No. 767,522. PATENTED AUG. 16, 1904.

H. T. LYTTLETON.

SPIROMETER.

APPLICATION FILED NOV. 2, 1903.

NO MODEL.

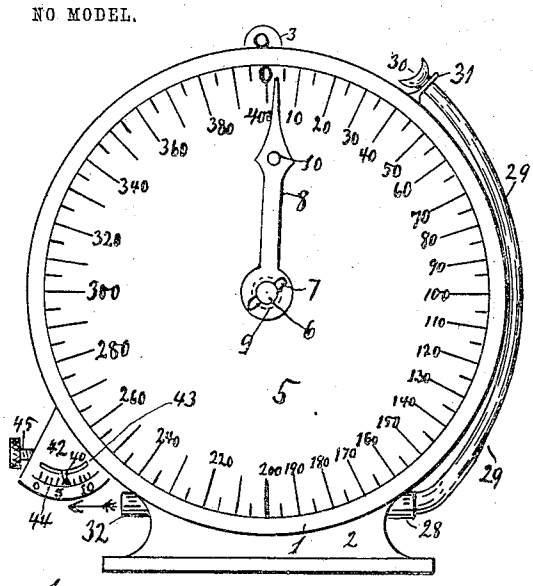


FIG. 1.

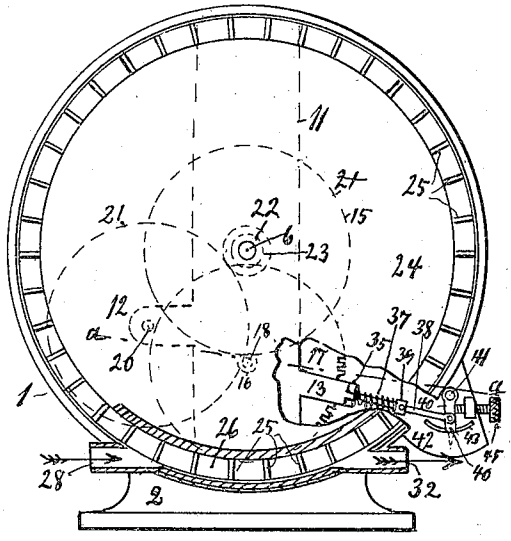


FIG. 2.

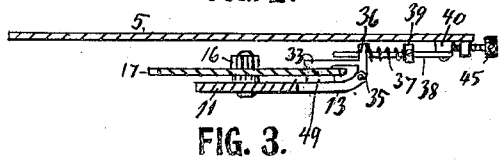


FIG. 3.

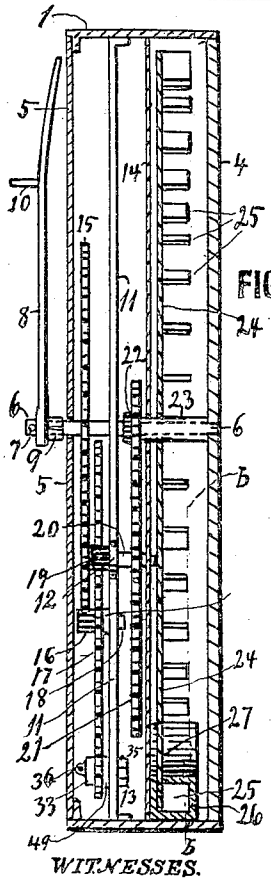


FIG. 5.

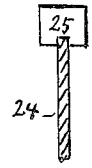


FIG. 6.

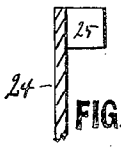


FIG. 7.

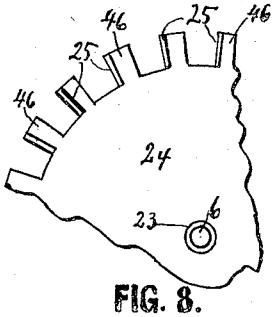


FIG. 8.

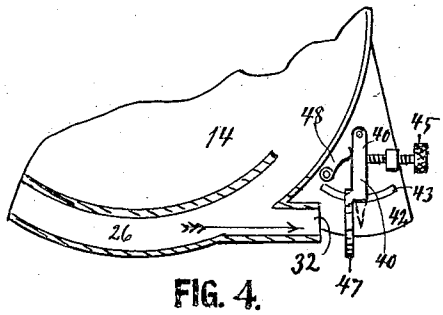


FIG. 4.

WITNESSES.

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No. 767,522. Patented August 16, 1904.

UNITED STATES PATENT OFFICE.

HENRY THOMAS LYTTLETON, OF MARSHALL, TEXAS.

SPIROMETER.

SPECIFICATION forming part of Letters Patent No. 767,522, dated August 16, 1904.

Application filed November 2, 1903. Serial No. 179,645. (No model.)

To all whom it may concern:

Be it known that I, HENRY THOMAS LYTTLETON, a citizen of the United States, residing at Marshall, in the county of Harrison and State of Texas, have invented certain new and useful Improvements in Spirometers; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form part of this specification.

My invention relates to improvements in spirometers or lung-testing machines; and the main objects of the invention are, first, to provide a lung-testing machine by which the quantity of air expelled from the lungs and the force with which it is expelled may be measured separately and combined; second, to make such lung-tester of a cheap and convenient construction. These and other objects I attain by the novel construction and combination of parts illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of my complete lung-tester. Fig. 2 is a rear elevation of the same with the rear cover removed and the lower portion in section on the line *b b* in Fig. 5. Fig. 3 is a sectional top view on the line *a a* in Fig. 2, showing clearly the brake by which the force is tested. Fig. 4 is a portion of Fig. 2 with the brake modified. Fig. 5 is a vertical substantially diametrical sectional view of Fig. 1, with no gear-wheels intersected, however. Figs. 6 and 7 are radial sections of the air-operated wheel with the wings in modified positions. Fig. 8 is another modification of the arrangement of the wings on the wind-wheel.

Referring to the drawings by reference-numerals, 1 designates a preferably cylindrical case provided with a foot-piece 2 for setting it on a table and with an eyepiece 3, by which to suspend it from a peg on a wall or post when so desired. The rear of the case is closed by a cover or back 4 and the front by a dial 5, which is graduated and numbered, so as to indicate cubic inches of air from zero up to four hundred, and upon a central shaft 6 is retained by a pin 7 a dial-finger 8, having a friction-sleeve 9 embracing the shaft, so that the finger or pointer may easily be turned on the shaft to its starting-point, zero, by taking hold of the pin 10 without turning any of the gears driving the shaft. In the case is secured a frame-bar 11, having two arms 12 and 13 and a partition 14, used to separate the wind-wheel from the gear-wheels and help to make up the framework for the latter.

The arbor or shaft 6 is preferably extended to and journaled in the rear wall 4, and upon it is secured the large gear-wheel 15, which is driven by the pinion 16, secured to the gear-wheel 17, revolving on the stud 18, secured in the frame 11. Said gear 17 is driven by the pinion 19, secured on the shaft 20, where also is secured the gear-wheel 21, driven by the pinion 22, secured on a sleeve 23, revolved freely on the shaft 6 by the wind-wheel 24, secured also on the sleeve. Said wind-wheel is preferably formed of sheet metal and provided along its periphery with radial blades or wings 25, which when the wheel revolves pass through a segmental tube or duct 26, having a slit 27 for the disk-like body of the wheel to move through, as best shown in Figs. 2 and 5, especially the latter. At one end of said duct is an air-inlet 28, provided with a hose 29 and mouthpiece 30, which when not in use is suspended on the fork 31. At the other end of the duct is the air outlet or exhaust 32.

The gearing and the size of the wings on the wind-wheel so far described are such that when the operator puts the mouthpiece to his mouth and blows air through the duct the dial-finger will indicate upon the dial the number of cubic inches of air exhausted from the lungs, and when a new trial is to be made the dial-finger is simply turned on its shaft to the starting-point before the air-current is applied.

In the manner just described the quantity of air contained in one or more breaths is measured; but as the gearing is a very easy working one there will be no particular pressure or force to the air required. Hence in order to obtain any desired resistance to the air, and

thus test the strength of the lungs, I provide one of the wheels with a brake consisting of the brake-shoe 33, (see Fig. 3,) pivoted at 35 to the frame-arm 13 and having an arm 36, pressed by a coiled spring 37, guided on a rod sliding through the arm and having a set-screwed collar 39, by which to adjust the tension of the spring toward the arm. The outer end of said rod 38 is pivoted to a pointer 40, pivoted at 41 upon the rear side of a small dial 42 and projecting through a slot 43 in the dial points out upon a scale 44 the pressure applied to the brake by screwing the thumb-screw 45 forward against the pointer 40, and thus increases the tension of the spring 37. The graduation shown upon the scale 44 and numbered "1" to "10" may be much varied and may have reference to ounces or pounds or any other unit by which the pressure or force may be measured or compared.

The wings may be fixed to or formed upon the wind-wheel in any suitable manner, of which some are illustrated in Figs. 2, 6, and 7; but I prefer to form the wings, as in Fig. 8, by cutting them out at two sides in the wheel itself and bend them on a radial line to a rectangular position with the side of the wheel, so that each wing is held by a radial margin 46, as clearly shown in said Fig. 8.

In Fig. 4 the force-indicator is so modified that instead of giving the pointer 40 a rod 38 and spring 37 it is provided with a plate or damper 47, which may be adjusted by the screw 45 more or less toward the exhaust 32, so as to resist the air exhausted therefrom or swung away from the opening by the spring 48 when the screw 45 so permits. 49 is a pad on the frame at the opposite side of the wheel to resist the brake-shoe.

In the operation of the device it is obvious that when the brake is set with the pointer at zero on the scale 44 the brake-shoe is to clear the wheel and the pointer 8 will show the quantity of air from the lungs, and if the brake is applied up to about half or even three-fourths of its capacity the numbers indicated by the pointers on the two dials may be multiplied by each other and will then form a compound unit of so many pound-inches or ounce-inches, which represent the combined force and quantity of the air expelled, and if the brake is very tightly adjusted, so that the pointer 8 will merely move, then the small pointer 40 may be considered as indicating only the force with which the lungs are able to expel the air.

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

1. A spirometer or lung-tester having two dials or scales and a pointer upon each dial, to indicate one of them the quantity and the other the force of the air expelled from the lungs through the machine, and a suitable mechanism for the air to act upon to cause the quantity-indicator to move; the other pointer being adjustable to the force it is desired to test, and means connected with the force-indicating pointer whereby the motion of the quantity-indicating pointer may be retarded.

2. A spirometer or lung-testing machine having, in combination, a wheel with radial wings or blades, a duct or passage for the wings to pass through, a slit in one side of the passage for the part of the wheel adjacent to the wings, an inlet and a mouthpiece provided at one end of the duct, and an exhaust-opening at the other end; a graduated dial with a dial-finger on it, and a train of speed-decreasing gear-wheels connecting the wind-wheel with the dial-finger.

3. A spirometer or lung-testing machine comprising in combination, a blast-operated wheel having wings upon its periphery, a slitted duct embracing the edge of the wheel to let the wings pass through the duct, an exhaust-opening at one end of the duct, and an inlet provided with a mouthpiece connected with the other end of the duct; a train of speed-decreasing gear-wheels connecting the blast-wheel and a dial-finger moved by the slowest one of the wheels, a graduated and numbered dial for the finger to move upon, and an adjustable friction-brake acting upon one of the wheels to retard or partly resist motion of the dial-finger.

4. A spirometer or lung-tester comprising in combination, a blast-operated wheel, a speed-reducing train of gear-wheels operated thereby, a graduated dial, a dial-finger friction-held on one of the shafts of the gear-wheels, a brake-shoe spring-pressed against one of the wheels, an adjustment-screw to increase the tension of the brake-spring, a pointer moved in one direction by the adjustment-screw and in the opposite direction by the said spring, and a scaled dial adjacent to the said pointer, to indicate the tension of the spring upon the brake, for the purposes set forth.

5. The herein-described means for measuring the capacity of lungs as to both strength and size, the same consisting of a blast-operated wheel having the wings operated upon inclosed in a passage and operated by the air expelled from the lungs, a numbered dial, a dial-finger moving thereon and operatively connected with the blast-operated wheel, a spring-pressed brake retarding the motion of the dial-finger, a second numbered dial and a hand-adjusted pointer thereon; said pointer acting as a tension-lever on the brake-spring, so that by computing the numbers indicated by the pointers on the two dials a unit is obtained indicating the combined strength and size of the lungs.

6. A spirometer or lung-testing machine comprising in combination, a blast-operated

winged wheel, a slitted duct embracing the wings of the wheel while they are acted on by the blast, a graduated dial with numbers representing cubic inches of air passed through the duct, a dial-finger on the dial, a speed-reducing train of gear-wheels transmitting the motion of the blast-operated wheel to the dial-finger; the size of the blast-operated wheel and its wings and the speed-reducing gearing being so proportioned that the dial-finger will indicate the number of cubic inches of air passing through the duct.

7. In a spirometer or lung-tester, the combination with a case having a partition dividing it into two compartments, of a blast-operated wheel in one of the compartments, a speed-reducing train of gear-wheels in the other compartment, operative connecting means through the partition, whereby the fastest-running gear-wheel is operated, a dial-finger having a friction-sleeve embracing the slowest-moving shaft of the gear-wheels, and a graduated dial for said finger to move upon, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY THOMAS LYTTLETON.

Witnesses:

A. F. McALLISTER,

S. W. WILLIAMS.