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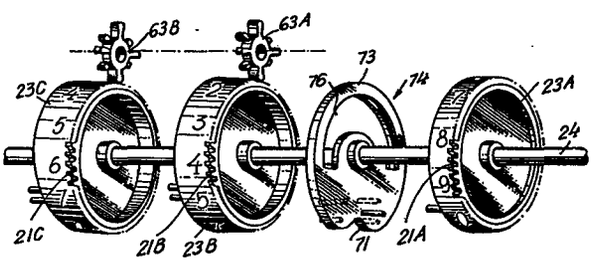
(54) Flip-over mechanism.

(57) The mechanism has an axle supporting a series of aligned cylinders, one of which is the driver cylinder and the rest are the driven ones. Between the driver cylinder and the adjacent driven cylinder there is a fly-wheel that flips over the driven cylinders during digit carry, causing the display number to change suddenly. The fly-wheel has a very unbalanced mass which during half a turn is dragged along until it reaches its highest point, from which it is accelerated by way of its own inertia. When the fly-wheel mass reaches its lowest point, the fly-wheel strikes the pinion driving the adjacent driven cylinder, adding one unit to its numeric display, and eventually to that of the remaining driven cylinders. The mass is removable from the fly-wheel to allow the mechanism to be adjusted for precise operation; the driver cylinder is solidary to the gear-wheel driving it and all reverse transmission is avoided, so that the sensitivity determined by the driver cylinder is maintained.



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FLIP-OVER MECHANISM

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention refers to an automatic flip-over mechanism that swiftly increments the numeric display determined by the turning of a set of cylinders, so that the display is always clear and easily readable without ambiguities and many chances of mistakes. The present invention is particularly suitable for cyclometric registers, such as those used in electric energy meters, for which it was particularly envisaged.

The meter measures the energy consumed during a certain period by a load fed by a supply line passing through the meter,

and displays the energy consumption on a set of cylinders, which, in some models, are six in quantity displaying successively tenths, units, tens, hundreds, thousands and tens of thousand kilowatt hours. Each cylinder is marked with the ten 0 to 9 digits of the decimal system.

The metering data is generated by a sensor and transducer disk coupled to the load's supply line. Through a series of transmitters, the disk is synchronously coupled to the cylinder indicating tenths of kilowatt hour, this cylinder is called the driver cylinder because, apart from displaying this data. it drives the rest of the cylinders at longer or shorter intervals according to their significance.

The driving action is carried out by a set of pinions, each engaging two consecutive cylinders. The driven cylinders only turn during a 9 to 0 transition of the respective immediate lower order cylinder, when carrying a digit to a higher order.

Generally, the driver cylinder turns extremely slowly, causing the moving cylinders to show portions of two consecutive numbers during a considerable portion of time. Apart from making a visual reading rather difficult, it may be appreciated that this may also be a source of reading mistakes. In short, there is sometimes a rather ambiguous display of the energy consumption, due to the slowness of the carry operation.

Description of the Prior Art

It has previously been attempted to correct this mishap

by adding a very unbalanced fly-wheel on the cylinder axle so that, pushed by the first or driver cylinder, it stored mechanical potential energy which was unleashed against the driven cylinders during a 9 to 0 transition, to hasten their switching.

Various setbacks were found in this system. Upon discharging the potential energy and converting it to kinetic energy, the fly-wheel oscillated about its minimum potential energy position. The fly-wheel would swing back and forth striking the first cylinder, bugging the indication of the least significant digit, for which reason it was customary to only record zeroes around it, relinquishing an order of magnitude of sensitivity. The sensitivity of those meters was then typically reduced to 1 kwh. Furthermore, no provision had been made to permit adjustment of the fly wheel's imbalance to attain exact operation of the mechanism.

Summary of the Invention

Therefore, an object of the present invention is a flip-over mechanism to obtain clear readouts, without ambiguities, at least from the most significant digits of the cyclometric register.

Another object of the present invention is to attain the previous object without sacrificing resolution and sensitivity.

A particular object of the present invention is to

obtain an electric energy meter having a net display with .1 kWh of sensitivity.

Another object of the present invention is to provide for and simplify adjustment of the effects caused by the fly-wheel's imbalance.

These and other objects of the present invention are achieved by inserting an unbalanced fly-wheel between the driver cylinder and the second cylinder and opening the connection between the driver cylinder and the first pinion (which directly coupled these two cylinders). The fly-wheel is connected to the driver cylinder so that during half a turn of the latter, it is dragged from a point of minimum energy to one of maximum mechanical potential energy. Upon reaching its point of maximum potential energy, the fly-wheel automatically disconnects itself and begins to rotate under the influence of its own inertia due to its considerable imbalance. The flywheel is connected to the first pinion in turn coupled to the second cylinder, so that at the instant the fly-wheel reaches its point of maximum kinetic energy, a striker solidary to the fly-wheel slams against the first pinion, unloading suddenly all its kinetic energy to increment the most significant digits in one unit practically instantaneously. The driver cylinder then gives another half-turn before reconnecting with the fly-wheel and recommencing the cycle. To optimize operation, a mountable and

removable weight is provided for permitting adjustment and readjustment of the fly-wheel's imbalance, to vary its capacity for accummulating potential energy and discharging kinetic energy.

Brief Description of the Drawings

Figure 1 illustrates a perspective of the automatic flip-over mechanism, partially exploded according to the present invention.

Figure 2 illustrates a cross-section of the cyclometric register including the automatic flip-over mechanism of the present invention.

Figure 3 shows a perspective view of the fly-wheel.

Figure 4 is a side view of the fly-wheel as seen from the second cylinder.

Lastly, figure 5 is view of the driver cylinder, as seen from the fly-wheel.

Detailed description of the preferred embodiments

The location of a fly-wheel 73 between the driver cylinder 23A and the second cylinder 23B is shown in figs. 1 and 2 The periphery of the driver cylinder 23A is marked with digits corresponding to tenths of kilowatt hour, and on that of the second cylinder, those corresponding to kilowatt hour units. The mechanism is driven by the gearwheel 21A solidary to cylinder 23A. The latter is coupled to cylinder 23B successively via the fly-wheel 73 and the pinion 63A. The higher

order cylinders are conventionally coupled by pinions to their adjacent cylinders; for clarity reasons, only pinion 63B and cylinder 23C are illustrated. The wheels 23A, 73, 23B, 23C are all mounted on an axle 24 of stainless steel, 3.17 mm diameter, 95 mm long.

Pinions 63A, 63B are mounted on an axle 57, also of stainless steel, 2mm diameter, 79 mm long. The cylinders 23A, 73, 23B, 23C and the pinions 63A, 63B are all of polyamide 11 (RILSAN) and are pressure mounted on their respective axles 24, 57.

The side face 74 of fly-wheel 73 giving onto cylinder 23B can be seen in a perspective view in figure 3 and in an enlarged plan view in figure 4. The driver cylinder 23 (not illustrated in these figures 3 and 4) is located behind the fly-wheel 73.

The fly-wheel 73 has a relatively large hole of about 180°which creates a considerable initial imbalance in it. Two pins 78A, 78B of the same polyamide 11 material are fixed to the solid portion 77, opposed by axle 24 to the hole 76 and removably mount an iron counterweight 81 (shown in dashed lines) weighing between 3 and 6 grammes, to adjustably increase the imbalance of fly-wheel 73. The counterweight has a pair of orifices corresponding to the pins 78A, 78B. During preliminary testing, the mass of counterweight 81 is gradually adjusted until exact operation of the mechanism is achieved, the protruding ends of the pins 78A, 78B are then heated and riveted

to fix the counterweight 81 to the fly-wheel 73. The imbalance is adjusted so that all the most significant digits may be driven either simultaneously or in chain fashion. The fly-wheel 73 also has a proper striker 82 associated with a slot 71. The striker 82 is for effecting the practically instantaneous carry function, as will be explained further along. During this function it is necessary to free pinion 63A by means of slot 71. As is known in the art, pinion 63A (alike pinions 63B, ...) has an alternating series of short 68 and long 69 teeth, the long teeth 69 stretching across the whole breadth of pinion 63A, whilst the short teeth 68 are located on the side engaging second cylinder 23B (i.e. the driven cylinder). The longer teeth 69 are for jamming the pinion 63A during intercarry periods, to avoid glitches producing undue transitions, due to e.g. external vibrations. Between carries, pinion 63A is jammed by the long teeth 69 against the fly-wheel 73. During carry, the striker 82, in fact two pins 82A, 82B on opposite sides of slot 71, engages the facing short teeth of pinion 63A, impelling it; at the same time, the next tooth, long tooth 69, penetrates slot 71, unjamming the pinion 63A. Once the carry is over, the slot 71 passes on, leaving the pinion 63A jammed yet again.

Figure 5 illustrates the face 83 of the driver cylinder 23A on the side of fly-wheel 73. Unlike the higher order cylinders 23B, 23C, it has a solidary bolt or tooth for impel-

ling, during half a turn, fly-wheel 73 by means of a tooth or pin 86 (fig. 1) fixed behind and below the slot 82 (figs. 3 and 4) of fly-wheel 73.

Both the radial and axial coordinates of salients 84, 86 coincide with each other, to permit direct contact therebetween.

The imbalance of cylinder 23A due to the eccentricity of bolt 84 is compensated by a counterweight 87, so as not to unduly affect operation of the cyclometric register, and basically, the linearity between the speed of the transducer disc and the load power sensed by the disc.

The mechanism operates as follows: while cylinder 23A travels from 5 to 9, bolt 84 is lifted and pushes fly-wheel 73 with it until the hole 76 reaches its lowest point, which coincides with the 9 to 0 transition of the cylinders 23A, after which it begins to rotate under the effect of its own inertia until the hole 76 is located at its highest point; this instant coincides with the striker slamming against the pinion 63A, incrementing in one unit the display of cylinder 23B. When the latter transits from 9 to 0, it transmits this data to the pinion 63B which updates cylinder 23C and so on, using the kinetic energy unloaded suddenly by the fly-wheel 73. The mechanism thus acts like a striker, storing energy during a time interval previous to discharging it practically instantaneously. This discharge is effected intermittently

and automatically when the stored energy reaches a certain level, precisely when the drive cylinder changes from 9 to 0.

CLAIMS :

1. An automatic flip-over mechanism for intermittently and suddenly advancing a numeric display determined by a set of cylinders normally free on a cylinder support axle which forms part of an apparatus such as, e.g. the cyclometric register of an electric meter; the set of cylinders comprising a driver cylinder and at least a second cylinder driven by and more significant than the driver cylinder; characterized in that said automatic flip-over mechanism further comprises a fly-wheel freely mounted upon the cylinder axle and located intermediate the driver cylinder and the second cylinder; a removable mass to be eccentrically mounted on the fly-wheel to increase its imbalance; a first salient fixed on the face of the driver cylinder adjacent the fly-wheel; a second salient fixed on the face of the fly-wheel adjacent the driver cylinder, the first and second salients being located at substantially the same distance from the cylinder axle so that the first salient is capable of pushing the second salient and so drive the fly-wheel; a pinion coupled in driver relationship to the second cylinder; and a striker fixed to the fly-wheel and capable of suddenly striking the pinion during fast passage of the fly-wheel by a certain angular position to practically instantaneously flip-over the display of the second cylinder.

2. The automatic flip-over mechanism according to

claim 1 characterized in that said fly-wheel has a hole across aproximately 180° of its body, the mass being fixable to the fly-wheel at a location substantially opposed by the cylinder axle to the hole.

3. The automatic flip-over mechanism according to claim 2, characterized in that said striker is fixed in a certain position to said fly-wheel so that it will strike the pinion at the instant the fly-wheel substantially acquires a maximum of kinetic energy converted by the imbalance from the mechanical potential energy accummulated previously during all the time the second salient was pushed during half a turn of the first salient of the driver cylinder up to a maximum mechanical potential energy.

4. The automatic flip-over mechanism according to claim 1, characterized in that said first and second salients comprise respective members in the form of teeth located at the same radial and axial coordinates.

5. The automatic flip-over mechanism according to claim 1, characterized in that said striker is a bolt fixed substantially on the periphery of the face of the fly-wheel adjacent the second cylinder, the teeth of the pinion being engageable one at the time with the bolt.

6. The automatic flip-over mechanism according to claim 1, characterized by forming part of the cyclometric register of an electric energy meter measuring the consumption of a

load connected to a supply line passing through said meter, the driver cylinder being coupled to a disk rotating with an angular velocity directly proportional to the electric power at the load, and by the cylinders suddenly flipping over from one number to the immediate higher number except the drive cylinder which progresses in continuous fashion, the set of cylinders displaying a number indicative of the total electric energy consumed by the load during a certain period.

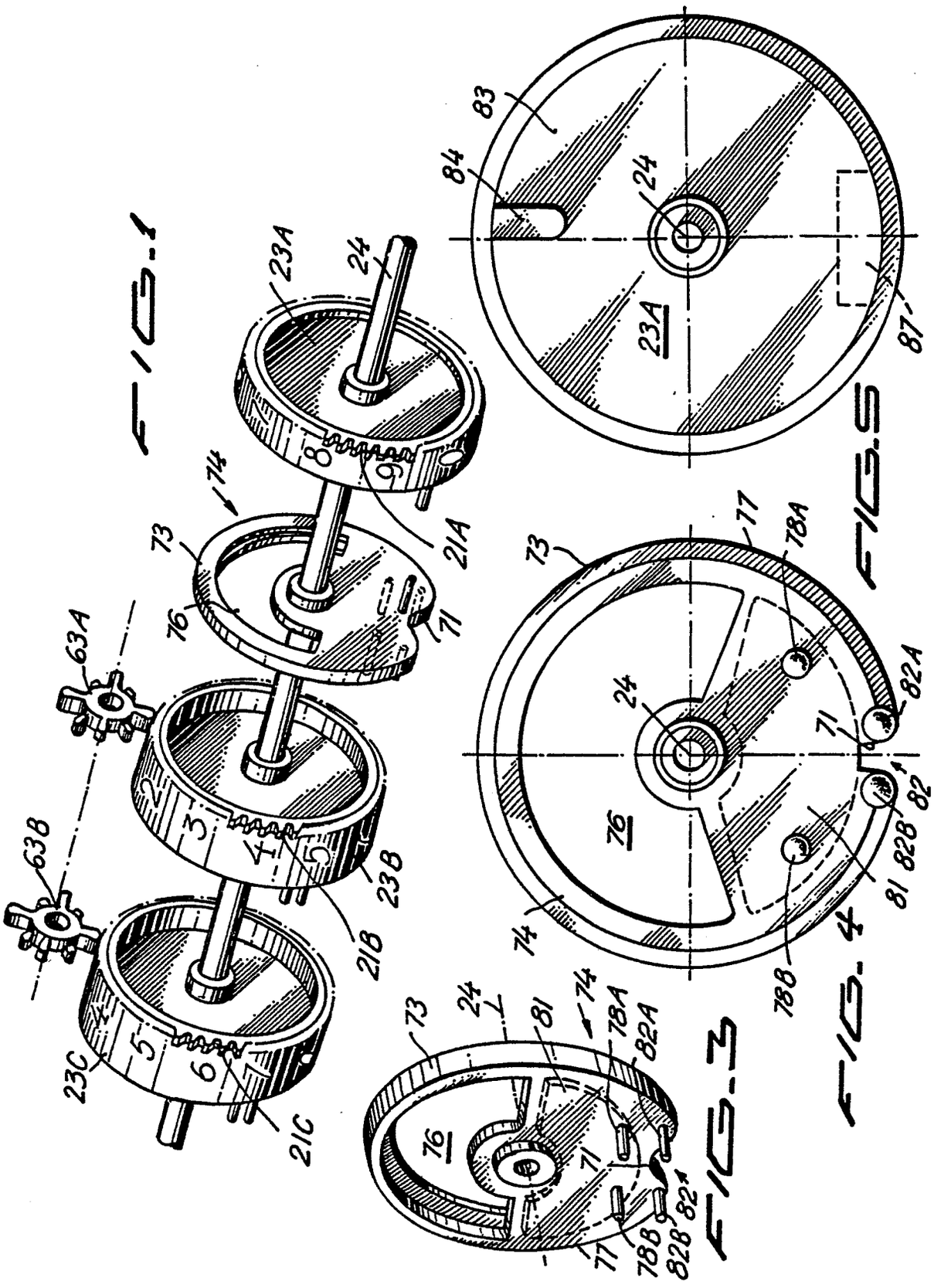
FIG.1
FIG.5
FIG.4
FIG.3
23A
24
83
84
87
73
74
76
71
21A
63A
63B
23B
23C
21B
21C
77
78A
78B
82A
82B
81

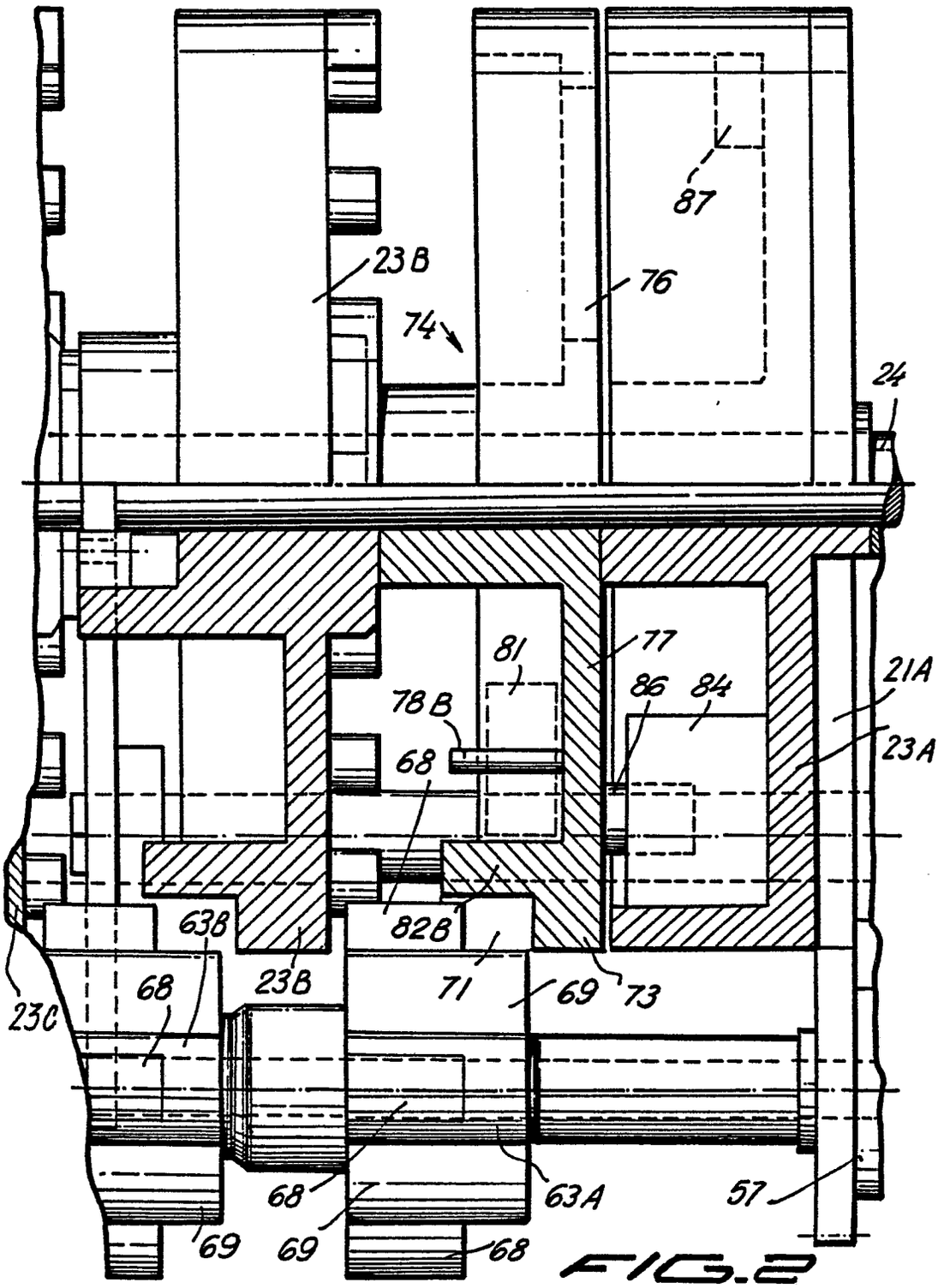
87
23B
76
74
24
81
77
21A
86
84
78B
23A
68
63B
82B
23B
71
69
73
23C
68
68
63A
57
69
69
68

FIG.2