

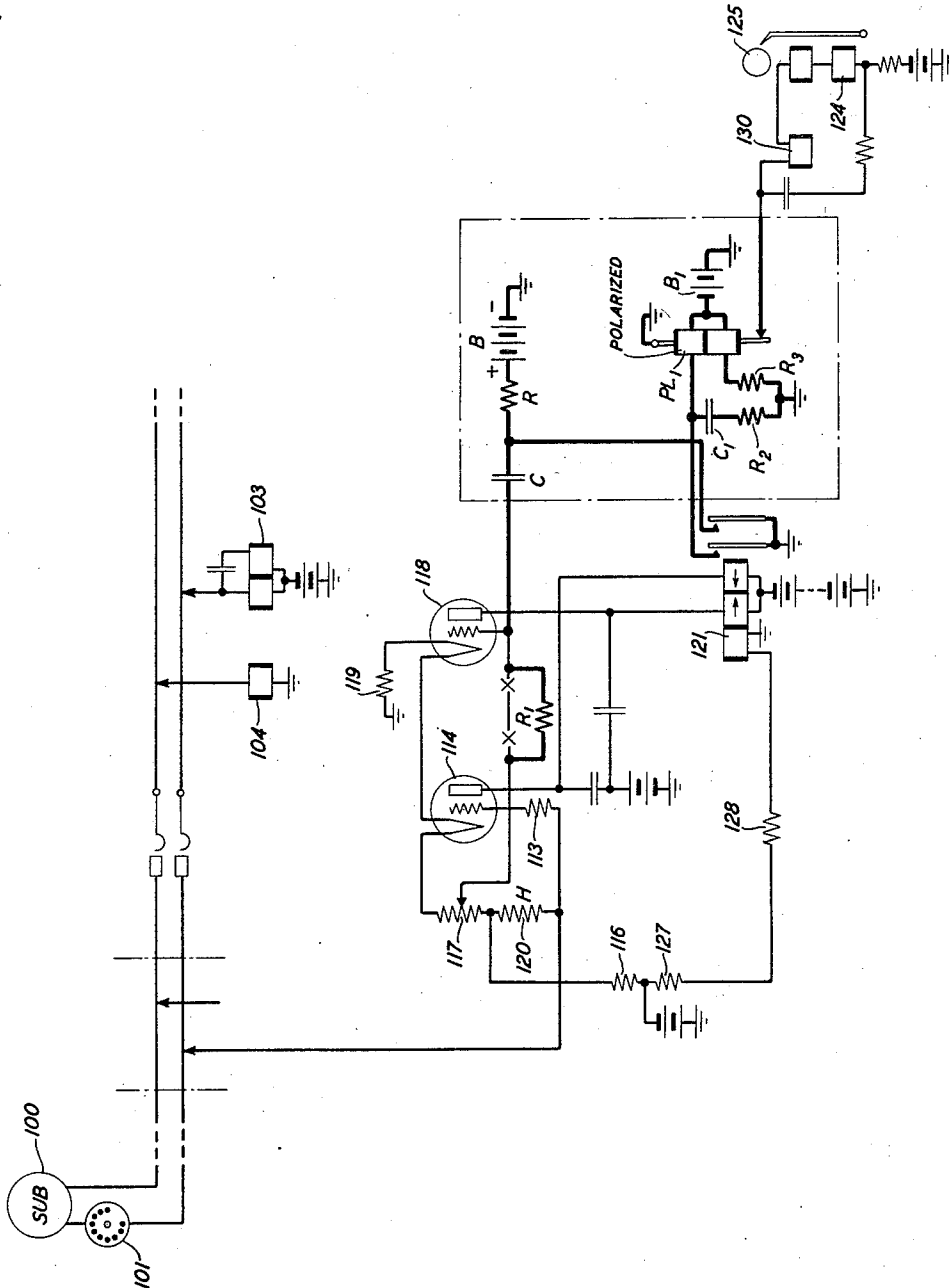
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L. E. VAN DAMME

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SERVICE OBSERVING SYSTEM

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INVENTOR
L. E. VAN DAMME
BY *A. V. Kugman*
ATTORNEY

UNITED STATES PATENT OFFICE

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SERVICE OBSERVING SYSTEM

Louis E. Van Damme, Weehawken, N. J., assignor
to Bell Telephone Laboratories, Incorporated,
New York, N. Y., a corporation of New York

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This invention relates to telephone service observing systems and more particularly to systems for registering dial pulses transmitted by a telephone subscriber, to control central office switching equipment, of the character originally described and claimed in United States Patent 1,795,656 to R. F. Massonneau, issued March 10, 1931, and later described in Patent 2,017,644 to L. H. Allen et al. issued October 15, 1935, in which later patent as described on page 11, line 27, left column, a condenser 448 is referred to as connected between the grid and filament of tube 424 for the purpose of preventing registration of split impulses, i. e., the registration of two short impulses instead of one impulse of normal length, which it may be explained is caused by oscillating transient voltages which appear during dialing on the ring conductor of the line under observation. Condenser 448 is of small capacity and tends to suppress or counteract excessive high peaks of such oscillating pulsations and prevents the reoperation of the dial pulse responsive relay 408 during the interval the dial contacts are opened.

In certain recently developed systems, for example the so-called automatic ticketing system disclosed in a copending application, filed June 27, 1942, in the name of F. B. Blake, Serial No. 448,753, the calling subscriber's line, after seizure by the line finder, is first connected to battery and ground through the conventional line relay (not shown) in the first selector 184, and later to battery and ground through a similar line relay 207, in the ticketing trunk (Fig. 2), both of which relays (in practice) have two equal resistance windings of 200 ohms each.

Following the description of the progress of a call, the tip conductor of the calling line is connected to ground and the ring conductor to battery in series with the middle winding of pulse responsive relay 1000 in the sender (Fig. 10) which connection serially includes a retardation coil 1001. In practice the middle winding of relay 1000 is 190 ohms and the retardation coil 1001 has a resistance of 133 ohms or a total resistance of 323 ohms between the ring conductor of the subscriber's line and battery, as compared to the 200-ohm resistance of the lower winding of the preceding pulse or line relays, such as 207, and consequently if we assume the grid of tube 424 of the pulse detecting and registering circuit, shown in the Allen et al. patent, is connected to the ring conductor of the line over which pulses are being transmitted, to conductor 188 (Fig. 1) of the above-mentioned Blake application, for

example the steady state potential of the grid of tube 424 will be less negative with respect to the filament when the dial contacts are closed and the calling line is connected to relay 1000, than when the line is connected to either of the preceding pulse relays such as 207, due to the greater drop in potential due to the increase in resistance from 200 to 323 ohms. Therefore, if the service observing system shown in the Allen et al. patent, as previously referred to, is connected to a line which, in dialing a call, is routed through the automatic ticketing system disclosed in the Blake application, we have the condition where the grid of the tube 424 is, at one stage of the dialing, subject to a certain potential variation and at a later stage subject to a different and wider variation, so, if the condenser between the grid and filament has the proper capacity so that the pulse relay responds properly under the first condition, under the second condition it will fail to reach a steady state during dialing due to the greater potential variation between dial open and dial closure and therefore the pulse detector relay will respond sluggishly and may fail to properly record the dial pulses transmitted to the automatic ticketing sender.

It is obvious from the foregoing that for more universal use, a condenser connected between the grid and filament of the pulse detector tube, as previously used, is objectionable and must be removed to permit proper registration when the observing circuit is connected to an automatic ticketing system and hence a more suitable and satisfactory means for controlling the pulse detector relay is necessary which is the object of the present invention, i. e., to eliminate both split pulses and false registration due to private branch exchange surges.

A feature of the invention resides in an improved arrangement whereby the foregoing objects are attained.

The improved arrangement, according to the present invention, will be best understood from the following description, when read in connection with the accompanying drawing which shows the pulse detecting and recording portion of the observing system disclosed in the previously mentioned Massonneau Patent 1,795,656 to which has been added, as shown in heavy line within the broken line box, means for preventing split and false pulse registrations regardless of variations in the potentials affecting the grid of the first detector tube at different stages of dialing a connection.

It will be understood that in the arrangement

disclosed in the Massonneau patent false operation and release of the pulse relay 121, due to oscillating transients in the line circuit, was not recognized and hence no means was suggested for correcting this trouble, but in the Allen et al. patent, as before referred to, a condenser is shown connected between the grid and filament of the first tube 424 (corresponding to tube 114 of Massonneau) which had for its purpose the correction of these troubles. This, however, as before described proved unsatisfactory when a more universal arrangement was required for use with systems embodying automatic ticketing, hence the improved arrangement hereinafter described.

Referring to the drawing, the reference numbers in the 100 series are the same and indicate the same elements as shown and described in the Massonneau patent and the alphabet characters C, R, PL₁, etc. indicate the equipment which has been added to the Massonneau arrangement to achieve the objects of the present invention which added equipment is shown within a broken line box at the lower right-hand side of the drawing.

As in the Massonneau patent until the pulse recording equipment is connected to a calling line, tubes 114 and 118 are in a normally balanced condition and the armature of relay 121 remains on its back contact.

When the equipment is connected to the line, before dialing begins, the grid of tube 114 is driven more positive due to the reduced negative potential of the ring conductor of the line and the plate current of tube 114 increases thereby causing the armature of relay 121 to close its front contact and connect ground to the upper winding of normally operated relay PL₁ to cause this relay to release. This is due to current flowing in the upper winding which is in a direction to overcome the flux in the lower winding which causes the armature to be attracted. Opening of the front contact of relay PL₁ releases magnet 124 and the pen is disengaged from the tape roller 125.

When the dial contacts are opened for the first pulse, the potential on the grid of the tube 114 becomes more negative thus reducing the plate current and causing relay 121 to release to open its front contact, thereby removing ground from the upper winding of relay PL₁ whereupon this relay reoperates as soon as condenser C₁ has become charged to the potential of battery B₁ in series with resistance R₂ and the upper winding of the relay.

When relay PL₁ operates, it energizes the pen register magnet 124 to cause the pen to engage the tape roller 125 thereby registering a dial impulse, i. e., the opening of the dial contacts.

When the dial contacts close thereby ending the impulse, the grid of tube 114 again becomes more positive and increased plate current again flows thereby causing relay 121 to operate to again connect ground to the upper winding of relay PL₁, thereby causing this relay to release, which in turn removes ground from the pen register magnet to permit the pen to be disengaged from the tape roller thereby registering a reclosure of the dial contacts.

Condenser C₁ which is charged when relay 121 released is now short-circuited in series with resistance R₂ and discharges. It will thus be obvious that relay PL₁ is delayed in its reoperation, in response to opening of the dial contacts, and hence a surge impulse following the reclosure of

the dial contacts at the end of a series of digit pulses, which pulse is in a direction to momentarily drive the grid of tube 114 more negative, and cause relay 121 to release, will be ineffective to cause the pen to register a false extra pulse.

It will be noted that an auxiliary source of positive potential, battery B (of the order of 100 volts), is connected, in series with a high resistance R (of the order of 1 megohm), and a low capacity condenser C (of the order of .04 microfarad), to the grid of balancing tube 118, but when the recording equipment is connected to the line before dialing starts, relay 121 will be operated thus short-circuiting this battery through the resistance R.

When relay 121 releases due to opening the contacts of the dial, the short-circuit is removed from battery B and a surge of current flows from its positive terminal in a circuit including resistance R, condenser C, high resistance R₁ and resistances 117 and 116 to the negative terminal of the filament battery. The drop in potential across resistance R₁ due to this current is such as to momentarily drive the grid of tube 118 more positive with respect to the filament thus increasing the plate current flowing in the middle winding of relay 121 which increases the opposition to this relay operating and therefore oscillating transient voltages present in the line during the interval the dial contacts are opened, which otherwise might tend to reoperate relay 121 by increasing the current flowing in its right-hand winding, will be offset by the increased current flowing in its middle winding caused by the surge of charging current through condenser C.

It will be evident from the foregoing that the arrangement of the present invention, as applied to the pulse recording system of the Massonneau patent, is effective to prevent the recording of split and extra false pulses without interfering with operation of the equipment when observing on lines whose ring conductor may, at various stages of a dialed connection, have different potentials when the dial contacts are closed.

What is claimed is:

1. In a system for recording dial pulses, transmitted over a line by a telephone subscriber, to control automatic switches, which comprises a pair of vacuum tubes, a differential relay having an individual winding included in the output circuit of each tube and adapted to operate and release in accordance with closures and openings of the dial contacts, and a mechanism controlled by the differential relay to graphically record the operated and released interval of said differential relay, in which system a potential surge may occur in the line following return of the dial to normal which is in a direction to momentarily release the differential relay and also in which oscillating transient potentials occur in the line each time the dial contacts are opened which potential may cause the differential relay to momentarily operate, characterized by time delay means intermediate said differential relay and the recording mechanism to prevent recording a false dial pulse due to a false momentary release of said differential relay, said delay means comprising a normally operated condenser-timed polar relay so arranged and connected that it is released to deenergize said recording mechanism when the differential relay operates and to reoperate with a predetermined delay to energize said recording mechanism when the differential

relay releases, and other means comprising a source of high potential and a low capacity condenser serially connected to the grid of one of said vacuum tubes and controlled by said differential relay for momentarily increasing the plate current in said tube and in one winding of the differential relay, when that relay is released, to prevent its immediate reoperation due to an increase of current in its other winding.

2. In a system for recording dial pulses transmitted over a line by a telephone subscriber to control the pulse relay of an automatic exchange which comprises a vacuum tube having its input circuit connected in parallel with said pulse relay and a differential relay connected to its output circuit which differential relay operates and releases in accordance with the closures and openings of the subscriber's dial contacts to control a pulse recording mechanism, in which system a potential surge immediately appears in the line each time the dial returns to normal which surge is in a direction to cause the differential relay to momentarily release, thus falsely recording an extra pulse, characterized by time delay means comprising a normally operated condenser-timed polar relay intermediate said differential relay and recording mechanism adapted to deenergize said recording mechanism

when the differential relay is operated and to energize said mechanism after a predetermined delay when the differential relay releases.

3. In a system for recording dial pulses, transmitted over a line by a telephone subscriber to control automatic switches which comprises a pair of vacuum tubes, a differential relay having an individual winding included in the output circuit of each tube and adapted to operate and release in accordance with closure and opening of the dial contacts and a mechanism controlled by the differential relay to graphically record the operated and released intervals of said differential relay, in which system an oscillating transient potential appears in the line each time the dial contacts are opened to cause the differential relay to momentarily operate, characterized by means comprising a source of high potential and a low capacity condenser serially connected to the grid of one of said vacuum tubes and controlled by said differential relay for momentarily increasing the plate current in said tube and in one winding of the differential relay, when that relay is released, to prevent its immediate reoperation due to an increase of current in its other winding.

LOUIS E. VAN DAMME.