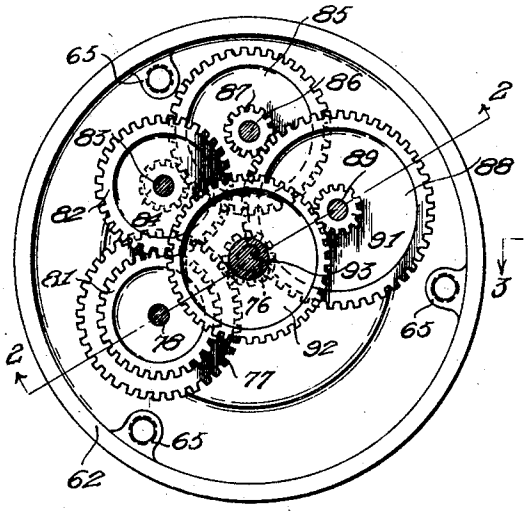
March 28, 1933. H. G. WEYMOUTH 1,903,074

METER

Filed April 6, 1929



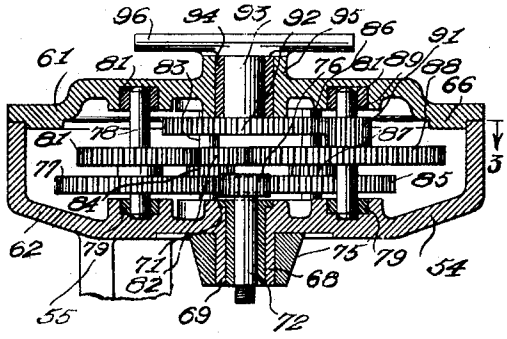


Fig. 2

Fig. 3

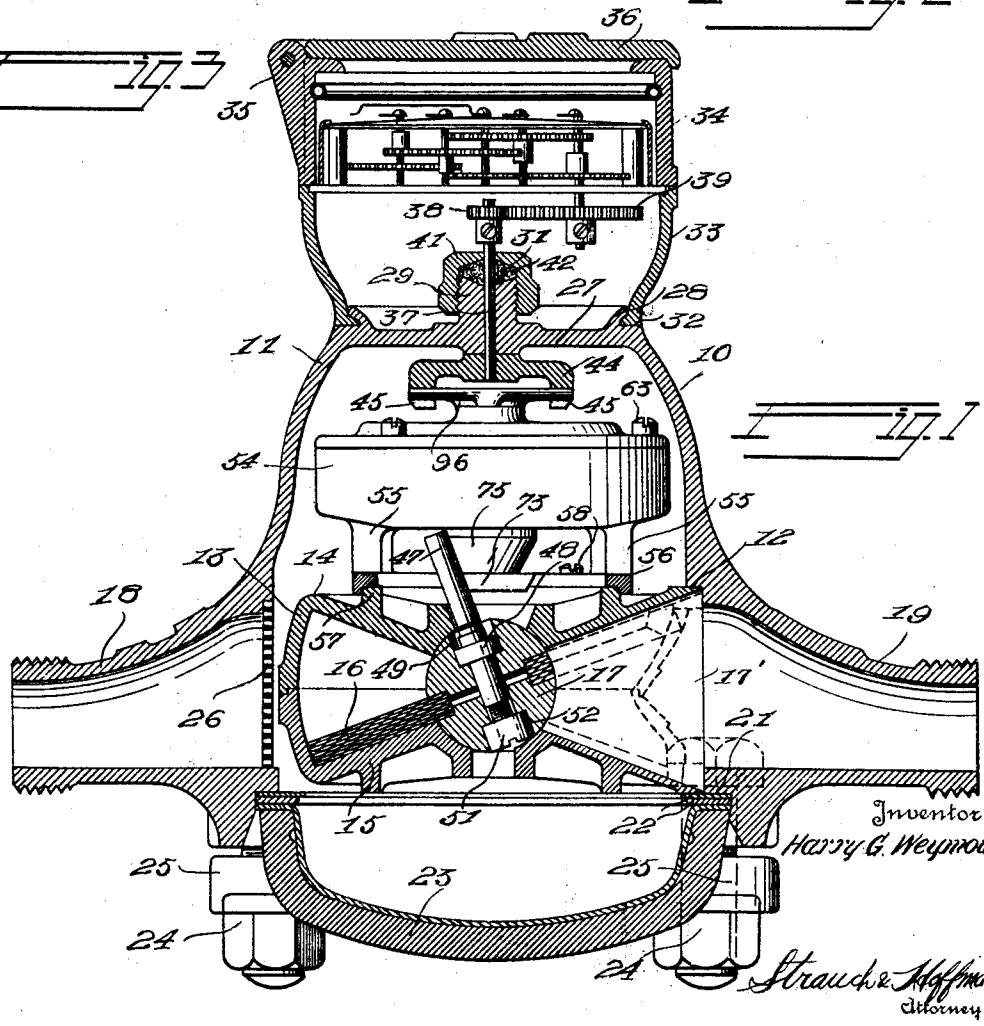


Fig. 1

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UNITED STATES PATENT OFFICE

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METER

Application filed April 6, 1929. Serial No. 353,186.

The present invention relates to meters.

More specifically, the invention relates to water or other liquid meters of the rotary or nutating disk type and pertains particularly to the reduction gearing in such meters, and to the manner of supporting and arranging such gearing.

Meters of this character, as is well known, comprise a casing provided with inlet and outlet openings between which openings are disposed measuring elements arranged to be actuated by the passage of the liquid from the inlet to the outlet thus imparting movement to a spindle, which in turn imparts movement to a gear train heretofore disposed in various ways in said casing above said measuring elements. The gear train is in operative connection with a registering mechanism mounted in a register box on said casing whereby said registering mechanism is driven by said gear train at a considerably reduced speed from that of said spindle.

The connection between the gear train and registering mechanism is ordinarily effected through a spindle rotatably mounted in a stuffing box designed to prevent leakage around the spindle. To accomplish this result successfully the stuffing box and spindle are constructed so as to provide a liquid-tight joint. Such a joint necessarily imposes a certain amount of friction on the spindle which must be overcome by the meter. As the meter is actuated by the flowing liquid, this resistance may become great enough, unless the gear reduction is ample, to render the meter unresponsive to small flows, because the resistance to the rotation of the spindle exceeds the forces exerted on the measuring elements by such flows, with the result that the liquid flows around said elements, which must be relatively loosely associated to avoid excessive friction at this point, without actuating them.

In the so-called "Arctic" meters, which are adapted for installation in very cold climates, provision is generally made for relieving the operating parts of permanent damage upon the freezing of liquid in the casing. This is sometimes effected by forming said bottom plate of the casing of cast iron held in place by securing lugs whereby upon the exertion of pressure by expanding ice, the securing lugs on said bottom plate are broken off, thus relieving the gear train from the effects of the expanding ice and thus avoiding permanent injury thereto.

In meters of this character it is desirable to make the upper portion of the gear casing small in diameter for making the pressure of the expanding ice more effective in breaking the bottom plate thus rendering the working parts less liable to injury should ice be formed by the freezing of liquid within the casing. The necessity for limiting the upper portion of the casing limits the space available for the insertion of the reducing gearing and has restricted the number of gears used in the reducing gear train.

Reduction gearing heretofore employed in meters is of differing constructions, but it has become quite customary to employ reduction gearing constructions that comprise three sets of gears. It has been proposed to enclose the reduction gearing in a closed casing for the reception of oil in which the gears are immersed and which casing is detachably supported in the meter casing in various ways, that do not insure accuracy in the mounting of the gearing with respect to the elements that cooperate therewith.

It has been found that with the three gear reduction gearing, the reduction was not sufficient to insure accurate operation of the meter on low flows due to the fact that the friction on the suffing box spindle was such as to impose sufficient resistance to prevent operation of the meter on such flows.

It is accordingly, a primary object of this invention to provide a reduction gear train embodying gears of usual form for liquid meters, which is compact and is interchangeable with gear trains now in use for effecting a substantially greater reduction in the speed of rotation of the registering mechanism operating spindle, so that the meter will operate on low flows.

It is a still further object of the present invention to provide a reduction gear train adapted for interchangeability with gear trains now in use, and comprising a casing

having a multiplicity of gears rotatably journaled therein, said casing adapted to be interposed between the nutating disk chamber and registering mechanism in accurate operative connection therewith.

A still further object of the invention is to provide a gear reducing train supported and arranged for convenient, ready, but accurate unitary insertion in a meter so as to provide relatively great reduction in speed of the register operating spindle, but arranged to operate with an extremely low friction opposing the actuation of the metering elements.

With the above objects in view as well as others, that will become apparent during the course of the following disclosure, reference will be had to the accompanying drawing forming part of same and in which:

Fig. 1 is a longitudinal vertical sectional view of a water meter disclosing an application of my invention thereto.

Fig. 2 is a transverse sectional view of the reduction gear train unit as seen on line 2—2 of Fig. 3, the gears being shown in elevation.

Fig. 3 is a horizontal section taken on line 3—3 of Fig. 2 particularly illustrating the compact arrangement of the individual gears in the gear casing.

Referring to the drawing by reference characters in which like characters designate like parts, 10 designates the meter casing which, as indicated at 11 is of relatively small diameter at the top thereof, in accordance with present practices.

Casing 10 is provided with an internal seat 12 to receive the metering mechanism. The space within casing 10 above seat 12 is designed for the reception of the reduction gearing. The metering mechanism or measuring chamber comprises a chamber casing 13 including a pair of hollow non-corrodible members 14 and 15 fitting accurately together and, preferably, presenting a slightly tapered exterior surface fitting snugly in casing 10. The interior of casing 13 is shaped in the usual manner for the reception of the nutating disk 16 and its central ball 17. Partition 17′ of well known form separates the inlet of casing 13 from the outlet of said casing, said outlet discharging into the meter casing outlet. These parts form no part of the present invention considered by themselves and apart from the combination in which they are used.

Casing 10 is provided with the usual inlet and outlet nipples 18 and 19. Casing 10 is further provided adjacent the bases of connections 18 and 19 with a seat 21 for the reception of suitable packing rings 22 against which the base of a cast iron cap 23 is secured by means of bolts 24 extending through slotted lugs 25, integral with cap 23, which lugs may be formed so that they will break off upon freezing of water in casing 10, thus avoiding damage to the metering mechanism.

As in usual practice, a suitable screen 26 is secured within casing 10 at the juncture therewith of inlet nipple 18.

The top of casing 10 is provided with a horizontal wall 27 provided with an outwardly diverging flange 28 and further provided centrally of flange 28 with a centrally vertically apertured externally threaded boss 29, which is indicated, is provided with a dished outer end 31. Flange 28 defines with casing 10 a recess 32 for the reception of the base of a bell shaped casing member 33 on the outer edge of which is supported the register box 34 in which is operatively supported the register mechanism. Pivotally secured to box 34 at 35 is an observation cover 36.

Rotatably supported in the aperture of boss 29 is a spindle 37 to the outer end of which is secured a pinion 38 meshing with a gear 39 within casing 33, which gear is operatively connected to the register mechanism within box 34 in well known manner. Threaded on boss 29 and defining therewith a stuffing box is a cap 41 between which and the outer end of boss 29 is disposed a packing 42 for preventing the ingress of water to the register mechanism as well as serving to retain lubricant for spindle 37. It is the packing 42 that tends to impose a resistance to rotation of the measuring elements. Carried by the lower end of spindle 37 is a fork or coupling element 44 provided with transversely alined recesses 45 for a purpose later explained.

As in usual practice ball 17 is provided with an axial pin 47 commonly called the control bar and which, as shown, further functions as a bolt for holding the parts of the ball together. To this end pin 47 is provided with a flange 48 seated in a recess 49 in one of the sections of ball 17 and the pin is threaded at the lower end thereof for engagement by a nut 51 seated in a recess 52 in the other section of ball 17.

As is well understood by those skilled in the art the flow of water or other fluid from inlet nipple 18 passes through an inlet in the disk chamber casing 13, passes around said casing imparting movement to the nutating disk 16 and then passes through outlet 19. The movement of said disk, imparts movement to pin 47 through ball 17, the motion of pin 47 being communicated to the integrating train or registering mechanism through spindle 37, meshing pinion 38 and gear 39 by an interposed reduction gearing unit or mechanism, which forms the particular subject matter of the present invention.

The reduction gearing unit comprises a cylindrical casing 54 provided with a plurality of supporting legs 55 integral there-

with. At the lower ends thereof said legs are integrally united with a ring 56 provided with an annular recess designed to snugly receive flange 57 of casing 13. Ring 56 and the gear casing are thus accurately located on the casing. Said ring is detachably secured by screws 58 to casing 13 in spaced relation thereto, as well as in accurate position for cooperation with pin 47 and spindle 37.

Reduction gear units, variously mounted for detachable engagement in various ways with the nutating disk chamber, have heretofore been provided, but such constructions are not entirely satisfactory on very low flows for the reason that the constructions were not provided with sufficient reducing gears to minimize the effect of friction imposed on the register operating spindle by the necessary packing of the stuffing box of that spindle.

Such prior constructions also failed to register small flows because of inaccuracies in the mounting of the reducing gearing introducing frictional resistance to the operation of the registering mechanism that prevented its operation on small flows due to the fact that the flowing liquid encountered less resistance in flowing around the measuring elements than in actuating said elements. The construction just described provides for the accurate location of the reducing gear with respect to spindles 47 and 37, since the locating surfaces on ring 56 and flange 57 may be finished with accuracy providing a construction of extreme simplicity and low cost that may be readily assembled so as to bring the parts of the gear train in exactly the position necessary to avoid the introduction of unnecessary friction due to improper alinement. The effect of the friction on spindle 37 on the metering elements is further minimized by increasing the amount of reduction in the movement of shaft 37 compared to the movement of disk 16.

The casing 54 is of substantially the same overall diameter as reducing gearing sets heretofore provided, so that it may be readily interchangeable for sets giving lesser reduction. It is further provided with gearing for effecting a much greater reduction in the speed of rotation of the register operating spindle without providing a cumbersome arrangement, whereby less resistance is imposed on the metering mechanism resulting in a certain, smooth and accurate operation of said mechanism under small flows.

Gear casing 54, as indicated, is provided with a detachable cover plate 61 which is preferably detachably secured to the body 62 of casing 54 by bolts 63, screw threaded into lugs 65 integral with body 62. Cover plate 61 is provided with an annular locating shoulder 66 accurately fitting in body 62 so as to properly and immovably locate the bearings in said cover plate in accurate alinement with the bearings in the bottom of said body.

The bottom of casing 54 is provided centrally thereof with a downwardly projecting sleeve 68 in which is positioned a bearing bushing 69 provided with a positioning head 71 in the form of an annular flange, said flange being countersunk in the outer end of sleeve 68. Rotatably journaled in bushing 69 is a shaft 72 to the inner end of which a dog crank 73 is secured. Said crank maintains the nutating disk pin guiding roller 75 in position on sleeve 68 with crank 73 positioned for operative engagement by pin 47 for rotation of shaft 72 upon movement of pin 47 induced by the movement of nutating disk 16.

Shaft 72 on the outer end thereof is provided with a pinion 76 in meshing engagement with a gear 77 provided with a spindle 78 the inner and outer ends of which are rotatably journaled in bearings 79 and 81 in body 62 and cover plate 61 respectively. Secured to spindle 78 in vertically spaced relation to gear 77 is a gear 81 of less diameter than gear 77. Gear 81 is in meshing engagement with a gear 82 secured to a spindle 83 rotatably journaled in bearings similar to bearings 79 and 81. Secured to spindle 83 below gear 82 is a pinion 84 in meshing engagement with a gear 85 secured to a spindle 86 also rotatably journaled in bearings similar to bearings 79 and 81. Secured to spindle 86 above gear 85 is a pinion 87 in meshing engagement with a gear 88 secured to a spindle 89 rotatably journaled at the inner and outer ends thereof in bearings 79 and 81 in body 62 and cover plate 61 respectively. Secured to spindle 89 above gear 88 is a pinion 91 in meshing engagement with a gear 92 provided with a vertically extending shaft 93 rotatably journaled in a bearing bushing 94 in a cylindrical extension 95 of cover plate 61. Shaft 93 is provided with a laterally projecting actuating pin 96 for operative engagement with recesses 45 of coupling element 44 before referred to for imparting rotation to spindle 37.

It will be seen from the foregoing disclosure that the individual gears and cooperating pinions are supported on spindles and shafts rotatably journaled in vertically alined bearings in cover plate 61 and casing body 62 whereby assembly as a unit with the measuring chamber may be expeditiously effected. At the same time all of the parts projecting from the reduction gear casing are brought into exactly the proper position for efficient cooperation with the metering and registering elements, minimizing friction in the operation of the whole assembly.

It will be further seen that while a comparatively large number of gears (here indicated as five sets in number) are employed for effecting a greater speed reduction of spindle 37 the gears are so disposed relative to each other as to provide a compact ar-

rangement, whereby the enclosing casing therefor does not occupy more space than reduction gearing now in use, but giving much less reduction, whereby the casing can be readily accommodated in the upper reduced casing section of meters now in use. Accordingly, the novel gearing arrangement may be readily substituted for gearing now in use in order to reduce friction and secure operation of the register on low flows. The invention has been shown as applied to a meter of the nutating disk type, but it may be readily applied to other types of meters.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What I claim and desire to secure by United States Letters Patent is:

1. A unitary reduction gear train adapted for detachable connection in a water meter for imparting rotation of the driving means to the register at substantially reduced speed; said gear train comprising a casing consisting of a body portion and a removable cover plate, a vertically disposed shaft rotatably journalled in the base of said body portion, said shaft provided with means on the end thereof external to said casing for driving engagement with said driving means and provided on the opposite end thereof with a pinion, a vertically disposed spindle rotatably journalled at opposite ends thereof in said body portion and said cover plate, a gear carried by said spindle in operative engagement with said pinion, a second gear carried by said spindle in vertically spaced relation to said first gear, a second vertically disposed spindle rotatably journalled at opposite ends thereof in said body portion and said cover plate, a gear carried by said second spindle in operative engagement with said second gear of said first spindle, a pinion carried by said second spindle below said gear carried thereby, a third vertically disposed spindle rotatably journalled at opposite ends thereof in said body portion and said cover plate, a gear carried by said third spindle in operative engagement with said pinion carried by said second spindle, a pinion carried by said third spindle above said gear carried thereby, a fourth vertically disposed spindle rotatably journalled at opposite ends thereof in said body portion and said cover plate, a gear carried by said fourth spindle in operative engagement with said pinion carried by said third spindle, a pinion carried by said fourth spindle above said gear carrier thereby, a shaft rotatably journalled in said cover plate in vertical alinement with said first shaft, said last shaft provided on the end thereof external to said casing with means adapted for driving engagement with a register and provided on its opposite end with a gear in operative engagement with said pinion carried by said fourth spindle; said gears and said pinions being of such relative dimensions that the speed of rotation of said last shaft is greatly reduced.

2. The combination defined in claim 1 in which said spindles are rotatably journalled in vertically alined bearings in said body portion and said cover plate, and in which said cover plate is provided with an annular flange to aline it with said body portion.

3. The combination defined in claim 1 in which said spindles are disposed in partially encircling relation to said vertically alined shafts and in substantially equally spaced relation thereto whereby a reduction gear train of substantial compactness is provided.

4. A liquid meter having a supporting casing; a measuring chamber rigidly positioned therein; a registering mechanism rigidly positioned in said casing in fixed cooperative relation to said measuring chamber; a train of five sets of reduction gears disposed in said casing between said measuring chamber and said registering mechanism, and having driving and driven shafts associated therewith; a housing formed of a cup shaped container and a cover completely enclosing said reduction gears fixedly mounted in said casing between said registering mechanism and said measuring chamber, said housing and gears therein being readily insertable into a meter having a lesser number of sets of reduction gears; said driving shaft extending through the bottom of said container; an elongated bushing carried solely by said container and supporting said driving shaft; said driven shaft extending through said cover, and an elongated bushing carried solely by said cover and supporting said driven shaft.

In testimony whereof I affix my signature.

HARRY G. WEYMOUTH.