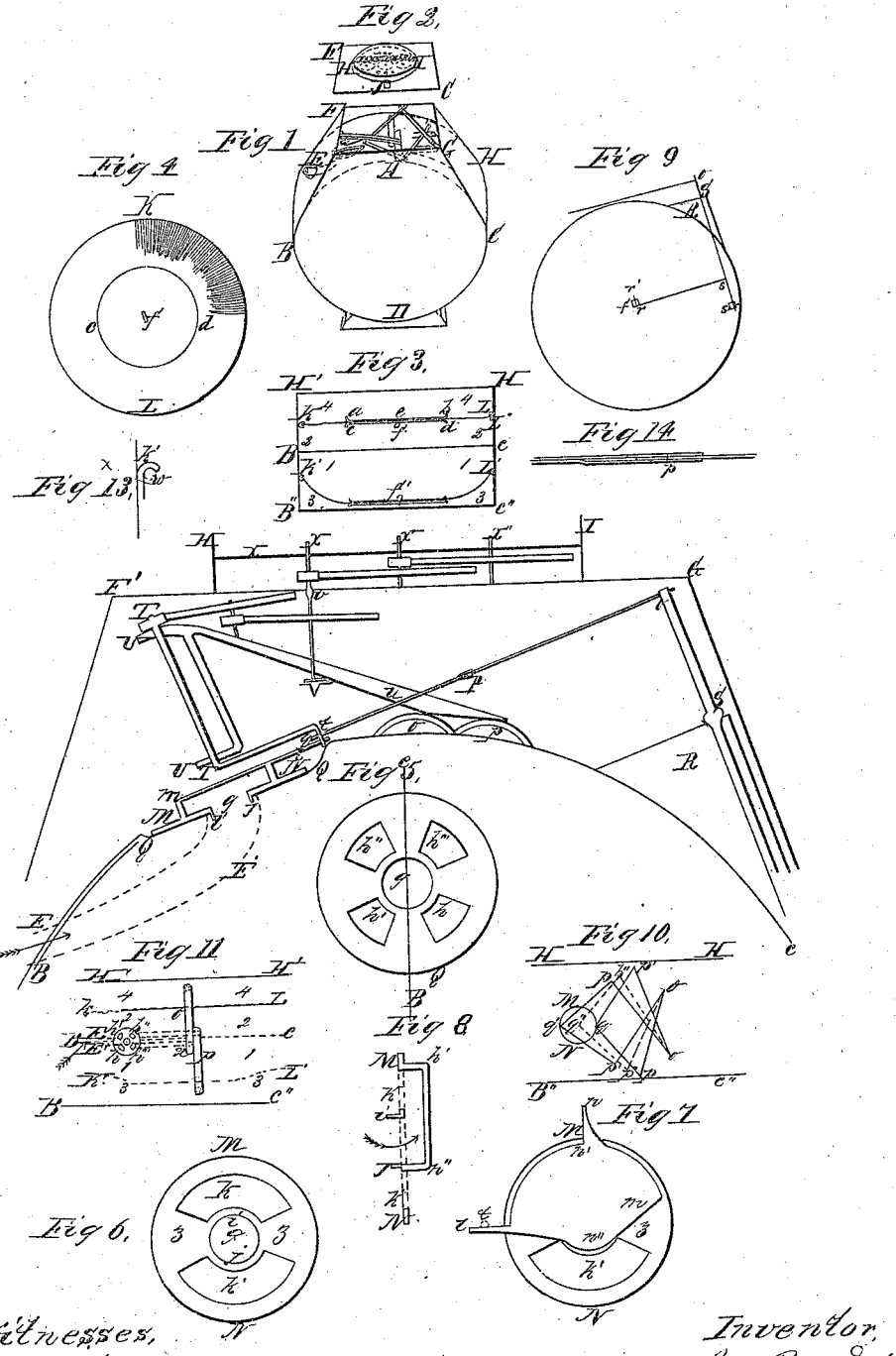
# J. Bogardus,

# Diaphragm Meter.

No. 425. Patented Oct. 12, 1837.

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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN THE MACHINE FOR MEASURING FLUIDS.

Specification forming part of Letters Patent No. **425**, dated October 12, 1837.

*To all whom it may concern:*

Be it known that I, JAMES BOGARDUS, of the city, county, and State of New York, have invented a new and useful Machine for Measuring Fluids, of which the following is a full and exact description.

On any suitable stand lies a cylinder, B D H, made of sheet-tin, the diameter of which, A D, is one-half greater than its length, C H. This cylinder is divided by the same material into two compartments of equal size, B H and B C″. At L L′, an equal distance from the ends of each compartment, a strip of sheet-lead, L or K′, is soldered, with its inner edge, K′, turned upward. Into this rim a circle of wire, W, fixes a partition, K L, termed the "diaphragm," and the outer edge of the lead is turned upward to secure it. Plates of sheet-tin H H′ and B″ C″ cover the ends of the cylinder, which is thus subdivided into four apartments, K H, K C, B L′, B″ L′, each air-tight and entirely separate.

To compose the diaphragm K L, two circular plates of sheet-tin, *a b* and *c d*, each about half the diameter of the cylinder, are employed. On one of these plates, *c d*, which has a small pin, *f e*, in its center, a piece of oiled silk, K L, or other substance equally flexible and impervious to air, is placed, and upon this the other plate, *a b*, is laid, which, having a small hole, *e*, in its center, receives the pin *f e* of the other, and is then fastened. The silk is fixed into the rim of lead K′, as aforesaid, being drawn together at the edges sufficient to enable it to move backward and forward as far as the limits of its compartment will admit. The diaphragm K′ *f*′ L′ when expanded thus presents the appearance of a frustum or zone of a sphere, the smaller end of which is the circular tin plates, the circumference of the greater end being the aforementioned circle of wire within the rim of lead. It may easily be formed with the assistance of a block of the same form and size; first, by adjusting properly the circle of wire and the pieces which compose the diaphragm, then by introducing the block thus adjusted within the cylinder and pressing the circle of wire into the rim of lead, the oiled silk being between them and equally tight all around.

Near the top of the cylinder, at an equal distance from its ends, a plane circle is made in a situation afterward described, about two inches in diameter, more or less. This circle may be formed either by depressing with a die, Q Q′, the metal which composes the cylinder or by constructing it close to the outer surface. Concentric to this a circle, *g*, is cut out half an inch in diameter, more or less. Around this circle four other holes, *h h*′ *h*″ *h*‴, are cut, each an equal distance apart from the two adjacent ones, and about a quarter of an inch from the circumference Q Q′ of the circular plane, each being the eighth part of the space inclosed by the circumferences of two concentric circles about three eighths of an inch separate, or so far that each, *h h*′ *h*″ *h*‴, may have an equal area with the central one, *g*, and so arranged that their axes may be inclined at an angle of forty-five degrees to the middle partition, B C.

A rotary valve, M N, is placed upon the circular plane Q Q′. The valve is cast of brass, turned smooth on the under side, M N, and revolves on a tube, *i j*, fixed as a center, which fits exactly the aforesaid circular hole *g*. Instead of four holes around the center *g* this casting has only two, *k k*′, each somewhat less than three times the size of one of those, *h*, on the fixed circular plane Q Q′ and at an equal distance from each other. One of these holes, *k*, together with the central one, *g*, is inclosed on the upper side in a small cell, *n*′ *n*″.

Into a small upright tube, *f*, fixed on the inner side of the diphragm, a wire, *r*, is inserted, around which it has free motion. (Of course this tube has to be fixed to the inner circular plate, *c d*, and hung on said wire before the diaphragm is inserted.) This wire is fixed to a horizontal limb, *r s*, which is a semidiameter of the cylinder. To this limb another, *s* S *o*, is attached at right angles within the cylinder close to the inner edge of the diaphragm, resting in a small tube beneath, within which it revolves, and passing upward through the cylinder. Outside the cylinder a cell, R, incloses it, through which it also passes. The cell is made air-tight, and the limb *s* S *o*, close to the hole S, through which it passes, is coated with a rim of metal increasing in thickness upward. The limb projects above the cell to a height somewhat greater than that of the cylinder, though, strictly speaking, the height depends upon the direction of the limb, which may be upright or inclined, more or

less. To this limb *s* S *o* the circular plane Q Q′ on the surface of the cylinder is at right angles. To the extremity *o* of each axis thus projecting without the cylinder and connected with the diaphragms arms of sheet-tin, *o p o p*, are fixed of equal length to the limbs *r s*, which guide the diaphragms, crossing each other toward the valve M N. These arms are fixed on the axes at such an angle that two connecting-rods, *p q*, *p q*, also of sheet tin and working in rule-joints *p p*, may meet over the center of the valve *q″* at right angles to each other, the length of the connecting-rods *p q p q* and the distance of the valve from the projecting axes *o o* being thus determined according to the size of the meter.

Close under the circular plane Q Q′ is a pipe, E E′, made of lead or any other suitable metal, connected with that, E, which conveys the fluid into the machine, and also with the circular hole *g*. The two holes *h h′*, which are nearest to the pipe, communicate, respectively, with the inner apartments, 1 2. The other two, *h″ h‴*, communicate transversely with the outer—that is, the right hole, *h‴*, communicates with the left outer apartment, 4, and the left, *h″*, with the right, 3; (but this arrangement might be reversed, provided that the two holes *h″ h‴* nearest to the projecting axes communicate transversely with their respective apartments.) I effect the latter object by means of pipes *h″x′ h‴x* running along the middle partition B C, one on each side of it, and afterward connected with two, O P, on the outer surface of the cylinder, parallel with its axis, which lead to the opposite outer apartments, 3 4; but the mode might be varied by any mechanic.

Fixed to the cylinder within the quadrilateral figure *o p q p*, formed by the arms and connecting-rods, is a casting of brass, U *u*, a strip of metal with two claws, U U′, projecting above the connecting-rods *p q p q* over *g*, the center of the valve. In holes in these claws the axis T T′ of a crank revolves vertically, its lever T′ *t* under the lower claw being turned toward the circumference of the valve a length not greater than B K, half the distance, B H′, through which the diaphragm passes, or so far as to allow the diaphragm to expand fully without rubbing against the sides of its compartment. On the arm *t* or handle of the lever the connecting-rods *p q p q* also turn, the wire *t* which forms the crank passing through them so far as to rub against a point, *l*, connected with the valve and projecting from it. This point *l* is in that diameter which passes through the middle of Z, the solid parts of the valve. A point, *n*, may also project over the open part of the valve a quadrant's distance from the former, and will prevent the possibility of fraud by reversing the operations of the machine. A pinion, T, is fixed to the crank immediately over the upper claw, U.

All the parts of the machine without the cylinder are inclosed in a case, B F G H, which is air-tight. Different modes of doing this might be proposed. I construct the pieces of sheet-tin, which cover the ends A D of the cylinder so as to form two of the sides of the inclosure, each of them being a figure, B D G, composed of a segment of a circle, B D C, and a trapezoid, B G C, the chord B C of the segment being the greater of the parallel sides of the trapezoid. A pipe, J, communicates with this part of the machine, through which the fluid is discharged, and the above-mentioned pinion T, turned by the revolution of the crank, gives motion to a series of wheels, as in the common gas-meter, or otherwise, which regulates the index H I.

As the fluid enters the machine by the central hole, *g*, in the valve, it can only force its way through the opening or openings inclosed by the cell and escape by those which are uncovered. One or two openings are always inclosed. When one, say *h″*, is inclosed two, *h′ h‴*, are covered by the solid part Z of the valve, and one, *h*, is uncovered, and when two, say *h″* and *h‴*, are inclosed, the remaining two, *h′ h*, are uncovered. Consequently an uninterrupted stream passes through at least equal to that which can pass through one of the holes, which will be greater or less according to its size. Owing to the method by which the holes in the valve are connected with the different apartments, one of the apartments is emptying during the whole time in which that on the other side of its diaphragm is in the act of being filled. The filling of an apartment causes its diaphragm to expand. This gives motion to the limb attached to it, which motion is conveyed to the valve by the arm, connecting-rod, and crank, and the movements are such that the power of each connecting-rod in giving motion to the crank is greatest when that of the other is least.

From the principles herein stated an ingenious mechanic might devise many other methods of arranging the arms and connecting-rods equally effective. I have specified the above because I now believe it to be the most easily manufactured.

The materials which compose the different parts of the machine might be varied. Those mentioned are suitable for measuring gases and liquids containing no substance which can combine with them. To measure certain acids a coating of beeswax is requisite, and where this is impracticable, as in the valve, suitable metals will have to be employed.

What I claim as my invention, and wish to secure by Letters Patent, is—

The manner of constructing the diaphragms and the valve, the manner of connecting the valve with the four different apartments, and the general arrangement of the parts of the machine, as herein described.

JAMES BOGARDUS.

Witnesses:
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