

W. H. KNIGHT.
GAS METER.

APPLICATION FILED AUG. 21, 1916.

Patented Nov. 13, 1917.

4 SHEETS—SHEET 1.

1,246,613.

Fig. 2.

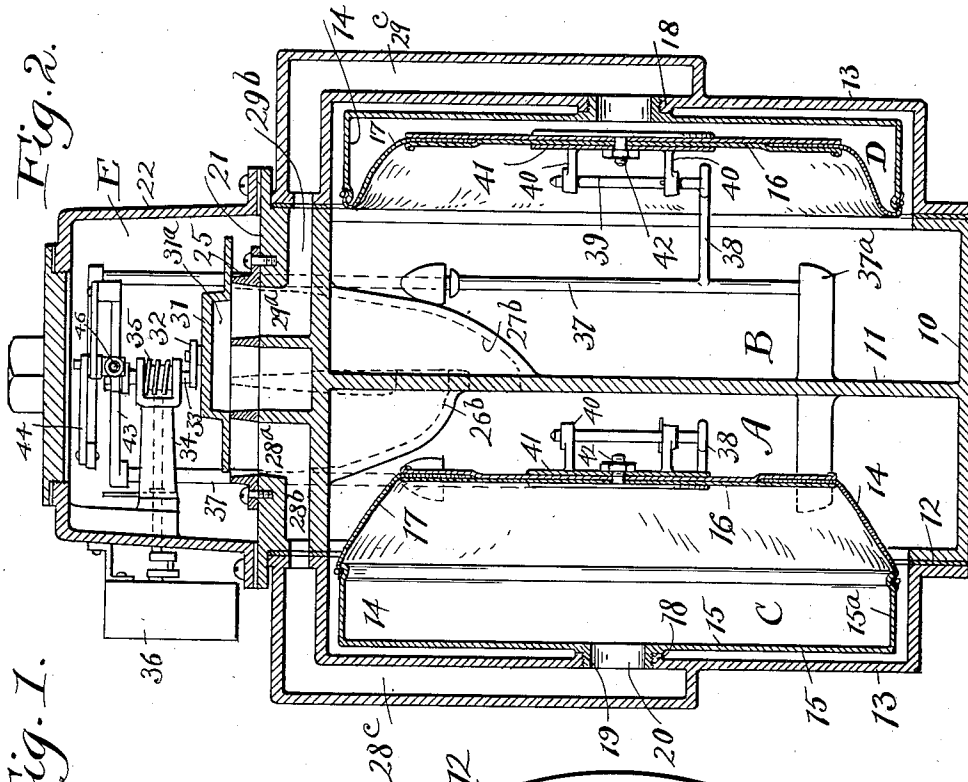
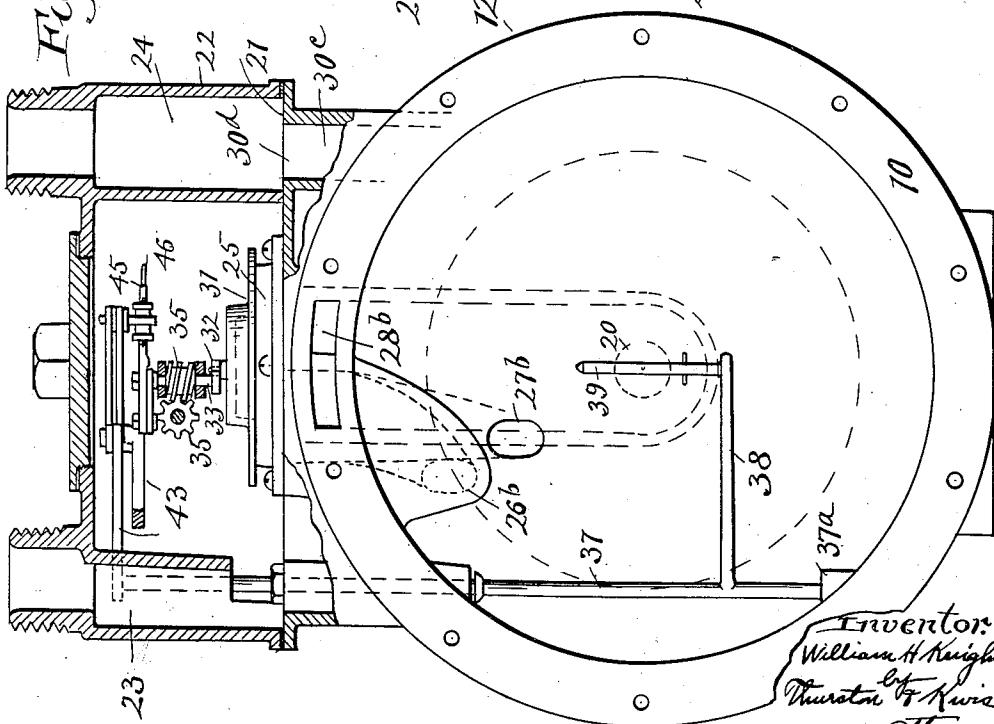


Fig. 1.



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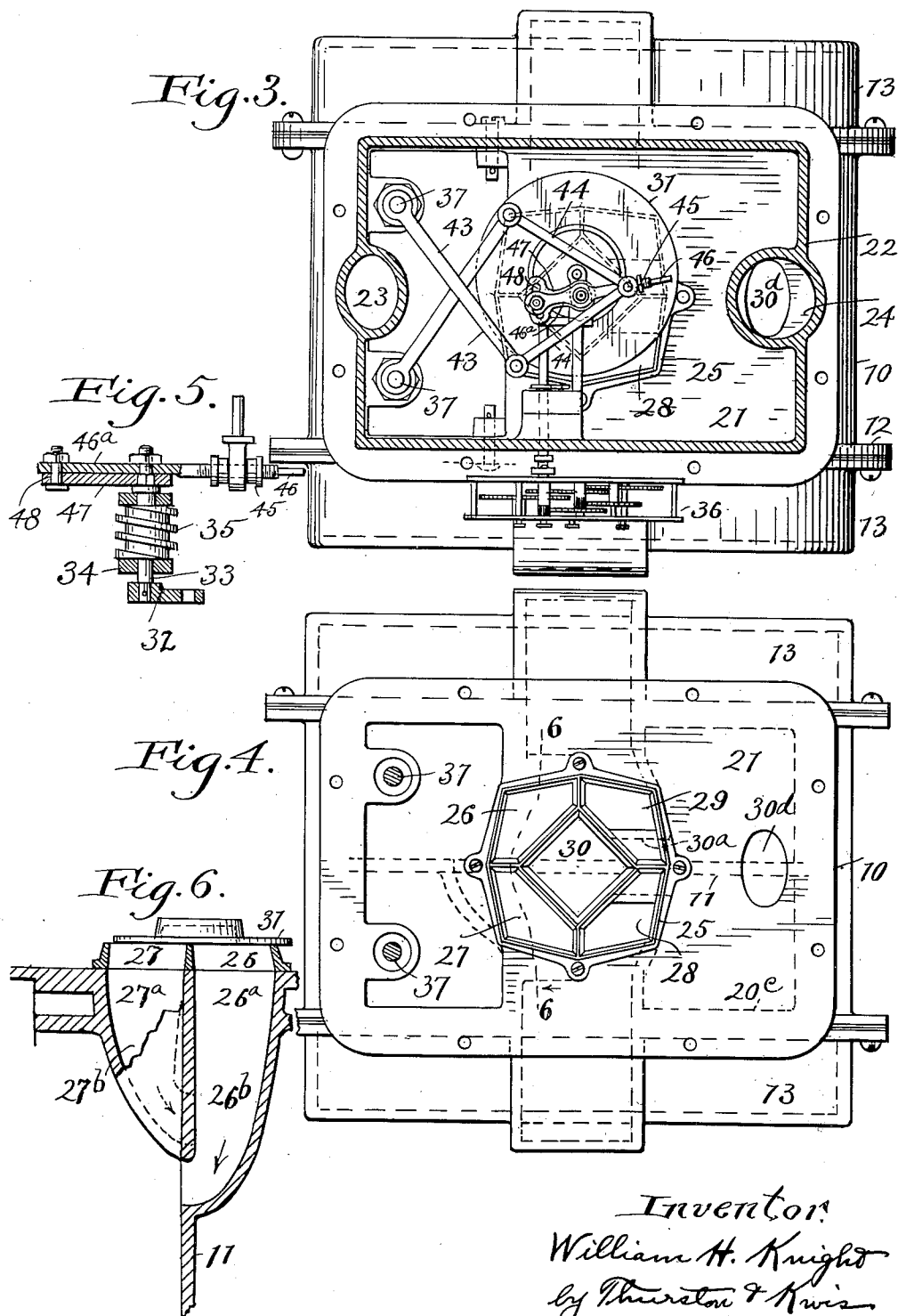
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4 SHEETS—SHEET 3.

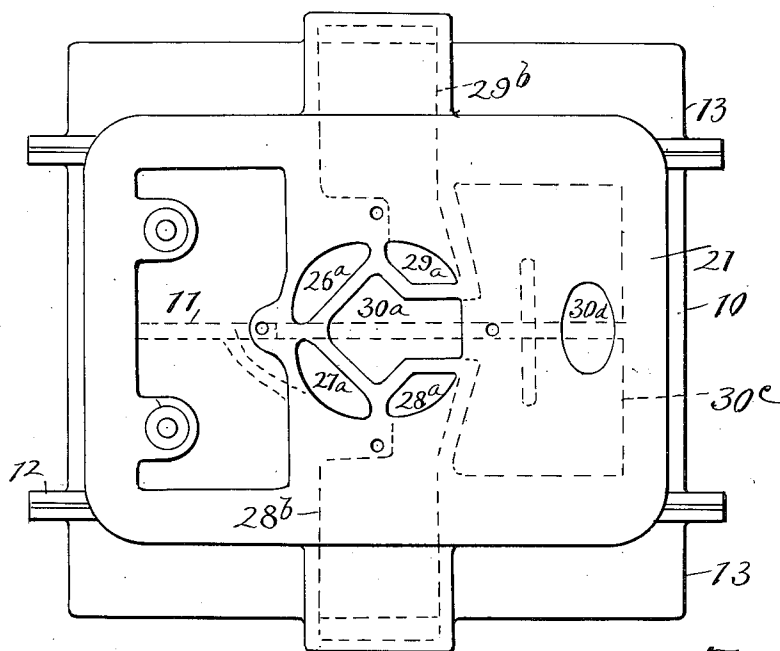
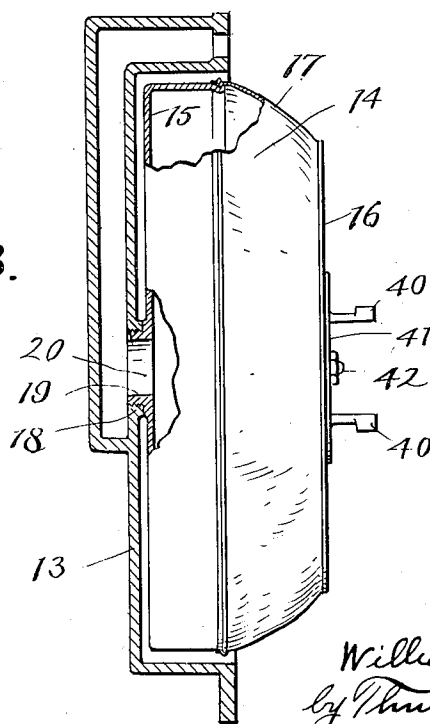


Fig. 7.

Fig. 8.



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4 SHEETS—SHEET 4.

Fig. 9.

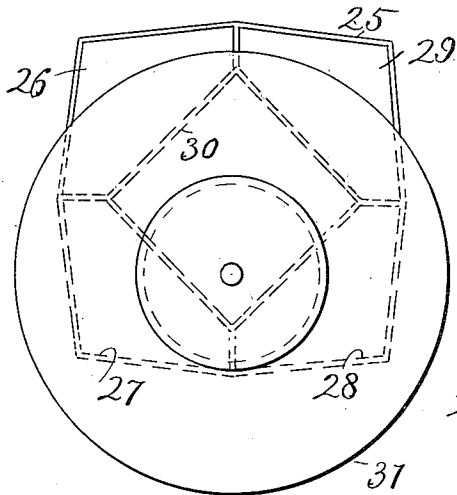


Fig. 10.

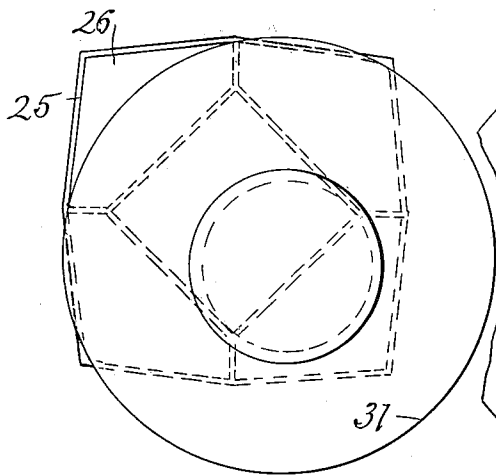
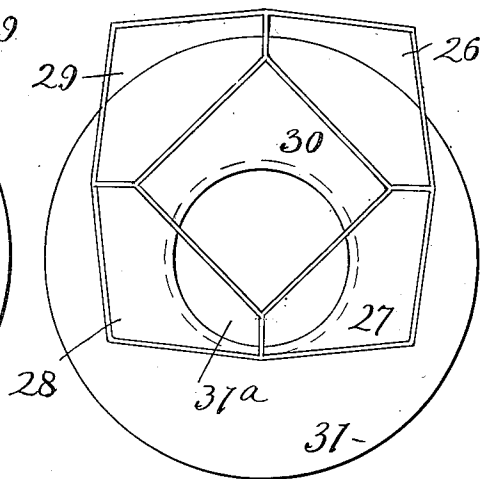


Fig. 11.

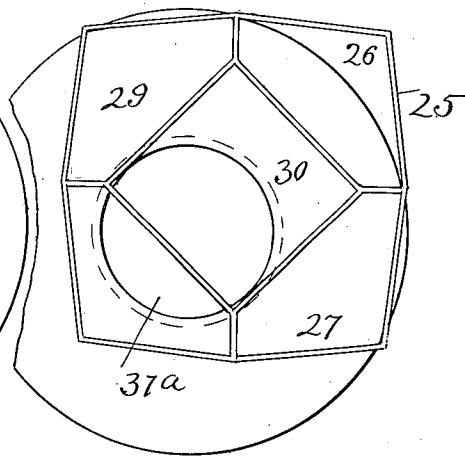


Fig. 12.

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UNITED STATES PATENT OFFICE.

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GAS-METER.

1,246,613.

Specification of Letters Patent.

Patented Nov. 13, 1917.

Application filed August 21, 1916. Serial No. 115,942.

To all whom it may concern:

Be it known that I, WILLIAM H. KNIGHT, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Gas-Meters, of which the following is a full, clear, and exact description.

This invention relates to gas meters and has for its chief object the provision of a gas meter which is accurate, simple in construction, of large capacity, which has ease of assemblage, and which can be manufactured at reasonable cost.

The invention resides in numerous features or details of construction including the provision of means whereby a four-compartment meter may be successfully operated with a single valve; also in the arrangement or disposition of the ports of the four-compartment meter controlled by a single valve; likewise in the manner of forming the diaphragms, and in the provision of means whereby each diaphragm and its associated side cover may be applied to or removed from the meter as a unit, and also in the construction and manner of adjusting the tangent which is associated with or connected to the valve and register operating mechanism.

My invention may be further briefly summarized as consisting in certain novel details of construction and combinations and arrangements of parts which shall be described in the specification and set forth in the appended claims.

In the accompanying sheets of drawings, Figure 1 is a face view of a gas meter embodying my invention, parts being in section and one of the side covers and its associated diaphragm being removed; Fig. 2 is a vertical sectional view through the same, the section being taken at right angles to the middle partition and to the diaphragms and side covers; Fig. 3 is a horizontal sectional view through the upper or gas receiving chamber; Fig. 4 is a top plan view with the upper cap or top cover and valve and register operating mechanism removed; Fig. 5 is a detail sectional view or an enlarged scale showing the adjustable tangent; Fig. 6 is a sectional view substantially along the irregular line 6-6 of Fig. 4, looking in the direction indicated by the arrow; Fig. 7 is a top plan view with the upper cap or cover, valve and operating mechanism for the valve

and register removed; Fig. 8 is a view showing one of the side covers and diaphragm units removed from the body of the meter; Figs. 9 to 12 are somewhat diagrammatic views of the valve and valve seat, illustrating the effective inlet and exhaust port openings with the valve in two different positions, Figs. 9 and 10 being respectively a top plan and a bottom view with the valve in one position, and Figs. 11 and 12 being respectively a top plan and bottom view of the same with the valve in a different position.

The meter includes the main portion or body 10 which is preferably in the form of an annular casting having a central vertical dividing partition 11, and open sides provided at their rims or peripheries with flanged faces 12, to which are adapted to be secured removable side covers 13. In the chamber between the partition and each side cover there is a diaphragm 14, forming four compartments, A, B, C and D. Two of these compartments, A and B, include the spaces on opposite sides of the partition not occupied by the diaphragms or the spaces within the diaphragms. The other two compartments, C and D, include the spaces within the two diaphragms, each of which is in the form of a closed chamber. Each of the diaphragms or diaphragm chambers includes an outer circular metal disk 15, which is stationary, a pair of adjacent inner metal disks 16 slightly smaller than and movable toward and from the disk 15, and a flexible connecting portion 17, of leather or equivalent material which is fastened in between the two disks 16 and onto the periphery of an annular inturred rim 15^a of the outer disk 15.

Each diaphragm chamber as a whole, including the stationary part 15 and movable portions 16 and 17, is supported from a central point on the associated removable cover so that the cover and diaphragm chamber can be attached to the meter, or removed therefrom as a unit. The attaching means between the cover and diaphragm preferably includes a threaded flanged opening 18 in the center of the cover and a threaded flange or boss 19 at the center of the outer disk 15 of the diaphragm, and designed to be screwed into the threaded opening. An ingress and egress opening 20 of ample size, extends through the threaded flange or boss 19.

On the flat top 21 of the body portion of

the meter there is secured a cover or casing member 22, forming with the top 21, a gas receiving chamber E, and an inclosure for the valve and major portion of the valve and register operating mechanism. This cover 22 is provided with an inlet passageway 23 which terminates at its upper end in a threaded flange adapted to receive a gas supply pipe, and an outlet passageway 24, which terminates at its upper end in a threaded flange adapted to receive the exhaust or outlet pipe for the gas, this passageway 24 extending downwardly to the flat cover 21 where there is an exhaust port 15 to be referred to presently.

Secured to the flat portion of the top 21 is a peculiarly shaped valve seat 25, which, as will be observed by reference particularly to Fig. 4, is substantially rectangular in external contour, but in fact octagonal as to the number of external sides, this seat being provided with eight outer port bounding or forming sides for four inlet ports, 26, 27, 28 and 29 and four inner port bounding or forming sides or walls for a central square exhaust port 30, from the corners of which there extend outwardly to the outer sides of the valve seat short walls or ribs. It will be seen, therefore, that each port 26 to 29 inclusive, is bounded by two of the outer sides or walls of the seat, by one of the inner walls forming the rectangular exhaust port and by two of the short walls connecting the latter to the outer walls, so that each inlet port is as here shown, in the form of an irregular pentagon, all sides of which are straight.

The four inlet ports 26 to 29 and the exhaust port 30 of the valve seat register with four inlet ports 26^a to 29^a and an exhaust port 30^a formed in the flat top 21, as will be seen by reference particularly to Figs. 2 and 7. As the arrangement of passageways extending from these ports is a matter of considerable importance, they will next be described in detail. It will be observed that from the ports 28^a and 29^a cored passageways 28^b and 29^b extend downwardly and laterally in opposite directions through the top portion 21, and through the flanged faces 12 to which the side covers are secured by screws. Communicating with these cored passageways 28^b and 29^b are cored passageways 28^c and 29^c extending outwardly along the top portions of the side covers, and then downwardly over the outer side faces to the openings 20 leading to the diaphragm compartments C and D. These cored openings 28^c and 29^c are formed in hollow ribs or enlargements cast onto the covers. From the ports 26^a and 27^a, passageways 26^b and 27^b extend downwardly and laterally through the partition 11 so as to communicate respectively with the two compartments A and B. It should be noted that these passage-

ways 26^b and 27^b are crossed, so to speak, inasmuch as the passageway leading from the port on the right side of the partition opens at its lower end into the compartment, on the left side of the partition, and the passageway leading from the port on the left side of the partition at its lower end communicates with the compartment on the right side of the partition. This crossing of the ports is essential for a four-compartment meter operated with a single valve. From the exhaust ports 30 and 30^a in the valve seat and top portion 21 of the meter, a passageway 30^c leads laterally through the top portion 21 to a port 30^d which is just beneath and communicates with the exhaust passageway 24 previously referred to.

The five ports in the valve seat are opened and closed so that the gas is supplied to and exhausted from the four compartments in the right order, and so that all four compartments receive equal volumes of gas by a single valve 31 in the form of a disk, the central portion of which is elevated, forming on the underside of the valve an annular chamber 31^a by which the gas is permitted to exhaust from the several ports leading to the different compartments into and through the exhaust ports and passageways. This valve is given an eccentric movement over the upper face of the valve seat by a crank arm 32 on the lower end of a shaft 33, which is supported in a bracket 34, which shaft through gearing 35 operates the register 36. As the register mechanism forms no part of the present invention, it will not be referred to further herein. The shaft 33 is operated or rotated in the bracket 34 by mechanism including two vertical flagwires 37, which are mounted in step bearings 37^a near the lower portion of the meter and located in the compartments A and B, these flagwires extending up through suitable gas tight bearings into the gas receiving chamber E. Each of the flagwires is provided near its lower end with a laterally projecting arm 38 having at its free end an upturned pin 39 designed to have an operative connection with the movable disk 16 of the associated diaphragm. In this case the upstanding pin 39, which by the way is rigid with the arm 38 and flagwire 37, passes through openings in two lugs 40 carried by the diaphragm. These lugs are integral with, or secured to a disk or other connecting member 41 secured by a nut and screw 42 to the center of the movable disks 16 of the diaphragm. By loosening the screw the bearings for the pin 39 can be turned until they are properly positioned with respect to the pin 39 of the flagwire, and then the nut will be tightened whereupon the parts can be made to operate with little friction.

At their upper ends the flagwires 37 are provided with flags 43, which are connected

in the customary manner by links 44 to an adjustable member 45 on the tangent 46. It will be observed by reference particularly to Fig. 5, that the tangent 46 is adjustably secured to the shaft 33. In this instance it has an extension 46^a which overlies, or is just above an arm 47 which is fixed to the shaft and has an arc-shaped slot 48 receiving the shank of an adjusting screw passing through the extension 46^a of the tangent arm or tangent. By this means the tangent can be adjusted by being turned either to the right or left after the nut on the adjusting screw is loosened. When it is in proper position to cause the valve to be properly positioned with respect to the ports of the valve seat, the nut will be tightened so that the tangent will be secured to and rotate the shaft 33.

In assembling the meter, the diaphragm will first be secured to the two side covers and can be conveniently tested before being applied to the meter. This provision for testing the diaphragms when attached to the covers before they are applied to the meter is one of the important features of the construction. Before securing the cover and diaphragm units to the body of the meter, the openings in the bearing lugs 40 are slipped onto the flagwire pins 39, and if there is any binding action, due to the lugs not being in exact alinement with the pins the lugs can be adjusted so that there will be practically no friction in operation. The covers will then be applied by fastening in place the securing screws, gaskets, of course, being placed between the covers and the body of the meter.

In operation, the meter is very efficient, the gas passing to and being exhausted from the several compartments in the right order to cause continuous and steady rotation of the shaft which operates the valve and register mechanism, the supplying of the gas to the different compartments in proper sequence, even though the ports are controlled by a single valve, being due to the novel disposition of the ports extending between the several ports of the valve seat and the different compartments. The high efficiency of the meter as a whole is due to a large extent to the design of the valve seat and particularly of the ports which are so shaped that equal volumes of gas are supplied to all the different compartments, and at the same time the gas can exhaust freely from the compartments, and there is no by-passing of the gas from one inlet port to the other, as would be the case if the valve ports in the seat were not properly shaped. In other words, all the gas which passes through the meter must pass into and then out of the measuring compartments, and will be measured. Furthermore, with the design of valve seat and ports here shown, the gas will be

properly distributed and the meter will work to its full or rated capacity for the reason that the effective port opening or openings through which gas is supplied to a compartment or compartments when the valve is in any position is substantially the same as the effective port opening or openings through which gas is at the same time exhausted from a compartment or pair of compartments (as the case may be). As the result of this construction, the gas will exhaust from the compartments at the same rate that it is admitted to the other compartments, which is a highly desirable feature and an essential feature to secure maximum efficiency. In Figs. 9 to 12 I have shown this equality of inlet and exhaust port openings, the valve seats being shown somewhat conventionally in these figures so that the relative sizes of these port openings can be clearly illustrated. In Figs. 9 and 10 I have shown respectively a top plan and a bottom view of the valve seat and valve, with the valve so positioned that gas will be supplied to two of the measuring compartments and exhausted from the other two measuring compartments. In Figs. 11 and 12 I have shown similar views, but with the valve in a position such that gas is admitted to one compartment and exhausted from another. It will be seen that in both positions of the valve, the effective area of the inlet opening or openings is substantially the same as the effective area of the exhaust port opening or openings. This same condition exists for all positions of the valve as it passes through a complete cycle of movement.

The equalizing of the gas volumes passing through the different compartments is due not only to the shape of the ports and of the valve which covers and uncovers them at the right time and the proper amounts, but also to some extent to the adjustability of the tangent arm which can be adjusted to a sufficient extent to initially properly position the valve so that the different compartments will receive the proper volumes of gas.

Having thus described my invention, what I claim is:

1. In a gas meter, a body portion having a dividing partition and open sides; side covers for closing the sides of the body portion; diaphragms on opposite sides of the partition forming with the covers and partition four separate measuring compartments, the diaphragms being secured to the covers independently of the body portion whereby a side cover and a diaphragm may be applied to or removed as a unit from the meter.

2. In a gas meter, a body portion having a dividing partition and open sides; side covers for closing the body portion; diaphragms on opposite sides of the partition

forming with the covers and partition four separate measuring compartments, the diaphragms being secured to the covers independently of the body portion whereby a side cover and a diaphragm may be applied to or removed as a unit from the meter, said diaphragms being secured to the covers at substantially the centers thereof.

3. In a gas meter, a body portion having a dividing partition and open sides; side covers for closing the body portion; diaphragms on opposite sides of the partition forming with the covers and partition four separate measuring compartments, the diaphragms being secured to the covers independently of the body portion whereby a side cover and a diaphragm may be applied to or removed as a unit from the meter, each diaphragm comprising a metal disk which is secured at substantially its center to the associated cover.

4. In a gas meter, a body portion having a dividing partition and open sides; side covers for closing the body portion; diaphragms on opposite sides of the partition forming with the covers and partition four separate measuring compartments, the diaphragms being secured to the covers independently of the body portion whereby a side cover and a diaphragm may be applied to or removed as a unit from the meter, each diaphragm comprising a metal disk which is secured at substantially its center to the associated cover and there being a passageway through said disk at the middle thereof, whereby gas may pass through said disk to and from a measuring compartment.

5. In a gas meter, a body portion having a dividing partition and open sides; side covers for closing the body portion; diaphragms on opposite sides of the partition forming with the covers and partition four separate measuring compartments, the diaphragms being secured to the covers independently of the body portion whereby a side cover and a diaphragm may be applied to or removed as a unit from the meter, the middle of each cover and the middle portion of the diaphragm adjacent the cover having engaging threaded portions through which gas may be supplied to or exhausted from a measuring compartment.

6. In a gas meter, a body portion having a dividing partition and open sides; side covers for closing the body portion; diaphragms on opposite sides of the partition forming with the covers and partition four separate measuring compartments, the diaphragms being secured to the covers independently of the body portion whereby a side cover and a diaphragm may be applied to or removed as a unit from the meter, each diaphragm comprising an outer disk secured to the cover, an inner disk, and flexible means connecting the same.

7. In a gas meter, a body portion having a dividing partition and open sides; side covers for closing the body portion; diaphragms on opposite sides of the partition forming with the covers and partition four separate measuring compartments, the diaphragms being secured to the covers independently of the body portion whereby a side cover and a diaphragm may be applied to or removed as a unit from the meter, each diaphragm comprising an outer disk secured to the cover, an inner disk, and flexible means connecting the same, and said inner disk having means by which operative connection may be made therewith to transmit movement therefrom.

8. In a gas meter, a body portion having a dividing partition and open sides; side covers for closing the body portion; diaphragms on opposite sides of the partition forming with the covers and partition four separate measuring compartments, the diaphragms being secured to the covers independently of the body portion whereby a side cover and a diaphragm may be applied to or removed as a unit from the meter, each diaphragm comprising an outer disk secured to the cover, an inner disk, and flexible means connecting the same, said inner disk having a movement transmitting member rotatably secured thereto.

9. In a gas meter, a body portion having a dividing partition; diaphragms on each side thereof forming a four-compartment meter; a valve seat having ports through which gas may be supplied to the four compartments and having a port through which gas may be exhausted therefrom; a single valve engaging said seat and controlling said ports; and valve operating mechanism connected with the diaphragms for giving said valve an eccentric movement relative to the center of the seat.

10. In a gas meter, a body portion having a dividing partition; diaphragms on each side thereof forming a four-compartment meter; a valve seat having ports through which gas may be supplied to the four compartments and having a port through which gas may be exhausted therefrom; a single valve engaging said seat; and valve operating mechanism connected with the diaphragms for giving said valve an eccentric movement relative to the center of the seat, two of the ports located on opposite sides of the partition having crossing passageways communicating with the compartments on opposite sides of the partition.

11. In a gas meter, a body portion having a dividing partition; diaphragms on each side thereof, forming a four-compartment meter; a valve seat having ports through which gas may be supplied to the four compartments and having a port through which gas may be exhausted therefrom; a single valve engag-

ing said seat; and valve operating mechanism connected with the diaphragms for giving said valve an eccentric movement relative to the center of the seat, two of the
 5 ports being connected to passageways adapted to conduct gas to the compartments on opposite sides of the partition, each passageway leading from a port on one side of the partition to the compartment on the opposite
 10 side of the partition.

12. In a gas meter, a body portion having a dividing partition and closing side walls; diaphragms on opposite sides of the partition, said partition, side walls and diaphragms forming a four-compartment
 15 meter; a valve seat having four ports adapted to supply gas to the four compartments, and another port serving as an exhaust port, said body and covers having passageways
 20 extending from two of the ports over the covers to substantially the middle thereof and serving to conduct gas to and from two of the compartments, and said body having
 25 passageways extending from two other ports and communicating respectively with the compartments on opposite sides of the partition.

13. In a gas meter, a body portion having a dividing partition and closing side walls; diaphragms on opposite sides of the partition, said partition, side walls and diaphragms forming a four-compartment
 30 meter; a valve seat at the upper portion of the body of the meter and having four ports adapted to supply gas to the four compartments, and another port serving as an exhaust
 35 port, said body and covers having passageways extending from two of the ports downwardly over the covers to substantially the middle thereof and serving to conduct
 40 gas to and from two of the compartments and said body having passageways extending from two other ports downwardly and communicating respectively with the compartments
 45 on opposite sides of the partition; a single valve resting on said valve seat; and means connected with said diaphragms for giving said valve an eccentric movement over the seat.

14. In a gas meter, a central body portion having a dividing partition and removable side covers; diaphragms having inner and outer metal portions and flexible connecting
 50 portions, the outer metal portions being secured to the side covers at substantially the center thereof; a valve seat having five ports, one being an exhaust port and the others being ports through which gas may
 55 pass to and from the four compartments; passageways extending from two of the ports through the body and cover to substantially the center of the latter, said passageways then communicating with two of
 60 the compartments through the center of the connections of the diaphragms with the

covers; and passageways connecting two other ports with the compartments on opposite sides of the partition, said passageways extending through the latter.

15. In a gas meter, a central body portion
 70 having a dividing partition and removable side covers; diaphragms having inner and outer metal portions and flexible connecting portions, the outer metal portions being secured to the side covers at substantially the
 75 center thereof; a valve seat having five ports, one being an exhaust port and the others being ports through which gas may pass to and from the four compartments; passageways extending from two of the
 80 ports through the body and covers to substantially the center of the latter, said passageways then communicating with two of the compartments through the center of the connections of the diaphragms with the
 85 covers; passageways connecting two other ports with the compartments on opposite sides of the partition, said passageways extending through the latter; a disk valve adapted to slide over said valve seat; means
 90 connected to the diaphragms for operating the valve; a gas receiving chamber and valve inclosure secured to said body; a gas inlet for said chamber; and a gas outlet passageway for said inclosure and communicating with said exhaust port.

16. In a gas meter, a casing; diaphragms therein; oscillatory flagwires connected to the diaphragms; flags connected to said flagwires; a valve; a shaft operatively
 100 connected to the valve for operating the same; an arm fixed to said shaft and having an arc-shaped slot therein; a tangent fitted loosely on the shaft and arranged alongside said arm and connected to said flag; and a
 105 securing screw passing through said tangent and through said slot whereby the tangent may be adjusted relative to said arm and may be secured at any adjusted position.

17. In a gas meter, a casing containing
 110 diaphragms and provided with four measuring compartments, a valve seat having four ports communicating with said compartments and having a centrally disposed exhaust port which is surrounded by the four
 115 first-named ports, a slide valve movable over the surface of said seat and provided on its under side with an annular chamber adapted to place the outer four ports successively in communication with the central exhaust
 120 port, and means for giving said valve an eccentric movement over said seat whereby the effective port opening or openings through which gas is admitted to either one or two compartments is substantially equal
 125 to the effective port opening or openings from which gas is exhausted from either one or two compartments.

18. In a gas meter, a casing having a dividing partition and diaphragms forming

four measuring compartments; a valve seat of substantially rectangular contour having a centrally disposed exhaust port and four inlet ports communicating with the four measuring compartments and located at the corners of the rectangle; a valve mounted to slide over said seat and means for giving said valve an eccentric movement over the seat.

19. In a gas meter, a casing provided with a central partition and with diaphragms forming four measuring compartments; a valve seat provided with a centrally disposed exhaust port and with four inlet ports arranged around the exhaust port and communicating with the four compartments, the major portion of the bounding or forming walls of said ports being in straight intersecting lines; a valve movable over said seat and means for giving said valve an eccentric movement over the seat.

20. In a gas meter, a casing, a measuring compartment within the casing and comprising a diaphragm, a valve for controlling admission to and exhaust of gas from the compartment, means for transmitting movement from the diaphragm to the valve, said

means comprising a flagwire mounted for oscillatory movement and operatively connected to the valve, and means for connecting the flagwire to the diaphragm comprising an arm projecting from the flagwire, and a member adjustably connected to the diaphragm and having interlocking engagement with a part of said arm.

21. In a gas meter, a casing, a diaphragm therein forming with the casing a pair of gas compartments, a valve for controlling the admission to and exhaust of gas from said compartments, means for transmitting movement from the diaphragm to the valve comprising an oscillatory flagwire operatively connected to the valve, and means for connecting the flagwire to the diaphragm comprising a member supported by the flagwire, and a second member attached to said diaphragm so that it may be turned or rotated thereon, said second member having means projecting therefrom and receiving said first member.

In testimony whereof, I hereunto affix my signature.

WILLIAM H. KNIGHT.