

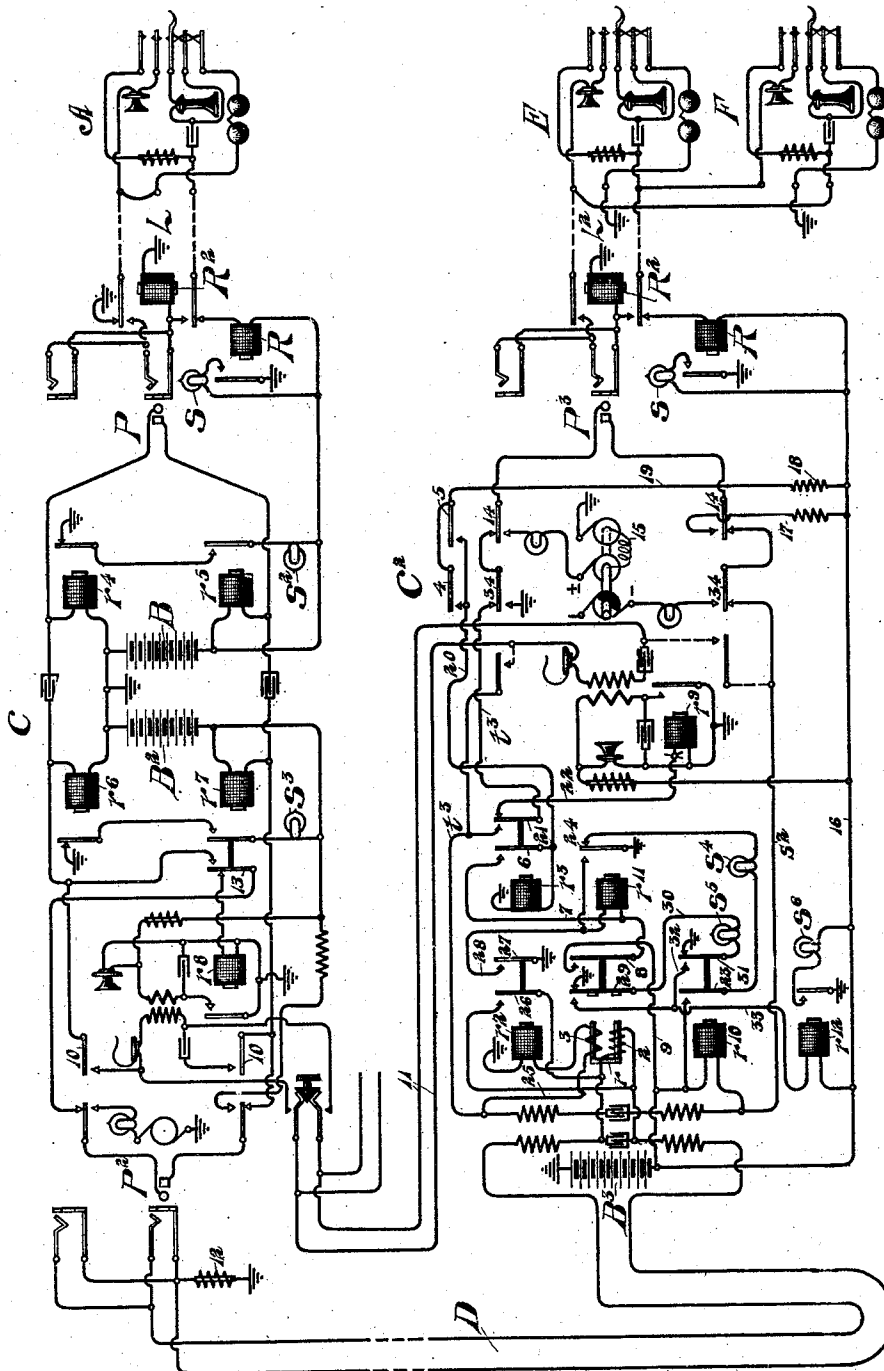
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W. W. DEAN.

TELEPHONE TRUNKING SYSTEM.

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Witnesses.

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TELEPHONE TRUNKING SYSTEM.

No. 841,769.

Specification of Letters Patent.

Patented Jan. 22, 1907.

Application filed February 6, 1903. Serial No. 142,114.

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Telephone Trunking Systems, of which the following is a specification.

In an application filed by me June 28, 1902, Serial No. 113,581, I have shown and described a telephone trunking system in which a relay serving to disconnect the test-relay and place the tip-strand of the trunk-cord in condition for conversation is actuated over a portion of the talking-circuit when the trunk-cord is connected with the called line. In a second application, filed January 22, 1903, Serial No. 140,166, I have shown a similar trunking system in which an auxiliary relay is employed for this purpose, said relay being initially actuated by the ringing-key when a wanted subscriber is called and thereafter controlled by the connection of the trunk-cord with the said line.

My present invention relates to the same general trunking system as the said latter application and employs likewise an auxiliary relay; but the energization of said relay after the subscriber is called is controlled from the outgoing end of the trunk and by the condition of the wanted-subscriber's telephone.

My invention is illustrated in the accompanying drawing, in which the figure represents a diagram of a trunking system embodying my improvements.

L indicates a subscriber's line of the well-known "two-wire" or "Dunbar" type extending from a subscriber's station A to a central office C, where a suitable operator's outfit is shown for the purpose of connecting the lines together for conversation and also for connecting the lines with the trunks, such as D, extending from the station C to another station C². At the latter station are lines of the same type as indicated at L², upon which subscribers' stations E and F are located.

At the station C² the trunk-relay *r* is provided with a high-resistance winding 2, connected with the outgoing end of the trunk, and with a low-resistance winding 3 in series with the tip-relay *r*². The auxiliary relay *r*³ is initially energized from the battery B³ by the actuation of springs 4 and 5 of the ring-

ing-key and is thereafter controlled through its spring 6 and forward contact, the conductor 7, spring 8 of the trunk-relay forward contact, and the wire 9, leading to the live pole of the said battery. In order that this trunk-relay shall be energized throughout the connection, it is necessary that the trunk-relay be also actuated during the connection, which is accomplished by the low-resistance winding thereof in circuit with the tip-relay.

The subscriber located upon the line L desiring a connection takes up her receiver and permits current from the battery B to flow over the telephone-line and through the line-relay R, which serves to close a circuit of the line-signal S. The operator observing the signal inserts the answering-plug P of her cord-circuit and depresses springs 10 of her listening-key to connect her instrument with the cord-circuit to receive the order. Supervisory signal S² is now extinguished by the operation of both supervisory relays *r*⁴ and *r*⁵. Upon ascertaining that a subscriber at the branch exchange is wanted, the calling-plug P² of the cord-circuit is inserted in one of the jacks of the trunk D, said trunk being nominated by the operator at office C² in response to the order of the first operator, which is communicated to the second operator over the order wire or circuit 11. At practically the same time the trunk-plug P³ is inserted in the jack of the wanted subscriber. The insertion of the plug P² in the jack of the trunk completes a path for current from the battery B² through the supervisory relay *r*⁷ and over the sleeve-strand of the cord and through the retardation-coil 12, which causes the actuation of said relay to disconnect the test-relay *r*⁸, associated with the cord, and to complete the tip-strand for talking through the spring 13 of said relay. The supervisory signal S³ is also operated to indicate that the wanted subscriber has not yet responded. The actuation of tip-relay *r*⁶, associated with the cord-circuit, is prevented by reason of the high-resistance-winding 2 of the trunk-relay at the office C², since it is included in the metallic circuit of the trunk and the calling end of the cord-circuit. The insertion of the plug P³ of the trunk-cord actuates the cut-off relay R² of the line L² to render the line-signal S inoperative and to connect the external line-circuit

with the switchboard-circuit of the line. If the subscriber F is the one desired, the springs 5 and 14 of the ringing-key are actuated, which serves to connect the generator 5 15 with the tip side of the line and to send current through the ringer at the station F, which is connected with the tip side of the line. The cut-off relay R^2 is maintained actuated by current from battery B^3 over the 10 battery-lead 16 and through conductor 17 when the sleeve-spring 14 of the ringing-key is depressed. The spring 5 of said key also serves to close a path for current from the battery B^3 over conductor 16, through resistance 18 in the wire 19, spring 5, conductor 15 20, and through auxiliary relay r^3 to ground. The actuation of this relay closes a locking-circuit for itself through spring 6, conductor 7, spring 8 of the trunk-relay, which is now energized, and conductor 9 to battery B^3 . This auxiliary relay remains actuated, therefore, after the ringing-key is returned to normal position and the spring 5 thereof released.

25 The auxiliary relay r^3 is provided with an additional spring 21, serving in its forward position to complete the tip-strand t^3 of the trunk-cord, but in its normal position to connect with a conductor 22, leading to a 30 grounded high-resistance and high-impedance test-relay r^9 . The sleeve-relay r^{10} at the incoming end of the trunk is now energized from the battery B^3 over the sleeve-strand s^2 of the trunk-cord. This relay, 35 through its spring 23 and forward contact, closes a path for current from the battery B^3 through the ringing-lamp S^4 , the circuit of which is completed at the back contact and spring 24 of a locking-relay r^{11} . This light 40 indicates to the trunk-operator that the called subscriber has not yet responded.

The response of the called subscriber permits current from the battery B^3 to flow over the sleeve-strand of the trunk-cord, the sleeve-conductor of the telephone-line, and thence 45 back to the central office over the tip side of the line and the tip-strand of the cord and thence through conductor 25, the low-resistance winding of the trunk-relay r , and through 50 the tip-relay r^2 to ground. The current in this path actuates said tip-relay, with the result that the high-resistance winding 2 of the trunk-relay is short-circuited by its spring 26 and forward contact, thus removing said 55 high resistance from the outgoing end of the trunk and permitting sufficient current over the metallic circuit thereof to operate the tip supervisory relay r^6 in the office C to extinguish the supervisory lamp S^3 . This indicates to the A operator that the called subscriber has responded. The flow of current through the low-resistance winding 3 of the trunk-relay prevents demagnetization of the same, so that the auxiliary relay r^3 is not 65 released. The spring 27 of tip-relay r^2 now

completes, through its forward contact and conductor 28, the circuit of locking-relay r^{11} , which is energized from the battery B^3 , and serves, first, to open the circuit of ringing-lamp S^4 , thereby extinguishing it and indicating to the B operator that the wanted 70 subscriber has responded, and, secondly, to close, through the forward contact of said spring, a locking-circuit for itself, whereby it remains actuated throughout the connection or as long as the trunk-relay is actuated. 75 At the termination of the conversation the subscribers return their receivers to their hooks, thereby opening the line-circuits and in the case of line L lighting the supervisory 80 lamp S^2 . In the case of line L^2 tip-relay r^2 is deprived of current, and the short circuit of the high-resistance winding 2 of relay r is broken, and the said high resistance reinserted in the metallic circuit of the outgoing end 85 of the trunk, which results in depriving supervisory relay r^6 at the A office of operating-current, and the supervisory signal S^3 is lighted. Upon observing both supervisory signals the A operator withdraws the plugs and 90 takes down the connection, thus restoring all parts to normal condition at her office. The withdrawal of the cord-circuit from the outgoing end of the trunk entirely deprives 95 the trunk-relay of operating-current, which allows its spring 29 to engage its back grounded contact, and thereby closes its circuit for the disconnecting-lamp S^5 over the conductor 30, spring 31 of sleeve-relay r^{10} , its forward contact, and conductors 32 and 33 100 and through the pilot-relay r^{12} and the battery B^3 to ground. The operator observing the pilot-signal S^6 and the disconnect-signal S^5 knows that the trunk has been disconnected at the outgoing end and that it is time to 105 withdraw the trunk-plug, which is accordingly done.

If the station E upon the line L^2 had been wanted, the trunk-operators would have depressed the springs 4 and 34 of the ringing-key, which would have accomplished the same results, as before described, so far as the operation of the relays is concerned, and the ringing-current would have been sent out 115 over the sleeve side of the line to ring the bell at station E. Before the trunk-plug is connected with the called line the said line is tested in the usual way by touching the tip of the plug to the test-rings thereof, which if the line is busy permits a flow of current over 120 the tip-strand and through the said test-relay r^9 . This relay is then actuated and causes a click in the operator's receiver. Any other test-responsive device or arrangement of the test-receiving circuits may of 125 course be employed. In case the calls to the office C² are infrequent it may be desired to dispense with the order-circuit 11 and use the trunk for communication between the operators. In this method of working the A op- 130

erator would first test the idle or busy condition of the trunk and insert the calling-plug in one that is idle. This would result in operating the trunk-relay r while the sleeve-relay r^{10} is deenergized, so that a path for current from the battery B^3 will be completed through the pilot-relay r^{12} , conductor 33, forward contact and spring 29 of the trunk-relay, conductor 30, through lamp S^5 and spring 31 and back contact to ground, thus lighting the lamp S^5 , which now serves as a calling-signal to the B operator. In response to this signal the B operator connects her telephone with the trunk and receives the order for connection from the A operator. The insertion of the trunk-plug in response to this order actuates the sleeve-relay r^{10} and severs the calling-lamp circuit. The remainder of the connection and disconnection is the same as that before described.

It will be understood that the ringing-keys and listening-keys mentioned may be of any usual type, preferably such as operate simultaneously the desired springs by the actuation of a single lever or key.

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

1. In a telephone trunking system, the combination with a testing outfit at the incoming end, a relay to control the connection of said outfit with said end of the trunk, means to control said relay from the outgoing end of the trunk and from the called-subscriber's line, and means to initially energize said relay in calling the wanted subscriber, substantially as described.

2. In a telephone trunking system, the combination with a telephone-line, of testing apparatus to determine the idle or busy condition of the line, a relay to control said testing apparatus, means to initially energize said relay in the actuation of the ringing-key, and means to control the further actuation of said relay from the outgoing end of the trunk, substantially as described.

3. In a telephone trunking system, the combination with a telephone-line, of a testing apparatus associated with the incoming end of the trunk, a relay to disconnect the testing apparatus from the incoming end of the trunk during conversation, means to initially operate said relay, and further means to control its actuation from the outgoing end of the trunk, substantially as described.

4. In a telephone trunking system, the combination with a telephone-line, of testing apparatus associated with the incoming end of the trunk, a relay to control said testing apparatus, means to first operate said relay, and further means to control the actuation of said relay from the outgoing end of the trunk and a called-subscriber's station, substantially as described.

5. In a telephone trunking system, the combination with a telephone-line, of testing apparatus associated with the incoming end of the trunk, a relay to control said apparatus, said relay being initially operated in the act of calling the wanted subscriber and thereafter controlled by the connection with the outgoing end of the trunk and by the called subscriber, substantially as described.

6. In a telephone trunking system, the combination with a telephone-line, of testing apparatus at the incoming end of the trunk-line, a relay at said end, means associated with the ringing-key for operating said relay for disconnecting said apparatus when the wanted party is called, and further means for maintaining the actuation of said relay until the answering subscriber has replaced his receiver upon the hook and the connection has been severed with the outgoing end of the trunk, substantially as described.

7. The combination with a telephone trunk-circuit adapted to connect lines together for conversation, of a relay the actuation of which completes the tip-strand of said trunk-circuit for talking purposes, a locking-circuit for said relay, a signal-circuit, a second relay the actuation of which opens said signal-circuit, a locking-circuit for said second relay, and a trunk-relay the demagnetization of which breaks each of said locking-circuits, substantially as described.

8. In a telephone system, the combination with a telephone-line, of a trunking circuit, a testing system for said line, a relay with normal contacts connecting said testing system with the trunking circuit and means not associated with said line for actuating said relay to disconnect said testing system, and means associated with the line for reconnecting said testing system, substantially as described.

9. In a telephone system, the combination with a telephone-line, of a trunking circuit, a testing system for said line, a relay with normal contacts connecting said testing system with the trunking circuit, means to actuate said relay, a locking-circuit for said relay, and means actuated over both ends of said trunking circuit for severing the locking-circuit of said relay, substantially as described.

10. In a telephone system, the combination with a telephone-line, of a trunking circuit, a testing system for said line, a relay with normal contacts connecting said testing system with the trunking circuit, means to actuate said relay, a locking-circuit for said relay, and means for severing said locking-circuit without disconnecting the trunk from the called telephone-line, substantially as described.

11. In a telephone system, the combination with a telephone-line, of a trunking circuit, a testing system for said line, a relay with normal contacts connecting said testing

system with the trunking circuit, means to actuate said relay, a locking-circuit for said relay, and means depending upon the condition of the called-subscriber's telephone for severing said locking-circuit, substantially as described.

12. In a telephone system, the combination with a cord-circuit and a telephone-line, of a trunking circuit adapted to connect the two for conversation, a testing system for said line, a relay with normal contacts connecting said testing system with the trunking circuit, means to actuate said relay to sever said connection, a locking-circuit for said relay, and means depending upon the condition of the called-subscriber's telephone and the connection of said cord-circuit with the trunk for severing said locking-circuit, substantially as described.

13. In a telephone system, the combina-

tion with a cord-circuit and a telephone-line, of a trunking circuit adapted to connect the two for conversation, a testing system for said line, a relay with normal contacts connecting said testing system with the trunking circuit, means to actuate said relay to sever said connection, a locking-circuit for said relay, and a trunk-relay actuated both by current over the outgoing end of the trunk and by current in the called-subscriber's line to maintain the continuity of said locking-circuit, substantially as described.

Signed by me at Chicago, county of Cook, State of Illinois, this 30th day of January, 1903.

WILLIAM W. DEAN.

Witnesses:

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GAZELLE BEDER.