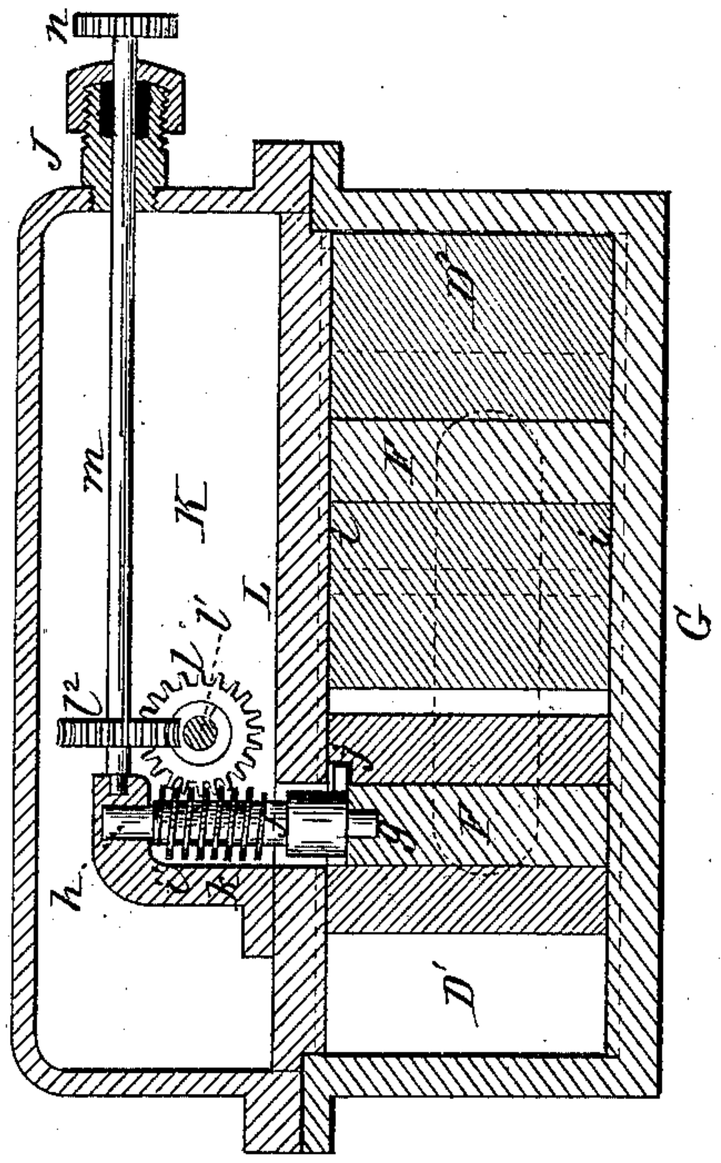
(Model.) 2 Sheets—Sheet 1

L. H. NASH.

ROTARY WATER METER.

No. 280,220. Patented June 26, 1883.

Fig. 2.



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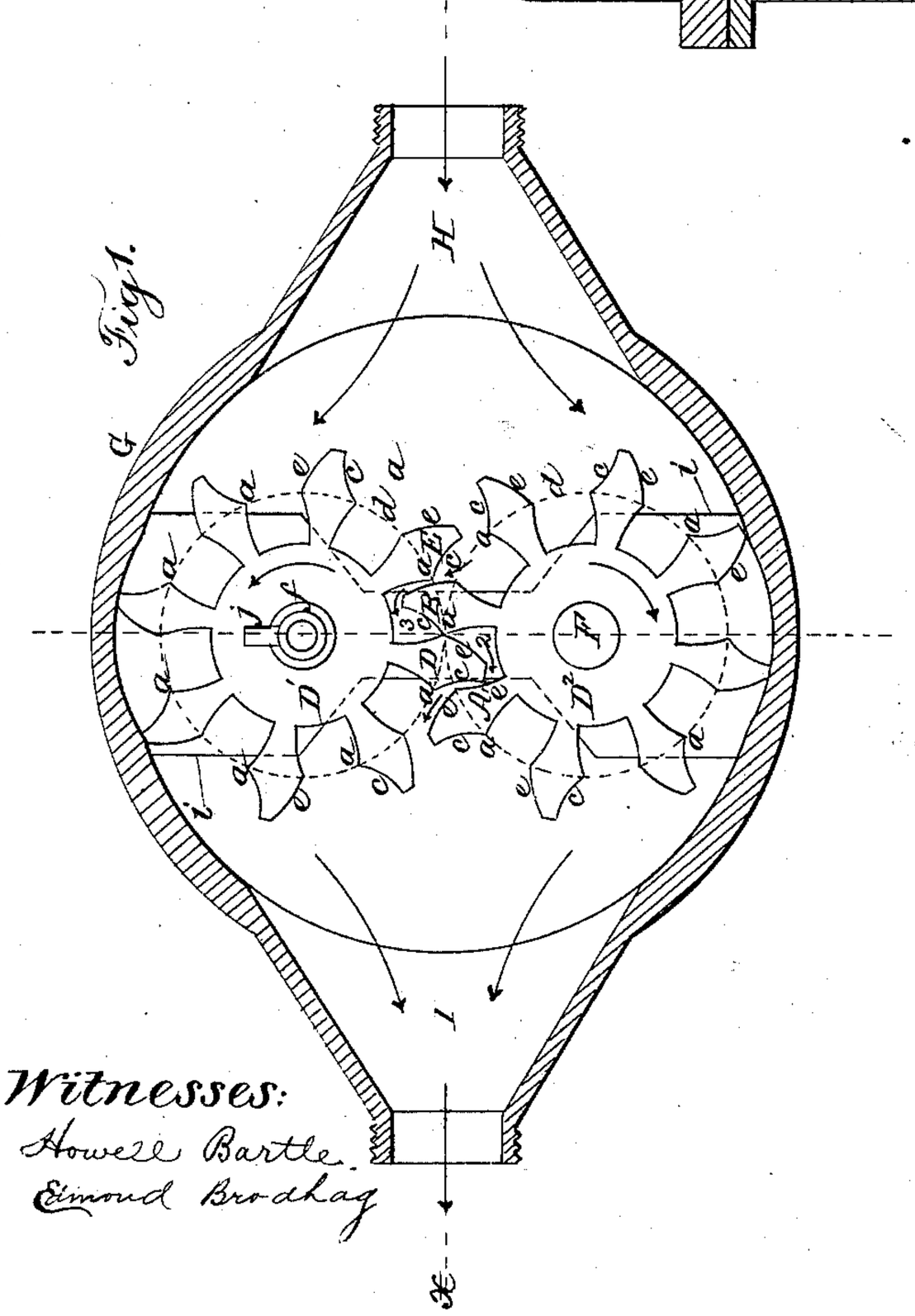

Witnesses:
Howell Bartle
Edmund Brodhag

Inventor:
Lewis Hallock Nash
by Johnson and Johnson
Attys

(Model.) 2 Sheets—Sheet 2.

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Fig. 3.

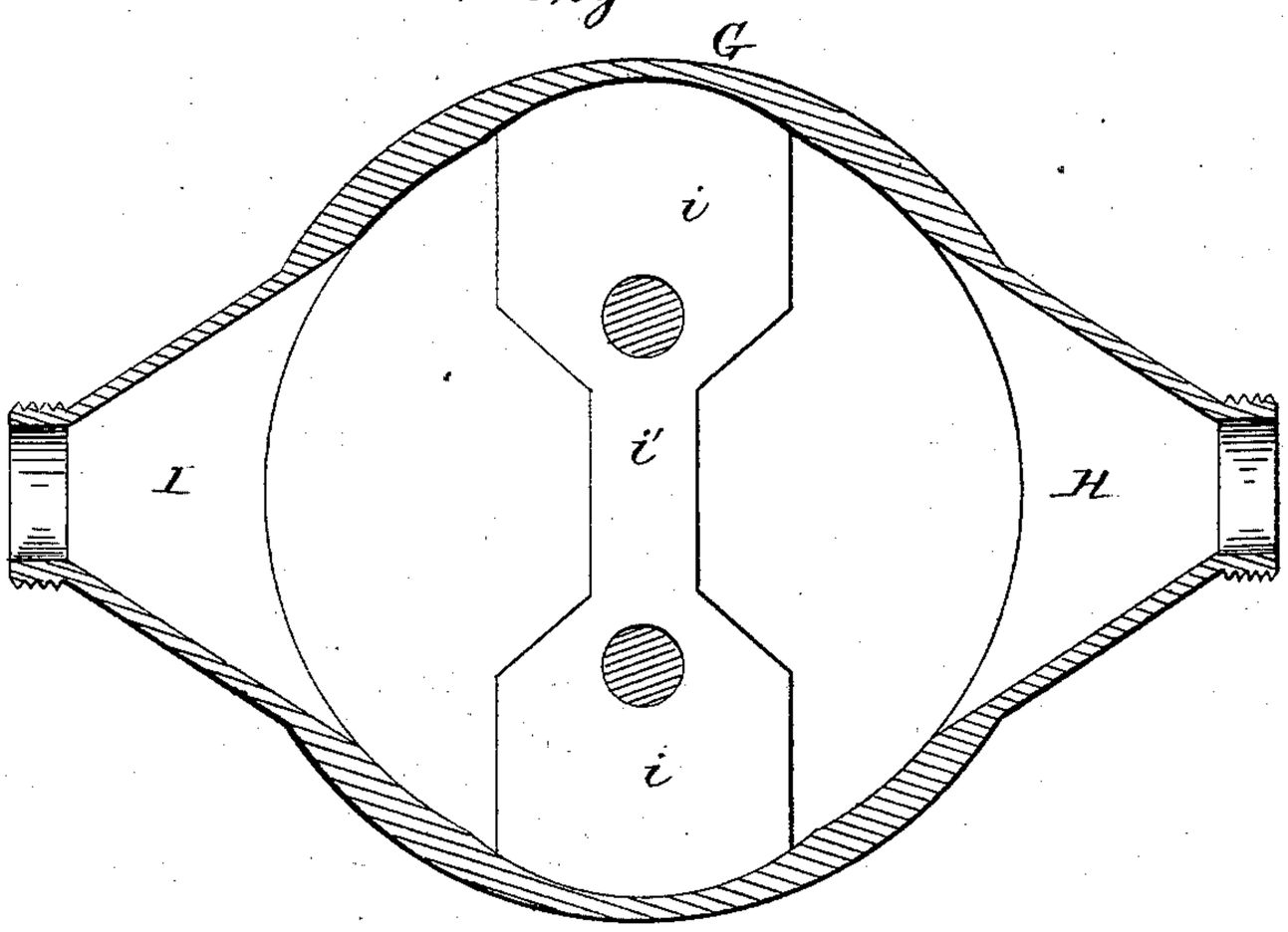
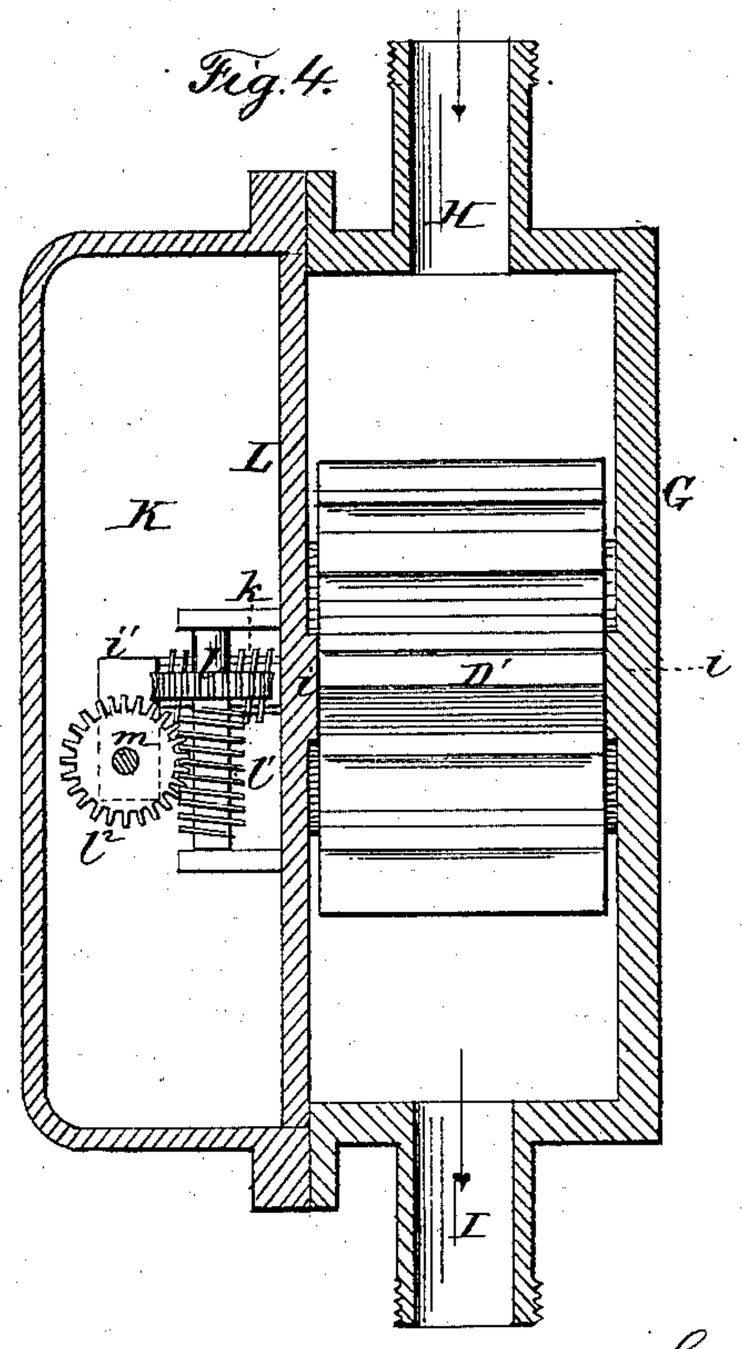


Fig. 4.



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UNITED STATES PATENT OFFICE.

LEWIS H. NASH, OF BROOKLYN, ASSIGNOR TO THE NATIONAL METER COMPANY, OF NEW YORK, N. Y.

ROTARY WATER-METER.

SPECIFICATION forming part of Letters Patent No. 280,220, dated June 26, 1883.

Application filed June 17, 1881. Renewed February 8, 1883. (Model.)

To all whom it may concern:

Be it known that I, LEWIS HALLOCK NASH, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Water-Meters, of which the following is a specification.

I have produced an improved water-meter constructed upon the plan of two circular rotary toothed pistons or wheels arranged for conjoint operation within a chamber, the water passing within the spaces of the teeth bounded by the walls of the chamber at each revolution of the pistons, the number of such revolutions made being recorded by a registering device connected with one of said pistons.

The objects of my improvements are, first, to produce a practically successful meter the pistons whereof are of circular toothed form and communicate their motion to the registering mechanism by intermediate power-producing gearing, whereby the friction of the packing-box is removed from direct influence upon the driving-piston or intermatching wheels; second, to provide toothed pistons of circular form with the longest intermatching teeth that will run smoothly and with the least friction; third, to prevent strain upon the piston-bearings by relieving the direct impact of the entering water and causing it to follow the direction of the motion of the pistons; fourth, to reduce the area of friction-surface at the ends of the pistons; fifth, to provide inlet and outlet ports or passages at the ends of the chamber to co-operate with the teeth at the junction of the pistons for the entrance and escape of the water of leakage between the teeth, and to render the toothed pistons light and uniform in their motions to effect a uniform flow of the water.

In the employment of pistons of circular form having long intermatching teeth it is of primary importance that the direction of the pressure of one tooth of one piston upon a tooth of the other piston should be such as to give a single point of contact to the driving-tooth in approaching and passing the center line of the pistons. The employment of intermatching circular toothed pistons, with the driven gearing arranged between them and the packing-box, is important in isolating from the pistons the retarding effect of the friction of the packing-box.

While it is an important matter of my improvement to increase the capacity of the flow as well as the effective driving area of the teeth by increasing their length, yet it is equally important that the advantages be obtained without increasing the friction of the teeth, and without lessening the effectiveness of the joint formed between the revolving pistons.

Referring to the accompanying drawings, Figure 1 represents a section of a water-meter, showing the contact of the intermatching teeth of the pistons; Fig. 2, a section taken through the axis of the toothed pistons, and showing the intermediate relation of the driven gear with the packing-box of the casing. Fig. 3 shows a section of the casing with the pistons removed, and Fig. 4 a section through the line *x x* of Fig. 1.

Now, referring to Fig. 1, I obtain the longest teeth possible with the least friction from the contact in the conjoint operation of the pistons by removing one face, *c*, of each tooth of each piston from the pitch-line *d*, for the purpose of preventing the teeth from making contact except upon one side of the line of centers of the pistons. This removal of the face of the tooth forms the bearing-ridge *a*, which is the only point of contact of the intermatching pistons, such ridge contact of the teeth of one piston being made with the convex faces *e* of the teeth of the other piston, the teeth of both pistons being alike and their bearing-ridges operating to make the contact, so that there can be no tendency to stick. It is this construction which effects the contact of one tooth only of each piston on one side of a line drawn through their centers, as shown in Fig. 1, and in every position of the joining teeth in approaching, crossing, and passing beyond said line. The joint of the pistons is thus maintained between two teeth until such contact is made between two other teeth. This construction, in connection with inlet and escape ports at the joint-forming ends of the pistons, allows a free escape of water-leakage between the intermatching teeth. In Fig.

1 this relation of the teeth is shown, in which the tooth D of the piston D′ is shown as entering the space 2 between the teeth of the piston D², so that the water from said space will flow out between the non-acting surfaces of the teeth D and A, which, by the concave face *c* of the tooth D and the convex face *e* and concave base *e′* of tooth A, form such outflow-passage on the side of the pistons next the outlet of the case. On the side of the pistons next the inlet of the case the tooth B is shown as leaving the space 3 between the teeth of the piston D′, and as the teeth D and B are in contact B and E will be separated sufficient to allow the water to fill the space 3, and thus give a free inlet and outlet leakage between the pistons. To reduce the area of the bearing-surface at the ends of the pistons, as shown in Fig. 4, and thus reduce friction, the inner sides of the ends of the piston-chamber are formed with diameter raised surfaces *i*, Fig. 3, of sufficient area to maintain a close joint with the end of each piston. That part, *i′*, of the raised surface *i* which crosses between the pistons is of a width only to act in unison with the teeth to make inlet and outlet ports or passages to allow a free escape of water-leakage, and prevent water choking between the teeth. The relation of this narrow raised surface to the teeth is shown in Fig. 1, wherein it will be seen that upon the inlet side of the pistons the tooth E has passed the edge of said bearing, and an opening is made at each end of the piston D′, to allow the water to enter the space 3 between said tooth and the next, thus filling the space, while upon the outlet side the water can escape from between the teeth D and A, through an opening made at each end of the piston D², by the edge of said bearing and the tooth A, which is moving toward said edge, until the tooth A closes said opening by passing upon the joint-forming surface. The width of this raised surface to form the leakage-ports is such as to allow the leakage to enter and escape between two intermatching teeth of each wheel as one tooth of each piston is leaving and approaching the opposite edges of said raised surface, and thus effect the free inlet and escape of the water from between the teeth-spaces at the junction of the pistons, and avoid the objection of water choking between the teeth. The bearing-surfaces at both ends of the pistons are formed and operate in the same manner in relation to the teeth. The toothed pistons are mounted loosely upon horizontal bearing-stems F, which are rigidly connected with the case G, and extend from one side thereof through the pistons, thereby causing them to run with much less friction.

The inlet and outlet ports H and I are on opposite sides of the pistons, and opposite their intermatching teeth, so that the flow will be in the spaces between the teeth and the walls of the case G, as shown by the arrows in Fig. 1, in which the direction of the inlet and outlet and the leakage flow are also indicated by arrows.

To prevent the impact of the inflowing water upon the pistons at their junction, which would cause strain upon their bearings, the inlet and outlet are enlarged or made flaring where they enter the meter-case, so that the water enters in a broad current and freely follows the motion of the pistons around between their teeth and the walls of the chamber. An equivalent construction would be two openings, each entering the case, so as to divide the inlet-passage and turn the water in opposite directions upon the pistons in the way of its outflow; but the outlet need not necessarily be of the same construction as the inlet. Were the driving-piston connected directly through the packing-box with the registering mechanism, there would be little value in the record of measurement, because of the friction of the packing, which, especially in small meters, would render such function unreliable.

To isolate the driving-piston from the retarding effect of the packing-box J of the case, I use intermediate gear—a simple arrangement of which is shown in Fig. 2—within a chamber, K, outside of and communicating with that within which the pistons operate, such outside chamber being formed by a division-plate, L, separate from the case and secured therein, so that its raised surface *i* forms a joint with the ends of the pistons. The intermediate gear consists of a short screw-stem, *f*, passing through the division-plate L, and secured by bearings—one, *g*, in the end of the fixed bearing F, on which the driving-piston turns, and the other, *h*, is an arm, *i′*, within the side chamber. The screw-stem *f* has a suitable coupling-connection, *j*, with the end of said piston, and a worm, *k*, matching with a worm-gear, *l*, on a short screw-stem, *l′*, which matches with a worm-gear, *l²*, on a rod, *m*, which is mounted in a bearing and extends through the packing-box J. A gear, *n*, on the rod *m* outside said box connects with the registering mechanism. Instead of the train-gear connection shown, a single gear may be used, by which to transmit the power of the driving-piston.

While the adaptation of the pistons for running loosely upon their bearings and transmitting their power by the worm-coupling gear, as described, is preferable, yet the pistons may be fixed upon and revolve with their shafts, and the driven piston or its shaft suitably connected with the intermediate gear, which may be worm or spur gear. This arrangement of the power-producing gearing is not modified by pistons having any particular form of teeth.

It is important that the toothed piston-wheels shall be as light as possible, and I find hard rubber or artificial ivory to be the best materials for the purpose, as they nearly float in water.

The case may be made with a cover, or in sec-

tions, and properly joined or covered to prevent leakage, and the inlet may be underneath and the outflow at the top of the case, but in the same relation to the pistons.

I have not shown the registering mechanism; but it will be understood that it is of the usual construction, and is connected with and operated by the pinion *n* outside of the case.

I have referred to the toothed piston D′ as the "driver" to distinguish it from the intermatching piston D², because the former is directly connected with and drives the registering mechanism, and the relative revolutions of the pistons are dependent upon their intermatching teeth, and not upon separate controlling-gearing. It is only in connection with a driver and a driven toothed piston having no connection with the power-transmitting gear that I obtain a smooth rolling motion of the pistons and relieve one of them from the direct friction of the power-transmitting gearing, and both from the direct friction of the stuffing-box.

I claim—

1. The pistons of a water-meter, having their teeth formed with a bearing-ridge, *a*, on one face, the opposite face, *e*, being convex, the said ridge of a tooth of one piston having a conjoint co-operation with the said convex face of a tooth of the other piston, to form a joint between the intermatching teeth of the pistons on one side only of a line drawn through their centers, and to reduce the friction of said joint-forming parts.

2. In combination, the pistons D′ and D², the stuffing-box J, the power multiplying and transmitting gear connecting with the piston D′ only, and the outside driving-gear, *n*, for the registering mechanism, connecting by the shaft *m* with the said multiplying-gear, the said pistons connected only by their intermatching teeth, and the said shaft *m* having no direct connection with said piston D², all substantially as described, for the purpose specified.

3. In a water-meter, intermatching toothed pistons of circular form, mounted loosely upon fixed bearings E, in combination with means for connecting one of said pistons with power-transmitting gear arranged between it and the packing-box, through which said gear is connected with the registering mechanism, outside of the meter-case, substantially as described, for the purpose specified.

4. The combination, in a water-meter, of the intermatching toothed geared pistons of circular form, mounted loosely upon bearings F within the case, with a coupling-stem, *f*, loosely connected with one, D′, of said pistons, and power-transmitting gear arranged between said piston D′ and the packing-box J of the case, substantially as described, for the purpose specified.

5. The piston-chamber having its closed sides formed with the raised surface *i i′*, crossing the ends of the pistons, of a width less than their diameter, and decreasing in width across the path of the intermatching teeth, whereby to reduce the bearing-surface of the ends of the pistons, and to allow of the free entrance and escape of the water from the spaces between the teeth in their passage over the narrow surface part *i′*, substantially as described.

6. The water-meter herein described, consisting of the case G, the toothed pistons of circular form, having teeth each constructed with a joint-forming ridge, *a*, power-transmitting gear arranged between said pistons and the packing-box J, the inlet constructed to divide the inflow into the case in the direction of the motion of the pistons, and raised joint-forming surfaces for the ends of the pistons, the said intermediate gear being connected with one of said pistons by a coupling-stem, *f*, having a non-fixed relation to the piston-bearing, substantially as described.

7. The combination, in a water-meter, of pistons of circular form, having intermatching teeth constructed with bearing-ridges *a*, adapted to form a joint between the teeth of the pistons on one side only of a line drawn through their centers, substantially as described, with an inclosing-case having raised surfaces extending diametrically across the ends of the pistons, and having the relation to their intermatching teeth substantially as described, for the purpose specified.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LEWIS H. NASH.

Witnesses:
EDWARD BARRACLOUGH,
WILLIAM M. BROWN.