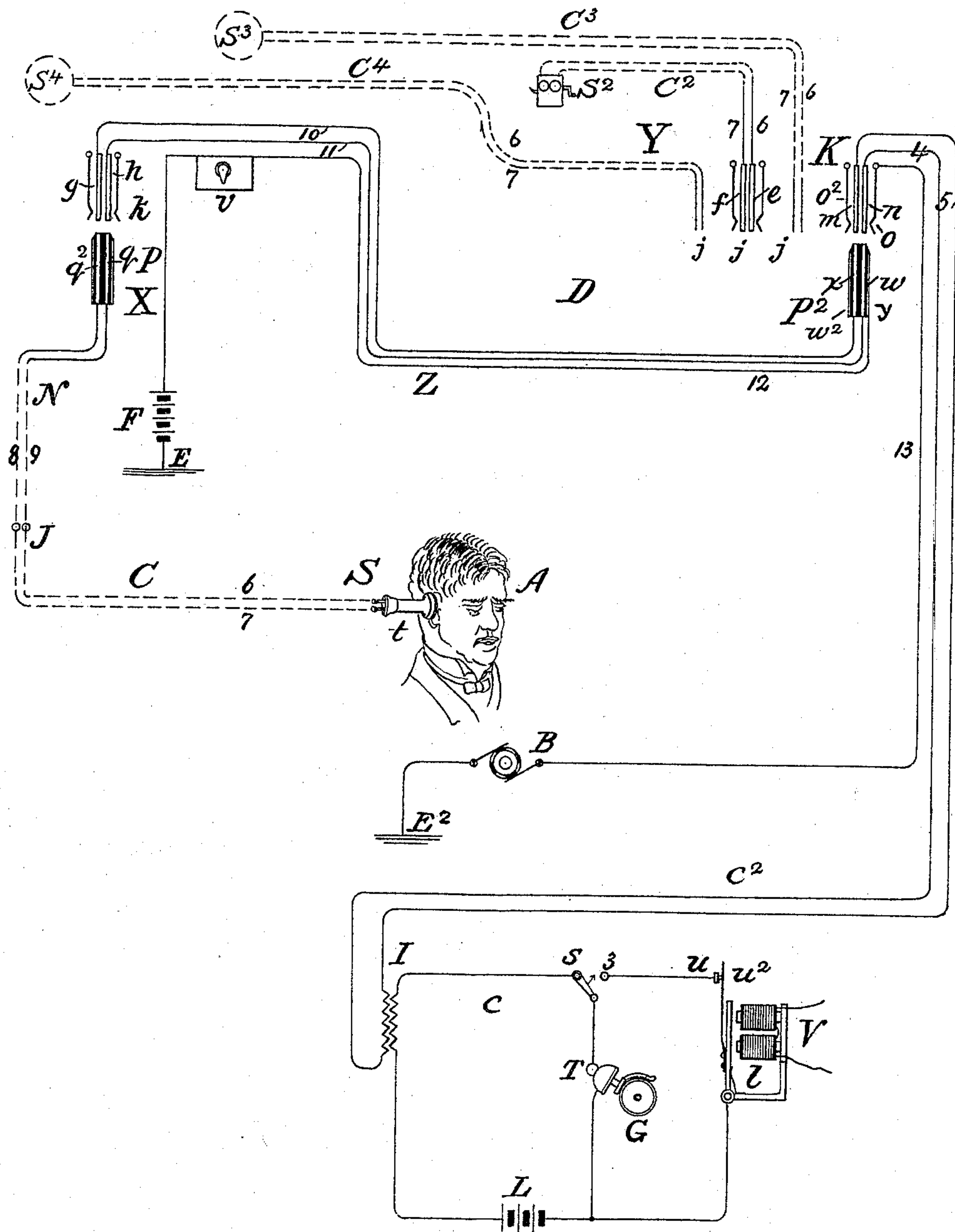


(No Model.)

E. J. HALL & F. A. PICKERNELL.  
BUSY SIGNAL FOR TELEPHONE CIRCUITS.

No. 492,483.

Patented Feb. 28, 1893.



Witnesses.

Reverend Lewis.  
Arthur A. Erb.

Inventors

Edward J. Hall and  
Frank A. Pickernell,  
by *W. A. D. D. D.*  
their attorneys.



# UNITED STATES PATENT OFFICE.

EDWARD J. HALL, OF MORRIS, AND FRANK A. PICKERNELL, OF NEWARK,  
NEW JERSEY, ASSIGNORS TO THE AMERICAN TELEPHONE AND TELE-  
GRAPH COMPANY, OF NEW YORK.

## BUSY-SIGNAL FOR TELEPHONE-CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 492,483, dated February 28, 1893.

Application filed October 13, 1892. Serial No. 448,767. (No model.)

*To all whom it may concern:*

Be it known that we, EDWARD J. HALL, of Morris township, in the county of Morris, and FRANK A. PICKERNELL, of Newark, in the  
5 county of Essex, State of New Jersey, have invented certain Improvements in Busy-Signals for Telephone-Circuits, of which the following is a specification.

This invention relates to the transmission  
10 of signals on telephone circuits, and has been found especially useful in connection with switchboards on which the same main circuit is represented at more places than one, and which therefore are necessarily to be supplied  
15 with some form of appliance for indicating at one point on such a switchboard that a given circuit is busy at another point.

Its main object is to provide convenient and suitable means by the aid of which the  
20 occupied state at one portion of a switchboard of a circuit with which connection is desired, may be automatically indicated to the operator at another portion of said switchboard who is seeking such a connection, and also simultaneously announced (preferably in spoken  
25 words) to the customer or substation attendant who desires to communicate; but the latter part of said operation alone is also frequently useful and desirable.

The invention which we point out specifically in its several phases, in the claims at the end of this specification, comprehends any main telephone circuit which extends from a  
30 terminal station where is located a receiving telephone, and its concomitant apparatus to a suitable central or other opposite terminal station, where it may be interconnected with others, or where alternatively it may readily be united to a continuation loop\* or branch  
35 circuit containing a transmitter adapted to act upon the said telephone receiver as soon as the said connection is made, and to produce or reproduce therein an oral or audible signal having a preconcerted meaning. The  
40 said transmitter is preferably a transmitting telephone connected directly or inductively in such continuation circuit, and mounted in intimate association with a constantly operating phonograph which repeats any predetermined  
45 word or phrase into the transmitter

mouthpiece, and such word or phrase being reproduced by the telephone receiver at the distant terminal station imparts any necessary information to the listening operator or attendant there. Instead however of a trans-  
55 mitter and phonograph, an electrotome or other intermittent or vibratory circuit breaker such as an ordinary buzzer may be employed, in which event of course the signal received by the said attendant at the terminal station  
60 in his telephone or upon his bell will be a peculiar buzz, hum, ring or rattle, constituting an arbitrary signal, having an understood meaning.

The invention also comprises the associa-  
65 tion with such a circuit, of an intermediate station or switchboard connection through which it passes and whence an independent signaling circuit extends to the terminal point of the main circuit; a visual signal indicator  
70 included in said independent circuit at the intermediate station, and an automatic intermittent circuit-breaking transmitting device adapted to effect changes of current in the  
75 said independent circuit to which the indicator therein will respond. This signal transmitter as well as that of the main circuit is included in a suitable branch or continuation  
80 circuit, and the two continuation circuits may be, and preferably are provided with a single terminal springjack or plugsocket within which the terminals of both are contained; both moreover being normally open or dis-  
85 continuous in the said springjack but adapted to be closed and to become operative upon the insertion within said springjack of a suitable plug connector. The action of this independent circuit transmitter is to produce a  
90 trembling or fluttering of the signal indicator, and thus to give a signal, which may by previous understanding have any special meaning. The said continuation circuits being thus provided with a compound signal trans-  
95 mitter and with a common terminal springjack, it is convenient to combine the terminals of the telephone and signaling circuits in a common plug connector adapted to be inserted in said jack, and thereby to complete both circuits and operate both signals.

One useful adaptation of this invention is



its application as a busy signal to divided or multiple switchboards. The telephone circuit leading from a substation may connect with two springjacks at different portions of the switchboard. Should a station call for a connection with a second station which is found to be busy, the plug terminal of the circuit of the first station may be placed in such a continuation circuit springjack as has been described, and by means of the associated transmitter and phonograph, or other device, the word "Busy," or any other prearranged word, phrase or other signal, may be transmitted to the calling station, and reproduced in the apparatus there, thus conveying the necessary information to the customer, in an unmistakable way. And in central stations where a calling circuit is to be connected with the desired circuit through the intermediation of office trunks, the visual signal indicator being placed at the call initiating end of such trunk, the plug connector forming the remaining trunk terminal becomes virtually the terminal of the call initiating circuit. When under these conditions the circuit desired is found to be temporarily occupied with another connection, and the terminal plug placed in the compound continuation circuit jack, both continuation circuits will be simultaneously closed, and the compound transmitter becoming operative, will cause the operation of the audible signal at the call initiating substation, and also the operation of the visual signal at that end of the office trunk nearest thereto; the operators both at the substation and at the central station being thereby both notified that the desired connection cannot at present be had.

In a separate application for Letters Patent filed of even date herewith by Edward J. Hall for a system of central station intercommunication, comprising divided switchboards, on one of which, incoming calls are received, while connections with desired lines are made on the other, the same being entitled an improvement in central office apparatus and circuits for telephone exchanges, Serial No. 448,762, he has described these utilizations of his invention, and has claimed certain combinations of which it forms an element.

The drawing which accompanies and forms a part of this specification, is a diagram illustrating conventionally the several arrangements of circuits and apparatus which have generally been indicated above.

With the exception of the points marked S, S<sup>2</sup>, S<sup>3</sup>, and S<sup>4</sup> which symbolize sub-stations fitted of course with the usual telephones *t*, and telephonic appliances, together with their respective main circuits C, C<sup>2</sup>, C<sup>3</sup>, and C<sup>4</sup>, each having direct and return wires 6 and 7, the entire drawing indicates the circuits and apparatus of a central station D. Circumstances however frequently occur where a given circuit as C, represented at one part X of the central station requires to be connected by means of an office trunk conductor Z with

a second circuit C<sup>2</sup> or C<sup>3</sup> at another part of the central station, or another portion Y of the switch-board. Under such conditions, the first point of connection, (that is to say the switchboard X where the call was received and where the work of connection was initiated,) is virtually an intermediate station on the circuit extending between the substation S, and the switchboard Y on which are located the connection devices *j* of the circuit wanted.

At the substation S, *t* is the receiving telephone, and is shown at the ear of a customer A, who is supposed to have sent in an order for connection of a certain line, and is now waiting to be told, either that the connection is completed; or else that the line wanted is occupied or busy. The terminal springjack J of the substation circuit C is represented as having already received the answering plug of the link connection N, whose two conductors 8 and 9 are thus at one end connected with the two main circuit conductors 6 and 7, while at the other end they terminate in conducting surfaces *q* and *q*<sup>2</sup> of the plug P; that being adapted for insertion in the springjack *k* of the trunk conductor Z, but shown apart for convenience of explanation. The said jack *k* has two spring contacts *g* and *h* which register and make contact with the plug contact surfaces. The spring contacts *g* and *h* are the terminals of the two wires 10 and 11 of the trunk conductor Z, and extend to the Y part of the switchboard or office, where they connect respectively with the contact surfaces *w* and *x* of another plug connector P<sup>2</sup> which forms the movable terminal of the said trunk conductor. The plug P being thrust into the jack *k*, the surfaces *w* and *x* of the other plug P<sup>2</sup> become at once the terminals of the substation circuit C, and the plug P<sup>2</sup> as a whole becomes the movable terminal of the said circuit; on which the switch connections at X have also become practically an intermediate station. If now the plug P<sup>2</sup> be placed in the springjack *j* of circuit C<sup>2</sup>, its contact surfaces *w* and *x* make contact with the spring contacts *e* and *f* of said jack, establishing through communication between the substations S and S<sup>2</sup> over the two circuits C and C<sup>2</sup>, the link connection N and the office trunk conductor Z.

K is an auxiliary springjack located at Y, its form being similar to the others. Its principal spring contacts *m* and *n*, are united to the ends of two conductors 4 and 5 of a loop circuit c<sup>2</sup> connecting with a signal transmitting device. At the other end of such loop circuit we show as alternative signal transmitters, a telephone transmitter T, and a phonograph G mounted immediately in front of the mouthpiece thereof; and a vibratory circuit breaker or buzzer V operated by an electromagnet *l* in a local circuit (not shown). These devices may of course be connected either directly in the circuit c<sup>2</sup>, or they may be, and preferably are connected as shown, in a local



circuit  $c$  and arranged to act upon the circuit  $c^2$  through and by means of an induction coil I, which has its primary helix in the circuit  $c$  and its secondary helix in the circuit  $c^2$ .

5 To operate the buzzer V, the switch  $s$  is placed on the button 3, and the buzzer then intermits the circuit  $c$  of the battery L at the points  $u$ ,  $u^2$ , rapidly, and thereby sends induced currents into the circuit  $c^2$  in rapid suc-  
 10 cession, which if a telephone be included in such circuit, will produce a loud buzz therein. we prefer however for our present purpose to use the transmitting telephone T. Any words spoken into this transmitter will of course in-  
 15 duce voice currents by means of the induction coil I in the circuit  $c^2$ . If a telephone be connected in the said circuit, the words which originated such voice currents, will be reproduced by their action therein, and a copy of  
 20 the said words will be heard in the telephone. The phonograph can readily of course be arranged to speak any words or phrases desired in the transmitter mouthpiece. We have used a phonograph in this association as a busy  
 25 switchboard and station signal, which we have equipped with a cylinder repeating the word "Busy" continuously. For such work the form of metallic record employed in the process described in Letters Patent of the United  
 30 States No. 372,786, granted November 8, 1887, to Emile Berliner would probably be well adapted. The plug  $P^2$  representing the terminal of the telephone circuit may be placed in the spring jack K. When so placed, the  
 35 circuit  $c^2$  may be regarded as a continuation circuit of the circuit C, which is now extended to the transmitter T and the words uttered by the phonograph are heard in the telephone at S.

40 Considering the invention in its application to switchboards, the jack K, may be entitled the "busy jack," and several may be employed. When therefore it is found that the circuit with which communication is required (say  $S^2$ )  
 45 is in use, the plug is at once placed in the busy jack, and the customer or attendant at S hears in his telephone the word "Busy" uttered by the phonograph. There is further another active spring contact  $o$ , in the said  
 50 springjack K. It registers and connects with a side contact surface  $y$  of the plug  $P^2$ : and this as shown in the drawings is the normally discontinuous terminal of the circuit con-  
 55 ductor 12, leading through the visual indicator  $v$  (which may be a self-restoring annunciator or a glow lamp), to the battery F whose other pole is united to an earth connection E. The circuit of the said battery thus is normally open. By inserting the plug  $P^2$  in the  
 60 jack K, this circuit is closed through the conductor 13, and through the automatic intermittent circuit breaking transmitter B, to an earth connection  $E^2$ ; and the conductor 13 is therefore a branch or continuation circuit for  
 65 the signaling circuit 12.

The signal transmitting device B may be a roller of non-conducting material, in which

are inlaid conducting strips making intermittent connection with circuit springs in a manner well understood, or it may be made in  
 70 any well known way. In operation it causes the visual signal indicator  $v$  to flutter or tremble, and since the signal is otherwise steady off, or steady on, the fluttering motion is always understood to have some peculiar sig-  
 75 nification. Of course instead of constructing this signal circuit of but one conductor, and completing it through the earth, we may if we so desire, construct its continuation circuit  
 80 in loop form, as is done with the circuit  $c^2$ , and in that case its conductors would unite with the two jackspring contacts  $o$  and  $o^2$ , instead of with  $o$  alone as now shown; and in like manner there would be an associate con-  
 85 ductor for the conductor 12 which at one end would terminate in the plug contact surface  $w^2$  and at the other would connect with the end of conductor 12 at that side of the bat-  
 90 tery which now has the earth connection. It is evident that the battery E may be placed at any point in the circuit either of the con-  
 95 ductor 12 or the continuation thereof 13. Placing the plug  $P^2$  in the busy jack K therefore completes both main and signaling circuits, causing an oral or other audible signal  
 100 to be automatically sent to the station S which is manifested in the telephone  $t$  and causing a visual signal to be sent to the switch connection X which is manifested on the indi-  
 105 cator  $v$ . And as the signal transmitter B of the signaling circuit and that T or V of the main circuit are controlled by the same switchboard apparatus, and operated by the same action, we call them collectively a compound signal transmitter.

We have now fully described our invention and its mode of operation and claim—

1. In combination with a main telephone circuit extending from a terminal station through an intermediate station to a switch-  
 110 board at which are located the connection devices of other main circuits; an audible signal receiving instrument at said terminal station; a visual signal receiving instrument at said intermediate station; and a compound  
 115 busy signal transmitter at said switchboard, adapted to simultaneously operate the said visual and audible signal instruments; and thereby to indicate at both terminal and in-  
 120 termediate stations that a given main circuit at the said switchboard with which connection may be desired, is in use, substantially as described.

2. In combination with a main telephone circuit extending from a terminal station through an intermediate station or connection  
 125 to a switchboard at which other main circuits are represented by connection devices; a telephone apparatus included therein at said terminal station; an independent circuit asso-  
 130 ciated with said main circuit and extending from the said intermediate station to the said switchboard; and a visual signal indicator at said intermediate station responding to



changes of current in said independent circuit; a compound signal transmitter at said switchboard, connected with both of the said circuits, and comprising an automatic arbitrary signal or articulating transmitting appliance in the main circuit adapted to produce vocal or other sounds in the telephone apparatus connected therewith, and an automatic intermittent vibrator or circuit breaker in the independent circuit, adapted to produce a fluttering action of the said visual indicator included therein, whereby a preconcerted signal may automatically be sent to both intermediate and terminal stations simultaneously, substantially as described.

3. In combination with a main telephone circuit extending from a terminal station through an intermediate station or connection to a switchboard at which other main circuits are represented by springjacks; a telephone included therein at said terminal station; an independent circuit extending in association with said main circuit between said intermediate station and switchboard; and a visual signal indicator at said intermediate station in said circuit adapted to respond to changes of current occurring therein; a compound transmitter at said switchboard connected with both of the said circuits, and comprising a telephonic transmitter, and an articulating phonograph therefor, in the main circuit whereby articulate signals may be sent to the terminal station and there reproduced in the said telephone; and an automatic vibrator or intermittent circuit breaker in the independent circuit, adapted to make and break the same and thereby operate the indicator at said intermediate station, substantially as described.

4. The combination in a switchboard, of a connecting plug constituting the movable terminal of two independent circuits containing signal receiving instruments; a compound springjack adapted to receive the said plug, and containing the fixed terminals of continuations of the said circuits; and an automatic signal transmitting device in each of the said continuation circuits, each adapted to be automatically brought into operation by the insertion of said plug into the said springjack, and thereupon to actuate the signal device in its own circuit; substantially as described herein.

5. The combination of a series of switchboard connections at a central station; a se-

ries of circuits each extending from a receiving telephone at a substation to one of the said central switchboard connections; an auxiliary switchboard connection, constituting the terminal of a loop or continuation circuit containing a telephone transmitter; a phonograph organized to report occupied circuits associated with said transmitter, and adapted to operate the same; and means as indicated for uniting the switchboard connections when unoccupied with one another, or, if the desired connection be already in use, with the said auxiliary connection whereby a verbal announcement of such busy condition may automatically be made in the said receiving telephone; substantially as described.

6. The combination of a continuation branch or loop circuit including a telephone transmitter, and provided with a phonograph associated with the said transmitter, and adapted for the operation thereof; a similar continuation circuit including an intermittent circuit breaker, or current varying device; and a springjack or equivalent switchboard connection, containing the terminals of both of the said continuation circuits, substantially as described.

7. The combination with a series of main circuits including each a receiving telephone and having switch board terminal connections, of an auxiliary circuit, a transmitting telephone therein, a phonograph associated with said transmitting telephone and adapted to operate the same, and connecting appliances for uniting said auxiliary circuit at will with any of said main circuits, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 23d day of September, 1892.

EDWARD J. HALL.

Witnesses:

GEO. WILLIS PIERCE,  
JOSEPH A. GATELY.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 30th day of September, 1892.

FRANK A. PICKERNELL.

Witnesses:

GEO. WILLIS PIERCE,  
VICTOR M. BERTHOLD.