

988,711.

Inventor  
John A. Holmes  
#11 F. O. Richey  
His Attorney

# UNITED STATES PATENT OFFICE.

JOHN D. HOLMES, OF PASADENA, CALIFORNIA, ASSIGNOR TO THE DEAN ELECTRIC COMPANY, OF ELYRIA, OHIO, A CORPORATION OF OHIO.

## CENTRAL TELEPHONE SYSTEM.

988,711.

Specification of Letters Patent.

Patented Apr. 4, 1911.

Application filed July 14, 1909. Serial No. 507,536.

### *To all whom it may concern:*

Be it known that I, JOHN D. HOLMES, a citizen of the United States, residing in the city of Pasadena, county of Los Angeles, and State of California, have invented certain new and useful Improvements in Central Telephone Systems; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make, install, and use the same.

My invention relates to telephone central exchange systems in which a cord circuit is used. In such systems it is common to test for a busy line before connection is made therewith. A head set is employed for the central operator, and when the line is busy, a special signal is given to the operator through her receiver. In the systems now in use, the operator's set is normally connected to receive this signal when the test is made. If, at the time she tests the desired line, an abnormal condition happens to exist there, due to induction from other sources of electrification, or to atmospheric conditions, she will receive a disturbance in her receiver which is sometimes mistaken for the busy signal.

One of the objects of my invention is to provide an improved busy testing system in which I avoid the arrangement of circuits subject to this fault. I also increase the efficiency of the busy test, making the signal louder and confining it to the operator's set. I accomplish this by short-circuiting the operator's receiver, and closing it in a local circuit which is free from the calling party's line. This occurs whenever a busy line is tested.

Other objects and advantages of my invention will be apparent to those skilled in the art.

My invention will be best understood by reference to the following description when taken in connection with the accompanying illustration, showing one specific embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

Referring to the figure of the drawing, I have illustrated a standard cord circuit with my improved test circuit applied thereto. The answering plug is shown at P'. The

calling plug is shown at P. These are connected by cords 1 and 5, 2 and 17. Condensers  $c$  and  $c'$  are interposed in these strands. The central battery is shown at B. The supervisory relays are shown at R, R', R<sup>2</sup>, and R<sup>3</sup>. At J and J<sup>2</sup> I show the jacks of a subscriber's line.

R<sup>5</sup> is the cut-off relay which is connected from the ring of the jacks to ground.

R<sup>6</sup> is the line relay, and L the line lamp.

T is the operator's transmitter, H the operator's receiver. These are inductively connected to each other and to the testing circuit through the coils of an induction coil I.

At 20 and 21 I show the operator's listening springs. The receiver H is connected to the listening spring contacts 22 and 23. A quick acting relay R<sup>4</sup> is legged to ground from the testing circuit, and is adapted to disconnect the operator's receiver from the contacts of the listening springs and to close a local circuit, including the winding 16 of the induction coil and the receiver H. The relay R<sup>4</sup> is high wound, and is operated only by a substantial flow of current.

The operation of my system is as follows: A subscriber having called central, the answering plug is inserted into the jack of the calling line. The listening springs are operated to connect the operator's set. The number of the subscriber desired is ascertained from the calling subscriber. The operator then proceeds to test the jack of the line of the desired subscriber. If the line connected to the jacks J and J<sup>2</sup> is busy, a potential higher than earth will exist at the ring contacts 3, owing to a plug of another cord circuit being inserted in the jack J<sup>2</sup>, as shown in the drawing. When the operator applies the tip 4 to the ring 3, a circuit will be completed as follows: ground at G', battery B, to the ring of jack J<sup>2</sup>, through 24, to the ring 3, tip 4 of the plug P, conductor 5, armature 6, back contact of the armature, conductor 7, contacts 8 and 9, condenser 10, winding 11, 12, and back to battery B. This disturbs the equilibrium of the condenser which was charged from ground G'—B—12—10—13—R<sup>4</sup>—G<sup>2</sup> and causes an impulse to be induced through the coil 16 and the operator's receiver. A branch of this circuit passes through conductor 13, relay R<sup>4</sup> to ground at G<sup>2</sup> energizing the quick acting re-

lay R<sup>4</sup> which pulls up its armature 14, interrupting the connection between the operator's receiver and the listening spring 21 at 14—18, and closing a local circuit through the operator's receiver H, 14, 15, 25, and 16. The impulse induced from the testing circuit passes through this local circuit, indicating to the operator, the busy condition of the desired line. Without this local circuit the impulse induced in the operator's circuit, would pass through the listening springs, the answering end of the cord circuit, the calling subscriber's line, and back to the operator's receiver. The calling subscriber would receive the objectionable click in his receiver, and the impulse through the operator's receiver would be cut down by the heavy resistance in this line. If for some purpose the calling subscriber had restored his receiver to the hook, this circuit would be interrupted and a very unsatisfactory busy signal would be given. By closing the local circuit I succeed in avoiding these objections.

While I have shown this particular embodiment of my invention which is the preferred form, it will be obvious to those skilled in the art that numerous and extensive departures from this form and the details thereof, may be made without departing from the spirit of this invention, the same being herein shown solely for the purpose of clearly illustrating one specific embodiment thereof.

I claim:

1. In a telephone system, a telephone line, a cord circuit, an operator's instrument, manually controlled listening key springs under control of the operator, normally closed circuit connections connecting said operator's instrument and said key springs, a switch in said connection, and means controlling said switch.

2. In a telephone system, a telephone line, a cord circuit, an operator's instrument, manually controlled listening key springs under control of the operator, normally closed circuit connections connecting said operator's instrument and said key springs, a switch in said connection, and electromagnetic means controlling said switch.

3. In a telephone system, a telephone line, a cord circuit, an operator's instrument, listening key springs under control of the operator, normally closed circuit connections connecting said operator's instrument and said key springs, and means adapted to interrupt said circuit connections and close a local circuit through said instrument.

4. In a telephone system, a telephone line, a cord circuit, an operator's instrument, listening key springs under control of the operator, normally closed circuit connections connecting said operator's instrument and said key springs, and an electro-magnetic

means adapted to interrupt said circuit connections and close a local circuit through said instrument.

5. In a telephone system, a line circuit, a cord circuit, an operator's instrument in said cord, listening key springs adapted to connect said instrument to said cord, circuit connections between said instrument and said springs, a busy testing circuit and means in said busy testing circuit controlling said circuit connections.

6. In a telephone system, a line circuit, a cord circuit, an operator's instrument in said cord, listening key springs adapted to connect said instrument to said cord, circuit connections between said instrument and said springs, a busy testing circuit, and electro-magnetic means in said busy testing circuit controlling said circuit connections.

7. In a telephone system, a line circuit, a cord circuit, an operator's instrument in said cord, listening key springs adapted to connect said instrument to said cord, circuit connections between said instrument and said springs, a busy testing circuit, and means in multiple circuit with said busy test circuit controlling said circuit connections.

8. In a telephone system, a telephone line, a cord circuit, an operator's instrument in said cord, operator's listening springs, normally closed circuit connections between said instrument and said springs, a busy test circuit, and means in said busy test circuit for closing a local circuit through the said operator's instrument.

9. In a telephone system, a telephone line, a cord circuit, an operator's instrument in said cord, means for connecting the operator's instrument into the cord circuit, normally closed connections between said instrument and said means, a busy test circuit, and means in said busy test circuit for closing a local circuit through the said operator's instrument.

10. In a telephone system, a telephone line, a cord circuit, an operator's instrument in said cord, means for connecting the instrument into the cord circuit, circuit connections normally closed between said instrument and said means, a busy test circuit and electro-magnetic means in multiple circuit with said busy test circuit for closing a local circuit through the said operator's instrument.

11. In a telephone system, a telephone line, a cord circuit, an operator's instrument in said cord, means for connecting the instrument into the cord circuit, circuit connections normally closed between said instrument and said means, a busy test circuit and means in multiple circuit with said busy test circuit for closing a local circuit through the said operator's instrument.

12. In a telephone system, a telephone line, a cord circuit, an operator's instrument,

operator's listening key spring contacts, normally closed circuit connections between said instrument and said contacts, a busy test circuit, and means in said busy test circuit for interrupting said connections and closing a local circuit through said instrument.

13. In a telephone system, a telephone line, a cord circuit, an operator's instrument, operator's listening key spring contacts, normally closed circuit connections between said instrument and said contacts, a busy test circuit, and electro-magnetic means in said busy test circuit for interrupting said connections and closing a local circuit through said instrument.

14. In a telephone system, a telephone line, a cord circuit, an operator's instrument, operator's listening key spring contacts, normally closed circuit connections between said instrument and said contacts, a busy test circuit, and means in multiple circuit with said busy test circuit for interrupting said connections and closing a local circuit through said instrument.

15. In a telephone system, a telephone line, a cord circuit, an operator's instrument, operator's listening key spring contacts, normally closed circuit connections between said instrument and said contacts, a busy test circuit, and electro-magnetic means in multiple circuit with said busy test circuit for interrupting said connections and closing a local circuit through said instrument.

16. In a telephone system, a telephone line, a cord circuit, an operator's instrument, operator's listening key spring contacts, normally closed circuit connections between said instrument and said contacts, a busy test circuit, and means in said busy test circuit for interrupting said connections and closing a local circuit through said instrument, said means operated when a busy line is tested.

17. In a telephone system, a telephone line, a cord circuit, an operator's instrument, operator's listening key spring contacts, normally closed circuit connections between said instrument and said contacts, a busy test circuit, and means in multiple circuit with said busy test circuit for interrupting said connections and closing a local circuit through said instrument, said means operative when a busy line is tested.

18. In a telephone system, a telephone line, a cord circuit, an operator's instrument in said cord, normally closed circuit connections for said instrument, a busy test circuit, and means in said busy circuit for closing a local circuit through the said operator's instrument, said means operated when a busy line is tested.

19. In a telephone system, a telephone line,

a cord circuit, an operator's listening instrument, busy testing means, and means for closing a local circuit through said operator's instrument when a busy line is tested.

20. In a telephone system, a telephone line, a cord circuit, an operator's listening instrument, busy testing means, and means for closing a local circuit through said operator's instrument when a busy line is tested, said means being in circuit with said busy testing means.

21. In a telephone system, a telephone line, a cord circuit, a listening key, an operator's instrument, busy testing means, and electro-magnetic means for closing a local circuit through said operator's instrument when a busy line is tested, said electro-magnetic means being controlled by said listening key.

22. In a telephone system, a telephone line, a cord circuit, a listening key, an operator's instrument, line connecting means for said instrument, busy testing means, a normally interrupted local circuit for said instrument, and means operated when a busy line is tested to interrupt said line connecting means and to close said local circuit through the operator's instrument, said means being controlled by said listening key.

23. In a telephone system, a calling line, a called line, a central telephone circuit, means to test the condition of said called line, an operator's set and means to exclude said calling line from the operator's set when the condition of the called line is tested and found busy.

24. In a telephone system, a calling line, a second line, central circuits, means in the central circuits for testing the condition of the second line, an operator's set, and means to disconnect said operator's set from the calling line when a busy line is tested.

25. In a telephone system, a calling line, a second line, central circuits, means in the central circuits for testing the condition of the second line, an operator's set, and means to disconnect the operator's set from the calling line and close a local circuit there-through when a busy line is tested.

26. In a telephone system, a calling line, other subscribers' lines, central circuits, means in said central circuits for testing the other lines, an operator's set, and means controlled over said testing means for excluding the calling line from the test and closing a local circuit through the operator's set.

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

JOHN D. HOLMES.

Witnesses:

A. C. WRIGHT,  
F. W. AUSTIN.