

Sept. 14., 1926.

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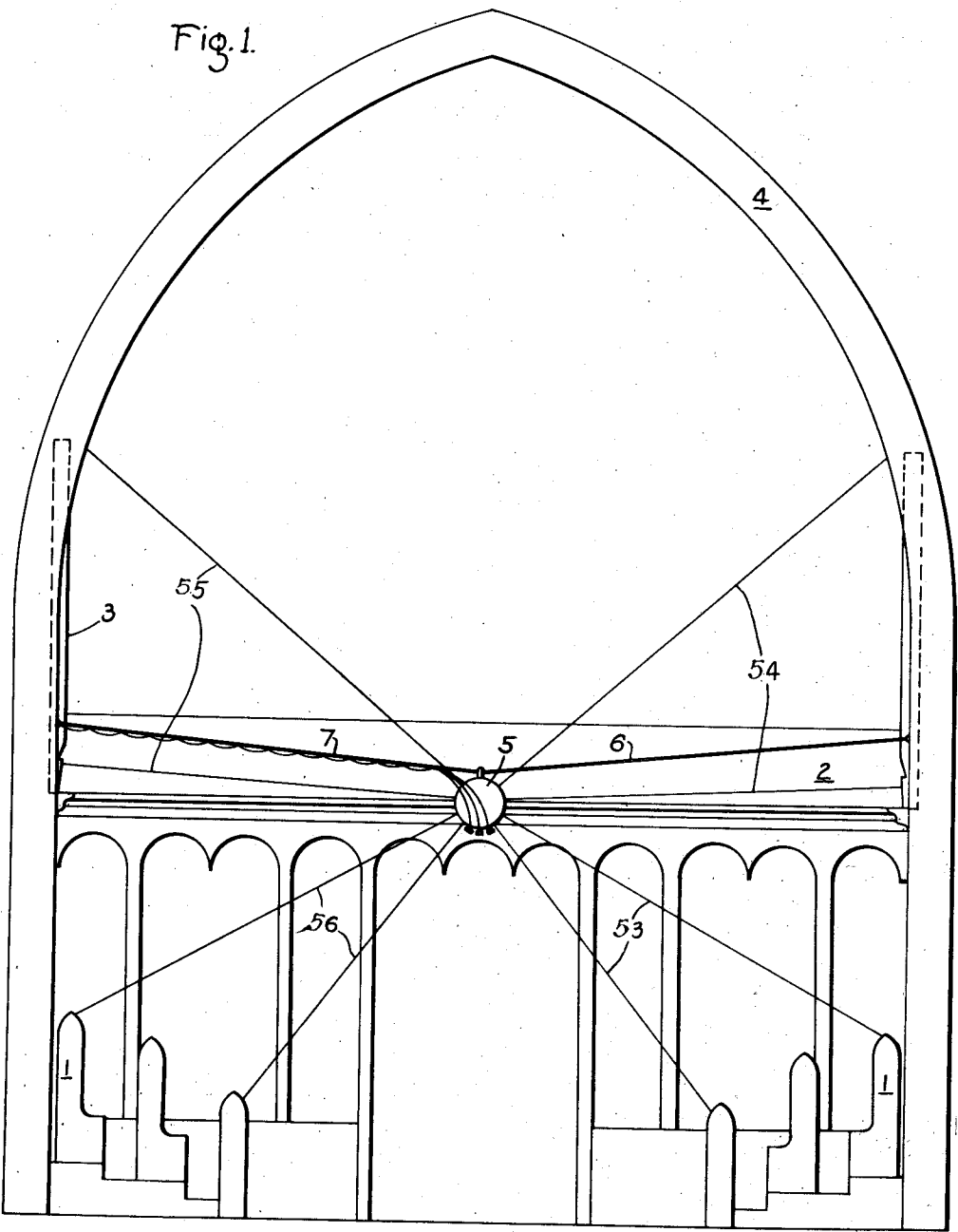
A. NYMAN

ECHO BOX MICROPHONE

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4 Sheets-Sheet 1

Fig. 1.



WITNESSES:

R. J. Butler
H. P. Hurline

INVENTOR

Alexander Nyman.

BY

Wesley Carr
ATTORNEY

Sept. 14 , 1926.

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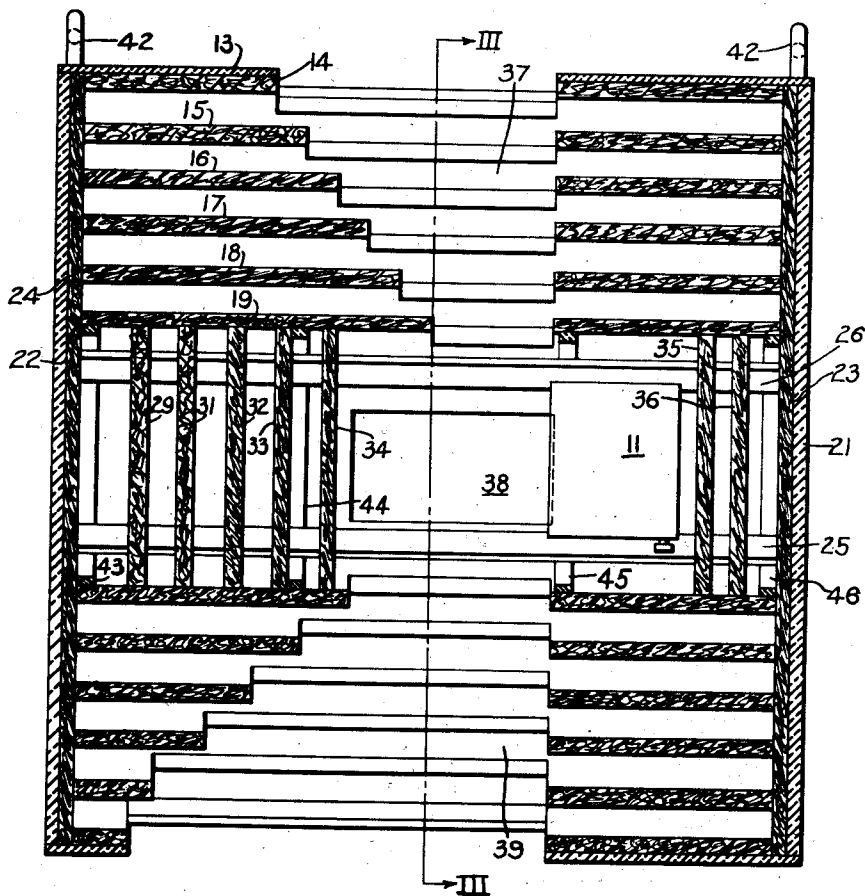
A. NYMAN

ECHO BOX MICROPHONE

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Fig. 2.



WITNESSES:

R. J. Butler.
H.D. Kinkline

INVENTOR

INVENTOR
Alexander Nyman.

BY

BT
Wesley E. Barr
ATTORNEY

Sept. 14 , 1926.

1,599,541

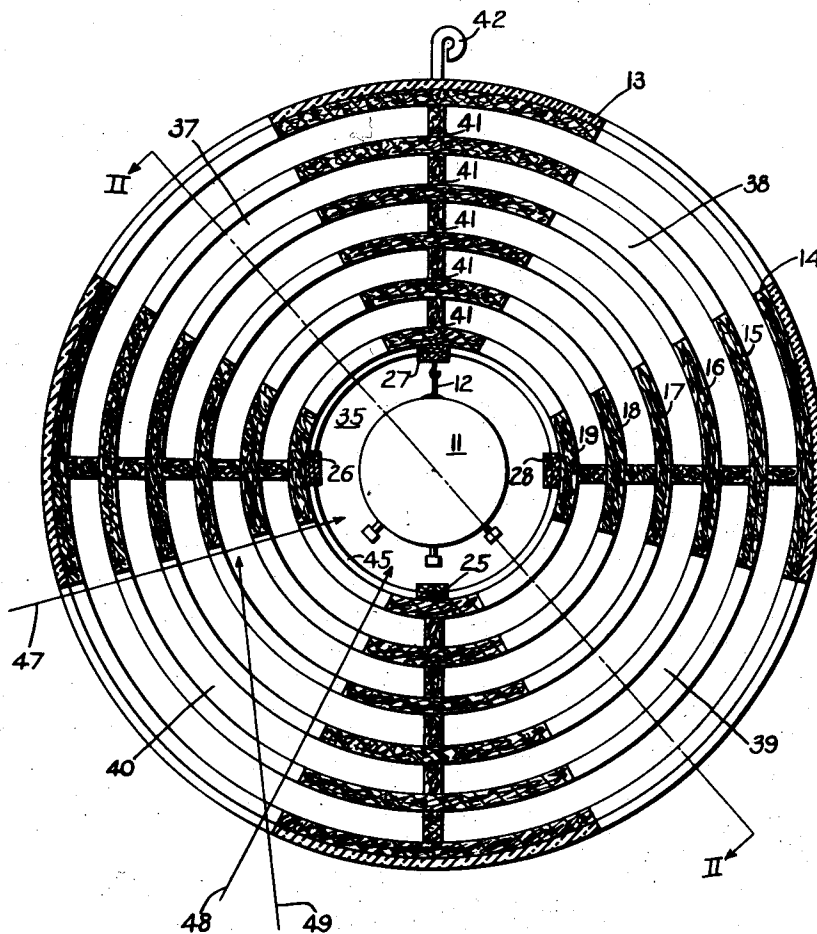
A. NYMAN

ECHO BOX MICROPHONE

Filed April 2, 1924

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Fig. 3.



WITNESSES:

R. J. Butler.
H. D. Hine.

INVENTOR

INVENTOR
Alexander Nymian.

BY

BY
Wesley E. Carr
ATTORNEY

Sept. 14, 1926.

1,599,541

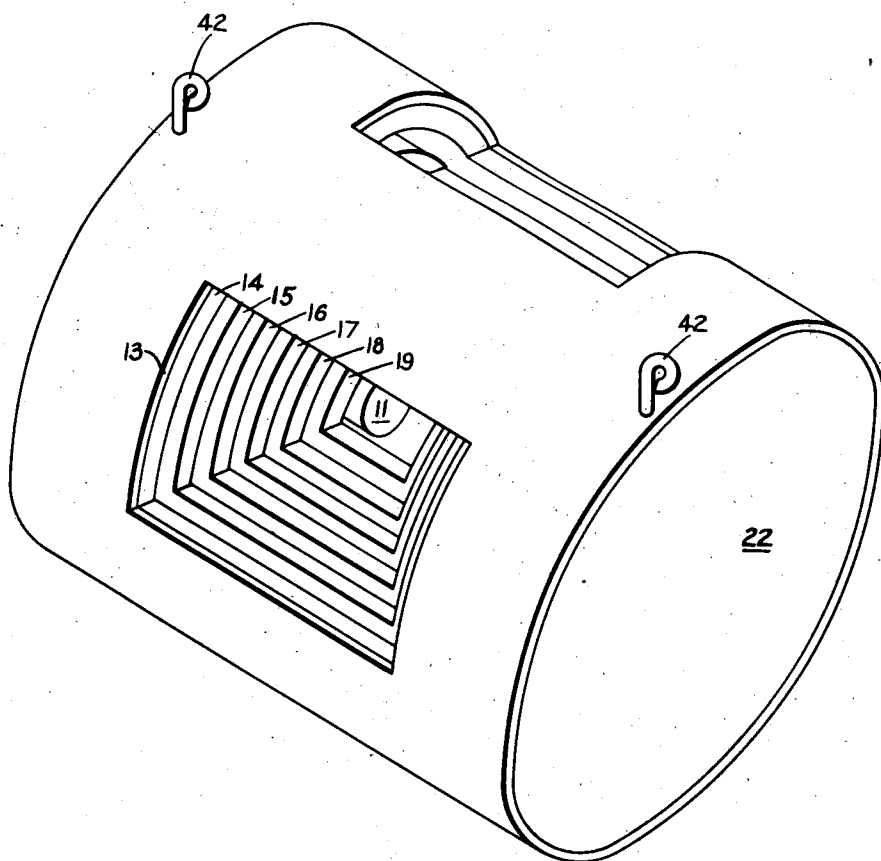
A. NYMAN

ECHO BOX MICROPHONE

Filed April 2, 1924

4 Sheets-Sheet 4

Fig. 4.



WITNESSES:

R. J. Butler
R. D. Hinkle

INVENTOR

Alexander Nyman.

BY

Herby E. Carr

ATTORNEY

UNITED STATES PATENT OFFICE.

ALEXANDER NYMAN, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO WESTINGHOUSE
ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

ECHO-BOX MICROPHONE.

Application filed April 2, 1924. Serial No. 703,864.

My invention relates to apparatus for the translation of sound into vibratory electric currents, and particularly to directionally selective microphone devices.

One of the objects of my invention is to construct a device for converting sound vibrations into electrical vibrations which shall respond to sound from certain sources more readily than from other sources.

Another object of my invention is to provide sound-absorbing and sound-shielding means in connection with a microphone and an attached electrical system which shall respond only to sound from a predetermined source thereby generating a vibratory electric current which produces a much more truthful copy of the sound waves from the predetermined source when reproduced in a telephone receiver connected to the same electrical system.

In the development of the prior art of telephony, microphones have usually been enclosed in a light metal case provided with a small horn for collecting and transmitting sound to the diaphragm. Relatively few microphone devices have been constructed suitable for sounds other than speech and, in their construction, few attempts have been made to avoid response by the microphone to extraneous sounds. The designers of such devices have placed much more dependence upon the greater sound volume from a speaker's voice when his face is in close proximity to the collecting horn, as compared with the volume of the extraneous sound preventing interference between its extraneous sound and speech. The microphone then is sufficiently insensitive to be unresponsive to the lesser sound volume of the extraneous noises.

Because of the lack of devices suitable for the reception of sound from substantial distances, the collection of sound from a group of musical instruments, a chorus, and similar sound sources, and its conversion into electrical vibratory currents, suitable for purposes such as that of modulating a radio-sending apparatus, have been found difficult.

Because of this lack, the broadcasting of vocal and instrumental music by a radio-sending apparatus from a sound "pick-up" secured by an ordinary telephone transmitter has been found unsatisfactory. Serious interference has been found to occur be-

tween sound received by a microphone directly from the singers and instruments and sound reflected from the walls, and also extraneous sounds, such as applause and other usual sounds made by an audience.

In the reception of sound by a microphone, it is necessary to distinguish between sounds of two types. Sounds emanating directly from the source to which response is desired may be called the primary sounds, and echoes and other extraneous noises, including applause and the ordinary sounds of an audience, may be called secondary sounds. The purpose of my invention is to obtain a principal response by a microphone to primary sounds and a minimum response to secondary sounds.

My invention provides means whereby this preferential response may be obtained which consists of a microphone mounting containing sound channels within its body. These sound channels are directed toward the source from which it is desired to receive the sound. The channels are formed from sound-absorbent material and are of substantial length. By this means, sounds from a direction included within an angle which subtends the sides of the channels is allowed to pass directly to the microphone and affect it, while sound from sources not included within this angle is caught and absorbed by the sides of the sound-conveying channel and thereby restrained from influencing the microphone.

Other objects and structural details of my invention will be apparent from the following description, when read in connection with the accompanying drawings, wherein:

Figure 1 is a diagrammatic view of the device of my invention, as associated with a church choir, a choir screen, choir stalls and an organ, showing the device in a typical location.

Fig. 2 is a view, in longitudinal section, of my device,

Fig. 3 is a view, in section, of my device taken at right angles to Fig. 2, and

Fig. 4 is a perspective view of the device of my invention.

Fig. 1 shows choir stalls 1, a choir screen 2, an organ 3, a choir arch 4 and a "pick-up" microphone 5. The microphone 5 is supported by the cords 6 and 7 which are attached to the walls of the choir arch 4 at points

hidden from the congregation by the choir screen 2, the microphone 5 being likewise hidden by the same means.

Referring to Figs. 2, 3 and 4, a microphone 5 comprises a sound-responsive element 11 that is supported by elastic cords within a containing envelope. This container comprises a cylinder 13 of "Micarta", fiber, metal, or other suitable material, and perforated at suitable points according to the position of the device with respect to the sound sources, to the output of which it is desired that the microphone respond. This cylinder encloses a series of concentric felt cylinders 14 to 19, inclusive. The ends of cylinder 13 are closed by walls 21 and 22 of similar material which is faced with felt disks 23 and 24. Supporting means 25 and 26, 27 and 28 serve to hold the felt cylinders in concentric position surrounding microphone 11. Other felt discs 29, 31, 32, 33, 35 and 36 are provided within the interior of cylinder 19 supported by means 25 and 26, 27 and 28. Openings 37, 38 and 39, and 40 are also provided.

Circular hoops 43 to 46, inclusive, are also provided for maintaining the proper shape of the interior of the concentric felt cylinders. Hooks 42 are attached to the exterior of the cylinder 13 for supporting means. Referring particularly to Fig. 3, the sound-sensitive microphone device 11 is supported on elastic cords 12 within the containing cylinder 13.

Spacing means 41 are placed between the successive felt cylinders 14 to 19, inclusive, these spacing means being felt strips which are repeated about the axis of the cylinder at a 90° spacing.

In the construction of my device, I provide openings 37 to 40, inclusive, so disposed with respect to microphone 11 that, when the assembly is supported adjacent to the sources of sound to which it is desired that the microphone respond, the openings are respectively directed toward these sources. These successive openings through the various felt cylinders are graduated in size and made to subtend an angle, with its vertex in the center of the microphone, equal to the angle which subtends the lines drawn from the center of the microphone to the boundaries of the space occupied by the sound source. This is indicated in Fig. 1 by lines 53 to 56 inclusive.

This construction permits sound coming from the area subtended by these angles to enter my device directly and impinge upon the microphone 11, as indicated in Fig. 3 by arrows 47 and 48. The microphone is thereby caused to respond to sound from a desired source. Sounds from other directions, however, such as that indicated by arrow 49, being secondary sounds, cannot reach the microphone directly but enter the

labyrinth of openings between the felt cylinders and are there absorbed and destroyed, by which means the secondary sound is prevented from affecting the microphone 11.

In Fig. 1, microphone device 5 is shown supported by cords 6 and 7. It has been found that loud organ music causes vibration of the entire structure of the building and such vibration, transmitted to a microphone, causes an objectionable rattling effect. This difficulty is avoided by the supporting cords 6 and 7 which carry the weight of the microphone device and hold it in position but do not transmit vibration to it.

In the operation of my device, I construct a sound-shielding means, as previously described, adapting the openings through the felt cylinders to the particular location in which the device is to be used. I then support the device so that the various openings are directed toward the respective sources which it is desired to receive, as shown in Fig. 1. I may then energize the microphone with electric current and it will respond to sound from the desired sources, since such sound is free to enter through the openings in the felt cylinders and impinge upon the transmitter.

Sounds from other sources do not, however, enter the openings in such a way as to reach the microphone, but enter the labyrinth between the felt cylinders and are absorbed and thereby restrained from reaching the microphone 11.

By this means, I am able to construct a shielding means which, surrounding a microphone, contains sound-conveying channels adapted to convey sound from predetermined sources to the microphone 11, and am able to prevent sound from other sources from impinging upon microphone 11. In this way, I am able to obtain preferential response of the microphone 11 to primary sounds, as compared with secondary sounds.

While I have shown only one embodiment of my invention in the accompanying drawings, it is capable of various changes and modifications without departing from the spirit thereof, including changes in angles subtended by the openings through the felt cylinders and changes in the number of openings, as well as other changes, and it is desired, therefore, that only such limitations shall be imposed thereon as are indicated in the prior art or in the appended claims.

I claim as my invention:

1. A directive reception microphone comprising, in combination, a sound-responsive device and a plurality of concentric perforated sound-damping elements surrounding said instrument.

2. A directive reception microphone com-

prising, in combination, a sound-responsive device, a plurality of concentric, perforated, sound-damping and sound-absorbing means surrounding said instrument, and spacing devices, said damping devices being spaced apart by said spacing devices.

3. A directive reception microphone device comprising a sound-sensitive device and a surrounding sound-absorbing device, said absorbing device being provided with sound-conveying channels, said channels being disposed to convey sound from certain directions only to said sound-sensitive device.

4. A directive reception microphone device comprising a sound-sensitive device, in combination with a sound-conveying device, said conveying device comprising a plurality of sound-absorbing containers perforated with a plurality of cooperating sound channels.

5. In a sound-responsive system, in combination, a microphone, and a surrounding plurality of sound-absorbent means having perforations constituting channels leading to said microphone.

6. In a sound-responsive system, in combination, a microphone, and a surrounding plurality of sound-absorbent means having perforations constituting channels leading to said microphone, said channels being directed toward the predetermined sources of sound.

7. The combination of a microphone and a plurality of sound-absorbent means having a plurality of sound-conveying channels therein.

8. The combination of a microphone and a plurality of sound-absorbent means having a plurality of sound-conveying channels therethrough, said absorbent means comprising a plurality of perforated felt cylinders.

9. The combination of a microphone and a plurality of sound-absorbent means having a plurality of sound-conveying channels therethrough, said absorbent means comprising a plurality of perforated felt cylinders concentrically surrounding said microphone.

10. The combination of a microphone and a plurality of sound-absorbent means having a plurality of sound-conveying channels therethrough, said absorbent means comprising a plurality of perforated felt cylinders concentrically surrounding said microphone, said perforations forming said sound channels and being disposed symmetrically with respect to a radius common to all of said cylinders.

11. The combination of a microphone and a plurality of sound-absorbent means having a plurality of sound-conveying channels therethrough, said absorbent means comprising a plurality of perforated felt cylinders concentrically surrounding said microphone, said perforations forming said sound

channels and being disposed symmetrically with respect to a radius common to all of said cylinders, said common radius being directed toward the source of primary sound.

12. The combination of a microphone and a plurality of sound-absorbent means having a plurality of sound-conveying channels therein, said absorbent means comprising a plurality of perforated felt cylinders concentrically surrounding said microphone, and felt spacing members positioned between said felt cylinders.

13. The combination of a microphone, a plurality of sound-absorbent means, a container and supporting and positioning means, said absorbing means and said container having sound-conveying channels therethrough, said absorbent means comprising a plurality of perforated felt cylinders concentrically surrounding said microphone, said container comprising a fibrous-material tube, said tube being also perforated for said sound channels.

14. The combination of a microphone, a plurality of sound-absorbent means, a container and supporting and positioning means, said absorbing means and said container having sound-conveying channels therethrough, said absorbent means comprising a plurality of perforated felt cylinders concentrically surrounding said microphone, said container comprising a solid fibrous-material tube, said tube being also perforated for said sound channels, said perforations forming said sound channels and being disposed symmetrically with respect to a radius common to all of said cylinders.

15. In combination, an auditorium including a part adapted for a program, a microphone, means associated with said microphone for hindering the arrival of sounds from certain directions, whereby the microphone is selectively sensitive to sounds from predetermined directions, and means for supporting the microphone and its associated means in such a position that the said predetermined directions are toward the part of the auditorium where the program is to be performed.

16. In combination, an edifice including a portion adapted for programs, a microphone, means for rendering the microphone selectively responsive to sounds from a predetermined direction and supports extending from the walls of the edifice for maintaining the microphone and said means in such position that said predetermined direction is toward the portion of the edifice where the program is to be performed.

In testimony whereof, I have hereunto subscribed my name this 17th day of March, 1924.

ALEXANDER NYMAN.