March 19, 1929. C. M. GOLDSTEIN 1,705,663

SOUND DUCT FOR TALKING MACHINES

Filed June 9, 1924

Fig. 1.

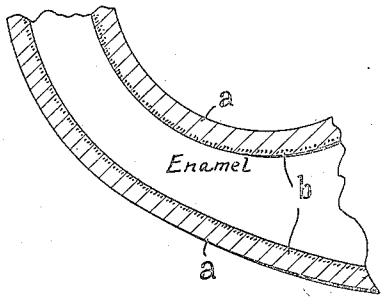


Fig. 2.

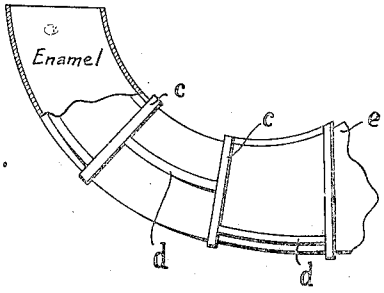


Fig. 3.

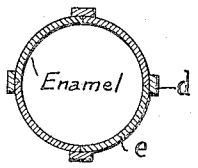


Fig. 4.

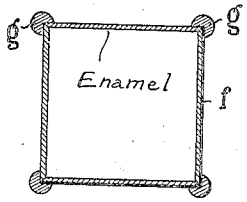
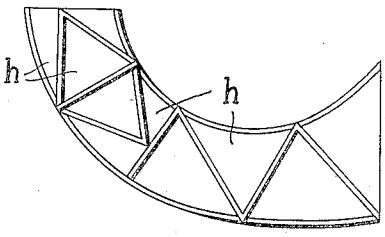


Fig. 5.



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UNITED STATES PATENT OFFICE.

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SOUND DUCT FOR TALKING MACHINES.

Application filed June 9, 1924, Serial No. 718,982, and in Germany November 10, 1923.

This invention relates to sound ducts for talking machines.

Sound ducts of greatly varying forms and made of the most different kinds of materials have been suggested and used for talking machines, without however there being obtained up to the present a sound duct which fulfils the desired purpose, namely a quite natural reproduction of the sounds produced.

The majority of sound ducts as hitherto made were incapable of giving the desired natural reproduction owing to the fact that they were constructed in accordance with the laws which obtain in the construction of musical instruments, either wind instruments or even stringed instruments,

The action of musical instruments, particularly with regard to their walls, does not consist in reproducing the sound produced by the string or the like in a manner true to nature, but in effecting a transformation of the sound by the transmission of the sound or vibrations produced by the string firstly to the body of air enclosed by the walls and secondly to the walls themselves so that the walls partake in a very special manner in the production and transformation of the sounds.

Such a production and transformation of the sound by the resonance action of the walls can naturally only be effected in a suitable manner for sounds of a fixed and definite character by an appropriate choice of the shape, size and material of the resonance walls, and the laws governing the construction and shape of the resonance walls differ from each other for different musical instruments.

It follows therefore from what has been mentioned above that for instruments reproducing music, such for example as talking machines, by which sounds or even noises of all kinds are to be produced in a manner true to nature, the laws governing ordinary musical instruments cannot be applied in a manner suitable to the purpose, as the resonance action of the extraordinarily elastic resonance medium, namely the enclosed column of air, should be the principal or preferably the sole resonance body, and all resonance action of the sound duct itself must be avoided, as the resonance action of the walls changes sounds of a definite character so as to sound harmoniously, but would produce an unnatural change in those of an irregular character or at least would influence them detrimentally.

In order to obviate this disadvantage of the sound ducts as hitherto constructed attempts have been made to construct sound ducts of a soft material, such as lead for example. Such sound ducts however only remedied the defects to a slight extent, and on the other hand were subject to the disadvantage that the soft material produced an absorption of the sound and therefore a weakening of the acoustic energy with the result that a flat hollow sound was produced.

The necessity arises therefore of constructing the sound duct in such manner as to exhibit no resonance action or sound absorption action of any kind by the walls, and further to offer no frictional or other resistance to the sound waves vibrating through it so as to avoid obstructions, marginal eddies or absorption of the sounds caused by rough or soft internal surfaces of the sound duct whereby the character of the vibrations of the sound waves would be impaired, changed or weakened.

For the purpose according to the present invention the weight of the sound duct is made so great in proportion to the surface area of the walls of the duct that resonance action of the walls of the duct is prevented, said walls of the duct being constructed of hard highly elastic material and with a smooth inner surface to prevent frictional resistance to the sound waves and any vibrations of the walls resulting from such resistance. Preferably the walls of the sound duct are provided internally with a smooth unoxidizable coating. In order to reduce the thickness of the walls of the sound duct and still maintain the required weight in proportion to its surface area, it may be provided with strengthening pieces, ribs or the like laid thereon, which prevent any vibration of the walls and consequent resonance action. The sound duct may be constructed of several portions particularly of metal, connected together in such manner as to ensure the homogeneity of the joints, for example by welding according to any usual process, and the joints may be provided with welded seams or the like which act as strengthening members. By this means in addition to the increase in the weight a division of the walls into separate area is ob-

tained, each of such areas being itself made heavy in proportion to its surface area and each area having a period of vibration which is different from that of the adjacent area.

In order that the said invention may be clearly understood and carried into effect the same will now be described more fully with reference to the accompanying drawings in which:—

Figure 1 is a longitudinal section of one construction of sound duct according to the present invention.

Figure 2 shows in side elevation and partial longitudinal section a modified construction.

Figures 3 and 4 are transverse sections of further modifications, and

Figure 5 is a side elevation of another construction.

The sound duct illustrated in Figure 1, may be made of metal or other suitable material, and the walls *a* are made so heavy in proportion to their surface that when sound waves pass through the duct concurrent vibration and consequently resonance action of the walls can not take place. On its internal surface *b* this sound duct is provided, after it has been suitably polished or smoothed, with a coating of enamel or the like, so that any friction between the sound waves passing through it and the walls is avoided.

The sound duct shown in Figure 2 may be made from lighter material, and is provided externally with suitable strengthening members, ribs or the like *c*, *d*, which are affixed in any desired manner and according to any desired arrangement to the external surface *e* of the sound duct. The internal surface *b* of the duct is also made smooth and provided with a coating as above described.

The sound duct itself may conveniently be made in several parts as shown in transverse section in Figure 3, the junctions of the various parts being covered by the ribs *d*. The joints of the sound duct may be arranged along its longitudinal axis or at an angle thereto.

Figure 4 shows a constructional form in which the side walls of the sound duct are made of comparatively light material and are joined at their abutting edges by means of a suitable process for ensuring the homogeneity of the joints, such as by autogenous welding. The welded seams *g* are in this case so strengthened that they form strengthening ribs which prevent any concurrent vibration of the connected walls *f*. Instead of the longitudinal welded seams used in this constructional form transverse welded seams may also be used or a combination of longitudinal and transverse seams with suitable strengthenings.

In Figure 5 is shown a modification in which the several areas *h* are made so small in proportion to their weight by the subdivision of their surface area that, notwithstanding their comparatively small thickness they produce no vibrations and therefore no resonance action.

In sound ducts which are made of a number of parts and subsequently jointed together, the smoothing and the coating of the internal surfaces (if this be required) may be carried out before the separate parts are put together.

Having now fully described my invention what I claim and desire to protect by Letters Patent of the United States of America is:

1. A sound duct for talking machines, in which the weight of the sound duct is so great in proportion to the surface area of the walls of the duct that resonance action of the walls of the duct is substantially prevented, said walls of the duct being composed of hard highly elastic metallic material and having a smooth inner surface to prevent frictional resistance to the sound waves and any vibrations of the walls resulting from such resistance.

2. A sound duct for talking machines, according to claim 1, in which the duct is composed of a number of metal parts homogeneously welded together, the welded seams being of such thickness as to form weights at a predetermined ratio to the area of the duct and prevent vibration and resonant action of the said connected parts.

3. A sound duct for talking machines according to claim 1, in which the interior surfaces of the walls of the duct are provided with a smooth coating of enamel for the purpose specified.

4. A sound duct for talking machines composed of a number of metal parts homogeneously welded together, the welded seams being of such thickness and weight as to substantially prevent vibration and resonant action of the said connected parts, the interior surfaces of the walls of the duct being provided with a smooth coating of enamel.

In testimony whereof, I affix my signature.

CARL MAX GOLDSTEIN.