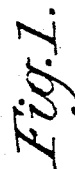


952,267.

3 SHEETS--SHEET 1.



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TELEPHONE EXCHANGE SYSTEM.
APPLICATION FILED MAR. 28, 1907.

952,267.

Patented Mar. 15, 1910.
3 SHEETS—SHEET 2.

Fig. 2.

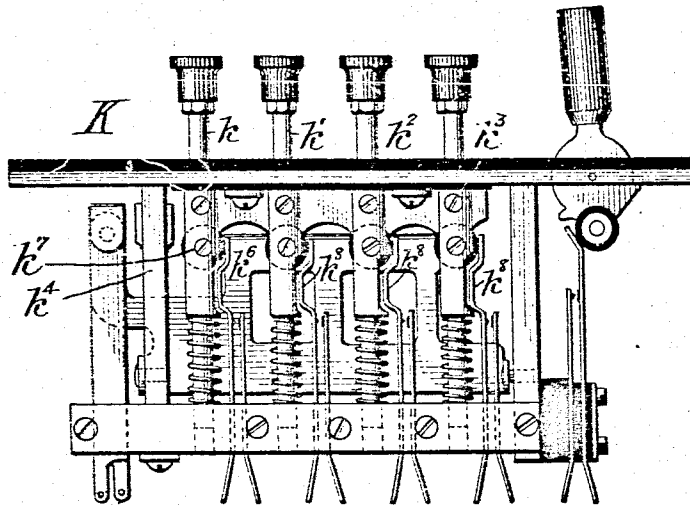
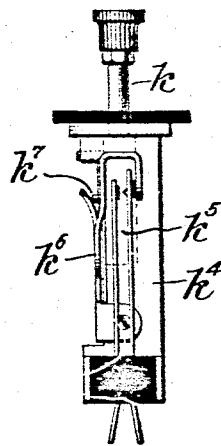


Fig. 3.



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952,267.

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Fig. 4

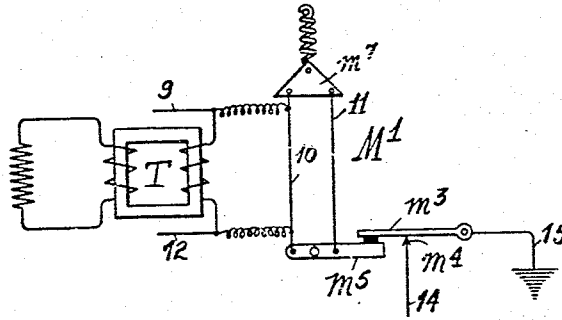
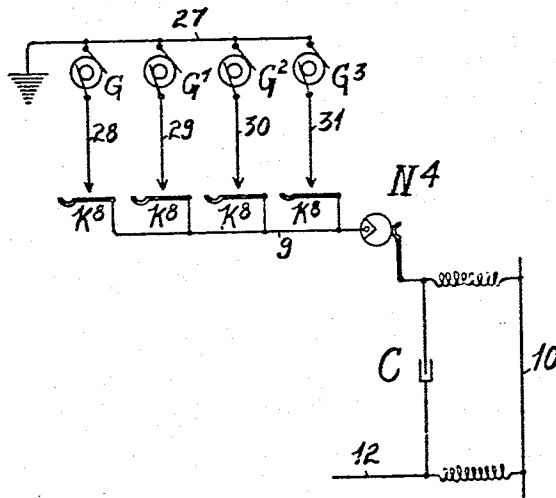


Fig. 5



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TELEPHONE-EXCHANGE SYSTEM.

952,267.

Specification of Letters Patent.

Patented Mar 15, 1910.

Application filed March 28, 1907. Serial No. 365,001.

To all whom it may concern:

Be it known that I, RAY H. MANSON, a citizen of the United States, residing at Elyria, in the county of Lorain and State of Ohio, have invented certain new and useful Improvements in Telephone-Exchange Systems, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to telephone exchange systems, and has for its object the improvement of such systems in divers particulars to be hereinafter pointed out.

The present invention has to do particularly with the devices and circuits through which signaling current is sent to the station of the wanted subscriber, and by means of which the source of current is disconnected or disabled when its function has been performed. In most cases this latter is best determined by the answering act of the called subscriber, but is not necessarily limited thereto.

Heretofore, various arrangements have been proposed to accomplish the results which I compass, but so far as I know these have been only measurably successful in practice. For example, according to one arrangement an electromagnet is included in the ringing circuit between the generator and the wanted subscriber. When the latter answers, the consequent rush of ringing current through the low resistance path of the receiver and transmitter branch effectively energizes this electromagnet, which acts to cut off the ringing generator. The ringing through this magnet is not as good as it would be through a clear circuit, because of the choking effect of the magnet windings; and in ringing over a very short line or over one which has become short circuited, there is great danger of burning out the magnet. According to another arrangement, the ringing current is put on at intervals, a separate and distinct relay responding to current in the subscribers' lines and controlling the ringing between the intervals. The disadvantage of such an arrangement is that if the subscriber answers while the ringing interval is passing, the ringing current will produce very disagreeable effects in the receiver held to his ear. According to still another arrangement, ringing current and battery current are alternately fed to line through the control-

ling devices. With such an arrangement, it is necessary in producing uniform results to have an approximately uniform voltage, which cannot be supplied by the ordinary common or talking battery for the reason that the ringing voltages are usually much higher than that of the talking current. Moreover, there is some danger of ringing current getting back on the main battery busses, with disastrous results so far as conversation is concerned.

As distinguished from all of the foregoing arrangements, my present invention employs (1) non-inductive controlling devices in the ringing circuit, (2) such devices being arranged so as to respond instantly by cutting off ringing current when the called subscriber answers; and (3) a driven source or an alternating current generator of any suitable frequency to replace the battery formerly employed between the ringing intervals.

My controlling devices preferably consist of thermic relays, commonly called "hot-wire relays". These relays, or one of them, must be included direct in the path of ringing current, or of other current going to line during ringing. Instead of a battery for non-ringing intervals, I employ a suitable alternating current generator for furnishing tripping current, of a frequency such that it will not operate the bells on the lines, whereby false signals will be avoided on party lines. This tripping current and the ringing current are put to line through a suitable commutator or other form of controlling device.

My invention is illustrated in the accompanying drawings in which—

Figure 1 is a diagram showing two subscribers' lines and the central station connecting circuits therefor, one line being extended to a single substation, while the other is a party-line. Fig. 2 is a side view and Fig. 3 is an end elevation of a form of selective ringing key which may conveniently be employed. Figs. 4 and 5 are modified detailed views of parts of the apparatus shown in Fig. 1.

Referring first to Figs. 2 and 3, I have therein shown a four-party selective key of the locking type, wherein each of the four plungers controls a pair of contacts included in the circuit of a particular ringing generator. These plungers are marked k , k' ; k^2 110

and L^2 . At the end of the frame k^1 I provide a pair of contacts L^3 common to all of the others, and closed when any of them are fully closed. The plungers k , k' , etc., have three positions each. In their first position, in which they are shown in the figures, they are all the way up. In their second position they are latched, and in their third position each one is able to close the circuit of the end springs L^3 by forcing back the latch plate L^4 . The latching is effected by the ends of the screws k^2 , which extend out from the plungers to engage the latch plate, as best shown in Fig. 3. When any one plunger is depressed it releases any other plunger which may have been previously depressed. The contact springs L^3 are provided with bent up portions or cams which engage with friction wheels on the plungers, so that each plunger will keep its circuit closed all the time it is down in a latched position, but will not close the end contacts L^3 except when in the extreme position.

Referring now to Fig. 1, A and A' are substations, each provided with the usual common battery equipment, comprising receiver, transmitter, hook-witch, ringer and condenser. The substation A has a special line 1—2 extending to the central office and terminating on the multiple jacks J, J' of a manual switchboard. The station A', on the other hand, is one of four stations served by the same line, and typified by the ringers Q, Q', Q² and Q³ bridged across the line. The substation equipment at station A' is supposed to be associated with the first ringer, Q, and each of the other ringers is associated with similar equipment, not shown. This poly-station or party-line, marked 3—4, extends to a spring jack or jacks J² at the central office.

I have not shown any direct connection from the main battery B to either of the lines 1—2 or 3—4, neither have I shown a line relay, a cut-off relay, or a line lamp controlled by the line relay, which in turn is controlled by the cut-off relay. These appliances form no part of my present invention, and may therefore be of any well known or suitable type which will work properly with those portions of my cord circuit which are involved in the present invention. It will be understood that I reserve to myself the full right to complete the equipment of the lines so as to include all necessary and usual line signal and other appliances, without limitation by reason of the simplified diagram herein.

For interconnecting the lines I show a pair of plugs P, P', connected by the cord conductors 5—6, 7—8, which include the condensers C between them, so as to divide the cord for purposes of supervision. Bridged across the two ends of the cord 5—7 and

6—8, are the relays R, R', R², R³, with the main battery B between them, having its positive terminal grounded as usual. The relays R, R' are supposed to jointly control the supervisory lamp associated with the plug P, while the relays R², R³ similarly control the supervisory lamp associated with the plug P'.

The ringers Q, Q', etc., are adapted to be actuated by means of current furnished by the ringing generators G, G', G², G³, and the same is true of the ringer Q' with respect to one particular generator, as for example G. I should here state that while I have herein shown and described and shall specifically claim the apparatus and circuits necessary to use my invention for poly-station signaling, it is by no means limited thereto, but in fact is broadly applicable to any kind of ringing. In any ringing, the cord circuit is adapted to be broken by the ringing key M, whose members m , m' , m^2 , cooperate with terminal contacts of the wires 6—8, 12—18—17, so that normally the conductor 6 goes to the plug P' by way of the wire 13, while the conductor 8 also passes to the plug by way of the wire 16. When the key M is actuated, the tip of the plug P' is connected through wires 13 and 12 to the thermic relay M' and so to the ringing generator wire 9. At the same time, the sleeve of the plug is connected to ground through the wires 15 and 17. The key M is controlled by the thermal device M², similar in its mechanical construction to the relay M'. The controlling device has a pivoted lever m^5 which works the key M, this lever being pivoted in the middle and connected on both sides of the pivot by wires 19 and 20 to the ends of a strain piece m^3 , which is provided with a spring to keep the wires taut. Since both wires are exposed equally to the atmosphere, they remain relatively unaffected by changes in external temperature, but the wire 19 is included in a controlling circuit for the key M, which may be traced as follows: from the ground by wire 22 to the key contacts L^5 (see Fig. 3), 21, 19, 22, R, 24, and ground. When the contacts L^5 are closed therefore, current passes through the wire 19 to heat the same, whereby the key M is actuated, and a locking circuit to keep the wire 19 warm is then closed, which may be traced as follows: battery B, 23, 19, 18, m' , 14, m^3 , m^2 , 15, and ground back to battery. The contacts m^2 and m^4 are under the control of the relay M', which has a pair of wires 10 and 11 connected at one end to the strain plate m^3 , and at the other to opposite points on the pivoted lever m^5 , controlling the contacts m^2 , m^4 . The wire 10 is included in the generator connection 9—12 to the key M, and is shunted by an equalizer e , which may be either a condenser of suitable capacity, a transformer T having its iron

circuit designed so as to be more efficient at one frequency than at another, or the like as shown in Fig. 4. The theory of this equalizer is that the amount of current shunted will vary with the frequency or the voltage, or both, so as to render the amount of current flowing through the wire 10 approximately constant for all frequencies and all conditions.

- 10 For single-party ringing, the generator wire 9 goes direct to a single machine. For example the circuit from the key M would be as follows: 12, 10, 9, 32, N, G and ground: with an alternatively closed branch 25 through generator G^4 to the ground wire 26. G^4 is a special generator for supplying tripping current which will not produce any disturbing effects in the line. Its current will not ring any of the bells Q^1, Q^2, Q^3, Q^4 , but it will heat the wire 19 of relay M^1 , just the same as the current of the generator G .

The generators G and G^4 are put on alternately by means of the commutator N , which is supposed to be constantly running, but which may of course be operated intermittently or in any desired manner. When the called subscriber answers, the relay M^1 is supposed to be energized to open the contacts m^3, m^4 , and to thereby release the ringing key M by cutting off the current of the controller M^2 . For ringing a single party, it is requisite to have only one pair of manually operated contacts, viz., those at k^5 .

For polystation ringing, the arrangement is the same as for single station ringing after the proper generator has been connected to the wire 9, and this is the function of the key K . As a matter of convenience, I cause the depression of any one of the selective keys k, k', k'', k''' , to also close the contacts k^5 , so as to complete the circuit 22, 21, 19, 23, B, 24, thus starting the ringing by pulling down the key M in the performance of the same act which determines the station to be called.

I have shown four commutators N, N', N'', N''' , which are supposed to be mounted on the same shaft and all run together. They may of course be replaced by a single commutator N^4 in the wire 9, the contacts of the keys k, k', k'', k''' , then going direct to the generators G, G', G'', G''' , as shown in Fig. 5.

55 The operation of my system is as follows:—Assuming that subscriber A calls, lights his line lamp and is answered by the insertion of plug P , which extinguishes the lamp, and that the operator has obtained the number wanted and has inserted the calling plug P' in the jack J^2 of the wanted line, then we come to the ringing, wherein the present invention resides. I will first assume that the ringing is to be selective, in 65 that one of the ringers only, as Q , is to be

actuated. The operator presses down the plunger k , which closes the contact k^5 to connect wire 32 to wire 9, and also closes contact k^5 . A circuit is thereupon completed for the flow of current through the 70 controlling device M^2 , as follows: B, 23, 19, 21, k^5 , 22, 24 and back to battery. The wire 19 expands, and as the strain plate m^3 is kept taut and level by its spring, the lever m^6 is tilted to press down the ringing key 75 arm m , which carries with it the other arms m', m'' , disconnects conductor 6 from wire 13 and conductor 8 from wire 16, and completes the following ringing circuit: generator G , 28, n , 32, k^5 , 9, 10, 12, m , 13, P' , 80 J^2 , 3, to the ringers, 4, J^2 , P' , 16, m^2 , 17, and ground back to the generator. As the commutator N rotates, an alternative circuit is closed as follows: generator G^4 , 25, n' , 32, k^5 , 9, 10, 12, m , 13, P' , J^2 , 3, ringers, 4, J^2 , P' , 85 16, m^2 , 17, ground, 26, G^4 . The ringers Q to Q^2 are wound to such a resistance in each case that the amount of current which will pass through the circuits thus traced, either from generator G or from generator G^4 , is 90 insufficient to heat the wire 10 to the point of expanding so as to actuate the spring m^5 . The generator G furnishes current at a proper frequency or a proper voltage, or both, to ring the bell Q only; while the generator G^4 furnishes current such that it will 95 not ring any of the bells. I have shown this generator as an alternator, and it is supposed to furnish alternating current at a frequency or a voltage or both to which the 103 ringers are irresponsive. Of course the character of the current may be varied in many ways in order to produce this effect. There is a strong tendency however in modern engineering practice, to make all the ringers 105 in a system standard harmonic type, so that they all have definite frequencies to which they respond. The most advantageous because the simplest way to design the tripping generator G^4 for such a system is to 110 make it an alternator with a frequency dissimilar from any to which the ringers in this system will respond.

After the operator has pressed down the key k , it remains latched, and so the ringing 115 and tripping current continues to flow to line as determined by the commutator N , until subscriber A' takes down his receiver. When he does this, a circuit is closed through his receiver and transmitter, which 120 are of much lower resistance than the ringers. A rush of current follows through the line wires 3—4 and through the wire 10 of the relay M^1 . The wire 10 expands, the lever m^5 becomes tilted thereby, the contacts 125 m^3, m^4 are opened and the controlling circuit or locking circuit of the ringing key M becomes inoperative. This controlling circuit is closed as soon as the key M is first set by the closure of contacts k^5 , and may be 130

traced as follows: B, 23, 19, 18, m' , 14, m^4 , m^3 , 15, ground, 24, B. This circuit being opened, and the springs k^5 remaining open, the wire 19 immediately cools off, the lever m^5 becomes straightened on its pivot, the key M resumes its normal position as shown in Fig. 1, the generator circuits are disconnected from the cord, and the cord circuit is completed for conversation.

In ringing out over a single station line the operation is precisely the same, except that only one generator is employed, and there is no necessity for a selective key. In other words, where there is to be no party-line ringing the generators G^1 , G^2 , G^3 may be dispensed with, together with their commutators N^1 , N^2 , N^3 , and all of the keys k , k' , k^2 , k^3 . The circuits up to the relay M^1 would then be direct as follows: generator G by wire 28 to segment n on the commutator N and thence by wire 32 to wire 9 direct, generator G^4 by wire 25 to the segment n' of commutator N, and thence by wire 22 direct to wire 9. The operator needs only the contacts k^5 , which are normally open but are closed just long enough to start the thermal controller M^2 . The same result of course may be obtained mechanically by putting a mechanical push button on the ringing key M so that it can be forced down by hand, current flowing through the circuit B, 23, 19, 18, m' , 14, 15, then serving to hold it down.

At station A' I have shown the ringer permanently bridged on the line, the ringers at the other stations on the same line being similarly connected. At station A the ringer Q is disconnected when the receiver is on the hook.

It will be apparent that many changes in matter of detail may be made in the system I have thus described, without altering the main or characteristic features of my invention. All such changes I contemplate as within the scope of my claims. Thus, a different arrangement of keys, relays, or commutators might be employed, without altering that part of the invention which relates to the tripping generator. Or different kinds of generators could be employed, perhaps differently connected or constructed, without altering the character of the structures M^1 , M^2 , or their combined use in the relations described. Or changes might be made in the character of any individual piece without changing the combination of all of them. It should be observed that as the commutators rotate a ringing generator is connected to line for a space say of two seconds, which rings the bell or bells, then the other generator comes in, which still furnishes current to the line through the relay M^1 , but the bells are silent for say four seconds. This is called in commercial parlance, "ring two seconds and off

again." I contemplate in some cases combining the generators G and G^4 in one unit, simply causing a change to be brought about in the character of the current cut-off at intervals so as to silence the bells.

It should also be observed that by using driven generators for both ringing and tripping, we are enabled to use approximately the same voltage and frequency, or at least voltages and frequencies of the same order. If the ordinary generator G gives 75 volts, and the associated generators vary from that to 150, the generator G^4 may advantageously be made of some intermediate voltage, and so with the frequencies. This however is purely optional.

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

1. In a telephone system, the combination with two telephone lines connected together, of a key adapted when depressed to include a calling generator in circuit and simultaneously open the connecting circuit and thermic means adapted to engage and to maintain said key depressed until the called subscriber removes his telephone from the hook.

2. In a telephone system, the combination with two telephone lines connected together, of thermally operable means adapted when actuated to include a calling generator in circuit and simultaneously sever the connecting circuit, and thermally operable means adapted to engage and maintain said first named means in actuated position until the called subscriber removes his telephone from the hook.

3. In a telephone system, the combination with two telephone lines connected together, of a key adapted when actuated to connect a calling generator in circuit, thermic holding and releasing means adapted to engage said key and means whereby the called subscriber may determine the operation of said holding and releasing means.

4. In a telephone system, means for connecting two lines together, a thermal ringing relay, a manual setting device therefor, a thermal tripping device therefor, and means whereby the called subscriber may actuate the tripping device in answering the call, substantially as described.

5. In a telephone system, means for connecting two lines together, a thermal ringing relay, a manual setting device therefor, a thermal tripping device therefor, a ringing generator and a tripping generator, means for connecting them alternately to the thermal tripping device, and means controlled by the called subscriber for determining the amount of current flow through the tripping device from either of them at the moment of answering the call, substantially as described.

6. In a telephone system, telephone lines, substations on said lines, a central station, a connecting circuit at said central station, a source of signaling current, non-magnetic means adapted to open said connecting circuit and connect the source of ringing current into the line, a circuit over which said means is controlled, and other non-magnetic means controlling said first non-magnetic means.

7. In a telephone system, telephone lines, a central station, a connecting circuit at the central station, a source of ringing current at the central station, non-magnetic means adapted to connect said source of signaling current into said line, a circuit over which said means is controlled and thermal means controlling said non-magnetic means.

8. In a telephone system, telephone lines, substations on said lines, a central station, connections for said lines at the central station, a source of signaling current at the central station, thermal means adapted to connect the source of signaling current to a called line, and other thermal means controlling said first named thermal means.

9. In a telephone system, telephone lines, substations on said lines, a central station, circuit connections for the telephone lines at said central station, a source of ringing current at said central station, and thermal means independent of said source of signaling current adapted to connect said source of signaling current to a telephone line.

10. In a telephone system, telephone lines,

substations on said lines, a central station, circuit connections for the telephone lines, a source of signaling current at said central station, and thermal means independent of the source of signaling current adapted to connect said source to the line, and means controlled by the called subscriber to operate said thermal means to disconnect the source of signaling current.

11. In a telephone system, telephone lines, substations on said lines, a central station, circuit connections for the telephone lines, a source of signaling current, and thermal means independent of said source controlling the continuity of the telephone line circuit connections and the connection and disconnection of said signaling source to said lines.

12. In a telephone system, telephone lines, substations on said lines, a central station, circuit connections for the telephone lines, a source of signaling current, and thermal means independent of said source controlling the continuity of the telephone line circuit connections and the connection and disconnection of said signaling source to said lines, and a second thermal means controlled by the called subscriber, said second thermal means controlling said first thermal means.

In testimony whereof I affix my signature in presence of two witnesses.

RAY H. MANSON.

Witnesses:

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