(No Model.) 4 Sheets—Sheet 1.

E. F. OSBORNE.

METER FOR STEAM HEATING APPARATUS.

No. 265,698. Patented Oct. 10, 1882.

Fig. 1.

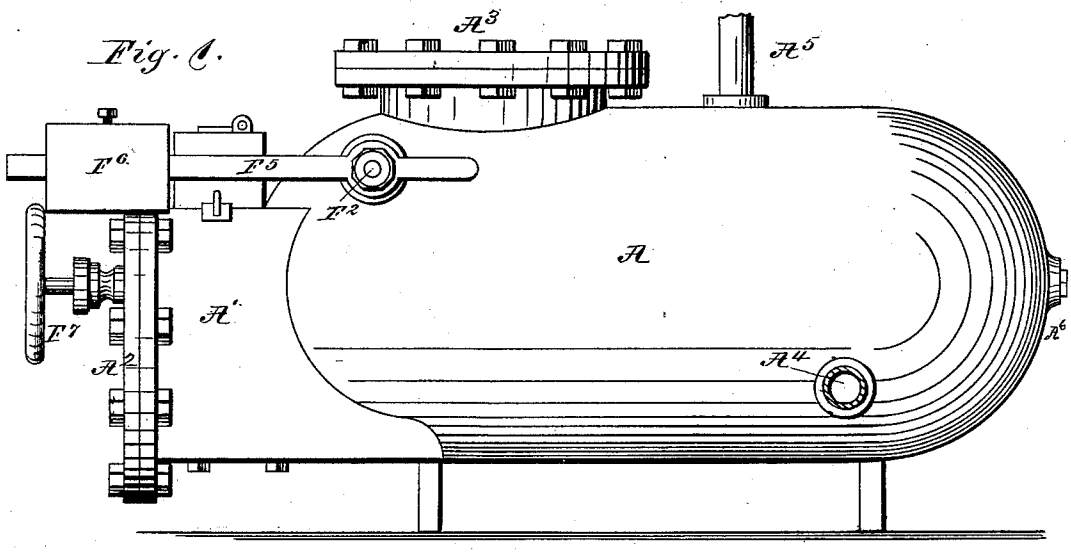
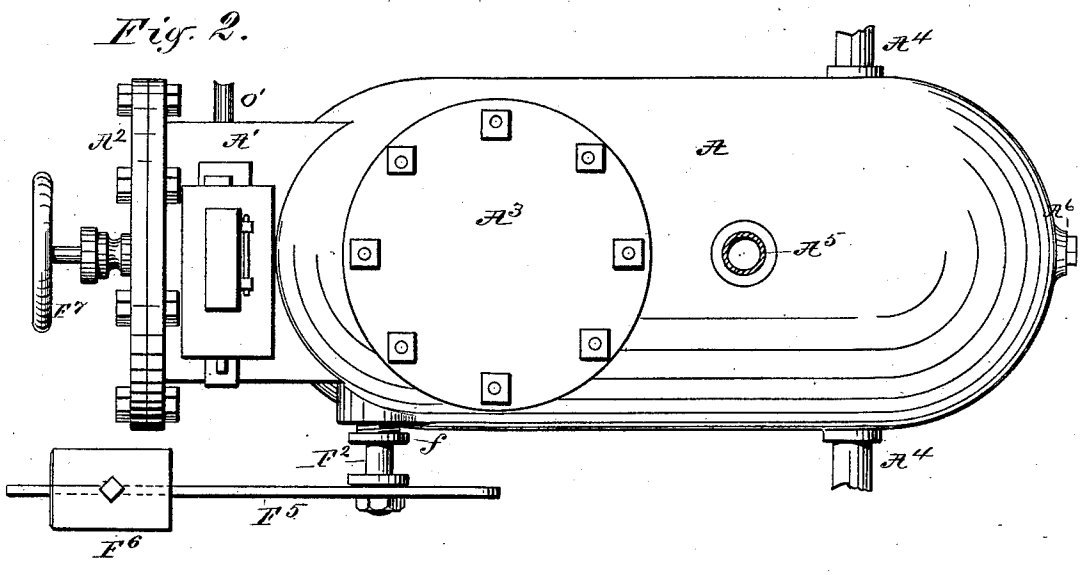


Fig. 2.



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Fig. 3.

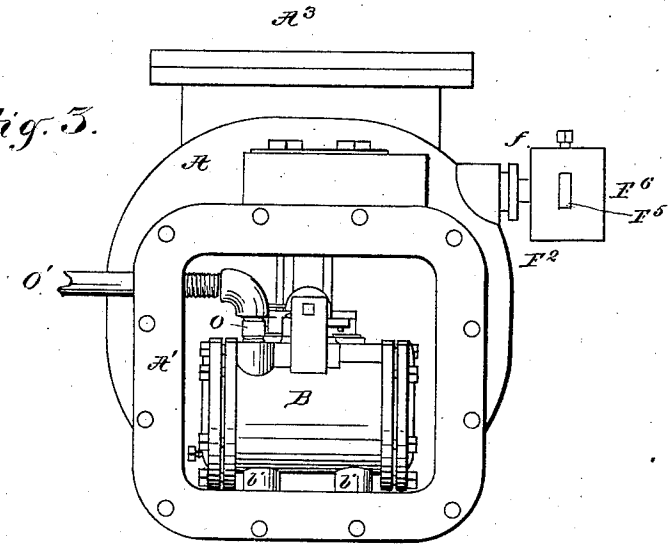
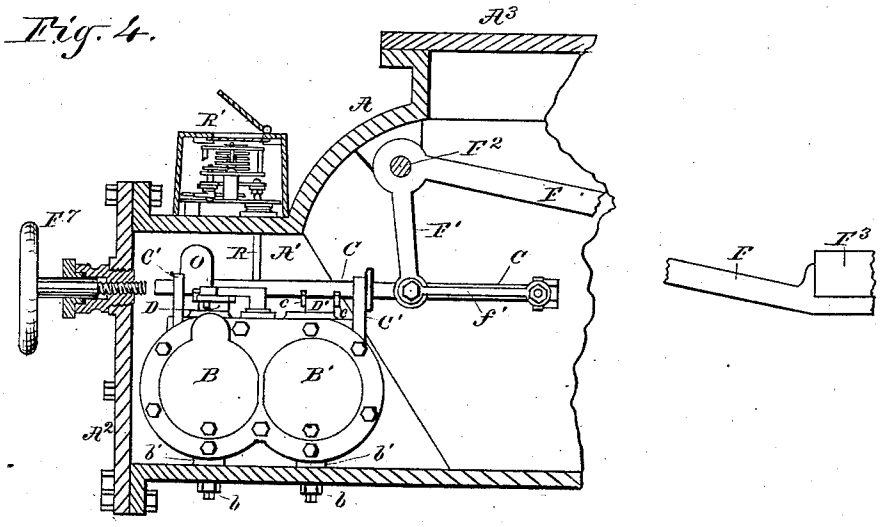


Fig. 4.



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Fig. 5.

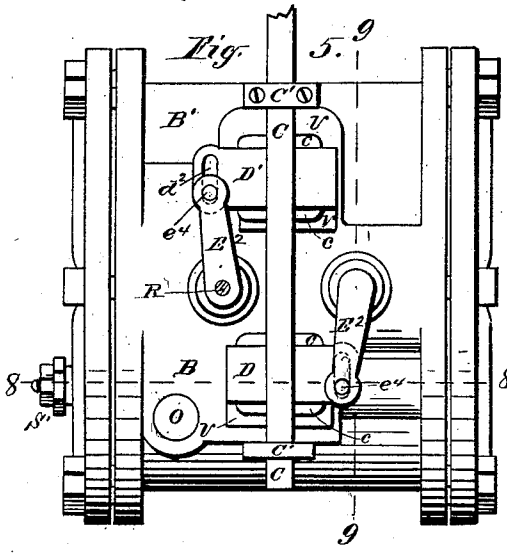


Fig. 6.

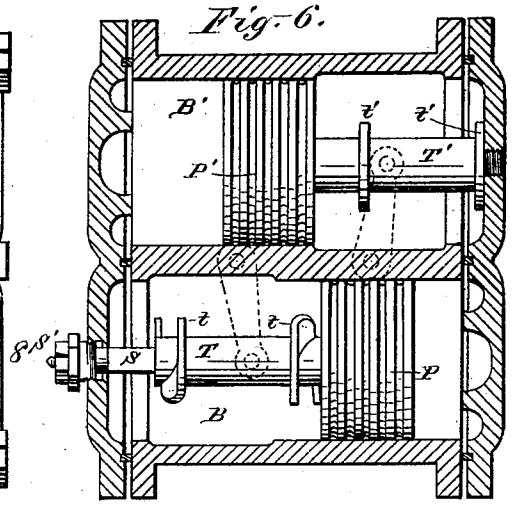
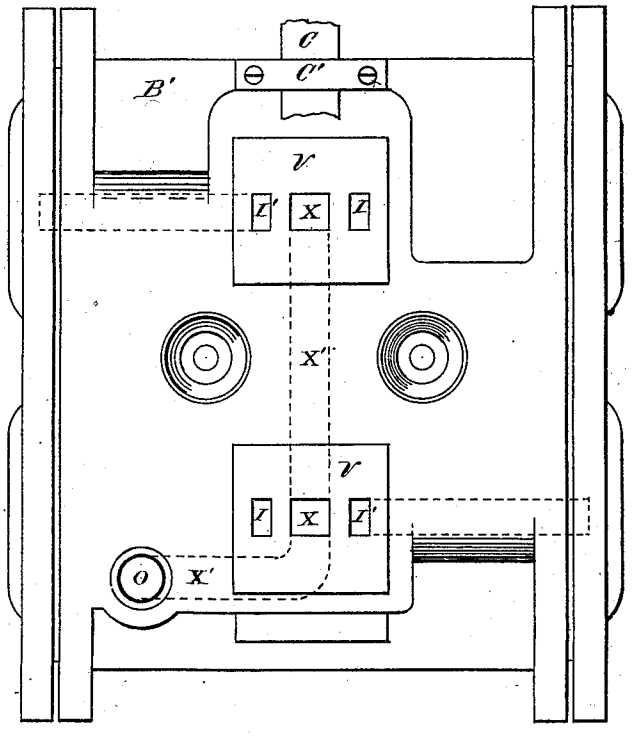


Fig. 7.



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Fig. 8.

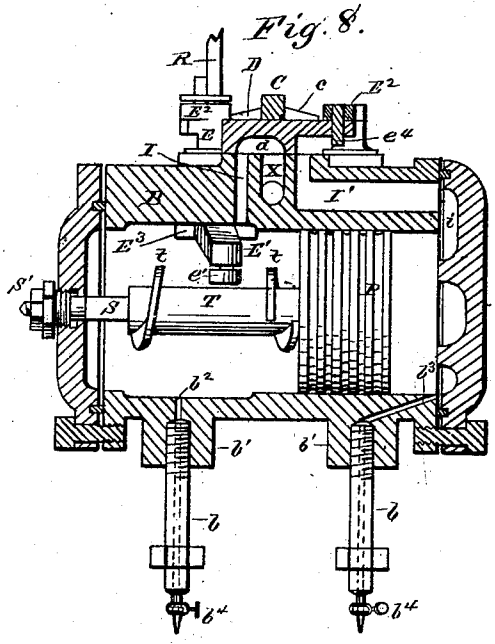


Fig. 9.

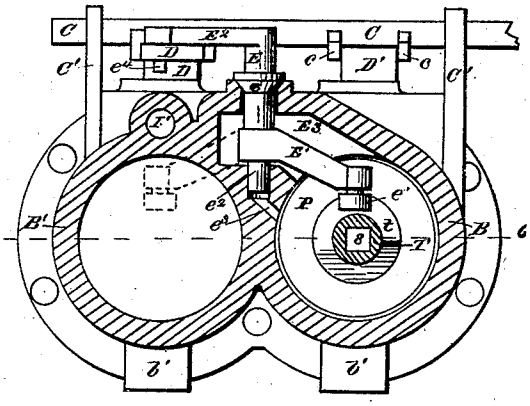


Fig. 10.

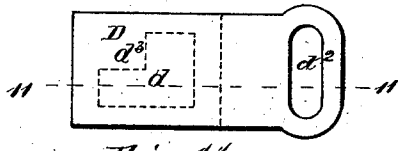


Fig. 12.

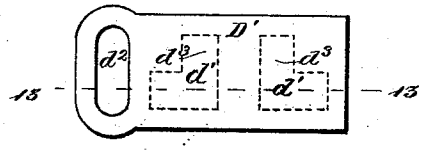


Fig. 11.

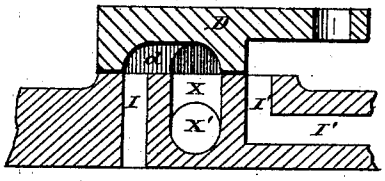


Fig. 13.

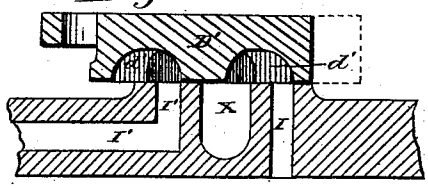
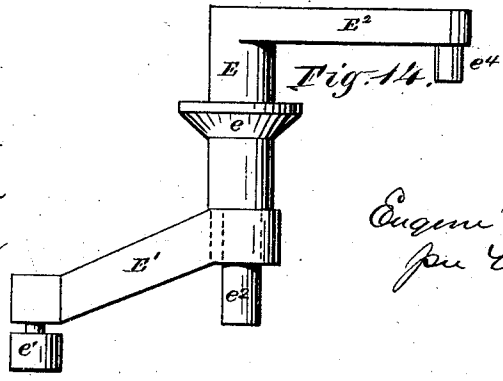


Fig. 14.



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UNITED STATES PATENT OFFICE.

EUGENE F. OSBORNE, OF ST. PAUL, MINNESOTA.

METER FOR STEAM HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 265,698, dated October 10, 1882.

Application filed June 27, 1881. (No model.)

To all whom it may concern:

Be it known that I, EUGENE F. OSBORNE, of St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Meters for Steam Heating Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to devices for measuring the water of condensation produced in steam heating apparatus. It is more especially intended for use in connection with a circuit conveying steam to a building or apartment to be heated, and returning the water of condensation to the generator.

In Letters Patent of the United States No. 236,247, dated January 4, 1881, which describes a system of general steam-heating for cities, I have shown a main circuit which supplies steam to a local heat-transmitting apparatus, and which returns the condense-water through, first, a meter, and, second, a trap to a pipe leading back to the generator. The meter in said patent, being thus located, is operated solely by the working-head of the branch circuit in which it is connected. In many situations the working-head of this branch circuit is necessarily low, and in the arrangement shown in said patent the whole or a considerable part of the force of such head would be exhausted in working the meter, leaving too little to effect a proper circulation. To obviate this difficulty I have made the present invention, in which the meter receives from the trap, and its discharge is controlled by the water-level of said trap through the medium of a float and proper connections. By this means I am enabled to use the entire head for the purpose of circulation, and the entire difference in pressure between the steam-supply and condense-water-return pipes as another and separate force for working the meter. I am also thereby enabled to secure the measurement of the water condensed in the steam-service pipe connected with the trap with which it is obviously proper to charge the consumer.

If the meter were simply placed after the trap to obtain the general advantage above named, other difficulties would be presented, to wit: By reason of the lower pressure on the meter steam would sometimes be liberated therein and would prevent or interfere with the operation of the meter; or by reason of the cooling of the water there would be a reduction of its volume and consequent inaccuracy of measurement. Moreover, if, to maintain the uniformity of pressure between the meter and trap so located, the meter-discharge be connected with the trap-float, stuffing-boxes will be necessary for such connections, which entail friction and require attention. While such a relative location and connection of the trap and meter will present the general feature of my invention, I prefer, by reason of the disadvantages just mentioned, and as the best embodiment thereof, to locate the meter within the trap, where it is directly subjected to the pressure of the trap, and the connections require no stuffing-boxes and operate with the least possible friction. Moreover, by reason of the location of the meter within the trap the outside parts of the meter are first heated when hot water enters the trap, or when the temperature of the water in the trap is raised, and as a consequence the pistons of the meter do not bind, but work freely at all times.

The accompanying drawings illustrate the trap and meter thus combined and arranged.

Figure 1 is a side elevation of the trap, of suitable form to contain the meter. Fig. 2 is a plan or top view of said trap. Fig. 3 is an open end view of the trap, revealing the interior meter. Fig. 4 is a vertical longitudinal section of the trap, showing the interior meter. Fig. 5 is a top view of the meter-cylinders detached from the trap. Fig. 6 is a central horizontal section of the meter-cylinders through 6 6 of Fig. 9. Fig. 7 is a top view of the cylinders with the valves absent, showing the ports and the direction of the port-passages. Fig. 8 is a central vertical longitudinal section of one of the meter-cylinders through 8 8 of Fig. 5. Fig. 9 is a transverse section of the meter-cylinders through 9 9 of Fig. 5. Figs. 10 and 12 are top views of the cylinder-port valves. Figs. 11 and 13 are vertical sections of said valves (respectively through 11 11 and 13 13 of Figs. 10 and 12) and of the cylinder-

ports. Fig. 14 is an elevation of the cranked shaft by which the valve of one cylinder is operated by the piston of the other cylinder.

The same letter indicates the same part in all figures of the drawings.

A is a cast-iron shell, preferably of cylindrical form with hemispherical ends, and having a top man-hole, A^3, and inlet A^4.

A′ is a rectangular extension of the shell A, having the removable head A^2. Within the trap is mounted a bent float-lever consisting of the horizontal arm F and shorter vertical arm F′, keyed to the transverse shaft F^2, which is supported at one end in a suitable bearing within the trap and at the other protrudes through the shell A by the stuffing-box *f*. At the extremity of the long arm F of the float-lever is secured a float, F^3, of stone or other suitable material, after the usual construction of a class of float-traps. The protruded end of the shaft F^2 bears a horizontal arm, F^5, on which is placed a sliding weight, F^6, which may be set to counterbalance the float F^3 to the extent of one-half its displacement. Instead of a counterbalanced stone float, a hollow float may be used, the weight of which, with its arm, is one-half the weight of the water it displaces when submerged.

B and B′ are two cylinders, cast in a single piece, located inside the trap, and arranged transversely within the extension A′. They are secured in place by means of the bolts *b b*, which pass upward through the bottom of the shell A into the feet *b′ b′*, cast on the cylinders. The cylinders have inlet from the interior of the trap through central valved ports in their top, and discharge through passages leading to the outlet O, as will be hereinafter more fully explained. The discharge of the trap is therefore through the meter, unless the meter should be out of order, when other outlet, as A^6, may be temporarily used; or, as will be hereinafter explained, the trap may be made to discharge through the passages of the meter without operation of the latter. Said cylinders B and B′ are respectively provided with pistons P and P′, which work a suitable distance at opposite ends of the cylinders, as seen clearly in Fig. 6. The pistons are provided with stems T T′, each having a longitudinal hole, *s*, Fig. 9, fitted to freely admit the rod S, which is fixed in the cylinder-head, toward which the apertured stem is (in each cylinder) directed. Said rods serve as guides to the pistons, and the rod S, entering the stem T, is square, to prevent the rotation of the stem to which it is applied, for a purpose that will presently appear. The stem T′ is provided with plain collars *t′* and the stem T with spiral or offset collars *t*, the use of which will be further explained hereinafter.

The cylinders are provided with horizontally-faced slide-valve seats V on their upper surface, having ports like those of a steam-engine cylinder, all as clearly seen in Fig. 7. I and I′ are the alternate inlet and outlet ports and X are the exhaust or discharge ports. The port-passages I′ lead through the metal of the cylinder-shell to the end of the piston-chamber, as in a steam-engine; but the passages I are vertical, since the piston never travels beyond this point. Both the central exhaust-ports, X, connect with a common passage, X′, which leads to the outlet O, as plainly shown in dotted lines in Fig. 7.

To the valve-seats V are fitted the valves D and D′, having neither lap nor lead, or, in other words, being "line-and-line." The valve D is positive or "direct-acting" and the valve D′ is negative or "back-acting," having reference to the difference in the number of their transverse bearing-faces, as illustrated in Figs. 11 and 13. The cavities *d′* of the negative or back-acting valve D′ are L-shaped, and arranged as indicated by dotted lines in Figs. 10 and 12. The valves D and D′ are given a compound movement upon their seats, as will be next explained. First, they have a movement longitudinal to the cylinders or to the line of the ports, as in a steam-engine, and, second, a movement transverse to the cylinders or at right angles with the line of the ports. The actual movement is usually oblique. The former or longitudinal movement of each valve, by which the corresponding cylinder-ports are alternately opened and closed to work the piston, is produced by the movement of the piston in the other cylinder through the medium of the double and oppositely-cranked shaft E. (Seen detached in Fig. 14, and shown in place in Fig. 9.) Two of said shafts are employed, one for each cylinder and valve. They are alike, and are each provided with the tapering bearing-shoulder *e*, fitted closely to a corresponding seat in the metal which joins the cylinders, and in the central line between the cylinder-chambers. The lower end, e^2, of the shafts is laterally retained in a socket, as seen in Fig. 9.

The upper crank-arm, E^2, is or may be of the same piece with the shaft, and is provided with a pin, e^4, which enters the slot d^2 of the valve with which it is connected. The lower crank-arm, E′, is firmly secured to the shaft when the latter is put in place, and is held from rotation by a spline and groove or other suitable means. Said arm works in a recess, E^3, leading out of the piston-chamber, and is provided with the roller-pin *e′* at its free end, arranged to strike the collars *t* or *t′* on the stem of the piston by which it is worked. Said collars are so placed on the piston-stems that as each piston nears the end of its movement in either direction it will by one of its collars encounter the roller-pin *e′*, and will thereby in completing its stroke oscillate the shaft E far enough to shift the valve of the opposite cylinder. The other or transverse movement of the valves D and D′, by which the size of the port-orifices I and I′ is widened or contracted or closed, is produced by the vertical movement of the float F^3. For this purpose a horizontal bar, C, is arranged transversely over the valves D and D′, and is laterally retained in place by the

guides C′ C′. Said bar is given a longitudinal movement transverse to the cylinders by means of a connecting-rod, *f′*, pivotally joining the bar C with the vertical arm F′ of the float-lever, as seen in Fig. 4.

To the bar C are attached the parallel transverse guide-flanges *c c*, arranged to depend one on each side of the several valves D and D′. Between these flanges said valves freely slide in their longitudinal movement; but obviously when the bar C is longitudinally moved by the float the flanges *c c*, secured to said bar, carry the valves sidewise or transversely to the cylinders. In this movement the pins e^4 slide in the slots d^2 of the valves. The parts are so arranged that when the float rises above the proper water-line the inlet-ports will be enlarged, and when the float descends said ports are narrowed or closed. The transverse wings d^3 of the cavities *d′* in valve D′ are provided for the purpose, first, of at all times giving free inlet to the receiving end of the cylinder B′, whatever the lateral position of the valves; second, to thereby secure maximum pressure on the discharge side of the piston of said cylinder, and, third, through the agency of such maximum pressure on the discharge side to more nearly balance said valve. For this last-mentioned purpose the cavity *d* of valve D may also preferably be winged, as indicated by dotted lines in Fig. 10.

The working water-line obviously cannot be lower than the level of the valve-seats V.

The lateral movements of the valves are limited, as here shown, by the vertical guides C′, which are set in position to arrest the valves either when fully open or when fully closed. The set screw F^7, arranged as seen in Fig. 4, may also be employed to arrest the valves in one of their lateral movements or to hold them open, should occasion require.

It will have been noticed that the collars *t* on the piston-stem T are set in opposite spiral arrangement on said stem. This is for the purpose of throwing the meter temporarily out of engagement to test its displacement or tightness, which operation will next be explained. The more proximate parts of the two collars *t t* are at a proper distance apart to encounter the roller-pin *e′* on the valve-shifting arm E′, while the more widely separated parts of said collars will not encounter said pin in a full stroke of the piston. Wherefore, when it is desired to test the meter, the square S is rotated one-half turn by an external squared head, S′, Fig. 8, carrying the stem T around, so as to bring its collars *t t* out of reach of the roller-pin *e*. The piston P of cylinder B (containing the spirally-collared stem T) will therefore not shift the valve of the cylinder B′, and the piston of said latter cylinder stops and remains stationary on the completion of its stroke. The piston of cylinder B as a consequence comes to rest on the completion of its stroke. Both pistons being at rest, if the meter is tight no water will escape at O; if otherwise, it will. Having thus tried the meter for leakage, next the square S′ is turned for a moment to its original position, which causes one of the spiral collars *t* to strike the roller-pin *e′* adjacent thereto and opens the valve of the cylinder B′. By immediately turning the square back again, so as to bring the spiral collars *t* out of reach of the roller *e′*, as in the first rotation of the square, above described, it is evident that each piston will make one stroke and thereupon come to rest again. By measuring the water passed by the meter in this one stroke of both pistons its capacity or displacement is ascertained. This done, the square S′ is turned back to its original position and allowed to remain there, holding the spiral collars *t* in position to shift the opposite cylinder-valves, and thus continue the meter in operation.

Should the meter get out of order, the trap may be discharged directly through the exhaust-passages X X′ by running in the set-screw F^7 against the end of the rod C, so as to push the valves D and D′ so far forward upon their seats as to leave the passages X constantly open.

A suitable registering apparatus, R′, Fig. 4, is located on the trap-extension A′ over the meter-cylinders, and the same is run by the oscillating rod R, which forms an extension of one of the shafts E of the valve-shifting devices described. Said register will preferably be arranged to record in pounds of condense-water; but it may record in gallons, or in units of value for quantity of heat supplied. The adjustment of the register to the contents of the meter, or vice versa, may be effected in the usual manner.

For the purpose of draining the meter-chambers the passages b^2 b^3 are provided, leading from the bottom of said chambers to the tapped holes which receive the holding-bolts *b b*. Said bolts are also provided with central longitudinal apertures in extension of the passages b^2 b^3, and are fitted with petcocks b^4 at their lower ends, as shown in Fig. 8.

The discharge O of the meter-cylinders is fitted with a pipe, O′, which connects with the return-pipe of the system described in the patent referred to, and in other cases leads to any desired point of final discharge.

The principal and more essential feature of the invention above described is, generically speaking, the control of the meter discharge or outlet by means of the water-level in the trap, and for this purpose I do not limit myself to the mechanism described, as any form of meter having a simple stop-cock in its outlet, controlled through a float and lever or otherwise by the water-level of the trap, would contain this feature of my invention.

I claim as my invention—

1. The combination, in a steam heating apparatus, of a trap, a fluid-meter, and a contrivance or contrivances for controlling the discharge of the meter from the water-level in the trap, substantially as and for the purposes set forth.

2. In combination with the steam-supply

pipe and the trap in a steam heating apparatus, a fluid-meter arranged to take from the trap, and operating by the difference in pressure between the supply and return pipes, as set forth.

3. In the combination of a trap and a fluid meter wherein the water-level serves to adjust the valves so as to control the ports of the meter, the said meter-ports arranged in open communication with the trap interior, whereby stuffing-boxes or other friction-joints are avoided, substantially as described.

4. In combination with a steam-supply pipe, a trap and a fluid-meter, the said meter being located within the trap, substantially as described, and for either one or all of the purposes specified.

5. In a steam heating apparatus, a meter provided with interior moving parts and submerged in the fluid it measures, substantially as described.

6. In combination with the float of a float-trap, a piston-meter provided with a port-valve having both a lateral and a longitudinal movement, and mechanism connecting said valve with the float, whereby the lateral movements of the valve are governed by the movements of the float, substantially as described.

7. Combined with and arranged within the trap of a steam heating apparatus, the duplex piston-meter described, consisting essentially of the cylinders B and B′, their pistons, inlet and outlet ports provided with the positive and negative port-valves D and D′, having the compound movements described, and mechanism, substantially as described, for operating the valve of one cylinder from the piston of the other.

8. In the combination of a trap and meter, the ports I, I′, and X of the duplex meter described, the compound-motioned valves D and D′, mechanism for shifting each valve from the piston of the other, and mechanism for varying the area of the entry-ports from the water-line of the trap, combined and operating substantially as described.

9. In combination with the fulcrumed float-lever F F′ and the compound-motioned port-valves D and D′, the rod C, provided with flanges *c* and controlled by guides C′, substantially as described.

10. Combined with the rod C, connected with the trap-float and meter-valve, as shown, the set-screw F^7, arranged and operating from the exterior of the trap, as and for the purposes stated.

11. In the combination of a trap and meter, as described, the shaft F^2, keyed to the float-lever and extended through the side of the trap-shell, combined with the arm F^5 and weight F^6, substantially as and for the purposes stated.

12. In the combination and arrangement of the trap and meter shown, the cylinders B and B′, provided with the passages b^2 b^3, and the bolts *b*, provided with longitudinal apertures and external petcocks, p^4, substantially as shown, and for the purposes specified.

13. The valve D′, having the L-shaped cavity *d′*, combined with the cylinder-ports, and with actuating mechanisms for producing both lateral and longitudinal motions, as set forth.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

EUGENE F. OSBORNE.

Witnesses:
M. E. DAYTON,
JESSE COX, Jr.