May 7, 1929. H. M. PRUDEN 1,711,651

SIGNALING SYSTEM

Filed Jan. 29, 1927

FIG. 1

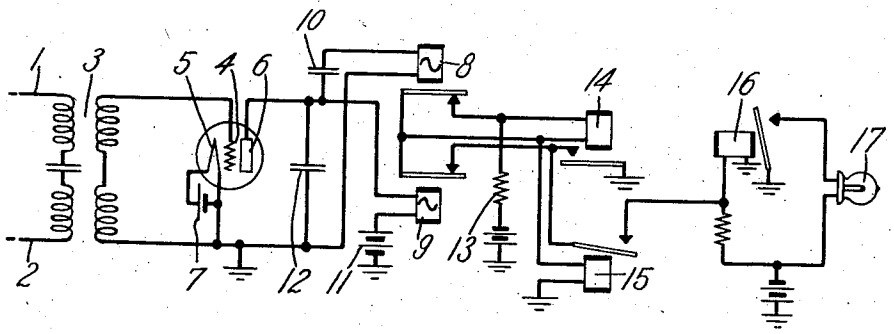


FIG. 2

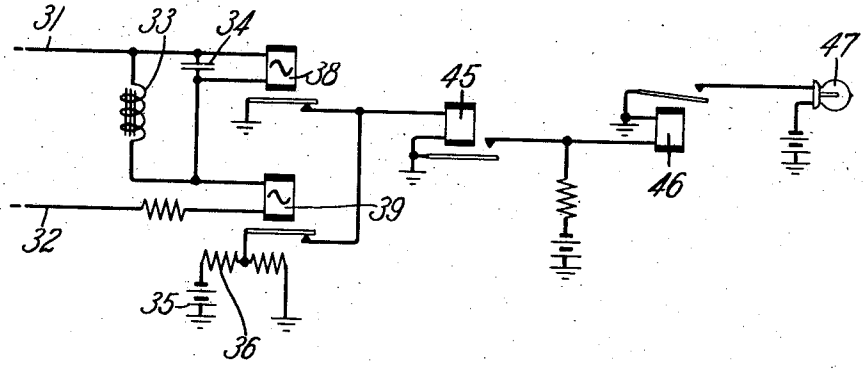
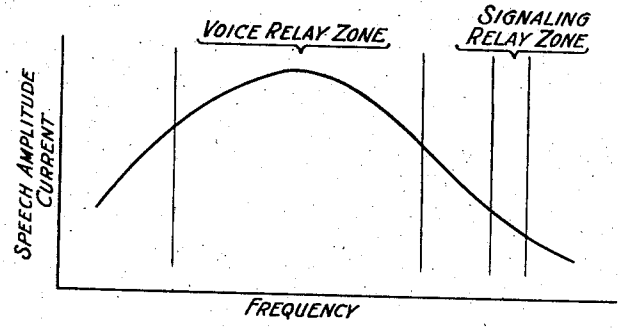


FIG. 3



Inventor:
Harold M. Pruden
by John C. Hall
Attorney

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UNITED STATES PATENT OFFICE.

HAROLD M. PRUDEN, OF WYOMING, NEW JERSEY, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

SIGNALING SYSTEM.

Application filed January 29, 1927. Serial No. 164,414.

This invention relates to signaling systems and particularly to telephone systems wherein call signaling is accomplished by current within the voice frequency range. The primary purpose of the invention is to eliminate or reduce the chance of false ringing on signaling.

It has been found that, due to the construction and arrangement of the present day long distance and toll telephone lines, signaling current is most effectively employed when it is within the voice frequency range. Usually there is provided a relay responsive to current of a definite frequency which, while within the voice frequency range, is near the boundary thereof so that the ordinary and most frequently used tones do not affect such relay. There are times, however, when particular frequencies are set up by the voice to which such relay will respond and the response of such relay, therefore, transmits a false signal. The present invention obviates this difficulty by employing another relay to render the signaling relay ineffective. Such other relay will not not respond directly to the current designed to operate the first relay, but will readily respond to other voice currents or current.

The invention has its preferred embodiment, specifically stated, in a relay for relaying calling signals which is made responsive only to current of a particular frequency within but near the boundary of the voice frequency range, in combination with another relay upon which the incoming currents are simultaneously impressed, for rendering the first relay ineffective, the second relay being made responsive to the most frequently occurring frequencies in the voice range. The first relay is sharply tuned, whereas the second is broadly tuned so that it will respond to currents over a wide range of frequencies. The second relay, moreover, is somewhat slow in action and will, therefore, maintain its armature operated if the voice currents include for an instant, the current of the frequency to which the signaling relay responds. The voice currents are generally made up of a plurality of different frequencies and when a frequency to which the signaling relay will respond is transmitted, it is generally accompanied by some of the more ordinarily occurring voice frequencies so that the second or controlling relay will be maintained operated. Preferably the controlling relay controls a circuit in which there is no current flow under normal conditions so that its contacts, due to almost continuous operation, will not be unduly worn or corroded by sparking.

A more complete description of the invention follows and is illustrated in the accompanying drawings in which two forms of the invention are shown.

Fig. 1 shows the preferred form of the invention and consists of a diagrammatic representation of a signal receiving circuit.

Fig. 2 shows an alternative form of the invention and consists of a diagrammatic representation of a signal receiving circuit.

Fig. 3 is a curve showing the relation between speech amplitude and frequency.

In Fig. 1 the conductors 1 and 2 may be connected to a telephone line. These conductors extend to the primary windings of a repeating coil 3, the secondary winding of which is included in the grid circuit of a vacuum tube amplifier, the grid being designated by the numeral 4. The filament 5 is energized by the grounded battery 7. The plate 6 extends into the signal receiving circuit. Relay 8 responds to signaling current and relay 9 responds to voice current.

An incoming signal current will be transformed by the repeating coil, will affect the grid 4 and set up in the circuit including plate 6 a corresponding current. This current will travel from the plate 6 through the condenser 10, the winding of relay 8 to ground at battery 7 and will thereby energize relay 8. A parallel circuit extends from plate 6 through the winding of relay 9, the plate battery 11 to ground, but relay 9 will not respond directly to signaling current. Condenser 12 connected between plate 6 and ground is employed in connection with condenser 10 for sharply tuning the circuit of relay 8, condenser 10 also serving to prevent a drain on battery 11. Condenser 12 is also used to tune the circuit of relay 9.

Upon the response of relay 8 a circuit is established from grounded battery, resistance 13, winding of relay 14, winding of relay 15 to ground. Relay 14 becomes energized and short-circuits relay 15 through the back contact of relay 9. Relay 15 becomes deenergized whereupon a circuit for shunting relay 16 is established through the front

contact of relay 14 and the back contact of relay 16. Relay 16 becomes deenergized and establishes an obvious circuit for signal 17.

During conversation on the telephone line the voice currents are transformed by the repeating coil 3, affect the grid 4, and produce in the circuit including plate 6 corresponding currents. These currents do not affect relay 8 but will affect relay 9. Relay 9 attracts its armature and opens the previously described circuit for shunting relay 16 so that should the current of the frequency to which relay 8 is tuned occur the consequent operation of relay 8 and relay 14 will be without effect. It should be noted that relay 9 opens a circuit which under normal conditions is opened at two other points and that consequently relay 9 which is operated most of the time does not break any current flow at its contents.

Fig. 2 shows a somewhat similar arrangement except that here no vacuum tube amplifier is indicated although one may be used without the exercise of invention. Conductors 31 and 32 may be connected to a telephone line. Relay 38 is tuned by means of impedance coil 33 and condenser 34 to a definite signaling frequency whereas relay 39 is broadly tuned to respond to voice currents.

When a signaling current is received relay 38 will respond and by attracting its armature will open a short-circuit about the winding of relay 45. Relay 45 now becomes operated in the circuit including grounded battery 35, resistance 36, the armature and back contact of relay 39, the winding of relay 45 to ground. Relay 45 by attracting its armature shunts the winding of relay 46 which establishes an obvious energizing circuit for signal 47.

During conversation relay 39 responds to voice currents and relay 38 remains inert. Relay 39 in attracting its armature opens the energizing circuit for relay 45 so that if a current of the proper frequency to operate relay 38 occurs the removal of the short-circuit from about the relay 45 will be ineffective.

Fig. 3 represents the relation between current strength and frequency for voice currents. The curve shows that the current strength increases with increase in the frequency up to a certain point whereupon it turns and thereafter decreases. The peak is at the most common voice frequency and the voice relay is tuned to respond to currents in a broad zone including this peak. The signaling relay is more sharply tuned at a point high up in the frequency values.

The voice relay may be adjusted so that it is sufficiently sensitive to operate on ordinary speech amplitudes so that the likelihood of a signaling frequency of sufficient amplitude to operate the signaling relay being present is very small. Any increase in speech strength making signaling operation likely, provides, therefore more positive action in the voice relay. In accordance with this method of adjustment the voice relay is held up continuously during talking and renders the signaling relay ineffective.

The voice relay may on the other hand be so adjusted that it does not respond to ordinary speech amplitudes but will respond to greater amplitudes. The ordinary speech amplitudes will not operate the signaling relay but if they are increased to the point where, should they contain a signaling frequency, the signaling relay would operate, then the voice relay would operate and render the signaling relay ineffective. The curve in Fig. 3 shows that there will be more operating energy around the frequencies of most common occurrence to which the voice relay is tuned and at the same time less at the higher signaling frequencies. This provides a natural increase in sensitivity to the voice relay and decreases the likelihood of its failing to operate in either case. In accordance then with this second method of adjustment neither the voice relay nor the signaling relay operate with ordinary speech, but the voice relay is much more likely to operate if the speech volume is increased.

What is claimed is:

1. In a signaling system, a relay for relaying signals responsive to currents of a narrow band of frequencies near the boundary of the band of voice frequencies and another relay for rendering ineffective said first relay responsive to currents of a wide band of voice frequency.

2. In a signaling system, a relay for relaying signals responsive to alternating current of a definite frequency and another relay to render ineffective said first relay responsive to composite currents of a plurality of frequencies and including said definite frequency.

3. In a signaling system, a relay for relaying the signals responsive to alternating currents of a narrow band of frequencies on each side of a definite frequency and another relay to render ineffective said first relay responsive to composite currents of a wide band of frequencies including said definite frequency, said wide band being centered about a different definite frequency.

4. In a signaling system, a relay for relaying signals responsive to a narrow band of voice frequency currents of infrequent occurrence and another relay for rendering ineffective said first relay responsive to a wide band of voice frequency currents of most common occurrence.

5. In a signaling system, a line, a first relay and a second relay, said relays being selectively responsive to currents transmit-

ted thereto over said line, a signal circuit including a normally open link, means under control of said first relay for closing said link and means under control of said second relay for opening said link.

6. In a signaling system, a sharply tuned relay for actuating a signal responsive to alternating current of a definite frequency and a broadly tuned relay for rendering said first relay ineffective, said broadly tuned relay being responsive to currents of voice frequency of most common occurrence, said relay further being sluggish in its response whereby during its actuation by said voice frequency currents it will remain actuated during the infrequent occurence of currents of said definite frequency.

In witness whereof, I hereunto subscribe my name this 27th day of January, A. D., 1927.

HAROLD M. PRUDEN.