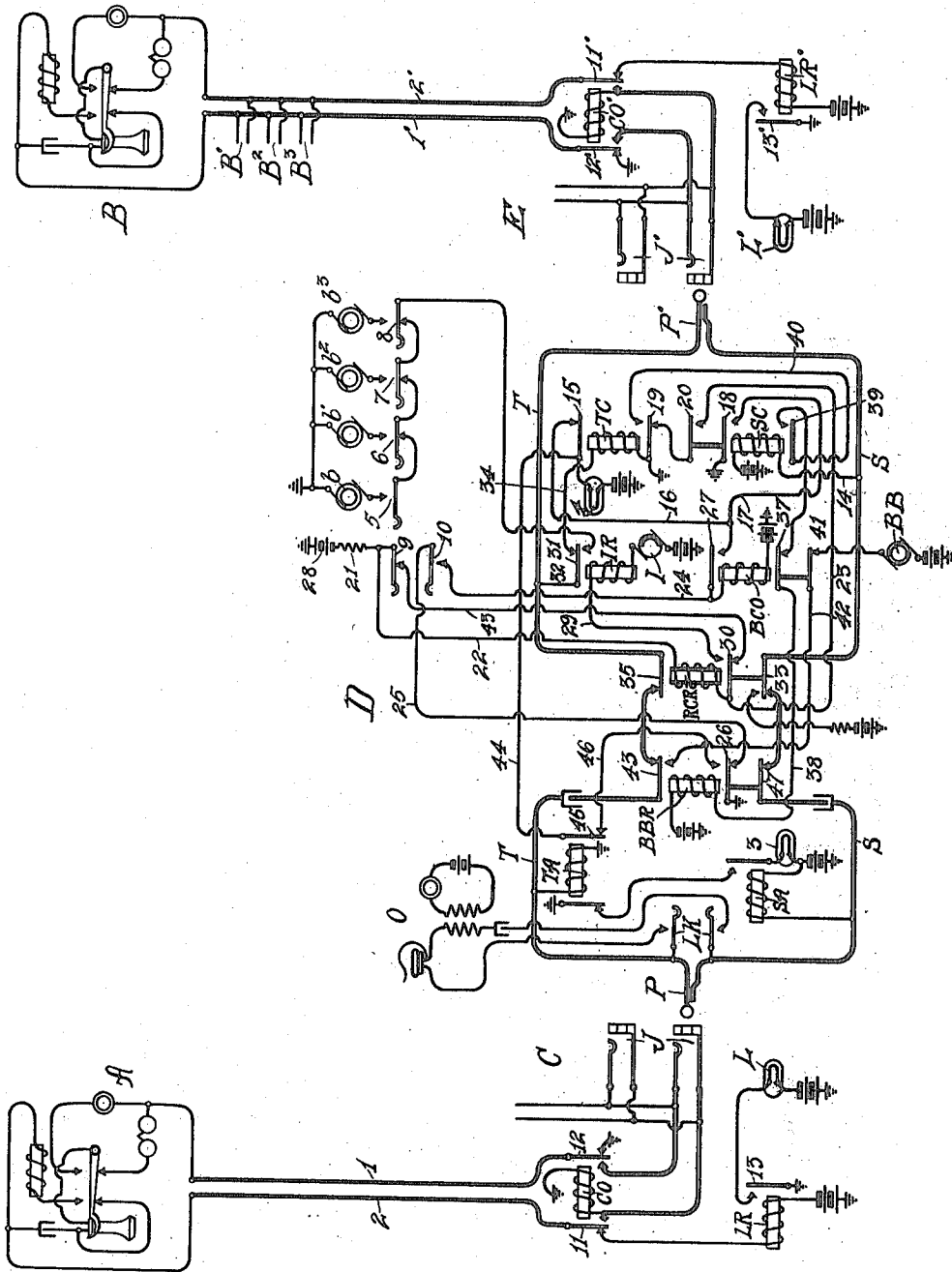


C. S. WINSTON.
TELEPHONE SYSTEM.
APPLICATION FILED JAN. 2, 1913.

1,157,746.

Patented Oct. 26, 1915.



Witnesses:

GE. Mueller
Wm. Berghahn

Inventor:
Charles S. Winston
By Curtis Blamp
Attorney

UNITED STATES PATENT OFFICE.

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

TELEPHONE SYSTEM.

1,157,746.

Specification of Letters Patent.

Patented Oct. 26, 1915.

Application filed January 2, 1913. Serial No. 739,656.

To all whom it may concern:

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

My invention relates to common battery telephone exchange systems, and more particularly to automatic ringing or signaling means and an automatic busy signal to notify a calling subscriber that the wanted line is busy. This busy signal is transmitted to the calling subscriber without the usual preliminary test to see whether the line is in an idle or busy condition.

An object of my invention is the provision of a simplified system of the above character having certain new features as will be more particularly pointed out.

Referring now to the accompanying drawing, I have illustrated a circuit arrangement adapted for interconnecting two common battery lines, the arrangement comprising a common battery substation A associated with the common battery line circuit C, a two-wire cord circuit D and a common battery substation B associated with the line circuit E. For the purpose of illustrating my invention we will assume an exchange with a number of common battery lines terminating at a switch-board in line circuits as C and E.

Referring now in detail to the apparatus used in the system as illustrated, the substation A is of a well-known common battery type connected by the line conductors 1 and 2 to the common battery line circuits C. The line circuit C comprises a cut-off relay CO, a line relay LR, line lamp L and multiple jacks J. To the right of the drawing is shown a four-party line having four substations B, B¹, B², and B³ connected thereto, the circuit of each of the substations being similar to that shown connected to the line at A. The substation B terminates at the exchange in a common battery line circuit E similar to that at C.

The common battery cord circuit D comprises an answering plug P and a calling plug P¹, the said plugs being conductively united by the heavily marked conductors T and S and the interposed condensers. As-

sociated with the answering end of the cord circuit is the tip answering supervisory relay TA and the sleeve answering supervisory relay SA, the tip supervisory and sleeve supervisory relays being operated to control the answering supervisory lamp 3. The busy back relay BBR is operated when the called line is busy to connect the busy signal BB to notify the calling subscriber that the wanted line is busy and also lights the calling supervisory lamp 4 of the calling end of the cord circuit D. The listening key LK is operated by the operator to connect her operator's set O with the cord circuit. The operator's set is common to and adapted to connect with any one of a number of cord circuits D in a well-known manner.

The tip calling supervisory relay TC and the sleeve calling supervisory relay SC are operated to control the calling supervisory lamp 4. For ringing purposes I preferably use four generators b , b^1 , b^2 and b^3 , each one being of a different frequency while the bells of the subscribers on the party lines are tuned to correspond with the frequencies of the said generators.

It is to be understood though, that my invention is not limited to party lines. In ringing the called-for subscriber one of the contact springs 5, 6, 7 or 8 is actuated depending upon the frequency of the bell of the called-for subscriber. The contacts 9 and 10 are master contacts associated with the ringing contacts and are closed when any one of the key plungers for contacts 5, 6, 7 or 8 is fully depressed. The ringing key plungers have three positions, normal, intermediate or locking and fully depressed. The key when in its fully depressed or third position has its ringing contacts and the master contacts 9 and 10 closed. The key when in its intermediate or locking position has its ringing contacts closed but the master contacts 9 and 10 normal. The ringing key plunger remains in its intermediate or locking position until another key plunger is fully depressed when the said locked key restores to its normal position.

The subscriber's bell is intermittently rung and this intermittent ringing is secured by means of the interrupter relay IR, this relay being adapted to have its energizing circuit opened and closed by means of the inter-

rupter I. The interrupter I is connected to the relay IR through contacts of the ringing control relay RCR. The relay RCR is actuated when one of the ringing key plungers is fully depressed, thus operating the master contacts 9 and 10, the opening of contact 9 removing the shunt from around the relay RCR. The busy back cut-off relay BCO is also actuated at the same time by the closing of contact 10 of the master contacts and is held in energized position by a locking circuit through its alternate contact 27 to ground at contact 18 of relay SC.

Operation.—Assuming now that the subscriber at substation A desires a connection with the substation B the subscriber at A takes his receiver from the switch hook closing an energizing circuit for the line relay LR, traced from battery through the said relay, normal contact 11 of the cut-off relay CO, the line limb 2 through the substation A, the line limb 1 to ground at normal contact 12 of cut-off relay CO. The energization of relay LR closes a circuit through the line lamp L traced from battery through the lamp L to ground at alternate contact 13 of relay LR. The operator observing the signal inserts a plug P into the answering jack J energizing the cut-off relay CO and effacing the line lamp L. The energizing circuit of relay CO may be traced from battery through the relay SA, the sleeve conductor S, of cord circuit D, sleeve contacts of the plug P and jack J through the winding of the relay CO to ground. The relays CO and SA are thus connected in series and energized. Upon the energization of relay CO a circuit is closed through the relay TA, the circuit being traced from battery through relay SA sleeve conductor S, the sleeve contacts of the plug P and the jack J, the circuit branching at alternate contact 11 of relay CO, the line limb 2 through the substation A, line limb 1, alternate contact 12 of relay CO, the tip contacts of jack J and plug P, tip conductor T through the winding of relay TA to ground. The relays TA and SA being energized, the supervisory lamp 3 is not lighted. The operator then throws the listening key LK and connects her operator's set O with the line and inquires the wants of the calling subscriber and assuming that it is the subscriber B, she inserts the calling plug P¹ into the jack J¹ without the usual preliminary test. Now, assuming that the substation B is idle a circuit for relays SC and CO¹ is established from battery through the relay SC, conductor 14, the sleeve conductor S, the sleeve contacts of the plug P¹ and the jack J¹ through the relay CO¹ to ground energizing said relays in series. Upon the energization of relay SC a circuit is closed through the supervisory lamp 4 from battery through said supervisory lamp

4, normal contact 15 of relay TC, conductor 16, conductor 17 to ground at alternate contact 18 of relay SC. The battery 28 passing through resistance 21, normal contact 9 conductor 43, normal contact 30 of relay RCR, conductor 23, alternate contact 20 of relay SC to ground at normal contact 19 offers the battery current a path of least resistance therefore shunting the winding of the relay RCR. The operator having plugged into the wanted line and assuming now that the bell of the desired subscriber is tuned to correspond to the frequency of the generator *b*, the operator closes the contact 5 and at the same time momentarily operates the contacts 9 and 10, the contact 5 remaining closed. As soon as the contact 9 is opened it removes the shunt from the relay RCR and a circuit is closed from battery 28 through the resistance 21, conductor 22, the winding of relay RCR, conductor 23, alternate contact 20 of relay SC to ground at normal contact 19 of relay TC energizing the relay RCR. The master contact 10 is closed the same time that contact 9 is opened, the contact 10 establishing circuit for the relay BCO from battery through the relay BCO, conductor 24, closed contact 10, conductor 25 to ground at normal contact 26 of relay BBR, energizing the relay BCO, which locks itself through its alternate contact 27 to ground at alternate contact 18. The relay BCO is energized and is locked in energizing position until the calling plug is withdrawn. The energization of relay BCO opens contact 37 so that when the called subscriber answers the relay BBR will not be energized by reason of open contact 37. The relay RCR upon energization closes a circuit through the interrupter relay IR from battery through the interrupter I, the relay IR, conductor 29, alternate contact 30, of relay RCR, conductor 23, alternate contact 20 of relay SC to ground at contact 19. Relay IR is now responsive to the interruptions of its circuit at interrupter I, and due to the intermittent energizations of the relay IR the contact 31 alternately connects tip relay TC and the generator *b* in bridge of the called line.

The circuit for ringing current is established from the ungrounded pole of the generator *b* through the alternate contacts 5, 31, conductor 32, the tip conductor T, the tip contacts of the plug P¹ and jack J¹, alternate contact 12¹ of relay CO¹, the line limb 1¹ through the condenser and bell of the substation B back over line 2¹, the alternate contact 11¹ of relay CO¹, the sleeve contacts of the jack J¹ and plug P¹, the sleeve conductor S, the alternate contact 33 of relay RCR through the resistance to battery, and then to the grounded pole of generator *b*. The contacts 35 and 33 of relay

RCR assume their alternate position as soon as it is energized disconnecting the answering end of the tip and sleeve conductors T and S so that the ringing of the called-for subscriber will not be heard by the calling subscriber. Each time the relay IR retracts its armature disconnecting ringing current from the line, the discharge of the condenser of the called line will have a tendency to kick up the relay TC thereby opening circuit of the relay RCR. To prevent the relay RCR from retracting its armature due to the interruptions of its circuit, the said relay is made slow-acting.

When the called subscriber answers and when the relay IR is in its deenergized condition a circuit is closed through the relay TC from battery through the relay SC, sleeve conductor S, sleeve contacts of the plug P¹ and jack J¹ through the alternate contact 11¹ of the relay CO¹, line limb 2¹, through the substation B, line limb 1¹, alternate contact 12¹ of relay CO¹, tip contacts of jack J¹ and plug P¹, tip conductor T, conductor 32, normal contact 31, conductor 34 through the relay TC to ground energizing the relay TC. The relay TC energizes and closes its alternate contact 19 removing the ground from the relay RCR, and the said relay RCR restoring, its contacts 33 and 35 close restoring the continuity of the talking conductors T and S. The contact 30 of the relay RCR also restores opening its alternate contact and thereby breaking the circuit of the relay IR. Also upon energization of relay TC, its normal contact 15 is interrupted effacing the supervisory lamp 4, notifying the operator that the called subscriber has answered. The subscribers at A and B are now connected in conversational circuit which may be traced over the heavily marked conductors T and S.

When the subscribers have finished conversation they restore their receivers to their respective switch-hooks thereby opening the circuits of the supervisory relays TC and TA the supervisory relays SA and SC remaining energized while the plugs P and P¹ are in the jacks J and J¹. The supervisory lamps 3 and 4 are thus lighted notifying the operator that the subscribers have finished conversation. The operator then removes the plugs P and P¹ from the jacks J and J¹ effacing the said lamps. The cord circuit D and the lines A and B thus are restored to normal and are now available for other connections.

Called subscriber busy.—Assuming now that the line B is busy at the time the subscriber at A wishes to make connection therewith, the operation of the circuit is the same up to the time when the operator connects the plug P¹ with the jack J¹ as already described. As soon as the plug P¹ is connected with the jack J¹ the relays SC and

TC operate from battery through the relay SC, conductor S, the sleeve contacts of the plug P¹ and jack J¹ over the busy line back through the tip contacts of the jack J¹ and the plug P¹, conductor T, conductor 32, normal contact 31, conductor 34, through the winding of relay TC to ground energizing said relays. Relay TC therefore closes its alternate contact 19 which closes a circuit for relay BBR from battery through relay BBR, conductor 38, normal contact 37, alternate contact 39, conductor 40, alternate contact 19 to ground energizing relay BBR. The relay RCR and relay BCO do not energize even though the contacts 9 and 10 are closed because normal contact 19 of relay TC is interrupted. The relay BCO remaining at normal, allowing the busy back signal to be sent over the calling line from busy back signal BB, through normal contact 41 of relay BCO, conductor 42, alternate contact 43, of relay BBR, the tip conductor T, tip contacts of the plug P¹ and the jack J¹, through the substation A back to ground through relay CO thus notifying the subscriber that the wanted line is busy. The interruption of alternate contacts 43, and 47 of relay BBR disconnects the calling side of the cord circuit from the answering and prevents the busy signal from being audible at the telephones of the two stations from which the conversation is being carried on. The calling subscriber in response to the signal replaces his receiver upon its switch-hook, deenergizing the relay TA which lights the supervisory lamp 3 and also lights the supervisory lamp 4. The circuit for lamp 4 is traced from battery, through said lamp 4, conductor 44, normal contact 45, conductor 46 to ground at alternate contact 26. The two supervisory lamps 3 and 4 being lighted, the operator is aware that the wanted line is busy and that the calling subscriber has replaced his receiver upon its switch hook. The operator then disconnects the plugs P and P¹ from jacks J and J¹. The removal of the plug P¹ deenergizes the relays TC and SC. The deenergization of the relay TC deenergizes the relay BBR opening the alternate contact 43 to disconnect the busy signal. It also removes ground from the supervisory lamp 4 at alternate contact 26 effacing the said lamp 4. The removal of the plug P deenergizes the relay SA and effaces the supervisory lamp 3. The cord circuit D and line A having been restored to normal, are available for other connections.

What I claim as new and desire to secure by United States Letters Patent is:

1. A telephone system comprising telephone lines, a link circuit connected at one end to a calling line, means for connecting the other end of said link circuit to a called line, a response supervisory relay TC for

said link circuit, said relay being adapted to be energized upon response from a called substation when connected to by said link circuit, means for energizing said relay upon connection made with the called line when busy, a busy signal, and means controlled by said response relay for connecting said busy signal to the calling line.

2. A telephone system comprising a calling telephone line, a link circuit connected at one end thereto, a called telephone line, means for connecting the other end of said link circuit to said called line, a response supervisory relay for said link circuit, means for energizing said relay by current over the called line when busy upon connection made therewith, and means responsive to such energization of said relay for transmitting a busy signal to the calling line.

3. A telephone system comprising a link circuit having a calling end, a called telephone line and means for connecting said calling end thereto, a response supervisory relay for said link circuit, means for energizing said relay by current over the called line when busy upon a connection made therewith, and means responsive to such energization of said relay for connecting a busy signal to the answering end of the link circuit.

4. A telephone system comprising a called telephone line, a two-conductor link circuit having a calling end for connecting thereto, a response supervisory relay connected to the tip strand of said link circuit, means for energizing said relay by current over the called line when busy upon connection made therewith, and means responsive to such energization of said relay for connecting a busy signal to the other end of the link circuit.

5. A telephone system comprising a link circuit having answering and calling ends, a called telephone line, a response supervisory relay for said link circuit, a busy signal, means effective upon connection made with the called line when busy for energizing said relay by current over the called line whereby said busy signal is connected to the answering end of the link circuit, means effective when connection is made with the called line if idle whereby said relay is not energized until the response from the called substation, and means to prevent such said second energization of the response relay from connecting said busy signal to the answering end of the link circuit.

6. A telephone system comprising a link circuit having answering and calling ends, a called telephone line and means for connecting said calling end thereto, a response supervisory relay for said link circuit, means for energizing said relay by current over the called line when busy upon connection made therewith, and a second relay responsive to

such energization of said first relay for connecting a busy signal to the answering end and rendering said link circuit discontinuous.

7. A telephone system comprising a link circuit having answering and calling ends, a called telephone line and means for connecting said calling end thereto, a response supervisory relay for said link circuit, means for energizing said relay by current over the called line when busy upon connection made therewith, a second relay responsive to such energization of said first relay for connecting a busy signal to the answering end and rendering said link circuit discontinuous, means whereby when connection is made with an idle called line said response relay is not energized until a response is secured from the called substation, and means to prevent such a second said energization of the response relay from effecting an energization of said second relay.

8. A telephone system comprising a calling telephone line and a called telephone line, a link circuit connected at its answering end with the calling line, means for connecting the calling end of said link circuit to the called line, a response relay for said link circuit, means for energizing said relay upon connection made with the called line when busy, a busy signal, means effective upon such energization of the response relay for transmitting said busy signal to the calling substation, answering and calling supervisory signals for the cord circuit, and means responsive to the replacing of the receiver at the calling substation to operate said signals.

9. A telephone system comprising a called telephone line, an operator's link circuit having answering and calling ends, a response supervisory relay for the cord circuit, a busy back device, an operator's key, automatically controlled ringing apparatus, means for energizing said relay upon connection made with the called line when busy whereby said busy device is connected with the answering end of the cord circuit, and means responsive to the actuation of said key if connection is made with said line when idle whereby said ringing apparatus is connected to the called line.

10. A telephone system comprising a called telephone line, an operator's link circuit having answering and calling ends, a response supervisory relay for the link circuit, a busy back device, a ringing key and ringing apparatus, means for energizing said relay upon connection made with the called line when busy, and means responsive to such energization of said relay whereby said busy device is connected with the answering end of the cord circuit and said ringing apparatus rendered ineffective.

11. A telephone system comprising a

called telephone line, an operator's link circuit having answering and calling ends, a response supervisory relay for the link circuit, a busy back device, a ringing key and ringing apparatus, said relay being energized upon connection made with the called line when busy, a busy relay responsive to such energization of said response relay whereby said busy device is connected with the answering end of the cord circuit, said relays when so operated also rendering said ringing key ineffective, and means whereby said key is effective if connection is made with said line when idle to connect the ringing apparatus to the called line.

12. A telephone system including a link circuit provided with a pair of terminals and a calling supervisory signal, means for connecting one of said terminals to the line of a calling subscriber, means for connecting the other of said terminals to the line of a called subscriber, and means dependent upon the idle or busy condition of said called line for either placing the control of the said calling supervisory signal under

the control of the said called subscriber or under the control of said calling subscriber.

13. In a telephone system a calling and a called subscriber's line, a link circuit provided with a pair of terminals and with a pair of supervisory signals, means for connecting one terminal of the said link circuit to the said calling subscriber's line thereby placing one of the said supervisory signals under the control of the calling subscriber, means for connecting the other terminal of said link circuit to the said called subscriber's line, and means dependent upon the idle or busy condition of said called line for either placing the control of the other supervisory signal under the control of said called subscriber or under the control of the said calling subscriber.

Signed by me at Chicago, county of Cook and State of Illinois in the presence of two witnesses.

CHARLES S. WINSTON.

Witnesses:

G. E. MUELLER,
B. O'BRIEN.