Sept. 11, 1956 A. HOLZNER 2,762,190

CYCLOMETER CLOCK SYSTEM

Original Filed May 28, 1945 2 Sheets-Sheet 1

Fig. 1.

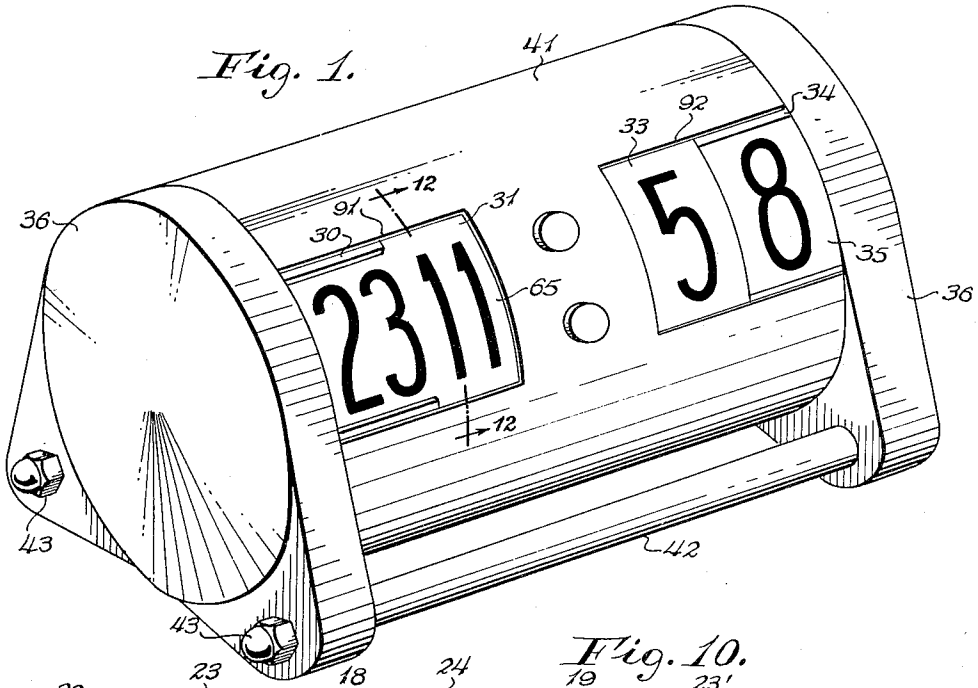


Fig. 10.

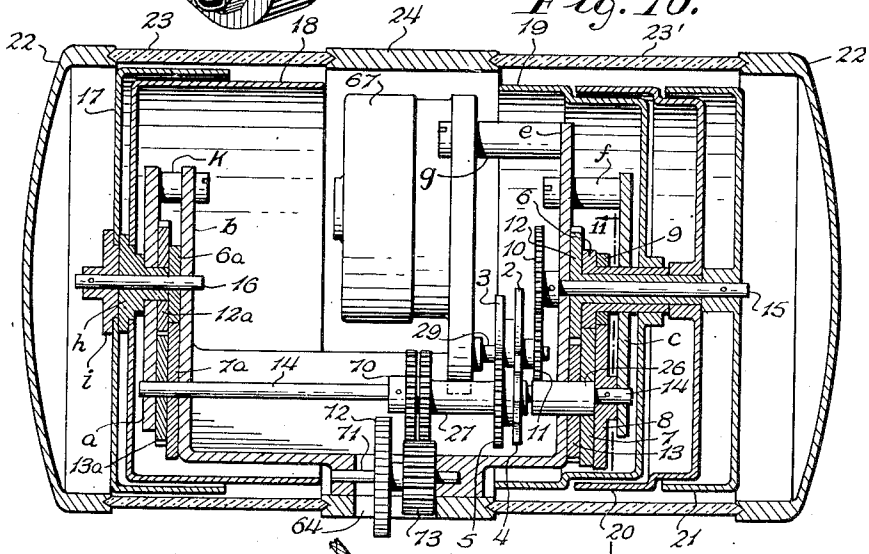


Fig. 11.

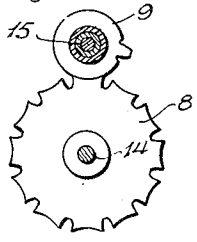
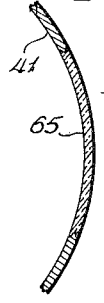


Fig. 12.



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CYCLOMETER CLOCK SYSTEM

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Fig. 2.

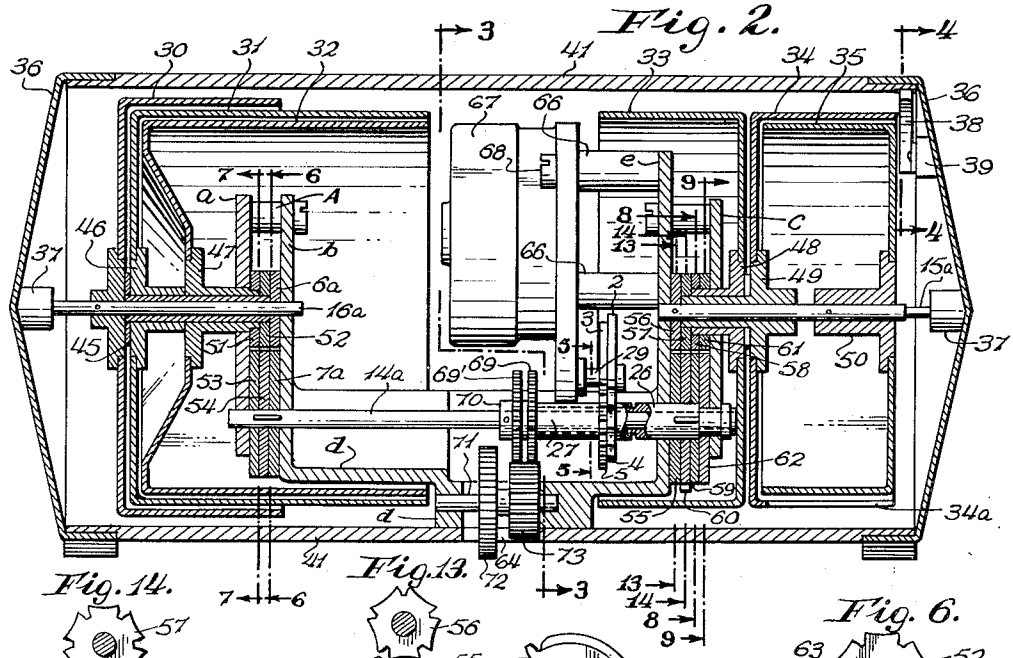


Fig. 14.

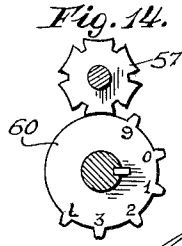


Fig. 13.

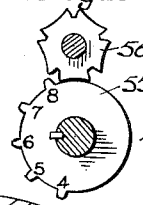


Fig. 5.

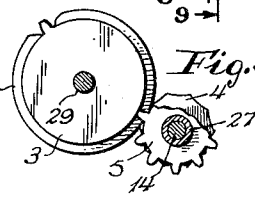
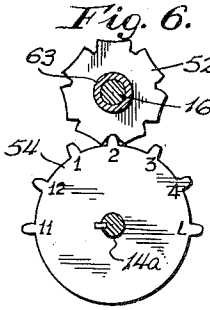


Fig. 6.



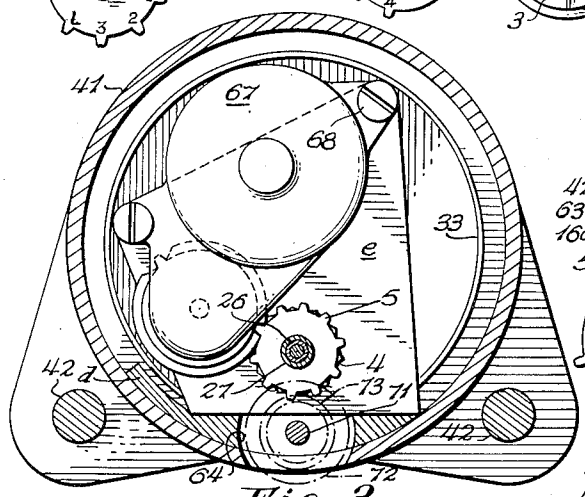
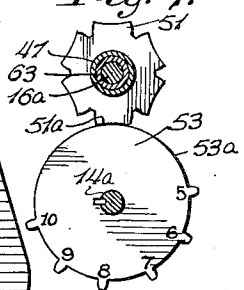


Fig. 3.

Fig. 7.



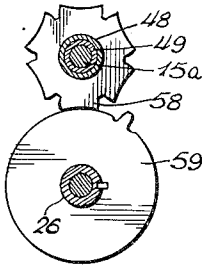
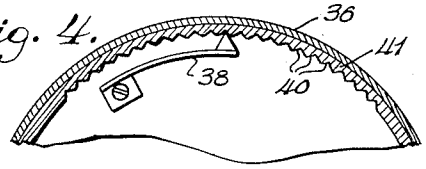


Fig. 8.

Fig. 4.



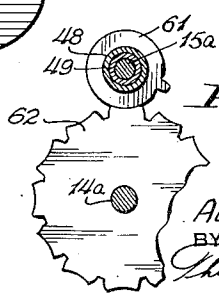


Fig. 9.

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2,762,190

CYCLOMETER CLOCK SYSTEM

Adolf Holzner, Merrick, N. Y.

Original application May 28, 1945, Serial No. 596,301, now Patent No. 2,576,119, dated November 27, 1951. Divided and this application October 22, 1951, Serial No. 252,472

27 Claims. (Cl. 58—125)

The present invention relates to clocks, and more particularly to improved cyclometer clock mechanism. The present application is a division of my application Serial No. 596,301, filed May 28, 1945, now issued Patent No. 2,576,119.

It is an object of this invention to provide cyclometer clock mechanism of very compact design, and to have the driving elements for the cyclometer numeral displaying elements or drums substantially internal of the drums, whereby it may be provided in a substantially cylindrical shell or housing.

It is a further object of this invention to provide simple and positive manual reset means, arranged for disengagement of the cyclometer drums from the drive motor and for resetting of the drums without any interference with the motor operation.

In direct-reading numeral clocks according to the prior art, and especially in those embodying Geneva driving and locking elements, serious interference occasionally occurs between the motor drive system action and the manual resetting. This is due to the occurrence of a motor actuation of a rotatable numeral displaying element at a moment during the considerable period of time during which the minutes displaying element is being manually rotated toward the proper time reading. It is one of the principal objects of the present invention to overcome this problem of the clock systems of the prior art, and to permit selective forward or backward resetting entirely free from any hazard of engagement of the motor power and disruption of the mechanism during such resetting.

It is yet a further object to arrange the cyclometer clock mechanism in such a way that special advantages of simplified assembly and disassembly will be realized, along with the foregoing features of compact design and drive disengagement and reset action.

Yet a further object is to provide a compact clock system providing full continuous readings on a 24-hour basis.

Another object is to provide a clock system simultaneously indicating on the 12-hour basis and the 24-hour basis, whereby it may be read directly for either time reporting system, and whereby it is made useful for educating observers to the correlation between the two systems of time reporting.

These features and advantages are achieved in a preferred embodiment of the present invention by the use of two coaxial shaft systems, one for the units and tens of minutes drums and for a seconds drum, if desired; and the other coaxial shaft system for the hours drum system. The motor preferably is situated between the minutes drums group and the hours drums group, and an intermittently advanced transfer shaft is situated eccentrically alongside the motor, and arranged to provide angular advancements of the hours drums upon the completion of the numeral cycles in the minutes and tens of minutes drums. The drive couplings to all coaxial drum shafts are arranged within the drum nearest the motor, in each

series of associated drums, so that the drums are readily removable (and replaceable), one after another, with freedom from such interfence as would result from the necessity for drive coupling units directly between the drums of a series.

In the drawings,

Fig. 1 is a perspective view and Fig. 2 is a longitudinal sectional view of a preferred embodiment of the present invention.

Fig. 3 is a cross-sectional view taken on the line 3—3 in Fig. 2;

Figs. 4, 5, 6, 7, 8, 9, 12, 13 and 14 are views of compact elements of the clock mechanism of Figs. 1, 2 and 3;

Fig. 10 is a longitudinal sectional view of an alternative embodiment of the invention; and

Fig. 11 is a view of component elements included in the clock mechanism of Fig. 10.

Referring now to Figs. 1 and 2, the clock mechanism of the present invention is shown housed in a case including a cylinder **41** and end caps **36**, the latter being fastened together by screw and stud units **42, 43**. The end caps have circular recesses wherein the cylinder **41** is manually adjustable to any desired angular position, for adaptability of the clock to any of several positions of rest.

The clock mechanism contained within cylinder **41** is mounted to this cylinder, and is entirely rotatable therewith. Windows **91** and **92** are provided at the left and right in cylinder **41**, the former for affording a view of a group of numerals on the hours drums, and the latter for viewing a group of numerals on the minutes drums.

The feature of angular adjustability of the clock mechanism and the viewing windows, together, for adaptability of the clock to use in a variety of positions, is claimed in the aforesaid parent application.

In the version of the present invention as shown in Figs. 1–3, the units-of-minutes carrier and the hours carrier are each made up of nested sets of drums, for enlarged numeral presentation in accordance with the principles of my Patent No. 2,351,814, issued June 20, 1944, the enlarged numeral feature being achieved in conjunction with the aforementioned features of compactness, improved reset action, and ready accessibility of the numeral drums for assembly and disassembly. In the version of Fig. 10, the numerals are smaller in relation to drum diameter, and are arranged in regular series on the drums; and a seconds drum is added.

With reference now principally to Fig. 2, a frame member *d*, having a cylindrical outer surface portion joined to the inner surface of cylinder 41, is used as the main central support for a clock motor **67** (which may be a synchronous motor clock drive unit). The frame member *d* comprises an upright plate portion *b* and another upright plate portion *e*, the motor **67** being situated therebetween. The motor **67** is shown atached to plate portion *e* of the frame member *d* by stud posts **66** and screws **68**.

A finger disc **3** and a locking disc **2** are fixed on the output shaft **29** of the motor **67**.

A multiple coaxial shaft assembly extends between plate portions *b* and *e* of the frame member *d*. This coaxial shaft assembly includes an elongated inner shaft **14***a*, and relatively short tubular shafts **26** and **27**, shaft **26** being freely rotatable over the right-hand portion of shaft **14***a*, and shaft **27** being freely rotatable over a portion of shaft **26**. A gear **5** and an associated locking cam **4** are situated on the right end of the outer tubular shaft **27**, and aligned with finger disc **3** and locking disc **2**, respectively, on the motor output shaft, to be intermittently driven through angular steps thereby, and to be retained locked in the intervals between driving engagements by the finger of disc **3**. The arrangement of these gears is shown in detail in Fig. 5.

A spur gear **69** is provided on the left end of hollow shaft **27**, and a similar spur gear **69'** is secured to the left-hand end of the inner tubular shaft **26**. Gears **69** and **69'** are normally intercoupled for rotation in 1:1 relation, by a wide-faced spur gear **73**. This gear **73** is fixed to a knurled thumb-wheel **72**, and arranged on a shaft **71** in bracket *d*, to be selectively transferred to the leftward manually and rotated to reset the clock readings, with freedom from interference with the motor drive coupling elements **2**, **3**, **4**, **5**, by the angular movement of the thumb-wheel **72**, prior to return unit **72**, **73** to its normal right-hand position of engagement with gear **69**.

The motor output shaft **29** makes one revolution per minute, and the finger disc **3** engages the **10**-toothed gear **5** to advance it through one-tenth revolution once every minute, and the locking disc **2** maintains engagement with one of the **10** concave surfaces of cam **4** between successive finger disc engagements. With the reset tumbler unit **72**, **73** in its normal right-hand position, hollow shaft **26** is made to match the angular movements of the outer hollow shaft **27**.

Three mutilated gears **55**, **60** and **59** are attached to hollow shaft **26** at the right-hand end thereof. Mutilated gear **55** is basically a 10-toothed spur gear with five successive teeth eliminated (Fig. 13), the five successive teeth on this gear, denoted, **4**, **5**, **6**, **7** and **8**, being spaced apart by circular arc sections of the gear. It operates in engagement with gear **56**, a five-toothed gear having locking cam concave outlines in the spaces between the tooth-receiving slots.

Mutilated gear **60** is similar to gear **55** in all respects except that only four successive teeth are cut away so that six successive teeth remain. The specially shaped gear **57** which is actuated by gear **60** has six tooth-receiving slots and six intervening concave locking cam surfaces, regularly spaced around its periphery (Fig. 14).

Gear **59** is a finger disc, as shown in Fig. 8 (i. e. a one-toothed mutilated gear), arranged to engage a gear **58** similar in all respects to gear **57**. Gear **59** may similarly be regarded as based on a 10-toothed gear in the same manner as gear **60**, but with nine of the ten teeth cut away.

Gears **56**, **57** and **58** are attached to the left-hand ends of three coaxial shafts, gear **56** being fixed to inner shaft **15***a*, gear **57** being fixed to a first hollow shaft bushing **49** freely rotatable relative to shaft **15***a* and gear **58** being fixed to hollow shaft bushing **48** which in turn is freely rotatable over hollow shaft bushing **49**. A first numeral drum **35** is fixed to shaft **15***a* by bushing **50**; a second numeral drum **34** is fixed to bushing **49**, and a third numeral drum **33** is fixed to bushing **48**. Drums **34** and **35** cooperate as a nested set, in the manner of my aforesaid Patent No. 2,351,814, the cylindrical surface of drum **34** being divided into six equal numeral areas, instead of ten. Five of these numeral areas are consecutively numbered, as with numerals "9, 0, 1, 2, 3" and the sixth is made into a window **34***a* through which the inner cylinder **35** may be viewed.

The remaining numerals of the 0–9 sequence are provided on the cylindrical surface of the inner drum **34**, which is divided into five equal areas, the numerals thereon for example being "4, 5, 6, 7, 8."

Drum **33** is divided into six equal surface areas, numbered "0, 1, 2, 3, 4, 5."

The one-tenth revolution angular advancements of shaft **26**, occurring once per minute, provide a series of actuations of gear **57** and drum **34** associated therewith, through numerals "9, 0, 1, 2, 3," and one further actuation, to the position bringing the window **34***a* into view, and exposing the numeral "4" on drum **35**. The next four one-tenth revolution actuations of hollow shaft **26** result in one-fifth revolution steps of gear **56** and drum **35**, exposing successively the numerals "5, 6, 7, 8" through window **34***a*. At this point, the relative positions of gears **55**, **56**, **57** and **60** are as indicated in Figs. 13 and 14.

The next following one-tenth revolution advancement of shaft **26** will bring about renewed angular step advancement of gear **57** and drum **34**, to the reading "9," with gear **56** and drum **35** now to be held stationary during a series of five further angular advancements of shaft **26**.

The finger disc or one-tooth mutilated gear **59** (Figs. 2 and 8) engages gear **58** and provides a one-sixth turn angular advancement thereof, timed in coincidence with the advancement of drum **34** from the reading "9" to the reading "0." Drum **33** is thus advanced one-sixth turn, from one numeral reading to the next higher numeral reading, relatively abruptly, once in each complete revolution of shaft **26**. Hence, drum **33**, reading tens of minutes, and drums **34** and **35**, reading units of minutes, cooperate to provide readings of minutes, in unit steps, from "00" to "59."

Each time the minutes reading of "59" is reached, it is necesary for the hours drum system to be advanced by one unit, in coincidence with the advancement of the minutes drums system from "59" to "00." For this purpose, a finger wheel **61** is attached to hub **48** and gear **58**, for one-sixth turn angular advancement therewith. The single tooth of this finger wheel **61** engages and advances gear **62** (Fig. 9) one-twelfth turn upon the completion of each cycle of the tens of minutes drum **33**. Gear **62** is fixed to shaft **14***a*, which serves as the transfer shaft from the right-hand side of the clock to the left-hand portion thereof.

A pair of nested drums **31** and **32** are provided for the hours numerals, and a shutter drum **30** having three equally spaced openings is provided, partially covering drum **31**. These three drums are fixed to three coaxial shafts, drum **30** being situated on the inner shaft **16***a*, drum **31** being fixed to the intermediate shaft **63** by hub **46** thereon, and drum **32** being fixed to hub **47** which serves as the outermost of the three shafts.

Gear **51** is fixed to the right-hand end of hub **47**, gear **52** is fixed to the right-hand end of the intermediate hollow shaft **53**, and gear **6***a* is fixed to shaft **16***a* near the right-hand end thereof. These gears are driven by gears **53**, **54** and **7***a*, respectively, all attached to the transfer shaft **14***a* near the left-hand end thereof. Gears **53** and **54** are mutilated gears (Figs. 7 and 6, respectively), which drive gears **51** and **52** and the respective drums **32** and **31** in the same general manner as gears **55** and **60** drive nested number wheels or drums **35** and **34**, respectively.

With reference to the numerals on the right-hand halves of their respective cylindrical surfaces, drum **32** bears the numerals "5, 6, 7, 8, 9, 10" in six equal (60-degree) surface portions, and drum **31** bears the numerals "11, 12, 1, 2, 3, 4" in six consecutive areas around its periphery, each of which occupies a space corresponding to one-seventh of its circumference. The remaining one-seventh-circumference segment is arranged as a window, to permit a view of the numerals of the inner drum **32**, in like manner as window **34***a* in drum **34** serves for a view of the sucessive numerals of drum **35**.

On the left-hand cylindrical surface portions of drums **31** and **32** are provided further numerals, whereon are represented readings equal to the sum of **12** and the respective readings in the right-hand areas. Thus the reading "17" appears on drum **32** immediately to the left of the aforementioned reading "5" thereon, reading "18" appears to the left of the "6," and so on, to reading "22," which appears to the left of the reading "10" thereon. Likewise, "23" appears on drum **31** to the left of "11," "00" appears thereon to the left of the reading "12," and so forth, to reading "16" which appears to the left of the reading "4."

The drive gear **7***a* for the shutter drum **30** is a one-tooth mutilated gear or finger disc, arranged to drive six-toothed gear **6***a* in the same manner as indicated for gear elements **59** and **58** in Fig. 8. Being fixed to shaft **14***a*, finger wheel **7***a* makes one angular movement per hour, each angular advance thereof being of one-twelfth turn

extent. Upon completion of a twelve-hour cycle, finger wheel 7*a* engages gear **6***a* and advances it through one-sixth turn, in coincidence with the advancement of drum **31** from the reading "12" to the reading "1" by the action of gear **54** on gear **52**. Due to the alternate 60-degree mask areas and 60-degree window areas of shutter drum **30**, the clock thus proceeds through twelve hours of operation (1:00 a. m. to 12:59 p. m.) with the hours readings "1–12" only exposed, and with the readings "13–00" masked, and thereafter proceeds through twelve hours operation (1:00 p. m. to 12:59 a. m.) with the supplementary reading "13–00" in view, enabling the users of the 24-hour reading system to make convenient direct reference to the advanced reading scale.

It will be readily apparent from the foregoing that the hours numeral drums and the masking drum for the selective exposure of the supplementary "13–00" hours readings are all removable and replaceable without disturbance of the drive elements therefor, since the multiple coaxial shafts are here used with grouped driven gears, as in the case of the minutes drums. It will be noted, moreover, that maximum compactness is achieved in the cyclometer clock system as here described, with the motor situated between the hours drums and the minutes drums, and preferably eccentrically positioned; with the transfer shaft 14*a* extending thereby; with the multiple coaxial shaft systems in the hours drums and the minutes drums and the reset mechanism; and with the positive, locking intermittent drive elements grouped within the interior space of the drums.

Fig. 10 illustrates a further embodiment, wherein a single drum is employed for each minutes digit system, and a single drum **18** bearing the numerals "1" to "12," inclusive, is provided for the hours readings. A seconds drum **21** is also provided in the clock of Fig. 10.

A shutter drum **17** with three windows and three alternate opaque areas is provided, for exposing to view the supplementary 24-hour readings on drum **18** during alternate 12-hour periods.

Drum **19**, for the tens-of-minutes indications, has the numerals 0, 1, 2, 3, 4 and 5 distributed around its surface. Minutes units drum **20** has numerals 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 on its cylindrical surface. Seconds drum **21** has sixty divisions marks on its surface, and bears the numerals 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55 at five-division intervals.

The frame *d*, the motor drive and driven members, and the frame end plates *a* and *c* are similar to the aforedescribed portions of Fig. 2.

Through regular gears **11** and **10** and shaft **15**, the motor **67** provides uniform rotation of drum **21** at one revolution per minute. As in Fig. 2, the motor shaft **29** is in addition provided with intermittent drive gears and locking elements **2** and **3** cooperating with elements **4** and **5** to provide one angular advancement of gear **69** per minute (i. e., per revolution of shaft **29**).

The reset mechanism in Fig. 10 is similar in all respects to that shown in Fig. 2 and described above.

Gear **69'**, intercoupled with gear **69** through gear element **73**, provides step advancements of elements **7** and **13**, of one-tenth revolution angular extent. Gear **13** and gear **12** in mesh therewith are conventional 1:1 spur gears, through which drum **20** is advanced one-tenth revolution each minute, to expose successively higher units digits. Element **7** is a finger disc like element **59** of Fig. 8, engaging gear **6** (like element **58** of Fig. 8) at the completion of ten revolutions of shaft **29**, just as drum **20** is being advanced from reading "9" to reading "0." The result of each such engagement of gear elements **7** and **6** is to advance drum **19** one step, to expose its next higher numeral reading once every ten minutes.

When drum **19** is advanced from the "5" reading to the "0" reading, finger disc **9** secured to gear **6** engages twelve-toothed gear **8** (see also Fig. 11) on shaft **14**, and rotates this shaft 1/12 revolution. Drum **18** is geared to shaft **14** by 1:1 spur gears **13***a* and **12***a*, so that upon the 1/12 revolution advancement of shaft **14**, the hours drum **18** is advanced through an equal angular extent, from one numeral reading to the next higher reading.

At the completion of 12 hours of operation, and as the drum **18** is being advanced from the "12" reading to "1" reading, finger gear 7*a* engages gear **6***a* and advances the shutter drum **17**, reversing its condition as to covering or rendering visible the supplementary readings of the 24-hour system of readings, in the same way as described in connection with Fig. 2.

The arrangement of Fig. 10 retains the features of several drums of a group being free of any gearing or coupling mechanism in their intermediate spaces. Also, the compactness thereof and the resetting system are achieved, as in Fig. 2. The numerals are smaller, but the intercoupler elements are simplified. In the arrangement of Fig. 10, if desired for a special reason, an end motor location may be used instead of the positioning thereof as shown in the middle of the clock system. If the motor is provided at the right-hand end, the output shaft thereof (at 1 R. P. M.) may be coupled directly to the shaft **15**, or geared thereto through spur gears. An illustrative arrangement of the installation of the drive motor at the right-hand end of the drive shaft is included in my U. S. Patent No. 2,636,339, issued April 28, 1953.

The mutilated-gear intercouplers between successive dials as shown in Figs. 2 and 10 and the accompanying coupling detail views provide the advantages of positive drive coupling and positive locking of the dials during the intervals between their moments of advancement. It will be appreciated, of course, that pawl intercouplers or other types of intercouplers could be used, if desired, with the principal features of the present invention being retained.

The clock mechanism of Fig. 2 is secured to the tube **41** (Figs. 1 and 2) and has end covers **36** on the ends thereof, the end covers having bearings **37** for shafts **15***a* and **16***a*. Each of the end covers **36** is received in a mortise in the housing cylinder **41**, and the end covers are held in this spacing by rods **42** at front and rear of the housing. End covers **22** of the housing of Fig. 10 may similarly be held together. In this housing, the clock mechanism is fixed to tube **24** of plastic or like material, or metal; and for the minutes view and the hours view, cylinders **23** and **23'** are provided. These cylinders may be made of transparent plastic material, but all except selected window areas thereof are painted or otherwise masked. This arrangement is slightly different from the arrangement in Fig. 1, wherein concave cylinder-section windows **65** are dovetailed into the main tubing portion of the housing **41**, as shown in Fig. 12.

As shown in Figs. 2 and 4, one of the end covers **36** is provided with a spring **38** mounted on a block **39** thereon, said spring having an end for engaging notches or teeth **40** in the end of tube **41**, serving as means to hold the tube fixed in position, once the clock has been adjusted for a desired position.

For best locking action, the gears of the intermittent drive coupling elements are provided with concave cam surfaces. For example, in Fig. 7, gear **51** has cam surfaces as **51***a* at the tops of its teeth, for conforming to the circular arc surface of gear **53** and being locked thereby during the intervals between engagements of the teeth of gear **53** with the tooth-receiving recesses of gear **51**.

It will be apparent that many of the features of the present invention, including the mask arrangement for the twenty-four hour readings are applicable to rotatable numeral displaying elements of various shapes, including flat discs as well as drums.

The system of continuing exposure of at least one series of numbers and of selective exposure and masking of a further series of numbers, as illustrated with mask **30** in the cyclometer indicating system of a clock, is of course

applicable to cyclometer counting and registration systems for various purposes.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without department from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A cyclometer clock system comprising a series of cyclometer drums having their axes in alignment, means including at least two of said drums and a cyclometer drive coupling therebetween for indicating units and tens of minutes, means including at least a further one of said drums and a cyclometer drive coupling therefor from said minutes indicating means for indicating the hours, a drive motor, a first gear driven by said drive motor, a second gear adjacent said first gear, said second gear being coupled to said minutes indicating means, and manually adjustable axially shiftable gear means normally intercoupling said first and second gears and thereby transmitting driving power from said motor to said minutes indicating means, and being selectively shiftable to a position of engagement with said second gear but out of engagement with said first gear, for manual adjustment of said minutes indicating means independently of said motor.

2. A cyclometer clock system comprising a series of cyclometer drums having their axes in alignment, means including at least two of said drums and a cyclometer drive coupling therebetween for indicating units and tens of minutes, means including at least a further one of said drums for indicating the hours, a drive motor situated between said minutes indicating means and said hours indicating means, means including a pair of coaxial shafts and a pair of gears aligned on the corresponding ends of said coaxial shafts for coupling said motor to said minutes indicating means, and a laterally shiftable gear unit intercoupling the gears of said pairs, one of said gears of said pair being coupled to said motor to be driven thereby, and said shiftable gear being movable out of engagement with said motor-driven gear and being manually rotatable for selective manipulation of said minutes indicating means.

3. A cyclometer clock comprising a series of cyclometer drums having their axes in alignment, means including at least two of said drums and a cyclometer drive coupling therebetween for indicating units and tens of minutes, means including at least a further one of said drums for indicating the hours, a drive motor situated between said minutes indicating means and said hours indicating means, a cyclometer drive coupling from said motor to the units drum of said minutes indicating means, and means including a shaft parallel to the axes of said drums but displaced therefrom for coupling driving power from said minutes indicating means to said hours indicating means.

4. A cyclometer clock as defined in claim 3, wherein at least a portion of said cyclometer drive coupling from said motor to the units drum of said minutes indicating means comprises at least one bushing coaxially situated on said shaft and freely rotatable with respect thereto.

5. A cyclometer clock as defined in claim 4, wherein said cyclometer drive coupling between said units and tens of minutes drums comprises a further bushing coaxially situated on said shaft and freely rotatable with respect thereto.

6. A cyclometer clock comprising a housing, a main bracket in said housing and rigid therewith, a motor secured to said bracket, a minutes reading drum system and an hours reading drum system in said housing, said bracket being situated between said minutes and hours reading drum systems, and cyclometer drive coupling means between said minutes reading drum system and said hours reading drum system, said last named means including a drive shaft extending from minutes reading drum system on one side of said bracket to said hours reading drum system on the opposite side of said bracket.

7. A cyclometer clock of the character described, a motor having a driver consisting of a finger disc and a locking disc, and a drive consisting of a gear and a locking cam and a reset gear, a direct drive unit having also a reset gear, a manual reset shaft having a wide gear in mesh with the reset gear of the drive and the reset gear of the direct drive unit while the clock is in operation and in mesh only with the reset gear of the direct drive unit while the setting takes place, this providing a means to set the clock while the motor's driver is still engaged in the drive.

8. A cyclometer clock of the type described, comprising a bracket, a motor, a housing and a plurality of number carriers and a shutter, said motor secured to said bracket on each side of the bracket a post secured thereon, each post having secured thereto a rear plate, on each side of the bracket a spindle passing through the bracket plate and passing through the rear plate, on the minute side of the bracket two bushings on said spindle extending through the rear plate, one being an inner and the other an outer bushing, the outer bushing journalled in said rear plate, the tenth of minute carrier secured to the outer bushing and surrounding the rear plate and part of the bracket, and the minute carrier secured to the inner bushing and the second indication carrier secured to the spindle and on the other hour side of the bracket one bushing on said spindle extending through the rear plate, the hour carrier secured to said bushing and surrounding the rear plate and part of the bracket, and the shutter secured to the spindle, a shaft for operating the number carriers located in both rear plates and in the bracket and for operatively connecting both sides of the minute and hour carrier, with the motor between the minute and hour carrier and said motor operatively directly connected to the spindle of the minute side for the second indication reading.

9. A cyclometer clock system comprising a frame, a drive motor situated thereon, a series of cyclometer drums having their axes in alignment, means including at least two of said drums and an intermediate cyclometer drive coupling therebetween for indicating units and tens of minutes, said motor being coupled to the units of minutes indicating portion thereof, means including at least a further one of said drums for indicating the hours, a set of coaxial shafts connected to the respective drums of said means for indicating units and tens of minutes, the intermediate cyclometer drive coupling and the coupling to said motor both engaging said coaxial shafts adjacent said motor and remote from the units indicating portion of said means for indicating units and tens of minutes.

10. A cyclometer clock system as defined in claim 9, wherein the tens of minutes drum surrounds the minutes intermediate cyclometer drive mechanism and the hours drum surrounds the hours drum drive mechanism.

11. A cyclometer clock system as defined in claim 9, wherein the plural drums of said means for indicating units and tens of minutes are individually and successively removable axially from the respective ones of said coaxial shafts without disturbance of the motor coupling and intermediate cyclometer drive coupling elements.

12. A cyclometer clock system as defined in claim 11, wherein said drive motor is situated between said means for indicating the hours and said means for indicating units and tens of minutes.

13. A cyclometer clock system as defined in claim 12, wherein said means for indicating the hours comprises a plurality of drums in axial alignment, and a set of coaxial shafts attached to respective ones of said plurality

of hours-indicating drums, said coaxial shafts being coupled at one end of the hours drums system by intermittent drive couplings to the means for indicating units and tens of minutes.

14. A cyclometer clock system as defined in claim 9, wherein said means including at least a further one of said drums for indicating the hours comprises numeral drum means having first and second parallel series of numerals, the first series comprising the numbers 1 to 12, inclusive, and the second series comprising the numbers 13 to 23 alongside the respective ones of the numbers 1 to 11, inclusive, and means including a selective shutter and intermittent drive mechanism coupled thereto for alternately exposing and masking the numerals of said second series for twelve-hour intervals.

15. A cyclometer clock system comprising means including at least two rotatable numeral displaying elements for indicating the minutes digits of time readings, means including at least one rotatable numeral displaying element for indicating the hours digits of time readings, a motor, intermittent drive coupling means from said motor to one of said minutes displaying elements, intermittent drive coupling means intermediate the rotatable numeral displaying elements of the clock system, said means for indicating the hours digits of time readings having first and second parallel series of numerals thereon, the first series comprising the numbers 1 to 12, inclusive, and the second series comprising the numbers 13 to 23 alongside the respective ones of the numbers 1 to 11, inclusive in said first series, a rotatable selective shutter overlying said second series of numerals, and intermittent drive mechanism coupled thereto and to said intermittent drive coupling means intermediate the rotatable numeral displaying elements of the clock system for alternately exposing and masking the numerals of said second series for twelve-hour intervals.

16. A cyclometer clock system comprising a series of cyclometer numeral drums, means including at least two of said drums and a cyclometer drive coupling therebetween for indicating units and tens of minutes, means including at least a further one of said drums for indicating the hours, a drive motor coupled to said minutes indicating drums, an axially shiftable and rotatable reset element, means responsive to an axial shift of said element for decoupling said motor from said minutes indicating drums, and means responsive to rotation of said reset element when shifted for changing the positions of said minutes drums.

17. A cyclometer clock system as defined in claim 16, wherein said reset element comprises an intercoupling element between said motor and said minutes indicating drums, said element being normally driven angularly by said motor, and imparting angular motion thence to said minutes indicating drums.

18. A cyclometer clock system comprising a frame, a drive motor situated thereon, a series of cyclometer drums having their axes in alignment, means including at least two of said drums and an intermediate cyclometer drive coupling for indicating units and tens of minutes, a shaft passing coaxially through said two drums coupled to said motor and to said intermediate drive coupling, said intermediate drive coupling including at least one sleeve over said shaft, said shaft being driven in continuous rotation by said motor, means including at least a further one of said drums for indicating the hours, said intermediate drive coupling further including intermittent drive means situated between said minutes indicating drums and said hours indicating drum and there intercoupling the units of minutes indicating drum with the end of said shaft nearest to said hours indicating drum, said intermediate drive coupling further comprising intermittent motion drive means for advancing one of said two drums in minute steps and the other of said two drums in tens-of-minutes steps, and further intermittent drive means intercoupling said last-named one of said

two drums to said further one of said drums for providing step advancements thereof at one-hour intervals.

19. A cyclometer clock system as defined in claim 18, further including a seconds drum directly coupled to said shaft.

20. A cyclometer clock system comprising means including at least two rotatable numeral displaying elements for indicating the minutes digits of time readings, means including at least one rotatable numeral displaying element for indicating the hours digits of time readings, a motor, intermittent drive coupling means from said motor to one of said minutes numeral displaying elements, intermittent drive coupling means intermediate the rotatable numeral displaying elements of the clock system, said means for indicating the hours digits of time readings having first and second parallel series of numerals thereon, the first series comprising the numbers 1 to 12, inclusive, and the second series comprising the numbers 13 to 23, inclusive, alongside the respective ones of the numbers 1 to 11, inclusive in said first series, a rotatable selective shutter overlying said second series of numerals, and intermittent drive mechanism coupled thereto and to said intermittent drive coupling means intermediate the rotatable numeral displaying elements of the clock system for alternately exposing and masking the numerals of said second series for twelve-hour intervals, said first series of numerals being retained clear of said selective shutter and indicating one of the 1–12 series of numerals at any time, an hour numeral of the first series being exposed in addition to an hour number of said second series when said selective shutter is positioned to expose a number in said second series.

21. A cyclometer clock system comprising a series of cyclometer numeral drums, means including at least two of said drums and a cyclometer drive coupling therebetween for indicating units and tens of minutes, means including at least a further one of said drums for indicating the hours, a drive motor coupled to said minutes indicating drums, a reset element for decoupling said minutes indicating drums from said motor, and means responsive to rotation of said reset element for changing the indicating positions of said minutes drums.

22. A cyclometer clock system as defined in claim 21, wherein said reset element comprises an intercoupling element between said motor and said minutes indicating drums, said element being normally driven angularly by said motor, and imparting angular motion thence to said minutes indicating drums.

23. Cyclometer clock apparatus comprising one rotatable numeral displaying element for reading tens of minutes, two nested rotatable numeral displaying elements for reading units of minutes, means operatively intercoupling said units of minutes rotatable elements and said tens of minutes rotatable element for consecutive readings of minutes, a driving power source coupled to said nested rotatable elements, means including a reset element for decoupling said driving power source from said nested rotatable elements, and means responsive to rotation of said reset element for setting the nested rotatable elements independently of said driving power source.

24. A cyclometer clock comprising a series of operatively connected rotatable numeral displaying elements including at least one rotatable element for indicating the hours, another rotatable element for indicating the tens of minutes, and two more rotatable elements having the numerals from 0 to 9 inclusive distributed thereon for indicating the units of minutes, a driving power source coupled to said units of minutes rotatable elements, the coupling between said power source and said units of minutes elements including mutilated gears for driving one of said elements through a series of positions and driving the other of said elements through a further series of positions, and means for decoupling said driving power source from said units of minutes displaying ele-

ments selectively forwardly or backwardly and for manually advancing or retarding the positions of said mutilated gears for setting the rotatable numeral displaying elements independently of said driving power source.

25. Cyclometer clock apparatus comprising a motor, driving means coupled thereto and including a multilated driver gear and a locking cam disc, a gear and locking cam driven thereby, a drive shaft coupled to said gear and locking cam to be actuated therewith, and means to uncouple the drive shaft from the gear and locking cam for actuating the shaft independently of said motor to vary the angular position of said shaft as desired.

26. Cyclometer clock apparatus comprising a motor, driving means coupled thereto and including a mutilated driver gear and a locking cam disc, a gear and a locking cam driven thereby, a first number wheel coupled to said gear and locking cam to be actuated therewith, and means to uncouple said first number wheel from the gear and locking cam for actuating said first number wheel independently to vary the angular position of said first number wheel as desired.

27. A cyclometer clock comprising a series of cyclometer drums, means including at least two of said drums and a first cyclometer drive coupling therebetween for indicating units and tens of minutes, means including at least a further one of said drums and a further cyclometer drive coupling therefor for indicating the hours, a main frame, the minutes and hours cyclometer drive couplings being supported on said frame, the tens of minutes drum surrounding said first cyclometer drive coupling and being at one side of said frame, and the hours drum surrounding said further cyclometer drive coupling and being at the opposite side of said frame.

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