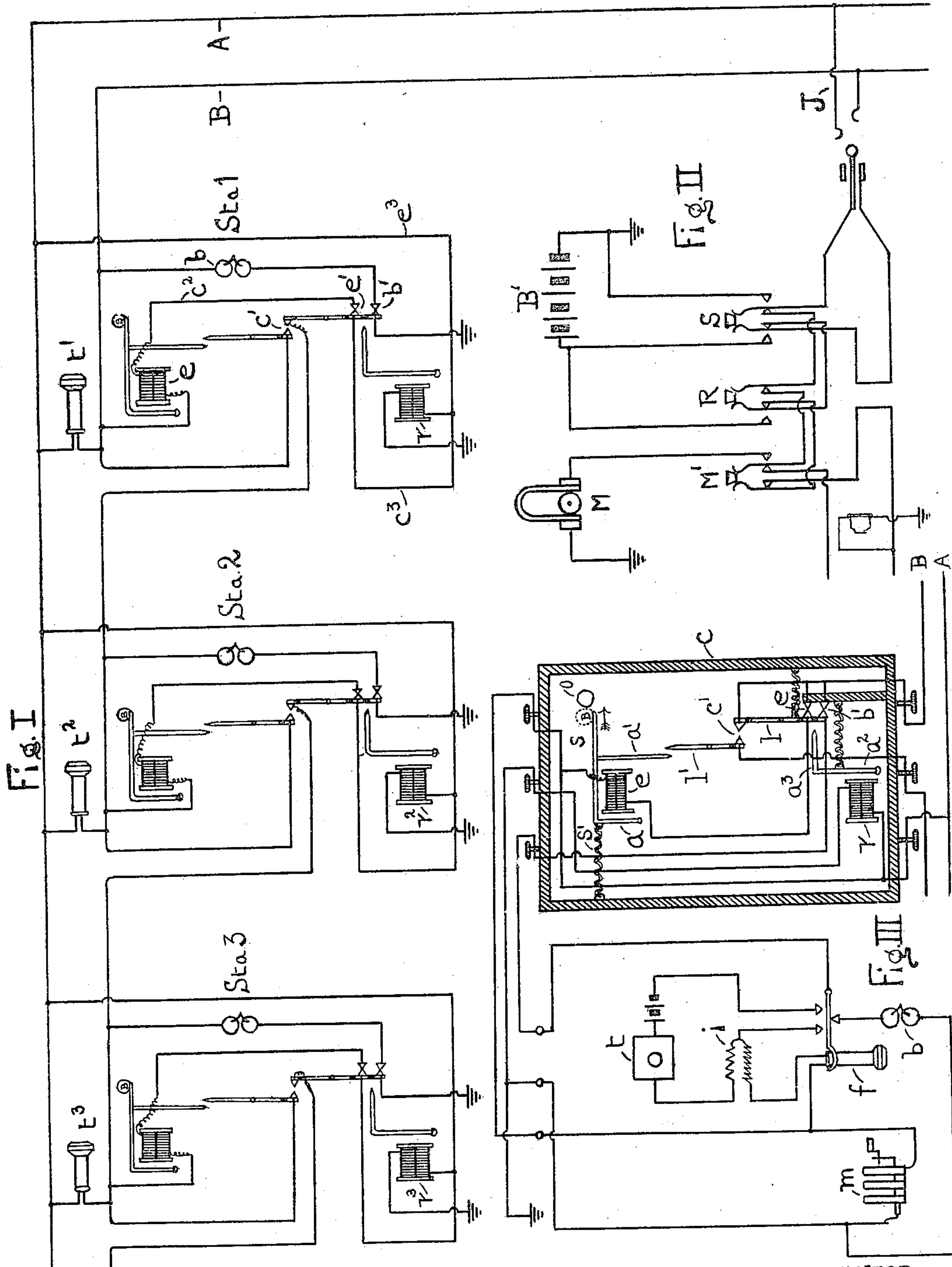


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 MULTIPLE STATION TELEPHONE LINE.  
 APPLICATION FILED OCT. 18, 1902.

Patented Feb. 15, 1910.

949,530.



WITNESSES.

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# UNITED STATES PATENT OFFICE.

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MULTIPLE-STATION TELEPHONE-LINE.

949,530.

Specification of Letters Patent.

Patented Feb. 15, 1910.

Application filed October 18, 1902. Serial No. 127,757.

*To all whom it may concern:*

Be it known that I, ARTHUR J. FARMER, a citizen of the United States of America, and a resident of Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Multiple-Station Telephone-Lines, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to improvements in multiple station telephone lines and apparatus therefor, and has for its object the provision of means controllable from the central office for selectively connecting in circuit and calling any subscriber upon such lines, to the exclusion of the remaining subscribers, and for restoring the lines and apparatus to normal condition. My invention looks toward the accomplishment of these results without the employment of complicated circuit arrangements, extra conductors, step-by-step switching mechanism, or sources of current of varying strength and polarity applied to line for selective action. Instead, my improvements contemplate the use at each station upon the line of a simple switching device of uniform type, designed when operated, to extend the circuit beyond such station and to its exclusion; thereby connecting the next station in circuit for talking and calling purposes. This successive action in extending the telephone circuit occurs in each instance, until the desired station is selectively connected in circuit. After conversation is concluded, all stations are restored to normal condition, wherein the central office can be called by any subscriber upon the line.

Before entering upon an extended explanation of my invention, I may briefly set forth the characteristics of a telephone line equipped in accordance therewith, by stating that one of the two limbs of the line extending to the several stations connected thereby, is normally open at each station except the first; an electro-magnetic switching device controlling contacts in said limb for extending the circuit to the next succeeding station and its corresponding switching device. A restoring electro-magnet is connected between the continuous limb and ground, while the signal bell is connected in a branch between the other limb and ground in the preferred form; the

talking circuit as established to each station being a full metallic circuit.

Other features will appear from the specification; all of which are shown diagrammatically in the accompanying drawings, in connection with which I will set forth more fully the particulars of my invention.

Figure I. of the drawings represents diagrammatically the first three stations of a telephone line equipped with my improvements; Fig. II. is a similar representation of the calling side of the operator's cord circuit associated therewith, and Fig. III. diagrammatically illustrates in more detail the apparatus at a subscriber's station of the telephone line.

Similar parts or elements are therein designated by the same character of reference.

For the purposes of illustration and description I have chosen to set forth my invention as applied to a magneto-call system with metallic talking circuit, of which but three stations and the calling side of the cord circuit only need be specifically considered; although it will be understood that any desired number of stations may be connected upon a single line circuit; that full metallic circuit is not necessarily used; and that my improvements may as readily be applied to a common-battery system.

A and B represent the two limbs of the telephone line terminating at the central office in the jack J and extending through a plurality of subscribers' stations equipped in part in the usual manner. Connected between the limbs are shown the subscribers' sets  $t'$ ,  $t^2$ ,  $t^3$ , of the respective stations. Conductor B, it will be noted, is continuous only to station 1 (upon the right) at which station the bell  $b$  is shown normally connected to ground through contacts  $b'$  of the selective switching appliance. Said conductor is looped into each of the subscribers' stations in turn. The electro-magnet  $e$  of the selective or circuit-extending switch is connected between the line conductors in a branch completed at contacts  $e'$ , while the continuity of the B conductor to station 2 and beyond is interrupted at contacts  $c'$  of said switch. The restoring electro-magnet  $r$  is connected in a permanent branch from the A conductor to ground. It will be understood that the several electro-magnets are properly wound to present relatively high resistances and impedances opposing the flow of electric



currents. Fig. III. shows somewhat diagrammatically, but more in detail the preferred arrangement of circuits and apparatus at these subscribers' stations. In addition to the receiver *f*, the transmitter *t*, the induction coils *i*, the bell *b*, and magneto *m* of the ordinary wall set, connected as shown; a separate casing *c* associated therewith, contains the circuit-extending switching apparatus and its restoring device already briefly referred to. One of each pair of contacts *b'*, *e'*, is stationarily mounted in the casing, before which a pivoted contact-making part of lever *l* movably mounts their associated or co-acting contacts, which are normally held in engagement with said contacts *b'*, *e'*. Upon the upper end of said lever is borne one of the paired contacts *c'*; the other contact being disposed adjacent thereto, but normally separated therefrom, upon the lower end of a second lever *l'*, also pivotally mounted. The upper end of the lever *l'* is in the path of movement of a depending arm *a'* actuated by the lateral movement of the armature *a* and its extension, associated with the electro-magnet *e*. A target or signal *s* likewise may be actuated by direct movement of the armature to display a busy-signal at opening *o* in the casing when the magnet has been excited and the switch actuated; an opposing spring *s'* serving to secure the normal retraction of the armature. The armature *a*<sup>2</sup> of the restoring magnet *r* has an extension or stop *a*<sup>3</sup> in the path of movement of the pivoted lever *l*, whose purpose will at once be made apparent. Immediately the switching or circuit-extending magnet *e* at any station is excited (which in practice must occur successively at the several stations until the one desired has been selected) its armature *a* is attracted against the tension of the spring *s'* and arm *a'* engages the upper end of lever *l'*, rocking it upon its pivot until the arm slips past said end. Upon deenergization of the magnet the arm engages the end of lever *l'* upon its opposite or right side, under the influence or tension of the spring *s'*, thereby tilting said lever *l'* so that the circuit-extending contacts *c'* are brought into engagement, and the lever *l* simultaneously is rocked thereby into engagement with the stop *a*<sup>3</sup> of the restoring magnet, thus separating respectively, the paired contacts *b'* and *e'* controlling the bell and magnet *e* of the station considered. This movement also serves to displace laterally the target *s* and exhibit its "B" or "busy" signal to indicate that the line is in use. The circuit-extending switching apparatus, thus is seen to be operatively actuated through the medium of the opposing spring, upon the deenergization of its magnet. To effect the restoration of the switching apparatus simultaneously with that at all other stations in abnormal position, each

electro-magnet *r* is energized by suitable current, thereby retracting its armature *a*<sup>2</sup> and the stop *a*<sup>3</sup> supporting laterally the lower end of lever *l*, which permits levers *l*, *l'*, to be rocked sufficiently upon their pivots, under the influence of spring *s'*, to release the depending end of arm *a'* from the upper portion of the lever *l'*; whereupon contacts *c'* are separated and contacts *b'*, *e'* are brought into engagement, thus re-opening the B conductor at all stations except the first.

At the central office the usual switching and connecting apparatus is provided; the calling side of the operator's cord circuit including a ringing key *M'* adapted to connect the calling magneto *M* between line conductor B and ground, and the selecting and restoring keys *S*, *R*, respectively adapted to connect the actuating battery *B'* between the line conductors, and between conductor A and ground.

The mode of selecting and calling any desired station will now be readily understood. Assuming that station 3 of the line shown is to be communicated with, the operator will simply press key *S* twice, and key *M'* to ring the party, and upon the conclusion of the conversation, will depress once the restoring key *R* before disconnecting the line. Station 1, being normally connected to line, would be rung and disconnected in the ordinary manner.

The operation of the system in calling subscriber 3 would be as follows:—Key *S* closes the battery circuit over the two line conductors, between which circuit-extending magnet *e* of station 1 is connected, and accordingly becomes excited. Upon the release of the said key contacts *c'* are united and contacts *b'*, *e'* are separated; circuit being traced from the left of battery *B'*, through one side of key *S* and jack *J*, over conductor B, magnet *e* at station 1, conductor *c*<sup>2</sup>, contacts *e'*, conductors *c*<sup>3</sup>, *e*<sup>3</sup> A, and through the other side of jack *J* and key *S* to the battery. Station 1 (including the telephone *t'* in practice) thus would be cut out and station 2 substituted therefor upon the line as described in connection with Fig. III. The second pressure and release of key *S* would cause a similar operation at station 2; the line being thus extended to station 3, which would thereupon be rung in the usual manner. When the disconnect signal is given at central, the operator before removing the connecting-plug from jack *J* would actuate all of the restoring magnets *r* by pressing key *R*, thus permitting the restoration of all the switching appliances to their normal condition after the manner previously described; circuit being traced from the left side of the grounded battery *B'*, through one side of keys *R*, *S*, and jack *J*, over conductors A and *e*<sup>3</sup>, the re-



storing electro-magnets *r* at each station, and to ground.

The circuit-extending or auxiliary apparatus described, plainly does not have any function, nor would it be required at the terminal station of the line, since the intermediate stations serve to establish circuit thereto.

From the foregoing it will at once be appreciated that the changes from an ordinary party-line necessitated by my improvements are but slight, the selective action is positive, and the apparatus and circuits required are of comparatively simple design.

Departures from the precise system set forth, obviously will be required to meet varying requirements and conditions, which modifications I desire to be understood as claiming, as follows:—

1. In a multiple station telephone line, the combination with metallic line conductors extending through a plurality of telephone stations, of an electro-magnetic switching device at each intermediate station respectively governing contacts in one of the line conductors for extending it to an additional station and for disconnecting a corresponding station, means therein opposing its electro-magnet for effecting the switching, whereby the device is caused to operate upon the deenergization of the electro-magnet, an electrically actuated restoring appliance associated therewith and connected with one of the line conductors for returning the switching device to its normal condition, and a source of electrical energy at

a central office for actuating the several switching and restoring appliances, substantially as set forth.

2. In a multiple station telephone line, the combination with line conductors A, B, extending through a plurality of telephone stations, conductor B being normally open at each station beyond the first, telephone apparatus at each station in bridges adapted to be connected between said conductors, and corresponding signal bells in branches adapted to be connected between conductor B and ground, an electro-magnetic switching device associated with each station to be connected to line, a normally open bridge between the line conductors including its electro-magnet *e*, contacts in said device for extending the line conductor B to an additional station and for disconnecting a corresponding station, a restoring electro-magnet *r* associated with each switching device, a branch from line conductor A to ground including the same, and at a central office, a cord circuit including a source of signaling current, a battery for actuating the switching and restoring appliances, and switching keys for connecting the same suitably between the line conductors and said conductors and ground, substantially as set forth.

Signed at Detroit, this 16th day of October 1902.

ARTHUR J. FARMER.

Witnesses:

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