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No. 786,181. PATENTED MAR. 28, 1905.

J. BALLANTYNE.

AUTOMATIC PERPETUAL CALENDAR.

APPLICATION FILED JUNE 22, 1904.

MODEL.

3 SHEETS—SHEET 1.

Fig. 1.

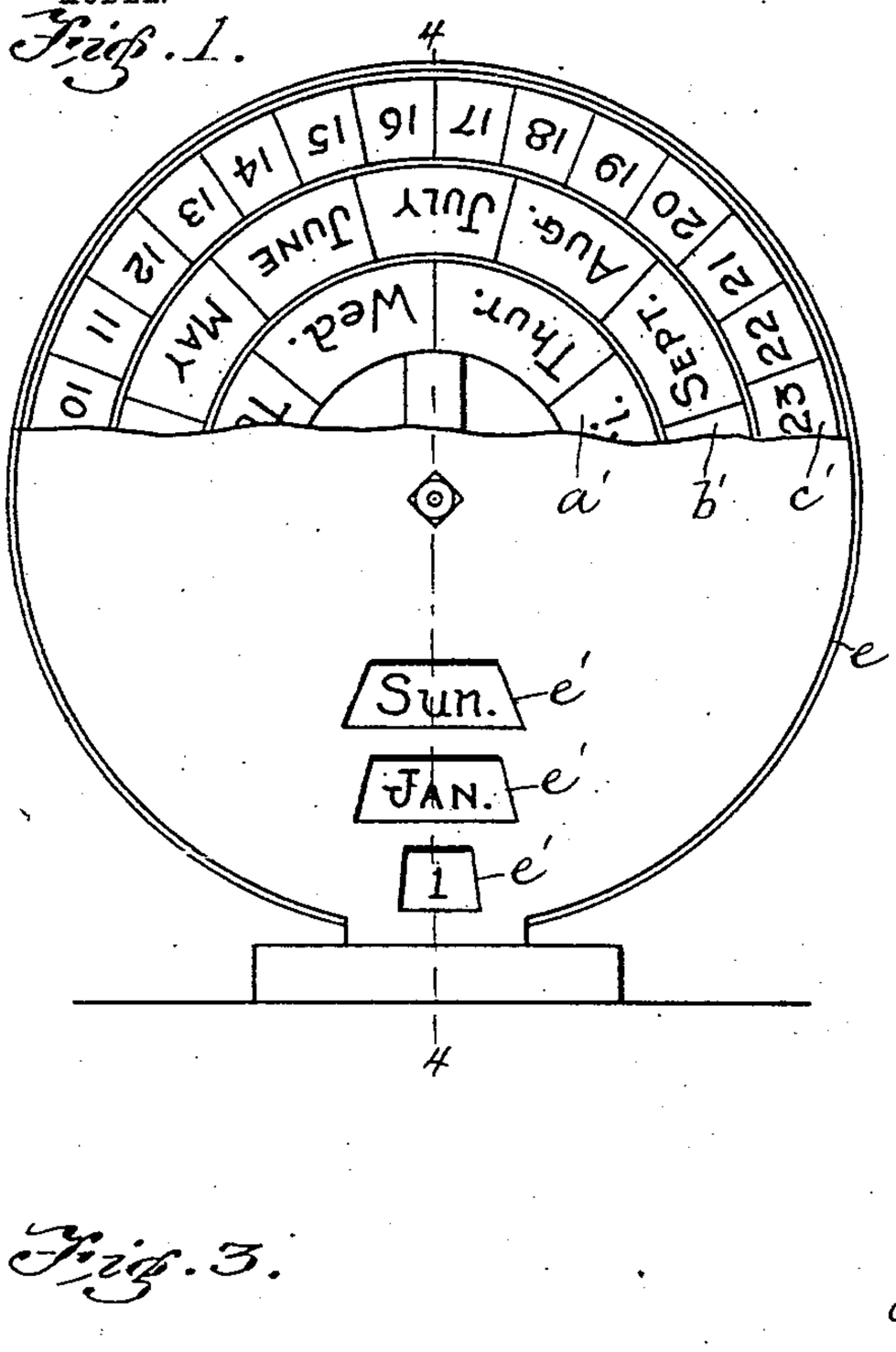


Fig. 2.

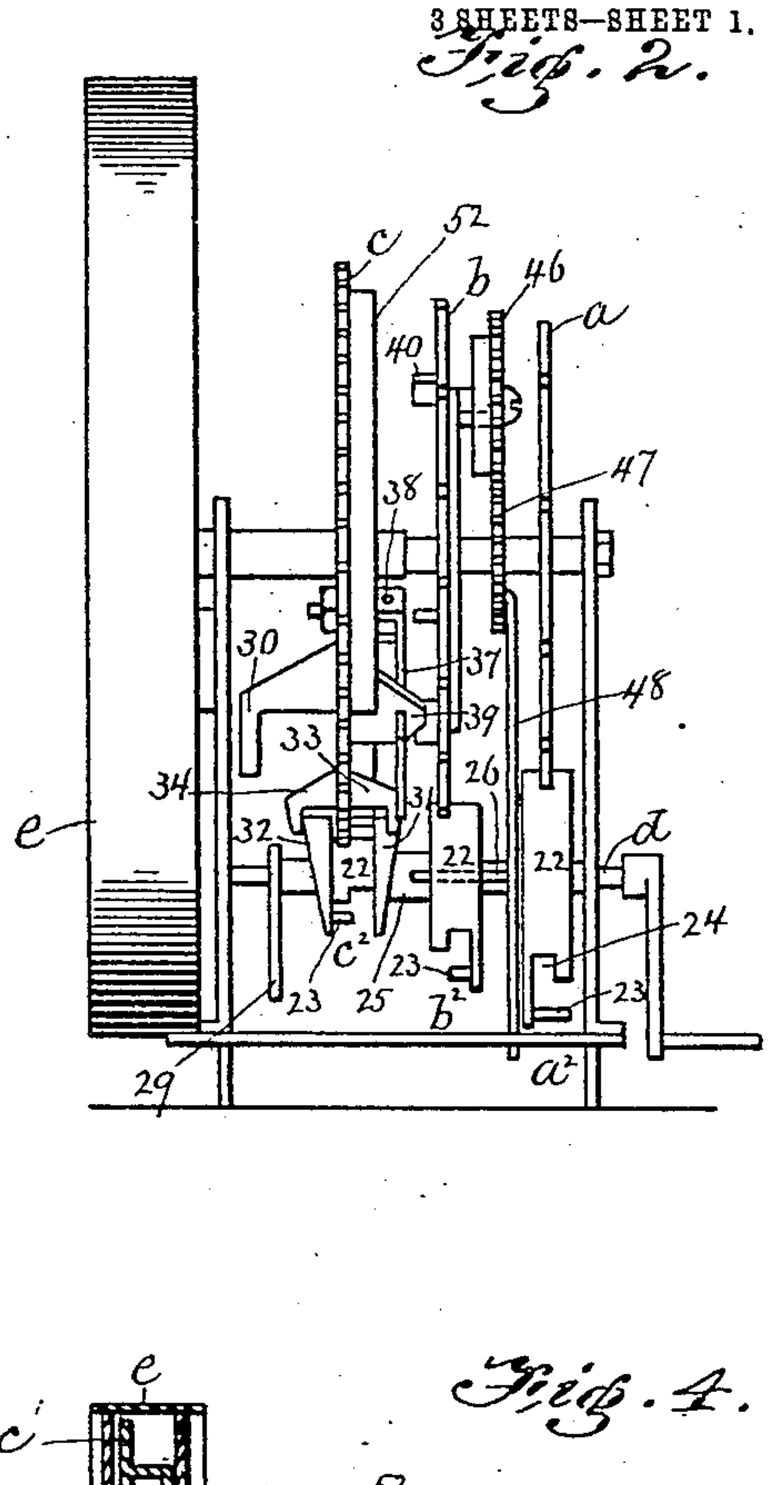


Fig. 3.

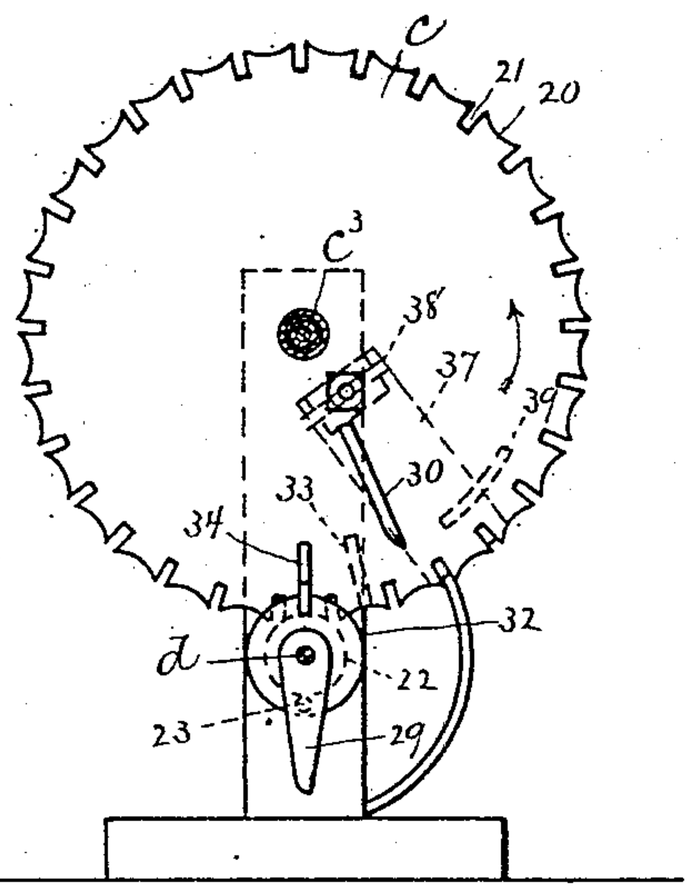
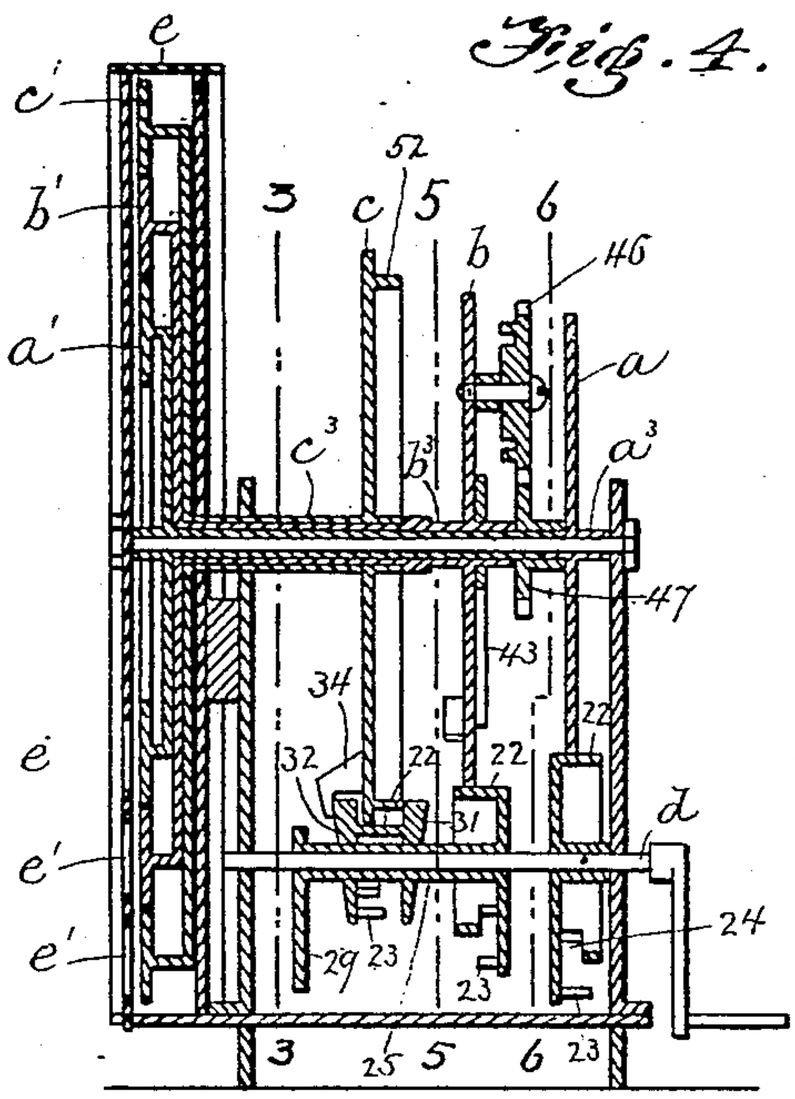


Fig. 4.



Witnesses:
Rollin Abell
E. Batchelder

Inventor:
James Ballantyne
by Wright Brown Quinby & Ailtys.

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MODEL. 3 SHEETS—SHEET 2.

Fig. 5.

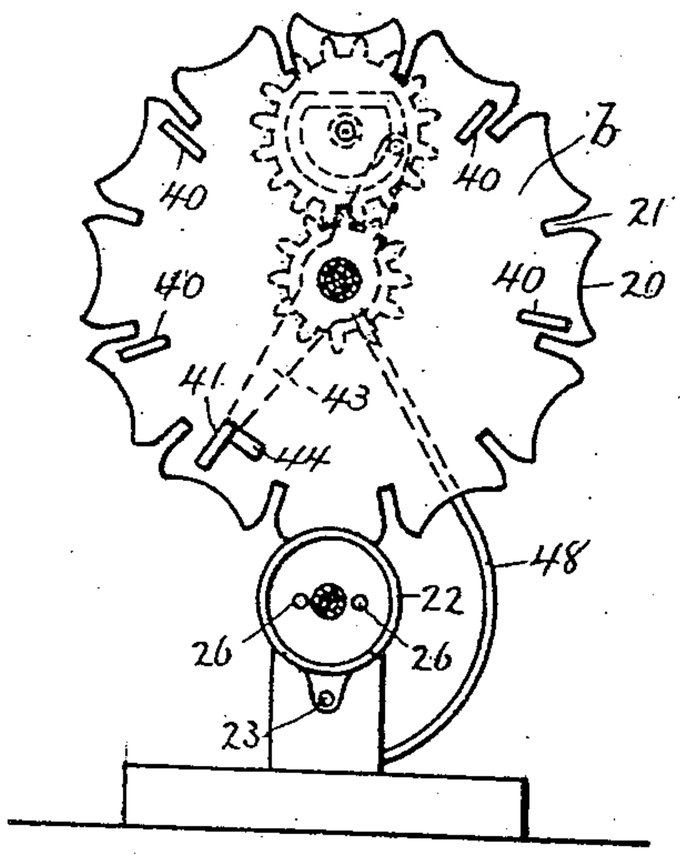


Fig. 6.

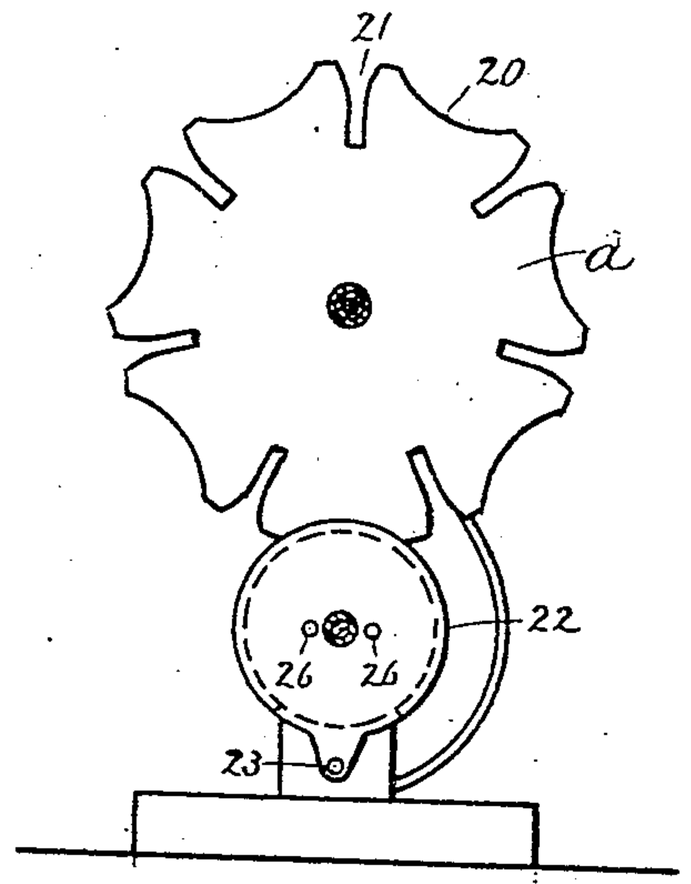


Fig. 6a.

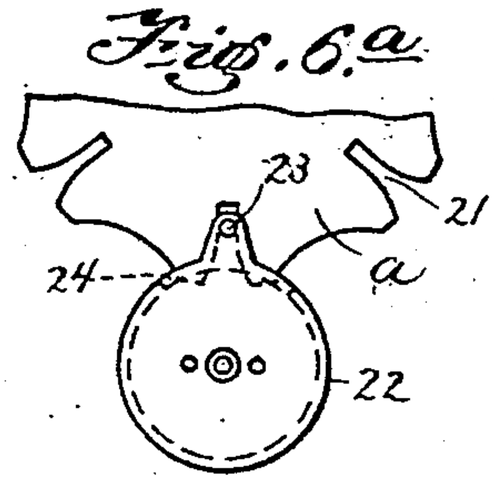


Fig. 7.

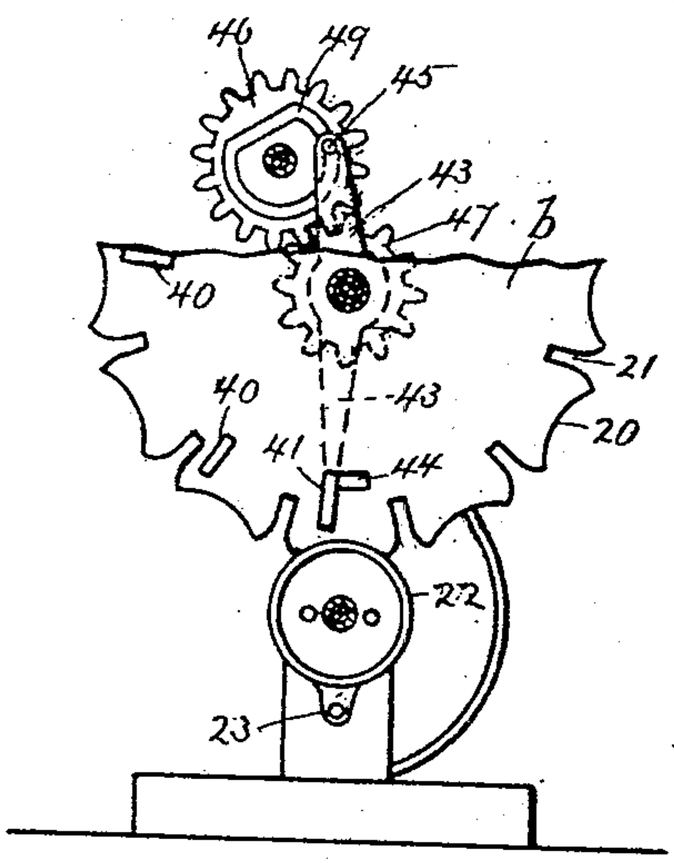
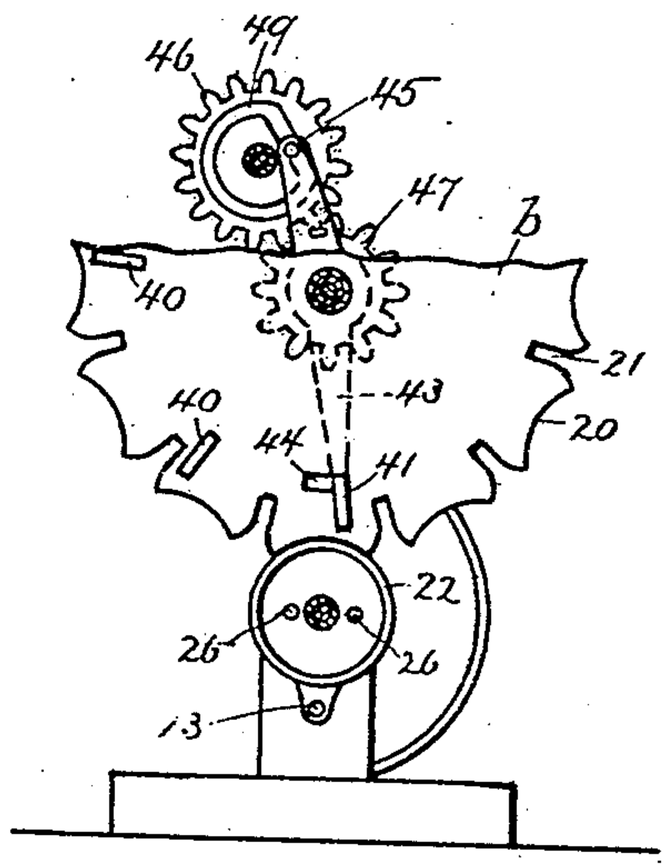


Fig. 8.



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MODEL.

3 SHEETS—SHEET 3.

Fig. 9.

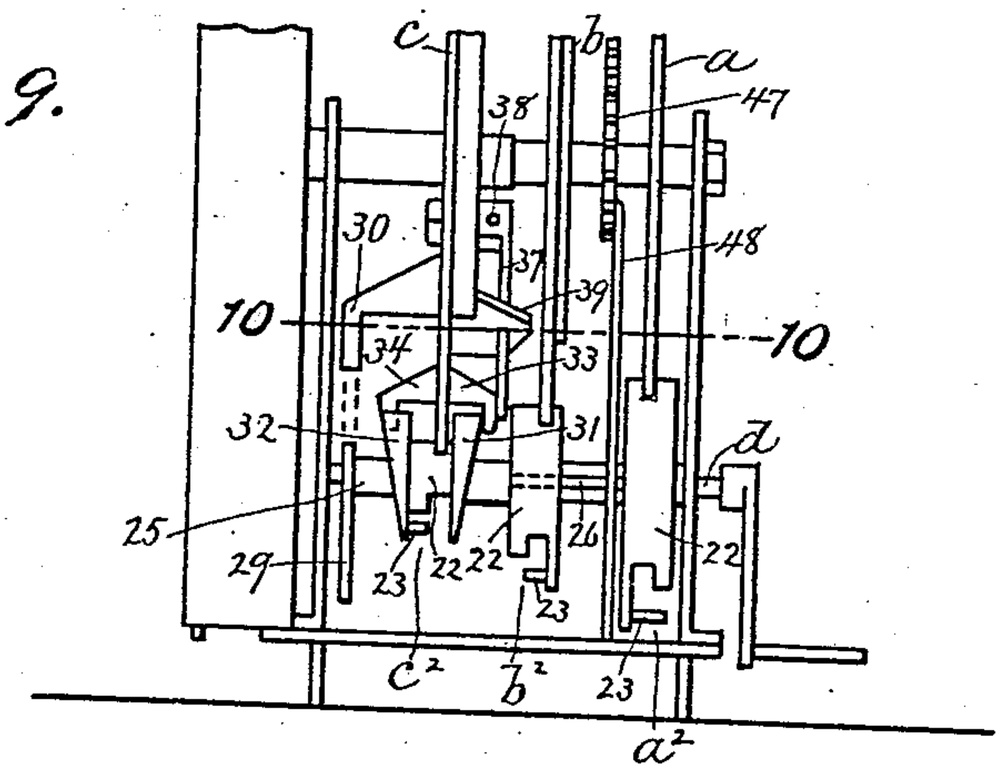


Fig. 10.

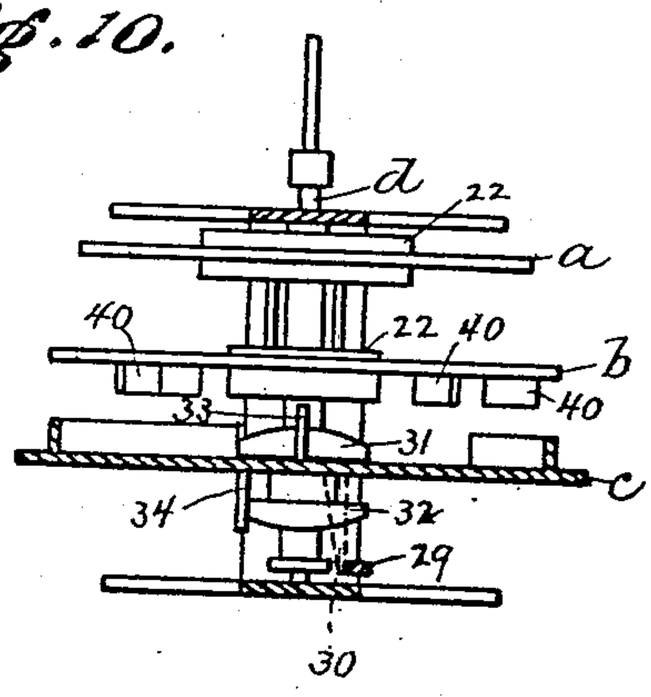


Fig. 11.

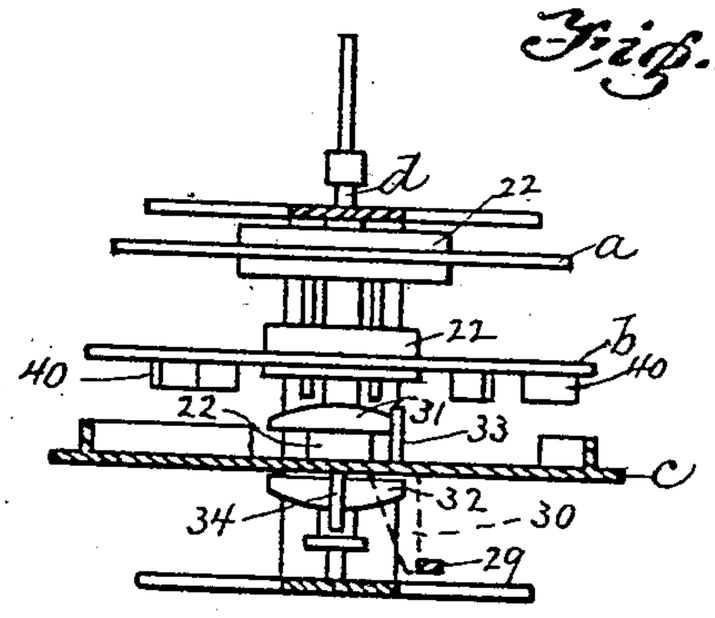
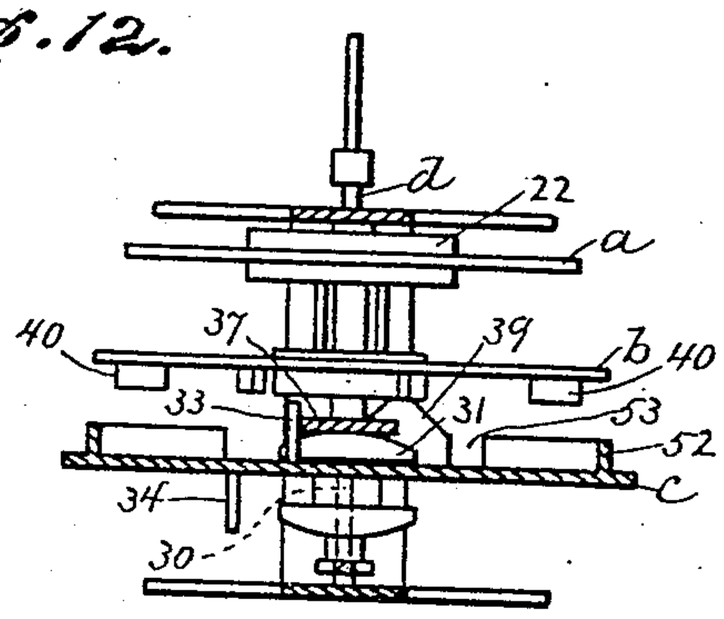


Fig. 12.



Witnesses:
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By Wright Brown Quinby
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No. 786,181. Patented March 28, 1905

UNITED STATES PATENT OFFICE.

JAMES BALLANTYNE, OF BOSTON, MASSACHUSETTS.

AUTOMATIC PERPETUAL CALENDAR.

SPECIFICATION forming part of Letters Patent No. 786,181, dated March 28, 1905.

Application filed June 22, 1904. Serial No. 213,628. (Model.)

To all whom it may concern:

Be it known that I, JAMES BALLANTYNE, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Automatic Perpetual Calendars, of which the following is a specification.

This invention has for its object to provide a simple, durable, and accurate automatic calendar mechanism adapted to be operated by clockwork and to correctly indicate, through a long term of years, the day of the week, the month, and the day of the month, provision being made for the variation of the number of days in the months and for the additional day occurring in each leap-year.

The invention consists in the improvements hereinafter described and claimed.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents an end elevation of a calendar embodying my invention, a part of the casing being broken away. Fig. 2 represents a side elevation of the same. Fig. 3 represents a section on line 3 3 of Fig. 4. Fig. 4 represents a section on line 4 4 of Fig. 1. Fig. 5 represents a section on line 5 5 of Fig. 4. Fig. 6 represents a section on line 6 6 of Fig. 4. Fig. 6^a represents a view similar to a portion of Fig. 6, showing the parts differently related. Figs. 7 and 8 are views similar to Fig. 5, showing different stages of the operation. Fig. 9 represents a view similar to the lower portion of Fig. 2, showing certain parts in different positions. Fig. 10 represents a section on line 10 10 of Fig. 9. Figs. 11 and 12 represent views similar to Fig. 10, showing different stages of the operation.

In the drawings, *a*, *b*, and *c* are rotary intermittent gear-wheels, to each of which a step-by-step rotation is imparted, as hereinafter described, said wheels being connected with and imparting movement to suitably-inscribed dials *a'* *b'* *c'*, one of which shows the names of the days of the week and is termed the "week-day" dial, another the numerals of the days of the month and is termed the "month-day" dial, and the third the names of the months of the year and is termed the "month-dial." The gear-wheels *a* *b* *c* are termed, respectively, the "week-day" wheel, the "month-wheel," and the "month-day" wheel. The gear-wheels have a common axis of rotation, and the dials are annular and are concentrically arranged. Each gear-wheel has in its perimeter a series of curved recesses 20 and between said recesses radial slots 21, said grooves and slots coöperating with driving members a^2 b^2 c^2, Fig. 2, which are mounted on and rotatively engaged with a driving-shaft *d*, the latter being rotated once in twenty-four hours by suitable clock mechanism. (Not shown.) Each of said driving members comprises a cylinder 22, the periphery of which is formed to enter a recess 20 in one of the gear-wheels, and a tooth or pin 23 projecting outside the periphery of the cylinder and extending parallel with its axis, the tooth being adapted to enter a slot 21 in the same wheel, as shown in Fig. 6^a. The driving members a^2 b^2 c^2 are continuously rotated in unison by the shaft *d*, and the teeth 23 of said members engaging the slots in the gear-wheels impart step-by-step movements to the said wheels and to the dials engaged therewith, the cylindrical perimeters of the driving members entering the recesses 20 between the slots of the gear-wheels and preventing rotation of said wheels when the teeth 23 are not in engagement with the slots. The gear-wheels are therefore alternately rotated and locked. The cylinder of each driving member is provided with an opening 24, Figs. 4 and 6^a, formed to receive the projecting portions of the accompanying wheel when the latter is being rotated. The week-day wheel *a* has seven slots 21 and is affixed to one end of a tubular spindle a^3, to the opposite end of which the inner or week-day dial *a'* is affixed. Said wheel and dial are therefore moved once in every twenty-four hours by the coöperation with the wheel *a* of its driving member a^2. The month-wheel *b* has twelve slots 21 and is affixed to a sleeve b^3, which surrounds and is rotatable on the spindle and has affixed to its outer end the month-dial, which is of greater diameter than the week-day dial. The month-day wheel *c* is affixed to a sleeve c^3, which surrounds and is rotatable on the

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sleeve b^3 and has affixed to its outer end the month-day dial c', which is of greater diameter than the month-dial. The dials are inclosed in a casing e, in the front of which are sight-openings e', arranged to simultaneously expose portions of the three dials. The week-day-wheel-driving member a^2 is affixed rigidly to the driving-shaft. The month-wheel-driving member b^2 and the month-day-wheel-driving member c^2 are affixed to a sleeve 25, Fig. 4, which is adapted to slide longitudinally on the driving-shaft, so that the teeth 23 of said members b^2 and c^2 are movable into and out of engagement with the month and month-day wheels b and c, the said members b^2 and c^2 being rotatively engaged with the driving-shaft by suitable means, such as studs 26, affixed to the cylinder 22 of the week-day-wheel-driving member a^2, and entering orifices in the cylinder of the month-wheel-driving member b^2, the latter being adapted to slide on said studs. The teeth 23 of the month and month-day-wheel driving members are arranged so that they operate alternately, one tooth 23 being out of engagement with the month-wheel when the other tooth is in engagement with the month-day wheel, and vice versa. The month-wheel b is provided with twelve slots 21, as shown in Fig. 5, and the month-day wheel c is provided with thirty-one slots, as shown in Fig. 3.

To the sleeve 25, supporting the driving members b^2 c^2, is affixed an arm 29, which cooperates with an arm 30, affixed to the month-day wheel in imparting a partial rotation to the month-day wheel, as hereinafter described. The sleeve 25 is automatically shifted when the month-day wheel c is approaching the end of a complete rotation (that is, the position which displays the numeral of the last day of the month through the sight-opening e') to withdraw the tooth 23 of the driving member c^2 from the wheel c and to move the tooth 23 of the driving member b^2 into position to engage the month-wheel b, the sleeve 25 remaining in this position until the month-wheel has been rotated one step and being then again shifted to restore the tooth of the driving member c^2 to engagement with the month-day wheel and remove the tooth of the member b^2 from engagement with the month-wheel. The means for thus shifting the sleeve 25 are organized to stop the rotation of the month-day wheel automatically on the last day of the month, whether it be the 28th, 29th, 30th, or 31st. The arm 29 on said sleeve acting through the arm 30 on the month-day wheel gives said wheel the necessary additional movement required to indicate the first day of the succeeding month and is adapted to move the month-day wheel either of the distances required to change from the last day of one month to the first day of the next. For example, when the month-day wheel is arrested on February 28 the arm 29 subsequently rotates the wheel four steps, or a distance equal to the length of four numbers, thus causing "29," "30," and "31" to pass the sight-opening without stopping, the wheel stopping when the numeral "1" is visible. When the month-day wheel is arrested on April 30, the arm 29 subsequently rotates the month-day wheel two steps, and when the month-day wheel is arrested on May 31 the arm 29 subsequently rotates the month-day wheel one step. Special means are provided operating only in leap-years to cause the arrest of the month-day wheel on the 29th of February, the arm 29 subsequently rotating the month-day wheel three steps.

The mechanism employed in this embodiment of my invention for producing the above-described results will next be described.

To the sleeve 25 are affixed two cams 31 32, which are preferably disks, the outer sides of which are inclined relatively to the axis of the sleeve, as shown in Figs. 2 and 4. 33 34 represent angular ears affixed to opposite sides of the month-day wheel c and having shoulders formed to engage the inclined sides of the said cams, as indicated in Figs. 4 and 9. The ear 33 is located a short distance in advance of the ear 34, as shown in Fig. 3, and the shoulders of the said ears are so spaced apart that they coöperate alternately with the cams 31 32 in shifting the sleeve 25 and the driving members carried thereby. When the month-day wheel has indicated "31," the ear 33 acts on the cam 31 and shifts the sleeve 25 and the driving members b^2 c^2 and arm 29 from the position shown in Fig. 2 to that shown in Fig. 9. The tooth 23 of the month-day-wheel-driving member is thus disconnected from said wheel and the tooth 23 of the month-wheel-driving member is moved to position to engage the month-wheel. At the same time the arm 29 is moved into the path of the arm 30 on the month-day wheel and subsequently gives the latter a partial rotation to indicate the first day of the month, as above stated. After the tooth 23 of the month-wheel-driving member has engaged the month-wheel and imparted a step-by-step movement thereto the ear 34 acts on the cam 32 to restore the sleeve 25 and its attachments to the position shown in Fig. 2, so that the step-by-step movements of the month-day wheel by its driver are resumed, the month-wheel being held stationary. The ear 33 is so located on the wheel c that it operates only when the month has thirty-one days, additional automatically-operated mechanism being employed to shift the sleeve 25 on the last day of each shorter month, leaving the com-

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pletion of the rotation of the month-day wheel to the arm 29. Said mechanism comprises a swinging ear 37, pivoted at 38 to the month-day wheel and having at its outer portion an enlargement 39. The month-wheel is provided with a series of four fixed lugs 40 and with an additional automatically-adjusted lug 41, Fig. 5. When the rotation of the month-day wheel *c* and month-wheel *b* brings one of said lugs into alinement with the enlargement 39, the lug holds the enlargement rigidly against the month-day wheel, and thus rigidly holds the pivoted ear 37. Said ear is located in advance of the fixed ear 33, and when thus made rigid it acts in the same manner as the ear 33 in shifting the sleeve 25 to the position shown in Fig. 9. The said ear 37 then practically acts as an extension of the ear 33, and being located in advance of the ear 33 it shifts the sleeve 25 sooner than the ear 33 alone would, and the two ears 37 and 33 hold the sleeve 25 shifted long enough so that the arm 29 acts on the arm 30 sooner and longer than would be caused by the ear 33 alone, thereby acting upon the arm 30 so as to rotate the month-day wheel two steps when the thirty-first day of the month is to be skipped. The lugs 40 are so arranged that one of said lugs will cooperate with the enlargement 30 on April 30, another on June 30, another on September 30, and the fourth on November 30, such coöperation causing the arm 29 to advance the month-day wheel two steps. When the pivoted ear 37 passes the cam 31 without meeting one of the said lugs, the ear yields to the cam and has no effect thereon. The adjustable lug 41 coöperates with the enlargement on the swinging ear 37 on the last day of February, whether said day be the 28th or the 29th. Said lug is formed on a lever 43, which is mounted to oscillate on the sleeve b^3. The lug 41 projects from one end of the lever 43 through a slot 44 in the month-wheel *b*. The opposite end of the lever has a stud 45, which enters a cam-groove 49 in a gear-wheel 46, which is mounted to rotate on a stud affixed to the month-wheel *b* and meshes with a fixed gear 47, which is mounted on the shaft a^3 and is prevented from rotating by a rod 48, Figs. 2 and 5, affixed at one end to said gear and at its other end to the supporting-frame. The gear 46 has a greater number of teeth than the gear 47, the number of teeth on the gear 46 in this embodiment of my invention being sixteen, while the number of teeth on the gear 47 is twelve. This variation, together with the form of the cam-groove 49, causes the position of the lug 41 to so change during each rotation of the month-wheel as to secure the above-described result. It will be seen that the rotation of the month-wheel causes the gear 46 to revolve step by step around the fixed gear 47, the said gear 46 having, therefore, an intermittent planetary motion, which causes the cam-groove 49 to change the position of the lever 43 and lug 41 from time to time, the extremes of the change being indicated in Figs. 7 and 8. The arrangement is such and the usual position of the lug 41 is such that on the 28th day of February (excepting in a leap-year) the lug 41 will be adjusted, as shown in Fig. 7, when it coöperates with the enlargement in the swinging ear 37 in making the latter rigid, the lug being in position to cause the arm 29 to give the month-day wheel a final movement of maximum extent, the wheel advancing four steps. In every leap-year the cam-groove 49 shifts the lever 43 so that the lug 41 will be adjusted backwardly, as shown in Fig. 8, so that it will begin to act a day later than when it is in the position shown in Fig. 7, the month-day wheel being thus caused to indicate "29" before it is finally advanced by the arm 29. The described mechanism is timed so that the lug 41 is in position to act for three successive years after the month-day wheel has indicated "28" and on the fourth year after said wheel has indicated "29." This is for the reason that since the planetary gear-wheel 46 has sixteen teeth, while the sun gear-wheel 47 has but twelve, at each revolution of the planet gear-wheel or at the end of each year the planet gear-wheel is rotated a distance equal to four teeth, and at the end of four years it accordingly makes a complete rotation and the lug 41 is again brought into the position shown in Fig. 8. The present year, 1904, is a leap-year, and every fourth year hereafter for nearly two hundred years will also be a leap-year. It will be seen, therefore, that the above-described mechanism provides for the correct automatic operation of the calendar until A. D. 2100, provided, of course, the driving-shaft *d* be continuously driven at the proper speed.

The month-day wheel *c* is provided with a segmental flange 52, which acts as a guard or stop to prevent the sleeve 25 and its attachments from being moved toward the left from the position shown in Fig. 4 until the proper time, the ends of said flange being separated by a space or opening 53, Fig. 12, which permits the cam 31 to move inwardly against the wheel *c*.

I claim—

1. An automatic calendar comprising a series of intermittent gear-wheels including a week-day wheel, a month-wheel and a month-day wheel, a driving-shaft, a driving member affixed thereto and engaging the week-day wheel, connected driving members having a sliding and rotative engagement with the shaft, and adapted to engage the month-wheel and the month-day wheel alternately, an arm affixed to said connected members and adapted to coöperate with a projection on the month-day wheel, and means oper-

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ated by the rotation of the month-day wheel for shifting said driving members and arm.

2. An automatic calendar comprising a week-day wheel, a month-wheel and a month-day wheel, a driving-shaft engaged with the week-day wheel, connected driving members slidingly and rotatively engaged with the shaft and adapted to engage the month-wheel and the month-day wheel alternately, a supplemental month-day-wheel-operating arm connected with said members, and means for shifting the driving members and arm, said means including a fixed or non-adjustable ear carried by the month-day wheel, and operating at the close of a period of maximum length, a normally loose ear also carried by the month-day wheel, and a series of lugs carried by the month-wheel, and adapted to coöperate successively with the said loose member at the close of periods of shorter duration.

3. An automatic calendar comprising a week-day wheel, a month-wheel and a month-day wheel, a driving-shaft engaged with the week-day wheel, connected driving members slidingly and rotatively engaged with the shaft and adapted to engage the month-wheel and the month-day wheel alternately, a supplemental month-day-wheel-operating arm connected with said members, and means for shifting the driving members and arm, said means including a fixed or non-adjustable ear carried by the month-day wheel, and operating at the close of a period of maximum length, a normally loose ear also carried by the month-day wheel, and a series of lugs carried by the month-wheel, and adapted to coöperate successively with the said loose member at the close of varying periods of shorter duration, one of said lugs being adjustable, and means operated by the rotation of the month-wheel for adjusting said lug.

4. An automatic calendar comprising a week-day wheel, a month-wheel and a month-day wheel, a driving-shaft engaged with the week-day wheel, connected-driving members slidingly and rotatively engaged with the shaft, a month-day-wheel-rotating arm affixed to said members, a pair of cams also affixed to said members, ears affixed to the month-day wheel and projecting from opposite sides thereof for engaging said cams and shifting the said driving members and arm, a swinging ear carried by the month-day wheel and having an enlargement, a series of lugs on the month-wheel, adapted to coöperate successively with said enlargement, one of said ears being adjustable, and means operated by the rotation of the month-wheel for adjusting said lug.

5. In an automatic calendar, a month-wheel having a series of lugs one of which is adjustable, a lever carrying said adjustable lug and adapted to oscillate on the axis of the month-wheel, a fixed gear concentric with the axis of the month-wheel, and a planet-gear meshing with said fixed gear and rotatively connected with the month-wheel, said planet-gear having a cam-groove engaging a stud on the said lever, one gear having a greater number of teeth than the other.

6. An automatic calendar, comprising a week-day wheel, a month-wheel and a month-day wheel, shiftable driving members for impelling the month and month-day wheels alternately, and automatic means actuated by the rotation of the said month and month-day wheels, for shifting said members.

7. An automatic calendar comprising a week-day wheel, a month-wheel and a month-day wheel, shiftable driving members for impelling the month and month-day wheels alternately, a supplemental month-day-wheel-impelling member connected with said driving members, and automatic means actuated by the rotation of the said month and month-day wheels for shifting said members.

In testimony whereof I have affixed my signature in presence of two witnesses.

JAMES BALLANTYNE.

Witnesses.
C. F. Brown,
H. L. Robbins.