Oct. 12, 1971 E. J. NIZNIK 3,611,705

DIGITAL CLOCK WITH NOVEL INDEXING DRUMS

Filed Feb. 2, 1970 2 Sheets-Sheet 1

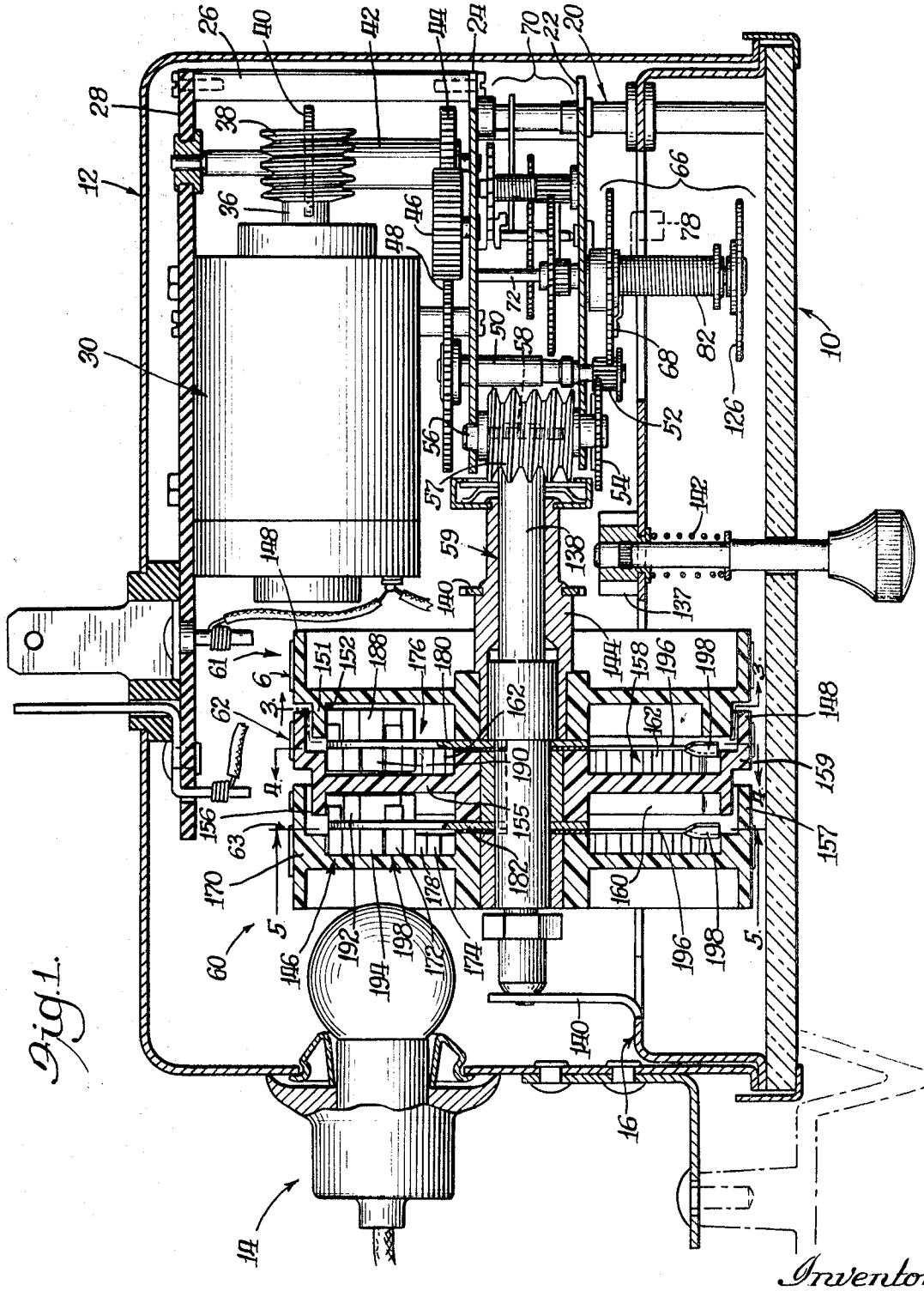

Fig. 1.

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Fig. 2.

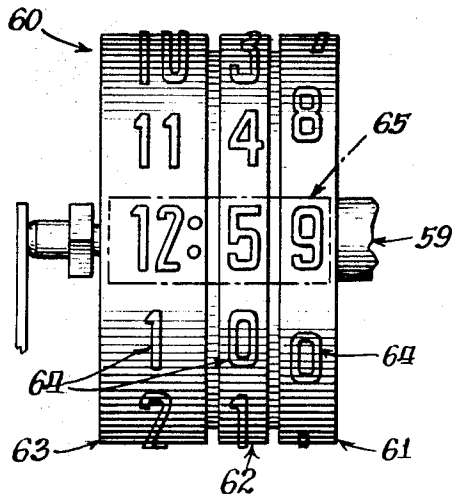


Fig. 6.

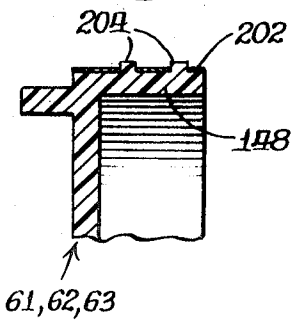


Fig. 3.

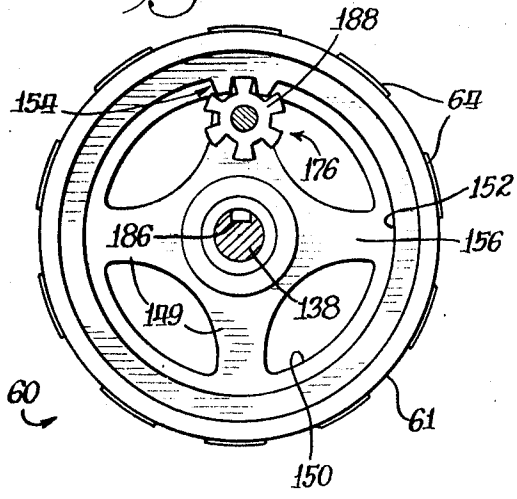
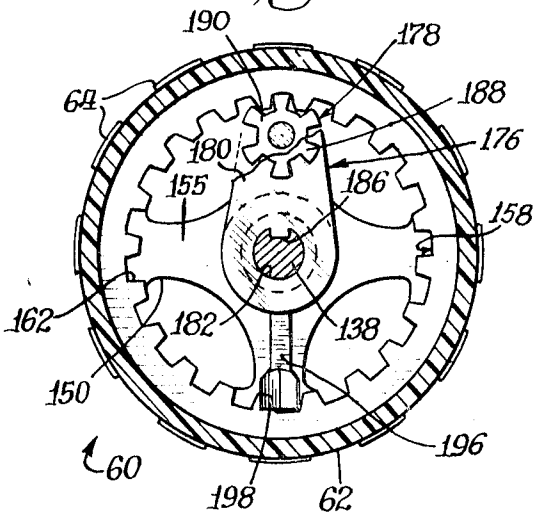


Fig. 4.



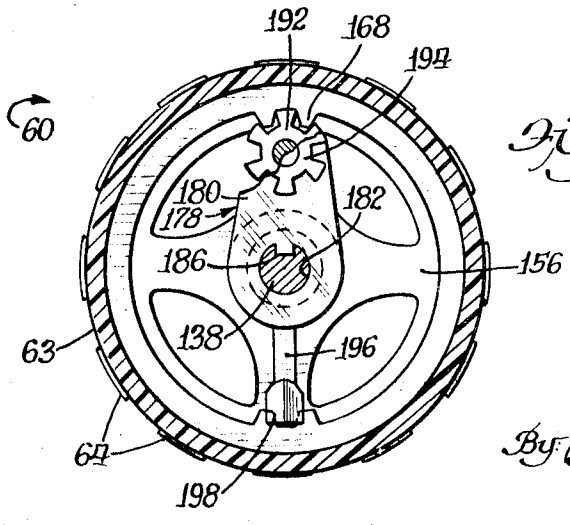


Fig. 5.

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3,611,705

DIGITAL CLOCK WITH NOVEL INDEXING DRUMS

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Int. Cl. G04b 19/30
U.S. Cl. 58—50 7 Claims

ABSTRACT OF THE DISCLOSURE

A digital clock having a plurality of drums showing the hours and minutes, and a Geneva movement having gear elements at the periphery of the drums, for greater accuracy and positioning of the drums.

CROSS REFERENCES

Applications of the same inventor filed of even date herewith: Ser. No. 7,470, Digital Clock Second Indicator; Ser. No. 7,471, Digital Clock.

OBJECTS OF THE INVENTION

A broad object of the invention is to provide a digital clock construction including digital drums bearing time indications, and novel Geneva movement construction for sequentially advancing the drums in periodic movements.

Another object is to provide a digital clock construction of the character just referred to in which the Geneva construction includes gears closely adjacent the periphery of the drums for providing greater accuracy of movement and control and to minimize friction in the movements of the drums.

A further object is to provide a digital clock construction of the foregoing general character incorporating novel and effective locking features as between the adjacent drums.

A still further object is to provide in a digital clock construction having a plurality of time indicating drums, in which the drums have novel construction providing good visibility by transmitting internal light through transparent portions forming the time indications.

A still further object is to provide a digital clock construction of the foregoing general character in the operation of which a minimum of power is required for advancing the drums.

DESCRIPTION OF A PREFERRED EMBODIMENT

In the drawings:

FIG. 1 is a view of the clock mechanism of the invention as viewed from the top and showing various elements in section;

FIG. 2 is an elevational face view of the digital time indicating drums, which are shown in section at the left of FIG. 1;

FIG. 3 is a view taken at line 3—3 of FIG. 1;

FIG. 4 is a view taken at line 4—4 of FIG. 1;

FIG. 5 is a view taken at line 5—5 of FIG. 1; and

FIG. 6 is a sectional view of a small portion of FIG. 1 indicated by the arrow 6 in that figure.

Certain portions of the disclosure in the present application are identical with or similar to corresponding portions in the cross reference applications identified above, and the corresponding elements and portions are given identical reference numerals in all the applications.

In the present instance, FIG. 1 shows a crystal 10 forming a base or supporting member supporting the remainder of the clock and serving as a principal means of mounting the clock in position, such as in an automobile. On the base is a housing 12 substantially enclosing the operating parts, and mounting an interior illuminating

lamp 14 which will be referred to again hereinbelow. The clock construction includes a supporting panel 16 in which are a plurality of posts 20 supporting a pair of spaced plates 22, 24, and mounted in the latter plate 24 are another plurality of posts 26 supporting a mounting plate 28.

An electric motor 30 is provided for driving the clock mechanism in periodic advancing movements. The motor 30 includes a drive shaft 36 having a worm 38 meshing with a worm gear 40 on a shaft 42 having a gear 44 in mesh with another gear 46 which in turn meshes with a gear 48. The gear 48 is mounted on a shaft 50 having a gear 52 in mesh with another gear 54 on a shaft 56 having a worm 57 in mesh with a gear 58. The gear 58 is mounted on shaft means 59 operatively connected with a digital time indicating unit 60, this unit 60 and its specific construction, constituting a principal feature of the invention. This unit will be described in detail hereinbelow.

Also included in the clock construction is a power transmitting or driving unit 66 and escapement mechanism identified as a whole at 70. These two components or units 66, 70 are described in detail in the cross reference applications referred to above and it is believed unnecessary to include herein a description of the details thereof. Briefly, the gear 52 meshes with the gear 68, and thereby turns or rotates the latter at the same time that the time indicating drums in the unit 60 are advanced. The unit 66 includes a torsion main spring 82 that is tensioned by the rotation of the gear 68, and the unit 66 continues to rotate a seconds indicator 126 and a control unit 78, under the control of the escapement mechanism 70. At each rotation of the unit 78 about the axis of the spring 82 the motor 30 is energized under the control of the unit 78 and operates through a predetermined period, which in this instance is on the order of 3–4 seconds; the size and proportion of the gear train between the motor and the unit 78, and between the motor and the unit 60 are such that at each energization and cyclic operation of the motor, the unit 78 is rotated once around the axis of the spring 82, and the time indicating unit 60 is advanced an increment representing one minute, as referred to again hereinbelow. The seconds indicator 126 is rotated constantly under the action of the coil spring 82 and under the control of the escapement mechanism 70, so that the indicator 126 makes one revolution or rotation per minute, and at the end of each minute-cycle again controls the motor 30 for advancing the time indicating drum unit 60 at that time, and energizing the coil spring 82. While details of operation of the control unit 66 are described fully in the cross reference applications identified above, it is desired to state that an element of the shaft means 59 is rotated at each minute interval, an increment representing one minute. The time indicating unit 60 includes a minute drum 61, a ten-minute drum 62 and an hour drum 63. Preferably the minute drum 61 is provided with ten digits 1 to 9, and 0 distributed in a single series thereabout; the ten-minute drum 62 preferably includes two series of digits, each from 1 to 5, and 0; and the hour drum 60 preferably includes a single series of digits of 1 to 12. These various drums are advanced at corresponding portions of the hour.

The shaft means 59 includes a shaft proper 138 fixedly mounted in supporting means of suitable and known kind. Rotatable on the shaft 138 is a sleeve 144 carrying the minute drum 61. The ten-minute drum 62 and the hour drum 63 are mounted on the shaft 138 for rotation relative thereto. The sleeve 144, with the drum 61, is rotated once each minute under the drive from the motor 30, through the gear 58, and the other two drums 62, 63 are rotated from the first one by means of a novel Geneva mechanism indicated in its entirety at 146 (FIG. 1).

The drums **61**, **62**, **63** may be of any suitable constructional shape, having outer cylindrical peripheral elements **148** bearing the indicia **64** on their outer surfaces presented suitably to view, such as exposure through a window **65** (FIG. 2).

The drums of the unit **60** for purposes of incorporating the novel Geneva mechanism **146** include construction as follows: the dum **61** (FIG. 3) includes a web in the form of spokes **149** forming openings **150** therebetween, and an axially extending annular rib **151** (FIG. 1) telescoping into the element **148** in the next drum **62**; the rib **151** on its radially inner surface **152** is provided with two tooth elements **154** at one location (see also FIG. 3); the ten-minute drum **62** similarly includes a spoke-web **155** and an annular element **156** extending into the outer peripheral element **157** in the drum **63**, and another annular element **159** on the other side of the spoke-web **155** providing radially inwardly facing surfaces **160**. The surface **158** is provided with a continuous series of teeth **162** while the surface **160** is provided with two tooth elements **168** (see also FIG. 5) at each of two locations this arrangement corresponding to the two series of digits on the outer surface of that drum; in a similar manner, the hour drum **63** includes the annular element **157** mentioned having a radially inwardly directed surface **172** on which is provided a continuous series of teeth **174**.

The Geneva mechanism **146** includes a first unit **176** and a second unit **178** substantially identical in construction.

Each Geneva mechanism component **176**, **178**, includes an arm **180** having an aperture **182** (FIGS. 3–5) receiving the shaft **138** and having a flat **186** locking the arms to the shaft against rotation. The arms extend radially outwardly, and in the outer ends thereof are gear components, that on the arm **180** including a first gear **188** and a second **190**, and that on the arm **182** having a first gear **192** and a second gear **194**.

In the case of the component **176** the gear element **188** is positioned within the annular element **151** for engagement by the tooth elements **154** and the other gear element **190** is positioned within the surface **158** and meshing with the continuous series of teeth **162**.

In the case of the component **178**, the gear element **192** is within the annular element **156** and in position to mesh with the tooth elements **168**; the gear element **194** is within the annular element **170** and in mesh with the teeth **174**.

The gear elements **188**, **192**, are so proportioned and shaped relative to the cooperating surfaces **152**, **160**, and the tooth elements **154**, **168**, that the tooth elements are operative for rotating the gear elements one tooth increment of movement, and thereafter the gear elements remain immovable as controlled by the surfaces **152**, **160**, in accordance with known characteristics of Geneva mechanisms. In the case of minute drum **61**, it is provided, as noted above, with a single series of digits of 1 to 9, and 0, and accordingly tooth elements **154** at a single location are provided so that in one revolution of that drum the gear element **188** acting through the companion gear element **190** advances the ten-minute drum **62** a corresponding amount which is one digit spacing, or $\frac{1}{12}$ of a complete revolution of the latter.

A similar movement and control of the component **178** is provided, and in this case two tooth elements **168** are provided, at each of diametrically opposite points, so that at the end of six advancements of the drum **62** which corresponds with six decades, the gear **192** is advanced an amount such that the gear **194** advances the hour drum **63** an amount representing one hour, which in this case is $\frac{1}{12}$ of a full rotation.

The construction also includes means for yieldingly retaining the drums **62**, **63** in fixed position between periodic advancements. This means includes flexible radial arms **196** respectively between the drums **61**, **62** and **62**, **63**, mounted on the shaft **138** against rotation and having inclined elements **198** which engage in the gaps between the teeth **162**, **174**. These arms **196** yield upon deliberate advancement of the drums, this davancement of the respective drums being in each case that represented by a single tooth spacing, the arms then interengaging in the next tooth gaps.

The Geneva movement construction provides operative interengagement between the drums at a position closely adjacent the periphery of the drums. This provides a long lever arm action, as contrasted with the gearing being positioned closely adjacent the hubs of the drums.

The advantages of the construction include greater accuracy and more simplified control because of the additional leverage provided by the greater distance from the axis of rotation; because of the greater distance from the axis of the gears, a given linear or peripheral increment of movement results in a lesser angular movement as compared with the previous constructions in which the gears are closely adjacent the axis. Another advantage is that static friction is more easily overcome because of the greater leverage provided by the greater radial distance from the axis.

The invention also includes novel means for presenting illuminated indicia for observation, the illumination deriving from the lamp means **14**. Preferably the drums **61**, **62**, **63**, are made of transparent plastic as represented in FIG. 6, and the lamp means **14** is positioned for directing the light into the interior space of the drum unit **60**, and to propagate the light throughout the unit as through the openings **150**. The outer surfaces of the elements **148** of the drums are provided with an opaque coating **202** around the configurations forming the indicia **64**, these configurations including embossments **204** forming extensions of the body of the transparent material making up the drums, whereby the illumination is enabled to pass through the embossments making up the indicia, and not through the coating **202**.

I claim:

1. Clock mechanism comprising

a time indicating unit including a succession of drums in turn including a first drum and at least one successive drum,

means including main shaft means for mounting the drums for rotation about the axis of that shaft means, the main shaft means including at least a rotatable element and the first of the drums being secured to that rotatable element for rotation therewith,

means operable in accordance with the passage of time for rotatably driving said element of the shaft means and thereby rotating the first of the drums,

the drums being of substantially greater diameter than the shaft means,

Geneva gearing for driving the successive drums from the first drum, including gear teeth on the drums at the periphery thereof and a gear component between each two adjacent drums,

each gear component including a gear element meshing with the gear teeth in the adjacent drum, the gear elements in all the gear components being disposed on axes remote from the axis of the main shaft means and close to the gear teeth at the periphery of the drums, and

the drive transmission between the drums being initiated by the first drum and transmitted to the successive drums through the peripheries of the drums.

2. Clock mechanism according to claim **1** wherein,

the main shaft means also includes a fixed element, and

the mechanism including a radial arm for each gear component secured at one end to the fixed element of the main shaft means and mounting the gear component at its extended end.

3. Clock mechanism according to claaim **2** wherein,

the arms are disposed at transverse planes between adjacent elements of adjacent drums,

the gear teeth on the drums are located on said adjacent elements of the drums, and

each gear component includes axially spaced gears engaging the gear teeth on the respective ones of the elements of the adjacent drums.

4. Clock mechanism according to claim 2 and including, a radial arm associated with each successive drum secured at one end to the fixed element of the main shaft means and having a flexible extended end yieldable in axial directions engageable with the teeth on the respective successive drum and thereby operative for yieldably retaining those drums against rotation between positive movements of the successive drums.

5. Clock mechanism according to claim 3 wherein, adjacent drums have axially intertelescoping elements, and the arms mounting the gear components, which are essentially between the adjacent drums, are enclosed, considered as viewed radially, by the intertelescoping elements of the drums.

6. Clock mechanism comprising a plurality of coaxially mounted time indicating drums and means for rotatably advancing the drums in accordance with passage of time,

the drums having axially intertelescoping elements precluding effective passage of light between drums,

the drums each including a web made up of spokes with spaces therebetween, the spaces forming openings extending axially throughout the drums,

the drums having peripheral elements made up of a background portion and time indicating elements,

the background portion on the one hand and the time indicating elements on the other hand having different light transmitting characteristics to provide visual contrast between the time indicating elements and the background portion.

7. Clock mechanism according to claim 2 wherein the drums include webs in the form of spokes with openings therebetween forming continuous openwork axially through the drums, and include peripheral elements of transparent material, and opaque material on the outer surface thereof around configurations forming time indicia whereby to enable passage of light through the peripheral elements and through the time indicia configurations, and light means illuminating the interior of the drums.

References Cited

UNITED STATES PATENTS

2,355,514	8/1944	Deane et al.	58—125
2,343,613	3/1944	Goldsmith, Jr.	58—125
2,459,107	1/1949	Johnson	58—19
2,748,560	6/1956	Clark	58—125

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58—125 C