(No Model.)

G. W. HALL.

SPIROMETER.

No. 343,310. Patented June 8, 1886.

Fig. 1

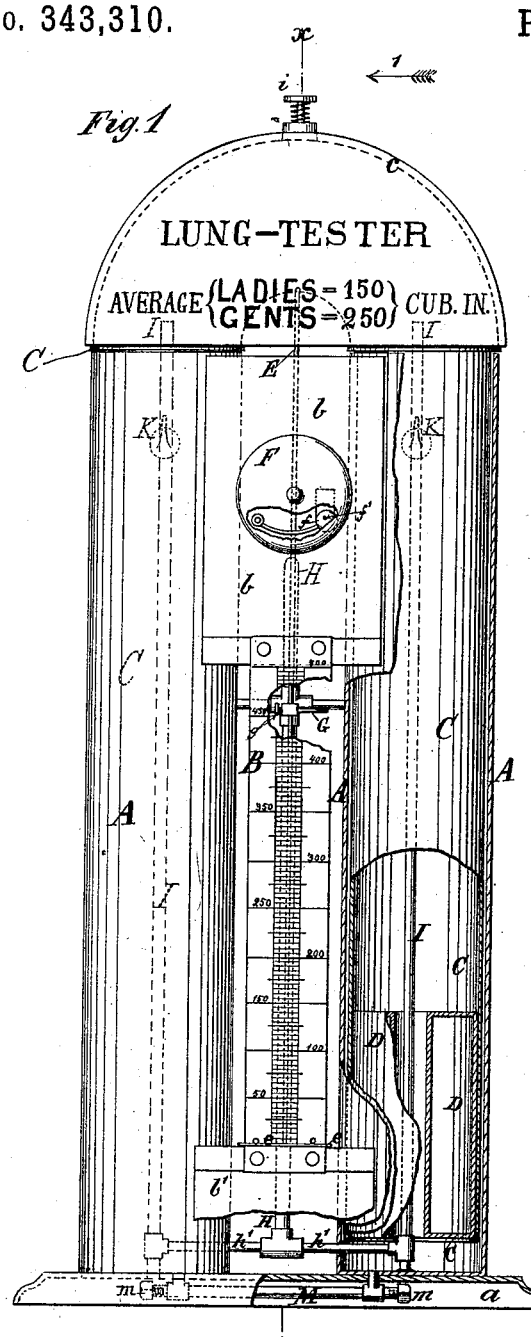
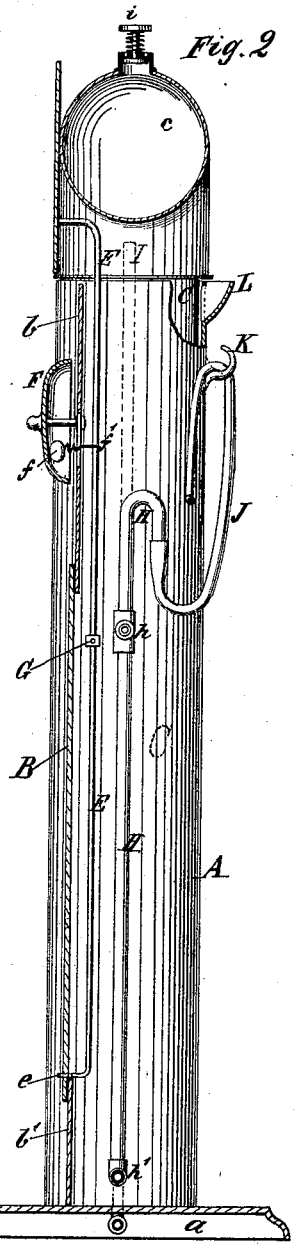


Fig. 2



Witnesses.
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GEORGE W. HALL, OF NEW YORK, N. Y.

SPIROMETER.

SPECIFICATION forming part of Letters Patent No. 343,310, dated June 8, 1886.

Application filed January 6, 1886. Serial No. 187,772. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. HALL, a citizen of the United States, and a resident of New York, in the county and State of New York, have invented new and useful Improvements in Lung-Testers, of which the following is a specification.

The invention relates to lung-testers, indicating in cubic inches, by the rise of an air-vessel, when inverted in a water-vessel and inflated by the exhalation from a person's lungs, the capacity of the said lungs, independent of pressure.

My improvement consists in certain novel construction and combination of parts, which will be hereinafter described, and specifically pointed out in the claims, reference being had to the accompanying drawings, in which—

Figure 1 represents a front elevation of my improved lung-tester, parts being broken out to better show the construction. Fig. 2 is a vertical section of the same, taken on about the line *x x* of Fig. 1, and seen in the direction of arrow 1.

Unlike other lung-testers of the same class, the stationary water-supplied portion consists of two upright tubes, A, closed at their lower ends and mounted on a common base, *a*. Plates *b b'* are secured to and between the tubes A at or near their upper and lower ends, respectively, and to the said plates, centrally between the said tubes A, is fixed a scale, B, graduated to indicate capacity in cubic inches from zero to five hundred. The vertically-movable portion, actuated to rise on the liquid in proportion to the volume of air exhaled into it from a person's lungs, consists of two upright tubes, C, fitting loosely in the tubes A, and united at their upper ends by a tubular arch, *c*. The lower ends of the tubes C are open and provided internally with buoys or air-vessels D, of proper size to just balance the weight of the movable vessel C C *c* and the parts attached thereto, so as to relieve the lungs of all exertion of force, and make the rise of the vessel dependent simply on the capacity of inflation.

To the arch *c* (or to a plate attached to the front thereof) is secured the upper end of a wire, E, which thence hangs down behind the scale-plate B, and is bent at its lower end around the said plate so as to form a pointer or index, *e*, which, as the vessel rises, passes successively in juxtaposition to the successive lines and figures on the scale.

To the plate *b* is attached a gong-bell, F. A hammer, *f*, is pivoted to the plate behind the bell. A flexible wire, *f'*, is attached to the hammer, as shown in Fig. 2, and projects inward through an opening in the plate *b*. A pin, G, fixed to a bored hub, which fits upon the wire E, is securable to the said wire by means of a set-screw, *g*, through the said hub, so that the said pin G may be slid upon the wire E and secured at any elevation upon the same. The object of the said pin G is to raise the hammer *f* by contact with the flexible wire *f'*, and to ring the bell, when the rising vessel, in its upward movement, has received a volume of air corresponding to any desired quantity chosen on the scale, the quantity generally being the average, which, for men, amounts to two hundred and fifty cubic inches, and for ladies, one hundred and fifty.

The dropping of the hammer is effected by the flexible wire *f* striking against the upper edge of the opening in the plate, through which it projects, (which thus acts as a stop to the further upward movement of the hammer,) and then, on the further upward movement of the pin G, the wire *f'* bends and deflects until its end slips off the pin G, thus allowing the hammer to fall.

To make the bell ring when the index *e* is opposite a certain desired figure on the scale, it is only necessary to raise the movable vessel until the index has reached the desired point, then hold it still in the said position while moving the pin G on the wire E until in position of having raised the hammer and deflected the wire *f'* so far as to be just on the point of dropping the hammer, and then fasten it in the said position by tightening the set-screw *g*.

The air is admitted through a pipe, H, located vertically and centrally between the two tubes A, the said pipe being secured by a brace, *h*, to the tubes A, and at its lower end secured by a T-joint to two pipes, *h'*, communicating with two vertical pipes, I, arranged one in each of tubes A, and running up centrally through the said tubes, a little above the up-

per ends thereof, in order that if too much water be put in the tubes it could not overflow and fill the air-pipes. The upper end of the metallic pipe H is bent, as shown in Fig. 2, and to it is attached the ordinary flexible or rubber pipe, J, generally provided with a mouth-piece to blow through.

To each of the tubes A, in the rear of the apparatus, is secured a hook, K, one of the said hooks being to thereon suspend the rubber pipe J, and the other to suspend a towel wherewith to wipe the mouth-piece of the pipe J. In breathing through the tube the air passes down through the pipe H, the cross-pipe *h'*, and the central upright pipes I, and enters the movable vessel at the upper end of the said pipes I. When the rising vessel has reached its highest position, dependent upon the capacity of a person's lungs, the rapid replacing of it in its lowest position is facilitated by depressing the spring raised inward, opening check-valve *i* on top of the arch *c*, which allows air to escape, when the movable vessel C C *c* descends.

The apparatus is supplied with water through a spout or funnel, L, attached to the upper end of one of the tubes A, and the two tubes A communicate with each other through a pipe, M, running from the bottom of one of them into that of the other, so that the water poured in through the funnel L will ascend to the same height in both tubes.

To let the water out of the apparatus it is only necessary to unscrew one or both of the screw-plugs *m*, arranged one in each of the pipes M.

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

1. In a lung-tester, the combination of two stationary upright tubes, A, provided with inlet-pipes H I, substantially as described, with the two movable tubes C, united at their upper ends and fitted to slide in the said tubes A.

2. In a lung-tester, the combination of two stationary upright tubes, A, provided with inlet-pipes H I, substantially as described, with the two movable tubes C, united at their upper ends by a hollow arch, *c*, provided with air-valve *i*, the said tubes C being fitted to slide in the said tubes A.

3. The combination of the stationary tubes A, having inlet-pipes H I, and the tubes C, united at their upper ends and fitted to slide within the tubes A, the said sliding tubes C being provided at their lower ends with buoys D, substantially as and for the purpose set forth.

4. The combination of the stationary tubes A, having inlet-pipes H I, and a fixed scale, B, with the united tubes C, sliding within the said tubes A, and carrying a wire, E, provided at its lower end with an index, *e*, passing the lines on the said scale, substantially as specified.

5. The combination of the stationary tubes A, having inlet-pipes H I, and a fixed scale, B, and bell F, having hammer *f*, with the united tubes C, sliding within the said tubes A, and carrying a wire, E, provided at its lower end with an index, *e*, passing the lines on the said scale, and having also a pin, G, securable upon the said wire in position to actuate the bell-hammer by the rising of the said sliding tubes C, substantially as and for the purpose set forth.

6. In a lung-tester, the combination of the two stationary tubes A, having air-inlets H I, the interconnected tubes C, arranged to slide in the said tubes A, and the pipe M, forming communication between the bottoms of the tubes A, to level the water-surfaces in the said tubes, substantially as specified.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 2d day of January, 1886.

GEORGE W. HALL.

Witnesses:
A. W. ALMQVIST,
T. M. CROSSMAN.