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Aug. 25, 1925. 1,550,724

F. A. HUBBARD

PUBLIC ADDRESS SYSTEM

Filed March 23, 1922

Fig. 1

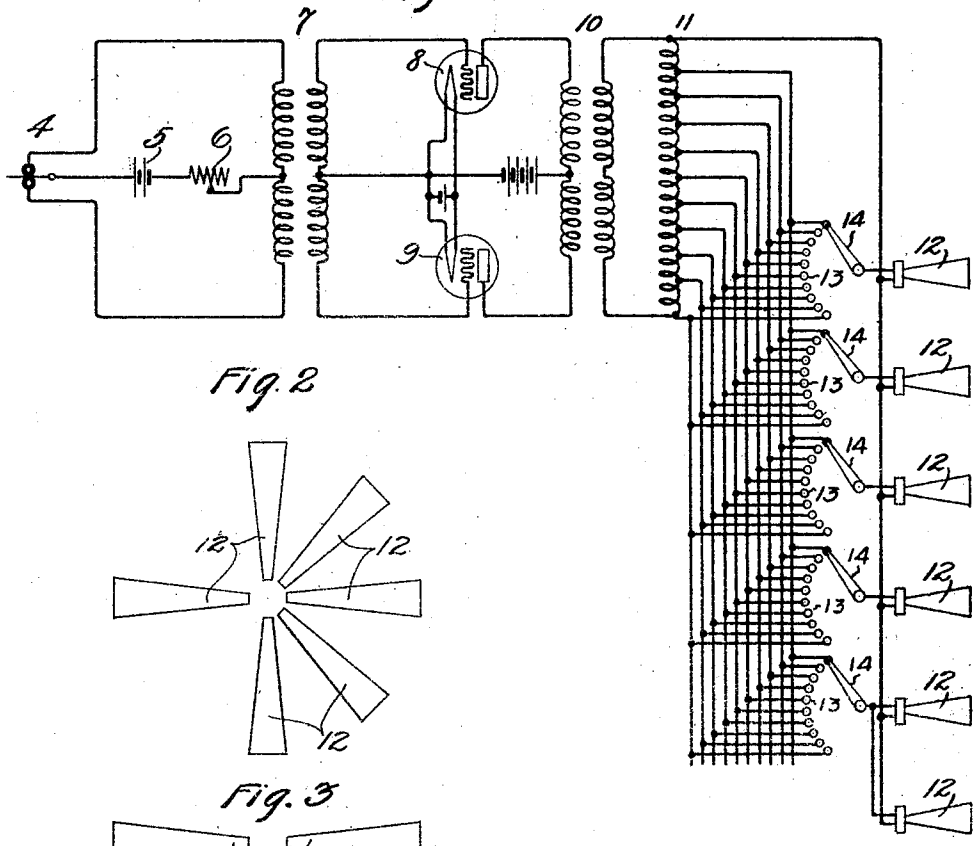
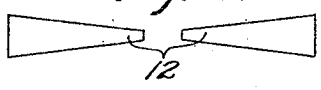
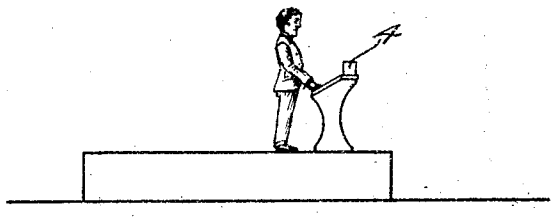


Fig. 2

Fig. 3





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UNITED STATES PATENT OFFICE.

FRANCIS A. HUBBARD, OF WEST ENGLEWOOD, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PUBLIC-ADDRESS SYSTEM.

Application filed March 23, 1922. Serial No. 545,993.

To all whom it may concern:

Be it known that I, FRANCIS A. HUBBARD, a citizen of the United States, residing at West Englewood, in the county of Bergen, State of New Jersey, have invented certain new and useful Improvements in Public-Address Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to electrical systems for the transmission of sound and particularly to those employing a plurality of loud speaker projectors for use in addressing or in entertaining audiences.

If loud speaking systems employing a plurality of loud speaking projectors were always used under ideal climatic and acoustical conditions, the projectors could advantageously be adjusted to the same volume. Although substantially ideal conditions may be provided so far as a speaker's voice is concerned, difficulties are encountered when his voice is highly magnified and distributed in all directions by loud speaker systems. Sound reflecting surfaces and objects ordinarily out of the speaker's voice range may be well within the projector's range and unless means are provided to control the volumes of the projectors, echoes and other interferences will result and materially interfere with the intelligibility and the proper distribution of the sound. This is true for both indoors and outdoors speaking.

It is also desirable to be able to control the volumes of the various projectors to compensate for the poor acoustics usually found in certain sections of auditoriums; and when the system is used outdoors to compensate for the direction and velocity of the wind. While it is desirable to adjust the projectors to give uniform distribution obviously in many cases this cannot be conviently accomplished. It is, therefore, necessary to adapt a loud speaking system to the surrounding conditions in order to produce satisfactory results.

An object of the invention is to provide a public address system with an efficient means for regulating the power delivered to the projectors.

Another object is to provide a public address system having a plurality of loud speaking projectors, the volumes of which may be varied in accordance with the climatic and acoustical conditions within the range of the projectors.

Other objects will appear hereinafter.

In general the invention comprises a transmitter connected to a plurality of loud speaking projectors through a multi-tap transformer for selectively and severally controlling the volumes of the projectors.

In the drawing, Fig. 1 represents schematically a loud speaker system embodying the invention.

Fig. 2 is a plan view of the projectors as installed.

Fig. 3 is an elevation of the arrangement shown in Fig. 2.

A high quality transmitter 4 is connected to the primary of a transformer 7. The transmitter 4 is preferably of the push-pull type disclosed in an application of G. R. Lum for Letters Patent Serial No. 570,970, filed June 26, 1922, which discloses a push-pull transmitter air damped in the manner shown in patent No. 1,456,538 of May 29, 1923 to I. B. Crandall. The diaphragm, or the common electrode, of the transmitter, is connected through a battery 5 and an adjustable resistance 6 to the neutral or central point of the primary, and the other electrodes are connected to the opposite ends. The secondary of the transformer is connected to the input of amplifiers 8 and 9 of an amplifying circuit such as disclosed in Patent No. 1,128,292, of February 16, 1915, to E. H. Colpitts, and the output circuit is connected to the primary of transformer 10, and the secondary of transformer 10 to an auto-transformer 11 having a plurality of taps which are connected to multi-point switches 13. One side of each projector 12 may be connected in common to one end of transformer 11, and the other side of each projector to a rotating arm 14 on the switch 13. With this arrangement, the power delivered to each projector may be accurately controlled with the minimum loss of energy and with efficient transform-

ers the energy loss between the output terminals of the amplifier and the projectors is negligible. Although the drawing shows an auto-transformer, it is obvious that the secondary of transformer 10 may be provided with taps and the auto-transformer omitted, and under certain conditions this may be the preferable arrangement. It should be noted in this connection that the output transformer 10 has two parallel primary windings and two parallel secondary windings with a common core, the secondary windings being superimposed upon the primary windings.

The projectors consist preferably of receivers of the type disclosed in Patent No. 1,365,890, January 18, 1921 to H. C. Egerton, equipped with suitable horns.

In an installation for reinforcing a speaker's voice and extending its range, the projectors may be arranged in a horizontal plane above the speaker, but are usually adjusted so as to be slightly lower at their open ends than at their receiver ends. The receiver ends are usually disposed as near as practical at the same point, the horns projecting radially therefrom. The center of the group of projectors is substantially above the speaker. The transmitter, or transmitters, as it may be desirable to use more than one in order to give the speaker more freedom, are located at any convenient place within the acoustical shadow of the projectors, that is, the region within the neighborhood of the projectors where the sound therefrom is substantially inaudible. This arrangement of the sound projectors and transmitter forms no part of the present invention, but it is disclosed and claimed in G. D. Edwards' application, Serial No. 560,507, filed May 12, 1922. Such an arrangement is important to prevent interference or howling between the transmitter and the projectors.

The invention also provides a convenient arrangement for eliminating transition losses. It is the practice to construct amplifiers to operate most efficiently on a fixed impedance load. For any other loads, therefore, a certain amount of energy is wasted, and in some cases, the energy so wasted in addition to the useful energy, would require a larger size amplifier. By providing a multi-tap transformer, and means for selectively and severally controlling the energy delivered to the loud speakers, the difference in the impedances of the amplifier and the load may be readily corrected by raising or dropping each receiver tap a given amount.

Figs. 2 and 3 represent schematically the relation of the speaker, the projectors, and the transmitter. The actual arrangement of the projectors, as well as their volumes, is dependent upon the distribution of the audience, and the acoustical characteristics of the surroundings. In the case of long distance transmission the audience depends entirely upon the projectors. In this case the projectors may be grouped as already described.

The invention claimed is:

1. A public address system comprising a plurality of loud speaking projectors, a voltage regulator common to said projectors and switching means individual to said projectors for selectively and severally controlling the volumes thereof, by altering the association of said common voltage regulator and said projectors.

2. A public address system comprising a transmitter, a plurality of loud speaking projectors a multi-tap transformer common to said projectors and switching means individual to said projectors for selectively and severally controlling the volumes thereof.

3. A public address system comprising a transmitter, a plurality of loud speaker projectors in parallel, a multi-tap transformer common to said projectors and switching means individual to said projectors for selectively and severally controlling the volumes thereof.

4. A public address system comprising a transmitter, a plurality of loud speaking projectors in parallel, a multi-tap transformer common to said projectors, and a plurality of multi-point switches connecting said projectors to said transformer.

5. A public address system comprising a transmitter, amplifiers, a plurality of loud speaking projectors, a multi-tap transformer common to said projectors, and switching means for selectively and severally controlling the volumes of said projectors.

6. A public address system comprising a transmitter substantially equally responsive to all voice frequencies for converting sound waves into electrical variations, substantially distortionless amplifiers for amplifying said electrical variations, a plurality of loud speaking projectors for translating the amplified electrical variations into sounds, a transformer common to said projectors and switching means for selectively and severally controlling the volumes of said projectors.

7. A public address system comprising a transmitter substantially equally responsive to all voice frequencies for converting sound waves into electrical variations, substantially distortionless amplifiers for amplifying said electrical variations, a plurality of loud speaking projectors in parallel, for translating the amplified electrical variations into sounds, a multi-tap transformer common to all projectors and a plurality of switches connecting said projectors to said transformer taps for selectively and severally varying the voltages across the projectors.

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8. In an electrical system for the transmission of sound, a transmitter substantially equally responsive to all sound waves, substantially distortionless amplifiers, a plurality of loud speaking projectors, a transformer having its primary connected to said amplifiers, a voltage regulator common to all projectors connected to the secondary of said transformer, multi-point switches for said projectors said switches connected in parallel to said regulator.

In witness whereof, I hereunto subscribe my name this 17th day of March A. D., 1922.

FRANCIS A. HUBBARD.