

(No Model.)

H. A. KOEHLER.  
LUNG TESTING APPARATUS.

No. 594,351.

Patented Nov. 23, 1897.

Fig. 1.

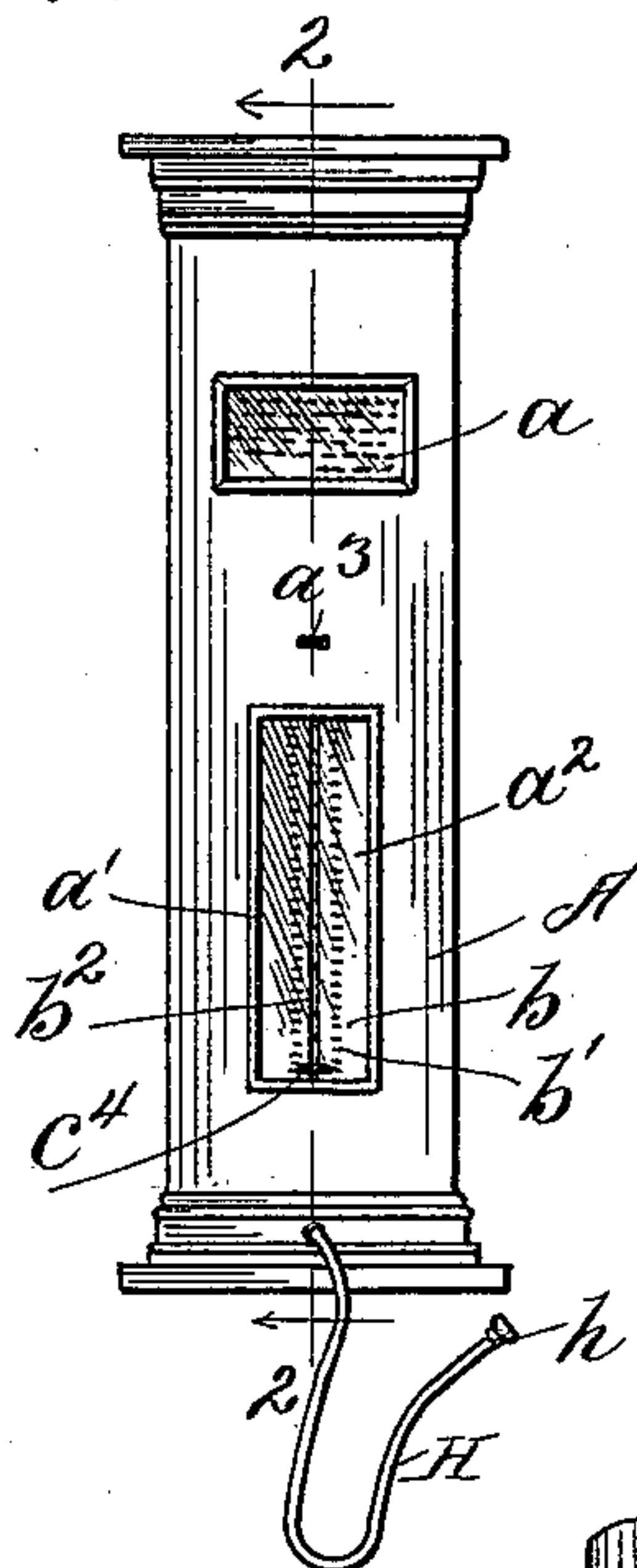


Fig. 2.

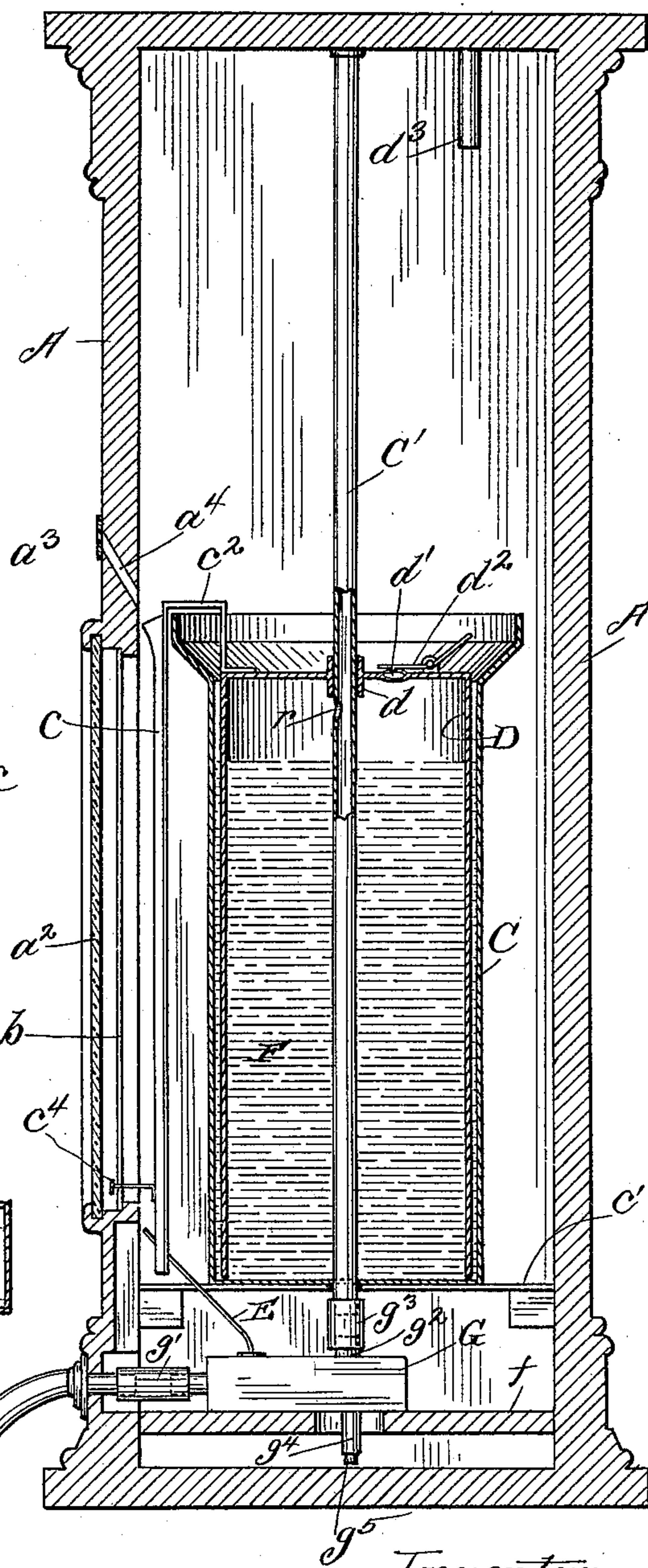


Fig. 4.

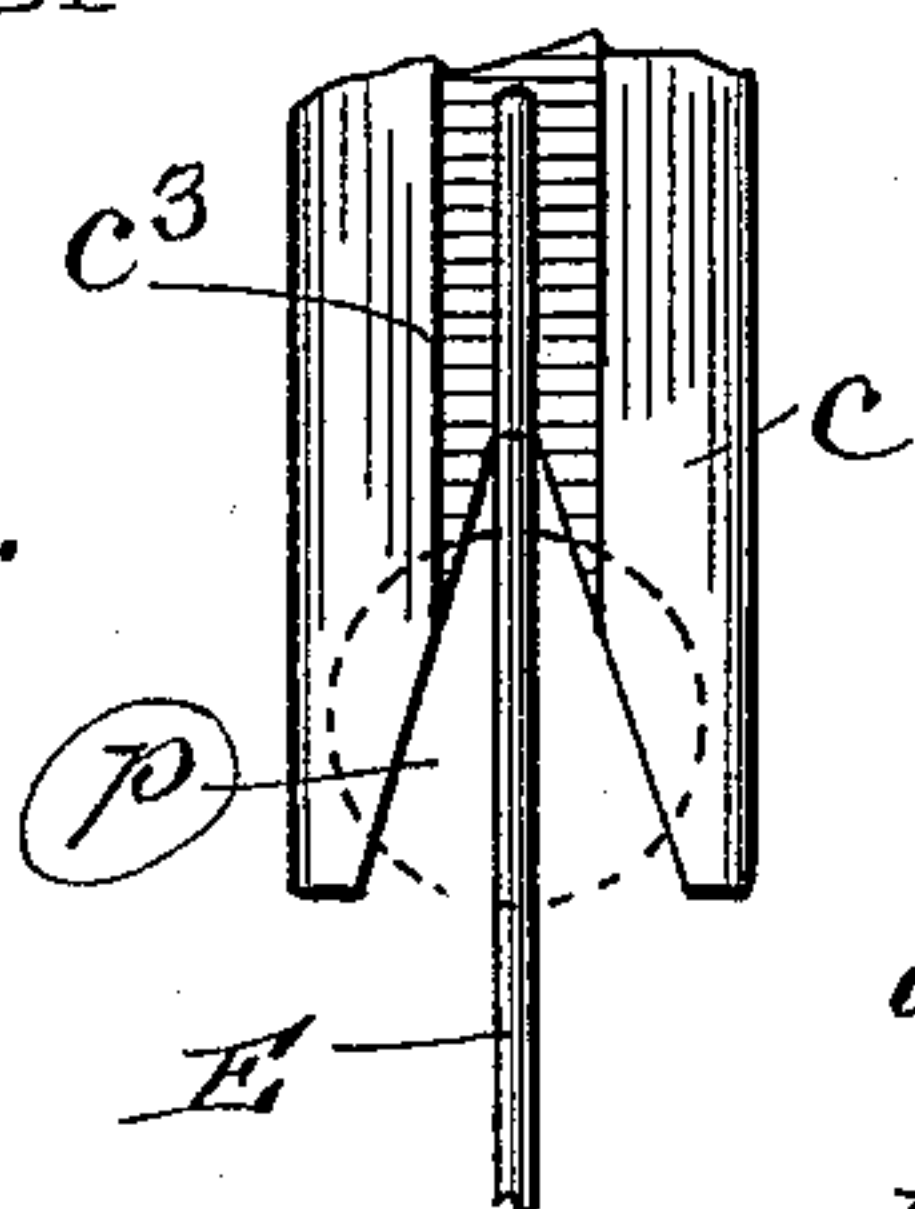
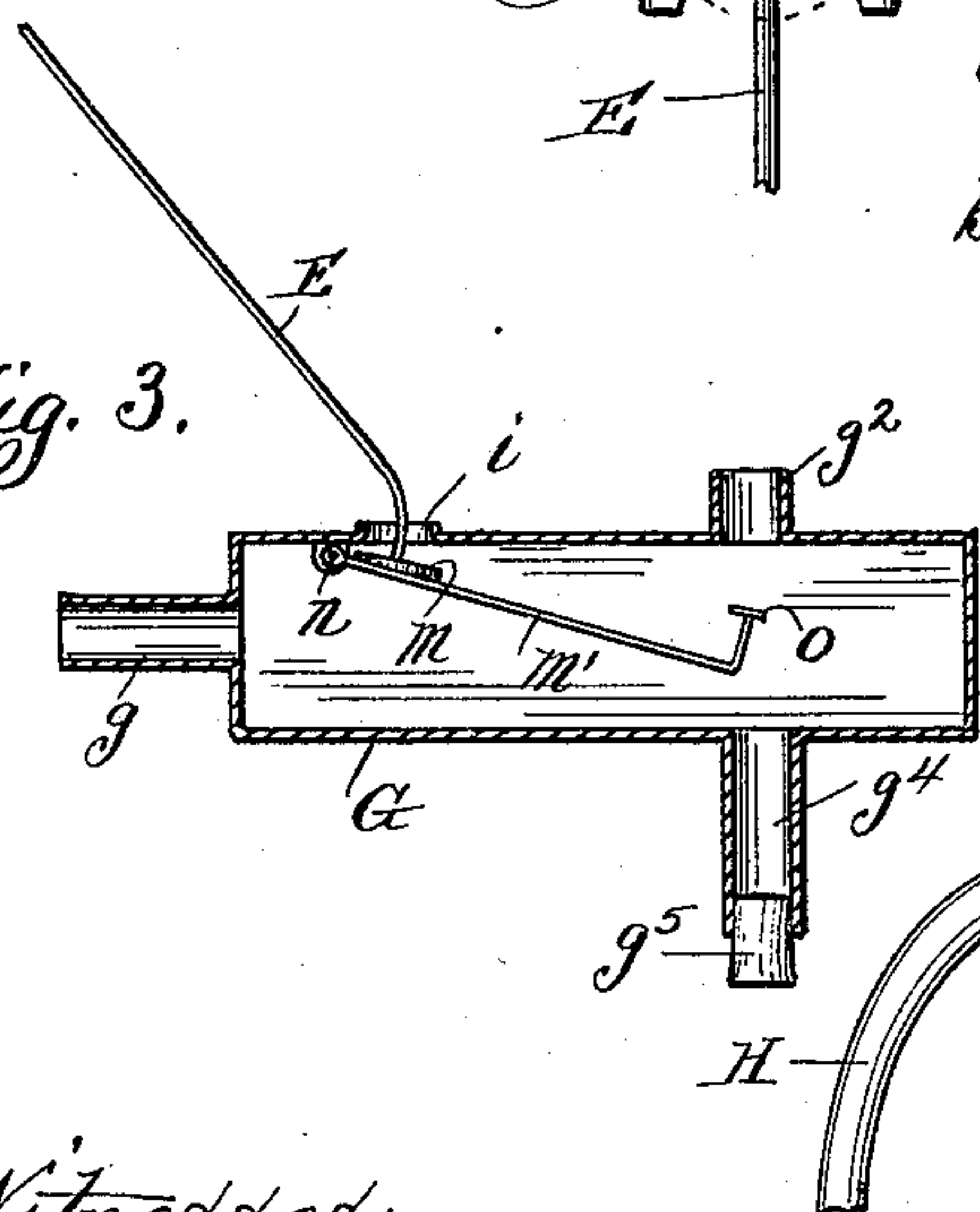


Fig. 3.



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# UNITED STATES PATENT OFFICE.

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## LUNG-TESTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 594,351, dated November 23, 1897.

Application filed September 25, 1897. Serial No. 652,953. (No model.)

*To all whom it may concern:*

Be it known that I, HERMAN A. KOEHLER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Lung-Testing Apparatus, of which the following is a specification.

This invention relates to improvements in that class of apparatuses used for testing the capacity or strength of the lungs in which a coin is used to free the mechanism, so that the power and capacity of the lungs may be ascertained and indicated by the operator blowing into the apparatus through a tube; and it consists in certain peculiarities of the construction, novel arrangement, and operation of the various parts thereof, as will be hereinafter more fully set forth and specifically claimed.

The objects of my invention are, first, to provide a lung-tester which shall be simple and inexpensive in construction, strong, durable, and attractive in appearance; second, to furnish a lung-testing apparatus which cannot be operated except by the deposit of a coin, and, third, to afford a controlling-valve which by reason of the peculiar construction, arrangement, and operation of its parts will render it impossible to operate the apparatus except by a continuous current of air forced through the blowing-tube.

In order to enable others skilled in the art to which my invention pertains to make and use the same, I will now proceed to describe it, referring to the accompanying drawings, in which—

Figure 1 is a view in front elevation of my apparatus, showing it inclosed in a casing and ready to be used. Fig. 2 is an enlarged central vertical sectional view, partly in elevation, taken on line 2 2 of Fig. 1, looking in the direction indicated by the arrows. Fig. 3 is an enlarged view, partly in section and partly in elevation, of the valve-box and its valves, showing the same detached. Fig. 4 is an enlarged view in elevation of a portion of the coin chute or guideway and a part of the operating-rod of the valves.

Similar letters refer to like parts throughout the different views of the drawings.

A represents a casing, which may be of any suitable size, form, and material, but is preferably made rectangular, as shown in the drawings, and is composed of wood. The front portion of this casing is provided near its upper end with an opening  $a$ , in which instructions for operating the device may be located and displayed. In the lower portion of the casing and extending to about its middle is another opening  $a'$ , which is provided with a glass  $a^2$ , and a scale  $b$ , which is provided with graduate marks  $b'$ , of any suitable number and arrangement, designed to indicate in cubic inches or by pounds the capacity or strength of the lungs. Just above the top of the opening  $a'$  the casing A is provided with a slot  $a^3$  and an inclined guideway  $a^4$  for the reception and guidance, respectively, of a coin to the movable chute or guideway  $c$ , as will be presently explained.

Near its lower portion the casing A is provided with a floor  $c'$ , on which rests and is supported a cylindrical vessel C, whose upper portion is somewhat flared, as shown in Fig. 2 of the drawings. Extending through the center of the vessel C is a tube  $C'$ , whose upper end is fixed to the top of the casing A and whose lower end projects through the bottom of the vessel C and the floor  $c'$ , on which said vessel rests. Within the vessel C is located and operates another vessel or plunger D, which is usually of a corresponding shape to the vessel C and has its lower end open and its upper end provided with a suitable opening  $d$ , through which the tube  $C'$  passes. The top of the plunger or vessel D is provided with a concave opening  $d'$ , which is normally closed by means of a lever  $d^2$ , fulcrumed on the top of the plunger D and which lever is tripped by impingement (when the vessel D is lifted) with the pin or projection  $d^3$ , depending from the top of the casing. Secured to the upper portion of the plunger or vessel D is a bracket  $c^2$ , which extends above the top of the vessel C and a slight distance beyond the wall of said vessel and supports the coin chute or guideway  $c$ , which is usually provided with a vertical slot  $c^3$ , extending from its lower end to near its upper end. The lower end of the chute or guide-



way  $c$  is bifurcated, as shown in Fig. 4 of the drawings, and strides the rod  $E$ , which operates the controlling-valves.

As shown in Fig. 2 of the drawings, the chute or guideway  $c$  is located in parallelism with the vessel  $C$  and has on its lower part an index or pointer  $c^4$ , which extends through a vertical slot  $b^2$  in the scale  $b$  and indicates thereon the number of cubic inches of air forced from the lungs into the vessel  $D$  or plunger.

Located beneath the floor  $c'$  and within the casing  $A$  is a valve-box  $G$ , which rests on a floor or other suitable support  $f$  on the interior of the casing. One end of the box  $G$  is provided with a tubular opening  $g$ , to which is secured, by means of a coupling-piece  $g'$  or otherwise, a flexible tube or hose  $H$ , which has at its free end a mouthpiece  $h$  of any desired construction. Near its other end and in its upper portion the box  $G$  is provided with a tubular opening  $g^2$ , which is connected to and communicates with the lower end of the tube  $C'$  by means of a coupling-piece  $g^3$  or otherwise.

Between the openings  $g$  and  $g^2$  and in the upper surface of the box  $G$  is formed an opening  $i$ , through which extends the rod  $E$ , and which opening is closed by means of a plug or valve  $m$ , made of felt or other suitable material and which is secured to the lever  $m'$ , which is fulcrumed at one of its ends, as at  $n$ , to the inner surface of the top of the valve-box. The free end of the lever  $m'$  is upturned and is provided with a valve  $o$ , made of flexible material and somewhat smaller than the opening  $g^2$ , in which it operates. The lower part of the box  $G$  is formed with an outlet tube or opening  $g^4$ , which may be closed by means of a stopper or plug  $g^5$  and is for the discharge of saliva which may accumulate in the valve-box.

The operation of my apparatus is simple and as follows: The vessel  $C$  is supplied with a quantity of water  $F$ , and the plunger or vessel  $D$  is located therein and pressed downwardly until its lower end rests on the bottom of the vessel  $C$ , in which position the index or pointer  $c^4$  will be located at the lower end of the slot  $b^2$  in the graduate scale, and the forked lower end of the guideway or chute  $c$  for the coin will strike the inclined rod  $E$ , which is secured at one of its ends to the lever  $m'$  and operates the same. By depositing a coin in the slot  $a^3$  it will pass through the guideways  $a^4$  and  $c$  until it strikes the rod  $E$ , when by reason of the weight of the coin  $p$  said rod will be deflected, which operation will cause the lever  $m'$  to be lifted until the valves  $o$  and  $m$  are inserted into the openings  $g^2$  and  $i$ , respectively, when by blowing through the tube  $H$  air will be forced through the opening  $g^2$  around the sides of the flexible valve  $o$  and into the vessel or plunger  $D$  through the tube  $C'$  and opening  $r$  therein, which opening, as shown in Fig. 2 of the drawings, is located above the water-line.

The air thus forced into the vessel or plunger  $D$  will cause the same to rise and carry with it the index or pointer  $c^4$ , which will indicate, by means of the graduate marks  $b'$  on the scale  $b$ , the number of cubic inches expelled from the lungs into said vessel. Should the vessel  $D$  be raised to about its limit, the lever  $d^2$  will impinge the projection  $d^3$ , which will lift said lever from the opening  $d'$  and open the same, which operation will produce a whistling alarm.

The construction of my controlling-valve is of great importance and is of such a nature that the moment the current of air is broken the lever  $m'$  will drop to the position shown in Fig. 3 of the drawings, which will permit the air to escape through the opening  $i$  and prevent the vessel or plunger  $D$  being again raised except by the deposit of another coin, which will not actuate the rod  $E$  until the vessel  $D$  and its chute or guideway  $c$  assume their normal position astride of said rod. While the valves  $m$  and  $o$  are in their respective openings and as long as a continuous current of air is forced through the tube  $H$  into the valve-box and from thence through the opening  $g^2$  and tube  $C'$  into the vessel  $D$  the said valves will be held in said positions by means of the air-pressure, as is apparent.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a lung-testing apparatus, the combination of a casing provided with a slot for the deposit of a coin, and a graduate scale, of a vessel located in said casing for the reception of a liquid, and another vessel or plunger located within the first-named vessel, a guideway or chute for a coin secured to the plunger and carried thereby and having its lower end bifurcated, an index or pointer secured on the lower portion of said chute, a tube extending through the top of the plunger and the bottom of the outer vessel and having an opening within the plunger above the water-line, a valve communicating with the lower end of said tube and having a rod to extend between the forks of the chute or guideway, when the latter is in its lowered position, and a tube connected to the valve-chamber, substantially as described.

2. In a lung-testing apparatus, the combination of a casing provided with a slot for the deposit of a coin, and a graduate scale, of a vessel located in said casing for the reception of a liquid, and another vessel or plunger located within the first-named vessel, a guideway or chute for a coin secured to the plunger and carried thereby and having its lower end bifurcated, an index or pointer secured on the lower portion of said chute, a tube extending through the top of the plunger and the bottom of the outer vessel and having an opening within the plunger above the water-line, a valve-box having in its upper portion an opening communicating with the lower end of said tube, and an opening  $i$ , in its up-



per part, the lever  $m'$ , fulcrumed in the valve-box and having the valves  $o$ , and  $m$ , the rod E, secured at one of its ends to the lever  $m'$ , and extending through the opening  $i$ , and between the forks of the chute or guideway, when the same is in a lowered position, and a tube communicating with the valve-box, substantially as described.

3. The combination of the casing A, provided with the slot  $a^3$ , of the graduate scale  $b$ , exposed in said casing, and having the vertical slot  $b^3$ , the receptacle C, the plunger D, having its upper end closed and its lower end open, the guideway or chute  $c$ , secured to the upper portion of the plunger, and having its lower end bifurcated, the pointer  $c^4$ , located on the lower portion of the said chute and extending through the slot  $b^3$ , in the graduate scale, a fixed tube  $C'$ , extending through the top of the plunger and bottom of the vessel C, the valve-box G, having the openings  $g$ ,  $g^2$ , and  $i$ , the lever  $m'$ , fulcrumed within the

valve-box and provided with the valves  $o$ , and  $m$ , the inclined rod E, secured at one of its ends to the lever  $m'$ , and extending through the opening  $i$ , and between the forks of the guideway or chute  $c$ , when the same is in its lowered position, and the flexible tube H, connected to and communicating with the tubular opening  $g$ , all constructed, arranged and operating substantially as and for the purpose set forth.

4. The herein-described valve, comprising a closed vessel G, having the openings  $g$ ,  $g^2$ , and  $i$ , a lever  $m'$ , fulcrumed within the vessel and provided with the valves  $o$ , and  $m$ , to close the openings  $g^2$ , and  $i$ , respectively, and the rod E, secured at one of its ends to the lever  $m'$ , and extending through the opening  $i$ , substantially as described.

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