H. G. WEBSTER.

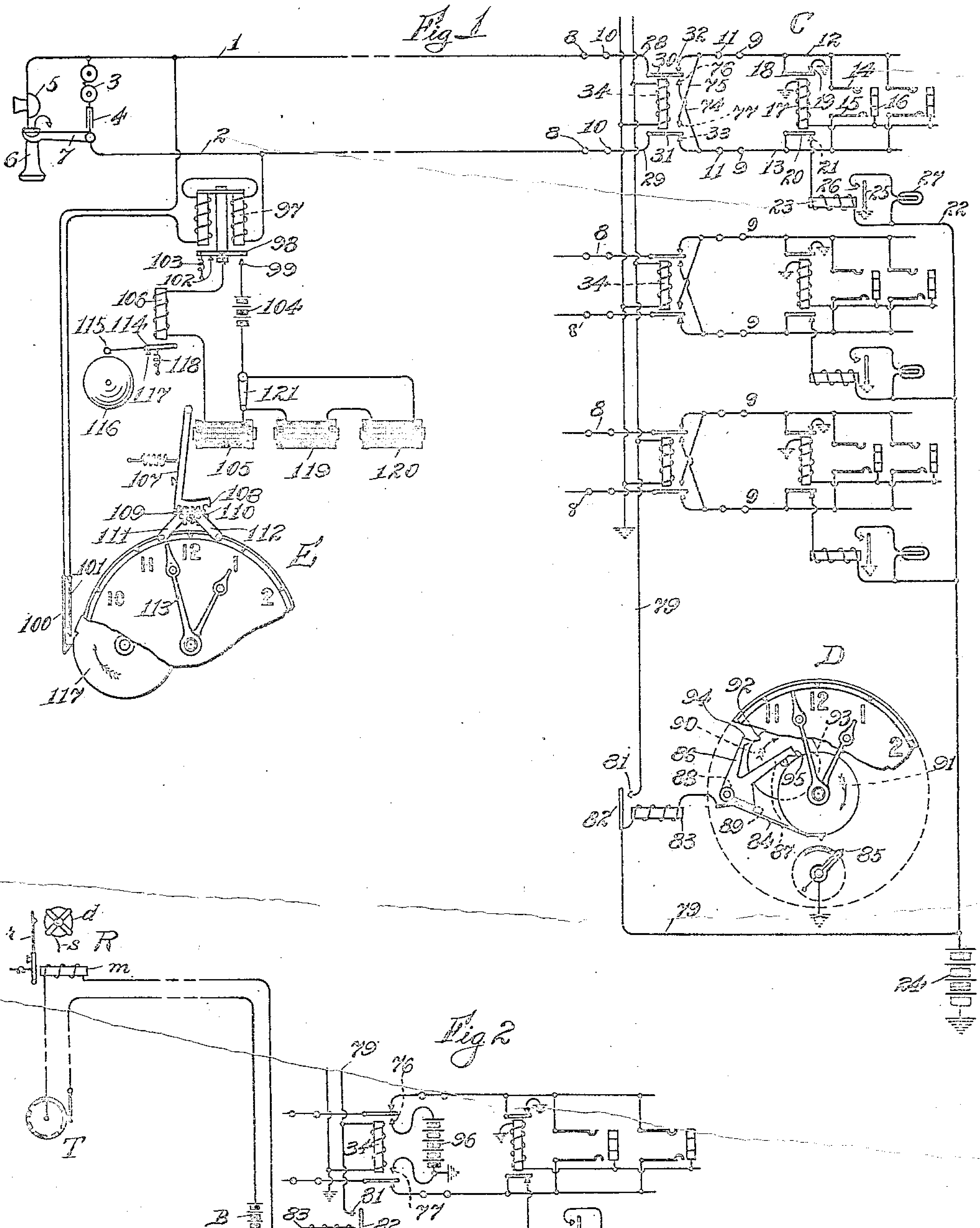
COMBINED TELEPHONE AND CONTROL SYSTEM.

APPLICATION FILED JAN. 15, 1906.

963,192.

Patented July 5, 1910.

2 SHEETS—SHEET 1.



Witnesses

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Fig. 3

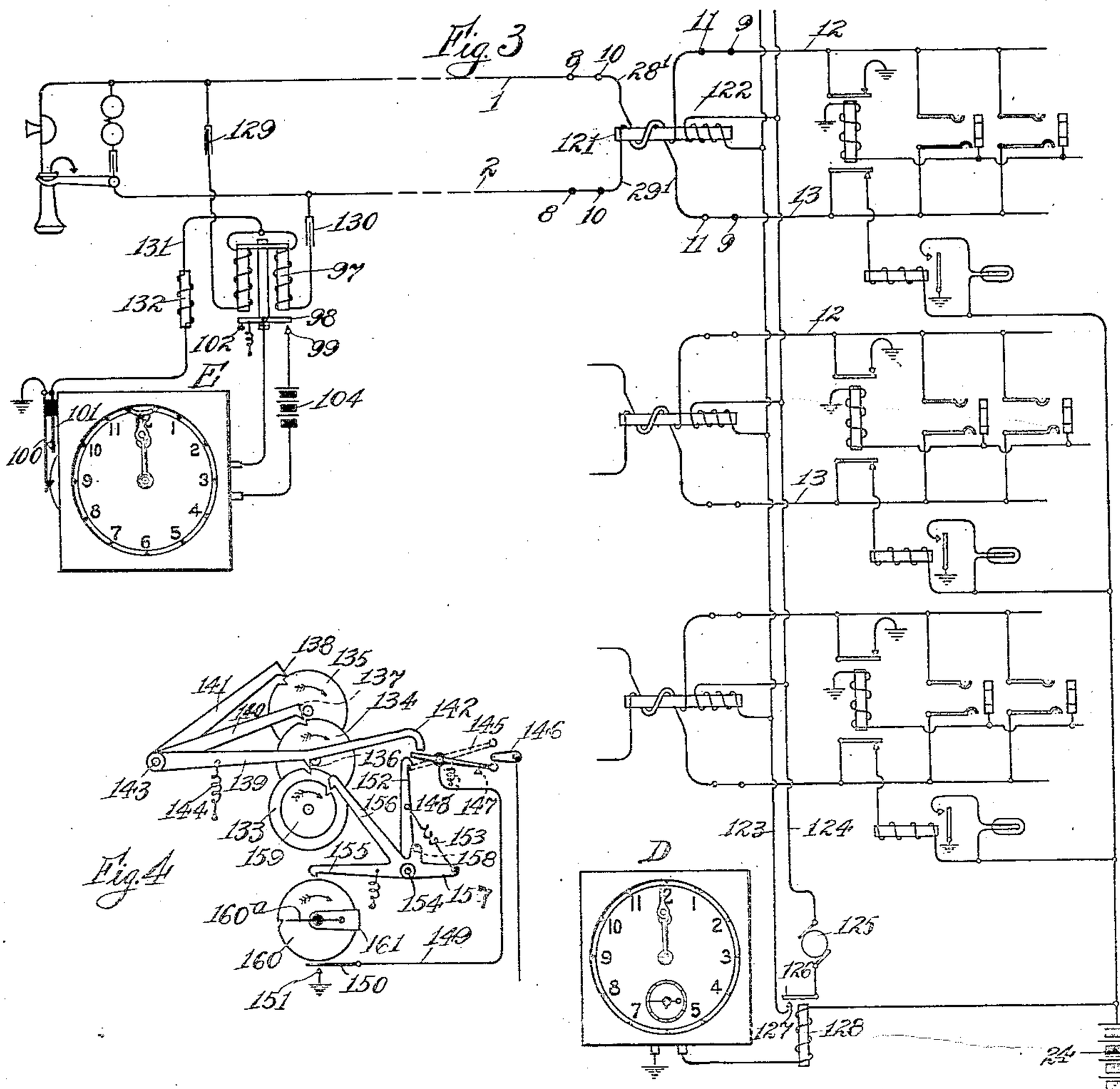
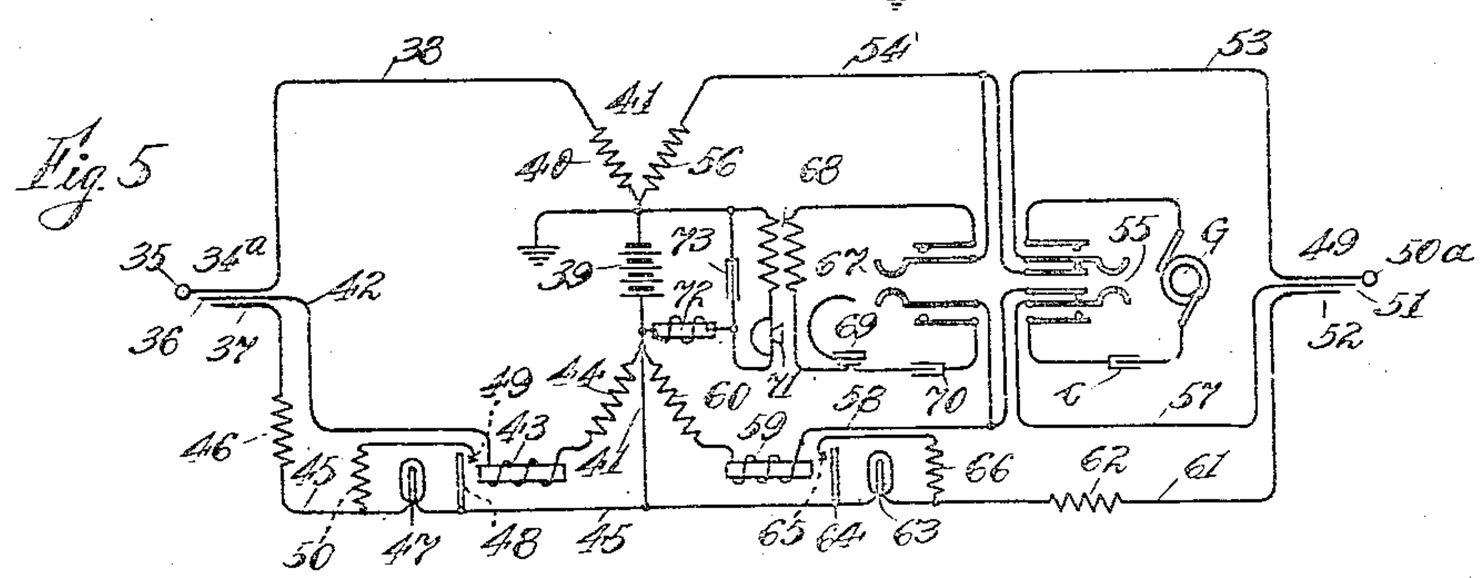


Fig. 4

Fig. 5



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UNITED STATES PATENT OFFICE.

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COMBINED TELEPHONE AND CONTROL SYSTEM.

963,192. Specification of Letters Patent. Patented July 5, 1910.

Application filed January 15, 1906. Serial No. 296,114.

To all whom it may concern:

Be it known that I, HARRY G. WEBSTER, a citizen of the United States, and resident of Chicago, county of Cook, and State of Illinois, have invented a new and useful Invention in Combined Telephone and Control Systems, of which the following is a specification.

The present invention relates to combined telephone and control systems and consists in a system of this class, in which the subscribers at the different substations may have their lines interconnected at the central office for conversation in the usual manner and in which a plurality of devices at the substations, or at other points along said lines, may be simultaneously actuated in response to the operation of a control device at the central office or other suitable point.

Although this invention is capable of use in many other relations, it is especially applicable to the setting of a number of clocks associated with the telephone lines, in response to the movements of a master clock at the central office, and it will, therefore, be described in that connection.

My invention also comprises certain novel features of construction, arrangements of parts and circuit connections, useful not only in the system above outlined, but elsewhere.

The nature of the invention, in its broad and specific aspects, will be more fully understood upon reference to the following description, taken in connection with the accompanying drawing, and its scope will be pointed out particularly in the appended claims.

Figure 1 of said drawing is a diagram of a portion of a combined telephone and control system constructed in accordance with the present invention, with portions of the controlling and controlled devices shown in mechanical detail; Fig. 2 is a diagram of modified arrangement whereby an independent source of current may be connected to the telephone line in response to the operation of devices in an auxiliary system; Fig. 3 is a diagram, similar to Fig. 1, illustrating modified controlling and controlled devices and connections; Fig. 4 is a detailed view of a modified form of controlling device, by which a momentary current impulse is transmitted over the telephone lines; and Fig. 5 is a diagram of the cord circuit arrangement used in connection with the line circuits disclosed in Figs. 1 and 3.

Referring to Fig. 1, C designates a central office from which telephone lines, comprising limbs 1 and 2, radiate to outlying substations. The substation telephone equipment, which may be of any desired type, comprises, in the present instance, a call-bell 3 permanently bridged in series with a condenser 4 between the limbs 1 and 2 of the telephone line, and a transmitter 5 in series with a receiver 6 adapted to be included in bridge of the telephone line when the receiver 6 is removed from its switch-hook 7. At the central office, the limbs of each telephone line are connected to terminals 8—8 of the usual distributing frame, which is provided with terminals 9—9, from which the extension conductors 12—13 lead to the contacts 14—15 of associated multiple jacks. The distributing frame is provided with additional terminals 10—10 and 11—11, between which the circuit of the line limbs may be completed by way of the contacts 30—32 of a controlling relay 34. The terminals 8 and 10 on the one hand, and 9 and 11 on the other, are connected by the usual "jumpers" in the distributing frame, while the controlling relay may be located on a separate relay frame, as is customary with line and cut-off relays. The test contacts 16 of the jacks are permanently connected to ground through the winding of a cut-off relay 17, and the extension conductor 12 is normally grounded through an armature 18 and contact 19 of said relay, while the extension conductor 13 is normally connected by a second armature 20 and contact 21 to a branch conductor 22, including the winding of the signal relay 23 and extending to the live pole of the grounded battery 24. The relay 23, when energized, attracts an armature 25 against a contact 26 to close a branch through the call signal lamp 27. The cord circuit for interconnecting the lines at the central office for telephonic communication may also be of any preferred type. In the present instance, I have illustrated in Fig. 5 a well known three-wire cord circuit which may be used with the line circuit shown. In this cord circuit, the answering plug 34ª is provided with a tip 35 and two sleeves 36—37. A strand 38 connects the tip 35 with the

grounded pole of the battery 39 through the winding 40 of a repeating coil 41. The strand 42 connects the sleeve 36 with the live pole of the battery 39 through the winding of the supervisory relay 43 and the winding 44 of the repeating coil 41. The strand 45 connects the sleeve 37 with the live pole of the battery 39 and includes the resistance 46 and the supervisory signal lamp 47. The supervisory relay 43 controls an armature 48 which is adapted to engage a contact 49 to close a circuit through the resistance 50 in shunt to the supervisory lamp 47. At the opposite end of the cord circuit is a calling plug 49 having a tip 50[a] and sleeves 51—52. The tip 50[a] is connected by strands 53—54 through normally closed contacts of the ringing key 55 and the winding 56 of the repeating coil 41 to the grounded pole of the battery 39. The sleeve 51 is connected by the strands 57—58 through normally closed contacts of the ringing key 55, winding of the supervisory relay 59 and the winding 60 of the repeating coil 41 to the live pole of the battery 39. The sleeve 52 is connected by a strand 61 through a resistance 62 and the supervisory lamp 63 to the live pole of the battery 39. A shunt circuit including the armature 64, contact 65 and resistance 66, is adapted to be closed about the supervisory lamp 63 in response to the energization of the supervisory relay 59. A normally open listening-key 67 is adapted to complete a path between the strands 54 and 58 through the secondary winding of an induction coil 68, the operator's receiver 69 and a condenser 70. The primary winding of the induction coil is included in series with the operator's transmitter 71 and the impedance 72 between the opposite poles of the battery 39. In bridge of this circuit is a condenser 73. The closing of the ringing key 55 also includes the generator G, in series with a condenser C, in bridge of the strands 53 and 57 of the cord-circuit.

In the operation of the telephone system, irrespective of the control system, a party at the substation, by removing his receiver 6, closes a circuit which will energize the call signal lamp 27. This circuit extends from the live pole of the battery 24, through the branch 22 including the winding of the call signal relay 23, contacts 21, armature 20, extension conductor 13, limbs 2 and 1 of the telephone line, extension conductor 12, armature 18 and contact 19 to ground. The closing of this circuit energizes the call signal relay magnet sufficiently to close the grounded branch from the conductor 22 through the signal lamp 27, and thereby cause its display. In answering the call, the operator inserts the plug 34[a] into the jack of the calling party and thereby completes a circuit from the live pole of the battery 39, through the strand 45, sleeve 37 of the plug 34[a], sleeve 16 of the jack, through the winding of the cut-off relay 17, to ground. This circuit sufficiently energizes the cut-off relay 17 to disconnect the extension conductors 12 and 13 from ground and branch 22, thus deënergizing the magnet of the relay 23, and effacing the call signal 27. The insertion of the plug 34 into the jack will also close a circuit through the strand 42, sleeve 36 of the plug 34[a], contact 15 of the jack, extension conductor 13, limbs 2—1 of the telephone line, extension conductor 12, contact 14 of the jack, tip 35 and strand 38 to the grounded pole of the battery 39. This circuit will sufficiently energize the relay 43 to close a shunt around the supervisory lamp 47 and thus prevent its display. Upon learning the wishes of the calling party, the operator will touch the tip 50[a] of the calling plug 49 against the contact 16 of one of the jacks associated with the line of the party desired. From the circuits previously traced, it will be seen that if such line is busy, a potential above that of ground will exist on the contact 16 of the jack. If this is the case, upon the operator depressing the listening key 67, the condenser 70 will be given a certain charge, due to the potential of the battery 39. The touching of the tip 50 of the plug 49 to the testing-sleeve will be sufficient to change the charge on the condenser 70 by way of the path through the strand 53, ringing-key contacts, listening key contacts, secondary winding of the induction coil 68, operator's receiver 69 to one side of the condenser. This change in charge of the condenser will cause a "click" in the receiver 69, which will indicate to the operator the "busy" condition of the line. If the line is found to be idle, the plug 49 is inserted into the jack. This closes a circuit through the cut-off relay of the called line by way of the strand 61, sleeve 52 of the plug and sleeve 16 of the jack. The cut-off relay, being thus energized, will remove the ground connections from the called telephone line. The operator then depresses the ringing key 55 and completes a metallic circuit from the generator G through the strands 53—57 and the limbs of the telephone line to actuate the call-ball at the substation, the condenser C being charged and discharged in the operation. The act of inserting the plug 49 into the jack also completes a circuit to the subscriber's station from the live pole of the battery 39 through the strands 58—57, sleeve 51 of the plug 49, contact 15 of the jack, limbs 2 and 1 of the telephone line, contact 14 of the jack, tip 50[a] of the plug 49, strands 53—54, to the grounded side of the battery 39. This circuit remains open at the substation until the called subscriber removes his receiver from its hook. In the meantime, the circuit through the strand 61 lights the supervisory lamp 63. As soon as

the subscriber answers the call, however, the shunt around lamp 63 is closed, thereby extinguishing it. With the lines thus connected, the supervisory lamps 47 and 63 remain dark until the subscribers hang up their receivers at the end of the conversation. This act in each instance breaks the circuit through the supervisory relay of the associated line and removes the shunt around the corresponding supervisory lamp and causes it to light. The lighting of both lamps 47 and 63 is a signal to the operator to disconnect.

The telephone system, above described, is a well known system, and, except in so far as it enters into coöperation with the control devices and connections associated therewith, constitutes no part of the present invention.

From the preceding, it will be seen that the limbs of the telephone lines are normally closed at the contacts 30—32 and 31—33 of the controlling relays 34, so that whenever a circuit is closed over a line by the telephone apparatus, there is always the same direction of current flow from the battery 24. The device at the substation, which is to be controlled, and which in the present instance is shown as clock setting mechanism, is adapted to respond to a reversal in the direction of this current flow over the telephone line. This reversal may be brought about in different ways, but is preferably accomplished by means of the cross connections 74 and 75, leading to the contacts 76 and 77, coöperating with the movable contacts 30 and 31 of the controlling relay 34 which is in effect then a reversing relay. The connection 74 leads from the conductor 29, which is connected with the live pole of the battery 24, to contact 76 which coöperates with the armature 30 to supply current from this side of the battery to the conductor 28, which is normally connected to the grounded side of the battery. Similarly, the connection 75 leads from the conductor 28 to contact 77, which coöperates with the armature 31 to connect the conductor 29 to the grounded side of the battery.

Obviously, instead of reversing the connections of the telephone line limbs to the battery in the manner above described, the reversed poles of the same battery or an independent source of either direct or alternating current might be connected in the manner illustrated in Fig. 2, wherein the contacts 76 and 77 of the structure of Fig. 1 are connected to the live and grounded poles, respectively, of the battery 96, in response to the actuation of the reversing relays. These reversing relays, which, obviously need be applied only to those telephone lines which are equipped with the devices to be controlled, have their windings connected in parallel between a grounded conductor and a lead 79, which is adapted to be connected to the live pole of the battery 24 whenever the contacts 81 and 82 of the relay 83 are closed.

The relay 83 may be controlled in its operation in any desired manner by including its winding in a suitable circuit, either in the same or an auxiliary system. As illustrated in Fig. 1, its winding is included in a local circuit which is made and broken by the movements of a master-clock located at the central office; while in Fig. 2, its winding is included in the circuit of an auxiliary system, here shown as a fire alarm system. In the former case, the winding of the relay is included in a branch between the conductor 79 and the spring contact-finger 84, carried by the clock mechanism and coöperating with a rotating contact 85. In the latter case, the winding of the relay 83 is included in a metallic circuit with a transmitter T, a recorder R and a battery B of a fire alarm system. The transmitter T may be of any preferred type and is here shown as a simple make and break wheel, coöperating with a suitable spring-contact. The recorder may also be of any preferred type and is shown in a simplified form as comprising an armature *r* provided with a stylus which is adapted to be brought into engagement with a record-sheet *s*, carried by the drum *d* in response to the energization of a suitable magnet *m* included in the metallic circuit.

The master-clock of Fig. 1, above referred to as constituting one means of controlling the energizing circuit of the relays 83, in operation maintains said circuit closed for an appreciable period of time—preferably, however, only the fraction of a second. This is brought about by the coöperation of the contacts 84 and 85 with the clock mechanism. The rotary contact 85 is mounted so that it will move with the second hand of the clock mechanism, thus making one complete revolution per minute. The contact-finger 84 is normally held out of engagement with the rotating contact 85 by means of the arms 86 and 87 of the pivoted member 88 which carries a block of insulation 89 upon which said finger is mounted. The arms 86 and 87 ride upon the peripheries of the wheels 90 and 91 of the clock mechanism, which are mounted so as to make one complete revolution in twenty-four hours and one hour respectively. These wheels are provided with peripheral notches 92—93 into which the projections 94 and 95, on the arms 86 and 87 respectively, are adapted to drop. This, however, is arranged to occur only when the clock approaches a pre-determined time,—say, twelve o'clock, midnight. When the projections 94 and 95 on the arms 86 and 87 pass into the notches 92 and 93, the con-

tact finger 84 is carried into the path of movement of the contact 85. This is arranged to occur some time during the minute just preceding the time at which it is desired to energize the relay 83. As the contact 85 then rotates, it will engage the contact finger 84 and complete the circuit through the relay 83 and close the contacts 81 and 82 and keep them closed until the contact 85 passes out of engagement with the contact 84. As previously indicated, this will leave the circuit closed only the fraction of a second, which, however, is of sufficient duration to energize the reversing relays 34 and send a current impulse of reversed polarity over the telephone lines with which such reversing relays are associated. In the operation of the system, after the contacts 84 and 85 have come into engagement to send the desired current impulse over the telephone lines, the projection on the arm 86 will be gradually forced out of the notch 92 so as to lift the contact finger 84 out of the path of movement of the contact 85 before the latter makes another revolution. The contact finger 84, when thus withdrawn, will be held in its retracted position for a period of practically twenty-four hours, or while the wheel 90 makes a complete revolution, and it will then be dropped into the path of movement of the rotary contact 85 to be engaged thereby as before. The controlled mechanism, which is adapted to be operated by this impulse of current of reversed polarity over the telephone line, will now be described.

A polarized relay 97 of any well known type, having an armature 98 and a coöperating contact 99, is bridged across the limbs 1—2 of the telephone line with which it is associated. This bridge may be permanently continuous between the line limbs but is preferably normally broken as illustrated in Fig. 1, by the contacts 100 and 101 under the control of the mechanism of the clock E, which it is purposed to set in response to the current impulse transmitted from the central office. The normal direction of current flow over the telephone line is such as to rotate the armature 98 against its fixed stop 102, while the reversal in direction will rotate said armature in the opposite direction against the tension of the spring 103 and into engagement with the contact 99. This movement will close a local circuit through a battery 104, the winding of the clock setting magnet 105 and the winding of a bell magnet 106. The closing of this circuit will energize the electro-magnet 105 sufficiently to attract the spring retracted arm 107, which, through the agency of its rack 108 and the coöperating pinions 109 and 110, will rock the arms 111 and 112 toward each other, thereby engaging the minute hand of the clock E and setting it at the desired position, which, in the present instance, is twelve o'clock. The particular setting mechanism described and shown is merely typical and, obviously, may be replaced by any other suitable means. The closing of the local circuit also energizes the magnet 106 which attracts its armature 114 to raise the tapper 115 out of engagement with the gong 116. Then, as soon as the local circuit is broken by the return of the armature 98 to its normal position, the armature 114 is drawn back to its normal position against the stop 117 by the spring 118, and the tapper 115 is thereby caused to strike the gong 116 and thus give an audible signal of the hour. The closing of the local circuit may be utilized to energize other control magnets 119 and 120, associated with the clock setting magnet 105 and adapted to be included in the local circuit therewith by the control switch 121.

The bridge through the winding of the polarized relay is made and broken at the contacts 100 and 101 through the agency of the wheel 117 of the clock mechanism, which is provided with a peripheral notch into which an insulating projection on the contact 100 may pass to allow the contacts to come into engagement. The notch in the wheel 117 is so positioned and is so shaped that the bridge through the windings of the relay is closed some time prior to the time at which the clock hands reach the hour to which the clock is to be set and remains closed some time after, thereby allowing the setting means to be operated even though the clock be considerably behind or ahead of the controlling clock.

Since in the operation of the telephone system, as previously pointed out, the call signal 27 is actuated by closing a bridge between the telephone line limbs at the substation, in order that the closing of the bridge through the polarized relay windings may not operate the call signal 27, these windings are made of high resistance so that the current flow permitted through them will be insufficient to operate said signal. This relay is also adjusted so that the ringing current from the generator G at the central office will not actuate it, thus preventing the actuation of the relay armature in case an operator happens to be calling over a line at the particular instant that the control current impulse is transmitted over it.

In the modification shown in Fig. 2, if an operator should happen to be sending ringing current over the line at the instant the controlling device operated to send the control current impulse, the ringing circuit would be broken and the ringing current thereby cut off.

The operation of the system of Fig. 1, then, in brief, is as follows: As the hour of twelve approaches, the contact 84 of the master-clock D is allowed to drop into the

path of movement of the contact 85. About this same time, or prior thereto, the polarized relay 97 at the substation is included in circuit by the closing of the contacts 100 and 101. Then at the central office, the contacts 84 and 85 pass into engagement and, through the agency of the relay 83 and the reversing relays 34, a current impulse of reversed polarity is transmitted over the telephone lines with which said reversing relays are associated, to actuate all of the associated polarized relays 97 to cause the simultaneous setting of all the controlled clocks E. The control current impulse is of sufficient strength to always actuate the relay 97, no matter what the condition of the telephone apparatus, associated with the line, may be. If the impulse is sent at the time the operator is calling the substation associated with the line, the relay 97 will be clearly actuated, since the calling current of itself cannot operate the relay 97, and the strength of the current impulse is sufficient to operate it, notwithstanding the presence of ringing current on the line. Again, the current strength of the impulse is so proportioned that the relay 97 will respond to it, notwithstanding the closure of a second bridge between the line limbs through the receiver and transmitter of the substation, which may exist at the time the current impulse is transmitted. If the subscriber should be in conversation at the instant the control current impulse is sent over the line, he will hear a "click" in his receiver. This, obviously, may serve as a signal to convey to him any desired information, such as the twelve o'clock indication. In this way, by omitting the polarized relays 97 with their associated mechanisms and utilizing the telephone receivers at the substations, signals may be simultaneously transmitted through the agency of the reversing relays at the central office. And since the relay 83, which controls the actuation of the reversing relays 34, may be operated in any desired manner, it will be apparent that any desired code signal might be simultaneously transmitted to the different substations and received thereat through the telephone receivers; for instance, by including the winding of the relay 83 in a fire alarm circuit, such as that of Fig. 2, the substation telephone receivers may be made to indicate the fire alarm box number, or other signal, sent out over the alarm circuit from the transmitter T to the recorder R. By omitting the clock setting mechanism at the substation, but retaining the polarized relay 97 with the bell magnet 106 and its associated parts, the signal, transmitted from the central office, will be indicated at the several substations by the strokes of the tapper 115 on the gongs 116, thus giving an audible signal independently of the telephone apparatus.

Referring now to the form of the invention disclosed in Fig. 3, in which modified means for varying the electrical condition of the telephone lines and modified polarized relay connections are shown in association with the same telephone system heretofore described, the desired operation of the controlled device is obtained without interrupting the flow of current from the battery 24 and without interfering with speech transmission over the telephone lines. In this form, the reversing relays are replaced by a three-winding transformer, which has two of its windings included in the connecting conductors 28′ and 29′, which extend between the terminals 10—10 and 11—11 of the distributing frame. Obviously, these transformers may be mounted on a separate rack in the same manner as the reversing relays 34, and the connecting conductors 28′ and 29′ run to the additional terminals 10—10 and 11—11 on the distributing board, as in the previous case. The conductors 28′ and 29′ complete the circuit from the line limbs 1 and 2 to the extension conductors 12 and 13, respectively. These conductors are wound upon an iron core 121 in non-inductive relation to each other, so as not to interfere with speech transmission over the telephone lines. Wound on this same core, and in inductive relation to the windings 28′ and 29′ in each instance, is a winding 122. The different windings 122 are connected in parallel between the conductors 123 and 124, which are arranged to be connected with the opposite poles of a suitable source of alternating, intermittent or pulsating current, exemplified in the generator 125. This circuit is controlled by the contacts 126 and 127 of a relay 128. This relay, obviously, may be controlled in the same way as the relay 83 heretofore described, but in the present case its winding is included in a circuit extending from the live pole of the battery 24 through the mechanism of the master clock D, which has been described heretofore. When this relay circuit is closed by the master-clock, the contacts 126 and 127 are brought into engagement and the circuit through the windings 122 is completed. The rise and fall of potential in the latter will induce a current flow in the same direction over both limbs of each of the telephone lines. Thus, in the case of a given line, at any assumed instant, current will flow outward from the central office toward the substation, over both limbs of the line in contradistinction to a flow out over one limb and back over the other, as is the case in the use of the line for telephonic purposes. The mechanism, actuated by this variation in the electrical condition of the telephone lines, in the present case comprises a polarized relay 97′ of the same construction as that heretofore

described, but with its windings differently connected to the telephone line and preferably of lower resistance. These windings are connected in bridge of the limbs 1 and 2, with condensers 129 and 130 interposed so as to prevent the flow of the battery current used in the operation of the telephone system, and with a branch 131 leading from a point intermediate of the windings of the relay, through an impedance 132, to ground. This ground connection is normally open at the contacts 100 and 101, which are controlled by the mechanism of the clock E in the manner heretofore described. The contacts 98 and 99 make and break a local circuit including the battery 104, to set the clock E in the manner heretofore described. In the operation of the telephone system, currents from the ringing generator G will be free to pass through the windings of the polarized relay 97′ from one limb of the telephone line to the other, but will not pass to ground even when the grounded branch 131 is completed by the engagement of the contacts 100 and 101, since there is no grounded connection for the generator at the central office. The flow of current, through the windings of the relay 97′ in series, will not energize the relay in the proper manner to attract the armature 98 away from its back contact 102. On the other hand, when current is transmitted in the same direction over both line limbs from the generator 125, the current flow at any assumed instant will be through the windings of the polarized relay 97′ in parallel branches to the grounded branch 131. This will change the polarity of the relay 97 so as to attract the armature 98 away from its back stop 102 thereby closing the local circuit.

Instead of employing transmitting mechanism which will maintain a circuit for a substantial length of time, as in the case of the mechanism disclosed in connection with Fig. 1, means may be employed for sending a single momentary impulse or "flash" over the line. Such a means is disclosed in Fig. 4, wherein 133, 134 and 135 designate wheels of the master-clock mechanism which make one complete revolution in twenty-four hours, one hour and one minute, respectively. These wheels are provided with peripheral notches 136, 137 and 138, which coöperate with pointed projections on the rigidly connected arms 139, 140 and 141, to control the action of an extension 142 of the arm 139. These arms are pivoted at 143 and subjected to the downward pull of a tension spring 144. The extension 142 is normally prevented from responding to the pull of the spring 144 and cannot do so until all the notches register with their respective cooperating projections. When, however, they do so register, the extension 142 engages a pivoted lever 145 to pass it over a fixed contact 146 into the position shown in dotted lines. This lever which is normally held in the full line position in engagement with a fixed back stop 147 by a tension-spring 148, is electrically connected to ground by way of a conductor 149, movable contact 150 and a fixed contact 151. The movement of the contact lever 145, from the full line position to the dotted line position, does not connect the fixed contact 146 to ground, since, at this time, the grounded branch is broken at the contacts 150 and 151. As the lever 145 is rotated to its dotted line position, its end adjacent to the extension 142 engages the inclined surface of the end of a latch 152, pressing it backward against the tension of its spring 153, which subsequently draws forward the latch to engage the lever 145 to hold it in its dotted line position. The latch 152 is pivoted at 154 concentrically with three spring retracted rigidly connected arms 155, 156, and 157, to the latter of which one end of the spring 153 is connected. The forward movement of the latch 152 is limited by a stop 158, carried by the arm 157. The arms 155 and 156 have pointed projections which coöperate with notches in the peripheries of the wheels 159 and 160 to control the release of the latch 152 to allow the contact lever 145 to wipe over the contact 146 under the pull of its spring 145. The wheel 159 is mounted so as to rotate with the wheel 133, while the wheel 160 is connected to the clock mechanism so as to make one revolution per minute, and is preferably mounted so as to rotate with the second hand. This wheel is provided with a cam projection 161 located diametrically opposite the notch in its periphery and operated to engage the movable contact 150 to press it into engagement with the grounded contact 151. The cam projection 161, by reason of its width, maintains the contacts 150 and 151 in engagement for an appreciable period of time, say, two or three seconds.

With the parts in the position illustrated in Fig. 4, it will be seen that as soon as the notch 138 registers with the projection on the arm 141, the extension 142 will be free to rock the lever 145 into its dotted line position, where it will be engaged by the latch 152. This will occur some time during the minute preceding that at which the grounded branch through the conductor 149 is to be closed. It now remains necessary only to release the latch 152 at the proper instant to momentarily close this grounded branch. This is done as soon as the notch in the periphery of the wheel 160 comes opposite the projection on the arm 155. When this position is reached, the latch is removed and the lever 145 passes over the contact 146 with a quick wiping action, due to the ten-

sion of the spring 148. It will be noted that the arm 156 is necessary in order to keep the projection on the arm 155 from falling into the notch on the wheel 160 each time the latter rotates. By reason of the slow movement of the wheel 159, relative to the wheel 160, the projection on the arm 156 will be free to move into its notch prior to the time that the projection on the arm 155 reaches its notch; but, except for the short interval of time prior and subsequent to the movement of the projection on the arm 155 into its notch, the projection on the arm 156 will ride on the periphery of the wheel 159 and thus hold the arm 155 against movement when its projection comes opposite the notch in the wheel 160. In order that the contact lever 145 may not be obstructed by the extension 142 when the former is tripped loose from the latch 152, the operation must be such that the extension 142 will be drawn upward out of the path of movement of the lever 145. This is accomplished by the wheel 135, which forces the projection on the arm 141 out of the notch 138 and thereby raises the extension 142 out of engaging position. Thus, it will be seen that prior to the instant of closing the grounded branch 149, the extension 142 is allowed to drop to set the contact lever 145, and is then returned to its former position before the lever 145 is tripped from its latch 152.

Although I have described and shown mechanism for setting the clocks at twelve o'clock, it will be obvious that they might be set at any other desired time. Obviously too, in the installation of a system embodying the invention disclosed herein, the batteries at the central office, herein shown separately, may be one and the same; and the ground connections, also separately shown, may be connected to a common return, or connected together and grounded at a single point. These and many other alterations and modifications will be apparent to those skilled in the art and may be made without departing from the spirit and scope of my invention. I therefore, do not wish to be limited to the specific matter disclosed herein, but aim to cover, by the terms of the appended claims, all such alterations and modifications.

What I claim as new, and desire to secure by Letters Patent of the United States is:—

1. A combined telephone exchange and control system comprising a telephone line extending to the exchange, substation telephone apparatus and a receiving device each connected to said line independently of the other, a source of current at the exchange adapted to be operatively associated with said line, means at the exchange for varying the connections of said source to vary the electrical condition of said line to operate said receiving device, other telephone lines, link-circuits for connecting said telephone line to said other telephone lines to establish conversational circuits through said substation telephone apparatus.

2. A combined telephone and control system comprising a telephone line having two limbs, a substation telephone transmitter and switch-hook in normally open bridge of said limbs, a line relay, a current source, means for utilizing current from said source to operate said relay upon the closing of said switch-hook, a receiving device including a polarized relay connected in bridge of said limbs and unresponsive to said line relay actuating current, means for closing a circuit over said line limbs to supply current of opposite polarity to actuate said receiving device relay.

3. A combined telephone and control system comprising a telephone line having two limbs, a substation telephone transmitter and switch-hook in normally open bridge of said limbs, a line relay, a current source, means for utilizing current from said source to operate said relay upon the closing of said switch-hook, a device, electrically controlled means for setting said device including a polarized relay connected in normally open bridge of said line limbs, contacts actuated by said device to close said polarized relay bridge, said polarized relay being unresponsive to said line relay actuating current, a master device, and means actuated by said master device to close a circuit over said line limbs to supply current of opposite polarity to actuate said polarized relay to set said device.

4. A combined telephone and control system comprising a telephone line extending from a substation to a central office, a link-circuit and connection terminals for extending the circuit of said line, a device at the central office for transmitting an impulse of current over said line, means for controlling said device over a circuit independent of said line, and means actuated by said device to interrupt said telephone circuit only during the interval consumed in transmitting said impulse.

5. A combined telephone and control system comprising a telephone line extending in two limbs from a substation to a central office, a link-circuit and connection terminals for extending the circuit of said line, a control relay having normally closed contacts included in said line limbs, a source of current connected so as to be included in circuit with said line limbs when said control relay is operated, and a timing device for closing a momentary circuit to operate said control relay to transmit an impulse of current from said source over said line.

6. A combined telephone and control system comprising a telephone line extending from a substation to a central office, a link-

circuit and connection terminals for extending the circuit of said line, substation telephone apparatus and a receiving device each connected to said line independently of the other, a device at the central office for transmitting an impulse of current over said line to operate said receiving device, means for controlling said device over a circuit independent of said line, and means actuated by said transmitting device to interrupt said telephone circuit only during the interval consumed in transmitting said impulse.

7. A combined telephone and control system comprising a telephone line extending in two limbs from a substation to a central office, a link-circuit and connection terminals for extending the circuit of said line, a telephone transmitter and switch-hook in normally open bridge of said line limbs at said substation, a line relay at the central office, a source of current, means for utilizing current from said source to operate said line relay upon the closing of said switch-hook, a receiving device including a polarized relay connected in bridge of said limbs and unresponsive to said line relay actuating current, a control relay having normally closed contacts included in said line limbs and normally open contacts through which current of opposite polarity may be applied to said line to operate said polarized relay, and a timing device for closing a momentary circuit to operate said control relay to transmit a current impulse of said opposite polarity over said line.

In witness whereof, I hereunto subscribe my name this 11th day of Jan. A. D. 1906.

HARRY G. WEBSTER.

Witnesses:
L. D. KELLOGG,
CAROLYN WEBER.