Sept. 28, 1926. 1,601,322

A. PRESS

DUPLEX RADIOTELEPHONY

Filed July 30, 1920

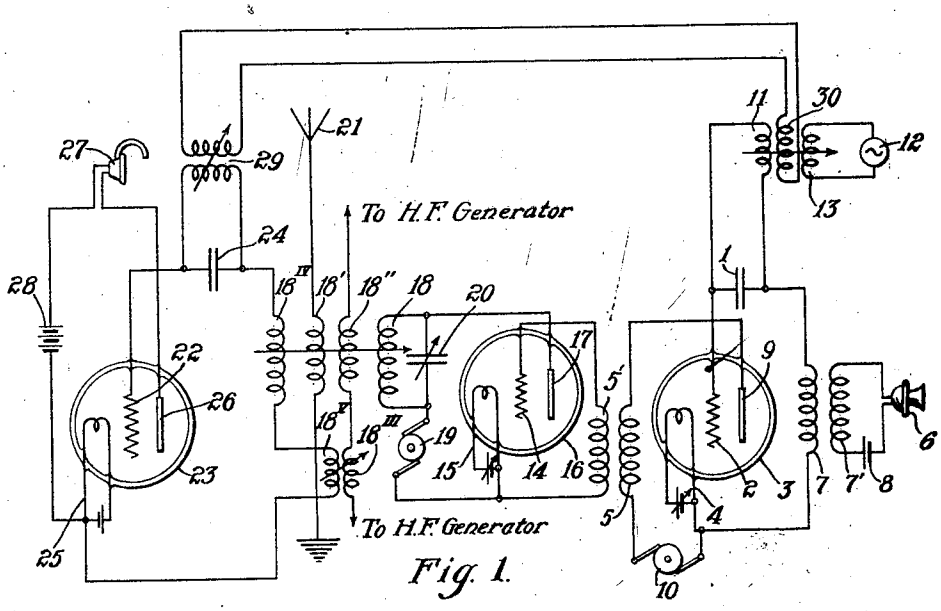



Fig. 1.

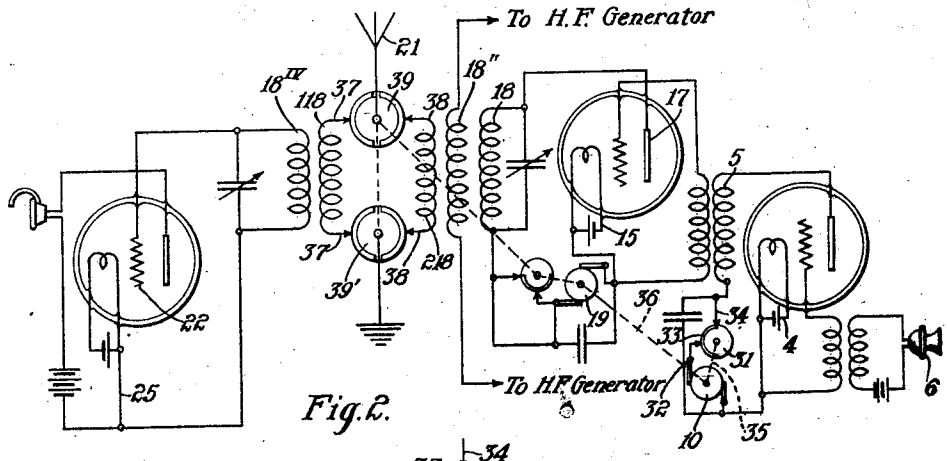



Fig. 2.

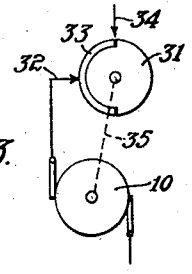


Fig. 3.

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# UNITED STATES PATENT OFFICE.

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## DUPLEX RADIOTELEPHONY.

Application filed July 30, 1920. Serial No. 400,084.

My invention relates to wireless telephoning and it has, for one of its principal objects, a system whereby the operator is able to transmit and receive messages simultaously.

A further object is to enable the operator to selectively transmit and receive from a designated station to the exclusion of any other station of the group.

Further objects will make themselves manifest from the description accompanying the drawings and will be incorporated in the appended claim.

Figure 1 is a diagrammatic view of an embodiment of my invention.

Fig. 2 is a similar view of an alternative form of my invention.

Fig. 3 is a detail view of the switching elements associated with the transmitting circuits.

In Fig. 1, I have indicated a stopping condenser 1 associated with a grid 2 of a triode 3 having a hot cathode 4 for impressing upon a transformer element 5 speech entering a transmitter 6 associated with the said triode. Thus, the stopping condenser 1 is connected, in the usual manner, by means of a transformer coil 7, to the hot cathode 4. On the other hand, the transmitter 6 is in circuit with the associated transformer coil 7′ and a battery 8. Again, the transformer element 5 is connected across the hot cathode 4 and the associated plate 9 through a battery or generator 10.

Current through the transformer element 5 will, therefore, be modulated in accordance with speech entering the transmitter 6. However, in order to permit the reception of signals, the present invention contemplates charging and discharging the stopping condenser 1 at such a time rate as to permit inoperative intervals, whereby the effect of the transformer element 5 is neutralized or deadened during such inoperative intervals, whereas, during the operative intervals, the element 5 is enabled to impress its modulating character upon the antenna to send forth signals in accordance with speech entering the transmitter.

To this end, therefore, I connect a transformer coil 11 excited, preferably, from an ultra-audio frequency generator 12 by means of its associated transformer coil 13. However, I do not wish it to be understood that my invention is limited to the precise number of cycles for which the generator 12 may be designed. Thus, the number of cycles may be less than four thousand or many times greater than that number. The exact number is a matter of convenience or suitability for the purposes required. By means of the generator 12, therefore, the stopping condenser 1 will function properly for the transmission of speech signals only during the operative periods in which such condenser is charged with the proper sign.

Coupled to the transformer element 5 is a second element 5′ connected to grid 14 and a hot cathode 15 of a triode 16. The plate 17 of said triode is connected to one end of a coupling coil 18, whereas the other end of the coupling coil is connected to the hot cathode 15 through a suitable generator 19. A variable condenser 20 may also be connected in shunt with the coupling coil for purposes well known to the art.

The coupling coil 18 is associated with a similar coupling coil 18′ forming part of an antenna system 21. A second coupling coil 18″ is also associated with the antenna system but is excited from a high-frequency generator in order that the modulating current passing through the coupling coil 18 may impress its character upon the antenna system 21 when excited by such high-frequency generator through its associated coupling coil 18″.

The high-frequency generator, it will be found, also comprises, preferably, a further coupling coil $18^{III}$ in series with the coupling coil 18″. Whereas the latter is coupled to the antenna by virtue of the associated coil 18′, the additional coupling coil $18^{III}$ is arranged to be uninfluenced by the antenna coupling coil 18′. The reason for this will apear later. A further coupling coil $18^{IV}$ is shown connected to a grid 22 of a triode 23. It is also connected to an eliminating coupling coil $18^{V}$ for association with the coupling coil $18^{III}$ in order to wipe out any direct effects of the high-frequency-generator circuit upon the triode 23. Thus, the grid-filament circuit of the triode 23 comprises a stopping condenser 24, the coupling coil $18^{IV}$, coupling coil $18^{V}$, and the hot cathode 25. The plate circuit, however, comprises the plate 26, telephone receiver 27 and the plate battery 28. In order to provide fractional speaking and transmitting periods in sequence, the stopping condenser 24 is excited

by means of a transformer 29 fed from the transformer coil 30 coupled to the generator 12. The connections to the two condensers 1 and 24 relative to the generator 12 are so arranged that, for one-half of the cycle, the stopping condenser 1 will be suitably charged and the stopping condenser 24 will be discharged, whereas, for the second half of the cycle of the generator 12, the stopping condenser 24 will be suitably charged and the stopping condenser 1 will be discharged. By means of the two stopping condensers 1 and 24, I am, therefore, able to provide inoperative and operative intervals in sequence for the transmitting and receiving devices of the above wireless telephone system.

As an alternative to the above automatic method of providing inoperative and operative intervals, I accomplish substantially the same result by purely mechanical means. Thus, in Fig. 2, instead of the generator 10 being continuously connected to the transformer coil 5, I provide a switching means 31, indicated in Fig. 3, in order to alternately provide inoperative and operative intervals for the generator 10 relative to the transformer element 5. Such switching means 31 comprises sliding contact 32 connected to one end of the generator 10, which contact co-operates with a segment 33 which, in proper time relationship, connects the generator 10 with the transformer element 5 and hot cathode 4. By properly coupling the generator 10 to the switch 31, as by means of a shaft 35, it is possible to allocate suitable time intervals in sequence to the sending and receiving. Generator 19 is similarly provided with a switch element 31 in order to introduce power properly into the plate circuit 15—18—17. The two generators 19 and 10 and their associated switches are suitably coupled, as indicated by the dotted line 36, in order to provide a simultaneity in the functioning of the two generators.

It will be seen that the antenna 21 of Fig. 1 is connected to a single coupling coil 18′, whereas, in Fig. 2, I alternatively provide two branches 118 and 218 for the antenna system. The two coupling coils just referred to are connected by means of contactors 37 and 38 with switch elements 39 and 39′ which are properly co-ordinated with respect to the switches 31 of the transmitter portion of my invention in order that, through the operative sending periods, the antenna-coupling coil 218 may be connected to the antenna, whereas, during the inoperative sending periods the coupling coil 118 may be properly connected to the antenna system 21 for the reception of signals. The receiver system, coupled to the coupling coil 118, is substantially similar to that of the receiver circuit indicated in Fig. 1. However, as an alternative, the coupling coil $18^{IV}$ in Fig. 2 is connected directly across the grid 22 and cathode 25.

In the operation of my invention, it is seen that I provide, in the main, an inoperative period and an operative period, the one for speech transmission and the other for speech reception. In order to bring about such time periods, I have shown two alternative methods, though other equivalent methods will also fall within the scope of my invention. Thus, in Fig. 1, the inoperative and operative periods are obtained by alternately charging and discharging the two stopping condensers 1 and 24 of the transmitting and receiving circuits. In Fig. 2, however, instead of charging and discharging the stopping condensers, I have provided a mechanical switching means whereby the modulating generators 10—19 are disconnected from the transmitting circuits at the same time that the antenna-coupling coils are switched on and off in order to provide proper periods for the reception of signals.

Having disclosed the nature of my invention, what I claim is:

In a radio system, a generator of high-frequency oscillations, an antenna upon which said oscillations are impressed, receiving means associated with said antenna, means actuated from said high-frequency generator to approximately counteract the effect upon said receiving means of the high-frequency oscillations impressed upon the antenna by said high-frequency generator, signal-controlled means for modulating the high-frequency oscillations in the antenna and means operating at ultra-audio frequency for alternately rendering the modulating means and the receiving means inoperative, whereby during one half-cycle of said ultra-audio frequency said receiving means is inoperative and during the next half-cycle thereof said oscillations are unmodulated and will not then interfere with the reception of signals by said receiving means.

In testimony whereof, I have hereunto subscribed my name this 28th day of July, 1920.

ABRAHAM PRESS.