

Dec. 15, 1931.

R. R. RIESZ

1,836,816

ARTIFICIAL LARYNX

Filed July 7, 1930

FIG. 1

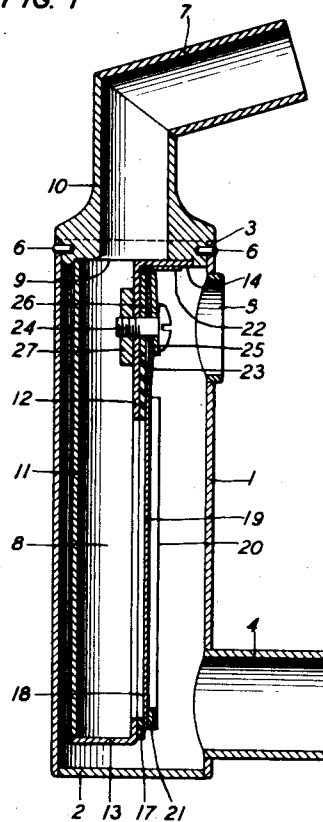


FIG. 3

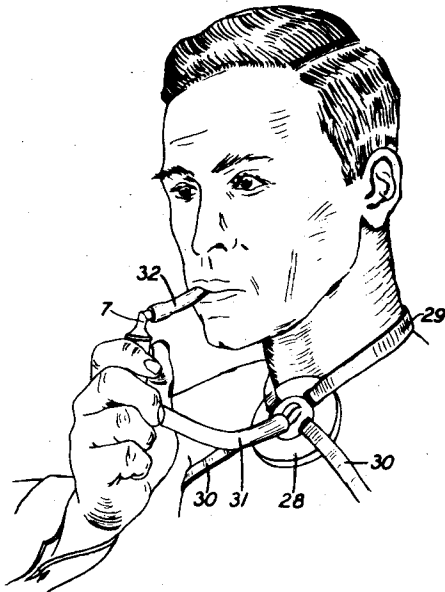
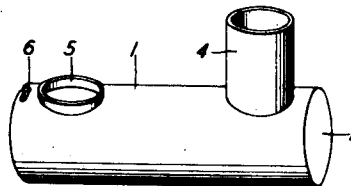
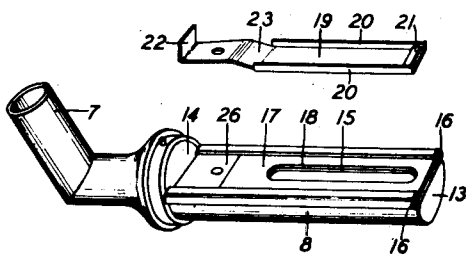


FIG. 2



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ARTIFICIAL LARYNX

Application filed July 7, 1930. Serial No. 468,064.

This invention relates to artificial larynges and more particularly to artificial larynges in which the vibratory element producing the sound is a reed.

5 An object of this invention is to provide an artificial larynx which will produce a tone resembling very closely that which is produced by the natural larynx in the throat of the average male person.

10 A feature of this invention resides in the reed structure employed which is a substantially flat beating type of reed having longitudinal stiffening ribs, a weighted free end and a spring portion which may be adjusted.

15 Other features which permit ready cleaning and sterilization of the various parts reside in the supporting of the reed and sound chamber by an outlet connection, removably secured to the casing by a bayonet connection, and in the holding arrangement for a comparatively soft rubber pad positioned between the under surface of the reed and a wall of the sound chamber.

20 In the attached drawings, Fig. 1 is a side elevation in section of an artificial larynx including the improvement;

Fig. 2 is an exploded view of the artificial larynx showing the vibratory reed separate from its supporting member; and

25 Fig. 3 is an illustration of a person using the artificial larynx.

In some cases of throat infection it becomes necessary to remove the larynx and to terminate the trachea or windpipe in an outside orifice at the base of the front portion of the neck.

30 In operations of this kind the patient invariably loses the power of speech because by removal of the larynx the vocal cords have been removed and it is impossible for the person so operated upon to produce a tone in the throat which may be modulated in the mouth or nasal cavities into articulate speech.

35 To restore the power of speech to a person so operated upon an artificial tone producing instrument commonly known as an artificial larynx has been provided.

40 This artificial larynx comprises usually a casing having inlet and outlet ports and a vibratory element supported within the cas-

ing. The inlet port is connected to the termination of the trachea at the base of the neck by a suitable fitting and the outlet port is placed in the mouth of the user or is extended thereto by a suitable mouthpiece.

55 Air exhaled from the trachea or windpipe through the orifice at the base of the neck passes into the casing of the artificial larynx through the inlet port and sets in vibration the vibratory element supported within the casing and produces a tone. The tone produced passes out of the casing through the outlet port and into the mouth of the user where, by means of muscular movement of the mouth and nasal cavities and movement of the tongue the user can modulate the tone produced by the artificial larynx and form this tone into articulate speech.

Artificial larynges employing various forms of vibratory elements as a tone producing medium have already been invented. Means have also been provided to vary the pitch of the tone produced by shortening or lengthening the operative part of the vibratory element. Such instruments have not been designed especially to produce any particular tone nor have they been designed particularly for use by either a male or a female person.

60 Upon experimentation it has been found that a certain type of vibratory element or reed supported relative to a sound chamber as will be later described, will produce a tone closely resembling in pitch the tone normally produced in the throat of a male person and that in this particular structure there is required only a very slight adjustment of the reed to make the tone produced resemble the natural voice tone of any particular male individual.

65 To further describe this invention, reference will now be had to the accompanying drawings in which 1 is a cylindrical casing having a closed end 2 an open end 3, inlet connection 4 and outlet port 5. Attached to the open end 3 by means of bayonet connections 6, 6 is an outlet connection 7 which may be an elbow connection adapted to receive a mouthpiece or formed so that it can be conveniently placed in the mouth of the user.

Supported within the casing 1 by the outlet connection 7 is a sound chamber 8. This sound chamber which has an opening at 9 registering with the bore 10 of the outlet connection 7 is hemispherical in cross-section and comprises a half-round tubular section 11 which may be made from a half section of a longitudinally split tube, a flat plate 12 soldered across the open side of the half-round tubular section 11 and having a turned-down end portion 13 circumferentially soldered to and closing one end of the sound chamber and a turned-up end portion 14 which is secured to the inner end of the outlet connection 7. In the flat plate 12 is an elongated substantially centrally located aperture 15 and the longitudinal edges of the plate are turned over to form cooperative channels 16, 16 to receive a rectangular semi-soft rubber strip 17. The rubber strip 17 is slid over the flat plate 12 and is held at its edges in the channels 16, 16. The rubber strip 17 is also provided with an elongated aperture 18 which registers with the elongated aperture 15 in the flat plate 12.

Extending over the semi-soft rubber strip 17 and covering the apertures 15 and 18 is a substantially flat reed member 19 of spring material having longitudinally turned-up edge portions 20, 20 which serve as stiffening members, a weight 21 on its free end and a turned-up end portion 22 to engage the turned-up end 14 of the flat plate 12. The reed 19 is provided with an arched and apertured portion 23 forming a spring and this spring portion is secured to the sound chamber near its open end 9 by means of a screw 24 which passes through an apertured upper plate 25, reed 19, an apertured lower plate 26, flat plate 12 and into a nut or threaded block 27 which is soldered to the inner surface of the flat plate 12.

The structure just described may be readily taken apart for cleaning and sterilization as shown in Fig. 2 by separating the outlet connection 7 with its attached sound chamber 8 and related parts from the casing 1 because of the bayonet connection securing means 6, 6. The rubber strip 17 may also be removed by sliding it outwardly in the channels 16, 16.

The reed 19, by reason of the stiffness inherent in the spring material of which it is made, the comparatively short arched spring portion, the longitudinally turned-up edge portions and the weight on the free end, has a natural period of vibration of a comparatively low frequency and when set into vibration produces a tone closely resembling a normal tone of the average masculine voice.

The weight 21 on the free end of the reed 19 is provided to give sufficient weight at this point to make the reed come down hard against the rubber strip 17 and momentarily close the apertures 15 and 18. This results in

abruptly cutting off the wave front and producing in the tone more high harmonics, of which there are an abundance in a natural voice tone. The weight 21 also serves as a loading member to cut down the natural frequency period of the vibration of the reed 19.

The rubber strip 17 between the flat plate 12 and the reed 19 prevents the striking of the reed 19 against the flat plate 12 and the producing of any metallic sound between these two members.

Such slight changes as are necessary in the natural period of vibration to make the vibrating reed produce a tone closely resembling the natural voice tone of any particular male person may be made by adjustment of the screw 24 to make slight variations in the effective length of the arched spring portion 23 of the reed.

Adjustment of the vibratory element 19 may also be made without separating the output connection 7 from the casing 1 by reason of the position of the adjustment screw 24 relative to the outlet port 5 in the casing 1 which makes it possible by insertion of a screw driver or suitable turning instrument through the outlet port 5 to turn screw 24 to regulate the tension of the spring portion 23 of the vibratory element 19.

In Fig. 3, a trachea connection 28 is shown as a means of connection between the artificial larynx and the trachea or windpipe of the user of the instrument. The trachea connection 28 is supported and held in place by a neckband 29 which encircles the neck of the user and by chest straps 30, 30 which pass downward over the chest. The flexible tube 31 serves as a means of connection between the trachea connection 28 and the inlet connection 4 of the artificial larynx. This particular type of trachea connection, however, is not of importance in connection with this invention, as other suitable means of connection between this invention and the trachea or windpipe of the user may be employed. There is also shown in this figure a flexible tube 32 attached to the outlet connection 7 and serving as a mouthpiece. This flexible tube 32 may also be replaced by any other suitable means for conveying the sound of the artificial larynx into the mouth of the user.

The outlet port 5 which is common to artificial larynges of this type serves as a breather port and allows the user of the instrument to breath through this artificial larynx, the air traveling to and from the lungs passing through this port 5, the casing 1, the inlet connection 4, the flexible tube 31, the trachea connection 28 and the windpipe of the user. When this outlet port 5 is closed by a thumb or finger of the user, air exhaled from the lungs through the trachea connection 28 and entering the artificial larynx through the inlet connection 4 passes around and under the reed 19 and through the elongated apertures.

18 and 15 respectively, in the rubber strip 17 and the flat plate 12. An area of low pressure is thus created under the reed 19. The reed is brought down against the rubber strip 17 and sufficient force developed in the spring portion 23 to bring the reed 19 back to normal position. This action being repeatedly gone through, reed 19 is set into vibration and a tone is produced which passing upward through the sound chamber 8 the outlet connection 7 and into the mouth of the user is modulated in the mouth and nasal cavities into articulate speech by natural talking movements of the mouth and tongue of the user.

What is claimed is:

1. An artificial larynx comprising a casing and a reed supported within the casing, said reed having a weighted free end, and reinforcements, said reinforcements comprising edge portions of said reed disposed normal to the plane of the reed.

2. An artificial larynx comprising a casing, a sound chamber supported within the casing and a flat reed attached at one of its ends to a wall of the sound chamber, said reed having edge portions bent normal to its plane, running longitudinally of the reed, a weighted free end, and a spring portion formed at the point of attachment of the reed to the wall of the sound chamber.

3. An artificial larynx comprising a casing, a sound chamber supported within the casing, a pad of semi-soft material supported against the wall of the sound chamber, a reed attached at one of its ends to the sound chamber and extending over said pad, turned-up edge portions on said reed running longitudinally of the reed, and a weight on the free end of the reed.

4. An artificial larynx comprising a casing, a sound chamber supported within the casing, an apertured flat side wall in the sound chamber, an apertured pad supported on the flat side wall of the sound chamber, a weighted flat reed supported on the sound chamber over the pad, a support for the reed, turned edge portions running substantially the length of said reed, and an arched spring portion on said reed at the point of attachment of said reed to the sound chamber.

5. An artificial larynx comprising a casing, an inlet connection on the casing, a breather port formed in the wall of the casing, an outlet connection detachably secured to the casing, a sound chamber supported within the casing by said outlet connection, an apertured flat wall in the sound chamber, an apertured pad detachably supported against said apertured flat wall, turned edges on said flat wall to hold the apertured pad, a flat reed attached at one of its ends to said sound chamber to beat against said pad, an arched spring portion

formed in said reed at its point of attachment to the sound chamber, and adjustable means securing said reed to said sound chamber, said adjustable means being in alignment with said breather port in the casing, and manually operable therethrough to adjust the spring tension of said arched spring portion of the reed.

6. An artificial larynx comprising a casing having an inlet connection and a breather port formed in a wall of the casing, a detachable outlet connection, a sound chamber supported within the casing by said outlet connection, an apertured flat side wall in the sound chamber, turned back edge portions of the flat side wall forming spaced channels, an apertured pad removably supported against the flat side wall by said channels, a flat reed supported over the pad to beat against the pad when set into vibration, an arched spring portion on said reed, and attachment means for said reed securing said reed at one of its ends to the flat wall of said sound chamber, said attachment means disposed in alignment with said breather port and adjustable therethrough to vary the spring tension of the arched spring portion of said reed.

In witness whereof, I hereunto subscribe my name this 3rd day of July, 1930.

ROBERT R. RIESZ.