E. C. WOOD.

DIAPHRAGM TUNING.

APPLICATION FILED SEPT. 18, 1917.

1,429,664. Patented Sept. 19, 1922.

Fig. 1.

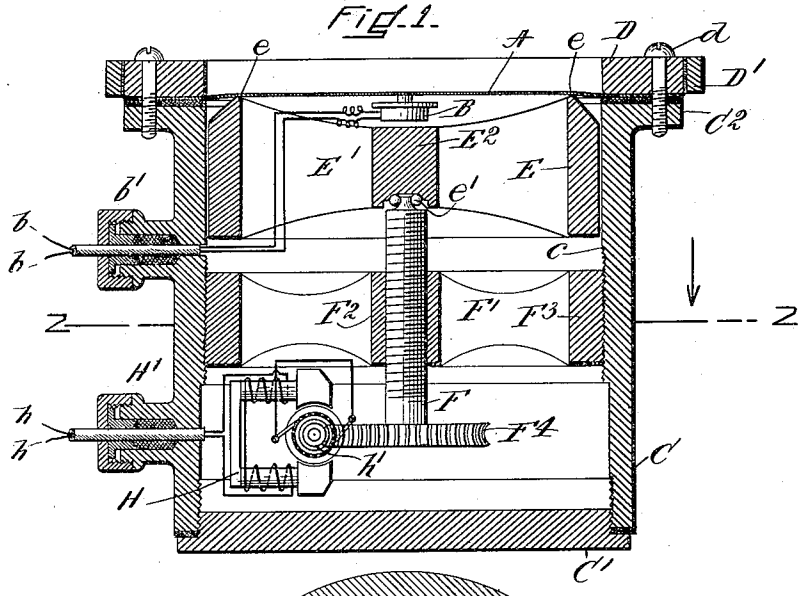


Fig. 2.

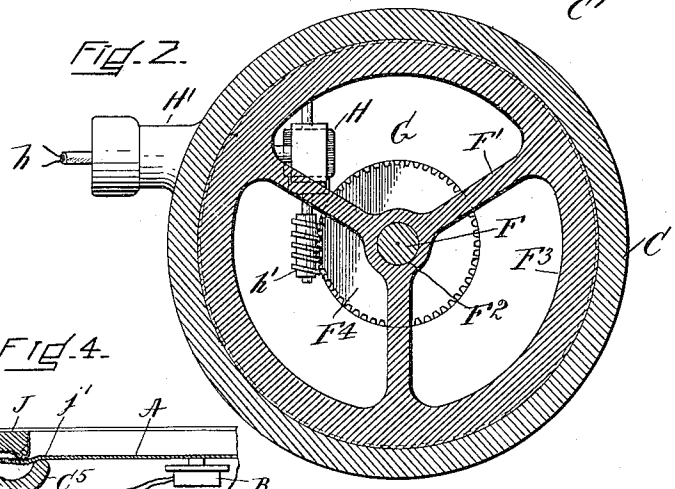


Fig. 4.

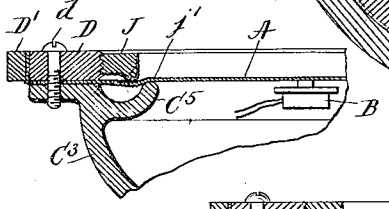
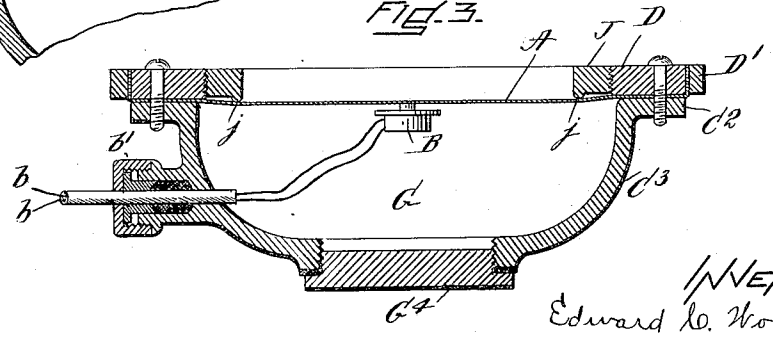


Fig. 3.



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UNITED STATES PATENT OFFICE.

EDWARD C. WOOD, OF SOMERVILLE, MASSACHUSETTS, ASSIGNOR TO SUBMARINE SIGNAL COMPANY, OF PORTLAND, MAINE, A CORPORATION OF MAINE.

DIAPHRAGM TUNING.

Application filed September 18, 1917. Serial No. 192,014.

To all whom it may concern:

Be it known that I, EDWARD C. WOOD, of Somerville, in the county of Middlesex and State of Massachusetts, a citizen of the United States, have invented a new and useful Improvement in Diaphragm Tuning, of which the following is a specification.

It is often desirable that a diaphragm to which, for example, a microphone is attached, shall be capable of being tuned to the pitch of an incoming sound. Thus, especially in submarine signaling, it may be desirable where each one of a number of ships is equipped with a sending instrument having its own period of vibration, that the receiving diaphragm may be capable of being tuned to the pitch at which the signals from a specific vessel are to be sent. So far as I know, this variable adjustment of the diaphragm of a receiver to make it responsive to any one of a number of signals has never been attempted heretofore, although it is known to mount a metallic diaphragm which has been expanded by heat on a mounting by solder so that it will contract on cooling, and its tension will be permanently increased.

My invention will be understood by reference to the drawings in which means are shown for tuning the diaphragm, although other ways for holding and tuning the diaphragm may suggest themselves to those skilled in the art.

Figure 1 is a section showing a means for tuning by increasing the tension on the inside surface of the diaphragm;

Fig. 2 a section on line 2—2 of Fig. 1, and

Fig. 3 is a section showing another means for tuning applied to the outer surface of the diaphragm.

Fig. 4 shows a further means.

The diaphragm is lettered A and as shown, to the centre of the diaphragm is attached a microphone B of ordinary construction, b being its leads which pass out through the stuffing box b^1. The microphone, however, may be mounted off centre or otherwise if thought desirable.

Referring to Figs. 1 and 2, C is a cylinder forming with the end piece C^1 an open-ended casing within which is formed a chamber G, the outer end of which chamber is closed by the diaphragm A. The diaphragm is held in place by a ring D bolted to a flange C^2 on the end of the part C by bolts d which pass through openings in the diaphragm. The edge of the diaphragm is bent about the ring D and is confined by the binding ring D^1 which is driven or shrunk into place. The diaphragm may be otherwise held fast if desired. When this device is to be submerged in water its joints should be suitably packed.

In order to adjust the tension on the diaphragm I have shown a sliding ring E mounted on the arms E^1 of a spider, the bearing edge e of the ring E being beveled so as to present a small engagement surface to the diaphragm, said edge being preferably located a short distance away from the inner edge of the ring D. The arms E^1 are connected by a central hub E^2 which has preferably ball bearings as at e^1 to engage one end of the adjusting screw F.

The interior of the cylinder C is threaded for a portion of its length as at c and a spider F^1, through a threaded opening in the hub F^2 of which the screw F passes, carries a ring F^3 the periphery of which is threaded into the threads c.

To adjust the position of the sliding ring E and hence the tension on the diaphragm, the ring E being inserted in the chamber G with its edge e against the diaphragm A, and the screw F being screwed a reasonable distance into the hub F^2, the spider F^1 is screwed into the interior of the cylinder C until the end of the screw F engages the hub E^2. Thereafter the further turning of the screw F in one direction or the other will increase or decrease the tension of the diaphragm, the ball bearings which engage the end of the screw reducing the friction.

As this device is intended primarily for use under water, either in a water tank on board ship or in the open water, the end piece C^1 is used to form a watertight closure of the chamber G and means are preferably provided by which the screw F may be turned and the tension of the diaphragm adjusted without removing the end piece C^1.

One convienient means for accomplishing this is shown in Figs. 1 and 2, where H is an electric motor carrying a worm h on an extension of its armature. The screw F carries a worm gear F^4 at its outer end with which the worm h^1 meshes. By sending the current through the motor in one direction the screw is turned, for example, to increase the tension on the diaphragm, and by revers-

ing the current the tension is diminished. As the constuction and means for supporting the motor may be of any convenient character, they are shown diagrammatically. H^1 is a stuffing box through which pass the leads h to the motor.

In Fig. 3 the chamber G is formed between the diaphragm A and the cup-shaped casing C^3 which is provided with a flange C^2 as before, the diaphragm A being held in place by the ring D, bolts d, and the binding ring D^1 as above described. C^4 is a plug which closes a hand-hole in the end of the casing C^3.

J is the tension-adjusting ring having an engaging edge j to engage the outer surface of the diaphragm. It is threaded on its periphery and in this case the interior of the ring D is threaded so that the adjusting ring may be screwed into it and against the diaphragm, a spanner or the like being used for the purpose. This is a convenient way of applying tension to the exposed surface of the diaphragm.

As a modification of the construction shown in Fig. 3, there is shown in Fig. 4 a similar construction wherein, however, the casing C^3 is provided with an internally-projecting annular lip C^5 having at its upper edge a surface j^1 over which the diaphragm A is to be stretched by means of the tension-adjusting ring J which lies between the lip and the holding ring D.

In either case by increasing the tension the diaphragm becomes responsive to a higher periodicity of vibration, while by decreasing the tension the opposite result is secured.

The diaphragm is preferably made of suitable thin sheet metal and, as stated above, by applying to it a proper amount of pressure it may be made responsive as desired or by releasing it from such pressure it will become attuned, i. e., responsive to substantially any vibrations, and the vibrations, whether tuned or attuned, will be taken up by the microphone and transmitted to a telephone receiver or other indicator.

Other ways of embodying my invention will occur to those skilled in the art.

What I claim as my invention is:—

1. The diaphragm mounting above described, comprising means for holding the diaphragm at its edges and adjustable means for stretching said diaphragm, said means being applied to said diaphragm between said holding means and the centre of the diaphragm, and comprising a slidable ring adapted to engage one surface of the diaphragm and means for adjusting said ring toward and from the diaphragm, the edge of said ring engaging said diaphragm being narrowed and located away from the inner wall of said casing, said adjusting means comprising a ring, threaded means for adjusting the ring with relation to the diaphragm and means comprising an electric motor to operate said threaded means.

2. As a means for adjusting the tension of a diaphragm in combination with said diaphragm and means comprising a watertight casing whereby the edge of said diaphragm is held, an engaging ring adapted to slide in said casing, a spider located in said casing and adapted to be adjusted toward and from said engaging ring, rotatable means adjustable in said spinder and adapted to adjust the distance between said engaging ring and said spider, and means operable from outside said casing whereby the tension of said diaphragm may be adjusted without opening said casing.

EDWARD C. WOOD.