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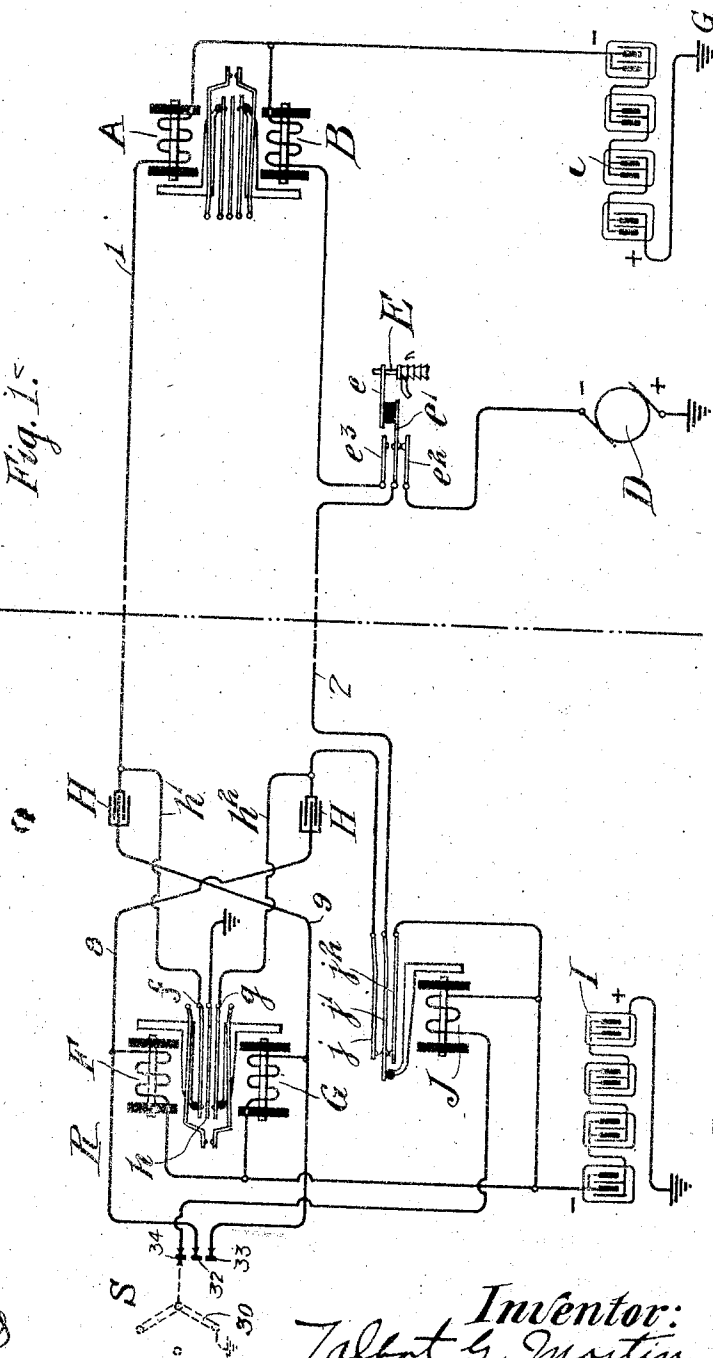
T. G. MARTIN.

MEANS FOR CHARGING STORAGE BATTERIES OF TELEPHONE SYSTEMS.

APPLICATION FILED FEB. 3, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses.

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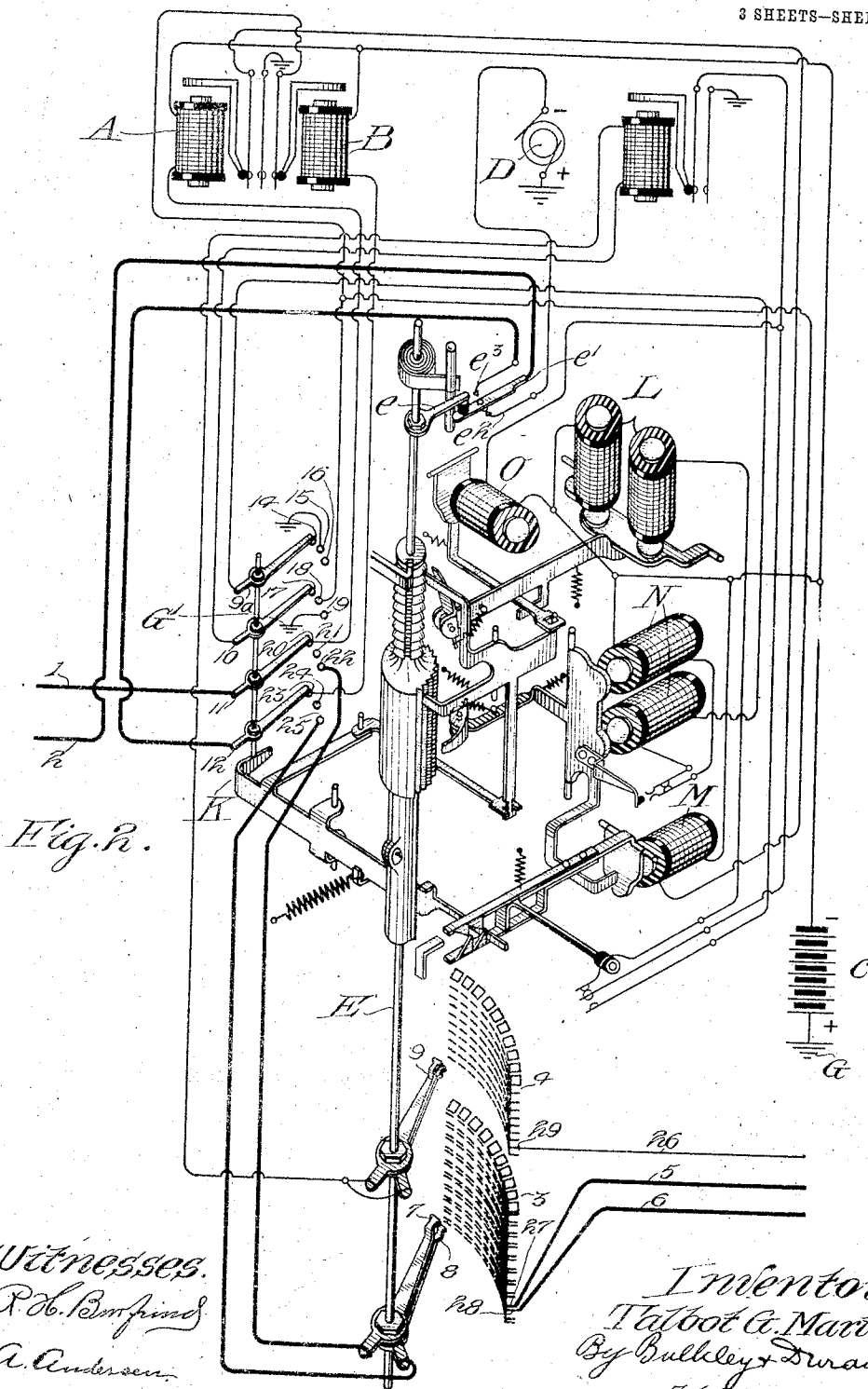
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3 SHEETS—SHEET 2.



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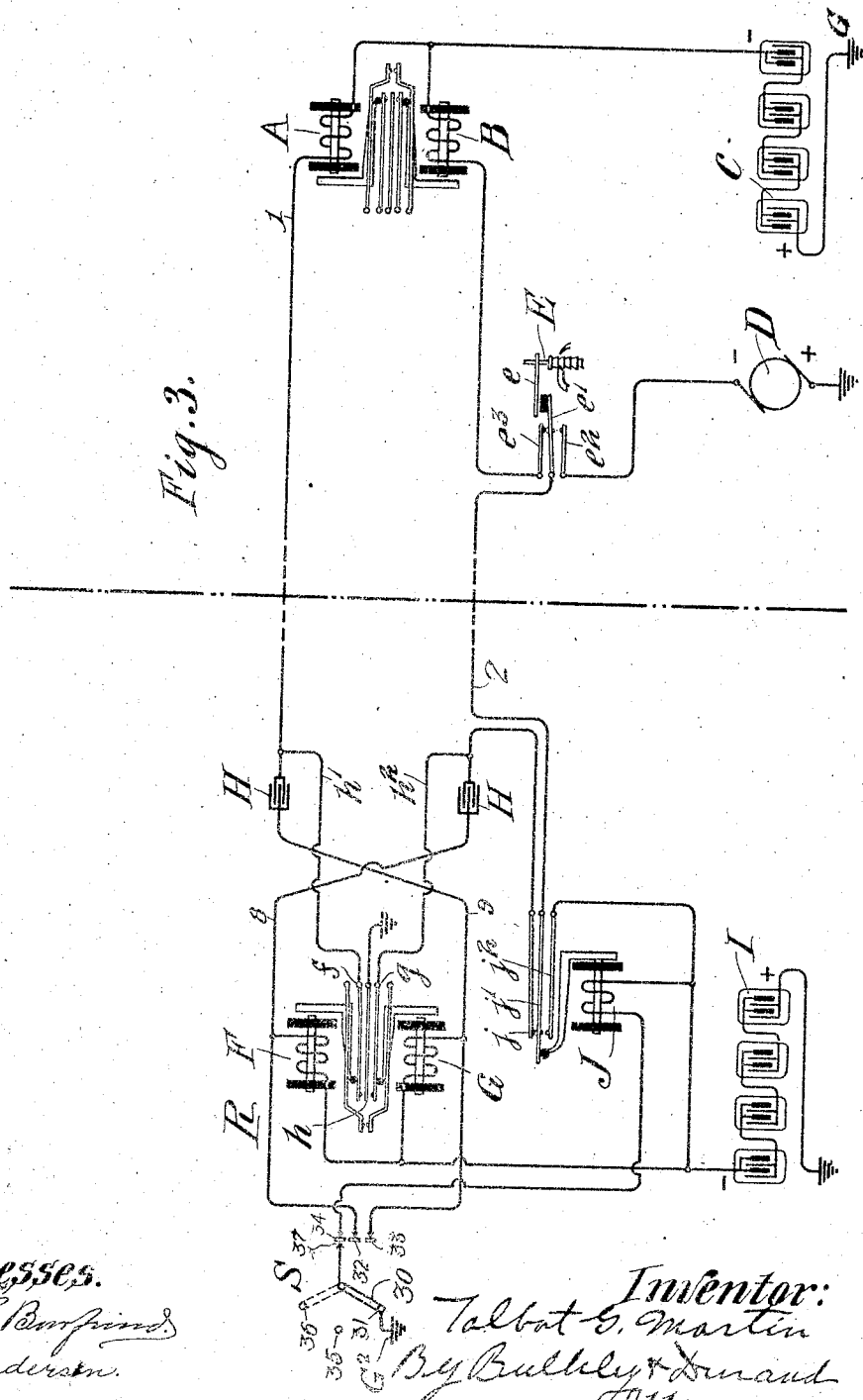
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3 SHEETS—SHEET 3.

Fig. 3.



Witnesses.

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UNITED STATES PATENT OFFICE.

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MEANS FOR CHARGING STORAGE BATTERIES OF TELEPHONE SYSTEMS.

No. 834,832.

Specification of Letters Patent.

Patented Oct. 30, 1906.

Application filed February 3, 1905. Serial No. 243,950

To all whom it may concern:

Be it known that I, TALBOT G. MARTIN, a citizen of the United States of America, and a resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Means for Charging Storage Batteries of Telephone Systems, of which the following is a specification.

My invention relates to automatic telephone systems in general, but more particularly to automatic systems in which the selective switching devices are operated on the step-by-step principle, and especially to systems of this character in which provision is made for trunking between two or more exchanges.

Generally stated, the object of my invention is the provision of a simple and efficient arrangement for charging the storage battery of one automatic exchange from a source of charging-current located at another automatic exchange.

A special object is the provision of a simple and efficient arrangement whereby the circuit for thus charging the said storage battery may include a trunk-line conductor extending between the two automatic exchanges and whereby the said charging-circuit is normally closed and the storage battery being charged during the time that the trunk-line is not in use, but whereby the said source of charging-current is cut off and the talking-conductors of the trunk-line closed as soon as it becomes desirable to use the trunk-line as a medium of connection between a subscriber of one exchange and a subscriber of the other exchange.

It is also an object, of course, to provide certain details and features of improvement tending to increase the general efficiency and serviceability of a storage-battery-charging arrangement of this particular character.

To the foregoing and other useful ends and purposes my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings, Figure 1 is a diagram illustrating a trunk-line connection between two automatic exchanges and showing the charging-circuit of the storage battery at one exchange closed, the said battery thereby receiving charging-current from the generator or dynamo at the other exchange. Fig. 2 is a diagrammatic perspec-

tive view of a selector-switch at which the trunk-line terminates in the exchange at the right of the broken line in Fig. 1 and shows the switching device controlled by the switch-shaft for closing the charging-circuit and also opening and closing one side of the said trunk-line. Fig. 3 is a view similar to Fig. 1, but showing the source of charging-current cut off or disconnected from the trunk-line and showing the two normally open switch-points in the lower trunk-line conductor closed and the trunk-line thereby in condition for use between the two exchanges.

The selector-switch may be any suitable type, and as shown is what is usually known as the "second selector." As represented in Fig. 3 the said selector is connected with a repeater at what may be considered a subexchange, (shown to the left of the dotted line in Fig. 3,) which repeater receives electrical impulses from any suitable source, to be hereinafter described, and repeats them to the trunk-line connecting the two exchanges with the so-called "vertical" and "rotary" line-relays A and B, but energized by current furnished from the battery C, located at the said right-hand exchange. It is necessary that the battery C at the said exchange be recharged from time to time, and for that purpose a charging-generator D must be provided. Since the said subexchange must be provided with a battery also and since said battery must also be charged from time to time, I have devised an arrangement controlled by the switch-shaft E whereby the battery I at the subexchange may also be charged by the said generator D whenever the trunk-line connecting the two exchanges is idle.

The interexchange trunk-line is composed of two conductors, one of which (the vertical trunk-line conductor 1) terminates at the right-hand exchange in the relay A and in the left-hand exchange in the condenser H, and the other side, 2, of said trunk-line is normally retained connected with the generator D by the switch-shaft arm *e* at the right-hand exchange, which retains the switch-shaft springs *e'* and *e''* in contact. When the switch-shaft E, however, is operated, the said switch-spring *e'* is permitted to leave the spring *e''* and engage the spring *e''*, at which

time the said trunk-line conductor 2 is connected instead to the rotary line-relay B, the spring e^3 being a terminal of the said relay B. The other end of said trunk-conductor 2 is under the control of the relay J at the sub-exchange. The said relay controls three springs j , j' , and j'' , of which the second is the terminal of the said trunk-conductor 2. When the relay J is energized, the spring j' is forced away from the spring j'' , with which latter it normally engages, and brought in contact with the spring j , which last spring is connected directly to the condenser H.

The selector provided at the exchange to the right of the dotted line in Figs. 1 and 3, or main exchange, being of a well-known type it will be understood that the shaft E, longitudinally disposed in front of the switch, is provided for the purpose of extending the trunk-conductors that lead to said switch, through trunk-lines which terminate in the line and private banks 3 and 4, respectively, with other switching apparatus, such as a connector, whereby a final connection may be established with some desired subscriber's line. The office of the switch in general is to connect the trunk-line conductors 1 and 2, respectively, with other trunk-line conductors 5 and 6, for example, through the medium of the well-known side switch K and the line-wipers 7 and 8. Said line-wipers of course are carried by the shaft E and insulated therefrom and from each other. Said wipers are adapted to engage any one of a hundred bank-terminals that comprise the line-bank 3. Upon the same shaft what is known as the "private" wiper 9 is also mounted and insulated from said shaft, which wiper is adapted to engage the private-bank contacts 4. Therefore the apparatus provided in the selector is to operate the switch-shaft E and the side switch K to a proper position in order that the desired connection may be completed and in order that after the said connection is no longer needed the said switch-shaft and side switch may be restored to normal position. The side switch is provided, as usual, with four side-switch wipers 9^a, 10, 11, and 12 and with four sets of contact-points 14, 15, and 16; 17, 18, and 19; 20, 21, and 22; and 23, 24, and 25.

Whenever the vertical trunk-conductor 1 is grounded, the vertical line-relay A is energized, and as a result the vertical magnet L is energized in turn, whereby the switch-shaft E is raised one step each time the said magnet L is energized and whereby the switch-shaft wipers may be raised to any one of ten levels. When the switch-shaft is thus operated, the spring e^3 , which is the terminal of the rotary trunk-conductor 2, is disconnected from the spring e^2 , which latter is one of the terminals of the generator D, and placed in contact with the spring e^1 , that is connected directly to the side-switch wiper 12.

Therefore the rotary trunk-conductor 2, which is normally disconnected from the rotary line-relay B after once the switch-shaft E is operated, is connected to said rotary line-relay through the side-switch wiper 12. The said trunk-conductor and relay being thus connected, a grounding of the trunk-line 2 will energize the rotary line-relay B, with the result that the private magnet M will also be energized. After the said trunk-line is grounded once the private magnet M is energized and deenergized, and as a result the side switch K passes to what is known as the "second" position of the side switch, at which time the side-switch wipers 9^a, 10, 11, and 12 leave the contact-points 14, 17, 20, and 23 and pass into engagement with the contact-points 15, 18, 21, and 24. The engagement of the side-switch wiper 9^a with the grounded contact-point 15 energizes the so-called "rotary" magnet N, whereby the switch-shaft E is rotated and the shaft-wipers brought into contact with the first idle trunk-line in the level to which they were raised by the vertical magnet L. For instance, after the vertical magnet has raised the shaft two steps, and thereby placed the wipers 7, 8, and 9 opposite the first contact of the second level of their respective banks, and if the first nine trunk-lines of the said second level are busy, the wipers will then be carried by the rotary magnet N onto the tenth contact of the second level of their respective banks which would therefore place the line-wipers 7 and 8 in contact with the vertical and rotary trunk-conductors 5 and 6 and the private wiper 9 in engagement with the private trunk-line 26 for well-known purposes. The said trunk-line conductors 5 and 6, it will be evident, are connected in any suitable manner to the bank-contacts 27 and 28, respectively, and the private trunk-conductor with the private bank contact 29.

When the wipers are carried beyond the last busy trunk-line, the side switch K passes to third position, and the wipers 9^a, 10, 11, and 12 then engage the contact-points 16, 19, 22, and 25. The result of this last movement of the side switch is to extend the vertical and rotary trunk-conductors 1 and 2 through the side-switch wipers 11 and 12 and contact-points 22 and 25, respectively, to the vertical and rotary line-wipers 7 and 8, and therefore to the trunk-conductors 5 and 6, respectively. Also a guarding-potential is established from the ground-terminal G of the battery C to the said ground-terminal G', contact-point 19, and side-switch wiper 10 to the private wiper 9, and therefore to the contact-point 29, for protecting said contact-point and trunk-line conductors 5 and 6 from further seizure. After a connection is established if the trunk-conductors 1 and 2 are grounded simultaneously the vertical and rotary line-relays A and B will then be energized simultaneously, and, as

is well known, the release-magnet O is energized and the switch restored.

Referring to Fig. 3, it will be understood that the side-switch wiper 30, contact-point 31, and bank-contacts 32, 33, and 34 at the subexchange correspond to the side-switch wiper 10, contact-point 19, and line-bank contacts 27, 28, and 29, respectively, of the switch shown in Fig. 2. Furthermore, the repeater R, represented diagrammatically, comprises the vertical line-relay F and the rotary line-relay G, which are bridged across that portion of the trunk-line separated from the trunk-conductors 1 and 2 by the condenser H, and with this arrangement the impulses communicated to the contact-points 32 and 33, and therefore to the relays F and G, are repeated to the conductors 1 and 2, respectively, through the medium of the relay-contacts *f*, *g*, and *h*, and through the conductors *h'* and *h''*, respectively, as the medium of connection between the spring *f* and the conductor 1 and the spring *g* and the conductor 2. At this same exchange the storage battery I has its positive terminal grounded and its negative terminal connected with the windings of the relays *f* and *g* in parallel. It will be seen, furthermore, that the spring *h* is connected with ground. The battery-switching-relay J, located at the same exchange with the repeater R, has one terminal of its coil connected with the negative pole of the battery I and its other terminal connected with the private-bank contact 34, and therefore with all other contacts that may be connected in multiple therewith.

It will be seen that the condenser at which the line-conductor 1 terminates is connected with a bank-contact 33 and with all other contacts connected in multiple therewith. In a similar way the condenser H, that corresponds to the conductor 2, is connected with the contact-point 32 and with all other contacts that may be connected in multiple. As shown, the line-relay J not only controls the continuity of the charging-circuit, but also that of the trunk-line conductor 2, as previously stated, through the medium of the springs *j*, *j'*, and *j''*. The springs *j* and *j'* are connected, respectively, with the condenser H and with the conductor 2. The spring *j''* is connected with the negative pole of the battery I. Normally the springs *j'* and *j''* engage each other, and thus maintain the continuity of the connection between the battery I and the conductor 2. At the subexchange, besides repeaters, (like repeater R,) there are selectors, like the selector described in the main exchange. One of said selectors is indicated to the left of the repeater R by the side-switch wiper 30, similar to the side-switch wiper 10 of the side switch K, and by three contact-points 31, 35, and 36, similar to the contact-points 19, 18, and 17, respectively, the said contact-point 31 being grounded

at the ground-terminal G². The said side-switch wiper 30 is retained in third position and connected with a wiper 37, similar to the private wiper 9, which wiper 37 is shown in engagement with the private-bank contact 34, which is similar to the private-bank contact 29 of Fig. 2.

The vertical and rotary line-relays F and G, respectively, are shown connected with bank-contacts 32 and 33, which are similar to the contact-points 27 and 28. The selector S is represented as having a selected trunk-line of two conductors, similar to the conductors 5 and 6 in Fig. 2, which terminate in the contact-points 32 and 33. The selective operation of course, it will be understood, occurs in the manner already described in connection with the selector shown in Fig. 2. It will be readily understood, however, that the side switch and other apparatus shown at the subexchange may be of any suitable known or approved character. Also, as shown in Fig. 1, the normally closed charging-circuit for the battery I includes the rotary trunk-conductor 2 between the two exchanges and includes contacts *j'* and *j''* of the relay J and contacts *e* and *e'* of the selector at the main exchange and the generator D. In this way one side of the trunk-line is used for charging the storage battery at one exchange from a source of charging-current at the other exchange when the trunk-line is not in use for switching or signaling or talking purposes. The said trunk-line, with the apparatus illustrated, can of course only be used in one direction—that is to say, it can only be used for extending a connection from the subexchange to the main exchange. For example, when the subscriber at the subexchange in the course of making a call seizes the selector S the latter selects the repeater R. At the instant that the side-switch wiper 30 passes onto the contact-point 31 the private wiper of said switch will be connected to ground G² in the customary way, thus connecting the private wiper 37 to ground and grounding, therefore, the private-bank contact 34, which it engages at the time. In this way the usual and well-known guarding-potential is established at the private-bank contact 34 and at all multiples thereof, and, in addition, the said private wiper of the calling-switch and the private-bank contact 34 are included in a closed circuit including the coil of the relay J and the battery I. The local but normally open energizing-circuit for the relay J being thus closed, its armature breaks contact between the springs *j'* and *j''* and closes contact between the springs *j* and *j'*. This, it will be seen, disconnects the battery I from the trunk-line conductor 2, extending between the two exchanges, and at the same time closes one of the normally open switch-points in said conductor. This relay J will remain

energized as long as the selector S is connected with the repeater R. After the selector S has established connection with the repeater R the calling subscriber will of course operate his calling device in such a manner as to send impulses over his vertical line-conductor and one impulse over his rotary line-conductor.

The ground impulses to the vertical line-conductor will reach the contact-point 32 through a side-switch wiper similar to the side-switch wiper 11 of the said switch K, and thereby operate the vertical line-relay F, so that the said relay upon attracting its armature causes the spring *f* to be forced onto the spring *h*, thereby sending a ground impulse to the vertical line-conductor 1. Grounding his rotary line-conductor will ground the contact 33, and therefore the rotary line-relay G in the usual manner. As a result, the armature of said relay G forces the spring *g* onto the spring *h*, and thereby sends a ground impulse to the rotary trunk-conductor 2, since the relay-springs *j* and *j'* are then in contact. The ground impulse delivered to the vertical trunk-conductor 1 energizes the vertical-line relay A, and as a result causes the shaft E to be raised. The latter upon rising permits the springs *e'* and *e''* to come into contact after the spring *e'* leaves the spring *e''*. The operation of said last springs disconnects the generator D from the trunk-line conductor 2 and connects the said trunk-line conductor with the rotary line-relay B. The connection between said rotary line-relay and said rotary trunk-conductor 2 being established after the vertical line-relay A is energized, the ground impulse sent to the rotary trunk-conductor 2 energizes the rotary line-relay B, but with the well-known effect upon the shaft E. During the use of the trunk-line for switching purposes, as described, the auxiliary charging-circuits will remain in the condition shown in Fig. 3.

It will be readily understood that after a connection is established the switches may be released in the usual and well-known manner, at which time the shaft E is restored to normal position, as well as the side-switch wiper 30. The result is that the switch-shaft spring *e'* at the main exchange and the relay-springs *j'* and *j''* reengage to restore the charging-circuit, as shown in Fig. 1.

What I claim as my invention is—

1. An automatic telephone system comprising a trunk-line extending between two automatic exchanges, a storage battery at one automatic exchange, a source of charging-current at the other automatic exchange, and a normally closed charging-circuit including said battery and source of current and a conductor of said trunk-line.

2. An automatic telephone system comprising a trunk-line having its ends connected with automatic exchanges, a storage battery, a source of charging-current for said battery,

and a normally closed charging-circuit including the battery and source of current and one conductor of said trunk-line.

3. An automatic telephone system comprising a trunk-line extending between two automatic exchanges, each end of said trunk-line terminating in an automatic switch, a storage battery at one exchange for supplying the current necessary for operating the apparatus thereof, a source of charging-current at the other exchange, and a normally closed charging-circuit including said battery and source of current and a conductor of said trunk-line.

4. An automatic telephone system comprising an automatic exchange provided with a storage battery for furnishing the current necessary for operating the automatic apparatus thereof, another exchange provided with a source of charging-current for said battery, a trunk-line extending between two exchanges, and a normally closed charging-circuit including said battery and source of current and a conductor of said trunk-line.

5. An automatic telephone system comprising an automatic exchange provided with a storage battery and a battery switching-relay, another exchange provided with a source of charging-current, a trunk-line extending between the two exchanges, and a normally closed charging-circuit including said battery and source of current and also including a conductor of said trunk-line and contacts of said relay.

6. A telephone system comprising an automatic exchange provided with a storage battery, another exchange, a trunk-line extending between the two exchanges, a source of charging-current at the said other exchange, a charging-circuit including said battery and source of current and a conductor of said trunk-line, and electromagnetically-operated means for disconnecting the battery from the trunk-line when the latter is to be used for switching, signaling or talking purposes.

7. A telephone system comprising two exchanges, a trunk-line extending between said exchanges, a storage battery at one exchange, a source of charging-current at the other exchange, a charging-circuit including said battery and source of current and a conductor of said trunk-line, a relay for disconnecting the battery from the trunk-line when the latter is to be employed in service between the two exchanges, and a normally open energizing-circuit for said relay, together with "private switching-contacts" adapted to be included in said energizing-circuit.

Signed by me at Chicago, Cook county, Illinois, this 20th day of January, 1905.

T. G. MARTIN.

Witnesses:

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W. LEE CAMPBELL.