United States Patent [19]

Ramstetter

[11] **3,814,309**

[45] **June 4, 1974**

[54] **DIGITAL TIMER WITH RESETTING MECHANISM**

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[73] Assignee: **American Manufacturing Company, Inc.,** Brooklyn, N.Y.

[22] Filed: **Dec. 20, 1972**

[21] Appl. No.: **316,982**

[30] **Foreign Application Priority Data**

Dec. 23, 1971 Germany 2164330

[52] **U.S. Cl.** ..... **235/130 R,** 235/144 EA, 200/38 R

[51] **Int. Cl.** **H01h 7/08,** G06c 15/42

[58] **Field of Search** ..... 200/38 R, 38 F, 38 FB; 235/130 R, 132 R, 144 EA

[56] **References Cited**

UNITED STATES PATENTS

3,610,847 10/1971 Houpt et al. ..... 200/38 R

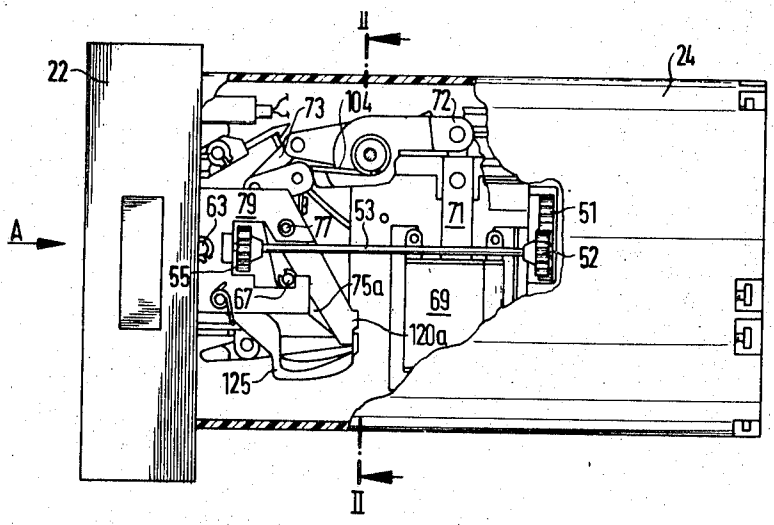
Primary Examiner—James R. Scott

Attorney, Agent, or Firm—Nelson E. Kimmelman; Maleson, Kemmelman & Ratner

[57] **ABSTRACT**

In a settable and resettable digital wheel timer or the like wherein resetting means rotate all the wheels back to their original starting position, a latching assembly is provided to lock the reset means in its wheel-engaging position until the clutch and carry gears associated with the wheels are brought into mesh with those wheels at the beginning of an operating cycle. The latching assembly is actuated by a first lever moving in unison with the gears which presses on a second lever that first keeps the resetting means engaging the wheels and then releases the resetting means from the wheels only when the clutch gear and the other gear actually engage the wheels. This latching action prevents undesired accidental rotary self-movement of the wheels when the clutch is disengaged but is moving into engagement.

6 Claims, 5 Drawing Figures



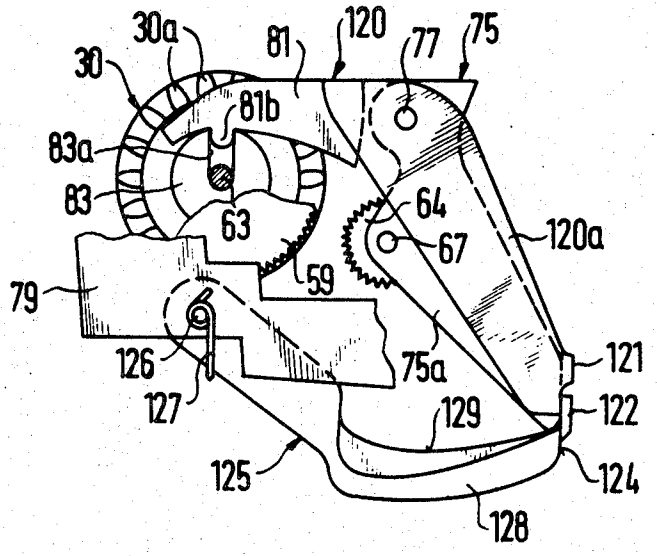


Fig. 1

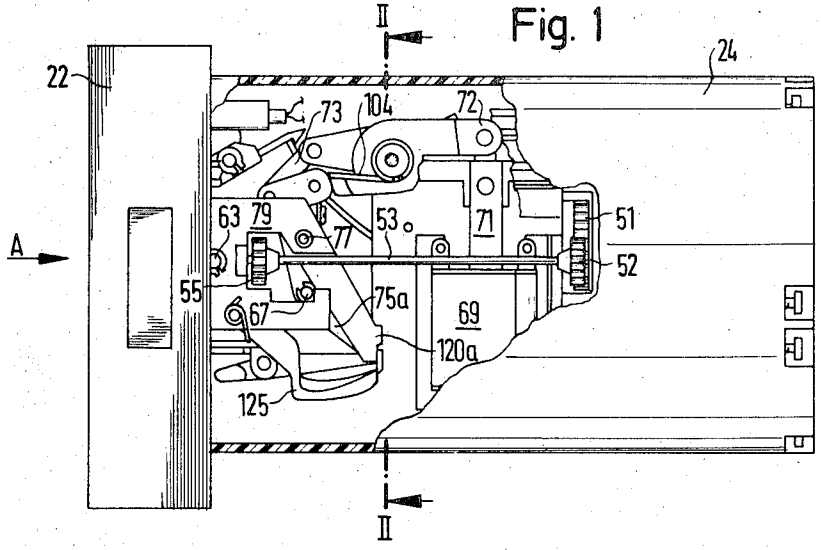
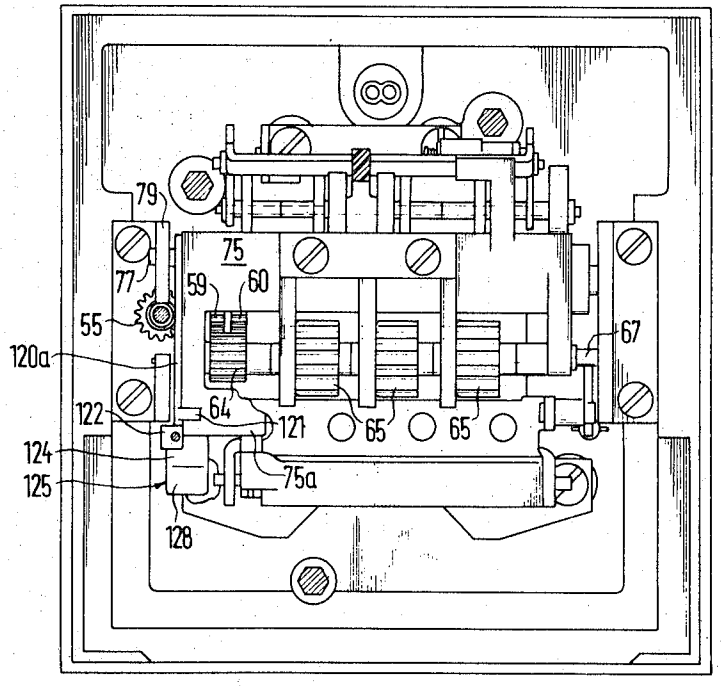

II
24
22
73
104
72
63
79
77
53
71
51
52
A
55
67
75a
69
120a
125
II

Fig. 2


79
75
77
59
60
55
67
120a
122
64
121
65
65
124
125
75a
128

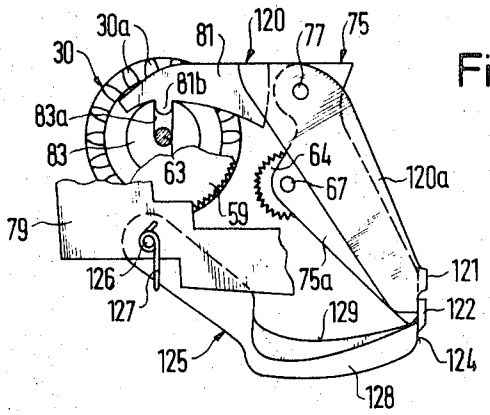


Fig. 3

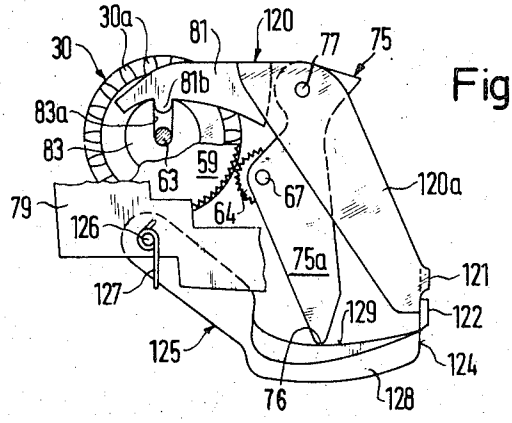


Fig. 4

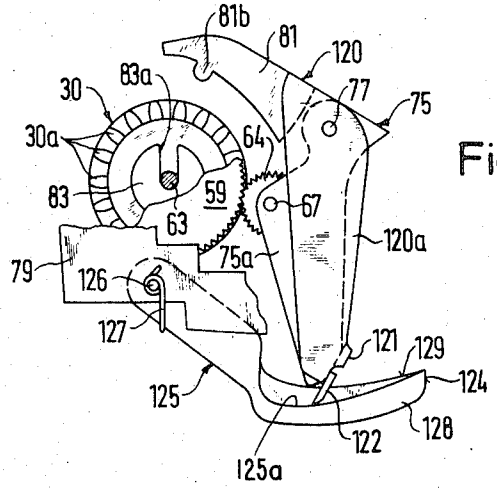


Fig. 5

DIGITAL TIMER WITH RESETTING MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to digital timers and in particular to digital timers or the like especially those having, resettable digit wheels.

2. Prior Art

The basic U.S. Pat. No. 3,610,847 concerns a time-delay relay with several indicating wheels capable of being set at a predetermined time value, with a drive mechanism acting to rotate at least one of the indicating wheels, and a switch mechanism coupled to the indicating wheels from the start of the operating cycle and triggered by the indicating wheels when they are at a certain coincidence position representing the predetermined time interval. Between the drive mechanism and the indicating wheels in that relay there was a clutch gear which transmitted power from said driving mechanism to at least one of said wheels and also a number of other gears which coupled adjacent ones of said wheels to one another. That patented structure also included a resetting mechanism being capable of motion in unison with said gears, which turned all of the indicating wheels back to their original or reset positions when the clutch and other gears were disengaged at the end of the cycle and held them in this position.

In the operating condition of the patented relay, the indicating wheels were connected to the drive mechanism via the clutch and other gears and are therefore not free to turn except in response to rotation of the clutch gear. On the other hand, when the gears were disengaged from the wheels at the end of a cycle, for example, upon transition from one state to another, the reset mechanism might not yet have engaged the wheels so situations occur in which neither the resetting mechanism nor the clutch and other gears engaged the indicating wheels so that the latter can idle, i.e., freely rotate. This transition time is, to be sure, short and comprises only fractions of seconds; nevertheless, in practical use of the time-delay relay, particularly when it is built into vibrating devices, cases have been noted in which one or several indicating wheels have turned by themselves.

Such a rotation corresponds to a change in the predetermined time value, because the indicating wheels may shift to a different mutual angular relation, signifying a correspondingly different total delay time when the clutch and other gears reengage them. When the time-delay relay is used as a digital time counter, an accidental shift in the positions of the indicating wheels destroys the accuracy of the timing cycle, the accuracy being affected as a function of the significance of the figure to which the indicating wheel involved corresponds.

The invention has the purpose of eliminating the danger of unintentional rotation of one or several number wheels during transitions in the conditions of the time-delay relay.

SUMMARY OF THE INVENTION

To solve this problem, the time-delay relay mentioned initially is provided according to the invention with a latching assembly which locks the resetting mechanism in that position in which it is engaged with the indicating wheels until movement of the clutch gear to a position in which it engages one of the indicating wheels and the other gears engage the other indicating wheels.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a side view of a time-delay relay with a partially cut-away housing so that a part of the inner mechanism can be seen in the state of rest of the relay;

FIG. 2 shows a somewhat enlarged section roughly along lines 2—2 of FIG. 1 in which the mechanism is again represented in the resting state of the relay;

FIG. 3 shows a detail of FIG. 1 in enlarged representation, the individual structural components of the relay being in the state of rest;

FIG. 4 shows a representation similar to that of FIG. 3, the structural components being in an intermediate position during the switch-on process of the relay; and

FIG. 5 again shows a representation similar to FIG. 3 in which the structural elements are in the operating position of the relay.

DETAILED DESCRIPTION OF THE DRAWINGS

As shown in detail in U.S. Pat. No. 3,610,847 of Houpt et al, indicating wheels **30**, which are partially shown in FIG. 3 through FIG. 5 (but are concealed in FIG. 1 by the holder **79**) are mounted on a shaft **63** and provided with numerals on their edges and may be seen through a window in the front part **22** of the housing from the direction of the arrow A in FIG. **1**. The indicating wheel **30** for the lowest digital position or least significant figure (in FIG. 2 on the extreme left) is provided on its left side according to FIG. **2** with a gear **60** attached to a toothed ring **30***a*. The other wheels similarly have toothed rings **30***a* on their respective left sides. The indicating wheels also carry cardioid cams **83** on respective other sides as shown in FIGS. **3–5**. All of the other indicating wheels **30** are also provided on their respective right sides (as viewed in FIG. **2**) with two conventional (not shown) "carry" transmission teeth. These two teeth enable a less significant figure wheel to move its adjacent, higher significant figure wheel to advance one digit for each complete revolution of the less significant figure wheel.

An electric motor (not shown) mounted in the rear part **24** of the housing drives a pinion **55** via a pair of gears **51, 52** and a shaft **53.** This pinion engages a crown gear **59** mounted on the shaft **63** and fixed to coaxially aligned gear **60** having the same radial serrations as the former. The transmission of the driving force from gear **59** to gear **60** takes place via their mutual engagement with a pinion **64** that is mounted so as to rotate freely on a shaft **67.** On the same shaft **67** are also mounted three mutilated pinions **65** which can rotate freely. Each pinion **65** can be moved into engagement with the teeth of ring **30***a* of one indicating wheel **30** and the "carry" transmission teeth of the wheel representing digits of the lesser significant figure next adjacent thereto. As the latter makes one complete rotation, the carry teeth engage the corresponding teeth of pinion **65** causing it to rotate one-tenth revolution which, since it also meshes with ring teeth **30***a*, causes the latter to advance (rotate) to the next digit.

Shaft **67** with pinions **64** and **65** comprise a clutch assembly **75** that can swivel about an axle **77.** The assem-

bly 75 is connected at its top via toggle joints 72 and 73 to the armature 71 of an electro-magnet 69. If the magnet 69 is attracting, the assembly 75 is pivoted in the clockwise direction (as seen in FIG. 1) so that the pinion 64 engages gears 59 and 60 and each pinion 65 engages one toothed ring 30*a* and one pair of "carry" teeth on two adjacent indicating wheels 30. On the left side according to FIG. 1, the assembly 75 includes a lever 75*a* protruding downward.

On axle 77, beside the assembly 75, a resetting assembly 120 is also mounted capable of pivoting independently of assembly 75 and having several feeler fingers 81 associated respectively with the wheels 30. Each finger 81 is provided at its front end with a nose 81*b* which cooperates with a cardioid cam 83 provided on each indicating wheel 30 to reset each wheel 30 to any predetermined original setting as described in the patent referred to. The cams 83 are substantially heart-shaped so that no matter what the instantaneous rotary position of the wheel 30 is, it is turned back to the original position when the assembly 120 is pivoted counterclockwise (when the electro-magnet 69 is turned off at the end of a timing cycle, for example). At the end of the counterclockwise pivoting, nose 81*b* fits into a recess 83*a*, thereby locking the cams and preventing their rotation. On the left side according to FIG. 2, the assembly 120 is provided with a lever 120*a* disposed beside the lever 75*a*.

Whereas in the time-delay relay according to the above patent the resetting assembly and the clutch assembly are always moved together, the special embodiment described herein uses separate resetting and clutch assemblies whose movements are influenced by additional latching members in such a way that during the "on" condition, the indicating wheels are held in position at every point, either by the clutch assembly or by the resetting assembly.

Lever 120*a* displays on its lower end a tab 121 lying behind the rear edge of the lever 75*a*. A spring (not shown) normally pulls the entire resetting assembly 120 clockwise so that the fingers 81 tend to come out of engagement with the notch 83*a* and the tab 121 presses against rear edge of lever 75*a*. Lever 120*a* also has on its bottom end a stop 122 extending in a direction opposite tab 121 and which can be formed by bending. Preferably, however, the stop 122 is screwed onto lever 120*a* in such a way that it can be adjusted in height. The stop 122 in the resting state of the time-delay relay (FIG. 3) lies against the tip 124 of a pivoting lever 125 mounted for rotation about shaft 126 on the bracket 79 and is tensioned by a spring 127 (FIG. 3) in the counterclockwise direction. The locking member 125 has a lower cam portion 128 running essentially horizontally, whose upper surface 129 lies against the bottom corner of lever 75*a*. The surface 129 is formed in such a way that its distance from axle 77 according to FIG. 3 becomes smaller from right to left. By means of this shaping, cam portion 128 is pressed downward when the lower corner of lever 75*a* is displaced in the clockwise direction (FIG. 3) and the latch member 125 is displaced in the clockwise direction against the action of spring 127.

When the time-delay relay is switched on the elements of the invention are as shown in FIG. 3 and the electromagnet 69 is excited causing pinion 64 to move into mesh with gears 59, 60 thereby to transmit motion to the least significant figure wheel 30. At the same time the gears 65 move into contact with the teeth of adjacent pairs of the wheels to transmit the "carries" from one wheel to the next. Movement of the gears 64 and 65, as well as of lever 75*a*, is in the clockwise direction via movement of toggle joints 72 and 73. The lower corner 76 of lever 75*a* runs along the cam surface 129 from the position shown in FIG. 3 in the clockwise direction and thereby presses the cam arm 128 downward as a result of the curvature of the cam surface described above. If the arm 75*a* has reached the position shown in FIG. 4, pinion 64 is almost in position to engage the teeth of gears 59. Similarly, pinions 65 at this moment are located in a position where they begin to engage the cam teeth 30*a* and the carry teeth of the indicating wheels 30. The cam arm 128 at this moment is pressed so far down that tip 124 is just about to release the stop 122 from the lower end of lever 120*a*. If lever 75*a* is moved farther in the clockwise direction, pinions 64 and 65 engage the corresponding teeth on the toothed rings, the stop 122 slides away over the tip 124, and lever 120*a* suddenly moves in the clockwise direction by the above-mentioned spring tension of the resetting member 120; the tip of stop 122 riding on the surface 125*a* (FIG. 5) until the tab 121 reaches the rear edge of lever 75*a*. During this sudden movement, the fingers 81 with their projections 81*b* are moved fully out of the notches 83*a* of the cardioid cams 83. The remaining rotary motion in the clockwise direction is covered jointly by the two levers 75*a* and 120*a* until pinions 64 and 65 fully engage the corresponding gear-tooth systems. This position is shown in FIG. 5.

The differences and advantages of the invention in comparison to the mechanism according to the patent cited above can easily be illustrated by imagining the latch member 125 gone. Since, as described above, lever 120*a* is so tensioned that it is pressed against lever 75*a* with its tab 121 if the locking member 128 were absent, both levers 75*a* and 128 would always move in unison, as is indeed the case in the device according to the patent cited above. The position shown in FIG. 4 would not occur in that case; instead, during the switch-on process, there would be an intermediate position in which the noses 81*b* would be raised out of the notches 83*a*, but pinions 64 and 65 would still not be meshing with their corresponding opposite-lying gear-tooth systems. In this state, the indicating wheels 30 could idle, i.e., rotate freely on axle 63 and the danger would exist that they could accidentally be rotated as a result of vibration. As shown, this condition is avoided by the invention. The problem cannot be solved merely by a simple reduction in the space between the fingers 81 and the pinions 64,65 because of the non-circular shape of the cams 83.

When the electromagnet 69 is cut off at the end of counting process, the lever 75*a* returns under the influence of a spring 104 (FIG. 1) to its initial position moving arm 120*a* along with it via tab 121, thus replacing projections 81*b* into notches 83*a* in the cardioid cams 83. As stated above, the cams 83 as a result of their shape, under the pressure of the fingers 81 at any point on their edges return to their initial predetermined "reset" positions in which the noses engage the notches 83*a*. The motor for driving the digital wheels 30 via gears 51, 52, 55, 59, 64, and 60 can either be running continuously or be turned on and off simultaneously with electromagnet 69.

Since other forms of the invention are possible and may be suggested to one skilled in the art upon reading of the present specification and perusal of the claims, the invention should be limited solely by the claims which follow.

I claim:

1. In a device for counting or the like wherein there are a plurality of wheels bearing indicia thereupon, rotary power means, a plurality of resetting means which move in unison and which can engage respective ones of said wheels and a plurality of gears which move in unison and can engage said wheels, at least one of said gears operating as a clutch to transmit rotary power from said rotary power means to at least one of said wheels, the improvement comprising: latching means operative when said gears start to move into engagement with said wheels for keeping said resetting means in engagement with said wheels until said plurality of gears engage said wheels and thereupon releases said resetting means thereby preventing idling and possible inadvertent rotation of said wheels in the interval in which said gears are moving toward engagement with said wheels.

2. The improvement according to claim **1** wherein said latching means comprises a first movable lever having a cam surface, a second lever moving in unison with said gears and further wherein said resetting means normally is biassed out of engagement with said wheels and includes a portion which is prevented by said first lever from moving in a direction in which said resetting means would be disengaged from said wheels, said second lever having a portion which bears on said cam surface and which, when moving with said gears toward said wheels, causes said first lever to move until the time it no longer prevents said resetting means from moving out of engagement, said time substantially coinciding with the beginning of the engagement of said wheels by said gears.

3. The improvement according to claim **2** wherein said first lever is mounted pivotally and biassed in a first rotary direction, wherein said second lever is pivotally mounted, and wherein said resetting means is pivotally mounted and biassed in a second rotary direction opposite said first direction, said resetting means portion having a stop element engaged by said first lever when said gears are out of engagement with said wheels.

4. The improvement according to claim **3** wherein said resetting means portion also includes a tab which engages an edge of said second lever and enables the latter to move said resetting means in unison with it in said first rotary direction.

5. The improvement according to claim **3** wherein said stop element is positionally adjustable relative to the tip of said first lever.

6. The improvement according to claim **4** wherein said tab is mounted in a plane substantially perpendicular to the plane in which said portion lies.

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