(Model.) 2 Sheets—Sheet 1.

H. A. TOBEY.

GAS METER.

No. 487,907. Patented Dec. 13, 1892.

Fig. 1.

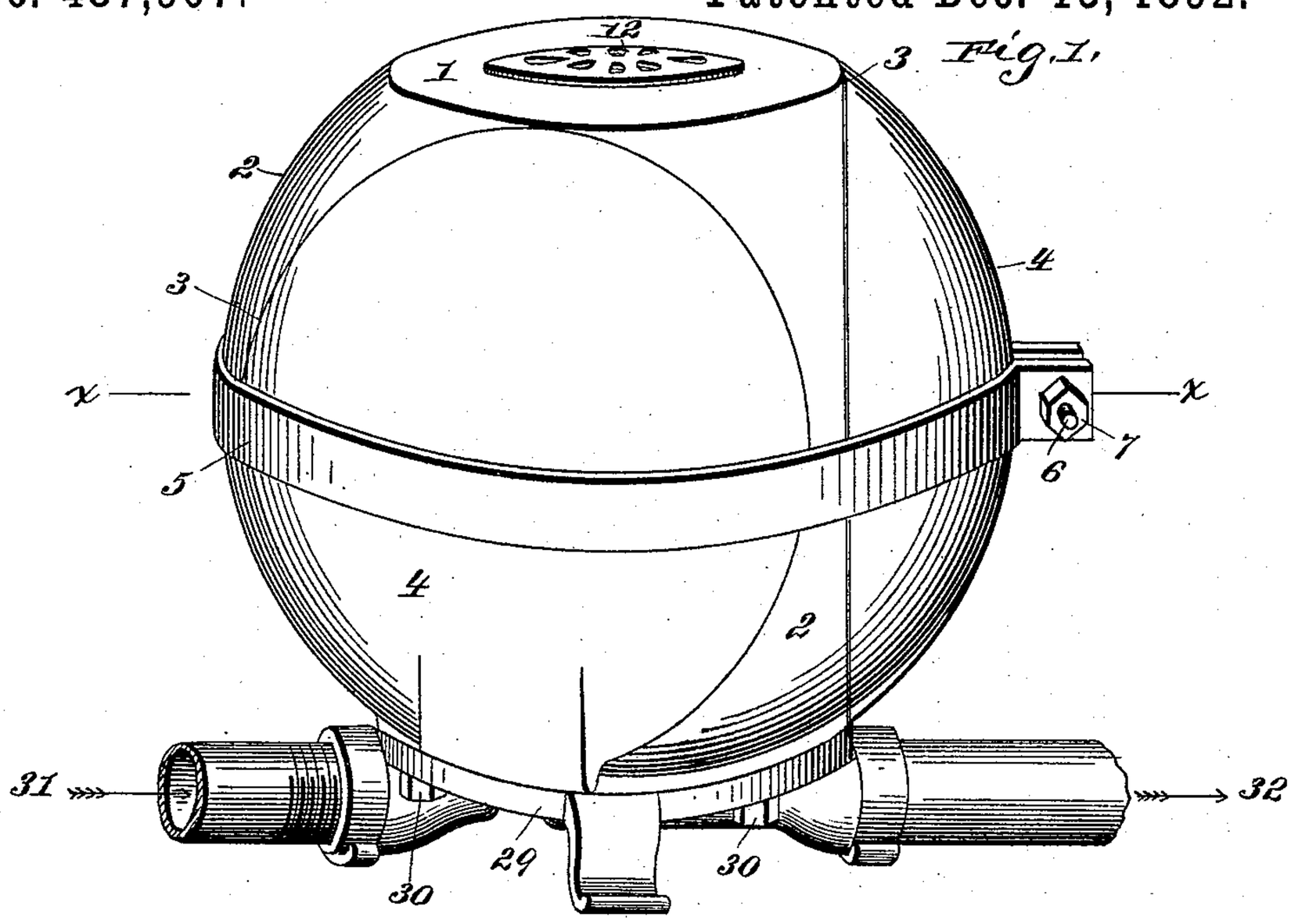
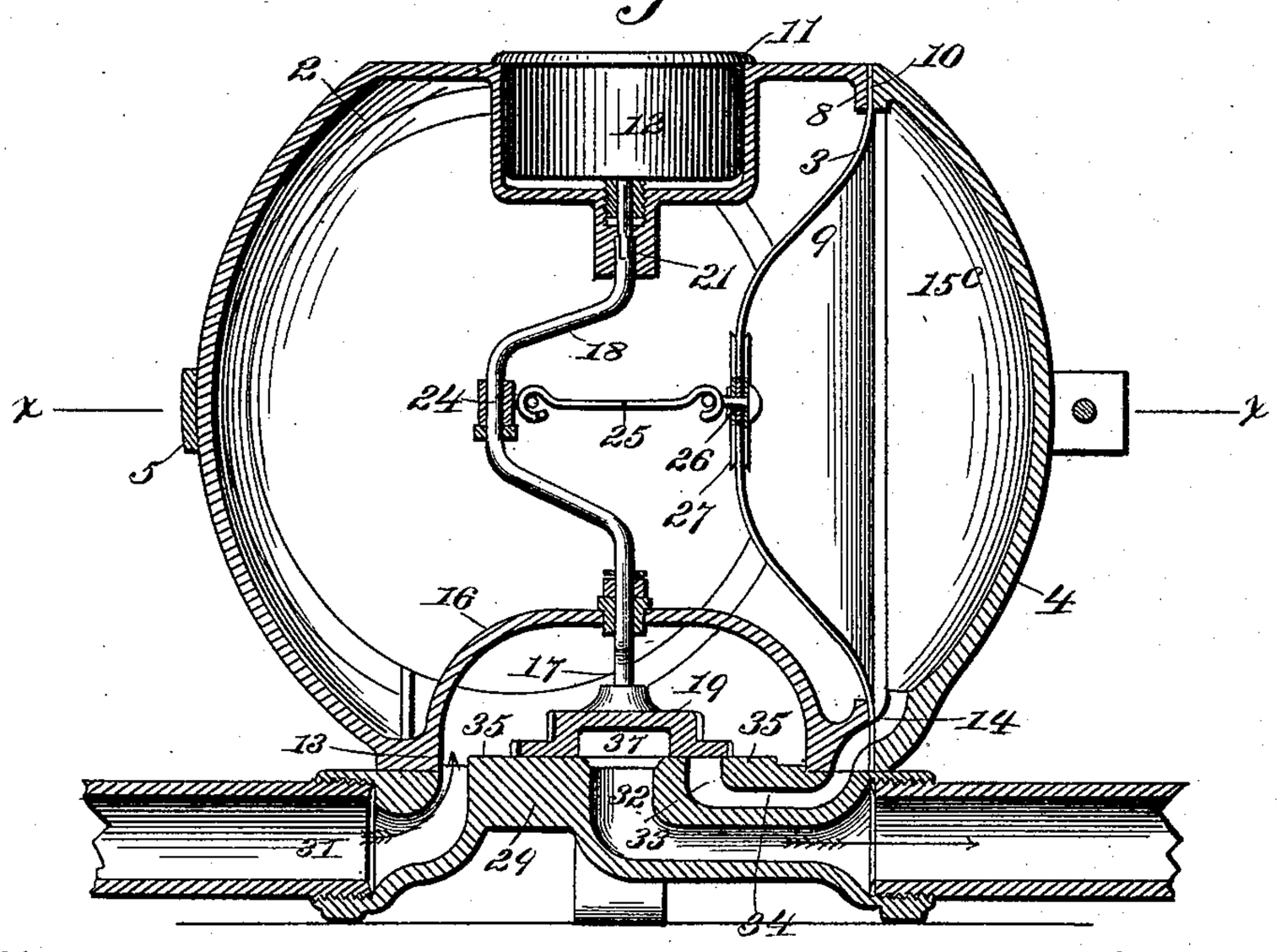


Fig. 2.



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(Model.) 2 Sheets—Sheet 2.

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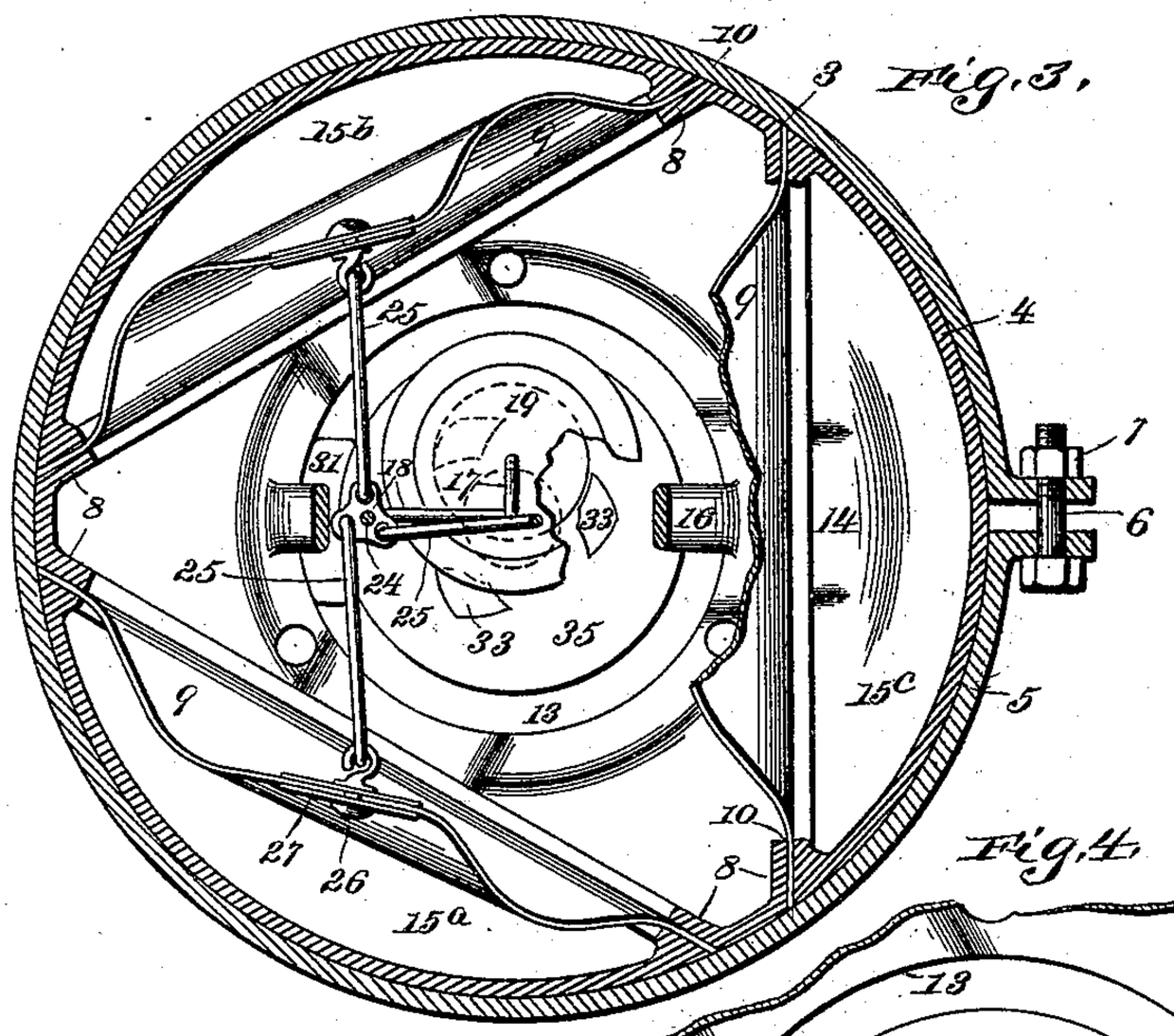


Fig. 3.

Fig. 4.

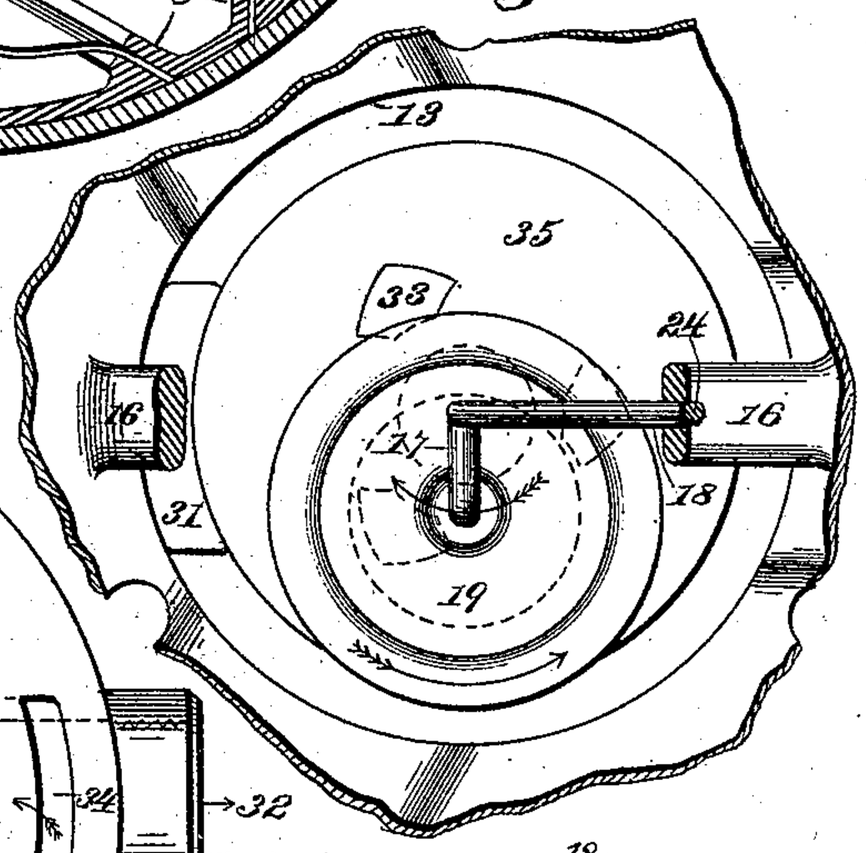
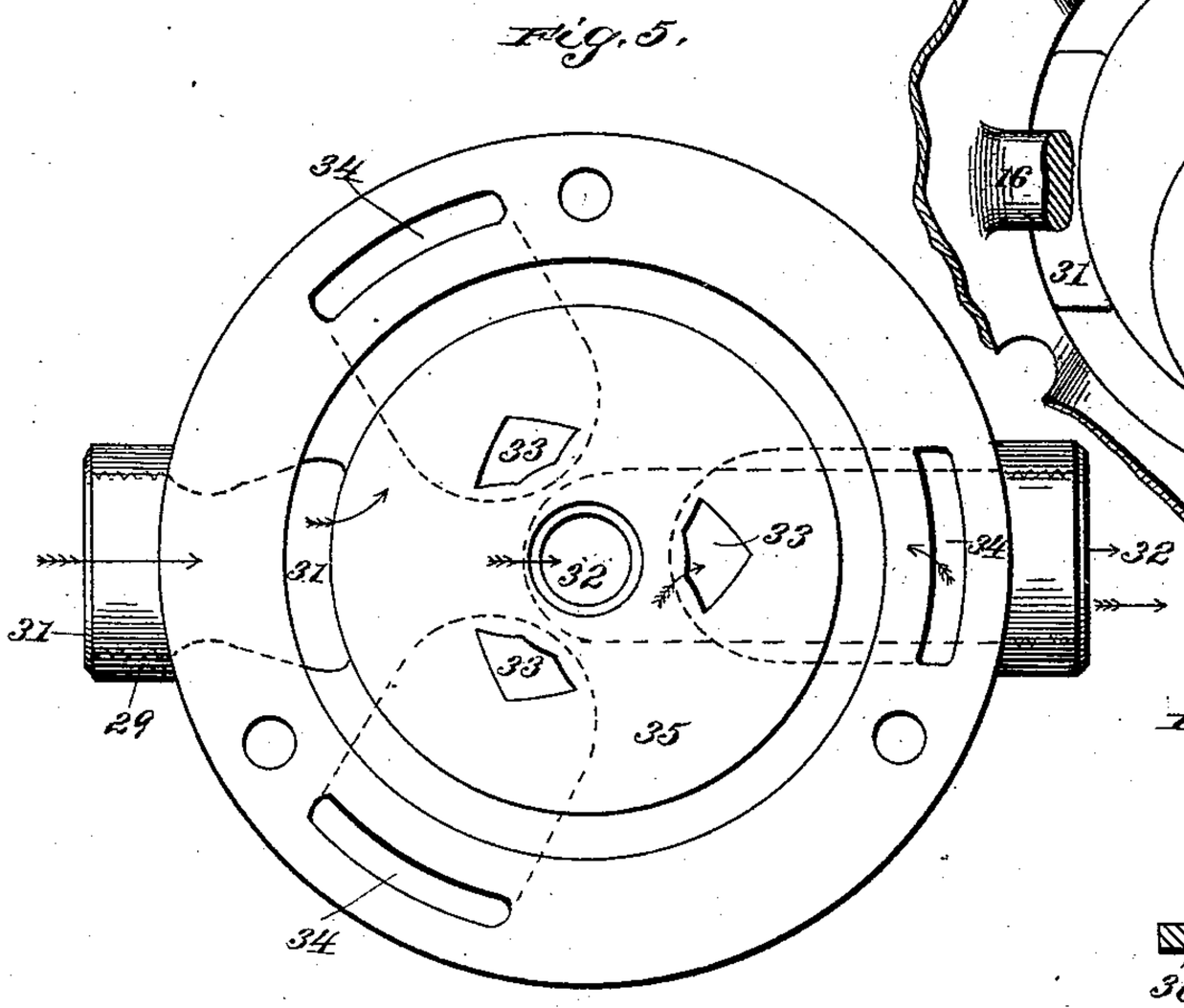


Fig. 5.



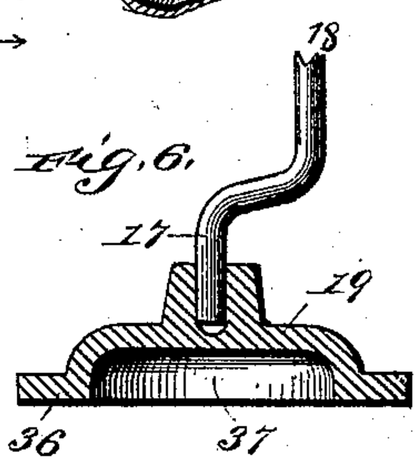


Fig. 6.

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UNITED STATES PATENT OFFICE.

HENRY A. TOBEY, OF TOLEDO, OHIO.

GAS-METER.

SPECIFICATION forming part of Letters Patent No. 487,907, dated December 13, 1892.

Application filed December 15, 1890. Serial No. 374,846. (Model.)

To all whom it may concern:

Be it known that I, HENRY A. TOBEY, a citizen of the United States, residing at Toledo, Lucas county, Ohio, have invented certain new and useful Improvements in Gas-Meters, of which the following is a specification.

My invention relates to meters of the class known as "dry" meters, and has for its object the construction of a device for measuring liquids, vapors, and gases which shall be simple in construction, cheap, light, compact, durable, positive in operation, noiseless, causing no pulsation by its valve movement, and reducing friction to a minimum.

The further objects of my invention are, first, to provide such meter with ports of peculiar form and arrangement and with a rotary slide-valve actuated by the pressure of the liquid to be measured, so that the induction and eduction ports shall present substantially a uniform and unvarying area of opening, thereby preventing pulsation; second, to provide such meter with a central crank-shaft actuated by the movement of a plurality of diaphragms and adapted to give motion to the rotary slide-valve, above referred to, and to the registering mechanism of the meter; third, to provide such meter with a valve and valve-seat in which the perfect contact of the surfaces shall be preserved by the uniform wear of the parts.

The invention consists in the parts and combination and arrangement of parts hereinafter described, and pointed out in the claims.

In the drawings made part hereof like figures represent like parts throughout the several views.

Figure 1 is a side elevation of a complete meter. Fig. 2 is a central vertical section with the front half removed to disclose the interior. Fig. 3 is a central horizontal sectional plan view on lines x x, Figs. 1 and 2, showing the valve in the position of one port closed, one port receiving, one port discharging, one diaphragm-chamber filled, one diaphragm-chamber filling, and one diaphragm-chamber exhausting. Fig. 4 is an enlarged plan view showing the valve in the position of having made a half-circle of the ports, showing the port discharging in Fig. 3 as receiving and the one receiving, same figure, as discharging; Fig. 5, a plan view of the base and valve-seat, showing ports; and Fig. 6 is a section in detail of the valve and portion of crank-shaft actuating the same.

In the example here shown the shell of the meter is spherical in general outline (except that it has a flat top and bottom) and has three equidistant circular openings in the sides, covered by lids forming segments of the sphere.

1 designates the shell, in the present instance shown as composed of a frame 2, formed with three circular openings 3, closed by removable lids or caps 4, held in place by an encircling-band 5, having a tensional adjustment by means of a bolt and nut 6 and 7, passed through the projecting ends of the band. Each opening is formed with a flange 8, upon which the outer edge of a flexible diaphragm 9 rests, which diaphragm is clamped firmly in place by a coincident flange or face 10 upon the cap 4, the edge of the diaphragm acting as a gasket between the surfaces of flanges 8 and 9, the space between the diaphragm and lid constituting a diaphragm-chamber. 11, as shown in Fig. 2, is a depression for the reception of a registering device 12, Figs. 1 and 2. The lower side of the shell has a circular opening 13, closed by the base, hereinafter referred to.

14 designates passages formed in the shell in communication with the central chamber of the meter and the diaphragm-chambers 15.

16 is a bridge or yoke across the lower part of the interior of the shell, and serves as a support for the lower end of crank-shaft 18, which passes through and is journaled in a central opening in the bridge or yoke. Crank-shaft 18 is disposed axially of the shell and is journaled at its upper end in the bearing 21 and is adapted to be connected with the gearing of any suitable registering device.

In the construction chosen for illustration of my invention I employ three diaphragms 9, each of which is connected with a crank 24 of crank-shaft 18 by means of a light connecting-rod 25, secured to the diaphragm by means of a hook and eyebolt 26, engaging metal washers or plates 27, the opposite end of the rod being connected with the crank by means of hooks and eyes or other suitable means.

Shell 1 rests upon and is secured to base 29 by bolts 30. (See Figs. 1 and 2.) Base 29 is formed with an inlet 31, leading from the sup-

ply-pipe into the interior of the shell, serving as the induction-port of the meter, there being an opening 32, leading from the center of the interior of the shell through the base, which serves as an eduction-port of the meter. Both ports are screw-threaded to receive connecting-pipes.

33 designates ports in the valve-seat communicating with openings 14, formed in the shell. Ports 33 when uncovered permit the passage of fluid to and from chambers 15 through conduits 33 34 14. (See Fig. 2.)

35 is a horizontal flat valve-seat projecting slightly above the remainder of the base, and in this valve-seat are formed ports 33 and eduction-port 32. Sliding upon this valve-seat is valve 19, which resembles in shape an inverted cup, the lower edge of the cup forming a flat annular face 36, (see Fig. 6,) designed when actuated by crank 17 on the lower end of crank-shaft 18 to rotate in a horizontal plane and to successively and progressively open and close ports 33 in the valve-seat. The cup or chamber 37 of valve 19 is of sufficient diameter to establish at all times communication between one of the ports 33 and the central opening 32 as the valve moves in its circular path round central port 32. The outer edge of the face of the valve projects slightly beyond the outer edge of the elevated valve-seat 35, and the valve being journaled loosely on the end of the crank-shaft is free to turn on its own axis as it travels bodily around the axis of the valve-seat. This double motion of the valve insures the uniform wear of the faces in contact, and prevents the accumulation of grit or dirt, which is constantly pushed outward and falls over the edge of the raised valve-seat.

In order to secure the greatest area of port-opening for ports 33, I adopt the form shown in the drawings. It will be observed that the lines of the outer edges of these ports are segments of a circle of the same circumference as the outer edge of valve 19, and that the two lines of the inner sides of these ports which intersect the outer lines are segments of a circle of the same circumference as the inner edge of the valve. These ports, in this instance three in number, are placed equidistant in the circular path of the valve and are arranged in such relation to the face of the valve that when the face of the valve covers either of the ports, preparatory to opening that port either to discharge or receive, the outer and inner edges of the valve-face coincide substantially with an outer and an inner edge of that port, as the case may be.

The operation of my device is as follows: The fluid is admitted to the meter through opening 31 and passes into the central triangular space formed by the diaphragms and the top and bottom of the meter. The position of the valve at all times is such that the central space is always open to one or more of chambers 15 through one of the ports 33, or substantially its equivalent in area, and one of the ports or its equivalent in area is always open to the discharge-opening 32 through concavity 37 in valve 19. (See Figs. 3 and 4.) It will be seen by reference to Fig. 3 that chamber 15^a is receiving, 15^b is discharging, and 15^c is filled. The movement of the valve is effected in the following manner: The central space being filled with the fluid at its initial pressure and the position of the valve such that one of the chambers 15^b is discharging, the return of the diaphragm to the inner surface of the shell, caused by the pressure exerted thereon by the fluid in the central space, causes the diaphragm to pull upon the crank through its connecting-rod 25, thereby revolving shaft 18, causing the lower crank 17 to move the valve in a circular path and to change the relation of the valve and port openings, so that the next diaphragm 15^c with its connecting-rod is operated upon in the same manner, and so on, in succession, until the crank-shaft and valve have described a complete revolution, one of the diaphragm-chambers being constantly full, or nearly so, one emptying, and the other filling. Thus the successive progressive filling and emptying of the diaphragm-chambers imparts a regular rotary movement to the shaft, the revolutions, each of which corresponds with the definite aggregate capacity of the three chambers, being indicated by the registering device. It will be seen that the constant direction of the force applied to the diaphragms is from within and outward, and that the valve and registering mechanisms are actuated by the successive progressive pulls of the connecting-rods 25, thus avoiding the click and noise of reciprocating parts. It will also be seen that the ports are opened and closed with a progressive shearing movement of the valve, which may result in the partial opening of one port and the partial closing of another, but at all times maintaining a uniform port-opening through the meter, thereby guarding against pulsation in the discharge of fluid.

While I may vary the form of the inclosing shell, I prefer the spherical form shown, it being not only compact and neat in appearance, but having a greater strength than any other form.

I do not limit my invention to a meter having three diaphragms, as obviously the diaphragm-chambers, connecting-conduits, and ports may be increased, if desired, as any number of ports in the circle of the travel of the valve will operate on the same principle as above indicated. Neither do I limit myself to the exact form of valve here shown, as other valves may be employed, singly or in series, without departing from my invention.

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

1. A meter spherical in general outline and having removable caps adapted to form measuring-chambers, in conjunction with the diaphragms, substantially as and for the purpose specified.

2. A meter having a shell composed of a frame provided with equidistant openings having detachable lids, substantially as shown and described, for the purpose specified.

3. A meter having a shell spherical in general outline, comprising in its construction a frame 2, having openings closed by lids, (spherical segments 4,) said lids being held in place by means of encircling band 5, substantially as shown and described, for the purpose specified.

4. A meter having a shell spherical in general outline, composed of a frame provided with equidistant openings having detachable lids, in combination with flexible diaphragms clamped between the margins of said openings and said lids, substantially as shown and described, for the purpose specified.

5. A meter having a shell spherical in general outline, composed of a frame provided with equidistant openings having detachable lids, in combination with flexible diaphragms clamped between the margins of said openings and said lids, the spaces between the diaphragms and lids forming measuring-chambers and the margin of the diaphragms serving as gaskets for the joints formed by the juncture of the lids and frames, substantially as shown and described, for the purpose specified.

6. A series of ports in a valve-seat arranged equidistant in the path of a valve adapted to move in a circle, the marginal lines of said ports being segments of the inner and outer circles of the annular face of said valve, substantially as shown and described, for the purpose specified.

7. A valve provided with an annular face and a central concavity and moving by the means described in a circular path, in combination with a valve-seat having a central opening, and a series of ports of substantially the contour described, adapted by means of their relation to the path of the valve, said central opening, the annular valve-face, and the concavity of the valve to maintain a port-opening through a meter of constant and unvarying area, all substantially as shown and described, for the purpose specified.

8. A gas-meter comprising in its construction a shell spherical in general outline, provided with equidistant openings having detachable lids, a series of flexible diaphragms arranged at intervals upon the interior of the shell, forming diaphragm or measuring chambers between the shell and diaphragms, a crank-shaft connected with said diaphragms, a registering mechanism connected with said crank-shaft, a valve connected with and actuated by said shaft, an inlet to said shell, an outlet therefrom, a series of conduits connecting said measuring-chambers with the central chamber of said shell, said outlet and said conduits being controlled by said valve, substantially as and for the purpose specified.

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