July 2, 1957 H. N. ROWE ET AL 2,798,121

ELECTROPNEUMATIC LOUD-SPEAKER

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Fig-1

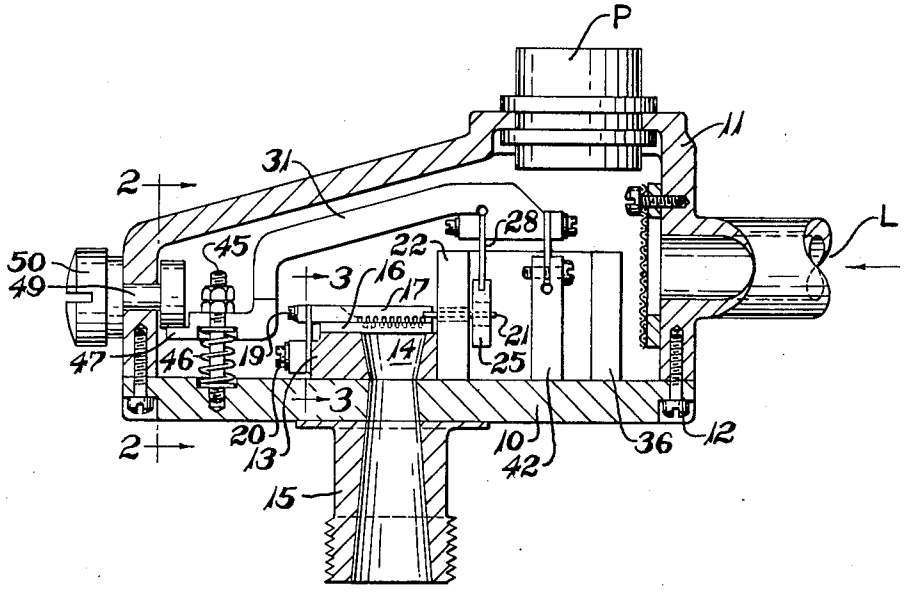


Fig-2

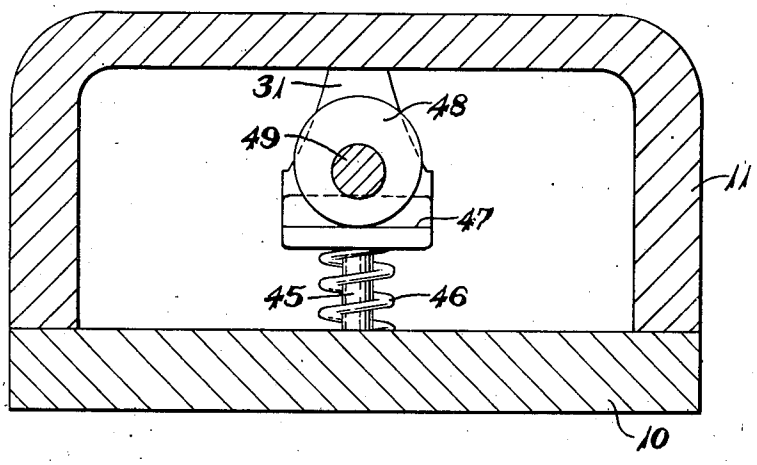
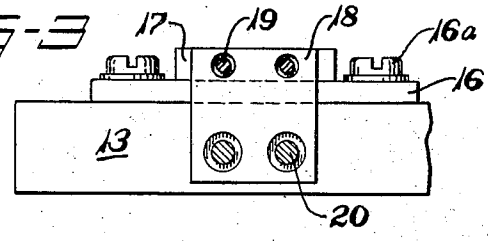


Fig-3



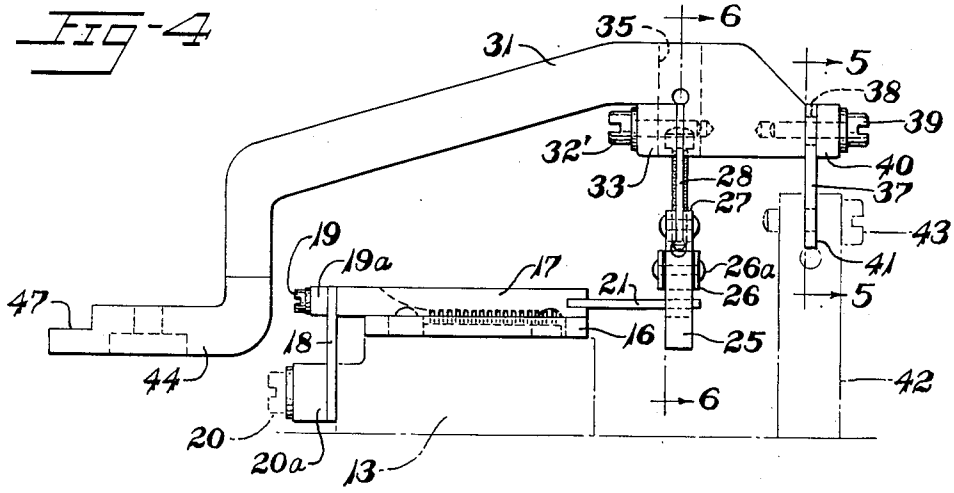
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ELECTROPNEUMATIC LOUD-SPEAKER

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Fig-4



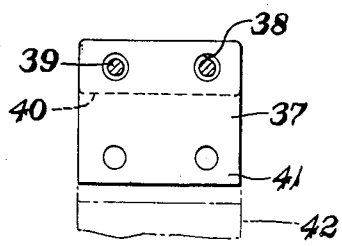


Fig-5

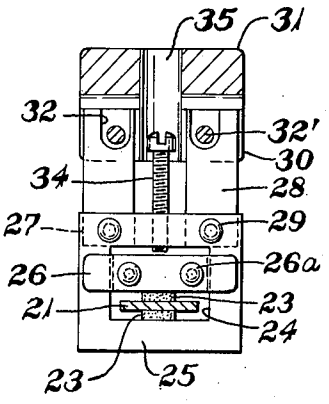


Fig-6

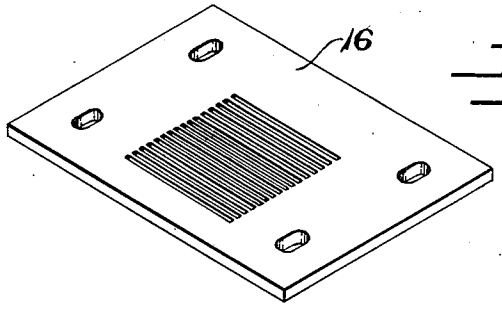


Fig-7

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ELECTROPNEUMATIC LOUD-SPEAKER

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Application May 12, 1954, Serial No. 429,273

5 Claims. (Cl. 179—108)

This invention relates to electropneumatic loud speaker units and an object is to improve the construction, arrangement and operation thereof enabling the same to be manufactured economically and efficiently on a quantity production basis.

Another object is to improve the mounting of certain parts of such obviating strains on the valve grid for example, and still make possible necessary fine adjustments in much less time and trouble than heretofore experienced.

Other objects reside in the construction, arrangement and operation of the component parts.

By way of illustration but not of limitation, an embodiment of the invention is shown on the accompanying drawings, in which

Figure 1 is a longitudinal sectional elevation of an electropneumatic loud speaker unit embodying the invention;

Figure 2 is an enlarged transverse sectional view substantially on the line 2—2 of Figure 1;

Figure 3 is an enlarged sectional view substantially on the line 3—3 of Figure 1;

Figure 4 is an enlarged side elevation of parts of the unit removed from the casing showing particularly the mounting of certain parts;

Figure 5 is a sectional view substantially on the line 5—5 of Figure 4;

Figure 6 is a sectional view substantially on the line 6—6 of Figure 4; and

Figure 7 is an enlarged perspective view of the valve seat.

The illustrated embodiment of the invention comprises an electropneumatic loud speaker unit having a base **10** and superimposed upon the base is an arched cover or housing **11** which is secured in place by screws **12**. As will be readily understood by those skilled in this art the inside of the housing, formed by the base and cover members is maintained under a pre-determined air pressure, air being introduced through an inlet L which is integral with one wall of the cover **11**. Electrical energy from a microphone, for example, is introduced through a plug member P which is electrically connected to the voice coil as will be readily understood, the voice coil being hereinafter referred to. Since the invention is not concerned with such details of construction and operation, detailed illustration and description are not considered necessary.

Mounted on the base **10** to be rigid therewith is a block **13** which has a passage **14** therethrough, the same communicating with a passage through the base **10** and a passage in a tube **15** which is rigidly secured to the under face of the base **10**. As will be readily understood, a horn may be attached to the screw threaded end of the tube **15**. The top surface of the block **13** is flat and bearing thereagainst is a stationary grid or valve seat **16** (Figure 7). This valve seat is formed with a series of closely spaced alternating bars and slits for the passage of air. Screws **16***a* pass through the four holes

in the valve seat or plate **16** for securing it rigidly to the block **13**. Cooperating with the valve seat **16** is a valve member or grid **17**, which is also provided with a series of alternating slits and bars, the latter being adapted to be superimposed upon the slits in the valve seat **16** so that when the valve bears against the seat, the slits in the seat are closed. The vibratory action of the valve **17** determines the sound emitted through the tube **15** as will be readily understood. Detailed discussion of the construction and operation of this valve unit is not given because it forms no part of the present invention and is fully understood by those skilled in the art.

In view of the fact that the valve **17** which is of plate form, vibrates to open and close the slits in the valve seat to permit the passage of air under pressure, the mounting of the valve grid **17** is important. In this instance a vertically disposed leaf spring **18** serves as a flexible or hinge-like mounting for the valve element **17**. The lower end portion of the spring plate **18** (Figure 3) abuts flatly against the adjacent face of the block **13**. The upper end of the spring abuts flatly against the adjacent end of the valve plate **17**. Two screws **19** pass through a transversely disposed bar **19***a*, the leaf spring **18** and into the end of the valve **17** and effect the rigid connection between the spring plate **18** and the valve. As shown in Figure 3 the holes in the spring plate **18** are slightly enlarged so that small vertical and lateral adjustments of the valve may be made relative to the spring plate. These adjustments are very important to properly position the valve **17** relative to the valve seat **16**.

Additionally it will be noted that the lower end of the spring plate has a pair of screws **20** which pass initially through a transverse bar **20***a* for securing the lower end of the spring plate **18** to the adjacent flat vertical face of the block **13**. The holes in the spring plate **18** receiving the screws **20** are also slightly enlarged in order to afford both vertical and lateral adjustments of the spring plate relative to the block **13** and thus enable the exact positioning of the valve relative to its seat. Thus the valve itself may be shifted relative to the spring plate **18** and also the spring plate may be adjusted vertically and laterally relative to the block **13**. Perfect adjustment can thus be achieved so that the valve will not only be flatly disposed relative to the valve seat but also that the bars intermediate the slits in the valve can be properly arranged relative to the slits in the valve seat in order to effect the proper closure of the latter.

Fixed to the opposite end of the valve **17** is a horizontally disposed metallic armature plate **21** which is flat and relatively thin. The armature plate **21** projects through a voice coil (not shown) disposed within an upright wall **22**. The leads to the voice coil from the plug P are not shown but it will be understood that current is delivered to the voice coil which effects the vibratory action of the armature **21**. Permanent magnet **36** is associated with the voice coil.

It will be observed that the armature plate **21** not only extends through the wall **22** but beyond it and on opposite sides of this outwardly extending portion are rubber pads or blocks **23** forming a cushion for the upward and downward movement of the armature plate. The rubber cushions **23** are disposed within an opening **24** formed within a vertically disposed rectangular plate **25** (Figure 6).

Slideable vertically in the opening **24** is a slide **26** formed of a pair of horizontally disposed strips which are disposed on opposite sides of the plate **25** and are connected by a pair of rivets **26***a*. The slide **26** bears against the upper cushion **23**, the lower cushion resting against the bottom edge of the opening **24**. The upper end of the plate **25** is provided with laterally spaced vertical slots

into which project the lower ends of a pair of leaf springs 28 which are fixed to the plate 25 by rivets 29 respectively. The upper ends of the springs 28 abut flatwise against a vertically disposed shoulder which forms a part of a horizontally disposed adjusting arm 31. As shown, the upper ends of the springs are notched, as indicated at 32, to accommodate screws 32'. The screws 32' pass through blocks 33 which bear directly against the leaf springs and clamp them rigidly to the shoulder 30 of the arm 31.

Formed in the arm 31 is a vertically disposed hole 35 which is open at its upper end to receive a screw-driver for adjusting an adjusting screw 34, the lower end of which screw threadedly extends through the upper portion of the plate 25. The lower end of the screw bears loosely against the slide 26. In this manner the amount of pressure exerted by the slide 26 against the rubber cushions 23, may be regulated.

The arm 31 has a leaf spring 37 which provides the flexible pivotal mounting for it. In the upper end of the leaf spring 37 are a pair of enlarged holes 38 (Figure 5) and through these holes extend screws 39 which are smaller than the holes to enable vertical and lateral adjustment of the spring plate 37. To clamp the spring plate 37 in place are blocks 40 individual to each of the screws 39. The lower end of the leaf spring 37 extends into a slit 41 formed in the upper end of an upright support 42 which is suitably fixed at its lower end to the base 10. Passing through a pair of holes in the lower portion of the leaf spring 37 are screws 43 respectively, which rigidly secure the lower end of the spring to the support 42. As shown the screws 43 are such as completely to fill the holes in the spring 37 so as to prevent relative movement there-between.

The opposite end of the adjusting arm 31 is formed with a horizontal extension 44 which is an integral part of the arm and, as shown on Figure 1, a screw 45 is threaded into the base 10 and passes freely through an opening in the arm extension 44 so that the arm can rock vertically to a slight extent thereon. Between the socketed under side of the extension 44 is a coil spring 46, the opposite end of which socketed in the base plate 10. On the extreme end of the extension 44 is a flat ledge 47 against which bears a cam wheel 48. The cam wheel 48 is rigid with a pin or shaft 48 which is rotatable in the adjacent wall portion of the cover housing 11. On the outer side of the housing and rigid with the pin 49 is an adjusting head 50 so that a screw-driver may be applied thereto for turning the cam wheel 48 to effect slight adjustments of the arm 31 and accordingly the armature plate 21 as will be readily understood.

From the above description it will be manifest that we have produced an exceedingly simple and satisfactory mounting for the movable parts of the electro-pneumatic speaker unit. By the provision of leaf springs which serve as flexible pivots for the important parts, the adjustments can be made efficiently and without encountering difficulties inherent in pivotable mountings, which militate against accuracy in the positioning of these parts. The structure by which the armature plate 21 is mounted to effect minute adjustments is also an important feature of the invention, the same greatly facilitating the accurate and efficient operation of the valve element. As above pointed out the difficulties heretofore experienced in achieving the desired relationship between the movable valve grid 17 and its stationary seat member 16 are obviated and true and accurate alignment of these parts can be effected with a minimum amount of time and trouble.

It will be understood that changes in details of construction, arrangement and operation may be effected without departing from the spirit of the invention, especially as defined in the appended claims.

What we claim is:

1. An electropneumatic loud speaker unit having a hollow chamber provided with an inlet for air under pressure and with an outlet, a stationary support adjacent said outlet, a grid fixed to said support and constituting a valve seat, a grid plate superimposed on said stationary grid and constituting a valve, a leaf spring for said valve and disposed at right angles thereto, one end portion of said spring abutting flatly against a flat wall of said support, on the side of the fixed grid adjacent said outlet said spring having apertures in said end portion, screws passing through said apertures respectively into said support and being smaller than the apertures to afford slight adjusting movement of the spring relative to the support when loose, the opposite end portion of said spring abutting flatly against an end of said grid plate and having apertures, screws smaller than said last apertures and passing through same into the grid plate, thereby to enable slight adjustment of the spring relative to the grid plate before the screws are tightened, and electromagnetic means including an armature associated with said grid plate.

2. The organization as claimed in claim 1 in which the armature comprises a flat plate secured to the end of the grid plate opposite to that to which the leaf spring is fixed, said armature plate projecting from said grid plate, an adjustable plate having an aperture through which said armature plate extends, resilient cushions on opposite faces of the armature plate and disposed in said aperture, said armature plate being free to shift laterally between said cushions, a slide parallel to the armature plate and shiftable in said aperture for imposing pressure on the cushions, screw means for actuating the slide, a transversely disposed lever arm extending across and above the grid plate and associated structure, a flexible connection between the upper end of said adjustable plate and an intermediate part of said lever arm, a flexible mounting for one end of said lever arm, and means operating against the opposite end of said lever arm for effecting slight rocking adjustments thereof thereby to move said adjustable plate relative to said armature plate.

3. The organization as claimed in claim 2 in which the connection between the adjustable plate and the lever arm comprises a pair of laterally spaced slits in the upper end of the adjustable plate, a pair of leaf springs having their lower ends anchored respectively in said slits, and means anchoring the upper ends of said leaf springs to said lever arm.

4. The organization as claimed in claim 3 comprising an adjusting screw in the upper portion of said adjustable plate and arranged between the leaf springs, a slide parallel to the armature plate and shiftable vertically in the opening of the adjustable plate and bearing loosely against the uppermost cushion, the lower end of the screw being adapted to engage the upper portion of the slide, said arrangement constituting the pressure regulating means for the cushions.

5. The organization as claimed in claim 2 in which the adjustment effecting means for the lever arm comprises spring means for urging the lever arm in one direction, a rotatable cam engaging said arm in opposition to said spring means, and means for actuating said cam.

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