

O. M. LEICH.
SELECTIVE SIGNALING SYSTEM.
APPLICATION FILED MAY 3, 1901.

1,002,713.

Patented Sept. 5, 1911.

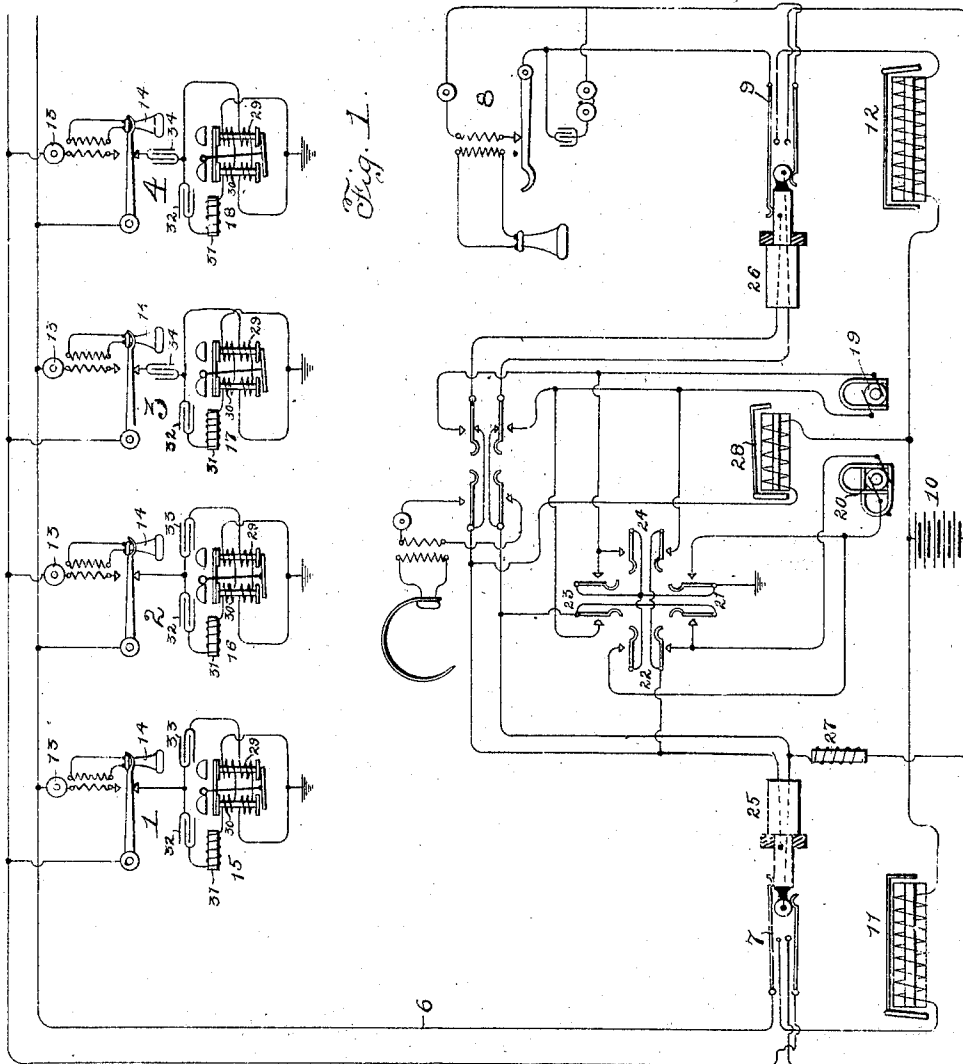


Fig. 1.

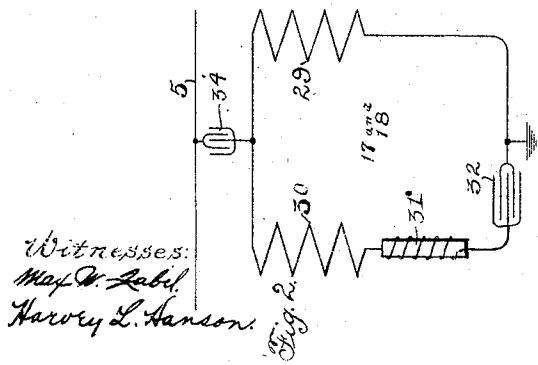


Fig. 2.

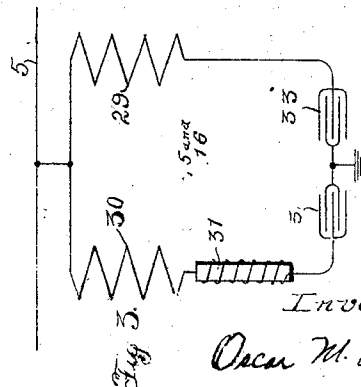


Fig. 3.

UNITED STATES PATENT OFFICE.

OSCAR M. LEICH, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, OF ONE-THIRD TO J. G. IHMSEN AND TWO-THIRDS TO P. C. BURNS, BOTH OF CHICAGO, ILLINOIS.

SELECTIVE SIGNALING SYSTEM.

1,002,713.

Specification of Letters Patent.

Patented Sept. 5, 1911.

Application filed May 3, 1901. Serial No. 58,647.

To all whom it may concern:

Be it known that I, OSCAR M. LEICH, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Selective Signaling 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 relates to selective signaling or calling apparatus, and has for its object the provision of improved means for transmitting selective signals to a plurality of stations, a signal transmitted to one station not affecting signals at other stations.

My invention is particularly applicable to party line telephone systems, and has for its object the provision of an improved system of non-interfering signal bells or ringers whereby it is possible to convey selective signals over such a telephone system to operate any desired sub-station signal without disturbing other signals of the party line.

My invention is primarily designed to overcome objections and insufficiencies of systems of the prior art designed to accomplish a similar purpose.

To this end my invention consists, when applied to a four party line telephone system, in the provision of a plurality of signals which are provided with two windings the relative impedances of which are of such a character that the signals are unresponsive when an alternating current of a given frequency is impressed on said signals, but which are responsive when an alternating current of different frequency is impressed thereon. The remaining signals of the line are then preferably so constructed as to be responsive to an alternating current of a frequency which does not operate the afore-said signals.

Generally stated, therefore, my invention comprises, in the preferred embodiment thereof, four signal receiving instruments adapted for association with the two limbs of a metallic circuit, and a common return which may preferably be a ground return, thus dividing the signals into two groups. The signal receiving devices are then preferably provided with windings which act differentially when energized by an alternating current of a certain frequency, thereby preventing operation thereof, and which

windings do not act in such manner when a current of different frequency is impressed thereon, whereby the signals may be actuated. The windings are so associated with reactive means that the ratio of the currents in the two windings vary when currents of different electrical character, such as currents of different frequency, are impressed thereon.

It will be seen, therefore, that my invention contemplates broadly the use of reactive means, such as impedance coils or condensers, for preventing false signaling in a party line system in which the ringing circuits are non-resonant for the different frequencies that are employed in selectively signaling the party line subscribers.

I will describe my invention more in detail by reference to the accompanying drawing illustrating one embodiment thereof, in which—

Figure 1 is a diagrammatic view of a telephone system built in accordance with my invention; Fig. 2 is a diagrammatic view of the arrangement of circuits of one of my improved signal receiving devices; and Fig. 3 is a similar view of another of my improved signal receiving devices.

Like characters of reference indicate like parts throughout the different figures.

I have illustrated a telephone party line system comprising the substations 1, 2, 3, 4 associated with the limbs 5, 6 of a metallic circuit terminating at the exchange in a spring jack 7. I have also shown a single metallic subscriber's telephone set 8, connected at the exchange to a spring jack 9. The spring jacks are shown as provided with two back contacts for disconnecting the battery 10 and the line signals 11, 12 respectively from the jacks when plugs are inserted therein. Suitable instrumentalities are provided at the exchange to effect interconnection between the telephone lines and to supply current thereto. The stations 1, 2, 3 and 4 of the party line are each provided with a transmitter 13, a receiver 14, and are also respectively provided with selective call-signal devices 15, 16, 17 and 18. The selective ringers or calling devices 15 and 17 are connected between the limb 5 and ground, and the similar signals 16 and 18 between the limb 6 and ground.

Alternating currents of different frequencies are adapted to operate one or the other

of the aforesaid signal receiving devices, and to this end I have provided at the exchange two generators 19 and 20, the generator 20 being adapted to supply an alternating current preferably of a frequency twice as great as that supplied by the generator 19, said frequencies being desirably 24 and 12. A four-way ringing key provided with four-sets of springs 21, 22, 23 and 24 is provided at the exchange to associate either generator in circuit with either limb 5 or 6 and the ground. Plugs 25, 26 effect connection between the jacks 7 and 9, and supply current to the lines from the battery 10 through an impedance coil 27 and a clearing-out relay 28. Suitable operators' telephone set and keys are provided in the cord circuit. Signal receiving devices 15 and 16 are adapted to operate on the high frequency current, and signals 17 and 18 are adapted to operate on the low frequency current. In accordance herewith, key 21 is adapted to associate generator 20 between limb 5 and the ground to operate signal receiving device 15; key 22 is adapted to associate generator 20 between limb 6 and the ground to operate signal receiving device 16; keys 23 and 24 in like manner associate generator 19 with the limbs to respectively operate signal receiving devices 17 and 18.

In order to have signal receiving devices 15 and 16 responsive to an alternating current of high frequency and unresponsive to a current of low frequency, I provide two windings 29 and 30 upon a magnetic core, said core acting inductively upon an armature for operating a signal bell or ringer. The armature is also preferably polarized. The windings 29 and 30 are differentially wound so that when equally energized they may neutralize each other's magnetizing effect. The coils 29 and 30 of each signal receiving device are connected in parallel circuits between the respective limb of the metallic circuit and the ground. I include an impedance coil 31 and a condenser 32 in series with each coil 30 of the devices 15 and 16, the impedance coil tending to neutralize the effect of the condenser on a high frequency, in this case on a frequency of 24. A condenser 33 is included in series with each coil 29 of the devices 15 and 16, said condenser preferably having a capacity a trifle greater than that of condenser 32. This arrangement is shown in diagram in Fig. 3.

When a low frequency is impressed on the parallel circuits of the device, (12, for instance,) then the impedance of coil 31 is low and the impedance of condenser 32 high, so that the impedance of the parallel circuit including said coil 31 is very nearly equal to the impedance of the circuit including condenser 33. Currents of very nearly equal strength will thus pass through the two circuits, and as coils 29 and 30 are dif-

ferentially wound no actuation of said devices 15 or 16 is secured. If, however, a current of high frequency (24, for instance,) is impressed on either device 15 or 16, the impedance of the condensers 32 and 33 is materially less than for the lower frequency, and the impedance of the coil 31 correspondingly increased; but as the impedance of the coil 31 tends to neutralize the effect of condenser 32, on the higher frequency, the circuit containing coil 30 receives a much larger amount of current than the circuit including coil 29, which latter is in series with an impedance in the form of condenser 33. As an unequal amount of current thus traverses the coils 30 and 29, on the high frequency, an actuation of the signal bell is secured. It will thus be seen that devices 15 and 16 are responsive to alternating currents of high frequency (24, in this case), and unresponsive to currents of low frequency, (such as 12).

By the terms "high frequency" and "low frequency," as used in connection with the embodiment of the invention herein shown, I mean simply to distinguish between two frequencies the relative, and not actual, values of which enter into consideration in the operation of the present case.

Signal receiving devices 17 and 18 are responsive to currents of low frequency and unresponsive to the currents of the high frequency generator. To obtain this result I again provide two differential coils 29 and 30 upon a suitable core, and again include with each coil 30 an impedance coil 31 and a condenser 32 which tend to neutralize on the higher frequency (24). No condenser is included with the coil 29 in this instance, but the two signal circuits are together included in series with a condenser 34, for the purpose to be set forth hereinafter. It will be seen that the current of higher frequency, tending to neutralize the impedance of coil 31 and condenser 32, passes in equal amounts through coils 29 and 30, and thus does not operate the signal bell. If, however, current of lower frequency is impressed on the circuits of devices 17 and 18, the inductance of the circuits including coils 30 is materially decreased and the impedance of the condenser greatly increased; so that said circuit now has an impedance greatly in excess of the circuit including coil 29. Considerably more current will thus flow through coil 29 than through coil 30, and the signal bell will be operated at either station 3 or 4, depending upon whether limb 5 or 6 is included in circuit.

By means of my invention I am enabled to so associate condensers with the signal receiving devices that no current from the common battery 10 can flow therethrough. Condensers 32 and 33 are associated with the devices 15 and 16, and condenser 34 ac-

compleishes a like result for the devices 17 and 18.

While I have herein shown and particularly described one embodiment of my invention, I do not wish to be limited to the precise construction and arrangement as herein shown and particularly described.

For the broader purpose of my invention, the means or provisions by which the signals or ringers at the substations distinguish between the different frequencies can be of any suitable character. Preferably, however, the reactive means of at least one signal are adapted to distinguish or assist in distinguishing between the different frequencies. Obviously, the reactive means can be applied to the bells or signals in any suitable manner. Preferably, smooth and uninterrupted alternating currents are employed, and the bells or signals are polarized by permanent magnets, as this combination I find gives the best and most satisfactory results.

It will be seen that reactive means are provided for preventing current of one frequency from ringing a bell intended to be rung by a current of a different frequency. In this way, the different ringing or signaling circuits are non-tuned in character, but at the same time an effective selectivity of signaling is secured. The reactive means, of any suitable character, prevent an operative flow of one frequency through the ringer intended to be rung by a different frequency. By the expression non-tuned, I mean that the ringing circuit of each bell or ringer is non-tuned relatively to the frequency by which the bell is rung. In other words, there is no electrical resonance or tuning of the ringer circuits relatively to the different frequencies by which they are operated. In this way a certain frequency in passing through a ringer to operate that ringer does not traverse a circuit which is tuned relatively to that particular frequency. This is for the reason that in the ringing circuits no attempt is made to so adjust the inductance and capacity as to attain resonance, or even to approximate such a condition.

It will be understood, of course, that I do not limit myself to any particular frequencies, or any particular capacity or resistance, as these may be varied without departing from the spirit of my invention. Take, as an example, a system of this kind in which the condensers 34 are all of two microfarad capacity, while the condensers 32 and 33 are all of one microfarad capacity, in which the windings 30 are all of five hundred ohms resistance, the windings 29 all of fifteen hundred ohms resistance, and the impedance coils 31 all of one thousand ohms resistance, in which a current of 20 cycles is employed for ringing low frequency bells,

and in which a current of 60 cycles is used for the high frequency bells. In such case, the high frequency current passes in practically equal amounts through the parallel windings of the low frequency bells, thus preventing the same from ringing. The 20 cycle current, however, will pass in larger quantities through the winding 29 of the low frequency ringer, owing to the capacity included in the other part of the branch, and the said ringer will be operated. But when the frequency is increased to 60 cycles, keeping the voltage at 100 volts, the reactance of the condenser associated with the high frequency ringer will be only one third of that which is true when a twenty cycle current is impressed upon the line. The impedance of the 1000 ohm coil is, however, three times as great, and, therefore, the current in the 1500 ohm winding of the high frequency ringer will be greatly increased over and above that in the 500 ohm winding. Also, the phase relation of the two currents in these parallel windings is greatly increased. It can be readily seen that when the two windings are connected differentially, when the currents are 180° out of phase, no neutralization will take place. Therefore, the larger the angle of phase up to 180° the less the neutralization. Under these conditions, therefore, the said high frequency ringer can be made unresponsive to a 100 volt 20 cycle current; but it will respond readily, as explained, to the 100 volt 60 cycle current. It will also respond should the conditions remain the same, except that the iron in the impedance coil be increased enough to neutralize the capacity of the condenser in series therewith when a 60 cycle current is impressed upon the line. In such case, it will be seen that a greater current will then flow through the 500 ohm winding of the high frequency ringer, and the latter can be made sensitive enough to ring under these conditions.

From the foregoing, it will be seen that only one ringer responds when any certain frequency is projected on to the line. More specifically considered, each ringing circuit includes but a single ringer. In this way, only one signal results from the use of any particular current. The ringers constitute a signal receiving device, and the condensers and impedance coils are associated therewith, forming a signal receiving apparatus, in the manner explained. Of the different frequencies which are actually used on the line, each ringer is adapted to respond to only one of them. The high frequency ringer is, however, so connected with the line that it would respond to any higher frequency which might be thrown on the line. This is also true of the low frequency ringer, as this ringer would respond to any lower frequency which might be thrown on the line

Each signal receiving means is, therefore, adapted to distinguish between the different frequencies which are actually used, so that the signaling is selective, and no false signaling occurs. The ringing or operating circuit of each substation is non-tuned or non-resonant for the particular frequency by which its allotted ringer or signal receiving device is operated. The circuit of the high frequency ringer is non-tuned or non-resonant for the high frequency current which is actually employed, and for any higher frequency. The low frequency ringer has its circuit non-tuned for the low frequency current which is actually used, and for any lower frequency. I am enabled, therefore, to obtain the desired selectivity of signaling by the use of reactive means in the circuits, but I do not use such reactive means for harmonically tuning the circuits—that is to say, the circuits are not made resonant for the different ringing currents.

It will be seen that there is a main or line circuit, and a branch circuit to and through each substation. It will also be seen that each substation and the ringer thereof has a path for ringing current which is non-tuned or non-resonant for the particular frequency to which the ringer is responsive, and by which the station can be signaled. Each ringer has an operating winding, and in addition thereto each ringer has a reactive shunt winding. Whichever winding of the ringer carries the most current will serve as the operating winding thereof, and the other winding then becomes the reactive shunt. In any event, therefore, each ringer, as stated, has a path which is non-tuned or non-resonant for the frequency to which the ringer is responsive.

I do not limit myself to the exact construction or method of operation shown and described, as it is obvious that various changes or modifications can be made, as by using different kinds of ringers, either tuned or non-tuned, and by using the reactive means, such as impedance coils or condensers, or both, at only one or more of the substations, instead of at all of the substations on the line, to prevent false signaling in a system in which the ringing circuits are non-tuned for the different frequencies; and without in any way departing from the spirit of my invention.

I claim as my invention:

1. In a party line system, the combination with an electric circuit, of means for independently impressing alternating currents of different frequency upon said circuit, to selectively signal the different subscribers thereon, a signal receiving device adapted for inclusion with said circuit and responsive to alternating current of certain frequency, a second signal receiving device responsive to alternating currents of different

frequencies, and electro-magnetic means associated with the second signal receiving device for preventing actuation thereof by currents of a frequency which are adapted to operate the first aforesaid device and branch circuits for the different stations of said signal receiving devices, each station circuit being non-tuned or non-resonant for the particular frequency by which its allotted signal receiving device is operated.

2. In a party line system, the combination with an electric circuit, of means for independently impressing alternating currents of different frequencies upon said circuit, to selectively signal the different subscribers thereon, a signal receiving device adapted for inclusion with said circuit and responsive to an alternating current of a certain frequency, a second signal receiving device responsive to alternating currents of a different frequency, electro-magnetic means associated with the first signal receiving device for preventing actuation thereof by currents of a frequency which are adapted to operate the second aforesaid device, and reactive means associated with the second signal receiving device to prevent actuation thereof by currents of a frequency which are adapted to operate the first aforesaid device and branch circuits for the different stations of said signal receiving devices, each station circuit being non-tuned or non-resonant for the particular frequency by which its allotted signal receiving device is operated.

3. In a party line system, the combination with an electric circuit, of means for impressing alternating currents of different frequencies independently upon said circuit, to selectively signal the different subscribers thereon, a signal receiving device adapted for inclusion with said circuit, reactive means in circuit with said signal receiving device whereby said signal receiving device is responsive to alternating currents of certain frequency, a second signal receiving device comprising electro-magnetic means for operating the signal, and reactive means for preventing the operation of the said electro-magnetic means upon energization of said reactive means, whereby said second signal receiving device is responsive to alternating currents of different frequency.

4. A subscriber's telephone substation signal receiving device comprising electro-magnetic means for operating a signal, in combination with reactive means for preventing the operation of said signal when alternating current of a given frequency is impressed on said electromagnetic means to operatively energize the same and means for supplying alternating electric currents of different frequency.

5. A subscriber's telephone substation signal receiving device comprising electro-

magnetic means for operating a signal, in combination with reactive means inductively associated with said electro-magnetic means for preventing the operation of said signal when alternating current of a given frequency is impressed on said means, and a non-tuned energizing circuit for said electro-magnetic means.

6. A subscriber's telephone substation signal receiving device comprising electro-magnetic means for operating a signal, a reactive shunt circuit about said means for preventing an operative actuation thereof when alternating current of a given frequency is impressed on said means and shunt circuit to operatively energize said shunt circuit and means for supplying alternating electric currents of different frequency.

7. A subscriber's telephone substation signal receiving device comprising electro-magnetic means for operating a signal, electric circuits for controlling the operation of said electro-magnetic means, and reactive means associated with said circuits whereby the relative impedance of said circuits is varied when alternating currents of different frequencies are impressed thereon thereby to prevent the operation of said signal upon an operative energization of one of said circuits and means for supplying alternating electric currents of different frequency.

8. A subscriber's telephone substation signal receiving device comprising electro-magnetic means for operating a signal, electric energizing circuits for controlling the operation of said electro-magnetic means and inductively associated therewith, and reactive means associated with said circuits whereby the relative impedance of said circuits is varied when alternating currents of different frequencies are impressed thereon.

9. A subscriber's telephone substation signal receiving device having differential windings, and reactive means associated therewith, said reactive means permitting an operative energizing of both of said windings when current of certain frequency is impressed thereon, and permitting of an operative energization of but one winding upon impression of current of different frequencies.

10. In a party-line telephone system, the combination of an electric circuit, a plurality of parallel branches in said circuit, a signal associated with each branch, reactive means for each branch, the reactive means of the different branches being differently adjusted, and the reactive means of each station being thereby adapted to prevent an effective passage through its allotted signal of all currents except those intended and adapted to cause the opera-

tion of such signal, and means for projecting alternating currents of different frequency on to said circuit for the purpose of selectively operating said signals, each branch leading through a different substation and being non-tuned or non-resonant for the particular frequency by which its allotted signal is operated.

11. In a party-line telephone system, the combination of an electric circuit, a signal-receiving apparatus connected with said circuit and responsive to alternating currents of a predetermined frequency, and to any higher frequencies that might be used, other signal-receiving apparatus connected with said circuit and responsive to alternating currents of a predetermined frequency, and to any lower frequencies that might be used, means for projecting alternating currents of different frequencies upon said circuit for the purpose of selectively operating the signals included in said apparatus.

12. In a selective party-line telephone signaling system, the combination with an electric circuit, of means for impressing currents of different frequencies upon said circuit, a signal receiving device included in said circuit and responsive to a current of a certain frequency, said signal-receiving device comprising electro-magnetic means for operating a signal and a reactive shunt circuit inductively associated with said electro-magnetic means for preventing an operative actuation thereof when current of a given frequency is impressed on said means and shunt circuit, a series of additional signal-receiving devices included in said circuit and responsive to currents of different frequency, and means associated with each of these additional signal-receiving devices for preventing actuation thereof by currents of a frequency which are adapted to operate the first mentioned signaling device.

13. A party-line telephone signaling system comprising an electric circuit, means for impressing alternating currents of different frequencies independently upon said circuit, a signal-receiving device connected with said circuit and responsive to alternating currents of a certain frequency, a second signal-receiving device also associated with the same circuit and responsive to alternating currents of different frequency, and reactive means associated with the second signal-receiving device, for preventing actuation thereof by alternating currents of frequencies which are adapted to operate the first-foresaid device, the different signal-receiving means being each adapted and designed independently of any signaling action of the other to perform its intended function of giving a signal to attract attention, and a branch circuit for the substation

of each signal receiving device, each station circuit being non-tuned or non-resonant for the particular frequency by which its allotted signal receiving device is operated.

14. A party-line telephone signaling system comprising an electric circuit, means for selectively impressing alternating currents of different frequencies upon said circuit, a signal-receiving device, connected with said circuit, reactive means associated with said signal-receiving device, whereby said signal-receiving device is responsive to alternating currents of certain frequencies, a second signal-receiving device comprising an electromagnet for operating the signal, and a reactive circuit for preventing the operation of the said electromagnet upon sufficient energization of said reactive circuit, whereby the said last-mentioned signal-receiving device is responsive to alternating currents of a different frequency, together with means for operatively energizing the reactive circuit.

15. A party-line telephone signaling system comprising an electric circuit, means for impressing alternating currents of different frequencies independently upon said circuit, a signal-receiving device connected with said circuit, reactance in series with said signal-receiving device, whereby said signal-receiving device is responsive to alternating currents of certain frequencies, a second signal-receiving device comprising an electromagnet for operating the signal, and reactive means for preventing the operation of the said electromagnet upon energization of said reactive means, whereby the said second signal-receiving device is responsive to alternating currents of a different frequency.

16. A party-line telephone signaling system comprising an electric circuit, means for impressing alternating currents of different frequencies independently upon said circuit, a signal-receiving device connected with said circuit, reactive means in circuit with said signal-receiving device, whereby said signal-receiving device is responsive to alternating currents of certain frequencies, and a second signal-receiving device comprising a polarized electromagnet for operating the signal and reactive means for preventing the operation of the said electromagnet upon energization of said reactive means, whereby the said second signal-receiving device is responsive to alternating currents of a different frequency.

17. A party-line telephone signaling system comprising an electric circuit, source of current and means for supplying and impressing alternating currents of different frequencies independently upon said circuit, a signal-receiving device connected with said circuit and responsive to alternating current of a certain frequency, a second

signal-receiving device responsive to alternating currents of a different frequency, and reactive means associated with the second signal-receiving device, for preventing the actuation thereof by alternating currents of a frequency which are adapted to operate the first-foresaid device, the different signal-receiving means being each adapted and designed independently of any signaling action of the other to perform its intended function of giving a signal to attract attention, and a branch circuit for the substation of each signal receiving device, each station circuit being non-tuned or non-resonant for the particular frequency by which its allotted signal receiving device is operated.

18. A party-line telephone signaling system comprising an electric circuit, source of current, means for impressing alternating currents of different frequencies independently upon said circuit, a signal-receiving device connected with said circuit and responsive to alternating current of a certain frequency, a second signal-receiving device responsive to alternating currents of a different frequency, said last-mentioned signal-receiving device including a shunt-circuit for precluding the actuation thereof by alternating currents of frequencies which are adapted to operate the first-foresaid device.

19. A party-line telephone electric signaling system comprising a circuit having a plurality of parallel non-tuned reactive signaling branches, there being a suitable translating device allotted to each branch, and means for projecting vibratory currents of different frequencies onto said circuit, said means and reactive branches being adapted, by reason of the different degrees of impedance offered by the branches to the different currents, to conjointly vary the relative current-flow through said translating devices, and each translating device being responsive to its allotted frequency of current, and to no other of the currents actually used, whereby the different currents may be used at will for selectively operating the different translating devices, and each signaling branch being non-resonant for the frequency by which its allotted translating device is operated, the different signal-receiving means thus provided being each adapted and designed independently of any signaling action of the other to perform its intended function of giving a signal to attract attention.

20. A party-line telephone electric signaling system comprising a circuit having a plurality of parallel non-tuned ringing branches, with a reactive shunt in each branch, and means for projecting vibratory currents of different frequencies upon said circuit, there being a reactive signal-receiving apparatus allotted to each branch, each

apparatus including a translating device, each signal-receiving apparatus being responsive to its allotted frequency of current, and to no other of the frequencies actually used, and the reactive means of said apparatus and the said means for projecting currents being adapted, by reason of the different degrees of impedance offered by the reactive means to the different currents, to conjointly vary the relative current-flow through said translating devices, whereby the different currents may be employed at will for selectively operating said devices, the different signal-receiving means being each adapted and designed independently of any signaling action of the other to perform its intended function of giving a signal to attract attention.

21. A party-line telephone electric signaling system comprising signal-transmitting apparatus adapted for sending vibratory or fluctuating currents of different frequencies, and reactive signal-receiving apparatus suitably connected with said signal-transmitting apparatus, said signal-receiving apparatus including a plurality of signal-magnets, and means whereby each magnet when sufficiently energized produces a signal, each signal-magnet being responsive to its allotted frequency of current, and to no other of the frequencies actually used, and the said transmitting and receiving apparatus being adapted, by reason of the different degrees of impedance offered by the receiving apparatus to intermittent currents of different frequency, to conjointly increase and decrease the relative flow of current in the different magnets, whereby the different currents may be used to selectively produce the different signals, said signal-transmitting apparatus including a switching device having keys corresponding to the different magnets and signals.

22. A party-line telephone electric signaling system comprising signal-transmitting apparatus adapted for sending alternating currents of different frequencies, reactive signal-receiving apparatus suitably connected with said signal-transmitting apparatus, said signal-receiving apparatus including a plurality of signal-magnets, and means whereby each magnet when sufficiently energized produces a signal, each signal-magnet being responsive to its allotted frequency of current, and to no other current used, the transmitting and receiving apparatus thus provided being adapted, by reason of the different degrees of impedance offered by the receiving apparatus to vibratory currents of different frequencies, to conjointly increase and decrease the relative flow of current in the different magnets, as the frequency of the current changes, whereby the different currents may be used to selectively produce the different signals, said

signal-transmitting apparatus including a switching device having keys corresponding to the different magnets and signals, the different signal-receiving means being each adapted and designed independently of any signaling action of the other to perform its intended function of giving a signal to attract attention.

23. In a party-line telephone system, the combination of a telephone line, a plurality of substations located on said line, a branch circuit for each substation, an exchange or central station, all party-line subscribers of the exchange being divided into different classes, a plurality of alternating current generators located at the exchange or central station, adapted to supply ringing currents of different frequencies, one definite frequency for each distinct class of party-line subscribers, means for connecting the requisite generator with the line of any called party-line subscriber, according to the class to which such called subscriber belongs, ringers at the party-line substations, suitable reactive means for preventing current of one frequency from operatively passing through the ringer designed for a different frequency, and a telephone for each ringer, located at the different substations on the line, one or more of said branch circuits being non-resonant for the current to which the ringer thereof is responsive.

24. In a party-line telephone system, the combination of a telephone line, a plurality of substations located on said line, each provided with a different character of call signal, but with similar common-battery telephone instruments, a branch circuit for each substation, a battery common to all of said telephone instruments, an alternating current generator having a certain frequency for operating one of said signals, an alternating generator current having a different frequency for operating a signal which is not responsive to said first-mentioned frequency, and reactive means for preventing current of one frequency from operatively passing through the call signal designed for a different frequency, one or more of said branch circuits being non-tuned for the current to which its call-signal is responsive.

25. The combination of a telephone line, a plurality of substations located on said line, a centralized source of talking current, means for supplying alternating signaling currents of different frequencies, one frequency for each substation, means at the substations for distinguishing the talking current from the signaling currents, and reactive means at one or more substations for distinguishing between the different signaling currents, circuit through one of said substations being non-resonant for the current by which the station is signaled.

26. The combination of a telephone line,

8
a plurality of substations on said line, a signal for each substation, parallel circuits for said signals, and means for supplying alternating currents of different frequencies, one frequency for each substation, said circuits having reactive shunts to assist in distinguishing between the different frequencies that are actually used on the line, whereby each signal only responds to its allotted frequency.

27. The combination of a telephone line, a plurality of substations on said line, a suitable signal winding for each station, parallel circuits for said signals, and means for supplying alternating currents of different frequencies, one frequency for each substation, said circuits each including reactive means associated in shunt with the signal winding thereof, and the reactive means of at least one circuit adapted to assist in distinguishing between the different frequencies that are actually used on the line, whereby the signal of such circuit only responds to its allotted frequency.

28. The combination of a telephone line, a plurality of substations located on said line, a signal for each substation, parallel branch circuits for said signals, means for supplying alternating ringing currents of suitable frequency, a different frequency for each signal, at least one of said circuits having reactive means associated with the signal thereof to assist in distinguishing between the different frequencies that are actually used on the line, by rendering the said one circuit non-resonant for the frequency to which its signal is responsive, and suitable provisions by which the other signals are equally effective in distinguishing between the different frequencies, whereby each signal only responds to its allotted frequency.

29. In a telephone exchange system, the combination of a telephone line, a plurality of substations on said line, a ringer apparatus at each substation, a plurality of constantly operating alternating current dynamos for supplying alternating ringing currents of different frequencies, a different frequency for each substation, means for at will applying the different currents to the telephone line, and a branch circuit and telephone for each substation, one said ringer apparatus having reactive means for preventing the passage therethrough of a high frequency current, but permitting the passage of a low frequency current to actuate the ringer thereof, and another said ringer apparatus having reactive means for preventing the passage therethrough of a low frequency current, but permitting the passage of the said high frequency current to actuate the ringer thereof, one of said branch circuits being non-resonant for the current to which its ringer is responsive, whereby

said currents of different frequency and said reactive means cooperate to produce selective ringing on the line.

30. In a telephone exchange system, the combination of a telephone line, a plurality of substations on said line, a ringer apparatus at each substation, dynamos for supplying alternating ringing currents of different frequencies, a different frequency for each substation, means for at will applying the different currents to the telephone line, one said ringer apparatus having reactive means for preventing actuation of the low-frequency ringer thereof by high frequency current, and another said ringer apparatus having suitable means for preventing actuation of the high-frequency ringer thereof by low frequency current, the substation of the low frequency ringer having a branch circuit that is non-resonant for the current to which its ringer is responsive.

31. In a telephone exchange system, the combination of a telephone line, a plurality of subscribers' stations on said line, a suitable ringer at each station, means for supplying alternating ringing currents of different frequencies, one different frequency for each ringer, ringing circuits for said ringers, each circuit non-resonant for the current to which its ringer is responsive, and means to prevent current of one frequency from passing through the ringing circuit of a ringer designed for another frequency, to an objectionable degree.

32. In a telephone exchange system, the combination of a telephone line, a plurality of electric bells or ringers normally connected therewith, parallel ringing circuits for said bells or ringers, each circuit non-resonant for the current to which its ringer is responsive, means normally alternating disconnected from said line and adapted to supply alternating ringing currents of different frequencies, means for connecting any frequency with the line, and reactive means for preventing current of one frequency from operatively passing through a ringer intended to be rung by a different frequency.

33. In a telephone exchange system, the combination of a plurality of parallel signaling circuits, means for supplying alternating signaling currents of different frequencies, each circuit non-resonant for its allotted current, and reactive means for preventing current of one frequency from operatively passing through a circuit intended for a different frequency.

34. In a telephone exchange system, the combination of a telephone line circuit, a plurality of telephones on said line, a ringer for each telephone, means normally disconnected from the telephone line at the central station for supplying ringing currents of suitable frequencies, a different frequency for each ringer, suitable switching devices

for extending talking connections from calling subscribers to the said telephone line, means for applying the ringing currents through the said switching devices to the telephone line, suitable reactive means including impedance for preventing an operative flow of one frequency through the ringer intended to be rung by a different frequency, and branch circuits at least one of which is non-resonant for the ringing current of its allotted substation.

35. In a telephone exchange system, the combination of a telephone line circuit, a plurality of telephones on said line, a ringer for each telephone, a spring jack for said telephone line, an operator's cord circuit provided with a plug adapted for insertion in said jack, means normally disconnected from the telephone line at the central station for supplying ringing currents of suitable frequencies, a different frequency for each ringer, a selective ringing key by which the operator applies the different ringing currents through the plug and jack to the telephone line, suitable reactive means including capacity for preventing an operative flow of one frequency through the ringer intended to be rung by a different frequency, and branch circuits at least one of which is non-resonant for the ringing current of its allotted substation.

36. In a telephone exchange system, the combination of a telephone line, a plurality of telephones on said line, a ringer for each telephone, means at the central station for supplying ringing currents of suitable frequencies, a different frequency for each ringer, suitable switching devices for extending talking connections from calling subscribers to the said telephone line, means for applying the ringing currents through the said switching devices to the telephone line, suitable reactive means for preventing an operative flow of one frequency through the ringer intended to be rung by a different frequency, and parallel ringing circuits for said ringers, each ringing circuit being non-tuned or non-resonant for frequency by which its allotted ringer can be operated.

37. In a telephone exchange system, the combination of a telephone line, a plurality of telephones on said line, a ringer for each telephone, a spring jack for said telephone line, an operator's cord circuit provided with a plug adapted for insertion in said jack, means at the central station for supplying ringing currents of suitable frequencies, a different frequency for each ringer, a selective ringing key by which the operator applies the different ringing currents through the plug and jack to the telephone line, suitable reactive means for preventing an operative flow of one frequency through the ringer intended to be rung by a different

frequency, and parallel ringing circuits for said ringers, each ringing circuit being non-tuned or non-resonant for frequency by which its allotted ringer can be operated.

38. In a telephone exchange system, the combination of a telephone line, a plurality of telephones on said line, a ringer for each telephone, means at the central station for supplying ringing currents of suitable frequencies, a different frequency for each ringer, suitable switching devices for extending talking connections from calling subscribers to the said telephone line, means for applying the ringing currents through the said switching devices to the telephone line, suitable reactive means for preventing an operative flow of one frequency through the ringer intended to be rung by a different frequency, and parallel shunt circuits including said reactive means.

39. In a telephone exchange system, the combination of a telephone line, a plurality of telephones on said line, a ringer for each telephone, a spring jack for said telephone line, an operator's cord circuit provided with a plug adapted for insertion in said jack, means at the central station for supplying ringing currents of suitable frequencies, a different frequency for each ringer, a selective ringing key by which the operator applies the different ringing currents through the plug and jack to the telephone line, suitable reactive means for preventing an operative flow of one frequency through the ringer intended to be rung by a different frequency, and parallel shunt circuits including said reactive means.

40. In a telephone exchange system, the combination of a telephone line, a plurality of telephones on said line, a ringer for each telephone, means at the central station for supplying ringing currents of suitable frequencies, a different frequency for each ringer, suitable switching devices for extending talking connections from calling subscribers to the said telephone line, means for applying the ringing currents through the said switching devices to the telephone line, suitable reactive means for preventing an operative flow of one frequency through the ringer intended to be rung by a different frequency, parallel ringing circuits for said ringers, and parallel shunt circuits including said reactive means, each ringing circuit being non-tuned or non-resonant for frequency by which its allotted ringer can be operated.

41. In a telephone exchange system, the combination of a telephone line, a plurality of telephones on said line, a ringer for each telephone, a spring jack for said telephone line, an operator's cord circuit provided with a plug adapted for insertion in said jack, means at the central station for sup-

plying ringing currents of suitable frequencies, a different frequency for each ringer, a selective ringing key by which the operator applies the different ringing currents through the plug and jack to the telephone line, suitable reactive means for preventing an operative flow of one frequency through the ringer intended to be rung by a different frequency, parallel ringing circuits for said ringers, and parallel shunt circuits including said reactive means, each ringing circuit being non-tuned or non-resonant for frequency by which its allotted ringer can be operated.

42. A selective ringing party line system, comprising a telephone line, a plurality of ringers on said line, a reactive ringing circuit for one ringer, suitable circuits for the other ringers, means for supplying alternating ringing currents of different frequencies, reactive means for preventing current of the wrong frequency from operatively passing through the ringer having said reactive circuit, said reactive circuit being non-resonant for the current to which its allotted ringer is responsive, and suitable provisions by which the other ringers are also each responsive to their allotted frequency.

43. A selective ringing party line system comprising a telephone line, a plurality of ringers on said line, a branch circuit for the substation of each ringer, an electromagnetic device allotted to the terminal of said line and adapted for use by the subscriber at any substation thereon in calling other subscribers, means associated with each ringer for controlling the operation of said electromagnetic device, a switch terminal for extending a talking connection to said line when a subscriber thereon is called, means for supplying alternating ringing currents of different frequencies through said switch terminal to said line, suitable reactive means for preventing current of one frequency from operatively passing through the ringer intended to be rung by a different frequency, and means for cutting off said reactive means when the subscriber answers the call of his ringer, at least one of said branch circuits being non-resonant for the frequency to which its allotted ringer responds.

44. In a telephone system, a party line, a plurality of ringers on said line, a branch circuit and telephone for the subscriber's station of each ringer, means normally disconnected from the line for supplying ringing currents of different frequencies thereto, parallel ringing circuits each containing but a single branch and ringer, and suitable reactive means for preventing current of one frequency from operatively passing through the ringer intended to be rung by a different frequency, the high frequency

ringer having a path that is non-resonant for the current to which it is responsive.

45. In a telephone system, a party line, a plurality of ringers thereon, a branch circuit and telephone for the substation of each ringer, parallel ringing circuits each including but a single branch and ringer, suitable instrumentalities for supplying ringing currents of different frequencies to the line, at least one of said circuits being non-resonant for its allotted frequency and provided with suitable reactive means for preventing an operative flow therein of current intended for the ringer of another circuit.

46. In a telephone system, a party line, a plurality of ringers connected with said line, a branch circuit and telephone for the substation of each ringer, means for supplying alternating currents of different frequencies, to selectively operate said ringers, each current causing the operation of but a single ringer, and reactive means for preventing current of one frequency from operatively passing through the ringer intended to be rung by a different frequency, the low frequency ringer having a path that is non-resonant for the current to which it is responsive.

47. In a party-line telephone system, the combination of a telephone line, a plurality of substations located on said line, a branch circuit for each substation, an exchange or central station, all party-line subscribers of the exchange being divided into different classes, a plurality of current generators located at the exchange or central station, adapted to supply ringing currents of different frequencies, one definite frequency for each distinct class of party-line subscribers, means for connecting the requisite generator with the line of any called party-line subscriber, according to the class to which such called subscriber belongs, ringers at the party-line substations, suitable reactive means for preventing current of one frequency from operatively passing through the ringer designed for a different frequency, and a telephone for each ringer, located at the different substations on the line, one or more of said branch circuits being non-resonant for the current to which the ringer thereof is responsive.

48. In a party-line telephone system, the combination of a telephone line, a plurality of substations located on said line, each provided with a different character of call-signal, but with similar common-battery telephone instruments, a branch circuit for each substation, a battery common to all of said telephone instruments, a current generator having a certain frequency for operating one of said signals, a current generator having a different frequency for operating a signal which is not responsive to

said first-mentioned frequency, and reactive means for preventing current of one frequency from operatively passing through the call-signal designed for a different frequency, one or more of said branch circuits being non-tuned for the current to which its call-signal is responsive.

49. The combination of a telephone line, a plurality of substations located on said line, a signal for each substation, parallel branch circuits for said signals, means for supplying ringing currents of suitable frequencies, a different frequency for each signal, at least one of said circuits having re-
15 active means associated with the signal thereof to assist in distinguishing between the different frequencies that are actually used on the line, by rendering the said one circuit non-resonant for the frequency to
20 which its signal is responsive, and suitable provisions by which the other signals are equally effective in distinguishing between

the different frequencies, whereby each signal only responds to its allotted frequency.

50. In a telephone exchange system, the combination of a telephone line, a plurality of subscribers' stations on said line, a suitable ringer at each station, means for supplying ringing currents of different frequencies, one different frequency for each
30 ringer, ringing circuits for said ringers, each circuit non-resonant for the current to which its ringer is responsive, and means to prevent current of one frequency from passing through the ringing circuit of a ringer
35 designed for another frequency, to an objectionable degree.

In witness whereof, I hereunto subscribe my name this 30th day of April A. D., 1901.

OSCAR M. LEICH.

Witnesses:

MAX W. ZABEL,

HARVEY L. HANSON.