May 15, 1923. 1,454,913

E. M. C. TIGERSTEDT

DIAPHRAGM ADAPTED TO RECEIVE AND PRODUCE SOUND

Filed July 8, 1919

Fig. 1

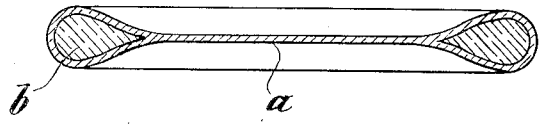


Fig. 2

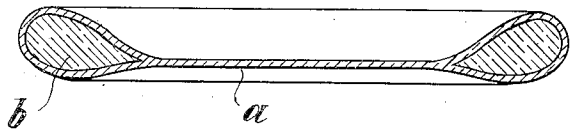
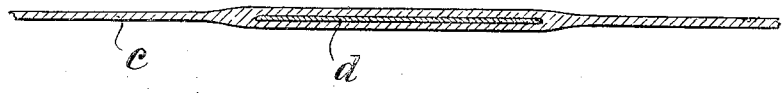


Fig. 3



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Patented May 15, 1923. 1,454,913

UNITED STATES PATENT OFFICE.

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DIAPHRAGM ADAPTED TO RECEIVE AND PRODUCE SOUND.

Application filed July 8, 1919. Serial No. 309,494.

To all whom it may concern:

Be it known that I, ERIC MAGNUS CAMPBELL TIGERSTEDT, engineer, a subject of the Republic of Finland, residing at Frederiksberg, near Copenhagen, Denmark, have invented certain new and useful Improvements in Diaphragms Adapted to Receive and Reproduce Sound, of which the following is a specification.

In the known hearing and talking apparatuses, the diaphragm consists ordinarily of a plane disc of mica, carbon or metal which is firmly screwed or held between rings. These discs are ordinarily cut from sheets or produced by pressing, and are rather thick which circumstances causes the reproduction of sound to be relatively weak. Thinner diaphragms, which have been tried occasionally, do not ordinarily possess the requisite stiffness or tension needed for a clean reproduction of sound.

The present invention relates to the use of very thin films as diaphragms for receiving and reproducing sound. This result is attained by the diaphragm being stretched in special manner by use of suitable liquids by the drying of which the diaphragm is stretched. This stretching is effected for instance, in case of an ordinary plane diaphragm, in the following manner.

In a supporting ring with an inside sharp edge, there is first placed, for instance by pasting, a thin film of any material whatever, for instance, thin paper. The diaphragm, which is previously cut to shape as a round plane disc, is now placed carefully and without air-space on this film, whereafter the entire device is given a coating of a suitable liquid, for instance varnish or collodium. By the drying of these liquid-films an intense contraction takes place, whereby the desired stretching of the diaphragm in radial direction is effected. The diaphragm may be fitted with several similar coatings, where this appears to be of advantage. There may also be used different liquids.

In certain cases, it has appeared advantageous to let the entire diaphragm consist of one or more liquid-films dried in succession. Instead of using a paper-film as initial material as mentioned in the above specified example of construction, a liquid-film is first formed by the ring or the holders being dipped into film-forming liquid suitable for the purpose. After the liquid-film formed in this manner has been dried, it may be fitted with several liquid-coatings. According to this principle it is practicable to stretch diaphragms of any desired shape, the corresponding holders being dipped into suitable liquids whereby liquid-films of minimum surface and high tension will be formed.

In certain cases, the diaphragms referred to may be removed from the supporting ring and fixed in position or stretched by mechanical means, provided that this is done after the diaphragm has attained sufficient tension and stiffness by means of the liquid-films.

The invention relates further to the arrangement that the diaphragms tightly enclose a supporting ring of oval, preferably pear-shaped cross-section the pointed end being directed towards the centre of the ring. On the drawing, there are illustrated two different manners of constructing these new diaphragms. Fig. 1 shows a cross-section of the diaphragm *a* and the supporting ring *b*. For the sake of clearness, the diaphragm is drawn considerably thicker than it really is.

The supporting ring consists suitably of some stiff material, for instance ebonite and the like, which does not yield to the pull which the diaphragm might exert on the supporting ring.

The diaphragm is a dried or hardened liquid-film, for instance collodium. This arrangement renders it practicable to use a diaphragm whose thickness may be reduced to or even below, 0.001 m/m. without the distinctness of the sound being decreased.

A diaphragm of this nature is eminently suitable for a simultaneously strong and pure reproduction of sound.

As shown by the drawing, the diaphragm encloses the supporting ring completely, without any space between the surfaces of contact. The characteristic combination of the swinging parts of the diaphragm and the supporting ring into an organic unity offers considerable advantages in comparison with the hitherto used diaphragms. In consequence of a high interior tension in radial direction, the reproduction of sound is very perfect and free of disturbing secondary sound. This pure reproduction of sound is also present when the diaphragm works in any position different from the plane one.

In certain cases it has appeared to be suit-

able to place a plane disc on the diaphragm. In ordinary talking machines, this plate serving to increase the sound consists for instance of mica. In other cases where the vibrations of the diaphragm are performed by action of an electro-magnet, the disc may be of metal possessing magnetic properties.

A further improvement in the above mentioned arrangement consists in the plane disc being entirely enclosed in the diaphragm as shown in Fig. 3 on the drawing, the disc *d* being on all sides enclosed by the diaphragm *c*. By this arrangement, the plane-parallelism of the diaphragm is retained, even during the most heterogeneous sound-impressions.

Having now described my invention what I claim is:

1. A diaphragm comprising a film and a stiff supporting member to which the peripheral portion of the diaphragm is directly attached, and in which said supporting member is embedded, said peripheral portion of the diaphragm covering said supporting member.

2. A diaphragm comprising a film and a stiff supporting member to which the peripheral portion of the diaphragm is directly attached, said supporting member comprising a ring of oval cross section whose pointed end is directed towards the center of the ring, said supporting member being embedded in and covered by the peripheral portion of said diaphragm.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ERIC MAGNUS CAMPBELL TIGERSTEDT.

Witnesses:

OLAV HALDING,

KAY TUM.