United States Patent

[11] 3,604,135

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[54] **CALENDARS**
8 Claims, 14 Drawing Figs.

[52] **U.S. Cl.** **40/113**
[51] **Int. Cl.** **G09d 3/08**
[50] **Field of Search** 40/111, 112, 107, 114, 358, 77.7, 113; 58/4, 6

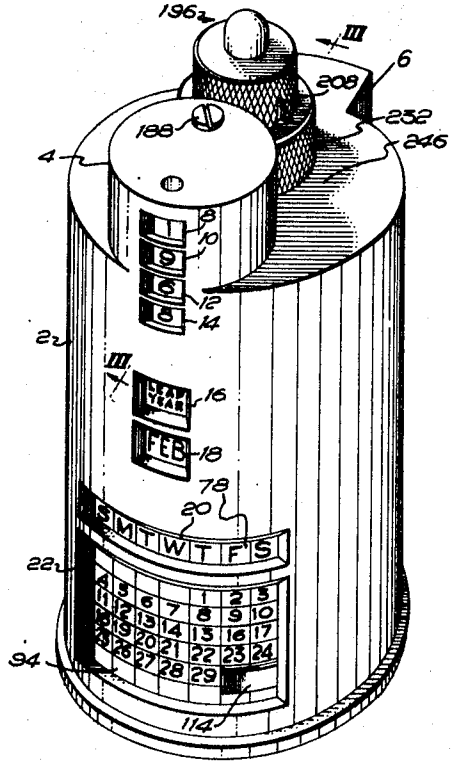
[56] **References Cited**

UNITED STATES PATENTS

Re.19,186	5/1934	Kluge et al.	40/112
2,126,469	8/1938	Huston	58/6
2,170,408	8/1939	Hillcourt	40/112
2,358,969	9/1944	Gatewood	40/111
2,369,917	2/1945	Roitman	40/114
2,523,206	9/1950	Fluette	40/109
2,921,394	1/1960	Elwood	40/114
3,400,510	9/1968	Schwarzer et al.	58/4

Primary Examiner—Robert W. Michell
Assistant Examiner—J. H. Wolff
Attorney—Norris & Bateman

ABSTRACT: A mechanical calendar for indicating the day of the week on which a date in any month in a year falls. Symbols for indicating the year numeral, the date numeral, the days of the week and months of the year being arranged on peripheries of annular gears which can be selectively interconnected by gearing mounted in a movable cradle. The cradle is moved so that the gearing selectively engages the year numeral annular gears and the date data annular gear such that when the gearing rotated by a person operating the calendar to change the year numeral to a desired year the date data displayed is simultaneously altered. The cradle is then further moved by the operator to bring the gearing into selective engagement with the months annular gear and the days of the week annular gear so that by further rotation of the gearing to bring the desired month into display the day of the week data displayed is also simultaneously altered.



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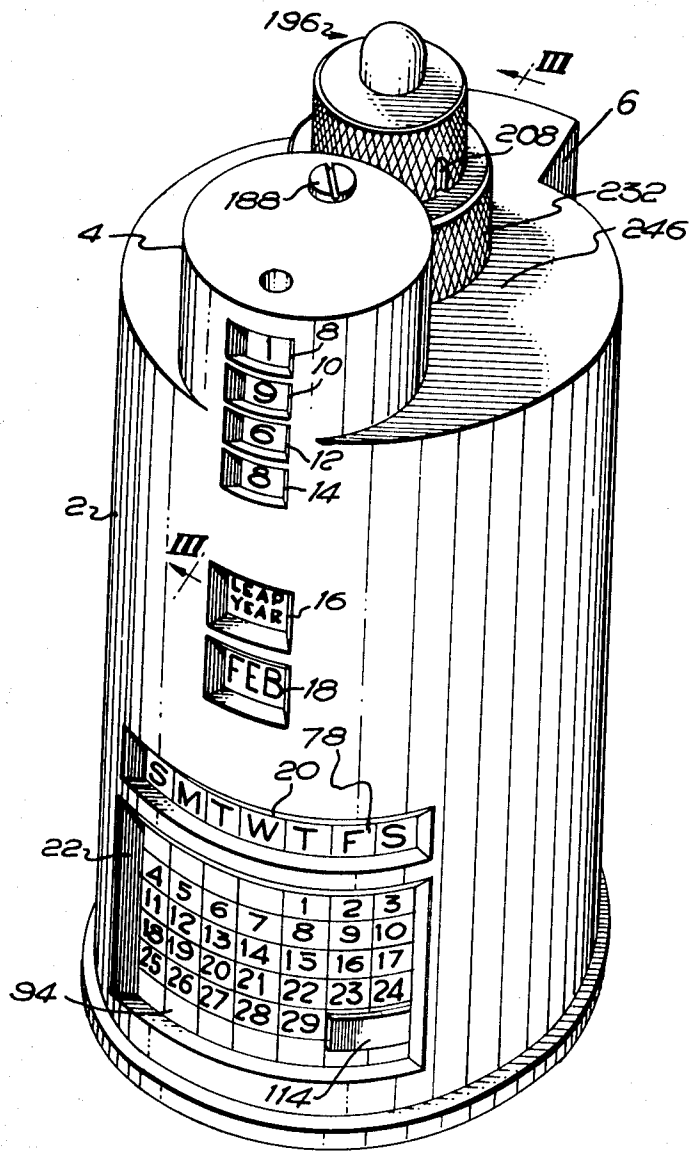


FIG. 1

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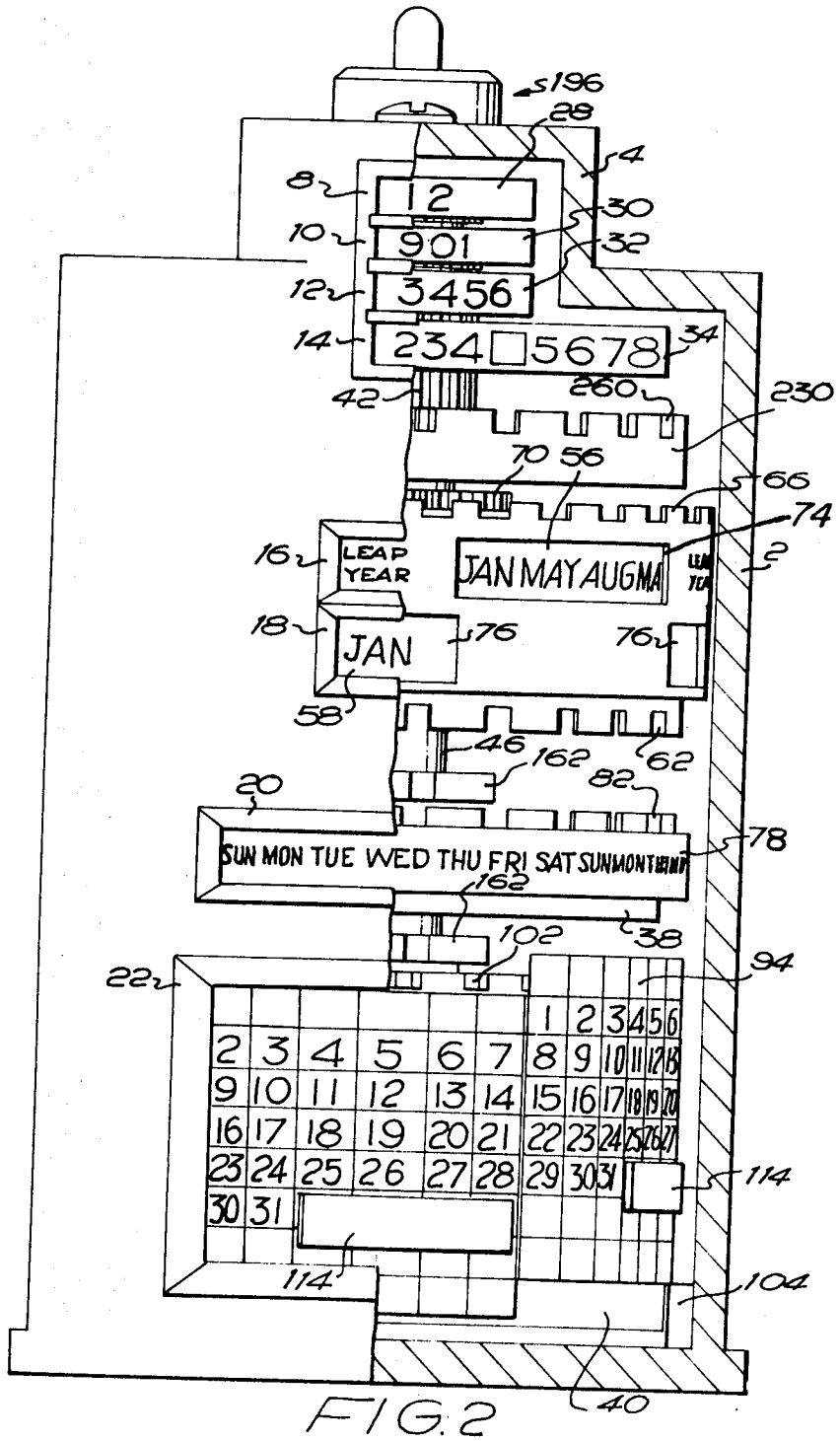


FIG. 2

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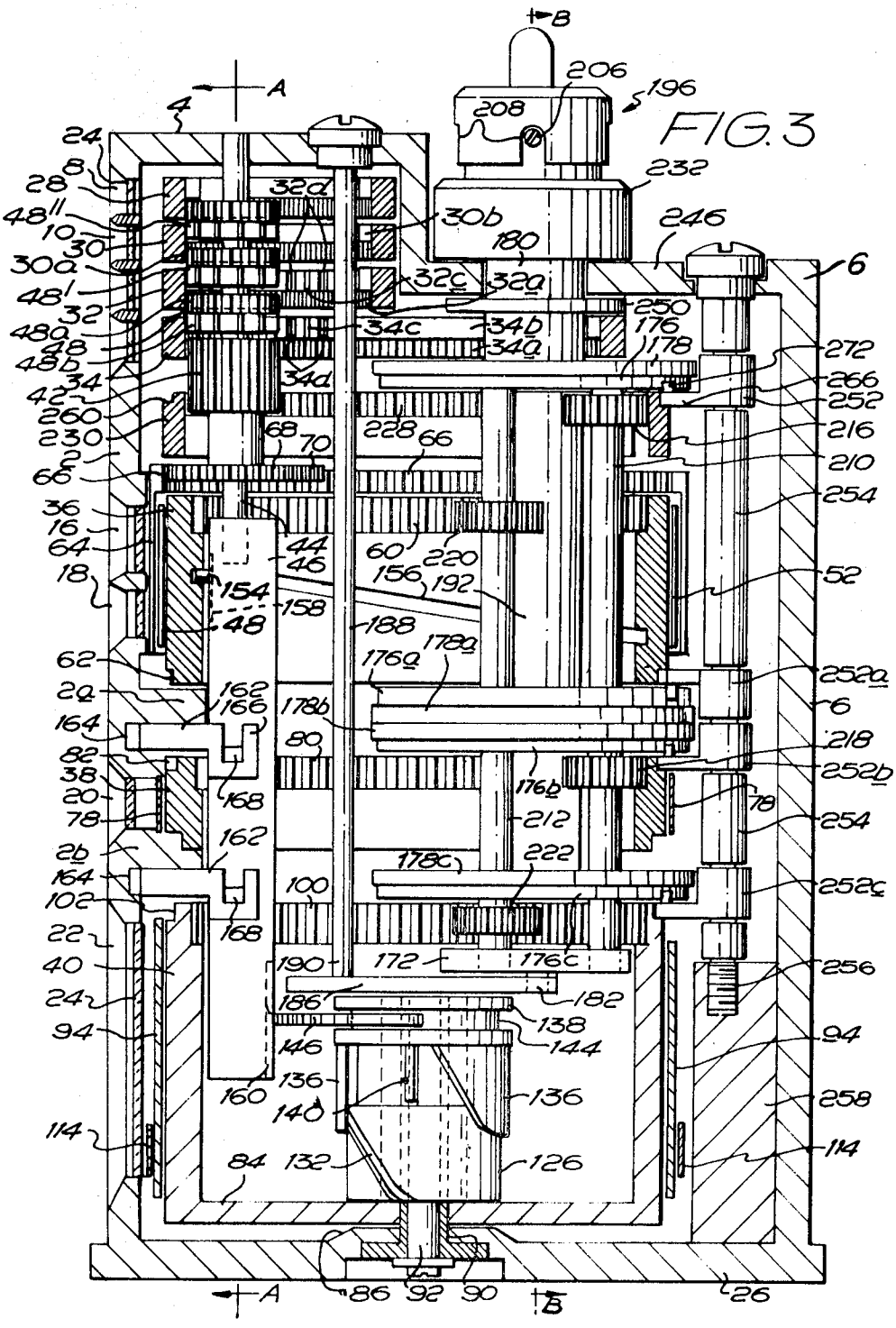


FIG. 3

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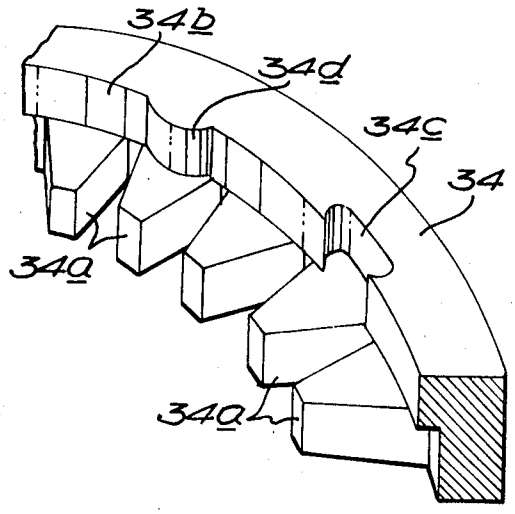


FIG. 3A

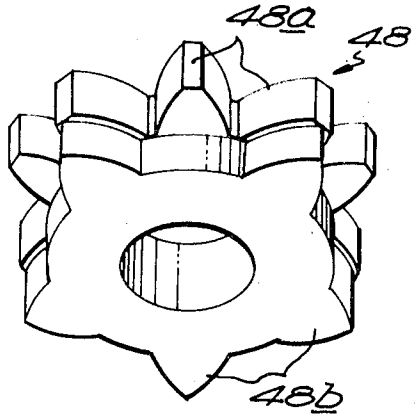


FIG. 3B

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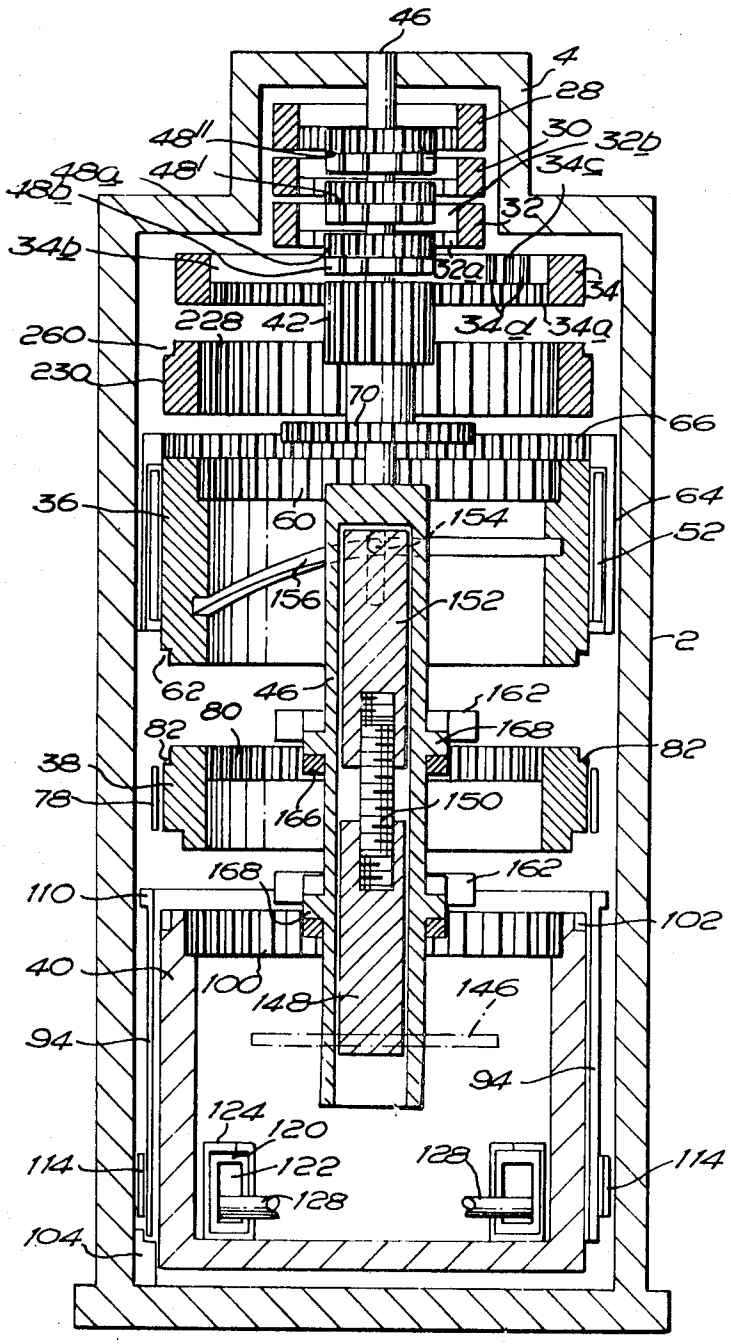


FIG. 4

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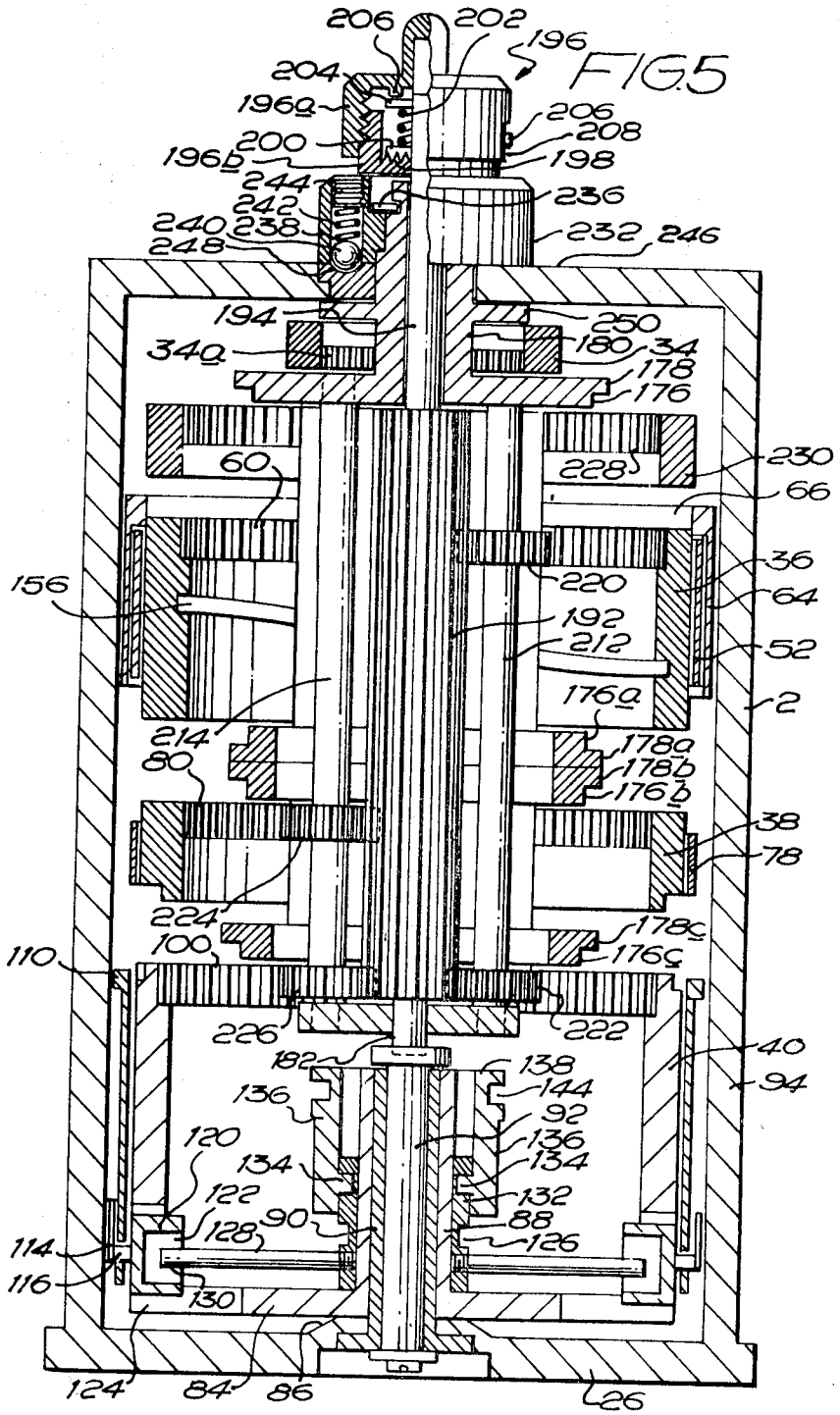


FIG. 5

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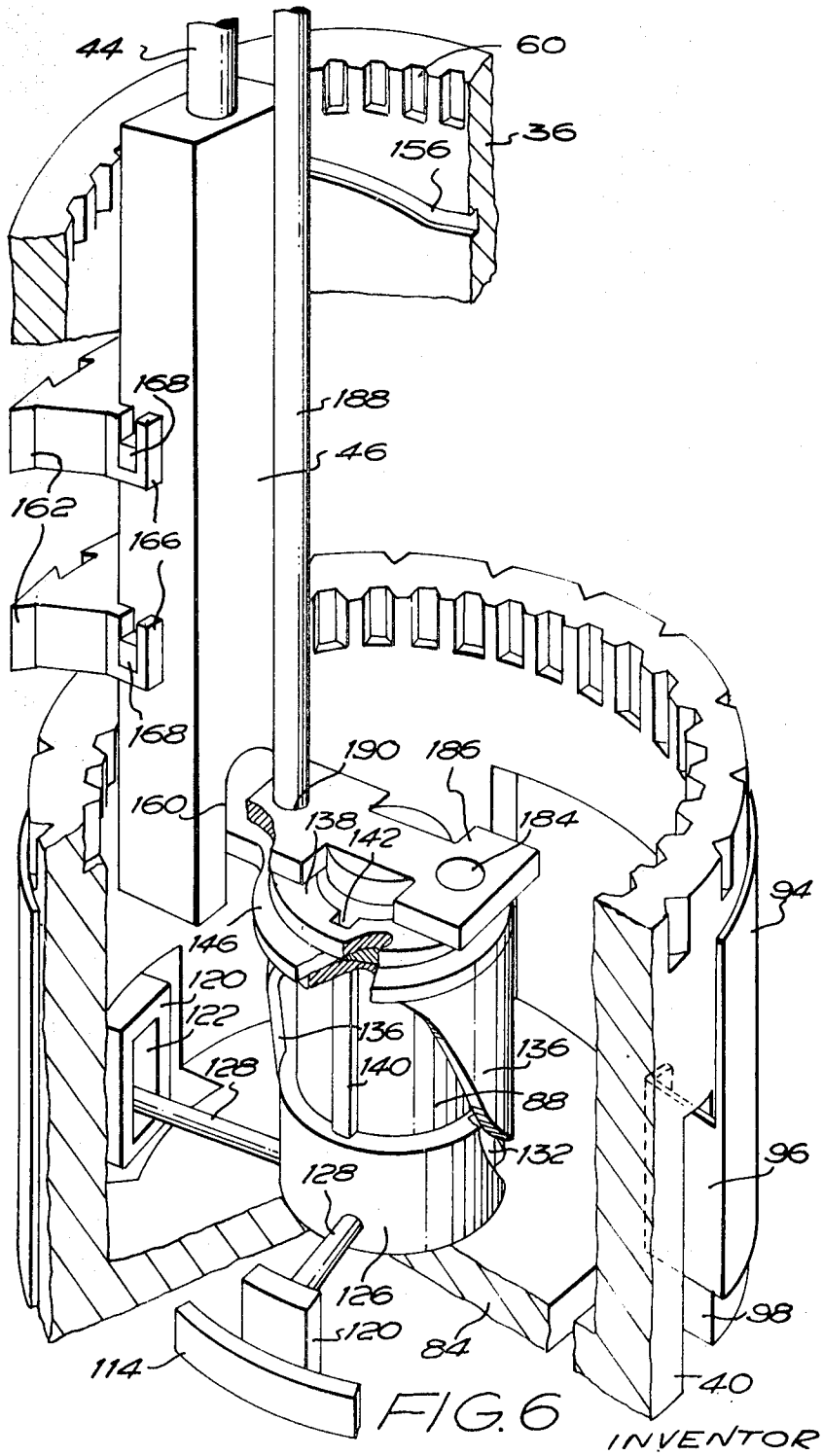


FIG. 6

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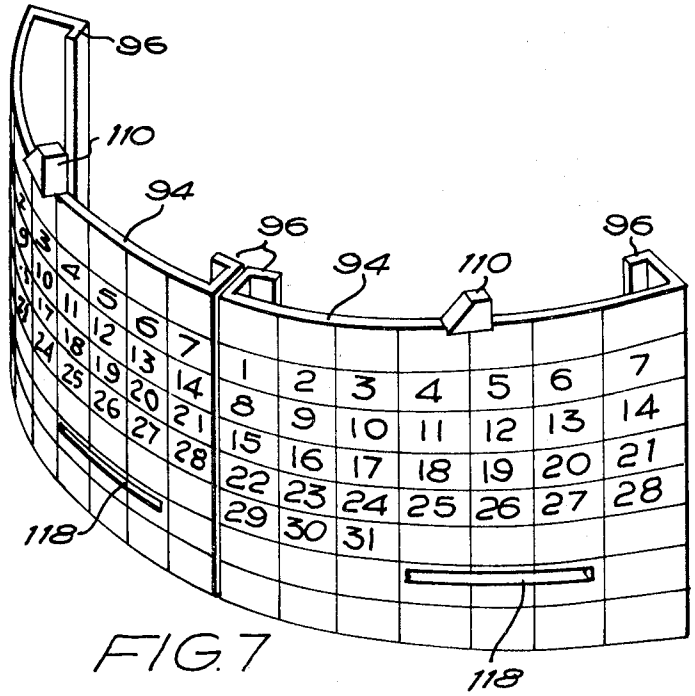


FIG. 7

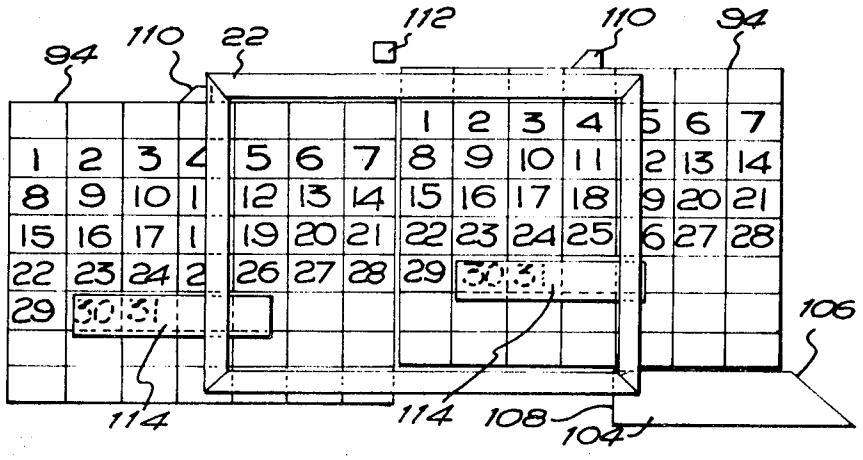


FIG. 8

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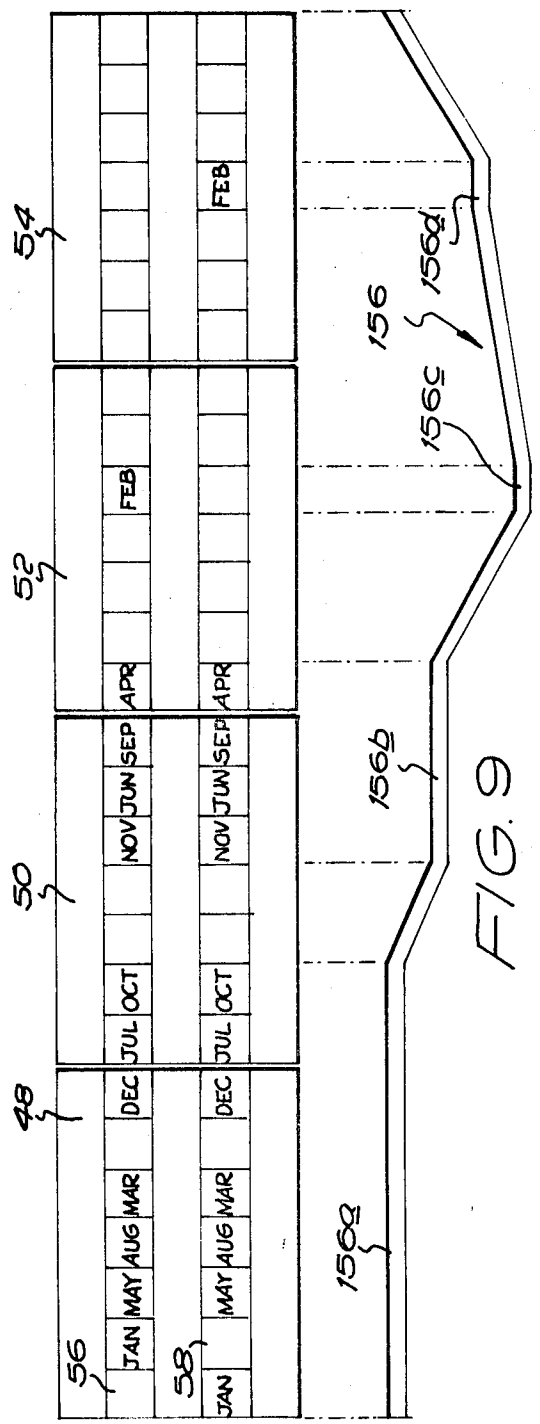


FIG. 9

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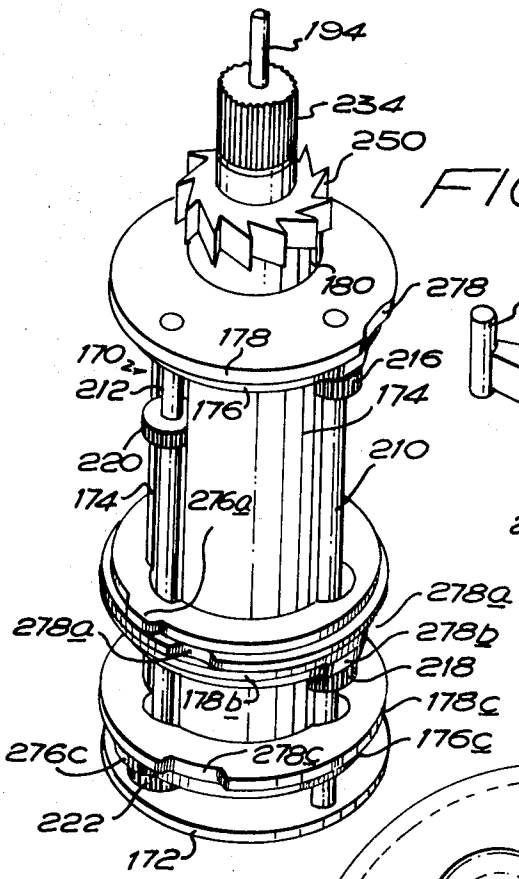


FIG. 10

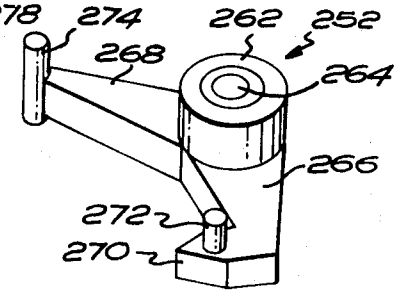


FIG. 12

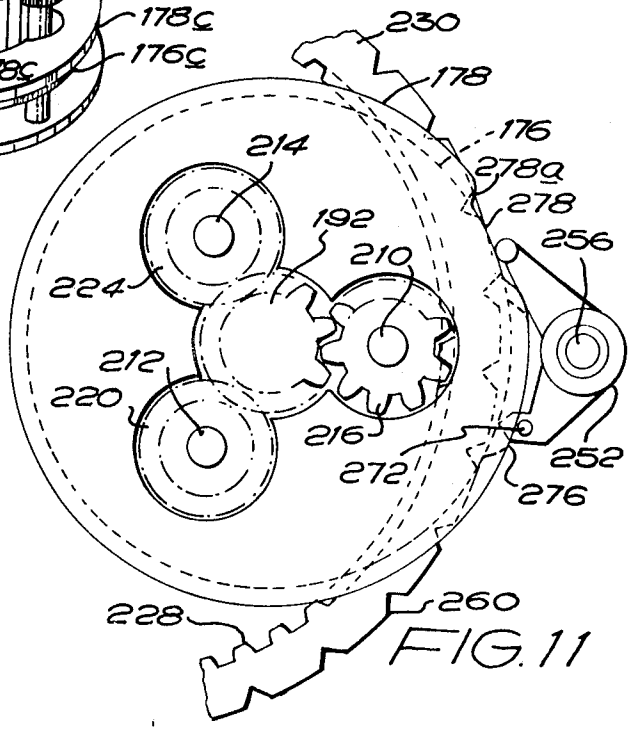


FIG. 11

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CALENDARS

This invention relates to an improved automatic or mechanical calendar.

In the improved calendar relationships which exists between the year, the month, the day of the week and the date are linked and cross-linked.

1ST RELATIONSHIP

A direct relationship exists between the year and the day of the week. If one advances or retreats through the years one-by-one then the dates of each particular month also advance or retreat respectively one-by-one through the days of the week. For example, if the first of January of one year falls on a Sunday, then leap years excepting, the first of January of the next year falls on a Monday and in the following year the first of January falls on a Tuesday. The occurrence of leap years breaks this pattern every fourth year for the months following February by displacing the dates by one extra day such that if in one year the first of March falls on a Sunday, for example, and the next year is a leap year, then the first of March in this year falls not on the Monday but on the Tuesday instead.

2ND RELATIONSHIP

A second and more subtle relationship exists between the months, the dates and the days of the week. If the months are set out in the order shown in either of the following diagrams

	Jan	May	Aug	Mar		Dec	July	Oct			Nov	June	Sept	Apr				Feb										

Jan		May	Aug	Mar		Dec	July	Oct			Nov	June	Sept	Apr										Feb				

then in any year each of these months has it commencement on succeeding days of the week; the blank spaces being given appropriate places in the diagram order. This apparently random pattern repeats every 21, therefore by using the factor 7, which is the number of days in the week it is possible to predict for each year the day of the week on which any month commences.

3RD RELATIONSHIP

By cross-linking the 1st and 2nd relationships the calendar pattern makes a symmetrical complex relationship between each pair of variables. By always maintaining a constant link it is possible to reproduce the desired forecasting of the day of the week with its appropriate day for any particular month in any particular year, and this fact is made use of in the present invention.

In a mechanical calendar formed according to the invention for indicating the day of the week on which a date in any month in a year falls, date, day of the week, month and year data displayed are variable, and gear means is provided by which the date data displayed is variable simultaneously with alteration of the display of year data to a desired year and the day of the week data displayed is variable simultaneously with alteration of the display of month data to a desired month.

In order that the nature of the invention may be more fully understood it will now be described with reference to the accompanying drawings in which:

FIG. 1 is a front perspective view of a calendar formed according to the invention;

FIG. 2 is a front elevation of the calendar in FIG. 1 with part of the outer casing cut away;

FIG. 3 is a section on the line III—III in FIG. 1;

FIG. 3A is a fragment of an annular gear bearing symbols for indicating the units part of a year numeral in the calendar in FIG. 1;

FIG. 3B shows an intermittent pinion which meshes with the gear in FIG. 3A;

FIG. 4 is a section on the line A—A of FIG. 3;

FIG. 5 is a section on the line B—B in FIG. 3;

FIG. 6 is a perspective view of a fragment of the calendar showing a date annular gear; a month annular gear and a yoke lever acting on means for moving date cover slides (a day annular gear located between the date and month annular gears being omitted for the sake of clarity;

FIG. 7 shows a pair of date quadrants for mounting on the exterior of the date annular gear;

FIG. 8 shows a developed view of information borne by a pair of adjacent date quadrants passing an aperture in the calendar casing;

FIG. 9 shows a developed view of information borne by four adjacent month quadrants and therebelow is a developed view of a cam groove which is formed in an internal wall of the month annular gear, the shape of this groove being shown in relation to the information on the quadrants;

FIG. 10 is a fragmentary perspective view of a gear cradle assembly provided in the calendar;

FIG. 11 is a fragmentary and diagrammatic view from above of the gear cradle in FIG. 10 showing the disposition of planetary gears about a drive pinion, and an annular gear in mesh with one of the planetary gears, and

FIG. 12 is a perspective view of a locking pawl used in the calendar to hold an annular gear in position.

Referring to the drawings, the calendar has a generally cylindrical hollow main casing body **2** surmounted at a front upper end by a generally cylindrical hollow housing **4** of smaller diameter than the main body, and at the rear, the casing body is formed with a hollow longitudinal excrescence **6**. Eight apertures or windows **8, 10, 12, 14, 16, 18, 20** and **22** in substantially vertical alignment are formed in a front wall of the casing and are covered by panes **24** of glass or other transparent material which are substantially prevented from misting over internally by the provision of ventilation holes (not shown) in the base **26** of the casing. Behind each window are annular gears **28, 30, 32, 34, 36, 38** and **40**.

THE YEARS ANNULAR GEARS ASSEMBLY

This assembly is formed by the gears **28, 30, 32** and **34** individually supported by interior ledges (not shown) provided on the wall of the housing **4**. The annular gear **34** is the units annular gear having on its circumferential face data for indicating the unit part of the year numeral displayed through the windows **8, 10, 12** and **14**. This unit date is disposed around the whole of the circumference and can be arranged either in the pattern:

1 2 3 4□5 6 7 8□9 0 1 2□3 4 5 6□7 8 9 0□

or in the pattern

2 3 4 5□6 7 8 9□1 2 3□4 5 6 7□8 9 0 1

such that the symbols in the pattern are substantially equally spaced apart. A plurality substantially similar and equally spaced gear teeth **34*a*** are formed around the whole of a lower part of an internal surface of the unit annular gear **34**. There can, for example, be fifty teeth **34*a*** in which case the unit date pattern is arranged so that the gear **34** must be rotated by two tooth pitches to bring the next symbol into view through the window **14**.

Rotation of the units annular gear **34** is produced by rota-

tion (to be subsequently described) of a gear 42, having teeth, which can for example, be 10 in number, meshing with the teeth 34a. The gear 42 is freely mounted on a substantially vertical spindle 44 located at its upper end in a bore in a top wall of the housing 4 and screw threaded at its lower end into an upper part of a yoke rod housing 46.

An upper inner portion 34a of the units annular gear is smooth over most of the area except for a pair of diametrically opposed recessed 34c (only one shown in FIG. 3) on either side of which are small excrescences or protuberances 34d.

A composite one piece intermittent pinion indicated generally at 48 freely mounted on the spindle 44 and spaced by means (not shown) from the gear 42 is formed with an upper set of gear teeth 48a and lower set of gear teeth 48b on its periphery. There are less teeth 48b than teeth 48a and the pinion can be formed, for example, with 10 substantially equally spaced teeth 48a and five substantially equally spaced teeth 48b disposed so that a tooth 48b coincides with every alternate tooth 48a . Each tooth 48b has a thin addendum and can engage in succession in the recesses 34c as the units annular gear is rotated so that for one complete rotation of the gear 34 the periphery of the intermittent pinion 48 is rotated through an arc equal in length to two pitches of the teeth 48b or four tooth pitches of the teeth 48b (in the case where there are twice as many teeth 48a as teeth 48b). As the units annular gear is rotated the protuberances 34d strike the addendum of a tooth 48b to ensure positive engagement of the tooth in the recess 34c.

The teeth 48a mesh with teeth 32a formed around the whole of a lower part of an inner surface of the annular gear 32, and the teeth 32a can, for example, be 20 in number. The gear 32 is tens annular gear bearing the symbols 0 1 2 3 4 5 6 7 8 9 substantially equally spaced around its outer periphery to indicate the tens part of the year displayed through the windows and if the gear is formed with 20 teeth 32a then the gear must be rotated through two tooth pitches of the teeth 32a by the pinion 48 to bring the next symbol into view through the window 12.

An upper part 32b of the inner surface of the tens gear 32 is substantially smooth except for one recess 32c formed therein similar to the recesses 34c, and protuberances 32d are formed on either side of the recess 32c.

Once per revolution of the tens gear 32 the recess 32c can engage a lower tooth of a pinion 48^1 similar in construction to the pinion 48 and freely mounted on the shaft 44. This pinion 48^1 is spaced by means (not shown) from the pinion 48 and has upper teeth meshing with teeth 30a in an inner lower surface of the gear 30, which teeth 30a can, for example, be 11 in number disposed in an arc about part of an inner surface of the annular gear. This annular gear 30 is the hundreds gear having the symbols 8 9 0 1 2 disposed on its exterior face in front of the arc of teeth 30a such that the hundreds gear must be rotated through two tooth pitches of the teeth 30a (in the case where there are 11 teeth) to bring the next hundreds symbol in the year display into view through the window 10. A recess similar to the recess 32c is formed above the center of the arc of the teeth 30a to engage, once per revolution of the gear 30, with a lower tooth on a pinion 48^{11} similar in construction to the pinions 48, 48^1 and freely mounted on the shaft 44 and spaced from the pinion 48^1 by means (not shown).

Upper teeth on the pinion 48^{11} mesh with teeth 28a in an arc about part of a lower inner surface of the annular gear 28. This annular gear is the thousands annular gear having on its outer periphery the symbols 1 2 in front of the arc of teeth 28a. For example, there can be 5 teeth 28a with the symbols arranged so that the thousands annular gear must be rotated through two tooth pitches of the teeth 28a (where there are five teeth 28a) to alter the thousands part of the year number displayed through the window 8.

It follows therefore that as the gear 42 is rotated the year numeral changes one unit at time to either increase or decrease this numeral depending on the direction that the gear is rotated.

THE MONTH ANNULAR GEAR

The annular gear 36 is the months annular gear supported on an internal ledge 2a provided on the casing 2. This gear is formed with a plurality of vertical slots (not shown) into which rearward projections (not shown) on four arcuate strips or month quadrants 48, 50, 52 and 54 (see FIG. 9) fit in dovetail relation to prevent vertical and horizontal movement of the quadrants relative to the gear 36. These quadrants extend wholly around the month annular gear and each quadrant bears data relating to the months which differ from the data on any other month quadrant. The manner in which the data on the individual quadrants is displayed can be seen in the developed view of the quadrants in FIG. 9 in which the means of the months are set out in two horizontal rows 56, 58 divided in each quadrant into seven vertical columns. The array of months in the upper row 56 relates to ordinary years and thus data is displayed when required, month by month through the window 16, whilst the array of months in the lower row 58 relates to leap years and this data is displayed when required, month by month through the window 18. A track of gear teeth 60 is formed wholly around an upper internal surface of the annular gear 36 and these teeth can, for example, be 56 in number and it is by engagement of these teeth with other gear means to be subsequently described that the annular gear 36 is rotated so that the month displayed through either of the windows 16 or 18 is changed. Around a lower part of the external surface of the gear 34 is a track of V-shaped locking notches 62 which may, for example, only number half as many as the number of the teeth 60 and can be disposed so that each notch corresponds with the position of alternate teeth 60.

THE MONTH MASK

The month mask is a device arranged to mask the month data in the lower row 58 during an ordinary year and mask the month data in the upper row 56 during leap years and display the words LEAP YEAR through the window 16. The month mask is formed by a rotatable annulus 64 supported by means (not shown) and disposed to surround the month annular gear 36. A track of gear teeth 66 are formed around an upper end of the mask 64 and there can, for example, be 50 teeth 66 meshing with teeth 68 of a sprocket 70 freely surrounding spindle 44. The sprocket 70 can, for example, have 10 teeth and is formed integral via a sleeve 72 with the gear 42 so that as this latter gear is rotated, the sprocket rotates to revolve the mask. An upper row of substantially equally spaced, substantially similar, elongated or substantially rectangular through apertures 74 (FIG. 2) is formed around the month mask, and a lower row of shorter, substantially equally spaced, substantially similar through apertures 76 extends around a lower part of the mask. The row of upper apertures 74 is substantially level with the window 16 and the row of lower apertures 76 is substantially level with the window 18.

If there are 50 teeth 66 and five upper apertures 74 for example; then each upper aperture can have a length substantially equal to eight tooth pitches of the teeth 66 and each upper aperture can be spaced from the next upper aperture by a distance substantially equal to two tooth pitches. In each space between the upper apertures 74 is inscribed the words "LEAP YEAR," and below each of these insertions is located one of the lower apertures 76 such that around the mask periphery the upper apertures alternate with the lower ones. Each lower aperture 76 can have a length, around the mask periphery, substantially equal to two pitches of the teeth 66 and successive lower apertures are spaced apart by a distance substantially equal to eight tooth pitches.

When the month mask is revolved and then halts so that an upper aperture 74 coincides with the window 16, month data for ordinary years in the row 56 on a month quadrant can be observed through the window 16, whilst the month data for

leap years in the row **58** is obscured at the window **18** by the wall of the mask. On the other hand when the mask is halted with an aperture **76** coincident with the window **18**, the words "LEAP YEAR" are displayed through the window **16** and month data for leap years in the row **58** on a month quadrant can be seen through the window **18**.

Because the sprocket **68** is unitary with the gear **42** the month mask is only rotated when the year numeral is changed and the words "LEAP YEAR" are automatically displayed through the window **16** only when the year is a leap year; for other years the words "LEAP YEAR" are automatically not displayed and in their place through the window **16** can be seen month data in the row **56**, whilst the data in the row **58** is masked.

THE DAY ANNULAR GEAR

The annular gear **38** supported on an internal ledge **2***b* is the day annular gear having on its periphery four arcuate strips or substantially similar day quadrants **78** arranged alongside one another so that the gear is encircled by them. Each day quadrant has at least one rearward projection fitting in dovetail relation into a substantially vertical slot (not shown) formed through the annular gear **38** and extending from the bottom of the gear part of the way towards the top of the gear. As these slots are open at one end the day quadrants can be readily detached and can also be interchanged as each bears on its outer face exactly the same days of the week data. That is the symbols S M T W T F S representing the days of the week from Sunday to Saturday as shown in FIG. **1** or abbreviations of these days such as Sun. Mon. Tue. Wed. Thur. Fri. Sat. shown in FIG. **2**. The day data can be seen through elongated window **20** and is rotated therepast by rotation of the day annular produced by rotation of a gear (to be described subsequently) meshing with teeth **80** in a track formed around an upper part of the interior of the annular gear **34**. There can, for example, be 56 teeth **80**. Around an upper part of the exterior of the annular gear **34** is formed a series of V-shaped locking notches **82** which may only number half as many as the teeth **80** and be disposed so that a locking notch coincides with the position of alternate teeth **80**.

THE DATE ANNULAR GEAR

The annular gear **40** is the date annular gear formed with a base **84** freely resting on a projecting **86** provided on an internal face of the casing base **26**. The base **84** is formed with a substantially central upstanding sleeve bearing **88** freely surrounding a flanged bush **90** around a spindle **92** projecting substantially vertically upwards through the casing base. Extending about the outer periphery of the annular gear **40** are four similar strips or date quadrants **94** each having on its outer face 42 spaces arranged in eight substantially horizontal rows and seven substantially vertical columns (see FIGS. **1**, **2**, **7** and **8**), with the numerals **1** to **31** set out in the spaces as shown in FIGS. **7** and **8**. Each date quadrant **94** is formed with a pair of rear flanges **96** each passing through one of a plurality of substantially vertical slits **98** spaced about a periphery of the annular gear **40** by angles of substantially 90° and formed through the gear so that a rear part of the flange engages against a rear face of the gear to prevent inadvertent detachment of the quadrants **96**. As each slit **98** extends from the lower end of the annular gear part of the way towards the upper end, a lower end of each slit is open to allow the date quadrants to be removed and replaced as desired. Each slit **98** is also longer than the flanges **96** so the quadrants can move vertically relatively to one another and to the annular gear **40**, but are constrained from moving horizontally relative to the gear.

The annular gear **40** is rotatable by gear means (to be subsequently described) meshing with gear teeth **100** extending around an upper internal part of the annular gear. There can, for example, be 50 teeth **100**. A train of V-shaped locking notches **102** is formed around an upper part of the annular gear periphery and these notches may number half as many as the teeth **100** and be disposed to coincide with the positions of alternate teeth **100**.

As the annular gear **40** is rotated, the date quadrants **94** are brought successively into view through the window **22** which is just long enough, in a direction around the casing periphery, for all the dates of a month to be seen on one date quadrant. However the calendar is also arranged so that the dates for one month can be displayed by using part of the day data from two adjacent date quadrants (see FIG. **8**). This is accomplished by the provision of a base cam **104** (see FIGS. **4** and **8**) provided inside a lower part of the casing **4** in a position alongside the window **22** so that as the annular gear **40** is rotated to bring the next date quadrant into view, an underside of this quadrant rides up an inclined surface **106** at one end of the base cam to raise the quadrant relatively to the annular gear by virtue of the vertical movement allowed to the flanges **96** in the slits **98**. Meanwhile the preceding date quadrant has dropped off a straight end **108** of the base cam and fallen relatively to the annular gear **40**; this fall being assisted by the interaction of a date quadrant cam **110** on an upper side of the data quadrant coming into contact with a projection **112** on the interior of the casing **2** in a position above the window **22**. The date quadrant on the base cam **104** is now a whole horizontal row of date numerals higher than the other date quadrant, but the rows seen are in alignment so that when the date numerals are read from left to right and from top to bottom through the window **22** a complete set of date numerals is presented, the numerals on the part of one quadrant which has gone out of view being supplied on the part of the next quadrant which has just come into view (see FIG. **8**).

As several months in the year have less than 31 days it is necessary to mask to redundant date numerals for such months. This is done by means of a date cover **114**.

THE DATE COVER

There are four date covers **114** each constituted by an arcuate strip provided with a rearward projection **116** extending through a substantially horizontal through slit **118** formed in each date quadrant in a position below and behind the date numeral "31" (taking the direction of rotation of the quadrant as forwards) and just wide enough, in a vertical direction, to receive the projection. Each of these projections is mounted on a front face of a substantially rectangular boxlike element **120** open at its rear side and having a hollow interior **122**. Each of the four elements **120** is located in one of four substantially rectangular through apertures **124** formed in the annular gear **40**. Part of each aperture **124** is located in the gear base **84** and the apertures are spaced about the periphery of the annular gear by angles of substantially 90°, and are located behind the slits **118**. Furthermore, the apertures **124** are sufficiently wide to allow the date covers **114** to make the necessary horizontal movement when masking or unmasking the date numerals "29, 30 and 31."

A collar **126** resting on the gear base **86** freely surrounds a lower end of the sleeve bearing **88**. Screwed into this collar are ends of four substantially horizontal spider rods **128** each extending radially outwards at substantially a right angle to the spider rod on either side, and a free end **130** of each rods is located in the interior **122** of a respective element **120**. Rotation of the collar in either direction produces an equivalent rotation of the spider rods which thus causes the date covers **114** to move horizontally to cover or uncover the date numerals "29, 30 or 31."

Rotation of the collar **126** is produced by the following mechanism. In substantially diametrically opposed sides of the collar are formed a pair of ascending helical grooves **132** of similar hand. A stud **134** is located in each groove **132**. Each stud is mounted on an inner face of a pair of arms **136** depending from an annular ring **138** surrounding an upper part of the bearing **88**, which ring is constrained to rotate with the bearing by a substantially vertical rib **140** mounted on the bearing

exterior and passing through a groove 142 in the ring's inner face to allow vertical movement of the ring relatively to the bearing. An annular groove 144 is formed around the exterior of the ring 138. A substantially horizontal C-shaped yoke lever 146 located in the groove 144 allows the ring 138 to be rotated relative to the yoke lever which is mounted on a lower end of a substantially square sectioned and substantially vertical lower yoke rod 148 interconnected by means of an adjusting screw 150 with an upper substantially square sectioned upper yoke rod 152 provided at its upper end with an outstanding upper stud 154 projecting towards the windows 16, 18 and slidably located in a cam groove 156 formed around an inner face of month annular gear 36. These upper and lower yoke rods are constrained to move substantially vertically within a hollow boxlike yoke rod housing 46, which housing is closed at the top and open at the bottom and has an interior substantially square in cross section to resist rotation of the yoke rods. The stud 154 projects outwardly from the housing 46 through a substantially vertically elongated aperture 158 which allows up and down movement of the stud relative to the housing, and a substantially vertical slot 160 in a lower part of the housing allows the yoke lever 146 projecting therethrough likewise to move up and down relative to the housing. The housing 46 is held stationary and mounted on an internal wall of the casing 2 by dovetail projections 162 snap fitting into suitably shaped recesses 164 in the casing wall. These projections each have a pair of spaced C-shaped female locking elements 166 engaging with male locking lugs 168 outstanding from opposite sides of the yoke rod housing.

The cam groove 156 is so shaped that as the month annular gear 36 is rotated the stud 154 is moved up and down to raise and lower the yoke rods 148, 152 thereby raising and lowering the yoke lever 146. This raises and lowers the ring 138, the legs 136 and the studs 134. Vertical movement of these studs in the helical grooves 132 compels the collar 126 to rotate and move the date covers 114 relatively to the date quadrants 94. This relative movement can be either in the same direction as the direction of rotation of the date annular gear when masking any of the date numerals 29, 30, 31 or in the opposite direction when unmasking any of these numerals. It must be emphasized that any backward movement (taking the direction of rotation of the gear 40 as forwards) of the cover slides is only relative to the date quadrant because rotation of the gear 40 compels the cover slides to move in the same forward direction relatively to the housing 2.

To produce the desired relative movement of the cover slides, the cam track 156 has the shape shown in the developed view in FIG. 9. This track is located behind the month quadrants 48 to 54 so that a high substantially horizontal portion 156*a* of the track is behind the month data relating the the 31 day months January May, August, March, Decemeber, July and October. The track then falls to another substantially horizontal portion 156*b* behind the data relating to the 30 day months November, June, September and April. From the portion 156*b* the cam groove descends to its lowest portion 156*c* behind the data for February of an ordinary year and then rises slightly to a portion 156*d* which is behind the data for February of a leap year. The groove continues rising until the portion 156*a* is reached.

When the upper stud 154 is located in the cam groove portion 156*a* the yoke-lever is fully raised so that the date covers 114 are located at their farthest rearward position relatively to the date quadrants and do not cover any of the date numerals. By rotating the month annular gear 36 the groove portion 156*b* is brought into engagement with the upper stud and the yoke lever is lowered slightly to rotate the collar forwards so that the date covers move in front of the date numerals "31." Further rotation of the gear 36 brings the groove portion 156*c* into engagement with the upper stud and the yoke-lever is fully lowered to move the date covers further forwards relative to the date quadrants to cover up the numerals "29, 30, 31." On continuing to rotate the gear 36, the groove portion between the portions 156*c* and 156*d* engages the upper stud so that the yoke-lever is raised slightly by the time and the stud locates in the portion 156*d*. This raising causes the cover slides to be rotated rearwardly relative to the date quadrants to uncover the numerals "29" but the numerals "30, 31" remain masked. These numerals are uncovered when further rotation of the gear 36 brings the groove portion 156*a* into engagement with the upper stud once more.

MECHANISM FOR ACTUATING THE CALENDAR

This mechanism comprises a gear cradle, indicated generally at 170, formed by a base plate 172 mounted on lower ends of three substantially vertical and rigid cradle struts 174 spaced about a central vertical axis by substantially equal angles. At their upper ends, the cradle struts are mounted on a pair of integral cams 176, 178 formed with a substantially central bore surrounded by a substantially upright sleeve bearing 180 mounted on the cam 178 and rotatably passing through an aperture in the top of the casing 2. A pivot pin 182 projecting downwardly through the cradle base plate 172 is rotatably located in a bore 184 in one end of a support plate 186 supported substantially centrally on an upper end of the spindle 92. The gear cradle is therefore rotatable about a substantially vertical axis passing through the sleeve 180 and the pivot pin 182. The support plate 186 being held against rotation by a locking pin 188 secured at an upper end in the housing 4 and located at a lower end 190 in a bore in the support plate.

An elongated drive pinion 192 rotatable about the axis of rotation of the gear cradle is located centrally of the cradle. At its upper end the drive pinion 192 is affixedly mounted on a rotatable shaft 194 passing through the sleeve 180 and at its lower end the pinion is mounted on the pivot pin 182. The shaft 194 is rotatable manually by means of a rotation knob 196 formed of an upper inverted cuplike part 196*a* screw threaded onto a lower cuplike part 196*b* having a roughened or serrated inner lower surface 198 against which a roughened or serrated lower surface of a clutch plate 200 is biased by a helical compression spring 202 surrounding the shaft 194. An upper end of the spring abuts against a ring shape plate 204 braced against an annular rib 206 formed in the interior of the part 196*a*. The clutch plate 200 is keyed in a slot (not shown) in the shaft 194 such that the clutch plate can move vertically relatively to the shaft but is constrained such that rotation of the clutch rotates the shaft and drive pinion 192. When the upper part 196*a* of the rotation knob is rotated by hand, the lower cuplike part 196*b* rotates therewith by reason that a screw 206 threaded into the lower cuplike part protrudes outwardly through one of a plurality of narrow elongated through apertures or notches 208 formed about the periphery of the part 196*a*. Rotation of the part 196*b* rotates the clutch plate 200 engaged thereagainst and the drive pinion 192 is therefore rotated. If the pinion 192 is prevented from rotating the serrations 198 slip across the clutch plate 200 when the knob 196 is rotated and thus provides a safety device preventing overwind. The force with which the spring 202 presses the clutch plate downwards can be varied by removing the screw 206 and then screwably moving the part 196*a* relative to the part 196*b* until the desired spring pressure is achieved. After which the screw 206 is replaced through an appropriate aperture 208.

Three substantially vertical spindles 210, 212 and 214 are spaced by angles of substantially 120° about the center of the gear cradle 170, and each spindle has top and bottom ends rotatably mounted in bores in the cams 176, 178 and in the base plate 172. A pair of planet gears such as shown 216, 218 or 220, 222 or 224, 226 is affixedly mounted on each spindle 210, 212, or 214, which spindles are disposed in the spaces between adjacent cradle struts 174 such that the planet gears mesh with the drive pinion 192. This pinion can have, for example, 10 teeth, and the planet gears 216, 218, 220, 222, 224

and 226 can also have, for example, 10 teeth each. The planet gears 216 and 218 are year and day planet gears respectively. In FIGS. 3 the day planet gear 218 is shown at a driving station, that is with the teeth of the planet gear meshing with the teeth 80 of the day annular gear 38, whist the gear planet gear 216 is shown meshing with teeth 228 formed around an inner surface of a slave annular gear 230 supported on ledges (not shown) provided in the interior of the casing 2. There may, for example, be 56 teeth 228, and these mesh with teeth on the pinion 42. Thus, still referring to FIG. 3, as the rotation knob 196 is revolved the drive pinion 192 rotates to rotate the planet gears 216 and 218. The slave annular gear is therefore rotated to revolve the pinion 42 which produces a change in the numeral displayed through the windows 8, 10, 12 and 14 and also results in the month mask 66 being rotated behind the windows 16 and 18. Rotation of the day planet gear 218 results in rotation of the day annular gear 38 to move the day data in the quadrants 78 past the window 20. The planet gears 220 and 222 on the spindle 212 are month and date planet gears respectively. When the gear cradle is rotated (by means to be described) to bring the spindle 212 into the driving station, that is into the position occupied by the spindle 210 in FIGS. 3 and 11, the gear 220 meshes with the teeth 60 of the month annular gear 36 and the gear 222 meshes with the teeth 100 of the date annular gear 40. When the planet gears 220, 222 are at the driving station, rotation of the knob 196 rotates the gears 220, 222 to rotate month annular gear 36 and the date annular gear 40 to produce a change in the month and date data displayed through the windows 16 or 18 and 22. The planet gears 224 and 226 on the spindle 214 are also day and date planet gears respectively. By rotation of the gear cradle about its longitudinal axis the gears 224 and 226 are brought into the driving station where the day plane gear 224 meshes with the day annular gear 38 and the date planet gear 226 meshes with the date annular gear 40. Thus rotation of the knob 196 at this time causes rotation of the day and date annular gears past the windows 20, 22 to produce a change in the day and date data displayed.

As stated above, the pairs of planet gears 216, 218; 220, 222; and 224, 226 are brought successively into the driving station by rotation of the gear cradle, this is done by manual rotation of a selector knob 232 which is keyed to substantially vertical splines 234 on an upper end of the sleeve bearing 180 and held against vertical movement relative to the sleeve bearing by a C-clip 236. A substantially vertical through bore 238 in the selector knob contains a ball 240 which is pressed downwards by a spring 242 held in place by a screw 244 into an upper end of the bore. When the selector knob is rotated the ball 240 runs over an upper surface 246 of the casing 2 until the ball drops into a recess 248 in the track described by the ball during such rotation. When the ball is in the recess there is some small resistance to further rotation but this resistance can be overcome by increasing the torque applied to the selector knob. The ball 240 and recess 248 therefore provide means by which the selector knob and gear cradle can be positively held in a given angular position relative to the axis of rotation of the latter. In fact there are three depressions 248 (only one shown in FIG. 5) spaced by angles of substantially 120° around the ball track.

Three reference marks (not shown) are provided on the selector knob, a reference mark being located immediately above each spindle 210, 212, and 214, so that when these reference marks are related to the planet gears carried on these spindles; one mark is a year-day reference mark, the second is a month-date reference mark and the third is a day-date reference mark. A reference point (not shown) is provided on the upper surface 246 in a position above the driving station. When the selector knob is rotated to bring a particular reference mark into alignment with the station reference point, the planet gear corresponding with that mark are in the driving station. For example, when the month-date reference mark is aligned with the station reference point, the planet gears 220 and 222 mesh with the annular gears 36 and 40 and then rotate these annular gears if the knob 196 is rotated.

The three recesses 248, are located for the ball 240 to drop into each one in turn as the selector knob 232 is rotated so that each of the three reference marks on the knob can in turn be held positively in alignment with the driving station reference point.

Although the rotation knob 196 can be rotated in either direction, the gear cradle can only be rotated in one direction by reason of a ratchet 250 which is affixed on the sleeve bearing 180 and cooperates with a pawl (not shown) provided inside the casing excrescence 6.

The slave annular gear 230 and the annular gears 36, 38 and 40 when not in mesh with any of the planet gears 216, 218, 220, 222, 224 or 226 are prevented from rotating by respective similarly constructed pawls 252, 252*a*, 252*b* and 252*c* rotatably mounted and spaced apart by spacers 254 on a substantially vertical pawl shaft 256 mounted at one end in the top of the excrescence 6 and at the other end in a ledge element 258 in the lower part of the excrescence. The pawl 252 can engage in V-shaped locking notches 260 formed around an upper part of the external periphery of the slave annular gear 230. These notches 260 may only number half as many as the number of gear teeth 228. The other pawls 252*a*, 252*b* and 252*c* can engage in the locking notches 62, 82 and 102 in the month, day and date annular gears 36, 38 and 40 respectively.

Each of these pawls (see FIG. 12) has a boss 262 formed with a through bore 264 to receive the pawl shaft 256. A pair of arms 266, 268 extend from the boss. The front or leading arm 266 is formed with a tooth or hook 270 at its free end and a short spigot 272 upstanding from the hook, whilst the rear or trailing arm 268 has a larger upstanding spigot 274 in its free end.

The operation of each of these pawls is substantially the same and will be described with reference to the pawl 252 in FIGS. 3, 10 and 11. Pawl 252 is actuated by the rotation of the plates 178, 176 rotated. The cam plates 176, 178 are generally circular in shape but the plate 176 is of smaller diameter and has a cam surface formed with a protuberance 276 adjacent to the planet gear spindle 210. The cam plate 178 has a cam surface formed with an indentation 278 somewhat to the rear of the protuberance 276 taking the direction of rotation of the gear cradle as forwards. Spigots 272 and 274 are arranged to contact the cam surface of cams 176 and 178 respectively such that when the spindle 210 is not at the driving station the long spigot 274 is in contact with the circular surface of the cam 178 and holds the pawl 252 with the hook 270 thereof engaged in a locking notch 260 in the slave annular gear 230. When the gear cradle is rotated to bring the spindle 210 into the driving station the indentation 270 is presented to the long spigot 274 and at the same time the protuberance 276 on the cam 176 comes into contact with the short spigot 272 and pushes the pawl hook 270 clear of the locking notch, in the slave annular gear whilst the long spigot enters the indentation 278. The slave annular gear can now be rotated by revolving the rotation knob 196. Further rotation of the gear cradle to move the spindle 210 out of the driving station causes the protuberance 276 to rotate beyond the short spigot 272 and brings a chamfered end wall 278*a*, of the indentation 278 into contact with the long spigot 274 so that the latter moves outwardly into the circular periphery of the cam 178 and pushes the pawl hook 270 into engagement with another locking notch 260 in the slave annular gear.

The pawls 252*a*, 252*b* and 252*c* are similarly operated when the month planet gear 220, the day planet gears 218, 224, and the date planet gears 222, 226 are moved into and out of the driving station cam plates 176*b* 178*b* and 176*c* 178*c* mounted on the gear cradle operate the pawls 252*b* and 252*c* respectively. Because there are two day planet gears 218 and 224 there are two suitably positioned protuberances 276*b* (only one shown in FIG. 10) in the smaller diameter cam 176*b* and

two indentations 178*b* (only one shown in FIG. 10) in the larger diameter cam 178*b*. Likewise because there are two date planet gears 222 and 226 there are two suitably positioned protuberances 276*c* (only one shown) in the small cam 176*c* and two indentations 278*c* (Only one shown) in the larger cam 178*c*. Two cam plates 176*a* and 178*a* on 178*c*. gear cradle operate the pawl 252*a*. This pawl is upside down relative to the others so the small diameter cam plate 176*a* is mounted above the larger one 178*a*. As there is only one month planet gear 220, the cam 179*a* has only one protuberance 276*a* and the cam 178*a* only one indentation 278*a*.

PROCEDURE FOR OPERATING THE CALENDAR

The calendar described above is designed to predict the day of the week on which any day falls in any month in any year from 1801 to 2199 A.D. From 1901 to 2099 A.D. no visual correction is necessary for the date but for the years from 1801 to 1900 A.D. and from 2100 to 2199 A.D. a visual correction of ± one unit must be made to the date displayed through the window 22.

The Calender is operated in the following manner:

I. The selector knob 232 is rotated until the year-day reference mark thereon is in alignment with the driving station reference point in the upper part 246 of the calendar casing and when this situation is reached the ball 240 locates in one of the recesses 248 to hold the selector knob in this position. The year planet gear 216 is therefore in mesh with the slave annular gear and the day planet gear meshes with the day annular gear.

II. The rotation knob 196 is now rotated until the desired year numeral displayed through the windows 8, 10, 12 and 14.

III. The selector knob is again rotated to bring the month-date reference mark into alignment with the driving station reference point and the ball 240 locates in another recess 248 to hold the selector knob steady. At this stage the month planet gear 220 is meshed with the month annular gear 36 and the date planet gear 222 meshes with the date annular gear 40.

IV. The rotation knob is once more rotated until the desired month is displayed through the window 16 or 18 depending on whether the year is a leap year or not.

V. As the date annular gear 40 was rotated during step II and the day annular gear rotated during step IV the dates corresponding to the days of the week on which they fall during the desired month and year are now displayed through the windows 40, 38 so that the appropriate dates are in vertical alignment with the correct days.

VI. If it is desired that the week displayed through the window 20 beings on a particular day, say a Wednesday, then the selector knob is rotated until the day-date reference mark is in alignment with the driving station reference point, the knob being held in this position by the ball 240 which locates in the third recess 248. This rotation of the selector knob brings the day planet gear 224 into mesh with the day annular gear 38 and the date planet gear into mesh with the date annular gear 40.

VII. The rotation knob is then rotated until the desired day name is displayed on the far left of the window 20.

As stated previously this rotation knob 196 can be rotated in either direction but it is only during step II that this facility can be fully utilized so that the user can rotate the knob forward or backwards to change the year numeral forward or backwards through the years as desired. During steps IV and VII a backwards rotation of the knob 196 causes the date annular gear 40 to rotate backwards and eventually a side of one of the date data quadrants 94 strikes the side 108 of the base cam 104 and the mechanism locks. However, no damage results, provided the spring 202 is not compressed to extreme pressure, because the surface 198 can slip over the clutch plate 200 in the overwind safety device provided in the rotation knob when the knob is further rotated in the backwards direction.

The year and date date in the aforedescribed calendar is in arabic numerals and the month and day data in English. These symbols can be changed to those in use in foreign countries without altering the calendar mechanism, provided such countries reckon their years and months according to the Gregorian Calendar. The detachable manner in which the month quadrants 52, the day quadrants 78 and the date quadrants 94 are mounted on the month, day and date annular gears enables different quadrants bearing data in symbols of any language or culture to be readily mounted on the annular gears.

The various components in the calendar can be made of any suitable materials including plastics materials which latter are particularly suitable for forming the casing, gearing and data quadrants.

I claim:

1. A mechanical calendar comprising a casing with first, second, third and fourth aperture means formed therein; first, second, third, fourth, fifth, sixth, seventh and eighth annular gears rotatably mounted within said casing and disposed in substantially parallel planes; the first, second, third, and fourth annular gears being disposed behind the first aperture means, and the sixth, seventh and eighth annular gears being disposed behind the second, third and fourth aperture means, respectively; data indicating the thousands, hundreds, tens and units parts of a year numeral being disposed on the outer peripheries of the first, second, third and fourth annular gears, respectively; gearing interconnecting said first, second, third and fourth annular gears to appropriately rotate the first, second and third annular gears in response to rotation of the fourth annular gear so as to display a succession of different year numerals through the first aperture means; the fifth annular gear being drive connected with the fourth annular gear; the sixth annular gear having on its outer periphery data items indicating months of the year in which said data items are displayed in turn through the second aperture means as the sixth annular gear is rotated; the seventh annular gear having on its outer periphery data indicating days of the week displayed through the third aperture means; the eighth annular gear having on its outer periphery a display of data in the form of numerals from 1 through 31 for indicating the date displayed through the fourth aperture means; first and second simultaneously rotatable drive gears and third and fourth simultaneously rotatable drive gears being disposed within the casing; operative means to selectively bring the first and second drive gears simultaneously into and out of meshing engagement with the fifth and seventh annular gears, respectively, and to bring the third and fourth drive gears simultaneously into and out of meshing engagement with the sixth and eighth annular gears, respectively; actuating means operable by the calendar user to rotate the first and second drive gears and the third and fourth drive gears about their respective centers; whereby rotation of the first and second drive gears when enmeshed with the fifth and seventh annular gears rotates said fifth and seventh annular gears to thereby simultaneously alter the year numeral and day data displayed; and rotation of the third and fourth drive gears when enmeshed with the sixth and eighth annular gears drives said sixth and eighth annular gears to thereby simultaneously alter the month and date data displayed.

2. A mechanical calendar as in claim 1, comprising fifth and sixth simultaneously rotatable drive gears disposed within the casing, said operative means being selectively activatable to bring the fifth and sixth drive gears simultaneously into and out of meshing engagement with the seventh and eighth annular gears, said actuating means being arranged to rotate the fifth and sixth gears about their respective centers, whereby rotation of the fifth and sixth drive gears when enmeshed with the seventh and eighth annular gears drives said seventh and eighth annular gears to thereby simultaneously alter the day and data displayed.

3. A mechanical calendar as in claim 2, a cradle rotatably mounted within said casing, a first shaft rotatably mounted in said cradle, an elongated pinion fixed on first shaft, said first shaft having one end projecting from said casing, manually

rotatable first knob means mounted in driving engagement with the projecting end of said first shaft for the purpose of actuation by the user to rotate said pinion; second, third and fourth shafts rotatably mounted in said cradle and extending substantially parallel to the axis of rotation of said pinion in spaced apart relationship around said pinion; the said first and second drive gears being fixed on second shaft, and said third and fourth drive gears and said fifth and sixth drive gears being fixed fast on said third and fourth shafts, respectively, and said first, second, third, fourth, fifth and sixth drive gears being in meshing engagement with said pinion; a sleeve mounted fast with said cradle, said sleeve rotatably projecting from the casing, and said first shaft projecting from said casing through said sleeve; second manually rotatable knob means mounted on a projecting portion of said sleeve for actuation by the user whereby said cradle is rotated to selectively bring the first and second, the third and fourth, and the fifth and sixth drive gears successively into and out of meshing engagement with the respective annular gears.

4. A mechanical calendar as in claim 3, wherein said cradle extends internally through said fifth, sixth, seventh and eighth annular gears, the axis of said pinion is at substantially a right angle to the respective planes of said fifth sixth and seventh and eighth annular gears, and gear teeth are formed around the interiors of said fifth, sixth, seventh and eighth annular gears for meshing engagement with the appropriate first, second, third, fourth, fifth and sixth drive gears.

5. A mechanical calendar as in claim 1, said eighth annular gear being disposed in a substantially horizontal plane, a plurality of arcuate date plates mounted on the eighth annular gear, said date plates extending side by side around the periphery of the eighth annular gear, and each plate having the numerals 1 through 31 represented thereon, the numerals on each plate being arranged in horizontal rows and seven vertical columns so that each numeral has a unique position in a row and column, means for allowing each plate a vertical movement relative to the eighth annular gear and the other plates, means for limiting the extent of vertical movement of each plate between a lowered position and a raised position to a distance equal to the vertical width of a said row, static cam means mounted within the casing adjacent to the fourth aperture means, said cam means positioned for engaging an underside of each plate in succession when each plate is rotated by the eighth annular gear into view through the fourth aperture means, said cam means shaped for lifting an engaged plate into the raised position, and said cam means also shaped for allowing the engaged plate to disengage the cam means and drop to the lowered position as all the numerals on the plate come into view through the fourth aperture means.

6. A mechanical calendar as in claim 5, the month data items being disposed in two vertically spaced rows extending around the sixth annular gear, the first row of month data items representing the months of an ordinary year set out in the cyclic order January, May, August, March, December, July, October November, June, September, April, February, the second row of the month data items representing the months of a leap year set out in the same cyclic order as the first row with January in the second row disposed in a position in advance of January in the first row and February in the second row disposed in a position rearwardly of February in the first row, a month mask in the form of an open ended cylinder rotatably surrounding the sixth annular gear within the casing, the wall of the month mask having first and second vertically spaced rows of month data revealing openings therein aligned with said second aperture means, the first row of openings being level with the first row of month data items, the second row of openings being level with the second row of month data items, the openings in the first row being spaced apart, the words 'leap year' inscribed on each wall portion of said mask between each opening in the first row, the openings in the second row being spaced apart and staggered in relation to the openings in the first row whereby each 'leap year' inscription appears in vertical alignment with an opening in the second row.

7. A mechanical calendar as in claim 6, said sixth annular gear having an inner face with a continuous cam groove formed therein, said cam groove comprising first, second, third and fourth groove portions connected one to another in succession by further groove portions, the first groove portion being at a higher vertical level than any other groove portion, said first groove portion disposed immediately behind the month data items relating to months of 31 days, the second groove portion being at a lower vertical level than the first portion, said second groove portion disposed immediately behind the month data items relating to months of 30 days, the third groove portion being at a lower vertical than the second portion, said third groove portion disposed immediately behind the February data item for an ordinary year, the fourth groove portion disposed at a vertical level intermediate the levels of the second and third groove portions, said fourth groove portion disposed immediately behind the February data item for a 'leap,' a first stud with one end slidably located in the cam groove to follow rises and falls of the groove during rotation of the sixth annular gear, the other end of said first stud mounted on an upper end of a vertical motion transmitting member, said member extending vertically within guide means adapted to restrict the member to vertical movement, said guide means mounted on the interior of said casing, a horizontal bifurcated yoke mounted on a lower end of the motion transmitting member; a horizontal floor mounted across a lower portion of the eighth annular gear, an upstanding cylindrical open ended second sleeve mounted on the floor, said second sleeve disposed at the center of the eighth annular gear, said second sleeve rotatably surrounding an upstanding fifth spindle, said fifth spindle mounted on the casing, a collar freely surrounding the second sleeve, said collar supported by the floor of the eighth annular gear, external faces of the collar formed with a plurality of ascending helical grooves, a ring surrounding the second sleeve disposed above the collar, a plurality of first arms depending alongside the collar from said ring, a plurality of second studs each having one end mounted on each first arm, the other end of each second stud slidably located in one of said helical grooves, an innerface of said ring formed with substantially vertical groove which slidably fits over a vertical rib, the rib mounted on the second sleeve and standing out therefrom above the collar, the extension of said ring being formed with a horizontal annular groove, and the bifurcations of said yoke slidably engaging in the annular groove, four horizontal spider arms extending outwardly from the collar below the helical grooves, each spider arm being at a right angle to adjacent spider arms, the outer end of each spider arm-engaging holding means, each holding means extending through opening means in the wall of the eight annular gear and each said date plate, the opening means in each said date plate being disposed adjacent to date numerals 29, 30, 31 on the date plate, an arcuate masking plate mounted on the holding means externally of the date plate and internally of the casing, each masking plate being at the same horizontal level as the numerals 29, 30, 31, and the opening means in the eighth annular gear and each said date plate being of sufficient dimension for allowing relative movement of each said masking plate moved by said spider arm to mask from view any of the numerals 29, 30, 31 on the date plate.

8. A mechanical calendar comprising a casing having first, second, third and fourth aperture means formed therein; first, second, third and fourth annular gear means rotatably mounted within said casing and being disposed behind said first, second, third and fourth aperture means, respectively; first data indicating a year numeral disposed upon the outer periphery of said first annular gear means and visible through said first aperture means; second data indicating the months of the year disposed on the outer periphery of said second annular gear means and visible through said second aperture means; third data indicating days of the week disposed on the outer periphery of said third annular gear means and visible through said third aperture means; fourth data in the form of numerals from 1 through 31 indicating the date disposed on said fourth annular gear means and visible through said fourth

aperture means; actuator means for rotating said first, second, third and fourth annular gear means; and variable positionable coupling means for selectively coupling said actuator means to said first and third annular gear means or alternatively to said second and fourth annular gear means, means mounting said coupling means in said casing for movement between a first position in which said coupling means couples said actuator means to said first and third annular gear means to simultaneously alter the year numeral and day data displayed without changing the month and date data and a second position in which said coupling means couples said actuator means to said second and fourth annular gear means to simultaneously alter the month and date data displayed without changing the year numeral and day data.