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VOICE OPERATED RELAY EQUIPMENT

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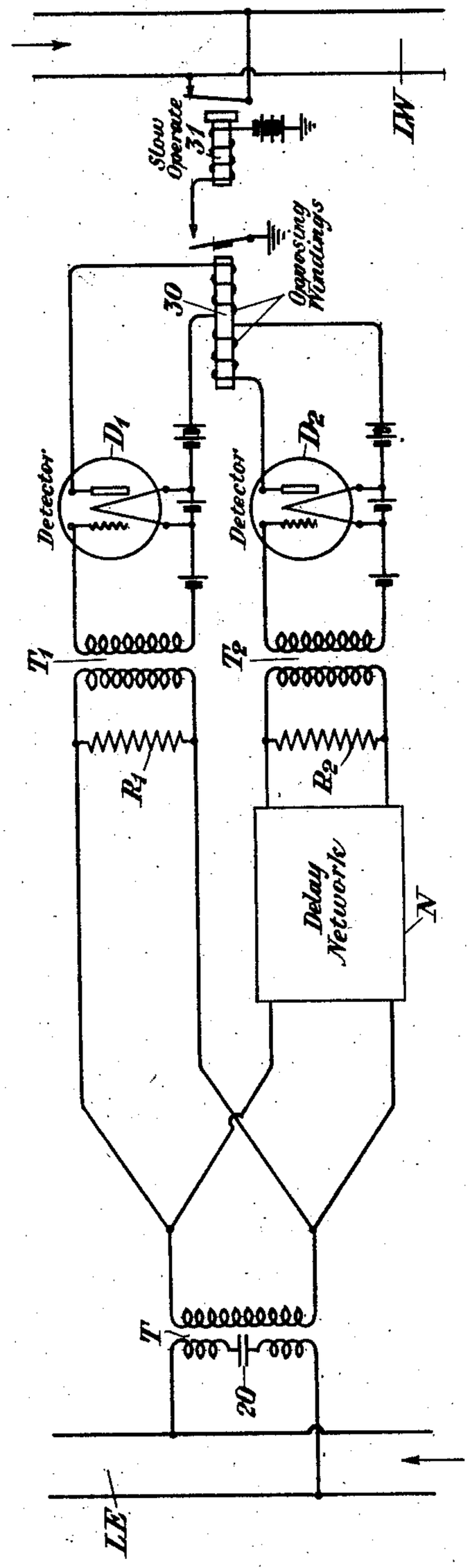

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VOICE-OPERATED RELAY EQUIPMENT.

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This invention relates to voice-operated relay circuits of the type used in echo suppressing equipment, voice-operated repeater circuits, and the like.

Tests have shown that steady currents, such as those set up in telephone circuits by induction from power lines and other adjacent circuits are a serious limitation on the sensitivity at which a voice-operated circuit such as an echo suppressor can be worked. The seriousness of this difficulty becomes apparent when it is considered that the sensitivity of an echo suppressor, for example, is limited by the noisiest circuit which may be connected to the echo suppressor at any given time, although for a large number of other connections a greater sensitivity would be possible.

One of the objects of this invention is to provide a voice-operated relay circuit which will be substantially non-responsive to steady noise currents, but which will be quite sensitive to voice currents even though the voice currents be of very small magnitude. The invention takes advantage of the fact that the noise currents are steady and continuous, whereas the voice currents which are intended to operate the relay are fluctuating currents.

This and other objects of the invention are attained by means of the arrangements set forth in detail in the following description and illustrated in the accompanying drawing, the figure of which illustrates the preferred embodiment of the invention.

Referring to the drawing, LE and LW designate transmission paths such as one-way paths of a 22 repeater or the one-way lines of a four-wire circuit. In the operation of such circuits, it is desirable, in order to prevent echos when talking over one of the paths, that apparatus shall be operated to disable the path transmitting in the opposite direction. In the drawing, voice-operated apparatus is illustrated associated with one of the paths to disable the opposite path. It will be understood, of course, that similar apparatus is associated with the second path to disable the first path when transmission is taking place over the second path.

The voice-operated equipment is bridged across the path LE through a transformer T in series with which is the capacity 20 so as to make the apparatus inefficient at frequencies for which the continuous disturbing currents are strongest. The current passing through the transformer will, therefore, be principally voice energy as distinguished from the noise energy. On the secondary side of the transformer the circuit divides so that part of the energy passes over an upper path to a resistance R_1 and thence through a transformer T_1 to the input of a detector D_1. Part of the energy is also transmitted through a lower path which includes a delay network N, and after passing through the network to the resistance R_2, the energy is transmitted through the transformer T_2 to the input circuit of the detector D_2. The delay network N may be of any type well known in the art.

The detectors may have their grid potentials normally adjusted to such values that when no alternating current is applied to the detectors, no direct current flows in the output circuits thereof. Consequently, when alternating current is applied to the detectors, rectified pulses of direct current flow in the output circuits. The output circuits of the two detectors include separate windings of a differential relay 30.

Now, if the actuating currents impressed upon the detectors are continuous, as in the case of noise due to power circuits, equal currents will flow in the two windings of the differential relay 30, and the resulting effect will be to cause no further operation of the relay circuit. However, when pulses of voice current are applied to the detectors, the space current in the detector D_1 is changed, immediately causing operation of the relay 30. A similar impulse is transmitted through the delay network to the input of the detector D_2. By the time the change in space current of the detector D_2 corresponding to this pulse occurs, the relay 30 is already operated to release the relay 31 and short-circuit the path LW. Depending on the length of the voice current impulse, the detected pulse in the output circuit of the detector D_2 may arrive at such time as to produce a magnetic flux opposing that due to the detector D_1 to release the armature of the relay 30, or it may arrive after the impulse due to the detector D_1 has ceased, in which case the impulse due to the detector D_2 will operate to hold up the armature of the relay 30, or if it is already released, to again pull it up. If the armature is released momentarily, it does not disturb the effectiveness of

the short-circuit applied to the path LW, as the relay 31 is made slow to operate. If the delayed impulse arrives at such time as to have the effect of holding the armature of relay 30 up longer, its only result is to slightly lengthen the period required, after an impulse has ceased, to remove the disabling short-circuit from the disabled path. This slight lengthening of the restoration period is not objectionable, and may, in general, be desirable.

The delay due to the network N will, in general, be but a small fraction of a second, merely long enough to enable the differential relay to operate before the delayed impulse arrives. The voice current pulses due to different syllables of words will follow each other fairly rapidly with the result that an operating pulse of detected current will be effective upon the differential relay 30 for each voice current pulse. The effect of steady or continuous alternating currents applied to the two detectors will be to maintain the same change in space current in the output circuits of the two tubes continuously, with the result that the two windings of the differential relay will oppose each other an instant after the continuous currents begin and thereafter will continuously oppose each other. It will therefore be clear that the arrangement above described will be unresponsive to continuous voice currents which are steady in amplitude for a period longer than the time required for the operation of relay 31, which is made slow for this reason, but will be effectively responsive to vocal impulses to substantially the same extent as the ordinary voice-operated relay arrangement.

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

What is claimed is:

1. In a voice-operated relay circuit, a path over which voice currents and steady alternating currents may be transmitted, branches for said path, means in each branch for translating alternating voice currents into one-way pulsating currents, a relay having windings differentially associated with said translating means, and means to delay the transmission of currents to the translating means in one branch as compared with the other.

2. In a voice-operated relay circuit, a path for transmitting voice currents and alternating currents, branches for said path, each branch including a detector, a relay having windings differentially associated with the output side of said detectors and a delay network in one of the branches.

3. In a voice operated relay circuit, a path over which voice currents and steady alternating currents may be transmitted, branches for said path, means in each branch for translating alternating voice currents into one-way pulsating currents, a relay having windings differentially associated with said translating means, and means to cause one branch to transmit currents with a higher velocity than the other.

4. In a voice operated relay circuit, a path over which voice currents and steady alternating currents may be transmitted, a plurality of detectors associated therewith, a relay having windings differentially associated with said detectors, and means to cause one detector circuit to respond before the other.

5. In a voice operated relay circuit, a path over which voice currents and steady alternating currents may be transmitted, two detectors associated in parallel therewith, a relay having windings differentially associated with said translating means, and means to delay the transmission of currents to the one detector as compared with the other.

In testimony whereof, I have signed my name to this specification this 4th day of November, 1925.

SUMNER B. WRIGHT