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PARTY LINE SELECTIVE SIGNALING SYSTEM.

APPLICATION FILED APR. 18, 1908.

1,023,482. **Patented Apr. 16, 1912.**

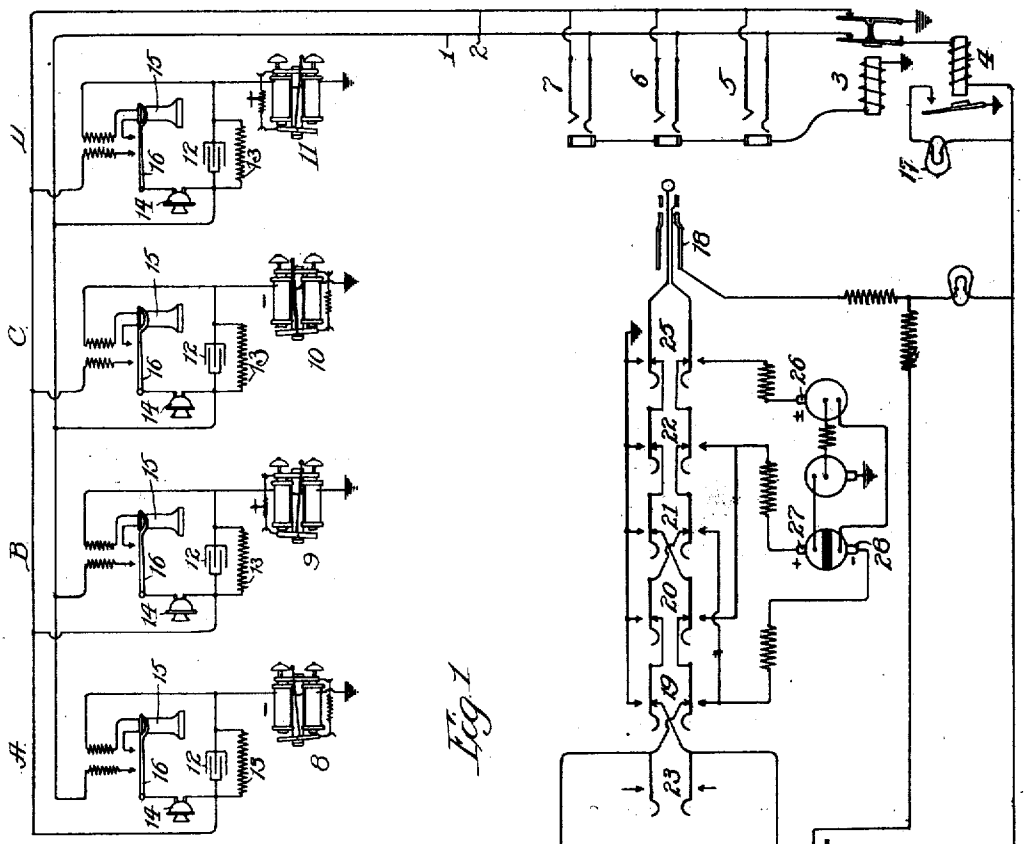

Fig. 1

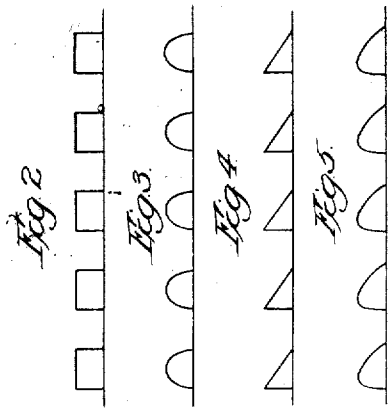

Fig. 2 Fig. 3 Fig. 4 Fig. 5

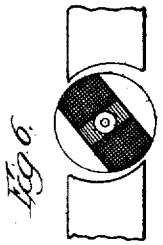

Fig. 6

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UNITED STATES PATENT OFFICE.

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PARTY-LINE SELECTIVE SIGNALING SYSTEM.

1,023,482. Specification of Letters Patent. Patented Apr. 16, 1912.

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To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, citizen of the United States, residing at Jericho, in the county of Chittenden and State of Vermont, have invented a certain new and useful Improvement in Party-Line Selective Signaling Systems, of which the following is a full, clear, concise, and exact description.

My invention relates to party line selective signaling systems, and is an improvement upon that party line telephone signaling system which is illustrated, described and claimed in Patent No. 555,725 to Angus S. Hibbard, dated March 3rd, 1896. This Hibbard system has been largely employed, and under the most favorable conditions has been found satisfactory.

In the practical operation of the system some modifications were introduced, among which I would mention that in each of the branches to ground at the different subscribers' substations there was included with the bell a resistance of about six thousand ohms, this resistance, added to the resistance of the bells employed, which was about a thousand ohms, making seven thousand ohms resistance or thereabout in each ground branch at each of the substations of a party line. Notwithstanding all the improvements or changes that were thus introduced into the Hibbard system, difficulties were encountered in connection with the operation, not only of the individual bells, but also in the operation of the supervisory relay and the line relay, due to line leakage, necessarily inherent in the system, and to earth voltages. Installations of that prior system in which the telephone lines are in proximity to power circuits, resulting in earth voltages, and also where the telephone lines themselves vary in length, capacity and resistance, and where the various substations upon a given line are at widely different distances apart, have been found quite unsatisfactory and even inoperative on account of the cross ringing of the bells, such cross ringing or false signaling resulting from some unfavorable condition at another station of the same line.

Earth potentials, as is well understood, may be thirty or forty volts where telephone lines are installed near electric railways and other utilities which employ electric current sent over wires and to ground. Variations in the voltage and frequencies of the signaling current due to changes in speed of the generator and variations in load increase the difficulties which I have already enumerated, and have resulted so unfavorably as to render the Hibbard system, if not wholly inoperative, at least exceedingly unsatisfactory. It will further be understood that in the Hibbard system the margin between the high resistance required to make the leakage moderate and the requirement that there shall be enough current to operate the bells is not wide. Even when the greatest care is taken there will be some normal flow of battery current which in the interests of economy it is desirable to decrease to the lowest amount consistent with practical operation. The bells or ringers at the different stations are biased. Pulsating current of the plus sign will accordingly operate a bell biased in a given direction, while the same bell will not be rung when traversed by pulsations of the opposite sign.

My invention is designed to avoid all the objections to the Hibbard system that have been enumerated.

Speaking generally, my invention consists in providing condensers in connection with the circuit of each party line substation, each condenser being in parallel with or shunted by a very high resistance, the connection to ground at each substation being made through a biased bell. Each bell is preferably mechanically attuned to cause the bell in each case to respond with maximum effect when traversed by current of the lowest practical voltage and frequency.

In carrying out my invention, I have found that a pulsating current of a peculiar wave form is very desirable if not essential to the commercial success of my system. The ordinary pole changer produces circuit waves which are abrupt, increasing almost instantly to a maximum and then receding to zero in the same abrupt way. The ordinary generator produces a wave form which is only less abrupt, the upper corners, so to speak, of the pulsations being rounded off. Theoretically, the form which I would prefer is one in which a single impulse increases to its maximum abruptly and then falls away gradually to zero.

The attuning of the bells is an important feature of my invention. The bells may be constructed to respond best when the generator is constructed and operated to send

pulsations at the rate of say a thousand pulsations per minute, the voltage impressed upon the line being at the same time only of the amount which is adapted to cause the bells to operate in a satisfactory manner; that is to say, I attune or weight the bells so as to be in harmony with the amount of voltage and number of impulses produced when the generator is operated at its practical minimum of speed, such speed, for example, as will cause a thousand impulses a minute upon the line, or some speed near the practical minimum. In case the speed is increased, the number of impulses will be increased in like ratio, and the bells being attuned or weighted, the increase in the frequency of the impulses will make their effect upon the bells less effective. That is to say, if the number of impulses shall be increased above the rate of a thousand a minute, this being a normal rate to which the bells have been attuned, the increase in frequency will make their effect upon the bells less, so that the bells will be less liable to cross ringing. Accordingly, when on increase in voltage due to increase in speed of the generator, the tendency to cross ringing would be amplified on account of the increase in the discharge from the condensers, this increased tendency due to increase in voltage will be offset or made harmless on account of the increase in the number of pulsations when the bells are attuned to the lower rate of vibration in accordance with my invention. By weighting or attuning the bells so that they will operate with the desired efficiency when the speed of the generator is moderate, I am enabled to maintain such desired efficiency in the operation of the bells when the speed of the generator is considerably increased, because the negative effect caused by the increase of pulsations is offset or counterbalanced by the positive effect resulting from the increase in the voltage of the pulsations due to the increase of the speed of operation. I am thus enabled to cause the bell of a station which it is desired to signal to respond, while at the same time, bells of other stations are prevented from cross ringing.

My invention will be more readily understood by reference to the accompanying drawing, wherein —

Figure 1 illustrates a four-party line circuit connected with central office apparatus in accordance with my invention; Fig. 2 illustrates graphically the form of pulsation produced by the ordinary pole-changer; Fig. 3 illustrates the form of pulsation produced by the ordinary generator; Fig. 4 illustrates the form of pulsation which I consider in theory most practical and efficient in my system; Fig. 5 illustrates the form of pulsation which I have used in actual practice and which has proven eminently satisfactory; and Fig. 6 illustrates the conformation of the pole pieces of a generator adapted to produce the form of pulsation illustrated in Fig. 5.

Like parts are designated by similar characters of reference throughout the several views.

In Fig. 1 I have illustrated only so much of a party line telephone circuit as is necessary to make clear the nature of my invention. It will be seen that the telephone line circuit consists of two limbs, 1, 2, extending from the central office out through four substations A B C D. At the central office is provided the usual cut-off relay 3, and the line relay 4. The line is shown connected with springjack switches 5, 6 and 7, as would be required in a multiple system, though the multiple arrangement is not a feature of my invention. The limb 1 is branched to ground through substations D and C. Limb 2 is branched to ground through substations B and A. The ringer 8 at substation A is biased to respond to negative impulses. The ringer 9 at substation B is biased to respond to positive impulses. At station C the ringer 10 will respond to negative impulses, while the ringer at substation D will respond to positive impulses.

In the ground branches of the different substations I place condensers, each condenser being in shunt of a very high non-inductive resistance. The condensers 12 may each have a capacity of say two microfarads, and the resistance 13 about the same may be of say sixty thousand ohms. I preferably make the ringers 8, 9, 10 and 11 each of about twenty-five hundred ohms resistance. They will have also necessarily rather high impedance. The transmitter 14, the receiver 15 and the telephone switch-hook 16 are of the usual form and may be connected in any well-known manner.

Referring to the central office apparatus, the line relay 4 will be of any usual construction and arranged and adapted to operate the call signal 17. The cord circuit includes the three part plug 18 and the switch keys 19, 20, 21 and 22, corresponding respectively with substations A B C D. The operator's listening-in key 23 will be of usual construction. I have not shown the operator's telephone set. The supervisory relay 24 is connected with the cord circuit in the ordinary manner to control the clearing-out signal.

I have represented the ringing generator in the usual diagrammatic form. It is adapted as shown to impress upon the line either alternating current or positive pulsations or negative pulsations, according to the connection made. The key 25, which is adapted to make connection with the brush

26 which controls the alternating current, is used when it may be desired to signal the substation upon a non-party line; such a single station is ordinarily provided with the usual polarized ringer. From brush 27 positive pulsations will be derived, and from brush 28 negative pulsations. The attuning of the bells is brought about by making the bell striker of the desired weight with respect to the striker rod. The inertia of the striker will thus be made sufficient so that pulsations of the moderate or normal rate will be practically in unison with the normal movement or vibrations of the striker of the ringer under operation. That is to say, the ringers are constructed so that they will respond with maximum effect when traversed by current of the lowest practical frequency.

The form of the pulsations of the current is important in connection with the charging and discharging of the condensers. Let us assume that key 22 is depressed when the plug 18 is inserted in the springjack of the line. The pulsating current acting through the condensers will cause the signal to be given by the ringer 11. The condenser 12 in the same circuit with ringer 11 will be charged abruptly by pulsations of the form shown in Fig. 5. The discharge, however, will be gradual. It will be apparent that when current made up of positive impulses is sent through ringer 11 that the same kind of positive pulsations will be sent through ringer 10, but ringer 10 is biased oppositely to ringer 11, and, therefore, will not respond. There is, however, current produced of the negative polarity through ringer 10 when its corresponding condenser is discharged. The object of the resistances 13 is to give the condensers in each case a chance to discharge in the local circuit through its resistance instead of through the corresponding ringer, as ringer 10.

By making the form of the circuit pulsations substantially such as described in connection with Figs. 4 and 5, the discharge of the condensers is made gradual, as distinguished from the abrupt manner in which it was charged, and therefore the current produced by the discharge of a condenser which is necessarily of the opposite sign to that of the pulsations of the current by which it was charged, will be better taken care of in the local circuit containing the resistance and by the impedance of the bell, and thus a ringer which might be falsely operated if pulsations were of the form shown in Fig. 2 or Fig. 3 will not be operated if the pulsations are of the form shown in Fig. 4 or Fig. 5. In the Hibbard system there was necessarily a waste of current going on due to leakage through the ringer, of the station of a given limb of a circuit, which it was not desired to operate.

In the prior systems to which reference has been made, not only have the ringers been caused to operate poorly by leakage and earth potentials, but also the signaling apparatus at the central office,—particularly the line relays and the supervisory relays have been caused to act erroneously, the line signal being disclosed or withdrawn when it should not, and the clearing-out or supervisory signal being falsely operated by abnormal currents caused to traverse the supervisory relay. By the use of my invention, all these various difficulties in the operation of party line circuits have been overcome, even where earth potentials exist and where the resistances of the several lines and particularly of the different portions of lines between party stations vary in length greatly.

In Fig. 6 I have shown a detail of the pole pieces of a generator adapted to produce the form of pulsatory current best adapted for use in my system as herein set forth. It will be readily seen that in a generator of the construction indicated, the armature winding will be cutting the largest number of lines of force at the beginning, approximately, of its rotary movement adjacent the pole pieces, (the armature in the figure being driven in a clockwise direction) and therefore at that time carrying the peak of the wave. As the winding continues its movement between the pole pieces, the flux decreasing and the number of the lines of force cut in any given movement decreasing owing to the recision of the pole faces, the wave will gradually slope to zero and produce thereby the form of wave desired. It should be understood that while I have illustrated this means for obtaining the desired wave, since it forms no part of my present invention, any means whereby the desired wave form may be obtained may be substituted.

While I have illustrated the telephone circuit as a metallic circuit and shown three switches supposed to be upon different sections of a multiple switchboard, it is evident that my invention might be applied to systems in which other forms of circuit and other switchboards are employed. While in the cord circuit is shown the centralized battery 29 and the repeating coils 30, it is evident that my invention may be applied to ordinary magneto systems.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. A circuit extending from the central office of a telephone exchange to two different substations, each substation being provided with a ground branch, the respective ground branches each including a condenser having high non-inductive resistance about the same, and a ringer of high self-induction

in circuit with the condenser, the ringers at the different substations being oppositely biased, in combination with means for sending pulsating current over said circuit of either negative or positive sign, whereby either ringer may be selectively signaled, and cross ringing prevented, substantially as described.

2. A circuit extending from the central office of a telephone exchange to two different substations, each substation being provided with a ground branch, the respective ground branches each including a condenser having high non-inductive resistance shunting same, and a biased ringer in circuit with the condenser, the ringers at the different substations being oppositely biased, in combination with means for sending pulsating current over said circuit of either negative or positive sign, the form of the pulsations being adapted to abruptly charge and gradually discharge the condensers, whereby either ringer may be selectively signaled, and cross-ringing prevented, substantially as described.

3. In a telephone exchange system, the combination with a metallic circuit telephone line, of four substations, each connected with a separate branch to ground, a different pair of said branch circuits being derived from the respective limbs of the metallic circuit, the apparatus at each substation of each limb including a condenser, a high non-inductive resistance shunted about the same, and a biased ringer, the ringers of the pair of a given limb being biased oppositely, in combination with a generator and switching apparatus at the central office adapted to direct pulsating current of either positive or negative sign over the different limbs, the said ringers being attuned or weighted to correspond with the rate of pulsations, an increase in the speed of the generator which increases the rate of the impulses serving also to increase the voltage, whereby cross ringing is prevented, substantially as described.

4. In a telephone exchange signaling system, the combination with the cord circuit and a telephone line extending to substations upon the line, of a source of pulsating current, and keys in the cord circuit for directing pulsations of the desired sign or direction over the different limbs of the line, a biased ringer at each of the substations, the ringers connected with the same limb being oppositely biased, a condenser included in series with each ringer, and a high resistance non-inductive shunt about each condenser, whereby either ringer may be operated and cross ringing prevented, substantially as described.

5. The combination with a key 19, of a generator having a brush 28 from which is derived a negative pulsating current, the limb 2 of a telephone circuit, switching apparatus for connecting the cord circuit with said limb, a subscriber's telephone station A provided with a condenser 12 and a high non-inductive resistance 13 shunting the same, and a biased ringer 8 in a ground branch from said limb in series with the condenser, said bell being biased to respond to negative pulsating current when connected with the generator, a second substation upon said line having apparatus and connections the same as at station A, except that the ringer 9 of said station B is biased oppositely to respond to positive pulsating current, whereby the ringer 8 may be operated without causing ringer 9 to give a false or cross ring.

6. The combination with a condenser and a high inductive ringer in circuit therewith, of a shunt about the condenser, including very high non-inductive resistance, means for impressing pulsating current upon the circuit including said condenser and ringer, the form of the pulsations being adapted to charge the condenser abruptly and permit the same to discharge gradually, the ringer being biased oppositely to the direction or sign of the current, whereby the ringer will not respond either by the charging impulses or by the impulses caused by the discharge of the condenser, substantially as described.

7. The combination with a condenser and a high inductive ringer in circuit therewith, of a shunt about the condenser, including very high non-inductive resistance, means for impressing pulsating current upon the circuit including said condenser and ringer, the form of the pulsations being adapted to charge the condenser abruptly and permit the same to discharge gradually, the ringer being biased oppositely to the direction or sign of the current, and a ringer in another branch adapted to be operated by said current which fails to cause the first mentioned ringer to respond, whereby said first-mentioned ringer will not respond either by the charging impulses or by the impulses caused by the discharge of its condenser when the other bell is operated, substantially as described.

In witness whereof, I, hereunto subscribe my name this 21st day of February A. D., 1908.

CHARLES E. SCRIBNER.

Witnesses:
RALPH G. JOHANSEN,
HIRAM D. CURRIER.