United States Patent

Painley

[15] **3,688,091**

[45] **Aug. 29, 1972**

[54] **ONE WAY DRIVE FOR REMOTE READER REGISTER**

[72] Inventor: **Elmer F. Painley,** Uniontown, Pa.

[73] Assignee: **Rockwell Manufacturing Company,** Pittsburgh, Pa.

[22] Filed: **Aug. 7, 1970**

[21] Appl. No.: **62,094**

[52] **U.S. Cl.** .....**235/92 H,** 235/94 R

[51] **Int. Cl.** **G06f 7/38,** B67d 5/22

[58] **Field of Search** .....235/92 H, 94 R, 95, 96, 97, 235/103, 103.5; 73/490; 340/177

[56] **References Cited**

UNITED STATES PATENTS

3,100,062	8/1963	Spalding	235/94 R
3,016,192	1/1962	Cook, Jr. et al	235/94 R

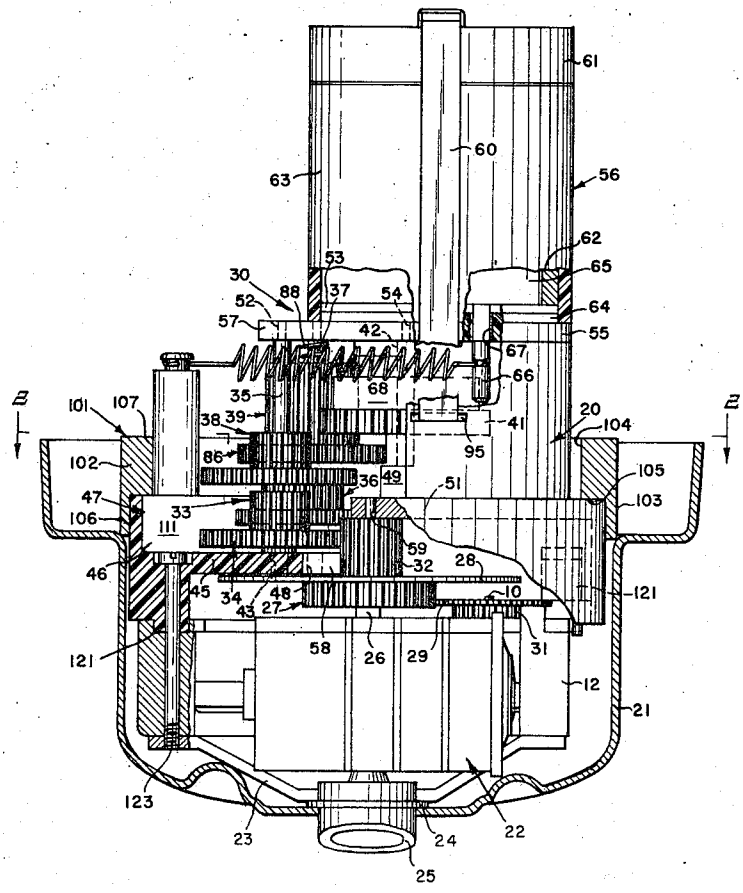
Primary Examiner—Daryl W. Cook

Attorney—Strauch, Nolan, Neale, Nies & Kurz

[57] **ABSTRACT**

A meter register readable at the meter site and including one-way driving gearing for an impulse generator transmitting electrical pulse currents for energizing a reader located at a point remote from the meter register.

6 Claims, 3 Drawing Figures

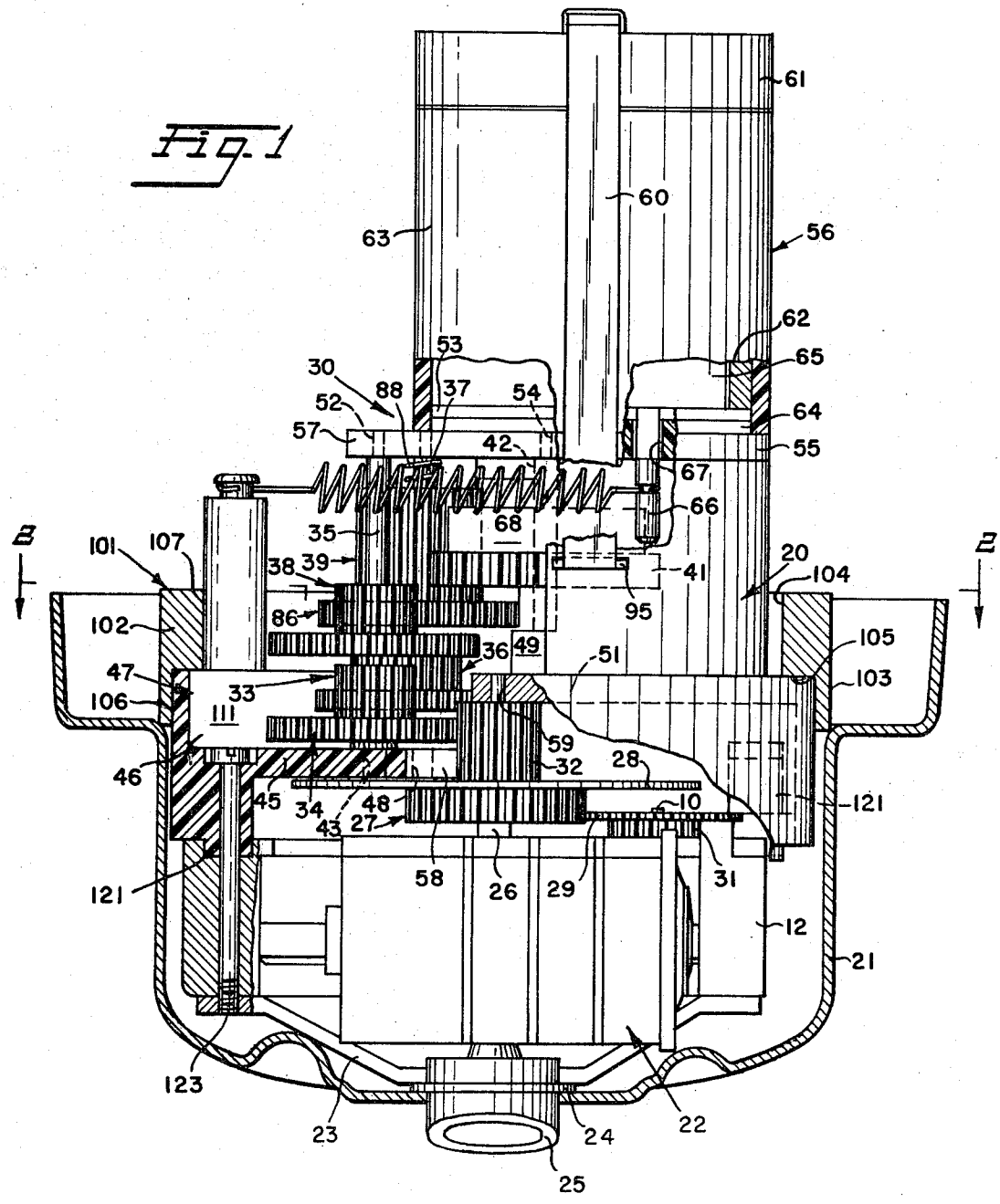


PATENTED AUG 29 1972

3,688,091

SHEET 1 OF 2

Fig. 1



INVENTOR

ELMER F. PAINLEY

BY Strauch Nolan Neale Nies & Kurz

ATTORNEYS

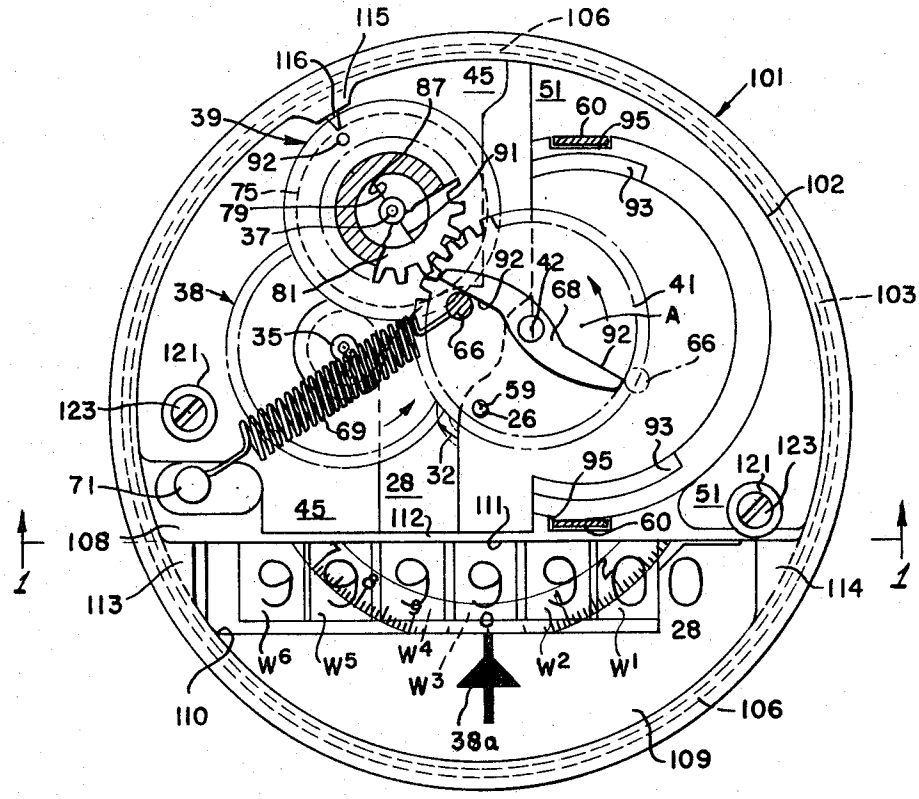


Fig. 2

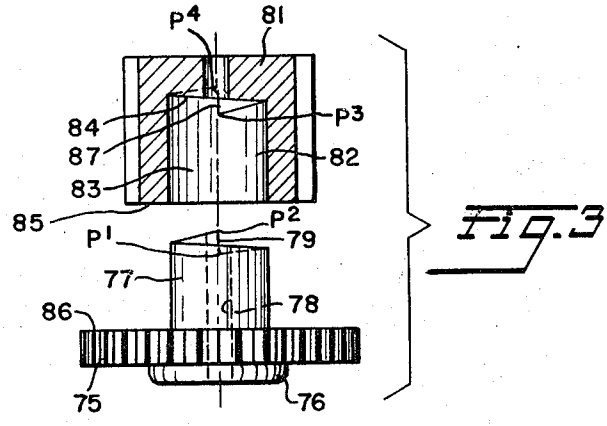


Fig. 3

INVENTOR

ELMER F. PAINLEY

BY Strauch Nolan Neale Nies & Kurz
ATTORNEYS

ONE WAY DRIVE FOR REMOTE READER REGISTER

BACKGROUND OF THE INVENTION

The present invention comprises an improvement of the drive gear train for the impulse generator of the Self Generating Remote Reader Register disclosed in copending application Ser. No. 822,246 of D. J. Gestler, Z. Kovats, and A. W. Kolakowski filed May 6, 1969, and owned by the assignee of the present application. The drive gear train of the prior application, while a distinctive improvement and simplification of the remote reader register drives of the type exemplified by U.S. Pat. Nos. 2,991,652 to R. S. Bassett issued July 11, 1961, 3,039,311 to R. S. Bassett issued June 19, 1962, 3,118,075 to M. J. Dunn et al. issued Jan. 14, 1964, and Swiss Letters Patent 363,266 to Contiga, Societe Anonyme issued July 15, 1962, like the prior structures, does not prevent damage to the gearing system by permitting slippage or preventing lock up where the meter is run in reverse direction as when backflow occurs and does not (1) permit reversal of the register odometer for the purpose of zeroing the number wheels or reducing the reading which is sometimes required, (2) permit reverse running of the meter register without destroying synchronization between the register odometer and impulse generator, and (3) permit advancement of the impulse generator drive cam gear to reduce testing time during factory assembly of the impulse generator without disrupting the desired synchronization of the register odometer and impulse generator. The present invention, while providing all the advantages of the structure of the aforesaid copending application, permits the attainment of the additional advantages suggested above by providing a one way drive connection in the drive gear train of the impulse generator. In addition, the present invention synchronizes the pulse generator with the odometer to obtain output pulses at the zero mark (or some predetermined number) of the lowest order numeral on the odometer.

While adaptable to any meter register having a rotating output shaft, the one way remote reader drive of the present invention is particularly suited to low torque registering mechanisms of the magnetic drive type illustrated in the aforesaid copending application where the register mechanism can be produced as a distinct and separable unit for ready removal, servicing, and/or replacement without the need of disrupting the fluid flow line.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a simple, rugged, and long lasting one-way impulse generator drive connection between the on site register mechanism and the impulse generator.

It is a further important object of the present invention to provide a meter register and impulse generator composed of an assembly of respective separate units one of which, the impulse generator unit, includes a one way drive gear train which automatically disrupts the drive train to the impulse generator in event of a reversal of the meter register drive train due to a back flow of fluid through the meter or reversal of the register odometer for the purpose of zeroing the number wheels or reducing the odometer reading while maintaining proper synchronization of the respective drive trains.

A further object of the present invention resides in the provision of a meter register and impulse generator composed of an assembly of respective separate units one of which, the impulse generator unit, includes a one way drive gear train which automatically disrupts the drive train to the impulse generator ahead of the impulse generator drive cam gear to permit independent advancement of the drive cam gear toward its release point to reduce the time required for testing the impulse generator during factory assembly while maintaining proper synchronization of the respective drive trains.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects will appear from the following description and appended claims when read in conjunction with the accompanying drawings wherein:

FIG. 1 comprises a partial vertical sectional view of a fluid meter register assembly equipped with an impulse generator one way drive gear train in accord with the present invention, with the alignment ring in place, taken substantially along line 1—1 of FIG. 2;

FIG. 2 is a top plan view of the fluid meter of FIG. 1 with the impulse generator removed, the output gear of the impulse generator drive train broken away and the one way drive gear sectioned in the plane of the one way drive connection to show the intermeshing of the one way drive connection; and

FIG. 3 is an exploded view illustrating the two piece construction of the compound gear and pinion (the pinion being shown in vertical cross section) to further illustrate the one way drive connection.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With continued reference to the drawings wherein the same reference numerals are employed throughout to indicate the same parts, numeral **20** indicates generally a meter register and impulse generator assembly disposed in a cup-like casing **21** forming the housing for the register gear train assembly **22** mounted on support frame and bracket **23** staked to flange **24** of a support post **25** housing the register drive spindle (not shown) of a magnetic drive piston meter, and the impulse generator subassembly **30** as more fully shown and described in the aforesaid copending application. The upwardly protruding shaft **26** fixedly mounted in the upper wall of register gear train support frame **22** journals a compound gear **27** carrying a transparent disk **28** of high impact strength clear polycarbonate (Lexan brand of General Electric Co.) the peripheral upper face margin of which is etched to provide a series of 100 equally spaced, radially directed, line markings adapting disk **28** together with painted arrow **28***a* to indicate incremental readings of the tens wheel of the meter odometer register wheel W^1 to tenths or other preselected fractions. Gear **27** is driven by compound transfer gear **29** fixed to odometer input drive shaft **10** and driven through its pinion gear portion **31** by the conventional register drive gear train (not shown) carried by support frame **22**.

Pinion portion **32** of gear **27** projects upwardly into the bottom opening recess of the base ring **46** of

generator support frame assembly **47** into driving engagement with the input gear **34** of impulse generator drive gear train **33** forming a part of the impulse generator subassembly **30**.

Gear train **33**, corresponding to that of FIGS. **9** and **10** of the aforementioned copending application, is designed to drive an impulse generator forming a part of subassembly **30**, the generator being designed to generate an electrical pulse signal for energizing a remotely located reader arranged to record 1,000-gallon increments of fluid registered by the meter odometer.

Referring particularly to FIG. **1**, gear train **33** is composed of compound input gear **34** journalled on upstanding shaft **35**; a second compound gear **36** journaled on shaft **37**; a third compound gear **38** journaled on shaft **35**; a fourth output compound gear **39** journaled on shaft **37** and drivingly engaged with a generator drive cam gear **41** journaled on shaft **42**. All of these shafts are idle shafts and have their lower ends press fitted into respective through bores provided in laterally oppositely directed partition walls of a base ring **46**. Thus shaft **35** is press fitted in through bore **43** of spacer rib **44** of partition wall **45** of base ring **46**, shaft **37** is press fitted in through bore **48** of partition wall **45**, and shaft **42** is press fitted in a bore formed in upstanding spacer boss **49** of partition wall **51** of base ring **46** oppositely related to partition wall **45**. The upper ends of these shafts are in turn freely but closely received in through bores **52**, **53**, **54** provided in bottom end plate **55** of three part generator assembly **56**. Bottom end plate **55** is generally cylindrical in configuration and provided with a segmental, laterally protruding, flange **57** containing through bores **52** and **53**. As best seen in FIG. **1**, partition wall **45** is provided at its inner end with a notch **58** to receive pinion **32** while the inner end of partition wall **51**, which is offset upwardly from partition wall **45**, is through bored at **59** to freely closely receive the upper end of shaft **26** journaling compound gear **27**.

The three part generator assembly **56**, fixedly mounted on base ring **46** by diametrically opposed spring metal clamp straps **60**, is composed of bottom end plate **55**, a cylindrical top end plate **61** and magnetic stator assembly **62** fixed to insulated housing **63** the opposite ends of which have a pressed fitted engagement with respective annular flanges **64** (that of end plate **55** only being shown) integrally formed on end plates **55** and **61**. The generator rotor **65** is carried by a rotor shaft journalled in concentric, coaxially aligned blind bores (not shown) in end plates **55** and **61** as more fully shown and described in the aforesaid copending application. Rotor **65** carries in radially outwardly spaced relation to the rotor axis A (FIG. **2**) a depending drive pin **66** (FIGS. **1** and **2**) extending downwardly through an arcuate slot **67** formed in end plate **55** radially outwardly of through bore **54** supporting the upper end of shaft **42**. As will be apparent from an inspection of FIGS. **1** and **2**, shaft **42** is offset radially to the left of the axis A of generator assembly **56**. The upstanding diametrically disposed double armed camming vane **68** of drive cam gear **41** is disposed to drivingly cooperate with drive pin **66** during its continuous, normal, slow speed counter clockwise rotation (see FIG. **2**) by gear train **33** until pin **66** passes the dot-dash illustrated position of FIG. **2** to release pin **66**. Upon its release from camming vane **68**, the tensioned spring **69** connected at one end to spring post **71** and its other end to pin **66** snaps pin **66** and the attached generator rotor at high speed clockwise generating an electrical impulse to energize the remote reader drive circuit (not shown) shown) as more fully explained in the aforesaid copending application.

The generator one way drive gearing of the present invention is effected by constructing one of the compound gears of gear drive train **33**, preferably output gear **39**, in two parts as shown in FIG. **3**. As there shown the wheel gear part **75** is formed with an integral, shallow spacer hub **76** on one face, a reduced diameter stub shaft section **77** on its other face, and a through shaft passage **78** dimensioned to have a journal fit with shaft **37**. The free end of shaft section **77** slopes in helical fashion from a point p^1 axially along a preselected spiral or helical lead relative to point p^1 to a point p^2 to provide an axially directed clockwise facing abutment or driving shoulder **79**.

The pinion gear part **81** is formed as a separate member having a stepped through bore **82** the larger diameter portion **83** of which is diametrically dimensioned to have a free journal fit on shaft section **77** and the smaller diameter portion of which is diametrically dimensioned to have a journal fit with shaft **37**. The length of larger diameter portion **83** is delimited by an axially facing abutment wall **84** which slopes in helical fashion from a point p^3, spaced inwardly from face **85** an axial distance equal to the axial distance of point p^1 from face **86** of gear part **75**, axially along the same preselected spiral or helical lead chosen for the free end face of shaft section **77** to point p^4 to provide an axially directed, counterclockwise facing abutment or driven shoulder **87**. When pinion part **81** is assembled on shaft section **77** by shifting it axially along shaft section **77** while rotating it, shoulders **79** and **87** will come into axial alignment and engage, the sloping abutment wall **84** of pinion part **81** will lie in full surface abutting contact with the abutting contact with the opposed sloping end of shaft section **77**, and the two parts of compound gear **39** will be assembled to rotate clockwise as seen in FIG. **2** as a unit. As a consequence of normal operation of the meter register a biasing spring **88** (FIG. **1**) acting between the upper end face of pinion part **81** and bottom end plate **55** of generator assembly **56** yieldingly maintains the gear parts in cooperating mating assembled relation.

In order to utilize the one-way drive arrangement of this invention for synchronizing the impulse generator with the register odometer, the upper or closed face of pinion part **81** is provided with a radially directed reference mark or line **91** (FIG. **2**) lying 180° offset from and in the diametrical plane defined by its abutment shoulder **87**. The face **86** of gear part **75** outwardly of the portion covered by pinion part **81** and at a point in the radial plane defined by its driving shoulder **87** is provided with a reference mark **92** shown as a through drilled passage to be used to effect rapid factory testing and synchronization of the register drive gear train and impulse generator drive gear train **33**.

Referring for the moment to FIG. **2**, synchronization of the generator drive gear train **33** to generator drive

pin 66 is first effected by assembling gears 34, 36, 38, and 39 on their respective shafts and rotating them in a direction to advance gear wheel part 75 into driving engagement with pinion part 81 and to bring reference mark 91 into alignment with a corner of a leading face 92 of either vane 68 of drive cam gear 41, which gear may be axially shifted on its shaft 42 out of engagement with pinion part 75 to effect such alignment. Once this relationship between gear 41 and pinion part 81 is established, subassembly 30 is completed by stalling generator assembly 56, with drive pin 66 rotated to the solid line position of FIG. 2, onto the upstanding arcuate lugs 93 of semicylindrical wall segment 94 forming an integral part of partition wall 51 of base ring 46 while interfitting the upper ends of shafts 35, 37 and 42 into the passage provided therefor in bottom end plate 55 (FIG. 1) and hooking the opposite ends of spring metal clamp straps 60 into diametrically opposed arcuate recessed 95 (FIG. 2) formed in wall 94 and over the edge of top end plate 61.

The assembled generator subassembly unit 30 is then given an operating test to determine its electrical effectiveness on a motorized runner preparatory to assembling the impulse generator subassembly 30 with the register subassembly 22 and synchronizing the generator drive gear train 33 with the register drive gear train and the odometer driven thereby.

To effect this latter synchronization, an alignment ring 101 adapted to telescope downwardly over base ring 46 is provided by this invention for use in factory assembly of subassemblies 22 and 30. As best seen in FIG. 1, ring 101 has a main body portion 102 defining with a dependent peripheral flange 103 a stepped bore 104 the annular axially facing shoulder 105 of which abuttingly engages the upper marginal face of base ring partition wall 51 and the upper edge of arcuate dependent flange 106 forming the ring portion of base ring 46. Ring 101, at the points of intersection of a plane defined by laterally extending wall face 111 of chordally directed rib 112 delimiting the lower edges of base ring partition walls 45 and 51, and the inner edge of a depressed window well 109 in base ring 46, is provided with chordally opposed, inwardly directed lug formations 113 and 114 integrally formed on the portion of bore 104 defined by main body portion 102 of ring 101. Lug formations 113 and 114 are designed to overly similar formations formed on base ring 46 at the intersection of flange 106 and the adjacent ends of rib 112 with their chordally aligned wall faces abutting the ends of rib wall 111 thereby angularly orienting ring 101 relative to base ring 46 and the generator drive gear train 33 carried thereby. Ring 101, at an empirically predetermined point 56° clockwise from lug formation 113, determined by the position of reference mark 92 when gear train 33 of the presynchronized generator assembly 30 is disposed as shown in FIG. 2, is formed with an inwardly directed arcuate rib 115 overlying flange 106 and an arrowhead type pointer 116. Pointer 116 establishes a reference point along base ring 46 to which reference mark 92 of previously synchronized generator assembly 30 is to be related as will now be pointed out.

Final synchronization is effected by rotating odometer counterwheels W^1 to W^6 (FIG. 2) to read 999990 and then positioning the generator drive gear train by manually rotating gear train 33 until opening 92 of gear part 75 appears opposite pointer 116. This will align the impulse generator drive gear train 33 up to generator one way drive, with the register drive gear train. The positioning is maintained as generator subassembly 30 with alignment ring 101 is place is lowered onto register support frame 22 while interfitting register shaft 26 of gear 27 into journal bore 59 of partition wall 51 and bosses 121 (FIGS. 1 and 2) integrally formed on the inner wall of base ring 46 into bosses 122 of register support frame 20 and meshing the ring gear of compound gear 34 (FIG. 1) with pinion 32 of register compound gear 27. Such positioning fixes base ring 46 and support frame 22 against relative angular shifting movement and locks generator gear train 33 due to the meshing engagement of pinion 32 and the ring gear of compound gear 34. Gear part 75 is now released and securing screws 123, entered through mating bosses 121 and 122 and threaded into suitably tapped bores in support frame bracket 23, are screwed home to secure the meter register impulse generator assembly 20 with its gear trains fully synchronized to bracket 23. Preloading is then accomplished by rotating gear 81 clockwise, allowing abutment wall 84 to ride up the helix of gear 75 against the bias of spring 88 until shoulders 79 and 87 come into registry at which time pinion 81 will move axially under the bias of spring 88 to engage shoulders 79 and 87. This will bring the generator parts into position of FIG. 2 with drive cam gear 41 positioned just before the point of release of rotor drive pin 66 (the relative position of vane face 90 and the dot-dash showing of pin 66 in FIG. 2).

After fastening, ring 101 is removed and the assembled meter register and impulse generator assembly then has electrical leads (not shown) connected to a cover member and the cover member then hermetically sealed to casing 21, as is more completely described in above-mentioned Ser. No. 822,246. Final operational testing is effected by drivingly associating the cup-like casing 21 with a factory maintained fluid test meter, the manner of association and operation being more fully explained in the aforesaid copending application, to advance units wheel W^1 through one complete revolution at which time the odometer wheels should return to zero reading (000000), all gear wheels should occupy their respective relative zero positions, and generator assembly 56 will have been released and rotated at high speed under influence of spring 69 to return drive pin 66 and its associated rotor clockwise as viewed in FIG. 2 to create a pulse current discharge effective to energize the remote reader (not shown). Actually the final test time is reduced by this invention to one-tenth (4 minutes) of the final test time (40 minutes) required in a unit without the rotor advance provided by the one-way drive of this invention.

Since one way drive gear 39 permits gear part 75 to overrun pinion part 81 upon reverse movement of gear part 75, the present invention preserves the established initial synchronization and the remote meter reading:

1. while permitting reversal of the register drive gear train and the generator drive train gears anterior to pinion part 81 due to backflow through the meter or when authorized personnel find it necessary to zero the number wheels or reduce the odometer register reading;

2. assuring disclosure of tampering with the odometer reading by unauthorized persons to escape proper charges; and

3. while permitting the reduction in factory testing time as previously pointed out.

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 is claimed and desired to be secured by Letters Patent is:

1. In combination with a fluid meter register including a register drive gear train, an impulse generator assembly including a generator drive gear train driven from the register drive gear train and having as its output a generator drive cam gear, the improvement which comprises a one-way drive connection within said generator drive gear train, said one-way drive connection normally conditioning said generator drive gear train to drive said impulse generator so long as said register drive train is driven forwardly and being operative to disrupt said generator drive gear train upon reversal of said register drive gear train.

2. The improvement of claim 1 wherein the one way drive connection comprises driving and driven rotating members coupled by means of oppositely facing, axially directed abutment surfaces formed by opposing helical end faces, and spring means arranged to bias one of said members axially to engage said end faces, whereby said generator drive gear train drives said impulse generator in one direction only.

3. The improvement of claim 2 wherein the one way drive connection comprises one of the compound gears which is constructed in two separate parts to provide (1) a gear wheel part having an integral stub shaft on one face the free end of which defines a helix having an axial lead in a direction away from said one face to provide an axially directed abutment surface inclined to face in the direction of rotation of said gear wheel; (2) a pinion part having a recess opening through one end dimensioned to rotatably receive said stub shaft, the inner end of said recess defining a helix having an axial lead in a direction away from said one end to provide an axially directed abutment surface inclined in a direction opposite the direction of rotation of said gear wheel part whereby said opposing abutment surfaces define oppositely facing, axially directed, driving shoulders disposed to be in driving contact so long as the gear wheel portion acts as the driver and will separate upon overrunning rotation of said pinion portion disrupting the driving connection and due to the relative movement of said helical surfaces, acting to shift said pinion part axially along said stub shaft in a direction away from said one face of said gear wheel portion; and (3) a biasing spring engaging the other end face to yieldingly resist said shifting movement and return said pinion part to normal meshed engagement when said axially directed shoulders become aligned.

4. The improvement of claim 3 wherein the two part compound gear comprises the gear of the generator drive gear train meshed with said drive cam gear, the other end face of the pinion part is provided along a radius lying in the plane defined by its axially directed, driving shoulder with a synchronization reference mark used in assembling the generator drive cam, and said generator drive cam comprises a gear wheel having an upstanding, henerally diametrically directed, camming vane on one face, one of the leading corners of which is aligned with said reference mark to establish synchronization between the drive cam gear and the impulse generator drive train.

5. The improvement of claim 4, wherein said impulse generator assembly includes a support ring for said generator drive gear train, the one face of said gear wheel part of said two part compound gear carrying said stub shaft is provided along a radius defined by its axially directed driving shoulder with a synchronization reference mark; an alignment ring selectively removably associated with said support ring of said impulse generator assembly is provided for assembling said generator assembly and fluid meter register, said alignment ring and support ring including cooperating engaging elements to predetermine a relative angular orientation of said alignment ring on said support ring, and said alignment ring having a reference pointer fixedly angularly related to said orientation engaging elements and with which said gear wheel synchronization reference mark is aligned by manually rotating the generator drive train to establish a preselected preloaded condition of said impulse generator drive gear train to be maintained as the impulse generator assembly is assembled with the register drive gear train.

6. In combination with a fluid meter register having a register drive gear train, an impulse generator assembly including a generator drive gear train driven from said register drive gear train and adapted to energize a remote register, the improvement comprising a one way drive connection within said generator drive gear train, said one way drive connection normally conditioning said generator drive gear train to drive said impulse generator so long as said register drive train is driven forwardly and being operative to disrupt said generator drive gear train upon reversal of said register drive gear train.

* * * * *