N. TANNAKA.

TELEPHONE RECEIVER.

APPLICATION FILED DEC. 19, 1916.

1,252,056. Patented Jan. 1, 1918.

Fig. 1.

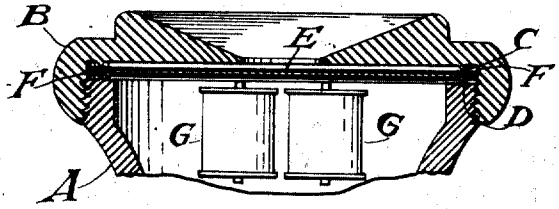



Fig. 2.

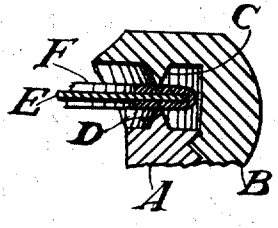



Fig. 8.

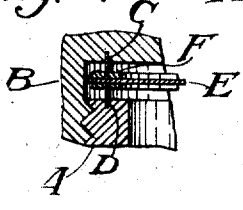



Fig. 3.

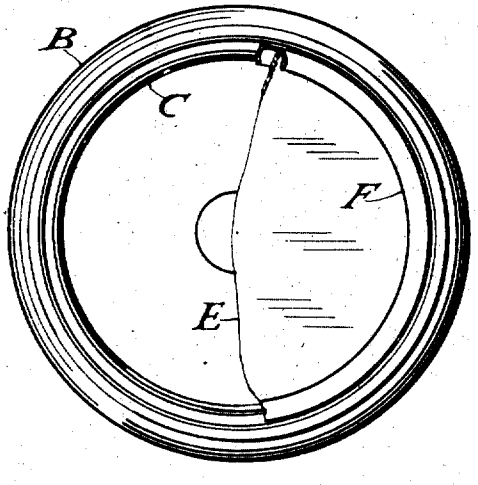



Fig. 4.

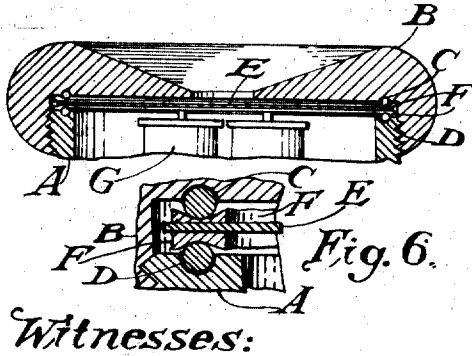



Fig. 6.

Fig. 5.

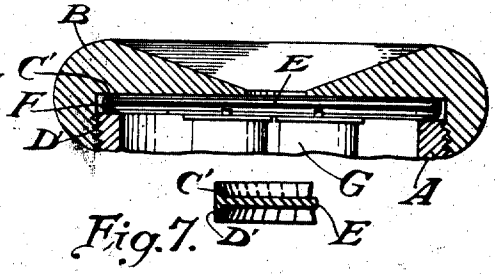



Fig. 7.

Witnesses:

Francis J. Fahey

Joseph M. Dumont.

Inventor:

Naho Tannaka

# UNITED STATES PATENT OFFICE.

NAHO TANNAKA, OF BOSTON, MASSACHUSETTS.

## TELEPHONE-RECEIVER.

1,252,056. Specification of Letters Patent. Patented Jan. 1, 1918.

Application filed December 19, 1916. Serial No. 137,775.

*To all whom it may concern:*

Be it known that I, NAHO TANNAKA, a subject of the Emperor of Japan, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Telephone-Receivers, of which the following is a full, clear, and exact description.

This invention relates to improvements in telephone receivers in which a diaphragm is somewhat yieldingly mounted in such manner, that only minute movement is permitted at the peripheral portion thereof.

As it is usual practice, when the diaphragm of a telephone receiver is directly clamped between rigid parts, the diaphragm tends to respond to electrical impulses with the vibration of the inherent cracking sound, such as is heard when the circuit connection is made or broken, or when strong pulsations are received, causing disagreeable or distorted sound in reproduction. The introduction of soft washers or cushions at the peripheral portion on opposite sides of the diaphragm eliminates or, at any rate, softens the sound, but the distance between the diaphragm and the magnetic poles, which is to be delicately adjusted and so maintained to obtain the best result, is subjected to undue variation or alteration, impairing the sensitiveness of the apparatus, unless the extra displacement due to the yielding of the cushions is limited. I have found that soft rubber or felt washers, when interposed between the casing and the diaphragm under proper pressure with a small contact area so that the peripheral vibration of the diaphragm is permitted within a narrow limit, is sufficiently yielding or flexible to minimize the distortion or, at least to soften the sound, yet maintaining delicate adjustment of the magnetic distance.

The essential object of my invention is to provide apparatus of this class, in which the diaphragm is faithfully responsive to the electrical impulses in its circuit, or with which sound is translated softer than with ordinary apparatus, without accompanying disagreeable harsh or cracking sound.

With the above and other objects in view, my invention comprises certain detail of construction and arrangement of parts as will be hereinafter more fully described, illustrated and claimed.

The invention is best understood from the description taken in connection with the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a vertical central section of a telephone receiver embodying my invention, partly broken away; Fig. 2 showing an enlarged view of a part thereof; Fig. 3, a back view of the front piece of Fig. 1 with a broken diaphragm and collar thereon; Figs. 4 and 5 are sectional views of modifications similarly embodying the invention; Figs. 6 and 7, enlarged detail views of parts respectively of Figs. 4 and 5; and Fig. 8 is another modification showing a part of the apparatus.

Similar characters of reference designate similar or corresponding parts throughout several views.

In the drawings, a receiver barrel or cup A and an ear piece B screwed therewith constitute a casing or housing. The shoulder C of the ear piece is edged as shown in Fig. 2, or equivalently an edged ring C is secured thereto, and similarly the open end D of the barrel or cup is edged or an edged ring D likewise mounted thereon. The edged or sharpened sides of the rings confront a diaphragm E which is cushioned with a circular rubber band or collar F or felt rings, as shown in Figs. 6 and 8, or the like, against the edged rings that hold them together. By the screwing the casing, the cushions or washers are placed under proper pressure, so that the desired minute movement of the diaphragm periphery is permitted, the proper adjustment of the distance, under such circumstance, between the diaphragm E and the poles of magnets G previously having been made. The circumferential edge of the diaphragm, if exposed, is preferably kept away from contact with the casing.

The responsive action to magnetic variation of such yieldingly mounted diaphragms is obviously different from those rigidly mounted as in ordinary receivers, *e. g.*, functionally in bending under centrally acting stresses, in that the former takes a form of singular curvature, while the latter curves near the fixed part as well as at the center, and that the former therefore has more freedom of vibration.

In Figs. 4 and 6, the edged rings are shown replaced by wire rings of circular section placed in recesses of the casing A, B, but the section may be of any other form, such as an angular one shown in Fig. 2, or a rectilinear one shown in Fig. 8. Felt

cushions F in form of rings are pressed between the diaphragm and the rings C and D on opposite sides of the diaphragm, the latter thereby being gently held by the rings.

In Figs. 5 and 7, a diaphragm E has a rim portion C' D' which corresponds to the edged rings C and D of Fig. 1 in combination, and is held between the ear piece and barrel of a casing through cushioning washers F, thus the rings being carried by the diaphragm in form of a rim edged perpendicularly thereto, instead of being attached to the casing.

The arrangement in Fig. 8 is the same as Fig. 6, excepting the form of the rings which are thin bands, and considered to be the most convenient form in applying the present invention to ordinary receivers.

The purpose of the employment of the rings being to have proper small area of pressure contact, the rings may take any other suitable form and shape, when desired. I have found that the structure as above mentioned permits required precise adjustment of the magnetic distance, and is compact enough to maintain it permanently, while it is sufficiently elastic for the purpose.

From the foregoing description taken in connection with the accompanying drawings, the advantage of the construction and arrangement of parts and the method of operation will be readily apparent to those skilled in the art to which this invention appertains, but I wish to have it understood that while I have described and illustrated the apparatus as now thought to be the best embodiments of my invention, the apparatus herein shown are merely illustrative, and that therefore, I do not confine myself to any strict conformity to the showing of the drawings, but that such changes and modifications may be made, when desired, as to fall within the scope of the invention as claimed.

Having thus described my invention, what I claim as new is:

1. In a telephone receiver, a cell and a diaphragm in coöperative relation with electrical means for translating electrical impulses into sound, stiff rings on opposite sides of the diaphragm, and cushioning washers disposed in contact with sides of the rings and pressed therewith together between the cell and the diaphragm, the said sides of the rings being shaped and related to the washers, in such manner that small part of each washer is effectually under pressure.

2. In a telephone apparatus, a vibrator mounting, comprising heaving members which terminate with small surface ends on opposite sides of a vibrator, and a yielding element in contact with the vibrator and held therewith together between the heaving members, so that a minor portion of the yielding element is effectually under pressure.

3. In a telephonic apparatus, the combination with magnetic means; of a cell and a diaphragm, one of the said members having parts which are oppositely projecting toward the other member, and cushions disposed over the said projecting parts and held between the cell and the diaphragm, so that small parts of cushions are effectually under pressure.

4. In a telephone apparatus, a diaphragm mounting, comprising members which have narrow edges on opposite sides of a diaphragm, cushions disposed in contact with the edges of the said members, and a casing containing all the above parts together under pressure.

5. In a telephone receiver, a casing, and a diaphragm, one of said members having projections which terminate with small surface edges on opposite sides of the diaphragm, and a pliable collar or cushion disposed in contact with the edges of said projections and held between said projections and the other of said members.

6. In a telephone receiver, the combination with a casing, magnetic means, and a diaphragm; of a yielding collar over the peripheral portion of the diaphragm, and shoulders on opposite sides of the collar in contact therewith, being so shaped and so related to the collar, that small parts of the collar are effectually under pressure.

7. In a telephone receiver, a diaphragm, cushions in contact with the peripheral portion thereof, and a casing having on opposite walls thereof inwardly heaving portions which terminate with small surface edges and hold said diaphragm therebetween through said cushions; in combination with magnetic means.

8. In a sound apparatus, a vibrator mounting, provided with a cushioning element in contact with the edge part of the vibrator, and shoulders, disposed on opposite sides of the vibrator and having narrow projecting edges, for pressing the vibrator and the cushioning element together.

9. In a telephonic apparatus, a mounting for the diaphragm thereof, provided with a casing which has projections on opposite sides of the diaphragm, at least one of the said projections being edged toward the diaphragm, and a yielding element disposed in contact with the edge part of the diaphragm and held therewith together between the said projections.

10 In a telephone apparatus, a diaphragm mounting, comprising yielding washers on opposite sides of a diaphragm, and rings pressing and holding said washers and the diaphragm together, and having small surfaces at the parts of pressure con-

tact with the washers, so that but narrow strips of washers are effectually under pressure.

11. In a telephone receiver, a diaphragm mounting comprising yielding members on opposite sides of a diaphragm, and opposing shoulders, at least one of which has a narrow edge and which are disposed in contact with said yielding members so as to press and hold said diaphragm from the opposite sides.

12. In a sonorous apparatus, a diaphragm mounting comprising a casing which has circularly narrow edged portions on opposite sides of a diaphragm, and cushions or yielding washers held together with the diaphragm between the said edged portions.

13. In a telephone receiver, a casing, a diaphragm in the casing, rings, each having a stiff rim of small surface, on opposite sides of the diaphragm, and cushions disposed in contact with the said rims and held with the rings between the casing and the diaphragm, so that a small portion of the mass in each cushion is effectually under pressure.

14. In a telephone receiver, the combination with a casing, magnetic means, and a diaphragm; of rings, each edged toward the other on opposite sides of the diaphragm in the casing, and a cushioning collar or pad disposed in contact with the peripheral portion of the diaphragm, and held therewith together between the said rings.

15. In a sonorous apparatus, a mounting for a diaphragm, comprising a casing, opposing rings having narrow edges with yielding parts at the confronting sides of the rings for holding the diaphragm between the said yielding parts.

16. In a sonorous apparatus, a vibrator mounting, provided with opposing shoulders, at least one of which has a narrow edge projection, pliable members disposed on opposite sides of a vibrator and pressed therewith together between the shoulders.

17. In a telephonic apparatus, a diaphragm mounting, comprising a casing provided with heaving parts terminating with small top surfaces on opposite sides of a diaphragm, and elastic members held between the diaphragm and the heaving parts, and so related to the heaving parts that small part of each of the elastic members is effectually under pressure.

In testimony whereof, I affix my signature in presence of two subscribing witnesses.

NAHO TANNAKA.

Witnesses:
J. A. McKay,
Joseph McDermott.