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APPARATUS FOR REVERBERATING SOUNDS

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Fig: 1

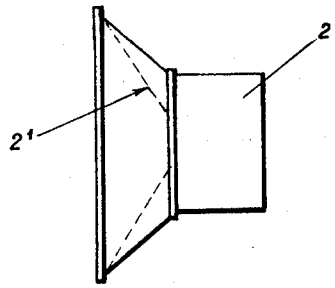


Fig: 2

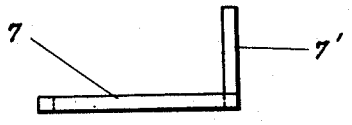


Fig: 2a

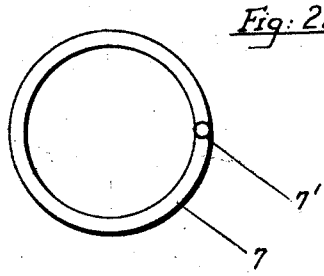


Fig: 4

Fig: 5

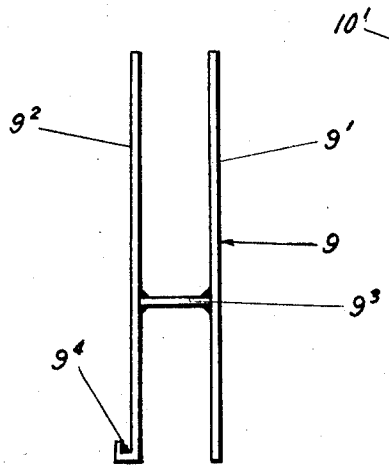
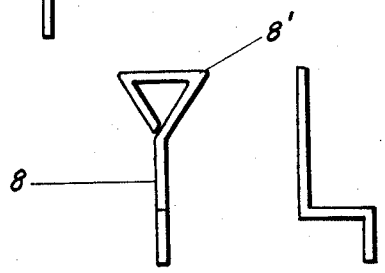


Fig: 3



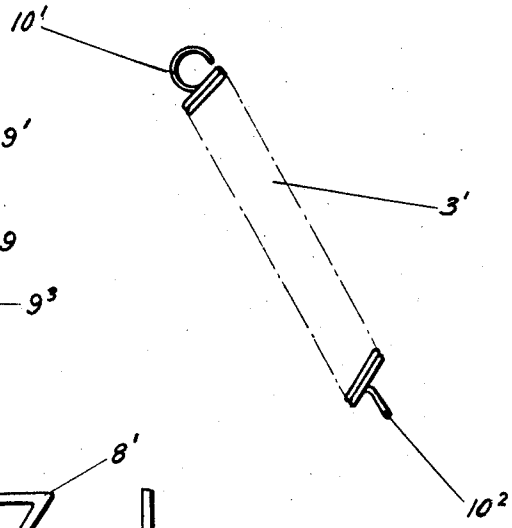


Fig: 3a

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Fig. 6

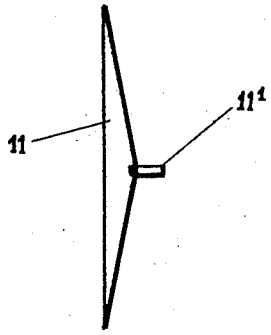

Fig. 6a

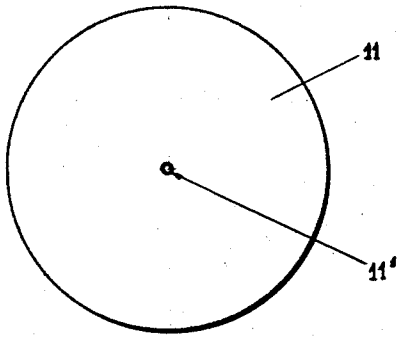

Fig. 8

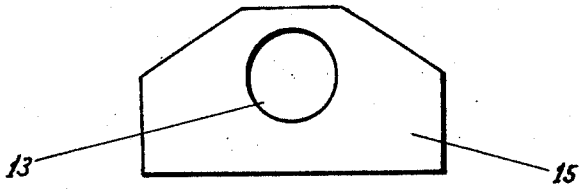

Fig. 7

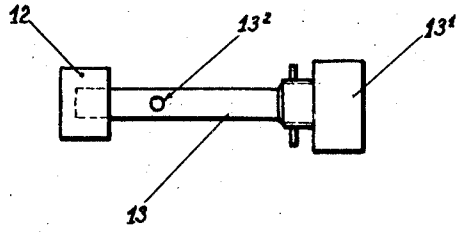

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Fig. 9

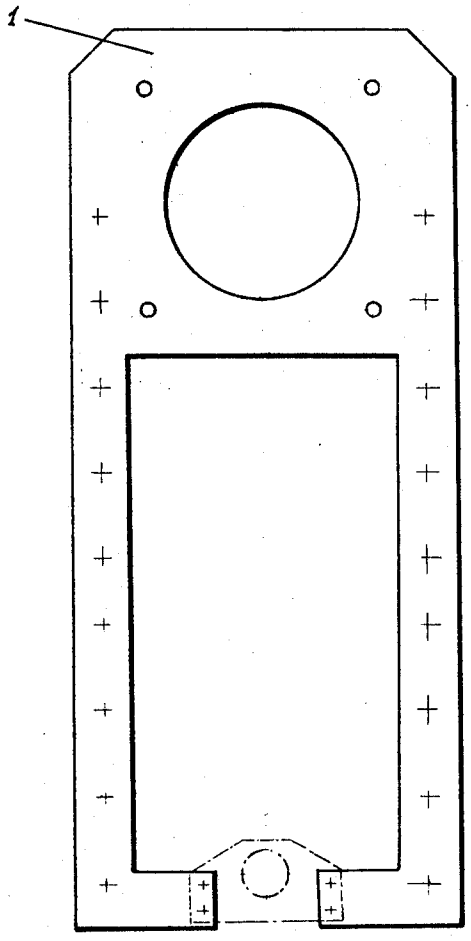

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Fig: 9a

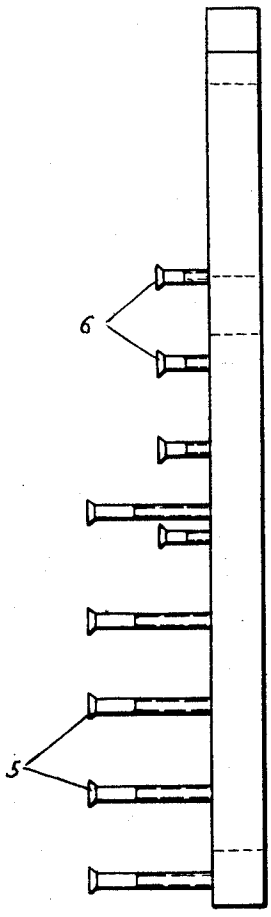

Fig: 9b

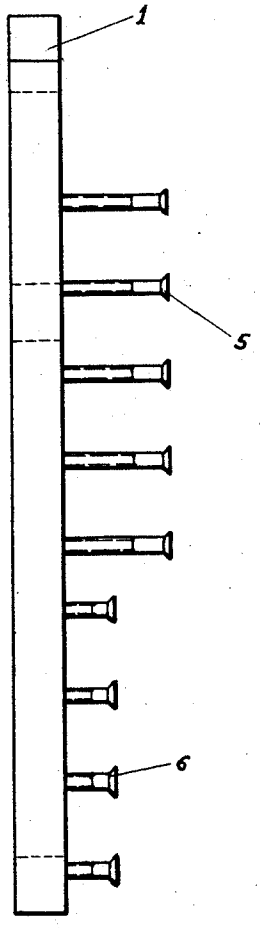

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Fig: 10

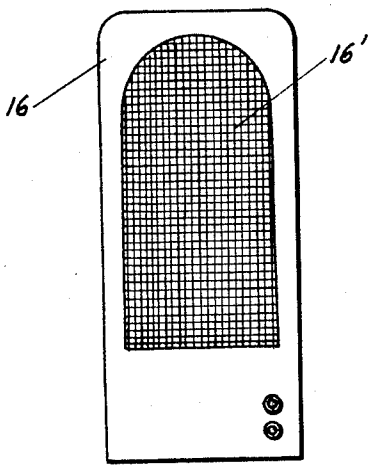

Fig: 10a

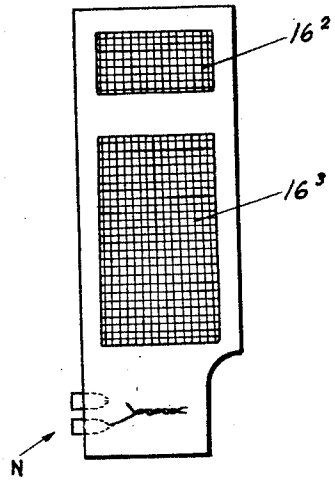

Fig: 11

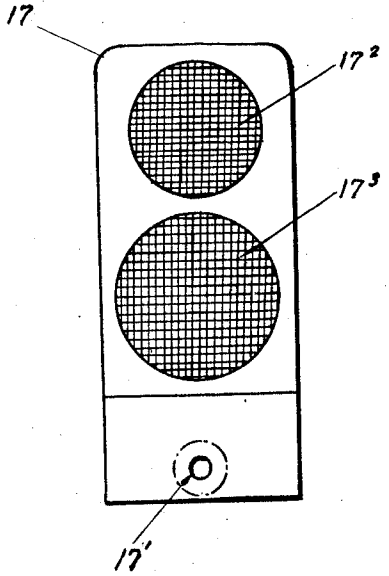

Fig: 11a

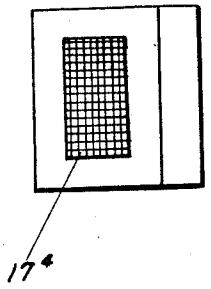

Fig: 11b

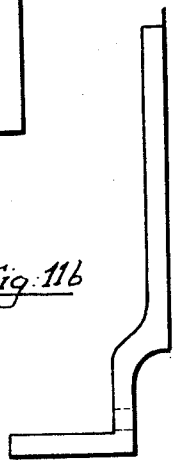

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Fig. 12a

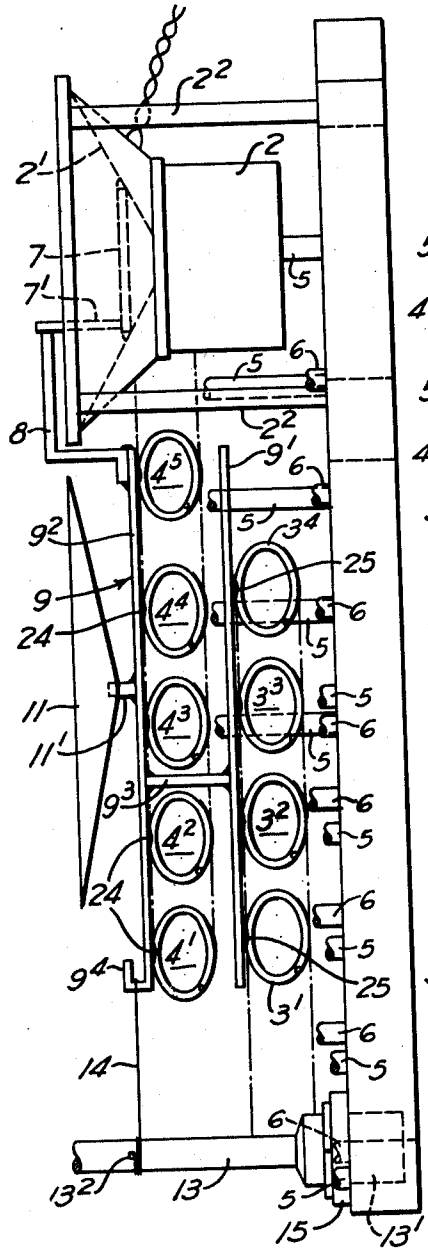
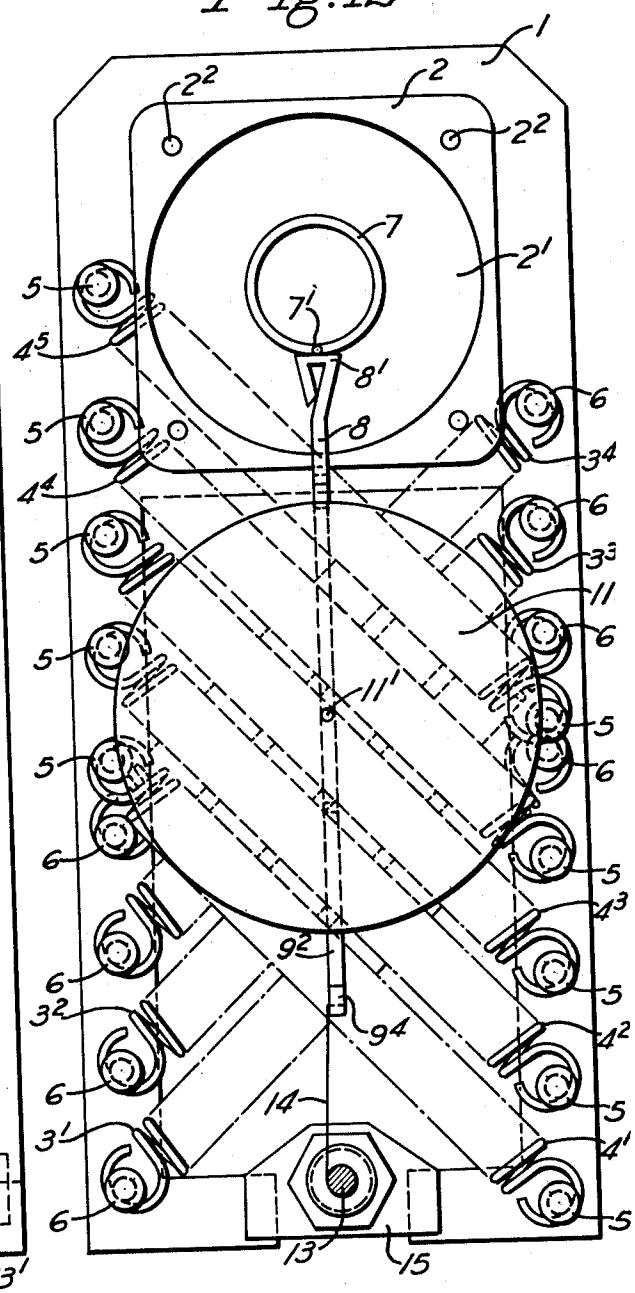


Fig. 12



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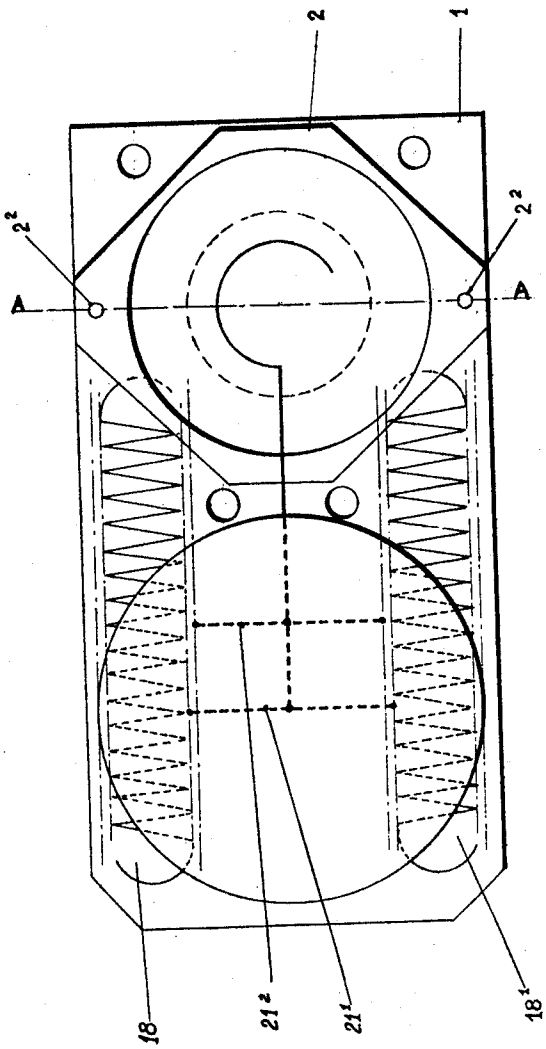

Fig 13

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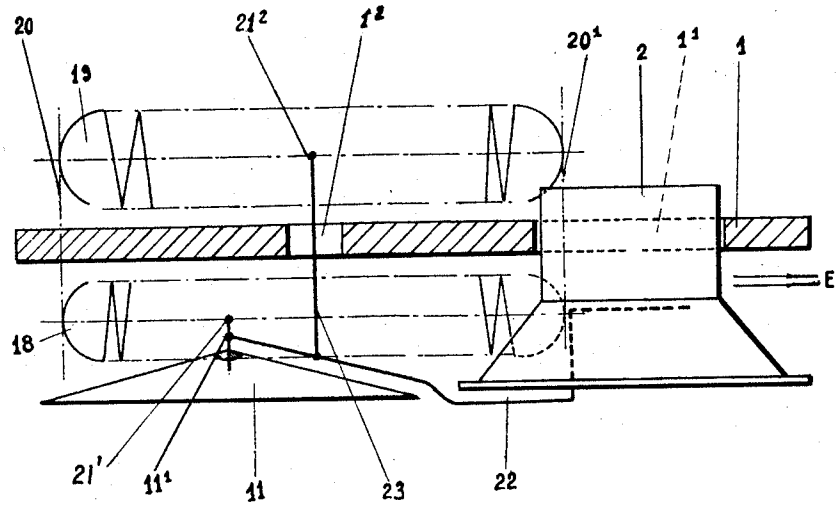
Fig 14



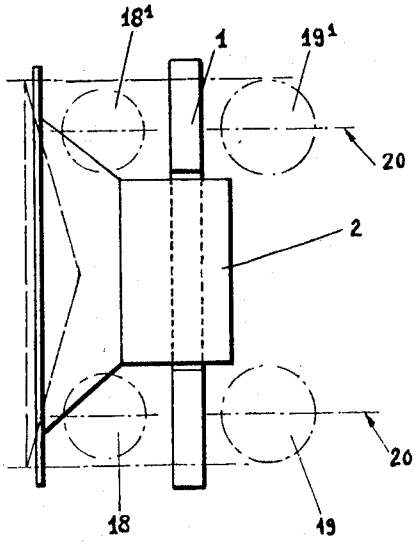


Fig 15

United States Patent Office 3,152,660 Patented Oct. 13, 1964

3,152,660

APPARATUS FOR REVERBERATING SOUNDS

Weber Louis Rehde, Bavans (Doubs), France

Filed Oct. 17, 1961, Ser. No. 145,666
Claims priority, application France, Nov. 30, 1960, 1,429, Patent 1,290,146; Aug. 3, 1961, 869,962, Patent 80,185

11 Claims. (Cl. 181—31)

The present invention has the purpose of producing a microphone enabling sound vibrations converted into mechanical vibrations to be maintained in a decreasing manner.

Another purpose of the invention is to produce, in a simple manner, an artificial sound reverberation, whatever the sound equipped hall may be.

Another purpose of the invention is to produce a reverberating microphone of particularly strong structure.

Other purposes and advantages of the invention will be revealed in the following description and the attached drawings, in which:

FIGURE 1 is a side view of a microphone.

FIGURE 2 is a side view of the resonance ring attached to the movable diaphragm of the microphone.

FIGURE 2*a* is a front view of the resonance ring.

FIGURE 3 is a front view of the rod connected to the resonance ring.

FIGURE 3*a* is a side view of the rod.

FIGURE 4 is a side view of the rod assembly holding the various springs together.

FIGURE 5 is a side view of a spring used for maining mechanical vibrations.

FIGURE 6 is a side view of the diaphragm connected to the springs, picking up sound vibrations.

FIGURE 6*a* is a rear view of the diaphragm.

FIGURE 7 is a side view of the controlling device for regulating the reverberation degree of the sounds.

FIGURE 8 is a front view of the support-plate of the knob for controlling the reverberation degree of the sounds.

FIGURE 9 is a front view of the support-plate of the microphone and springs.

FIGURE 9*a* is a side view of the support-plate, showing the rods supporting the springs which are attached to the right-hand side of the support-plate of FIGURE 9.

FIGURE 9*b* is a side view of the support-plate, showing the rods supporting the springs which are attached to the left-hand side of the support-plate of FIGURE 9.

FIGURE 10 is a front view of the casing of a reverberating microphone.

FIGURE 10*a* is a right-hand view of FIGURE 10.

FIGURE 11 shows a rear view of the removable cover mounted on the back of the casing of FIGURES 10 and 10*a*.

FIGURE 11*a* is a view seen from below the cover of FIGURE 11.

FIGURE 11*b* is a side view of the cover.

FIGURE 12 shows a front view of the mechanism of the reverberating microphone.

FIGURE 12*a* is a right-hand view of FIGURE 12, but with the spring-supporting rods broken off and the springs broken away at their centers for clearness.

FIGURE 13 shows a view from the front of another form of embodiment of the reverberating microphone.

FIGURE 14 shows in diagrammatical longitudinal section the reverberating microphone of FIGURE 13.

FIGURE 15 is a section taken along A—A of FIGURE 13.

The reverberating microphone shown in FIGURES 1 to 12 and 12*a* consists of a support-plate **1** on to which the dynamic microphone **2** is fixed (see FIGURE 12) as well as the springs 3_1, 3_2, 3_3, 3_4, 4_1, 4_2, 4_3, 4_4, 4_5.

This microphone **2**, possessing a movable diaphragm 2_1 is fixed on the support-plate by means of rods 2_2 passing through opening made in this microphone.

The springs 3_1 to 3_4 and 4_1 to 4_5 can be arranged parallel or form an angle in relation to each other.

In the example of embodiment of FIGURES 1 to 12 the springs 3_1 to 3_4 form an angle with the springs 4_1 to 4_5, which is the preferred arrangement.

These springs are fixed on the support-plate by means of rods **5** and **6**. These rods **5** and **6** have two lengths, the rods **5** being longer than the rods **6** and enable the springs 4_1 to 4_5 on the one hand, and 3_1 to 3_4 on the other, to be fixed in two stages.

On the movable diaphragm 2_1 of the microphone **2** a resonance ring **7** is fixed having a part 7_1 bent in a right angle, in relation to the plane of the resonance ring **7** (see FIGURES 12 and 12*a*).

This resonance ring **7** is fixed by soldering or any other means to the movable diaphragm 2_1 of the dynamic microphone. A rod **8** (see FIGURES 3 and 3*a*) having a triangular part 8_1 at one of its ends, is fixed to the part 7_1 of the resonance ring **7**, in order to establish the mechanical liaison between this resonance ring **7** and the element **9** connected to the springs.

This element **9** (see FIGURE 4) consists of two parallel rods (9_1 and 9_2) joined by a rod 9_3 fixed by soldering. A hook 9_4 is formed at one of the ends of the rod 9_2 which acts for fixing the wire for regulating the degree of sound reverberation.

The rod 9_1 of the element **9** is connected, such as by solder **25** or the like, to the central parts of a series of parallel springs 3_1, 3_2, 3_3, 3_4, whereas the branch 9_2 is connected in the same manner (solder **24**) to the central parts of the other series of parallel springs 4_1, 4_2, 4_3, 4_4, 4_5, it being understood that these two series of springs form an angle between them.

These springs are, for example, spiral springs (see FIGURE 5) and comprise hooks 10_1, 10_2 at their ends for hooking them on to the rods **5** or **6**.

On the rod 9_2 of the element **9** there is also a movable diaphragm **11** fixed (see FIGURES 6 and 6*a*), which is intended to pick up sound vibrations and convert these sound vibrations into mechanical vibrations.

The fixing of this diaphragm **11** on to the rod 9_2 of the element **9** takes place by a connecting rod 11_1 which is fixed by soldering or any other means, on the one hand, to the center of the diaphragm **11**, and on the other, on the rod 9_2.

By reason of this mounting of the movable diaphragm **11**, it is suspended by the various springs through the intermediary of the rods 9_1 and 9_2 and the connecting rod 11_1 (see FIGURES 12 and 12*a*).

The regulation of the degree of reverberation of sounds is obtained through a knob **12** mounted at the end of a spindle **13**. This spindle **13** can, for example, be formed by the control rod of a potentiometer 13_1. There is a hole 13_2 in this spindle **13** into which a wire or cable **14** is fixed.

The free end of this wire **14** is fixed on the hook 9_4 of the rod 9_2, which enables, by turning the knob **12**, the winding of the wire **14** on the spindle **13** and thus more or less stretch the wire or cable **14**.

The pull of the wire **14** is transmitted to the springs 3_1 to 3_4 and 4_1 to 4_5 through the element **9**, consequently enabling the pull and also the elasticity of the springs to be varied. The pull on rods 9_1 and 9_2 is slight. The pull on the diaphragm is equally weak and, besides, is in a transverse direction so that there is practically no reaction on the microphone. The only real effect is on the springs, the mechanical vibrations of which are thereby limited or attenuated, especially when those vibrations attain a certain amplitude. By this device, it is thus pos-

sible to modify the degree of reverberation of sounds or sound echoes produced by this microphone.

The potentiometer 13_1 is fixed on the support-plate 1 by means of a small plate 15 fixed on the support-plate 1 by screws or other means.

The mechanism of the reverberating microphone, shown in FIGURES 12 and 12*a* is placed in a casing 16, whose walls are provided with openings 16_1, 16_2 and 16_3 masked by canvas, which enables the user to attack the diaphragm 11 and the movable diaphragm 2_1 of the microphone by speaking in front of these canvases 16_1, 16_2, and 16_3. The rear face 17 of this casing 16 is removable and is fixed on the casing 16 by means of a screw housed in an aperture 17_1 in the removable cover 17. On this cover 17 there are also several openings 17_2, 17_3, 17_4, for the free passage of sound vibrations.

This device thus enables the maintaining, in a decreasing manner, of sound vibrations which are converted into mechanical vibrations by the diaphragm 11 and conveyed by the connecting rods 9_2, 8 and 7, to the dynamic microphone 2, which converts the mechanical vibrations into alternating current. Actually, when the user speaks in front of the casing of the reverberating microphone, the sound vibrations are picked up by the diaphragm 11 and the movable diaphragm 2_1 of the microphone 2. In this manner, the mechanical vibrations of the diaphragm 11 maintain the mechanical vibrations of the diaphragm 2_1 of the microphone.

The reverberating microphone shown in FIGURE 13 also consists of a plate of wood or similar material on which the various elements are placed forming this reverberating microphone.

There is an aperture 1_1 in this plate inside which the rear part of the dynamic microphone 2 is housed. This dynamic microphone 2 is also fixed to the small plate 1 by means of screws (not shown) placed at 2_2.

Four springs 18, 18_1, 19, 19_1 are fixed to this plate 1 by means of rods diagrammatized at 20, which pass through the small plate 1. In this way, each rod 4 can maintain one of the springs at its two ends.

This reverberating microphone thus uses four springs which are placed parallel to one another.

Two of these springs 18 and 18_1 are placed on the upper face of the plate 1, the two others, 19 and 19_1 are placed on the lower face.

The two springs 18 and 18_1 placed on the upper face of the plate 1 are connected to each other by a metal rod 21_1.

Likewise, the two springs 19 and 19_1 placed on the lower face of the plate 1 are connected to each other by a metal rod 21_2.

The rods 21_1 and 21_2 connecting the springs are fixed on these springs by soldering or any other means.

The varnished cardboard diaphragm 11 is placed near to the microphone 2. This diaphragm 11 comprises an attachment cap or a metal rod 11_1 which connects this diaphragm 11 to the rod 21_1 connecting the two springs 18 and 18_1. This rod 11_1 is also connected to the movable diaphragm 2 of the microphone by means of a rod 22 which terminates at the side of the microphone by a resonance ring fixed by soldering to said diaphragm. On this rod 22 connecting the diaphragm 11 to the microphone 2 there is also a rod 23 fixed holding the rods 21_1 and 21_2 together integral with the springs placed on each of the faces of the plate 1. This rod 23 passes through an aperture 1_2 in the support-plate 1. In this way, the four springs, 18, 18_1, 19 and 19_1 vibrate simultaneously, transmitting these vibrations to the diaphragm of the microphone 2.

This microphone operates in the following manner:

When the user speaks in front of the microphone 2, the sounds also strike on the diaphragm 11, which transmits the mechanical vibrations coming from the sound to the springs 18, 18_1, 19 and 19_1. In their turn, these springs begin to vibrate, as they are connected to the

diaphragm of the microphone by means of the rods 22 and 23, these vibrations being also transmitted to the microphone, so as to produce the reverberating or echo effect sought.

The initial sounds are thus maintained during a certain time and in a decreasing manner; however, the degree of reverberation of the sounds will be determined according to the characteristics of the springs, the pull of the latter between their attachment points, and also according to the characteristics of the diaphragm 11 which picks up the sounds.

This reverberating microphone is quite easy to make, enabling an artificial reverberation to be obtained, no matter what kind of sound installation may be in a hall, it being only necessary to connect up any kind of amplifier to the output of the microphone 2 to obtain the power required.

What I claim is:

1. In reverberating apparatus, a microphone having a movable diaphragm, a support, springs fastened by their ends to the support, a second diaphragm for picking up sound vibrations, and means connecting both diaphragms with the middle points of the springs.

2. In reverberating apparatus according to claim 1, movable means carried by said support and operatively connected with said springs for regulating the degree of sound reverberation.

3. In reverberating apparatus, a microphone having a movable diaphragm, a support, springs fastened by their ends to the support, rods connecting the middle points of the springs, a second diaphragm for picking up sound vibrations, and means connecting both diaphragms with said rods.

4. In reverberating apparatus according to claim 3, a spindle rotatably mounted on said support, a wire connected to said rods and wound on said spindle, and a knob rigidly mounted on the spindle for turning it to regulate the degree of sound reverberation.

5. In reverberating apparatus, a microphone having a movable diaphragm, a support, springs fastened by their ends to the support, springs fastened by their ends to the support, rods connecting the middle points of the springs, a second diaphragm for picking up sound vibrations, said second diaphragm being connected to said rods, and a resonance ring mounted on said microphone diaphragm and connected with said rods.

6. In reverberating apparatus according to claim 5, said springs being arranged in two spaced stages, one of said rods being connected to the springs in one of said stages, and another of said rods being connected to the springs in the other stage.

7. In reverberating apparatus according to claim 6, said stages being parallel.

8. In reverberating apparatus, a microphone adapted to be connected to an amplifier and having a diaphragm exposed to vibration by sound waves, a support adjacent the microphone, spring means having ends connected to said support, a substantially stiff member fastened to the central portions of the spring means and to said diaphragm, and a second diaphragm carried by said stiff member and exposed to vibration by said sound waves so as to vibrate said member and spring means, whereby said microphone diaphragm is vibrated by said stiff member also.

9. In reverberating apparatus according to claim 8, adjustable means flexibly connected with said stiff member for damping the vibrations thereof.

10. In reverberating apparatus, a microphone adapted to be connected to an amplifier and having a diaphragm exposed to vibration by sound waves, a support adjacent the microphone, a plurality of springs spaced from said support and having ends, means connecting said spring ends to the support, a resonance ring fastened to said diaphragm, rod means rigidly connected to said ring and extending away from the microphone, means fastening

the central portions of the springs to said rod means, and a second diaphragm carried by said rod means and exposed to vibration by said sound waves so as to vibrate said rod means and springs, whereby said microphone diaphragm is vibrated by said ring also.

11. In reverberating apparatus according to claim 10, a wire connected to said rod means remote from the microphone, and means connected with said support and wire for varying the tension on the wire to regulate the degree of vibration of the rod means and springs.

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