Jan. 26, 1943. J. L. HATHAWAY 2,309,109

MICROPHONE

Original Filed June 4, 1937

Fig. 2.

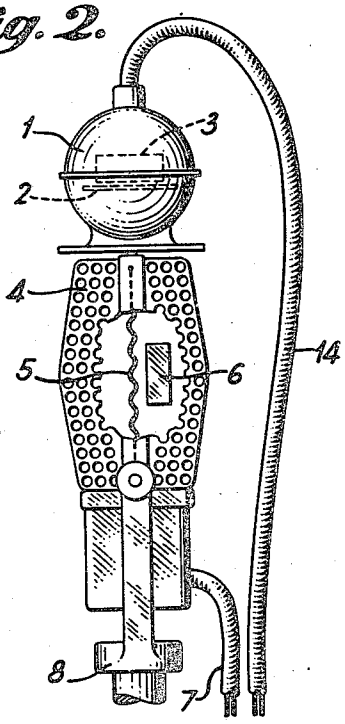


Fig. 1.

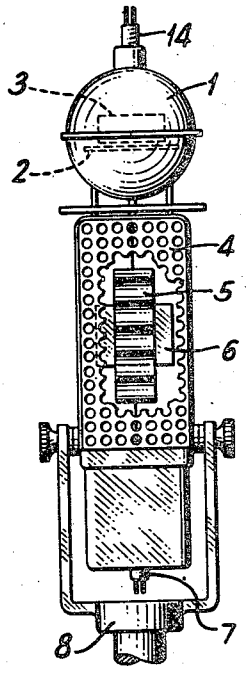


Fig. 3.

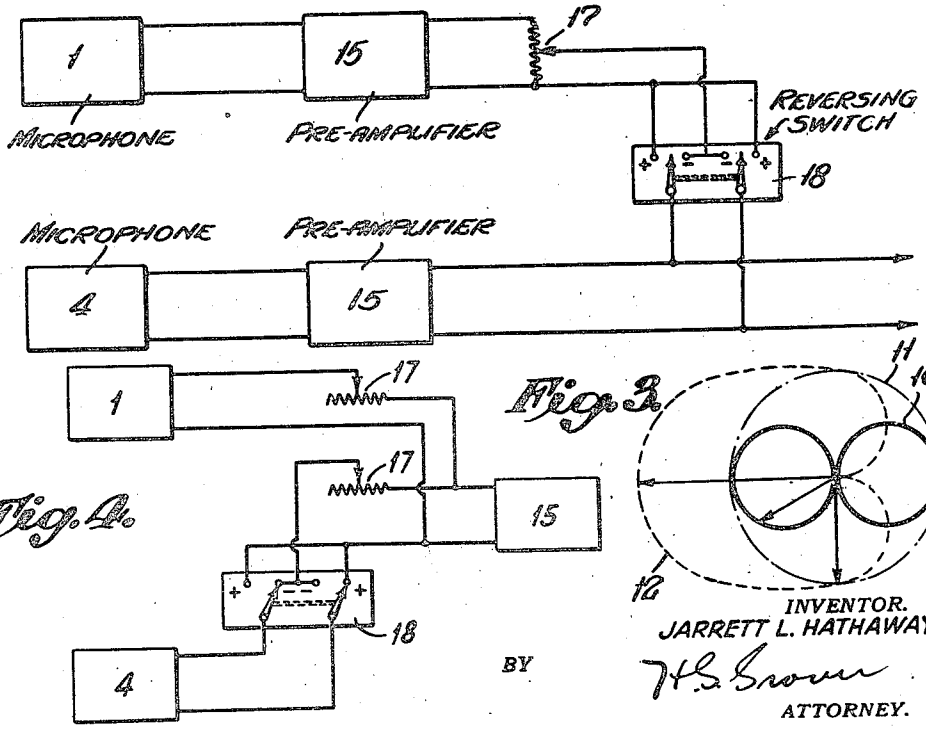


Fig. 4.

Fig. 3.

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Patented Jan. 26, 1943 2,309,109

UNITED STATES PATENT OFFICE

2,309,109

MICROPHONE

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Original application June 4, 1937, Serial No. 146,405. Divided and this application December 8, 1939, Serial No. 308,239

2 Claims. (Cl. 179—1)

This invention relates to a new and novel composite microphone arrangement which involves the use of two microphones to produce an improved uni-directional pickup.

This application is a division of my copending application Serial No. 146,405, filed June 4, 1937, the claims in this application being directed to the microphone switching circuits. This application is also somewhat allied to the Anderson Patent #2,173,219, patented Sept. 19, 1939, in which patent there is an arrangement of a multiplicity of pressure gradient responsive ribbons at suitable angles to each other. Outputs of the pressure gradient responsive ribbons are put through a suitable mixing device. By manipulating the mixer, the directional pattern of the microphone may be varied at any desired angle, whereas in this application, the arrangement comprises two microphones having different electrical response characteristics, and a switching arrangement is provided for changing the pattern and sense of direction of the microphone pickup.

An object of this invention is to provide an electrically combined microphone arrangement in which an improved uni-directional pickup can be obtained.

Another object of this invention is the improved switching arrangement whereby it is possible to change the uni-directional characteristics by one hundred and eighty degrees (180°) by merely reversing the output polarity of either one of the microphones comprising the uni-directional microphone. Also, by the use of suitable impedance microphones, the switching may be done at a point which is a long distance from the microphones, or at a point where the sound originates.

A feature of this invention is the combining of a non-directional microphone with a bi-directional microphone to give an improved uni-directional pattern, which may be controlled in pattern shape and sense of direction by the operator.

Another feature of this invention is the novel arrangement of the sound responsive elements in which a non-directive sound responsive element is located in the horizontal plane and the bi-directional sound responsive element is located in a perpendicular plane.

This invention will best be understood by referring to the accompanying drawing, in which:

Fig. 1 is a front view of the improved combined microphones;

Fig. 2 is a side view of Fig. 1;

Fig. 3 is a microphone directional pattern plotted in polar coordinates to show the directional characteristics of this combined microphone;

Fig. 4 is a simple circuit arrangement showing the method by which the uni-directional pattern is changed by one hundred and eighty degrees (180°) by reversing its output polarity; and

Fig. 5 shows a circuit switching arrangement, wherein the microphones are directly fed to separate pre-amplifiers.

Referring now in detail to Figs. 1 and 2 of the drawing, the non-directional microphone 1 is mounted on a bi-directional microphone 4. The non-directional microphone consists essentially of a small diaphragm 2, an armature, coil, and a permanent magnet 3 supported within a small, spherical casing. The entire structure of this microphone is so small as to make it non-directional for all frequencies involved. The bi-directional microphone 4 is of the velocity type, and comprises a ribbon 5 which is suspended in position in free space between the poles of a permanent magnet 6. Sound waves reaching the ribbon vibrate it within the magnetic field set up by the magnet. The vibrations of the ribbon being in exact accordance with the sound vibration occurring as it does within the magnetic field sets up a corresponding alternating current potential which is brought out by the leads 7. The combined microphones 1 and 4 are pivotally mounted on a support 8.

Referring now to the curve shown in Fig. 3 of the drawing, the bi-directional characteristic pattern is indicated in full by lines 10, the non-directional field pattern characteristic being shown by the dot and dash line 11 and the improved combined uni-directional pattern is indicated by the dash lines 12, and it will be noted that the voltage output of the new and improved uni-directional combination is substantially twice that of either the bi-directional or non-directional microphone in one direction, and approximately zero in the opposite.

This invention is not to be confused with the uni-directional microphone device which makes use of two ribbons, one operating as a velocity ribbon and the other as a pressure ribbon, for while such a device is satisfactory for most purposes, the utility of this improved device of my invention is often greater in that the two microphones may be so combined that not only uni-directional characteristics in one direction but in the opposite direction, as well, may be obtained,

or it may be connected to be used as a bi-directional or non-directional microphone, and these changes of characteristics may be controlled remotely from the microphone location. The output leads 7 and 14 may be fed to a preamplifier 15, as shown in Fig. 4, through separate faders 17, the leads of the bi-directional microphone 4 being connected to a polarity reversing switch 18 in such a manner that the output polarity may be reversed at will. This arrangement makes it possible to obtain four different patterns without moving the physical position of the stand. For example, the non-directional microphone may be used separately, the bi-directional microphone may be used separately, the non-directional and bi-directional microphones 1 and 5, respectively, of Fig. 2, may be used in combination to give a pattern facing to the left, as shown in Fig. 3, or its direction may be reversed by reversing the polarity of switch 18 to give a pattern, not shown, to the right.

While Fig. 4 shows but one of the various electrical means for combining the two microphones, other means may be obtained by feeding the microphones direct to the preamplifiers and from the preamplifiers combining the outputs through an attenuator 17 and switch 18, as shown by Fig. 5, or, if desired, the non-directional and the bi-directional microphones may also be provided with simple resistor networks to obtain the correct amplitude relationship before entering the preamplifiers.

The mechanical arrangement of the microphones may be reversed and also other angular relationships of the microphones used, provided, however, that close proximity of each microphone is established. Furthermore, this invention should not be limited to the device shown, but only by such limitations as are clearly imposed in the appended claims.

What is claimed is:

1. A microphone system comprising two microphones, one of said microphones having a non-directional characteristic and the other microphone having a bi-directional characteristic, two fading resistances, a preamplifier, said microphone having the non-directional characteristic being connected in series with one of said fading resistances, and to the input circuit of said preamplifier, a switch for electrically connecting the microphone having the bi-directional characteristic in parallel with the last-mentioned microphone to the input of said preamplifier and in series with the other fading resistance, and also for reversing the output circuit of at least one of said microphones to change the overall directional response pattern of said microphones when used together.

2. A microphone circuit comprising two microphones, one of which has a non-directional characteristic and the other of which has a bi-directional characteristic, two fading resistances, a preamplifier, a double pole, double throw switch connecting both of said microphones in parallel and to the input circuit of said preamplifier, said microphone having the non-directional characteristic being connected in series with one of said fading resistances and the other microphone having the bi-directional characteristic being connected in series with the other fading resistance, the poles of said double pole, double throw switch being arranged and connected to reverse the direction of the current flow from the output of at least one of said microphones to the input circuit of said preamplifier to change the direction of response, of the microphones when used together, approximately 180°.

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