Nov. 3, 1931. F. L. HETZEL 1,829,991

SOUND AMPLIFYING SYSTEM

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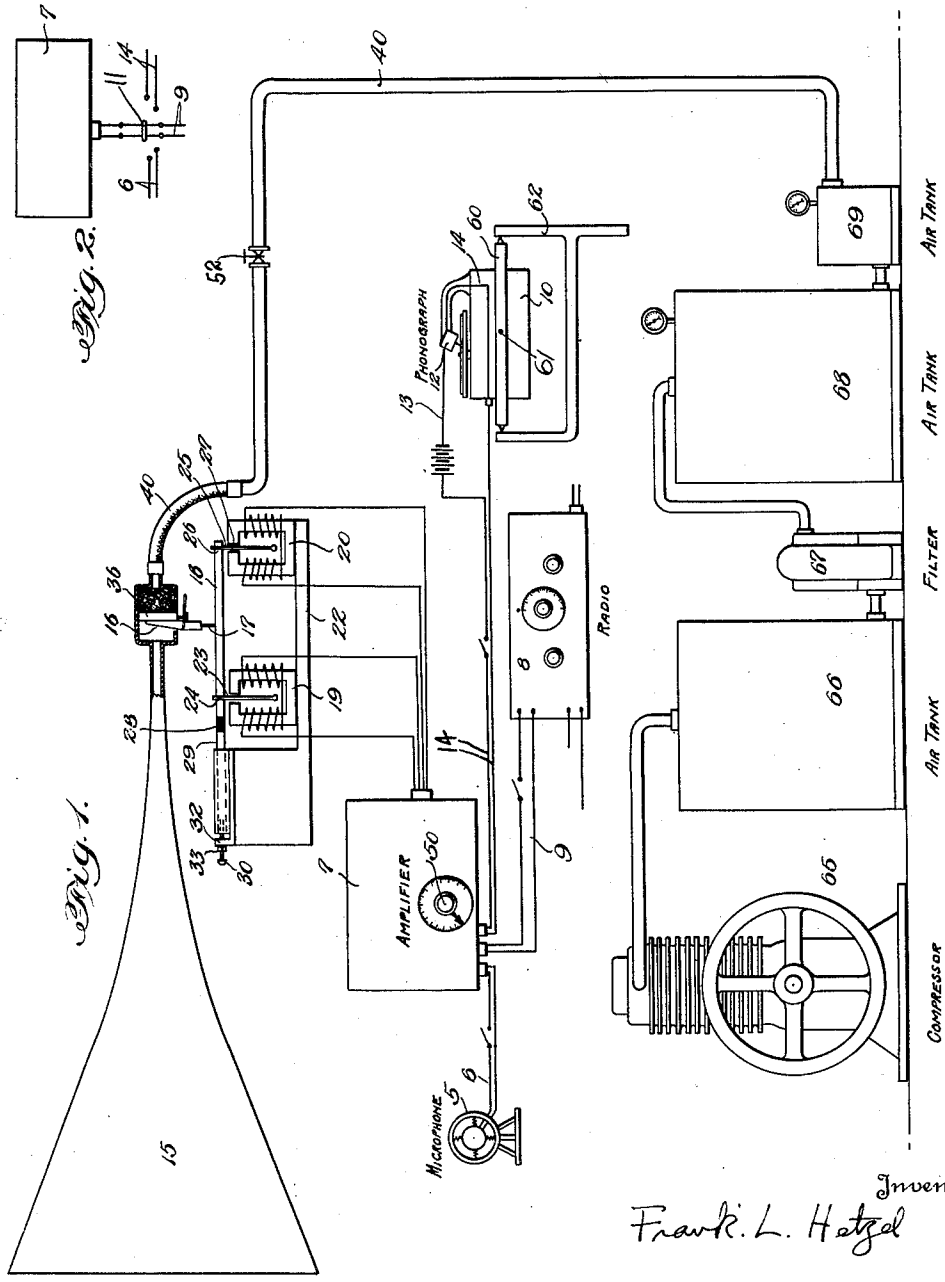


Fig. 1.

Fig. 2.

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Fig. 3.

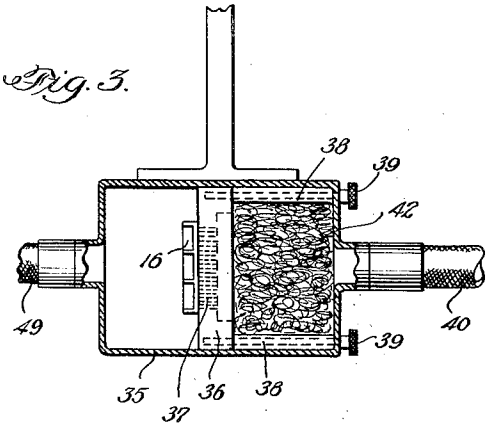


Fig. 4.

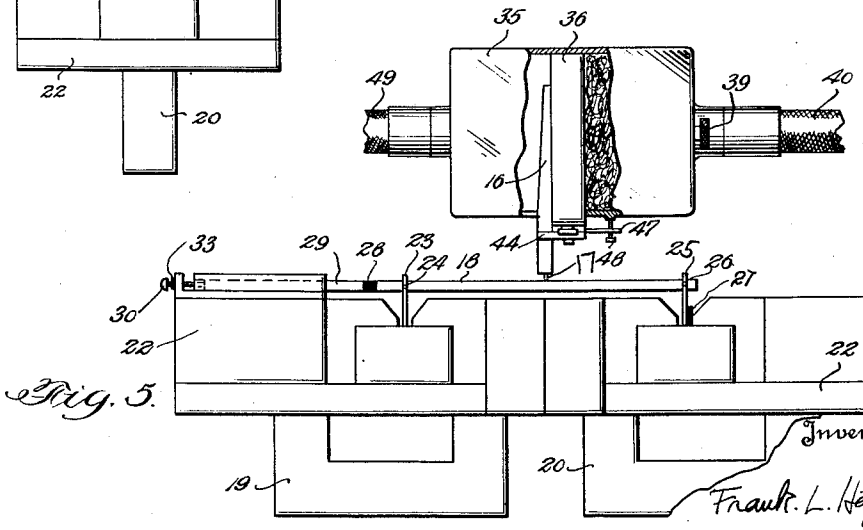


Fig. 5.

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UNITED STATES PATENT OFFICE

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SOUND AMPLIFYING SYSTEM

Application filed June 3, 1929. Serial No. 368,037.

This invention is a system for amplifying and projecting sound waves. A primary source, such as a microphone, radio set, talking picture, telephone or phonograph, produces a small pulsating electric current which has a frequency and characteristics corresponding to the frequency and characteristics of the original sound. This small current is amplified, and by electromagnetic means, controls an air valve, to control the volume of air released through a loud speaker. The air valve vibrates at the same rate that the current varies, and so gives a pulsating air current having the same characteristics as the original sound, only in much greater volume.

An important feature of the invention is the electromagnetic unit, which comprises a pair of electromagnets, the armatures of which are connected to control the movements of the air valve. The electromagnets are connected in series or parallel, and operate a bridge member which is connected to the valve. The bridge member is variably positionable, and it is balanced by resilient devices lightly opposing its movement.

The above described and other features of the invention will be described by reference to the accompanying drawings, illustrating, more or less diagrammatically, the preferred embodiment of the invention.

In the accompanying drawings:

Fig. 1 shows in diagrammatic view the entire apparatus.

Fig. 2 shows a switch.

Fig. 3 is a horizontal section through the valve box.

Fig. 4 is an end view of the valve box and associated parts; and

Fig. 5 is an enlarged side view, partly in section, of the electromagnetic unit and valve box.

Referring now to the drawings in which similar reference characters indicate similar parts, a microphone 5, is connected by wires 6 with an amplifier 7; a radio receiving set 8 is also connected by wires 9 with the amplifier 7; a phonograph 10, provided with a transmitter sound box 12, connected to a source of current by wires 13, and sends a variable current to the amplifier 7 by wires 14.

The microphone, the radio receiving set and the phonograph each produces a varying electric current, having frequencies and characteristics corresponding to the frequencies and characteristics of the original sources of the sound. The three elements just described may be individually connected with the amplifier by a three-way switch 11 as in Fig. 2.

The amplifier 7 may be of any known or suitable type, containing usually three or four vacuum tubes, for amplifying the weak currents produced by the microphone, radio set or phonograph to suitable strengths for actuating the electromagnets and loud speaker, now to be described.

The loud speaker 15 is of the type where a current of air under pressure is supplied thereto, the amount of air released through the loud speaker being controlled by a carefully balanced valve, which moves at a rate and at an amount corresponding to the frequencies and characteristics of the original source of sound. The valve is controlled by electromagnetic means, which in turn are actuated by the amplified current from the amplifier 7.

The valve for the loud speaker is indicated at 16; it is connected by a connector 17 to the bridge member 18 of an electromagnetic unit comprising two substantially U-shaped electromagnets 19 and 20 carried by the frame 22. Armature 23 of electromagnet 19 is pivoted at its lower end and connected, as by pivot pin 24, with the bridge member 18; armature 25 of electromagnet 20 is pivoted at its lower end and connected, as by pivot pin 26, with the bridge member 18. The movement of the bridge member 18 is opposed in one direction by a resilient element 27, carried by electromagnet 20 and in the other direction by a resilient element 28, carried by rod 29. These resilient elements act to balance the bridge member, but do not stop its movement in either direction in response to the electromagnets.

The bridge member 18 is manually settable in desired adjusted position by a set screw 30, mounted in bracket 32, which bears against the rod 29. A lock nut 33 locks the set screw in adjusted position. The degree

of opening of the valve with respect to the bridge member may be thereby controlled.

The electromagnets 19 and 20 are energized by the currents amplified by amplifier 7, the electromagnets being connected in series or parallel, but preferably in series, whereby the bridge member 18 and valve 16 are moved laterally at a rate and amount corresponding to the frequencies and amplitude of the original sound waves.

The valve 16 is mounted in a box 35. In the valve box is a plate 36 provided with a plurality of slots 37, forming a grated exit for the air this grated exit being normally closed by the flat valve-plate member 16. The positioning of the plate 36 is controlled by the threaded bolts 38, having manually actuable heads 39. Air, under a pressure of approximately 27 pounds is supplied to the valve box from a pipe 40, the air being filtered by a mass of fibrous material 42 before it reaches the valve plate 36.

The valve 16 has a flat face which normally is against plate 36, to close the grating 37; the valve is pivotally mounted. The valve has supporting arms 44, supported by plate 45, carrying pivot points 46 for minimizing friction. A resilient arm 47 is connected to the valve, the resilience of which is controlled by a set screw 48.

As the bridge member 18 vibrates rapidly in response to the electromagnets 19 and 20, the valve 16, pivoting about points 46, opens and closes correspondingly, thereby controlling the amount of air released to the loud speaker 15 by pipe 49, and produces a pulsating air current having the characteristics of the original sound, thereby reproducing the original sound, amplified as many times as desired. The degree of amplification may be adjusted by controlling the amount of amplification in 7, as by the usual volume control handle 50, and by controlling the amount of air supplied to the valve box 35 by pipe 40. This may be controlled by a valve 52 in pipe 40, by controlling the speed of the air compressor, etc.

In the device as actually used, there are four units, that is, four sets of electromagnets 19 and 20, four valves 16, four valve boxes 35, etc. all feeding air into one loud speaker 15. By using one or more, or all, of the units, the volume of sound can be controlled over a wide range. In actual practice, the sound from the loud speaker could easily be heard at a distance of a quarter to half a mile, and greater distances under quite conditions.

The valve box 35 may be adjustably supported by a bracket 55, having a tubular part 56 which is movable up and down on a threaded support 57, the positioning being controlled by nuts 58.

The described apparatus has been designed for and used on a motor truck. In order to compensate for inequalities in the road, the phonograph may be pivoted in a ring 60 by pivots 61, ring 60 being pivoted on an axis at right angles, in a bracket 62.

Compressed air from a compressor 65 passes into a tank 66, then through an air filter 67 and through balance tanks 68 and 69, the several tanks keeping the air pressure more nearly uniform.

While one embodiment of the invention has been described in some detail, it should be understood that the invention is not to be limited to these details, but may be carried out in other ways.

I claim as my invention:

1. A sound amplifying system, comprising a loud speaker, means for supplying air under pressure thereto, a pivotally mounted valve for controlling the amount of air released through the loud speaker, a pair of electromagnets, a bridge member actuated by the electromagnets, and means operatively connecting the bridge member and the valve for rocking the valve on its pivot.

2. A sound amplifying system, comprising a loud speaker, means for supplying air under pressure thereto, a pivotally mounted valve for controlling the amount of air released through the loud speaker, a pair of electromagnets, a bridge member actuated by the electromagnets, means connecting the bridge member and valve, and means for supplying a variable electric current to the electromagnets.

3. A sound amplifying system, comprising a loud speaker, means for supplying air under pressure thereto, a valve controlling the amount of air released through the loud speaker, a pair of electromagnets, a bridge member actuated by the electromagnets, manually settable means for varying the movement of the valve with respect to the throw of the bridge member, and means operatively connecting the bridge member and the valve for operating the valve.

4. A sound amplifying system, comprising a loud speaker, means for supplying air under pressure thereto, a pivotally mounted valve for controlling the amount of air released through the loud speaker, a pair of electromagnets, a bridge member actuated by the electromagnets, means for variably positioning the bridge member, and means operatively connecting the bridge member and the valve for operating the valve.

5. A sound amplifying system, comprising a loud speaker, means for supplying air under pressure thereto, a pivotally mounted valve for controlling the amount of air released through the loud speaker, a pair of electromagnets, a bridge member actuated by the electromagnets, means for variably positioning the bridge member, means for supplying a varying current having the frequencies of sound waves, to the electromagnets, and means operatively connecting the

bridge member and the valve for operating the valve.

6. A sound amplifying system, comprising a loud speaker, means for supplying air under pressure thereto, a valve for controlling the amount of air released through the loud speaker, a pair of substantially U-shaped electromagnets, an armature for each electromagnet, a bridge member connected to both armatures, and also connected to the valve for controlling it, and means for supplying a varying electric current to the electromagnets.

7. A sound amplifying system, comprising a loud speaker, means for supplying air under pressure thereto, a valve for controlling the amount of air released through the loud speaker, a pair of substantially U-shaped electromagnets, an armature for each electromagnet, a bridge member connected to both armatures, and also connected to the valve for controlling it, means for supplying a varying electric current to the electromagnets, and manually settable means for varying the movement of the valve with respect to the throw of the bridge member.

8. A sound amplifying system, comprising a loud speaker, means for supplying air under pressure thereto, a pivotally mounted valve for controlling the amount of air released through the loud speaker, a pair of electromagnets, a bridge member actuated thereby and operatively connected to said valve, resilient means opposing the throw of the bridge member, and means for supplying a varying electric current to the electromagnets.

9. A sound amplifying system, comprising a loud speaker, means for supplying air under pressure thereto, a valve for controlling the amount of air released through the loud speaker, a pair of electromagnets, a bridge member actuated thereby and operatively connected to said valve, resilient elements opposing the movement of the bridge member in either direction, and manually settable means for controlling the movement of the valve.

10. A sound amplifying system comprising in combination a pair of electromagnets, each having an armature, a bridge member pivotally connected to each armature, a pivotally mounted valve, operatively connected to the bridge member, a grated seat for the valve, means for supplying air under pressure to said grated seat, and means for supplying a varying electric current to the electromagnets.

In testimony whereof I affix my signature.

FRANK L. HETZEL.