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SPEECH FACILITATING ATTACHMENT FOR THROAT TUBE

Filed Jan. 9, 1961

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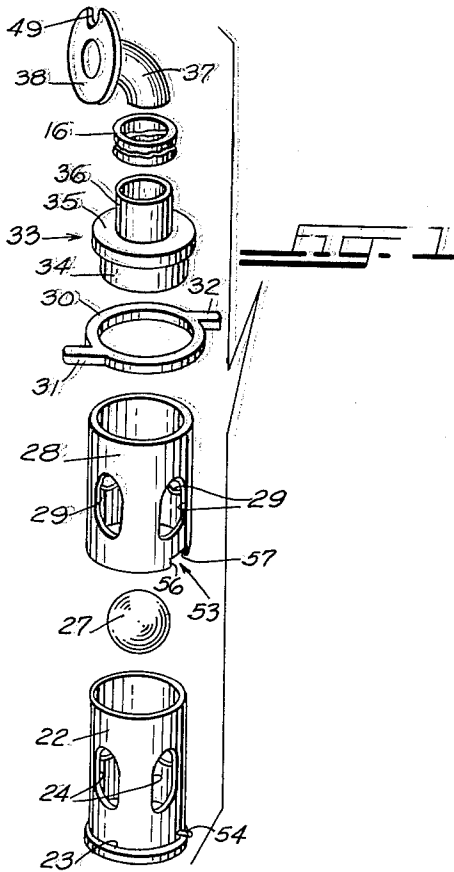
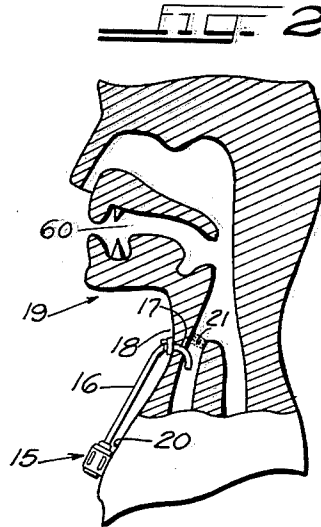
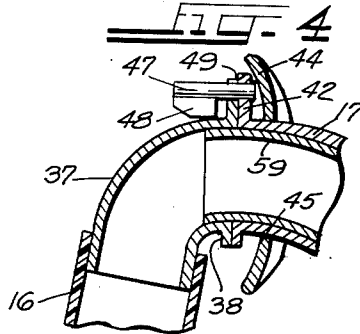
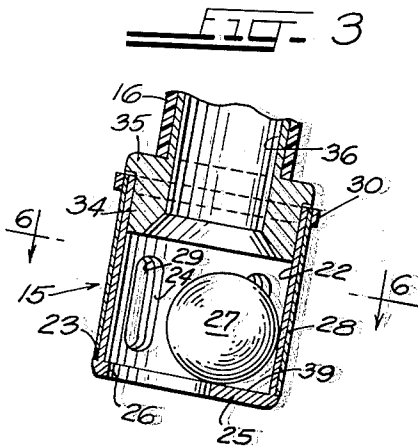
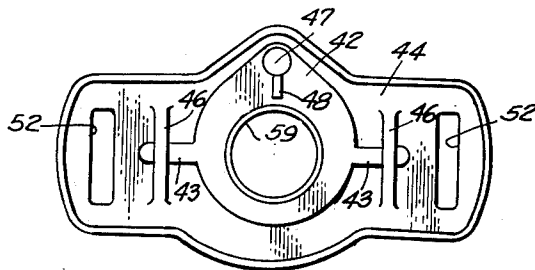


FIG. 5



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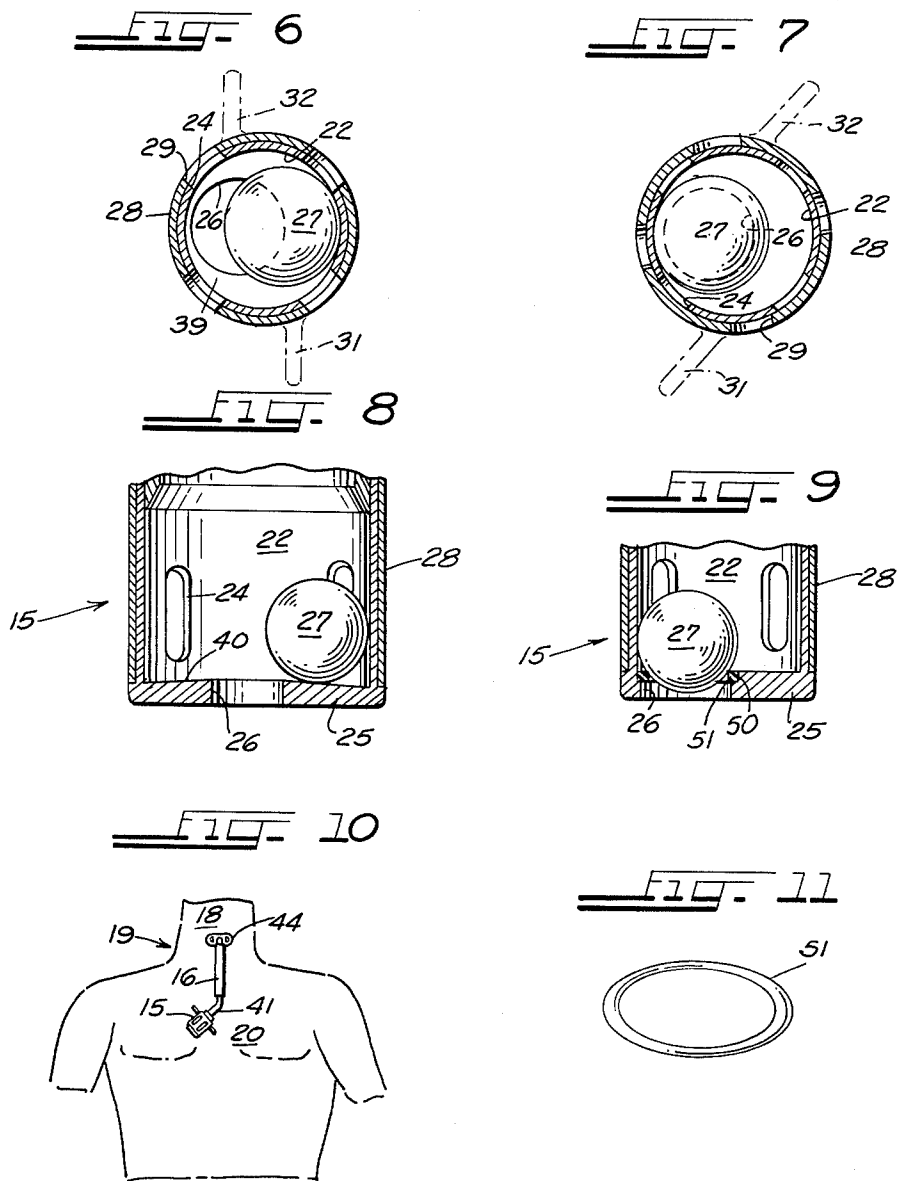
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## SPEECH FACILITATING ATTACHMENT FOR THROAT TUBE

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9 Claims. (Cl. 128—351)

The present invention relates generally to a prosthetic appliance for a person having a breathing impediment in his throat and more particularly to an automatically-functioning speech-facilitating device attachable to the conventional throat tube usually worn by such a person.

The subject device is intended for use in those cases in which the impediment obstructs breathing but does not prevent speaking. In such cases the person has usually undergone a tracheotomy whereby a tube is inserted in an opening made in the throat between the impediment and the lungs, said tube providing an unobstructed passageway for the unimpeded inhalation and exhalation of air. However, in order for the tube wearer to speak, the tube passageway must be closed so that exhaled air is rechanneled upwardly past the vocal cords and outwardly through the mouth. This can be done by placing a finger over the open outer end of the tube, but is inconvenient and undesirable because it ties up one hand for use almost exclusively as a speaking aid and because it makes the wearer self-conscious about his prosthesis.

The present invention, constituting an attachment to the open outer end of a conventional throat tube, maintains an open passageway between the tube and the atmosphere when the wearer is breathing, automatically closes this passageway when the wearer begins to speak, and automatically reopens the passageway when the wearer again inhales.

Basically, the device comprises a housing having a floor and an enclosing wall, a conduit connecting the housing to the throat tube and mounting the housing in an operative position in which the inner surface of the housing floor is inclined, and an opening in the housing floor; the opening, the housing and the conduit providing a breathing passageway between the atmosphere and the throat tube. The device also includes, as its only moveable part, a ball moveable into a seated position in the opening to close the passageway and thereby facilitate speaking. The closed passageway can be opened for breathing purposes by any normal inhalation on the part of the wearer, said inhalation sucking the ball upwardly cut of its seat in the opening whereupon the ball rolls down the inclined inner floor surface of the housing to a position at one side of the opening. The ball stays in this position while air moves inwardly and outwardly through the opening in response to normal inhalations and exhalations by the wearer. However, when the wearer begins to speak, his exhalation is greater than normal and the suction created by the strong outwardly rushing current of air draws the ball back uphill and forces it into its closed position seated in the opening.

The above described device, having only a single moveable part, is simple in construction and operation, and, since it has no springs or irregularly shaped components, can be easily maintained in a sanitary condition merely by rinsing periodically with tap water. The device is relatively small and can be worn against the chest and arranged so that both the housing and the conduit are hidden from view by the shirt and collar of the wearer so that he need not feel self-conscious in public. Notwithstanding the smallness of the device, the passageway provided by the floor opening, the housing, and the conduit is large enough so that the normal flow of air through the throat tube is not decreased.

Contamination of the throat tube by the discharge of mucous or sputum from the throat into the tube during

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coughing is prevented by the subject device. Coughing causes the ball to immediately close the housing floor opening, and this causes a column of air to build up in the housing, conduit and throat tube, and effectively block the entry of sputum.

As an additional feature the subject device has auxiliary breathing ports for use when the wearer is climbing stairs or performing some other exertion which causes heavy breathing. Under such conditions the ball would normally be moved to its closed position with each exhalation, and the device would have lost its utility. To avoid this, the housing wall is provided with ports and is enclosed by a rotatably mounted sleeve also having ports. Under conditions of heavy exertion the sleeve can be rotated until its ports are aligned with the housing ports thereby providing a continuously open breathing vent. Under more normal conditions the sleeve ports are maintained in disalignment with the housing ports so as to allow the automatic speech-facilitating structure to operate.

As a further feature the opening in the housing floor may be provided at its inner end with a ball-engaging washer made of sound-muffling material for decreasing the characteristic clicking noise made by the ball as it seats in the opening.

Therefore it is an object of the present invention to provide a speech-facilitating device for use as an attachment to the conventional throat tube worn by persons who have undergone a tracheotomy.

Another object of the present invention is a speech-facilitating device which automatically adjusts itself for speaking or breathing as the necessity arises.

A further object is a device of the type described which is simple in construction and operation.

Another object is a speech-facilitating device which is easy to keep clean, and which prevents contamination of the throat tube.

Still another object is a speech-facilitating device having auxiliary breathing ports for use under conditions of heavy breathing.

A further object is a device of the type described and which is relatively noiseless in operation.

Other objects and advantages are inherent in the structure claimed and disclosed as will become apparent to those skilled in the art from the following detailed description in conjunction with the accompanying drawings wherein:

FIG. 1 is an exploded perspective view of the subject device;

FIG. 2 is an elevational view partially in section showing the device as it is worn by a person;

FIG. 3 is an enlarged fragmentary sectional view of the device shown in FIG. 2.

FIG. 4 is an enlarged fragmentary sectional view illustrating the connection between a conduit and a throat tube shown in FIG. 2.

FIG. 5 is a front view of the throat tube and an attaching plate;

FIG. 6 is a sectional view taken along line 6—6 in FIG. 3;

FIG. 7 is a sectional view similar to FIG. 6;

FIG. 8 is a sectional view similar to FIG. 3 and showing another embodiment of the subject device;

FIG. 9 is a sectional view similar to FIG. 8 showing a modification of the subject device;

FIG. 10 is a front elevational view showing the device worn in a manner different than that of FIG. 2; and

FIG. 11 is an enlarged perspective view of a washer used in the modification of FIG. 9.

Referring initially to FIG. 2 there is generally indicated at 15 a speech-facilitating device in the form of a valve connected to the lower end of a flexible conduit

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16 the upper end of which is connected to a conventional throat tube 17 projecting from the throat 18 of a person generally indicated at 19 having a throat growth 21 which impedes breathing but does not prevent speaking. When the subject device is mounted in the operative position shown in FIG. 2, air enters valve 15 and passes through conduit 16 and throat tube 17 to the lungs upon inhalation by the person 19, and is exhausted through the same passage, in reverse, upon exhalation. When the person begins to speak the above described passageway is automatically closed, and exhaled air from the lungs moves upwardly past growth 21 and the vocal cords (not shown) and out through the mouth 69 of the person.

Valve 15, shown in greater detail in FIGS. 1 and 3, comprises an inner housing wall 22 extending integrally from a housing floor 25 and surrounded by a lower peripheral ridge 23. Floor 25 has an off-center hole or opening 26 and wall 22 has a plurality of slot-like ports 24. A ball 27 is normally contained within housing wall 22 and is seatable in hole 26 to close the latter. An outer sleeve 28, having slot-like ports 29 matching those of wall 22, rests atop ridge 23 and is dimensioned for sliding, rotating movement around housing wall 22. Movement of sleeve 28 around housing wall 22 is limited by the engagement of a pin 54 projecting from the bottom of wall 22 with one of the vertical walls 56, 57 of a lower slot 53 in outer sleeve 28. A ring 30 having a pair of offset, oppositely extending arms 31, 32 is tightly secured around the upper end of sleeve 28, the arms 31, 32 providing handles for rotating sleeve 28. A housing top generally indicated at 33 has a lower relatively wide tubular portion 34 which fits snugly inside housing wall 22, a peripheral shoulder 35 which overlaps the top edges of both wall 22 and sleeve 28, and an upper narrower tubular portion 36 which fits inside the lower end of conduit 16. The upper end of conduit 16 is in communication with a tubular elbow 37 terminating in a flange 38 having a cutout portion 49.

When valve 15 is mounted in the operative position shown in FIG. 2 the upper surface 39 of floor 25 is maintained in an inclined position (FIG. 3) by the slope of the wearer's chest 20 (FIG. 2) against which valve 15 rests.

Assuming ball 27 to be seated in a hole-closing position in floor hole 26 (FIG. 7), any normal inhalation by person 19 will suck the ball upwardly and to the right side of hole 26 (as viewed in FIGS. 3 and 6) following which the ball will be gravity urged downwardly along inclined floor surface 39 to the hole-opening position shown in FIGS. 3 and 6. As shown in the drawing floor hole 26 is located uphill from the ball when the latter is in its hole-opening position. By placing hole 26 in an off-center position and mounting device 15 so that the hole is positioned away from the chest of the person, the ball 27 is maintained in the downhill hole-opening position by gravity during the following normal exhalations and inhalations of the person 19. When the person begins to speak, his exhalation is greater than normal, and the exhaled air rushing outwardly through hole 26 draws ball 27 upwardly from its hole-opening position, forces it into a position seated in hole 26, and holds it there to close the hole (FIG. 7). Ball 27 remains in this position while the person is talking and hole 26 is not reopened until the person again inhales.

Off-center hole 26 can be located in an uphill position by mounting device 15 as shown in FIG. 2, or by connecting device 15 to an angular elbow 41 (FIG. 10). In this latter embodiment the device should be arranged so that hole 26 is adjacent the left side of device 15 as viewed in FIG. 10. In either of these positions device 15, conduit 16, and throat tube 17 are hidden from view by the shirt and collar (not shown) worn by person 19.

Another embodiment for producing the uphill-downhill effect is shown in FIG. 8, wherein the upper floor surface 40 of device 15 extends downwardly in all direc-

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tions from a centered floor hole 26. In this embodiment the device 15 does not have to be mounted in an inclined position but can be vertically disposed.

When person 19 is climbing stairs or performing some other abnormally exerting activity his breathing is heavy enough to move the ball to the hole-closing position with each exhalation. To offset the necessity of sucking the ball 27 out of hole 26 with each inhalation during heavy exercise the subject device 15 is provided with auxiliary air-admitting openings. As previously noted, housing wall 22 and sleeve 28 have matching ports 24, 29 respectively. When the rotatable sleeve 28 is moved to a position in which ports 29 are aligned with ports 24 an opening is provided for the continuous entry of air into device 15.

Referring to FIGS. 6 and 7, the ports 24, 29 are normally maintained in the unaligned positions shown in FIG. 7, thereby permitting ball 27 to automatically open or close hole 26 in response to normal breathing and speaking. When the person engages in heavy exercise and desires to have a continuously open air-admitting passage, he merely rotates the outer sleeve 28 to the position shown in FIG. 6. This is accomplished by pushing arm 31 of ring 30 in a counterclockwise sense (as viewed in FIGS. 6 and 7) from the position shown in dash dot lines in FIG. 7 to the position shown in dash dot lines in FIG. 6. Rotation of arm 31 in this manner rotates outer sleeve 28 to a position in which the ports 29 of sleeve 28 are aligned with ports 24 of wall 22. This position is determined by the abutment of vertical wall 56 on sleeve lower slot 53 with pin 54 on housing wall 22. When the exerting activity has ended and the person desires to speak he can return the sleeve to the speaking position shown in FIG. 7 merely by pushing on arm 32 so as to rotate it in a clockwise sense (as viewed in FIGS. 6 and 7) from the position shown in the dash dot lines in FIG. 6 to the position shown in the dash dot lines in FIG. 7. This position is determined by the abutment of pin 54 with vertical wall 57 of slot 53.

Device 15 is made of aluminum or some other light non-corrosive alloy except for ball 27 which is made of hard rubber or plastic. Referring to FIG. 9, there is shown a modification of the subject device wherein floor 25 is provided with a peripheral groove 50 around hole 26, groove 50 receiving a washer 51 made of rubber or some other noise-muffling material. Washer 51 engages ball 27 when the latter moves into its seated position and eliminates the characteristic clicking noise otherwise made when the hard surfaced ball 27 moves against the uncovered hard surface of hole 26.

Contamination of throat tube 17 by mucous or sputum which might enter tube 17 from throat 18 during coughing is prevented in the subject device because when person 19 coughs, ball 27 immediately closes hole 26 causing a column of air to build up in device 15, conduit 16 and throat tube 17, thereby effectively blocking the entry of sputum into the tube.

All of the parts of speech-facilitating device 15 may be disassembled readily for cleaning purposes merely by initially removing housing top 35. Ball 27 can then be removed from within housing wall 22 and sleeve 28 can be removed from its position surrounding wall 22. The upper end of conduit 16 is readily detachable from its connection with throat tube 17 by structure shown in detail in FIGS. 4 and 5.

As previously indicated the upper end of conduit 16 is in communication with an elbow 37 terminating in a flange 38. Elbow 37 fits over a sleeve 59 projecting outwardly from within throat tube 17, and flange 38 engages another flange 42 at the outer end of throat tube 17. Tube 17 projects through an opening 45 in a plate 44 shaped to fit the outer contours of throat 18 and having a pair of punched out slot-like openings 52 (FIG. 5). As shown in FIG. 5 flange 42 has a pair of oppositely extending projections or wings 43 which engage behind a pair

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of bands 46 struck out from plate 44, said engagement preventing outward movement of the throat tube 17 relative to the throat plate 44, the latter being secured to the throat by a strap or the like (not shown). Flange 42 overlaps plate opening 45 and limits movement of tube 17 inwardly into the throat. Pivotaly mounted on flange 42 is a pin 47 having a laterally-extending projection or wing 48 at its outer end. When elbow 37 is to be connected to throat tube 17 pivot pin 47 is rotated from the position shown in FIG. 4 wherein the wing 48 points downwardly to a position in which wing 48 points upwardly. The flanges 38 and 42 are then brought into face to face abutment, elbow 37 receiving sleeve 59 and cut away portion 49 on flange 38 receiving pivot pin 47. Pivot pin 47 is then pivoted back to the position shown in FIG. 4, wing 48 abutting flange 38 to lock the elbow in place. To detach elbow 37 from throat tube 17 pin 47 is merely rotated to a position in which the wing 48 is pointing upwardly, and the elbow and throat tube are then readily detachable.

There has thus been shown a device for use with a throat tube, which device automatically facilitates speaking or breathing of the wearer, is readily detachable from the throat tube, is easily disassembled for cleaning purposes, contains essentially only a single moving part, and possesses numerous other advantages as indicated above.

It should be noted that the embodiments shown and described are merely some of the many forms which the present invention may take in practice without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A speech-facilitating device for use with a throat tube worn by a person who has undergone a tracheotomy, said device comprising:

a housing having an enclosing wall and a floor; conduit means for connecting said housing to said throat tube and for mounting said housing in an operative position adjacent the chest of said person; an opening in said housing floor;

said opening, said housing and said conduit means providing a passageway between the atmosphere and the throat tube for an air stream moving inwardly in response to an inhalation by said person and outwardly in response to an exhalation by said person; said floor having an upper surface normally sloping downwardly from said opening when the device is in said operative position;

and a ball seatable in said opening in a position to close the latter;

said ball including means which render it moveable from said closed position to an open position atop said sloping floor surface by said inwardly moving stream of air, and moveable from said open position to the closed position by the outwardly moving stream of air resulting from an above normal exhalation pursuant to the speech of said person, whereby exhaled speaking air is channeled internally through the throat past the vocal cords and outwardly through the mouth of the person.

2. A device as recited in claim 1 wherein said opening is situated in an off-center location on said housing floor, and, when the device is in said operative position, is located closer to the housing wall portion farthest removed from said person's chest than to the wall portion closest to said chest.

3. A device as recited in claim 1 wherein said opening is normally located uphill from the ball when the device is in said operative position and the ball is in its open position.

4. A device as recited in claim 1 wherein said opening is situated in the center of said floor and said floor upper surface tapers downwardly from said opening to said housing wall.

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5. A device as recited in claim 1 and comprising: a first auxiliary breathing port in said housing wall; a sleeve in surrounding engagement with said wall; a second auxiliary breathing port in said sleeve; and means mounting said sleeve for rotation around said housing wall between an opening-creating first position in which said first and second ports are in adjacent alignment and a second position in which the housing port is aligned with the wall of said sleeve.

6. A device as recited in claim 5 and comprising means for imparting said rotation to said sleeve, said rotation imparting means constituting a ring in peripheral engagement with the outer surface of said sleeve, said ring having a pair of arms extending in opposite directions and disposed in offset relation to each other.

7. A device as recited in claim 1 and comprising: a washer in said opening adjacent said floor upper surface for engaging said ball when the latter is in its closed position;

said washer being composed of sound-muffling material so as to lessen the noise made by the ball when it moves into its closed position.

8. The combination with a throat tube for a person who has undergone a tracheotomy, of a speaking valve comprising:

a valve body having a floor and sides extending upwardly from said floor;

means for connecting said valve body to the outer end of said throat tube and for mounting said valve body in an operative position alongside said person;

an air-admitting hole in said floor;

said hole, said valve body, and said connecting means providing a passageway between the atmosphere and said throat tube for an air stream moving inwardly in response to an inhalation by said person and outwardly in response to an exhalation by said person; and a closure element seatable in said hole in a hole-closing position;

said closure element including means which render it moveable from said closed position to an open position, to one side of said hole, by said inwardly moving stream of air and moveable from said open position to the closed position by the outwardly moving stream of air resulting from an above normal exhalation pursuant to the speech of said person, whereby exhaled speaking air is channeled internally through the throat past the vocal cords and outwardly through the mouth of the person;

said floor including means for preventing movement of the closure element from its open to its closed position when the valve body is in said operative position and said exhalations are normal.

9. A breathing and speaking apparatus to be connected to the outer end of a throat tube worn by a person who has undergone a tracheotomy; said apparatus comprising:

walls;

a floor;

a hole in said floor;

said hole and said walls providing a passageway between the atmosphere and said throat tube for an air stream moving inwardly in response to an inhalation by said person and outwardly in response to an exhalation by the person;

and a ball moveable between a hole-closing first position in which the ball is seated in said hole and a hole-opening second position in which the ball is located to one side of said hole;

said ball including suction actuated means for initiating movement of the ball from said first position to said second position in response to a normal inhalation, and from the second position to the first position in response to an above normal speaking exhalation whereby exhaled speaking air is channeled internally through the throat past the vocal cords and outwardly through the mouth of the person;

said ball including gravity actuated means for continuing said suction-initiated movements of the ball between its first and second positions;  
said floor including means for preventing movement of the ball from its second position to its first position when said exhalation is normal. 5

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