E. E. HINRICHSEN.

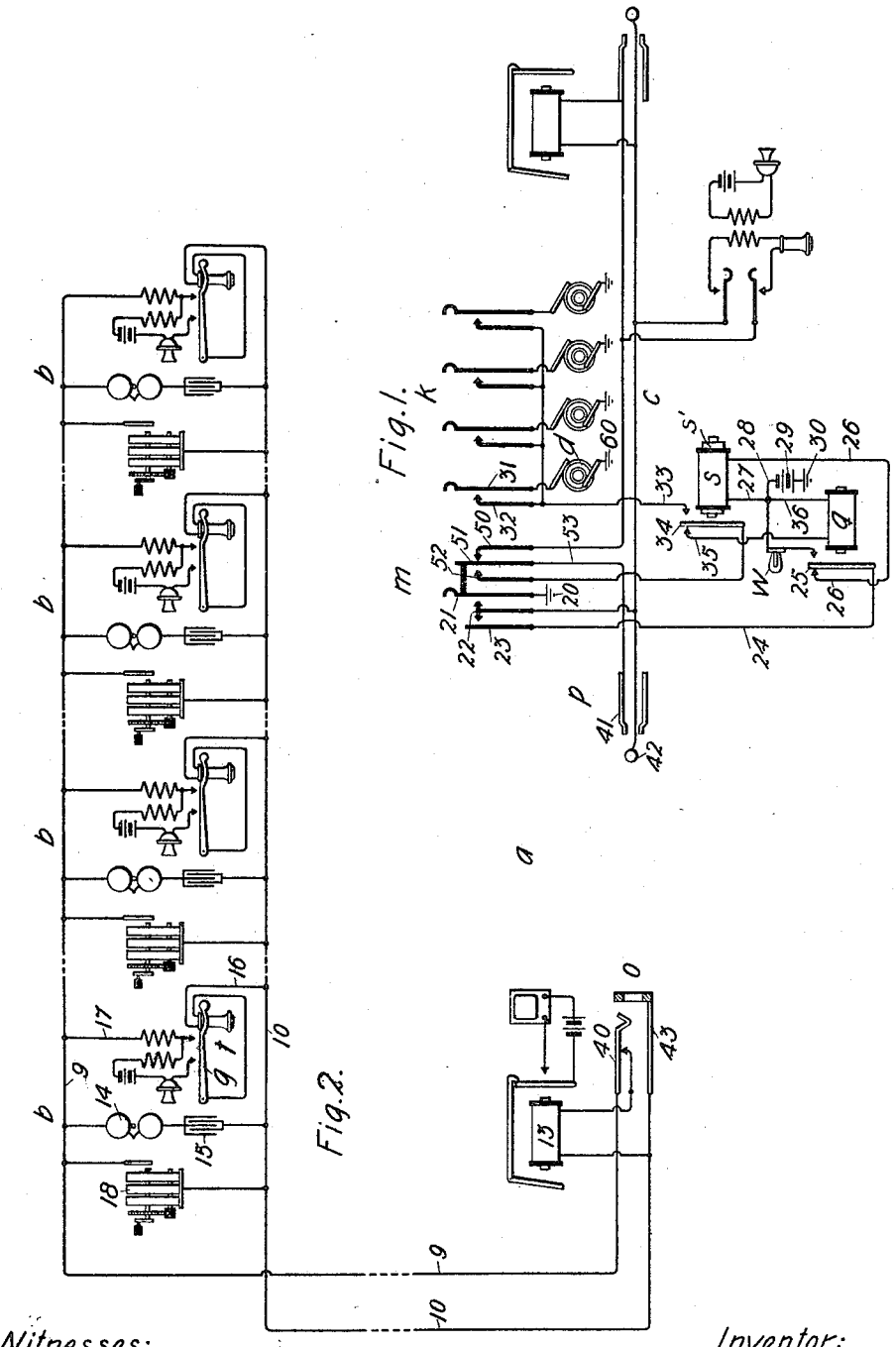
TELEPHONE EXCHANGE APPARATUS.

APPLICATION FILED NOV. 30, 1910.

1,127,889.

Patented Feb. 9, 1915.

2 SHEETS--SHEET 1.



Witnesses:
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Herbert L. Clark

Inventor:
Edward E. Hinrichsen.
by D. C. Bennet, Atty.

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

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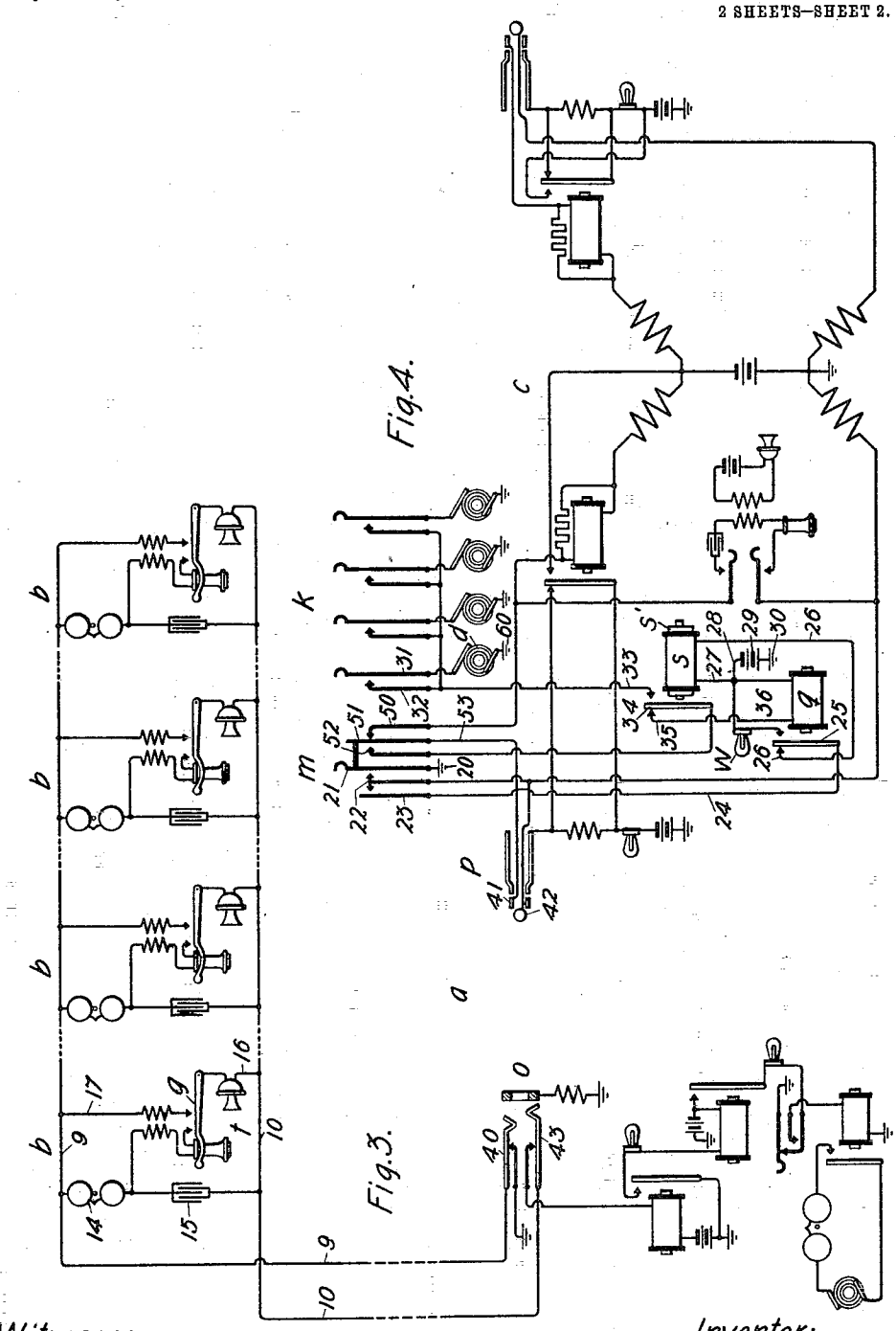
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UNITED STATES PATENT OFFICE.

EDWARD E. HINRICHSEN, OF ALEXANDER, ILLINOIS, ASSIGNOR TO WESTERN ELECTRIC COMPANY, OF NEW YORK, N. Y., A CORPORATION OF ILLINOIS.

TELEPHONE-EXCHANGE APPARATUS.

1,127,889. Specification of Letters Patent. Patented Feb. 9, 1915.

Application filed November 30, 1910. Serial No. 594,899.

To all whom it may concern:

Be it known that I, EDWARD E. HINRICHSEN, citizen of the United States, residing at Alexander, in the county of Morgan and State of Illinois, have invented a certain new and useful Improvement in Telephone-Exchange Apparatus, of which the following is a full, clear, concise, and exact description.

This invention is an improvement in telephone exchange apparatus and its object is to prevent a central station operator from ringing on a substation line while the substation telephone is in use.

The invention includes the use of a circuit connecting the exchange with one or more substations. At each substation there is a telephone set including a gravity switch, and a branch circuit containing a bell in series with a condenser. The circuit is therefore normally open to direct current. At the exchange there is a source of ringing current including one or more generators each developing a characteristic series of short and rapidly recurring current impulses, preferably reverse impulses, and there is a ringing key for impressing ringing current upon the line. The improvement includes means whereby when this key is closed and a telephone at the substation is off the hook the circuit between the ringing generator and the line is broken. This means consists of an electromagnetic switch operated by the described key and a branch circuit, and a second electromagnetic switch in the circuit of the coil of the electromagnet first referred to. This second magnet is in a circuit controlled by the gravity switch hook at the substation and by the first named electromagnetic switch and key. When the ringing key is closed and the gravity switch has been operated to close the circuit at the substation, circuits are closed through both magnet coils by the operation of the key, but the magnets are so constructed that one operates slightly in advance of the other. The break points controlled by the slow-acting magnet are in series with the key, and the break points controlled by the quick-acting magnet are in series with the coil of the slow-acting magnet. It therefore results that the key when operated closes a branch circuit through the slow-acting magnet and directs ringing current to line, provided the substation is in its normal condition. If, however, circuit is closed through a telephone at the substation, circuit is closed simultaneously by the operation of the key through the quick-acting magnet which operates in advance of the slow-acting magnet to break circuit through the coil of the slow-acting magnet so that the key and generator circuit is held open at the break point by the slow-acting magnet.

In the accompanying drawings—Figure 1 shows the cord circuit at a telephone exchange arranged for signaling on a party line having four substations; Fig. 2 shows the usual arrangement at the four substations, together with the circuit terminating at the switchboard of the exchange; Fig. 3 shows the substation and line circuit arranged for use with the common battery located at the exchange, and Fig. 4 shows the cord circuit of a well known common battery type at the exchange.

Referring to Figs. 1 and 2 there is the central exchange *a* and the series of substations *b* united by a metallic circuit 9, 10. At each substation of the series *b* there is a magneto electric ringing generator 18 in a normally open branch, and a vibratory bell 14 in a parallel branch in series with a condenser 15; there is a pivoted switch arm *g* operated by the influence of the telephone *t* in a normally open branch 16, 17. The circuit at this station is normally open to direct current. When the telephone *t* is raised the branch 16, 17 is closed. The circuit 9, 10 terminates in the springjack *o* which includes contacts 40, 43. The annunciator 13 is in a normally closed branch. The plug *p* has contacts 41, 42 forming the terminals of the conductors in the cord circuits *c*. For ringing there are shown four generators *d*, preferably alternating current generators of respectively different frequency, and a key *k* having multiple contacts, one for each of the generators *d*. Each contact of the described key is independently and mechanically connected with the series of contacts *m*, substantially as shown in the patent to McBerty, No. 776,413, dated November 29, 1904. The magnet *s* is a slow-acting magnet. It is preferred to locate a close fitting copper tube *s'* upon the core to retard its action. Magnet *q* is, therefore, comparatively quick-acting as compared with magnet *s*. When key *k* is operated a ringing circuit is closed

at one of two break points in said circuit and whether or not it is closed by the same movement at the second break point depends on whether or not telephone *t* is off the switch arm *g*. Let us trace the circuit for ringing currents referred to:—from ground at 60 via elements *d*, 31, 32, 33, 34, 52, 51, 53, 41, 43, 10, 15, 14, 9, 40, 42, 22, 21 to ground at 20, but this circuit is held open at the electromagnetic switch contacts 33, 34. When key *k* was operated a branch circuit was also closed in addition to that just described; this is traced as follows:—from ground at 20 via elements 21, 22, 23, 24, 25, 26, *s*, 27, 28, 29 to 30. Magnet *s* responds, break points 33, 34 are closed, and the ringing current is established in the circuit first traced. Let us suppose that when key *k* is operated telephone *t* is off the gravity arm *g* and the circuit at the substation is closed for direct current; this circuit is traced as follows:—from 30 via elements 29, 28, 36, *q*, 35, 34, 52, 51, 53, 41, 43, 10, 16, *t*, 17, 9, 40, 42, 22 to ground 20. Magnet *q* responds and although circuits have been simultaneously completed through coils of *s* and *q*, the magnet *q* acts quicker than magnet *s* and breaks circuit through the coil of magnet *s* at 25, 26, before magnet *s* can respond. When circuit is completed through the coil of magnet *q* a lamp or indicating device *w* in circuit with contacts controlled by magnet *q* indicates to the operator the condition of the substation circuit.

The improvement has been described by reference to a magneto call substation circuit and exchange apparatus. In Figs. 3 and 4 the circuits and apparatus characteristic of a common battery or central energy supply and substation circuit are conventionally represented, all well known; and this improvement is shown applied to such a system substantially as described with reference to Figs. 1 and 2.

What I claim is:—

1. In a telephone exchange, a normally open substation circuit; means for signaling a substation, including a source of rapidly recurring current impulses; a telephone switch and circuit connections at the substation arranged to close the circuit; a slow-acting electromagnetic switch at the exchange and a circuit therefor; a key and circuit connections to close said circuit through said magnet and direct ringing current to line; a quick-acting electromagnetic switch at the exchange and a circuit therefor; means whereby closing the circuit at the substation and said key at the exchange operate said quick-acting magnet; and means whereby said quick-acting magnet controls the ringing current.

2. In a telephone exchange, a normally open substation circuit; means for signaling a substation, including a source of rapidly recurring current impulses; a telephone switch and circuit connections at the substation arranged to close the circuit; a slow-acting electromagnetic switch at the exchange and a circuit therefor; a key and circuit connections to close said circuit through said electromagnetic switch and direct ringing current to line; a quick-acting electromagnetic switch at the exchange and a circuit therefor; means whereby closing the circuit at the substation and said key at the exchange operate said quick acting magnet; and means whereby said quick-acting magnet holds the key circuit open.

3. In a telephone exchange, a normally open substation circuit; means for signaling a substation, including a source of rapidly recurring current impulses; a telephone switch and circuit connections at the substation arranged to close the circuit; a slow-acting electromagnetic switch at the exchange and a circuit therefor; a key and circuit connections to close said circuit through said electromagnetic switch and direct ringing current to line; a quick-acting electromagnetic switch at the exchange and a circuit therefor; means whereby closing the circuit at the substation and said key at the exchange operate said quick acting magnet; and means whereby said quick-acting magnet prevents ringing in the substation telephone.

4. In a telephone exchange, a substation circuit normally open to direct current; an alternating current ringing generator at the exchange; a circuit closing switch at the substation operated by the influence of the telephone; a switch in said ringing generator circuit; a magnet controlling said switch; a circuit for said magnet; a second switch and a circuit therefor in said first named magnet circuit; a multiple contact ringing key controlling the ringing current and the circuits of both said magnets; and means whereby one of said magnets operates in advance of the other in response to key movement when circuit is closed at the substation.

5. In a telephone exchange, the combination of a ringing generator supplying rapidly recurring electric impulses at the exchange; a substation circuit normally open to direct current; means for closing said circuit at the substation; an electromagnetic switch in the ringing circuit and a controlling circuit therefor; an electromagnetic switch in said controlling circuit of said switch; a ringing key controlling the first named switch; and means whereby closing circuit at the substation and closing said key at the exchange operates one of said switches in advance of the other and prevents ringing in said circuit.

6. In a telephone exchange, a substation circuit normally open to direct current at

the substation; and at the exchange a ringing generator, a normally open switch contact in the generator circuit, a magnet and circuit for controlling said switch; a normally closed switch contact in the circuit of said magnet; a magnet and circuit for controlling said switch; a multiple contact ringing key simultaneously operating switch contacts in the ringing generator circuit, in the circuit of the first named magnet and in the circuit of the second named magnet, means at the exchange for closing the normally open circuit; and means for indicating the closure of the circuit at the substation.

7. In a telephone exchange, the combination of a substation circuit normally open to direct current, a switch for closing said circuit at the substation, a key at the exchange for applying ringing current to said circuit, and means controlled by the conjoint action of said substation switch and said key, whereby the application of said ringing current to said circuit is prevented.

8. In a telephone exchange, the combination with a substation circuit normally open to direct current, a switch at said substation for closing said circuit, a key at the central station for applying ringing current to the line, and electromagnetic switching means operated by the ringing key when the substation circuit is closed to prevent application of ringing current to the line.

In witness whereof, I, hereunto subscribe my name this 28th day of November A. D., 1910.

EDWARD E. HINRICHSEN.

Witnesses:

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MORGAN WASHBURN, Jr.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."