(No Model.)

J. THOMSON.

DIFFERENTIAL REGISTER.

No. 285,322. Patented Sept. 18, 1883.

Fig. 1.

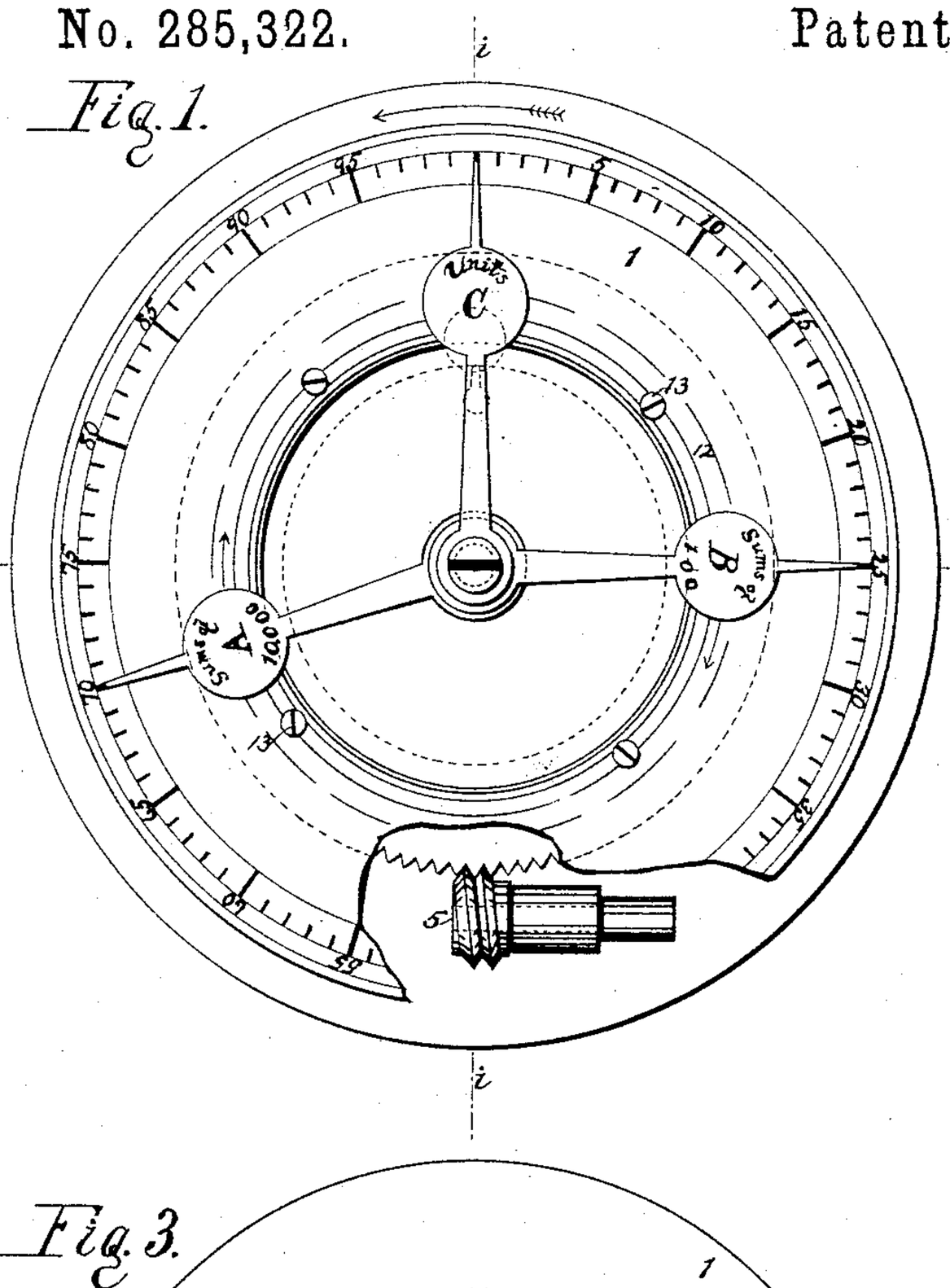


Fig. 2.

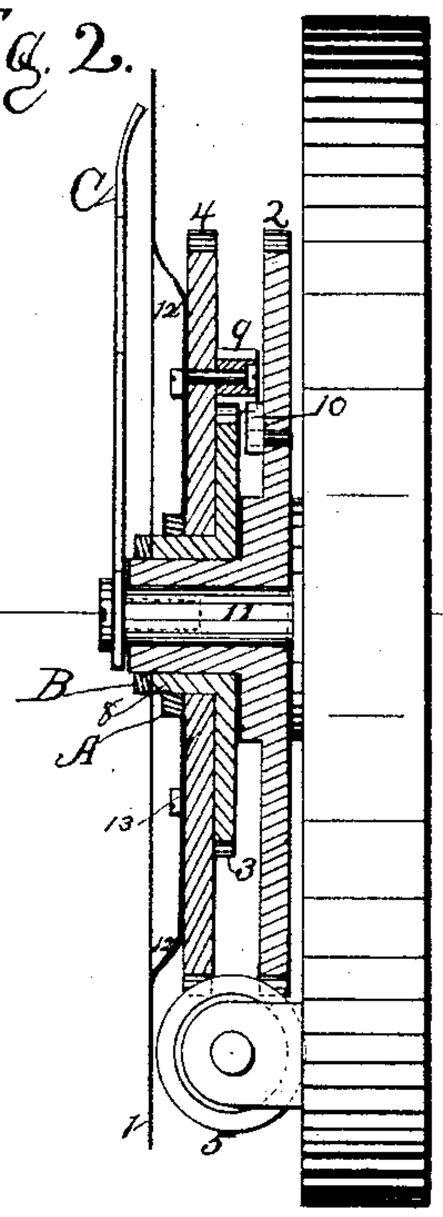


Fig. 3.

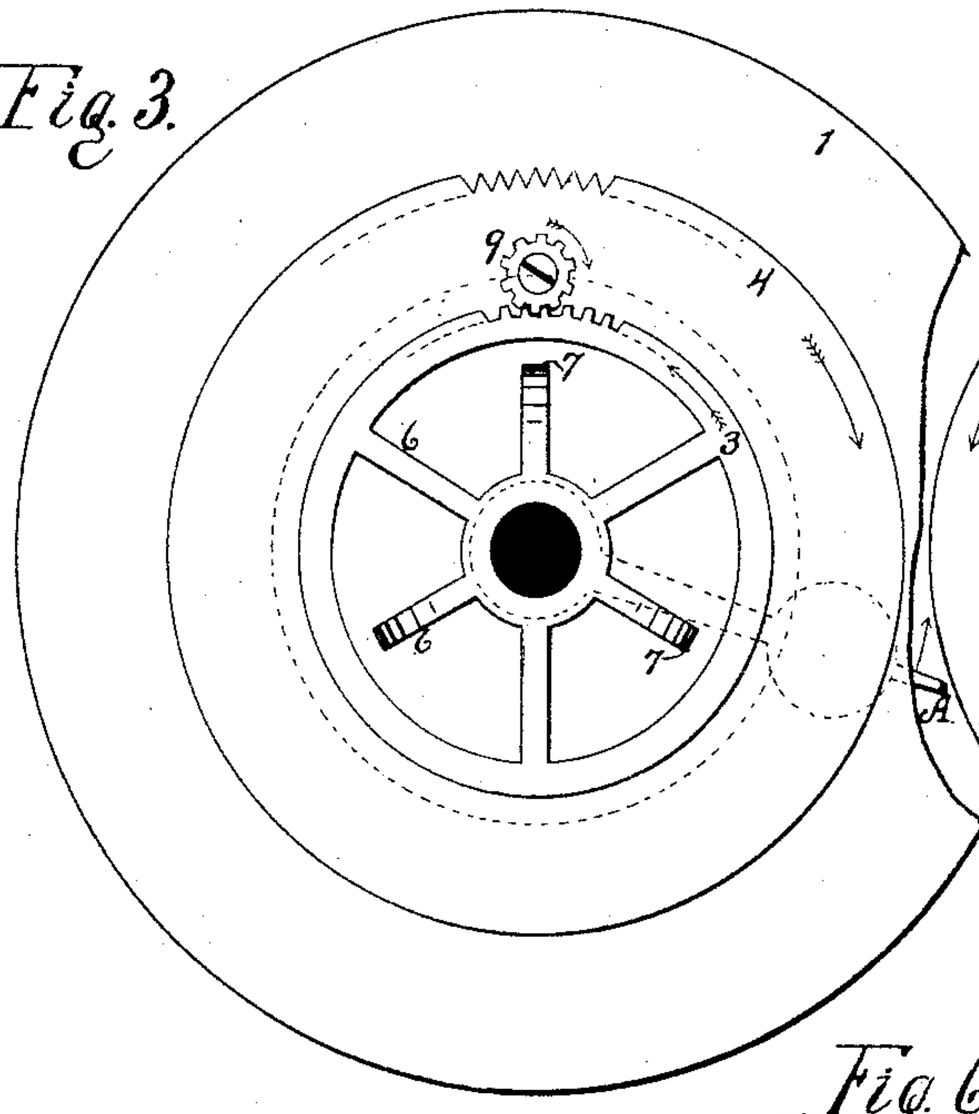


Fig. 4.

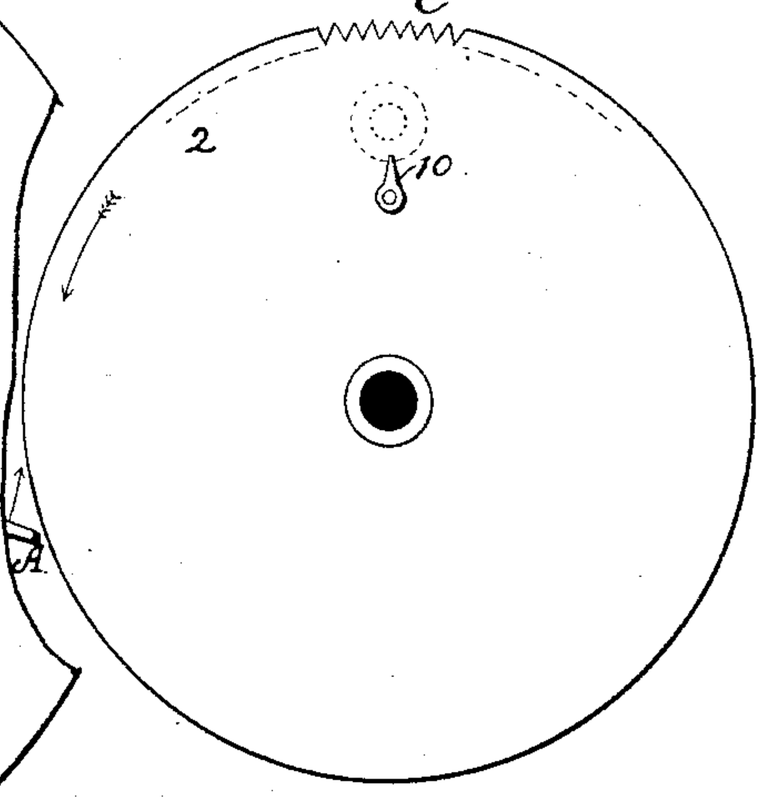


Fig. 6.

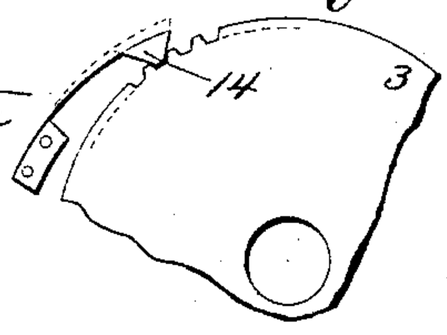
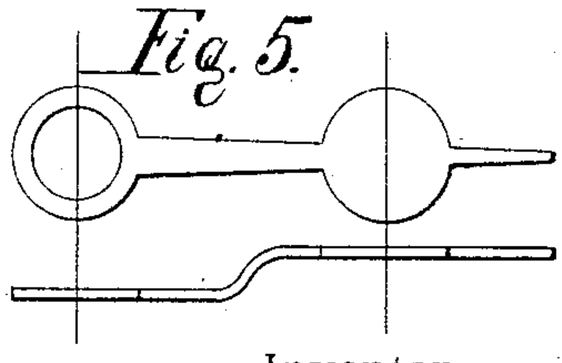


Fig. 5.



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UNITED STATES PATENT OFFICE.

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DIFFERENTIAL REGISTER.

SPECIFICATION forming part of Letters Patent No. 285,322, dated September 18, 1883.

Application filed December 27, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN THOMSON, a citizen of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Differential Registers, of which the following is a specification.

This invention relates to differential registers, and in its general scope and object is collateral with a recently allowed patent application of the United States in this class, now awaiting issue to the present applicant.

In the drawings, Figure 1 is a front elevation. Fig. 2 is a side elevation in partial section on line *i*, but for clearness of illustration is considerably exaggerated in thickness. Fig. 3 is an inside plan view of dial, dial-wheel, and device for operating the hand which indicates the sums of highest value. Fig. 4 is a front plan view of follower-wheel with detent. Fig. 5 is a detached view of hand or pointer as adapted to a raised dial; and Fig. 6 shows a partial detached plan view of wheel 3 with modified form of friction-clutch.

In this register one dial, having a single complement of graduations and three hands or pointers, is caused to indicate in geometrical progression, the sum of the units of the graduation being the multiplier. Thus the ultimate or aggregate indication of the hand of second value with a dial having, say, a graduation of one hundred units, would be the sum of $100\times100=10,000$. For the hand of first or highest value the ultimate sum—*i. e.*, the aggregate of the different like sums of its indication—would be $100\times100\times100=1,000,000$. This ratio of indication is effected, first, by the fixed unit-hand C, under which rotates the dial 1; second, by the hand B, which is fast to and may be considered as a part of the follower-wheel 2; and, third, by the hand A, which is fast to the friction gear-wheel 3, but may be considered as a fixed part of the dial-wheel 4 during ninety-nine parts of time.

In the dial-wheel shown in the present instance there are formed one hundred teeth, and in the differential follower-wheel one hundred and one teeth, both of which engage with the same motor—as, say, the worm 5. Hence one hundred turns of the worm will cause one complete rotation of the dial-wheel, gaining upon the hand B one-hundredth part of one revolution, or the space of one graduation upon the dial. This gives the second indication, for obtaining which the means so far described are well known.

The third indication, but first in point of value, is that of the hand A, and forms the most important feature of my former as well as the present invention. In the application hereinbefore referred to this is shown as being effected by securing the hand A to a ratchet-wheel, in which are formed one hundred teeth, a blind-wheel and a friction-clutch being interposed between the said hand or ratchet wheel and the dial-wheel and all moving together with the dial-wheel. A pawl and spring are attached to the follower-wheel and operate in effect to lock the follower-wheel with the hand of highest value during the time of one revolution, thus permitting the dial to travel under the said hand the amount of the differential gain of one complete rotation. In the present instance I entirely obviate the use of the blind-wheel, the extra friction-clutch, the pawl, and the spring, and substitute therefor a positive movement, which drives the hand over the graduations instead of stopping the hand from moving with the dial.

As already stated, the hand A is rigidly secured to the friction gear-wheel 3. In this wheel are formed one hundred teeth and a number of arms, as six, the alternate arms of which are separated from the rim of the wheel, as at 7, and slightly bent inward beyond the plane surface of the wheel; hence, when the hand A and collar 8 are secured to each other the friction developed by the spring of the separated arms will clutch and hold the hand A, wheel 3, and pinion 9 with any degree of firmness desirable at any relative position to which they may be turned upon the dial-wheel. Thus the two functions of gear-wheel and friction-clutch are performed by one part—the friction gear-wheel 3.

Meshing with the wheel 3 is a freely-pivoted pinion, 9, having ten leaves, but is considerably thicker and projects farther outward from the surface of the dial-wheel than that of the friction gear-wheel. The said pinion is secured to and may also be considered as a part of the dial-wheel.

Projecting from the face of the follower-wheel is a fixed detent or spur, 10, the point of which is formed to a gage approximating that of the teeth of the wheel 3, its relative position upon the follower-wheel being such as to engage with the projecting pinion, so that for each single revolution gained by the dial-wheel upon the follower-wheel the said detent will turn the pinion the space or pitch of a single tooth. Hence, as it will be borne in mind that the differential gain of the dial-wheel over the follower-wheel for each revolution is one-hundredth of one revolution, and as it requires one hundred turns of the dial-wheel to gain one relative rotation upon the follower-wheel, it will be seen that during the time of one hundred revolutions the detent will only be in contact with the pinion during the time of one revolution, or one-hundredth part of time. The consequence of this contact is that the pinion is caused to turn one-tenth of a revolution, and thereby the wheel 3 one-hundredth of a revolution, thus the hand A, being moved the distance of a single space of the graduation, indicates a reading of 10,000 units.

The reason for forming the pinion of thicker material than the friction gear-wheel, which thereby projects beyond the outer face of said wheel, is that the detent may engage from between the bearing of the pinion and the center upon which the driven gear-wheel turns, as in this way the hand A is caused to move over the graduations in an opposite direction to that of the movement of the dial itself. Therefore, as the hand A is caused to move over the dial and the dial is caused to gain, relatively, under the hand B, the apparent effect is the same as if the dial were restrained from rotation and both hands were driven in the same direction over the graduations of the dial.

It will readily be seen that the friction gear-wheel might be made solid and the frictional means be interposed, after the manner of my previous invention hereinbefore referred to, or that the friction might be applied to the hand, to the pinion, or by a yielding detent, as 14, Fig. 6, interlocking either the teeth of gear-wheel 3 or pinion 9. The detent 10 may be attached separately or formed from the body of the follower-wheel, of which it is a part.

In my said previous invention the unit-hand C is shown as being secured to a separate and distinct standard. In the present instance the unit-hand is secured to the journal 11, upon and about which the entire structure of the register rests and revolves. Hence all of the hands radiate from the same center. This construction dispenses with the extra standard, permits the use of a uniform length and style of hand, locks the mechanism as a whole upon the journal, and is more economical of space. Also, in the said previous invention the dial is shown as a flat annulus contained within and upon the face of the dial-wheel. In the present case the dial 1 is a "cupped annulus," as at 12, formed of any suitable material, and which, being properly graduated, is secured to the dial-wheel by screws, as 13. In this way the outer portion of the dial is made to clear the teeth of the dial-wheel and the motor apparatus, as 5, to any extent desirable or necessary, and may also extend unrestrictedly beyond the perimeter of the dial-wheel. The advantages of this are that the graduations may be made much larger, and therefore more distinct, and that the wheel-work of the register apparatus proper may be constructed of the minimum size, regardless of the diameter of the dial and length of the hands to be carried; hence, in manufacturing a single size of register, mechanism may be adapted for a plurality of dials and sets of hands of varying diameters and radiants, the duty for which the register may be intended—as, say, for a meter or for a printing-press—being entirely determined by the size of its dial and hands.

What I claim is—

1. In combination with a rotating dial carried by a dial-wheel, as 4, a differential follower, as 2, and operating means, as shown, the hand A, wheel 3, and friction-clutch, the pinion 9, and detent 10, as and for the purpose set forth.

2. In combination with the rotating dial-wheel 4, a differential follower-wheel, 2, and means, substantially as described, for operating the same simultaneously, the wheel 3 serving the double function of gear-wheel and friction-clutch, the wheel 9, detent 10, and pawl 14, as and for the purposes set forth.

3. In a register, the dial 1, formed as a cupped annulus, adapted to extend above and beyond the perimeter of the dial-wheel, substantially as and for the purpose set forth.

JOHN THOMSON.

Witnesses:

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