

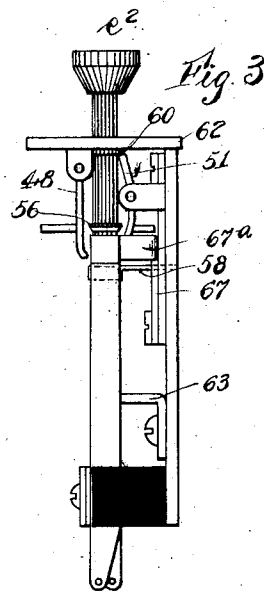
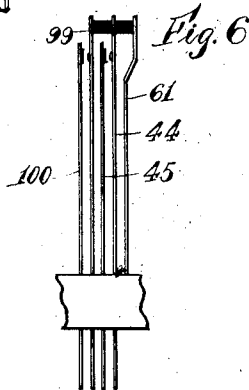
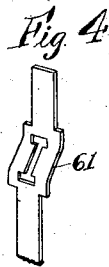
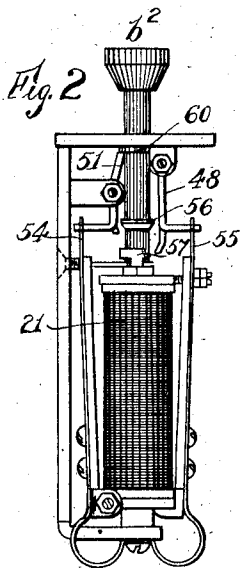
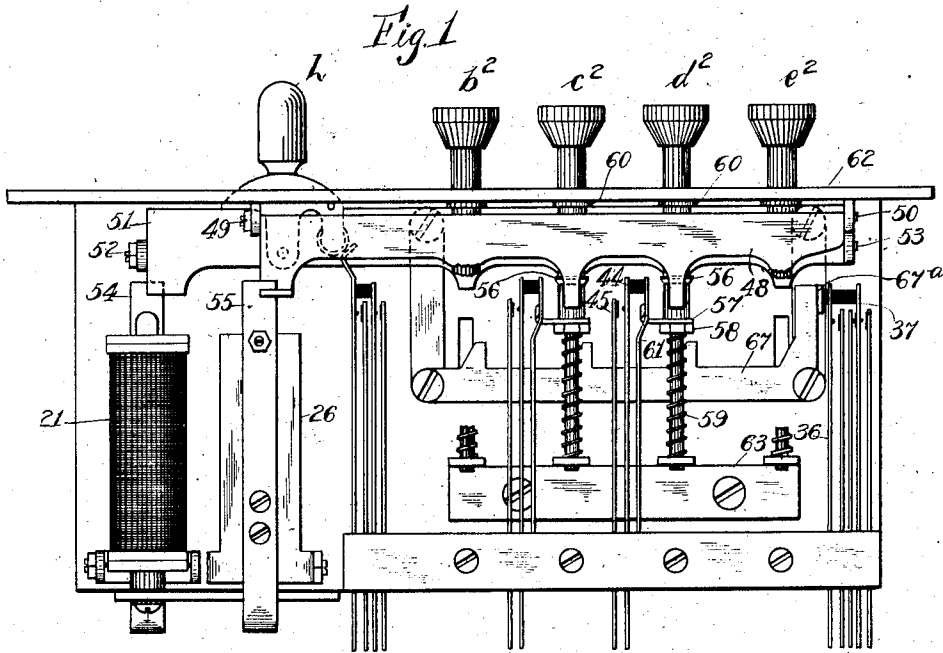
A. H. DYSON.
TELEPHONE SYSTEM.

APPLICATION FILED MAR. 19, 1906. RENEWED APR. 17, 1912.

1,208,718.

Patented Dec. 12, 1916.

7 SHEETS—SHEET 1.



Witnesses
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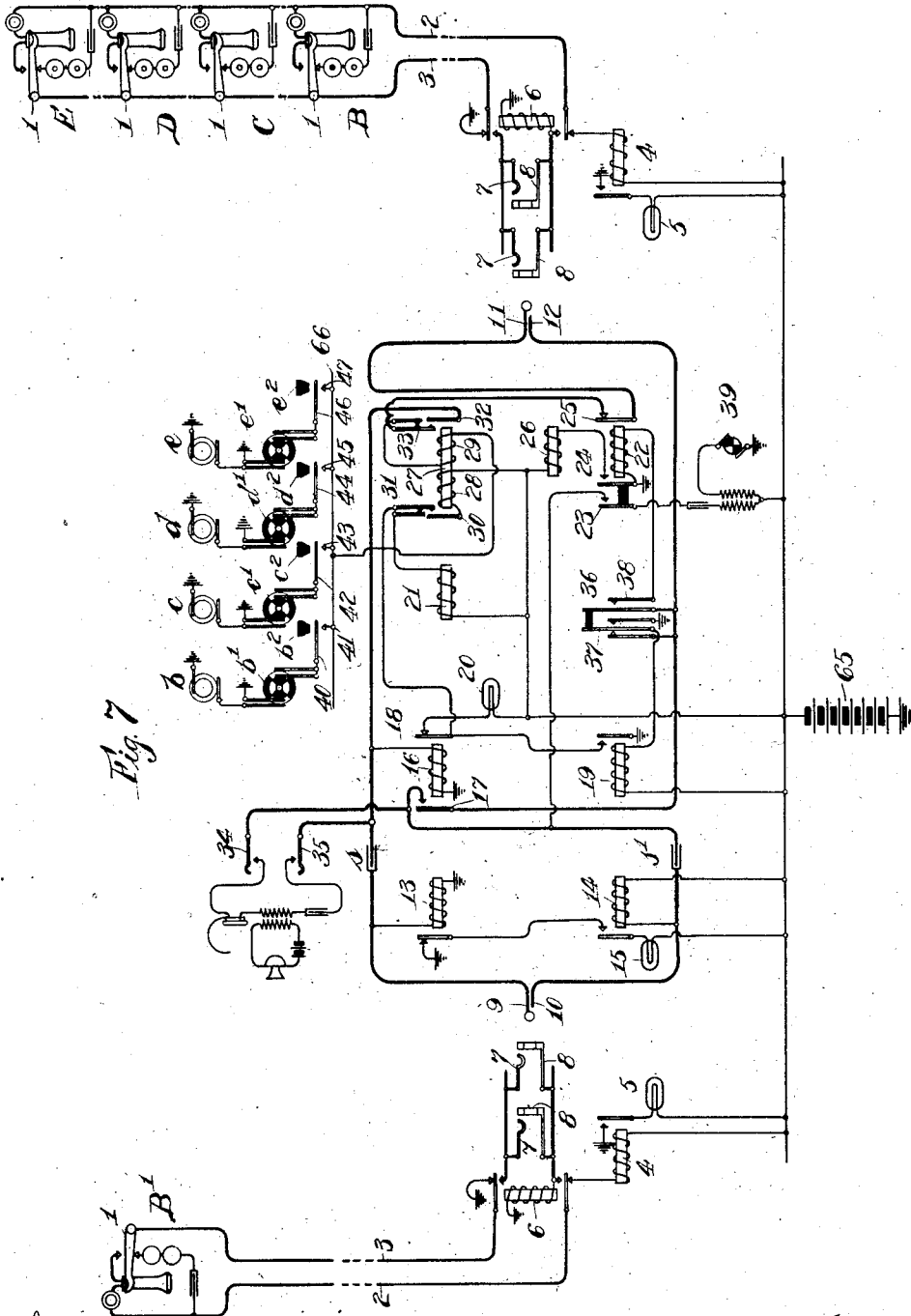


Fig. 7

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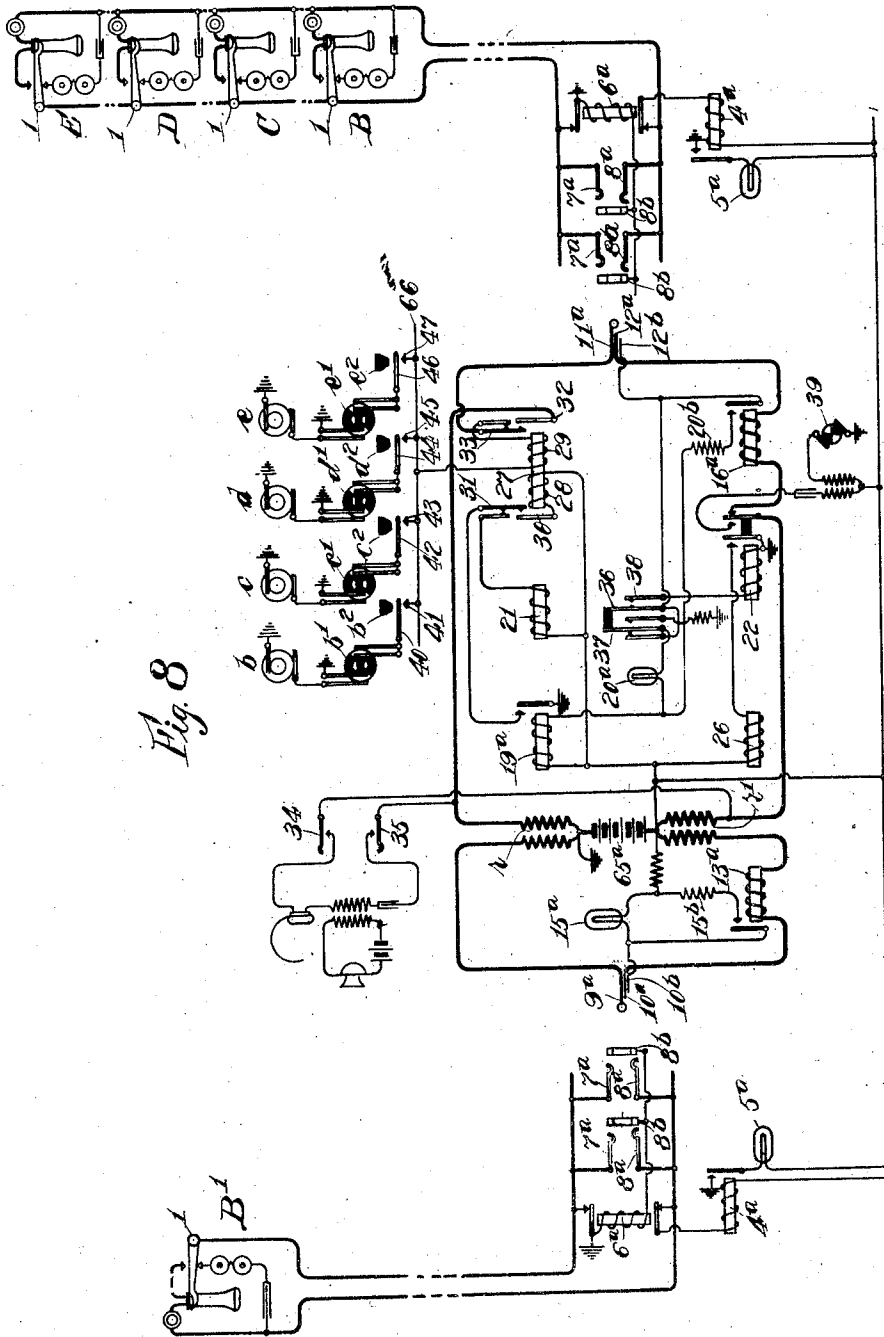


Fig. 8

Witnesses

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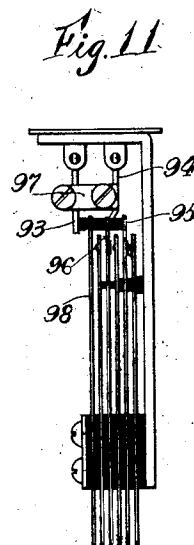
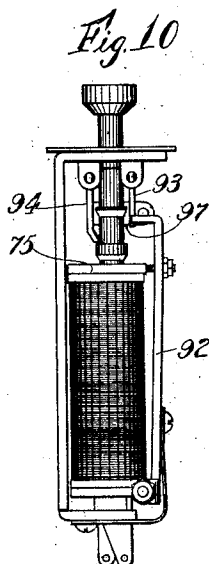
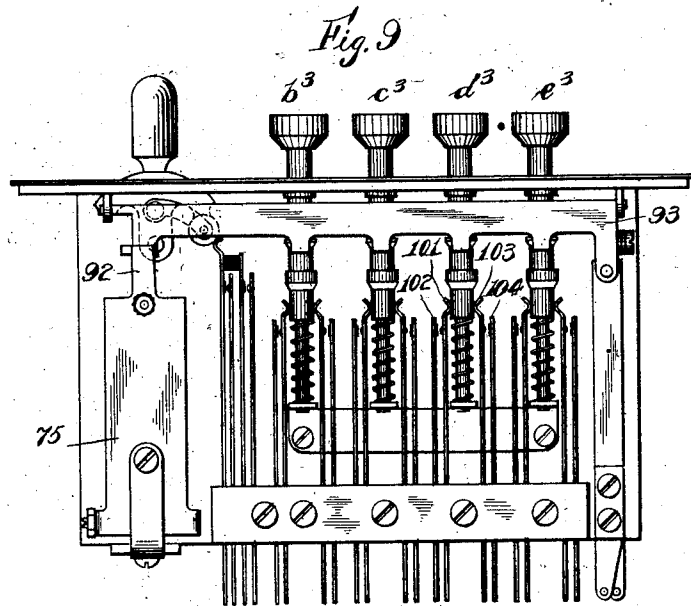
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7 SHEETS—SHEET 4.



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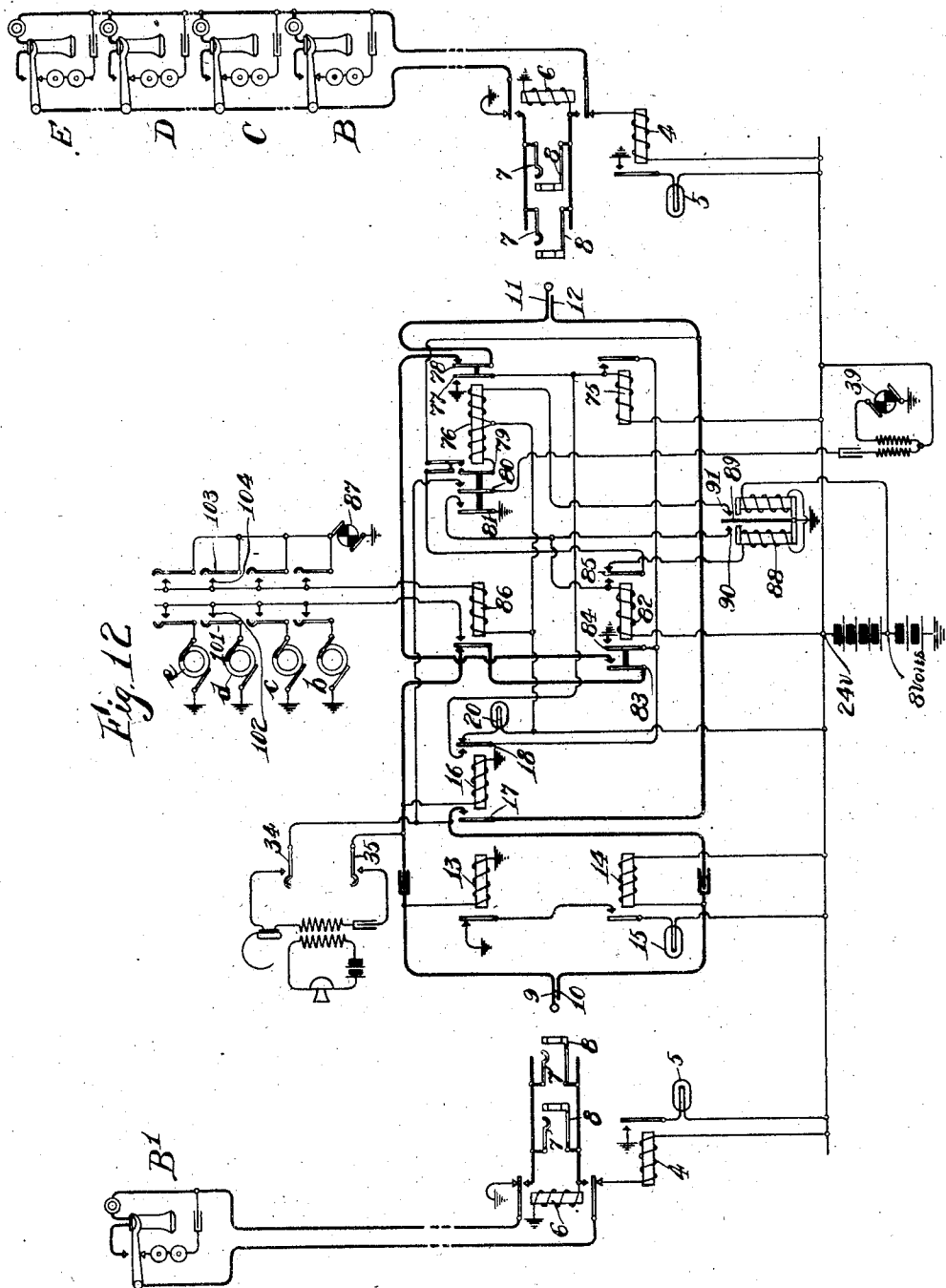
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7 SHEETS—SHEET 5.



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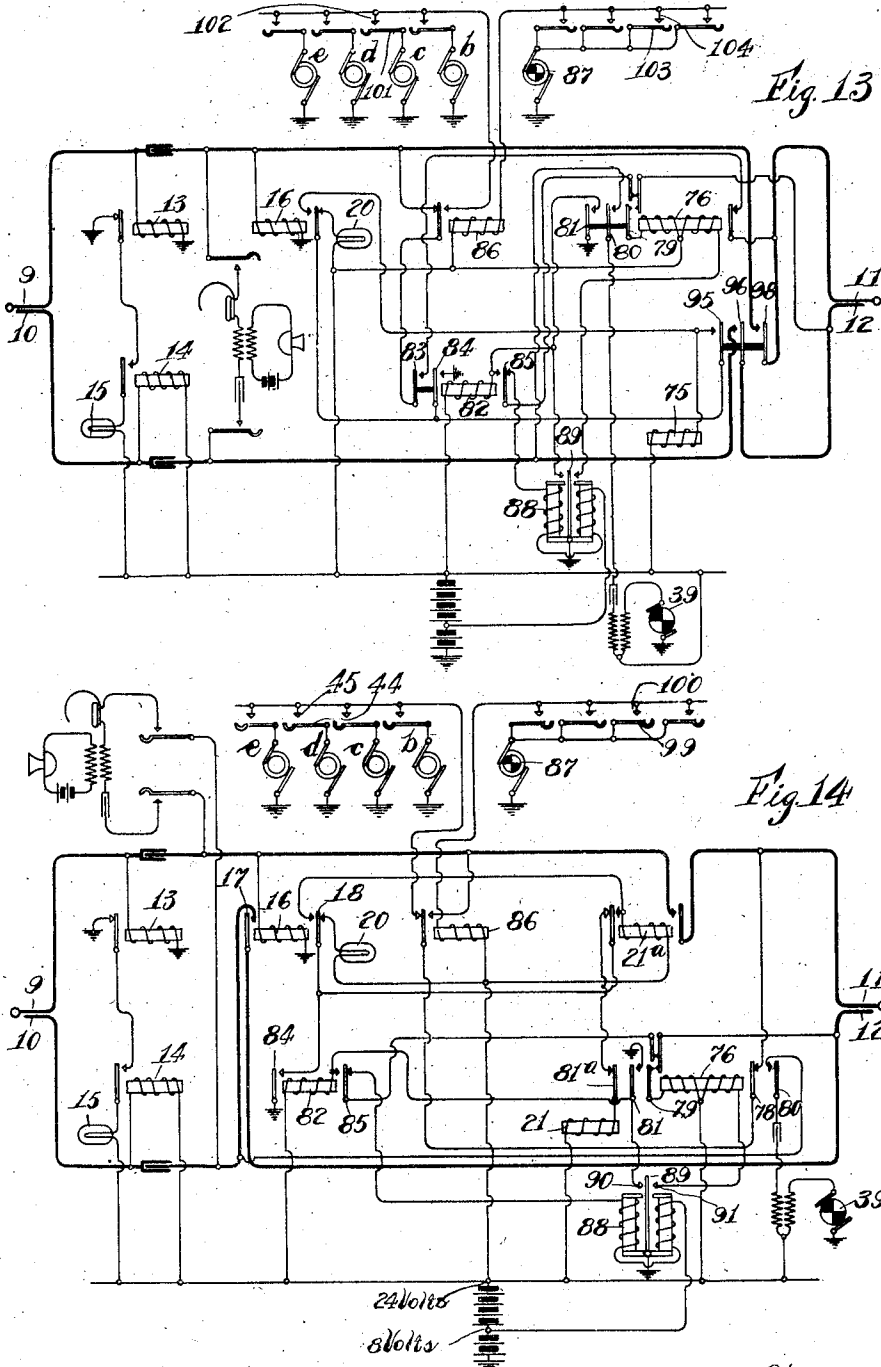
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7 SHEETS—SHEET 6.



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7 SHEETS—SHEET 7.

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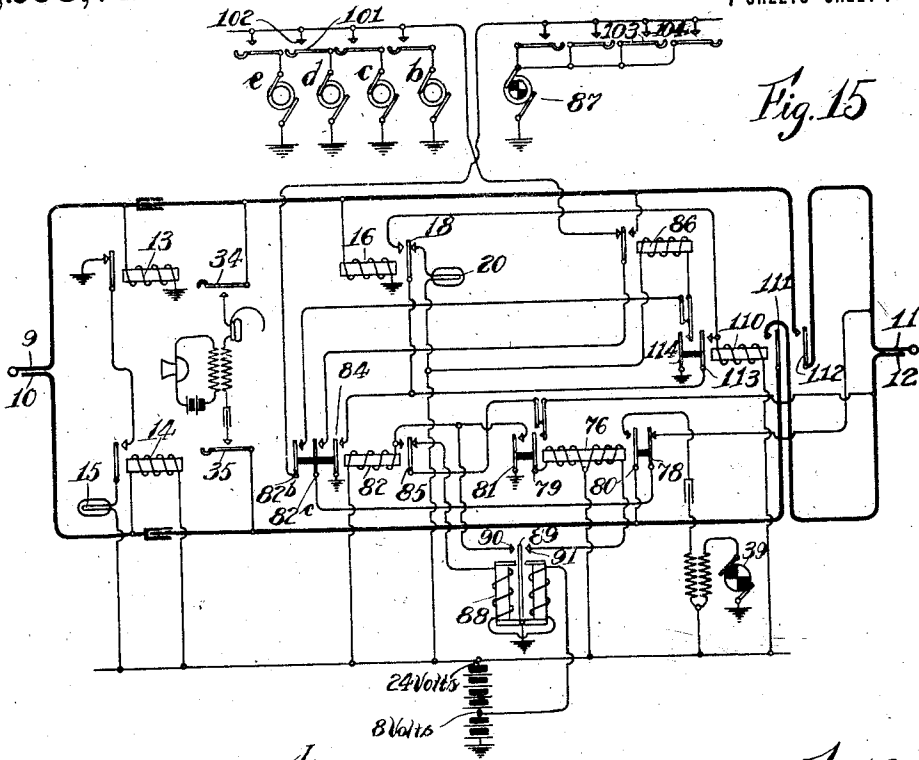


Fig. 15

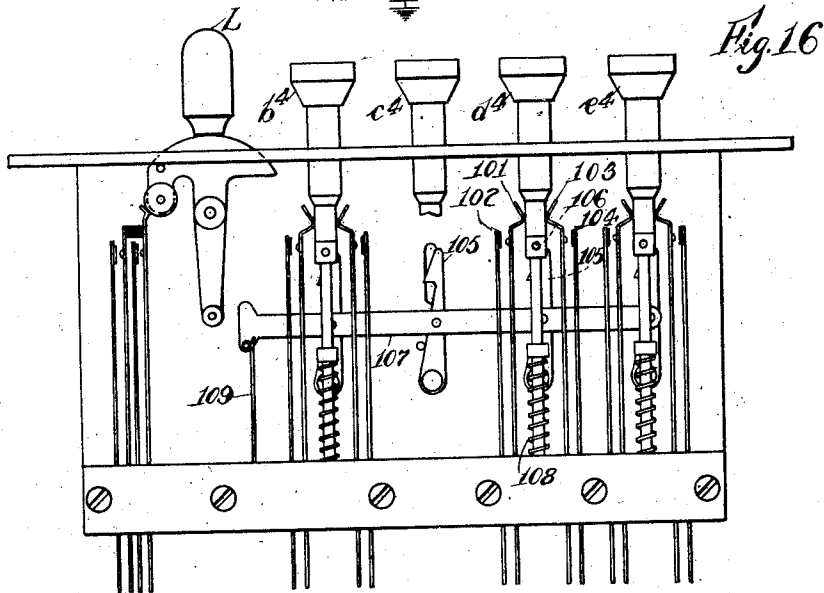


Fig. 16

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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

1,208,718.

Specification of Letters Patent.

Patented Dec. 12, 1916.

Application filed March 19, 1906, Serial No. 306,817. Renewed April 17, 1912. Serial No. 691,505.

To all whom it may concern:

Be it known that I, ALFRED H. DYSON, residing in Chicago, county of Cook, and State of Illinois, have invented new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to multiple switchboard systems and more particularly to the means employed for signaling a called subscriber that his attention is wanted and for signaling the calling subscriber that the line wanted is busy, should such be the case.

The object of my invention is to provide a structure, capable of employment for party line service, in whose use the operator may, on learning the called subscriber's number, insert the calling plug immediately into the jack of the wanted line, without waiting to preliminarily test the line, and perform the switching operation for ringing the subscriber wanted, automatically controlled means being provided to render this act ineffective, should the line be busy, and to extend to the calling subscriber a busy signal.

I am aware that it is not new to provide means for automatically extending a calling signal or a busy signal, the signal extended being determined by the engaged or disengaged condition of the called line, but as far as I am aware, it is new to provide for the automatic extension of busy signals in combination with structures employing manually operated party line ringing keys.

My invention involves primarily special apparatus connected with the operators' cord circuits, and may be employed in connection with a plurality of known forms of line circuit arrangements without change therein, being thus adapted for ready installation in connection with existing telephone exchange systems.

Referring to the drawings, Figure 1 illustrates a side view of a key structure employed in connection with my invention; Fig. 2 is a left-end view thereof, omitting the listening cam L and its springs and the ringing springs of plunger b^2 ; Fig. 3 is a right end-view of the key structure of Fig. 1. Fig. 4 shows in perspective the upper portion of spring-lever 61. Fig. 5 is a front view of arm 57 employed to actuate the spring-lever 61. Fig. 6 shows the association of the circuit changing springs with spring-lever 61 adapted for use in connection with the circuit of Fig. 14. Fig. 7

illustrates two telephone lines and operator's cord connecting apparatus arranged in accordance with my invention. Fig. 8 shows the application of my invention to a varying form of telephone exchange system. Fig. 9 shows a form of key structure that may be employed in carrying out my invention. Fig. 10 shows a left end view thereof, the listening cam and its springs being omitted. Fig. 11 is a right end view showing the spring combination of the structure of Fig. 9. Fig. 12 shows a pair of telephone lines and cord connecting apparatus adapted for use in connection with the keys shown in Figs. 9 to 11. Fig. 13 shows a modification of the cord circuit structure of Fig. 12. Fig. 14 illustrates a varying form of cord circuit embodying my invention. Fig. 15 illustrates another form of cord circuit embodying my invention. Fig. 16 illustrates a key structure adapted to be employed in connection with the circuit arrangement of Fig. 15.

The key structure shown in Fig. 1 comprises the usual listening cam L adapted, when thrown over, to connect the operator's talking set with the cord strands. In addition, plungers b^2 , c^2 , d^2 and e^2 are provided, as is usual in selective party line ringing systems, each being adapted, when operated, to cause the bell of one subscriber's substation on the called line to ring, and of one only. Two magnets 21 and 26 are provided for controlling the operation of the plungers, magnet 21 being arranged to be operated when connection is made with a called line and to hold a depressed plunger in its ringing position until the called subscriber responds or the operator withdraws the plug from connection with his line, a response failing. The other magnet 26 is operated only in case the called line is busy, and when so operated prevents a depressed plunger from assuming its ringing position, so that interference with existing conversations by ringing current is prevented. In Fig. 1, parts of plungers b^2 and c^2 and their associated mechanisms are omitted, so as to disclose parts of the key structure that would otherwise be concealed. All of the plungers b^2 , c^2 , d^2 , and e^2 are identical, have similar working parts, and are controlled in the same manner by magnets 21 and 26. The former, 21, is provided with an armature and a spring 54 fastened thereto, interlock-

ing with rocker arm 51 as shown in Figs. 1 and 2. The said arm 51, pivoted at 52 and 53, has four pawls, two of which are visible in Fig. 1 beneath plungers b^2 and c^2 , the other two being concealed by c^2 and d^2 . When the armature of 21 is at normal, as shown in Fig. 2, the pawls of 51 are out of engagement with the plungers, while the upper edge of 51 engages the shoulders 60 of the plungers preventing their depression, until such time as magnet 21 becomes energized, which occurs as soon as connection is made with a called line, when spring 54 rocks arm 51, so that it disengages shoulders 60 while its pawls press against the plungers. This is to prevent the operator from depressing a plunger until connection has been made with the called line, so that, should the line be busy, magnet 26 will be actuated in time to prevent a depressed plunger from assuming its ringing position.

Magnet 26, by its spring 55 (Figs. 1 and 2) fastened to its armature, interlocks with rocker arm 48, whose four pawls—two being shown complete in Fig. 1 and two as broken off—are normally held disengaged from their respective plungers. When 26 is actuated, spring 55 moves arm 48 about its pivots 49 and 50, so that the said pawls press against their plungers. As shown in Figs. 2 and 3, arms 48 and 51 are disposed on opposite sides of the plungers.

The plungers and the parts individual to them being identical, but one, d^2 , will be specifically described. It is journaled to mounting plate 62 and support 63, and when depressed and released, its spring 59 tends to raise it to its normal position shown. In addition to shoulder 60 before referred to, shoulder 56 is provided, which descends below the pawls of arms 51 and 48 on depression of the plunger, whereby its ascent is rendered controllable first by magnet 21, and thereafter by magnet 26. Fastened to the plunger is arm 57 whose T shaped extremity fitting into the I shaped orifice of spring lever 61 (Figs. 1, 4, and 5), on downward stroke of plunger d^2 , passes on the left side of 61, while on the upward stroke it passes on the right side of 61 to a position where it causes the closure of contact 44—45. This is the ringing position of the plunger, and in this position the plunger is held (provided the line wanted is idle) due to the energized condition of magnet 21 and the consequent engagement of arm 51 with shoulder 56, until, on the response of the subscriber, 21 is deenergized. The plunger also carries arm 58 which extends through the frame as shown in Fig. 3. When the plunger is fully depressed 58, engaging its particular angular surface of rocker arm 67, pivotally connected to the vertical and pivoted supporting arms shown, moves the said arm 67 to the right, which, by its ex-

tension 67^a, moves mechanically connected springs 36 and 37 to their alternate positions. Should the called line be busy and magnet 26 therefore energized when the plunger is depressed, arm 48 by its pawl engages shoulder 56 and holds the plunger practically completely depressed, so that springs 36 and 37 continue in their alternate positions, while arm 57 is prevented from assuming its ringing position.

Having described in detail the special mechanism employed in connection with my invention, I shall describe the circuit drawings, in which, for the sake of clearness, but few mechanical elements, and those in diagrammatic form, are shown, without cross references to Figs. 1 to 5, assuming that the mechanical combinations are borne in mind. Similar parts, appearing in Fig. 7 and Figs. 1—5, have corresponding reference characters.

In Fig. 7, I have illustrated a telephone line extending from substation B' to the exchange and there provided with a well known line circuit arrangement. The mechanism at B' includes hook-lever 1 normally maintaining the condenser and bell in bridge of limbs 2 and 3, and adapted on removal of the receiver to open the bell circuit and connect the transmitter and receiver with the line limbs. The various ground connections illustrated at the exchange indicate connections to the grounded side of battery by the office return. The line limbs 2—3 of substation B' are connected to the opposite sides of battery 65, the line relay 4, controlling line signal lamp 5, being connected between limb 2 and the active side of battery. The cut-off relay 6, connected from ground to the sleeve contacts 8 of the spring jacks, when actuated, by its armatures opens the normal connections of limbs 2 and 3 and connects them to jack contacts 8 and 7. A second telephone line is shown, to which are connected substations B, C, D and E, to each of which the description of substation B' also applies. The central office circuit of this line is similar to that of the line of B'. An operator's cord circuit is shown including an answering plug having tip and sleeve contacts 9 and 10, and a calling plug having tip and sleeve contacts 11 and 12. Associated with the answering plug contacts are relays 13 and 14, jointly controlling the answering supervisory signal 15, while, in association with the calling plug contacts, are relays 16 and 19 controlling the calling supervisory signal 20. Relay 16, by armature 17, further controls a contact in the sleeve cord strand, normally open, whereby interruption with an existing conversation by busy machine 39 is prevented, should the operator plug into a jack of a busy line. Relay 19, having preferably a high resistance winding, by its

armature controls the circuit of key magnet 21 to effect its energization as soon as the calling plug is inserted in a line jack, whereby plungers b^2 , c^2 , d^2 , and e^2 are unlocked.

A depressed plunger causes springs 37 and 36 to assume their alternate positions, the actuation of 36 uniting test relay 22 with the sleeve contact 12 whereby it becomes sensitive to the busy condition of a called line. By its armature 24, relay 22 controls the key magnet 26. Armature 23 controls the connection of busy machine 39 with the line of the calling subscriber. The circuit of magnet 21 extends through spring 31 of relay 27 and its normal contact, which latter relay has an actuating winding 29, normally connected to tip contact 11 of the plug and conductor 66, and a locking winding 28 controlled by armature 30. Conductor 66 is adapted for connection with any of the ringing springs 40, 42, 44 and 46.

The generators b , c , d , and e , deliver current of varying frequencies and the call-bells at substations B, C, D and E are tuned so that each is responsive only to current of the frequency delivered by the generator designated by the corresponding small letter. Such a harmonic selective ringing system is described in U. S. Letters Patent to Wm. W. Dean, title, Party line telephone system, No. 779,533, issued Jan. 10, 1905.

By means of the plungers b^2 , c^2 , d^2 and e^2 , the operator can connect the proper generator with an idle called line to ring the subscriber wanted. Interrupters b' , c' , d' and e' are provided to alternately interrupt and close connection between springs 40, 42, 44 and 46 and their associated generators, whereby the substation bells are intermittently caused to ring. In addition to the two brushes effecting this are provided two additional brushes, so arranged that conductor 66 is always grounded when one of springs 40, 42, 44 and 46 is connected to it, in order to insure that when the called subscriber removes his receiver, circuit will instantaneously be completed through relay 27, whereby magnet 21 is deenergized to disconnect the generator. The remaining connections will be understood best from the description of the operation.

Assuming that subscriber B' desires to converse with subscriber D, the removal of the receiver at substation B' completes circuit through line relay 4, the current traveling through hook lever 1 and its alternate contact. The attracted armature of relay 4 effects the display of lamp 5 to attract the operator's attention. She inserts the answering plug into the jack of the calling line, closing contacts 7—9 and 8—10, which latter completes a circuit of battery 65 through supervisory relay 14 and cut-off relay 6 in series. The attracted armatures of relay 6 open the circuit of relay 4 (whose

retracted armature renders signal 5 inert) and by engaging their alternate contacts, connect limbs 2 and 3 to contacts 8 and 7. Relay 14 attracts its armature, which would cause the display of supervisory signal 15 were this not prevented by the attraction of the armature of relay 13, now energized by current through its winding, contact 9—7, armature of relay 6, hook-lever 1, returning through the other armature of relay 6, contact 8—10 and through relay 14 to battery.

The operator, ascertaining in the usual manner what subscriber is wanted, inserts the calling plug into a multiple jack of the line connected to the said subscriber's station closing contacts 11—7 and 12—8. Current flows from ground, through cut-off relay 6 of the called line, contact 8—12, its normal contact and spring 37, relay 19 to battery 65. The attracted armature of relay 19 closes circuit from ground, through spring 31 and its normal contact, key magnet 21 and to battery, whose actuation causes plungers b^2 , c^2 , d^2 and e^2 to be unlocked. The attracted armature of relay 19 also effects the display of supervisory signal lamp 20. The operator now depresses plunger d^2 to its full extent, which throws over springs 37 and 36 to engage their alternate contacts. To this point, the operation of the system is the same whether the called line is busy or idle.

The described movement of spring 36 connects the winding of test relay 22 with the sleeve strand of the cord and through contact 12 with the sleeve contacts 8 of the spring jacks of the called line. The actuation described of spring 37 disconnects temporarily the sleeve strand of the cord from the active side of battery 65 and completes a new path for current through relay 19 to ground.

Assuming first that the called line is idle, it will be observed that the grounded winding of relay 22 is connected through contacts 38—36, 12—8, to the grounded winding of cut-off relay 6 of the called line. No flow of current results through relay 22, and the depressed plunger d^2 ascends to the ringing position because, owing to the deenergized condition of relay 22, key magnet 26 remains inert. The contact of springs 37 and 36 with their alternate contacts being in this case momentary only, they resume their normal positions, circuit being again completed from ground at the called line, through cut-off relay 6, contacts 8—12, spring 37, relay 19 to battery. The attracted armatures of cut-off relay 6 complete circuit for current from generator d , through interrupter d' , contact 44—45, plunger d^2 being now in ringing position, through winding 29 of relay 27, its normal contact and spring 33, armature 25 of relay 22, contact 11—7, the attracted armature of relay 130

6, limb 3, through the call bells and condensers of substations B, C, D and E in parallel, returning over limb 2, the attracted armature of relay 6, contact 8—12, spring 37, relay 19, to battery. Due to the substitution condenser the relay 27 is not energized; and the frequency of current being out of tune with the call bells of all the substations other than D, the subscriber at that station is alone signaled. By the removal of the receiver at substation D, circuit is instantly completed from ground at the exchange, through one or the other of the brush pairs of interrupter d' , contact 44—45, winding 29 and, following the before traced path of ringing current, to battery 65. This being direct current, relay 27 is energized, whose attracted armature 30, engaging spring 31, completes a locking circuit through winding 28 for relay 27 and immediately thereafter opens the circuit of key magnet 21, whose deenergization allows the return of plunger d^2 to its normal position. The attracted armature 32 of relay 27, engaging spring 33, completes the talking circuit of the tip strand of the cord circuit and thereafter opens the circuit of winding 29 of relay 27. On the closure of contact 32—33, a path for the flow of current was established through the grounded winding of relay 16, over the talking circuit as indicated by the heavy lines, to limb 3 of the line of subscriber D, returning over limb 2 and through relay 19 to battery. The attracted armature 18 of relay 16 opens the circuit of supervisory lamp 20 which is thereby put out, notifying the operator that the response has been made. The attracted armature 17 of relay 16 completes the talking circuit of the sleeve strand of the cord circuit, and the two subscribers are now in conversation through condensers s and s' , the talking circuit being indicated from substation B' to substation D, through the exchange, by the heavily marked conductors, current for energizing their respective transmitters being supplied from battery 65 through the sleeve supervisory relays 14 and 19 respectively, the return path being traced through the relays 13 and 16 respectively.

When subscriber B' replaces his receiver, circuit is opened through relay 13, whose retracted armature effects the display of lamp 15; and when D replaces his receiver, circuit is opened through relay 16, whose retracted armature 18 closes circuit through lamp 20. The operator, observing the simultaneous display of the two supervisory signals, withdraws the answering plug from the calling line, effecting the deenergization of relays 6 and 14, while the withdrawal of the calling plug interrupts circuit through relays 6 and 19. The retracted armature of relay 19 opens circuit through lamp 20 and also through the locking winding 28 of re-

lay 27, whose retracted armature 30 allows spring 31 to engage its normal contact, again placing key magnet 21 under the control of relay 19; while the retracted armature 32 of relay 27 allows spring 33 to engage its normal contact, again placing conductor 66 in operative relation with tip contact 11 of the calling plug.

The insertion of either an answering plug or a calling plug into the spring jack of a line causes a flow of current from battery 65, through the respective sleeve supervisory relay 14 or 19, to ground through the cut-off relay 6 of the line. Owing to the resistance of the cut-off relay winding, sleeve contacts 8 of the line spring jacks are, under this condition, of a potential other than that of ground. Assuming that, when the operator inserted the calling plug into a spring jack of the line of subscriber D, the just described condition existed, upon the complete depression of d^2 throwing over springs 37 and 36 to engage their alternate contacts, the raised potential of the sleeve contact 8 of the jack, into which the calling plug was inserted, would cause a flow of current through sleeve contact 12 of the calling plug now inserted in the busy line, through contact 36—38, the winding of test relay 22 to ground. The attracted armature 24 of this relay then completes circuit through busy magnet 26, whose actuation prevents the return of plunger d^2 to the ringing position by holding it practically fully depressed so that springs 37 and 36 are continued in their alternate positions. The attracted armature 23 of relay 22 completes circuit from interrupter 39, through the induction coil and condenser, through the sleeve strand condenser s' and contact 10—8 to the calling line, whereby the calling subscriber is notified that the line wanted is busy. He thereupon replaces his receiver, thereby displaying supervisory relay 15 and advising the operator that the line should be disconnected. The withdrawal of the calling plug opens the circuit of test relay 22, whose retracted armatures 23 and 24 disconnect the busy machine 39 and deenergize key magnet 26, whereupon plunger d^2 ascends to a position where springs 36 and 37 assume their normal positions. As soon as 37 disengages its alternate contact, relay 19 becomes inert, and the retracted armature opens the circuit of key magnet 21, whose deenergization allows the return of plunger d^2 to normal.

In Fig. 8, I have illustrated a telephone exchange system of well known character, employing three conductor spring jacks and cord circuits in association with the structure of my invention. Salient features differentiating this system from that shown in Fig. 7 include the placing of cut-off relays 6^a in circuits independent of the talking circuits, the supervisory signals 15^a and 20^a

being placed in series with the cut-off relays on connection of the plug terminals with the line jacks. The supervisory relays 13^a and 16^a, having the functions of rendering the supervisory signals inert when the substation circuits are completed by the removals of the receivers, render them inert by shunting them by resistances 15^b and 20^b respectively. The two connected subscribers' lines in Fig. 8 are inductively united for conversation by windings r, r' , of a repeating coil, instead of by condensers s, s' , as shown in Fig. 7.

Briefly, the operation of Fig. 8 is as follows: When subscriber B' initiates a call, relay 4^a and lamp 5^a are energized. On the insertion of the answering plug into the jack of the calling line, the placing in series of the signal lamp 15^a with cut-off relay 6^a would cause its display, were it not immediately shunted by resistance 15^b on the attraction of the armature of relay 13^a, which relay is energized at once by current over the calling line. The operator, learning in the usual manner what subscriber is wanted, assumed to be D, inserts immediately the calling plug in a spring jack of the called line, closing contacts 11^a—7^a, 12^a—8^a, and 12^b—8^b. Thereupon current flows from ground, through cut-off relay 6^a (attracting its armatures), contact 8^b—12^b, spring 37, signal 20^a (displaying it), relay 19^a to battery 65^a. The attracted armature of relay 19^a effects energization of key magnet 21, releasing the key plungers and setting the ringing position pawls against the plungers. The operator, now depressing plunger d^2 , causes springs 37 and 36 to engage their alternate contacts, the closing of contact 38—36, placing test relay 22 in operative relation with sleeve 12^b of the calling plug. If the plug of another cord is already connected to the called-for line, contacts 8^b and 12^b will be at a potential other than ground, due to a flow of current from the other cord, through the resistance of cut-off relay 6^a of the called line, to ground. Relay 22 will therefore be energized, and its attracted armatures will connect interrupter 39 with the calling line and cause the actuation of key magnet 26 respectively, to transmit the busy signal to subscriber B' and prevent plunger d^2 from assuming its ringing position. Subscriber B', replacing his receiver, thereupon deenergizes relay 13^a, whose retracted armature removes the shunt of 15^b from signal 15^a. Both signals being displayed, the operator removes the two plugs and the apparatus resumes its normal condition. Should, however, the called line be idle, 8^b and 12^b will be at the potential of ground, relay 22 and magnet 26 remain deenergized, and plunger d^2 assumes its ringing position, whereby contact 44—45 is closed and ringing current projected from generator d ,

through winding 29 of relay 27, over the called line to ring the bell of subscriber D, as before described. On the removal of the receiver at D, direct current flows from ground, through contact 44—45, winding 29, contact 11^a—7^a, through lever 1 at D, returning through 8^a, 12^a, supervisory relay 16^a to battery 65^a. Armatures 30 and 32 of relay 27 operate to deenergize magnet 21, to allow the return of plunger d^2 , and to complete the talking circuit of the tip cord strand. The attracted armature of relay 16^a shunts signal 20^a to render it inert by means of resistance 20^b.

When subscribers B' and D replace their receivers, relays 13^a and 16^a are deenergized, and their retracted armatures remove the shunts of resistances 15^b and 20^b from about signals 15^a and 20^a, whose simultaneous display notifies the operator to remove the answering and calling plugs, which causes the line circuits and the cord circuit to resume their normal positions.

The key structure shown in Figs. 9, 10 and 11 includes the four plungers b^3, c^3, d^3 , and e^3 , common to which are the two levers 93 and 94 shown in Fig. 10 which are bound together by the plate 97 and provided each with four pawls for the four plungers. In this structure no locking pawls are required. Armature 92 of magnet 75 interlocks with lever 93 and when retracted, holds the pawls of 93 out of contact with the plungers and those of 94 in contact therewith. A depressed plunger as d^3 will be held in its fully depressed position, closing contacts 101—102 and 103—104 by the engagement of the appropriate pawl of 94 with its upper shoulder, until the actuation of magnet 75 occurs whose attracted armature actuating 93 and 94 allows upward movement of d^3 until its said upper shoulder engages 93. In this position it is locked until deenergization of magnet 75, which only occurs when the operator removes the plug from the called line. This is the "indicating position," the top of the plunger being held somewhat below the tops of its fellows, so that the operator may know which of the party substations she has signaled until disconnection is finally completed. Controlled by the magnet 75 as shown in Fig. 11 by means of a stud upon lever 93 are circuit changing springs 95, 96 and 98, the attraction of armature 92 causing them to respectively engage their associated springs.

The above described key is employed in connection with the embodiment of my invention shown in Fig. 12. The description of the line circuits given for Fig. 7 applies to those of Fig. 12, as does the there given description of the answering end of the cord. The tuned bell party line system described is employed in this and the additional diagrams shown.

In the structure of Fig. 12 and in the succeeding figures, a polarized relay 88 is employed whose winding is connected to a battery tap having a potential of approximately 8 volts, taken as shown from the usual 24 volt common battery, although obviously a separate battery may be employed. Its operation in Fig. 12 and Figs. 13, 14 and 15 is the same, and as follows: A flow of current from the 8 volt tap through relay 88 to the return side of battery through the cut-off relay of an idle line, causes the actuation of armature 89 to the left. A flow of current through relay 88 in the reversed direction will cause the actuation of 89 to the right. Such a flow will result when the calling plug of the cord circuit is connected to a busy line as in such case the 24 volt tap of battery will be connected through the already connected cord to the sleeve of the tested jack, and owing to the resistance of the cut-off relay of the busy line, which in such systems is ordinarily 500 ohms, the tested sleeve will be at a minimum potential of about 14 volts, the minimum occurring when the substation receiver is off the hook. This potential being in excess of 8 volts connected to the opposite end of the winding of 88 a reversed flow is produced there-through. The actuation of armature 89 to the left effects the energization of the sleeve relay 82 to place by armature 83 the ringing apparatus, when a plunger is depressed, in operative relation with the cord and to cause by armature 84 the display of supervisory signal 20. The arrangement to secure intermittent ringing of the called substation bell shown in Fig. 12 includes the constantly rotating interrupter 87 controlling, when connection is made with an idle line, the circuit of relay 86, whose attracted and retracted armature alternately connects and disconnects the generator lead from the tip cord strand. The actuation of armature 89 to the right effects the energization of relay 76 to actuate sleeve relay 82 and key magnet 75, the latter allowing the return of a depressed plunger to its indicating position whereby the ringing apparatus is instantly removed from operative relation with the cord. The energized relay 76, by armature 80, also completes a circuit from busy machine 39 to the calling line, and by armature 79 a locking circuit for itself only destroyed on the removal of a calling plug.

Assuming B' desires his line connected to the line of D, he removes his receiver and the operator answers and learns his want as described in connection with Fig. 7. Having depressed the plunger associated with the ringing current of proper frequency to ring the bell of the wanted subscriber, the operator then inserts the calling plug in a jack of the line of D. Assuming this line idle, relay 88 attracts 89 to the left closing circuit through relay 82 whose attracted armature 85 deenergizing relay 88 establishes a locking path through its winding from the 24 volt battery tap through spring contacts of relay 76, contact 12—8 through high wound relay 6 (attracting its armatures) to ground. All jack contacts 8 of D's line have their potential raised as before mentioned. Attracted armatures 83 and 84 respectively complete the tip talking strand of the cord and effect display of lamp 20. The operator having depressed plunger d^3 , Fig. 9, contacts 101—102 and 103—104 are closed and the bell at substation D is rung by current from d traversing contact 101—102, armature of relay 86 when attracted, armature 83, armature 78, contact 11—7, armature of relay 6, substations B, C, D and E in parallel, returning through contact 8—12 and relay 82. As soon as D removes his receiver and interrupter 87 is in such position that relay 86 is deenergized, current flows from ground through relay 16, the retracted armature of 86, armatures 83, 78, 11—7, through transmitter and receiver at D returning through 8—12, armature 85, relay 82 to battery. Attracted armatures 17 and 18 respectively complete the talking circuit of the sleeve cord-strand and put out lamp 20, while armature 18 in addition closes circuit through itself from ground, armature 84 of relay 82, key magnet 75 to battery. The consequent attraction of its armature locks magnet 75 by current through armature 84 of relay 82 to battery. The attracted armature of 75 also moves levers 93 and 94 (Fig. 10) so that plunger d^3 assumes its indicating position and generator d is cut-off. At conclusion of conversation the replacing of the receivers causes the deenergizations of relays 13 and 16, and on the resulting displays of lamps 15 and 20 the operator removes the plugs deenergizing relays 6, 14 and 82, the retracted armature 84, of the latter deenergizing magnet 75 which causes plunger d^3 to return to normal when all apparatus is restored. If during the time contacts 11—7 and 12—8 or 9—7 and 10—8 are closed another operator connects the calling plug of a second cord circuit to a spring jack of either line, a reversed flow of current takes place through relay 88 of this second cord and its armature 89 engages contact 91 to close circuit through the right hand winding of its relay 76 whose attracted armatures 77 and 78 respectively actuate key magnet 75 to place a depressed plunger in indicating position and open the tip strand of the cord to render impossible interruption of an existing conversation by generator current and also the operation of relay 16 which would otherwise occur. Attracted armature 80 of relay 76 connects busy machine 39 with the sleeve strand of the answering plug to signal the calling sub-

station, while armature 79 opens circuit through relay 88 and establishes a locking circuit for its relay 76 through the cut-off relay 6 of the busy line, in order that relay 82 may continue energized by current over the circuit established by the attracted armature 81, whereby the continued display of lamp 20 is secured. The calling subscriber hearing the busy signal replaces his receiver whereupon signal lamp 15 is displayed and the operator removes the plugs. The calling end of the cord is placed at normal by the resulting opening of circuit through the left hand or locking winding of relay 76, whose retracted armatures deenergize 82 and 75.

In Fig. 13 I have illustrated a modification of the cord circuit shown in Fig. 12. Its method of operation is substantially the same as is the arrangement of parts, the difference being that springs 96 and 98 shown in Fig. 11, and not employed in connection with Fig. 12, are here employed to complete the talking circuits of the two cord strands, the employment of armature 17 of relay 16, Fig. 12 being here dispensed with. It will be observed that the talking circuit of the tip cord strand in Fig. 12 passes serially through armature contacts of relays 86, 82 and 76. In Fig. 13 a talking circuit is provided in parallel with that of Fig. 12 containing the single switch contact of spring 98 (closed on the actuation of key magnet 75) and possible trouble due to the presence of the three series contacts in the talking circuit above referred to, is obviated.

In Fig. 14 I show my invention carried out in a form employing the polarized relay 88 and adapted to be used in connection with the key structure of Figs. 1 to 5; with the exception that key magnet 26 and its lever 48 are not employed, while fastened to lever 61 of each plunger is to be provided an additional switch spring 99 with its associated contact 100, as shown in Fig. 6, adapted when a plunger is in its ringing position to connect interrupter 87, Fig. 14 with relay 86. The line circuits shown in Figs. 7 and 12 may be employed in connection with Fig. 14. On connection made with an idle line by the calling plug of Fig. 14, armature contact 89—90 of relay 88 is closed to energize relay 82 whose armature 85 establishes a locking path for current for 82 from the 24 volt battery tap, through the switch springs of relay 76 and the cut off relay 6 of the called line (Fig. 12) which flow puts the busy potential on the sleeve contacts of the spring jacks. The attracted armature 84 of relay 82 closes circuit through lamp 20 displaying it, a branch circuit through key magnet 21 being also established to actuate 21 which unlocks the plungers (see Figs. 1 and 2) and places the pawls of lever 51 in position to hold a depressed plunger in ringing position. Assuming the plunger of

generator *d* (Fig. 14) to be depressed, contacts 44—45 and 99—100 will be closed and current will intermittently flow from generator *d* through armature of relay 86, when retracted, armature 78 of relay 76 to the called line. On the response of the subscriber, relay 16 is actuated by current passing through the armature of relay 86 when attracted, armature 78 and over the called line. The attracted armature 18 of relay 16 puts out lamp 20 and establishes a flow of current to energize relay 21^a whose attracted armatures open circuit through key magnet 21 (allowing the return of a depressed plunger to normal, whereby contacts 44—45 and 99—100 are opened) and complete the talking circuit of the tip cord strand. Should the called line, however, be busy when the calling plug of Fig. 14 is connected to a spring jack thereof, armature 89 of relay 88 engages contact 91, and relay 76 is energized whose armatures 78, 79, 80 and 81 operate in a manner corresponding to similarly designated armatures of Fig. 12, while armature 81^a opens a contact in the circuit of key magnet 21 and prevents its actuation which would otherwise occur when relay 82 attracts armature 84. The plungers shown in Fig. 1 remain therefore locked against depression by the operator and she hence knows that the called line is busy as soon as she attempts to depress a plunger without waiting for the display of signal lamp 15, and she may therefore without delay remove the plugs of the cord circuit from the jacks of the two lines, whereby the cord apparatus is restored to normal, the calling subscriber having meanwhile for a short period heard the busy signal in his receiver.

Referring now to Fig. 16 this illustrates a key structure adapted for use in connection with Fig. 15 and includes four plungers *b*⁴, *c*⁴, *d*⁴ and *e*⁴, employed respectively in connection with generators *b*, *c*, *d* and *e* in Fig. 15. Each plunger is provided with a pivoted pawl 105 linked to lever 107. The arrangement of all the plungers being similar, that of *d*⁴ only will be particularly described. When depressed, the plunger causes springs 101 and 103 to engage respectively 102 and 104, the plunger being thereafter locked in its depressed position by the engagement of pawl 105 with pin 106 inserted in the plunger. The depressed plunger *d*⁴ remains in this position until the cord with which the key, Fig. 16, is associated is again employed in completing a call, when the operation of the listening key *L*, moves lever 107 and pawls 105 to the right so that a depressed plunger returns to normal. When key *L* is restored spring 109 carries lever 107 and pawls 105 to normal.

The cord circuit structure shown in Fig. 15 is adapted for employment in connection

with the line circuits of Figs. 7 and 12. The operator having connected answering plug contacts 9—10 with contacts 7 and 8 of the jack of the calling line, by throwing
 5 over listening cam L (Fig. 16) restores any plunger that may be depressed to normal. Learning the number of the called subscriber assumed to be D she inserts the calling plug into a multiple jack of the line con-
 10 nected to his substation and depresses the plunger d^1 which causes contacts 101—102 and 103—104 to be closed, (Figs. 15 and 16). If the called line is idle, armature 89 of relay 88 engages contact 90 to energize sleeve
 15 relay 82 whose attracted armature 85 opens circuit through 88 and locks the said relay 82 by connecting its winding to ground through the cut-off relay 6 of the called line, and whose attracted armatures 84, 82^c and
 20 82^b respectively close circuit through lamp 20 displaying it, connect generator d with tip 11 of the plug and place interrupter 87 in operative relation with relay 86 whereby said relay is alternately energized and de-
 25 energized, and by the operation of its armature, current adapted to cause the ringing of the bell of substation D is intermittently supplied to the called line. When now the called subscriber responds by removing his
 30 receiver, as soon as interrupter 87 reaches a position such that relay 86 is energized, current will flow from ground through relay 16 (whose attracted armature 18 effaces
 lamp 20 and causes energization of relay
 35 110) through the actuated armature of relay 86, armature 82^c of relay 82, armature 78 of relay 76 to the tip contact 11 of the plug, over the line returning through sleeve
 40 contact 12 and winding of relay 82 to battery. Attracted armature 114 of relay 110 disconnects relay 86 from interrupter 87 and establishes a new path through said relay
 45 86 so that its armature continues attracted. Armature 113 establishes a locking circuit for relay 110, while its armatures 111 and 112 complete the talking circuits of the tip
 50 and sleeve strands of the cord circuit respectively. When at the conclusion of conversation the subscribers replace their receivers, relays 13 and 16 become deenergized, lamps 15 and 20 are displayed, and the operator withdrawing the two plugs from the
 55 line jacks effects the deenergization of relay 14 and 82 whereby the cord circuit is restored to normal.

If the called line is busy when the calling plug of Fig. 15 is connected to its spring jack, relay 88 closes contact 89—91 to energize relay 76, of whose armatures 81 causes
 60 energization of relay 82, 79 disconnects armature 85 from the sleeve contact 12, and locks relay 76 by current to ground through the cut-off relay of the called line. Armature 78 disconnects tip contact 11 from the
 65 generator circuit to be established by ener-

gization of relay 82 and as this occurs before relay 82 is energized the existing conversation is not interrupted by generator current. Armature 80 of relay 76 connects
 70 busy machine 39 with the calling line and the subscriber in response to the signal replaces his receiver. Lamps 15 and 20 being then displaced the operator withdraws the plugs, restoring the apparatus to
 75 normal.

It is not my intention to limit myself to the particular devices and arrangements herein shown and described, as the principle of my invention is capable of varying
 80 employments, but

What I do claim and desire to secure by Letters Patent is:—

1. A telephone exchange system including a telephone line, a signal at the exchange adapted to be displayed responsive
 85 to currents over said line, a second telephone line, a plurality of substations connected therewith, operators' means for uniting said lines, apparatus connected therewith for selectively ringing a desired one of said plu-
 90 rality of substations, and means responsive to the busy condition of said second line to render said apparatus ineffective and to extend a signal.

2. A telephone exchange system including a telephone line, a signal at the exchange adapted to be displayed responsive to currents over said line, a second telephone line, a plurality of substations connected there-
 100 with, operators' means for uniting said lines, apparatus connected therewith for selectively ringing a desired one of said plurality of substations, means responsive to the busy condition of said second line to render said apparatus ineffective and to extend
 105 a signal, and means effective upon a response at a called substation to render said apparatus ineffective.

3. A telephone exchange system including party lines, operators' means for uniting
 110 said lines for conversation, apparatus associated therewith for selectively signaling the parties of said lines, and means responsive to the busy conditions of said lines to render said apparatus ineffective and to extend
 115 signals.

4. A telephone exchange system including telephone lines, a plurality of substations connected to some of said lines, multiple
 120 terminals of said lines at the exchange, signals responsive to currents over said lines, operators' link-circuits adapted for connections to said terminals, means for altering the normal electrical condition of the terminals of a line when a link-circuit is con-
 125 nected to one, party line signaling mechanism associated with said link-circuits for projecting selective signaling current over said lines, and electro-magnets for said link-circuits sensitive to the altered electrical con-
 130

ditions of said terminals to prevent the projection of said current and extend signals.

5. A telephone exchange system including telephone lines, a plurality of substations 5 connected to some of said lines, multiple terminals of said lines at the exchange, signals responsive to currents over said lines, operators' link-circuits adapted for connections to said terminals, means for altering 10 the normal electrical condition of the terminals of a line when a link-circuit is connected to one, party-line signaling mechanism associated with said link-circuits for projecting selective signaling current over 15 said lines, electro-magnets for said link-circuits sensitive to the altered electrical conditions of said terminals to prevent the projection of said current and extend signals, and electro-magnets for said link-circuits 20 controlled by responses at called substations adapted to terminate the projection of signaling current over said lines.

6. In a telephone system including telephone lines, signals therefor at the exchange, 25 and operators' link-circuits for connecting said lines; the combination, with a line, of a station connected thereto, an operator's link-circuit connected with said line rendering it busy, a second link-circuit connected with 30 said line, an operator's manually operated ringing key associated with said link-circuit, and apparatus sensitive to the connection of said first link-circuit with said line to stop said key when freed manually, in 35 non-ringing position and to extend a signal.

7. A telephone exchange system including telephone lines, a plurality of stations connected to one of said lines, a link circuit 40 having a movable terminal connected to said one of said lines, a second link circuit having a movable terminal adapted for simultaneous connection to said line, apparatus associated with said second link circuit adapted to transmit a flow of current 45 over said line when idle to selectively signal a substation thereon, and apparatus operated responsive to the connection of said first link circuit to prevent transmission of 50 said current and extend a signal when said second link circuit is connected to said line.

8. A telephone exchange system including telephone lines provided with terminals at the exchange, a plurality of substations 55 connected to some ones of said lines, a link circuit for connecting said lines adapted to be connected to said terminals, a polarized electro-magnet associated with said link circuit adapted for energization on connection 60 made with a line, apparatus controlled thereby on connection made with an idle line to establish a path for ringing current, apparatus controlled thereby on connection made with a busy line to prevent the establishment of 65 a path for ringing current and to extend a

signal, and means for establishing a current flow to selectively signal a substation of an idle line.

9. A telephone exchange system including telephone lines, a plurality of substations 70 connected to some ones of said lines, a link circuit for connecting said lines, a polarized electro-magnet associated with said link circuit adapted for energization on connection made with a line, apparatus 75 controlled thereby on connection made with an idle line to establish a path for ringing current, apparatus controlled thereby on connection made with a busy line to prevent the establishment of a path for ringing current and to extend a signal, means for establishing a current flow of predetermined character to selectively signal a substation 80 of an idle line, and apparatus actuated on the response of the called subscriber to terminate the flow of signaling current. 85

10. A telephone exchange system including a calling telephone line and a called telephone line, a plurality of stations connected to said called line, multiple terminals 90 of said lines, a link circuit connected with the calling line, a calling terminal for said circuit for connecting with a terminal of the called line, a polarized electro-magnet connected with said calling terminal adapted 95 for energization on connection of said terminal with said line, a second link circuit and terminals therefor adapted to be connected with said called line and when so connected to alter the condition of its terminals 100 to render them busy, signaling keys for said first link circuit for selectively signaling the stations of the called line, armature mechanism for said polarized electro-magnet, means for causing said 105 mechanism to assume one position when connection is made with an idle line and a second position when connection is made with a busy line, apparatus operated when said mechanism assumes the first position 110 to establish a connection to said calling terminal for the transmission of signaling current, and apparatus operated when said mechanism assumes the second position to prevent the establishment of said connection, and to connect a source of signaling 115 current with the calling line.

11. A telephone exchange system including a calling telephone line and a called telephone line, a plurality of stations connected to said called line, multiple terminals 120 of said lines, a link circuit connected with the calling line, a calling terminal for said circuit for connecting with a terminal of the called line, a polarized electro-magnet 125 connected with said calling terminal adapted for energization on connection of said terminal with said line, a second link-circuit and terminals therefor adapted to be connected with said called line and when 130

so connected to alter the condition of its terminals to render them busy, signaling keys for said first link circuit for selectively signaling the stations of the called line, armature mechanism for said polarized electro-magnet, means for causing said mechanism to assume one position when connection is made with an idle line and a second position when connection is made with a busy line, apparatus operated when said mechanism assumes the first position to establish a connection to said calling terminal for the transmission of signaling current, apparatus operated when said mechanism assumes the second position to prevent the establishment of said connection, and to connect a source of signaling current with the calling line, and an electro-magnet actuated on a response at the called substation to terminate the flow of signaling current.

12. A telephone exchange system including a calling telephone line and a called telephone line, a plurality of stations connected to said called line, multiple terminals of said lines, a link-circuit connected with the calling line, a calling terminal for said circuit for connecting with a terminal of the called line, a polarized electro-magnet connected with said calling terminal adapted for energization on connection of said terminal with said line, a second link circuit and terminals therefor adapted to be connected with said called line and when so connected to alter the condition of its terminals to render them busy, signaling keys for said first link circuit for selectively signaling the stations of the called line, armature mechanism for said polarized electro-magnet, means for causing said mechanism to assume one position when connection is made with an idle line and a second position when connection is made with a busy line, an electro-magnet energized by said mechanism when caused to assume its first position to place said signaling keys in operative relation with said calling terminal, and a second electro-magnet adapted to be energized responsive to said mechanism when caused to assume its second position to prevent the placing of said signaling keys in said operative relation and to extend a busy signal to the station of the calling line.

13. A telephone exchange system including a calling telephone line and a called telephone line, a plurality of stations connected to said called line, multiple terminals of said lines, a link-circuit connected with the calling line, a calling terminal for said circuit for connecting with a terminal of the called line, a polarized electro-magnet connected with said calling terminal adapted for energization on connection of said terminal with said line, a second link-circuit and terminals therefor adapted to be connected with said called line and when so con-

nected to alter the condition of its terminals to render them busy, signaling keys for said first link circuit for selectively signaling the stations of the called line, armature mechanism for said polarized electro-magnet, means for causing said mechanism to assume one position when connection is made with an idle line and a second position when connection is made with a busy line, an electro-magnet energized by said mechanism when caused to assume its first position to place said signaling keys in operative relation with said calling terminal, a second electro-magnet adapted to be energized responsive to said mechanism when caused to assume its second position to prevent the placing of said signaling keys in said operative relation and to extend a busy signal to the station of the calling line, and an electro-magnet actuated on a response at the called station to place said signaling keys in operative relation with said calling terminals, whereby the flow of signaling current over the called line is terminated.

14. In a telephone exchange system including telephone lines, substations connected thereto, signals at the exchange adapted for display responsive to currents over said lines, multiple terminals associated with said lines and link-circuits for interconnecting said lines, adapted for connection with said terminals to render them busy, the combination with a link circuit of party line ringing mechanism therefor comprising a plurality of keys adapted for actuation by the operator, means sensitive to the electrical condition of the called line for holding an actuated key in a ringing position to signal a called substation when connection is made with said line, and apparatus for automatically extending a busy signal to a calling substation when connection is made with a busy line.

15. In a telephone exchange system including telephone lines, substations connected thereto, signals at the exchange adapted for display responsive to currents over said lines, multiple terminals associated with said lines and link-circuits for interconnecting said lines, adapted for connection with said terminals to render them busy, the combination with a link circuit of party line ringing mechanism therefor comprising a plurality of keys adapted for actuation by the operator, means for holding an actuated key in a ringing position to signal a called substation when connection is made with an idle line, an electro-magnet for said link circuit operated on the response at the called substation adapted when operated to cause an actuated key to leave the ringing position to assume an indicating position, and apparatus for automatically extending a busy signal to a calling substation when connection is made with a busy line.

16. In a telephone exchange system including telephone lines, substations connected thereto, signals at the exchange adapted for display responsive to currents over said lines, multiple terminals associated with said lines and link-circuits for interconnecting said lines, adapted for connection with said terminals to render them busy, the combination with a link-circuit of party line ringing mechanism therefor comprising a plurality of keys adapted for actuation by the operator, means for holding an actuated key in a ringing position to signal a called substation when connection is made with an idle line, an electro-magnet for said link circuit operated on the response at the called substation, adapted when operated to cause an actuated key to leave the ringing position to assume an indicating position, means for operating said electro-magnet when connection is made with a busy line, and apparatus for automatically extending a busy signal to a calling substation when connection is made with a busy line.

17. A telephone system including a subscriber's line, a link-circuit for connection therewith, a polarized relay for said circuit at the exchange, a terminal for said line at the exchange, means for controlling said relay over a circuit including a talking contact of said line terminal and switching devices effective on operation of said relay to disconnect the same from said contact.

18. A telephone system including a telephone line having a plurality of substations, a link-circuit for connection therewith, a plurality of ringing circuits adapted for connection with said link-circuit for selectively ringing the stations of said line, multiple connection terminals of said line, a relay for said link-circuit operated over a circuit including a talking contact of a terminal of the line, and switching contacts controlled by said relay for determining the operative or inoperative relation of a ringing circuit with the line to selectively signal a station thereon.

19. A telephone system including a telephone line, a plurality of stations connected thereto, a source of signaling current, means for associating said source with said line to selectively signal a station thereof, a relay controlling the connections of said source and sensitive to currents over a circuit including a portion of the talking circuit of the line for determining the operative connection or disconnection of said source with said line, according to the idle or busy condition thereof.

20. A telephone system including a telephone line, a plurality of stations connected thereto, a source of signaling current, means for associating said source with said line to selectively signal a station thereof, a relay for controlling the connections of said

source to the line, and means for operating said relay over a circuit including a portion of the talking circuit of the line, said relay being sensitive to the idle or busy condition of said line.

21. A telephone system including a subscriber's line, multiple terminals at the exchange therefor including talking contacts, a link-circuit having an adjustable terminal including contacts for connection with said talking contacts, a plurality of stations connected with said line, and means for connecting a source of signaling current with said link-circuit to selectively signal a station of said line, and a relay controlled over a circuit including a talking contact of the line sensitive to the idle or busy condition thereof to render said means effective or ineffective.

22. A telephone system including a pair of telephone lines, a link-circuit connecting said lines, a test terminal for said link-circuit, a plurality of substations connected to the called line, apparatus for application to the called line over a connection including a portion of said link-circuit to selectively signal a station of said line, a test device connected to said test terminal sensitive to the idle or busy condition of said line, means automatically controlled by said device responsive to the busy condition of said line to prevent the application of said apparatus thereto, and responsive to the idle condition thereof to allow the effective application of said apparatus, a circuit-changing device at the exchange for causing disconnection of said apparatus from the idle called line, a normal high resistance circuit at the substations of said line preventing the actuation of said circuit-changing device when said apparatus is first connected thereto, and means controlled by the removal of a receiver at a substation to close a circuit of relatively low resistance to operate said circuit-changing device.

23. The combination with a subscriber's telephone line having multiple terminals at the exchange, of an operator's cord-circuit having a terminal for connection with said multiple terminals, a signal device associated with said cord-circuit, a polarized relay for controlling said signal device, means for operating said relay over a circuit including a contact of the connection terminal and a talking contact of a multiple terminal and electromagnetic means actuated responsive to said relay to open its circuit.

24. A telephone system including telephone lines, a link-circuit to connect with called lines, automatic ringing and busy test means for said circuit responsive to connection of said circuit with a line, a plurality of ringing keys for projecting signaling current of varying characters over called

lines, and a common magnet for controlling an actuated one of said keys, said magnet being controllable responsive to current over the called line.

25. A telephone system including telephone lines, a link-circuit to connect with called lines, automatic ringing and busy test means for said circuit responsive to connection of said circuit with a line, a plurality of ringing connections for said link-circuit, manually operable actuating devices, one for each said connection, a magnet common to said devices for controlling the position of an operated device, and means for controlling said magnet.

26. A telephone system including telephone lines, a link-circuit to connect with called lines, automatic ringing and busy test means for said circuit responsive to connection of said circuit with a line, a plurality of ringing connections for said link-circuit, manually operable actuating devices, one for each said connection, and a magnet common to said devices for controlling the position of an operated device, said magnet being controllable responsive to current over the called line.

27. A telephone system including telephone lines, a link-circuit to connect with called lines, automatic ringing and busy test means for said circuit responsive to connection of said circuit with a line, a plurality of ringing keys for projecting signaling current of varying characters over called lines, a common magnet for controlling an actuated one of said keys, and means for operating said magnet.

28. A telephone system including multiple terminal contacts, a link-circuit for connection with said contacts, a plurality of ringing keys adapted to connect signaling current of differing characters with said link-circuit, a magnet common to said keys for controlling the operative position of an actuated key, a circuit for said magnet, and means sensitive to the idle or busy condition of a contact connected with said link-circuit for determining the condition of said circuit.

29. A telephone system including multiple terminal contacts, a link-circuit for connection with said contacts, a plurality of ringing keys adapted to connect signaling current of differing characters with said link-circuit, a magnet common to said keys for controlling the operative position of an actuated key, a supervisory relay, and a manually operated switch adapted to change the connections of a contact connected with said link-circuit whereby said relay is operated to control said magnet.

30. A telephone system including multiple terminal contacts, a link-circuit for connection with said contacts, a plurality of ringing keys adapted to connect signaling current

of differing characters with said link-circuit, a magnet common to said keys for controlling the operative position of an actuated key, a circuit for said magnet, a supervisory relay for controlling said circuit, a manually operated switch adapted to change the connections of a contact connected with said link-circuit, said relay being responsive to such change to alter the electrical condition of said magnet's circuit.

31. A telephone system including telephone lines, a link-circuit having a terminal for connection with called lines, a plurality of ringing keys controlling the ringing connections of said link-circuit, a magnet common to said keys to restore an operated one, a supervisory relay for controlling said magnet, and means controlled at the substation of a called line to operate said relay for actuating said magnet.

32. A telephone system including telephone lines, a link-circuit having a terminal for connection with called lines, a plurality of ringing keys controlling the ringing connections of said link-circuit, a magnet common to said keys, mechanical connections for said magnet serving to control any actuated key, a supervisory relay for controlling said magnet, and means controlled at the substation of a called line whereby said relay is energized for actuating said magnet.

33. A telephone system comprising a called party telephone line, a link circuit connected thereto, ringing keys for connecting ringing currents of different character to said line and link circuit, a magnet common to said keys, a relay and source of direct current in bridge of said line and link circuit, a switch at the called substation of said line adapted to be closed to cause operation of said relay by said source, and circuit connections effective upon such operation whereby said magnet is operated to release any actuated key.

34. A telephone system comprising telephone lines, a link circuit for connection to said lines, ringing keys for associating different ringing currents with the calling end of said link circuit, a common magnet for said keys, a source of direct current, a relay for said link circuit, circuit connections whereby said relay is operated by said source upon response from a connected called substation, and means responsive to such relay operation whereby said magnet is operated to release an actuated one of said keys.

35. A telephone system, including telephone lines, a link circuit to connect with a called one of said lines, ringing currents, manually operated keys for causing association of any one of said currents with said line, a busy signal, automatic apparatus differently operable according to the idle or busy condition of the called line whereby

the selected ringing current is connected to said line if idle or the busy signal is connected to a strand of the link circuit if said line is busy.

36. A telephone system, comprising subscribers' lines terminating in multiply connected two contact jacks at the exchange, a link-circuit for establishing connection between the said contacts of calling and called lines, and means for automatically transmitting a busy signal to the calling party upon the connection of the link-circuit to a busy called line.

37. A telephone system, comprising subscribers' lines terminating in multiply connected two contact jacks at the exchange, a link-circuit for establishing connection between the said contacts of calling and called lines, and automatic apparatus differently operable according to the idle or busy condition of the called line whereby ringing current is connected to said line or a characteristic busy signal is connected to a link circuit strand according to such idle or busy condition.

38. A telephone system comprising subscribers' lines terminating in multiply connected two contact terminals at the exchange, a link circuit for establishing connection between the said contacts of calling and called lines, and apparatus differently operable according to the idle or busy condition of the called line to automatically connect ringing current to said line or transmit a characteristic busy signal to the calling substation according to such idle or busy condition.

39. A telephone system comprising subscribers' lines terminating in multiply connected two contact jacks at the exchange, an operator controlled link circuit for interchangeably establishing connections between said contacts of calling and called lines, and apparatus differently operable according to the idle or busy condition of the called line connected with to connect ringing current to said line or transmit a characteristic busy signal to the calling substation according to such idle or busy condition.

40. A telephone system comprising subscribers' lines terminating in multiply connected two contact jacks at the exchange,

some of said lines having a plurality of substations connected therewith, a link circuit for establishing connection between said contacts of calling and called lines, ringing currents for selectively signaling such substations, means for associating any one of said currents with the link circuit, and apparatus differently operable according to the idle or busy condition of the called line to connect the associated ringing current to said line or transmit a characteristic busy signal to the calling line according to such idle or busy condition.

41. A telephone system comprising subscribers' lines terminating in multiply connected two contact jacks at the exchange, a link circuit for establishing connections between the said contacts of calling and called lines, signals for each of said line circuits, apparatus operated responsive to connection made with an idle line to selectively operate one of said signals, and automatic means for transmitting a busy signal upon connection to a busy line.

42. A telephone system including party lines, a link circuit having connecting plugs for connection thereto, means for selectively ringing a desired substation on one of said lines, said means being ineffective if said line is busy upon connection made therewith, and means responsive to the busy condition of said called line to extend a busy signal if said means is ineffective.

43. A telephone system comprising subscribers' lines terminating in multiply connected two-contact jacks at the exchange, a link circuit for establishing connection between the said contacts of calling and called lines, signals for each of said line circuits, apparatus for selectively operating said signals, said apparatus being responsive to connection made with an idle line, and automatic means for transmitting a busy signal upon connection to a busy line.

In witness whereof, I hereunto subscribe my name this 17th day of March, 1906.

ALFRED H. DYSON.

Witnesses:

H. C. OLMSTEAD,
L. O. KELLOGG.

Correction in Letters Patent No. 1,208,718.

It is hereby certified that in Letters Patent No. 1,208,718, granted December 12, 1916, upon the application of Alfred H. Dyson, of Chicago, Illinois, for an improvement in "Telephone Systems," an error appears in the printed specification requiring correction as follows: Page 13, after line 96, insert the following claim:

44. *A telephone system including a telephone line, a plurality of stations connected thereto, a source of signaling current, means for associating said source with said line to selectively signal a station thereof, a relay controlling the connections of said source and sensitive to currents over a circuit including a portion of the talking circuit of the line for preventing the operative connection of said source with a busy line and for permitting the operative connection of said source with an idle line, according to the busy or idle condition of the line.;*

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23d day of January, A. D., 1917.

[SEAL.]

F. W. H. CLAY,

Acting Commissioner of Patents.

Cl. 179 35.