

Feb. 14, 1939.

H. BASLER

2,147,280

CLOCK CALENDAR

Filed Feb. 17, 1936

5 Sheets-Sheet 1

Fig. 1

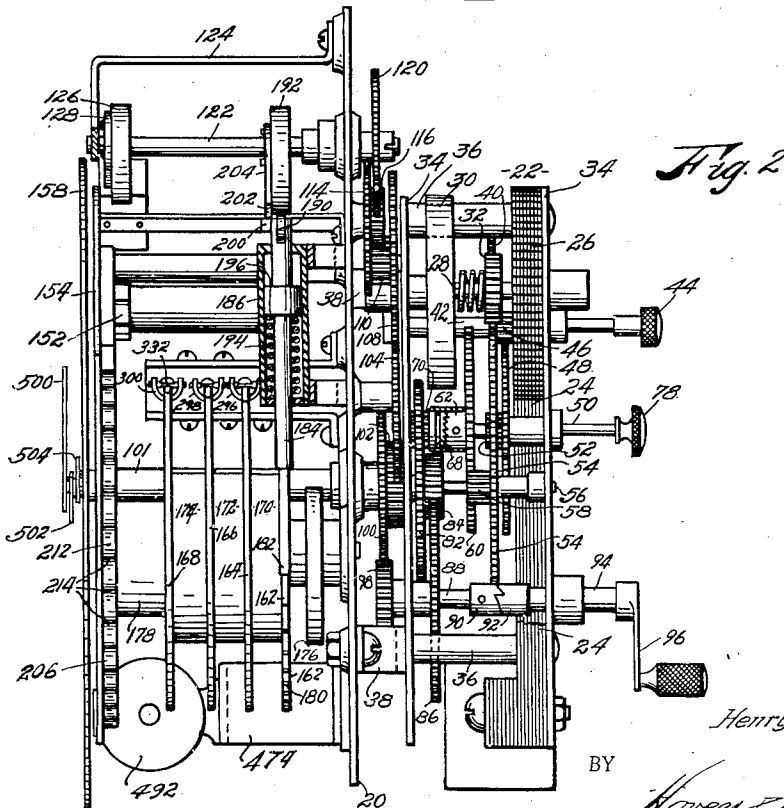
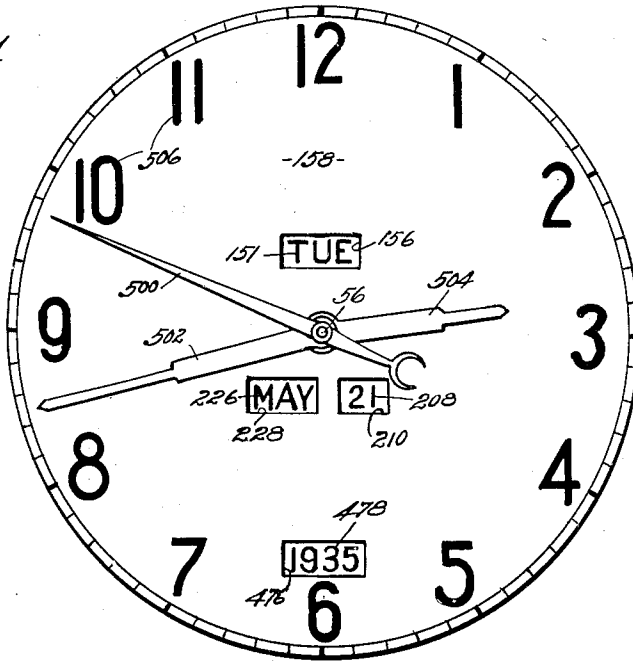


Fig. 2

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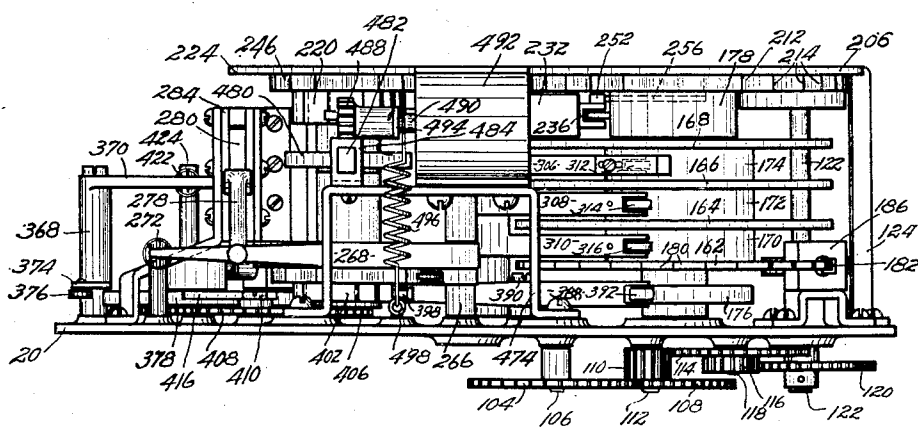
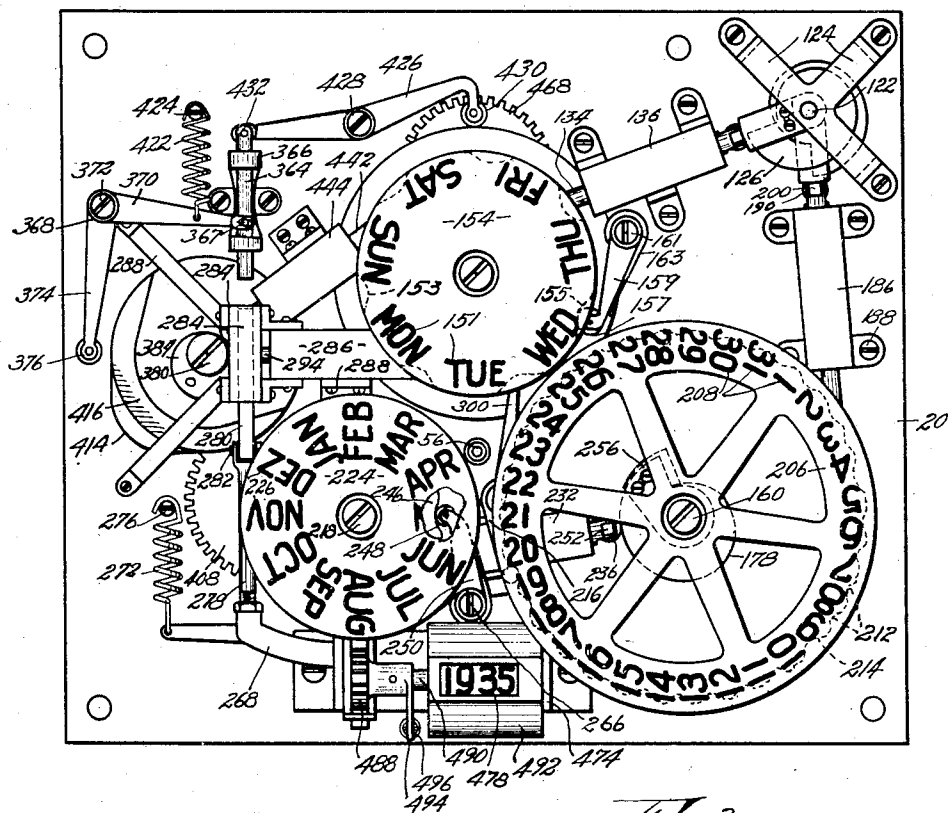
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CLOCK CALENDAR

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5 Sheets--Sheet 2



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2,147,280

CLOCK CALENDAR

Filed Feb. 17, 1936

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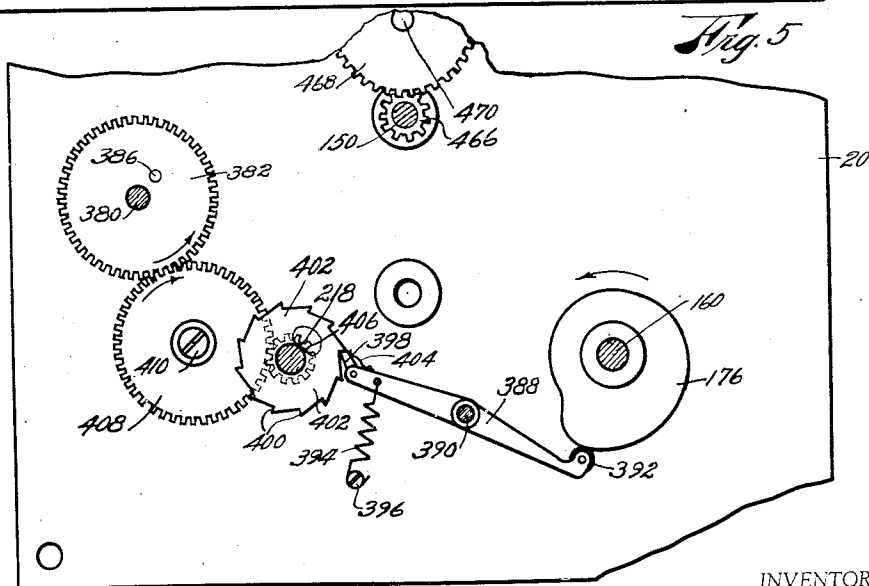
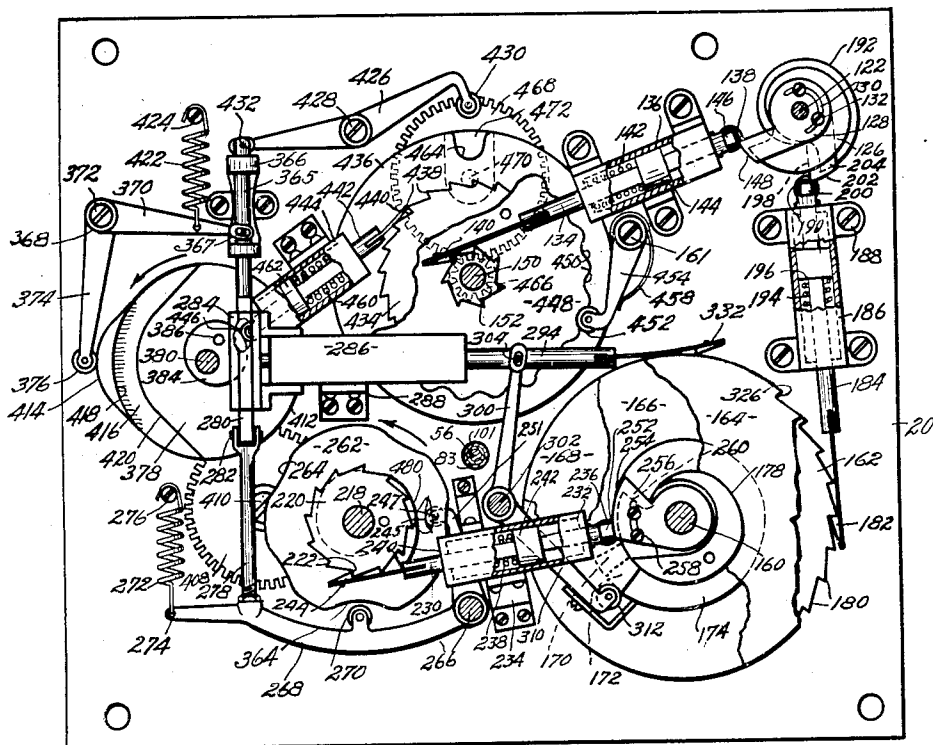


Fig. 6

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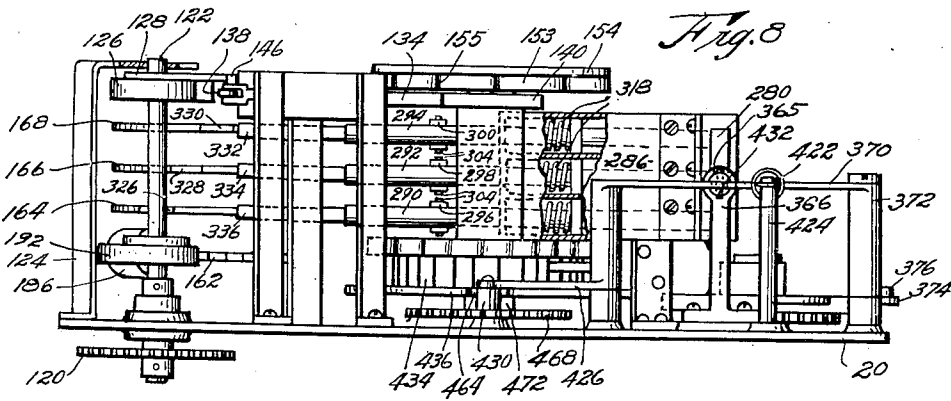
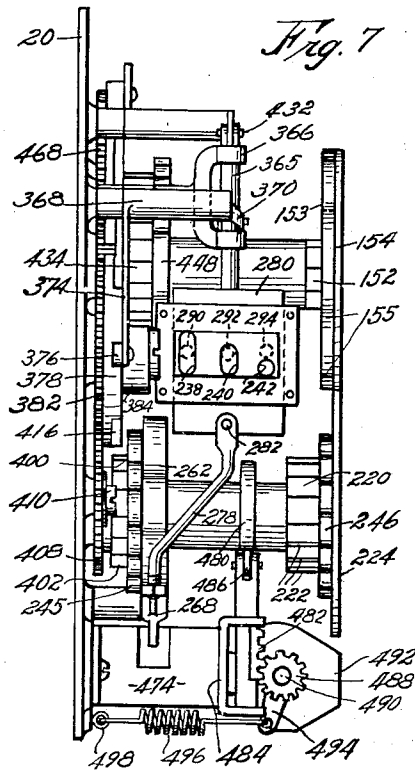
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CLOCK CALENDAR

Filed Feb. 17, 1936

5 Sheets-Sheet 4



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2,147,280

CLOCK CALENDAR

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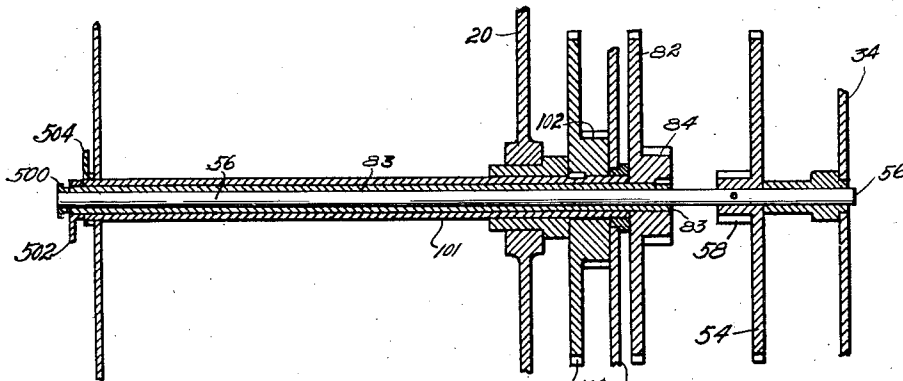


Fig. 9

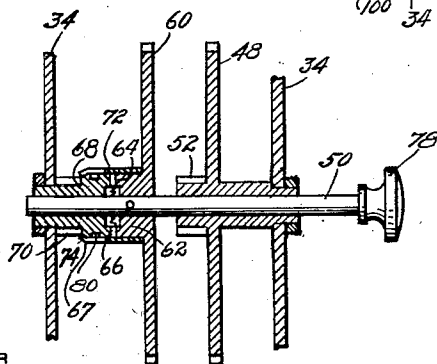


Fig. 10

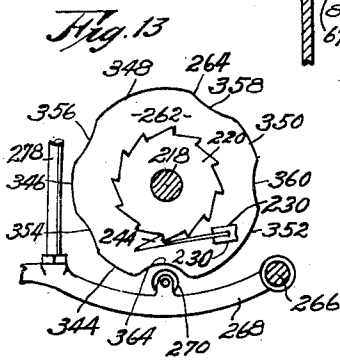


Fig. 13

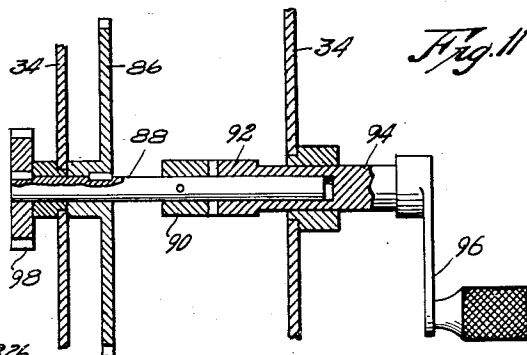


Fig. 11

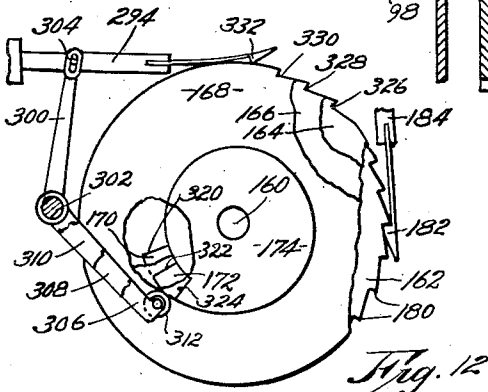


Fig. 12

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UNITED STATES PATENT OFFICE

2,147,280

CLOCK CALENDAR

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Application February 17, 1936, Serial No. 64,257

6 Claims. (Cl. 40—112)

This invention relates to chronometers and particularly to a clock which will correctly indicate the year, the month, the day of the month, the day of the week, hour, minute and second, so long as suitable driving power, such as a synchronous electric motor is provided.

It is an accepted fact that each of our calendar years has a duration of 365 days, 5 hours, 48 minutes and 48 seconds.

To compensate for the uneven time of the astronomical year as compared with days, the Gregorian calendar, now in general use, provides that the normal year shall consist of 365 days and every year divisible by four is a leap year, and contains 366 days, except that the centesimal years are leap years only when the number of the year is divisible by 400. Therefore, only one in each four successive centesimal years will be a leap year having 366 days, while the other three will have only 365 days. For example, the years 1600, 2000, 2400 would have 366 days, while the intermediate centesimal years would have 365 days.

The principal object of the present invention is the provision of a clock having mechanism that will indefinitely and correctly indicate the time, including the year, the day of the month and day of the week so long as a properly timed motive power is provided as a driving force.

Another object is the provision of a chronometer mechanism that will, when driven, automatically make all the necessary changes in the indicating discs to show the proper day of the week, day of the month and the year corresponding with the Gregorian calendar.

A further object is the provision of a clock that will automatically indicate 366 days for each centesimal year divisible by 400 and will indicate 365 days for all other centesimal years.

Other objects are the provision of a clock that is simple and economical in construction, easy to set, and adapted to function to take care of all time corrections as set forth in the Gregorian calendar.

With these objects in view, as well as others that will appear during the course of the specification, reference will now be had to the accompanying drawings, wherein:

Figure 1 is a face view of the clock dial with its associated parts shown in elevation.

Fig. 2 is a side elevation of the clock mechanism in which some of the parts are omitted for clearness and some are in section.

Fig. 3 is a front elevation of the clock with

the dial and certain of the other parts removed for clearness.

Fig. 4 is an inverted plan view of a part of the clock mechanism.

Fig. 5 is a front elevation of the clock mechanism with some of the parts omitted and with some parts broken away for clearness.

Fig. 6 is an elevation of certain of the members making up the train of timing parts.

Fig. 7 is a partial side elevation of the clock mechanism.

Fig. 8 is a plan view of the chronometer mechanism with parts omitted.

Fig. 9 is an enlarged sectional view of the hand-carrying shaft and sleeves and their associated parts.

Fig. 10 is an enlarged, detailed, sectional view of parts associated with the clutch control shaft.

Fig. 11 is an enlarged view of the setting shaft with the associated parts in section.

Fig. 12 is a fragmentary elevation of a part of the timing mechanism, and,

Fig. 13 is a detailed view of the month control disc and some of its associated parts.

Numeral 20 designates a frame to which the working parts are secured, all of which may be mounted in any suitable housing not shown. Carried by frame 20 at its posterior side is an electrically driven synchronous motor 22 of the usual type having field magnet 24 and armature 26. When supplied with the properly timed electrical current from a source not shown, the movement of the motor will be synchronized therewith. Armature 26 is rigidly mounted on shaft 28, on which is secured for rotation therewith a fly wheel 30 and a pinion 32. Shaft 28 is mounted for rotation in the motor from plates 34 which are maintained in fixed, spaced-apart relation by spacing members 36. These plates 34 are in turn carried by frame 20 through the intermediacy of brackets 38. Pinion 32 intermeshes with gear 40 mounted on shaft 42, which is rotatably mounted in plates 34, and has at its outer end a starting knob 44. Mounted concentrically with and secured to gear 40 is a pinion 46 that meshes with gear 48 rotatably mounted on the shaft 50. Pinion 52 is rotatably mounted with gear 48 and engages gear 54, which in turn is fixed on second hand shaft 56. Secured to gear 54 and rotatable therewith is a pinion 58 which meshes with gear 60 secured to shaft 50. The clock mechanism thus far described is substantially the same as that now in general use and it is from this point on that a new and novel arrangement of parts is provided.

Hub 62 of gear 60 is provided with ratchet teeth 64 at its outer end. Teeth 64 engage teeth 66 formed on hub 68 of a pinion 70 which is rotatably mounted on shaft 50. Ratchet teeth 64 and 66 are adapted to engage, thereby serving as a driving clutch to drive pinion 70. The ratchet teeth are normally held in the operative position by means of sleeve 72 carried by hub 62, which sleeve has an inturned flange 74 that engages shoulder 76 of hub 68. By engaging knob 78 secured to the outer end of shaft 50, the shaft may be moved longitudinally and flange 74 moved from shoulder 76 to groove 80 to disengage the clutch for reasons hereinafter set forth. The clutch may be re-engaged by pressing inwardly on knob 78 to cause flange 74 to disengage groove 80 and again engage shoulder 76.

Pinion 70 meshes with gear 82 which is rigidly mounted on the minute hand sleeve 83 which in turn is mounted for rotation on second hand shaft 56. Securely attached to gear 82 is a pinion 84 which meshes with gear 86 rigidly mounted on shaft 88. This shaft extends through plates 34 and is provided with a rigidly attached toothed clutch member 90 adapted to engage toothed clutch member 92 carried by sleeve member 94 rotatably mounted on the outer end of shaft 88. Sleeve member 94 is provided at its outer end with an operating crank 96. It will be observed that clutch member 92 is spaced apart from plate 34 a distance sufficient to permit sleeve 94 to be moved longitudinally a distance sufficient to disengage clutch members 90 and 92, thus permitting rotary movement of clutch member 90 without rotating crank 96.

Securely affixed to the inner end of shaft 88 is a pinion 98 that meshes with gear 100 mounted on the hour hand sleeve 101, carried by shaft 56, as clearly shown in Fig. 2. Concentrically mounted with and secured to gear 100 is a pinion 102 which in turn meshes with gear 104 rotatably mounted on stud shaft 106. This gear 104 is in driving relation with gear 108 having an axially aligned pinion hub 110 and mounted for rotation on stud shaft 112. Pinion 110 drives gear 114 having integral therewith pinion 116, which is mounted for rotation on shaft 118. Pinion 116 meshes with gear 120 mounted on shaft 122 that is rotatably mounted in frame 20 and bracket 124. Through the train of gears just described this shaft 122 is caused to rotate once every twenty-four hours and it is by this accurately rotated shaft that much of the timing of the parts hereinafter set forth is obtained.

Rigidly mounted on shaft 122 is an offset cam 126 having an adjustable cam member or trip arm 128 which serves to provide close adjustment of the indicating mechanism as hereinafter set forth. This trip arm is rotatably mounted on shaft 122 and is provided with an arcuate slot 130 through which securing set screws 132 extend to engage threaded holes in cam 126. Positioned in operative relation with cam 126 is an operating plunger 134 slidably mounted in housing 136, which is secured to frame 20. Plunger 134 extends through housing 136 and is provided at its end adjacent cam 126 with a roller 138 which normally bears against said cam face while its other end is provided with a flexibly mounted tooth-engaging member 140. A compression spring 142 is mounted in housing 136 so as to exert a pressure against shoulder 144 formed on plunger 134 to maintain the roller against cam 126. Spring 142 is positioned on 134 before 134 is inserted into housing 136 and has its one end held

against movement by 136, while its other end rests against shoulder 144.

In order to obtain an accurate timing of the release of plunger 134, a squared stud 146, extending laterally from plunger 134 adjacent roller 138, is adapted to engage the face 148 of arm 128. This member 128 is so positioned relative to cam 126 as to carry roller 138 beyond the offset in cam 126, thereby effecting a sharp release of the plunger which could not be obtained by the use of the roller alone. Securely attached to frame 20 and carried thereby, is a shaft 150 which is disposed transversely to the movement of plunger 134 and carries a rotatably mounted ratchet wheel 152 which carries for rotation therewith, a disc 154, having thereon characters 151 to indicate the days of the week. Since it is desired to move the disc one space each twenty-four hours, the ratchet wheel is provided with seven teeth so that with each movement of plunger 134 a successive day is shown through an opening 156 formed in the clock face or dial 158. On the rear side of disc 154 is a flange 153, having seven equally spaced undulations 155, into which the spring actuated roller 157 rides to maintain disc 154 in proper position to display the characters 151 thereon. Roller 157 is rotatably mounted on arm 159 pivoted at 161 to the frame. This arm 159 is urged toward 153 by spring 163.

The following mechanism has to do with the registering of the day of the month and is operated by shaft 122, which rotates once each twenty-four hours. Stud shaft 160 is rigidly affixed at its inner end to frame 20 and extends transversely thereto. Mounted in axial alignment for rotation on shaft 160 is a series of toothed discs 162, 164 and 166 and 168. The discs 164, 166 and 168 have but one tooth each, for reasons hereinafter set forth. These teeth are 326, 328, 330 respectively. These discs are spaced apart by means of cams 170, 172 and 174. Also, cam 176 is positioned intermediate disc 162 and frame 20 and adjacent the outer end of shaft 160 and associated with disc 168, is a cam 178. All of these discs and cams are interconnected and rotate as one unit on shaft 160.

Disc 162 is provided with thirty-one equally spaced ratchet teeth 180 which are engageable by the spring actuated member 182, carried by plunger 184, which in turn is slidably mounted in housing 186. This housing 186 is securely attached to frame 20 by means of screws 188. The outer end of plunger 184 is provided with a roller 190 which normally rides on the periphery of cam 192 due to the action of compression spring 194 which rests against shoulder 196 formed on plunger 184 and the end flange of housing 186. Since this cam is rigidly mounted on shaft 122 which rotates once every twenty-four hours and has an offset 198, plunger 184 will move outwardly each twenty-four hours, thereby causing disc 162 to move up one tooth each day. In order to obtain an accurate timing of the release of plunger 184, a square faced pin 200 is carried by plunger 184 and adapted to engage face 202 of the auxiliary cam 204 which is adjustably carried by cam 192. By means of this auxiliary cam, roller 190 clears the high point of cam 192 and is in position to drop to the low point of the cam without interference.

Rotatably mounted on shaft 160 and secured to cam 178 is a day indicator wheel 206, having numerals 208 that are successively registered with opening 210 in dial 158 to indicate the day of the month. The rear side of 206 is provided with an

annular flange 212 having thirty-one evenly spaced undulations 214 corresponding to the numerals on its front face. A spring detent 216 is adapted to engage these undulations to prevent accidental movement of 206 and to cause the numerals 208 to properly register with opening 210.

Disc 162 is provided with thirty-one equally spaced ratchet teeth 180, and since actuating member 182 is reciprocated once each twenty-four hours as described above, disc 162 will make one complete revolution each thirty-one days. It is apparent that this complete revolution of disc 162 as operated by 182 will properly indicate the time period of the seven months having thirty-one days. However, in order to make a complete revolution of disc 162 when the other five months of the year having less than thirty-one days are being indicated, it becomes necessary to provide means for rotating disc 162 through part of its revolution by means other than 182. For this purpose the following mechanism is provided.

Mounted on frame 20 in parallel relation with shaft 160 is a stud shaft 218, on which is rotatably mounted a ratchet wheel 220. This ratchet wheel is provided with twelve teeth 222 which are equally spaced and indicate respectively the twelve months of the year. Securely attached to ratchet wheel 220 and rotatable therewith is a disc 224, having the twelve months of the year 226 indicated thereon in equally spaced relation. These months are adapted to be registered successively with opening 228 formed through dial 158.

Ratchet wheel 220 is rotated one tooth at a time by the action of cam 178 and associated parts. These associated parts include a reciprocable plunger 230 carried by cylinder 232 which is rigidly carried by frame 20 through the intermediacy of bracket 234. Plunger 230 is provided at one of its ends with a roller 236 which is held in contact with cam 178 by the compression spring 238 that is interposed between end wall 240 of cylinder 232 and shoulder 242 formed on plunger 230. The other end of the plunger is provided with a resiliently mounted tooth-engaging member 244 which is adapted to engage teeth 222 and rotate the ratchet 220 through thirty degrees in one direction at each complete reciprocal movement of the plunger.

To prevent backward movement of ratchet wheel 220 and its associated parts, a corrugated disc 246 attached to disc 224 is adapted to be engaged by a tension roller 248 mounted on arm 250. There are twelve corrugations on this disc 246 corresponding to the twelve teeth on the ratchet and so positioned as to properly retain the month characters in the proper register position with the opening 228. Plunger 230 is also provided with transversely disposed square faced pin 252 which is adapted to engage face 254 of auxiliary cam 256 that is adjustably positioned by means of screws 258 to overlap offset 260 of cam 178 to permit a more accurate and definite release of plunger 230. It is evident that with this structure just described the months of the year will be successively shown through opening 228 formed through the dial. This is due to the fact that all the rotating parts on shaft 160 make a complete revolution for each month of the year regardless of the number of days in the current month.

Rotatably mounted on shaft 218 and rotatable with ratchet wheel 402 which is caused to rotate once per year by mechanism hereinafter described is a disc 262 having a grooved periphery 264. Pivoted below 262 on stud shaft 266 is a lever arm 268, having a roller 270 mounted thereon and

adapted to ride on the periphery of disc 262 and regulate the position of lever 268 which is normally held in the raised position by means of expansion spring 272 engaging the free end of said lever at 274 and the stationary pin 276 carried by frame 20. Connected to lever 268 intermediate its free end and roller 270 is a standard 278 which is pivotally connected to plate 280 by pin 282. Plate 280 is reciprocally mounted in a frame 284 carried by housing 286, which in turn is rigidly carried by frame 20 through the means of bracket 288. The movement of disc 262 and ratchet 402 which rotate together is controlled by means of disc 245 having twelve equally spaced corrugations which are adapted to receive the spring tensioned roller 247 mounted on pivoted arm 251.

Mounted in housing 286 are the plunger rods 290, 292 and 294 which are respectively in alignment with discs 164, 166 and 168, and positioned substantially perpendicular to plate 280 against which they are adapted to abut under certain conditions as hereinafter set forth. Bell crank levers 296, 298 and 300, all mounted for oscillation on pin 302, are interconnected with plungers 290, 292 and 294 respectively by means of pins 304 (see Fig. 5).

The lower arms 306, 308 and 310 of bell cranks 296, 298 and 300 respectively have rollers 312, 314 and 316 respectively. These rollers 312, 314 and 316 are in substantially axial alignment and contact the surfaces of cams 174, 172 and 170 respectively and are held thereagainst by means of compression springs 318 mounted in housing 286. Each spring 318 is associated with one of the plungers 290, 292 and 294 in such a manner as to control their respective bell crank levers. Referring to Fig. 12, it will be observed that cams 170, 172 and 174 are respectively provided with offsets 320, 322 and 324 which are arranged in relatively spaced-apart positions so as to successively drop as the rotary assemblage including said cams is rotated as described above. The spacings of these offsets relative to the ratchet tooth notches 326, 328 and 330 on discs 164, 166 and 168, Fig. 5, respectively is such that when their respective bell crank lever is operated by the action of a spring 318 as above described, then the spring-actuated detents 332, 334 and 336 respectively carried by plungers 294, 292 and 290 will successively engage notches 330, 328 and 326 to move the wheel unit comprising cams 170 etc., and discs 162, etc. up one notch. It will be noted by referring to Fig. 8 that notches 326, 328 and 330 are just one tooth apart so as to be in position to be operated by their respective detents through the action of the contributing rocker arms 296, 298 and 300. Each of the detents 332, 334 and 336 will be effective to move the said wheel unit forward a distance corresponding to one tooth of disc 162 when the month has but twenty-eight days. If the month has twenty-nine days, then the detent 332 will not operate to engage notch 330 to operate 162. However, detents 334 and 336 will operate to move 162 two teeth, thus placing it in position to start the new month on the first day as indicated by the numeral registering with opening 210 on the dial.

In like manner it will be noted that when there are thirty days in the month, only the detent 336 will be in position to move disc 162 forward one notch to make the complete revolution of disc 162 in order that the numeral one on the day indicator wheel 206 will be properly positioned to start the succeeding first day of the month.

Referring to Fig. 12, it will be noted that the offsets 320, 322 and 324 are so related that the bell crank levers operate successively and at intervals corresponding to the lead of one of the teeth 180 of 162. Since it is desired and unnecessary to prevent the operation of certain of the levers 296, 298 and 300 in order to maintain the proper relations of the indicia on certain of the indicator discs, the following mechanism is provided.

Referring to Fig. 7 in which all the mechanism is in the position it would attain February 29, 2000, it will be noted that the plungers 290, 292 and 294, shown in dotted lines, are respectively in alignment with the vertical axes of openings 238, 240 and 242 formed through plate 280 so that when the openings are in horizontal alignment with the plungers, the plungers will pass through their respective opening and permit the operation of the associated bell crank lever. With the parts in the position shown, plunger 294 will abut plate 280, thereby preventing the operation of the parts associated therewith. Both plungers 292 and 290 are in register with their respective openings and will therefore be permitted to operate and through the train of mechanism controlled thereby, cause disc 162 to be moved up two teeth, as is required to complete its revolution, as described above. For moving plate 280 to the required position to control the movement of plungers 290, 292 and 294 as described above, disc 262 is provided at its periphery 264 with depressions, as clearly shown in Figs. 5 and 13.

The high surfaces 344, 346, 348, 350 and 352 (see Fig. 13) are of equal radial arcs and serve to maintain lever 268 in a position against the action of spring 272 and to so place plate 280 that none of the plungers will operate to cause the rotation of disc 162. Depressions 354, 356, 358 and 360, Fig. 13, are of the same depth and permit movement of 268 sufficiently to allow the operation of plunger 290, Fig. 8, to move day disc 162 one notch. These depressions correspond to the months April, June, September and November, having thirty days, which would require the movement of 162 only thirty teeth, thereby making it necessary to step 162 up one tooth before starting the next month on the first day, as indicated on the day indicator wheel 206.

Depression 364 is of a greater depth than the other depressions to allow a greater movement of lever 268, and is so positioned on the disc 262 as to correspond with the month of February which normally has twenty-eight days, and therefore requires the movement of 162 through an arc equal to three of the teeth 180 to properly position wheel 206 to display the numeral one on the first day of March. In Figs. 5, 7, 8, 12 and 13, the parts are set for February 29, 2000, which is a centesimal leap year and the roller 270 does not contact the disc periphery 264, but is spaced apart therefrom for reasons hereinafter set forth. During all years except leap years, roller 270 contacts the periphery of 262 throughout its complete revolution, which requires one year's time, and when it rests in depression 364, all the plungers 290, 292 and 294 will register with their respective openings formed through plate 280 so that each plunger will function to move 162 forward one tooth as required when February has only twenty-eight days.

Referring to Fig. 7, it will be noted that plungers 290 and 292 are in register with their respective openings 238 and 240, while plunger 294 is

out of register with opening 242. Should roller 270 be permitted to rest in the depression 364, plate 280 would be moved upwardly, by action of spring 272, and all three plungers would register with their respective opening and each would operate. When any one of the plungers 290, 292 or 294 operates, it is necessary for its respective notch 326, 328 or 330 to be in such a position that it will be engaged on the outward movement of the plunger and thereby cause disc 162 to rotate upon inward movement of the plunger.

The following operation occurs when the month has only 30 days. Referring now to Figs. 8 and 12 in which the relative position of notches 326, 328 and 330 are clearly shown, when plunger 184 operates and moves disc 162 forward another tooth, detent 332 will drop into notch 330 in disc 162. Cam 174 which is carried by shaft 160 and rotates with the disc 162 then releases bell crank lever 300 which in turn permits compression spring 310 to expand to move plunger 294 when the same is in register with opening 242 in plate 280 so that detent 332 will move disc 162 forward one tooth. This movement of disc 162 will cause disc 162 to be moved forward the desired extra tooth. Detent 182 is provided with a resilient shank which allows the detent 182 to ride over the tooth on disc 162 as the disc is moved forward. The detent 334 will now be in engagement with notch 326 and as soon as bell crank lever 298 is released by cam 172, because of the movement of disc 162 by plunger 294, then disc 162 will again be moved one tooth forward as plunger 292 moves by the action of its spring 318. Since plunger 294 is not in register with hole 242, it cannot operate, though its controlling bell crank lever 300 is released by cam 170.

In order to make clear the movements of ratchet wheel 162 and its associated indicating member 206 just described above, the steps will be set forth in their proper sequence. To start with, suppose the numeral 29 on wheel 206 is visible through opening 210 of the dial. The action of plunger 184 first moves the numeral 30 on wheel 206 to the opening 210, then plunger 290 (Figures 7 and 8) operates to move disc 162 forward one tooth, thereby causing the numeral 31 on wheel 206 to register. Plunger 292 also moves 162 forward one tooth so that the number one on 206 registers with opening 210. It is apparent that by these movements of the mechanism the change from February 29th to March 1st has been made almost instantly.

The mechanism is so set as to make the change at exactly 12 o'clock midnight. Should it be desired to change from February 28th to March 1st, it is very evident that this could be accomplished by the added action of plunger 294 which would be effective when roller 270 rests at the bottom of depression 364, on non-leap years, so as to position opening 242 in alignment with plunger 294 as described above.

Further reference will now be had to the control disc 262. Since this disc is in fixed position relative to ratchet wheel 402 (Fig. 6), having twelve equally spaced teeth 400, and rotates a twelfth of a revolution with each full revolution of disc 162, it must follow that disc 262 will make a complete revolution each year. Since this disc 262 and its associated mechanism is set for February, it is apparent that the particular tooth 222 shown in engagement with member 244 will always be so engaged during February of each and every year and the depression 364 will main-

tain its proper relation to this particular tooth.

The same is true of all the teeth 222 and their respective corresponding disc surfaces. It will be observed that the high surfaces 348 and 352 are subtended by substantially a sixty degree angle, while the others are subtended by about a thirty degree angle. This becomes necessary because each month of the two pairs of successive months July and August and December and January have thirty-one days. The depth of depression 364 is substantially three times the depth of the other depressions, and normally will allow the maximum movement of plate 280, except during leap years when roller 270 will be held out of engagement with disc 262 as shown in Fig. 13 by means of the following mechanism.

A reciprocally mounted bar 365, carried by frame 20 through the intermediacy of the U-shaped bracket 366, is adjustably connected intermediate its ends by pin 367 to arm 370 of the offset, bell crank lever 368 pivoted at 372 to frame 20. This bar 365 is in alignment with plate 280, and adapted to contact therewith at certain times to hold roller 270 away from disc 262, against the action of spring 272 as shown in Fig. 5. The other arm 374 of lever 368 is provided with a roller 376 which rides on surfaces of a specially constructed cam 378 mounted for rotation on stud shaft 380 carried by frame 20 in parallel relation with shafts 218 and 160. Rigidly affixed to cam 378 at its opposite sides respectively by means of pin 386 is a spur gear 382 and an eccentric disc 384.

Cam 378 is caused to rotate once in four years by cam 176 which, as stated above, rotates once each month, through a train of mechanism comprising a lever 388 pivoted at 390 intermediate its ends to frame 20 and having at one of its ends a roller 392 adapted to rest on the cam surface of 176 to cause an oscillation of the lever as the cam rotates. Spring 394 attached at one of its ends to lever 388 and at its other end to pin 396 mounted in frame 20, causes the roller to constantly contact the irregular cam surface. The other end of lever 388 is provided with pivoted pawl 398 which is adapted to be forced into operative engagement with teeth 400 of ratchet wheel 402 by spring 404. Wheel 402 is loosely mounted on shaft 218 and is provided with a concentric, spur-toothed hub 406 which meshes with intermediate gear 408 mounted for rotation on pin 410 carried by frame 20. This intermediate gear also meshes with gear 382.

Ratchet wheel 402 has twelve teeth and the cam is so constructed as to cause pawl 398 to move ratchet wheel 402 forward one tooth at each revolution of the cam which revolves once each month. Also the ratio of gears 382 and 406 is four to one. Therefore, gear 382 and its associated cam will rotate once each four years.

Cam 378 (Fig. 5) has a concentric surface 412 throughout the major portion of its circumference and is provided with a short curved projection 414 which raises above surface 412. A groove 416 formed in the face of 378 has an outer wall 418 that is in circular alignment with a part of the surface 412, and in conjunction with which it forms a complete circle, and an inner wall 420 and is adapted to receive roller 376 for three successive centesimal years so as to cause February of those years to have but twenty-eight days. The tension spring 422 is attached at one of its ends to arm 370 and at its other end to a pin 424 carried by frame 20, and causes roller

376 to ride under tension against the cam surfaces of cam 378.

Referring to Fig. 5, it will be noted that bar 365 is forced against plate 280 by means of cam 414 acting through bell crank lever 368 to cause roller 270 to be disengaged from cam surfaces 262. This above described functioning of the parts causes each four years to register twenty-nine days in February except in the three successive centesimal years when roller 376 passes through groove 416 as stated above.

The following mechanism is provided to cause roller 376 to pass through groove 416. A lever 426, pivoted intermediate its ends on pin 428, carried by frame 20, is provided at its one end with a roller 430 and at its other end with a loose pivot 432, by means of which it is secured to the upper end of bar 365. Referring especially to Figs. 5 and 8, it will be noted that the ratchet wheel 434 and disc 436 are secured together and mounted for rotation on shaft 150. Ratchet wheel 434 has twenty-five equally spaced teeth 438 for proper timing of the movement of certain parts as hereinafter set forth and which are adapted to be engaged by the spring mounted pawl 440 carried by reciprocable plunger 442. Plunger 442 is mounted in a housing 444 in radial relation to shaft 380 and is provided at its outer end with a roller 446 which rides an eccentric disc 384 to cause a complete reciprocation of plunger 442 each four years. The length of travel of 442 is such that it causes the rotation of 434 through one tooth. To position and prevent an over running of ratchet 434, disc 448, having undulations 450 corresponding in number to the twenty-five teeth 438, is securely attached to ratchet wheel 434 and rotatable therewith. A positioning roller 452 mounted on the free end of arm 454 pivoted to 20 by means of pin 161 is urged into the depressions of undulations 450 by means of spring member 458. Plunger 442 is urged toward eccentric 384 by means of spring 460 mounted in housing 444 under compression and in such a position as to rest against collar 462 formed on plunger 442.

Roller 430 normally rests on the periphery of disc 436, due to the pull of spring 422, except when raised therefrom by cam projection 414 as described above. Disc 436 rotates once each hundred years and is provided with a recess 464 in its periphery, which on each centesimal year is in the path of travel of roller 430 which will enter therein, due to the pull of spring 422 unless otherwise prevented. When, during each centesimal year not divisible by four hundred, 430 moves into recess 464, the roller 376 will, by the action of spring 422 and the resultant oscillation of arm 370 and arm 374 be moved into groove 416, thereby permitting the indicating mechanism to show twenty-eight days for February. This must occur for three successive centesimal years; however, on the fourth centesimal year, 430 must not be permitted to enter recess 464 and it is for this purpose that the following mechanism is provided.

Mounted on shaft 150 to rotate with disc 436 is a pinion 466 which meshes with gear 468, mounted on pin 470, carried by frame 20. The ratio of pinion 466 and gear 468 is one to four so that the gear 468 makes one complete revolution in four hundred years. Gear 468 is provided with a ledge 472 which once in four hundred years is so positioned adjacent recess 464 as to bridge across the same and serve as a support for the outer end of roller 430 which ex-

tends thereabove, while during the other three centesimal years of its revolution the ledge 472 will be out of register with recess 464, thereby permitting roller 376 to pass through groove 416 as roller 436 enters recess 464, as described above.

Supported by bracket 474 carried by frame 20 is a counting device 492 which successively displays the numerals 478 through opening 476 formed in dial 158. This counter indicates the current year and can be made to indicate as large numerals as desired.

Referring to Figs. 5 and 7, it will be noted that a cam 480 is mounted on shaft 218 for rotation with ratchet 220, which rotates once each year. A rack 482, reciprocally mounted in a bracket 484 carried by frame 20 has a roller 486 at its upper end in engagement with cam 480. This rack is in operative engagement with a pinion 488 rigidly mounted on shaft 490 of the well known counting device 492. The operating lever 494 of this counting device is connected at one end to shaft 490 and at its other end with one end of a spring 496 which is secured at its other end to frame 20 by means of eyelet 498. As rack 482 moves downwardly each year by the action of cam 480, the spring 496 will be tensioned to actuate the counter so that it will show the next higher numeral, thereby, keeping a correct count of the years.

A second-hand 500 carried by 56, a minute-hand 502 secured to sleeve 83 and an hour-hand 504 carried by sleeve 101 are visible on the dial 158. The time of day may be definitely determined by the relation of these hands to the index numerals 506 on the face of the dial.

It is apparent from the foregoing specification that this clock mechanism when properly driven by an accurately timed motor will, without any outside adjustments or interference, correctly indicate the year, month, day of month, day of week, hour, minute and second for an indefinite period of time, as provided in the Gregorian calendar.

As stated above, some of the figures in the drawings show the clock mechanism with the parts in proper relative position as they would appear on February 29, 2000, while the other figures indicate the position of the parts as of Tuesday, May 21, 1935.

Many modifications in the trains of gears and other mechanisms used in obtaining the proper relative movements of the parts might be made without departing from the spirit of this invention, and it is desired that I be limited only by the terms of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a clock mechanism, a rotatably mounted ratchet wheel having 31 ratchet teeth; timed operating means to move said wheel forward through a space of one tooth each day; operating means carried by said wheel; and mechanism including plungers operable by the operating means carried by said wheel, to move said wheel forward a predetermined number of teeth, whereby the wheel is rotated through 360 degrees each month of the year.

2. In a clock mechanism, a timed driving means; a ratchet wheel carrying a series of characters to indicate the day of the month adapted to be rotated through the space of one character each day by said driving means; three operating plungers, having driving means actu-

ated and controlled by said ratchet wheel, adapted to be separately released at each revolution of the ratchet wheel to rotate said ratchet wheel; and means operable to cause certain of said plungers to be made inoperative.

3. In a clock mechanism, a timed driving means; a rotatably mounted member carrying a series of thirty-one spaced-apart characters adapted to be positioned consecutively to indicate the current day of the month; means operable, by said driving means, to move said characters forward one character space each day; mechanism associated with the said rotatably mounted member; means carried by said rotatably mounted member to operate said mechanism to cause said rotatably mounted member to complete its revolution each month through 360 degrees when the current month has less than thirty-one days; and means operated by said driving means whereby one day is added to the month of February each Gregorian leap year.

4. In a clock mechanism, a timed driving means; a rotatably mounted member carrying a series of thirty-one spaced-apart characters adapted to be positioned consecutively to indicate the current day of the month; means operable, by said driving means, to move said characters forward one character space each day; operating means carried by said rotatably mounted member; mechanism operable by said means carried by said rotatably mounted member to cause the said rotatably mounted member to complete its revolution each month through 360 degrees when the current month has less than thirty-one days; and means including a spring energized and controlled by said timed driving means whereby one day is added to the month of February during only such centesimal years that are evenly divisible by four hundred.

5. In a clock mechanism, a timed driving means; a rotatably mounted member carrying a series of thirty-one spaced-apart characters adapted to be positioned consecutively to indicate the current day of the month; means operable, by said driving means, to move said characters forward one character space each day; operating means carried by said rotatably mounted member; mechanism operable by said means carried by said rotatably mounted member to cause the said rotatably mounted member to complete its revolution each month through 360 degrees when the current month has less than thirty-one days; and means including a spring energized and controlled by said timed driving means whereby one day is added to February each successive year that is evenly divisible by four except those centesimal years that are not evenly divisible by four hundred.

6. In a clock mechanism, a timed driving means; a rotatably mounted member carrying a series of 31 spaced apart characters adapted to be positioned consecutively to indicate the current day of the month; means operable by said timed driving means to move said characters forward one character space each day; means including a power spring energized and controlled by said timed driving means operable to complete a full resolution of the character carrying member during months having less than 31 days; and means driven by said timed driving means and controllable by said character moving means whereby one day is added to the month of February each and every Gregorian leap year.

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