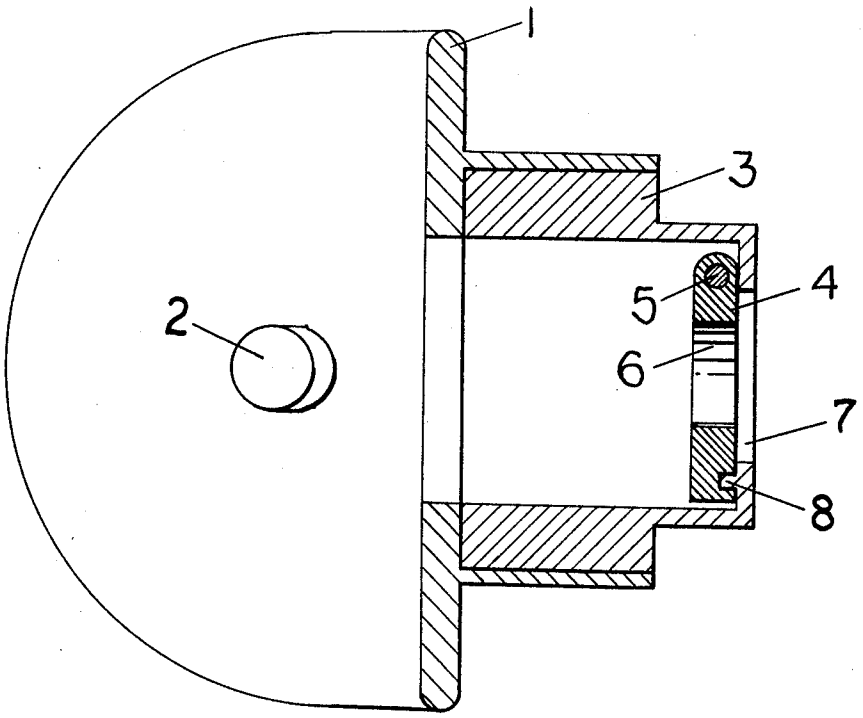
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EXPIRATION REGULATORS

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INVENTOR.
GUS SCHREIBER

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EXPIRATION REGULATORS

Gus Schreiber, Medical Arts Bldg., Dallas, Tex. 75201

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1 Claim. (Cl. 128—27)

My invention is a simple mechanical device with a single purpose—to elevate the expiratory pressures of patients suffering with pulmonary emphysema. It consists of a high capacity inlet check valve with an aperture in the valve leaf providing thereby for reduced expiratory flow through the leaf of the inlet check valve, the device fitting onto either a mouthpiece or a cuffed tracheostomy tube. The mouthpiece may be similar to a metabolator mouthpiece which fits between the gums and lips and held in place between the teeth or any other type of mouthpiece may be utilized as desired. The device is thereby placed directly in front of the lips of the patient with the mouthpiece in place between the lips. My invention relates only to the device attached to the mouthpiece or tracheostomy tube. Federal (U.S.A.) law restricts this device to use on the order of a physician.

The device is attached to the mouthpiece or tracheostomy tube in such a fashion that it is easily and quickly removable since it must be removed before the patient allows a cough to occur. This device is particularly suited for the patient who is well oriented and desires its use because of its small and inconspicious nature. This mechanism is not designed for use in any other condition such as bronchial asthma or congestive heart failure, hence would seldom be required by any patient under fifty years of age. Because it must be removed before a cough occurs its use is limited to the waking hours of patients who are oriented and cooperative. The patient may, if he or she desires, inhale through the nose and exhale through the device however the mechanism is designed for both inspiration and expiration to occur through the mouth. Aerosol therapy may be administered with a mask over this device in place, either on a mouthpiece or a tracheostomy tube, unless coughing is expected to occur. It is planned that this mechanism will be utilized by the patient most of the time during his waking hours when in the upright position.

Pulmonary emphysema is characterized by loss of lung and elastic tissues which normally maintain the patency of the bronchioles and alveolar ducts by external tension upon these terminal air pasageways. It is generally recognized that because of this loss of tissue these terminal passageways collapse with expiration and by such an action these passageways become inlet check valves to the lungs. Such an abnormal obstruction of expiratory flow serves to "trap" air within the lung spaces causing thereby a vicious circle of further external pressure upon the collapsible terminal air passageways. It has long been theorized that by increasing the expiratory intrabronchiolar pressures that this collapse can be at least partially reduced in degree, thereby serving to "decompress" the over-distended lungs.

This concept of the altered pulmonary physiology of pulmonary emphysema has led physicians to instruct their

patients to exhale through partially obstructed (pursed) lips, thereby increasing the expiratory intrabronchiolar pressures. This instruction is either ignored or quickly forgotten by the patient in the distress of difficult breathing, hence the need of a mechanical device to perform this task automatically. As will be evidenced my device reduces the rate of expiratory flow, elevates the expiratory intrabronchiolar pressures, and lengthens the expiratory phase of respiration. These actions should tend to lessen the collapse of these terminal air passageways and reduce the tendency to the above described vicious circle of air entrapment in the air sacs of the lung.

Since my device will be used during most of the waking hours of the patient suffering from pulmonary emphysema it must fulfill certain physiological and aesthaetic requirements. It is of minimal volume so as not to increase the physiological dead space (this is the space between the lung sacs and the outside atmosphere) a significant amount. It is unobtrusive in appearance and operates noiselessly. It is constructed of non-corrosive materials to permit frequent washings to remove accumulated saliva. The expiratory gases are directed forward so as not to blow on the nose or face of the patient.

Apparently no previous art has a similar function, purpose or design. Devices for oxygen administration or for under water usage of air bear no resemblance to my invention.

The drawing illustrates a vertical section taken through the mouthpiece and the attached device so that the left half of the entire mechanism is represented. The mouthpiece **1** utilizes a small projection **2** on each side to fit between the teeth as do metabolator mouthpieces. The body **3** of the mechanism fits within (or outside of) the mouthpiece in such a fashion that the shaft **5** of the valve leaf is placed at the highest elevation. The air orifice **7** of the body **3** is partially closed when the valve leaf **4** is in contact with the periphery of the orifice **7**. The valve leaf **4** contains an orifice of such a size (approximately seven square millimeters) as to produce an expiratory pressure of about ten centimeters of water.

On inspiration the valve leaf **4** swings up and permits an unobstructed inspiration. A small dashpot **8** consisting of a small cylindrical protrusion of the body of the mechanism **3** designed to closely fit into a receiving cup in the valve leaf **4**, serving thereby to decelerate the closure of the valve leaflet which thereby causes the valve leaf to close silently. By having the shaft **5** at the highest elevation the weight of the valve leaf **4** serves to close the valve without the need of a spring. At the discretion of the manufacturer a small spring may be added so that the valve leaf will close against gravity. By constructing the valve leaf of a plastic material the orifice can be enlarged (if desired by the physician) by reaming with a knife.

It is now clear that this mechanism permits an unobstructed flow of inspiratory air but produces a moderate obstruction of expiratory flow through the small aperture in the valve leaf. Such an expiratory flow obstruction both serves to elevate intrabronchiolar expiratory pressures and to slow the rate of breathing of the patient as he necessarily has to have a prolonged expiration to completely exhale. Such a reduction in respiratory rate is

generally considered advantageous. The best results are obtained with this mechanism when the patient is encouraged to completely exhale with each respiration.

What I claim that is new and useful in my invention is:

A valve structure for the control of expiration in emphysema patients comprising: a valve housing having one end attached to a mouthpiece, said valve housing having a fluid passageway therethrough communicating with said mouthpiece, said passageway being controlled by a pivotally mounted valve leaf constituting an inlet check valve, dashpot means limiting closing movement of said valve leaf, said valve leaf having an aperture therein, whereby free flow is obtained through said passageway upon inhalation and said aperture restricts flow upon exhalation.

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WILLIAM F. O'DEA, *Primary Examiner.*

ISADOR WEIL, *Examiner.*

R. GERARD, *Assistant Examiner.*