

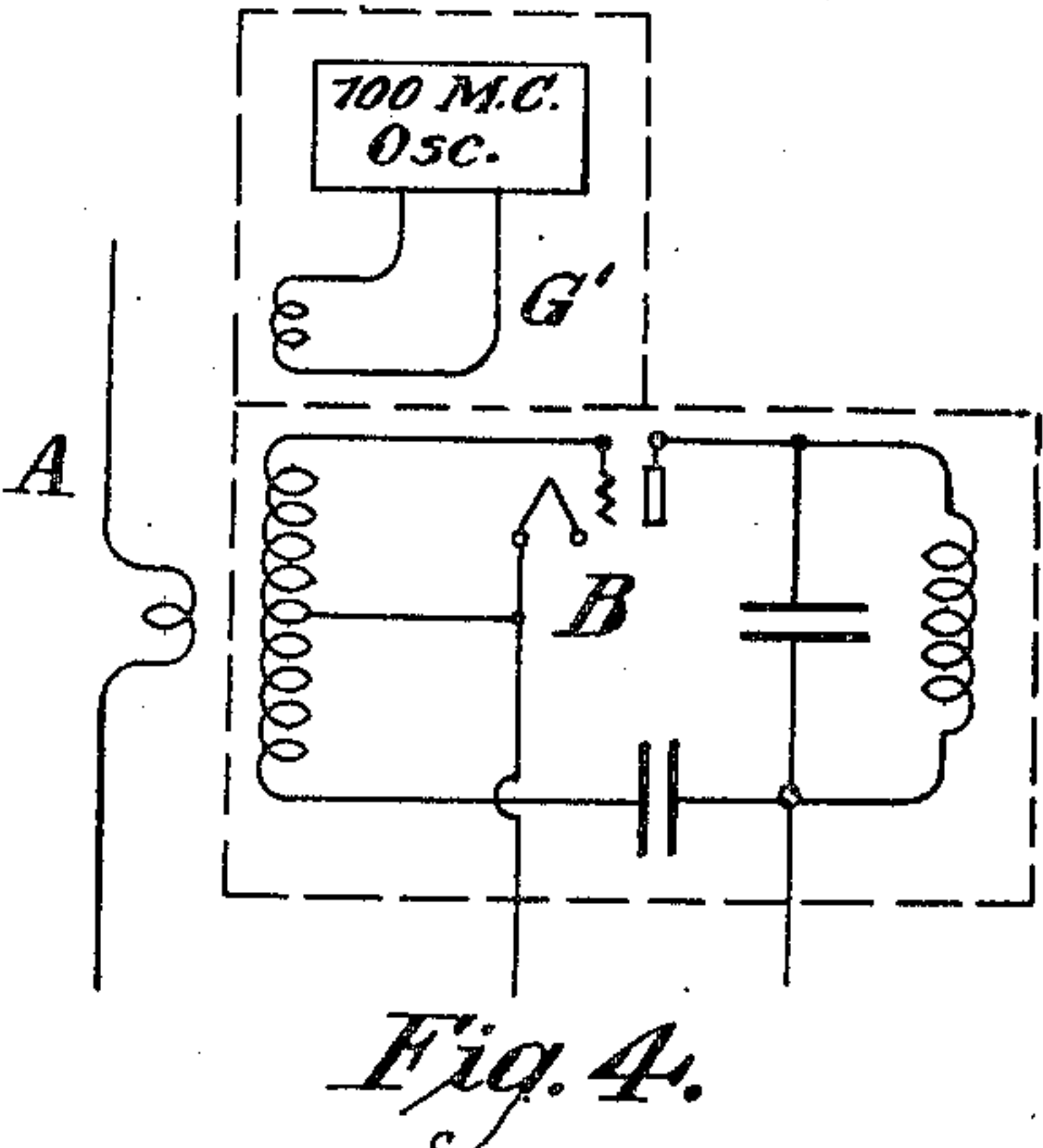
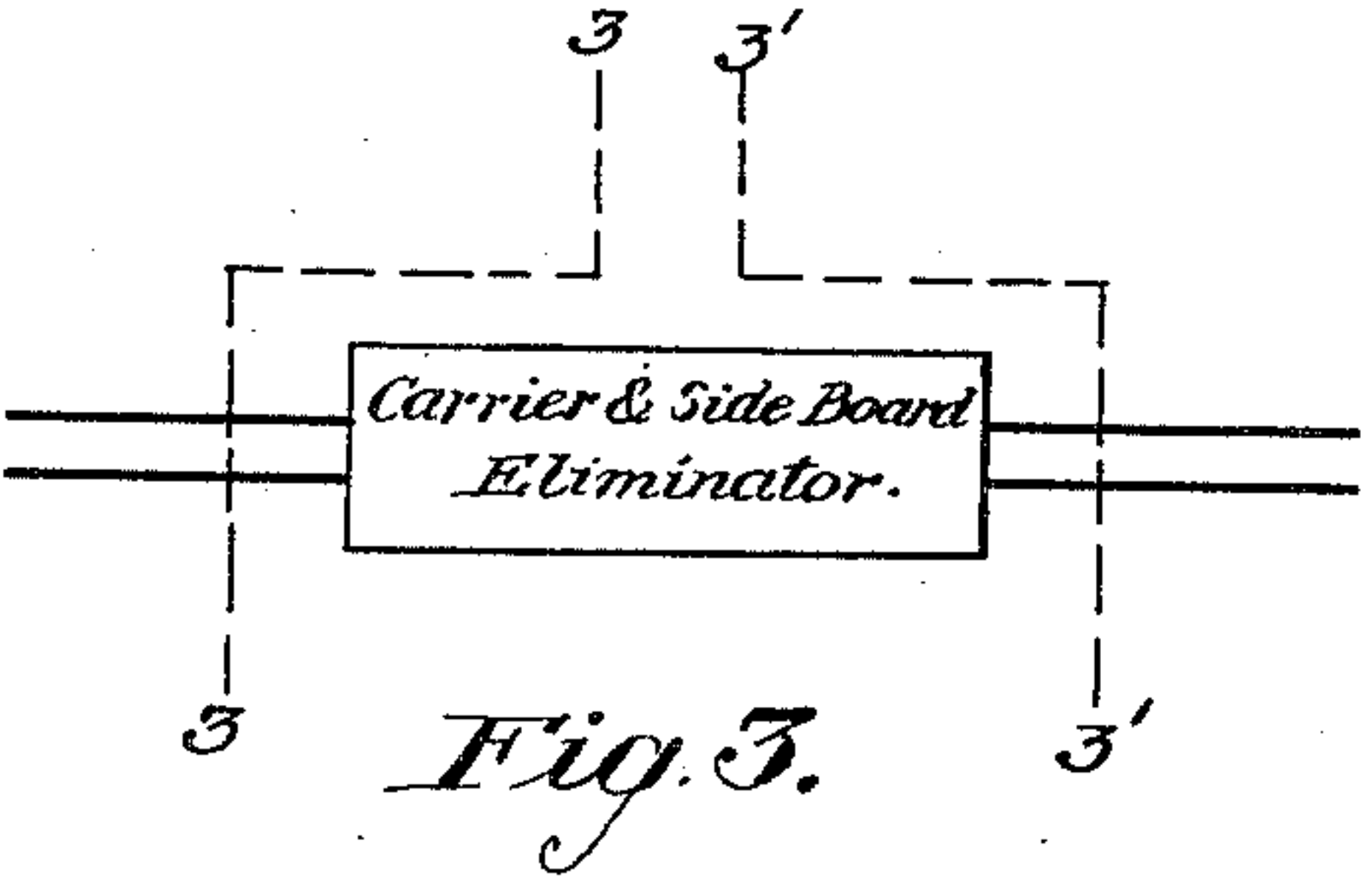
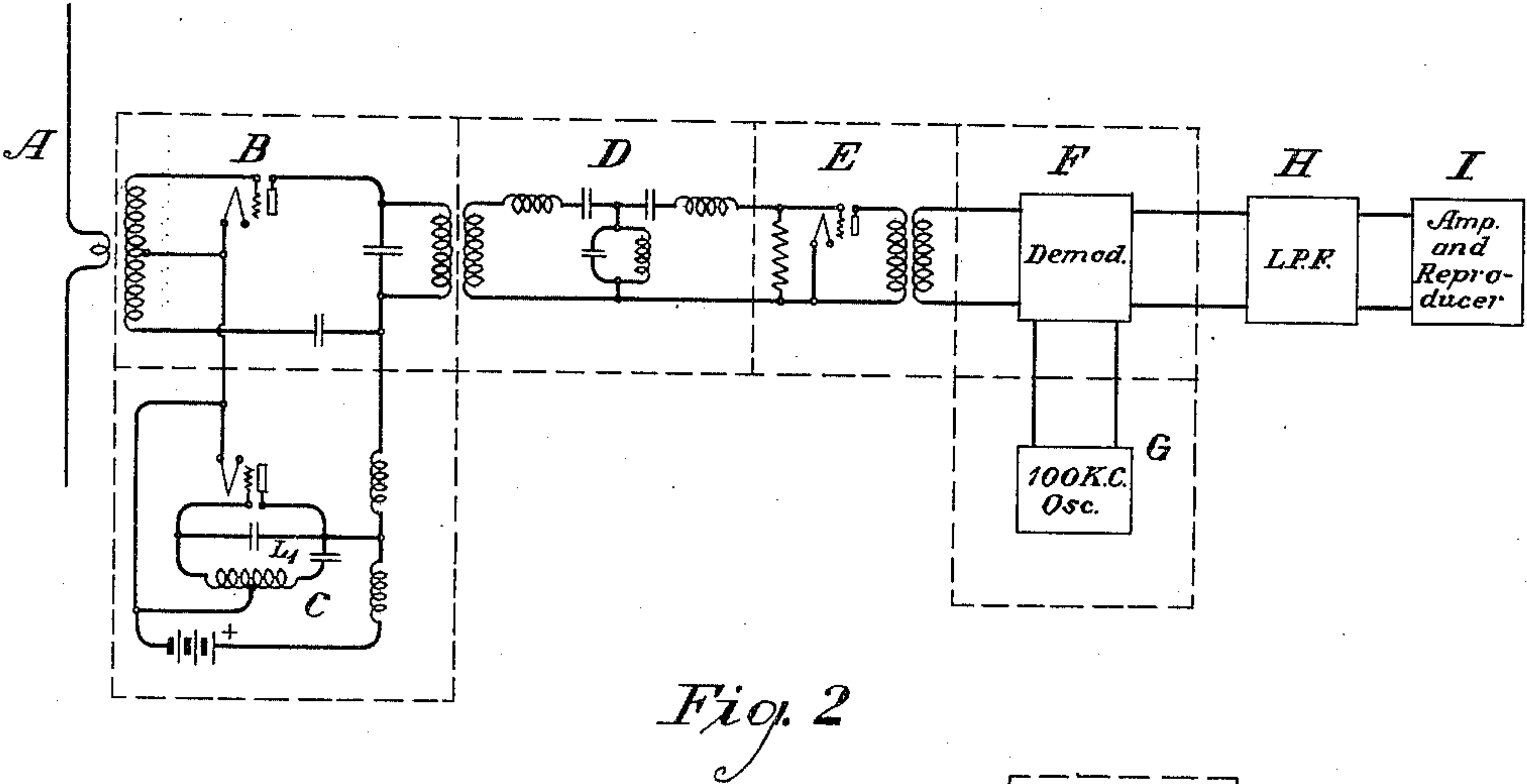
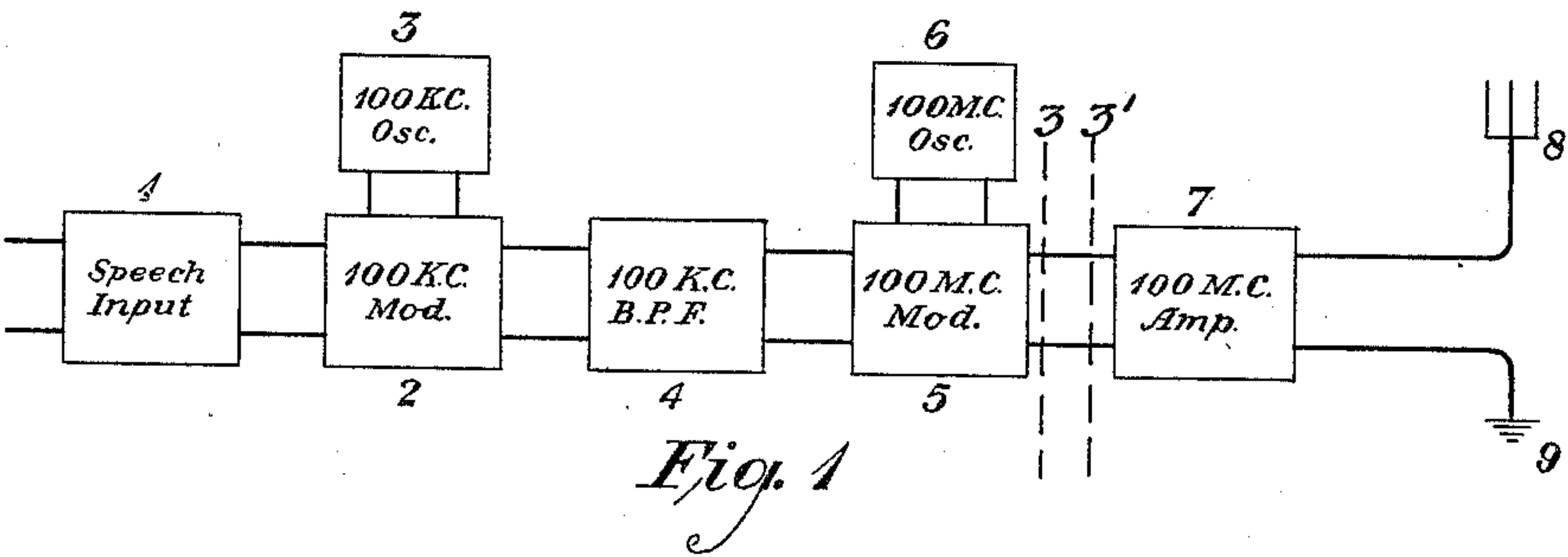
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SHORT WAVE RADIO SIGNALING

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SHORT WAVE RADIO SIGNALING

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This invention relates to short wave radio signaling, and more particularly to a super-regenerative and double demodulation system for ultra short wave radio signaling. Its object is to secure the combined advantages of the so-called super-regenerative and super-heterodyne method in one system.

Briefly, the invention consists in double modulation at a transmitting station followed at the receiving station by super-regenerative demodulation, amplification at an intermediate frequency, demodulation to signal frequency, and such further amplification and reproduction as may be desired.

The invention will be better understood by reference to the following specification and accompanying drawing, in which Figure 1 shows in block form the elements of my transmitting station, Fig. 2 shows the circuit of the receiving station and Figs. 3 and 4 show modifications to the transmitting and receiving circuits of Figs. 1 and 2.

Referring more particularly to Fig. 1, there is shown a source of speech input at 1, which supplies any suitable signal to a modulator 2, this modulator being supplied also from an oscillator 3 with a frequency of any suitable value, here indicated as 100 kilocycles for illustrative purposes. The output of the modulator 2 is passed through a band-pass filter 4, which passes the carrier frequency of 100 kilocycles and one of its modulation side bands. This, in turn, is used to modulate a much higher carrier frequency, such as 100 megacycles, from the oscillator 6. The output of the modulator 5 containing the carrier and two side bands may then be amplified to any suitable value by the amplifier 7, the output of which is impressed on a radiating system here shown as an antenna 8 grounded at 9. It will be understood, however, that any appropriate type of antenna system may be used.

At the receiving station there is an antenna A, which here is shown as a Hertzian doublet, although again any antenna suitable for receiving the short waves contemplated may be used. Associated with the antenna A is a super-regenerative detector B, the association here being shown as by means of a loose inductive coupling. The circuit B comprises a vacuum tube with interconnected circuits constituting essentially an oscillator at the incoming carrier frequency. Also this oscillator has applied to its circuit, in addition to the normal bias, a variable voltage effective on both plate and grid which, during each cycle of its variation, starts and stops the

oscillation of the detector-oscillator B. The rate of starting and stopping is governed by the frequency of a super-regenerative oscillator C, which for illustrative purposes we may assume to oscillate at about 3000 kilocycles. For best results this oscillator must be much lower in frequency than the incoming carrier and must also be much higher in frequency than the side band frequency separation from the carrier frequency. With the illustrative values of frequencies already given, this would mean that the frequency of the oscillator C should be much less than 100 megacycles and much more than 100 kilocycles, and the value of 3000 kilocycles mentioned above would be an appropriate value.

The details of the oscillator C are evident from the drawing and it will be noted that it consists of a Hartley type of oscillator with the filament connected to the midpoint of the tuning inductance L_1 and the positive of battery connected to plate through a suitable choke. A single source of B voltage may be used for supplying the plate circuit of the tubes in both circuit B and circuit C, there being appropriate choke coils and condensers such as are used in circuits of this type, which are well known in the art.

The circuit B is a vacuum tube circuit which acts as a detector but under normal conditions its efficiency as a detector is comparatively low. If feedback is supplied from the output to the input this detection efficiency may be increased and as the circuit approaches the oscillatory condition the efficiency rises to very large values. When, however, the oscillatory condition is established then detection immediately falls to substantially zero. When oscillations cease detection again commences increasing in efficiency as the establishment of the condition for oscillations is again approached. In the circuit of Fig. 2 the establishment and blocking of oscillations occurs at the rate of 3,000,000 times per second and demodulation between the carrier and its side bands coming in on the antenna A occurs a corresponding number of times and during each one of these periods of detection a moment of very high efficiency occurs just before the circuit B breaks into oscillations. There is thus present in the output of the circuit B a wave corresponding to the modulation of the carrier frequency, this wave, however, being broken into a large number of short impulses. The envelope of these impulses, that is, the modulation curve itself, is passed on to the circuit D comprising a band filter adapted to pass frequencies in the neighborhood of 100 kilocycles, eliminating such other components

as may have appeared in the output of the circuit B.

This intermediate frequency is now amplified to any desired extent in the circuit E, there being
5 bridged across the input circuit of the first of such amplifiers an impedance of value to properly terminate the filter D in a manner well known in the art. The amplification in the circuit E is carried on at such frequencies as to give the
10 usual advantages of superheterodyne reception, in particular this being at a frequency which gives freedom from the noises and other disturbances characteristic of many audio frequency amplifiers.

The output of the amplifiers E, along with oscillations from the oscillator G, are now impressed upon a second demodulator F, the frequency of the oscillator G, which in this case would be 100 kilocycles, corresponding to the intermediate frequency of the oscillator 3 in Fig. 1. The output
20 of the circuit F will then contain, among other things, a reproduction of the signal frequency supplied in the circuit 1 of Fig. 1, and such signal is segregated by means of a suitable low pass filter
25 H. Further amplification of this voice frequency or other signaling frequency and its reproduction in any appropriate device, such as a loud speaker, or transmission to remote points, may now take place in the circuit I.

Various modifications of the circuit as thus far described may be made. Thus, for instance, instead of the double modulation described in connection with Fig. 1, it would be possible to modulate a frequency of 100.1 megacycles directly
35 with the speech eliminating all but one side band. Still another modification might consist in modulating the 100 kilocycle oscillations with the speech message, passing these through the usual band filter, modulating the 100 megacycle carrier
40 and then suppressing all but one side band, say the upper side band, by means of selective circuits so that the transmitted wave would then consist essentially of a carrier of 100.1 megacycles modulated with speech. The modification of the
45 transmitter of Fig. 1 to obtain the results indicated above is obtained by introducing at some point of the circuit such as 3—3' the circuit portion shown in Fig. 3, which portion may consist of any of the suitable means known in the art for
50 eliminating the carrier frequency and one sideband. At the receiving station in this event it would be necessary to supply a generator of 100 megacycles which, combined with the incoming modulated carrier would then give an output of
55 100 kilocycles with the upper and lower speech modulation and this may after amplification be detected directly with the elimination of G. This modification of the receiver circuit of Fig. 2 may be obtained by having the 100-megacycle oscil-

lator connected as shown in Fig. 4 at G' and in this event it will not be necessary or even desirable to use the 100-kilocycle generator G.

By means of such systems as described, it is thus seen that use is made of the extreme sensitivity of a super-regenerative receiver without introducing large amounts of audio gain which are apt to introduce considerable noise especially if used in mobile services such as is frequently the case for ultra short wave signaling. Another advantage of this system is that much greater selectivity can be obtained and the noise is reduced below the values which would be expected if double demodulation alone were used on a signaling carrier and two side bands of the ordinary broadcasting variety.

What is claimed is:

1. In a radio signaling system for ultra short waves, a receiving station at one end to receive a carrier frequency modulated with an intermediate frequency and its message side band, the receiving station comprising a detector oscillator for detecting the received wave down to intermediate frequency, means for periodically increasing the detector efficiency to a high value at a frequency high compared to the intermediate frequency, and means for amplifying said intermediate frequency output and for demodulating it to signal frequency and a filter preceding the last demodulator element.

2. In a radio signaling system for ultra short waves, a transmitting station, means thereat for modulating a speech signal against an intermediate carrier frequency, means for modulating this output against a high carrier frequency, a selective circuit for eliminating the high frequency carrier and one of its side bands, a receiving station comprising a super-regenerative detector and a source of the high frequency carrier, a filter passing the detector side band of modulated intermediate frequency, an amplifier therefor, and a detector to detect the modulated intermediate frequency to signal frequency.

3. In a radio signaling system for ultra short waves, a receiving station at one end to receive a carrier frequency modulated with an intermediate frequency and its message sideband, the receiving station comprising a circuit for detection to intermediate frequency, said circuit being brought to a highly efficient unstable state periodically at a frequency high compared to the intermediate frequency, a second circuit for demodulating the resulting wave of intermediate frequency to signal frequency, and a band-pass filter in the output of the detector to pass a narrow band including the intermediate frequency.

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