Oct. 22, 1957 A. F. LOEFFLER ET AL 2,810,522

COUNTER

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Fig. 1

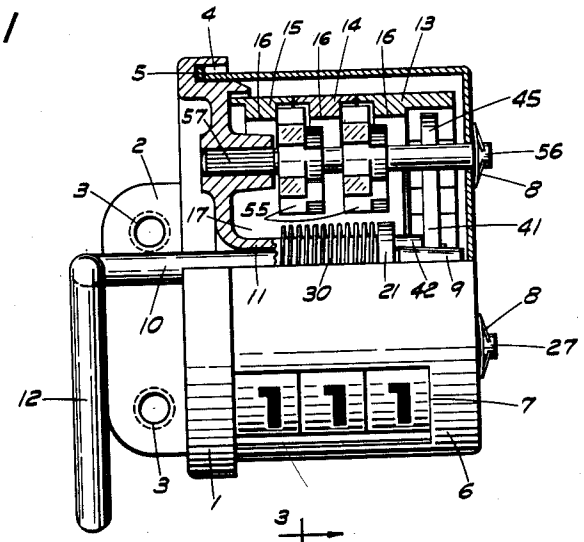
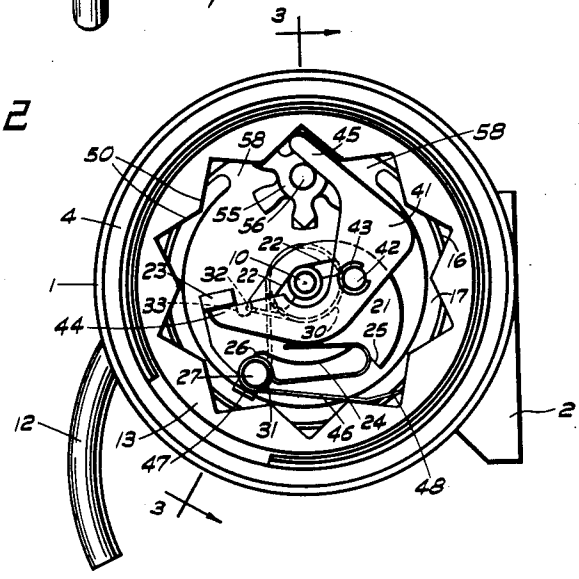


Fig. 2



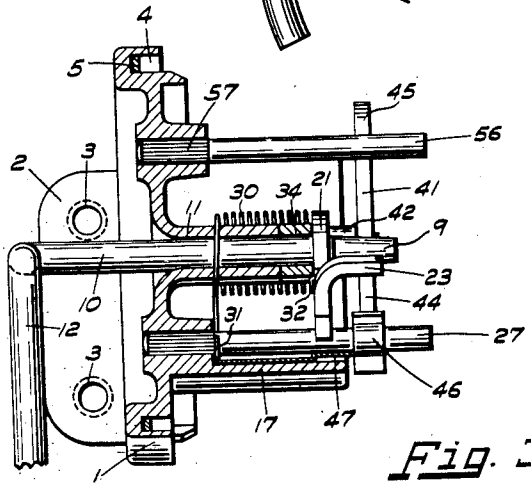


Fig. 3

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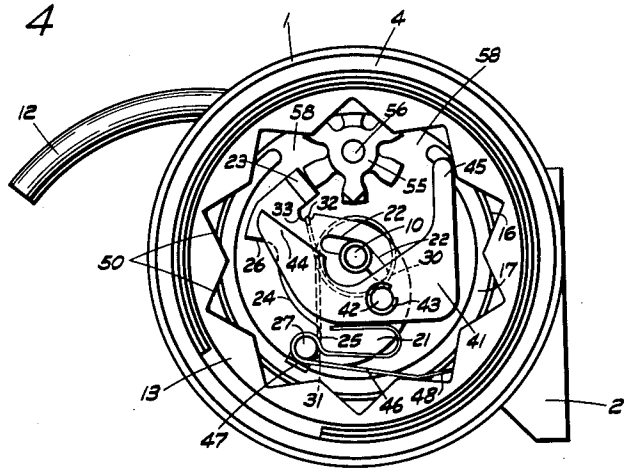
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COUNTER

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Fig. 4



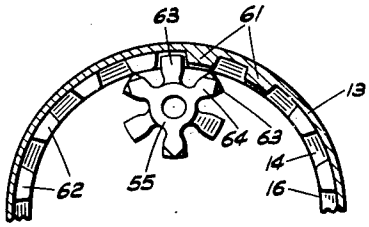


Fig. 5

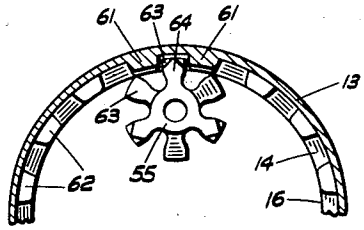


Fig. 7

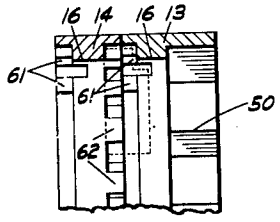


Fig. 6

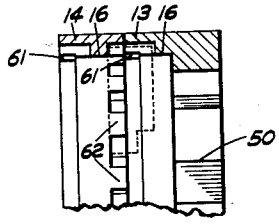


Fig. 8

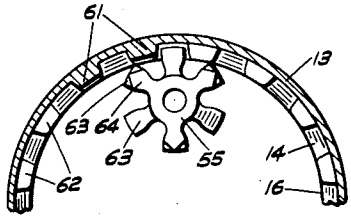


Fig. 9

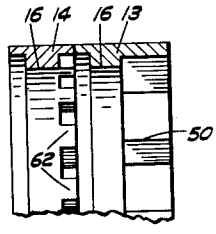


Fig. 10

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COUNTER

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Application April 29, 1954, Serial No. 426,392

2 Claims. (Cl. 235—117)

This invention relates to a counter of the type which registers an increase of one digit each time its operating shaft is turned through a partial revolution and permitted to return to normal position.

Counters of this type regularly include an operating shaft projecting from a housing and arranged to impart step-by-step rotational movement, through suitable intermediate mechanism within the housing, to a first digit wheel which in turn imparts rotational movement to a plurality of adjacent number wheels by means of transfer mechanism which becomes operative when the digit wheel passes through a position corresponding to its digit "9" to a position corresponding to its digit "0."

Driving force for the counter may be supplied to its shaft by any suitable reciprocatory driving element, whose number of reciprocations it is desired to count, through a crank arm clamped on an exposed end of the shaft.

Counters of the type described in general terms in the preceding paragraphs have heretofore been encumbered with certain inherent disadvantages which this invention seeks to remove. For example, inertia overtravel has been a frequent source of trouble. By this is meant that the counter responds to an extremely rapid movement of the driving member by registering or counting more than one digit when only a single movement of the driver was supposed to be counted, thereby introducing a cumulative error in the final summation recorded by the counter.

Another disadvantage in step-by-step prior art counters results from transferring intermittent driving force from an oscillating shaft to a revoluble digit wheel through intermediate mechanism having elements arranged in such manner as to develop considerable radial bearing thrust on the pivots which interconnect the mechanism. This, of course, increases both wear and friction between the parts so that the life of the counter is reduced and the amount of power required to operate it is increased.

It is among the objects of this invention to overcome inertia overtravel by providing the counter with a single ratchet element which performs the functions of driving the digit wheel, acts to positively arrest its circumferential movement at the termination of each step counted, and prevent its reverse rotation regardless of the rotational velocity imparted to the operating shaft.

Another object is to arrange the ratchet element for being driven by a force applied normal to its axis of rotation and so that it transmits force in a like manner in a direction tangent to the circumferential path of the digit wheel, thereby minimizing radial thrust, insofar as possible, on all moving parts.

Still another significant object of the invention is to make the operating crank arm angularly adjustable with respect to the counter body, so that it may be conveniently aligned with a driving member, through frictionally coupling the operating shaft to the actuating mechanism interiorly of the counter housing.

Fulfillment of these and other objects will become more apparent in the following description of an embodiment

of the invention read with reference to the accompanying drawings wherein:

Fig. 1 is an elevational view of the assembled counter, partly in section;

Fig. 2 is a plan view taken endwise of Fig. 1, showing the counter as it appears with the closure cap removed;

Fig. 3 represents a section at the line 3—3 of Fig. 2, with certain of the parts omitted;

Fig. 4 is similar to Fig. 2 except that the operating mechanism is shown in a position different therefrom;

Figs. 5, 7 and 9 are fragmentary sectional plan views illustrating a sequence of steps for transferring rotary movement between adjacent numeral wheels; and

Figs. 6, 8 and 10 represent the side elevational views accompanying the three preceding figures respectively.

Like reference numerals designate like parts throughout the various views.

Referring to the drawing, the counter comprises a die cast annular base **1** having an integral bracket **2** projecting at a right angle from its plane for mounting by means of screw holes **3**. An annular groove **4** adjacent the outer margin of base **1** is equipped with a gasket **5** upon which a thin metallic closure cap **6** is seated. Cap **6** is held in place by speed-nuts **8**.

A window **7** in closure cap **6** facilitates reading the numerals of the counter. It is desirable to cement a thin transparent substance interiorly of cap **6** over the window to prevent entry of dirt and moisture into cap **6**.

The mechanism of the counter includes an operating shaft **10** journaled in a central sleeve bearing **11** which projects from the base **1**. Operating shaft **10** has a crank arm portion **12** at one end for engagement by any suitable driving means (not shown) whose number of reciprocatory movements it is desired to count.

Through suitable intermediate mechanism, described in detail hereinafter, reciprocatory movements of shaft **10** are transferred to a digit wheel **13** which is caused to rotate unidirectionally and is journaled on a shell-like bearing **17** projecting from base **1** concentrically with shaft **10**. Note that digit wheel **13** and adjacent numeral wheels **14** and **15** are each formed interiorly with a smooth annular bearing surface **16** for journaling the wheels on the shell-like bearing **17**.

An actuator or plate member **21**, pressed onto shaft **10** in a plane normal to its axis, reciprocates with the shaft during each counting operation. The shaft may be permanently affixed in plate member **21** so as to preclude any relative movement between them, but it has been found highly advantageous to be able to vary the angular relationship between plate member **21** and shaft **10** when it is desired to orient the crank arm **12** of the shaft with respect to a driving mechanism (not shown) after the mounting bracket **2** has been fastened. For this purpose, the shaft **10** is pressed through an aperture in plate member **21**, which aperture is inherently resilient as a result of it being provided with two radially extending slots **22** which yield upon entry of the shaft **10** therein. Hence, although the plate member **21** seizes shaft **10** firmly enough to transmit the modest driving power of the counter, the plate **21** may be caused to slip relative to the shaft by manually turning crank **12** to its angular limit and exerting sufficient force thereafter to cause slippage. When crank **12** is properly aligned with the form of driving member being employed, the manual force may be terminated.

In Figs. 2 and 4 it will be seen that plate member **21** has the regular contour of its margin interrupted by a cutaway portion **24** bounded by circumferentially spaced radially projecting stopping surfaces **25** and **26** which establish the limits to rotation of plate member **21** and shaft **10** by butting a fixed pin **27** which is interposed between stops **25** and **26**. Another function of pin **27**

is to hold back plate member 21 during adjustment of crank arm 12 with respect to the counter as explained in the immediately preceding paragraph.

A torsional spring 30 has convolutions which surround sleeve bearing 11. One end 31 of spring 30 is anchored to stop pin 27 and the other end 32 engages plate member 21 in an appropriate notch 33, most apparent in Fig. 4. As a consequence of the action of spring 30, stop 26 is urged against pin 27 when the counter is resting in normal position as in Fig. 2. However, when the counter is in cocked position, illustrated in Fig. 4, where the crank arm 12 is restrained in opposition to spring 30, stop 25 butts pin 27. During operation of the counter spring 30 is alternately partially loaded and fully loaded in accordance with the angular movements of shaft 10.

For minimizing friction in a direction along the longitudinal axis of the shaft 10, a small free fitting collar 34 is interposed between sleeve bearing 11 and plate member 21. Collar 34 also serves to properly locate member 21 with respect to shaft 10, whereas shaft 10 is properly located by means of its tapered end 9 bearing against closure cap 6 as seen in Fig. 1.

Refer to Figs. 2 and 4 in connection with the forthcoming description of ratchet 41 and its mode of cooperating with plate member 21 and digit wheel 13 for transmitting power from the former to the latter. Ratchet 41 is pivotally carried near its mid-section on a pin 42 located concentrically with shaft 10 and permanently affixed in plate member 21. A loose fitting collar on pin 42 spaces the ratchet with respect to the plate member and a snap ring 43 retains the ratchet 41 on the pin. The driven end 44 of the ratchet 41 has a straight edge which, if extrapolated, would extend through the ratchet pivot pin 42 coincident with a radius of the latter. Force for driving the end 44 about pivot pin 42 is obtained from an upstanding ear 23 formed integral with plate 21 and projecting into bearing relation with the ratchet 41. At the end of ratchet 41 opposed to the driven end 44, the ratchet is constricted to form a finger portion 45 engageable with successive triangularly shape teeth 50 internal of digit wheel 13.

A flat ratchet spring 46 embraces stop pin 27 and is prevented from sliding downwardly thereon by means of a metallic strip 47 juxtaposed to stop pin 27. Regardless of the radial position of ratchet 41, spring 46 will always act to bias the ratchet's straight driven end 44 toward ear 23 and its finger end into contact with teeth 50.

Thus far, from the description of the structure, it should be apparent that finger 45 of ratchet 41 is capable of sliding over a single triangular tooth 50, thereafter engaging the next tooth and advancing the digit wheel 13 one count. Assuming for the moment that the digit wheel 13 is caused to move in a step-by-step manner on bearing shell 17, thereby registering an increasingly large number, it is convenient at this juncture to describe the means for transferring such movement to the adjacent "tens" and "hundreds" numeral wheels 14 and 15, respectively. For that purpose, refer to Figs. 1, 2 and 5 through 10 inclusive. In Fig. 1 will be seen a pair of multilated transfer pinions 55 journaled for rotation on a pin 56 anchored by means of serrations 57 in die cast annular base 1. Pin 56 is disposed in a suitable longitudinal opening 58 through the wall of the shell-like numeral wheel bearing 17 with ample clearance to permit rotation of pinions 55.

When digit wheel 13 reads "9" through window 7 it is ready to actuate its associated pinion 55 to cause the "tens" numeral wheel to advance one step. This condition prevails in Fig. 5 which is a section taken through the digit wheel in such manner as to show the two cogs 61 internal to the digit wheel 13 on a face opposite to that embodying the ten triangular teeth 50. The next adjacent "tens" wheel 14 has twenty teeth indicated by the reference character 62 which are meshed at all times with one of the six pinion teeth 63. In elevation, however,

note that three of the pinion teeth are of greater depth than the others and that they are characterized by their diamond shaped tips 64. Hence, assuming counterclockwise rotation of digit wheel 13 in Fig. 5, it will be evident that cog 61 is about to engage a pinion tooth 63 causing it to revolve. This, of course, causes the "tens" wheel 14 to advance one half of a single digit. In Fig. 7 a diamond tipped tooth 64 and its underlaying tooth portion 63 is meshed between cogs 61 and further rotation of the digit wheel as seen in Fig. 9 completes advancement of one whole number. Upon this event, one tooth 63 of the pinion 55 remains meshed with one of the twenty teeth 62 on the "tens" wheel 14 and the teeth 64 diverge at 120 degrees with respect to each other so that digit wheel 13 is clear thereof for making a full revolution before repeating the cycle. Transfer of movement from the "tens" wheel 14 to the "hundreds" wheel 15 is made in a like manner. It should be self-evident that the counter can be adapted for reading any size number by merely duplicating the elements described hereinbefore.

Operation of the counter commences with its elements positioned in cocked position as in Fig. 4. Here plate member 21 is swung with shaft 10 until the stop 25 has struck pin 27. Ear 23 has separated spatially from ratchet end 44 and the whole ratchet 41 has been carried excentrically about shaft 10 on pivot pin 42 by means of member 21. Torsion spring 30 is fully loaded. The finger 45 of ratchet 41 is poised for driving digit wheel 13 through the medium of teeth 50. Note that spring 46 biases finger 45 into continual contact with the teeth 50.

In Fig. 2 crank arm 12 is shown in a position different from that in Fig. 4 such as would occur if it had been urged to that position by a driving member (not shown) or merely allowed to recoil by the energy stored in torsion spring 30. During this step, ear 23 bears normal to straight end 44 of ratchet 41 so that no thrust can possibly be transmitted radially toward ratchet pivot pin 42. Consequently, stress on the pivot pin is minimized and wear is reduced.

Referring further to Fig. 2 it will be noted that finger 45 has wedged itself between pinion pin 56 and a triangular tooth 50, precluding further rotation of digit wheel 13. Only physically damaging the counter would enable further rotation of the digit wheel. Since digit wheel 13 and finger 45 are always in contact relation, they must necessarily always have the same rate of angular acceleration. Hence, the finger is effective in preventing inertia overtravel of the wheel regardless of the speed of the driving member (not shown).

Reverse rotation of digit wheel 13 is prevented by two independent means. First, through the medium of ratchet finger 45 which is held firmly against the digit wheel by the action of ear 23 pressing on the driven end 44 of the ratchet 41; and second, through engagement of triangular teeth 50 by the end 48 of flat spring 46.

It is claimed:

1. A counter having an internally toothed rotatable digit wheel and reciprocating actuating means for step-by-step peripheral advancement thereof, said means comprising a shaft centrally disposed within said wheel, a plate member frictionally clamped to the shaft in a plane normal to the axis thereof and having an ear radially spaced from the shaft and projecting parallel thereto, said plate member having a shaft receiving aperture and a substantially radial slot communicating therewith for outward yielding of said aperture, a torsion spring biasing said plate member into a first angular position, a ratchet pivotally carried by said plate member eccentrically to said shaft, a finger portion on said ratchet movable to engagement with succeeding internal gear teeth on said digit wheel through the medium of reciprocating said plate member to a second angular position, a straight edge portion on said ratchet in alignment with the pivot point of said ratchet and the axis of said operating shaft while said ear urges said ratchet from said second to said first angular position, stop pin means inte-

riorly adjacent said digit wheel, whereby said finger portion of said ratchet may wedge between one of said teeth and said stop pin means when in said first position.

2. A counter comprising a base having a longitudinally slotted cylindrical bearing protruding therefrom, a digit wheel journaled on said bearing, internal teeth on said digit wheel, at least one number wheel on said bearing coaxial with said digit wheel, a fixed pin carrying transfer pinion means which project through said longitudinal slot in said cylindrical bearing into meshing relation with said number wheel, an operating shaft axially coincident with said cylindrical bearing, a plate member frictionally clamped to said shaft in a plane normal to the axis thereof and reciprocatory therewith and having an integral driving ear spaced radially from the shaft and projecting parallel thereto, stop means carried by said plate member, a torsion spring biasing said plate member to normally inactive position against said stop means, a ratchet member having at one end a digit wheel engaging finger portion

and at the other end a driving force receiving portion, pivot means radially displaced from said shaft supporting said ratchet intermediate its ends for reciprocatory movement with said plate member, said driving force receiving portion being in alignment with the pivot means for said ratchet and the axis of said operating shaft while said ear is driving said ratchet, said ear being carried by said plate member in driving relation to said ratchet for tangentially advancing said digit wheel through the medium of said finger portion until said finger portion arrives at an inactive position in wedging relation between said fixed pin and a tooth of said digit wheel.

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