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W. W. DEAN.

TELEPHONIC MEASURED SERVICE SYSTEM.

(Application filed Nov. 16, 1897.)

(No Model.)

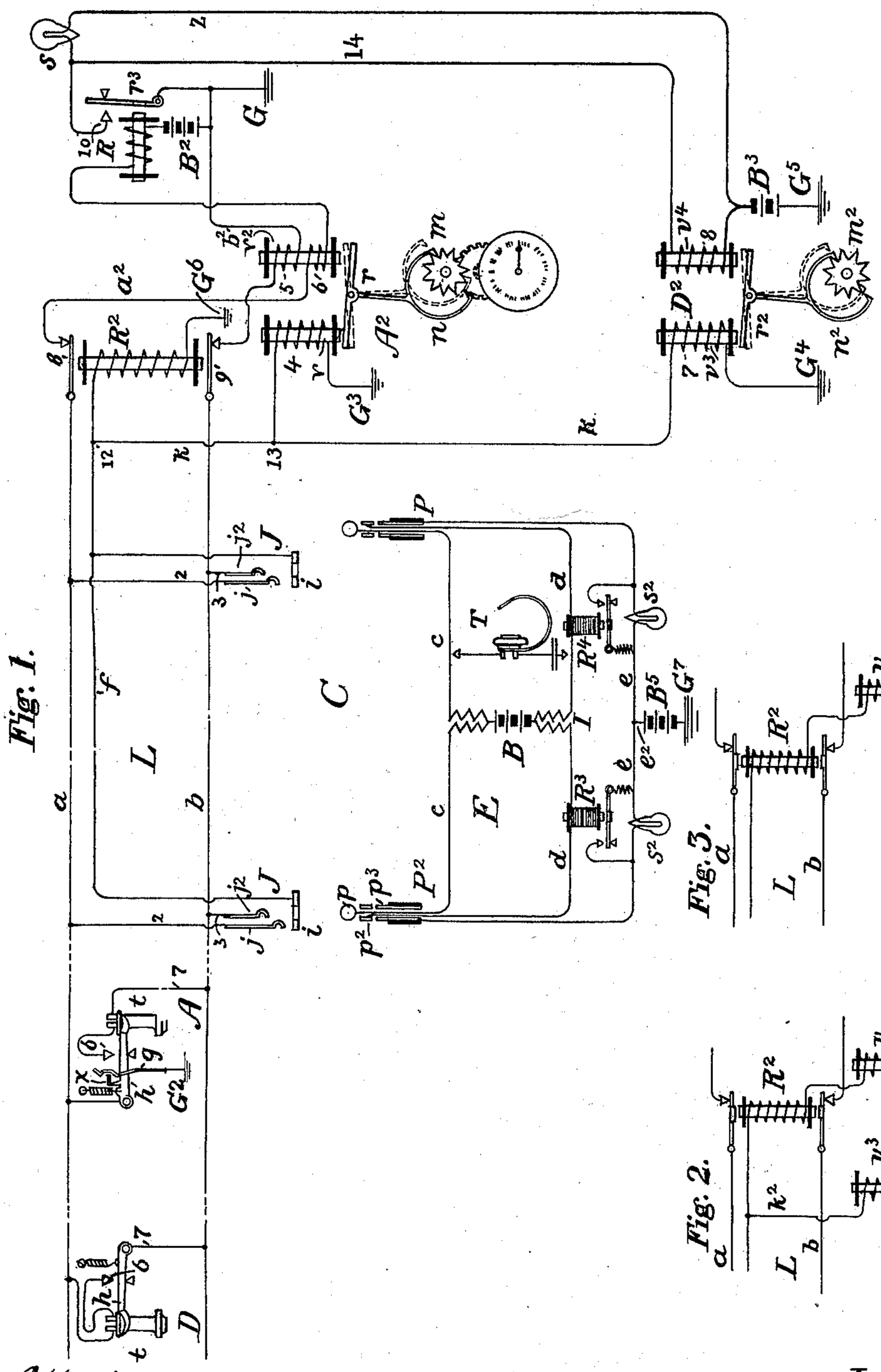

Fig. 1.

Fig. 3.

Fig. 2.

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TELEPHONIC MEASURED-SERVICE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 609,331, dated August 16, 1898.

Application filed November 16, 1897. Serial No. 658,679. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Telephonic Measured-Service Systems, of which the following is a specification.

This invention relates to the measurement of telephone-service, and is applicable to telephone-exchanges which have adopted the measured-service system of charging, and especially to such circuits of exchanges which being arranged to serve two subscribers' stations are frequently termed "two-party lines."

Its object is the provision of efficient and suitable means whereby all calls for connections sent in by either substation of such a circuit and answered by the operator at the central station may be automatically registered by appropriate registering mechanism placed at the said central station, it being, however, provided that calls transmitted from the substations which for any reason remain unanswered by the central-station operator shall not be registered, counted, or charged for, and that the use of the circuits and apparatus by the called or wanted substation forming the second party in a communication, and, indeed, the use thereof consequent on the reception of any incoming message, shall not establish the conditions requisite to the operation of either of the registers of such circuit.

In Letters Patent No. 586,685, granted to Hammond Vinton Hayes July 20, 1897, is disclosed a measured-service system of recording matured calls comprising a call-registering mechanism placed at the central station in association with the circuit of the subscriber whose business is to be registered and such an arrangement of the substation and central-station signaling and answering apparatus and circuit connections that the said measuring mechanism can be made operative to register service to be charged for only by the orderly performance of the complete cycle of operations resulting when two successive current impulses are caused to traverse the main circuit, the first due to the action of the subscriber in sending the call and the second due to the action of the central-station operator in answering it. Thus to register a charge the conjoint action of the customer and operator is requisite, and neither customer nor operator is afforded any opportunity to produce an erroneous or falsified record by an improper manipulation of the apparatus.

In Letters Patent of the United States No. 589,431, granted to Hammond V. Hayes and Thomas C. Wales jointly, is described means for applying a similar mode of operation to "party-lines" having two or more stations for the purpose of counting the answered calls of the several stations individually. It is, however, therein provided that a toll or call-registering appliance or mechanism shall be placed at each substation to register the calls of such station and of no other.

My present invention retains the same general principles of operation as are involved in the said two patents, but dispenses with the necessity of placing a counting apparatus at each substation, it being as a rule desirable that such apparatus shall be located at the central station.

It consists in the combination, with a two-party main telephone-circuit, of means or mechanism associated with such circuit and located at the central station, which means is actuated by the conjoint operation of sending the call and answering the same and is adapted to distinguish between the calls sent by the two substations respectively, so that the answered calls of the substations may discriminatively be counted, registered, and properly apportioned between the said stations, each being debited with those only which were initiated by it.

It also consists in combining a two-party main telephone-circuit with two call-registering or call-counting mechanisms placed at the central station and each operated to produce a record only when their electromagnets are excited by two successive current impulses, one of which is consequent upon action occurring at the substation in sending a call-signal and the other upon action occurring

at the central station in response to such call, the calls of one substation being counted and indicated directly by its corresponding registering mechanism, while the calls of both are counted and registered by the other registering mechanism, so that the number of calls attributable to the second substation can readily be determined by a comparative examination of the record of both registers.

In the drawings accompanying and illustrating this application, Figure 1 is a diagram of a two-party telephone-exchange circuit extended between the substations thereof and a central station and so much of its appropriate switching and signaling apparatus as is related to this invention, together with call-registering mechanism at the central station. Figs. 2 and 3 are modified plans for the electromagnet connections of the registering apparatus.

In the figures, L is a two-party telephone-circuit, A and D are subscribers' stations connected therewith, and C is the central station. The arrangement of the circuit and its switching devices generally is well known. As shown, the main conductors *a* and *b* thereof are electrically separated at the substations while the line is not in use and the telephones *t* in place on their respective switch-hooks *h;* but when the telephone at either station is raised from its switch-hook the circuit is closed at such station at the switch-contact 6 through the bridge 7, wherein the telephone is connected.

R is the call-signal relay, *s* the signal-lamp controlled thereby, and R^2 the cut-off relay. The main circuit L, entering the central station, is normally closed at the circuit-closing points 8 and 9 of the latter relay R^2, continuing from point 8 by wire a^2 through the winding of the line-relay R and the signal-current battery B^2, and thence by wire b^2 to point 9.

E is a switch-cord connection, of which each operator is provided with a number, and has switch-plugs P P^2, one at either end, each having three switch-contacts p p^2 p^3, the tip-contacts p of the two plugs being united by the cord-strand *c*, the front sleeve-contacts p^2 by the strand *d*, and the rearward sleeve-contacts p^3 by the strand *e*.

A transmitter and signal-current battery B and induction-coil I, as usual, are bridged between the strands *c* and *d*, and the latter has supervisory signal-relays R^3 R^4 in its circuit, one on each side of the bridge end, adapted to control by means of shunt-circuits their respective lamp-signals s^2, which are in the circuit of the third strand *e*.

T is the operator's telephone, which at will may be connected in a manner well understood with any pair of cords. From the center of the said third strand a branch e^2 connects with an earth connection at G^7 through a battery B^5, supplying current for the busy test and cut-off relay R^2.

It will be evident that when the plugs P P^2 are placed in the sockets J of any line the talking-circuit of such line is closed between the socket contact-springs j j^2, which connect by branches 2 and 3 with the main conductors *a* and *b* and the corresponding plug-contacts p p^2, and that the circuit of the battery B^5 is closed at the remaining socket and plug contacts *i* and p^3, so that the current of the said battery is enabled to flow therein through a path traceable from ground G^7, through the battery B^5, the branch e^2, the strand *e* of the cord E, the plug-contact p^3, the switch socket-ring *i*, the branch 3 and wire *f*, and helix of relay R^2 to ground at G^6.

The sending of a call from the substation by lifting up the telephone closing the main circuit L excites the relay R, which attracts its armature and closes the local circuit *z* between G and G^5 at the point 10, permitting current from the battery B^3 to flow through and illumine the lamp call-signal *s*.

When the operator in response to a call places a plug, say P, in the socket J to answer by means of the telephone T, the cut-off relay opens the main circuit at the points 8 and 9 and the lamp-signal disappears.

A^2 and D^2 represent call counting and registering mechanisms, which for their operation require the passage through their magnet-coils of two successive current impulses, the first due to the substation act of sending the call and the second contingent upon the central-station act of answering it. These mechanisms may in form and general character be similar to those described by Letters Patent Nos. 586,685 and 589,431, to which I have hereinbefore referred, the precise form being immaterial, provided the electrical arrangement and mode of operation are substantially as described herein. The registering mechanism A^2 belongs to substation A and the mechanism D^2 belongs to substation D. As shown, both are provided with two electromagnetic spools, each inclosing a suitable core, and with an armature hung centrally or in such manner as to be capable of oscillating between the poles, as one or the other exercises attraction upon it.

The register A^2 has a single winding 4 on its spool *v* and two windings 5 and 6, differentially disposed, on its spool v^2.

The register D^2 has one winding 7 on its spool v^3 and one winding 8 on its spool v^4.

A conductor *k* extends from a point 12 on the associate conductor *f* of the main circuit L, dividing at 13 into two branches, one leading through the magnet-winding 4 of register A^2 and the other through winding 7 of register D^2 to earth at G^3 and G^4, respectively. The two differentially-disposed windings 5 and 6 of spool v^2 of this register A^2 are in series, but opposed to one another in the main circuit extension a^2 b^2, as shown.

The winding 8 on spool v^4 of register D^2 is, together with its exciting-battery B^3, con-

tained in a branch circuit extending between the earth connections G and G^5 by way of the armature r^3 of relay R, its circuit-closing points 10, and conductor 14. The armature r^3 and its ground connection G are common to the local circuit of battery B^3 and the local circuit z of the signal-lamp s, and the said armature is thus adapted to control both of the said local circuits.

The mechanical parts of the registering mechanisms A^2 and D^2 may be alike and are indicated conventionally by the star-wheels m and m^2, the register A^2 showing also the connecting-gears and indicating-dial. The said star-wheels are of course adapted to be engaged and actuated step by step, two steps to the registration of each call, as the anchor and pallets n and n^2 oscillate with their respective armatures. In each registering mechanism the normal position of the armature is that indicated in solid lines.

When substation D calls the central station, the receiving-telephone is taken from the hook and the main circuit closed, as hereinbefore described, the relay R being thus enabled to attract its armature, whereby the local circuit z is closed at the points 10. It is manifest that this action of the said relay likewise closes the battery B^3 through the local circuit 14, which circuit includes magnet-winding 8 of the registering mechanism D^2. The magnet v^4 is thus excited and the armature r^2 thereof is attracted into the dotted-line position, acting, through its anchor and pallets n^2, upon the star-wheel m^2 and effectuating the first step in the two-step operation required to enable the register to record or indicate a call.

The helices 5 and 6 of magnet v^2 of registering mechanism A^2 are, it is true, both in the main circuit L, and the main current of battery B^2 passes through them. Since, however, they act differentially and oppose one another, no magnetic effect ensues, and the armature r retains its normal position, the entire apparatus remaining unaffected. The first step of registration is therefore made in the registsring mechanism D^2, representing station D alone.

When the operator observing the display of the line-signal s inserts a plug P in the socket J, and thus closes the test and cut-off-relay circuit through the relay R^2, the derived circuit through the conductor k and its branches is likewise established and receives current from the cord-battery B^5 by way of the associate f and point 12. The current thus caused to traverse the conductor k splits at 13, part going to the ground G^3 through magnet v of register A^2 and part to ground G^4 through magnet v^3 of register D^2. No result follows in register A^2, since its armature r is in its normal position—that is to say, attracted toward the magnet v—but the armature r^2, having previously oscillated to its dotted-line position close to magnet v^4, is now drawn back by the attraction of magnet v^3 to its normal position, thus making the second step of the registering operation. The answered call of substation D is thereby counted and registered by the corresponding registering mechanism D^2, while no record or count is made by the mechanism A^2. Substation D alone is charged with the service.

When substation A desires to communicate through the central station with some other line, this is done in the same way by taking the receiver from its hook, and the call-signal is received and answered at the central station also in the same way as are calls from station D. The call-counting operation is, however, different.

Referring to the apparatus at substation A, there is provided, in connection with the switch-hook h, a spring-contact g, having a ground connection G^2. This is so placed that the projecting contact x of the said switch will graze it as the switch h passes upward under the pull of its counter-spring when freed from the weight of the telephone. By this means a connection is transiently made between the main conductor a and the earth whenever the subscriber takes up his telephone for use. The grounded circuit thus established is traceable from earth G^2 by way of spring g, projection x, switch h, main conductor a, relay-contact 8, conductor a^2, winding 6 of magnet v^2, relay R, and battery B^2 to earth G. It therefore contains the winding 6, but not the opposing winding 5, of magnet v^2. The said magnet is consequently excited and attracts its end of the armature r, which oscillates, imparting the requisite first step in the call-counting operation to the registering mechanism A^2.

When the call is answered by the insertion of the plug P, as hereinbefore indicated, a current from battery B^5 traverses the magnet-coil 4 of magnet v of register A^2, exciting the said magnet, bringing its armature r back to the normal position, thus making the second necessary step, and counting or recording the call. It is to be observed that when on the call of A the line-relay R is operated and its armature attracted to display the signal s the local circuit of battery b^3, which contains the winding 8 of magnet v^4 of register D^2, is also closed. The said magnet is of course excited and necessarily performs at D^2 the first step in a duplicate registration of the call of A, and when the operator answers the said call of A the magnet v^3 of register D^2, being excited simultaneously with magnet v of register A^2, in the same way performs the second step of the registration of A's call in duplicate. So it happens that while registering mechanism A^2 counts and records the calls of substation A alone the registering mechanism D^2 counts and records the calls of both substations A and D, or, in other words, D^2 records all of the answered calls of the circuit.

It is evident, however, that the number of calls initiated by station A being positively known by the record of register A^2 the number initiated by station D can readily be ascertained by noting the difference between the readings of the two registers. For example, A sends twenty calls and indicates twenty on register A^2, while D sends, say, thirty calls and records on its own account thirty calls on register D^2; but the register D^2 also counts and indicates the calls of A, and therefore gives a total reading of fifty calls, and the difference between fifty and twenty being thirty it is obvious that thirty is the correct record of station D.

Outgoing calls—those sent by the central station for a wanted substation—cannot of course have any effect on the registering mechanism described herein, for the reason that the register magnet-armatures are all normally attracted to the magnet v or v^3, whose circuit is closed by the insertion of the plug. Thus though the circuits of the said magnets of called lines become closed and their magnets excited no movement of the armature can result and no record will be made.

Of course the system can be modified in a variety of ways without departing from the spirit of the invention. Especially is this so with respect to the relative arrangement of the electromagnets of the relay R^2 and the magnets v v^3 of the registers A^2 and D^2. For example, I may, as in Fig. 2, connect magnet v in series with that of relay R^2 and magnet v^3 in an independent parallel branch k^2, or reversely, or, as in Fig. 3, I may place both v and v^3 in series with R^2. Other arrangements will doubtless suggest themselves to those skilled in the art to which this invention relates.

It is of course to be understood that many of the earth connections mentioned herein as such may, if desired, be return-conductors. For example, a return-conductor may be extended between the point G^7 and the three points G^3, G^4, and G^6, and, again, from the point G to the point G^5.

I claim as my invention—

1. The combination in a telephone-exchange system of a subscriber's circuit connecting two substations with a central station, call-sending devices at the substations, call-answering devices at the central station, and two call-registering mechanisms associated with said circuit at the central station, actuated by the normal operation, successively of the call-sending devices of either substation and the central call-answering devices, for discriminatively counting and registering the calls of the said substations, substantially as set forth.

2. The combination in a telephone system of an exchange-circuit having two substations and extending to a central station, call-sending devices at the substations; call-answering devices at the central station; with two associated call counting or registering mechanisms placed at the central station, one adapted to count and register the answered calls of one of the said substations, and the other to count and register the answered calls of both substations, whereby the number of matured calls chargeable to each substation severally can readily be determined; substantially as described.

3. In a telephone-exchange system, the combination of a main telephone-circuit; two substations and a central station connected therewith; call-signal-transmitting devices at the said substations; call-signal-answering devices at the central station; two call-registering mechanisms representing the two substations respectively, associated with the said main circuit and each having two actuating-electromagnets and being organized to count and record a call only when their said magnets are excited by two successive current impulses, one consequent on the operation of the substation-call-transmitting devices, and the other consequent on the operation of the central-station-answering devices, and connections whereby one of said actuating-electromagnets of one registering mechanism only is energized to attract its armature when the call-transmitting device of one station is operated, and an electromagnet in each of the registering mechanisms is energized to attract its armature when the call-transmitting device of the other station is operated, the said registering mechanisms being respectively adapted to count and indicate the calls of their corresponding substations, one directly and the other comparatively, substantially as and for the purposes set forth.

4. The combination in a telephone system, of a metallic main circuit connecting two substations with a central station; a grounded circuit extending between one of the said substations and the central station and having for its main line one of the conductors of the said metallic circuit; a call-signal-receiving relay at the central station included in both of the said circuits, means at the two substations for closing the said two circuits respectively by the act of transmitting a call-signal; call-answering switch devices at the said central station; two local circuits at the central station, one controlled by the said call-receiving relay, and the other by the said call-answering switch devices; two call-registering mechanisms representing the substations respectively, each having two actuating-electromagnets, one magnet of each being in the local circuit controlled by the call-answering devices, the remaining magnet of one, being in the said two main circuits, but operatively in the grounded circuit only, and the remaining magnet of the other being in the relay-controlled local circuit; whereby

the registering mechanism having the main line-magnet is enabled to register the calls of one of the substations, while that having the relay-controlled magnet is enabled to register the calls of both substations; substantially as specified.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 9th day of November, 1897.

WILLIAM W. DEAN.

Witnesses:
GEO. WILLIS PIERCE,
JOSEPH A. GATELY.