April 15, 1930. E. E. CLEMENT 1,754,881

RADIO TRUNK SYSTEM

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Fig. 1.

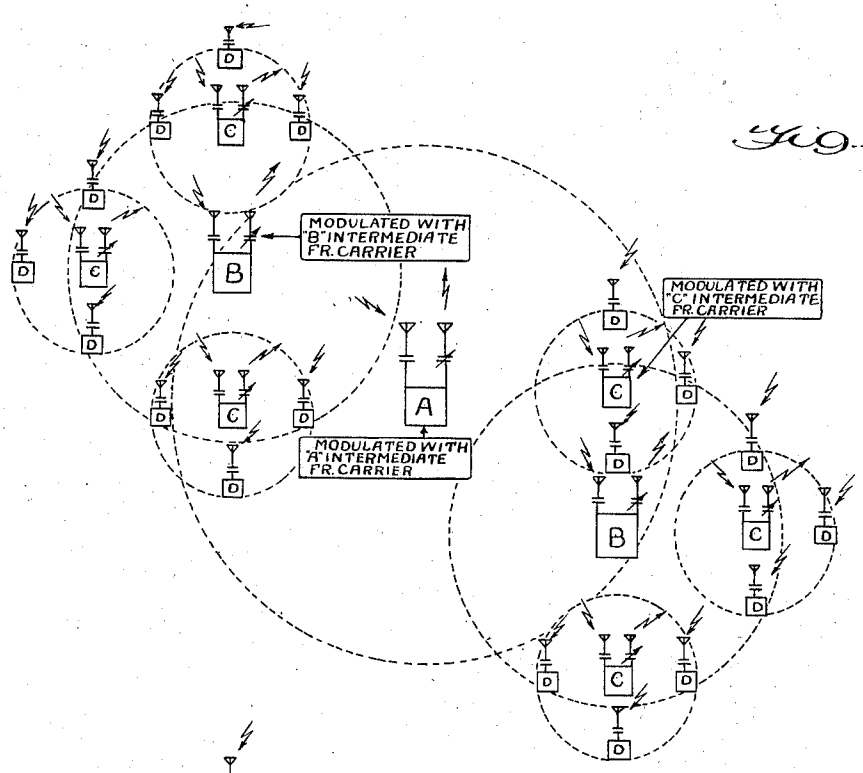

Fig. 2.

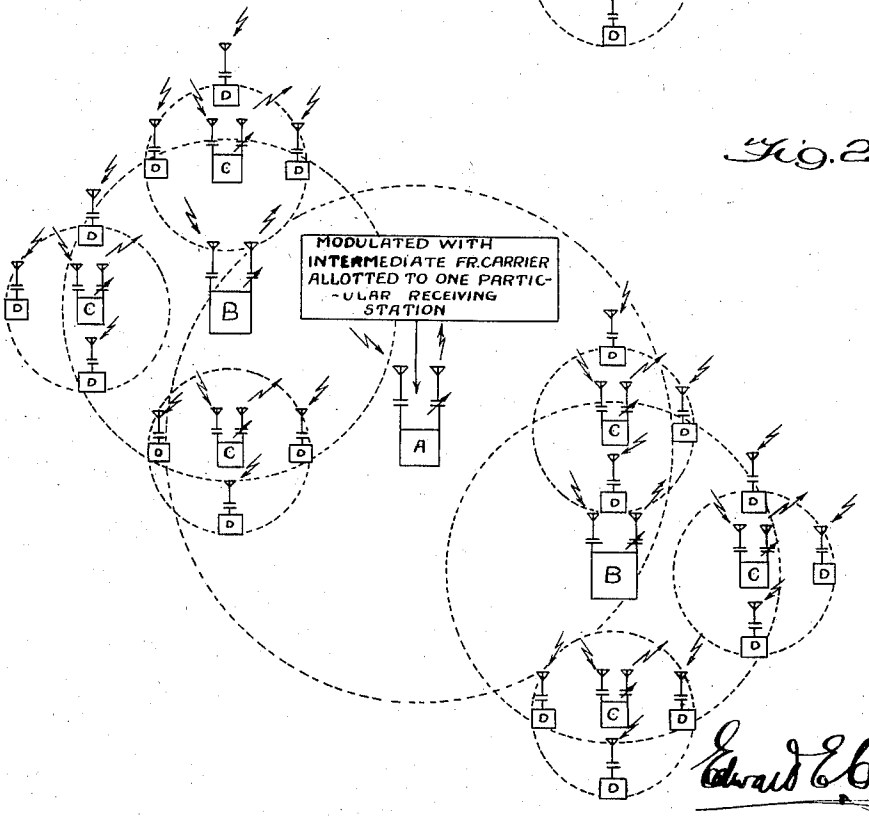

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Fig. 3.

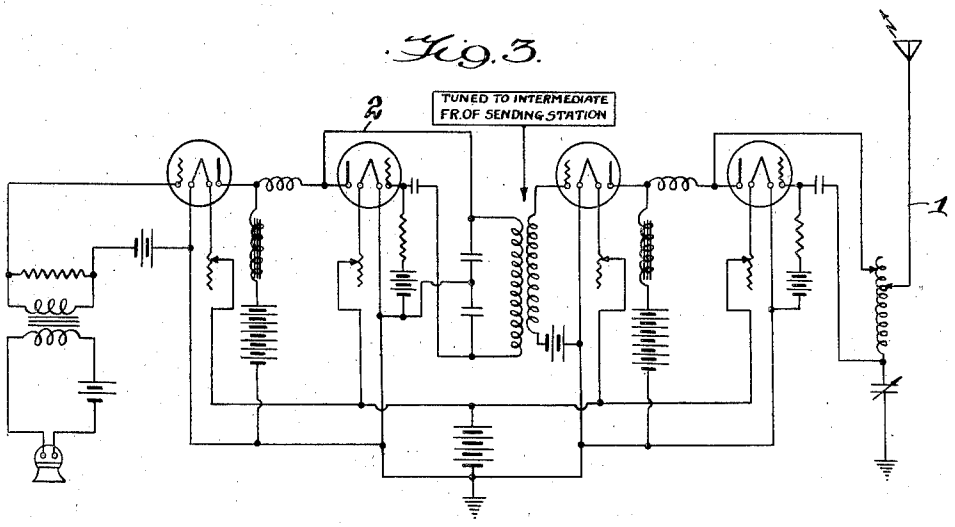

Fig. 5.

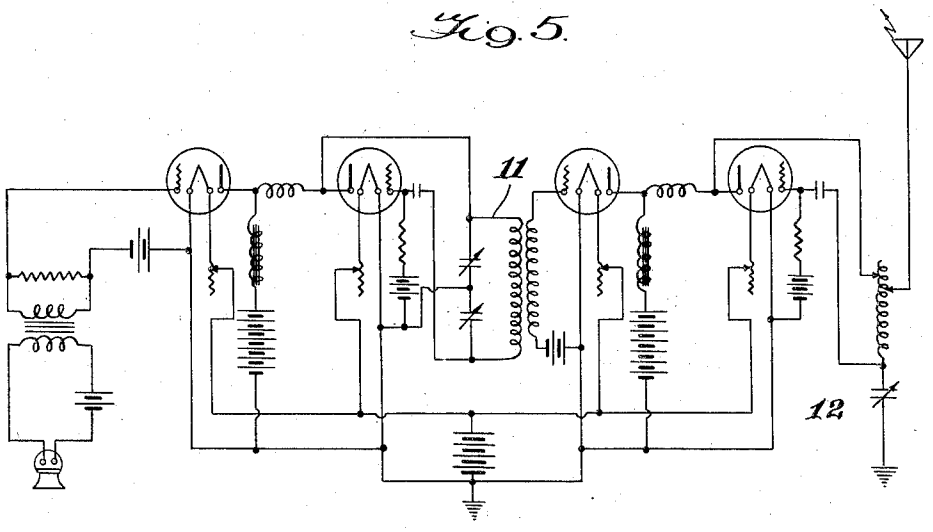

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Fig. 4.

TUNED TO INTERMEDIATE FREQUENCIES OF SENDING STATIONS

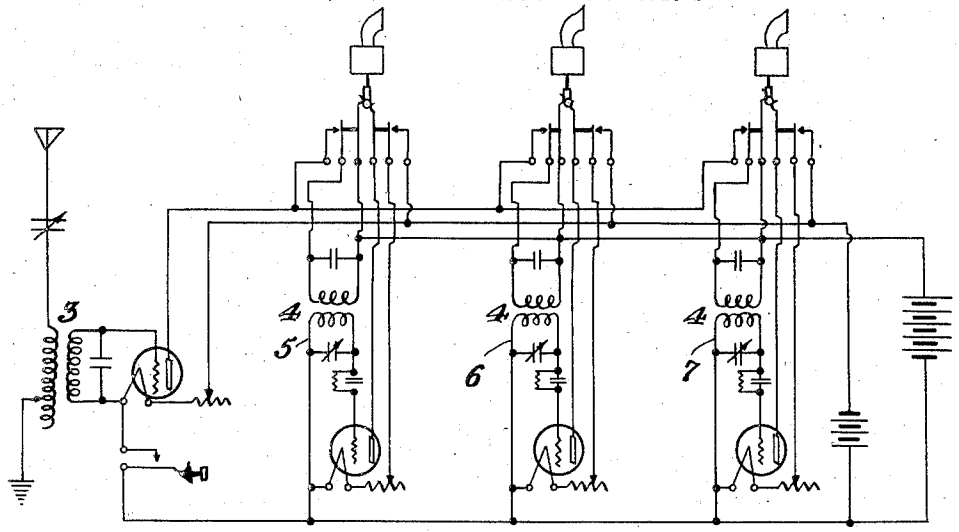

Fig. 6.

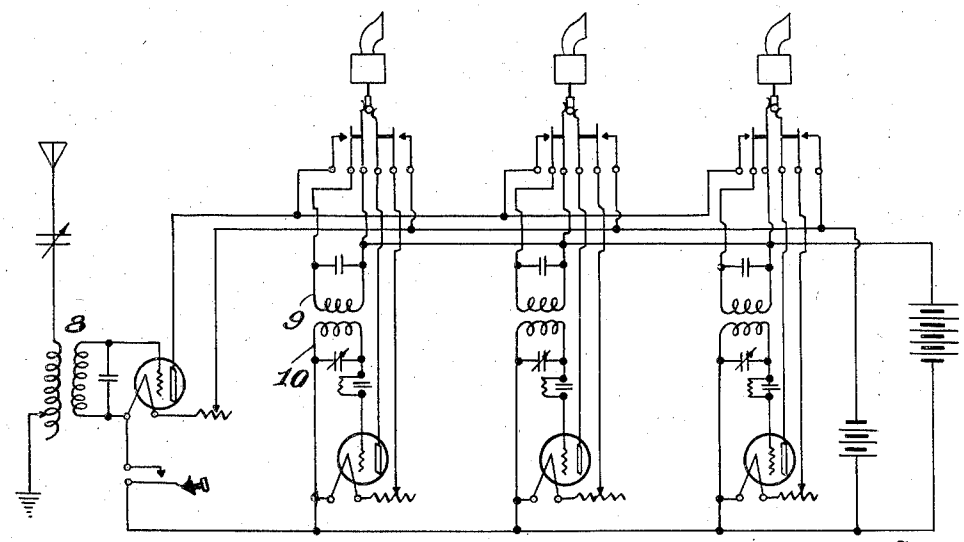

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Fig. 7.

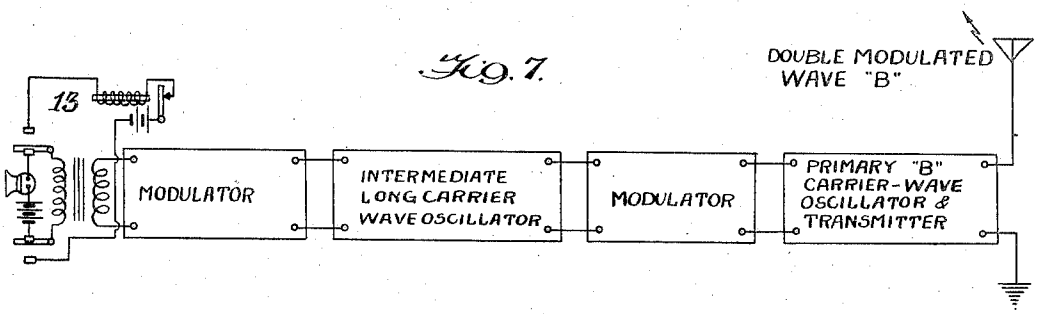


Fig. 8.

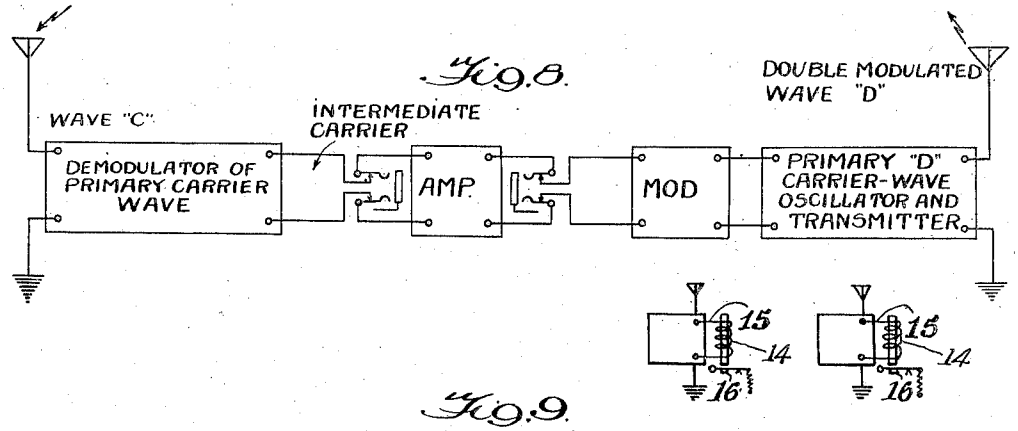
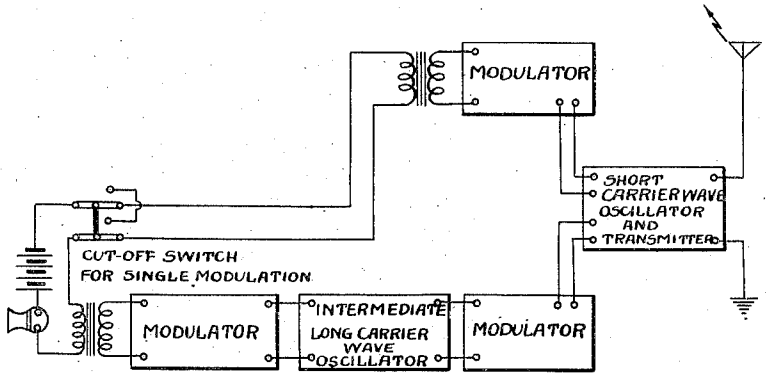


Fig. 9.



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Patented Apr. 15, 1930 1,754,881

UNITED STATES PATENT OFFICE

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RADIO TRUNK SYSTEM

Application filed August 7, 1925. Serial No. 48,866.

My invention relates to radio broadcasting, and has for its object to enable calling and two way signaling to be carried on selectively and secretly, especially between relay stations.

I attain my object by allotting certain primary carrier wave frequencies as receiving frequencies, by which the stations are permanently identified. In case of an organized system comprising stations divided into classes, such an identifying frequency may be allocated to an entire class. In order to identify the station calling, an intermediate frequency carrier is employed which by double modulation is imposed upon the primary carrier wave. This intermediate frequency carried is one allotted to the particular sending station, or its class of stations.

In order to enable selection to be made of several stations of the same class, so that individual communication can be had therewith, I may provide means whereby the sending station, instead of using its own allotted intermediate frequency may use an intermediate frequency allotted to the particular station with which it desires to communicate, or it may use both.

If in the second case stated, it be desired not only to select the particular receiving station, but also to identify the sending station, then I may impose upon the intermediate carrier a third frequency such as a harmonic vibration of low frequency, as a 60 cycle hum or alternating current, so that it will work a tuned relay or signal device.

My invention is illustrated in the accompanying drawings, in which—

Fig. 1 is a diagram showing a broadcasting system with my present invention applied thereto.

Fig. 2 is a diagram similar to Fig. 1, showing the second phase of the invention, in which selection of a particular B or C station is possible.

Fig. 3 is a detailed diagram showing the transmitting apparatus of Fig. 1.

Fig. 4 is a detailed diagram showing the receiving apparatus of Fig. 1.

Fig. 5 is a detailed diagram showing transmitting apparatus of Fig. 2.

Fig. 6 is a detailed diagram showing the receiving apparatus of Fig. 2.

Fig. 7 is a detailed diagram showing double modulation, using low frequency vibrations in place of audio modulations for additional selective purposes.

Fig. 8 is a diagram showing the relay circuit, and

Fig. 9 shows a selective circuit similar to that of Fig. 4, hooked up direct to a broadcasting circuit using a single modulated wave.

Referring to the drawings and particularly to Fig. 1, A designates the master station or the broadcasting station in which B and C are relay stations, repeating modulated waves received from each other and from A, in successive steps, so as to distribute the same among ultimate receivers or subscribers D. A sends to B on a frequency permanently allotted to B; and B sends to C on a receiving frequency permanently allotted to C; while C sends to the subscribers in its local area on a frequency permanently allotted to the subscribers. Any of the stations of the system can send to A, on a frequency permanently allotted to A. These frequencies are primary carrier wave frequencies only, and double modulation is used for two purposes, (1) to identify the sending station, and (2) to identify and select a particular one of the receiving stations. The latter arrangement is shown in Fig. 2.

In Fig. 3 is shown a Heising circuit modified for double modulation. The primary carrier wave frequency is adjustable by tuning the circuit 1; but the secondary carrier wave frequency is preferably fixed and determined by permanent tuning of the circuit 2.

In Fig. 4, the antenna and input circuit are tuned for the fixed receiving frequency of the station, as indicated at 3; and at 4 are shown couplers for the selectively tuned circuits 5, 6 and 7, each fixedly tuned to a low frequency wave identified with one of the sending stations.

As a result of this arrangement, if A calls B, or if any other B station calls B or if C calls B, the particular class or the particular station, according to the arrangement made, will be indicated by the receiver which takes

the signal. By leaving the instrument connected and in service this signal can be made audible, or visible at all times, and will serve not only as a call signal but as an identifying signal. In broadcasting work this is very important, as the intermediate announcers at relay stations must be able to identify the source of matter coming through with instant precision, in order that it may be routed without loss of time or mutilation. Where the matter is to be broadcast or relayed to a broadcast station direct from the receiving circuit, connections will be made accordingly. Such a relay arrangement is shown in Fig. 8 based on the same combination of elements as Figs. 3 to 6 inclusive.

Referring to Figs. 2, 5 and 6, A is supposed to be transmitting to a particular one of several B stations, all of which use the same frequency in receiving, which is known as the B frequency. In this case, the purpose is not broadcasting but the passage of orders or some other communication requiring individual selection of stations. To enable this to be done, the receiving circuit shown in Fig. 6 is supposed to be located at each station for incoming individual calls. The input circuit 8 is tuned as before to the permanently allotted receiving frequency of the B stations in common; but the filter coupler and amplifying circuits 9 and 10 are tuned to a particularly intermediate frequency, which is individually allotted to the particular B station in question. Thus each B station, on this set of instruments, will receive its own orders or communications and no others.

Fig. 5 shows the transmitting apparatus to cooperate with the receiver of Fig. 6, being a Heising circuit adapted to have its first oscillator circuit 11 tuned variably so as to modulate the primary carrier generated in the circuit 12, this latter being also tunable variably for the obvious purpose of selecting the class of stations with which it is desired to communicate.

Referring to Fig. 7, 13 is an audio modulation circuit containing a source of low frequency oscillator vibrations, and 14 is an element adapted to correspond thereto in a corresponding circuit 15 in the receiving station, (Fig. 8). In this case either sending arrangements of Fig. 1 or Fig. 2, as desired, may be employed with the addition of the low frequency vibratory element. At the receiving station double demodulation takes place, and when the audio frequencies are produced in the circuit 15, a tuned element 16 in the particular circuit intended, will vibrate in unison with the received current oscillations.

It is to be well understood that the system used for illustration is not to limit the application of this invention, which may be employed wherever such selection is necessary. It is however specially useful in the system shown, which is the same as that described and claimed in my prior application Serial No. 746,357, filed October 28, 1924, Patent No. 1,635,153, July 5, 1927. Recent advances in the art have made it possible to employ very short waves in transmitting which with other improvements, make the pure radio service dependable even in the day time, at all seasons. This being so, and the short waves being particularly suitable for heterodyning or double modulation, it is considered practicable to substitute pure radio links for wire links between distant master stations or distant relay stations, such as shown and described in the organized system of my prior application referred to. In other words, it is entirely feasible to have a pure radio system, completely organized, for communication over radio trunks between the central broadcasting stations, as well as for broadcasting.

I claim:

The method of selective signalling between a plurality of transmitting stations and a plurality of receiving stations which consists in permanently allotting to each receiving station a primary carrier wave frequency to which the receiving apparatus at said station is permanently and fixedly tuned, permanently allotting to each of the transmitting stations a particular secondary or intermediate frequency to which its transmitter is permanently and fixedly tuned, but leaving its primary frequency variable for selective purposes, and leaving the secondary frequency at the receiving stations variable for selective purposes, then causing selection of a desired receiving station by a particular transmitting station by first adjusting the frequency of said transmitter to the fixed primary frequency of the desired receiving station, and then causing identification thereat of the transmitting station by tuning to receive the signal on its fixed, secondary, or intermediate frequency.

In testimony whereof I hereunto affix my signature.

EDWARD E. CLEMENT.