Dec. 28, 1948. H. F. OLSON ET AL 2,457,712

METHOD AND APPARATUS FOR NOISE CONTROL OF REPRODUCED SOUND

Filed Sept. 21, 1945 2 Sheets-Sheet 1

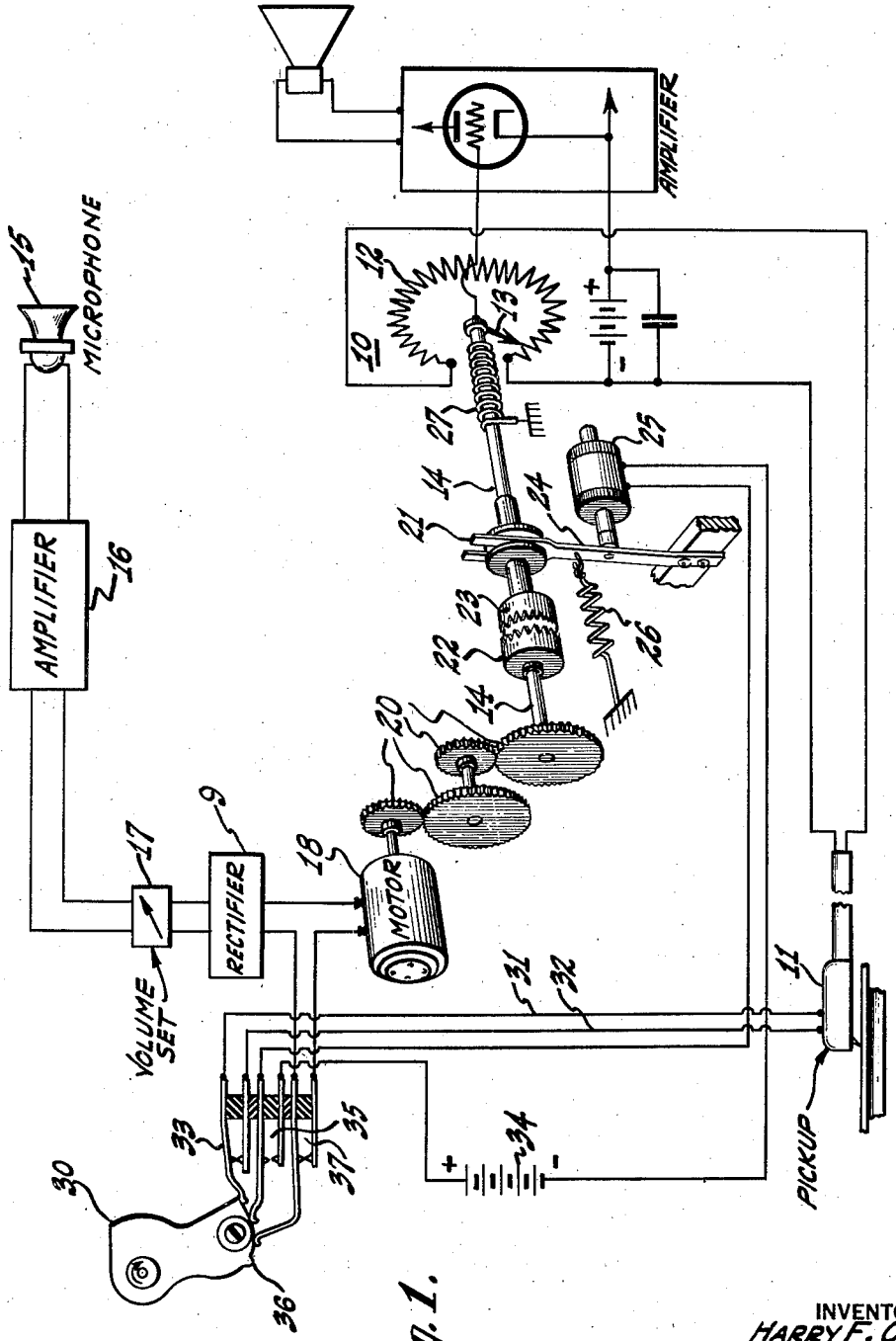


Fig. 1.

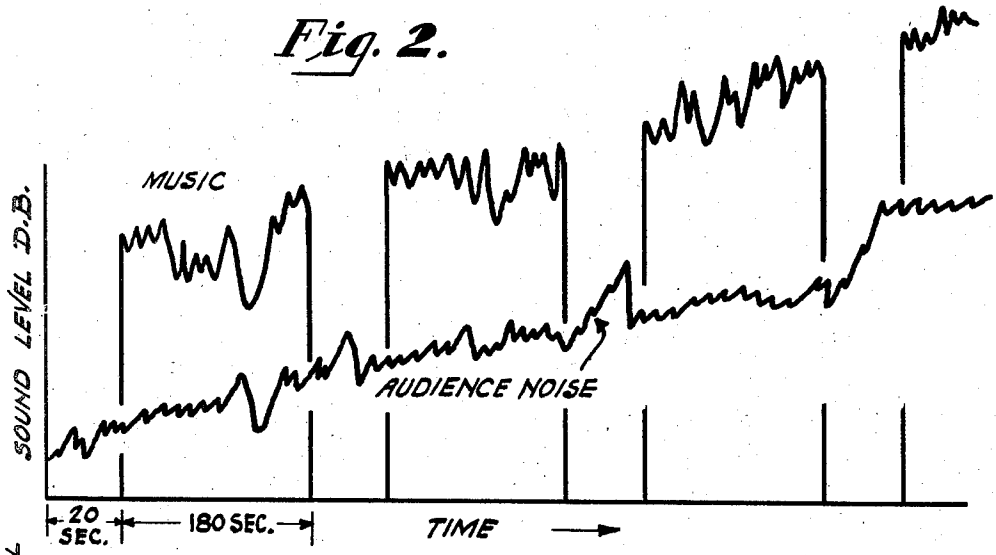
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Filed Sept. 21, 1945 2 Sheets-Sheet 2

Fig. 2.



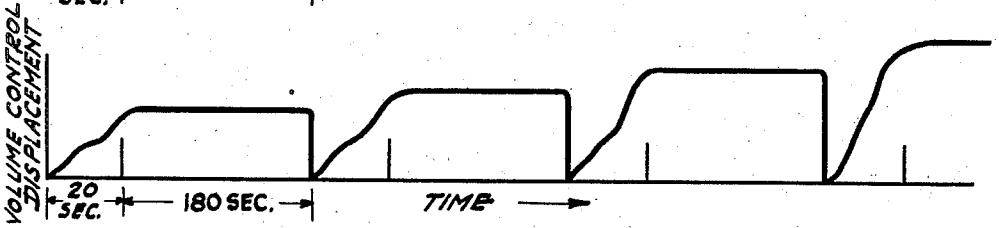


Fig. 3.

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Patented Dec. 28, 1948 2,457,712

UNITED STATES PATENT OFFICE

2,457,712

METHOD AND APPARATUS FOR NOISE CONTROL OF REPRODUCED SOUND

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Application September 21, 1945, Serial No. 617,858

4 Claims. (Cl. 179—1)

1

The present invention relates to phonographs and particularly to the control of sound output relative to ambient noise.

In the operation of phonographs, so called "juke boxes" and the like, and particularly in public places, the ambient noises are a highly disturbing factor to persons desirous of obtaining the benefit of the sound output of the phonograph. Thus, in one instance, the ambient noise may be of such a magnitude as to either drown out the sound entirely, or be so disconcerting that the output cannot be appreciated, and in another instance, the ambient noise may be of such minimum volume that the sound output becomes unbearably loud with the result the reproduction of the music or other reproduced sound loses that quality so necessary to the cultivated musical ear. For example, in public places the noise level increases as the number of people increase, so if the level is correct for an empty restaurant, then the music cannot be heard when the restaurant is filled.

Some of the objects of the present invention are: to provide a novel system of music to noise control; to provide means for maintaining automatically a predetermined difference in level between the sound output and the ambient noise in a sound reproducing system; to provide a control system for phonographs, magnetic wire recording and reproducing systems and the like wherein the output is automatically regulated as a function of the ambient noise; to provide a method of maintaining a predetermined difference in noise level between reproduced sound and ambient noise; to provide a means for and a method of regulating the sound output of a phonograph of the record-changer type during the intervals between the playing of the sound records whereby the next record will be played automatically at the selected level; and to provide other improvements as will hereinafter appear.

In the accompanying drawings, Fig. 1 represents diagrammatically a sound output-noise system embodying one form of the present invention; Fig. 2 is a sound level time graph; and Fig. 3 is a volume control displacement time graph.

Referring to the drawings, one form of the present invention consists of a volume control unit 10 of the type ordinarily employed in a phonograph for controlling the amplified sound as delivered from the pick-up 11 which rides in the sound track of prepared records. It is the purpose of the present invention to control automatically the output of the unit 10 as a function

2

of the ambient noise in the room where the phonograph is located.

In order to control the volume unit 10 so that the difference in level between the phonograph sound output and the ambient noise is constant, the circuit of the volume unit 10 includes a potentiometer 12 having a control pointer 13 fixed to a split shaft 14 which is arranged to be turned and set by a novel proportioning system functioning in response to ambient noise received by a microphone 15 and amplified by an amplifier 16. The output of the amplifier 16 is set to a selected sound level by an auxiliary volume control 17 having its output in a circuit including a motor 18 of the type wherein the motor speed is proportional to the voltage input. A rectifier 9 is provided when a D.-C. motor is used. If an A.-C. motor is used the rectifier is not required. During this sampling of the ambient noise the phonograph pick-up 11 is automatically rendered inoperative but is restored to operation at the conclusion of the sampling step. The shaft 14 is arranged to be driven by the motor 18 through the medium of reduction gearing 20. A clutch 21, the latter having one toothed member 22 keyed to one of the meeting ends of the shaft 14 and having the other toothed member 23 keyed for sliding movement on the other of the meeting ends of the shaft 14. This latter member 23 includes a portion which is circumferentially slotted to receive the forked end of the clutch actuating lever 24, which is suitably pivoted to a fixed part. This lever 24 is arranged to engage and disengage the clutch 21 by a solenoid 25 and spring 26.

For returning the potentiometer pointer 13 to zero for setting to a new volume control, a torsion spring 27 is attached at one end to the shaft 14 and at the other end to a fixed point so that in unclutched condition the spring 27 biases the pointer 13 to its zero position.

From the foregoing it will be seen that the cycle of operation includes a means for rendering the pick-up inoperative, a means for setting the volume control to zero, a means for sampling the ambient noise and setting the volume control proportioned to such ambient noise, and means for restoring the pick-up to operation and thereby reproducing the sound at the required level in accordance with the set position of the volume control. The foregoing means are all automatically controlled by the operation of a cam 30 of a record changer as set forth in United States patent to Thompson, No. 2,012,326, reference to which may be had to supplement the present description.

For controlling the operation of the pick-up 11 conductors 31 and 32 terminate respectively at opposite sides of a contactor switch 33, which is open during the playing of records, but closed to short circuit the pick-up 11 when the ambient noise is being sampled. The switch 33 has its contactor in the path of the cam 30 which is timed to engage the contactor at the proper time in the cycle as will be understood.

For controlling the operation of the clutch 21, the solenoid 25 is in a circuit including a battery 34 and a contactor switch 35, this latter having its contactor extending into the path of a projection 36 carried by the cam 30, and the operation is such that when the projection 36 snaps past the contactor, the switch 35 momentarily closes the solenoid circuit so that the clutch lever 24 disconnects the clutch 21 whereupon the torsion spring 27 returns the volume control pointer to zero. Immediately thereafter the solenoid is de-energized and the spring 26 shifts the lever 24 to reengage the clutch 21 ready to reset the pointer for the next sampling noise level.

For controlling the switching in and out of the ambient noise sampling unit, a contactor switch 37 is included in the sampling circuit for the motor 18 and has its contactor arranged in the path of the cam 30, the timing position being such as to close the noise sampling circuit just after the volume control 10 has been set to zero and while the pick-up circuit is short circuited.

Thus, the noise sampling circuit and the pick-up circuit are alternately operated in such a manner that after each record is played the ambient noise is sampled and the volume control set accordingly. The operation and steps of the method are as follows: Assuming a record has just finished playing, the cam 30 of the record changer will cause the projection 36 to actuate the switch 35 so that the solenoid 25 is energized long enough to release the clutch 21 and thus allow the torsion spring 27 to return the pointer 13 to zero. Immediately thereafter the cam 30 operates the switch 33 to short circuit the pick-up 11, while switch 37 is closed by the cam 30 to close the circuit of the motor 18 and connect the sampling unit for a period of, say, five seconds. During this interval motion is transmitted through the gearing 20 and clutch 21 to the potentiometer pointer 13, which is moved to the required position as determined by the ambient noise level. After this setting of the volume control, the cam 30 moves beyond the switch contactor so that the switches are automatically returned to again bring the pick-up 11 into operation and to render the sampling circuit ineffective. This cycle is repeated after each record so that there is alternate sampling of ambient noise and playing of the records.

While in the foregoing a separate amplifier is provided for the sampling microphone, the invention contemplates having a common amplifier for the microphone and for the phonograph, in which case additonal switching means are to be provided whereby at the proper time in the cycle the common input amplifier can be alternately connected to the output of the microphone and the output of the phonograph pickup. Thus, at the time the motor 18 is to operate, the amplifier output circuit would be switched from the phonograph output to the microphone output.

We claim, as our invention:

1. Apparatus for regulating the difference in level between reproduced sound and ambient noise, comprising the combination of a phonograph volume control, an electrical circuit including a pick-up for reproducing sound from a record, a microphone responsive to ambient noise, means for translating ambient noise received by said microphone into electrical energy, means operated by said energy for setting said volume control proportionately to the ambient noise, and selective switching means automatically operable for alternately connecting said setting means and said pick-up to said volume control.

2. Apparatus for regulating the difference in level between reproduced sound and ambient noise, comprising the combination of a phonograph volume control, an electrical circuit including a pick-up for reproducing sound from a record and also including said volume control, a microphone responsive to ambient noise, means for translating ambient noise received by said microphone into electrical energy, means operated by said energy for setting said volume control proportionately to the ambient noise, a record changer, and means operated by said record changer for alternately connecting said setting means and said pick-up to said volume control.

3. Apparatus for regulating the difference in level between reproduced sound and ambient noise, comprising the combination of a phonograph volume control, an electrical circuit including a pick-up for reproducing sound from a record, said circuit also including said volume control, means including a microphone and an amplifier for translating ambient noise into electrical energy, means for setting said volume control to zero output, means operated by said energy for setting said volume control proportionately to the ambient noise, means for rendering said pick-up inoperative during the operation of said setting means, and means to render said pick-up operative after the volume setting means has functioned.

4. Apparatus for regulating the difference in level between reproduced sound and ambient noise, comprising the combination of a phonograph volume control, an electrical circuit including a pick-up for reproducing sound from a record, said circuit also including said volume control, means including a microphone and an amplifier for translating ambient noise into electrical energy, means for setting said volume control to zero output, means operated by said energy for setting said volume control proportionately to the ambient noise, means for rendering said pick-up inoperative during the operation of said setting means, and means to render said pick-up operative after the volume setting means has functioned, said last three means being controlled by a record changer.

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