W. W. DEAN.

TELEPHONE SYSTEM.

APPLICATION FILED NOV. 2, 1908.

1,011,168.

Patented Dec. 12, 1911.

2 SHEETS—SHEET 1.

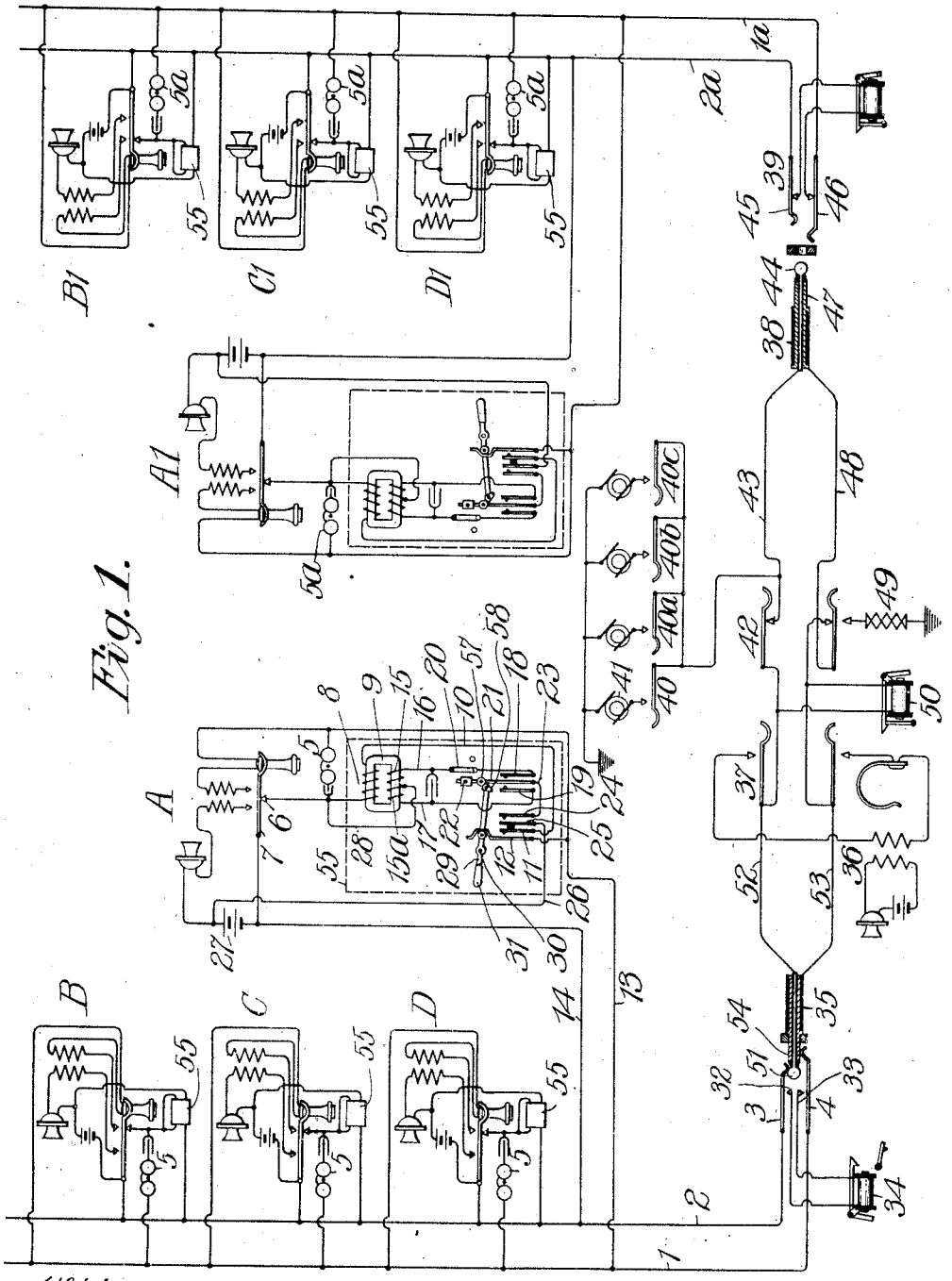

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 3.

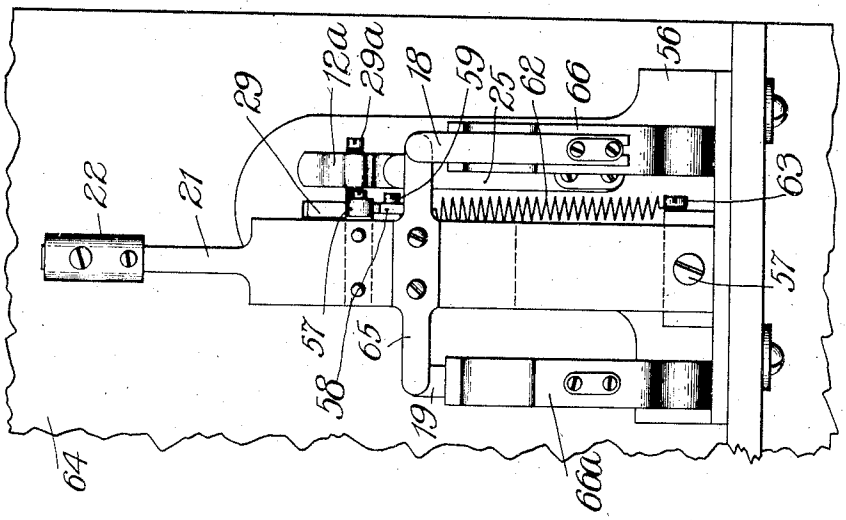
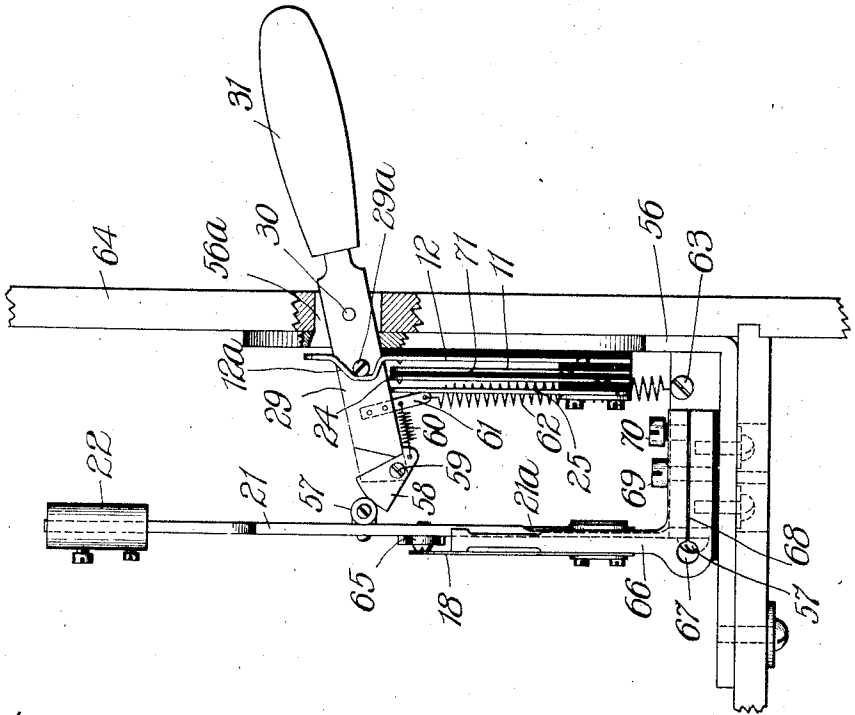


Fig. 2.



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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

1,011,168. Specification of Letters Patent. Patented Dec. 12, 1911.

Application filed November 2, 1908. Serial No. 460,596.

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States, residing at Elyria, in the county of Lorain and State of Ohio, have invented a certain new and useful Improvement in Telephone Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention is particularly adapted for use in connection with telephone exchanges in which a part or all of the lines terminating thereat are of the type known as local battery lines; that is, lines connected to substations at each of which a battery is installed for furnishing talking current. Lines thus equipped have ordinarily been furnished in the past with magneto generators, for the use of the subscribers in signaling the operator at the exchange when a connection is desired and for signaling the operator to take down a connection at the close of a conversation.

While magneto generators have answered very satisfactorily in the past in connection with local battery lines, either of the single substation type or party lines using code ringing, in connection with later developments of local battery party lines in which the selective signaling has been accomplished by means of tuned ringers at the substation operated by alternating currents of corresponding frequencies from the exchange, it has been found that the magneto generators commonly employed at the substation cannot be made to signal the exchange without operating more or less the tuned ringers connected to the line. This improper operation of the tuned ringers is both annoying and confusing, in that often the subscribers think they are being signaled by the operator, when the ringing is really caused by another party on the line attempting to ring up the operator at the exchange.

By my invention, I eliminate the difficulties referred to, by replacing the magneto generator at each substation by tuned vibrating mechanism, adapted, when operated, to send current impulses from the local battery through a small transformer, and thence to line. This mechanism is so constructed that it will send impulses to line of a frequency sufficiently different from the frequency of any current sent to line by the exchange operator, that the tuned ringers connected to the line will not respond thereto. For instance, it is common practice, in connection with a four-party line, to employ alternating currents of $16\frac{2}{3}$ cycles, $33\frac{1}{3}$ cycles, 50 cycles and $66\frac{2}{3}$ cycles, for the purpose of operating the four tuned ringers selectively. In connection with such an equipment, I have found it satisfactory to employ mechanism at each substation so tuned as to deliver current impulses from the local battery through the transformer to line, at about 24 cycles per second. The difference between this frequency and any one of the alternating frequencies referred to is sufficiently great so that none of the four tuned ringers is operated.

My invention further contemplates an improved construction of vibrating mechanism for accomplishing the results described, which is adapted to be wholly contained in the telephone cabinet usually employed at the substation and to be operated by the downward motion of a lever extending through the wall of the telephone cabinet. In connection with the vibrating mechanism and the operating lever, switches are provided for the purpose of normally interrupting both the supply circuit from the local battery and the circuit connection between the transformer and the line. These switches are so associated with the vibrating mechanism that when the outer end of the lever is depressed, the vibrating mechanism is operated, and at the same time the switches are closed, to permit the vibrating mechanism to send the current impulses to line. The operating lever, when in its normal position, serves to prevent motion of the vibrating mechanism, and thus prevents accidental injury to or operation of the same.

It is a further object of my invention to construct the vibrating mechanism in a simple and economical manner, and to provide adjusting means in connection therewith which are positive and effective.

The several drawings illustrating my invention are as follows:

Figure 1 is a diagrammatic view of my telephone system, complete; Fig. 2 is a side view of the vibrating mechanism located at one of the substations, and its associated switching and operating mechanism; Fig. 3 is a face view of the parts shown in Fig. 2.

Similar numerals refer to similar parts throughout the several views.

Referring to Fig. 1, two party lines are

shown, each having connected thereto four substations, as indicated. These two lines are identical as to their construction, and hence detail explanation is necessary in connection with the apparatus associated with but one of such lines.

As indicated, the line wires 1, 2 extend from the jack springs 4, 3 at the exchange to substations A, B, C, D. Each of these substations is equipped with apparatus identical with the other substations, and hence, a detail description of the apparatus at substation A will serve to indicate the operation of the system. At the substation A, a ringer 5 is normally connected through the lower contact 6 of hook switch 7 between the line limbs 1 and 2. The contact 6 is also connected to one terminal of the secondary winding 8 of a transformer 9, the other terminal of which is connected by wire 10 with contact 11. Contact 11 is so disposed relatively to contact 12 that when such contact 12 is operated, a circuit is closed from line limb 1, by wire 13 through contacts 11 and 12, the secondary winding 8, hook switch 7 and wire 14 to line limb 2. The primary winding of the transformer 9 is divided into two sections, 15 and 15^a, one end of each of which is connected through wires 16 and 17 with springs 18 and 19. A switch 20 is located in the wire 16, in order that this conductor may be opened or closed, as desired, to make use of both primary windings 15 and 15^a, or the section 15^a alone. The springs 18 and 19 are adapted to coöperate with a vibratory member 21, tuned by means of a weight 22 to vibrate when operated at a predetermined frequency. The member 21 is connected by conductor 23 with a contact spring 24, with which a contact spring 25 is adapted to cooperate. The contact spring 25 is connected by an insulating block, as indicated, with contact spring 11, as a result of which the movement of contact spring 12 to bring the contact springs 11 and 12 together, may also be made to bring the springs 24 and 25 in contact with each other. The spring 25 is connected by wire 26 with one terminal of the battery 27, the other terminal of which is connected with the receiver hook 7. The contact 6 is connected by wire 28 with the other ends of the sections 15 and 15^a of the primary winding of the transformer. In connection with the vibratory member 21 and the contact springs 11, 12, 24 and 25, a lever 29, pivoted at 30, is employed, which is so conformed that when the handle 31 is depressed the vibratory member 21 is operated and the spring 12 is moved so as to engage the spring 11 and to also cause engagement between the springs 24 and 25. As a result of the connections described, when this operation is effected current is supplied by battery 27 through wire 26, contacts 25 and 24, wire 23, and vibratory member 21, alternately to springs 18 and 19, and thus alternately through wires 16 and 17 to the sections 15 and 15^a of the primary winding of the transformer 9. From these sections of the primary winding, the impulses return by a common path through wire 28 to contact 6, hook switch 7, and then back to battery 27. The impulses induced in the secondary winding 8 are communicated to line through the following path: line limb 1, wire 13, contact spring 12, contact spring 11, wire 10, secondary winding 8, contact 6, hook switch 7, wire 14, line limb 2.

The jack springs 3 and 4 connected to the line limbs 2 and 1 normally make contact with the springs 32 and 33, connected with a line signal 34 at the exchange. As a result of this, when the operator's plug is not in the line jack, operation of the vibratory member 21 communicates current impulses through line limbs 1 and 2, jack springs 4 and 3, spring contacts 33 and 32 and line signal 34, thus causing its operation. In response to the signal thus given, the operator at the exchange inserts the plug 35 into the line jack, and by the usual operator's set 36 connected to the cord by the listening key 37, ascertains the connection desired. Having learned that one of the subscribers connected to line wires 1^a, 2^a is desired, the operator inserts the plug 38 in the line jack 39 connected to the line limbs 1^a, 2^a. The desired subscriber is then signaled by the operation of one of the keys 40, 40^a, 40^b, 40^c, depending upon the frequency of current required to operate the ringer at the substation wanted. The alternating current generators indicated diagrammatically in connection with the ringing keys are designed to supply current of frequencies corresponding to the tuning of the ringers at the substations connected to the lines of the system. In connection with the operation of one of the selective keys 40, 40^a, 40^b and 40^c, the ringing key 42 must be operated in order to prevent the possibility of back ringing, and to connect the sleeve strand of the calling plug with ground. The selective ringing keys and the main ringing key 42 may be operated separately, as indicated, or may constitute a part of the same structure and be so constructed that the operation of any of the selective keys will operate the key 42.

Assuming that the subscriber A^1 is wanted, and that the generator 41 supplies current of a frequency adapted to operate the ringer at substation A^1, the circuit may be traced as follows, when the key 40 is operated: generator 41, key 40, tip strand 43, tip 44, jack spring 45, line limb 2^a, to substation A^1, to and through the ringer 5^a back to line limb 1^a, jack spring 46, sleeve 47, sleeve strand 48, key 42, resistance 49 to ground, and thus back to generator 41.

At the end of the conversation, the operation of signaling the exchange that the connection is no longer desired, may be understood by reference to substation A, which is shown in connection with the operator's cord. As a result of this connection, a circuit is closed from the signaling mechanism at the substation A through the clearing out signal 50 connected with the cord, as follows: secondary winding 8 of the transformer 9, hook switch 7, wire 14, line wire 2, jack spring 3, tip 51 of plug 35, tip strand 52, to and through the clearing out signal 50, sleeve strand 53, sleeve 54 of plug 35, sleeve spring 4, line wire 1, wire 13, spring 12, spring 11, wire 10, to secondary winding 8. As a result of the circuit just traced, if, at the close of a conversation, the handle 31 is moved downwardly and the member 21 is thereby vibrated, the resulting impulses delivered from the secondary winding 8 will cause the operation of the clearing out signal 50. Substation A^1 is not shown in connection with the operator's cord, in order to indicate the normal condition of line apparatus at the exchange to permit a subscriber to signal the exchange operator for a connection.

The impulse sending mechanism described as located at the substation A is shown inclosed by a broken line 55, which inclosure is indicated in connection with each one of the substations to represent diagrammatically impulse sending mechanism identical with that described.

Referring to Figs. 2 and 3, the vibratory member 21 is shown as rigidly secured at its lower end to a base 56 by means of a screw 57. The member 21 is reduced in thickness at 21^a, near its lower end, to constitute such member a spring, to facilitate vibration thereof. The member 21 has adjustably secured to its upper end a weight 22, so proportioned and located upon the member 21 that, taken in conjunction with the dimensions of the lower end of the member 21, the desired rate of vibration is secured. The member 21 has pivotally secured thereto a roller 57, adapted to engage a latch 58 pivoted at 59 to the left hand end of the lever 29, as shown in Fig. 2. The latch 58 is normally held in the position indicated by a spring 60, fastened at one end to the latch 58 and at the other end to an arm 61 secured to the lever 29. The arm 61 has connected thereto a spring 62, the other end of which is connected at 63 to the base 56, thereby serving to normally maintain the lever 29 in the position shown in Fig. 2. The lever 29 is pivoted at 30 to a projection 56^a extending from the base 56 into the wall of the cabinet 64. The member 21 has secured thereto a transverse bar 65, adapted to engage by its ends the contact springs 18 and 19 as the member 21 is vibrated. The springs 18 and 19 are located upon opposite sides of the bar 65, as a result of which, contact is made by the bar with the springs alternately as the member 21 is moving in one direction or the other. The spring 18 is rigidly secured to a bracket 66 supported by, but insulated from, the base 56. The bracket 66 has drilled therethrough a hole 67, from which a slot 68 is formed to the right hand end of the horizontal portion of the bracket and which serves to permit adjustment of the vertical member of the bracket by means of the screws 69 and 70. The screw 69 tends to close the slot 68 while the screw 70 tends to open such slot, and as a result, the two screws together provide a means for securing any desired adjustment of the vertical portion of the bracket 66 relatively to its horizontal portion, and thus any desired adjustment of the spring 18 relatively to the bar 65. It is to be noticed that the spring 18 is prevented from moving to the right, as shown in Fig. 2, by the upper end of the bracket 66, but is free to be moved to the left, as a result of which, motion of the member 21 to the left serves to engage the spring 18, which readily yields, as a result of the engagement, but on the return of the member 21 to the right, a sharp break is effected when the spring 18 comes in contact with the upper end of the bracket 66.

The spring 19 is supported in a manner similar to that described for the spring 18, from a second bracket, 66^a, with the exception that such spring is located upon the opposite side of the vertical member of such bracket. The bracket 66^a is supported from the base 56 in the same manner as is the bracket 66. The base 56 serves also to support the springs 11, 12, 24 and 25, as indicated. As shown in Fig. 2, these springs are secured at their lower ends to the base 56, but insulated therefrom. The spring 12 is extended at its upper end and has a cam 12^a formed thereon, adapted to engage a pin 29^a carried by the lever 29. The spring 11 is supported in operative relation to the spring 12, and the spring 24 is located in a position parallel to the spring 11 and separated therefrom by a block or strip of insulation 71. The spring 25 is so supported as to be engaged by the spring 24 when operated. As a result of the arrangement of the springs just described, when the handle 31 is moved downwardly, the pin 29^a, by its engagement with the cam projection 12^a, moves the spring 12 to the left and into engagement with the spring 11, after which continued motion of the handle 31 moves spring 24 into engagement with the spring 25 as a result of the motion of the spring 11 being communicated to the spring 24 by the block 71. As the handle 31 is moved downward, the latch 58 engages the roller 57 and

displaces the member 21 to its extreme left hand position, for which position the latch 58 passes by the roller 57 and above such roller, so as to be out of the path of its vibration as it is carried back and forth by the member 21. The handle 31 is maintained in its lower position as long as it is desired to send signaling impulses, and may be operated a number of times in succession if it is found desirable to send such signaling impulses repeatedly. When the handle 31 is released, the spring 62 moves such handle to its upper position, thereby bringing the latch 58 into engagement with the roller 57, but as a result of the construction and support of the latch 58 and the action of the spring 60, the latch 58 moves to the right upon the pivot 59 and passes by the roller 57, so that the upper edge of the latch 58 engages the under side of the roller 57. In this position, the latch 58 serves to effectively prevent vibration or operation of the member 21.

It is to be observed that as a result of the construction of the impulse sending mechanism as above described, that all of the cooperating mechanical parts are supported by the same base, independently of the telephone cabinet, as a result of which, this apparatus may be assembled and adjusted before installing it in the cabinet. Furthermore, changes in the condition of the cabinet, due to careless handling or shrinkage of the wood, will not affect the operation of the mechanism, since the base is made of metal and so supported in the cabinet as to not be affected by such changes. The opening in the side of the cabinet made to receive the projection 56ª may be large enough to permit the passage therethrough of the handle 31, or the handle 31 may be made removable from the lever 29, as desired.

It is to be understood that the system disclosed is equally applicable to an eight-party line system, in which case the ringers at the substations are connected four of them from each line limb to ground, and suitable provision is made in the cord circuit for connecting the live pole of the generators to either line limb, as desired.

While I have shown my invention in the particular embodiment herein described, I do not, however, limit myself to this construction, but desire to claim broadly any equivalent modification that will suggest itself to those skilled in the art.

I claim—

1. In a telephone system, the combination of a plurality of telephone lines extending to an exchange, apparatus at the exchange for connecting the lines for conversation, signaling devices at the exchange associated with the lines, simple harmonic frequency means including a manually operated lever located at the sub-stations adapted to send impulses to the line to operate such signaling devices, and tuned signals at the substations irresponsive to the impulses of a frequency produced by said substation impulse sending means.

2. In a telephone system, a telephone line extending by its limbs from a substation to an exchange, a signal associated with the line at the exchange, simple harmonic frequency means including a manually operated lever located at the substations adapted to send current impulses to line to operate such signal and a tuned ringer connected to the line, said ringer irresponsive to impulses of a frequency produced by said substation impulse sending means.

3. In a telephone exchange system, a telephone line extending by its limbs from a substation to an exchange, a tuned ringer connected to the line, a battery at the substation, a signal associated with the line at the exchange, and manually operated simple harmonic frequency producing means located at the substation for sending current impulses from the battery to line to operate such signaling device, such ringer being irresponsive to impulses of frequencies which the substation impulse sending means is capable of producing.

4. In a telephone exchange system, a telephone line extending by its limbs from a substation to an exchange, a tuned ringer connected to the line, a talking battery at the substation, a signal associated with the line at the exchange, and manually operated simple harmonic frequency producing means located at the substation for sending current impulses from such talking battery to line to operate such signaling device, such substation impulse sending means being incapable of sending impulses of a frequency to which the tuned ringer is responsive.

5. In a telephone exchange system, a telephone line extending by its limbs from a substation to an exchange, a tuned ringer connected to the line, a battery at the substation, a signal associated with the line at the exchange, and a pole changer at the substation for sending current impulses from the battery to line to operate such signaling device, such impulses being of a frequency not adapted to operate such ringer.

6. In a telephone exchange system, a telephone line extending by its limbs from a substation to an exchange, a tuned ringer connected to the line, a talking battery at the substation, a signal associated with the line at the exchange, a tuned pole changer at the substation for sending current impulses from the battery to line to operate such signaling device, such impulses being of a frequency not adapted to operate such ringer, switching means in a normally open circuit from the battery to the pole changer, and common means for operating the pole

changer and for operating such switching mechanism to close such circuit.

7. In a telephone exchange system, a telephone line extending by its limbs from a substation to an exchange, a tuned ringer connected to the line, a battery at the substation, a signal associated with the line at the exchange, a transformer at the substation having its secondary winding in a circuit extending to the line, and a pole changer in a circuit extending from such battery through the primary winding of the transformer, such pole changer adapted when operated to send current impulses to the line to operate such signaling device, such impulses being of a frequency not adapted to operate such ringer.

8. In a telephone exchange system, a telephone line extending by its limbs from a substation to an exchange, a tuned ringer connected to the line, a battery at the substation, a signal associated with the line at the exchange, a transformer at the substation having its secondary winding in a circuit extending to the line, a pole changer in a circuit extending from such battery through the primary winding of the transformer, such pole changer adapted when operated to send current impulses to the line to operate such signal device, a switching mechanism in circuit with each winding of the transformer serving normally to open such circuit, and common means for operating the pole changer and such switching mechanisms to close such circuits.

9. In a telephone exchange system, a telephone line extending by its limbs from a substation to an exchange, a tuned ringer connected to the line, a battery at the substation, a signal associated with the line at the exchange, a transformer at the substation having its secondary winding in a circuit extending to the line, a pole changer in a circuit extending from such battery through the primary winding of the transformer, such pole changer adapted when operated to send current impulses to the line to operate such signal device, a switching mechanism in circuit with each winding of the transformer serving normally to open such circuit, common means for operating the pole changer and such switching mechanisms to close such circuits, and a common support for such pole changer, switching mechanisms and such operating mechanism.

10. In a telephone exchange system, a telephone line extending by its limbs from a substation to an exchange, a tuned ringer connected to the line, a talking battery at the substation, a signal associated with the line at the exchange, a cabinet at the substation for containing telephone apparatus associated with the line, a transformer at the substation having its secondary winding in a circuit extending to the line, a pole changer in a circuit extending from such battery through the primary winding of the transformer, such pole changer adapted when operated to send current impulses to the line to operate such signaling device, a switching mechanism in circuit with each winding of the transformer serving normally to open such circuit, a lever for operating in common the pole changer and such switching mechanisms to close such circuits, and means independent of the cabinet for supporting the pole changer, switching mechanisms and lever in operative relation to each other inside of the cabinet, such lever projecting through the cabinet to facilitate its operation.

11. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines, batteries at the substations, signaling devices at the exchange associated with the lines, and manually operated simple harmonic frequency producing means located at the substations for sending current impulses from the batteries to line to operate such signaling devices, such substation impulse sending means being incapable of sending impulses of a frequency to which the tuned ringers are responsive.

12. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines, talking batteries at the substations, signaling devices at the exchange associated with the lines, and manually operated simple harmonic frequency producing means located at the substations for sending current impulses from such talking batteries to line to operate such signaling devices, such substation impulse sending means being incapable of sending impulses of a frequency to which the tuned ringers are responsive.

13. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines, batteries at the substations, signaling devices at the exchange associated with the lines, and pole changers at the substations for sending current impulses from the batteries to line to operate such signaling devices, such impulses being of frequencies not adapted to operate such ringers.

14. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines, talking batteries at the substations, signaling devices at the exchange associated

with the lines, tuned pole changers at the substations for sending current impulses from such talking batteries to line to operate such signaling devices, such impulses being of frequencies not adapted to operate such ringers, switching means in normally open circuits from the batteries to the pole changers, and common means for operating the pole changers and for operating such switching means to close the circuits associated therewith.

15. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines, batteries at the substations, signaling devices at the exchange associated with the lines, transformers at the substations having their secondary windings in circuits extending to the lines connected to such substations, and pole changers in circuits extending from such batteries through the primary windings of the transformers, such pole changers when operated adapted to send current impulses to the associated lines to operate the signaling devices connected therewith, such current impulses being of frequencies not adapted to operate such ringers.

16. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines, batteries at the substations, signaling devices at the exchange associated with the lines, transformers at the substations having their secondary windings in circuits extending to the lines connected to such substations, pole changers in circuits extending from such batteries through the primary windings of the transformers, such pole changers when operated adapted to send current impulses to the associated lines to operate the signaling devices connected therewith, switching mechanisms in circuit with the windings of the transformers serving normally to open such circuits, and common means for operating the pole changers and for operating the switching mechanisms to close said circuits.

17. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines, batteries at the substations, signaling devices at the exchange associated with the lines, transformers at the substations having their secondary windings in circuits extending to the lines connected to such substations, pole changers in circuits extending from such batteries through the primary windings of the transformers, such pole changers when operated adapted to send current impulses to the associated lines to operate the signaling devices connected therewith, switching mechanisms in circuit with the windings of the transformers serving normally to open such circuits, and common means for operating the pole changers and for operating the switching mechanisms to close such circuits, each of such pole changers and its associated switching and operating mechanisms having a common support.

18. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines, talking batteries at the substations, signaling devices at the exchange associated with the lines, cabinets at the substations for containing the telephone apparatus associated with the lines, transformers at the substations having their secondary windings in circuits extending to the lines connected to such substations, pole changers in the circuits extending from such batteries through the primary windings of the transformers, such pole changers when operated adapted to send current impulses to the associated lines to operate the signaling devices connected therewith, switching mechanisms in circuit with the windings of the transformers serving normally to open such circuits, a lever for operating in common each of such pole changers and its associated switching mechanisms to close the circuits leading thereto, and means independent of the cabinet containing such apparatus for supporting such pole changers, switching mechanisms and lever in operative relation to each other inside of the cabinet, such lever projecting through the cabinet to facilitate its operation.

19. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines at the substations, signaling devices at the exchange associated with the lines, and manually operated simple harmonic frequency producing means located at one of the substations for sending current impulses to operate the associated signaling device, said means incapable of producing impulses of the frequency to which the substation ringers are responsive.

20. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines at the substations, signaling devices at the exchange associated with the lines, and manually operated simple harmonic frequency

producing means located at one of the substations for sending alternating current impulses to line to operate the associated signaling device, such impulses being of a frequency not adapted to operate such ringers.

21. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines at the substations, batteries at the substations, signaling devices at the exchange associated with the lines, and manually operated simple harmonic frequency producing means located at one of the substations for sending current impulses from the battery there located to line to operate the associated signaling device, such substation impulse sending means being incapable of sending impulses of a frequency to which the tuned ringers are responsive.

22. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines at the substations, talking batteries at the substations, signaling devices at the exchange associated with the lines, and means located at one of the substations for sending alternating current impulses from the battery there located to line, to operate the associated signaling device, such impulses being of a frequency not adapted to operate such ringers.

23. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines at the substations, batteries at the substations, signaling devices at the exchange associated with the lines, and a pole changer at one of the substations for sending current impulses from the battery there located to line to operate the associated signaling device, such impulses being of a frequency sufficiently different from the frequencies to which the ringers are tuned to prevent their operation.

24. In a telephone exchange system, a plurality of telephone lines extending from substations to an exchange, apparatus at the exchange for connecting the lines for conversation, tuned ringers connected to the lines at the substations, talking batteries at the substations, signaling devices at the exchange associated with the lines, a pole changer at one of the substations for sending current impulses from the battery there located to line to operate the associated signaling device, such impulses being of a frequency sufficiently different from the frequencies to which the ringers are tuned to prevent their operation, switching means in a normally open circuit from said battery to said pole changer, and common means for operating the pole changer and for operating said switching mechanism to close such circuit.

25. A substation signaling mechanism, consisting of a tuned reed, switching mechanism independent of said reed, a lever for operating said reed and controlling said switch, and a pivoted catch on said lever adapted to engage and vibrate said reed.

26. A substation signaling mechanism consisting of a tuned reed, switch contacts adapted to coöperate with the reed when it is vibrated, a cast metal base for supporting the reed, spring brackets extending from the base to support the contacts, and means for adjusting the brackets and contacts relatively to the reed support.

27. In a telephone exchange system, a telephone line extending by its limbs from substations to an exchange, differently tuned ringers connected to the line, a signal associated with the line at the exchange, and means located at one of the substations for sending current impulses to the line to operate such signaling device, such ringers being irresponsive to impulses of frequencies which the substation impulse sending means is adapted to produce.

28. In a telephone exchange system, a telephone line extending by its limbs from substations to an exchange, differently tuned ringers connected to the line, a battery at each of the substations, a signal associated with the line at the exchange, and means located at one of the substations for sending current impulses from the battery there located to line to operate such signaling device, such substation impulse sending means incapable of sending impulses of frequencies to which the substation ringers are responsive.

29. In a telephone exchange system, a telephone line extending by its limbs from substations to an exchange, differently tuned ringers connected to the line, a battery at each of the substations, a signal associated with the line at the exchange, a pole changer at one of the substations for sending current impulses from the battery there located to line to operate such signaling device, such impulses being of a frequency sufficiently different from the frequency to which such ringers are tuned to prevent the operation of any of them.

30. In a telephone exchange system, a telephone line extending by its limbs from substations to an exchange, differently tuned ringers connected to the line, a talking battery at each of the substations, a signal associated with the line at the exchange, a tuned pole changer at one of the substations for sending current impulses from the battery there located to line to operate such

signaling device, such impulses being of a frequency sufficiently different from the frequencies to which such ringers are tuned to prevent the operation of any of them, switching means in a normally open circuit from the battery to the pole changer, and common means for operating the pole changer and for operating such switching means to close such circuit.

31. In a telephone exchange system, a telephone line extending by its limbs from substations to an exchange, differently tuned ringers connected to the line, a battery at each of the substations, a signal associated with the line at the exchange, a transformer at one of the substations having its secondary winding in a circuit extending to the line, and a pole changer in a circuit extending from the associated battery through the primary winding of the transformer, said pole changer adapted when operated to send current impulses to the line to operate such signaling device, such impulses being of a frequency not adapted to operate such ringers.

32. In a telephone exchange system, a telephone line extending by its limbs from substations to an exchange, differently tuned ringers connected to the line, a battery at each of the substations, a signal associated with the line at the exchange, a transformer at one of the substations having its secondary winding in a circuit extending to the line, a pole changer in a circuit extending from the associated battery through the primary winding of the transformer, said pole changer adapted when operated to send current impulses to the line to operate such signaling device, such impulses being of a frequency not adapted to operate such ringers, a switching mechanism in circuit with each winding of the transformer serving normally to open such circuit, and common means for operating the pole changer and such switching mechanisms to close such circuits.

33. In a telephone exchange system, a telephone line extending by its limbs from substations to an exchange, differently tuned ringers connected to the line, a battery at each of the substations, a signal associated with the line at the exchange, a transformer at one of the substations having its secondary winding in a circuit extending to the line, a pole changer in a circuit extending from the associated battery through the primary winding of the transformer, said pole changer adapted when operated to send current impulses to the line to operate such signaling device, such impulses being of a frequency not adapted to operate such ringers, a switching mechanism in circuit with each winding of the transformer serving normally to open such circuit, common means for operating the pole changer and such switching mechanisms to close such circuits, and a common support for such pole changer, switching mechanisms and such operating mechanism.

34. In a telephone exchange system, a telephone line extending by its limbs from substations to an exchange, differently tuned ringers connected to the line, a talking battery at each of the substations, a signal associated with the line at the exchange, a cabinet at the substation for containing telephone apparatus associated with the line, a transformer at one of the substations having its secondary winding in a circuit extending to the line, a pole changer in a circuit extending from the associated battery through the primary winding of such transformer, such pole changer adapted when operated to send current impulses to the line to operate such signaling device, such impulses being of a frequency not adapted to operate such ringers, a switching mechanism in circuit with each winding of the transformer serving normally to open such circuit, a lever for operating in common the pole changer and such switching mechanisms to close such circuits, and means independent of the cabinet for supporting the pole changer, switching mechanisms and lever in operative relation to each other inside of the cabinet, such lever projecting from the cabinet to facilitate its operation.

35. In a telephone system the combination of a plurality of telephone lines extending to an exchange, a signaling device at the exchange associated with the lines, simple harmonic frequency producing means located at the substation for sending current impulses to line to operate such device and tuned signals at the substations, said means capable of producing such frequencies of current only as will not operate the tuned signals at the substation.

36. In a telephone system, the combination of a telephone line extending to a main station, a signaling device at the main station associated with the line, means located at the substations for sending current impulses to line to operate such signaling devices and tuned signals at the substations, said means capable of producing current of one frequency only and incapable of operating said tuned signals.

In witness whereof, I hereunto subscribe my name this 28th day of October A. D. 1908.

WILLIAM W. DEAN.

Witnesses:
A. D. T. LIBBY,
R. Y. SANDS.