

No. 722,390.

PATENTED MAR. 10, 1903.

H. H. SPRAGUE.
GAS METER.

APPLICATION FILED APR. 5, 1902.

NO MODEL.

3 SHEETS—SHEET 1.

Fig. 1.

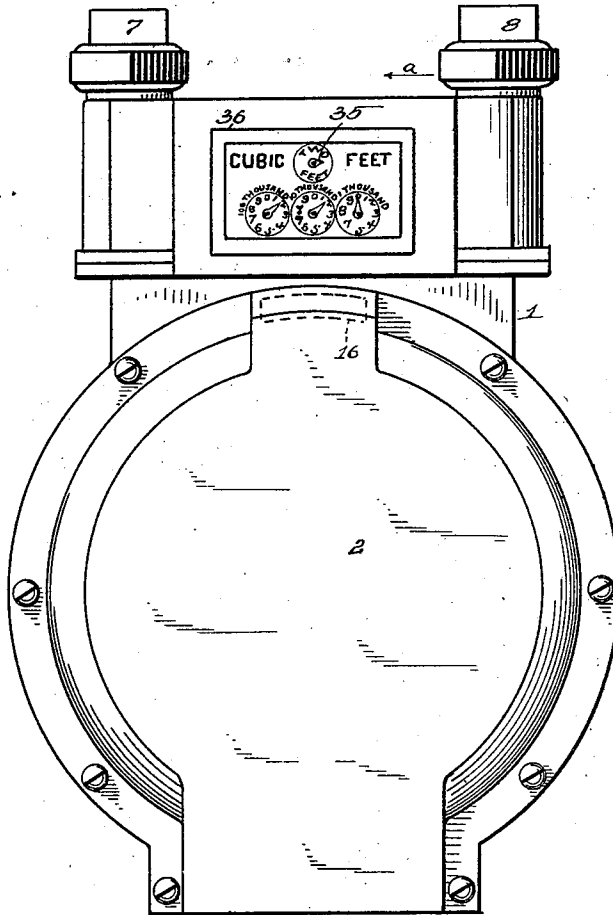
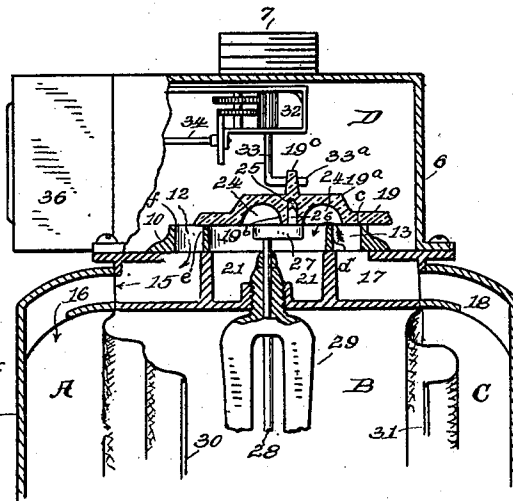


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

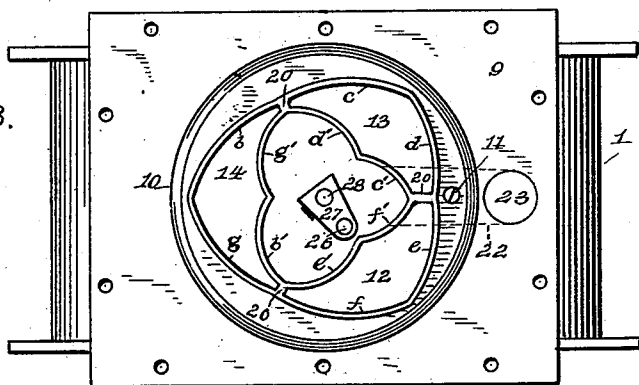


Fig. 4.

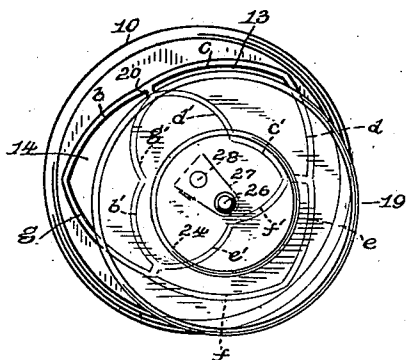


Fig. 5.

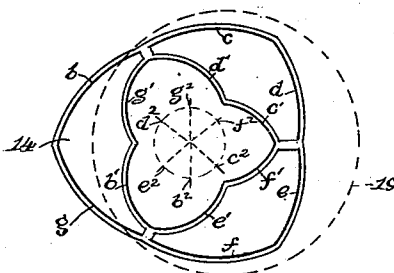


Fig. 6.

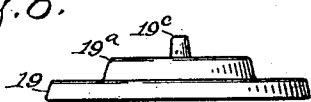
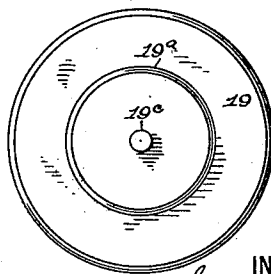


Fig. 7.



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3 SHEETS—SHEET 3

Fig. 9.

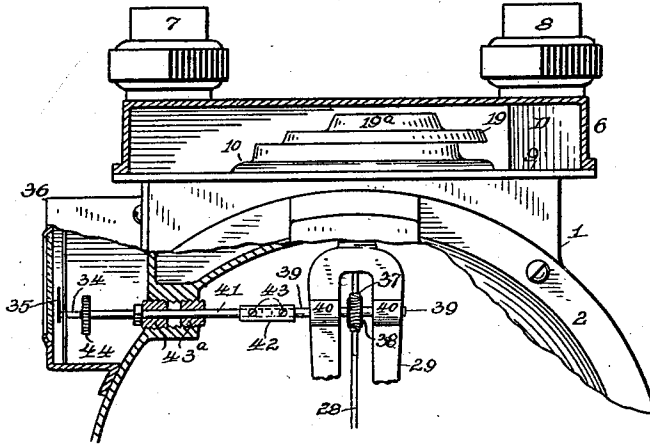
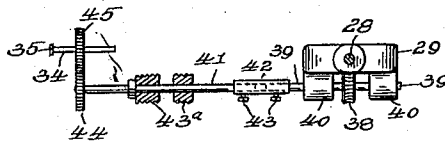


Fig. 10.



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UNITED STATES PATENT OFFICE.

HENRY H. SPRAGUE, OF SAUGATUCK, CONNECTICUT.

GAS-METER.

SPECIFICATION forming part of Letters Patent No. 722,390, dated March 10, 1903.

Application filed April 5, 1902. Serial No. 101,513. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. SPRAGUE, a citizen of the United States, and a resident of Saugatuck, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Gas-Meters, of which the following is a specification.

My invention relates to an improvement in gas-meters; and it consists of certain details of construction relating to the valve and its operating mechanism, to be more fully set forth in the following specification.

To enable others to understand my invention, reference is had to the accompanying drawings, in which—

Figure 1 represents a front elevation of the gas-meter embodying my invention. Fig. 2 is a broken sectional view looking in the direction of arrow *a*, Fig. 1. Fig. 3 is an upper plan view of the central body portion of the meter with the cover of the gas-distributing chamber removed to show the valve-seat. Fig. 4 is an upper plan view of the valve-seat and valve, upper end of the crank-shaft with the valve-operating crank-arm on said shaft. Fig. 5 is a diagram of the valve-seat with the valve shown in dotted position. Fig. 6 is a detail side elevation of the valve. Fig. 7 is a detail plan view of the upper side of the valve. Fig. 8 is a detail central sectional view of the valve, broken view of the crank-shaft with the crank-arm mounted on the upper end thereof with its driving-pin engaged with the valve. Fig. 9 is a broken sectional view of the upper part of the meter, showing the case containing the recording mechanism located on the side of the meter, said recording mechanism being driven through the medium of a horizontal shaft connected to the crank-shaft by means of a worm and worm-gear, this construction being a modification of the construction shown at Figs. 1 and 2. Fig. 10 is a detail upper plan view of the mechanism connected with the recording mechanism, also upper plan view of the crank-shaft bracket and sectional view of the crank-shaft.

Its construction and operation are as follows:

My improved valve shown in the drawings is connected with a meter, having the central body 1, recessed side covers 2 and 3, dia-

phragms 4 and 5, which diaphragms divide the interior into the three measuring-chambers A, B, and C, and removable cap 6, forming the distributing or valve chamber D.

7 is the gas-inlet opening into chamber D, and 8 is the gas outlet or exhaust from the meter.

9 is the level surface integral with the central body 1 and is adapted to support the cap 6 and the valve-seat 10, which seat is secured in place by the screw 11, Fig. 3. If desired, this valve-seat may be made an integral part of the body 1; but for all practicable purposes it is better that it be separated from said body. This valve-seat is provided with the ports 12, 13, and 14, which ports communicate with the measuring-chambers A, B, and C as follows: The port 12, Fig. 2, communicates with the front measuring-chamber A through the medium of the port 15 of the body 1 and the port 16 in the side cover 2. The port 13 communicates with the back measuring-chamber C through the port 17 of the body 1 and the port 18 of the rear side cover 3, while the port 14 communicates with the central measuring-chamber B through a port similar to 15 and 17 (not shown) of said body.

The valve-seat proper is composed of a narrow raised clover-leaf or triform shaped lip whose contour is formed of the curves *b c d e f g*, on whose upper edge is placed the glass valve 19, Fig. 4. Within the inclosed area represented by this lip is a smaller triform-shaped endless webbing whose contour is composed of the curves *b' c' d' e' f' g'*. The inner clover-shaped webbing is integrally connected to the outer triform-shaped construction by the partition 20. Within this inner triform-shaped construction is the exhaust-port 21, opening into the transverse passage 22, Fig. 3. 23 is a hole in the surface 9, which hole communicates with this transverse passage, and through this hole the gas passes through the outlet 8.

The valve 19, as before mentioned, is made of glass, and preferably so, as there is less friction and wear between the valve and its seat than if both seat and valve were made of metal. This valve is of circular construction and has (see Fig. 8) the central annular recess 24 and the raised central upper surface 19^a to provide for this recess.

19^b is a projection integral with the valve and centrally located with respect to annular recess 24. 25 is a hole central with this projection, and it extends up into the valve to
 5 freely admit the driving-pin 26, secured in the free end of the crank-arm 27, which arm is attached to the upper end of the crank-shaft 28, depending within the central measuring-chamber B and journaled in the hanging bracket 29, Fig. 2. The crank connection
 10 between the lower end of the crank-shaft and the diaphragms 30 and 31, as well as the exact construction of the hanging bracket 29, forms no part of my present invention, and
 15 therefore is not shown, it being understood, however, that the rotation of the crank-shaft is effected by the movement of the diaphragms and the movement of the valve through the rotation of said crank-shaft.

20 One important feature of my invention is to produce a maximum opening of the intake and exhaust ports by a minimum travel of the valve, which minimum travel is effected through the medium of a short crank-arm,
 25 and consequently a saving of power. To accomplish this, I have made the curved periphery of the valve to correspond to the curved edges *b c d e f g* of the valve-seat lip and by means of the crank-arm connection
 30 impart an eccentric motion to the valve. This eccentric movement, combined with the fact that the outer circular edge or periphery of the valve and the curves of the outer valve-seat lip are the same, will give an opening the
 35 full length of any of the curved portions of said lip that the outer edge of said valve may come in contact, as shown at Fig. 4. The curved edges *b' c' d' e' f' g'* are struck from the same center—viz., *b² c² d² e² f² g²*, Fig. 5—
 40 that the outer curves of the lip *b*, &c., are and they are struck in pairs—that is, the curves *d d'* are struck from the same center—viz., *d² c c'* from *c²*, and so on. The dotted circle on which are located the centers from which these curves are struck represents the center of motion of the crank-pin
 45 26. The edge of the annular recess 24 in the bottom of the valve bears the same relation to the inner curved edges *b' c'*, &c., that the periphery of the valve does to the curved
 50 edges *b c*, &c. Therefore when the valve has uncovered the edge *c* of the intake-port 13, Fig. 4, the exhaust-port lip *c'* will close the exhaust from said port and permit an un-
 55 interrupted flow of gas to the measuring-chamber with which such intake-port communicates. This applies to the curved edges of all the ports, no matter in what direction the valve is traveling, and, vice versa, the instant any one of the outer curved edges of the intake-ports are covered by the outer periphery of the valve its corresponding exhaust-port lip will be uncovered to permit the gas from the measuring-chamber gov-
 60 erned by said port to flow into the recess 24 of said valve and out through the centrally-located exhaust-port 21. In order to main-

tain the proper burning conditions of the gas flowing through the meter, it is absolutely necessary that this flow should be free and uninterrupted. This free flow of gas I maintain by my peculiarly-constructed valve and seat. When, therefore, one intake-port is open, the other two intake-ports are exhausting, and when there are two intake-ports open the remaining intake-port is exhausting. In this way there is both a free intake as well as a free exhaust, and the diaphragms are kept continuously in motion. The curved lips of the intake-ports coinciding as they do with the curved periphery of the valve will, as before mentioned, give an opening the full length of said ports, so that when the diaphragms have reached the limit of their travel in one direction a large volume of gas is instantly admitted to start them in the opposite direction. I thus obtain a greater opening both of the intake and exhaust ports than can be obtained with any other form of rotary valves. Thus the diaphragms are evenly balanced and are relieved of all strain by reason of the fact that the intake and exhaust ports are balanced as nearly as possible. This will enable the crank-shaft carrying the valve to rotate freely and without the slightest resistance.

Another important feature is that the power of the crank-arm 27 is exerted directly on the line of the meeting faces of the valve and its seat, thereby reducing to a minimum the friction at that point and also removes any tendency to lift or tilt the valve which the valve-moving power would have, if it were applied either above or below these meeting faces. The annular form of the valve and its circular exhaust-recess combined with its eccentric motion enables the valve to cover and uncover every portion of its seat at every revolution of the crank-shaft, and thus scrape off any matter liable to lodge thereon.

The clockwork 32, Fig. 2, for operating the recording mechanism is of the usual construction, except that the vertical shaft 33 has the foot 33^a, adapted to be engaged by the projection 19^c of the valve, whereby said mechanism is operated by the eccentric motion of the valve. 34 is the usual horizontal shaft carrying the unit index-pointer 35, Fig. 1. The foot 33^a also operates to prevent the valve dropping off its driving-pin when the meter is being handled. When the meter is in working position, the valve will of course drop into position by its own weight. As the recording mechanism is driven by the crank-shaft through the medium of the valve it is possible that such recording mechanism might, under favorable conditions, offer sufficient resistance to the valve to cause it to tilt or lift from its seat, in which case the driving power can be entirely removed from the valve and transmitted directly from the crank-shaft 28, Fig. 9, in the following manner, viz: 37 is a worm on said shaft engaging with the worm-gear 38 on the horizontal shaft 39. This

latter shaft is journaled in the ears 40 of the hanging bracket 29. 41 is a shaft directly in line with the shaft 39 and is connected therewith by means of the slip-coupling 42, having the screws 43. The shaft 41 is journaled in the stuffing-box 43^a in the shell of the meter. In this construction the glass valve is freed from any possible influence tending to make it move out of its proper plane. The shaft 41 is thrown too far out of alinement with the recording mechanism to permit of its carrying the unit index hand or pointer. Therefore this feature is counteracted by the two gears 44 and 45, one on the shaft 41 and the other on the index-pointer shaft 34, which shaft in this construction is much shorter than in the construction shown at Fig. 2. The purpose of the slip-coupling 42 is so that the shafts 39 and 41 may be uncoupled whenever it becomes necessary to unscrew the hanging bracket 29.

The above modified construction will not only insure a free unobstructed movement of the valve, but it enables the distributing-chamber cap 6 to be cut down, so that its ceiling will just clear the valve. In this construction the driving projection 19^c, Fig. 6, will be removed from the valve, as shown at Fig. 9.

While I show the valve constructed with a view to its use in connection with a meter having two diaphragms and three measuring-chambers, I hold myself at liberty to apply the principle on which the valve and seat are constructed to any kind of meter where it may be applicable.

It will be understood that when the curves of the intake-ports are exactly equal to the curved periphery of the valve and the curves of the exhaust-port are exactly equal to the curved wall of the annular recess in the bottom of the valve and the width of the flat surface—or, in other words, the distance from the edge of this annular recess to the periphery of the valve—exactly equals the difference in the length of the radii of the intake and exhaust port curves, then the flow of gas through the meter will be smooth and uninterrupted and the working of the meter will be perfect. Therefore it is desirable to conform as near as possible to these exact conditions, as the slightest variation therefrom will either cause an interruption in the flow of gas or permit leakage of the same; but as it is impossible to fulfil exact conditions as to measurements I do not wish to be limited to any terms that would imply exact measurements, but hold myself at liberty to work as near as it is mechanically expedient.

From the foregoing description I have assumed that the current of gas is in a fixed direction with the central port an exhaust and the three outer ones intake-ports, with the gas-distributing chamber above the valve. However, if without altering the shape of the valve and its seat the current of gas is reversed, thus making the present exhaust-port

an intake-port, with the present intake-ports exhausting into the present distributing-chamber, which would then be an exhaust-chamber, then the working principle of the valve and its peculiarly-constructed seat will remain the same; but to thus reverse the current has not been found satisfactory in practice, as the pressure of the gas on the under side of the valve will, under favorable conditions, lift it and permit part of the gas to flow through the meter unmeasured.

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

1. The combination, in a gas-meter having movable diaphragms, of measuring-chambers, a crank-shaft centrally located with respect to said measuring-chambers, gas intake and exhaust ports in the body of said meter, a gas-distributing chamber above said ports, a valve-seat overlying said ports, gas-intake ports therefor, curved lips for said ports, an exhaust-port surrounded by said intake-ports, curved lips or edges for said exhaust-port, the number of curved edges of the intake-ports and exhaust-ports being equal, the curved edges or lips of the intake and exhaust ports being struck from the same centers, in pairs, a circular valve adapted to operate on said seat and have an eccentric movement thereon, a crank-arm on the end of said crank-shaft adapted to engage and drive said valve, substantially as set forth.

2. The combination, in a gas-meter, of a valve-seat provided with intake-ports having curved walls of substantially the same radius, a trifurcated exhaust-port embraced by said intake-ports and provided with curved walls of substantially equal radius, a circular disk valve provided with an annular exhaust-recess in the bottom, said valve adapted to have an eccentric movement on said seat so as to open and close both the intake-ports and exhaust-port, in the manner substantially as described.

3. The combination, in a gas-meter, of a valve-seat provided with intake-ports whose lips form plural arcs of a circle, all of which arcs are of substantially equal radius, an exhaust-port embraced by said intake-ports, the wall or side of said exhaust-port being formed of a plurality of curves of substantially equal radius, a circular disk valve provided with an annular exhaust-recess in the bottom, said valve adapted to have an eccentric movement on said seat so as to open and close both the intake-ports and exhaust-port, in the manner substantially as described.

4. The combination, in a gas-meter, of a valve-seat having gas-intake ports whose edges or lips are arcs of a circle of substantially the same radius, an exhaust-port surrounded by said intake-ports whose outer wall is formed of curves of substantially equal radius and corresponding in number to the curved lips of the said intake-ports, a circular disk valve whose periphery and the curva-

ture of the lips of said intake-ports are substantially equal, a centrally-located exhaust-recess, of annular construction, in the bottom of said valve, the annular wall of said recess being substantially of the same curvature as the curved wall of said exhaust-port, said valve adapted to have an eccentric movement on its seat so that, when any of said intake-ports are opened, the exhaust from said ports will be closed, and when any of said intake-ports are closed, there is a free exhaust from said intake-ports, substantially as set forth.

5. The combination, in a gas-meter, of a valve-seat having intake-ports whose curved edges or lips are arcs of a circle of substantially the same radius, an exhaust-port surrounded by said intake-ports whose outer wall is formed of curves of substantially equal radius, and corresponding in number to the curves of the said intake-ports, each curve of the intake-ports and its corresponding curve of the exhaust-port being struck from the same center, in pairs, a circular disk valve whose periphery and the curvature of the lips of said intake-ports are substantially equal, a centrally-located annular recess in the bottom of said valve, the periphery of which is substantially equal to the curves of said exhaust-port, said valve adapted to have an eccentric movement on said seat sufficient to cover and uncover the intake and exhaust ports at every revolution, substantially as described.

6. The combination, in a gas-meter, of a valve-seat, intake-ports therefor, an exhaust-port embraced by said intake-ports, a circular disk valve having an annular exhaust-recess on its under side, a crank-shaft carrying a crank arm and pin, said crank-arm located in said exhaust-port and below said valve, a projection central with said recess and integral with said valve, said projection having a hole therein to receive the said crank-pin and adapted to have a free rotatable movement thereon and also an eccentric movement by reason of said crank-arm, substantially as set forth.

7. The combination, in a gas-meter, having measuring-chambers and movable diaphragms, of a crank-shaft carrying a crank-arm and crank-arm pin, a distributing-chamber, a valve-seat having intake-ports provided with a plurality of curved walls of substantially equal radius, a triform-shaped

exhaust-port having a plurality of curved walls of substantially equal radius and corresponding in number to the curved walls of said intake-ports, a circular disk valve mounted on said crank-pin and adapted to have a free rotatable movement thereon and an eccentric movement by reason of said crank-arm, an annular exhaust-recess in the bottom of said valve, a central projection rising from the upper surface of said valve, means connected with the recording mechanism to engage said projection whereby said recording mechanism is operated by the eccentric movement of said valve, substantially as set forth.

8. The combination, in a gas-meter having movable diaphragms and measuring-chambers of the irregularly-shaped intake-ports 12, 13 and 14 having the outward-curved edges *b c d e f g* and all of substantially equal radius, an exhaust-port embraced by said intake-ports and separated therefrom by a partition comprising the outward curves *b' c' d' e' f' g'* all substantially of the same radius, substantially as described.

9. In a gas-meter, the herein-described valve-seat provided with intake-ports and an exhaust-port embraced by said intake-ports, said intake-ports having the outward-curved walls or edges *b c d e f g* and all substantially of equal radius, said exhaust-port bounded by the outward-curved walls or edges *b' c' d' e' f' g'* and all substantially of equal radius, the outward-curved walls of the intake-ports and the corresponding curved walls of the exhaust-port being struck from the same center, substantially as set forth.

10. The combination, in a gas-meter having ports for intaking and exhausting gas, movable diaphragms and measuring-chambers, of a driving-shaft adapted to communicate motion to the recording mechanism, said recording mechanism located on the side of the meter and below said ports, means whereby motion is imparted to said recording mechanism directly from the body of said shaft through the side of the meter, substantially as described.

Signed at Bridgeport, in the county of Fairfield and State of Connecticut, this 4th day of April, A. D. 1902.

HENRY H. SPRAGUE.

Witnesses:

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SAMUEL J. CHAFFEE.