April 23, 1929. H. L. MacNEILL 1,710,229

COUNTING MECHANISM

Filed April 5, 1928

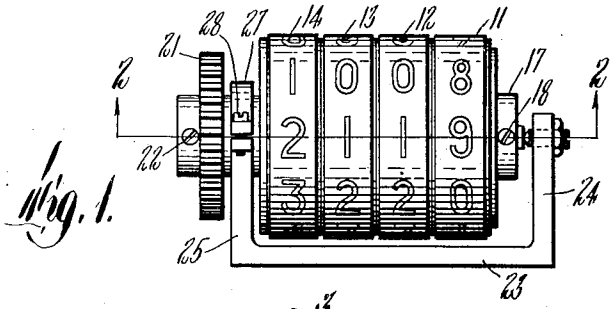

Fig. 1.

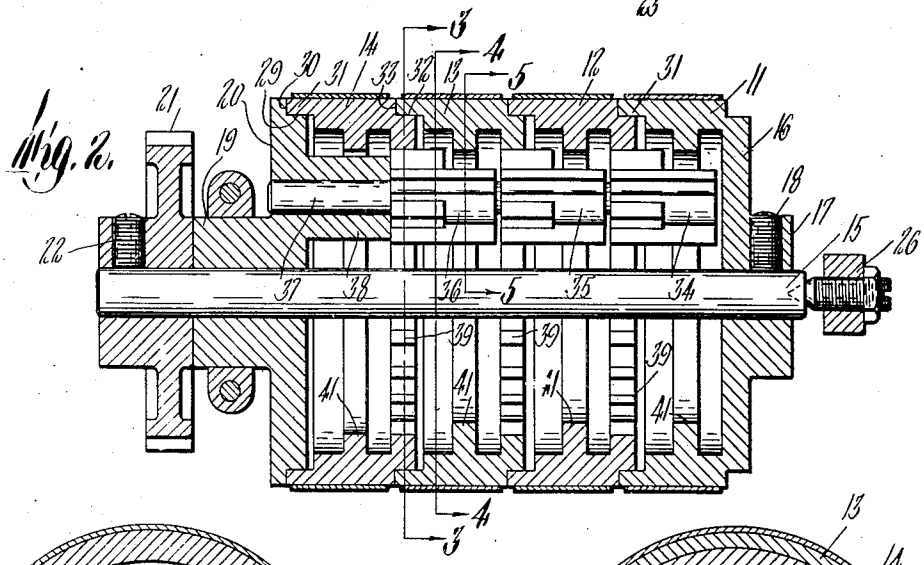

Fig. 2.

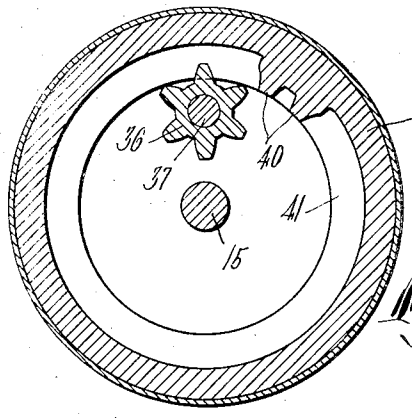

Fig. 4.

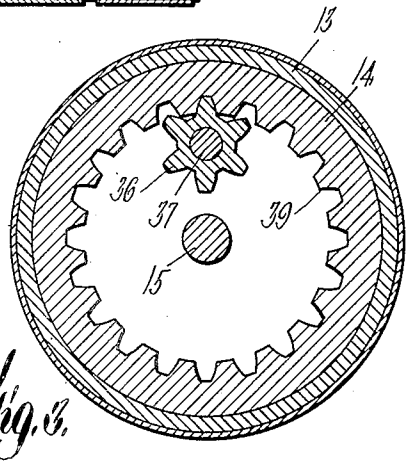

Fig. 3.

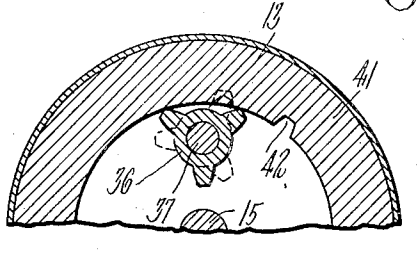

Fig. 5.

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UNITED STATES PATENT OFFICE.

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COUNTING MECHANISM.

Application filed April 5, 1928. Serial No. 267,579.

This invention relates to counters for indicating the number of revolutions or movements made by parts of machinery and other moving parts, or distances or other values measured by the circumference of a rotating or rolling wheel, as in the case of odometers, etc.; and particularly relates to counters comprising a series of disks or wheels in axial alinement, carrying on their peripheral surfaces the numbers or other indices by which the required indications are given. For the purpose of description in this specification, the indicating units or members of the counter which are thus arranged in axial alinement as above stated will be referred to as number wheels, with the understanding that this term is not to be construed in an unnecessarily limiting sense.

In the counters of the type herein particularly referred to, the number wheels have generally been supported independently of one another and carrying means, generally in the form of idle pinions, have been provided to transmit a fractional rotation from each number wheel of lower order to the next adjacent one of higher order at a given point in the rotation of the former. Owing to the inevitable backlash between intermeshing gear teeth, and other factors of looseness in the mounting of these parts, the driven number wheels lag somewhat behind the driving wheels during the transfer of motion to one from the other, and when such motion is transmitted at the same time through several wheels at once (as, for instance, when the indication changes from 999 to 1000) the lagging of the highest order wheel thus moved behind the lowest order wheel is very marked. These wheels are always mounted in a casing having a window through which one number only on each wheel can be seen; and the lagging of the highest order wheel is frequently so great that part of the number coming into view on a wheel of higher order remains covered by the border of the window after the movement given by the carrying mechanism has ended. Even if the obscuring of a number in such cases is not great enough to raise a liability of error in reading it, nevertheless the appearance of a row of numbers in a helical line, instead of in a straight line parallel with the boundaries of the window, is objectionable. Various means have been devised to impart an increment of movement, either to the carrying pinions or to the number wheels directly for the purpose of taking up backlash and settling the number wheels with their numbers in the desired straight alinement; but such devices are additional to the normal mechanism and at best involve an appreciable increment of complication and cost in the instrument.

My object is to overcome the objectionable lagging in instruments of this type, and to do so by means which not only involve no increase in the complication and expense of the instrument, but even permit a simplification of construction and a reduction in cost. Briefly stated, this object is accomplished by making each number wheel of higher order provide the supporting and centering bearing for the next wheel of lower order, or vice versa, whereby the friction of each moving diving wheel upon the driven wheel tends to advance the latter and takes up the back lash of the intermediate carrying members; and from which also it results that the number wheels may be made of annular form providing an open interior space in which the carrying pinions and the holder or support therefor may be mounted. Other advantages also follow, as will be presently explained in the following specification.

The drawings herewith illustrate a counter embodying this invention, with a conventional mount adapted to hold the several parts of the counter in cooperative relationship. They do not purport to show the means for imparting rotation to the lowest order wheel of the counter, or any of the numerous adjuncts which may be provided in connection with counters for special purposes, such as trip odometers, etc., whereby the driver may be disconnected from the number wheels to permit of the latter being set at the zero position or any other desired position.

Fig. 1 is a side elevation of the illustrative counter above referred to;

Fig. 2 is a longitudinal axial section taken on line 2—2 of Fig. 1 and shown on an enlarged scale;

Figs. 3, 4 and 5 are cross sections taken on lines 3—3, 4—4 and 5—5, respectively, of Fig. 1.

The counter here illustrated is one of four number wheels designated successively from

the one of lowest order to that of highest order as 11, 12, 13 and 14. As shown in Fig. 2, the lowest order wheel 11 is mounted on a drive shaft 15, being provided with a web 16 at one end and a hub 17, which is fitted to the shaft and contains a set screw 18 to make it tight thereon. Shaft 15 passes through the hub 19 of a disk 20 at the opposite end of the counter in which it has a bearing, and is equipped with means on its outer end for receiving rotational driving force. The means here shown illustratively for this purpose is a gear wheel 21 fastened to the shaft by a set screw 22, but any of the well known or other suitable equivalents may be used in place of this gear; which here typifies any rotation imparting means. A mount, typifying any supporting structure, is here shown conventionally as a frame comprising a base bar or plate 23 and and uprights 24 and 25; the upright 24 supporting an adjustable cone pointed bearing screw 26 entering a socket in the adjacent end of shaft 15, and the upright 25 having a concave recess in its upper end, in which the hub 19 is seated, and provided with lateral flanges to which the ends of a strap 27, overlying the hub 19, are secured by screws 28. The last described part of the mount furnishes a bearing, which is also a clamp, in which the hub 19 is secured non-rotatably.

The disk 20 is formed with a groove which opens at the circumference of the disk and also at its inner face, the boundaries of such groove providing preferably a cylindrical bearing surface 29 coaxial with shaft 15, and an end thrust bearing face 30 preferably in a plane perpendicular to such axis. I have described these surfaces as preferably cylindrical and plane, respectively, to indicate that some variations from these forms are permissible; that is, that each of the surfaces may be conical in greater or less degree, but that the preferred forms are superior to others.

The number wheel 14 of highest order is provided at one end with a lip 31 which overlaps the bearing 29 and abuts against the end thrust bearing 30; while at its opposite end the wheel is grooved or rabbeted in a simular manner to the disk 20 to provide bearing surfaces 32 and 33 similar to the surfaces 29 and 30, respectively. All the other number wheels except the one of lowest order, are similarly formed so that each overlaps and bears upon the one of next higher order, and all are interchangeable. The lowest order wheel also has an overlapping lip or flange 31, and differs from the other number wheels only in having the web 16 and hub 17 by which it is supported and secured on the driving shaft. All the other wheels are rings wholly open in the interior and wholly supported by their bearings on the end disk 20, the lowest order wheel 11, and each other.

It is to be understood that, although I have here shown and described the wheels as each overlapping and bearing on the next wheel or supporting structure at the left, the direction of overlap may be reversed without departing from the principle of the invention or the scope of the protection which I claim.

The intermediate carrying pinions 34, 35 and 36 are arranged within the space surrounded by the annular number wheels and are mounted to turn about a shaft 37 rigidly fixed at one end in a boss 38 which projects inward from the end disk 20. While the shaft 37 is supported only at one end, the relatively large open space within the annular number wheels enables it to be made large enough to have ample rigidity for the purposes of an instrument of this character, and enables the boss 38 to have length enough to hold this shaft rigidly without being extended at all beyond the outer face of the disk 20. The same feature enables the carrying pinions to be made relatively large and rugged, with large, strong teeth.

The characteristics of the number wheels and carrying pinions, by which a fractional rotation is transmitted to each wheel of higher order at a given point in each complete rotation of the next wheel of lower order, are essentially the same in this counter as in other counters heretofore used. Each wheel, except the one of lowest order, has at its right hand end a continuous series of equally spaced internal teeth 39, twice as many as the steps of the wheel in making a complete rotation; and each wheel, including the one of lowest order, has within its right hand end two teeth 40 (Fig. 4) of the same pitch as the teeth 39, and an intermediate locking rib 41 provided with a notch 42 (Fig. 5) in alinement with the space, corresponding to a tooth space, at the outer side of the first tooth 40. The teeth 40 and rib 41 are not necessary in the highest order wheel, but such wheel is equipped with them in the interest of interchangeability of parts and to reduce to the minimum the number of special parts required to be made in quantity production. Each of the carrying pinions provided with a series of teeth of the same pitch as the gear teeth 39 and 40. All of the teeth extend across the adjacent tooth bearing zones of each two contiguous number wheels, but alternate teeth terminate short of the locking rib in the wheel of lower order; while the intermediate teeth extend across such rib and cooperate therewith to prevent rotation of the pinion except when the notch 42 permits.

It will be apparent that, owing to the engagement of the number wheels with one another, the rotation of each tends to rotate the next one in the same direction, by friction. The force thus exerted may be made as great or little as desired by adjusting the wheels endwise, the manner in which they are mounted permitting them to be engaged more or

less firmly with one another on their end thrust bearing surfaces. In any event, however, the circular bearing of one on the other causes an appreciable amount of friction. Thus the wheels tend to rotate in unison and do so when permitted by unlocking and rotation of the carrier pinion; maintaining the desired alinement between the numbers on adjacent wheels and wholly overcoming the objectionable lagging and skewed arrangement of numbers at the time of carrying characteristic of the previously used counters as hereinbefore explained. Incidentally also the absence of intermediate supports for the several number wheels enables the length of the counter as a whole to be made the absolute minimum and permits the entire space within the wheels to be open and available for the reception of large and rugged pinions. A further advantage is the reduction of parts to a minimum of six for a counter consisting of two wheels, and of only two more for each additional wheel.

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

1. A counting mechanism comprising a series of wheels in axial alinement adapted to carry counting indications, a shaft on which the wheel of lowest order is secured and supported, and a stationary support on which the wheel of highest order is supported, the intermediate wheels bearing on, supporting, and being supported by one another.

2. A counting mechanism comprising a series of wheels in axial alinement adapted to carry counting indications, a shaft on which the wheel of lowest order is secured and supported, and a stationary support on which the wheel of highest order is supported; all said wheels having overlapping bearing portions whereby they give support to one another.

In testimony whereof I have affixed my signature.

HARRIS L. MacNEILL.