with the accompanying drawings in which:

Fig. 1 shows schematically a four-wire toll tele-

phone circuit equipped with an echo suppressor of the amplitude break-in type embodying one modification of the invention; and

Fig. 2 shows schematically in more detail an alternative echo suppressor of the amplitude break-in type in accordance with the invention which may be used in the system of Fig. 1.

In Fig. 1, the four-wire telephone circuit includes a one-way, two-wire transmission path EA including the amplifier Ae, normally conditioned to transmit in the direction from west to east between the two-way line WL and the two-way line EL; and a one-way, two-wire transmission path WA including the one-way amplifier Aw, normally conditioned to transmit in the direction from east to west between the same two-way lines. The transmission path EA and the transmission path WA are coupled at the west and east terminals of the four-wire telephone circuit in conjugate relation to each other and in energy transmitting relation with the two-way line WL or EL by the hybrid coil Hw and associated line balancing network Nw, or hybrid coil He and associated line balancing network Ne, respectively.

Connected across the path EA at an intermediate point 1 is the input of a switching circuit 2, operating as a combined echo suppressor and break-in control circuit, including the one-way amplifier 3 followed by the wave rectifier (detector) 4 and the electromagnetic switching relays 5 to 8 adapted to be operatively energized in parallel by the rectified signal output of the rectifier 4. Similarly, connected across the path WA at an intermediate point 9 is the input of a switching circuit 10, operating as a combined echo suppressor and break-in control circuit, including the one-way amplifier 11 followed by the wave rectifier (detector) 12 and the electromagnetic switching relays 13 to 16 adapted to be operatively energized in parallel by the rectified signal output of the rectifier 12.

In the switching circuit 2, relay 8 to be referred to hereinafter as the west break-in relay, is relatively insensitive compared to the other switching relays 5 to 7 in that circuit, as indicated by the series resistances 17 in the energizing circuit for the former relay only. Also, the energizing circuit for the relay 8 is normally disabled by an open circuit at the point 18 so that the relay is normally not in condition to be operated by the rectified signal output of rectifier 4, whereas the energizing circuits for the relays 5 to 7 are normally operative so that the latter relays may be immediately operated by a

rectified signal output from the rectifier 4. Similarly, in the switching circuit 10 the relay 16, to be referred to hereinafter as the east break-in relay, is relatively insensitive compared to the other relays 13 to 15 in that switching circuit, as indicated by the resistances 19 in the energizing circuit of the former relay only. Also, the energizing circuit for the break-in relay 16 is normally disabled by a normal open circuit at the point 20 so that normally the relay is not in condition to be operated by signal output from the rectifier 12, whereas the energizing circuits for the relays 13 to 15 are normally operative so that these relays are in condition to be immediately operated by the signal output from the rectifier 12.

Relay 5 in the switching circuit 2, to be referred to hereinafter as the west echo suppressor relay, when operated, connects a short-circuiting connection across the path WA at a point 21 beyond the point 9 to which the input of the switching circuit 10 is connected, to disable that path. Similarly, the relay 13 in switching circuit 10, to be referred to hereinafter as the east echo suppressor relay, when operated, closes a short-circuiting connection across the path EA at the point 22 beyond the point 1 to which the input of the switching circuit 2 is connected, to disable the latter path. The one-way amplifier A_E is connected in the path EA between the points 1 and 22 to prevent the disabling of that path from affecting the input of the switching circuit 2. Similarly, the one-way amplifier A_W is connected in the path WA between the points 9 and 21 to prevent the disabling of the path WA from affecting the input to the switching circuit 10.

In the following description of operation of the system of Fig. 1, it will be convenient to speak of a "loud talker," meaning one who can operate a break-in control and a "weak talker," meaning one who cannot. Since we are to deal with circuits at the terminals of which portions of signals are returned as echoes, it is assumed that a loud talker in order to break-in must operate a control at least insensitive enough so that it will not operate on the echo of the other talker's speech energy.

Let it be assumed that a west telephone subscriber associated with the line WL starts to talk, and at that time the east subscriber associated with the line EL is silent. The speech waves of the west subscriber received over the line WL are impressed by the hybrid coil H_W on the path EA of the four-wire circuit and, that path being in its normally operative condition with the short-circuiting connection at the point 22 open, will be transmitted thereover amplified by the amplifier A_E to the east terminal of the four-wire circuit, where the main portion will be transmitted through the hybrid coil H_E to the line EL leading to the east subscriber, and another portion will be reflected as echoes into the oppositely directed one-way path WA and will be transmitted back over that path.

A portion of West's speech signals will be diverted at the point 1 in path EA into the switching circuit 2 and will be amplified by amplifier 3 and rectified by the wave rectifier 4. The rectified signals in the output of rectifier 4 will cause the immediate operation of the switching relays 5 to 7, but, regardless of their amplitude, will not be able to operate the break-in relay 8 because of its normally inoperative energizing circuit. Relay 5 will operate to close the short-circuiting connection across the path WA at the

point 21 to disable that path, so as to suppress at that point the echoes of West's speech waves received over the path WA from the east terminal of the four-wire circuit and to prevent any subsequent voice signals received over the path WA from the east subscriber associated with the line EL from being transmitted over that path to the line WL and thence to the west subscriber during the period in which the relay 5 is maintained operated by West's speech waves.

Relay 6 will simultaneously operate to disable the energizing circuits for the relays 13 to 15 of the east switching circuit 10, so as to prevent subsequent operation of those relays by operation of the wave rectifier 12 in response to later signals of the east subscriber in the path WA, while the west subscriber continues to talk. Relay 7 will simultaneously operate to close the open circuit at the point 20 in the energizing circuit for the east break-in relay 16 in the east switching circuit 10, so as to enable the latter relay to be thereafter operated by any rectified signals in the output of the wave rectifier 12 of sufficient amplitude to overcome the desensitization provided by the resistances 19 in its energizing circuit. The west subscriber now has obtained exclusive directional control of the echo suppressor circuits and has conditioned those circuits so as to enable break-in by the east subscriber.

Now, if while West is still talking, East desires to interrupt him, the latter will start to talk and raise his voice so that at least a portion of his speech signals will have an amplitude sufficient to overcome the desensitization of the east break-in relay 16 provided by the resistances 19 in its energizing circuit. Then the portion of East's higher amplitude speech waves diverted into the switching circuit 10 from the path WA will be amplified by amplifier 11 and rectified by rectifier 12 and will cause the operation of the east break-in relay 16 to open the energizing circuit for the west echo suppressor relay 5 only. The consequent release of the west echo suppressor relay 5 to break the short-circuiting connection across the path WA at the point 21 will enable that path so as to allow East's speech waves to pass over the output of that path through hybrid coil H_W to line WL and over that line to the west subscriber.

If the west subscriber continues to talk, the rectifier 4 in switching circuit 2 will be maintained operated by his speech currents to hold relays 6 and 7 operated to maintain the energizing circuit for the east break-in relay 16 operative and the energizing circuits for the other relays 13, 14 and 15 in the east switching circuit 10 disabled. The path EA, therefore, will be also maintained unblocked so that both subscribers will hear each other, but there will be no echo suppression and both subscribers will hear echoes. This condition will continue until the loud talker (East) lowers his voice sufficiently to cause the east break-in relay 16 to release and thus allow the west echo suppressor relay 5 to be again operated by West to block the path WA at the point 21 giving directional control of the circuit again to the latter, or until the weak talker (West) stops talking. In the latter case, the relays 6 and 7 of the switching circuit 2 will release and allow relays 13, 14 and 15 to be operated by East to give directional control of the circuit to him, and to condition the west break-in relay 8 for subsequent operation by West if the latter again starts talking with sufficient loudness to over-

come the desensitization of that relay provided by the resistances 17.

Now, if while East is talking loudly, West also raises his voice to a loudness sufficient to overcome the desensitization of the west break-in relay 8, there will be no change in the operation since, because the energizing circuit for the relay 13 of the switching circuit is already in the disabled condition due to the operation of the switching relay 6 under control of West's previous weak speech waves. Thus the transmission paths EA and WA will remain enabled and both talkers will hear each other and echoes during the period of double talking.

Similarly, if the east subscriber starts talking first, he will obtain directional control of the circuit by operating switching circuit 10 to disable the path EA at the point 22, to disable the energizing circuits for the relays 5, 6 and 7 of the west switching circuit 2, and to render the energizing circuit for the west break-in relay 8 operative to enable West to break-in subsequently by talking loudly enough to overcome the desensitization of that relay provided by the resistances 17.

To make the above-described type of break-in effective, it is necessary that the various echo suppressor and break-in controls have their relative sensitivities properly proportioned. The values of the resistances 17 and 19 in the energizing circuits for the west break-in relay 8 and the east break-in relay 16, respectively, should be selected so that when the energizing circuits for these relays are operative, the break-in control will be made sufficiently insensitive so that each break-in relay will not be operated in response to the maximum amount of signal echo which may occur in the associated signal transmission path. Also, the several switching relays should be provided with sufficient hang-overs in operation to prevent their premature release to cause clipping or allow echoes.

Fig. 2 shows a portion of a four-wire telephone circuit like that of Fig. 1 equipped with an alternative type of amplitude break-in echo suppressor in accordance with the invention. As shown, the hybrid transformer H₁ is inserted in the west-to-east path EA of the four-wire circuit at an intermediate point corresponding to the point 1 of Fig. 1, and a hybrid transformer H₂ is connected in the east-to-west path WA at an intermediate point corresponding to the point 9 in Fig. 1. The hybrid transformer H₁ comprises two line windings connected in the path EA and a third winding 23 inductively coupled thereto which is normally short-circuited through the normally closed back contacts of the unoperated east echo suppressor relay 24, and the hybrid transformer H₂ comprises two line windings connected in the path WA and a third winding 25 inductively coupled thereto which is normally short-circuited through the normally closed back contacts of the unoperated west echo suppressor relay 26. In the normal condition of the hybrid transformer H₁ with its third winding 23 short-circuited, the transformer is unbalanced so as to permit signal transmission over the path EA of the four-wire circuit. Similarly, in the normal condition of the hybrid transformer H₂ with its third winding 25 short-circuited, the latter transformer is unbalanced so as to permit signal transmission over the path WA.

Connected across the path EA at a point between the line windings of hybrid transformer H₁ is the input of a combined echo suppressor and

break-in control circuit 27, to be referred to hereinafter as the west switching circuit, including in order: the vacuum tube amplifier 28; the two-element vacuum tube detector 29; the west break-in master relay 30 controlling the operation of the west break-in relay 31 and its associated hang-over circuit; the direct current vacuum tube amplifier 32; the west master switching relay 33; and the west echo suppressor relay 26 with its associated hang-over circuit. Similarly, connected across the path WA at a point between the line windings of the hybrid transformer H₂ is the input of the combined echo suppressor and break-in control circuit 34, to be referred to hereinafter as the east switching circuit, including in order: the vacuum tube amplifier 35; the two-element vacuum tube detector 36; the east break-in master relay 37 controlling the operation of the east break-in relay 38 and its associated hang-over circuit; the direct current vacuum tube amplifier 32, the east master switching relay 39 having its operating winding connected in series with the operating winding of the west master switching relay 33 in the plate-cathode circuit of the direct current amplifier 32; and the east echo suppressor relay 24 with its associated hang-over circuit.

The west two-element vacuum tube detector 29 and the east two-element vacuum tube detector 36, which may, as shown, be contained in a single tube, are oppositely poled with respect to the control grid-cathode circuit of the direct current amplifier 32. Each is also biased in the non-conducting direction by batteries 56 and 57, respectively. The west master switching relay 33 is more sensitive than the east master switching relay 39 so that the former is held operated by the normal plate current (current with no voltage applied to its control grid from either detector) of the direct current amplifier 32 flowing through its operating winding and the operating winding of the east master switching relay 39, this normal plate current not being sufficient to operate the latter relay the armature of which is maintained on the back switching contact. This normal plate current is determined by the difference in the selected voltages of batteries 47 and 58.

The other elements of the echo suppressor circuits of Fig. 2 will be referred to in the following description of operation.

Let it be assumed that the subscriber at the west terminal of the four-wire telephone circuit is speaking, and at that time the subscriber at the east terminal of the four-wire telephone circuit is silent. Because of the normal unbalanced condition of the hybrid transformer H₁, the west subscriber's speech waves will pass freely over the path EA with the amplification provided by amplifier A₂ and other amplifiers (not shown) to the line leading to the east subscriber, and at the east terminal of the four-wire circuit a portion of these waves will be reflected as echo currents into the oppositely directed transmission path WA.

A portion of West's speech waves will be diverted from the path EA at a point between the line windings of the hybrid transformer H₁ into the west switching circuit 27 and will be amplified by the amplifier 28 and rectified by the detector 29 therein. The master break-in relay 30 in the output of the detector 29 is made sufficiently insensitive so that it will not be operated by the rectified signals of normal amplitude passing through its operating winding from the output

of detector 29. The rectified signal current passes through the winding of the latter relay, the 2-megohm resistance 40 and the input potentiometer 41 for the direct current amplifier 32 in such direction as to apply a negative bias to the control grid of that amplifier thus reducing the plate current of the latter. The reduction in the plate current of the direct current amplifier 32 flowing through the operating winding of the west master relay 33 and the operating winding of the east master relay 39 in series, will cause the former more sensitive relay 33 to release to break its normally closed front switching contact and to make its normally open back switching contact, whereas it will have no effect on the less sensitive east master switching relay 39 which is already in the released condition. The break of the front switching contact of the west master switching relay 33 will open the normal short-circuit on the operating winding of the west echo suppressor relay 26 causing that winding to be operatively energized by current from the battery 42. The make of the back switching contact of relay 33 will cause the condenser of the resistance-condenser hang-over arrangement 43, normally charged by current from the battery 44 through the hang-over winding of the relay 26, to be discharged to ground, so that when West ceases talking the release of the west echo suppressor relay 26 will be delayed for a desired hang-over interval determined by the time required for that condenser to be charged up to the potential of battery 44 through the hang-over winding of relay 26 when relay 33 returns to its normal operated condition, the current through the hang-over winding energizing that winding to hold the relay operated.

When the west echo suppressor relay 26 operates it will break its back switching contact and make its front switching contact. The break of the back switching contact will open the normal short-circuit across the winding 25 of the hybrid transformer H_2 in the path WA causing that hybrid transformer to be balanced and thus effectively insert a disabling loss into the path WA which will suppress the echoes of West's speech waves when they arrive at that point in the path. The make of the front switching contact of relay 26 will cause the negative battery 45 to be connected to the upper terminal of the potentiometer 41 through the 2-megohm resistance 46. As an equivalent negative battery 47 is connected to the lower terminal of that potentiometer, this will effectively isolate the output of the east detector 36 from the input of the direct current amplifier 32 while retaining an operative connection of the east break-in master relay 37 in series with battery 45 across the output of the east detector 36 thereby conditioning the circuit for break-in by the east subscriber.

Now, if, while West is still talking, the east subscriber desires to interrupt him, the latter will start talking and will raise his voice sufficiently so that the portion of his speech waves diverted from the east to west path WA at the hybrid coil H_2 into the east switching circuit 34 and amplified by the amplifier 35 and rectified by the detector 36 therein, will be of sufficient amplitude to cause the operation of the east break-in master relay 37 in the output of that detector. The operation of the latter relay to close its switching contacts will cause the operating winding of the east break-in relay 38 to be supplied with energizing current from the battery 49, and will cause the condenser of the associated hang-

over circuit 50 normally charged from battery 49, to be discharged to ground. The consequent operation of the east break-in relay 38 will connect the negative battery 51 to one side of the winding 25 of the hybrid coil H_2 . As an equivalent negative battery 45 is connected to the other side of the winding 25, that winding is thus effectively short-circuited to unbalance the hybrid coil H_2 in the path WA allowing East's speech waves to be transmitted out over that path to the west subscriber.

The isolation of the output of the east detector 36 from the input of the direct current amplifier 32 maintained by operation of the west echo suppressor relay 26 in response to West's speech waves in the manner which has been described, will prevent East from causing the operation of the east master switching relay 39 in the output of that amplifier, while West continues to talk. Thus, the east echo suppressor relay 24 for that condition will be maintained in its normally unoperated condition to hold the hybrid transformer H_1 in the path EA unbalanced to allow West's continuing speech waves to be transmitted over that path to the east subscriber. Thus, both subscribers will hear each other during the period of double talking, but there will be no echo suppression and both parties will hear echoes. This condition will continue until the loud talker (East) lowers his voice sufficiently to cause the release of the east break-in master relay 37 and thus finally the release of the east break-in relay 38 to remove the negative battery 51 from one side of the winding 25 of hybrid coil H_2 to remove the effective short circuit from that winding. This will allow West to regain directional control of the circuit by continued operation of the west echo suppressor relay 26 to hold its back contact open. The release of the east break-in relay 38, of course, will be delayed for a given hang-over interval required for battery 49 to charge up the condenser of the hang-over circuit 50 through the winding of relay 38 after the east master relay 35 releases, thus maintaining the break-in effective for normal pauses in the transmission of East's speech waves.

If while East is talking loudly, the weak talker (West) stops talking so that his relay 33 releases causing the release of the west echo suppressor relay 26 after the expiration of its hang-over (completion of charge of the condenser of hang-over circuit 43 from battery 44 through the hang-over winding), the connection of the negative battery 45 to the upper terminal of the potentiometer 41 for direct current amplifier 32 will be broken. Thus the isolation of that amplifier from the output of the east detector 36 will cease. Then the rectified speech signals of East in the output of the detector 36 will apply through the winding of relay 37, resistance 46 and potentiometer 41 a positive bias to the control grid of the direct current amplifier tube 32 to increase the plate current of that amplifier sufficiently so that the east master relay 39 in its output will be operated and the west master relay 33 will be maintained in its normal operated condition. The consequent shifting of the armature of relay 39 from the back to the front contact will cause the operating winding of the east echo suppressor relay 24 to be energized from battery 52 and will cause the condenser of the condenser-resistance hang-over arrangement 55 normally charged from battery 53 through the hang-over winding of relay 24 to be discharged to ground through the made front contact of

relay 39. The consequent operation of the east echo suppressor relay 24 to break its back contact will remove the normal short circuit from the winding 23 of the hybrid coil H₁ in the path EA to unbalance that hybrid transformer so as to put an echo suppressing loss into that path. Also, the make of the front contact of the relay 24 will connect negative battery 54 through the 2-megohm resistance 40 to the upper terminal of the input potentiometer 41 for the direct current amplifier 36. As an equivalent negative battery 47 is already connected to the lower terminal of that potentiometer, this will cause the input of the direct current amplifier 32 to be effectively isolated from the west detector 29, while maintaining an operative connection of the west break-in master relay 30 in series with battery 54 across the output of that detector. Therefore, the relay 30 is in condition to be operated in response to rectified signals of the west subscriber of sufficient level (greater than normal level) to enable break-in by West in a manner similar to that which has been described in the case of the east subscriber.

When East ceases talking the east echo suppressor relay 24 will be maintained operated to block the path EA for a desired hang-over time interval determined by the time required for the condenser of the hang-over network 55 to be charged up from battery 53 through the hang-over winding of the relay.

Now, if while the west or east subscriber is talking loudly, the other subscriber east or west also starts to talk loudly, there will be no change in operation from the case where one subscriber is talking weakly and the other loudly, because, in that case both master break-in relays 30 and 37 will be operated to cause the operation of the west break-in relay 31 and the east break-in relay 38, respectively, to unbalance the respective hybrid transformers H₁ and H₂ to render both paths EA and WA operative.

Because of the conjugate relation of the third winding 23 of the hybrid transformer H₁ to the input of the west switching circuit 71 and the conjugate relation of the third winding 25 of hybrid transformer H₂ to the input of the east switching circuit 34, the disabling of the respective transmission paths EA and WA will not affect the inputs of the two switching circuits.

It will be apparent that because of the combination functions of certain of the controls of the system of Fig. 1, and of the system of Fig. 2, that both echo suppressor and break-in may be obtained with the use of a smaller amount of apparatus than would be required if these two functions were exercised by two entirely separate control circuits.

Various modifications in the circuits which have been illustrated and described and within the scope of the invention will occur to persons skilled in the art.

What is claimed is:

1. In a two-way telephone system, two oppositely directed one-way transmission paths for respectively transmitting over the system the voice signals of the subscribers at opposite ends of the system, one switching device connected to each path having a plurality of switching branches with some transmission apparatus in common, certain of said switching branches operating in response to the voice signals of one subscriber in that path, in the absence of prior voice signals of the other subscriber in the other

oppositely directed path, to disable said other path and said certain switching branches of the other switching device connected thereto, so as to give directional control of signal transmission over the system to the subscriber who first starts to talk, and means to facilitate interruption of the talking subscriber by the other subscriber comprising a normally disabled, relatively insensitive switching branch for each switching device, which, when operated, disables the transmission path disabling function only of the other switching device and means responsive to operation of said one switching device connected to one path by the voice signals of said subscriber who first starts to talk to immediately render operative the relatively insensitive switching branch of the other switching device connected to the other path so as to enable operation of the latter branch in response to subsequent voice signals of the other subscriber which are of sufficient loudness to overcome its desensitization.

2. In a two-way telephone system, two oppositely directed one-way transmission paths for respectively transmitting the oppositely directed voice signals, and a switching device connected to each path, consisting of a common signal detector operatively responsive to voice signal transmission in the connected path, and a plurality of switching branches operatively controlled by the signal output of said detector, certain of said switching branches operating in response to operation of said detector by voice signal transmission in the connected path, in the absence of prior voice signal transmission in the other path, to respectively disable said other path beyond the point of connection of the other switching device thereto, to transform said other switching device so as to permit its operation, while the signal transmission in the first path continues, in response to subsequently initiated voice signals in said other path, only of an amplitude level at least a given amount greater than normal level, to cause said other path to be enabled, and to disable all functions of said other switching device except its transmission path enabling function.

3. The system of claim 2, in which one of said plurality of switching branches of the switching device connected to each pin, is relatively insensitive and is normally disabled, said one switching branch when operated in response to operation of the associated detector by applied voice signal transmission of sufficient amplitude level in the associated transmission path, disabling the transmission path disabling function only of the other switching device, the transforming of the other switching device caused by operation of said one switching branch of the first switching device consisting in removing the normal disability from the relatively insensitive switching branch of said other switching device.

4. The system of claim 1, in which said plurality of switching branches of the switching device connected to each path includes a common wave detector operatively responsive to the direct voice signals in the associated transmission path but unresponsive to the signal echoes of maximum amplitude produced therein, and individual relays in the several branches, the individual relays in said certain branches of the switching device connected to each path being responsive to the rectified voice signal output of the detector in that switching device, in the absence of a prior rectified signal output for

the detector in the other switching device connected to the other path, to insert an echo suppression loss in said other path, and to effectively disable the individual relays in said certain branches of said other switching device, the relay in the other switching branch of each switching device being made effectively relatively insensitive compared to the relays in said certain branches thereof, so as to be inoperative for a rectified signal output of the detector in that device produced by voice signals of normal amplitude in the associated transmission path

but to be operated in response to a rectified signal output for that detector produced by voice signals of an amplitude a given amount greater than normal amplitude in said associated path, 5 to effectively prevent the echo suppression loss from being inserted in said associated transmission path by operation of the other switching device connected to the other transmission path, or to effectively remove that loss if already 10 inserted in said associated path.

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