1,023,653

# PATENT SPECIFICATION

DRAWINGS ATTACHED

**1,023,653**

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COMPLETE SPECIFICATION

## Improvements in or relating to Directional Transducers

We, STANDARD TELEPHONES AND CABLES LIMITED, a British Company, of Connaught House, 63 Aldwych, London, W.C.2, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to directional transducers and, more particularly, horn-loaded transducers of the kind in which it is desirable to incorporate a transformer for coupling the transducing element to an external circuit and to do so in a relatively compact transducer assembly.

According to the invention there is provided an electro-acoustic transducer assembly including a horn acoustically coupling a transducing element to the acoustical medium external to the assembly, and a transformer for electrically coupling said transducing element to an electrical circuit external to said assembly, wherein said transformer is located in front of a plane passing through the transducing element and extending perpendicularly to the axis of the horn and is mounted in a space bounded by the horn surface, part of said assembly and an outer casing containing said assembly.

According to one arrangement of the invention, there is provided an electro-acoustic transducer assembly including a horn acoustically coupling a transducing element to the acoustical medium external to the assembly, and a transformer for electrically coupling said transducing element to an electrical circuit external to said assembly, wherein said transformer is mounted within the mouth of said horn.

Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 shows a ribbon microphone in which the coupling transformer is mounted within the mouth of the horn,

[*Price 4s. 6d.*]

Fig. 2 shows a ribbon microphone in which the coupling transformer is mounted in a cavity formed in the material of the horn, and

Fig. 3 shows a ribbon microphone in which the coupling transformer is mounted in a space bounded by the rear surface of the horn, the outer casing and a part of the transducer assembly.

Referring now to the three figures of the accompanying drawings, each of these illustrates a transducer assembly of a ribbon microphone embodying the invention in different ways. An outer casing 1, which in the preferred embodiment is of die cast metal, contains the transducer assembly. The principal components of the transducer assembly are the transducing element, i.e. the ribbon 2, mounted between pole pieces 3 which form members of the magnet circuit in which the magnet 4 operates to provide a transverse magnetic field for the ribbon. In front of the pole pieces, i.e. to their left in the accompanying drawings, is a structural member which is used as a mechanical support 5 for various portions of the assembly and also serves as a partition member to the rear of the horn 6 to assist in defining an internal volume 7, which, in conjunction with one or more openings in the side or rear of the outer casing such as for example indicated at 8, enables the rear face of the ribbon 2 to be coupled to the acoustical medium external to these openings, with a shift in phase relative to the acoustical medium in front of the microphone coupled to the front face of the ribbon 2 by the aperture 9 in the horn 6. This aperture 9 communicates with the acoustical medium in front of the microphone through an opening covered by a perforated metal front grille 10. In the preferred embodiment, the or each opening 8 is covered with silk to provide an element of acoustical resistance in the path to the internal volume 7. The outer casing has a stand 11 attached to it in conventional

manner for enabling the microphone to be pivotally mounted and is provided with an outlet through which a cable 12 may be fed for coupling the transducer to external circuits, such as the input circuits of amplifying equipment.

In common with some other types of electo-acoustical transducers, the impedance of the actual transducing element of the ribbon transducer is sufficiently low to make it at least highly desirable—if not essential—to use a transformer for coupling the transducing element either directly to the rather higher input impedance circuits of associated amplifying equipment or indirectly via lines operated at some intermediate impedance level. For purely practical reasons, it is desirable to incorporate these transformers in the transducer assemblies and to do so without therefore enlarging the assembly unduly if at all. At the same time, in the case of those types of transducer assemblies which incorporate permanent magnets for producing fields of relatively high intensity, it is desirable to dispose the transformer as far away as possible from the permanent magnet, or a gap in the magnetic circuit in which a field of high intensity is produced, in order to avoid magnetic saturation of the transformer core.

Ideally, it is desirable to mount the transformer with the laminations of its core in line with the neutral axis of the magnet. Such an arrangement is illustrated in Fig. 1. The transformer 13, in the preferred embodiment, is encapsulated in epoxy resin forming a case 14 secured in position by a number of pins (not shown) moulded into the case 14 and engaging with corresponding holes in the surface of the horn 6, which in this embodiment is preferably moulded in rubber; alternatively, the case of the transformer may be secured to the metal front grille. It is desirable for the shape of the cross-section of the case 14 to be similar to the shape of the adjacent cross-section of the aperture of the horn and —by suitable shaping of the case and the profile of the horn—to preserve the acoustically correct flare, i.e. the rate of change of the net cross-sectional area of the aperture 9 along its cylindrical axis. The transformer 13 may be of very small size if the laminations are made of Super Permalloy. The dimensions and shape of the case 14 of the transformer can be arranged to be such that the passages 15 formed between the case and the horn together with the volume enclosed in front of the ribbon constitute a high frequency resonator which will augment the effect of the horn in extending the upper range of the high frequency response of the microphone. The leads from the primary winding of the transformer 13 to the ribbon 2 and from the secondary winding of the transformer to the cable 12 are indicated in Fig. 1 by the reference 16 for illustrative purposes only.

An alternative embodiment is shown in Fig. 2, which differs from that shown in Fig. 1, in that the transformer 13 is now no longer mounted on the neutral axis of the magnet 4, but in a cavity or recess formed in the material of the horn. In a given practical case, this may obviate the need to encapsulate the transformer in a specially shaped case and permit the use of a larger transformer with laminations that may be cheaper because of the less stringent requirements on their quality.

Yet another embodiment is shown in Fig. 3, which differs from that shown in Fig. 2, in that the horn 6 is now no longer a moulding solidly filling all the space between the profile of the horn aperture 9, the outer casing 1 and the member 5 except that of the recess or cavity. Instead, the horn 6 is now relatively thin walled in section and having a volume 18 at its rear face bounded by that rear face, the inner surface of the outer casing 1 and the front surface of the partition member 5. The horn may be moulded in a thermo-setting synthetic plastic material and have projections 17 moulded integrally with the horn. The projections 17 have threaded metallic inserts moulded into them for receiving screws (not shown) clamping the transformer 13 to the horn. Alternatively, the horn may be pressed from aluminium or other suitable metal, in which case bushes 17 would be provided in place of the aforementioned integrally moulded projections 17. These bushes have screws (not shown) passing through them for clamping the transformer 13 to the horn. Other methods of manufacturing the horn 6 and of securing the transformer 13 in the volume 18 shown in Fig. 3 will be readily apparent to those skilled in the art. Thus, provided due care is taken to avoid magnetic saturation of the transformer core by flux from the magnet system, the transformer 13 may be attached to or mounted on the partition member 5 or the outer casing 1.

WHAT WE CLAIM IS:—

1. An electro-acoustic transducer assembly, including a horn acoustically coupling a transducing element to the acoustical medium external to the assembly, and a transformer for electrically coupling said transducing element to an electrical circuit external to said assembly, wherein said transformer is located in front of a plane passing through the transducing element and extending perpendicularly to the axis of the horn and is mounted in a space bounded by the horn surface, part of said assembly and an outer casing containing said assembly.

2. An electro-acoustic transducer assembly including a horn acoustically coupling a transducing element to the acoustical medium external to the assembly, and a transformer for electrically coupling said transducing element to an electrical circuit external to said assembly, wherein said transformer is mounted

within the mouth of said horn.

3. An assembly as claimed in claim 1, wherein said transformer is mounted in a cavity formed in the material of said horn.

4. An assembly as claimed in claim 1, wherein said transformer is enclosed in a space bounded by a plane passing through the transducing element and extending perpendicularly to the axis of the horn, the outer casing and the rear surface of the horn which is substantially parallel to the front surface of the horn.

5. An assembly as claimed in any one of the preceding claims, wherein said transformer is encased in a thermosetting substance.

6. An assembly as claimed in claim 2, 3 or 4, wherein the case of said transformer is secured to said horn.

7. An assembly as claimed in any one of the preceding claims, wherein the material of said horn is of rubber.

8. An assembly as claimed in any one of the preceding claims wherein said transducing element is a conductive ribbon suspended in a magnetic field.

9. A ribbon microphone comprising a transducer assembly as claimed in any one of the preceding claims.

10. A ribbon microphone including an outer casing containing the ribbon transducing element, a horn acoustically coupling one face of the ribbon of said transducing element to the acoustical medium external to an opening in the front of said casing, a partition member to the rear of said horn between the horn and the transducing element and parallel to the plane of the latter defining an internal volume between said member and said casing, said internal volume acoustically coupling the other face of said ribbon to the acoustical medium external to one or more openings in the side or rear of said casing, and a transformer for electrically coupling said ribbon to an electrical amplifier circuit, wherein said transformer is located in front of a plane passing through the transducing element and extending perpendicularly to the axis of the horn and is mounted in a space bounded by the horn surface, said partition member and said outer casing.

11. A ribbon microphone including an outer casing containing the ribbon transducing element, a horn acoustically coupling one face of the ribbon of said transducing element to the acoustical medium external to an opening in the front of said casing, an internal volume acoustically coupling the other face of said ribbon to the acoustical medium external to one or more openings in the side or rear of said casings, and a transformer for electrically coupling said ribbon to an electrical amplifier circuit, wherein said transformer is mounted in a cavity formed in the material of said horn.

12. A ribbon microphone including an outer casing containing the ribbon transducing element, a horn acoustically coupling one face of the ribbon of said transducing element to the acoustical medium external to an opening in the front of said casing, an internal volume acoustically coupling the other face of said ribbon to the acoustical medium external to one or more openings in the side or rear of said casing, and a transformer for electrically coupling said ribbon to an electrical amplifier circuit, wherein said transformer is mounted within the mouth of said horn and is enclosed in a case having a shape corresponding to the shape of the portion of the horn mouth adjacent said case.

13. A ribbon microphone substantially as herein described with reference to and as illustrated in Fig. 1 of the accompanying drawings.

14. A ribbon microphone substantially as herein described with reference to and as illustrated in Fig. 2 of the accompanying drawings.

15. A ribbon microphone substantially as herein described with reference to and as illustrated in Fig. 3 of the accompanying drawings.

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For the Applicants.

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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

**Sheet 1**

*Fig. 1.*

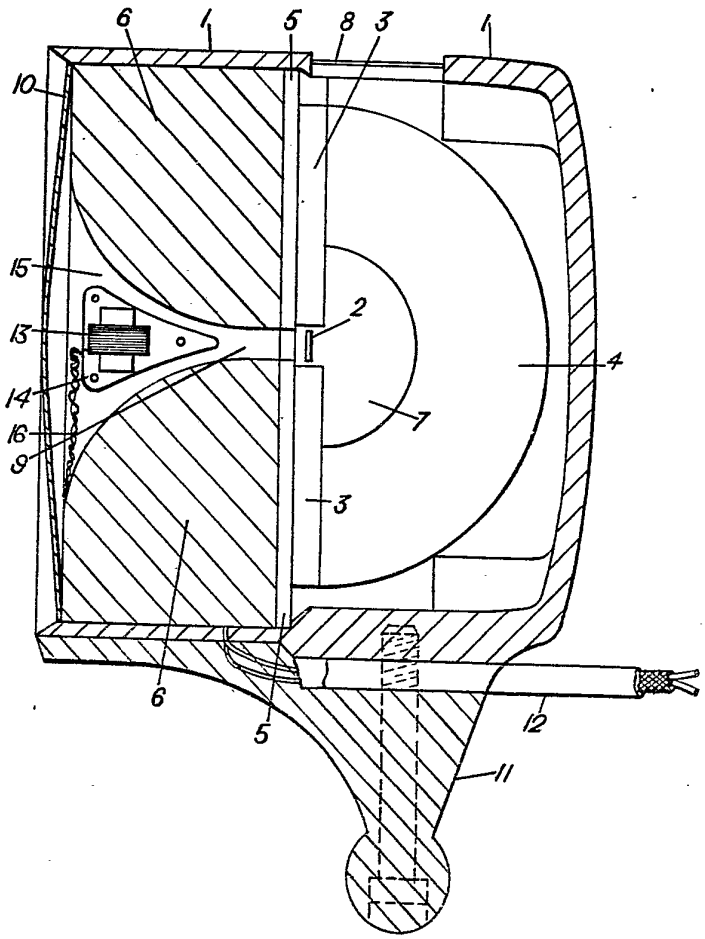
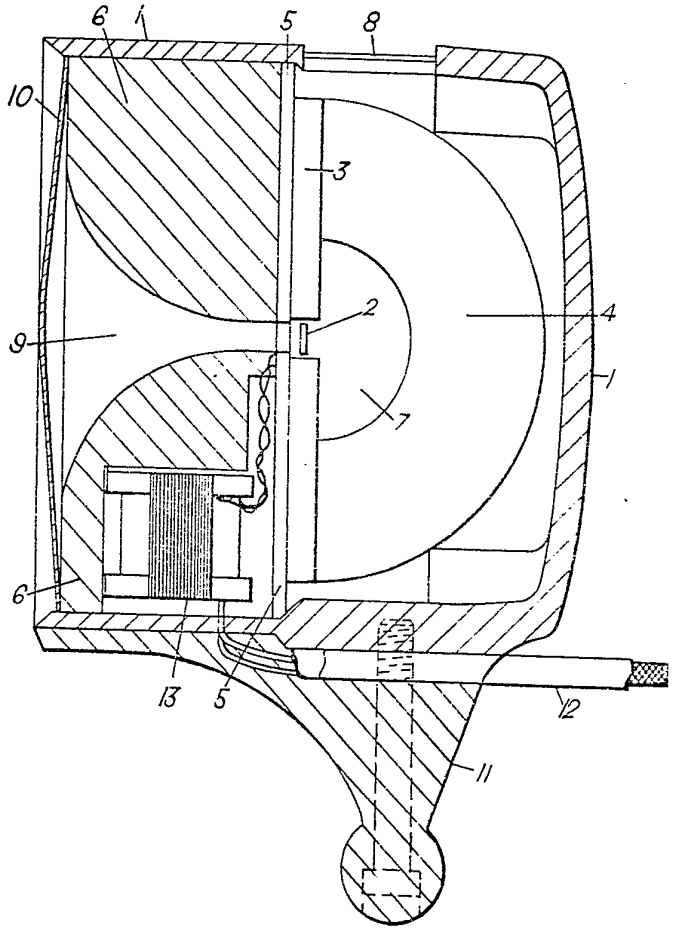


Fig.2.



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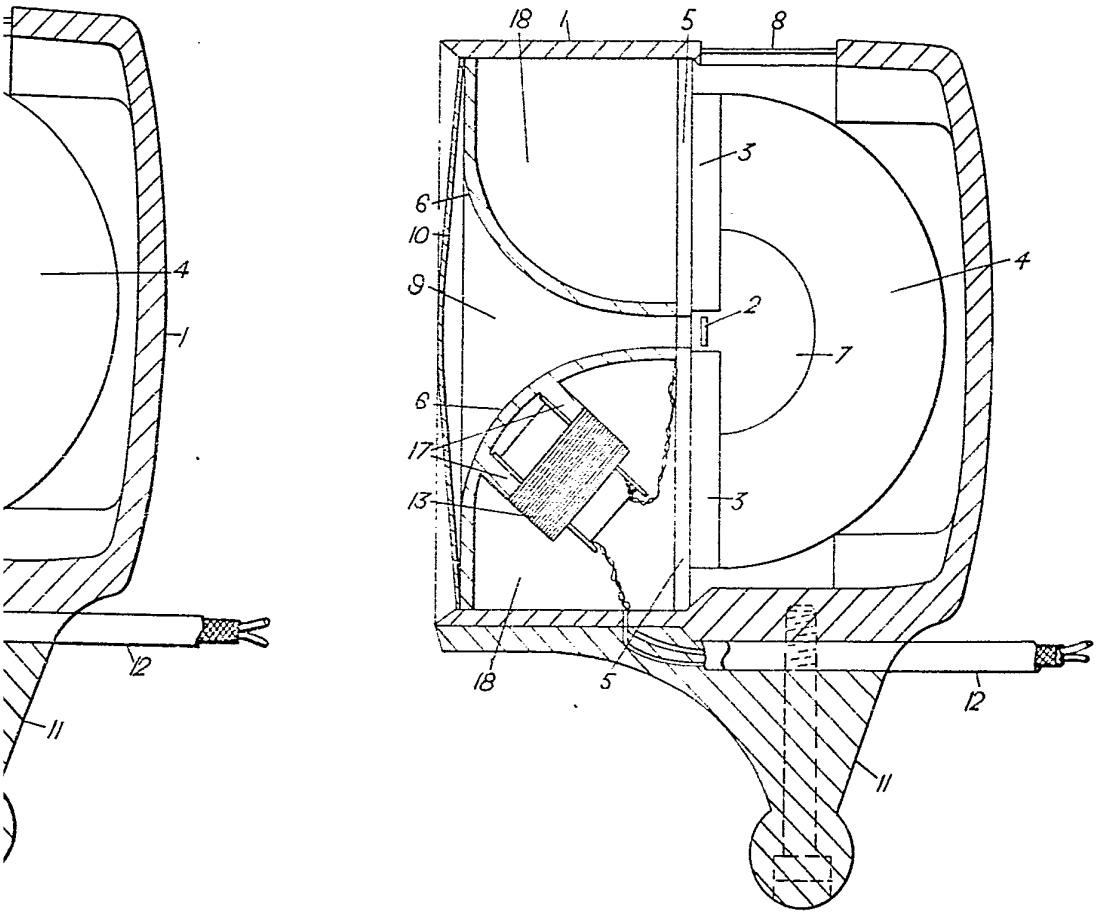
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 2 & 3

Fig 3



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3 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheets 2 & 3

Fig.2

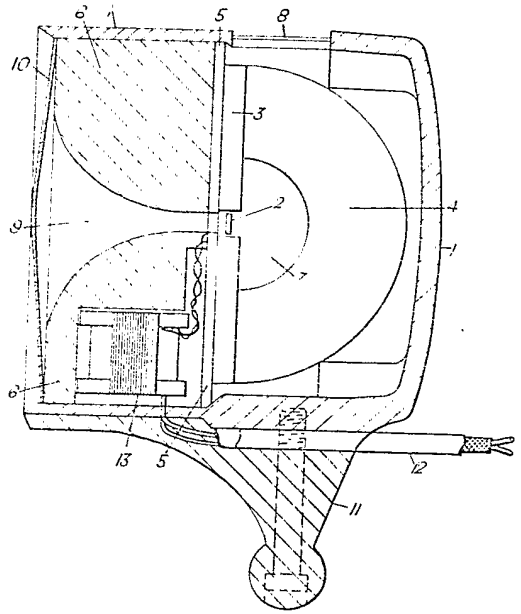


Fig.3