Nov. 14, 1939. H. M. JONES 2,180,057

MEASURING DEVICE

Filed April 30, 1938 2 Sheets-Sheet 1

Fig. 1.

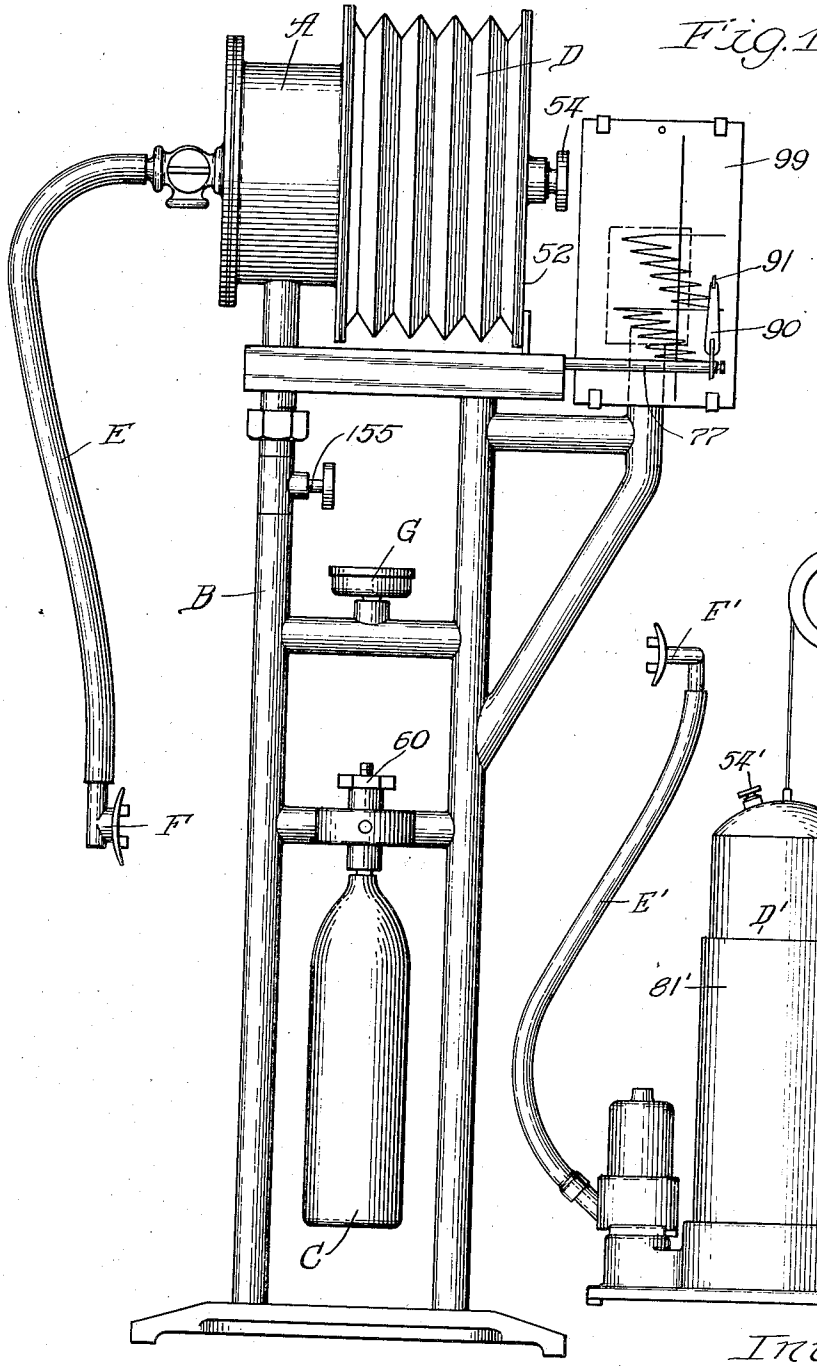


Fig. 3.

Inventor:
Horry M. Jones,
By Clinton, Miles, Davies, Kirschl & Dawson,
Attys.

Nov. 14, 1939. H. M. JONES 2,180,057

MEASURING DEVICE

Filed April 30, 1938 2 Sheets-Sheet 2

Fig. 2.

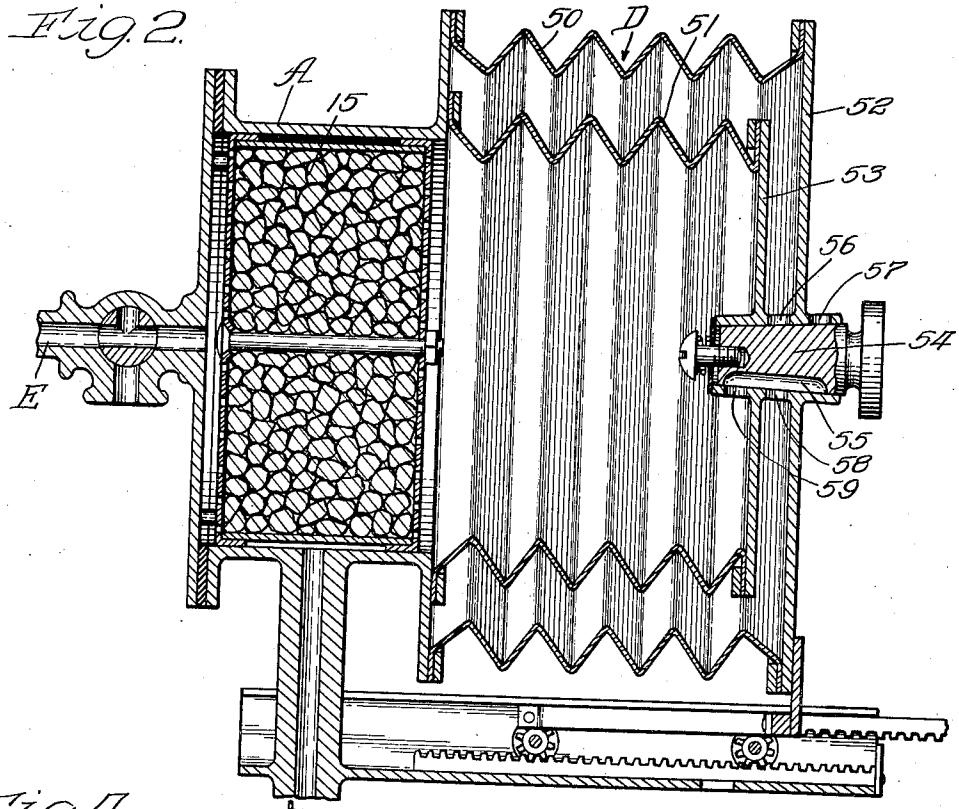


Fig. 4.

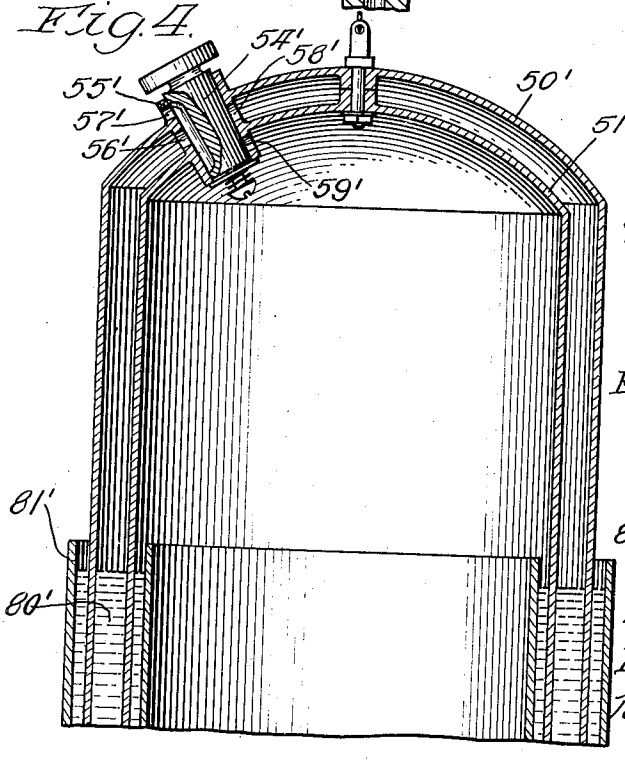
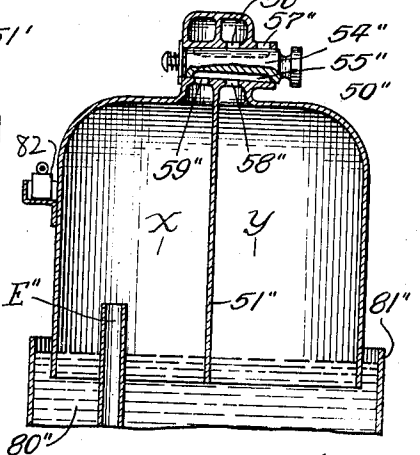


Fig. 5.



Inventor:
Harry M. Jones,
By Britton, Wiles, Davies,
Kirsch & Brown, Attys.

Patented Nov. 14, 1939 2,180,057

UNITED STATES PATENT OFFICE

2,180,057

MEASURING DEVICE

Horry M. Jones, Chicago, Ill.

Application April 30, 1938, Serial No. 205,351

3 Claims. (Cl. 128—191)

This invention relates to improvements in measuring devices and more especially to a measuring device of the general character of that shown in my earlier United States Patent No. 1,474, 904 dated November 20, 1933.

Measuring devices of the character referred to are especially adapted for measuring the amount and rate of oxygen consumption by a human being in the breathing process. One of their purposes is to determine the rate of metabolism or to diagnose pathological conditions.

The present invention relates particularly to improvements in the expansible container in which the exhalations of the patient are confined. This expansible container is in the nature of a spirometer and may take various forms. For example, it is here shown in the form of a bellows preferably made of rubber and also in the form of an inverted bell water-sealed at the bottom as is commonly used in conventional devices now on the market.

The particular feature of the invention is the making of a double-walled expansible container so that the capacity of the same (disregarding the changes in volume due to the breathing) can be readily changed. In other words, I provide two containers, one inside of the other with valve means so that either the inner or outer container can be used. This is of decided advantage in adapting the apparatus to patients having different lung capacities.

It will readily be seen that in apparatus of the character described here there is always some error due to leakage, temperature changes, moisture condensation, and the like. It is apparent also that these errors can be somewhat lessened by adapting the volume of the particular container used more accurately to the particular patient. In other words, it will be seen that if a small patient with very small lung capacity uses apparatus with a very large respiration container or breather bellows, the error will be somewhat greater than if the capacity of the container is made somewhat smaller to more nearly fit the lung capacity of the patient. Such a small container, however, might not be large enough for a patient having large lung capacity and consequently in such cases a larger container must be used. One of the features of this invention is to provide apparatus of the character referred to in which the fixed volume of the breath container can easily be altered.

Other features and advantages will appear more fully as I proceed with my specification.

In those forms of devices embodying the features of my invention shown in the accompanying drawings:

Fig. 1 is a view in side elevation; Fig. 2 is an enlarged sectional view of the spirometer or respiration container, here shown in the form of a breather bellows; Fig. 3 is a view in side elevation of a different form of measuring apparatus employing as the spirometer or breath container a rigid water-sealed bell; Fig. 4 is a vertical sectional view of the spirometer of the device of Fig. 3; and Fig. 5 is a view similar to Fig. 4 showing another modification.

As shown in the drawings A indicates in general a tank containing suitable material for removing carbon dioxide, for example, charcoal and sodium hydroxide as indicated by 15; B indicates the frame of the machine made of hollow tubing to provide a confined hollow space serving as a pressure measuring tank; C is a tank containing compressed oxygen; D is the breather bellows which is preferably made out of rubber; E indicates a breather tube; F a mouthpiece; and G a pressure gauge in communication with the confined space in the tubing B.

In the operation of the device, the patient or subject takes the mouthpiece F in his mouth and the nostrils are closed so that all gas exhaled and inhaled passes through the tube E into the bellows D. As the patient exhales and inhales, the bellows D expands and contracts. By means of the hollow frame B and the gauge G a measured quantity of oxygen is admitted into the hollow space in the frame B by means of the valve 60. This oxygen is then allowed to flow into the breather bellows D by means of the valve 155. Movements of the bellows are traced on the moving card 99 by means of a pencil 91 carried by the pencil support 90 mounted on the arm 77 attached to the movable end of the breather bellows. As the known quantity of oxygen is consumed in the tank A the tracing will move to the left so that the length of time required to consume a given quantity of oxygen can be determined by the movement of the card, the rate of movement of which is known. This construction and operation so far described is well known in the art and details need not be given.

The particular feature of my invention is the provision of a double bellows, spirometer, bell, or breath container so that the volume may be increased or decreased as desired. For example, as shown in Fig. 2, the bellows D is provided with a double wall, 50 indicating the outer wall and 51 the inner one. The outer wall carries the plate

52 and the inner wall the plate 53. 54 indicates a valve adapted to place the space between the walls in communication with the atmosphere or connect the space between the walls with the space inside of the inner bellows. To this end, the valve 54 is provided with a port 55 adapted to connect the port 56 entering the space between the walls with the port 57 leading to atmosphere, or when turned in another position adapted to connect the port 58 leading to the space between the bellows with the port 59 entering the space inside of the inner bellows.

With this construction it will be seen that the capacity or volume of the bellows can be substantially altered without materially changing the stroke. That is, when the inner bellows alone is used a certain volume of air is required to expand the bellows a definite distance. When the outer bellows is put into communication with the inner bellows so that the space in size increases, a larger amount of gas is required to expand the bellows the same amount. The movements of the bellows are recorded on the card 99 by means of the pencil 91 and it is desirable to keep the tracings more or less within certain limits. If the capacity of the bellows could not be changed it will be seen that a person with large lung capacity would give a greater travel of the pencil than a person with small lung capacity. This might lead to difficulties. It is desirable to make the travel of the pencil as wide as possible on the card. The longer the travel, the easier it is to measure the same and the less the error will be. If the device were made for a person of a certain lung capacity, however, the markings would be smaller for a person with a smaller lung capacity while a person with a larger lung capacity might cause the markings to go beyond the limits of the card. These difficulties are obviated by the use of my invention in which the volume of the breath container can be altered to adapt it to varying lung capacities so that both a large and a small lung capacity will give substantially the same markings on the card.

In Figs. 3 and 4 the invention is shown embodied in apparatus using a bell-type of spirometer instead of a bellows. In such device the breathing tube E' is connected to the spirometer D' which has a bell with a double wall submerged in the liquid 80 in the circular trough 81. I have shown the outer wall of the spirometer as indicated by 50' and the inner wall by 51'. 54' is a valve similar to the valve 54 having a port 55' and adapted to place the space between the walls either in communication with the atmosphere by connecting the ports 56' and 57' when the inner bell is closed, or connect the two bells by connecting the ports 59' and 58' in which case the outer bell is closed to atmosphere.

Instead of making the spirometer as shown in Fig. 4 with a double wall it is possible to form two compartments in the spirometer by the use of a vertical partition. For example, as shown in Fig. 5, the spirometer or bell 50'' may have a vertical partition 51'' dividing the bell into the two chambers x and y. E'' may indicate the tube connected to the breather tube. The chambers x and y may be either interconnected, or x may be closed off and y vented to the atmosphere by means of the valve 54''. When the chamber x alone is used it may be necessary to employ a weight 82 to assist in balancing the bell. The lower end of the bell is sealed in the liquid 80'' in the tank 81''.

While there are shown and described certain embodiments of the invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims, in which it is intended to claim all novelty inherent in the invention as broadly as permissible, in view of the prior art.

What I claim as new and desire to secure by Letters Patent is:

1. In a device for confining the exhalations of a patient and permitting their re-inhalation, a container having two expansible and contractible chambers therein, a passage connecting said chambers, a valve controlling said passage, a breathing tube connected to one chamber, and means for venting the other chamber to atmosphere, whereby said chambers may be caused jointly to confine the exhalations, or the exhalations may be confined slowly to one chamber with the other vented freely to atmosphere.

2. A device as claimed in claim 1 in which the container has a double wall, one chamber lying inside of the inner wall and the other chamber lying between the walls.

3. A device as claimed in claim 1 in which the container is a double-walled bellows, one chamber lying between the walls of the double-walled bellows.

HORRY M. JONES.