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TELEPHONE EXCHANGE SYSTEM

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Fig. 1.

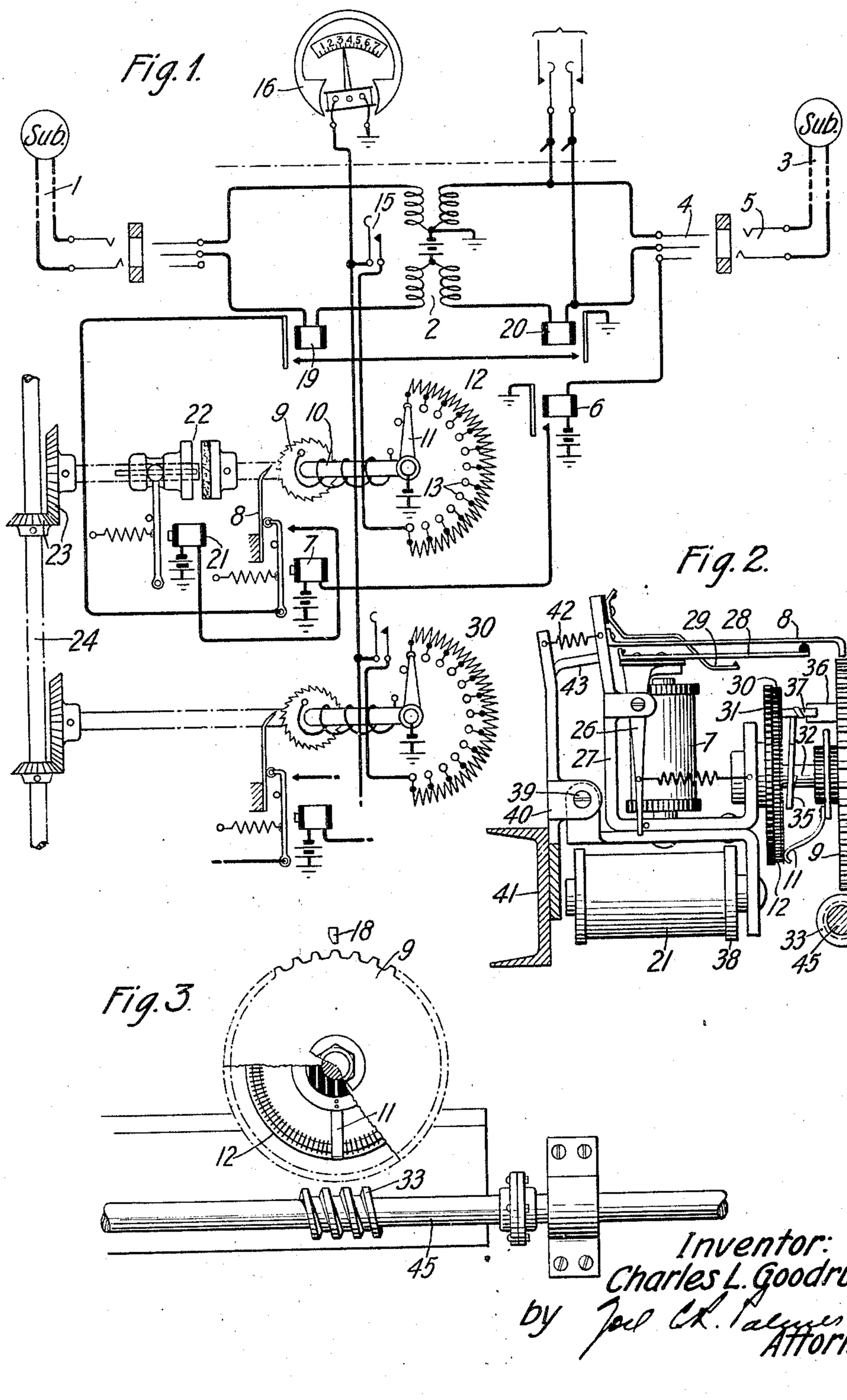


Fig. 2.




Fig. 3.




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## TELEPHONE-EXCHANGE SYSTEM.

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This invention relates to a metering system for telephone exchanges and more particularly to a device for measuring the time consumed in conversation between two subscribers.

According to this invention an operator's cord circuit is provided with a progressively operable device which advances, during the period a connection is established, to proportionately vary the value of a resistance, which resistance, when included in circuit with a meter upon the subsequent operation of a key, causes the meter to indicate the duration of the conversational period.

At each position there is provided a variable resistance unit for each cord circuit, a common driving means for operating a plurality of such units, and a common meter for reading the effects of variations in resistance in any one of said units. A relay and circuit arrangement is provided with this equipment so arranged that when a cord circuit is connected to the calling and called subscribers' line and the called subscriber has answered the call, the actuation of the two supervisory relays in the cord circuit causes the operation of the associated variable resistance unit through the common driving means to advance the brush of the resistance unit to change the amount of current that may pass from a battery through said unit. When either of the subscribers hangs his receiver on the hook, the brush remains in its advanced position. The operator will then close, by means of a button or other suitable switch, a circuit from the battery through the variable resistance and through the meter which is thereby actuated to advance its pointer to a corresponding position. The pointer is arranged to travel over a scale that is calibrated in units of time, whereby the operator may read directly the length of time the conversational connection was established.

This invention has been illustrated in the accompanying drawings in which Fig. 1 shows in one diagrammatic form a calling and a called subscriber's line and a cord circuit for connecting the same and a circuit and apparatus means arranged to measure the time of conversation in accordance with this invention;

Fig. 2 is a side view of an apparatus including a variable resistance unit and a mechanism for actuating it designed in accordance with this invention;

Fig. 3 shows a front view of a portion of the apparatus shown in Fig. 2 and a part of a driving shaft for this apparatus which is commom to a plurality of devices of this sort that are individual to each cord circuit.

The invention may be described in connection with Fig. 1 by assuming that the calling subscriber's line 1 has been connected through the cord circuit 2 to the called subscriber's line 3 and that the called subscriber has answered the call. It will be noted that when plug 4 was inserted in jack 5 of the called subscriber's line 3, the sleeve relay 6 was actuated to close an obvious circuit for the actuation of magnet 7. This magnet 7 in operating its armature permits the holding pawl 8 to engage the ratchet wheel 9 so as to hold it in any position to which it may be rotated as long as the magnet 7 is actuated. This ratchet wheel is mounted on a shaft 10 at one end of which is also mounted the brush 11 of the variable resistance unit 12. This brush is adapted to advance over the switch contacts 13 of resistance unit 12. The switch contacts 13 are connected to the resistance to include between them equal portions thereof. When the brush 11 is advanced over these contacts it consequently changes the resistance in the circuit from the battery connected to the brush 11 and through the portion of the resistance unit connected by the brush 11 through the key 15 and the magnet of meter 16 to ground.

When both subscribers have removed the receivers from their hooks and consequently caused both the supervisory relays 19 and 20 to be actuated, a circuit is closed for the relay or magnet 21 as follows: Battery, magnet 21, armature and front contact of magnet 7, armatures and front contacts of relays 19 and 20 in series to ground. Magnet 21 may be arranged to connect shaft 10 for rotation, through the clutch 22 and the bevel gears 23, with the constantly rotating shaft 24. This shaft may be provided with gears such as 23 for a plurality of resistance units each of which is individual to a cord circuit. Another one of these units has been shown at 30. Consequently on the operation of magnet 21, that is, when the subscribers 1 and 3 are in conversational connection, the brush 11 is advanced over the contacts 13

to change the resistance through the circuit for the meter and when either of the subscribers hangs up his receiver and releases the corresponding supervisory relay, magnet 21 releases. As the holding pawl 8 engages the ratchet wheel 9, brush 11 will now remain in its advanced position. Hence when the operator finds, in the usual manner, that the conversation is ended, she will simply depress key 15 and thus close the circuit from battery through the resistance unit included between brush 11 and key 15 to the meter 16.

This meter may be calibrated so as to indicate in units of time the value of the resistance which, as is evident, is changed in direct proportion to the time a conversational connection is established. In this particular arrangement the resistance in the circuit is lowered in direct proportion to the time of a conversational connection and if the pointer of the meter travels from left to right it will indicate increasing units of time. With this arrangement therefore the only operation on the part of the operator will be to actuate an individual key, such as 15, for each conversational connection and read on the meter 16 the exact time during which the conversational connection was established.

It should be understood that Fig. 1 merely illustrates in a diagrammatic form the means for actuating the resistance units and that it may take a variety of forms. A specific mechanical arrangement for the resistance unit and the means for operating it has been illustrated in Figs. 2 and 3. In these figures the magnet 7 with its armature 26 is represented as mounted on a bracket 27. On the armature 26 is mounted a spring 28 that is electrically insulated from the armature and also from the pawl 8 and so arranged as to normally hold the pawl 8 out of contact with the teeth of the ratchet wheel 9, but when the armature 26 is attracted by the magnet 7, spring 28 permits the pawl 8 to engage the teeth of the ratchet wheel 9. Spring 28 will also itself be electrically connected to the spring 29 when the armature is actuated, this connection being completed for the circuit for magnet 21 as hereinbefore mentioned.

On bracket 27 is also mounted the resistance unit 12 which consists of a resistance coil 30 arranged in a circle, which is secured to a circular plate 31 of insulating material by being partly embedded therein. This plate is permanently connected to the bracket 27. Through the center of the plate 31 extends the shaft 32 fixed at one end to the bracket 27. On the other end of this shaft 32 is rotatably mounted the ratchet wheel 9 which in this case may be an ordinary gear wheel suitable for engagement with the worm 33 in a manner hereinafter described. The gear 9 is secured to the electrically insulated brush 11 adapted to travel over the resistance coil 30. Brush 11 and gear 9 are held in a normal position by the spiral spring 35 secured at one end to a pin 37 attached to plate 31 at the other end to shaft 32. A stop 36 on gear 9 engages stop 37 to hold the gear in this normal position.

To bracket 27 is secured another bracket 38 on which is mounted the magnet 21. This bracket 38 is pivoted at 39 to the armature 40 which is permanently fixed to the mounting structure 41. It will be noted that the normal position of the apparatus including the brackets 27 and 38, magnets 7 and 21, the resistance unit 12 and the gear 9 are held by means of a spring 42 and stop 43 in such a position that the gear wheel 9 will not engage the worm 33, that is, the spring 42 is secured at one end to an extension of armature 40 and at the other end to bracket 27, and stop 42 determines the normal distance between these parts. Hence, on the energization of magnet 21 it will itself be attracted to the armature 40 and bring the whole apparatus in such a position as to have the gear 9 engage worm 33. As worm 33 is mounted on the shaft 45 which is constantly rotated this worm will drive through the gear 9, brush 11, over the resistance unit 12. As magnet 7 is energized at such a time, pawl 8 will engage the teeth of gear 9 so that when magnet 21 is deenergized and gear 9 is separated from the constantly rotating worm 33, gear 9 will be held in the advanced position by pawl 8. When magnet 7 is deenergized pawl 8 will release gear 9 which will then return to normal position under control of spring 35.

A unit such as shown in Fig. 2 is individual to each cord circuit in the switchboard and may be mounted along side of each other at any convenient place on the switchboard with the shaft 45 arranged with the worms such as 33 to engage the various gear wheels 9 of the individual units. The shaft 45 may be driven through any suitable motor means.

What is claimed is:

1. In a telephone system, a calling line, a called line, link circuits for interconnecting said lines for conversation, means associated with each said link circuit progressively set in accordance with the time said lines are in conversational connection, and means common to said link circuits controlled by said last means for indicating the duration of said conversational period.

2. In a telephone system, a calling line, a called line, link circuits for interconnecting said lines for conversation, means associated with each said link circuit progressively set in accordance with the time said lines are in conversational connection, and a visual indicator common to said link circuits controlled by said last means for indicating in units of time the conversational period.

3. In a telephone system, a calling line, a

called line, link circuits for interconnecting said lines for conversation, a source of current, a normally open circuit therefore, a current measuring device common to said link circuits in said circuit, progressive means associated with each said link circuit for controlling the amount of current that may flow in said circuit in accordance with the time said lines are in conversational connection, and means effective after said conversational connection is broken for closing said circuit to cause said device to indicate the elapsed time of said connection.

4. In a telephone system, a calling line, a called line, a link circuit for interconnecting said lines for conversation, a variable resistance associated with said link circuit, an electric meter calibrated in units of time, a source of current, a normally open circuit from said source through said variable resistance and the meter, means responsive when the two lines are connected for conversation for changing the resistance in said last mentioned circuit, and means for closing said last mentioned circuit to actuate the meter to indicate the time the conversational connection was established.

5. In a telephone system, a calling line, a called line, a link circuit for interconnecting said lines for conversation, two supervisory relays in said link circuit, each controlled by a connected line, a variable resistance unit, an electric meter, a source of current, a normally open circuit extending from said source through the variable resistance and the meter, means for controlling said resistance unit to change the resistance of said circuit when current flows therethrough, means including a circuit and a magnet responsive when both supervisory relays are actuated for actuating said resistance control means, and means for closing the normally open circuit to actuate the meter to indicate the time the supervisory relays are actuated.

6. In a telephone system, a calling line, a called line, a plurality of link circuits for interconnecting said lines for conversation, and means for measuring the time elapsed during conversational periods including a device individual to each link circuit, progressively set in accordance with said elapsed time, an indicating means common to said link circuits responsive to said devices and means for connecting said indicating means to any one of said devices.

7. In a telephone system, a calling line, a called line, a plurality of link circuits for interconnecting a calling line with a called line for conversation, a variable resistance unit associated with each link circuit, a meter common to all of said link circuits, a source of current, a normally open circuit from said source through each variable resistance unit and meter, a common means for actuating any one of said resistance units to change the resistance in the individual circuit connected therethrough, means effective during the connection of a calling line with a called line through a link circuit for actuating the corresponding resistance unit, and means individual to each link circuit for closing the corresponding circuit through the meter for indicating in units of time the amount of current flowing through said circuit for indicating the amount of time a conversational connection is established over said link circuit.

In witness whereof, I hereunto subscribe my name this 10th day of November A. D., 1926.

CHARLES L. GOODRUM.