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Dec. 11, 1928.

E. E. CLEMENT

1,695,172

RADIO RECEIVING INSTRUMENT

Filed Feb. 9, 1924

3 Sheets-Sheet 1

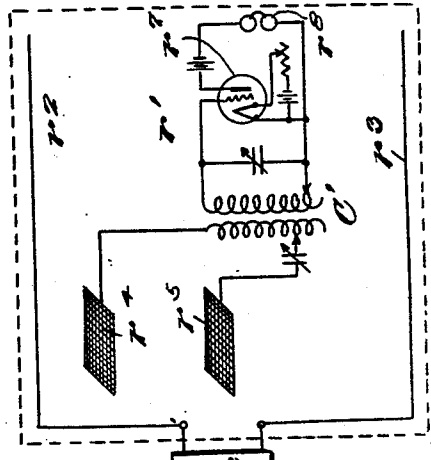
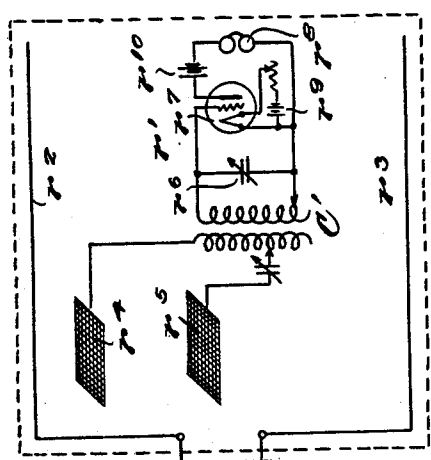


Fig. 2.

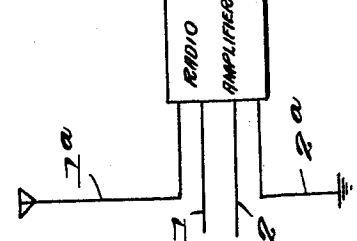
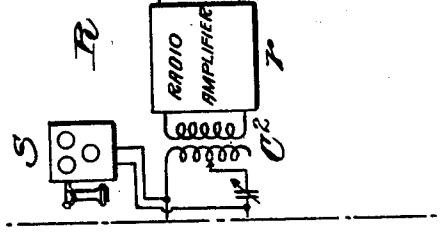
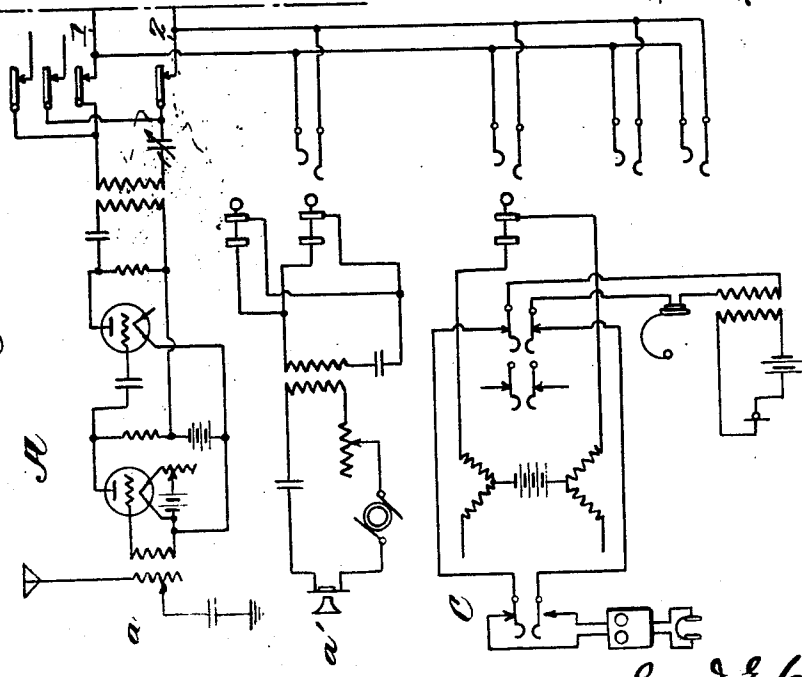


Fig. 1.



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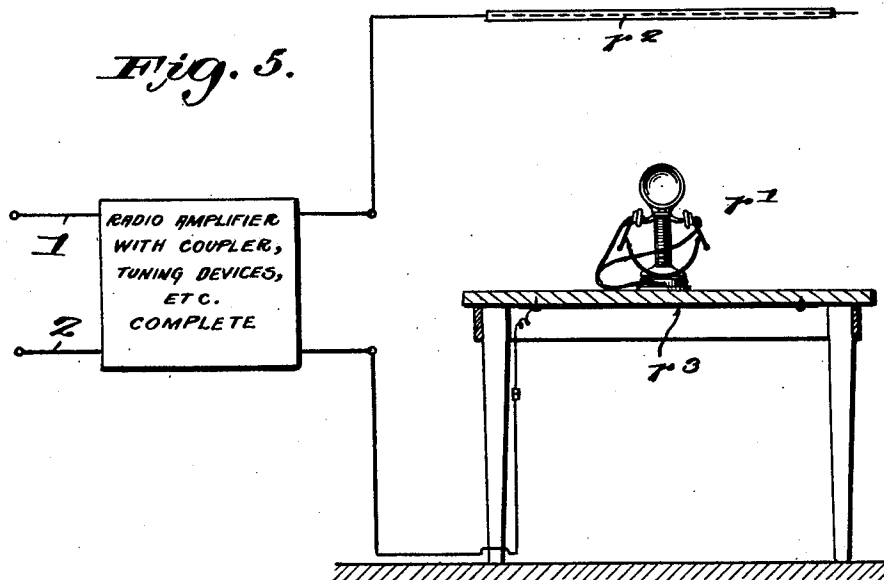
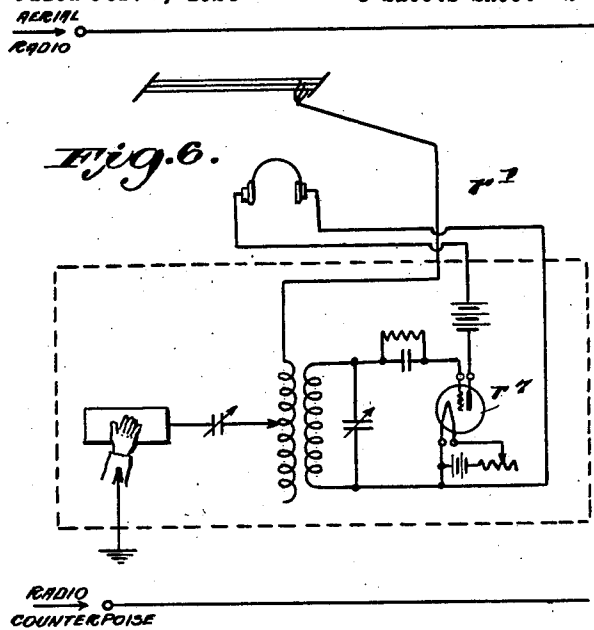
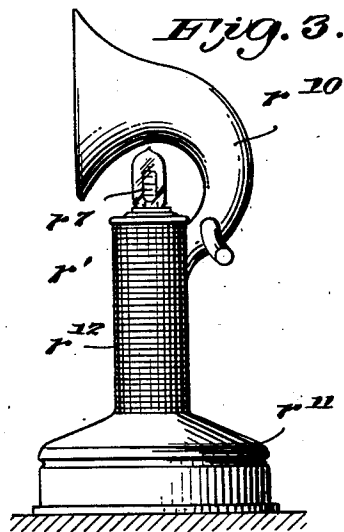
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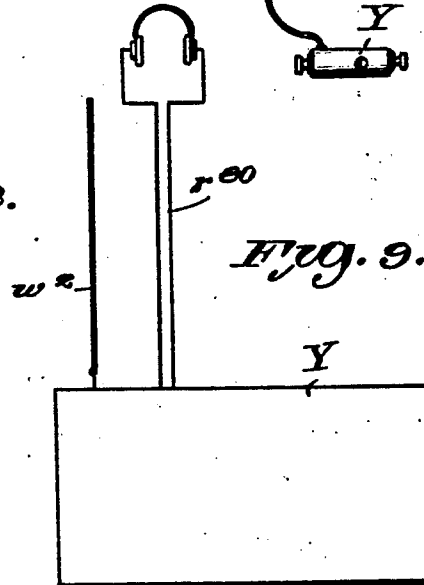
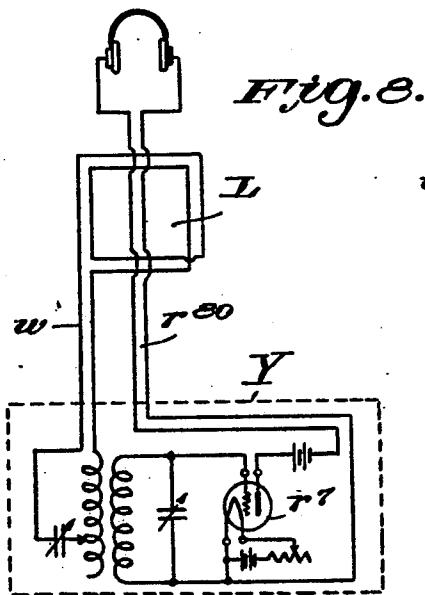
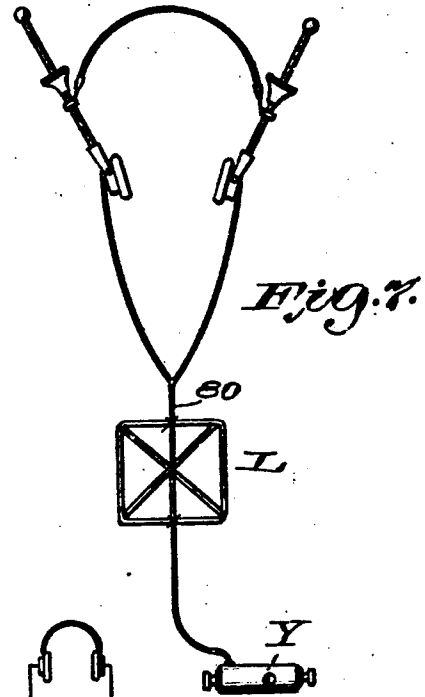
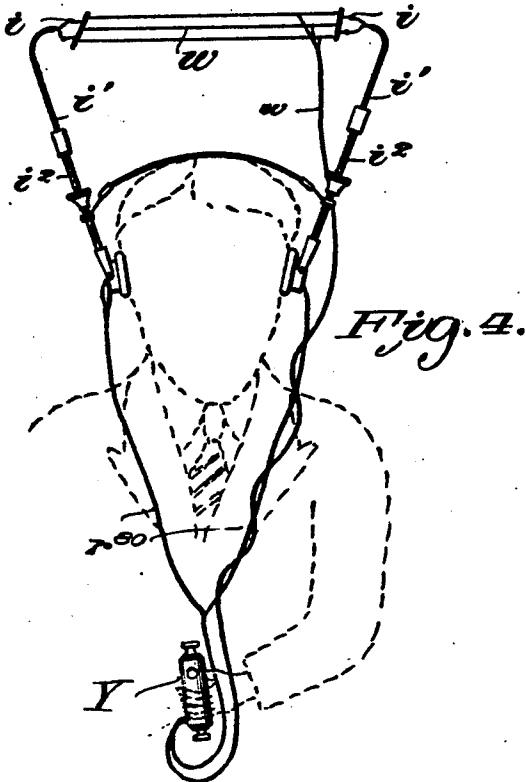
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RADIO RECEIVING INSTRUMENT

Filed Feb. 9, 1924

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Inventor

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UNITED STATES PATENT OFFICE.

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RADIO RECEIVING INSTRUMENT.

Application filed February 9, 1924. Serial No. 691,823.

My invention relates to radio broadcasting and has for its object the production of an organized system in which a centralized agency will operate the broadcasting station and will render service therefrom to regular subscribers. An ancillary object is to simplify the subscriber's instrument and in particular to make it portable and convenient to use.

I attain my object by distributing from a central point modulated carrier waves, either by guided wave transmission or by pure radio methods, which are picked up at the several subscribers' stations, amplified, and transferred to the subscriber's local receiving instrument by pure radiation or induction. The subscriber's instrument has no physical connection with the telephone or other wired line.

My invention is illustrated in the accompanying drawings in which

Fig. 1 is a diagram of a broadcasting system embodying my invention and distributing either relayed or originating signals by guided wave transmission to the subscribers' stations.

Figure 2 is a diagram of a modified system employing pure radio distribution.

Fig. 3 is a side view of a detached desk set for subscribers.

Fig. 4 is a front view of one form of detached head set for subscribers.

Fig. 5 is a diagrammatic view indicating the method of use of the desk set in Fig. 3.

Fig. 6 is a diagram of the circuits of Fig. 4.

Fig. 7 is a front view of another form of detached head set for subscribers, in which a loop is employed for collecting the waves, attached to the receiver cord.

Fig. 8 is a diagram of the circuits of the apparatus in Fig. 7.

Fig. 9 is a diagram of a modification employing a single wire instead of the loop shown in Figs. 7 and 8.

Referring to the drawings, and especially to Fig. 1, A is a central station equipped to both relay and originate signals to be distributed to subscribers. Receiving and relaying apparatus is indicated at a and an originating modulating circuit is indicated at a' . From the central office line wires 1 and 2 extend to subscriber's station S, where they may be equipped with a telephone to

cooperate with the telephone central station C. In addition to the telephone at each station S, a radio telephone receiving equipment R is provided, including a coupler C^2 , radio amplifier r , and the subscriber's receiving set r' , the latter being physically detached from any of the other apparatus, and deriving its energy modulations through an aerial r^2 , with a counterpoise r^3 , and a receiving antenna r^4 , and counterpoise r^5 attached through tuning and coupling means C' to the subscriber's instrument circuit r' . This includes preferably the simplest combination of elements, shown in the drawing as a tuning condenser r^6 , a detector tube r^7 , and a receiver r^8 , together with the usual A and B batteries r^9 and r^{10} .

As Fig. 2 employs the same local instrument circuit as Fig. 1, it may be briefly described before giving any statement of operation. In this figure, an antenna 1^a and ground wire 2^a take the place of the line wires 1 and 2 of Fig. 1, otherwise the connections and operations are the same. It is noted, however, that wires 1 and 2 are shown in Fig. 2, and are to be understood as used in the same manner and for the same purposes disclosed in my prior copending application Serial No. 581,829, filed August 14, 1922, Patent No. 1,522,357, issued January 6, 1925, reissued December 15, 1925, as Reissue No. 16,231. That is to say, the line wires 1 and 2 are employed in the circuits of Fig. 2 and may be employed in the circuits of Fig. 1, to convey battery current from the central office A or C to the subscriber's instrument, where it is employed for directly supplying energizing current for the tubes and other apparatus, or may be employed for charging the batteries which directly supply filament and plate current. As this arrangement does not of itself form part of the present invention, but only in combination with other features covered in the claims herein, it need not be described in detail, reference being had to the foregoing application for a full disclosure thereof.

In operation, referring to both Figs. 1 and 2, modulated waves are received over the circuit 1—2 or 1^a — 2^a , and amplified at radio frequency, by means of the radio amplifier indicated in the drawings, after which the

amplified waves are transmitted over the local subscriber's transmitting aerial r^2 and counterpoise r^3 , so arranged as to produce an oscillating field between them, carrying modulations impressed upon the original waves. Subscriber's instrument has a receiving antenna and a receiving counterpoise r^4 — r^5 , which pick up the amplified waves from the conductors r^2 — r^3 , and transmit them through the tuned coupler C' to the local instrument circuit r' . The detector r^7 rectifies the waves and in a well understood manner renders the modulations thereof audible in the telephone receiver r^8 . Circuit r' is of course to be taken as typical only, since there may be further radio or audio amplification, or various modified arrangements of the circuits, to produce the desired result. The main point is the receiving over a local gap, which makes it possible to use a completely detached instrument, another form of which is disclosed in my prior copending application Serial No. 597,422, filed October 27, 1922, Patent No. 1,576,308, March 9, 1926.

Referring to Figs. 3 and 5, I have shown therein the local instrument r' embodied in a desk set provided with a metal horn r^{10} and a base r^{11} united to insulating standard or column r^{12} upon which is mounted the electron tube r^7 , which is thus protected by the horn from any accidental damage. The horn may be so attached and adjusted that it may be moved to one side in order to permit the removal and replacement of the bulb. In the base of the desk set is supposed to be a grid or plate forming the receiving counterpoise as r^5 , and the metal horn r^{10} may serve as the receiving antenna r^4 . A very convenient arrangement is shown in Fig. 5 in which the desk set is placed upon a table substantially beneath the local transmitting antenna r^2 , and above the local transmitting counterpoise r^3 which is attached to the under side of the table. With this arrangement, one or more desk sets can be placed upon the table, and either used as acoustic amplifiers or the head sets taken down and placed at the ears for individual reception. One set might be sufficient for a group of listeners, or several sets may be employed simultaneously in the manner indicated in Fig. 5, so as to serve as mutual amplifiers and resonators cooperating both electrically and acoustically. It is assumed of course that they will all be tuned in unison.

The tuning of these instruments may be done by an inspector from the central office, who, after adjusting the parts of the instrument, may lock them in position.

It is believed, that detailed description of Figs. 4, 7, 8 and 9 will be unnecessary in view of the foregoing explanation. Fig. 4 shows an antenna W secured between insulators i

carried on spacing rods i' secured by swivel nuts on the upper ends of the receiver rods of an ordinary telephone head set. A lead wire w is carried to the case, shown as a small cylinder Y , which contains the tube and other parts of the receiving set. The receiver cords r^{80} are carried to the same box or casing. The circuits and operative parts within this box are shown in diagram at the bottom of Fig. 8, enclosed within a dotted line; and the same circuits and operative parts are supposed to be included within the box Y shown in solid lines at the bottom of Fig. 9. In Figs. 7 and 8, instead of the overhead antenna a loop L is employed, which may be located on any part of the apparatus desired, but is shown carried upon the receiver cord 80 in front of the subscriber. The ends of this loop are connected by wires w' to the coupling coil, and in this case no counterpoise would be needed. A simpler form of receiving wire or antenna is shown at w^2 in Fig. 9, being a single conductor preferably carried on the receiver cord, but which may be a rigid vertical wire or even a loop projecting from the cylinder or case Y , or from the upper part of the head set.

While I have shown tubes r^7 used as a detector, the circuits of Figs. 1, 2, 6 and 8 may be materially simplified by using a crystal detector, with any suitable form of receiving circuits or antenna. Even a loop will give results with a crystal detector where the radio amplification is sufficient and the aerial and counterpoise in such case may be formed into a large loop, substantially as disclosed in my prior application, Serial No. 597, 422, filed October 27, 1922.

I claim:

1. In a radio broadcasting exchange system, a central office and a subscriber's station with means at the central office for transmitting modulated waves of superaudio frequency, means external to the subscriber's station to receive and absorb said modulated waves and conduct them into said station, means in said subscriber's station inductively coupled to said external receiving and absorbing means, for receiving and amplifying said waves, output terminals for said amplifying means so arranged within said station as to constitute a pair of radiators, and a mechanically detached self-contained wave responsive device with input terminals adapted to receive and absorb the amplified waves from said radiators.

2. The method of radio broadcast distribution which consists in transmitting from one point broadcast modulated waves of superaudio frequency, receiving and absorbing the same at a receiving station at another point, passing the same through inductive coupling means therein while excluding all but the waves desired therefrom, amplifying

and radiating the same by capacity radiation across a circumscribed area within said receiving station, and finally collecting and absorbing the locally radiated waves by
5 means freely movable within said area and detecting the same to reproduce the original modulations while maintaining the local receiving means free from any mechanical connection with the local radiators or the outside receiving and absorbing medium. 10
In testimony whereof I hereunto affix my signature.

EDWARD E. CLEMENT.