May 14, 1940. T. W. VARLEY 2,200,461

ANNOUNCING SYSTEM

Filed Feb. 24, 1938

FIG. 1.

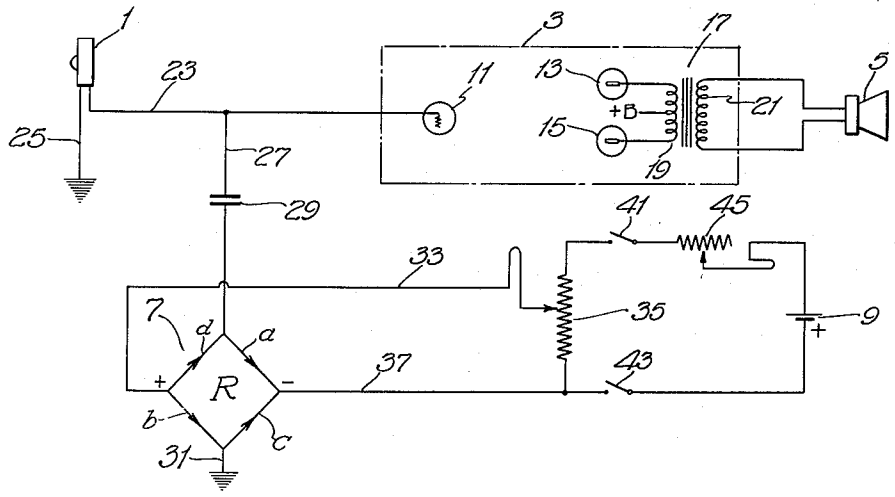
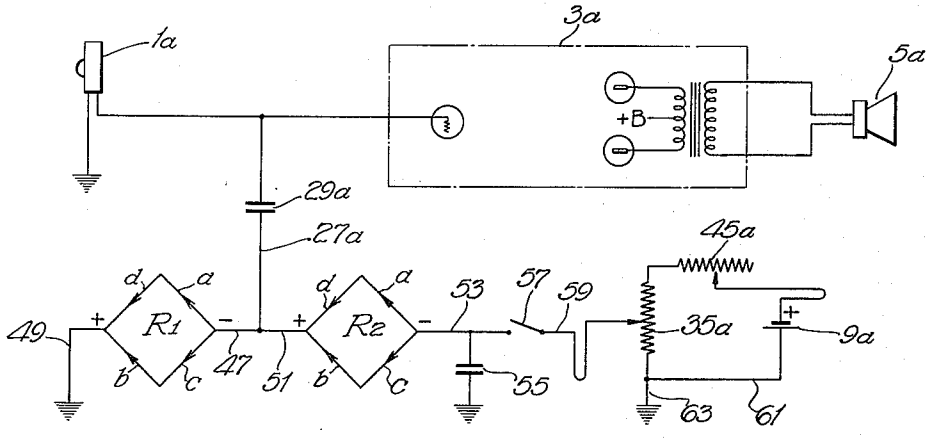


FIG. 2.



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ANNOUNCING SYSTEM

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5 Claims. (Cl. 179—1)

My invention relates to electronic systems of sound transmission and it has particular reference to so-called announcing or public address systems.

When systems of this class are employed within the confines of a single room or auditorium, they are subject in service to detrimental feed-back disturbances and resultant howling or squealing, which may be occasioned either by the microphone picking up the sounds emanating from the loud speaker or by other extraneous sounds and noise, which set up undesired and objectionable sustained oscillations in the system.

One of the objects of my present invention is to provide a system of the above indicated class, which is simple and inexpensive in arrangement and construction, which shall operate efficiently and effectively to amplify and deliver the origin message, be it speech or music, and which at the same time, shall positively obviate the possibility of sustained oscillations and feed-back disturbances.

More specifically, it is an object of my invention to provide the usual type of announcing system with a definite, positive and quickly responsive control feature, which shall function to prevent or to immediately suppress any feed-back disturbances which may tend to set up deleterious sustained oscillations in the system.

In an even more specific aspect, it is an object of my invention to secure the benefits and advantages above referred to through the provision of one or more rectifying devices, preferably of the so-called "Rectox" type, which are connected in shunt circuit relation to the microphone so as to bleed off from the amplifying tube any excess energy that may develop by reason of feed-back, whereby the building up of unwanted sustained oscillations is effectively obviated.

Another and still more specific object is to impress upon the rectifying device or devices an extraneous source of electrical energy in such manner as to render such devices particularly sensitive and effective for their intended purposes.

These and other objects and features of my invention may be better understood from the following description of the invention, in connection with the accompanying drawing, which merely illustrates certain preferred systems which typify and embody the fundamental principles of the invention.

In the drawing,

Fig. 1 is a diagrammatic view of a system embodying the invention and in which a single Rectox type rectifying device is employed, and which optionally includes an extraneous source of electrical energy which may be utilized if desired to augment and modify the action thereof, and

Fig. 2 is another diagrammatic view of a somewhat different system embodying a modification of my invention and in which two rectifying devices of the Rectox type are employed, and which may or may not include the use of an extraneous source of electrical energy to functionally influence the operation of the rectifying devices.

Referring to the drawing, and particularly to Fig. 1 thereof, my invention as illustrated therein comprises an announcing system including a microphone 1, an electronic amplifying unit 3, a loud speaker 5, a feed-back control feature 7 and, optionally, an auxiliary battery 9.

The microphone 1 and the speaker 3 may comprise any of the usual and well-known types of such devices as are suitable for the purpose.

The electronic amplifying unit 3 may be of any conventional type, having one or more stages of amplification, together with one or more power tubes, which, if desired, may be arranged in push-pull relation. In the drawing, for purposes of simplification, only the first amplifying tube 11 and the push-pull power tubes 13 and 15 are shown, together with the usual output transformer 17, the primary coil 19 of which is connected between the power tubes, while the transformer secondary coil 21 is connected to the speaker 5. The mid-point of the transformer primary coil 19 has a positive battery connection +B, in accordance with customary practice.

The input side of the amplifying unit 3 has its first amplifying tube 11 connected to the microphone 1 through conductor 23, while the other terminal of the microphone is connected to ground through conductor 25.

So far as already described, the system and operation is conventional, and it is deemed unnecessary to describe it further. Such a system is subject to disturbances and sustained oscillations set up by any unusual shock, extraneous noise, or feed-back.

In order to prevent such detrimental influences, I provide the control feature 7 which includes a rectifying device R which is preferably of the dry copper oxide type, known in the art as Rectox, such as that described in Patent No. 1,640,335, granted August 23, 1927, to Grondahl, although my invention is not limited to rectifiers of this specific class. This type of rectifying device is indicated diagrammatically in the drawing and

is marked with arrows in its several legs, as is conventional in the art, to indicate the direction of flow of current permissible therethrough, while the positive and negative terminals thereof are conventionally indicated by plus and minus signs.

The rectifying device R is connected in shunt to the microphone 1 by means of a conductor 27, preferably having a condenser 29 in circuit therewith, said conductor 27 being connected to the upper terminal of the rectifying device R which has its lower terminal connected by conductor 31 to ground. The positive terminal of the rectifier R is connected by means of a conductor 33 with an adjustable resistance 35, while the negative terminal is connected by conductor 37 to the lower end of the adjustable resistance 35.

Before describing the manner of connection and operation of the extraneous battery 9, which, while often desirable, is not essential to the operation of my system, I will set forth more fully the mode of operation of the system so far described.

Let us assume that the announcing system of my invention is functioning under normal conditions with the speaker, lecturer, or the like, within suitable pick-up distance from the microphone 1 and the generated electrical waves of alternating character being amplified by the electronic amplifier 3 and delivered at the desired volume through the loud speaker 5 into the room.

Since the rectifying device R is connected in shunt to the microphone 1 it is obvious that the electrical waves originating in the microphone 1 will tend to divide between that branch of the circuit including the amplifying unit 3 and that branch including the rectifying device R. The degree or amount of energy of the electrical waves which are permitted to pass to the amplifier tube 11, will depend upon the degree and amount of energy of these waves which is shunted or bled off to ground through the rectifying device R, and this in turn will depend upon the resistance of the rectifier R.

Now, one of the peculiar and characteristic features of a rectifying device of the Rectox type is that its internal resistance decreases as a function of an increased amount of current passing through it.

Having initially chosen a Rectox device of the proper resistance and capacity to meet the normal operating conditions of service, it is evident that a certain predetermined amount of current will pass through the Rectox, which therefore will have a certain definite resistance. Moreover, this current and resistance will remain substantially constant so long as the operation remains normal.

However, if some abnormality develops or occurs, such, for instance, as a tendency to feedback disturbances or some extraneous noise, which would start to develop sustained oscillations in the system, the control feature of my invention comes into action immediately to prevent or suppress in the incipient stages any tendency to oscillate.

Assuming, for instance, the initiation of setting up or building up sustained oscillations by reason feed-back, the operation is as follows:

The excess energy developed in the microphone circuit will cause an increased amount of current to flow through the rectifier circuit, which in turn will decrease the resistance of the Rectox device, which, of course, will permit even more current to flow. Thus, the energy through the amplifier unit will be restricted, and the development of oscillations prevented.

In the event that the shock or tendency to feedback develops during the positive portion of the electrical wave, the shunt current through the Rectox will traverse the conductor 27, condenser 29, leg *a* of Rectox, conductor 37, adjustable resistance 35, conductor 33, leg *b* of the Rectox and conductor 31 to ground. If the disturbance arises or continues during the negative portion of the electrical wave, the shunt current will pass from the ground through conductor 31, leg *c* of the Rectox, conductor 37, adjustable resistance 35, conductor 33, leg *d* of the Rectox, condenser 29 and conductor 27 to the conductor 23.

By suitably selecting the resistance of the Rectox and the adjustment of the resistance 35, the bleed off or dissipation of excess energy caused by any sudden shock or tendency to feed-back, will prevent or immediately suppress the development of feed-back or other troublesome oscillations.

Even superior results may be accomplished through the use of the extraneous source of electrical energy, such as battery 9, which may be utilized merely by closing switches 41 and 43, which serve to connect the battery 9 through an adjustable resistance 44 across the terminals of the adjustable resistance 35. Thus, a properly selected voltage may be impressed upon the active portion of resistance 35, and a predetermined amount of direct current passed through the Rectox R. The amount of this direct current may be so adjusted that, when added to the normal amount of shunt current from the alternating current wave, the total amount of current will be sufficient to reduce the resistance and cause the Rectox device to operate with greater sensitivity and effectiveness for the desired purpose. In other words, the Rectox resistance will have a sort of normal bias, so that it functions normally upon that portion of its characteristic current-resistance curve which is optimum for the desired result.

When biased to operate in this manner, any shock to the system will cause an increased amount of alternating current to flow through the Rectox, thus further lowering its resistance, which permits an additional amount of current to flow therethrough from the battery. In this way, the resistance is still further decreased which permits an added amount of alternating current energy to be shunted through the Rectox. Thus, the suppression of any tendency to oscillate is even more rapid and positive, and the possibility of sustained oscillations is prevented. Of course, no direct current from the battery 9 is permitted to pass through the condenser 29 to the microphone circuit.

If desired, the battery 9 may be replaced by means of a source of alternating current, preferably of a frequency above audibility, so as to break up or prevent the development of sustained oscillations within the range of audibility.

Referring now to Fig. 2, which shows a modified embodiment of my invention, a pair of rectifying devices, preferably of the Rectox type, are employed instead of a single device, as described in connection with Fig. 1.

In this form of the invention, the circuits of the microphone 1_a, electronic amplifier 3_a and loud speaker 5_a are the same as those already described. The control feature of my invention, however, includes two rectifiers R_1 and R_2 which

are connected in parallel between the common conductor 27_a and ground, as follows:

The lower end of conductor 27_a is connected to conductor 47 which is connected to the negative terminal of the Rectox device R_1, the positive terminal of which is connected by conductor 49 to ground, while the lower end of conductor 27_a is also connected by conductor 51 to the positive terminal of the Rectox device R_2, while its negative terminal is connected by conductor 53 and condenser 55 to ground.

With these circuit connections, any tendency to develop sustained oscillations by reason of feed-back or other disturbances, if occurring during the positive portion of the electrical wave, will cause an increased amount of current to pass through the shunt circuit including conductor 27_a, conductor 47 and in parallel paths through the legs *a*—*d* and *c*—*b* of the Rectox device R_1 and thence by conductor 49 to ground. On the other hand, if the disturbance occurs during the negative portion of the wave, the excess current will pass from ground through condenser 55, conductor 53 and in parallel paths through the legs *a*—*d* and *c*—*b* of the Rectox device R_2, and thence by conductor 51 to conductor 27_a.

The Rectox devices will, of course, function in their characteristic manner, as already explained, to bleed off and dissipate the excess energy tending to create undesirable oscillations within the system, and thus act to suppress and eliminate feed-back or other oscillation disturbances.

If desired, the operation may be further modified and the operation improved by the utilization of a separate battery 9_a. This may be accomplished by closing switch 57, thereby establishing an electrical connection between conductor 53 and conductor 59, which is connected by a variable or adjustable tap to resistance 35_a, the upper terminal of which is connected through an adjustable resistance 45_a to one side of the battery 9_a, while the other side is connected by conductor 61 to the lower terminal of resistance 35_a, which is also connected by conductor 63 to ground.

In this way, a selected and predetermined amount of direct current may be passed through the Rectox devices R_1 and R_2, which serves in the manner already described to bias the operation to the desired optimum portion of the characteristic resistance-current curve thereof.

By reason of the provision of the ground connection 63 in the form of the invention shown in Fig. 2, it is possible not only to utilize an extraneous or separate battery, such as 9_a, but, if desired, this source of current may comprise the usual +B source of energy which is employed in connection with the electronic amplifier unit, and which, therefore, may have a high voltage, such as that pertaining to the usual house current. Of course, if such a +B source of current be employed, the resistances 35_a and 45_a will necessarily be adjusted accordingly. Condenser 29_a is preferably employed in order to prevent the passage of direct current to the microphone circuit.

As described in connection with Fig. 1, under certain conditions, a high frequency source of alternating current may be employed in lieu of the extraneous source 9_a, but in such event, the ground connection including the condenser 55 should be eliminated.

Having shown and described my invention for illustrative purposes, as embodying more or less specific circuit arrangements and construction of the component parts, it should be understood that my invention is not so restricted and that many modifications may be made therein without departing from the spirit and scope of my invention. Therefore, only such limitations should be imposed as are indicated in the appended claims.

I claim as my invention:

1. An announcing system comprising a microphone, an electronic amplifying unit and a loud speaker, in combination with controllable means including a rectifier having a negative resistance-current characteristic connected in shunt relation to said microphone and electrically independent of the loud speaker circuit for preventing the development of sustained oscillations within the system.

2. An announcing system comprising a microphone, an electronic amplifying unit and a loud speaker, in combination with controllable means including a rectifier having a negative resistance-current characteristic connected in shunt relation to said amplifying unit and electrically independent of the loud speaker circuit for preventing the development of oscillations within the system and means for passing current from an extraneous source through said Rectox device.

3. An announcing system comprising a microphone, an electronic amplifying unit and a loud speaker, in combination with a plurality of rectifying devices having negative resistance-current characteristics connected in shunt relation to said microphone and in shunt relation to one another for dissipating any excess energy developing in said microphone, one of said devices operating upon the positive portions of the alternating current electrical waves and the other operating upon the negative portions thereof.

4. An announcing system comprising a microphone, an electronic amplifying unit and a loud speaker, in combination with a plurality of rectifying devices having negative resistance-current characteristics connected in shunt relation to said microphone and in shunt relation to one another for dissipating any excess energy developing in said microphone, one of said devices operating upon the positive portions of the alternating current electrical waves and the other operating upon the negative portions thereof and means for passing current from an extraneous source through both of said rectifying devices, whereby the development of sustained oscillations within the system is prevented.

5. An announcing system comprising a microphone, an electronic amplifying unit and a loud speaker, in combination with controllable rectifying means, having a negative resistance-current characteristic, connected in shunt relation to said microphone and electrically independent of the loud speaker circuit for bleeding off and dissipating alternating current electrical energy from the microphone circuit whenever it exceeds a predetermined normal amount whereby the energy transmitted to said amplifying unit is restricted to an amount which prevents the development of sustained oscillations in the system.

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