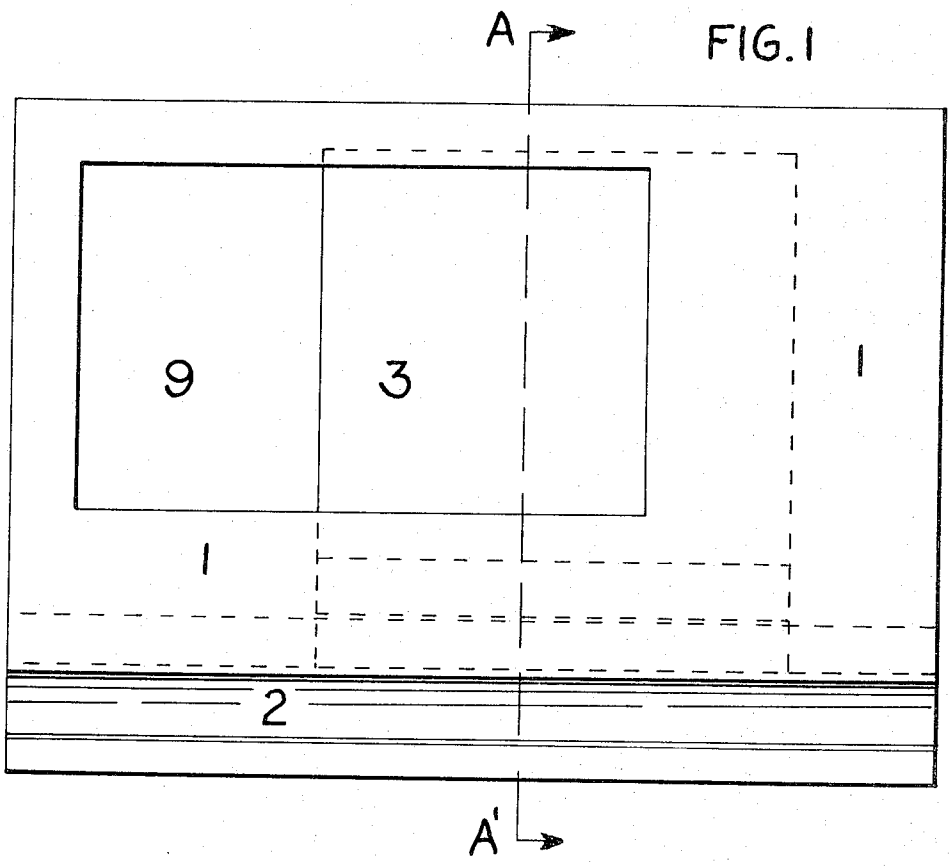
Dec. 12, 1967 G. SCHREIBER 3,357,424

RESPIRATORY DEVICE FOR EMPHYSEMA PATIENTS

Filed Dec. 5, 1964 2 Sheets-Sheet 1

FIG. 1



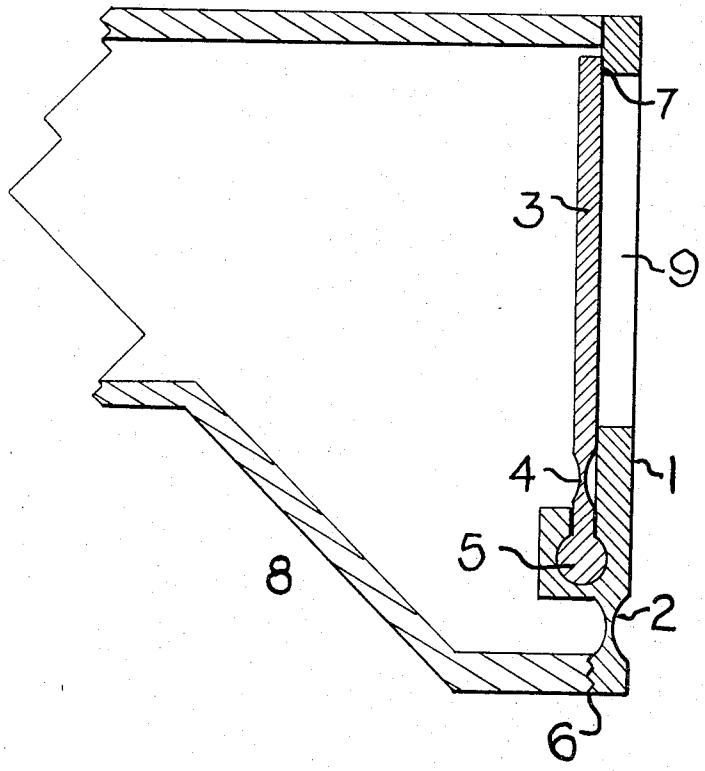
Geo Schreiber
INVENTOR.

Dec. 12, 1967 G. SCHREIBER 3,357,424

RESPIRATORY DEVICE FOR EMPHYSEMA PATIENTS

Filed Dec. 3, 1964 2 Sheets-Sheet 2

FIG. 2



Gus Schreiber
INVENTOR.

United States Patent Office 3,357,424
Patented Dec. 12, 1967

3,357,424

RESPIRATORY DEVICE FOR EMPHYSEMA PATIENTS

Gus Schreiber, 3993 NW. Highway,
Dallas, Tex. 75220

Filed Dec. 3, 1964, Ser. No. 415,641
2 Claims. (Cl. 128—136)

ABSTRACT OF THE DISCLOSURE

My invention is a small mechanical device for emphysema patients to hold between their lips, its purpose being to mechanically produce a desirable and optimal slow expiration while permitting a rapid and unobstructed inspiration. The mechanism uses an orifice **9** in the front slate **1** of the mechanism, this orifice being of such a cross-sectional area as to permit an unobstructed inspiration. A pivoted valve leaflet **3** acts as an inlet (inspiration) check valve over a portion of the orifice so that on expiration a portion of the orifice remains open and constitutes the expiratory passageway. The valve leaflet **3** is provided with means for lateral movement thereby permitting a regulation of the cross-sectional area of the expiratory orifice. This lateral movement of the valve leaflet has not previously been described.

In addition the entire front plate **1** of the mechanism (containing the above described orifice and adjustable valve leaflet) is provided with a means of yielding **2** so that a pressure relief valve action is obtained permitting the entire front plate of the mechanism to yield should the patient cough before removing the device from between his lips.

My invention is a simple mechanical device with a single purpose—to slow the flow of expiratory air of patients suffering with pulmonary emphysema. It is of minimal volume and consists of a pressure relief valve, a high capacity inlet check valve, and an orifice with a variable cross section area. The device may be an integral part of a mouthpiece to be held between the teeth, thus placing the device between and in front of the lips of the patient, or it may be designed to be attached to a cuffed tracheostomy tube. Its use is only for patients with emphysema and its use should probably be limited to an order of a physician.

Pulmonary emphysema is characterized by operative loss of lung and elastic tissues which normally maintain the patency of the bronchioles and of the alveolar ducts by external tension upon these terminal air passageways. It is generally recognized that because of this operative loss these terminal passageways collapse with expiration and by such an action they act as 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 cycle of further external pressure upon the collapsible terminal air passageways.

Exhaling through "pursed" lips has long been an instruction of physicians to patients with pulmonary emphysema. Although this was formerly thought to be helpful by elevating oral pressures, hence intrabronchiolar pressures, it has recently been shown (R. William Schmidt, K. Wasserman, and G. A. Lillington: The Effect of Air Flow and Oral Pressure on the Mechanics of Breathing in Patients with Asthma and Emphysema; Amer. Rev. Resp. Dis.: 90:564–571, 1964) that a slow expiratory rate without an elevated oral pressure permits the greatest reduction in residual volume of such patients. These authors postulate that the improvement resulting from such a slow expiratory flow rate is due to a lessening

of the Bernouilli effect causing thereby a reduction in the tube-collapsing effect of rapid air flow.

It has frequently been noted that patients rapidly forget to exhale slowly, with or without "pursed lips," in the panic of respiratory distress and easily slip into the vicious circle above described. For this reason a mechanical device which automatically forces a slow expiration (without necessarily increasing respiratory work and while permitting a free inspiration) should prevent some of the air-trapping so characteristic of this disease. By the use of a variable aperture the most optimal orifice can be selected for use by the patient or by his physician. By constructing the device of minimal volume the dead air space should not be significantly increased.

This device is designed for almost constant use during the waking hours of an emphysema patient. During its routine use on a mouthpiece inhalation may be allowed to occur either through the device or through the nose. Expiration should be through the device. It should be constructed of such materials as to allow maintenance of proper hygiene.

Without any new inventiveness my mechanism may be constructed with any one of many materials; might utilize springs to control the valves; and might use a movable plate to vary the cross section area of the orifice. The design presented here utilizes non-fatiguing plastic which permits the valve leaflets to yield without accessory springs and utilizes a laterally movable inlet check valve leaflet to vary the orifice size.

FIGURE 1 is a frontal view of the mechanism while FIGURE 2 is a sectional view taken through the plane A–A′ of FIGURE 1. The entire mechanism is part of plate **1** which is securely fastened at **6** to the lower rim of the mouthpiece **8** or tracheostomy tube. Plate **1** is thinned at **2** in such a manner that a pressure of thirty centimeters of water causes it to yield forming thereby a pressure relief valve. (Such an action permits a cough to occur without damage to the patient should the device not be removed before coughing occurs.)

The plate **1** also has attached to it a laterally movable leaflet **3** forming an inlet check valve. This leaflet is made to ideal flexibility by the thinness of the area **4**. The leaflet **3** is topped by the ridge **7** of the plate **1**. The leaflet **3** is held to plate **1** by a key-shaped protrusion **5** so designed that the leaflet **3** may be moved laterally. Such lateral mobility permits control of the area of orifice **9**.

For purposes of manufacture the area of the orifice **9** with the inlet check valve open should approximate 75 $mm.^2$. The area of the orifice **9** closed will likely vary from 10 to 30 $mm.^2$.

It is now obvious that this device will permit an essentially unenhampered inspiration with the inlet check valve open; that it will produce a small orifice during expiration which will automatically encourage a desirable slow exhalation by the patient; and by means of the pressure relief valve will permit coughing to occur without danger to the patient.

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

1. A valve structure for the control of expiration in emphysema patients comprising: a mouthpiece, a valve housing having one end attached to said mouthpiece, said valve housing having a fluid passageway therethrough communicating with said mouthpiece, a valve leaf pivotally mounted in said passageway, said passageway being partially obstructed on expiration by said pivotally mounted valve leaf constituting an inlet check valve over a portion of the fluid passageway, whereby free flow is obtained through said passageway upon inhalation and said smaller aperture on expiration restricting flow upon exhalation; means provided for the lateral movement of

the valve leaflet permitting thereby regulation of the cross-sectional area of the expiratory passageway.

2. A valve structure for the control of expiration in emphysema patients comprising: a mouthpiece, a valve housing having one end attached to said mouthpiece, said valve housing having a fluid passageway therethrough communicating with said mouthpiece, a pivotally mounted valve leaf in said passageway constituting an inlet check valve over a portion of the fluid passageway; a plate partially closing the other end of the valve housing, means on said plate for allowing the entire plate to operate as a relief valve so as to permit a safe cough with the device in place.

References Cited

UNITED STATES PATENTS

3,079	5/1843	Rose	128—147
635,232	10/1899	Carroll	128—25
737,008	8/1903	Nichol	128—25
1,392,700	10/1921	Oyen	272—57
1,635,272	7/1927	Hartl	128—136
3,265,060	8/1966	Schreiber	128—147

RICHARD A. GAUDET, *Primary Examiner.*

CHARLES F. ROSENBAUM, *Examiner.*