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F. E. YOUNGS.

AIR OR GAS METER.

No. 485,076. Patented Oct. 25, 1892.

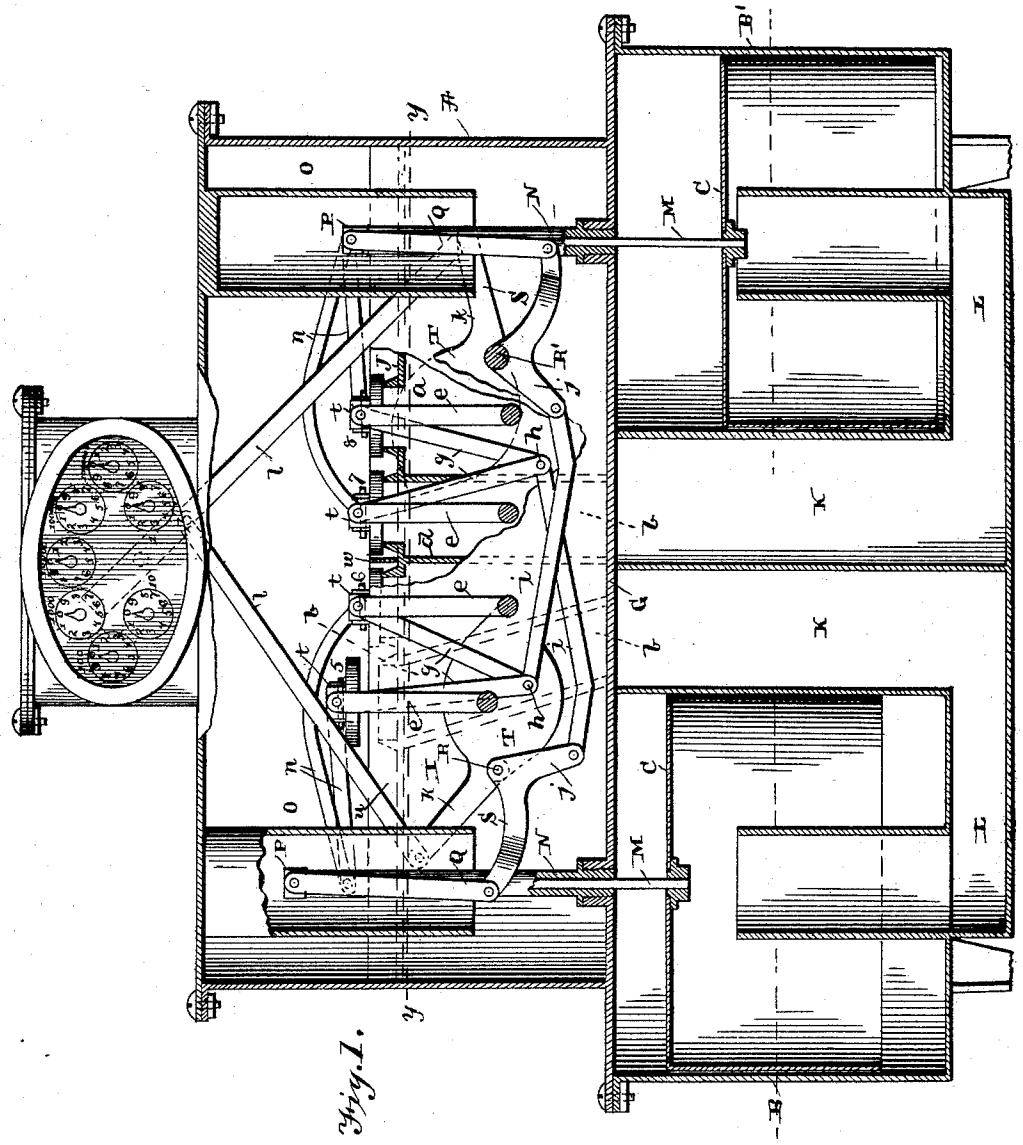

Fig. 1.

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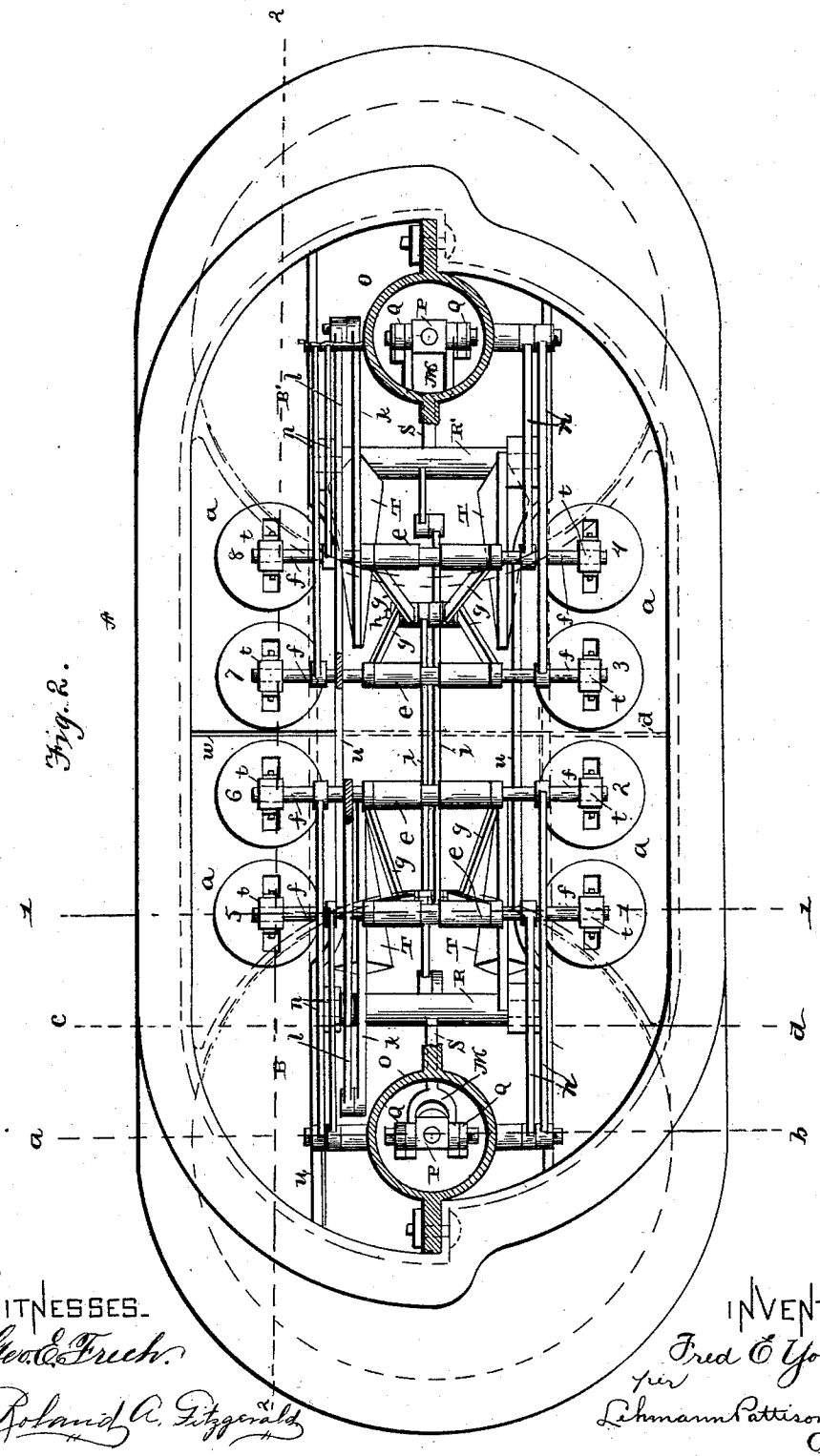

Fig. 2.

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AIR OR GAS METER.

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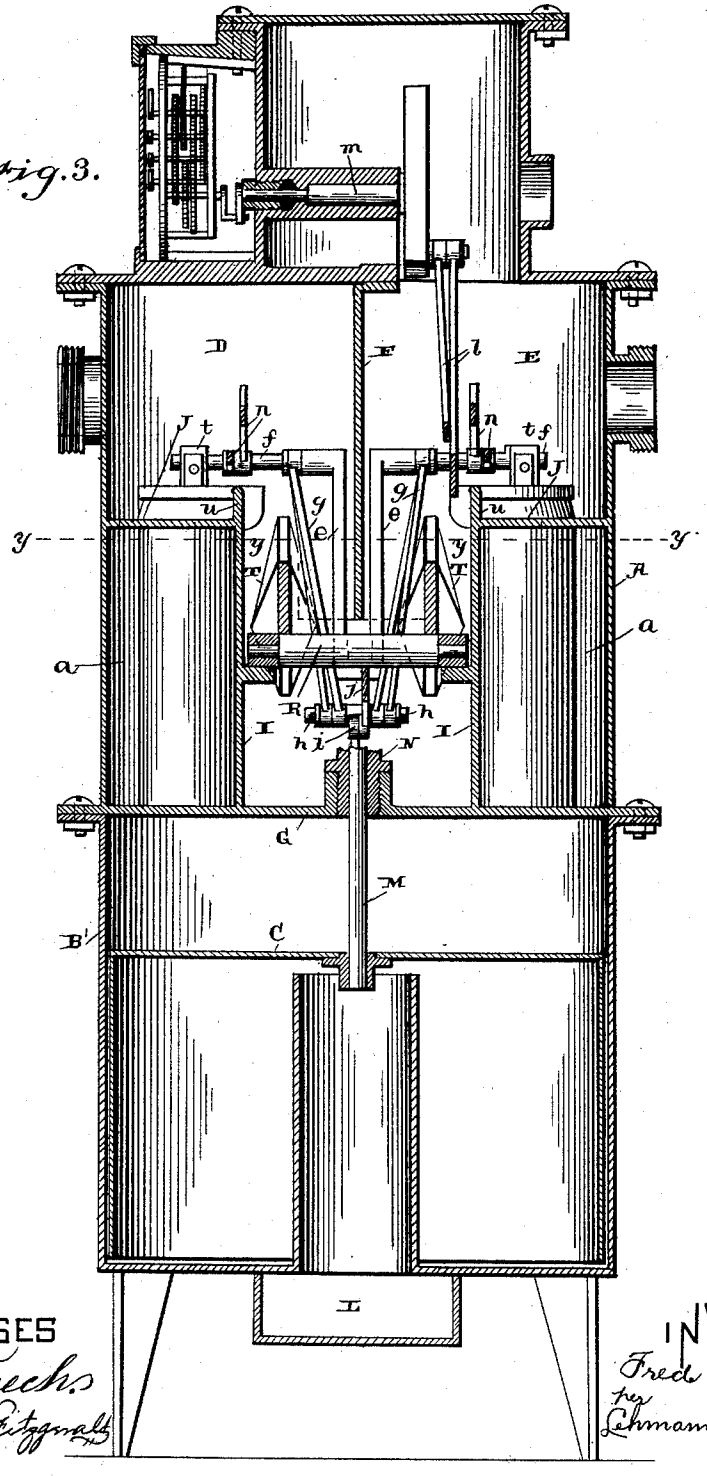
Fig. 3.



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AIR OR GAS METER.

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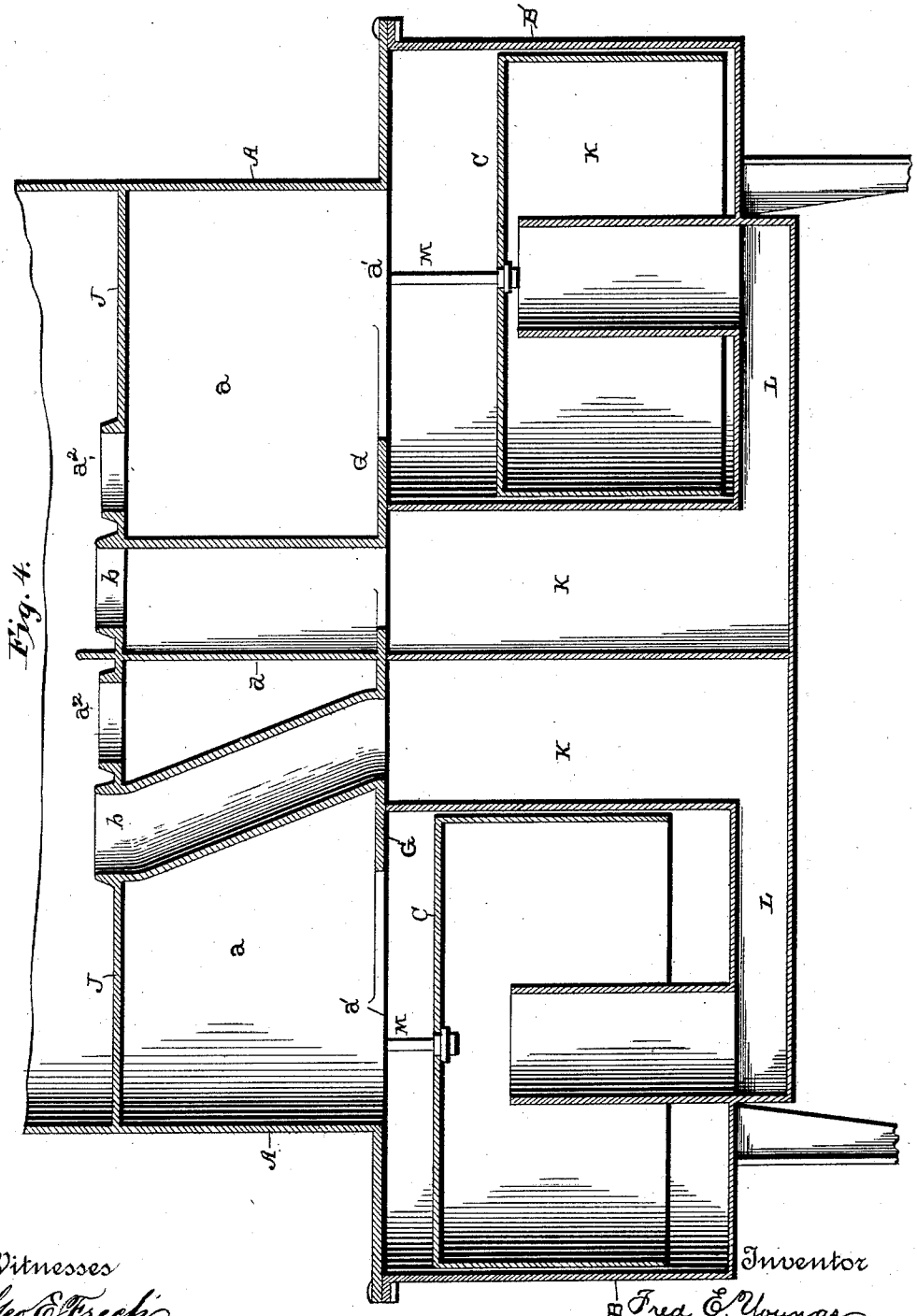

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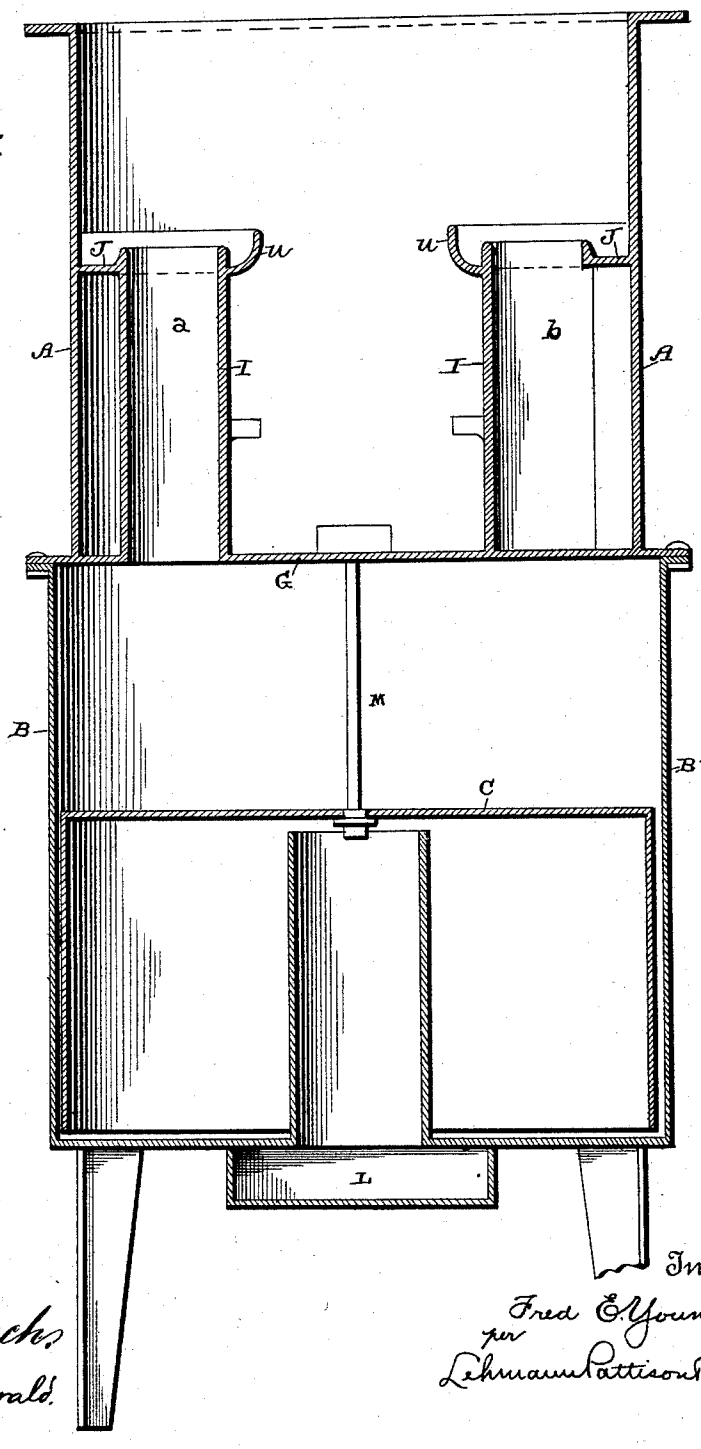
Fig. 5.



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UNITED STATES PATENT OFFICE.

FRED E. YOUNGS, OF ALLEGHENY, PENNSYLVANIA.

AIR OR GAS METER.

SPECIFICATION forming part of Letters Patent No. 485,076, dated October 25, 1892.

Application filed December 19, 1891. Serial No. 415,673. (No model.)

To all whom it may concern:

Be it known that I, FRED E. YOUNGS, of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Valve Mechanisms; and I do hereby 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 pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in valve mechanisms, which is especially intended and adapted to be used in connection with air or gas meters; and it consists in the construction and arrangement of parts, which will be fully described hereinafter, and particularly referred to in the claims.

The object of my invention is to provide a valve mechanism for meters so constructed that the ordinary wear in service cannot interfere with the perfect carrying out of the function of the valves and leaking thereof prevented under all conditions of flow.

In the drawings, Figure 1 is a vertical longitudinal section of a meter and valve mechanism embodying my invention. Fig. 2 is a plan view with the top removed. Fig. 3 is a vertical cross-section taken through the cylinders on the dotted lines *a b* of Fig. 2 and on the dotted lines *c d* of the same figure above the cylinders. Fig. 4 is a vertical longitudinal section taken on the dotted line 2 2 of Fig. 2. Fig. 5 is a vertical transverse section taken on dotted line 1 1 of Fig. 2.

A indicates a valve-casing which is preferably made of the shape shown in plan, to the lower side of which is connected in any suitable manner the cylinder-casing containing the cylinders B and B′ and the parts leading thereto. Placed in these cylinders are the reciprocating pans or pistons C in the ordinary manner, the cylinders being partially filled with liquid to make a gas-tight seal with the pans.

The valve-casing A is divided throughout its length into an inlet-chamber D and an outlet-chamber E by a vertical partition F, extending downward from the top, leaving a space between its lower edge and the bottom G of the said casing.

Gas or air is fed into the inlet-chamber D, and is prevented from passing under this partition F to the outlet-chamber by an oil or liquid seal with which the central portion of the casing is filled to the dotted line *y y*, thus sealing the inlet and outlet chambers against any escape of gas from one to the other without first passing into the cylinders B B′ in a manner to be fully described hereinafter.

Extending upward from the bottom G of the casing A are the vertical longitudinal walls I, which form the sides of a well between them to receive and hold the liquid which seals the lower side of the partition F, as aforesaid; also, placed within this casing are port-chambers *a* at each end thereof that are closed at their upper ends by a cover or partition J, which port-chambers are in communication with the upper ends of the cylinders through openings *a′*, Fig. 4.

Placed within the inlet-chamber D are four valves 1, 2, 3, and 4, the first two of which open communication with the cylinder B and the two latter with the cylinder B′; also, placed within the outlet-chamber E are four valves 5, 6, 7, and 8, the two first of which open communication with the cylinder B and the two latter with the cylinder B′. The valves 1, 6, 3, and 8 communicate with the port-chambers *a* through openings a^2, made in the top thereof and which form seats for the said valves, which are in communication with the upper ends of the cylinders through openings *a′*, made in the tops thereof, while the valves 2, 4, 5, and 7 communicate with the ports *b*, which have their lower ends communicate with chambers K, which communicate with the lower ends of the cylinders through channels L, as shown.

Extending upward from the pans or pistons C are the vertical rods M, which pass through tubes N, which extend into hoods O, that form a part of the partition F. The upper ends of the tubes N extend above the level of the liquid placed in the well, and the lower ends of the depending hoods extend below the liquid level, thus making a gas seal without a stuffing-box to prevent the escape of gas into or from the upper end of the cylinders through the rod-tubes N. Secured to the upper ends of these rods M are cross-heads P, from opposite ends of which are suspended the links Q.

Supported in the well are rock-shafts R and R′, which are provided with outwardly-projecting arms S, which have their outer ends bifurcated to extend upon opposite sides of the tubes N and connected, respectively, to the lower ends of the said links Q. Extending inward from the said rock-shafts are counter-weights T, which balance the weight of the pans or pistons C through the medium of intermediate mechanism, hereinafter described, the upper and lower edges of the said weights being sharpened to prevent a swashing of the liquid in which they move.

The port-chambers *a*, which communicate with the cylinder B, are separated from those which communicate with the cylinder B′ by vertical partitions *d*. (Shown in dotted lines in Fig. 2.)

Connecting the valves of the inlet and outlet chambers in pairs are the valve-yokes *e*, which are essentially-U shaped, to the outer ends *f* of which are attached the valves, preferably by the ordinary gimbal or universal joint *t*. The object of using universal joints to connect the valves with the yokes *e* is to insure the valves resting squarely and with equal pressure all over their seats. These yokes connect one of the valves in the inlet-chamber with the valve in the outlet-chamber which is opposite it by extending down under the partition F, as shown in Fig. 3. Depending from the horizontal portions *f* of these yokes, at opposite sides of the partition F, are the links *g*, which are braced or inclined toward each other to prevent side swaying of their lower ends. The links of these two yokes which operate in connection with one cylinder extend toward each other and are connected by a bolt or pin *h*, which passes through their lower ends. In this manner the valves are connected in fours by the links, while at the same time in pairs by the yokes *e*. Connected with the lower ends of these links *g* are the links *i*, which have their opposite ends connected with downwardly-extending arms *j* upon the rock-shafts R R′, thus connecting the valves through the medium of the mechanism thus described with the rods M of the pistons C. It will be noticed that the rod *i* that is connected with the piston of one cylinder has its opposite end connected with the valves which operate in conjunction with the other cylinder.

Projecting outward from the shafts R R′ are the arms *k*, which have their outer ends connected with the lower ends of the pitman *l*, which have their upper ends connected with the crank of a shaft *m*, that operates an indicating mechanism of any desired construction.

For the purpose of holding the valves against endwise displacement in relation to their seats, links *n* are pivoted therewith at one end, their opposite ends being pivoted on pins attached to the sides of the hoods O. These links, however, may be omitted and vertical guideways provided for the horizontal portions of the yokes, as will be readily understood, which will serve the same purpose.

A vertical flange *u* extends around the inner edge of the covers J, to form a pocket for catching any liquid that may be sprayed from the cylinders through the outlet-ports when the capacity of the meter is overtaxed, which sometimes occurs. The valve-seats on the outlet side which communicate with the upper ends of the cylinders are made slightly lower than the valve-seats which communicate with their lower ends, so that the liquid sprayed from the cylinders into the said pocket will run over the lower valve-seats into the upper ends of the cylinders when the meter has stopped or is running within its rated capacity, as will be understood. For the purpose of preventing the liquid that is sprayed from one cylinder running into the other cylinder, and thus causing it to accumulate in one and be lessened in the other, a partition *w* extends across the said pocket, thus dividing it into two pockets and preventing the liquid sprayed from one cylinder passing into the other.

The valves consist of a disk which has secured to its under face a piece of felt, wash-leather, or other suitable material, which becomes thoroughly saturated with the liquid, which is preferably oil, thus causing the valves to seat themselves gas-tight. The felt on the valves becoming so thoroughly saturated with oil, the valve is made double gas-tight by capillary attraction.

From the above description it will be seen that when the rock-shafts are operated, and through the mechanism of the links *i* and *g* one pair of valves is raised the others fall down upon their seats before the valves to be raised start up, which must of necessity be so, owing to the fact that one set of valves forms the fulcrum upon which the others are raised, as shown in Fig. 1. From this figure it will be seen that the pair of valves of which the valve 5 is one and the pair of valves of which the valve 6 is one are coupled together by the links *g*, so that when the said links are tilted, as shown in this figure, both the valve 6 and the valve 2, connected therewith, must fall down upon their seats before either the valves 5 and 1, connected with it, can be raised. This operation and arrangement makes positive and absolute the closing of both valves of each pair before either valve of the other pair can be opened. In this manner it is impossible to raise two pairs of valves at the same time or to have either one or both valves of one pair slightly raised while either one or both valves of the other pair are off their seats, thus causing a leakage and allowing the gas to flow without operating the valve and the pistons when there is a very small volume passing through the meter. This is a usual and serious defect of other meters when they have become worn out even to a very small degree. In my meter it will be seen that the

weight of the respective yokes and links for operating the valves are sustained by the respective valves to which they are connected, and it is absolutely necessary for one pair of valves to be at rest upon their seats when the gas is flowing through the other pair. This being so, the gas must of necessity pass into the cylinder at one or the other end, as the case may be, and out at the other and thus operate the piston or pan therein. This operation of the pan in return must of necessity operate the valves, so that the alternate opening and closing of the valves is made positive and the operation of the meter certain, no matter how small the volume of gas. The two valves of each pair communicate with the upper and lower ends of the cylinders, respectively—that is to say, the valve 1 communicates with the upper end of the cylinder B through the adjacent port-chamber *a*, while the valve 5 communicates with the lower end of the cylinder B through the port *b*, chamber K, and channel L. In this manner, when the piston-rod of the cylinder B′ is moving down the valves 1 and 5 are raised, thus allowing gas to pass through the valve 1 into the upper end of the cylinder B, forcing the pan down and the gas in the lower end of the cylinder B out of the valve 5. When the mechanism has reached the position shown in Fig. 1, the piston of the cylinder B′ has reached the lower limit of its stroke and its pitman on a dead-center, while the piston of the other cylinder B is about half its stroke and on its downward movement. The gas, passing in over the piston of cylinder B through the valve 1, forces it down, carrying the pitman connected with the cylinder B′ past the dead-center, as will be understood. Now the continued movement downward of the piston in the cylinder B rocks its adjacent shaft R, which is connected with the valves of the other cylinder, pushing its link *i* toward the cylinder B′, which raises the valves 4 and 8 off their seats, thus admitting gas through the valve 4 to the lower end of the cylinder B′, which forces its piston up, driving gas above it through the valve 8, while at the same time the rock-shaft R′, connected with the piston-rod of the cylinder B′, is being rocked, thus drawing its rod *i* toward the said cylinder B′ and allowing the valves 1 and 5 to fall upon their seats. As soon as the valves 1 and 5 are seated the continued movement of the said shaft R′ shifts the fulcrum-point of the links *g* from the valves 2 and 6 to the valves 1 and 5, thus raising the valves 2 and 6 from their seat, which allows gas to pass through the valve 6 to the upper end of the cylinder B, the piston of which has at this instant reached the upper limit of its stroke, and the gas to pass from the lower end of the said cylinder through the valve 2 into the outlet-chamber. From this description it will be seen that the four valves of the respective cylinders are alternately raised in pairs to allow the gas to be alternately fed and forced out of the upper and lower ends of the cylinders, as just described, one valve of each pair being an inlet-valve and the other an outlet-valve. In this way the cylinders receive and exhaust gas upon opposite sides of their pistons like unto the cylinders of a steam-engine. The upper faces of the valve-seats are preferably rounded to furnish a smooth seat for the faces of the valves to rest upon.

I do not desire to limit myself to the use of this valve movement in connection with a meter, for it will be readily conceived that this principle can be applied to cylinders in other connections for alternately feeding and exhausting steam, air, gas, or water at opposite sides of the piston.

While I here use the terms "pan" and "piston," placed in the cylinders, they are intended to comprehend a pan moving in a liquid, a tightly-fitting piston, a diaphragm, or any equivalent device to opposite sides of which air, gas, or other fluid is admitted.

It is evident that it is merely a matter of choice whether the felt facing of the valve is placed upon the moving part of the valve or upon the valve-seat so long as it is adapted to close the valve-port securely.

I do not claim in this application a valve mechanism comprising two or more valves, which are fulcrumed one upon the other, for this is the subject-matter of the claims in my pending application, Serial No. 415,672; but what I do claim is two or more valves connected and moving in pairs and one pair fulcrumed upon another pair.

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

1. A valve mechanism comprising two or more pairs of valves connected and fulcrumed one upon the other and a means connected therewith for operating them.

2. A valve mechanism for cylinders, having a piston, the said mechanism comprising four valves which are connected in pairs to move together, a means connecting the said pairs, which is fulcrumed thereon for alternately moving them in pairs, the valves closing ports at opposite sides of the said piston, and an operating means connected with the said connecting means, substantially as specified.

3. A valve mechanism for two cylinders, having pistons, the said mechanism comprising two pairs of valves for each cylinder, the valves of each pair moving together and closing, respectively, ports leading to opposite sides of the pistons, and a means connected with the piston of one cylinder for alternately operating each pair of valves which coact with the other cylinder, substantially as specified.

4. A valve mechanism for cylinders, having pistons, the said mechanism comprising four or more valves connected to move in pairs, a means connecting the said pairs of valves and

fulcrumed thereon, and a connection between the piston and the said fulcrumed connections, substantially as shown.

5. A valve mechanism for cylinders, comprising four valves connected and moving in pairs, links connected loosely at one end to each pair, and an operating mechanism connected with the links at their opposite ends for reciprocating them, whereby the valves are alternately operated, substantially as set forth.

6. A valve mechanism for cylinders, having pistons, the said mechanism comprising four valves connected and moving in pairs, the valves of each pair closing, respectively, ports leading to opposite sides of the piston, links loosely connected at one end to the valves and inclining toward each other and loosely connected together at their opposite ends, and an operating mechanism connected with the links for reciprocating them, whereby the pairs of valves are alternately operated, substantially as specified.

7. A meter comprising inlet and outlet chambers, two cylinders having piston-valves connected in pairs and in fours for each cylinder, the valves of each pair closing, respectively, ports which lead to opposite sides of the cylinder-pistons, and opening, respectively into the inlet and outlet chambers, and connections between the pistons of one cylinder for operating the valves of the other cylinder, substantially as specified.

8. A meter comprising a casing having a well carrying a liquid, a partition extending downward from the top of the casing into the liquid, forming inlet and outlet chambers, and a cylinder, valves in the inlet and outlet chambers communicating, respectively, with opposite ends of the cylinder, yokes extending under the said partition and connecting the valves in pairs, and a means connected with the valves for alternately operating them in pairs, substantially as shown.

9. A meter comprising a casing having a well carrying a liquid, a partition extending downward from the top of the casing into the liquid and having a space between its lower edge and the bottom of the well, forming inlet and outlet chambers, valves in the said chambers communicating, respectively, with opposite ends of the cylinder, connections extending under the said partition for connecting the valves in pairs and in fours, and an operating mechanism connected with the connection which connects the valves in fours, substantially as described.

10. A meter comprising inlet and outlet chambers, two cylinders carrying pistons, two pairs of valves for each cylinder, opening into the inlet and outlet chambers, rock-shafts carrying counter-weights connected with the pistons, and a connection between the rock-shafts and the pairs of valves for operating the two pairs of valves for each cylinder alternately, substantially as set forth.

11. A meter comprising inlet and outlet chambers, valves placed in the said chambers, two cylinders, ports connecting the valves and opposite ends of the cylinders, pistons carrying piston-rods, a well below the inlet and outlet chambers, containing a liquid, a tube surrounding the piston-rod, extending above the liquid-level, a hood surrounding the tube, which extends into the liquid, and a connection between the valves and the piston-rods, substantially as specified.

12. A meter comprising two pistons, inlet and outlet chambers, ports connecting the said chambers and opposite sides of the pistons, a rock-shaft for each piston, which is connected therewith, valves for closing the said ports, an operating connection between the valves and pistons, consisting of a crank and pitman-link, and connecting-arms upon the said rock-shafts, whereby the pistons are held in their proper relative positions throughout their strokes, substantially as set forth.

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

FRED E. YOUNGS.

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