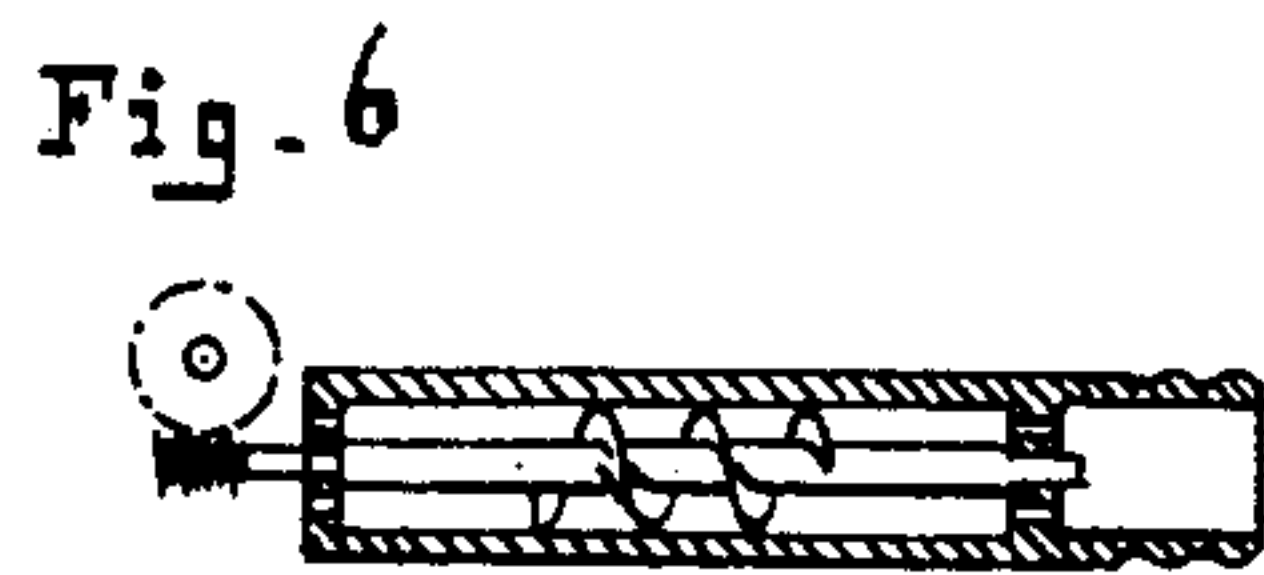
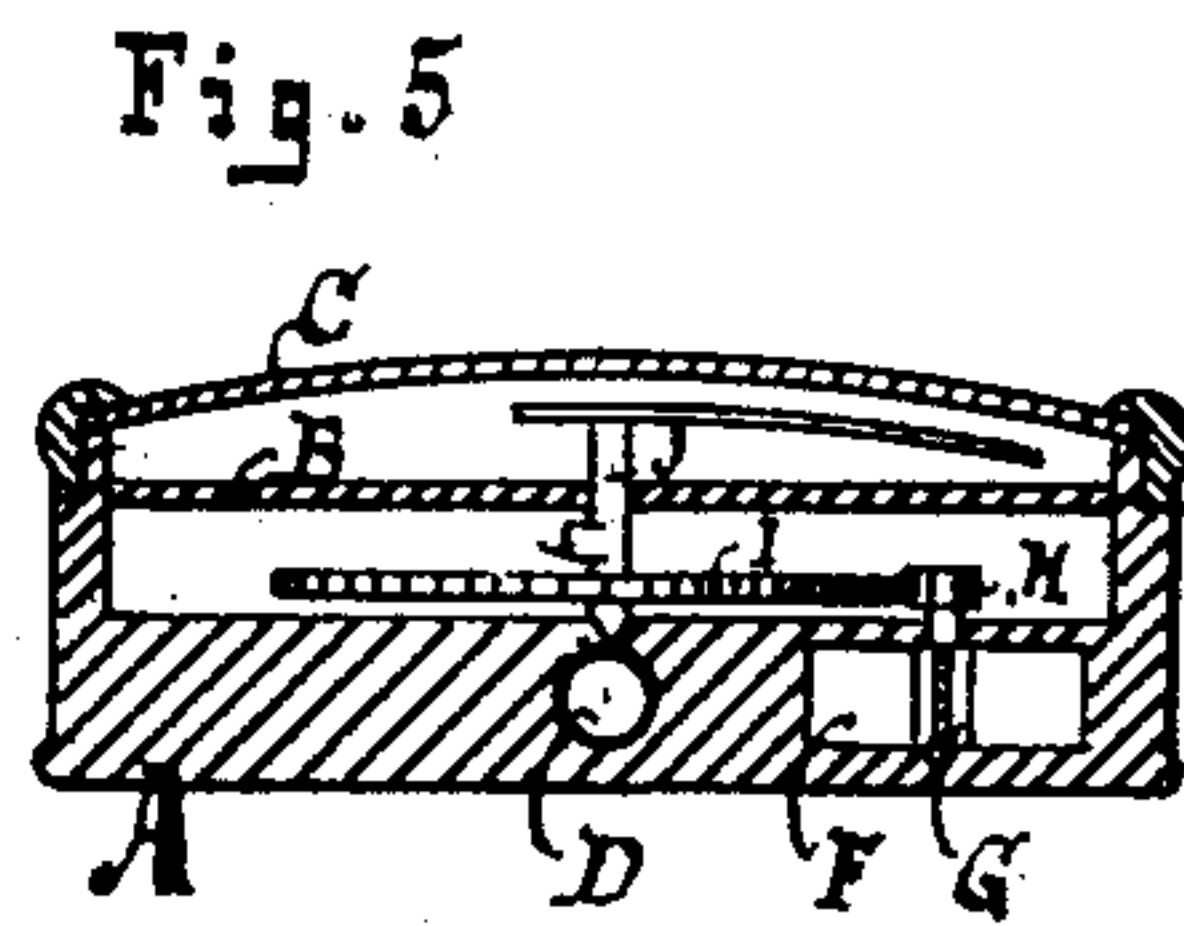
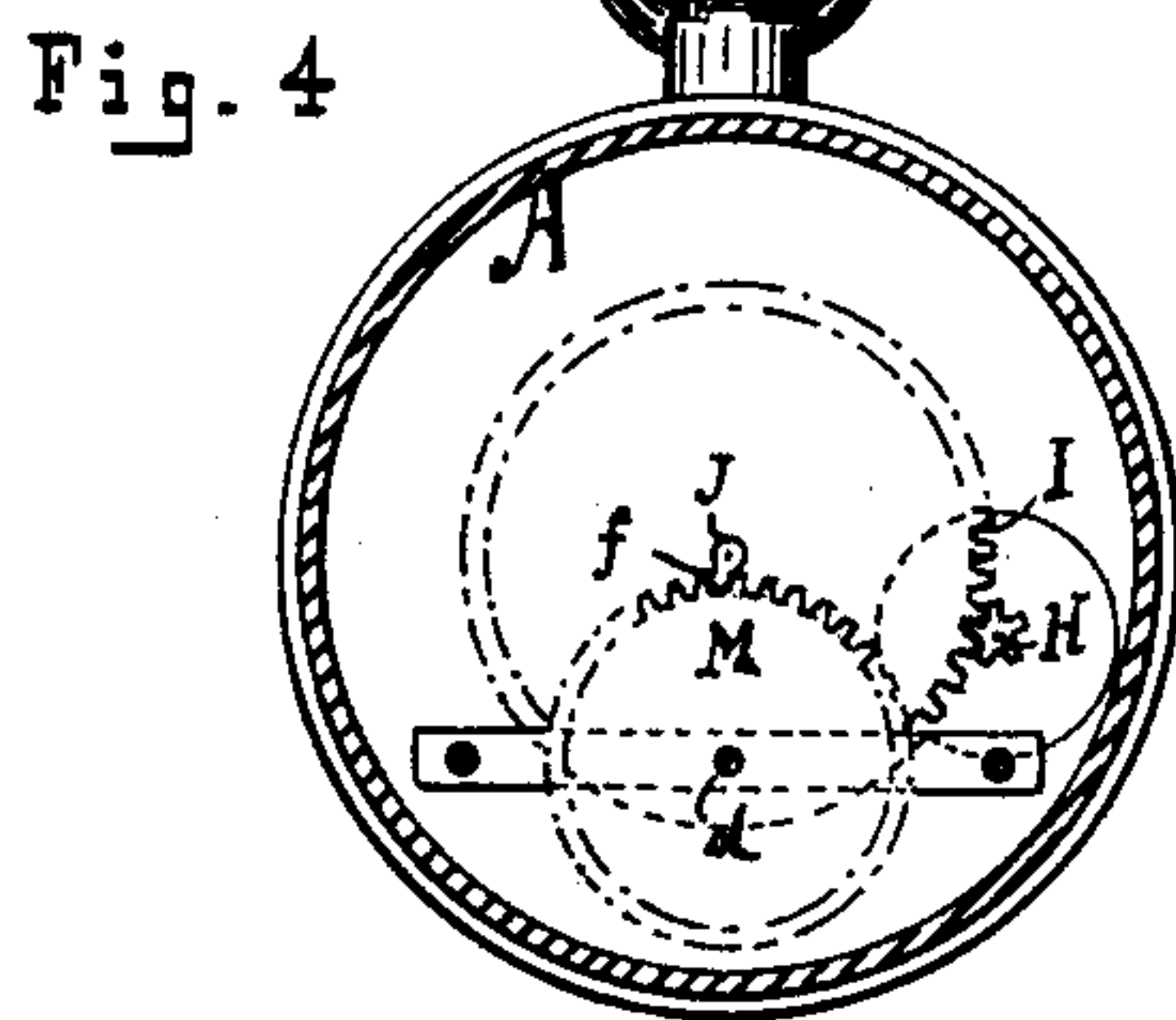
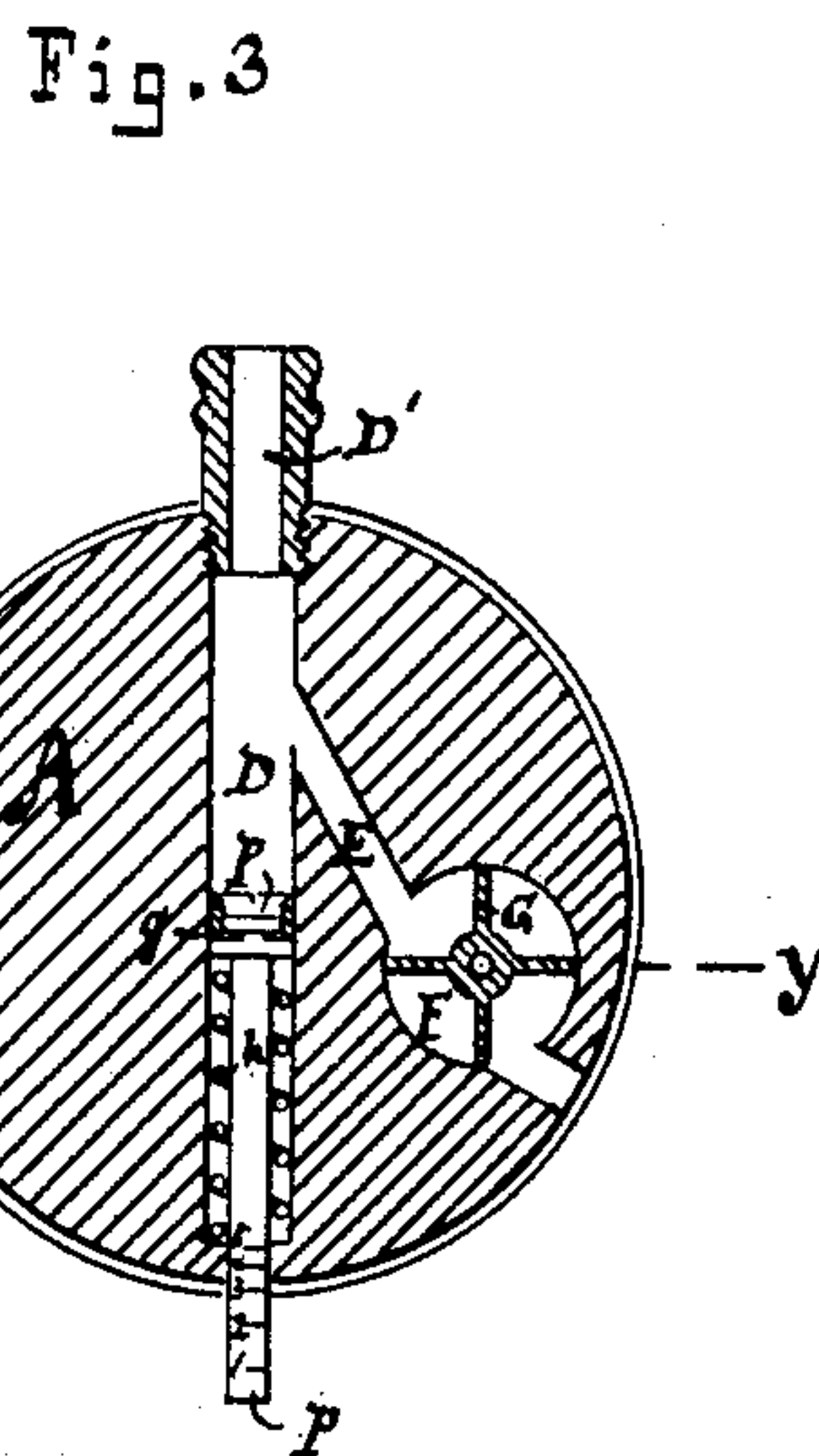
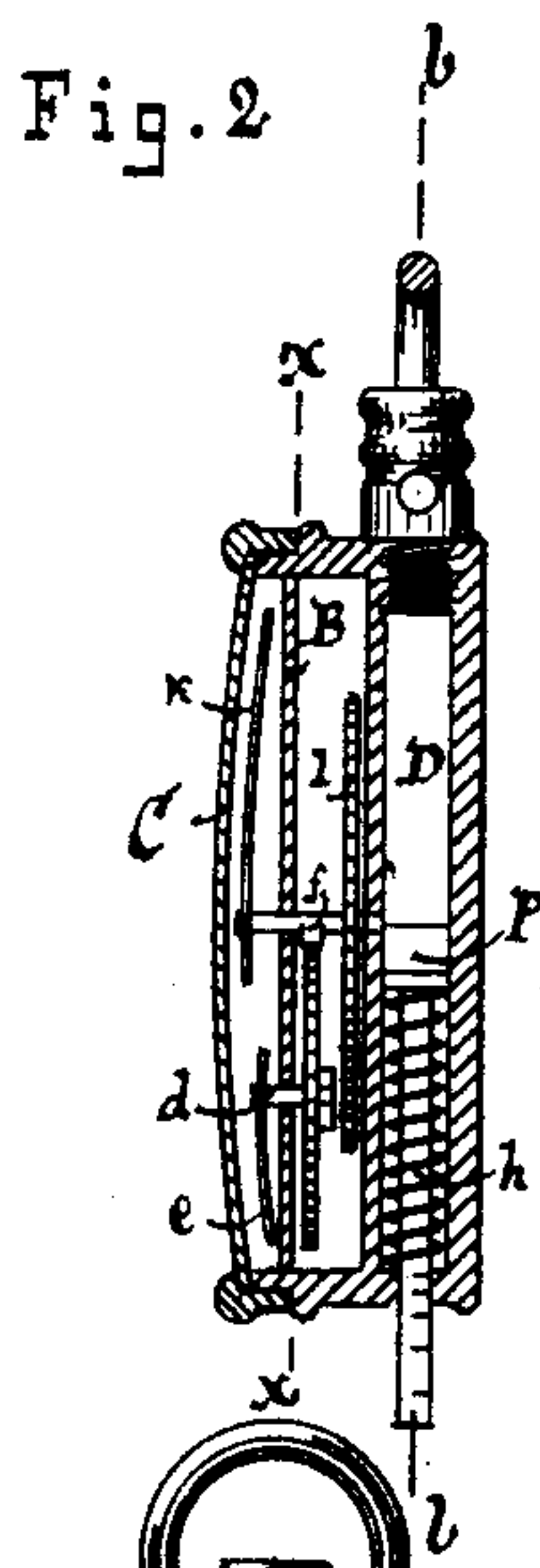
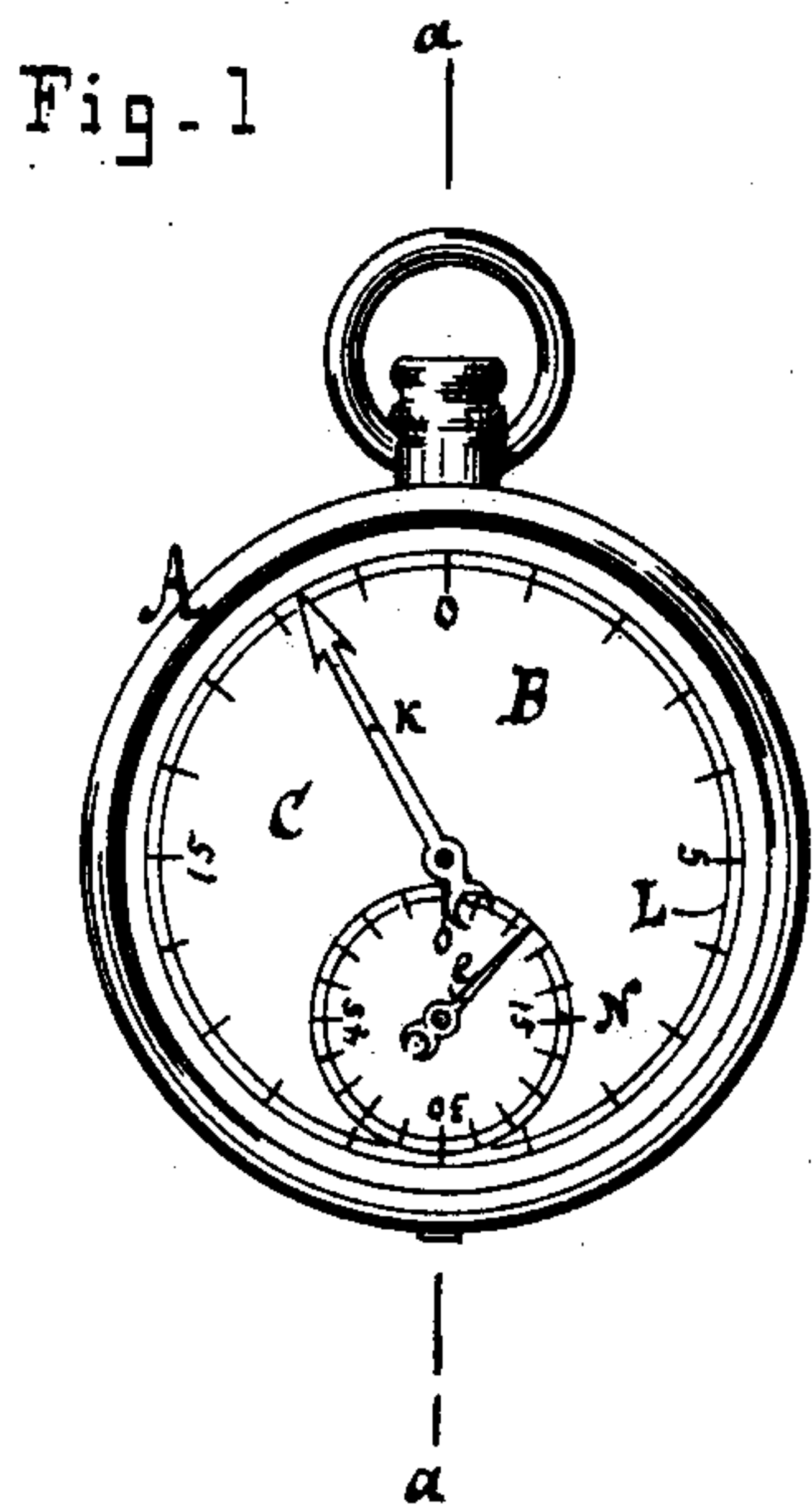


J. P. MARSH.
Respirometer.

No. 220,399.

Patented Oct. 7, 1879.



WITNESSES =

J. E. Wilde
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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN RESPIROMETERS.

Specification forming part of Letters Patent No. **220,399**, dated October 7, 1879; application filed December 4, 1878.

To all whom it may concern:

Be it known that I, JAMES P. MARSH, of Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Respirometers; and I do hereby declare the following to be a full, clear, and exact description thereof, which will enable others skilled in the art to which my invention appertains to make and use the same, reference being had to the accompanying drawings, forming part of my specification, in which—

Figure 1 represents a face view of the respirometer embodying my said invention. Fig. 2 represents a transverse section of the same, showing those parts which are at the left hand of the line *a a*, drawn across Fig. 1. Fig. 3 represents a sectional plan, showing those parts which are at the right hand of the line *b b*, drawn through Fig. 2. Fig. 4 represents a like section, taken on the line *x x* in Fig. 2. Fig. 5 represents a cross-section taken on the line *y y*, drawn across Fig. 3; and Figs. 6 and 7 represent details, showing a modification of the means employed for imparting motion to the indicating-points.

Like letters of reference indicate like parts.

The object of my invention is to provide an instrument for measuring the amount of air passing into and from the lungs at each natural or forced respiration; also, the muscular power of the lungs measured by the pressure per square inch, so as to aid physicians in more perfectly diagnosing lung-diseases; and to that end my invention consists in the arrangement of the several parts as hereinafter described and claimed.

In the accompanying drawings, A represents the case of the instrument, which is made of any suitable metal, preferably in a circular form, of any desired size. B is a dial-plate, which is fitted into the case so as to leave a space between it and the back of the case, for the reception of a train of geared wheels, hereinafter described. C represents the face of the instrument, which is made of any suitable transparent material, and is fitted to the case so as to admit of being removed when desired.

The back wall of the case is nearly equal in thickness to the gross thickness of the instrument, as shown in Figs. 2 and 5, and is provided with an air-chamber, D, both ends of

which extend through the wall of the case, one end being provided with a suitable mouth-piece, D', as shown in Fig. 3. E is an air-passage, which communicates at one end with the air-chamber D, and extends from said chamber through the wall of the case. F is an annular recess, which is formed within the back of the case, so as to communicate with the air-passage E, as shown in Fig. 3. G is a fan-wheel, which is journaled so as to revolve within the recess, and so that each fan will cross the path of the air-space at one side of the recess at each revolution of the wheel. The arrangement of the air-space relative to the recess and wheel is such that as a current of air is drawn through the air-space it will strike the fans, and thus impart a rotary motion to the wheel, measuring all the air that passes from one opening to the other.

Mounted upon the shaft of the fan-wheel is a geared pinion, H, which engages a gear-wheel, I, on a shaft, J. Journaled within the dial-plate, and so as to extend through the same, mounted upon the shaft, is the indicating-point K, which traverses the dial L, as shown in Fig. 1. M is a gear-wheel, which is mounted upon a shaft, *d*, extending through the dial-plate, as shown in Fig. 2, and carrying an indicating-point, *e*, which traverses the dial N.

The shaft J is provided with a lug, *f*, which engages one of the teeth of the wheel M at each revolution of the wheel I, so as to turn the indicating-point *e* one space forward at each complete revolution of the indicating-point K.

The spaces on the dial L are so graduated as to each represent one cubic inch of air passing through the air-space, and the spaces upon the dial N are so graduated as to each represent one complete revolution of the indicating-point K.

P is a pressure-gage, for measuring the force of air per square inch escaping from the lungs. This gage is fitted into the air-chamber D so as to extend through the wall of the case, and so as to admit of a longitudinal movement, and is provided at its inner end with a packing, *g*, adjusted to fit against the walls of the air-chamber, so as to prevent the escape of air, and at the end extending through the case a

series of figures are arranged to indicate the pressure of the air upon the gage.

Mounted upon the gage between the packing and end of wall of the air-chamber is a spring, *h*. (Shown in Figs. 2 and 3.) The tension of this spring is such as to hold the gage within the chamber, and to yield according to the amount of force of air per square inch upon the packing, so as to allow the gage to move outward, whereby the force is indicated by the marks and figures which are on the outside of the wall of the case.

In using my invention the patient inserts the mouth-piece within his mouth and draws a natural breath, when the air passes through the air-space against the fan-wheel, and from thence to the lungs, imparting a rotary motion to the fan-wheel, which is communicated to the indicating-point *K* through the medium of the gear-wheel *I*, so as to turn the indicating-points to the figures upon the dials representing the number of cubic inches of air drawn into the lungs. The air is then forced from the lungs, which imparts a reverse rotary motion to the several parts, turning the indicating-points backward on the dial until the air has been expelled from the lungs, which represent upon the dials the number of cubic inches of air which have escaped at each natural or forced respiration.

In using the pressure-gage, place the finger firmly over the opening in the air-space which extends through the wall of the case, so as to prevent the escape of air when the force of air escaping from the lungs is communicated to the gage, moving the latter outward, indicating the force of air, as before described.

It will be readily seen that this device is capable of measuring the amount of air passing into and from the lungs at each forced respiration, as well as to measure the air passing into and from the lungs at each natural respiration; also, of measuring the force of the air passing from the lungs at a forced respiration, hence measuring the muscular strength of the lungs.

I do not limit myself to the use of the fan-wheel for imparting motion to the moving parts, as I sometimes use the spiral fan shown in Fig. 6, which will produce the same result.

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

1. The combination, in a respirometer, of mechanism adapted to indicate the volume of air passed through the same in either or both directions, and mechanism adapted to indicate the pressure of expiration, substantially as described.

2. In a respirometer, the combination of passage or chamber *D*, provided with the pressure-gage *P*, situated in position to receive the direct force of the expiration, the passage *E*, giving escape or admission to the air, and mechanism adapted to indicate the volume of the respiration, connected with the passage *E*, together arranged and operating substantially as described.

JAMES P. MARSH.

Witnesses:

J. C. WILCKE,
WM. SHERBURNE.