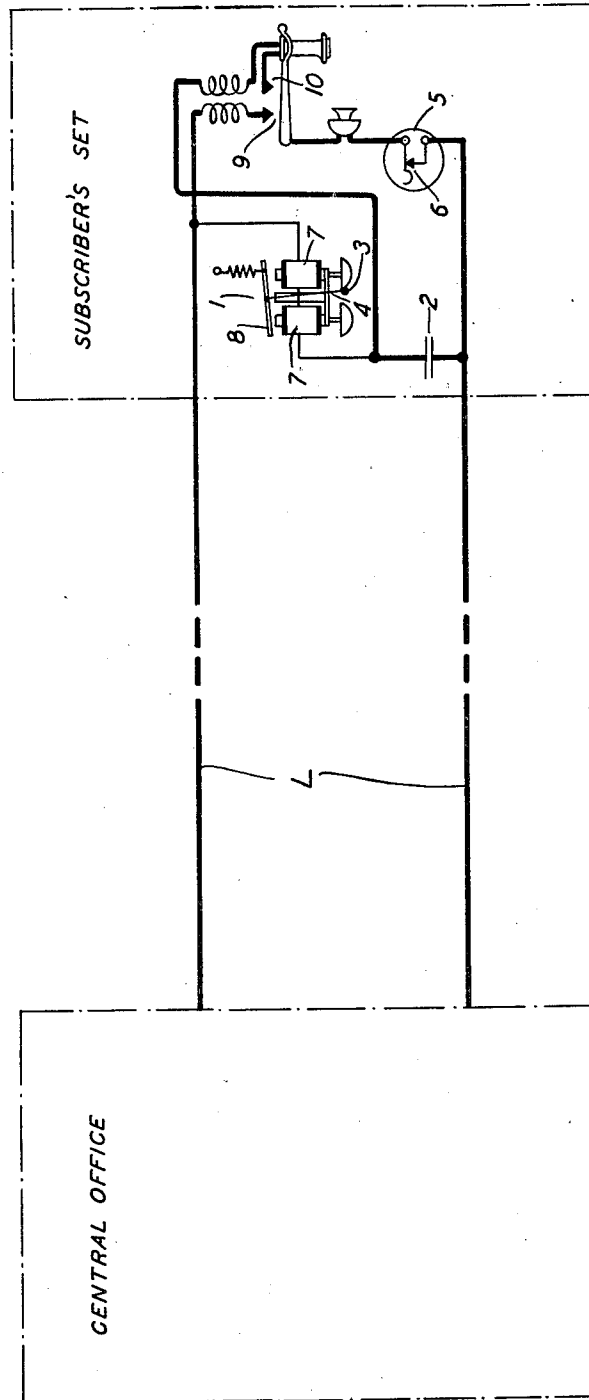


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L. J. STACY
TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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This invention relates to telephone systems and more particularly to ringing responsive devices to be used in connection with such systems.

5 An object of the invention is to eliminate false ringing caused by dialing, switchhook operation, testing and other causes. A feature of the invention therefore, whereby the preceding object is attained, resides in electrically and mechanically tuning the ringing responsive device to respond with maximum efficiency at the frequency of the ringing current and to be non-responsive at frequencies outside a predetermined band including the ringing frequency. For example, if the ringing responsive device be tuned to operate at the ordinary ringing frequency of 20 cycles, false operation by dialing pulses which are usually of the order of 8 to 11 cycles, can be avoided.

20 The invention has particular application to systems using biased ringers. Heretofore, it has been the practice to attach a biasing spring to the armature of a polarized ringer in order to hold the armature normally in engagement with one pole of the electromagnet so the ringer will operate on current in one direction only. This bias prevents false operation of the ringer on currents in the other direction. The non-ring currents in this direction may be of the same value or of greater value than ringing current without causing operation of the ringer. In dial systems the pulses of current in the ringer caused by dialing are in one direction upon the closing of the dial contacts and in the other direction upon their opening, the oscillations upon opening being much greater than those on closing. The pulses when the dial contacts open are frequently of the order of ringing current strength but they do not cause operation of the ringer due to the bias against operation on currents in this direction. In order to prevent operation on dial pulses or other extraneous currents in the opposite direction and still to render the ringer responsive to ringing pulses in this direction the tension of the spring must be between certain marginal values, for example, it must be

great enough to prevent tapping due to the relatively weaker dial pulses or the like and still not so great as to prevent operation due to the relatively stronger ringing currents. The invention disclosed in this application makes possible a greater margin between the biasing spring tension necessary to prevent tapping during dialing and that which would prevent ringing.

The invention will be understood from the following description, and the accompanying drawing, in which one embodiment of the invention is set forth. The drawing shows the application of the invention to the ringing responsive device of an ordinary dial subscriber's telephone line. The line L from the central office is bridged by the ringing responsive device consisting of the ringer 1 in series with the condenser 2. Battery is supplied to the line at the central office and means is provided at the central office to apply to the line alternating or pulsating current of a ringing frequency, for example, 20 cycles.

There is a frequency at which the ringer has its maximum response, that frequency depending upon the mechanical proportions of the ringer; for example, upon the size and weight of clapper 3 and the length of clapper rod 4. It is therefore proposed to so adjust these proportions that the ringer will have its greatest response at the frequency of the ringing current, i. e., 20 cycles, for example. Furthermore, the condenser may be made of such capacity that the ringer winding and condenser constitute a tuned bridge electrically resonant at the ringing frequency.

Also connected across the line is the subscriber's telephone and a dialing device 5 provided with contacts 6 adapted to be made and broken during dialing thereby producing pulses of current in the line of a frequency which in practice may be of the order of 8 to 11 cycles. During dialing the receiver is off the hook and contacts 9 and 10 are closed.

The operation of the system herein described is as follows: When ringing current is applied to the central office end of line L it flows out over the line and through the windings of ringer 1 alternately charging and discharging condenser 2 in accord with

the current pulses, the electrically resonant qualities of the ringer bridge causing it to offer a minimum of impedance to this ringing frequency current. The greatest possible effect is thus produced on the ringer electromagnets 7 causing them to attract armature 8 intermittently in unison with the current pulses. The force intermittently applied to the armature intermittently overcomes the biasing spring tension causing the armature and clapper 3 to travel back and forth in unison with the pulses of current. By virtue of the mechanical tuning of the ringer the armature is attracted to the magnets only when it is traveling toward them thereby receiving the greatest possible impulse from each current pulse. The result is that the bells are rung more effectively than they would be without electrical and mechanical tuning.

In an outgoing call from the subscriber's station the dial is operated resulting in the opening and closing of contact 6, thereby interrupting battery current from the central office and causing a series of pulses of dialing frequency to be applied to the line. On each opening of the contact there is a pulse of current through ringer 1 to build up a charge on condenser 2. This pulse is in such a direction as to produce no effect on the ringer due to its bias. On each closing of the contact the condenser discharges through the ringer and the closed contact 6 of the dial producing a pulse of current in the opposite direction. These alternate pulses taking place in succession constitute an alternating current of dialing frequency through the ringer bridge. Since the bridge is electrically tuned to be responsive at ringing frequency and not at dialing frequency its electrical impedance to dialing pulses is greater than it would be if it were resonant closer to dialing frequency and the oscillations through the ringer bridge are consequently smaller. In addition the mechanical response will be smaller than it would be if the ringer were mechanically resonant closer to dialing frequency, at no time becoming great enough to cause the clapper to strike the bell.

While the invention has been disclosed as embodied in a dial telephone system it is understood that it is capable of application to other systems wherein it is desired to prevent the ringer from being operated by a variety of electric impulses not intended for ringing purposes and still operate on ringing current of a definite frequency. It is also understood that while the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable, it is capable of embodiment in many and other widely varied forms without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a telephone system, a single party line connecting a subscriber's set with a central office, means at said central office for applying current of a signaling frequency to said line, means for applying current of a dialing frequency to said line, and a biased ringer at said subscriber's set permanently bridged across line and mechanically tuned to be responsive at said signaling frequency and non-responsive at said dialing frequency.

2. In a telephone system, a single party line connecting a subscriber's set with a central office, means at said central office for applying current of a signaling frequency to said line, means for applying current of a dialing frequency to said line, and a biased ringer in series with a condenser permanently bridged across the line at said subscriber's set, said condenser in combination with the ringer coils being electrically tuned and said ringer mechanically tuned to be responsive at said signaling frequency and non-responsive at said dialing frequency.

3. In a telephone system, a line connecting a subscriber's set with a central office, means at said central office for applying current of a signaling frequency to said line and means for applying current of a dialing frequency to said line, and a circuit including an electromagnetic mechanism permanently bridged across said line at the subscriber's set, said circuit being electrically tuned, and said electromagnetic mechanism mechanically tuned to respond only to said signaling frequency and to be non-responsive to said dialing frequency.

4. In a telephone system, a line connecting a subscriber's set with a central office, means at said central office for applying currents of a signaling frequency of twenty cycles per second to said line, means for applying dialing pulses at a frequency of eight to eleven per second to said line, and a biased ringer in series with a condenser permanently bridged across the line at said subscriber's set, said condenser in combination with the ringer coils being electrically tuned, and said ringer mechanically tuned, to be responsive at said signaling frequency and to be non-responsive to said dialing pulses.

5. In a telephone system, a telephone line connecting a subscriber's set with a central office, means at said central office for applying currents of a signaling frequency of twenty cycles per second to said line, means at the subscriber's set for applying dialing pulses at a frequency of eight to eleven per second to said line, and a biased ringer in series with a condenser permanently bridged across the line at said subscriber's set, said condenser in combination with the ringer coils being electrically tuned, and said ringer mechanically tuned, to be responsive at said

signaling frequency and to be non-responsive to said dialing pulses.

6. In a telephone system, a line connecting a subscriber's set with a central office, means at said central office for applying current of a signaling frequency to said line, means at said subscriber's set for applying current of a dialing frequency to said line, and a ringer circuit permanently bridged across the

line at said subscriber's set between said dialing means and the central office and electrically and mechanically tuned to be responsive at said signaling frequency and non-responsive at said dialing frequency.

In witness whereof, I hereunto subscribe my name this 14th day of August, 1931.

LELAND J. STACY.