(No Model.)

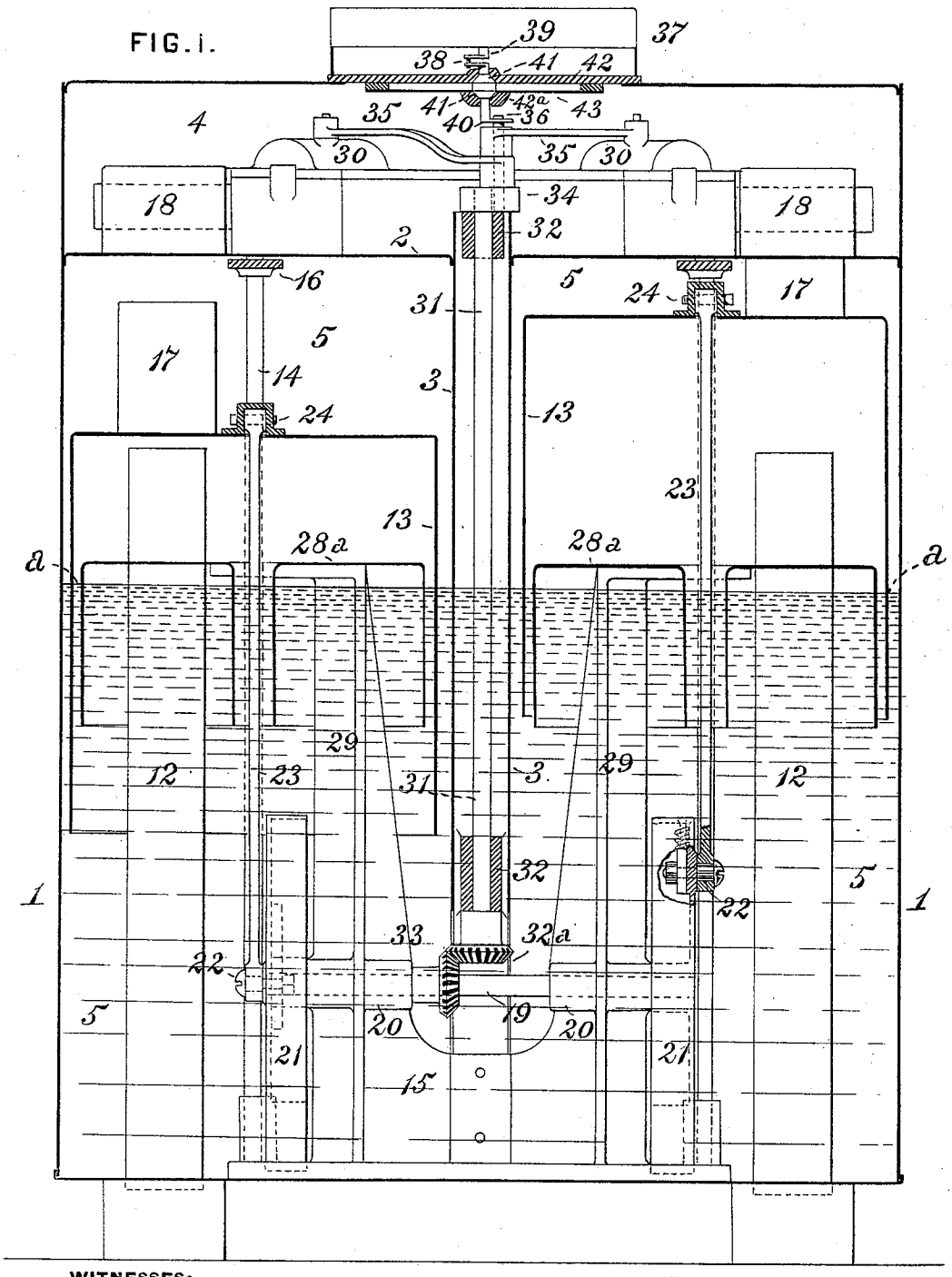
3 Sheets—Sheet 1.

E. RUUD.

FLUID METER.

No. 451,881. Patented May 5, 1891.

FIG. 1.



WITNESSES:

R. F. Whittemore

F. E. Gaither.

INVENTOR.

Edwin Ruud

By J. Snowden Bell,

Att'y.

(No Model.) 3 Sheets—Sheet 2.

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FLUID METER.

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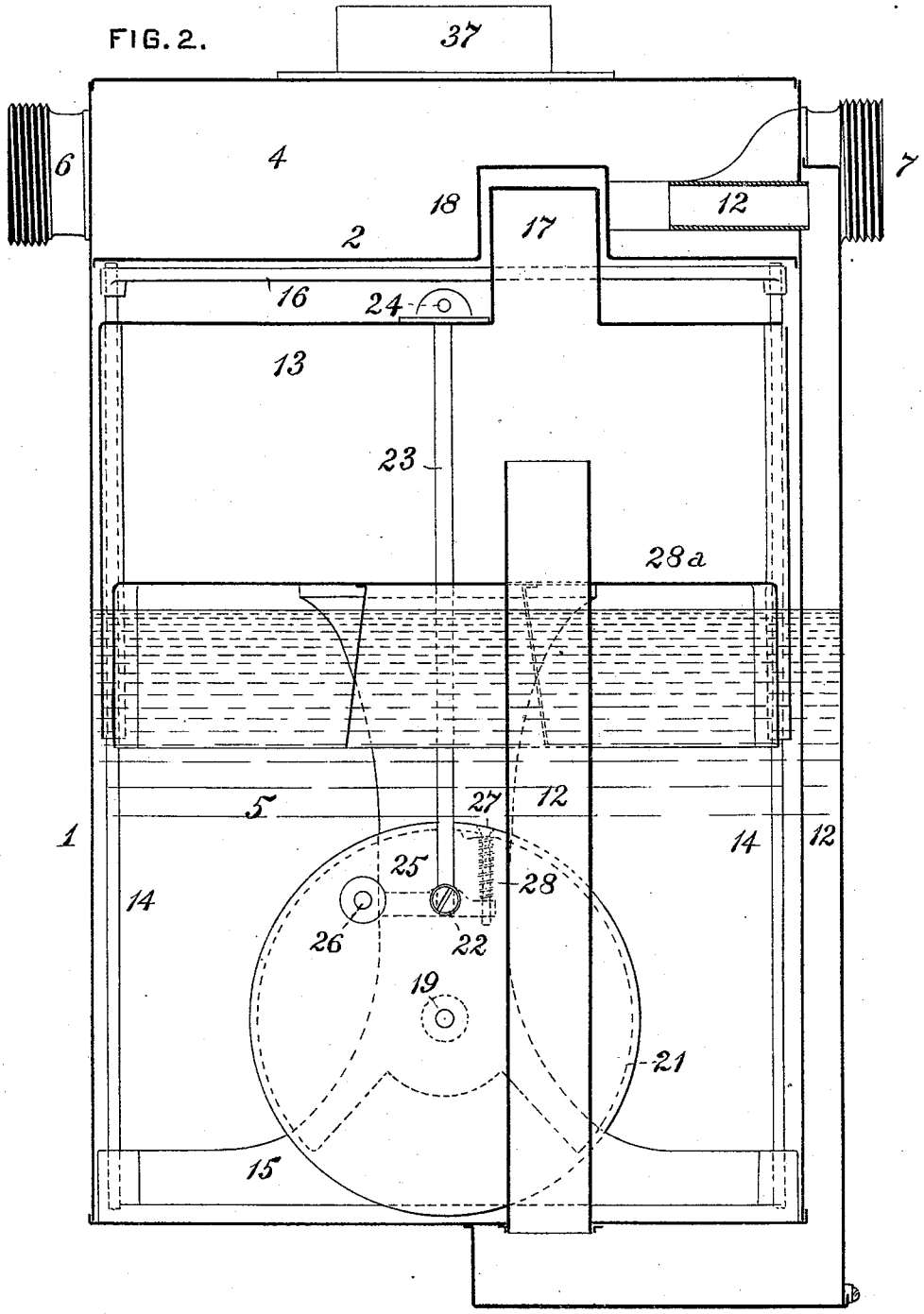
FIG. 2.



WITNESSES:

R. H. Whittlesey

F. E. Gaither

INVENTOR,

Edwin Ruud.

by Howden Bell,

Att'y.

(No Model.) 3 Sheets—Sheet 3.

E. RUUD.

FLUID METER.

No. 451,881. Patented May 5, 1891.

FIG. 3.

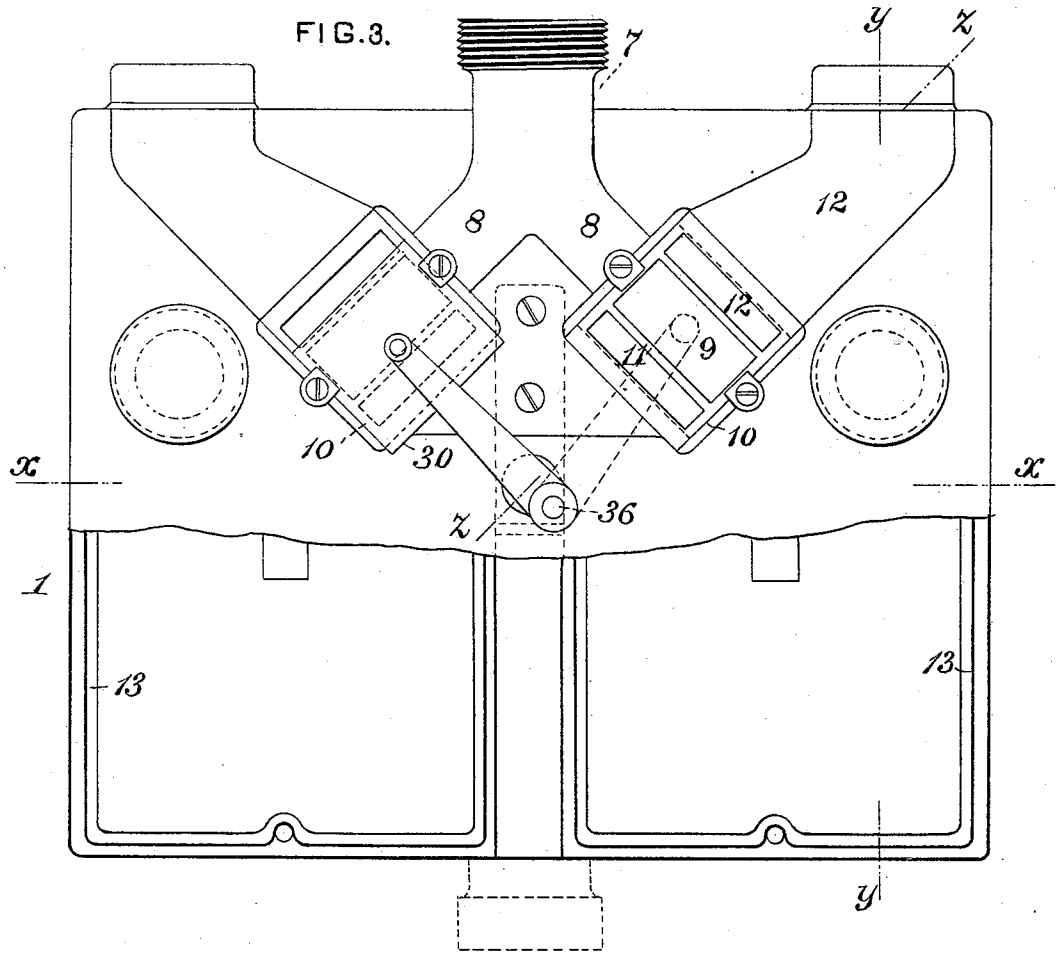
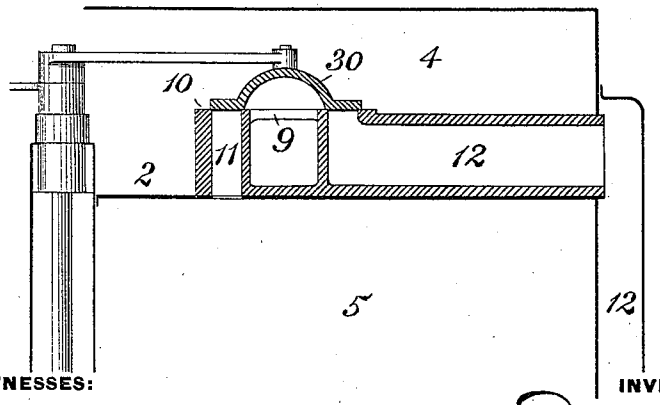


FIG. 4.



WITNESSES:

R. F. Whiddeny

F. E. Gaither

INVENTOR.

Edwin Ruud

by J. Bowden Rell

Att'y.

UNITED STATES PATENT OFFICE.

EDWIN RUUD, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE FUEL GAS AND MANUFACTURING COMPANY, OF SAME PLACE.

FLUID-METER.

SPECIFICATION forming part of Letters Patent No. 451,881, dated May 5, 1891.

Application filed June 19, 1890. Serial No. 355,932. (No model.)

To all whom it may concern:

Be it known that I, EDWIN RUUD, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Fluid-Meters, of which improvement the following is a specification.

The object of my invention is to provide a double-acting meter—that is to say, one in which fluid is both received and discharged at each stroke of the pistons or measuring cups, which shall embody the advantages of simplicity and inexpensiveness of construction, accuracy of measurement, steady and continuous delivery of fluid, maximum capacity within determined volume, and low degree of friction.

To this end my invention, generally stated, consists in the combination of a chambered casing, two or more pistons or measuring-cups, each fitted to reciprocate in one of the chambers thereof, supply and exhaust passages leading into each chamber on opposite sides of its measuring-cup, valves controlling said passages, and a crank-shaft journaled and coupled to the measuring-cups below the level of the sealing-fluid thereof. The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a vertical section through a meter embodying my invention at the line $x\ x$ of Fig. 3; Fig. 2, a similar section at the line $y\ y$ of Fig. 3; Fig. 3, a plan or top view, partly in section; and Fig. 4, a similar section through the valve-chamber at the line $z\ z$ of Fig. 3.

In the practice of my invention I provide a casing 1, which is preferably of sheet metal, and is divided by a horizontal partition 2 and vertical partitions 3 into an upper valve-chamber 4 and two measuring-chambers 5, located side by side below the valve-chamber. An inlet-nozzle or supply-passage 6, adapted to be connected to a fluid-supply pipe, is fixed to one side of the valve-chamber 4, and an outlet-nozzle or delivery-passage 7, adapted to be connected to a fluid-delivery pipe, leads from the opposite side of the valve-chamber, the outlet-nozzle communicating with exhaust-passages 8, leading to ports 9 in valve-faces 10, fixed to the bottom plate 2 of the valve-chamber. A fluid receiving and delivery passage 11 leads from each valve-face into the top of the adjacent measuring-chamber 5, and a similar passage 12 leads from each valve-face on the opposite side of its exhaust-port 9, to and downwardly on the outside of the casing 1 to the bottom thereof, and thence extends upwardly in the adjacent measuring-chamber 5 for a sufficient height to enable its upper open end to be cleared by a piston or measuring-cup 13, which is fitted to reciprocate in said chamber, when the measuring-cup is at the lower limit of its traverse.

The measuring-cups 13, one of which works in each measuring-chamber 5, are light metallic shells closed at their upper and open at their lower ends, and are of corresponding form to but of slightly less dimensions in transverse section than the measuring-chambers 5, so as to work freely therein, and their true rectilineal movement is insured by vertical guide-rods 14, secured at their lower ends in sockets on a bearing-casting 15, fixed to the bottom plate of the casing 1, the pair of guide-rods of each chamber fitting lateral recesses in its measuring-cup 13 and being connected at top by a transverse bar 16. In order to admit of the desired traverse of the measuring-cups being effected with a minimum of height of the casing, a cap 17, having a closed top and open bottom, is secured to the top of each measuring-cup over a corresponding opening therein, said caps fitting freely over the upper ends of the passages 12 in the downward traverse of the cups, and fitting freely within corresponding caps 18, of slightly greater transverse section, fixed upon the bottom plate 2 of the valve-chamber 4. The downward movement of one of the measuring-cups 13 and the upward movement of the other are effected coincidently by the pressure of the fluid admitted on their upper and lower sides, respectively, and their traverse is made coincident and equal in range by coupling them below the level of the sealing-fluid a in the measuring-chambers to a crank-shaft 19, journaled in bearings 20, also located below the level of the sealing-fluid, which is preferably oil and serves as a lubricant for the working parts. The bearings 20 of the

crank-shaft 19 are formed in a bearing-casting 15, fixed to the bottom of the casing, and the crank-shaft carries upon each of its ends a balance-wheel 21, to which is connected an adjustable crank-pin 22. Each of the measuring-cups 13 is connected to the crank-pin of the adjacent balance-wheel 21 by a connecting-rod 23, which is coupled at its upper end to a pin 24, fixed to the top plate of the measuring-cup and at its lower end to the crank-pin. In order to render the crank-pins 22 adjustable toward and from the center line of the crank-shaft, and thereby to lessen or to increase, respectively, the traverse of the measuring-cups, as may from time to time be required, the crank-pins are connected to arms 25, each of which is journaled at one end by a pin 26 to one of the balance-wheels, and is moved about the axis of the pin 26, so as to raise or lower the crank-pin which it carries by an adjusting-screw 27, adapted to turn in a bearing on the balance-wheel, and a spring 28, surrounding said adjusting-screw and bearing against the outer end of the arm 25. It will be seen that by the rotation of the adjusting-screw in one or the other direction the arm 25 will be raised or lowered, as the case may be, and will bring the crank-pin nearer to or farther from the center line of the crank-shaft.

An equalizing-chamber 28^a, of corresponding form to, but of slightly smaller transverse section than, the measuring-cup 13, is fixed in each measuring-compartment with its top adjacent to the level of the sealing-fluid therein, the measuring-chamber surrounding and moving freely past the equalizing-chamber. The equalizing-chambers 28^a, which are secured to and supported by standards 29 on the bearing-casting 15, are provided for the purpose of reducing the error due to the depression and elevation, respectively, of the sealing-fluid on the inside and outside of the measuring-cups, and, being substantially similar to those heretofore known in practice, are not in and of themselves claimed as of my present invention.

The admission and exhaust of the fluid to be measured to and from the upper and lower sides of the pistons or measuring-cups 13 is effected by slide-valves 30 of the recessed or D type employed in steam-engines, said valves being reciprocated on the valve-faces 10 and controlling the ports 11, 9, and 12 thereof. Movement is imparted to the valves 30 by a valve-shaft 31, journaled in bearings 32 between the vertical partitions 3 of the casing, and carrying on its lower end a bevel-gear 32^a, which engages a similar gear 33 of equal diameter on its pitch-line and fixed upon the crank-shaft 19. A crank 34 is fixed upon the upper end of the shaft 31, and the valves 30 are coupled by connecting-rods 35 to the pin 36 of said crank, the valves being set to traverse at right angles one to the other in correspondence with the location of the crank-pins 22 on the balance-wheels 21.

The registration of the measurement of fluid passing through the meter is effected by a registering mechanism of any suitable and known construction which does not form part of my present invention, the same being located in a register-case 37, fixed upon the top of the casing 1, and actuated by a crank 38 on a shaft 39, journaled in bearings in said casing concentrically with the valve-shaft 31. The shaft 39 is rotated coincidently with and at the same speed as the crank-shaft 19 and valve-shaft 31 by a crank 40, fixed upon its lower end and coupled to the pin 36 of the valve-shaft crank 34. A stuffing-box of any suitable construction is provided to prevent leakage of fluid from the valve-chamber 4 around the shaft 39 into the register-case 37. As shown in Fig. 2, two oppositely-inclined conical faces 41 are formed upon the shaft 39, said faces fitting corresponding recesses in a socket in the bottom plate 42 of the register-case 37 and in a socket 42^a, fixed in a flexible diaphragm 43, secured peripherally to the bottom plate 42. Such construction is not claimed as of my present invention, as the same forms the subject-matter of Letters Patent No. 433,824, granted and issued to the Fuel Gas and Manufacturing Company as my assignee under date of August 5, 1890.

It will be obvious that the essential features of my invention may be retained by a modification of the construction above described in which the meter is single acting instead of double acting, as in this instance, the passages 12 being in such case led at top directly into the exhaust-passages instead of leading to independent valve-face ports, as shown. The equalizing-chambers 28^a would not under such modification be essential and may be dispensed with, as the measuring function of the cups 13 is exerted on their upper sides only.

In the operation of the meter the fluid to be measured enters the valve-chamber through the inlet-nozzle 6, and in the position of the parts shown in the drawings passes through the port and passage 11 of the right-hand valve-face 10 into the right-hand measuring-chamber 5, above its measuring-cup 13, and through the valve-face port and downward and upward passage 12 of the left-hand valve-face into the left-hand measuring-chamber below its measuring-cup. The pressure of the entering fluid forces the right-hand measuring-cup downward and the left-hand measuring-cup upward, the fluid below the right-hand measuring-cup passing in the downward traverse thereof through the passage 12 of its chamber and through the exhaust-cavity of the valve 30, controlling the same into the adjacent exhaust-passage 8, and thence to and through the outlet-nozzle 7. In the coincident upward traverse of the measuring-cup of the left-hand measuring-chamber the fluid above the same passes out through the adjacent passage 11 and exhaust-cavity of the left-hand valve 30 into the adjacent exhaust-

passage 8, and to and through the outlet-nozzle. At the end of the stroke of the measuring-cups their respective directions of movement are reversed and the operation is similarly repeated, the valves having been by the rotation of the shaft 31 brought into proper positions for effecting the supply and discharge of fluid in the opposite movements of the measuring-cups, as required to maintain the continuous measurement and delivery of fluid.

It will be seen that the sealing-fluid in which the lower edges of the measuring-cups are constantly immersed acts as an effective and practically frictionless packing, and that so long as the difference of pressure between the fluid in the inlet and outlet nozzles does not exceed that due to the weight of the sealing-column no fluid can pass through the meter without being measured. The crank-shaft with its bearings, crank-pin connections, and valve-shaft gearing being also immersed in the sealing-fluid, the working parts are constantly and thoroughly lubricated, and their friction in operation is reduced as low as is practicable.

I claim as my invention and desire to secure by Letters Patent—

1. In a fluid-meter, the combination of a measuring-chamber, a piston or measuring-cup fitted to reciprocate therein, a crank-shaft fitted to rotate in bearings therein within the sealing-fluid space and below the fluid-seal level, and a connection coupled within the sealing-fluid space and below the fluid-seal level to a crank on said shaft and coupled to the measuring-cup, substantially as set forth.

2. In a fluid-meter, the combination of a casing having separate measuring-chambers, pistons or measuring-cups fitted to reciprocate in said measuring-chambers, a crank-shaft fitted to rotate in bearings fixed to the casing within the sealing-fluid space and below the fluid-seal level, and connections, each coupling one of the measuring-cups to one of a pair of cranks set at right angles on the crank-shaft, substantially as set forth.

3. In a fluid-meter, the combination of a casing having separate measuring-chambers, pistons or measuring-cups fitted to reciprocate in said measuring-chambers, valve-controlled fluid supply and delivery passages leading into each of said measuring-chambers above and below its measuring-cup, a crank-shaft fitted to rotate in bearings fixed to the casing within the sealing-fluid space and below the fluid-seal level, and connections, each coupling one of the measuring-cups to one of a pair of cranks set at right angles on the crank-shaft, substantially as set forth.

4. In a fluid-meter, the combination of a casing having separate measuring-chambers and a valve-chamber, a fluid-inlet leading into the valve-chamber, pistons or measuring-cups fitted to reciprocate in said measuring-chambers, fluid receiving and delivery passages leading from the valve-chamber into each of said measuring-chambers above and below its measuring-cup, an exhaust-passage leading out of the valve-chamber, a crank-shaft fitted to rotate in bearings fixed to the casing within the sealing-fluid space and below the fluid-seal level, connections, each coupling one of the measuring-cups to one of a pair of cranks set at right angles on the crank-shaft, valves controlling the fluid receiving and delivery and exhaust passages, a valve-shaft geared directly to the crank-shaft within the sealing-fluid space and below the fluid-seal level, and connections coupling the valves to the valve-shaft, substantially as set forth.

5. In a fluid-meter, the combination of a measuring-chamber, a piston or measuring-cup fitted to reciprocate therein, a crank-shaft journaled therein below the fluid-seal level, a crank-pin adjustably connected to a crank on said shaft, and a connection coupled below the fluid-seal level to said crank-pin and coupled to the measuring-cup, substantially as set forth.

In testimony whereof I have hereunto set my hand.

EDWIN RUUD.

Witnesses:
J. SNOWDEN BELL,
R. H. WHITTLESEY.