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TONE RECEPTION FOR CARRIER TELEGRAPHY

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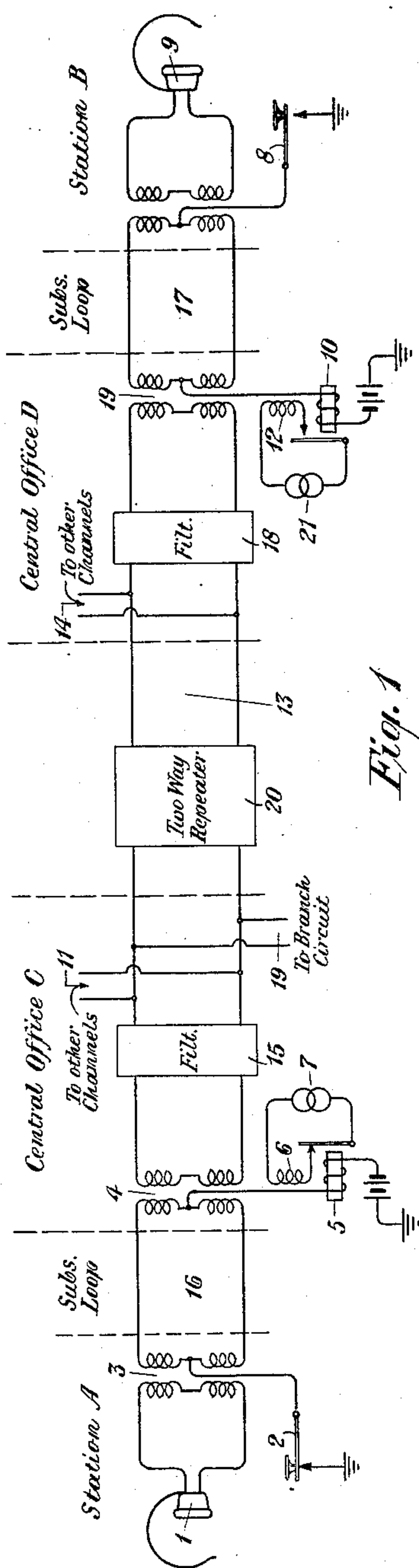


Fig. 1

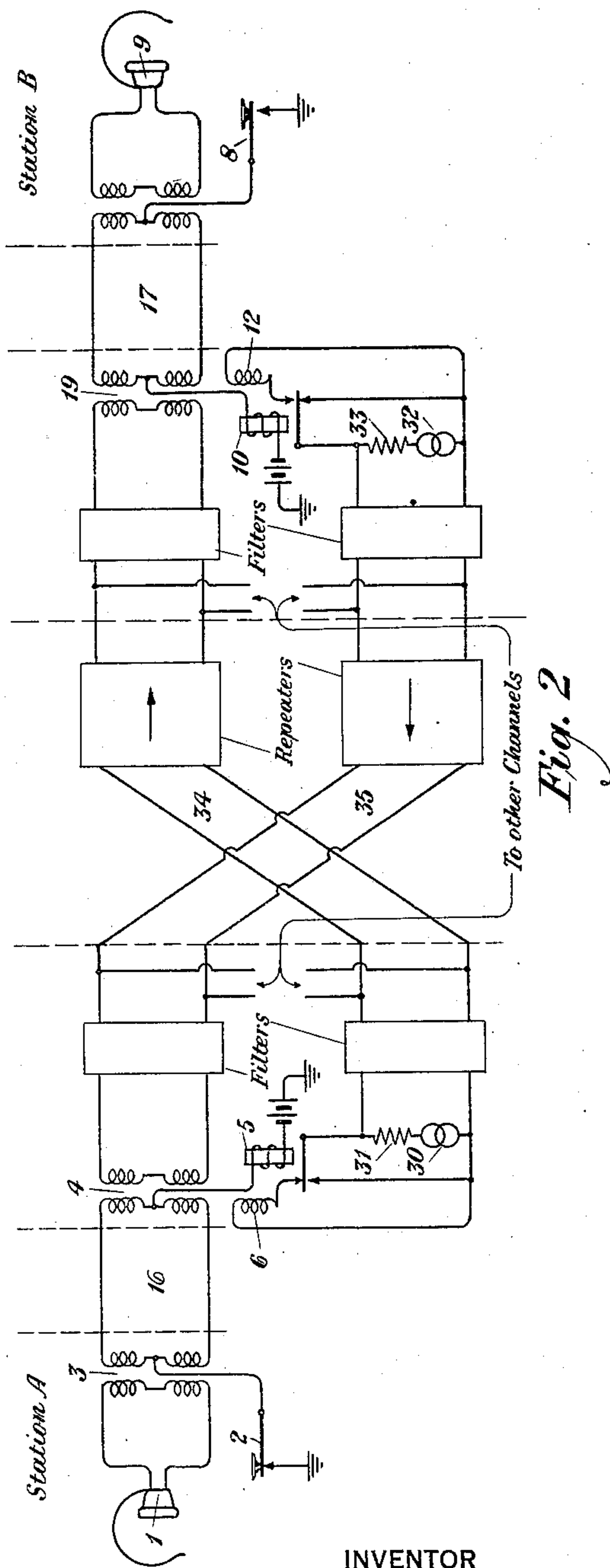


Fig. 2

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## TONE RECEPTION FOR CARRIER TELEGRAPHY

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This invention relates to the art of telegraph communication and discloses an improve method of reception applicable chiefly to carrier current telegraphy whereby the signals are read by means of a tone instead of the usual sounder clicks. This method of reception is similar to that employed in the majority of radio receiving stations.

In carrier current telegraph systems each subscriber's telegraph station is in general connected to a local central office over a subscriber's loop. Two distant subscribers' stations are connected together by means of an interconnecting trunk circuit extending between the receptive central offices. A sender key located at each station controls a direct current signaling circuit operating over the subscriber's loop and applies a source of alternating current potential to the toll circuit in accordance with the operation of the sender key. At the distant central office the received alternating current is rectified and caused to operate direct current signaling means at said central office which in turn operates the usual D. C. telegraph sounder mechanism at the distant subscriber's station. A considerable amount of expensive equipment is thus required at the receiving terminal of the toll circuit to translate the alternating current pulses into clicks on the sounder. This equipment could be eliminated by using the tone method of reception.

With the tone method of reception the only receiving apparatus required at the subscriber's station would be an ordinary telephone receiver, while at the central office no translating apparatus would be required if tone transmitted from the sending station were in the audio frequency range. Even where this is not the case the D. C. receiving signal equipment would be eliminated at the central office, the carrier current pulses being merely demodulated to a suitable frequency for tone reception.

In addition to the economies in terminal apparatus, the tone method of reception offers other advantages. The system would lend itself readily to the connection of branch lines without the necessity of repeaters having

movable parts. Furthermore the supply of available operators should be greatly increased inasmuch as there are now many professional and amateur radio operators who are skilled in tone reception but are unable to read sounder signals. The number of persons learning sounder reception, it might be added, is now almost negligible.

The system employing tone reception is best explained by reference to the drawings of which Figures 1 and 2 show two different circuit modifications.

Referring to Fig. 1 station A is connected to central office C over a subscriber's loop 16 and thence over trunk circuit 13 and through central office D to subscriber's station B over loop 17. Each subscriber's station is equipped with a telegraph sending key and a telephone receiver connected to a transformer as shown. Referring to station A, sender key 2 controls the operation of relay 5 at office C by opening and closing the operating circuit thereof. The operation of relay 5 upon depression of key 2 transmits tone from source 7 to stations A and B through winding 6 inductively coupled to the other two windings of transformer 4. Release of key 2 in turn releasing relay 5 opens the circuit containing tone source 7 and thus prevents the further transmission of tone to stations A and B. The purpose of transmitting tone to station A is to enable the operator there to monitor by means of receiver 1 and thus determine the correctness of the transmitted message. The operator at station B reads the received signals by listening with receiver 9.

If the operator at station B desires to transmit a message, he operates key 8 in turn operating relay 10 to transmit tone from source 21 to stations A and B through winding 12 of transformer 19.

Filters 15 and 18 pass the frequency from tone sources 7 and 21 and a narrow band extending above and below this frequency but suppress other frequencies and thus permit other telegraph channels to be operated over toll circuit 13 without interfering with signals transmitted between stations A and B. Other channels wired in a manner identical

with that shown for stations A and B are connected to leads 11 and 14 respectively. Each channel thus connected operates on a different frequency from any other channel and is of course equipped with suitable filters to prevent interference from other channels.

It is sometimes desirable that a station on a branch circuit be able to communicate with stations A and B. This is accomplished by connecting such a branch circuit at an intermediate point on the main circuit as indicated by leads 19. The branch station is of course equipped with the same type of filter and other terminal equipment as is used for station A or B. A transformer is usually inserted in leads 19 in order to match up the impedance relations.

In Fig. 1 the circuit is arranged for half-duplex operation which means that only one message at a time can be transmitted between stations A and B. Fig. 2 also discloses a circuit arranged for half duplex operation, but one which utilizes a four wire circuit between central offices. In Fig. 2, key 2 controls the operation of relay 5. With the key depressed, source of tone 30 is applied to circuit 34 through resistance 31. This tone is transmitted to receiver 9 at station B. Simultaneously therewith tone from source 30 is also applied to winding 6 of transformer 4 and is thus transmitted to receiver 1 at station A to enable the operator there to read the transmitted message. With key 2 released, the release of relay 5 connects a short circuit across the input to circuit 34 and thus prevents the further transmission of tone to receiver 9. The release of key 2 also disconnects winding 6 from tone source 30. The operation of key 8 at station B causes tone from source 32 to be transmitted to station B over circuit 35 and to station A over loop 17.

Fig. 2 may be converted into a full duplex system by disconnecting windings 6 and 12 from tone sources 30 and 32, respectively. With this change accomplished, the operation of key 2 would transmit tone to receiver 9 only, and the operation of key 8 would transmit tone to receiver 1 only. Thus, two messages could be simultaneously transmitted over the circuit between stations A and B without interference, one in each direction. The disadvantage of this arrangement would lie in the fact that the operator transmitting a message could not hear his own signals.

This difficulty could be avoided by transforming the four wire circuit into two separate one-way circuits. For example, if two circuits similar to Fig. 1 were connected between stations A and B, omitting from one such circuit key 8 and the tone equipment at office D, i. e., relay 10, winding 12 and tone 21, and omitting from the second circuit similar equipment at office C and station A, a full duplex system would be obtained such that a transmitting operator could hear the trans-

mitted signals. These circuits, of course, would require only one-way repeaters in place of the two-way repeater 20, shown in Fig. 1. For the first of the above circuits, the repeater would transmit in the direction from station A to station B, and in the reverse direction for the second circuit. With the first such circuit, for example, the operation of key 2 would transmit tone to the receivers at stations A and B associated with said first circuit, while with the second circuit the operation of key 8 would similarly transmit tone to the receivers at both stations associated with the second circuit.

What is claimed is:

1. In a telegraph system, in combination, a telegraph circuit extending from a first point through intermediate central offices to a second point, a telegraph sending key and a telephone receiver associated with said telegraph circuit at the first point, a telephone receiver associated with said telegraph circuit at the second point, and means at said central offices adjacent the first point for transmitting a tone to both said receivers in accordance with the operation of said telegraph key.

2. In a telegraph system, in combination, a telegraph circuit extending from a first point through intermediate central offices to a second point, a telegraph sending key and a telephone receiver associated with said telegraph circuit at each of said points, means at the central office adjacent the first point for transmitting a tone to the receiver at the second point in accordance with the operation of the telegraph key at the first point, and means at the central office adjacent the second point for similarly transmitting tone to the receiver at the first point in accordance with the operation of the telegraph key at the second point.

3. In a telegraph system, in combination, a telegraph circuit extending from a first point through intermediate central offices to a second point, a telephone receiver and a telegraph sending key associated with the telegraph circuit at each said point, means at the central office adjacent the first point for transmitting tone to the receiver at each point in accordance with the operation of the telegraph key at the first point, and similar means at the central office adjacent the second point for transmitting tone to the receiver at each point in accordance with the operation of the telegraph key at the second point.

4. The method of telegraph communication which consists in transmitting from a sending station to a central office pulses of direct current to represent signals in accordance with a predetermined code, causing said current pulses to operate alternating current means at the central office to produce alternating current pulses proportional in length to said direct current pulses, and causing said alternating current pulses to operate

acoustical means at the receiving station to produce tones proportional in length to said current pulses.

5 5. The method of telegraph communication which consists in transmitting from a sending station to a central office pulses of direct current to represent signals in accordance with a predetermined code, causing said current pulses to operate alternating current  
10 means at the central office to produce alternating current pulses proportional in length to said direct current pulses, and causing said alternating current pulses to produce in telephone receivers at said sending station and  
15 at a distant receiving station audible tones proportional in length to said transmitted pulses.

6. In the art of telegraph communication, a telegraph circuit extending from a first to  
20 a second point, a telegraph sending key and a telephone receiver associated with said circuit at each said point, means located at a third point remote from said other points and under control of said key at the first  
25 point to transmit tone to the receivers at said first and second points in accordance with the operation of said key, and means located at a fourth point remote from said other points and under control of said key at the second  
30 point to similarly transmit tone to the receivers at said first and second points in accordance with the operation of said key at said second point.

7. In the art of telegraph communication,  
35 a telegraph circuit extending from a first point to a second point, a telephone receiver and a telegraph sending key associated with said circuit at said first point, a telephone receiver associated with said circuit at said  
40 second point, and means located at a third point remote from said other points and under control of said key at said first point for transmitting a tone to both said receivers in accordance with the operation of said key.

45 8. In the art of telegraph communication, a telegraph circuit extending from a first point to a second point, a telegraph sending key at said first point and a telephone receiver at the said second point associated with said  
50 circuit, and means located at a third point remote from said other points and under control of said key for transmitting a tone to said receiver in accordance with the operation of said key.

55 9. In the art of telegraph communication, a telegraph trunk circuit extending between two offices, loop circuits individual thereto at each office and extending respectively each to a local telegraph subscriber's station, a telegraph sending key and a telephone receiver  
60 associated with said loop at each said station, a source of tone associated with the telegraph circuit at each office, relay means at each office controlling the output of the corresponding tone source, an operating circuit

for each said relay means including the loop circuit terminating at said office and the sending key associated with said loop, and means to transmit tone from a given said source to the receivers at both stations, in accordance with the operation of said sending key controlling said tone source.

10. In the art of telegraph communication, a telegraph trunk circuit extending between two offices, a loop circuit connected thereto at each office and extending each to a local subscriber's telegraph station, a telegraph sending key and a telephone receiver associated with the loop at one station, a telephone receiver associated with the loop at the second  
80 station, a source of tone associated with the telegraph circuit at the office adjacent the first station, relay means at said office controlling the output of said source, an operating circuit for said relay means including  
85 the loop circuit terminating at said office and said sending loop connected thereto, and means to transmit said tone to both receivers in accordance with the operation of said key.

11. In the art of telegraph communication, a telegraph trunk circuit extending between two offices, loop circuits individual thereto at each office extending each to a local subscriber's telegraph station individual to said loop, a telephone receiver and a  
95 telegraph sending key associated with said loop at each station, a source of tone at each office associated with the telegraph circuit, relay means at each office controlling said tone source, an operating circuit for each said relay means including the loop circuit  
100 terminating at the corresponding office and the sending key connected to said loop, and means to transmit tone from the source at either office to the receiver at the station adjacent the distant office in accordance with the operation of the sending key controlling said tone source.

12. In a telegraph system, in combination, a telegraph circuit extending from a first to  
110 a second station, branch telegraph circuits connecting with said first circuit and extending to a plurality of branch stations, a telegraph sending key and a telephone receiver associated with said circuit at each said station, and means located at a point remote from said stations and controlled by the sending key at any said first station for transmitting tone to all said receivers in accordance with the operation of said sending  
120 key.

13. In a telegraph system, in combination, a telegraph circuit extending from a first to a second station, a branch telegraph circuit connecting with said first circuit and  
125 extending to a third station, a telegraph sending key and a telephone receiver associated with said circuit at each said station, and means located at a point remote from said stations and controlled from the send-

ing key at any said station for transmitting tone to all said receivers in accordance with the operation of said sending key.

14. In a telegraph system, in combination, a telegraph circuit extending from a first point through intermediate central offices to a second point, a receiver associated with said telegraph circuit at the second point, a receiver and an induction coil associated with said telegraph circuit at the first point, a telegraph sending key connected from the midpoint of one of the windings of said induction coil to ground, a second induction coil associated with said telegraph circuit at the central office adjacent the first point, relay means and a source of current connected from the midpoint of one of the windings of said second induction coil to ground, a tone source controlled by said relay means in accordance with the operation of said sending key, and means connecting said tone source to said telegraph circuit.

15. In a telegraph system including a sending station, a central station and a single loop circuit interconnecting said stations, in combination, a sending key at said sending station, a tone source at said central station, and means controlled by said sending key for causing said tone source to transmit tones over said loop circuit in accordance with the operation of said sending key.

16. In a telegraph system including a sending station, a receiving station, a central station and a single loop circuit connected between said central station and said sending and receiving stations, respectively, in combination, a sending key at said sending station, a tone source at said central station, and means controlled by said sending key for causing said tone source to transmit tones over said loop circuits to said sending and receiving stations in accordance with the operation of said sending key.

17. In a telegraph system, in combination, a telegraph circuit extending from a first point through intermediate central offices to a second point and having a single loop circuit extending from each said point to the central office adjacent said point, a telephone receiver and a telegraph sending key associated with the telegraph circuit at each said point, means at the central office adjacent the first point for transmitting tone to the receiver at each point in accordance with the operation of the telegraph key at the first point, and similar means at the central station adjacent the second point for transmitting tone to the receiver at each point in accordance with the operation of the telegraph key at the second point.

In testimony whereof, I have signed my name to this specification this 6th day of July, 1928.

ROY B. SHANCK.