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ROTATING DIAL NUMERAL CLOCK

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My invention relates to rotating dial counters and in particular to rotating dial numeral clocks, and its object is to provide such a counter in which the numbers to be exposed are large but in which the dials carrying such numbers are arranged in a relatively small space. In carrying my invention into effect the front dial has openings or windows through which numerals on dials on the rear thereof may be exposed. In this way relatively large dials carrying relatively large numerals may be provided in a space the lateral dimensions of which need be little greater than that of the largest dial.

The features of my invention which are believed to be novel and patentable will be pointed out in the claims appended hereto. For a better understanding of my invention reference is made in the following description to the accompanying drawing in which Fig. 1 is a face view of a numeral clock embodying my invention with the positions of the various number dials indicated in dotted lines; and Fig. 2 is a perspective view of the essential parts of the clock mechanism with the relative positions of such parts greatly exploded in a direction parallel with the axis of rotation of the various dials. In actual construction, the depth of the entire clock mechanism, including the driving motor, will not be greater than two inches.

In the counter of my invention as arranged for telling time of day there will be at least three dials, and if seconds are to be indicated, there will be a fourth dial. In the drawing these four dials are indicated by reference characters H, 10m, m and s. Dial H is the hour dial and has numerals 1 to 12 consecutively placed thereon in a clockwise direction about its front periphery to designate the hours from 1 to 12. This dial will be advanced once per hour on the hour $\frac{1}{12}$ of a revolution in a counterclockwise direction so as to bring the selected proper hour numeral graduation opposite window 13 in the front face plate 14 of the clock. In the illustration numeral 12 is opposite window 13 and in Fig. 2 a dot and dash line indicates the alignment of numeral 12 on the hour dial with window 13. Dial 10m is the ten minute dial and has numerals 0, 1, 2, 3, 4, and 5 consecutively placed about its front periphery in a counterclockwise direction to indicate the ten minute intervals. This dial will be advanced $\frac{1}{6}$ of a revolution every ten minutes in a clockwise direction to bring the selected proper ten minute numeral into alignment with the left half of window 15 in the front plate 14. Dial 10m is placed back of and has its axis of rotation some-

what to the left of the axis of rotation of the hour dial H but on the same horizontal line. In order that the proper numeral on dial 10m may be seen through window 15 with dial H intervening, the center of the latter is made transparent as by being cut away to leave a large opening 16, and this dial H rotates on a large hollow sleeve, a portion of which is shown at 17 supported from the front plate of the clock. In the illustration ten minute numeral 4 on dial 10m is in visual alignment with the left half of opening 15 and may be seen therethrough through the central openings in sleeve 17 and dial H. A dot and dash line indicates such alignment in Fig. 2.

Dial m is the minute dial and has numerals 0, 1, etc. up to 9 consecutively placed about its front periphery in a counterclockwise direction to indicate the minutes time intervals. This dial will be advanced $\frac{1}{60}$ revolution every minute in a clockwise direction to bring the proper minute numeral into alignment with the right half of window 15 in the front dial plate 14 and also in horizontal alignment and close to the ten minute numeral seen therein, so that these two numerals together indicate the minutes. Dial m is on the same axis of rotation as dial 10m, is back of dial 10m but is enough larger that its numeral band is not hidden by dial 10m. In practice the smaller dial 10m will rotate in a recess 18 in dial m so that their numeral faces are flush with each other. The central openings in sleeve 17 and dial H are sufficiently large that the proper numeral on the minute dial m can be seen therethrough when visually aligned with window 15. In the illustration minute numeral 5 on dial m is in alignment with the window opening and such alignment is indicated by a dot and dash line in Fig. 2.

When a seconds dial s is included, it may be mounted on an axis of rotation to the right of and on a horizontal line with the axes of rotation of the other dials. The dial s will have suitable second graduations on its front periphery reading upward in a direction opposite to its direction of rotation and will revolve continuously at 1 revolution per minute. It will have a diameter such as not to overlap the minute dial m and so as not to extend beyond or materially beyond the right extremity of hour dial H. The hour dial H is provided with twelve openings or windows 19 evenly positioned about the dial between the numeral band and the central opening 16. By windows or openings I means to include transparent portions. These openings 19 are so positioned that when the hour dial H is in any one of its twelve

stationary indicating positions, one of these openings 19 will be in alignment with a seconds window 20 in the front dial plate and also in alignment with the left front periphery of seconds dial *s* such that the proper seconds indication on such dial may be seen in window 20. Thus, in the drawing, seconds indication "30" on dial *s* is seen through the opening 19 in dial H adjacent numeral "6" thereon and through window 20. In shaping the openings 19, I prefer to leave a pointer shaped projection extending from the center of the inner edge thereof to serve as a reference point for more exactly reading the seconds dial. Such pointer projection is indicated at 21 and is the only part of dial H that can be seen through window 20 when dial H is in an indicating position. Such pointers are preferably colored to contrast with the color of the seconds dial so as to be clearly visible. Thus, the only time the seconds dial *s* is obscured in any way by dial H is during the few seconds at the end of each hour when the dial H is advanced $\frac{1}{2}$ revolution as will become evident when the advancing mechanism is described. At all other times dial H is stationary with one of its pointer projections 21 centered in the left edge of window 20 and with the rotating seconds dial *s* clearly visible there-through.

It will be understood that the numbering on all of the dials will be such as to appear right side up when opposite their indicating windows. Thus, the numerals on the left of the hour and seconds dials will appear right side up while the numerals on the right of the 10*m* and *m* dials will appear right side up. It will be noted that the dial arrangement brings the hour, minute and seconds indications in horizontal alignment, reasonably close together and in their proper order. The numeral space and the numerals on the more important hour, ten minute and minute dials is sufficiently large that the time may be read from a good distance without resorting to the use of dials of undesirably large diameter. These dials are graduated in size in accordance with the number of indications thereon so that the numbers may be made of a uniform size without crowding.

The clock is operated by a suitable timing motor. In this instance I have shown a self-starting, synchronous motor 22 for this purpose. 23 indicates an inclosed gear reduction from which a terminal shaft 24 extends and this shaft will be assumed to operate at 1 revolution per minute in a clockwise direction. The seconds dial *s* is driven continuously from the motor shaft 24 at 1 revolution per minute in a clockwise direction through the gears shown at 25. The shaft between dial *s* and its driving gear is broken away in the illustration.

The mechanism for advancing the minute dial *m* may comprise any suitable mechanism and in the illustration comprises a cam 26 on shaft 24, a ratchet operating lever 27 reciprocated by cam 26, a ratchet pawl 28 and a ten tooth ratchet wheel 29 secured on a hollow shaft 30 to the forward end of which minute dial *m* is also secured. Lever 27 is pivoted at 31 and has three arms extending therefrom. An upward extending arm carries a pin 32 bearing against cam 26. A downward extending arm is biased by a spring 33 to maintain pin 32 against the cam 26. The ratchet pawl 28 is pivoted to the rearwardly extending arm of this ratchet operating lever, and the ratchet pawl is retained in contact with the ratchet wheel 29 by a light spring

34. Ratchet wheel 29 is prevented from backward rotation by a pawl 35 shaped to aid in exactly positioning minute dial *m* in its various stationary positions. This mechanism for advancing minute dial *m* in steps at the end of each minute $\frac{1}{6}$ of a revolution operates as follows: As cam 26 operates at a uniform speed in a clockwise direction at one revolution per minute its high part slowly moves ratchet lever 27 to the rear, retracting pawl 28 and stretching spring 33 and drawing pawl 28 over and behind the next tooth in ratchet wheel 29. Pin 32 then drops over the step in the cam 26 and the lever 27 is rotated more quickly in a clockwise direction by spring 33 during which movement pawl 28 advances ratchet wheel 29 exactly $\frac{1}{6}$ revolution which brings the next number, "6" in this case, into alignment with the right side of window 15.

The ten minute wheel 10*m* is advanced by a mechanism driven by shaft 30 consisting of the gears 36 and 37, a shaft 38, a finger 39 on this shaft, and a pin gear wheel 40, on a shaft 41 which shaft extends forward through hollow shaft 30 and rotates dial 10*m*. The gear ratio between shaft 30 and shaft 38 is a one to one ratio and, hence, pin 39 moves into driving relation with pin gear 40 once every ten minutes. Pin gear 40 has six teeth and is advanced $\frac{1}{6}$ revolution every ten minutes. A spring pawl 42 assists in exactly positioning shaft 41 and dial 10*m* and holding it in its six stopping positions which are such as to consecutively align the numerals on dial 10*m* in the center of the left side of window 15. The position of pin 39 on shaft 38 is such that when dial 10*m* is advanced it is advanced simultaneously with dial *m* when the latter moves to expose numeral "0". Thus, when dial *m* is being advanced to change its indication from 9 to 0, dial 10*m* is being advanced simultaneously to expose its next consecutive numeral which, in the illustration, will be "5".

The mechanism for advancing hour dial H at the end of each hour comprises a pin 43 extending forward from the periphery of a disc 44 on the forward end of shaft 41 and a 12 tooth pin gear 45 extending from the rear of dial H. Disc 44 is horizontally to the left of the axis of rotation of dial H and its pin gear 45 as is best shown in dotted lines in Fig. 1. Disc 44 and its pin 43 rotate clockwise and when pin 43 is to the right it contacts with a pin at the left in pin gear 45 and advances dial H $\frac{1}{12}$ revolution in a counterclockwise direction. Pin 43 is in the approximately same rotative position as numeral "0" on dial 10*m* and hence, when the ten minute indication changes from "5" to "0" the hour dial H moves $\frac{1}{12}$ revolution and these advancing operations are such as to exactly center the hour numerals in window 13. A positioning pawl 46 assists in this centering operation. It will be evident that the time consumed in any advancing operation of the 10*m* and H dials is no longer than that consumed in advancing the *m* dial one step, which is not more than a few seconds at the most. When all dials, *m*, 10*m* and H are advanced, they are advanced simultaneously.

In order to advance dials *m*, 10*m* and H in clock setting operation, shaft 38 is provided with a beveled gear 47 at its rear end. A cooperating beveled gear 48 is secured on a shaft 49 which may be pushed downward manually against the tension of a spring 50 towards and into engagement with gear 47 and then turned by hand to rapidly advance shaft 38. This advances all of

the dials in driving relation with shaft 38 in the same relation that they are advanced by the timing motor except at a much more rapid rate. When the hand is removed from the thumb nut on setting shaft 49, it moves away under the action of spring 50 and gears 47 and 48 are demeshed. This operation in no way interferes with the operation of the timing motor and ratchet lever 27 and the normal operation of the timing motor in advancing the dials is resumed following a manual setting operation. A manual setting operation must be in an advancing direction and not a reverse direction of the dials.

When a self-starting synchronous motor is used to drive the clock, I prefer to combine with it an indicator for indicating on the face of the clock any interruption in the power supply to the motor. Such indicator comprises a magnetic finger 51 pivoted with a shaft 52 near the field iron of the electric motor 22, together with a semaphore signal arm 53 on the forward end of shaft 52. When the motor is energized and finger 51 is rotated to the dotted line position in Fig. 2, it is held in this position by magnetic attraction. The bolt 54 for holding the laminations together may be made of iron and extend towards the attracted position of finger 51 to augment the leakage flux. In the attracted position of this device, the semaphore arm 53 is hidden from view. However, when the motor is deenergized and finger 51 is no longer attracted, shaft 52 rotates clockwise either by gravity or by a light spring 55 or by both, to the full line position shown. This brings the upper end of semaphore arm 53 into view between window 13 and the dial H, as best shown in Fig. 1 and indicates to one observing the clock that sometime previously, the clock has been stopped, although it may be running at the time of such observation, and should be set correctly before its time indication is to be relied upon. The finger 51 will not be pulled to the attracted position by magnetic action alone when the motor is again energized, but must be reset by hand. For resetting the indicator to non-indicating position, I prefer so to associate it with the clock setting mechanism that both the dials and the signal may be reset simultaneously. To this end, the signal shaft 52 is provided with a finger 56 which extends back of a pin 57 in a lever 58 operated by the clock setting device. It will be seen that when bevel gear 48 is lowered in a clock-setting operation, lever 58 will be swung to the rear and will carry with it lever 56 to bring finger 51 into position where it will be attracted and held by the leakage flux of the motor when it is energized. This resetting combination feature is broadly covered in United States Letters Patent No. 1,954,660 to Aldis, April 10, 1934, assigned to the same assignee as the present invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A clock comprising a face plate having a pair of windows therein, a rotatable hour dial back of said plate having hour numerals about its front periphery such that any selected hour numeral thereon may be rotated into visual alinement with one of said windows, said hour dial having a central opening in alinement with the other window of said plate, coaxial, rotatable minute and ten minute dials of different diameters back of said hour dial having minute and ten minute numerals about their front peripheries such that any selected numerals thereon

may be rotated into visual alinement with said other window and said central opening, a timer motor, and mechanism operated by said timer motor for rotating said dials to indicate the time through said windows.

2. A clock comprising a face plate having a pair of horizontally alined windows therein, a rotatable hour dial back of said plate having hour numerals about its front periphery such that any selected hour numeral thereon may be rotated into visual alinement with the left-hand window, said hour dial having a central opening in alinement with the right-hand window of said plate, coaxial, rotatable minute and ten minute dials back of said hour dial and having minute and ten minute numerals about their front peripheries, said minute and ten minute dials being of different diameters and having their right-hand peripheries and the numbers thereon visible through the right-hand window of said plate and the central opening in said hour dial, a timer motor, and mechanism operated by said timer motor for rotating said dials to indicate time through said windows.

3. A clock comprising a face plate having a pair of horizontally alined windows therein, a large rotatable hour dial back of and parallel with said plate having (twelve) hour numerals uniformly distributed about its front periphery, such that any selected numeral thereon may be rotated into visual alinement with the left window, said hour dial having a central opening in alinement with the right-hand window, a smaller minute dial back of and parallel with the hour dial having (ten) minute numerals uniformly distributed about its front periphery, a still smaller dial parallel and between said other dials and having (six) ten minute numerals uniformly distributed about its periphery, the minute and ten minute dials having the same axis of rotation and having their right-hand peripheries and the numerals thereon visible through the right-hand window and said central opening, a timer motor, and a mechanism operated by said motor for advancing the minute dial $\frac{1}{60}$ revolution every minute, the ten minute dial $\frac{1}{6}$ revolution every tenth advance of the minute dial and the hour dial $\frac{1}{12}$ revolution every sixth advance of the ten minute dial to indicate time through said windows.

4. A clock comprising a face plate having three alined windows therein, a rotatable hour dial back of said plate having (twelve) hour numerals about its front periphery such that any selected numeral may be rotated into visual alinement with the first one of said windows, second, minute and ten minute rotatable dials, all smaller than the hour dial located back of said hour dial and having second, minute and ten minute, time graduations respectively on their front peripheries, a central opening in said hour dial in alinement with the second one of said windows through which selected graduations on the minute and ten minute dials are visible, twelve openings in the hour dial arranged in a circle inside and adjacent to the (twelve) hour numerals thereon, such that when the hour dial is positioned to indicate any hour numeral through the first window, one of said twelve openings is in alinement with said third window and a selected part of the graduated portion of the second dial is visible therethrough.

5. In a clock a rotatable hour dial having hour numerals uniformly distributed about its front periphery, a corresponding number of uniformly distributed openings in said dial arranged in a

circle inside of said numerals, a face plate in front of and parallel with said dial having a window opposite one portion of the numbered periphery of said dial, and a second window opposite the circle of openings in said dial, said windows being so positioned that when a numeral is in alignment with the window first mentioned one of said openings is in alignment with the second window, a rotary dial back of the hour dial having time graduations on its front periphery, a selected portion of which graduations are visible through the second mentioned window and any opening in the hour dial aligned therewith, the openings in said hour dial being formed to provide a central reference mark by means of which the time graduations seen therethrough may be more accurately read, a timer motor for rotating the time graduated dial and mechanism operated by said motor for advancing said hour dial from one of said window-aligned positions to the next consecutive window aligned position once per hour.

6. A clock comprising a face plate, a central window therein and other windows to the right and left of the central window, a rotatable hour dial back of and parallel to said plate having a central opening aligned with said central window and having its periphery extending beyond the other windows, coaxial minute and ten minute dials of different diameters each smaller than the hour dial, located back of and parallel with said hour dial with their right-hand peripheral portions visible through said central window, a rotatable seconds dial back of and parallel with said hour dial having its left-hand peripheral portion in visual alignment with the right-hand window, a plurality of hour indicating numerals and a corresponding number of openings arranged in concentric circles on and in said hour dial, a numeral on the left side of the numeral circle being visible through the left-hand window when the opening at the right in the circle of openings is in alignment with said right-hand window, time indications on the dials back of the hour dial, selected portions of which are visible through the central and right-hand windows, a timer motor and a mechanism driven by said motor to advance all of said dials at different average rates to indicate time through said windows.

7. A clock comprising a front face plate provided with a pair of horizontally aligned windows, an hour dial rotatably mounted parallel and closely adjacent the rear of said plate and having a circular row of hour numerals about its front periphery, any numeral of which is rotatable into alignment with the left-hand window in the face plate, said dial having a central window portion

in alignment with the other window in said face plate; coaxial rotatable minute and ten minute dials closely adjacent and back of the hour dial, the ten minute dial having ten-minute numerals arranged in a circle on its front periphery, the numeral on the right of which is in alignment with the left side of the central window in said hour dial, the minute dial being of larger diameter than, and to the rear of, the ten minute dial but having a peripheral band extending forward in the same plane as the ten minute dial and having a circular row of minute numerals thereon, the right numeral of which is in alignment with the right side of the central window in said hour dial, a clock motor and a mechanism operated by said motor for advancing said dials in steps, the minute dial every minute, the ten minute dial every ten minutes and the hour dial every hour, a distance equal to the spacing of the numerals on said dials to indicate time through said windows.

8. A clock comprising a face plate having three horizontally aligned windows, an hour dial, closely adjacent the rear of said plate and parallel thereto, said dial having a circle of hour numerals uniformly distributed on its outer front periphery, the numeral on the left of which may be positioned in the left-hand window, said dial having a central observation opening in alignment with the central window of the face plate and a plurality of observation openings arranged in a circle within the number circle equal in number to the hour numerals, said plurality of openings consecutively aligning with the right-hand window of the face plate as the hour numerals on the hour dial are consecutively aligned with the left-hand opening in the face plate, rotatable minute and ten minute dials back of said hour dial and having circular rows of corresponding time graduations on their fronts which rows are rotatable past the central opening in the hour dial to expose time indicating combinations of said graduations through the central window of said face plate, and a continuously movable member having second indicating graduations thereon back of the hour dial and the right-hand window in said face plate, such that a selected portion of such graduations may be seen therethrough, a timer motor, means operated thereby for advancing said dials and the seconds indicating member so as to expose clock time through said windows, said hour dial being advanced in step once per hour and in the intervals having stationary positions where time markings on all of said dials and the seconds indicating member are clearly visible through said windows.

EDGAR BOURQUIN.