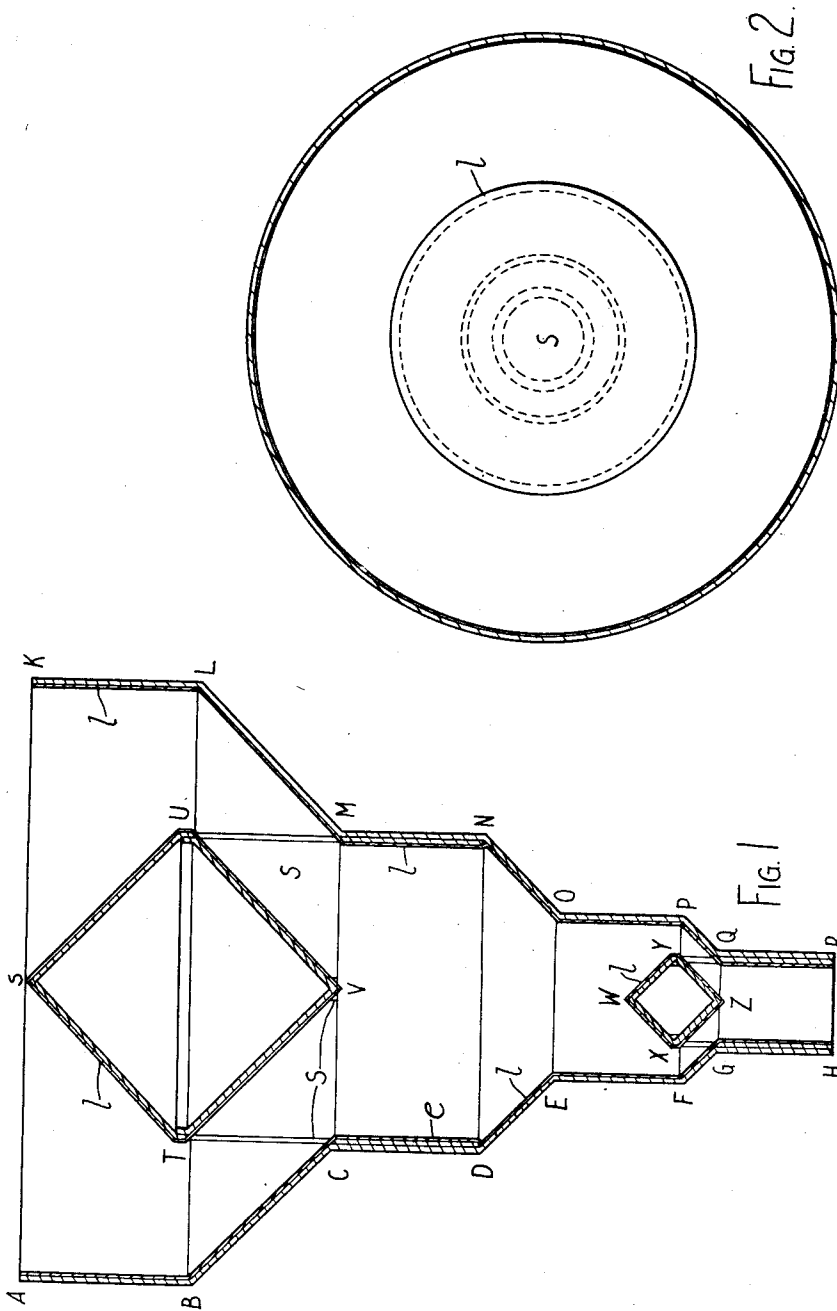


Sept. 7, 1937.

D. S. SPENS STEUART
APPARATUS FOR CONDUCTING SOUND

2,092,428

Filed Nov. 29, 1935



Inventor
Douglas Stuart Spens Steuart
By Spear, Gordon & Hall
attys.

UNITED STATES PATENT OFFICE

2,092,428

APPARATUS FOR CONDUCTING SOUND

Douglas Stuart Spens Stuart, London, England

Application November 29, 1935, Serial No. 52,256
In Great Britain December 10, 1934

20 Claims. (Cl. 181—0.5)

The present invention relates to improvements in or relating to the transmission and reception of sound waves and more particularly concerns improvements in the surfaces which the sound waves pass or are reflected by in the course of their passage from one part of an acoustic device to another. The invention may be applied to loudspeakers, mouthpieces for transmitters, speaking tubes or the like. Previously it has been found that the most satisfactory surface to be employed for reflecting sound waves is obtained by utilizing an alloy of copper and zinc and while aluminium has been tried it has been found to be particularly unsatisfactory.

According to the invention aluminium suitably treated so as to have an oxide surface is utilized for the purpose of forming the surfaces of mouthpieces, sound tubes, earpieces, diaphragms, and the like hereinafter referred to generally as sound conducting apparatus.

It has been found that aluminium mouthpieces when treated by what is known as the anodizing process give superior results to those employing the usual copper/zinc alloy, but the invention is not limited to this particular process as other known methods of producing a similar oxide surface can be employed without departing from the spirit of the invention. The invention is particularly suitable for use in connection with deaf aid instruments as it enables the weight of the device to be used in connection with the ear to be reduced very considerably.

In order that the invention may readily be understood an example of sound conducting apparatus to which the invention may be applied will now be described with reference to the accompanying drawing wherein

Fig. 1 is a sectional view of a sound conducting apparatus, and

Fig. 2 is a plan view thereof.

The apparatus shown which corresponds to that illustrated in Figs. 9 and 10 of my application filed of even date herewith, now Patent No. 2,087,052, has an outer shell-like member formed of aluminium or aluminium alloy or having an inner layer of aluminium or aluminium alloy. This member is composed of a series of cylindrical shell portions AKBL, CMDN, EOFP and GQHR each of successively smaller diameter. These portions are arranged co-axially in suitably spaced relationship. The largest diameter portion AKBL is joined at one end to one end of the next smaller diameter portion CMDN by a frusto-conical shell portion BLCM while the cylindrical shell portion CMDN is joined at its other

end to one end of the next smaller portion still, namely, EOFP by the frusto-conical shell portion DNEO. Similarly the cylindrical shell portion EOFP is joined by the frusto-conical shell portion FPGQ to the smallest cylindrical shell portion GQHR. In this manner the outer shell-like member is arranged to have cylindrical shell portions alternating with portions shaped like the surface of a frustum of a cone so as to form a passage having a small opening at one end and a large opening at the other.

The inner surface of the aluminium or aluminium alloy wall of the outer shell like member is according to the invention treated in such a way as to have a much harder consistency than that of pure aluminium or the alloy for instance by anodical treatment or by a known chemical process so as to produce a coating having a high degree of adherence and considerable hardness.

Arranged within the outer shell-like member are one or more members formed of aluminium or aluminium alloy or at least on their outer surface facing the sound passage and having conical surfaces. One of these members is shown at STUV and has the shape of two equal conical shells placed base to base, the apices being S and V and the common base plane designated by TU. The plane TU is arranged to coincide with that of the junction of the cylindrical portion AKBL with the frusto-conical part BLCM, while the axial line of the double cone member is arranged coincident with that of the outer member.

The outer aluminium or aluminium alloy surfaces of the double cone member are coated by anodic or like treatment as previously described and act as sound reflecting means, the upper cone in conjunction with the cylindrical portion AKBL forming a passage of uniformly varying cross-section while the lower cone in conjunction with the frusto-conical part BLCM serves to reflect sound from one opening towards the other.

A similar double cone shaped member WXYZ is arranged at the junction plane of the cylindrical portion EOFP with the frusto-conical part FPGQ and operates in a similar manner to that just described.

The above described apparatus is merely by way of example and the invention is applicable to sound conducting tubes or reflectors generally and particularly to the devices illustrated and claimed in my co-pending application of even date, above mentioned.

In sound conducting tubes the effect of the hardened surface is that sound is transmitted

with a minimum of loss; in fact it has been generally recognized that aluminium although advantageous on account of its lightness could not be satisfactorily employed whereas with the method according to the invention very satisfactory results are obtained and the use of heavier metals can thus be avoided. Actually I have found that pure aluminium gives the most satisfactory results but as improved results are also obtained with aluminium alloys these must be considered as included within the scope of my invention.

In sound reflecting apparatus, the hardness of the surface employed according to the invention also gives very efficient results so that in an apparatus such as illustrated both advantages are made use of and when such apparatus is used as a mouthpiece very satisfactory results are obtained, speech uttered at a distance of two feet is capable of being reproduced with considerable loudness and with a remarkable freedom from distortion which is prevalent in other forms of mouthpiece.

The various parts of the apparatus as described above are preferably constructed by means of spinning, in which case the outer member can be constructed in one piece while the double cone members are each arranged as a two-piece construction the upper cones being formed integral with tubular extensions *e* which are adapted to fit and be secured within the next smaller cylindrical portion of the outer member.

Several large portions of each of the tubular extensions *e* lying between the base plane of the double cone member and the supporting cylindrical portion of the outer member are cut away so as to leave only narrow supporting arms *s*.

It should be pointed out that by processes involving the anodic treatment of aluminium and its alloys coatings of varying degrees of resistance and hardness may be produced. The coatings which come into question in the present invention are those characterized by a high degree of adherence and considerable hardening, i. e. a hardening materially greater than that of aluminium or aluminium alloy itself. Such coatings may also be produced on aluminium and its alloys by purely chemical methods.

The treatment of the surfaces as described may be effected either before or after the assembly of the parts while the exterior surfaces may also be similarly treated if desired.

I claim:

1. Sound conducting apparatus formed of aluminium-containing metal which is provided with a hard superficial layer produced by processes involving anodic treatment.

2. Sound conducting apparatus formed of metal mainly consisting of aluminium which is provided with a hard superficial layer produced by processes involving anodic treatment.

3. Sound conducting apparatus formed of substantially pure aluminium which is provided with a hard superficial layer produced by processes involving anodic treatment.

4. Sound conducting apparatus formed of metal mainly consisting of aluminium which is anodically treated so as to offer a hard surface facing the sound passage.

5. Sound conducting apparatus formed of substantially pure aluminium which is anodically treated so as to offer a hard surface facing the sound passage.

6. Sound conducting apparatus having sound reflecting members formed of aluminium-con-

taining metal which is provided with a hard superficial layer produced by processes involving anodic treatment.

7. Sound conducting apparatus having sound reflecting members formed of metal mainly consisting of aluminium which is anodically treated so as to offer a hard surface facing its sound passage.

8. Sound conducting apparatus having walls embracing a passage formed of aluminium-containing metal the surface of the lining facing the sound passage being provided with a hard superficial layer produced by processes involving anodic treatment.

9. Sound conducting apparatus having walls embracing a passage formed of metal mainly consisting of aluminium the surface of the lining facing the sound passage being provided with a hard coating by anodic treatment.

10. Sound conducting apparatus having cylindrical walls formed of aluminium-containing metal which is provided with a hard superficial layer produced by processes involving anodic treatment on the inner surface.

11. Sound conducting apparatus having cylindrical walls formed of substantially pure aluminium anodically treated on the inner surface.

12. Sound conducting apparatus having a wall shaped like the surface of a conical frustum and formed of aluminium-containing metal which is provided with a hard superficial layer produced by processes involving anodic treatment on the inner surface.

13. Sound conducting apparatus having an outer wall shaped like a cylindrical surface and formed of metal mainly consisting of aluminium which is provided with a hard layer by anodic treatment on its inner surface and an inner wall shaped like the surface of a cone and formed of metal mainly consisting of aluminium which is provided with a hard layer by anodic treatment on its outer surface, the two walls forming a passage of uniformly varying cross section.

14. Sound conducting apparatus having an outer wall shaped like a frustum of a cone and formed of metal mainly consisting of aluminium which is anodically treated so as to provide a hard layer on its inner surface and an inner wall shaped like the surface of a cone and formed of metal mainly consisting of aluminium which is anodically treated so as to provide a hard layer on its outer surface, the two surfaces forming a passage by which sound may be reflected from one surface to the other.

15. Sound conducting apparatus comprising a spinning of metal mainly consisting of aluminium anodically treated so as to provide a hard layer on its inner surface and arranged to have cylindrical portions alternating with portions shaped like the surface of the frustum of a cone so as to form a passage having a small opening at one end and a large opening at the other end.

16. Sound conducting apparatus comprising a spinning of substantially pure aluminium anodically treated so as to provide a hard layer on its inner surface and arranged to have cylindrical portions alternating with portions each shaped like a frustum of a cone so as to form a passage having a small opening at one end and a large opening at the other end one or more members shaped like the surface of a cone also formed of substantially pure aluminium anodically treated so as to provide a hard layer on the outer surface and spaced centrally in said spinning for the purpose of reflecting sound in conjunction with the

frustum shaped portions from one end opening towards the other.

5 17. Sound conducting apparatus formed of a metal alloy comprising aluminium which is provided with a hard superficial layer consisting of an aluminium compound.

10 18. Sound conducting apparatus formed of substantially pure aluminium which is provided with a hard superficial layer consisting of an aluminium compound.

19. Sound conducting apparatus having sound

reflecting members formed of a metal alloy comprising aluminium which is provided with a hard superficial layer consisting of an aluminium compound.

20. Sound conducting apparatus having walls embracing a passage formed of a metal alloy comprising aluminium the surface of the lining facing the sound passage being provided with a hard superficial layer consisting of an aluminium compound.

DOUGLAS STUART SPENS STEUART.

10