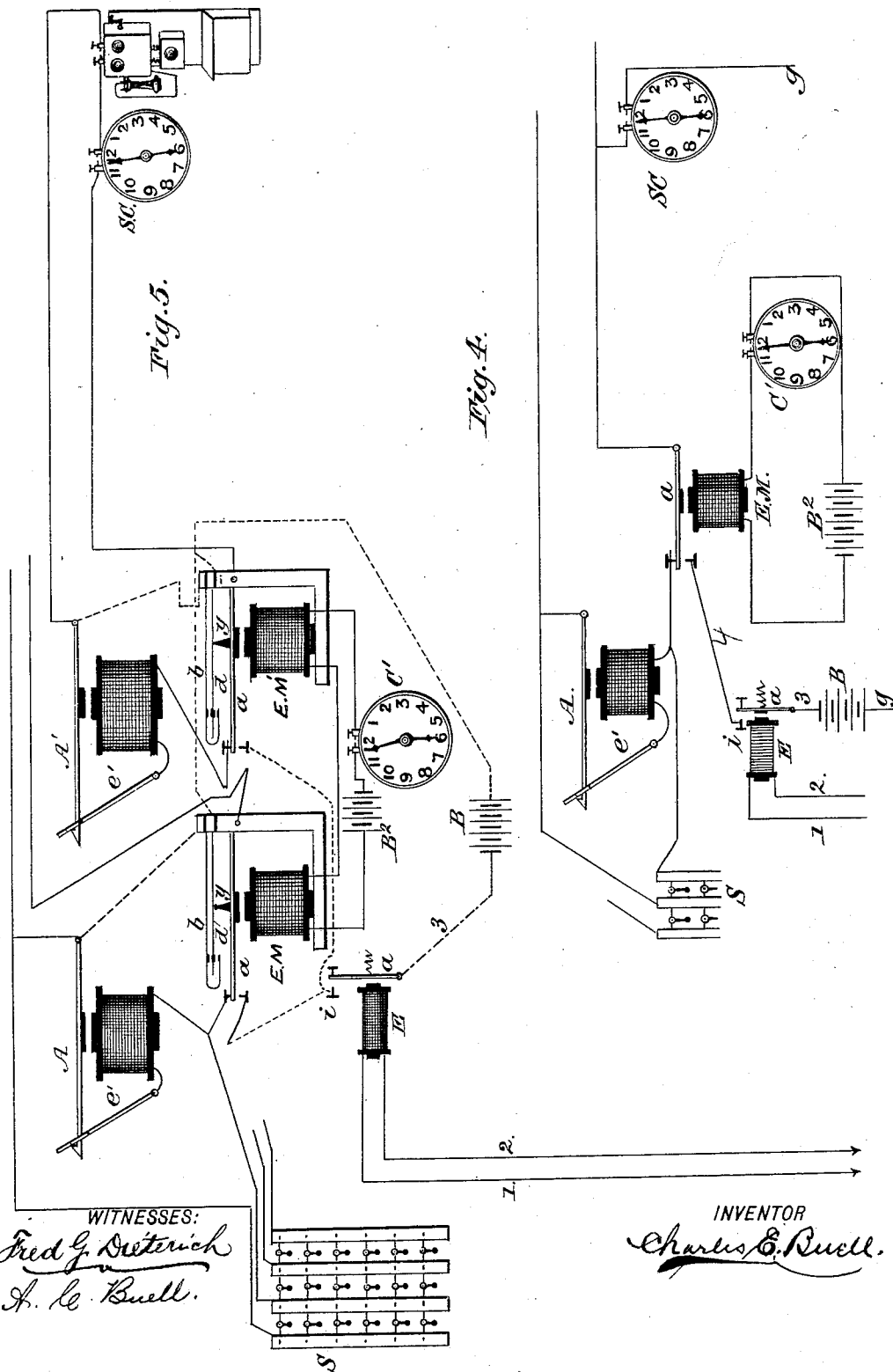


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TRANSMITTING TIME SIGNALS.

No. 549,346.

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WITNESSES:
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TRANSMITTING TIME-SIGNALS.

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To all whom it may concern:

Be it known that I, CHARLES E. BUELL, of North Plainfield, Somerset county, State of New Jersey, have invented Improvements in Transmitting Time-Signals, of which the following is a specification.

My invention consists, primarily, in combining electric time-transmission apparatus with the closed metallic circuits of telephone systems for the synchronizing of clocks from the central office of a telephone-exchange system over wires in use for telephonic purposes, substantially as hereinafter described.

My invention further consists in certain combinations and sub-combinations to be hereinafter described.

In the accompanying drawings, Figure 1 shows my invention in a combined electric clock and telephone system. Figs. 2 and 3 show details of the apparatus. Fig. 4 shows modifications in the apparatus to be employed, and Fig. 5 shows still further modifications in the apparatus and arrangement of the same for combining electric clocks with systems of telephonic telegraphs. Fig. 6 shows a detail of my invention.

The same letters and figures indicate corresponding parts in each of the drawings.

Referring to Fig. 1, there is shown a central switchboard S with its accessories of call mechanism *m* for outgoing signals, annunciators A A' for indicating incoming calls, a telephone T, a transmitter T', and plug *p* for connecting the telephone set with the several lines of a system by the interposing of the plug *p* in the spring-jacks. The various accessories are all well known and require no description. There is shown a clock-synchronizing apparatus consisting of the drum D, carrying a metal bar inserted in the insulating material of which the drum is composed. The drum is so connected to a propelling mechanism as to be rotated by the weight G when the drum is tripped by the electromechanical device consisting of the lever *j*, which engages with the projections *e e'* on the armature extension of the electromagnet EM. When the armature of said magnet is in the position shown, the metal bar is brought in contact with a series of metal strips or fingers *f f' f'' f''' f⁴*, &c., and thereby the strips which are the terminals of

the wires *w' w'' w'''*, &c., are connected electrically to the wire 4, that is normally open, but is at predetermined intervals connected to the charging-battery B by the operation of relay E. The electromagnet EM and the tripping mechanism of this electromechanical device are shown in an enlarged view in Fig. 6.

When the apparatus is in the position shown and a time-signal is sent over wires 1 and 2 by the distant clock in the usual manner of sending time-signals for synchronizing secondary clocks, the current from battery B is distributed over the several telephone-lines through the secondary clock SC, and the said secondary clocks are thereby set to the standard time of the distant clock G.

The apparatus is brought into the position as shown at predetermined intervals by the clock C', which at, say, two minutes before the hour of six, respectively brings the drum D to the position shown, and the secondary clocks SC cause a ground-wire to be connected through the synchronizing-magnet of each of such clocks to the metallic circuit used for telephoning, so that when the impulse is transmitted over wires 1 and 2 the current from battery B will be sent over one limb of the metallic circuits and returned through the ground, and at the same time the clock C', having reached the hour of six, opens the circuit of battery B², causing the armature *a* of the magnet EM to retract against its knob contact *k'*, and the drum it set in motion to disconnect the strips *f f'' f'''*, &c., from the bar of metal that otherwise connects them, and the wires *w w' w''*, &c., are left open and disconnected not only to the wire 4, but from each other, so that the several lines used for telephoning are not connected by the joining of the said wires except during the interval when the clocks along said lines require to be synchronized. At the same time that the several wires are thus disconnected the ground-wires are opened at the secondary clocks and the lines for telephoning are free from cross connections and grounds and conversation over said lines is not liable to be sent to lines for which it is not intended, except for two minutes each day.

The several clocks used are of well-known construction and require no description of

the details employed for accomplishing the work required of each.

It might occur that the sending out of a current over the several lines to synchronize the secondary clocks would act to throw down all of the annunciator-drops, and thereby make unnecessary labor in restoring the drops. To avoid this, I connect the time-transmitting branch wires outside of the annunciator-magnets, and if the lines are not very long the currents sent will not be diverted through the annunciator-magnets sufficiently to operate them, as they are of high resistance and the currents sent out are not adapted to do the work of operating such magnets.

When desired, the annunciator-magnets can be wound with two wires, making them differential magnets, and the time-signal currents be sent through the two windings in opposite directions in the usual manner of operating differential magnets, and the neutralizing effects will prevent the throwing down of the drops. In Fig. 2 the differential winding is shown as separate helices upon the cores, the wire *c'* being somewhat finer than the wire *n*.

Instead of employing a double-wound magnet, as shown in Fig. 2 and described, the current from the time-signal generator may be sent in opposite directions through the helices of the cores of magnet A, as shown in Fig. 3, by connecting the wire *n* from the generator with the wires already wound on the magnets of the annunciators.

An outlying subscriber's telephone-station is shown at X with the well-known accessories of the telephone T, call *m*, transmitter T', and the local battery *l*, all of well-known construction.

Fig. 4 shows an electromagnet EM, operated by a local circuit through the action of the clock C', which closes the said circuit at two minutes before six. The armature of the electromagnet EM is then attracted, making contact with a stop, which is the terminal of wire 4, and opening the line to exclude the annunciator A from the circuit of generator B, when it is connected to synchronize clock SC. After the generator B has been connected to charge the line and synchronize clock SC the armature *a* of magnet EM is retracted by the automatic opening of the local circuit by the action of clock C'. A separate generator B² can be employed to charge the local circuit. A number of electromagnets like the magnet EM, each controlling a distinct line, can be operated from a derived or local circuit and have a connection to the wire 4, whereby the several lines of a series will be opened and connected to a generator common to the series for the simultaneous transmission of a time-signal to the several lines in an obvious manner, the clock C' being capable of manipulating the circuit for closing the several magnets.

In Fig. 5 the battery B² operating magnets EM EM' results in opening the several lines

and introducing therein the battery B in a manner to charge that portion of each of said several lines that do not include the annunciators A A', and the secondary clocks in said lines are not, in this instance, connected to ground, but are included in the lines so charged. To prevent the disturbing of the clocks in such lines by the currents of the magneto-call *m*, the clock is shunted out of circuit, except at the brief interval devoted to synchronizing, or the magnets employed in a secondary clock can be wound for a current of greater quantity than is furnished by the magneto-call and be made to respond only to the heavy current from battery B.

The electromagnets EM EM' are fitted with armatures *a a*, each of which carries an insulated piece *y*, that normally holds the tongue *d* out of contact with the strip *b* of each. When, however, the armature *a* is attracted, the tongue *d* and strip *b* are in contact, and they connect the battery B into their respective lines over the wire 3, (shown in dotted line,) and at the same time the armature *a* of each breaks the line which it operates, cutting out the annunciator from said line and preventing the battery-current from throwing down the drop.

The lines of a system of telephones would vary in length and the current from the battery sent to the several lines to synchronize the clocks would be stronger upon the lines of less length unless some provision were made to distribute the battery-currents equally among the several lines. To accomplish an even distribution of current, I place an adjustable resistance in each of the several lines, whereby the several lines of a system can be made to derive a uniform current from a battery common to all the lines. The resistance R R, (shown in Fig. 1,) represent resistances for this purpose.

In place of the batteries shown for operating the clock I may employ another form of generator for the necessary currents to be used.

The details of the combined telephone and clock system may vary without departing from my invention.

What I claim is—

1. A series of circuits centering at a switch board, apparatus for sending outgoing time signals over the said circuits at predetermined intervals, that comprises automatic mechanism for connecting the several circuits of the series for a brief interval, a generator of electricity having connection to the joined circuits through mechanism that is controlled by a standard clock, for transmitting the signals to the series of circuits, secondary clocks on the said circuits that are adapted to be set to standard time by the transmitted signals, and an annunciator in each circuit that is located in a neutral portion of the system, temporarily, during the transmission of the outgoing time signals.

2. A series of metallic circuits centering at

a switch board, an apparatus for sending outgoing time signals over the series of circuits simultaneously, at predetermined intervals, that comprises mechanism for introducing a charging generator into the several circuits of the series, an electro magnet controlled by a standard clock for closing the circuit of the introduced generator for transmitting the time signals to the series of joined circuits, secondary clocks that are included in the said circuits during the transmission of the time signals, an annunciator in each circuit, and means for disconnecting the annunciators from the portion of the circuit charged by the introduced generator, during the transmission of time signals.

3. A series of circuits centering at a switch board, an apparatus for sending outgoing time signals over the series of circuits at predetermined intervals, that comprises mechanism for connecting a charging generator to the several circuits, and in a brief interval thereafter disconnecting the generator from said circuits, an independent circuit including connections to a master standard clock, and an electro magnet for closing the circuit of the connected generator for transmitting the time signals, secondary clocks disposed upon the several circuits and adapted to be set to standard time by the transmitted time signals, an annunciator in each circuit, and devices for excluding magnetizing currents from the several annunciators during the transmission of time signals.

4. The combination of the following named elements; a series of metallic circuits centering at a switch board that are provided with apparatus for oral communication, annunciators in the said circuits, an apparatus for sending outgoing time signals over the series of circuits simultaneously, at predetermined intervals, that comprises electro-mechanical devices for connecting the series of circuits together, a standard clock, an electro-magnet controlled by said standard clock, and a generator of electricity having connection to the joined circuits through mechanism that is actuated and controlled by the last mentioned electro-magnet for transmitting time signals to the series of circuits, and secondary clocks on the said circuits adapted to be set to standard time by the transmitted signals.

5. A series of circuits centering at a switch

board that are provided with apparatus for oral communication and an apparatus for sending outgoing time signals over the several circuits at predetermined intervals that comprises an electro-mechanical device for connecting the several circuits of the series to a generator of electricity for producing time signals, through branch conductors each of which includes an adjustable resistance and are, each, adapted to be open at two points between the said circuits and the said generator during the intervals between sending the time signals, and, annunciators in the several circuits that are provided with means for excluding magnetizing currents from said annunciators during the transmission of time signals.

6. In a combined system of telephonic and electric time transmission, a series of telephone lines having metallic circuits, and centering at a switch board common to the said lines, telephonic apparatus for oral communication upon the several lines, clock mechanism at outlying points along said lines that is adapted to become electrically connected to the said lines at predetermined intervals, and, electro-mechanical time transmitting apparatus at the central station having connections to the several lines that are automatically opened and closed at predetermined intervals for transmitting the time signals over the lines of the system at predetermined intervals, and an independent circuit that includes an electro magnet, and a standard clock, for automatically connecting the automatically closed lines to an electric generator for transmitting the time signals.

7. A series of metallic circuits radiating from a central station, an annunciator in each circuit, secondary clock mechanism adapted to become automatically electrically connected to and disconnected from said circuits at predetermined intervals, and a time transmitting apparatus having connections to the several circuits to temporarily exclude the annunciator in each from magnetizing currents, and, connections to a regulated current of electricity for each circuit during the transmission of the time signals.

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Witnesses:

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