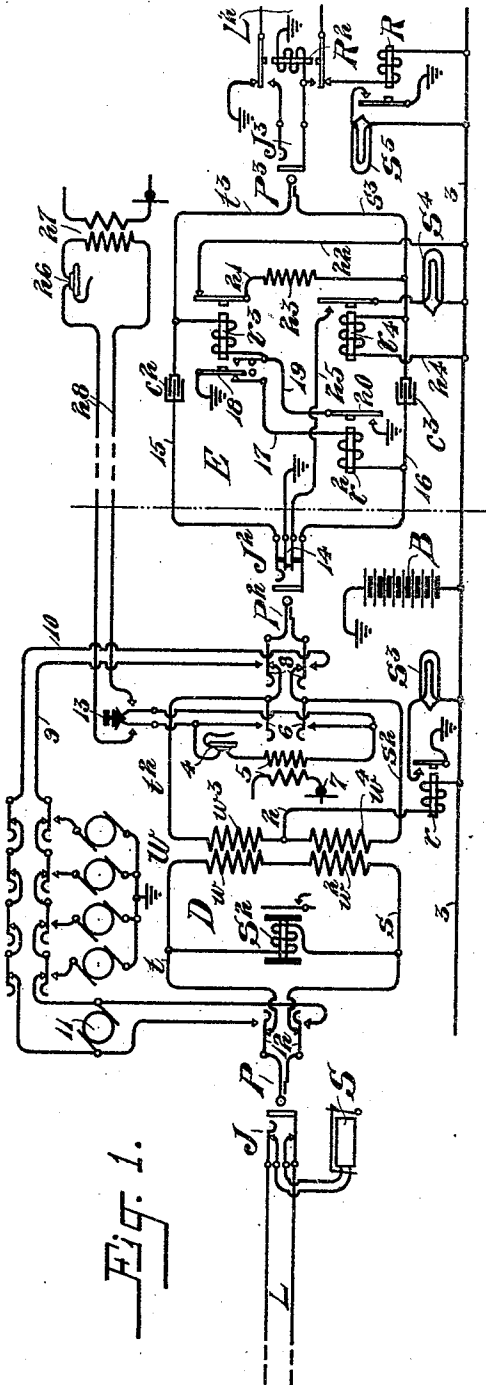


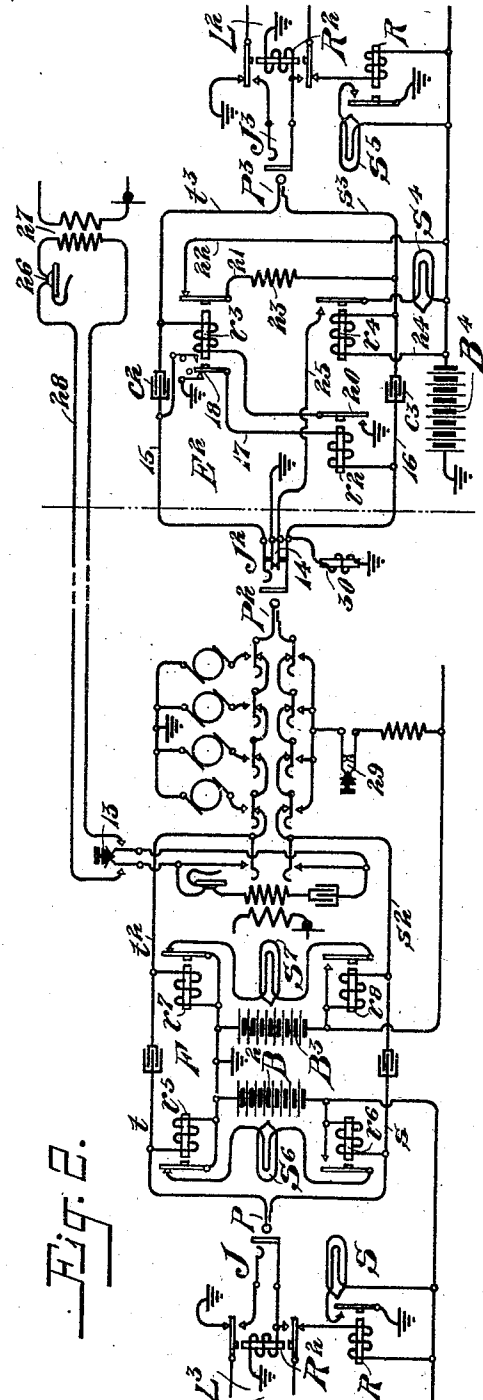
C. S. WINSTON.
TELEPHONE TRUNKING SYSTEM.
APPLICATION FILED SEPT. 21, 1904.

933,149.

Patented Sept. 7, 1909.



Witnesses.
R. H. Burfield
Edith F. Grier.



Inventor:
Charles S. Winston
By Robert Lewis Ames.
Attorney.

UNITED STATES PATENT OFFICE.

CHARLES S. WINSTON, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD & SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE TRUNKING SYSTEM.

933,149.

Specification of Letters Patent.

Patented Sept. 7, 1909.

Application filed September 21, 1904. Serial No. 225,301.

To all whom it may concern:

Be it known that I, CHARLES S. WINSTON, a citizen of the United States, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Trunking Systems, of which the following is a specification.

My invention relates to telephone trunking systems and more particularly to such systems in which the operator initiating the connection is provided with means for calling the subscriber with which the trunk circuit is adapted to be connected. In former systems of this class various objections have existed. For instance, in some arrangements repeating coils in the trunk circuit were depended upon to repeat the ringing current from one portion of the circuit to the other and in still other arrangements the ringing current passes through relays or other electro-magnetic devices connected with the trunk. Such systems are objectionable on account of the loss due to the repeating coils or the relays, and also because the ringing current in passing through the relays causes them to rattle. In my invention I so arrange the apparatus that the path for ringing current is free from repeating coils and relays and does not suffer loss by reason of such devices in its path.

Other objects of the invention are to produce a trunking system which is convenient to install and operate, which is simple and inexpensive and which is efficient in operation.

Still other objects and advantages of the invention will appear from the detailed description and claims.

My invention is illustrated in an accompanying drawing in which:

Figure 1 is a diagram of a trunking system extending between the usual toll board and a local board of the common battery type; and Fig. 2 is also a diagram showing a similar system between two boards of the local subscriber or common battery type.

Referring to Fig. 1, I have shown at the left of the drawing a spring-jack J of a toll line L, together with the annunciator or drop S normally in connection therewith but adapted to be disconnected therefrom upon the insertion of a connecting plug in the spring-jack. This represents the toll type of line referred to though it will be under-

stood that it may represent an ordinary magneto line or as hereinafter explained, it may be a line of any desired type. The cord circuit which is adapted for use at this toll board is provided with an answering plug P and a calling plug P² provided with tip and sleeve contacts adapted to register with the corresponding contact surfaces of the spring-jacks when inserted therein. The flexible strands *t* and *s* lead from the tip and sleeve contacts respectively, of the answering plug to the windings *w* and *w*² of the repeating coil W while the similar strands *t*² and *s*² extend from the tip and sleeve contacts of the calling plug P² to the windings *w*³ and *w*⁴ of said repeating coil. Across the answering end of the cord circuit between the strands *t* and *s* a clearing-out drop S² is bridged. In association with the calling plug P² is a supervisory signal S³, preferably in the form of a small incandescent lamp, having its circuit controlled by means of a relay *r* which is connected upon one side by a conductor 2 with the middle point of the windings *w*³ and *w*⁴ of said repeating coil and upon the other side with the common lead 3 extending from the live pole of the central office common battery B and whose other pole is grounded. The operator's head receiver 4 and the secondary of her induction coil 5 are adapted to be bridged between the calling strands *t*² and *s*² of the cord circuit by means of the listening key springs 6. The operator's transmitter 7 and the primary of her induction coil are adapted to be charged from any suitable source of current and which may be the battery B. A ringing key represented by the springs 8 is placed in the calling end of the cord circuit and is connected by the leads 9 and 10 with the ringing generator 11; said leads 9 and 10 including the normal contacts of a plurality of ringing keys forming part of a selective ringing outfit for party line work. The opposite end of the cord circuit is provided with a similar ringing key 12 adapted to connect also with said ringing generator 11. The operator's set is provided with an order wire 28 which, when the order key 13 is depressed, serves to connect her head telephone with the telephone 26 of the operator at the other end of the trunk. The trunk E is shown as extending between the toll board and a section of the multiple board, containing local subscribers' lines of

the common battery type. This trunk is provided with a jack J^2 upon the toll board containing normally-closed auxiliary contacts 14 which are adapted to be separated when the plug is inserted in the jack. The opposite end of the trunk terminates in a connecting plug P^3 also provided with tip and sleeve contacts to register with the corresponding contacts of the jacks of the local subscribers' lines. Flexible strands t^3 and s^3 connect the contacts of this plug with the wires 15 and 16 of the trunk line which include the condensers c^2 and c^3 . A relay r^2 at the incoming end of the trunk E is connected upon one side with the conductor 16 and upon the other side by means of the conductor 17 with the normal contact of a grounded spring 18, of a second relay r^3 one of whose terminals is connected to the strand t^3 of the trunk and whose other terminal is branched not only to the forward contact of said spring 18 but also by means of a conductor 19 to the spring 20 of said relay r^2 , the forward contact of which spring is likewise grounded. The relay r^3 controls through other of its normally-closed contacts a path for ringing current from the sleeve strand s^3 to the battery lead 3, which includes the conductors 21 and 22, the former containing a non-inductive resistance 23. The spring 18 of relay r^3 makes its forward contact before breaking its contact on being energized, as is indicated in the drawing. A third relay r^4 is connected from one side with the strand s^3 and upon the opposite side by a conductor 24 with the battery lead 3. This relay controls through its normally-open contacts the circuit of the disconnect signal S^4 associated with the incoming end of the trunk; the forward contact of the spring of said relay being joined by a suitable conductor 25 with one of the normally-closed contacts of the jack J^2 of the said trunk, the other closed contact being grounded. The incoming trunk operator's receiver 26 and the secondary of her induction coil 27 are connected directly with the order circuit 28 leading to the opposite end of the trunk. All of this apparatus associated with the trunk is at the incoming end except for the jack J^2 , as is indicated by the vertical broken line. The local subscribers' lines of which the line L^2 is a type, are of the common battery type and are each provided with a plurality of jacks extending to the jack J^3 upon said board. The usual line relay R controlling the line signal S^5 and the ordinary cut-off relay R^2 are provided for the line.

In the operation of the arrangement shown in this figure, when a toll subscriber has either called in or has been secured in response to an order from this end of the line and the answering plug P is inserted in the spring-jack of the toll line, the order key 13 is depressed and the toll operator is in-

formed by the B operator what trunk to use, whereupon she inserts the calling plug P^2 in the jack J^2 of the trunk thus designated by the incoming operator. At the same time the B operator takes up the plug P^3 of the same trunk and inserts the same in the spring-jack of the wanted line. The insertion of the trunk plug P^3 energizes the cut-off relay R^2 of the wanted line L^2 by current from the battery B over conductors 3 and 24, the relay r^4 , strand s^3 of the cord circuit and through said cut-off relay to ground. This places the line L^2 in condition for conversation and prevents the operation of the line signal S^5 thereafter. It is obvious that a suitable test may be applied to the incoming end of the trunk, but in the arrangement shown the idle or busy condition of the line is indicated to the toll operator by the lighting or failure to light of the lamp S^3 , so that no confusion results.

Upon the insertion of the plug P^2 of the cord circuit D the ringing key 8, together with one of the selective ringing keys, are depressed, which permits current from the selective ringing generator to flow from ground out over the tip side of the cord circuit, conductor 15 of the trunk through condenser c^2 , strand t^3 of the trunk, the tip side of the telephone line, thence through the bridged bell at the substation of the telephone line and back to the central office by way of the other side of the telephone line, the sleeve side of the jack J^3 and plug P^3 , strand s^3 , conductors 21 and 22, common lead 3 and thence through battery B to ground. Owing to the fact that the sleeve strand s^2 of the cord circuit is now open at the ringing key 8, battery current is cut off from relay r^2 at the opposite end of the trunk, and the ground branch 19 from strand t^2 is opened. The ringing current has thus an uninterrupted path to the substation and is not required to pass through relays or repeating coils and is not shunted by ground connections. After the subscriber has been called but before he responds a path for current is provided through the supervisory relay r associated with the cord circuit D , said path being as follows: from the live pole of the battery B , over conductor 3, through the relay r , thence by way of conductor 2 and through the repeating coil winding w^4 and the sleeve strand s^2 of the cord circuit to sleeve conductor 16 of the trunk circuit and thence through relay r^2 , conductor 17 and spring 18 of the relay r^3 to ground. This supervisory relay r is therefore actuated and lights the supervisory lamp S^3 which indicates to the toll operator that the local subscriber has not yet responded. The operation of the relay r^2 at this same time closes a path for current from strand t^3 through its spring 20; when the called subscriber does respond a path for current from the battery

B is provided through supervisory relay r^4 and over the sleeve side of the telephone line, through the substation devices and back to the central office over the tip side of the line, through conductor t^3 and relay r^3 , conductor 19 and spring 20 to ground, the current in this path being sufficient to energize said relay r^3 , which pulls up its armature 18 and providing a locking circuit for itself through said armature 18 and its forward contact to maintain it actuated and to open the non-inductive path through conductors 21 and 22, and at the same time deenergizing the relay r^2 at the incoming end of the trunk and relay r at the outgoing end, the latter serving to retire the supervisory signal S^3 , thus indicating to the A operator that the called subscriber has responded.

When the conversation is terminated the toll subscriber sends an alternating ringing current over the telephone line which is sufficient to operate the bridged clearing-out drop S^2 , thus giving a clearing-out signal at this end of the cord circuit. The hanging up of the subscriber's receiver upon the line L^2 opens the circuit through the relay r^3 at the incoming end of the trunk, which permits the spring 18 to close with conductor 17 a path for current through supervisory relay r associated with the cord circuit D, thereby again energizing the latter and lighting the supervisory signal S^3 . The toll operator observing these signals withdraws the plugs and takes down the connection. The withdrawal of the plug P^2 permits the contacts 14 of the jack J^2 to close together and since the relay r^4 at the incoming end of the trunk is now actuated by current from the battery B flowing through the cutoff relay of the line L^2 , a complete path for current is established through the disconnect signal S^4 associated with the trunk P^3 and the same is lighted. When this signal is noticed by the operator she takes down the trunk plug and all parts are restored to normal condition. In the case of a single subscriber upon the line L^2 , one of the selective generators only need be used, or in case there are no party lines provided with selective calls, an ordinary ringing generator may be employed. With selective calling the proper generator is of course connected for ringing. In case it becomes necessary to call the toll subscriber the ringing key 12 alone is depressed, and in case the cord circuit is employed to connect two toll or similar subscribers, only the key 8 need be depressed to ring such called toll subscriber since the generator 11 has its circuit completed through the normal contacts of the selective ringing key. In case of the latter kind of connection the clearing-out drop S^2 is alone depended upon for indicating the end of the conversation.

In Fig. 2 I show a similar arrangement

but in which a common battery line L^3 of the same type as L^2 is shown at each office while the cord circuit F is that ordinarily employed in connection with such common battery lines. The trunk E^2 is modified only slightly so as to make it possible to use said cord circuit F. This cord circuit comprises the usual arrangement of relays r^5 and r^6 connected between the opposite poles of a central common battery B^2 and the strands t and s together serving to control the circuit of the supervisory lamp S^6 while a similar pair of relays r^7 and r^8 associated with the calling plug of the cord circuit, likewise control the circuit of the supervisory signal S^7 , a battery B^3 being furnished for the operation of these relays. The connection of the ringing generator and operator's telephone will be readily understood from the description heretofore given. A push button 29 is placed in the sleeve connection of the ringing keys to sever the battery connection when the cord is used with the trunk. The trunk is provided with a grounded retardation coil 30 connected with the sleeve side of the trunk, and the relay r^3 is arranged when energized to bridge the relay r^2 across the trunk. When it is desired to make connection with the trunk with this form of cord circuit the order key is depressed in the usual way and the proper trunk is designated by the incoming operator who immediately inserts the trunk plug in the jack of the wanted line. The insertion of the plug P^2 of the cord circuit F permits current to flow through the supervisory relay r^3 , the sleeve strand s^2 of the cord circuit and the grounded retardation coil 30 of the trunk to thus cause a positive action of said relay. At the same time sufficient current flows through the relay r^2 via the grounded spring 18 of the relay r^3 , to energize said relay, thereby completing a path for return current from line L^2 when the subscriber answers. The supervisory signal S^7 is therefore lighted since relay r^8 is now operated while relay r^7 is unexcited. As in Fig. 1, the spring 18 makes its forward contact before breaking from the back contact. It should be stated, however, that upon the insertion of the plug P^2 the ringing key is operated, key 29 being also depressed, said ringing key being shown as adapted for selective signaling over metallic lines, and a ringing current passes out over the tip side of the trunk line and to the substation upon the line L^2 and back to the central office, thence through conductor 21, including resistance 23 and conductor 22, to the live pole of the battery B^4 and to ground, the current taking this path in preference to that through the relay r^4 since the resistance 23 is purposely made non-inductive. As in the case of Fig. 1, relay r^2 is inert during ringing, so that the ringing current does not

pass through relay r^3 . When the called subscriber responds the relay r^3 is energized and through its spring 18 completes a path across the trunk circuit to permit current
 5 from the battery B^3 in the cord circuit F to flow in the local metallic path of said end of the cord circuit and the trunk, thereby operating the supervisory relay r^7 and extinguishing the lamp S^7 . Conversely the
 10 hanging up of the subscriber's telephone de-energizes the relay r^3 which opens the bridge formed by conductor 17 and thereby causes the deenergization of the relay r^7 to permit lighting of the supervisory lamp S^7 . The
 15 signal S^6 indicates the hanging up of the telephone on line L^3 , and the taking down of the cord causes lamp S^4 to light. The parts are thus restored to normal condition. Inasmuch as this cord is designed to be used
 20 for ordinary connections between such lines as L^3 , the battery connection including key 29 is needed to furnish current for holding up the cutoff relay of the line while ringing.

It will be understood that the battery B^4
 25 may be the same as either of the batteries B^2 or B^3 , or in fact that one battery only may be used for all purposes.

I claim:

1. In a telephone system, the combination
 30 with a trunk circuit terminating in a plug at one end and a jack at the other, of a cord circuit adapted to be connected with the latter end, a ringing outfit associated with the cord circuit for sending ringing current
 35 over the trunk to the called subscriber's station, a branch connection normally extending from a limb of said trunk to a third return conductor when the cord circuit is connected with the trunk, and means for sever-
 40 ing said branch connection when ringing current is applied to said limb of the trunk circuit, substantially as described.

2. In a telephone system, the combination
 45 with a trunk circuit terminating in a plug at one end and a spring jack at the other, of a cord circuit adapted to be connected with the spring-jack of the trunk, a ringing outfit associated with the cord circuit and adapted for sending ringing current out
 50 over the trunk and to the called subscriber's station, a branch connection from the side of said trunk over which the ringing connection passes, a relay associated with the trunk and controlling said branch connection, a
 55 source of current associated with the cord circuit to energize said relay to complete said connection under normal conditions when the cord circuit is connected with the trunk, and means for depriving said relay
 60 of operating current when the ringing outfit is being used, whereby said branch connection is opened to prevent the shunting of the ringing current, substantially as described.

65 3. In a telephone system, the combination

with a trunk circuit terminating in a plug at one end and a spring-jack at the other, of a source of current arranged to send current out over one side of the trunk to the subscriber's station for talking purposes with
 70 return over the other side of the trunk, a branch connection normally extending from the latter side of the trunk to a return conductor during a connection, a cord circuit adapted to be connected with said spring-
 75 jack, a ringing generator outfit associated with the cord circuit and arranged to be connected with the latter side of the trunk to send ringing current over the same to the called subscriber's station, and means for
 80 rendering said latter side of the trunk temporarily free from said branch connection while said ringing outfit is in use, substantially as described.

4. In a telephone system, the combination
 85 with a trunk circuit terminating in a plug at one end and a spring-jack at the other, of a cord circuit adapted to be connected with the spring-jack, a source of current to send current out over the trunk circuit to the
 90 called subscriber's station for talking purposes, a branch connection from one side of the trunk to afford a path for said current, a relay connected with the trunk to control said branch connection, a source of current
 95 associated with the cord circuit to normally energize said relay when the cord circuit is connected with the trunk, a ringing outfit associated with the cord circuit to send current out over the side of the trunk to which
 100 said branch is connected, and thence to the called subscriber's station, and means for cutting off current from said relay in the operation of said ringing outfit, whereby said branch connection is opened and the
 105 ringing current is prevented from being shunted therethrough, substantially as described.

5. In a telephone system, the combination
 110 with a trunk circuit adapted to be connected with a subscriber's line at one end and a cord circuit with which the other end is adapted to connect, of a ringing outfit associated with the cord circuit, and means
 115 associated with the cord circuit adapted to so affect the trunk circuit as to temporarily render one of its limbs free from branch circuits during ringing, whereby all of the current from said ringing outfit will be sent out over the subscriber's line, substantially as
 120 described.

6. In a telephone system, the combination
 125 with a trunk circuit, of a subscriber's line adapted to be connected therewith at one end, and a cord circuit with which the other end is connected, a branch connection between said trunk circuit and a third conductor at its incoming end, a ringing outfit associated with the cord circuit, and means
 130 for severing said branch connection when

the ringing outfit is connected with the cord circuit, whereby a shuntless path from the generator is secured through the trunk circuit to the line of the subscriber to be signaled, substantially as described.

7. In a telephone system, the combination with a trunking circuit, of a cord circuit adapted to be connected with its outgoing end, and a telephone line with which its incoming end is adapted to connect, a source of steady current associated with the cord circuit, a relay associated with the trunk circuit controlling a branch circuit and energized from said source, a source of ringing current associated with the cord circuit, and means to remove the connection between said steady source and one limb of the trunk circuit during ringing, whereby the branch circuit will be opened and the ringing current will not be shunted away from the subscriber's line to be called, substantially as described.

8. In a telephone system, the combination with a trunk circuit adapted to be connected with a subscriber's line at one end and a cord circuit with which the other end is adapted to connect, of a ringing outfit associated with the cord circuit, a branch circuit associated with the trunk circuit, and means to temporarily sever said branch circuit during ringing whereby current from said ringing outfit will not be shunted from the telephone line, substantially as described.

9. In a telephone system, the combination with a trunking circuit, of a cord circuit adapted to be connected with its outgoing end, and a telephone line with which its incoming end is adapted to connect, a source of steady current associated with the trunk circuit and adapted during connection to furnish current for the transmitter of the called subscriber's line, a source of ringing current associated with the cord circuit, and

a relay energized by current flowing over the outgoing end of the trunk and having contacts in the circuit of said steady source and one limb of the trunk, said contacts being adapted to be maintained open during ringing, whereby the ringing current will not be shunted away from the subscriber's line, substantially as described.

10. In a telephone system, the combination with a trunk circuit, of a cord circuit adapted to connect with its outgoing end, and a telephone line with which its incoming end may be connected, a source of steady current and a source of ringing current each associated with said cord circuit, a branch connection associated with said trunk circuit, and a relay associated with said trunk circuit to control said branch connection, said relay being adapted to be actuated by current from said steady source when the line is in condition for conversation, and means to remove said steady current from its connection with said relay during ringing, whereby said branch connection is severed from the trunk line, substantially as described.

11. In a telephone system, the combination with a trunk line, of a cord circuit to connect with its outgoing end, and a telephone line with which its incoming end may be connected, branch connections associated with the trunk circuit, a source of ringing current associated with the cord circuit, and means to automatically remove all branch connections from a limb of the trunk circuit by the act of applying ringing current to the trunk circuit, substantially as described.

In witness whereof, I hereunto subscribe my name in the presence of two witnesses.

CHARLES S. WINSTON.

Witnesses:

ROBERT LEWIS AMES,
EDITH F. GRIER.