Oct. 27, 1959 C. A. SWANSON 2,910,546

LOUD SPEAKER ASSEMBLY

Filed Feb. 24, 1954

Fig 1

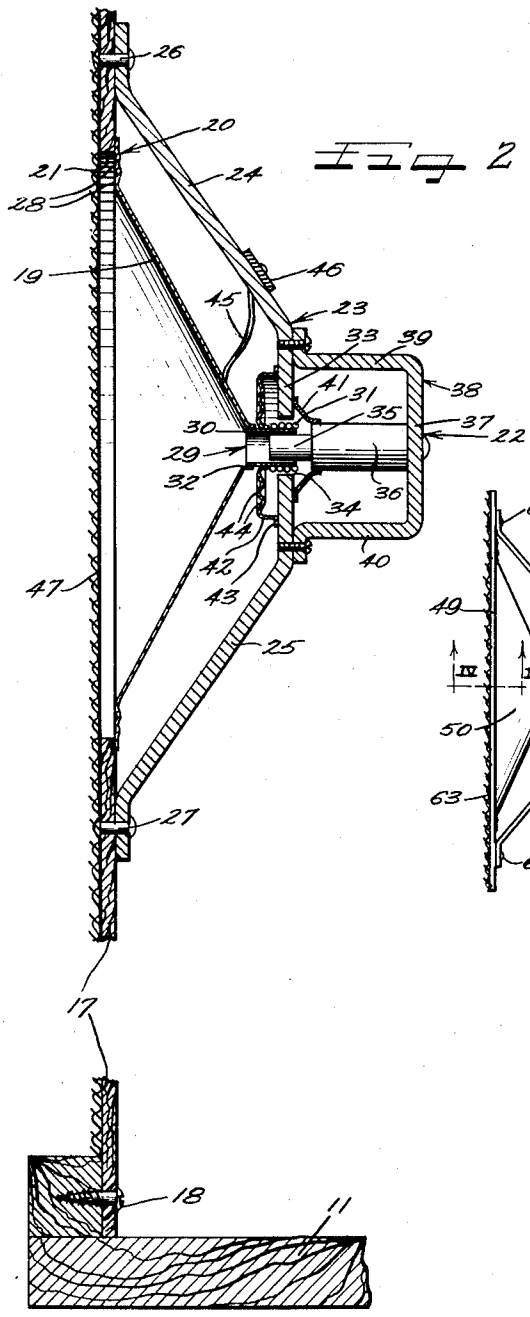


Fig 2

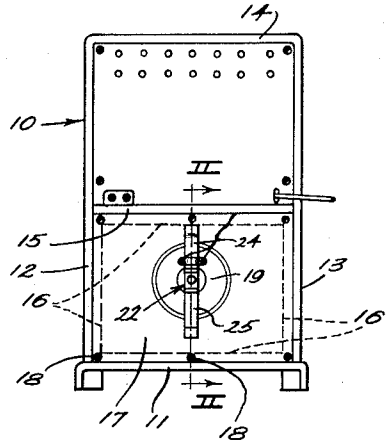


Fig 3

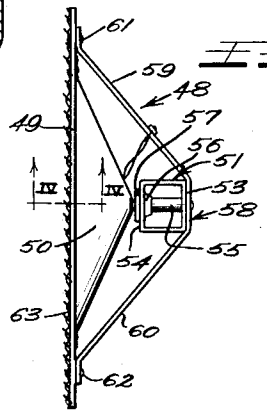
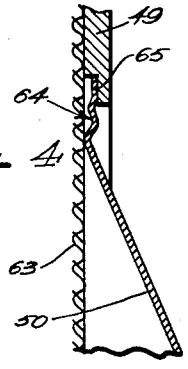


Fig 4



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LOUD SPEAKER ASSEMBLY

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According to this invention, a speaker unit is constructed with a baffle member as an integral part thereof. In particular, a baffle member is provided with an opening therein and a diaphragm is provided with its peripheral edge portion supported from the baffle at the opening. An electro-acoustical driver is connected to a central portion of the diaphragm and is supported from the baffle member by means independent of the support of the peripheral edge portion of the diaphragm.

Preferably, the diaphragm may be of conventional conical shape, either circular or elliptical, and has a voice coil secured thereto which moves between magnetic poles of the driver. The means for supporting the driver may comprise a strap or the like extending to points on the baffle member on opposite sides of the opening therein and spaced outwardly therefrom.

In the conventional construction, the speaker has a specially stamped frame which includes a ring or annulus from which the peripheral edge of the diaphragm is supported, the driver unit being supported from the rings by spoke-like members. Such a speaker is then bolted to a baffle with a sealing gasket or cushion between the ring and the baffle.

With the construction of this invention, as described above, the necessity for the specially stamped frame, the sealing gasket and the bolting of the frame to the baffle is eliminated, thus effecting considerable economy in manufacture.

The baffle member may be sufficiently large so that it together with the diaphragm and driver unit supported therefrom constitutes a complete sound generating unit. Ordinarily, however, the baffle member will be mounted in a cabinet to form a unitary part thereof. For example, a radio or television receiver cabinet may be readily constructed to receive the baffle member which may be of a convenient rectangular shape, for example, and form one wall, or a portion of one wall, of the cabinet. The speaker unit of this invention including the baffle member may be manufactured as a unit with less labor and expense than that required to manufacture a conventional speaker unit, and may be readily installed in the cabinet thus obviating the labor and expense of bolting a speaker unit to a baffle.

According to a specific feature of the invention, the speaker unit of this invention including the baffle member may be manufactured as a unit, as suggested above, and a protective and ornamental grill cloth may be secured to the baffle member to form a unitary part of the assembly, and the assembly may be mounted in one step in the cabinet of the radio or television receiver, or like sound reproduction unit.

According to an important feature of this invention, it has been found that increased efficiency and fidelity of sound reproduction, as well as reduced cost of manufacture, is achieved by securing the integral peripheral edge portion of the diaphragm directly to the baffle member about the opening therein.

In conventional speaker construction, the diaphragm is

supported from the outer annular portion of the frame either through an annular member of leather or the like or through a flexible annular portion of the cone. It has been recognized that the leather system is superior from the standpoint of efficiency and fidelity of reproduction but the one-piece cone and suspension system is cheaper to manufacture.

With the construction of the present invention, however, it has been found that the one-piece cone and suspension system may be used and yet increased fidelity and efficiency of sound reproduction is achieved with the peripheral edge portion of the diaphragm secured directly to the baffle member about the opening.

The scientific reasons accounting for such improved results are not known. However, it is believed that two important factors enter into the improved results. One of these factors is that when the cone vibrates, it tends to create an out of phase vibration in the baffle. For example, when the cone travels in a rearward direction, air pressure will build up on the rearward side of the baffle and tend to force the baffle forwardly or when the cone travels forwardly air pressure on the rearward side of the baffle will be reduced and tend to force the baffle rearwardly. Accordingly, the sound generated by flexure of the baffle will be out of phase with sound generated by the diaphragm, thus reducing efficiency.

With the arrangement of this invention, due to the direct connection of the diaphragm to the baffle and due to the support of the driver from points spaced substantial distances from the connection of the diaphragm to the baffle, the baffle may be driven from the diaphragm in synchronism therewith and thus counteract the tendency of the baffle to vibrate in phase opposition to the cone. Accordingly, efficiency of reproduction is increased.

Another factor is that restriction of the movement peripheral edge portion of the diaphragm tends to produce non-linear characteristics which introduce distortion. With the support of the driver from points spaced substantial distances from the connection of the diaphragm to the baffle, the baffle may flex to a certain extent and allow increased flexure of the diaphragm, thus tending to minimize the non-linear characteristics.

It will be appreciated that these factors will have their greatest effect at the lower frequencies and it has been found that the lower frequency tones are actually reproduced with greater intensity and with greater clearness and fidelity with the arrangement of this invention.

It will be appreciated that in addition to increased fidelity and efficiency of sound reproduction, it is less expensive to suspend the diaphragm from the baffle with an integral portion thereof.

If desired, the integral peripheral edge portion of the diaphragm could be secured directly to the baffle about the opening therein by means of a clamping ring or similar structure. However, the use of a clamping ring tends to reduce any flexure of the baffle and thus partly or wholly obviate the desirable effects obtained from the direct connection of the integral peripheral edge portion of the diaphragm with the baffle.

Most preferably, the peripheral edge portion of the diaphragm is adhesively secured to the baffle member about the opening therein, thus allowing flexure of the baffle member. Furthermore, it is more economical to adhesively secure the diaphragm to the baffle and it is easier to seal the entire peripheral edge portion of the diaphragm to the baffle than it would be with a clamping ring or similar structure.

The peripheral edge portion of the diaphragm may be secured against the radially inwardly facing surface of the opening in the baffle but is preferably secured against one face of the baffle adjacent the opening. In one preferred embodiment, the peripheral edge portion of the

diaphragm is adhesively secured against the same face of the baffle as the driver while in a second preferred embodiment, the peripheral edge portion of the diaphragm is secured against the face of the baffle opposite to that on which the driver is mounted. The first embodiment has the advantage of offering more protection for the diaphragm and the advantage of spacing the diaphragm from the grill cloth, when such is provided, so that the diaphragm in moving will not engage the grill cloth. The second embodiment has the advantage in that the diaphragm may be removed from the face of the baffle opposite the driver, and replaced without necessitating removal of the driver. In the second embodiment, the baffle may preferably be recessed about the opening therein to receive the peripheral edge portion of the diaphragm and to space the diaphragm from the grill cloth, when such is provided, and prevent interengagement between the diaphragm and the grill cloth.

According to a specific feature of the invention, a strap member may perform the dual function of supporting the driver and forming a part of the magnetic circuit thereof. By this feature, the strap member may have a center portion apertured to receive the voice coil secured to the diaphragm with leg portions secured to the baffle on opposite sides of the diaphragm. A magnetic pole of the driver extends into the voice coil and is supported from the center portion of the strap member on opposite sides of the voice coil.

An object of this invention, accordingly, is to provide an improved loud speaker assembly with a baffle as an integral part thereof.

Another object of this invention is to provide improved methods of constructing a sound generating system.

A further object of this invention is to provide an improved loud speaker assembly in which a diaphragm has a peripheral edge portion supported from a baffle at an opening therein with a driver supported from the baffle at points spaced outwardly from opposite sides of the opening therein.

A more specific object of this invention is to provide a loud speaker unit in which a diaphragm has a peripheral edge portion secured directly to a baffle member about an opening therein solely by adhesive engagement therewith.

Another specific object of the invention is to provide a unitary loud speaker assembly in which a diaphragm and a driver unit therefor are independently supported from a baffle and in which a protective grill cloth is secured against one face of the baffle to protect the diaphragm.

A still further object of the invention is to provide a loud speaker assembly which is very simple in construction, extremely economical to manufacture and yet having high efficiency and fidelity of sound reproduction.

This invention contemplates other objects, features and advantages which will become more fully apparent from the following detailed description taken in conjunction with the accompanying drawings which illustrate preferred embodiments and in which:

Figure 1 is a rear elevational view of a cabinet incorporating a loud speaker assembly constructed and installed according to the principles of this invention;

Figure 2 is a sectional view, on an enlarged scale, taken substantially along lines II—II of Fig. 1 and illustrating in detail the construction of one preferred form of loud speaker assembly;

Figure 3 is a side elevational view of another preferred form of loud speaker assembly constructed according to the principles of this invention; and

Figure 4 is a sectional view, on an enlarged scale, taken substantially along lines IV—IV and illustrating a detail of the construction of the loud speaker assembly of Fig. 3.

In Figure 1, reference numeral **10** designates a cabinet having a base **11**, side walls **12** and **13** and a top **14**. The cabinet **10** may house a radio or television receiver which may be mounted on a shelf **15** disposed at a level intermediate the face **11** and the top **14**. The lower portion of the front face of the cabinet **10** may have a rectangular opening therein, as designated by dotted lines **16**, of less width than the distance between the side walls **12** and **13** and of less height than the distance between the base **11** and the shelf **15** so as to provide a shoulder at the forward end of the space defined by base **11**, shelf **15** and side walls **12** and **13**. A panel or baffle **17** is secured against the shoulder so defined by means of screws **18**.

According to this invention, the baffle **17** forms a unitary part of a loud speaker assembly. In particular, a diaphragm **19** which may be of a conventional felted paper construction and of generally conical shape, has a peripheral edge portion **20** supported from the baffle **17** about an opening **21** therein. A driver unit generally designated by reference numeral **22** is arranged to actuate a central portion of the diaphragm **19** and is supported from the baffle **17** by means independent of the support of the diaphragm **19**. Such means may comprise a strap member **23** having legs **24** and **25** secured to points respectively spaced above and below the opening **21** as by rivets **26** and **27** respectively.

Although the diaphragm **19** might be secured to the baffle **17** in other ways, it is most preferably secured to the baffle **17** solely by adhesive engagement between the baffle **17** and the integral peripheral edge portion **20** of the diaphragm **19**.

To increase the amplitude of vibration of the central portion of the diaphragm **19**, the peripheral edge portion **20** may have peripherally extending corrugations **28** spaced inwardly from the opening **21** in the baffle member **17**.

For actuation of the diaphragm **19**, a voice coil **29**, which may comprise a sleeve **30** and wire **31** wound thereon, is cemented or otherwise secured within a central opening **32** in the diaphragm **19**. The strap member **23** may have a center portion **33** apertured at **34** to receive the voice coil **29** and a magnetic pole member **35** may project within the voice coil **29** and within the aperture **34**. A magnetic flux is developed between the member **35** and the center portion **33** of the strap **23** at the opening **34** therein and with current flowing through the wire **31** of the voice coil **29**, the coil will be forced in a direction depending upon the direction of flow of the current, as will be readily appreciated by those skilled in the art.

The strap member **23** should therefore be of a paramagnetic material such as iron or steel and the member **35** should likewise be of such a material. To provide the magnetic flux, a permanent magnet **36** may have one pole in engagement with the pole **35** the other pole being in engagement with the bight portion **37** of a generally U-shaped member **38** having legs **39** and **40** secured to the center portion **33** of the strap **23** at opposite sides of the opening **34**. If desired, the member **38** might be cup-shaped and a coil and core might be substituted for the permanent magnet **36**. A dust shield **41** may be disposed between the magnet **36** and the center portion **33** of the strap **23**.

The voice coil **29** may be maintained in alignment with the air gap between pole member **35** and the inner surface of the aperture **34** by means of a generally cup-shaped member **42** of resilient material having a central opening to receive the voice coil sleeve **30**, a peripheral lip **43** cemented or otherwise secured to the center portion **33** of the strap **23** and annular corrugations **44** to increase the flexibility thereof.

The opposite ends of the wire **31** of the voice coil assembly **29** may be connected through flexible wires **45** (only one of which is illustrated in the sectional view of Fig. 2) which are connected to terminals upon an insulator plate **46** secured to the leg portion **24** of the strap **23**.

According to a specific feature, a protective grill cloth

47 is secured to and covers the entire front face of the baffle 17.

Most preferably, the diaphragm 19, driver unit 22 and grill cloth 47 may be assembled as a unit on the baffle 17 after which the unit may be mounted within the cabinet 10 as illustrated in Figure 1 and affixed thereto by screws 18.

It will be apparent that this speaker assembly is very simple and economical to construct and, in fact, the entire assembly can be constructed at a total cost in labor and material less than, and in any event not substantially greater than, the cost of manufacturing the conventional speaker unit without baffle.

Further, as pointed out in the foregoing preliminary discussion, the unit achieves more efficient and higher fidelity reproduction of sound than the conventional construction, particularly in the lower frequency range, which is apparently due to the fact that the peripheral edge portion 20 of the diaphragm 19 is directly supported about the opening 21 in the baffle 17 with the driver unit supported from the baffle 17 at points spaced substantial distances from the peripheral edge 20 so that the baffle may flex in response to vibration of the diaphragm 19.

It may be noted that although the baffle 17 could be of metal, it is preferably of a less expensive and lighter material such as wood, it being understood that the term wood as used herein includes both natural woods and synthetic woods such as masonite and plastic composition materials. The baffle 17 should be thin enough to achieve a certain amount of flexibility, in order to achieve the desirable results pointed out above. A masonite panel slightly less than one quarter inch thick has been found to be very satisfactory.

In Figure 3, reference numeral 48 generally designates a modified speaker assembly including a panel 49, a diaphragm 50, and a driver unit 51. The driver 51 may be of somewhat different construction from the driver 22 above described and may comprise a generally rectangular frame member 53 having a portion 54 having the same function as the center portion 33 of the strap member 23 in the embodiment of Figs. 1 and 2. The frame 53 supports a permanent magnet 55, a dust shield 56, and a voice coil centering member 57, generally the same as the member 42 above described. The diaphragm 50 may, of course, support a voice coil in the same manner as the diaphragm 19 above described.

According to the construction of Figure 3, the driver unit 51 is supported by means of a strap 58 having a center portion secured against the rearward end of the frame 53 and having leg portions 59 and 60 respectively secured to points above and below the diaphragm 50, as by means of rivets 61 and 62, respectively.

A grill cloth 63 may preferably cover the front face of the panel 49.

As shown in Figure 4, the diaphragm 50 may have a peripheral edge portion 64 generally the same as the peripheral edge portion 20 of the diaphragm 19 as above described but in this embodiment, the peripheral edge portion 64 is secured in a recess 65 in the outer surface of the baffle 49 about the opening therein.

This construction has an advantage over that illustrated in Figure 2 in that the diaphragm 50 may be removed and replaced without removing the driver unit 51 but, on the other hand, the arrangement of Figure 2 has

an advantage in that it offers better protection for the diaphragm 19.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

I claim as my invention:

1. In a sound generator, a baffle having an opening therein, a diaphragm having a peripheral edge portion supported from said baffle at said opening, a voice coil secured to a central portion of said diaphragm, a strap of paramagnetic material having a center portion apertured to receive said voice coil and having a pair of leg portions secured to said baffle at opposite sides of said opening and spaced from said peripheral edge portion of said diaphragm means defining a magnetic pole extending into said voice coil, and means supporting said pole and completing a magnetic circuit therefrom to points on said center portion of said strap on opposite sides of said voice coil.

2. In a sound generator, a baffle having an opening therein, a diaphragm having a peripheral edge portion supported from said baffle adhesively on one face of the baffle, a driver connected to a central portion of said diaphragm, means independent of the support of said peripheral edge portion of said diaphragm for supporting said driver from said one face of said baffle, a protective grill cloth secured against the opposite face of said baffle, a cabinet having an opening in one face thereof, and means securing said baffle together with said grill cloth against an internal surface portion of said cabinet about said opening to thereby close said opening.

3. In a sound generator, a baffle having an opening therein, a diaphragm having a peripheral edge portion supported from said baffle at said opening, a voice coil secured to a central portion of said diaphragm, a strap of para-magnetic material having a center portion apertured to receive said voice coil and a pair of leg portions secured to said baffle at opposite sides of said opening and in spaced relationship to said diaphragm, means defining a magnetic pole extending into said voice coil, means supporting said pole and completing a magnetic circuit therefrom to points on said center portion of said strap on opposite sides of said voice coil, a cabinet having an opening in one face thereof and means securing said baffle against an internal surface portion of said cabinet about said opening to thereby close said opening.

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