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W. W. DEAN.

PARTY LINE TELEPHONE SYSTEM.

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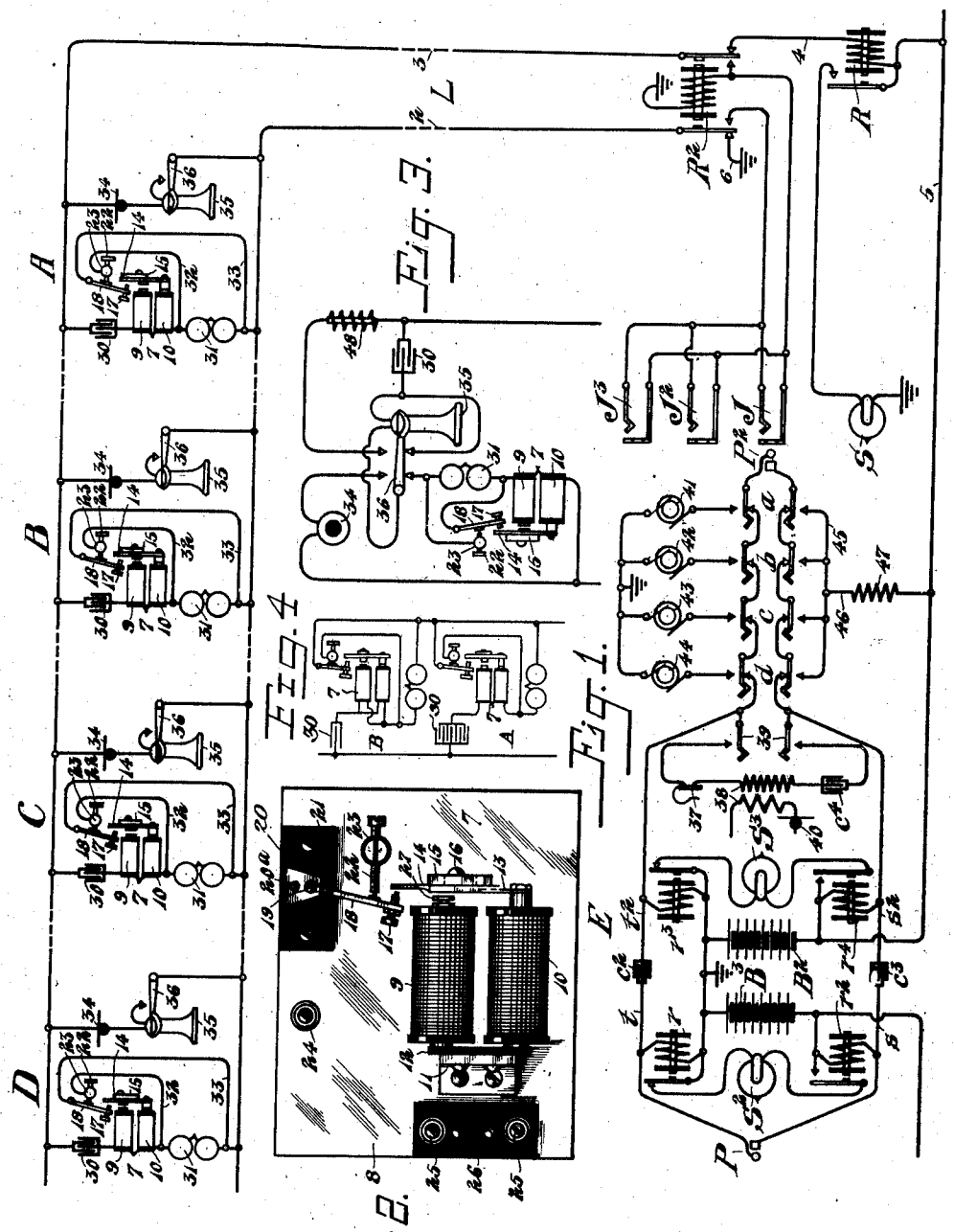

Fig. 3.

Fig. 2.

Fig. 4.

Fig. 1.

Witnesses.

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PARTY-LINE TELEPHONE SYSTEM.

No. 878,779. Specification of Letters Patent. Patented Feb. 11, 1908.

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To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States of America, and resident of Chicago, county of Cook, and State of Illinois, have invented new and useful Improvements in Party-Line Telephone Systems, of which the following is a specification.

My invention relates to improvements in party line telephone systems and has for its objects, generally speaking, the provision of a harmonic selective signaling system for such lines.

My invention particularly relates to systems having at the central office a plurality of generators adapted to impress upon the line preferably alternating current of different frequencies, and consists in providing a separate electro-magnetic device at each substation, which is furnished with a tuned reed having a certain definite rate of vibration, and this device is arranged to suitably control the signaling bell at the substation. In my preferred arrangement, I locate the said harmonic device and an ordinary polarized signaling bell in a bridge of the line conductors, and control through the medium of said harmonic device the normally closed shunt of the said signaling bell. A weighted contact is arranged to normally close the said shunt and the reed tongue of the harmonic device is adapted when vibrated to strike the said weighted contact to open the shunt. When the shunt is thus opened by the harmonic device the ringing current is permitted to pass directly through the signaling bell to actuate the same. When the invention is applied to common battery telephone lines in which a source of current is normally connected therewith at the central office, I preferably include in each of the bridges of the signaling devices a suitable condenser which serves to prevent the flow of steady current but permits the passage of the ringing current.

My invention is illustrated in the accompanying drawing in which the same reference characters are used throughout and in which

Figure 1 is a diagram of a telephone system embodying my improvements; Fig. 2 is a side elevation of the harmonic device that I prefer to use, and Fig. 3 is a diagrammatic view of the substation circuits that are preferably employed. Fig. 4 is a modification of my invention by means of which the current flow through a particular harmonic device is modified by the adjustment of the capacity and impedance in the circuit of the device.

In Fig. 1, L indicates a telephone line of the poly-station type extending in two limbs 2 and 3 from the substations A, B, C and D to the central office E, where it is fitted with the usual appurtenances including a line signal S, an answering jack J, and a plurality of multiple jacks such as J^2 and J^3 in any desired number. The line conductor 3 is normally connected with branch conductor 4 which is connected with the common battery bar 5 leading from the live pole of the central common battery B^2, while the line conductor 2 is normally grounded through a branch connection 6. The conductor 4 includes the winding of the line relay R which controls through its normally open contact the local circuit of the line signal S, while a cut-off relay R^2 serves to disconnect said line conductors 2 and 3 from their normal extensions and to connect them with the switchboard sections of the line leading to the spring jacks. The winding of this cut-off relay R^2 is legged to ground from the sleeve side of the said switchboard section of the line.

The electro-magnetic harmonic device which is used at each substation is shown in Fig. 2, and is indicated by the numeral 7. Said device consists of a suitable plate 8 upon which a horse-shoe magnet consisting of the coils 9 and 10 is mounted by means of an angle plate 11 secured to the yoke 12 which joins the rear ends of the cores of coils 9 and 10. The core of the magnet 10 is extended beyond the forward end of the coil and the tuned reed rigidly secured thereto. This reed consists of a spring strip 13 secured at its lower end to the projecting end of the core of coil 10 and at its upper end to the armature 14 which carries upon its outer face an adjustable weight 15 that is secured in any longitudinal position thereon by means of a suitable set screw 16 passing through a slot in the weight 15 and threading into the armature 14. The upper reduced end of the armature 14 is adapted when the reed is vibrated to strike the adjustable set screw 17 carried in the lower end of a comparatively heavy contact 18 that is loosely swung upon a pivot 19 carried by the bracket 20 extending outwardly from the face of the

insulating plate 21 that is secured by suitable screws to the plate 8. Said bracket 20 also serves through the medium of binding screw 20^a and an intersecting aperture as a binding post or terminal for the contact 17. An adjustable screw contact 22 is carried by a post 23 secured to the plate 8 and the tip of the screw 22 as well as the engaging portion of the contact 18 are provided with a small amount of platinum to make a good electrical contact. A suitable binding post 24 is secured to the metallic plate 8 and forms the terminal for contact 22. Other posts 25 are mounted upon a suitable insulating block 26 secured to plate 8 and serve as terminals for the coils 9 and 10 of the horse-shoe magnet. The forward end of the core of the magnet 9 may be provided with an adjustable pole piece 27 consisting of a threaded portion screwing into the end of the core. When an alternating or pulsating current of the proper frequency traverses the coils 9 and 10 of this device, the armature 14 is suitably actuated and the reed is caused to vibrate. In the vibration of the reed it strikes the screw 17 of the heavy contact 18 and serves to swing said contact 18 out of engagement with the contact 22. Owing to the inertia of the contact 18 the rapid vibration of the tuned reed does not permit the same to close upon the contact 22 so that the circuit controlled between the contacts 18 and 22 is thus continuously opened. The operative rate of actuation of this device is thus the natural rate of vibration of the reed as modified by its action in striking against the weighted contact 18, and the frequency of the operating current must closely approximate this resultant rate of actuation in order to successfully operate the device. Likewise the said frequency must be sufficiently close to the natural rate of vibration of the reed to start the same from a state of rest. The rate of vibration of the reed may be varied by adjusting the weight 15 along the armature.

In Fig. 1 I have shown in simple diagram the substation apparatus including the harmonic device. At each station the said device 7 is placed in a bridge of the line conductors 2 and 3 together with a suitable condenser 30 and an ordinary polarized or alternating current signaling bell 31. The said contacts 18 and 22 of the harmonic device 7 serve to normally short circuit the bell 31 through the medium of branch conductors 32 and 33 connected from opposite sides of the bell 31 to the said contacts. A transmitter 34, and receiver 35 are adapted to be included in a bridge of the line conductors when the receiver is removed from the switch hook 36. The same apparatus is shown at each substation but the weight 15 is adjusted to different positions upon the armature 14 and hence the reeds have different rates of actuation. The reed at station A, for example, is preferably adjusted to cause the reed to operate at 1000 vibrations per second; that at station B at 2000 vibrations per second, and those at stations C and D at 3000 and 4000 vibrations per second respectively.

At the central office, the operator's cord circuit is provided with suitable means for impressing ringing current of the desired frequency upon the telephone line. This cord circuit comprises as usual, an answering plug P and a calling plug P^2 having tip and sleeve contacts adapted to register respectively with the corresponding contacts of the spring jacks of the telephone line, the tip contacts of said plugs being joined by means of flexible strands t and t^2 and the interposed condenser c^2, while their sleeve contacts are similarly united by the strands s and s^2 and the interposed condenser c^3. The supervisory relays r and r^2 are adapted to be connected upon opposite sides of the common battery B^3 in a bridge at the answering end of the cord circuit, said relays serving to control the local circuit of the supervisory lamp S^2 associated with the answering plug P, while similar supervisory relays r^3 and r^4 are connected in like manner with the battery B^2 across the calling end of the cord circuit and similarly control the local circuit of the supervisory signal S^3. The operator's head telephone 37, the secondary of her induction coil 38 and a suitable condenser c^4 are adapted to be bridged across the calling end of the cord circuit by means of the springs 39 of any suitable listening key, while her transmitter 40 and the primary of her induction coil are adapted to be charged from any suitable source of current which may be the battery B^2 or B^3.

Associated with the calling end of the cord circuit are a plurality of ringing keys a, b, c and d, corresponding to the substations upon the line. Each ringing key, in the arrangement shown in the drawing, is adapted to connect the calling plug P^2 with its associated generator 41, 42, 43 or 44, capable of developing ringing current of the proper frequency to actuate the harmonic device at the particular substation. For instance with the reeds operating at the rates specified, the generator 41 is capable of developing a ringing current preferably alternating in character having a frequency of 1000 cycles per minute, the generator 42 of 2000 cycles per minute, the generator 43 of 3000 cycles per minute and the generator 44 of 4000 cycles. The opposite terminals of said generators are shown grounded, while the sleeve springs of the ringing keys when they are actuated connect with the branch conductors 45 and 46 leading to the battery lead 5, a suitable resistance 47 being included in said conductor 46.

The operation of establishing the connection with the calling subscriber is carried out in the usual manner. The subscriber taking up his receiver closes a circuit over the telephone line from the battery B^2 or B^3, and operates his line relay R to actuate the signal S. Upon observing the signal the operator inserts the answering plug P of her cord circuit in the answering jack of the telephone line and depresses her listening key to connect her telephone with the cord circuit that she has used to answer the subscriber. The insertion of the plug P causes current from the battery to flow through the cut-off relay of the calling line to thereby disconnect the line relay R to render the line signal inoperative. After learning the order of the calling subscriber the wanted line is tested in the usual manner by touching the tip of the calling plug P^2 to the test ring of the multiple jack of the said line.

If the line is found idle the calling plug is inserted and the ringing key corresponding to the party wanted upon the line is operated. For example, having inserted the calling plug P^2 in one of the jacks of the line L the depression of the ringing key *a* causes current from the generator 41 to flow from ground over the tip side of the telephone line through the shunt circuits including the conductors 33 and 32 and contacts 18 and 22, and thence through the harmonic devices 7 and the condensers 30 at the substations. Owing to the fact that this ringing current is of the frequency corresponding to the signaling devices 7 at the substation A, only this device is operated, and when so operated it opens the shunt circuit about the signaling bell 31 at said station which then permits ringing current to flow directly through the signaling bell 31 and actuates the same to call the subscriber. The depression of any of the other ringing keys will, in a similar manner, operate the signaling bell at the corresponding stations on the telephone line and will not operate the others.

After the subscriber has been called but before his response current from the battery B^2 flows through the supervisory relay r^4 and through the cut-off relay R^2 of the telephone line to ground. This supervisory relay closes the local circuit of the signal S^3 associated with the plug P^2 which is lighted until the subscriber responds. In thus responding the metallic circuit of the telephone line is completed and current flows back to the central office through the supervisory relay r^3, which is energized and retires the said supervisory signal.

During conversation the battery B^2 is sending current out over the telephone line L to operate the subscriber's transmitter while the battery B^3 is sending current out over the calling subscriber's line for the operation of his transmitter. At the termination of the conversation the return of the subscribers' receivers to their hooks opens the line circuits to steady currents and permits the relays *r* and r^3 to close the local circuits of the corresponding supervisory signals S^2 and S^3, which are lighted to indicate to the operator that the conversation has terminated. The operator may then withdraw the plugs from the telephone lines and restore all parts to normal condition.

The substation arrangement shown in Fig. 3 is preferred. This includes, in addition to the parts shown in Fig. 1, a suitable retardation coil 48 and the connections are such that normally the bridge of the signaling devices is closed through the contacts of the hook switch 36, but when the receiver is lifted from the hook said bridge is opened and the transmitter 34 and receiver 35 together with the retardation coil 48 and the condenser 30 are suitably connected in the circuit. Thus the condenser 30 is utilized for both talking and signaling.

In the arrangement shown in Fig. 1, no provision is made for adjusting the capacities of the condensers 30 and the inductance of the harmonic device 7 to make their branches resonant to the ringing currents but it is obvious that this may be readily done. A practical manner of approximately so adjusting these parts is to arrange the two coils 9 and 10 of the device 7 in such manner that at some of the stations they may be connected in series and at others they may be connected in parallel. Such an arrangement is shown in Fig. 4, in which the station marked A will be called by the use of a low frequency current and the station marked B will be called by the use of a high frequency current.

While I have described one specific manner of utilizing the harmonic devices and, in general, of carrying out the invention, I would have it understood that the invention is not to be so limited in all respects as various modifications and arrangements may be made without departing from the intended scope of the invention.

What I claim and desire to secure by Letters Patent is:—

1. In a party line telephone system, the combination with a telephone line, of a plurality of substations located on the line, a harmonic device at each substation adapted to respond to current of predetermined frequencies, a bell also at each substation, a shunt circuit of the bell adapted to be continuously broken during the actuation of the device, and a source of current at the central office for each substation adapted to impress current upon the line of the proper frequencies to operate said harmonic devices, substantially as described.

2. In a party line telephone system, the combination with a telephone line, of a plu-

rality of substations located on the line, a harmonic device at each substation adapted to respond to current of predetermined frequencies, a signaling bell at each substation, a shunt of the bell continuously broken by the actuation of the device, a source of current at the central office adapted to impress upon the line ringing current of the proper frequencies to actuate said harmonic devices, and means whereby when the said shunt circuits are opened the said bells are operated by the current from the said source independently of intervening means at the central station, substantially as described.

3. In a party line telephone system, the combination with a telephone line, of a plurality of substations located on the line, a harmonic device and a bell connected in branches from the line conductors at the substations, the said harmonic devices controlling shunts of the said bells, means at the central office for impressing upon the line current of the proper frequencies to actuate the harmonic devices, and maintain a break in said shunt, the bells when the shunt circuits are opened being operated by the same current that actuates the harmonic devices, substantially as described.

4. In a party line telephone system, the combination with a telephone line, of a plurality of substations located on the line, a harmonic device and a signaling bell in a bridge of the line conductors at each substation, the said devices each controlling a shunt circuit of the associated bell, and adapted to maintain a break in said shunt during the actuation of the device, and means at the central office for impressing upon the line ringing current of frequencies corresponding to the rates of actuation of said devices, said bells being also actuated by said currents when the associated harmonic device opens the shunt, substantially as described.

5. In a party line telephone system, the combination with a telephone line, of a plurality of substations located on the line; a condenser, harmonic device and bell located in a bridge of the line conductors at each substation; said devices controlling shunts of the corresponding bells, and being adapted to maintain a break in said shunt during actuation, means at the central office for impressing upon the line ringing current of frequencies corresponding to the rates of actuation of said devices, the said bells responding to the same current flow when their shunts are opened by the said devices, substantially as described.

6. In a party line telephone system, the combination with a telephone line, of a plurality of substations located on the line, a harmonic signaling device at each substation adapted to respond to current of predetermined frequencies, a signaling bell, a shunt of said bell controlled through the normally closed contacts of said harmonic device, a weighted member adapted to be operated by the vibrating reed of said device when current of the proper frequencies is sent over the line, said member when said device is operated being adapted to maintain said contacts open to thereby remove the shunt about the bell to permit its operation, substantially as described.

7. In a telephone system, the combination with a telephone line, of a harmonic device at the substation having a vibrating reed and a weighted member against which said reed is adapted to strike in its vibration, said member controlling normally closed contacts whereby when the reed is actuated said member owing to its momentum opens said contacts, the operative rate of actuation of the said device being the natural rate of the reed as modified by the action of the said member in being struck, and means for impressing current upon the line of a frequency corresponding to the said operative rate of actuation and sufficiently close to the natural reed to start the same, substantially as described.

Signed by me at Chicago, county of Cook, State of Illinois, this 31st day of December 1903.

WILLIAM W. DEAN.

Witnesses:
E. A. GARLOCK,
ROBERT LEWIS AMES.