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2,397,079

TELEPHONE SYSTEM

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Fig. 1

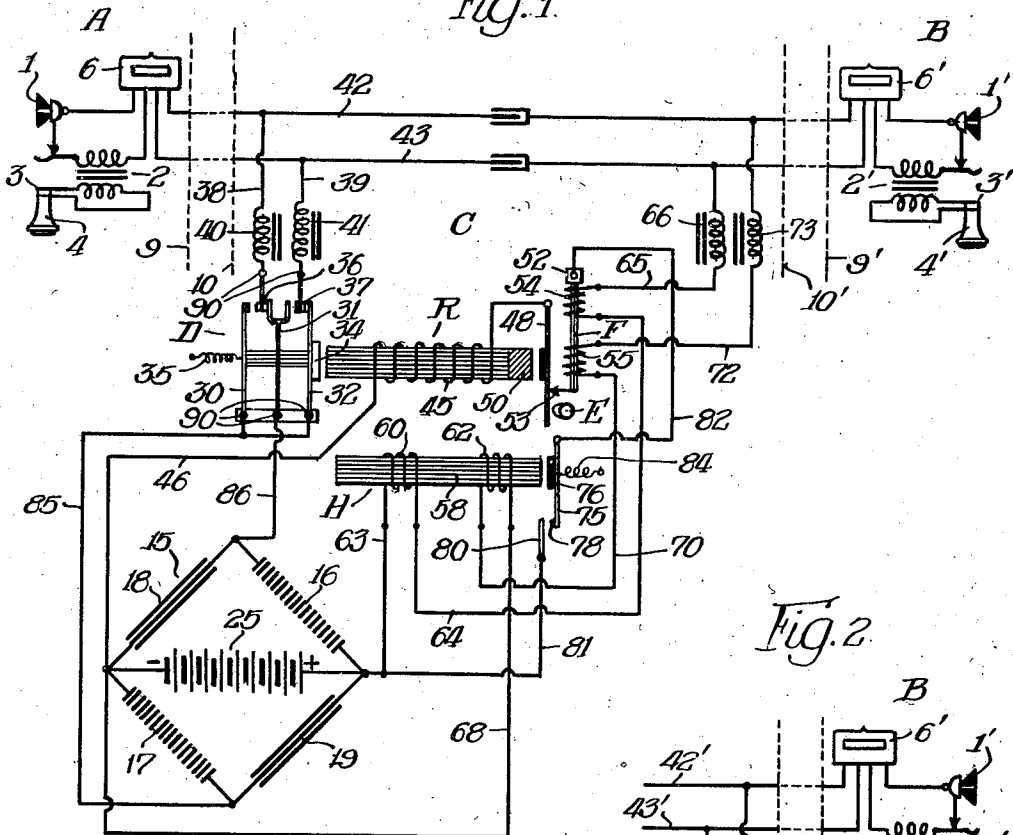
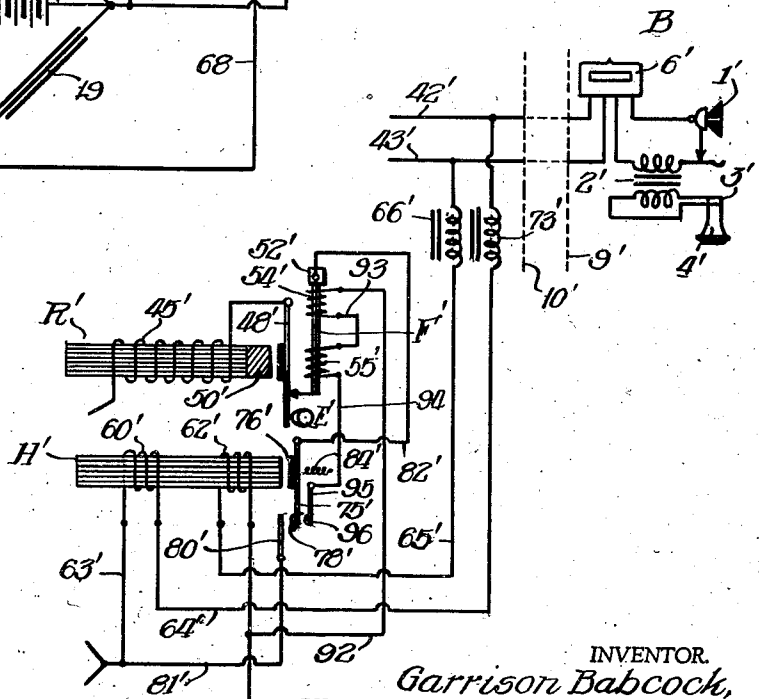


Fig. 2



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UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

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19 Claims. (Cl. 179-7.1)

This invention relates to telephone systems, and more particularly to telephone system employing means for giving metered service.

One of the main objects of the present invention is to provide means for registering a message surcharge upon the meter at the "calling" station, in addition to the usual "time use" charge, and particularly in a "telechronometer" type of system in which the service is metered by periodic reversals of current although it is to be understood that the invention in its broader aspects may be embodied in other forms for use elsewhere as suitable or desired.

It is also an object of the invention to provide message surcharge metering means which is operative to register the surcharge per message only when the calls are completed, and message surcharge metering means of the class set forth which is of simple character and adaptable to previously provided equipment with minimum alteration of existing circuits and regardless of whether a manually operated exchange or automatic or auto-manual operation is employed.

Further objects and advantages of the invention will appear from the following detailed description taken in connection with the accompanying drawing, in which:

Figure 1 is a diagrammatic illustration of a telephone system embodying the present invention; and

Figure 2 is a fragmentary portion of the diagrammatic illustration of Figure 1, showing a substitute wiring arrangement.

Referring to the drawing, the telechronometer system in which I have shown an illustrative embodiment of the present invention is illustrative and may be varied within the scope of the present invention.

The system shown more or less diagrammatically in Figure 1 may be similar to the systems more fully illustrated and described in my prior Patents Nos. 1,138,174, patented May 4, 1915, 1,138,175, patented May 4, 1915, 1,186,464, patented June 6, 1916, 1,189,525, patented July 4, 1916, 1,230,835, patented June 26, 1917, 1,547,489, patented July 28, 1925, 1,594,587, patented August 3, 1926, or it may be a system having a zone system of rates as more fully illustrated and described in my prior Patent No. 1,694,934, patented December 11, 1928, or of any other suitable or preferred form.

For purposes of illustration, suffice it to state that the system shown more or less diagrammatically in Figure 1 comprises a calling sub-station A, called sub-station B, and connecting cord cir-

cuit C located preferably at a central switch-board.

The calling substation A comprises a transmitter 1, induction coil 2, automatic switch hook 3, receiver 4, and a suitable call bell (not shown). In addition, there is a "telechronometer" or register or meter 6 having its coils connected serially in the two limbs of the subscriber's line. The sub-station A may be connected by suitable line wires 9 and 10 to line signalling and switching apparatus in the manner more fully illustrated and described in my above mentioned prior patents, or in any other suitable or preferred manner.

The sub-station B of the called subscriber in the particular system shown in the drawing is provided with similar apparatus the parts of which are designated by primed reference numerals corresponding with those of the calling line.

Current may be supplied to the talking strands of the cord circuit upon the ringing end, for example, through a supervisory relay (not shown), directly, so as to provide unidirectional flow of current over the called line, and current is supplied to the answering end of the cord circuit through a time controlled current flow reversing device indicated generally by the reference character 15 for securing periodic reversals of current flow over the calling line for operating the "telechronometer" or register or meter 6 at the sub-station of the calling party. A complete cycle of change of polarity occurring in the calling line from positive to negative, or vice versa, causes an actuation or registration upon the meter 6 at the calling station.

The time-controlled current flow reversing device or pole changer 15 shown in Figure 1 depends for its current reversing properties upon four carbon pile rheostats 16, 17, 18, and 19 arranged, for example, as the four arms of a Wheatstone bridge. In the diagrammatic showing, the compressed rheostats 16 and 17 are indicated by cross lines, and the released rheostats 18 and 19 are indicated by longitudinal lines. The circuit is completely broken when all of the rheostats are released. The pair of rheostats 16 and 17 and the other pair of rheostats 18 and 19 are alternately compressed, for example, by time controlled pressure means as more fully illustrated and described in my prior patents, or in any other suitable or preferred manner. Means may be provided, such as shown and described in my prior Patent No. 1,694,934, for automatically changing the rate of reversals of polarity so

that, for example, during the "peak" or busy load periods reversals of current on the calling line may occur more frequently than during the remainder of the twenty-four hours. Also, as already pointed out, means may be provided for metering or charging at different rates in different zones or parts of the system and for changing the rates in different zones as illustrated and described in my last mentioned prior patent.

The exchange battery 25 may be connected across the bridge circuit as shown in the drawing, the negative side of the battery being shown as connected to the bridge circuit between the rheostats 17 and 18, and the positive side of the battery being shown as connected to the bridge circuit between the rheostats 16 and 19.

The illustrated form of message surcharge means embodying the present invention comprises a slow acting relay R (preferably less than ten cycles per second as the telechronometer is designed not to respond to current of higher frequency to avoid operation by "ringing" frequencies) provided with a circuit maker and breaker means D, controlled as to duration of function as such, for example, by an adjustable cam E and thermostatically operated contact arm F. The reference letter H designates a message control relay which is actuated upon the response of the "called" subscriber, whereby the surcharge per message occurs only when the calls are completed.

The circuit maker and breaker means D comprises a plurality of contact arms 30, 31, and 32 and an armature 34. The contact arms 30, 31, and 32 and armature 34 are actuated to retracted position and held in retracted position, for example, by a spring 35 as shown in Figure 1 of the drawing. When in this position, the contact arms 31 and 32 make contact with contacts 36 and 37 connected through conductors 38 and 39 and relays or coils 40 and 41 to the talking strands 42 and 43, respectively. Upon energization of the relay R the armature 34 is drawn to attracted position, breaking contact between the contact arms 31 and 32 and the contacts 36 and 37, and making contact between the contact arms 30 and 31 and the contacts 36 and 37, respectively. Upon deenergization of the relay R the contact arms 30, 31 and 32 return to the positions shown in Figure 1.

The core of the relay R has an energizing coil 45 surrounding same. One end of this coil 45 is connected through a conductor 46 to the bridge circuit between the rheostats 17 and 18. The other end of the coil 45 is connected in circuit with a contact arm 48 the position of which may be adjusted by the adjustable cam E to control the duration of energization of the relay R and thereby the duration of function of the circuit maker and breaker means. Retardation 50 may be provided between the end of the core of the relay R and the contact arm 48.

The thermostatically operated contact arm F is shown as comprising a bimetallic arm anchored or fixed at one end at 52. The other end of this bimetallic arm F has a contact 53 for contact with the contact arm 48 to complete the electric circuit through the coil 45 for energizing the relay R. The bimetallic arm F has a pair of heating coils 54 and 55 shown as coiled about the arm F, although this, of course, may vary as may the other details shown and described.

The message charge control relay H is shown as comprising a core 58 surrounded by a pair of energizing coils 60 and 62. One end of the coil 60 is connected through a conductor 63 with

the bridge circuit between the rheostats 16 and 19. The other end of the coil 60 is connected through a conductor 64 with one end of the coil 54 for heating the bimetallic arm F. The other end of the heating coil 54 is connected through a conductor 65 and relay or coil 66 to the talking strand 43 at the answering end. One end of the coil 62 is connected through a conductor 68 with the bridge circuit between the rheostats 17 and 18. The other end of the coil 62 is connected through a conductor 70 with one end of the second coil 55 for heating the bimetallic arm F. The other end of the heating coil 55 is connected through a conductor 72 and relay or coil 73 to the other talking strand 42 at the answering end.

A contact arm 75 has an armature 76 and a contact 78, which contact 78, upon energization of the relay H, is adapted to be attracted into contact with a contact arm 80. This latter contact arm 80 is connected through a conductor 81 with the bridge circuit between the rheostats 16 and 19. The contact arm 75 is connected through a conductor 82 in circuit with the anchored or fixed end of the bimetallic arm F which, when the contact 78 is in contact with the contact arm 80, with the contact 53 in contact with the arm 48, forms a part of the electric circuit which includes the coil 45. The contact arm 75 is actuated to retracted position and held in retracted position by a spring 84. A conductor 85 connects the contact arms 30 and 32 to the bridge circuit between the rheostats 17 and 19. A conductor 86 connects the contact arm 31 to the bridge circuit between the rheostats 16 and 18.

Briefly, the operation of the illustrated embodiment of the invention is as follows:

Assuming that the calling subscriber A raises his receiver from the switch hook 3 and desires to call through central, the subscriber B, closing the hook switch places current of normal potential upon the line wires 9 and 10, energizing the line relay and line signal (not shown), whereupon the operator makes a connection with the usual answering plug with the line of the calling subscriber through the usual answering jack, thereby effacing the calling signal, disconnecting the line conductors 9 and 10 from the battery 25, and applying the potential prevailing in the strands 42 and 43 of the cord circuit employed.

The normal current moves the magnet of the telechronometer 6 about its pivot in one direction. A reversal of current causes the magnet to move about its pivot in the opposite direction, thereby completing the cycle of operation necessary to make registration on the telechronometer 6.

With the circuit maker and breaker D positioned as shown in Figure 1, current flows from the positive side of the battery 25 through compressed rheostat 16, conductor 86, contact arm 31, conductor 38, and relay or coil 40 to the talking strand 42, and from the talking strand 43 through conductor 39, relay or coil 41, contact arm 32, conductor 85, and compressed rheostat 17 to the negative side of the battery 25.

The message charge control relay H is actuated upon the response of the "called" subscriber so that the surcharge registration per message on the telechronometer 6 of the "calling" party occurs only when the call is completed. When the call is completed, current flows from the positive side of the battery 25 through the conductor 63, coil 60, conductor 64, heating coil 54, conductor 65, and relay or coil 66 to the talking strand 43, and from the talking strand 42 through relay or coil 73, conductor 72, heating coil 55, conductor

70, coil 62, and conductor 68 to the negative side of the battery 25.

The flow of current through the coils 60 and 62 energizes the relay H, drawing the armature 76 to attracted position and closing the contact 78 into contact with the contact arm 80. Current then flows from the positive side of the battery 25 through conductor 81, contact arms 80 and 75, conductor 82, bimetallic arm F, contact 53, contact arm 48, coil 45, and conductor 46 to the negative side of the battery 25. The flow of current through the coil 45 energizes the slow acting relay R, drawing the armature 34 to attracted position with an accompanying movement of contact arms 31 and 32 out of contact with contacts 36 and 37, and movement of contact arms 30 and 31 into contact with contacts 36 and 37, respectively.

This reverses the current which now flows from the positive side of battery 25 through the compressed rheostat 16, conductor 86, contact arm 31, conductor 39, and relay or coil 41 to the talking strand 43, and from the talking strand 42 through the conductor 38, relay or coil 40, contact arm 30, conductor 85, and compressed rheostat 17 to the negative side of the battery 25. A message surcharge is thus recorded on the telechronometer 6 at the "calling" subscriber's substation in addition to the time controlled "time use" charge.

The flow of current through the heating coils 54 and 55 heats the bimetallic arm F which warps in a direction to disengage the contact 53 from the contact arm 48. This opens the circuit for the coil 45, thus deenergizing the relay R, and the contact arms 30, 31 and 32 are returned by the spring 35 to the position shown in Figure 1, with contact arms 31 and 32 in contact with contacts 36 and 37, respectively. A complete cycle of change of polarity from positive to negative and back to positive, or vice versa, either from the illustrated position of the circuit maker and breaker D to the position to which it is actuated upon energization of relay R, or from the position to which it is actuated upon energization of relay R back to its illustrated position, causes a message surcharge actuation or registration upon the meter 6 at the calling station.

The adjustable cam E is adapted to adjust selectively as desired the position of the contact arm 48 to adjust the duration of contact of the contact 53 with the contact arm 45 upon heating of the bimetallic arm and to adjust the interval required for the bimetallic arm F to warp the contact 53 out of contact with the arm 48. The adjustable cam E and bimetallic arm F thus control as to duration of function the slow acting relay R.

Terminals 90, 90 may be provided at the slow acting pole changing relay R whereby a suitable (condensers or non-inductive resistance) noise and spark suppressor means may be applied as will protect the contacts of the pole-changer spring arrangement and reduce the disturbance in the connected telephone line.

The system shown fragmentarily in Figure 2 is similar to the system shown fragmentarily in Figure 1 except for another form of wiring which is illustrative of a variation whereby the heating elements of the thermostat arm F may be supplied from a locally controlled source, rather than through the utilization of the subscriber's line current as provided, for simplicity, in the diagram of Figure 1.

In Figure 2 the circuit from the positive side

of the battery is through conductor 63', coil 60', conductor 64', and directly through relay or coil 73' to talking strand 42', the talking strand 43' being connected directly through the relay or coil 66', conductor 65', coil 62', and conductor 68' to the negative side of the battery. The conductor 68' is connected through a conductor 92 to one side of the heating coil 54', the other side of which coil is connected through a conductor 93 to one side of the heating coil 55'. The other side of the coil 55' is connected through a conductor 94 to an additional contact arm 95 which has a contact 96 with which the contact arm 76 is held in contact by the spring 84'. The other parts corresponding with the parts shown in Figure 1 are designated by primed reference numerals corresponding with those used in Figure 1.

Except for the distinctions already pointed out, the operation of the embodiment of the invention shown in Figure 2 is similar to the operation of the embodiment of the invention shown in Figure 1.

In the operation of each of the two illustrated embodiments of the invention the subscriber's station meter will receive a "time unit" charge to cover the use of equipment during the operator's, or dial, time, in ringing the line of the called party. If answered, the message charge device will cause a "completed call" or "message charge" consisting of as many "telechrones," i. e., time units of telephone service, as may be required by the prevailing rate schedule. The control of this charge is accomplished through the character of the winding or windings employed as the heating element for the thermostat arm F, and the exact adjustment procured through the cam E.

The embodiments of the invention shown in the drawing are for illustrative purposes only, and it is to be expressly understood that said drawing and the accompanying specification are not to be construed as a definition of the limits or scope of the invention, reference being had to the appended claims for that purpose.

I claim:

1. In combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, means for reversing the polarity of current over said lines and controlling the frequency of such reversals, a registering device impelled by reversals of the polarity of the line current for registering the talking intervals over the talking line, and message surcharge means for registering by reversals of current on said registering device a message surcharge in addition to the talking interval charge.

2. In combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, time controlled means for reversing the polarity of current over said lines, a registering device impelled by reversals of talking current for registering the talking intervals over the talking line, message surcharge means for registering by reversals of current on said registering device a message surcharge in addition to the talking interval charge, and means actuated upon response of the called subscriber for causing registration of the message surcharge only when the calls are completed.

3. In combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, means at

the subscriber's station for registering a talking interval charge for the talking intervals over the talking line, said registering means being actuated by the talking current source and means operable over the connecting circuit between said lines for registering on said registering means a message charge in addition to the talking interval charge.

4. In combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, means actuated by the talking current supply for registering a talking interval charge for the talking intervals over the talking line, means located at the subscriber's station and operable over the connecting circuit between said lines for registering on said registering means a message charge in addition to the talking interval charge, and means actuated upon response of the called subscriber for causing registration of the message charge only when the calls are completed.

5. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time controlled pole-changer source of current supply for said system, superimposed pole-changer circuit making and breaking means for reversing the polarity of current over said lines, a relay designed to operate slower than ringing frequencies for operating said pole changer circuit making and breaking means from a first position to a second position, means actuated upon response of the called subscriber for deenergizing said relay for operation of said pole changer circuit making and breaking means to said first position, and register means operable by the time controlled pole-changer source of current supply and by said superimposed pole-changer circuit for registering a time interval charge and a surcharge.

6. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time controlled pole-changer source of current supply for said system, superimposed pole-changer circuit making and breaking means for reversing the polarity of current over said lines, a relay designed to operate slower than ringing frequencies for operating said pole-changer circuit making and breaking means from a first position to a second position, means actuated upon response of the called subscriber for deenergizing said relay for operation of said pole-changer circuit making and breaking means to said first position, and a registering device for registering a message charge by a complete cycle of change of polarity by said pole-changer circuit making and breaking means, said registering device also registering a surcharge by the reversal of current by said superimposed pole-changer circuit making and breaking means.

7. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply for said system, superimposed pole-changer circuit making and breaking means for reversing the polarity of current over said lines, a relay designed to operate slower than ringing frequencies for oper-

ating said pole-changer circuit making and breaking means from a first position to a second position, thermostatically operated means actuated upon response of the called subscriber for deenergizing said relay for operation of said pole-changer circuit making and breaking means to said first position, and a registering device for registering a message charge by a complete cycle of change of polarity by said pole-changer circuit making and breaking means.

8. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply for said system, superimposed pole-changer circuit making and breaking means for reversing the polarity of current over said lines, a relay designed to operate slower than ringing frequencies for operating said pole-changer circuit making and breaking means from a first position to a second position, a bimetallic contact arm having one position for energizing said relay for operation of said pole-changer circuit making and breaking means from one position to the other position and operable when heated to another position to deenergize said relay for operation of said pole-changer circuit making and breaking means to its first position, and means actuated upon response of the called subscriber for heating said bimetallic contact arm.

9. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply for said system, superimposed pole-changer circuit making and breaking means for reversing the polarity of current over said lines, a relay designed to operate slower than ringing frequencies for operating said pole-changer circuit making and breaking means from a first position to a second position, a bimetallic contact arm having one position for energizing said relay for operation of said pole-changer circuit making and breaking means from one position to the other position and operable when heated to another position to deenergize said relay for operation of said pole-changer circuit making and breaking means to its first position, means actuated upon response of the called subscriber for heating said bimetallic contact arm, and means for adjusting the duration of function of said pole-changer circuit making and breaking means.

10. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply for said system, superimposed pole-changer circuit making and breaking means for reversing the polarity of current over said lines, a relay designed to operate slower than ringing frequencies for operating said pole-changer circuit making and breaking means from a first position to a second position, a bimetallic contact arm having one position for energizing said relay for operation of said pole-changer circuit making and breaking means from one position to the other position and operable when heated to another position to deenergize said relay for operation of said pole-changer circuit making and breaking means to its

first position, means actuated upon response of the called subscriber for heating said bimetallic contact arm, and means for adjusting the duration of function of said pole-changer circuit making and breaking means, said last means comprising an adjustable cam cooperating with said bimetallic contact arm for adjusting the position thereof.

11. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply for said system, superimposed pole-changer circuit making and breaking means for reversing the polarity of current over said lines, a relay designed to operate slower than ringing frequencies for operating said pole-changer circuit making and breaking means from a first position to a second position, a bimetallic contact arm having one position for energizing said relay for operation of said pole changer circuit making and breaking means from one position to the other position and operable when heated to another position to deenergize said relay for operation of said pole-changer circuit making and breaking means to its first position, means for heating said bimetallic contact arm, and a message charge control relay actuated upon response of the called party for completing a circuit through said heating means.

12. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply including alternately compressed and released rheostats, a registering device actuated by line talking current and located at the subscriber's line terminal, and pole-changer circuit making and breaking means connected in circuit between the system and said time-controlled pole-changed source of current supply and operable upon response of the called subscriber for causing by reversal of current over the connecting circuit registration of a message charge when the calls are completed.

13. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply including alternately compressed and released rheostats, a registering device actuated by line talking current and located at the subscriber's line terminal, pole-changer circuit making and breaking means connected in circuit between the system and said time-controlled pole-changer source of current supply and operable upon response of the called subscriber for causing by reversal of current over the connecting circuit registration of a message charge when the calls are completed, and a relay operable when energized to operate said pole-changer circuit making and breaking means to one position and, when deenergized, releasing said pole-changer circuit making and breaking means for operation to its first position.

14. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply including alternately compressed and released rheostats, a

registering device actuated by line talking current and located at the subscriber's line terminal, pole-changer circuit making and breaking means connected in circuit between the system and said time-controlled pole-changer source of current supply and operable upon response of the called subscriber for causing by reversal of current over the connecting circuit registration of a message charge when the calls are completed, a relay operable when energized to operate said pole-changer circuit making and breaking means to one position and, when deenergized, releasing said pole-changer circuit making and breaking means for operation to its first position and a bimetallic arm controlling the circuit through said relay.

15. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply including alternately compressed and released rheostats, a registering device actuated by line talking current and located at the subscriber's line terminal, pole-changer circuit making and breaking means connected in circuit between the system and said time-controlled pole-changer source of current supply and operable upon response of the called subscriber for causing by reversal of current over the connecting circuit registration of a message charge when the calls are completed, a relay operable when energized to operate said pole-changer circuit making and breaking means to one position and, when deenergized, releasing said pole-changer circuit making and breaking means for operation to its first position, a bimetallic arm controlling the circuit through said relay, and a second relay operable upon response of the called subscriber to cause actuation of said bimetallic arm to position for opening the circuit through said first relay.

16. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply for said system, superimposed pole-changer circuit making and breaking means for reversing the polarity of current over said lines, a relay designed to operate slower than ringing frequencies for operating said pole-changer circuit making and breaking means from a first position to a second position, a bimetallic contact arm having one position for energizing said relay for operation of said pole-changer circuit making and breaking means from one position to the other position and operable when heated to another position to deenergize said relay for operation of said pole-changer circuit making and breaking means to its first position, means for heating said bimetallic contact arm, means for supplying current to said heating means from a locally controlled source of supply for actuating said bimetallic arm to deenergize said relay upon response of the called subscriber, and a message charge registering device operable by the time-controlled pole-changer source of current supply and by said superimposed pole changer circuit for registering a time interval charge and a surcharge.

17. In a telephone service metering system having a calling line provided with a telephone set, a called line having a telephone set, and a connecting circuit for interconnecting said lines for telephonic communication, the combination of a slow

acting pole changer relay provided with adjustable cycle control, and means under the control of the called line for starting the operation of said relay and operable to stop the operation of said relay.

18. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply for said system, superimposed pole-changer circuit making and breaking means for reversing the polarity of current over said lines, means for operating said pole changer circuit making and breaking means from a first position to a second position, means for disabling said last means for operation of said pole-changer circuit making and breaking

means to said first position, and a registering device for registering a message charge by a complete cycle of change of polarity by said pole-changer circuit making and breaking means.

19. In a telephone system, in combination, a calling line having a telephone set, a called line having a telephone set, a connecting circuit for interconnecting said lines for telephonic communication, a conversational time-controlled pole-changer source of current supply for said system, superimposed pole-changer circuit making and breaking means for reversing the polarity of current over said lines, and register means operable by the time-controlled pole-changer source of current supply and by said superimposed pole-changer circuit for registering a time interval charge and a surcharge.

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