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VOICE OPERATED CIRCUITS

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FIG. 1

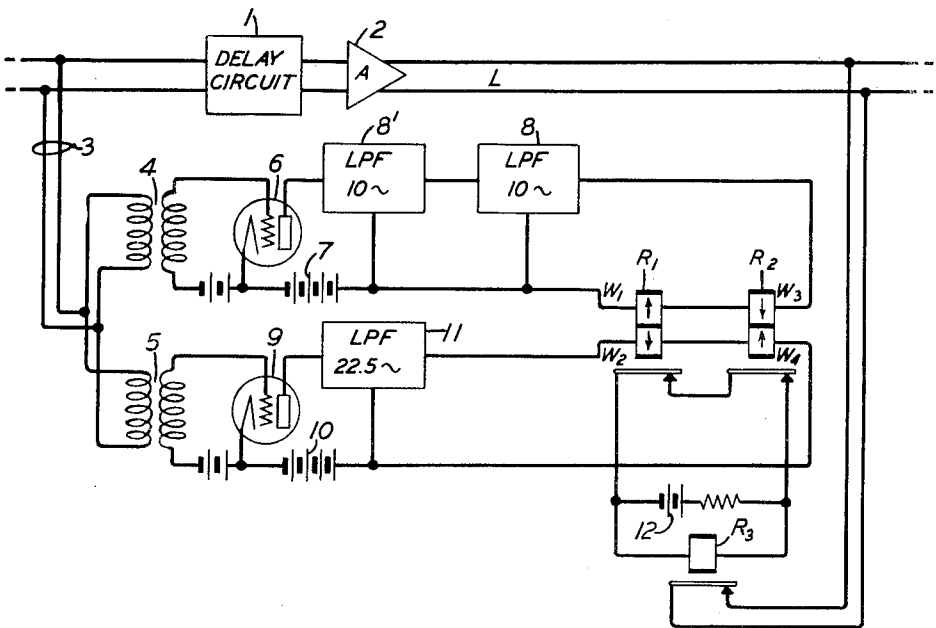
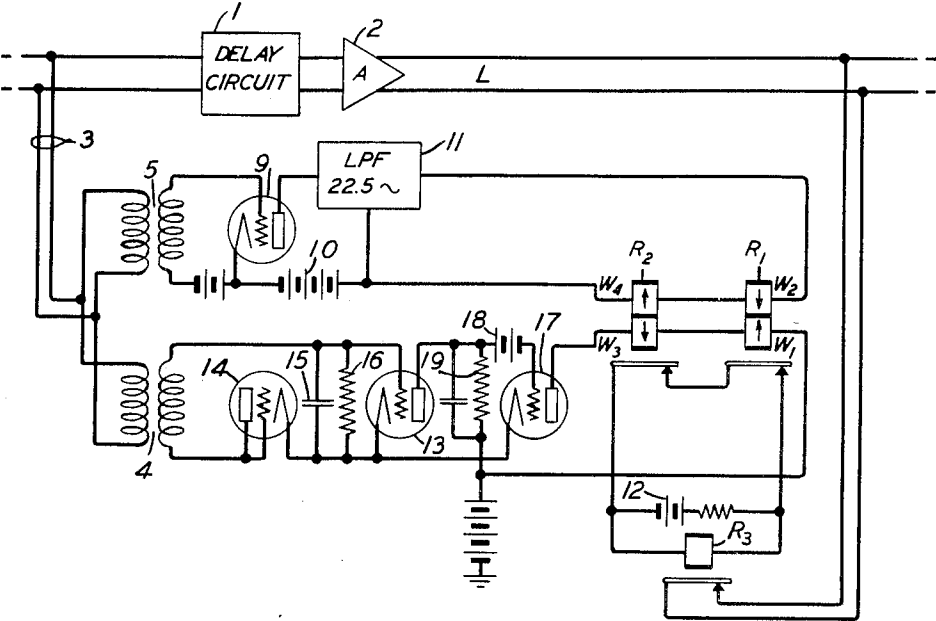


FIG. 2



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VOICE-OPERATED CIRCUITS

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4 Claims. (Cl. 178—44)

This invention relates to transmission systems and more especially to voice or signal operated devices by means of which echoes, singing or other disturbances likely to occur in long transmission lines are avoided.

These devices are applicable to many uses, one example being a two-way four-wire transmission circuit equipped with apparatus adapted to be actuated by voice currents in one one-way circuit to permit transmission thereover and/or prevent transmission over the opposite one-way circuit. One of the troubles experienced with apparatus of this type is the false operation of the devices by noise currents which are impressed on the line from various well known sources. To overcome this trouble various schemes have been proposed.

Certain of these schemes are based on the fact that the syllabic frequency of normal speech is between 2 and 22.5 cycles per second. This affords a basis for discriminating against noise currents having frequencies outside this band. Filters are provided which eliminate the currents outside the frequency band mentioned and the devices are operated by currents, the frequencies of which are within the band.

In another type of circuit a relay has opposing windings included in two circuit branches including filters so that rapidly varying currents such as are represented by speech impulses are fed mostly to one winding while slowly varying currents representing steady noise energy are fed to both windings and its effects balanced out.

Both types of circuits work very satisfactorily in case of noises which are constant for considerable intervals and do not contain energy components which vary in the same manner as the mean power in speech.

One circumstance which limits the effectiveness of the first mentioned type or "syllabic" type is that the noise may contain power components in the frequency range of 2 to 22.5 cycles relied upon for discrimination.

In the other type discussed above using two circuit branches and opposed relay windings, if the reducer branch is made slow acting a difficulty arises from inability of the circuit to adjust itself to voice changes. If less delay is used in the reducer branch but enough to enable an operating current to be produced on the rise of a syllable and if peak current limiting is used in the reducer branch so as to enable the strong part of the syllable to hold the relay operated a long hangover may be required to insure against

final clipping, that is, release of the relay before the final parts of the syllable are transmitted.

The present invention combines advantageous features of both above mentioned types of circuits and not only makes for effective discrimination against noise but avoids necessity of long hangover effects by operating on the decay as well as on the rise of syllables to operate the circuit control devices.

An object of the invention is to cause the operation of voice operated devices when noise is present without the limitations heretofore incident to such arrangements.

Another object of this invention is to prevent operation of the controlling relay by noise currents having components within the syllabic frequency band.

The invention and its objects and features will be understood from the following description in connection with the attached drawing:

Fig. 1 of which shows one form the invention may take while Fig. 2 shows a modification thereof.

In order to simplify the drawing and description the invention is illustrated as applied to one side of a two-way four-wire circuit, it being obvious to those skilled in the art that a suitable circuit may be applied to the other side of the circuit for a complete system.

Referring now to Fig. 1, line wires L represent a one-way line of a four-wire two-way transmission circuit. Included in line L is the usual delay circuit 1 and amplifier 2. Connected to line L by conductors 3, as shown, are two branched circuits provided with input transformers 4 and 5. The secondary winding of transformer 4 is connected to the input electrodes of space discharge device 6. The output circuit of device 6 includes the usual anode battery 7, winding W₁ of relay R₁, winding W₃ of relay R₂ and low-pass filter delay circuits 8 and 8'.

The secondary winding of transformer 5 is connected to the input electrodes of device 9. The output circuit of device 9 includes anode battery 10, winding W₄ of relay R₂, winding W₂ of relay R₁ and low-pass filter 11.

It is to be understood that low-pass filters 8 and 8' are used for convenience and that any other satisfactory type of delay circuit may be used.

Relays R₁ and R₂ at their associated armatures and contacts control the operation of relay R₃ by removing the short circuit around battery 12.

Relay R₃ at its associated armature and contact is adapted when energized to open a short

circuit normally existing across line L near the output of amplifier 2.

The windings of relays R_1 and R_2 are so adjusted that winding W_2 predominates over winding W_1 and winding W_3 predominates over winding W_4 with equal currents in the windings.

Due to the delay through filters 3 and 3' currents impressed through transformer 5 on device 9 are effective in relays R_1 and R_2 before those currents due to the same source which are impressed on device 6 through transformer 4. On the drawing the arrows associated with the relay windings indicate the direction the armatures tend to move when current flows through the windings.

Assume now that voice currents are present in line L. The major portion of these currents pass through delay circuit 1 and are amplified in amplifier 2. A small portion of the currents pass through conductors 3 and the input windings of transformers 4 and 5 in parallel.

Currents in the output circuit of the transformer 5 due to the beginning of a syllable are impressed on device 9 and pass through low-pass filter 11 and windings W_4 and W_2 of relays R_2 and R_1 , respectively.

Currents in the output circuit of transformer 4 also due to the beginning of a syllable are impressed on device 6 and pass through delay filters 8 and 8' and windings W_3 and W_1 of relays R_2 and R_1 , respectively. These currents are slightly delayed so that currents in windings W_4 and W_2 are effective first.

The currents in winding W_4 therefore cause the armature of relay R_2 to be attracted breaking the short circuit around battery 12. The currents in winding W_2 of relay R_1 maintain its armature unoperated.

Relay R_3 then operates attracting its armature thereby opening the short circuit which existed across line L permitting currents to pass from the output of amplifier 2 over the line. This action takes place quickly during the short time that the currents are delayed in delay circuit 1 thereby avoiding initial clipping of words.

After the slight delay in delay filters 8 and 8' currents in this branch pass through windings W_3 and W_1 and as the currents in windings W_4 and W_2 decrease due to the decay of the syllable windings W_3 and W_1 gradually predominate causing the armature of relay R_2 to fall back and that of relay R_1 to be attracted. There will be no final clipping of words in line L since the short circuit around battery 12 will be kept open at the armature of relay R_1 .

If noise currents are present in line L, currents due to them will pass through both windings of both relays and since winding W_3 predominates over winding W_4 and winding W_2 predominates over winding W_1 the armatures of relays R_1 and R_2 are maintained in the unoperated position so that relay R_3 remains unoperated and the short circuit exists in line L.

When voice currents are superposed on the existing noise currents the action described above due to voice currents alone occurs.

The arrangement of Fig. 2 is very similar to that of Fig. 1 except that space discharge device circuits are used in the slightly slower operating branch instead of the delay filter as in Fig. 1. The upper branch of Fig. 2 is the same as the lower branch of Fig. 1. The output of the upper branch passes through the windings W_4 and W_2 of relays R_2 and R_1 , respectively. In the lower branch of Fig. 2 the output winding of trans-

former 4 is connected to the input electrodes of device 13 through space discharge rectifier 14; a condenser 15 and resistance 16 are connected in shunt thereto. The anode of device 13 is connected to the grid of device 17 through grid bias battery 18. A parallel condenser-resistance combination 19 is associated with the anode current path of device 13. The anode current path of device 17 includes windings W_3 and W_1 in series.

The rectifier-condenser-resistance combination 14, 15 and 16 is quick acting and is arranged as shown to cause the grid of the device 13 to become more negative due to current flow from rectifier 14. The anode current through device 13 is therefore decreased but the condenser of condenser-resistance combination 19 will then begin to discharge through its associated resistance so that the grid of device 17 is maintained sufficiently negative for a short time to prevent anode current flow through device 17 and windings W_3 and W_1 . The characteristics of condenser resistance combination 19 are made such that the delay in this branch is of the same order of magnitude as the delay in delay filters 8 and 8' of Fig. 1.

The relation of the relay windings as to which predominates and the operation of relays R_1 , R_2 and R_3 are the same as in Fig. 1 and a repetition of this operation is not believed warranted.

What is claimed is:

1. A transmission system comprising line wires, means whereby the continuity of said line wires is controlled comprising branch circuits adapted to receive part of the currents in said line wires, said branch circuits having different times of transmission therethrough, multi-winding relays, the effects of currents in said windings being opposed and unequal, one winding of each of said relays being included in the output of each of said branch circuits in such a manner that current in the fast transmitting branch flows through the predominant winding of one relay and current in the slow branch flows through the predominant winding in the other relay, the relays being so arranged that the predominant winding of each in response to such currents actuates the continuity controlling means in the same sense.

2. In combination with a line for transmitting speech currents, a circuit control means for rendering said line effective or ineffective to transmit, a pair of branch circuits, multi-winding relays, the effects of equal currents in said windings being opposed and unequal, one winding of each of said relays included in the output of said branch circuits, the predominant winding of one of said relays being in a different branch circuit from the predominant winding of the other relay, said branch circuits being traversed by speech and noise currents and having different transmission times for speech whereby one of said relays is actuated by an impulse through the faster of said branch circuits and upon the decrease of the impulse, the retarded impulse through the slower of said branch circuits actuates another of said relays and means controlled by said relays to control said circuit control means.

3. In a voice operated circuit, a line for transmission of speech currents, circuits branched from said lines, a first switching means, a second switching means, each controlled from both of said branched circuits, a circuit control element in said line, said two switching means, when either is operated, exerting identical control of said circuit control element, said branched

circuits when carrying simultaneously equal currents controlling said two switching means against operation, whereby steady noise currents are balanced out in their effects on said circuit

5 control element, the branched circuit of less transmission time for speech, when it alone carries current, causing operation of the first switching means and the branched circuit of greater transmission time for speech, when it alone carries current, causing operation of said second

10 switching means, whereby said circuit control element is actuated by both the initial and final portions of a speech impulse.

windings, one of which predominates over the other for equal currents in the windings, one winding of each relay being included in each branch circuit such that each branch includes one of the predominant windings, which latter when energized tend to hold the relay unoperated, whereby noise currents traversing both branch circuits alike tend against operation of either relay, whereas speech impulses being delayed in one branch with respect to the other, first cause operation of one of said relays and finally cause operation of the other relay, and a circuit control element in said line, each of said relays upon operating exerting similar control of said element.

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4. In a voice operated circuit, a line for transmitting speech currents, circuits branched therefrom having different transmission times for speech, relays each having two mutually opposing

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