

April 28, 1953

A. HOLZNER
CYCLOMETER INDICATOR MECHANISM FOR
TWENTY-FOUR HOUR CYCLOMETER CLOCKS

2,636,339

Filed March 2, 1949

2 SHEETS—SHEET 1

Fig. 1.

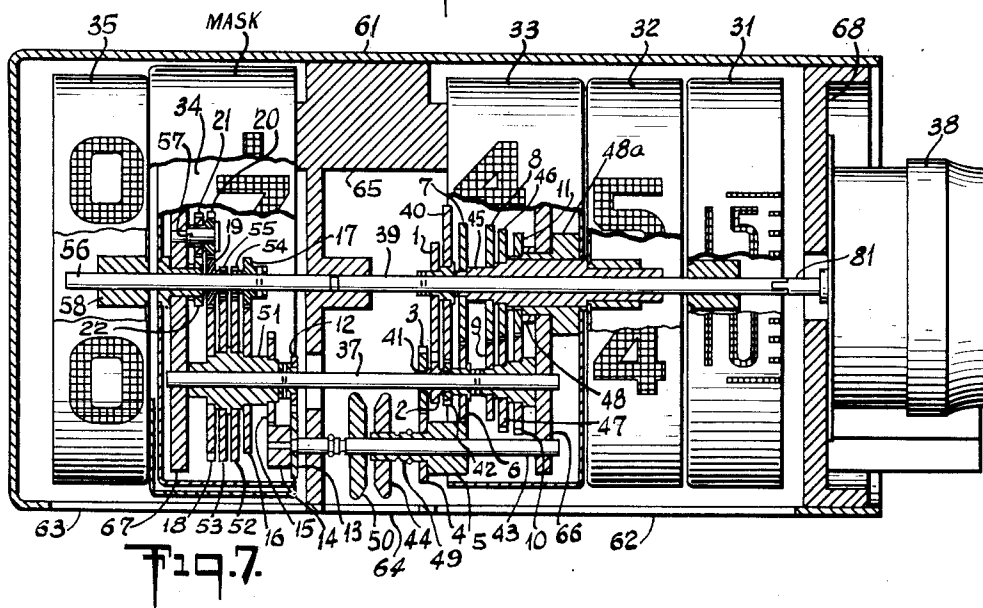


Fig. 7.

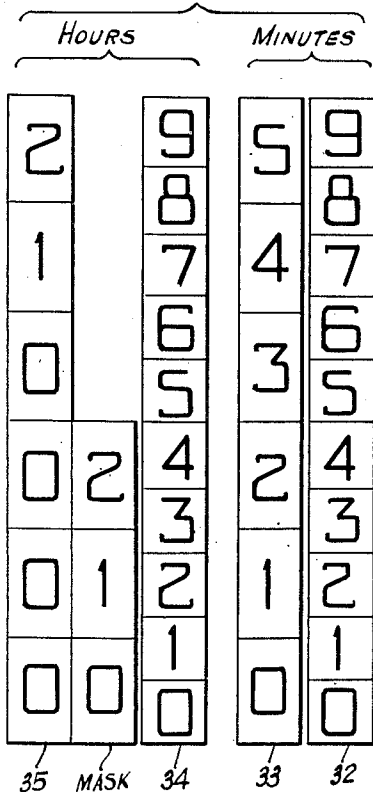
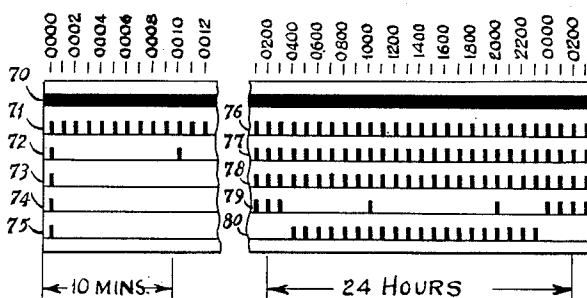


Fig. 8.



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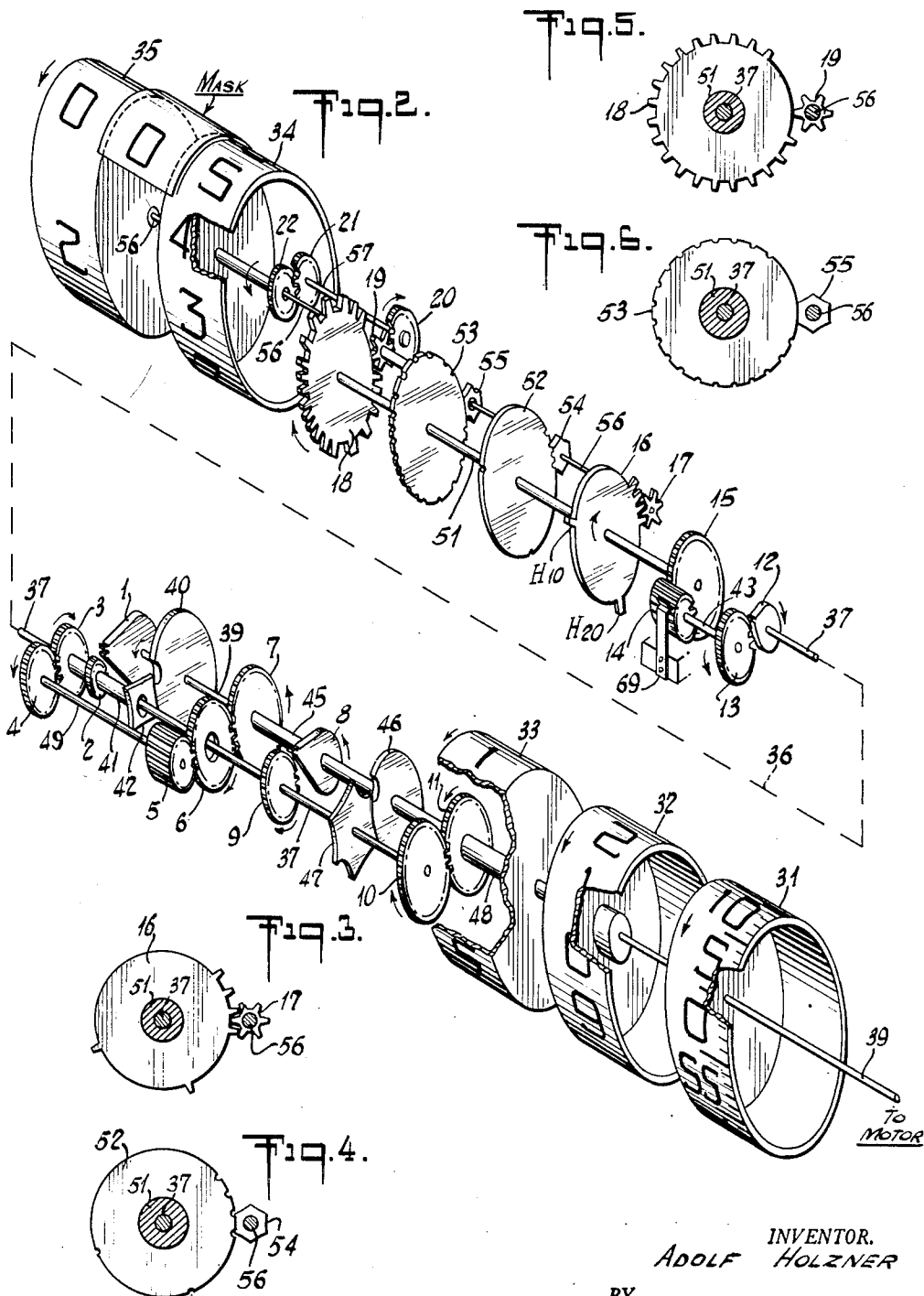
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2 SHEETS—SHEET 2



UNITED STATES PATENT OFFICE

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CYCLOMETER INDICATOR MECHANISM
FOR TWENTY-FOUR HOUR CYCLOMETER CLOCKS

Adolf Holzner, Merrick, N. Y.

Application March 2, 1949, Serial No. 79,183

21 Claims. (Cl. 58—125)

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This invention relates to cyclometer clocks and more particularly to a novel design of clock mechanisms which will meet certain requirements for simplicity, attractive appearance and advantageous operation.

It is an object of my invention to provide a novel 24-hour cyclometer clock, the drum dials of which are driven intermittently to show the hours and minutes by means of large numerals exposed through a window opening in the case.

Another object is to provide a novel gear train for intermittent movement of the number wheels of a 24-hour cyclometer clock in such manner that the tens and units digits of the hour are properly displayed on two number wheels having an irregular stepping schedule.

Again, it is among the objects of my invention to provide a cyclometer clock having a plurality of aligned drum dials which surround their gear train, the arrangement being such that the dial which shows seconds is rotated continuously and the other dials are stepped quickly from one to the next indicating position where they rest for suitable periods to correctly indicate the time of a 24-hour day.

Other objects include the provision of means for independently setting the minute dials in one operation and the hour dials in another operation.

Still other objects and advantages of my invention will become apparent in the description to follow. Among these is the provision of cyclometer indicator means counting up to a predetermined maximum number comprising digits other than "9's," as for example, 2359, or 359. This description is accompanied by drawings, the several figures of which may be briefly mentioned as follows:

Fig. 1 shows a longitudinal cross-section of the clock with its drum dials and enclosed gear mechanism,

Fig. 2 shows an expanded view of the gear mechanism,

Figs. 3 and 5 show certain mutilated gears which are used in the gear train,

Figs. 4 and 6 show Geneva movements which are associated with the mutilated gears of Figs. 3 and 5, respectively,

Fig. 7 shows a developed outline of the hour and minute drums.

Fig. 8 is a timing diagram which shows continuous and intermittent operation of various members in the clock mechanism.

Referring first to Fig. 1, a clock-case 61 of substantially cylindrical form is arranged to house

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five drum dials and a gear train which is mounted within the dials. The case 61 has a rectangular window 62, for the seconds and minutes drums, and another window 63 for the drums which indicate the hours. There is also a hole 64 in the case which gives access to two knurled wheels 44 and 50 for independently setting the drums for the minutes and for the hours.

A main frame 65, which may be a casting, is secured within the casing and has bearings therein for certain of the spindles or shafts. Two bearing plates 66 and 67 serve to support certain of the spindles, while an end member 68 provides a base for a driving motor 38.

Referring now to Fig. 2, I show therein, an arrangement of coaxially mounted drum dials of which dial 31 is marked to show the seconds. Dial 32 is marked with ten numerals to show the units of minutes. Dial 33 is marked with six numerals to show the tens of minutes. Dial 34 is marked with ten numerals to show the units of hours and dial 35 is marked with a succession of four zeros and the numerals 1 and 2 to show the tens of hours on a 24-hour basis. The four zeroes are successively displayed during the hours 00, 01, 02 and the last zero for a seven-hour period from 03 to 09 inclusive.

The broken line 36 serves to indicate that there is a continuation of the spindle 37 in the two parts of the figure, these two parts being separated in order to show the entire gear train on one sheet of drawings. The coaxial alignment of all the drum dials will, therefore, be understood.

My novel clock design lends itself to being driven either by a synchronous clock motor or by a spring-wound motor. Where a dependable voltage-regulated D. C. power supply is available, a constant speed D. C. motor may be substituted for a synchronous motor. For the sake of accurate timing, however, the synchronous motor drive is preferred. In any event, the motor 38 is arranged to drive the spindle 39 continuously at a rate of 1 revolution per minute.

The drum 31 for showing seconds is fixedly mounted on the shaft 39. It is graduated to bring the seconds markings progressively past a fixed index. The shaft 39 extends through two independently rotatable bushings 45 and 48. A finger gear 1, and a Geneva cam 40 are fixedly mounted on the shaft 39. Gear 1 has two teeth which intermittently engage with a full gear 2 and cause rotation of the latter through a quarter of a revolution each time of meshing. A bushing 41 carries the gear 2 and also a Geneva

cam 42 which is normally locked against rotation by riding on the periphery of a cam 40, but can turn when a depression in the cam 40 is brought around with the teeth of the finger gear 1.

The bushing 41 also carries a full gear 3 which meshes with another gear 4 in a 1:1 ratio. As shown in Fig. 1, gear 4 and knurled wheel 44 are mounted on a hub-like extension 49 of gear 5 and these three elements constitute a unitary member which slips freely on shaft 43. By manipulation of wheel 44 both axially and rotatively gears 3 and 4 may be thrown out of mesh so as to set the units and tens drums 32 and 33 for the minutes registration. Gears 5 and 6 are at all times intermeshed.

Full gears 5, 6 and 7 are rotated intermittently at the rate of one step per minute, due to the intermittent action of the finger gear 1. Gear 6 is an idler between gears 5 and 7. A speed reduction of gear 7 with respect to gear 5 is that of 2.5:1. This gear reduction is such that gear 7 makes one revolution every ten minutes but in ten intermittent steps per revolution.

Gear 7, mounted on hollow shaft 45, drives the units-of-minutes dial 32 which is also mounted on this same hollow shaft.

The hollow shaft 45 carries the driven gear 7 and the driving finger gear 8, as well as a Geneva cam 46. The periphery of cam 46 is engaged by one or another of six concave edges of a star wheel 47. A recess in the periphery of the cam 46 permits turning of the star wheel when gear 9 is driven by gear 8.

Driven gear 9, drive gear 10 and a star wheel 47 are mounted on a common bushing which is keyed to a shaft 37. Also keyed to this shaft is another finger gear 12.

Gears 10 and 11 are continuously intermeshed in a 1:1 ratio and gear 11 is mounted on a bushing 48 to which a hub 48a for the tens-of-minutes drum 33 is affixed. The drum 33 makes its revolution, therefore, in six successive steps, at each step of which it exposes one of its six numerals in the window to show the proper tens-of-minutes digits during every hour.

Looking now at the upper portion of Fig. 2, it will be observed that the single-tooth finger gear 12, mounted on shaft 37, engages intermittently with a full gear 13, the latter being mounted on a counter shaft 43. This shaft also carries a thick gear 14 and a knurled wheel 50 which is shown only in Fig. 1. Wheel 50 is manipulatable in the same manner as wheel 44 and provides for setting the units and tens drums 34, 35 which indicate the hours. The setting of these drums is facilitated by axial movement of the shaft 43 so as to displace gear 13 with respect to the meshing plane of gear 12. The independent manipulation of knurled wheels 44 and 50 facilitates separate setting of the minutes and hours drums without turning the former through many revolutions. A single displaceable gear setting arrangement is shown and claimed in my copending application Serial No. 252,472, filed October 22, 1951, a division of application Serial No. 596,301, filed May 28, 1945, now Patent No. 2,576,119. In that system, the correct hours setting is obtained only by adjusting the minutes drums through successive complete cycles until the required number of steps of the hours drums have resulted. The setting of the seconds drum 31 is preferably accomplished by opening the circuit of the clock motor just as the seconds drum reach a 0-read-

ing and closing the circuit again on reception of a time signal representing a start of another minute. If for any reason it were desired to manually set the seconds drum 31 while the clock motor 38 is running, provision may be made for doing this by means of a separable linkage between the motor shaft 81 and the shaft 39 which is coaxial therewith. Gears 14 and 15 are constantly inter-meshed. They have a 3 to 1 gear ratio, so that gear 15 rotates once a day in 24 hourly steps. This movement will be understood by noting that gear 13 rotates through $\frac{1}{6}$ of a revolution each time of its intermittent hourly meshing with the finger gear 12.

The hub 51 (Fig. 1) carries gear 15, a mutilated gear 16, another mutilated gear 18, and two Geneva cams 52 and 53, which engage respectively with star wheels 54 and 55. In Fig. 2, the separation of these five members made it necessary to show the hub 51 as though it were a long shaft, but actually it is relatively short. Mutilated gear 16 drives a pinion 17 which is mounted with star wheel 54 on a shaft 56 extended through the hubs of pinion 19 and gear 22 to a bushing 58 which supports the tens-of-hours drum 35. Pinion 19 and cam 55 have a common hub which is loosely mounted on shaft 56. The mutilated gear 16 has isolated teeth H10 and H20; also a group of four adjacent teeth. The angular positions of teeth H10 and H20 are such that these teeth will mesh with the pinion 17 on hours 10 and 20, respectively. The resulting intermittent motions applied through shaft 56 to the tens-of-hours drum 35 provide for the display of the figures 1 and 2 when driven by teeth H10 and H20, respectively. Other movements applied to the drum 35 take place when the pinion 17 is driven by the four adjacent teeth of the mutilated gear 16. At each of these positions a different numeral "0" is brought into view through the window 63 and this display takes place during the hours 00 up to 09. The reason for displaying a succession of zeros will be explained hereinafter. The intermittent movements of drum 35, when it is necessary to actuate the same, are made on the hour, but this drum has certain rest periods extending over periods in which different numerals are displayed by the units-of-hours drum 34.

The mutilated gear 18 has twenty teeth which mesh with a pinion 19, acting as an intermediate idler pinion with respect to gears 18 and 20. Gear 20 is mounted on a counter-shaft 57 along with the full gear 21, where the latter meshes with a gear 22, mounted on a hub which extends through the pivot plate 67 and supports the units-of-hours drum 34. Gears 21 and 22 have a 1:1 ratio, whereas gears 18 and 20 have a 12:5 ratio. These gear ratios provide that the units-of-hours drum shall rotate twice during each 24-hour period, but because this drum is masked during the hours 00, 01 and 02, it first displays its "3" upon being unmasked, and afterwards shows the units digits for successive hours "04" to "23" inclusive.

During periods when pinion 17 is not meshed with any teeth of the mutilated gear 16, the counter shaft 56 is held from turning by means of the start wheel 54 in engagement with the periphery of the Geneva cam 52. The engagement of star wheel 55 with the periphery of the Geneva cam 53 also insures against improper turning of pinion 19 while disengaged from the teeth of gear 18. A resilient detent

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69 pressing lightly against the teeth of gear 14 serves to prevent mis-alignment of the mesh between gears 13 and 12 during manipulation of the setting wheel 50. Further means for maintaining alignment may be optionally provided by the mounting of a locking cam such as 46 along side of gear 12 to be normally meshed with an 8-point star wheel similar to star wheel 47, but which would be mounted on shaft 43.

From the foregoing description of the gear train, it will be seen that the 6-tooth pinion 17 is driven by the mutilated gear 16, through one revolution per day in six steps which are taken at the commencement of the hours 10, 20, 00, 01, 02 and 03. Pinion 17 on spindle 56 drives the tens-of-hours drum so as to display the numerals for the tens-of-hours as indicated in the previous sentence. Additionally, however, the numerals for the units-of-hours 0, 1 and 2 are also displayed by the masking portion of drum 35 at their proper times. The masking function lasts for three hours, being within a rest period of five hours for the units-of-hours drum. Throughout this five-hour rest period the masked numeral "3" stands in front of the window.

Now, to recapitulate the operation of the gear train for intermittent movement of the minutes and hours drums, it will be seen that on each engagement of the finger gear 1 with gear 2, motion is transmitted once per minute through gears 3, 4, 5, 6 and 7, to the units-of-minutes drum 32 and turns this drum $\frac{1}{6}$ of a revolution to display a different number each minute. Through the intermittent gear reduction provided by gears 8 and 9, and through gears 10 and 11, motion is transmitted intermittently to the tens-of minutes drum 33 so as to rotate this drum in six equal steps at ten minute intervals through one revolution per hour.

By operation of the finger gear 12 in mesh with gear 13 and through the gearing that extends to the mutilated gears 16 and 18, a composite result is obtained which causes hourly movements of the units and tens drums. These movements are irregularly timed as follows: At the commencement of hours 00, 01 and 02, the unit "3" stands under the window but is masked by the units' figures on the right side of the tens drum. At the commencement of the hour 03, the tens-drum exposes its fourth successive zero on the left side, through the window 63 and exposes the units-of-hours drum to display the numeral "3." Drum 34 is now at the beginning of its twenty-step course and takes each step at the beginning of each hour. When the unit "0" is exposed for the first time by the units drum, the tens drum steps from "0" to "1" in the tens-digit column and leaves the units-drum exposed for a full revolution. When the unit "0" of the units drum is exposed for the second time, the tens-drum steps to expose the numeral "2" in the tens-digit column and leaves the units-drum exposed for four hours, during which it is stepped to display its own numbers 0, 1, 2 and 3. At the end of time 23:59, the tens-drum steps to 00, thereby masking the "3" on the units drum. So the cycle of operations is repeated every twenty-four hours. As will be readily apparent, drum 34 may be a single drum with the ten consecutive numerals 0-9 occupying the ten respective 36-degree segments thereof as shown or may equally well comprise a pair of nested drums for enlarged numerals occupying 60-degree segments as taught

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in my U. S. Patent No. 2,351,814, with their accompanying alternately operating step drive means as described therein employed where gears 21 and 22 are shown in Fig. 2 of the present application.

It should be noted that the intermittent movement provided by the finger gear 1 causes a complete step to be taken by the units-of-minutes drum 32 from one to another indication. In an embodiment which I have constructed, this movement takes place within a period of approximately five seconds and is completed to show the commencement of each minute indication when the seconds drum passes from 59 to 00 seconds. At ten minute intervals the intermittent movement of the tens-of-minutes drum 33 takes place. This movement also is completed within a period of approximately five seconds. Drum 33, however, must move through $\frac{1}{6}$ of a revolution in this time as against $\frac{1}{6}$ of a revolution for the units-of-minutes drum 32.

Considering also the nominal five-second period for the movement of the drums, this period applies equally well to the two drums 34 and 35 for showing the hours. In the case of drum 34, its step extends through $\frac{1}{6}$ of a revolution and in the case of the tens-of-hours drum 35, its step extends through $\frac{1}{6}$ of a revolution. Hourly movement is provided by the finger gear 12 and the motion applied to gear 13 during each engagement is completed within a period of approximately five seconds. Thus it is provided that the large numerals on drums 32 and 33 stand at rest and are fully exposed for a period of at least 55 seconds during every minute and on the hours drums 34 and 35 for 59 minutes 55 seconds during every hour.

Fig. 8 is a timing diagram. The horizontal band 70 indicates continuous rotation of the motor shaft 81, shaft 39 and the seconds drum 31. The marks along line 71 indicate motions of 5 seconds each, made once per minute by members 2, 3, 4, 5, 6, 7, 8 and drum 32. The marks along line 72 indicate motions at 10-minute intervals made by members 9, 10, 11 and drum 33. The marks on lines 73, 74 and 75 indicate hourly steps taken by members 13, 16 and 18 respectively. Lines 76, 77 and 78 show the same steps as on lines 73, 74 and 75, but on a 24-hour scale. Line 79 shows the hours at which stepping movements are applied to pinion 17, shaft 56 and drum 35. Line 80 shows the hours at which stepping movements are applied to pinion 19, gears 20, 21, 22 and drum 34.

It will be apparent that it would not require the exercise of invention to adapt my novel gear train to the operational control of flat disks for displaying numerals in front of a flat window opening.

While I have described in detail an exemplary embodiment of my invention, it will be understood by those skilled in the art, that the novel features of the invention itself may be incorporated into clocks of other design without departing from the spirit and scope of the invention.

One of the matters of design variation which involves no departure from the spirit and scope of the invention should be specifically brought out as follows: There is no necessity for introducing the 5-hour rest period in respect to the units-of-hours drum 34 at the particular part of its cycle when the numeral "3" faces the window opening 63. A phase shift of the four grouped teeth on mutilated gear 16 with respect to teeth H10 and H20 may be made so as to

cause said 5-hour rest period to commence on any of the hours 20, 21, 22 or 23, the 23rd hour being the one to which Fig. 7 applies, and wherein there is a suitable showing of numerals on drum 35 and its mask. Thus, the progressive display of numerals on drum 35 and its mask may be according to any of these arrangements, reading upwardly because the dial motion at the window 63 is downward:

Arrangement	A		B		C		D	
	T	M	T	M	T	M	T	M
	2		2		2		2	
	1		1		1		1	
	0		0		0		0	
	0	2	2	3	0	0	0	1
	0	1	2	2	2	3	0	0
	0	0	2	1	2	2	2	3
During 5-hour rest period the numeral on drum 34 which confronts window 63 is	3		0		1		2	

Arrangement A corresponds to the showing in Fig. 7, with which Fig. 8 is in agreement. Arrangements B, C and D entail a phase shift of the marks on lines 79 and 83 in Fig. 8, except that on line 79 the marks at hours 10 and 20 cannot be moved. In the above table T represents tens-place numerals and M represents units-place numerals on the mask only.

It is apparent that if coupling means such as two adjacent 60-tooth gears were to be respectively mounted on the shafts 81 and 39 and if these gears were to be normally meshed with a relatively thick idler gear, then the manual setting of the seconds drum 31 would be facilitated simply by lateral displacement of the thick gear to throw it out of mesh with the gear that is mounted on shaft 81.

It will be readily apparent that the principles of my cyclometer numeral presentation system as illustrated in Figs. 7 and 8 may be applied to various counting purposes where the transfer from the maximum digital readings to a series of zeros is to be accomplished at a predetermined finite number whose digits are not nines. For example, the feature of partially overlapping numeral drums or discs is applicable for reading 000-359 degrees and repeat, as well as for reading time, 0000 to 2359 and repeat.

I claim:

1. In a 24-hour clock; a plurality of rotatable members for displaying in different digital places the tens and units numerals representing the hours, one of said members having a masking portion extending therefrom which overlies the other member during certain hours, means including an intermittent gear train means for rotating said members step-by-step in accordance with a predetermined timing schedule, said last-named means including means for causing said one member to display the tens and units numerals and to mask the other member during three successive hours and for exposing said other member to display progressively the numerals 4 through 9, 0 through 9 and 0 through 3 in twenty hourly steps, and to be held stationary during substantially five hours, the first and fifth of which are while it exposes its numeral 3, and the second, third and fourth of which are while it is masked, and driving means including means for rapidly advancing each of said rotatable members from one numeral position to another so that the

motion of any rotatable member between successive positions is restricted to a few seconds.

2. The combination according to claim 1 and including a rotatable member having six display positions whereat the numerals 0 through 5 are progressively shown in the tens-of-minutes place, and another rotatable member having ten display positions whereat the numerals 0 through 9 are progressively shown in the units-of-minutes place, an intermittent gear train arranged and adapted to rotate the last said members step-by-step, thereby to make a properly progressive display of the tens and units digits of each minute in the hour, and driving means arranged and adapted to so operate the last said gear train that its motion is restricted to a very few seconds during each minute.

3. The combination according to claim 2 and including a rotatable member marked to display 60 seconds progressively, and driving means for maintaining this member in constant motion.

4. In a 24-hour clock, a plurality of drum dials having numerals on their peripheries for display through one or more window openings in the clock case, there being at least four digital positions in said one or more openings, two of said dials telling the minutes of each hour and two others being jointly operable to cyclically indicate the 24-hour progression of time, an intermittent gear train for causing stepwise advancement of the first of said dials in ten steps during 10-minute cycles, a second intermittent gear train driven from the first gear train for causing stepwise advancement of the second of said dials in six steps at 10-minute intervals during each hourly cycle, a third intermittent gear train for causing stepwise advancement of the third of said dials in twenty hourly steps which give it two complete revolutions per day with an intervening rest period of substantially five hours, and a fourth intermittent gear train for advancing the fourth of said dials in six steps per cycle and one cycle per 24-hour period, said fourth dial being provided with numerals in the tens-of-hours digital place and with a masking portion which overlies the periphery of the third drum and, when masking the same, displays numerals in the digital place for units of hours.

5. In a 24-hour clock, a clock case defining window means, separate rotary display members therein for the tens and units orders of digits for indicating the hours and minutes, each member bearing a series of numerical characters to be progressively displayed through said clock case window means, mechanism for advancing each member stepwise to display different characters from time to time, said mechanism having an operating period which is quite short relative to the rest period of said members, another rotary display member for indicating fractions of a minute, constant speed driving means for rotating the last said display member and for interrelating said mechanism, intermittent gear trains included in said mechanism arranged and adapted to move two of the members which respectively indicate units of hours and units of minutes through 36° per step, and other intermittent gear trains included in said mechanism arranged and adapted to move the members which respectively indicate the tens of hours and tens of minutes through 60° per step.

6. In a 24-hour clock, a plurality of coaxially rotatable number wheels, including one for indicating fractions of a minute, others for indicating units of minutes, tens of minutes, and

units of hours, and an hour-indicating number wheel having a masking portion extending therefrom which extends angularly half-way around its circumference and overlies the units-of-hours wheel, said hour-indicating number wheel bearing suitable numerals for making indications which at times include both tens and units order indications.

7. The combination according to claim 6 and including motor driven intermittent gear train means for driving said number wheels stepwise and on a schedule indicating the hours and minutes.

8. The combination according to claim 7, wherein one of said intermittent gear trains is operable on the hour for 20 hours to progressively expose the units-of-hours numerals 4 to 9 inclusive and 0 to 3 inclusive, said gear train having substantially a five hour rest period during which the numeral 3 stands in the indicating position but is masked by said masking number wheel during the hours 00, 01 and 02.

9. In combination, a clock case defining window means, a plurality of drum dials therein for a 24-hour cyclometer system, one dial of which displays ten numerals successively in the units place for indicating minutes, a second dial of which displays six numerals successively in the tens place for indicating tens of minutes, a third dial of which displays ten numerals successively in the units place for indicating hours, and a fourth dial for stepwise rotation in 60° steps for indicating tens of hours, this fourth dial being provided with a semi-cylindrical portion which overlies said third dial and displays three numerals successively in the units-of-hours place while masking that portion of said third dial which is then presented to said clock case window means, and means including a motor driven intermittent gear train for advancing said dials in angular steps at the times for correctly indicating each of 24 hours daily and each of 60 minutes hourly.

10. The combination according to claim 9 and including manipulatable dial setting means for decoupling one portion of said gear train from another portion thereof, said last-named means comprising means for setting the hours dials independently of the minutes dials, and vice versa.

11. The combination according to claim 9 and including a drum dial for displaying fractional parts of a minute, and driving means for rotating this dial at a constant rate of one revolution per minute.

12. The combination according to claim 9 and including locking means of the Geneva cam type for maintaining an alignment of the numerals which are displayed through said clock case window means and appear on the peripheries of said drum.

13. In a cyclometer clock, first and second rotatable drum members for displaying in different digital places the tens and units numerals representing the hours, said first member having a masking portion which overlies said second member during certain hours, means including an intermittent gear train for angularly advancing said first member step-by-step and in accordance with a timing schedule that causes the tens and units numerals for certain hours to be displayed by said first member while it masks said second member and thereafter unmasks said second member, and means for angularly advancing said second member to

progressively display its numerals in the units-of-hours place while unmasked, the same numeral on said second member being brought into display for an hour preceding, and an hour following the masking period.

14. In a cyclometer clock having dial drums for the individual display of indicia in different digital places and for telling the time in hours and minutes, first and second independent manual setting devices for the hours drums and the minutes drums respectively, a common driving power source, first intermittent drive means for driving said minutes drums from said driving power source, second intermittent drive means for driving said hours drums from said minutes drums, said first and second intermittent drive means comprising means for regularly advancing said minutes and hours drums suitably for telling the time, a gear in said second intermittent drive means coupled to said first manual setting device and axially shiftable and angularly adjustable under the control thereof, said gear being coupled to said hours drums and being axially disengageable from coupling to said minutes drums upon axial movement, and a further gear in said first intermittent drive means coupled to said second manual setting device and axially shiftable and angularly adjustable under the control thereof, said further gear being coupled to said minutes drum and being axially disengageable from coupling to said driving power source.

15. In a cyclometer clock having drum dials for the individual display of numerals in different digital places and for telling the time in hours and minutes, a motor having an output shaft, a gear train coupling said output shaft of said motor to the minutes dials, a second gear train coupling the first gear train to the hours dials, manually operable uncoupling means effective upon a portion of the first said gear train to free it from the driving power of the motor, thereby to set the minutes dials, and a second manually operable uncoupling means effective upon a portion of the second said gear train to free it from the driving power of the first said gear train and to set the hours dials independently of the first said gear train.

16. The combination according to claim 2 and including first and second setting means independently operable to position the hour-displaying members and the minute-displaying members, respectively, said first setting means comprising means for interrupting said intermittent gear train means between said hour-displaying members and said driving means therefor, and said second setting means comprising means for interrupting said intermittent gear train to free said minute-displaying members from coupling to said driving means therefor, whereby the minute-displaying members and the hour-displaying members may be separately set without drive interference.

17. In combination, a series of number wheels including a first number wheel, a second number wheel, and a third number wheel, said wheels being aligned, said third number wheel having a segmental portion masking said second number wheel at a series of angular positions of said third wheel and exposing the registering numeral of said second number wheel at all other positions of said third wheel, said third wheel having a series of numerals on said segmental masking portion, and means responsive to completed cycles of said first number wheel for pro-

viding intermittent step advancements of said second and third wheels, said last-named means including means for advancing said second number wheel one digit step per turn of said first wheel and advancing said third wheel one step per turn of said second wheel, and means arresting said second wheel when masked and advancing said third wheel one step per turn of said first wheel until said segmental portion is advanced beyond the position of masking the registering numeral of said second wheel.

18. Multiple-wheel numeral indicating apparatus comprising a series of number wheels, means for exposing respective digits of said number wheels to provide a multi-digital total reading, intermittent motion drive means intercoupling each lower order number wheel to each next higher order number wheel for providing angular advancements of the higher order wheels at predetermined points in the rotation of the lower order wheels according to a predetermined schedule, at least one of said higher order number wheels having a segmental portion overlapping the next adjacent number wheel and masking the registering digit thereof when the segmental portion is in one of a series of predetermined angular positions, said segmental portion having a series of numerals thereon, and means in said intermittent motion drive means for driving said number wheel having said segmental portion through a series of steps corresponding to the numerals on said masking portion and holding the masked number wheel fixed, and thereafter shifting said number wheel to a position unmasking the adjacent number wheel and providing step advancements of the unmasked adjacent number wheel.

19. Cyclometer numeral indicator means for indicating a series of numbers wherein the maximum number reading includes at least one digit other than 9, comprising a pair of numeral dials cooperating to present digits of two consecutive orders, one of said dials presenting all of the digits of one order and part of the digits of the other order, and the other of said dials presenting the remaining digits of said other order, means for driving one of said dials in a series of intermittent steps while holding the other of said dials fixed and for thereafter holding said one dial fixed and driving the other of said dials in a series of intermittent steps, one of said dials including means for selectively masking one digit of the other of said dials.

20. Cyclometer numeral indicator apparatus for indicating a series of numbers wherein the maximum number reading includes at least one digit other than 9, comprising first and second

numeral dials cooperating to present digits of two consecutive orders, said first dial presenting all of the digits of the higher order and some digits of the next lower order, and said second dial presenting digits of said next lower order during certain step sequences, said indicator apparatus further comprising means for driving said first dial through a sequence of steps while holding said second dial fixed and for thereafter driving said second dial through a further sequence of steps while holding said first dial fixed, one of said dials including means for selectively masking the lower-order digits of the other dial during predetermined step sequences and exposing to view the lower-order digits of the other dial during other step sequences.

21. A 24-hour cyclometer clock having separate drum dials for units and tens places of digits of the minutes, and the same of the hours, intermittent gear trains for stepwise rotation of two of said dials to display a decimal progression of numerals of the numerals place, both for minutes and for hours, one of said gear trains including means for holding the units-of-hours dial stationary for a period of substantially five hours, a transfer mechanism for stepwise rotation of the tens-of-minutes dial in 60° steps at the rate of six steps per hour, the drum dial for the tens of hours including a masking portion extending therefrom over the drum dial for the units of hours and also including means for progressively displaying the numerals 0, 1, and 2 at suitable times in the tens place and for displaying at suitable times on said masking portion the numerals 0, 1, and 2 in the units place, said last-named means including means for superimposing said masking portion over the periphery of said units-of-hours dial for concealing the numeral 3 thereon during the intermediate three hours of said 5-hour period, and means including an intermittent gear train for stepwise rotation in 36° steps of said units of hours dial and for stepwise advancement in 60° steps of said tens of hours drum dial including said masking portion, these steps being taken in conformity with the timing requirements for properly indicating the 24 hours daily.

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