

March 10, 1925.

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J. O. WATKINS

COMMUNICATION RECEIVING SYSTEM

Filed Sept. 19, 1921

2 Sheets-Sheet 1

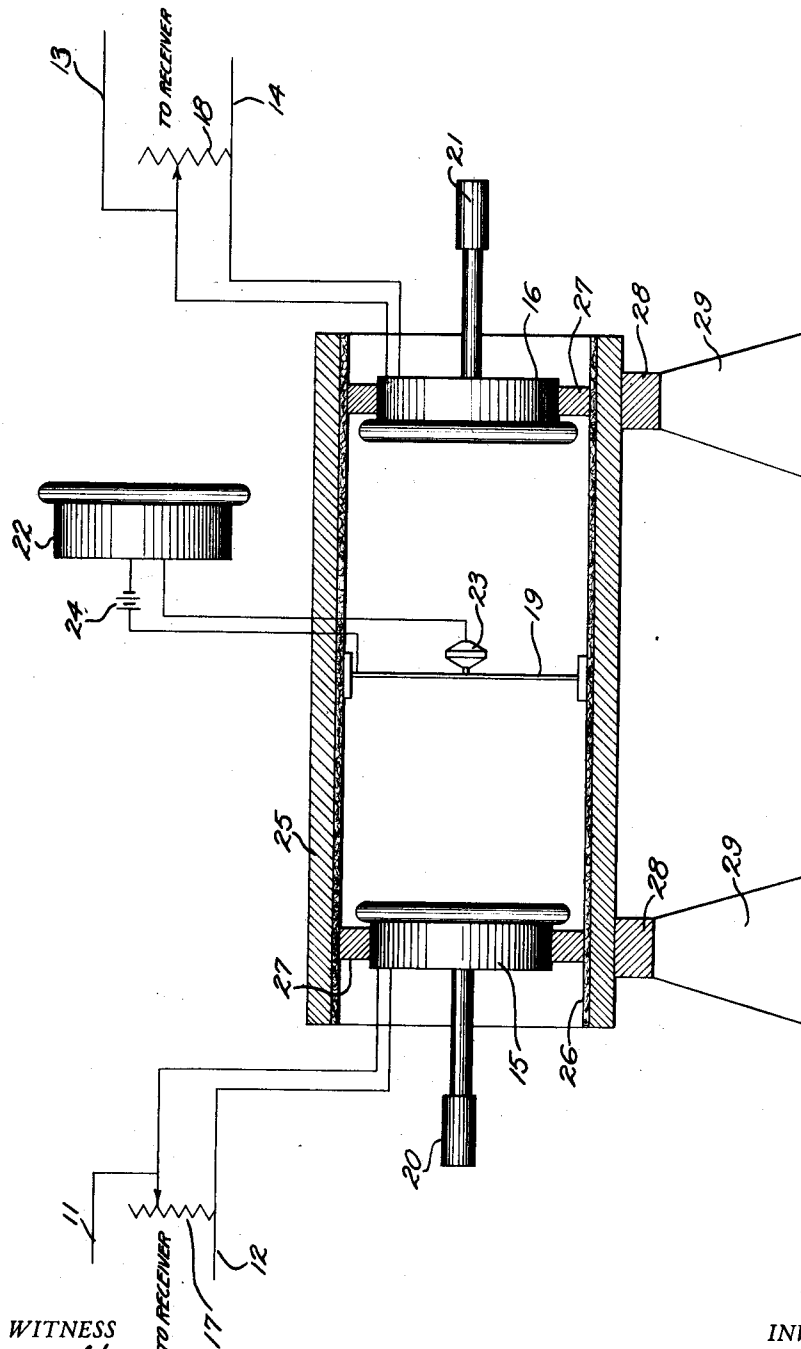


Fig. 1

WITNESS

M. E. Allery

INVENTOR

JAMES O. WATKINS

BY

White Prosser Evans
his ATTORNEYS

March 10, 1925.

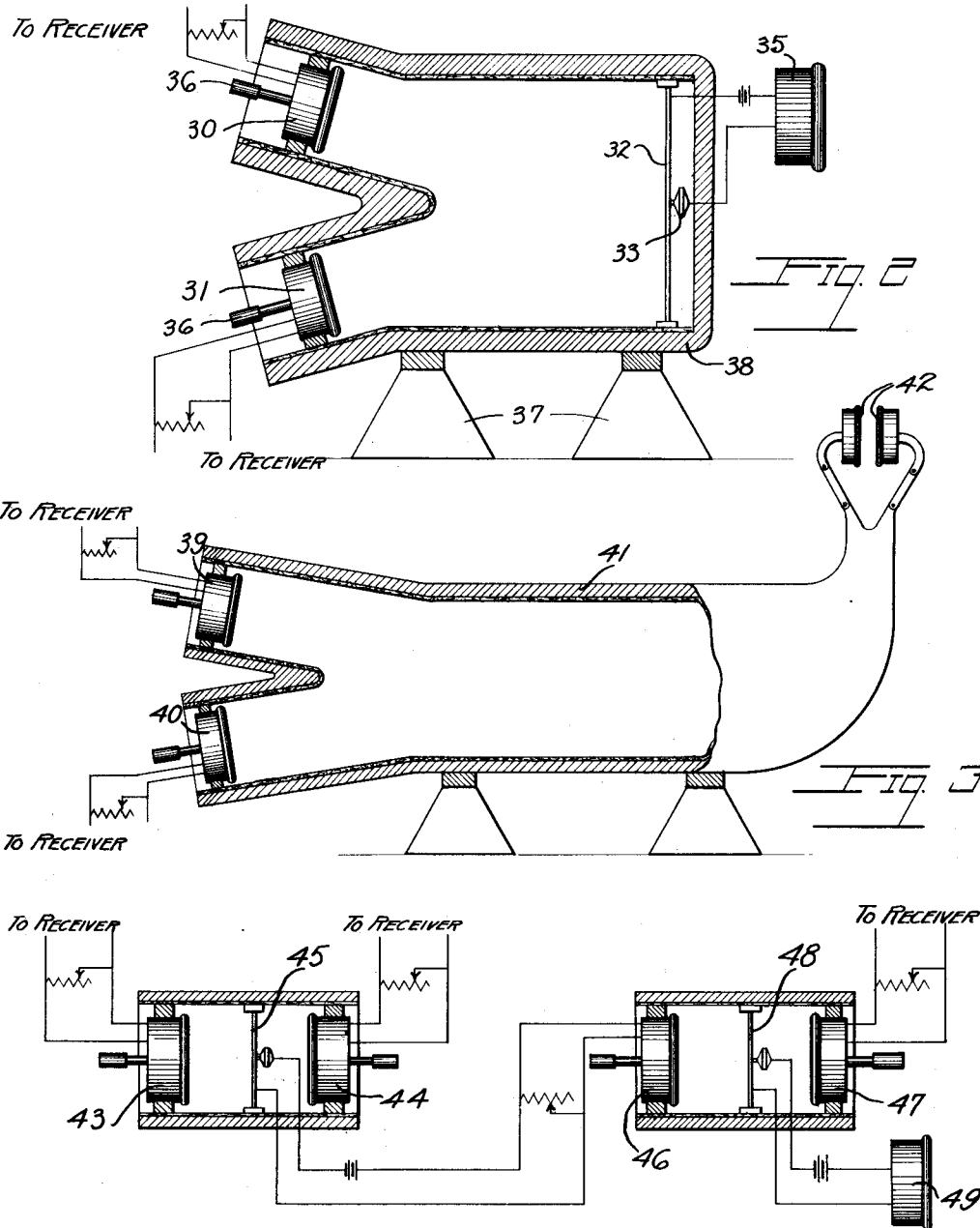
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2 Sheets-Sheet 2



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FIG. 4

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UNITED STATES PATENT OFFICE.

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COMMUNICATION-RECEIVING SYSTEM.

Application filed September 19, 1921. Serial No. 501,569.

To all whom it may concern:

Be it known that I, JAMES O. WATKINS, a citizen of the United States, and residing in the city and county of San Francisco, State of California, have invented a certain new and useful Communication-Receiving System, of which the following is a specification.

My invention relates to a communication receiving system, and more particularly to a system arranged to perceive signals produced by oscillations or waves, such as electric undulations or sound waves.

Examples of such systems are ordinary telephone and telegraph receiving systems, or radio receiving systems, and so far as my invention is concerned, it may be utilized with any of the systems mentioned. It is quite common, in order to receive signals, to utilize the effect of oscillations or waves upon one of the senses, usually the sense of hearing, of the operator at the receiving station. The perception of the signals by the operator may be greatly hampered by many irregular disturbances produced upon the oscillations; these disturbances are usually designated as strays, static, atmospherics, and so on. Sometimes the effect of these disturbing influences is so great that it is difficult to perceive the signal, especially where the signals are weak, because of transmission from a great distance.

It is an object of my invention to eliminate, as far as possible, these disturbances and to render the perception of the signals surer.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description, where I shall outline in full those forms of the invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. In the drawings I have shown several embodiments of my invention, but it is to be understood that I do not limit myself to these forms, since the invention, as set forth in the claims, may be embodied in a plurality of other forms.

Referring to the drawings:

Figure 1 is a view, mainly diagrammatic, of one form of my invention, the electrical connections being indicated, and the me-

chanical parts being shown mainly in section;

Fig. 2 is a diagrammatic view of another form of my invention;

Fig. 3 is a diagram of still another form of my invention; and

Fig. 4 is a diagram showing how it is possible to extend the invention to eliminate the disturbances due to a plurality of causes.

For the purpose of illustrating my invention, I have chosen a system in which electric oscillations or pulsations are received and transformed into sound waves, and the sound waves in turn are caused to be perceived by an operator. Instead of using but one receiver circuit, I utilize in the form shown in Fig. 1, two receiver circuits. In connection with them, I utilize two devices for transforming electric oscillations into sound waves, and I cause one of the receiving circuits and one of the devices to transform all of the oscillations whether useful or those causing the disturbances. The other circuit and its associated device transform only the disturbing oscillations into sound waves. The two devices are then so arranged with respect to each other that the sound waves of that one which transforms only the disturbing oscillations are caused to oppose the sound waves of the other, whereby the disturbing waves are neutralized. Thus, the resulting sound waves are free of the disturbances and they may be caused, in any well known manner, to influence the sense of hearing of the operator.

The elements which may be used to carry out the method just outlined are diagrammatically illustrated in Fig. 1. The details of the receiver circuits are not shown, since they may be either radio, telephone or telegraph circuits. The conductors 11, 12 as well as 13, 14 connect to the receiving circuit in such a way that they carry the electric oscillations or pulsations which are transmitted through the receiver. Either a common receiver for both sets of conductors may be used, or separate receivers, as is most desirable. The conductors 11 and 12 connect to some form of transforming device such as a telephone 15, by means of which the electric oscillations transmitted through the conductors 11 and 12 are transformed into sound waves. The oscillations or pulsations trans-

mitted through conductors 13 and 14 are similarly transformed into sound waves by another telephone 16. The two signal receivers from which the conductors 11, 12 and 13, 14 lead, are differently tuned, so that while the telephone 15 connected to one of them, for example, transforms all of the pulsations, both useful and that due to disturbances, into sound waves, the telephone 16 connected to the other receiver, transforms only the pulsations due to the disturbances. By the use of adjustable impedances 17 and 18 arranged in parallel to the telephones 15 and 16, the strengths of the sound waves produced by these telephones may be proportioned to the proper relative values so as to obtain the desired result.

The sound waves produced by the telephone 16 are made to oppose those produced by the telephone 15, so that the difference between the two groups of sound waves may be perceived. Thus, in Fig. 1, the two telephones 15 and 16 are located on opposite sides of a diaphragm 19. In this way, the vibrations of this diaphragm are made to be responsive to the difference between the groups of waves emanating from the telephones 15 and 16. It may be necessary to adjust very carefully the distances between these telephones and the diaphragm 19 in order to get the proper phase relation of the sound waves as they reach the diaphragm, and for this purpose adjusting handles 20 and 21 are provided. The vibrations of the diaphragm 19 may in turn be caused to affect a telephone 22 in any well known manner, as by means of a microphone 23 sensitive to the vibrations, and energized by the battery 24 or other source of electrical energy. Vibrations of the diaphragm cause variations in the resistance of the microphone, as is well known, whereby the current supplied to the telephone 22 is also varied. This telephone may now be used in the ordinary manner to receive the signals.

In order to shield the entire arrangement from outside disturbances, a housing 25 may be provided, lined with the felt or cork lining 26, or other non-resonant material that absorbs sound waves and does not reflect them. The telephones 15 and 16 may also be carried by non-resonant packing rings 27 sealed within the housing 25. Due to the use of non-resonant material inside of the housing 25, stray sound waves not reaching the diaphragm are suppressed, and their disturbing effects minimized. The entire housing 25 is preferably mounted on resilient cushions 28 carried on supports 29, so that outside vibration may not affect the delicate parts within.

A slightly different arrangement of the parts is shown in Fig. 2, although the principle of operation is substantially similar to that just described. In this instance the

telephones 30 and 31, which are connected to the receiving circuits, are both located on the same side of the diaphragm 32 which affects a microphone 33 and the telephone 35. The subtraction of the sound waves is effected in the present instance solely by accurate adjustment of the distance of the telephones 30 and 31 from the diaphragm. This is accomplished by means of the handles 36. Theoretically, the two telephones should be at such a distance from the diaphragm that there is interference between the disturbing sound waves emanated from both receivers. They thus cancel each other, and only the useful signaling waves are left. The supports 37 and housing 38 are similar in construction to those shown in Fig. 1.

It is not essential, in either of the forms just described, that the resultant sound waves be magnified by any diaphragm or microphone arrangement. They may be led directly to the ear, if they are already of sufficient magnitude, or ear pieces only may be provided. Such an arrangement is shown in Fig. 3, where the two telephones 39 and 40 are so adjusted within the tube 41 that the disturbing waves are in opposition. The resulting waves consisting solely of the useful sound waves, travel along the tube 41 to the ear pieces 42 where they may be perceived by the operator.

In some instances, the disturbances may be of a compound nature; for example they may be due to a plurality of causes. Under such circumstances, it may not be possible to eliminate substantially all of the disturbances with just one pair of receiver circuits. A scheme is shown in Fig. 4 where such disturbances may be eliminated by the use of more receiver circuits. The receiver connected to telephone 43 takes all the disturbing elements, while the receiver connected to telephone 44 is so tuned that it takes only one character of disturbance. The resulting differential waves affect a diaphragm 45, which in turn affects the telephone 46 by means of a microphone arrangement. The telephone 46 has all the waves except that eliminated by the use of telephone 44. Another kind of disturbance may be eliminated by the use of another telephone 47 connected to a receiver tuned to take only the waves of that disturbance. The telephones 46 and 47 may then be opposed as regards diaphragm 48, and the resulting desired wave obtained at the telephone 49. As may readily be seen, the process may be carried on indefinitely so as to eliminate all the disturbing waves.

I claim:

1. In a system for receiving signals by means of electric pulsations, means for eliminating disturbances in the signals comprising a receiver tuned so as to be sensitive to substantially all of the pulsations and to

transmit them, means for transforming these transmitted pulsations into sound waves, another receiver tuned so as to transmit at least some of the disturbing pulsations, means for transforming these latter pulsations into sound waves, and means whereby the difference between the two sets of sound waves may be perceived.

2. In a system for receiving signals by means of electric pulsations, means for eliminating disturbances in the signals comprising a receiver tuned so as to be sensitive to substantially all of the pulsations and to transmit them, means for transforming these transmitted pulsations into sound waves, another receiver tuned so as to transmit at least some of the disturbing pulsations, means for transforming these latter pulsations into sound waves, means for adjusting the magnitude of the sound waves, and means whereby the difference between the two sets of sound waves may be perceived.

3. A receiving system for electric oscillations, comprising a receiving circuit tuned to the frequency of the oscillations to be received, a receiving circuit tuned so that it will not receive said oscillations, a device associated with each circuit for translating the received impulses into sound waves, a device for translating sound waves into a variable electric current arranged to be influenced by said sound waves, so that their effects are subtracted, and a device for translating said variable electric current into sound waves.

4. A receiving system for electric oscillations, comprising a receiving circuit sensitive to the frequency of the oscillations to be received and to natural disturbances, a second receiving circuit sensitive to natural disturbances and insensitive to the frequency of the oscillations to be received, means associated with each circuit for translating the electrical conditions therein to sound waves, a sound sensitive device arranged to be influenced by said two groups of sound waves and to produce an electric current varying in accordance with the difference between said two groups of sound waves, and means for translating said variable electric current into sound waves.

5. A receiving system for electric oscillations, comprising means for producing sound waves corresponding to the received signal and natural disturbances, means for producing sound waves corresponding to the natural disturbances, a sound sensitive device arranged to be oppositely influenced by said two groups of sound waves whereby a varying electric current corresponding to the received signals is produced and means for translating the varying current into a perceptible manifestation.

6. A receiving system for electric oscillations, comprising a telephone arranged to produce sound waves in accordance with the

received signal and natural disturbances, a second telephone arranged to produce sound waves in accordance with the natural disturbances, a diaphragm arranged between said telephones to receive one group of sound waves on one side and the other group on the other side, whereby the sound waves due to the natural disturbances are neutralized, means operated by movement of the diaphragm to produce a variable electric current corresponding to the received signal and means for translating the varying current into a perceptible manifestation.

7. A receiving system for electric oscillations, comprising a telephone arranged to produce sound waves in accordance with the received signal and natural disturbances, a second telephone arranged to produce sound waves in accordance with the natural disturbances, a diaphragm arranged between said telephones to receive one group of sound waves on one side and the other group on the other side, whereby the sound waves due to the natural disturbances are neutralized, means for varying the relative distances between the diaphragm and the telephones, means operated by the movement of the diaphragm to produce a variable electric current corresponding to the received signal, and means for translating the varying current into a perceptible manifestation.

8. A receiving system for electric oscillations, comprising a telephone arranged to produce sound waves in accordance with the received signal and natural disturbances, a second telephone arranged to produce sound waves in accordance with the natural disturbances, a diaphragm arranged between said telephones to receive one group of sound waves on one side and the other group on the other side, whereby the sound waves due to the natural disturbances are neutralized, means for varying the relative distances between the diaphragm and the telephones, means operated by the movement of the diaphragm to produce a variable electric current corresponding to the received signal, and a telephone receiver influenced by said varying current.

9. A receiving system for electric oscillations, comprising a telephone arranged to produce sound waves in accordance with the received signal and natural disturbances, a second telephone arranged to produce sound waves in accordance with the natural disturbances, means for causing the sound waves in the two telephones produced by the natural disturbances to be of substantially equal intensity, a diaphragm arranged between said telephones to receive one group of sound waves on one side and the other group on the other side, whereby the sound waves due to the natural disturbances are neutralized, means operated by movement of the diaphragm to produce a variable elec-

tric current corresponding to the received signal and means for translating the varying current into a perceptible manifestation.

10. A receiving system for electric oscillations, comprising a telephone arranged to produce sound waves in accordance with the received signal and natural disturbances, a second telephone arranged to produce sound waves in accordance with the natural disturbances, a non-resonant chamber in the opposite ends of which said telephones are arranged, a diaphragm disposed in said chamber intermediate the telephones to receive one group of sound waves on one side and the other group on the other side whereby the effect on the diaphragm of the sound waves due to the natural disturbances are neutralized, means operated by movement of the diaphragm to produce a variable electric current corresponding to the received

signal and means for translating the varying current into a perceptible manifestation.

11. In a receiving circuit for electric oscillations, a non-resonant chamber, a telephone arranged to produce a group of sound waves arranged at one end of the chamber, a telephone arranged to produce a group of sound waves corresponding in part to the waves of the first group arranged at the other end of the chamber, a diaphragm arranged in said chamber arranged to be oppositely influenced by said groups of sound waves, means for translating the movement of the diaphragm into a varying current and means for translating the variable current into a perceptible manifestation.

In testimony whereof, I have hereunto set my hand.

JAMES O. WATKINS.