G. RICHARDSON.

MACHINE CLOCK.

No. 75,196. Patented Mar. 3. 1868.

Fig. 1.

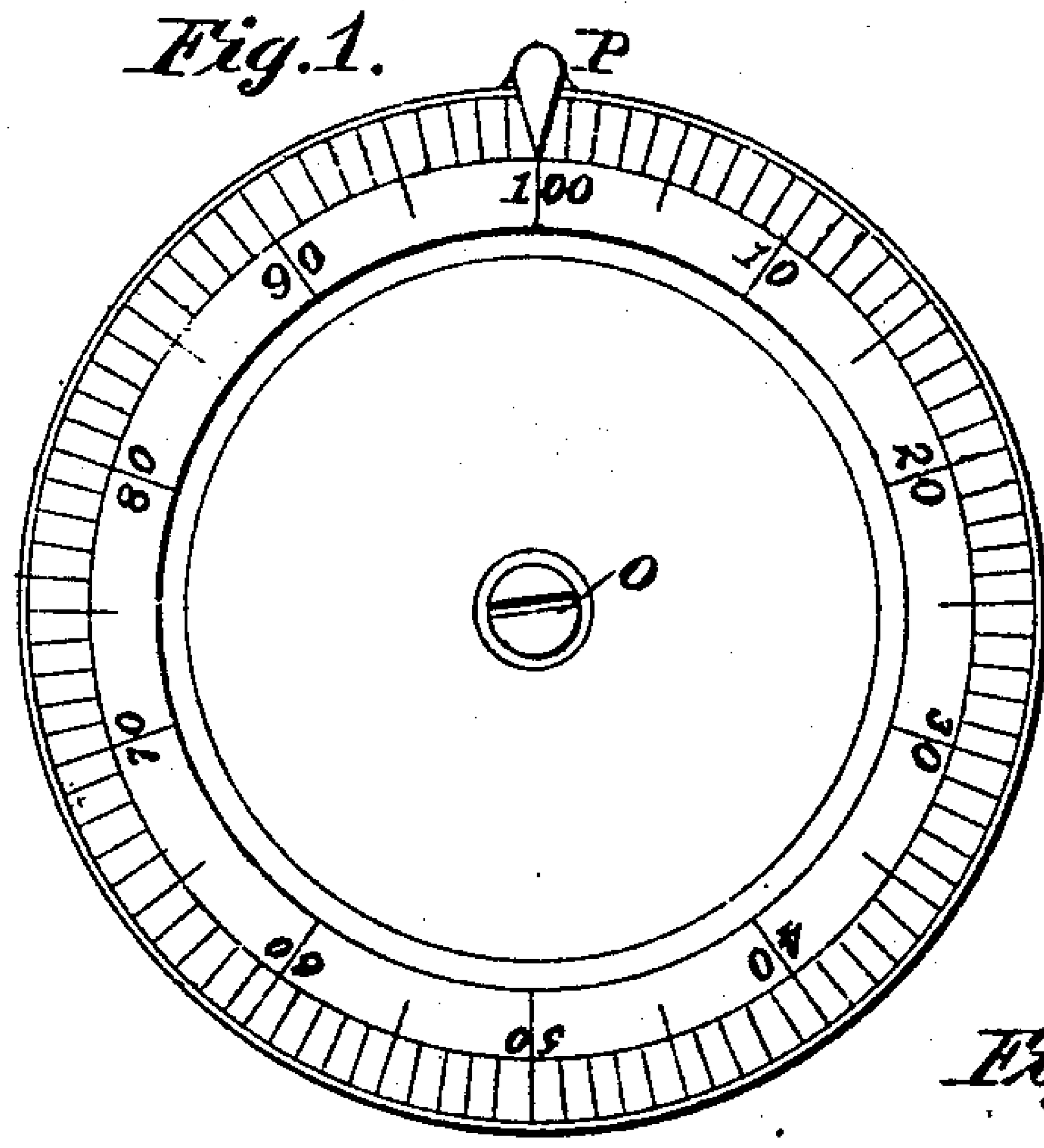


Fig. 2.

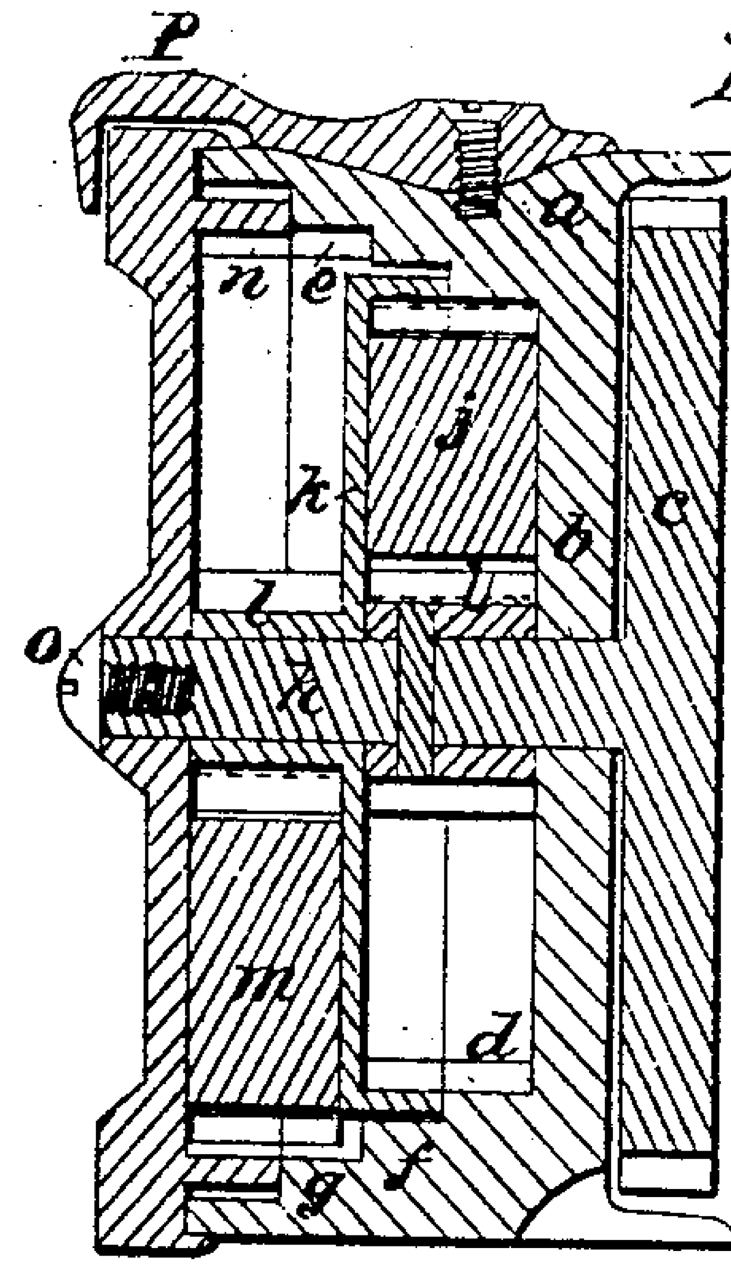


Fig. 4.

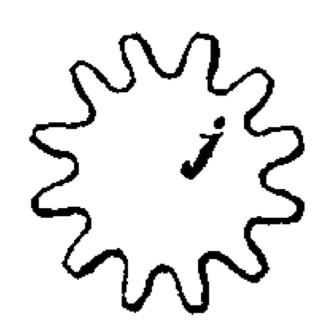


Fig. 3.

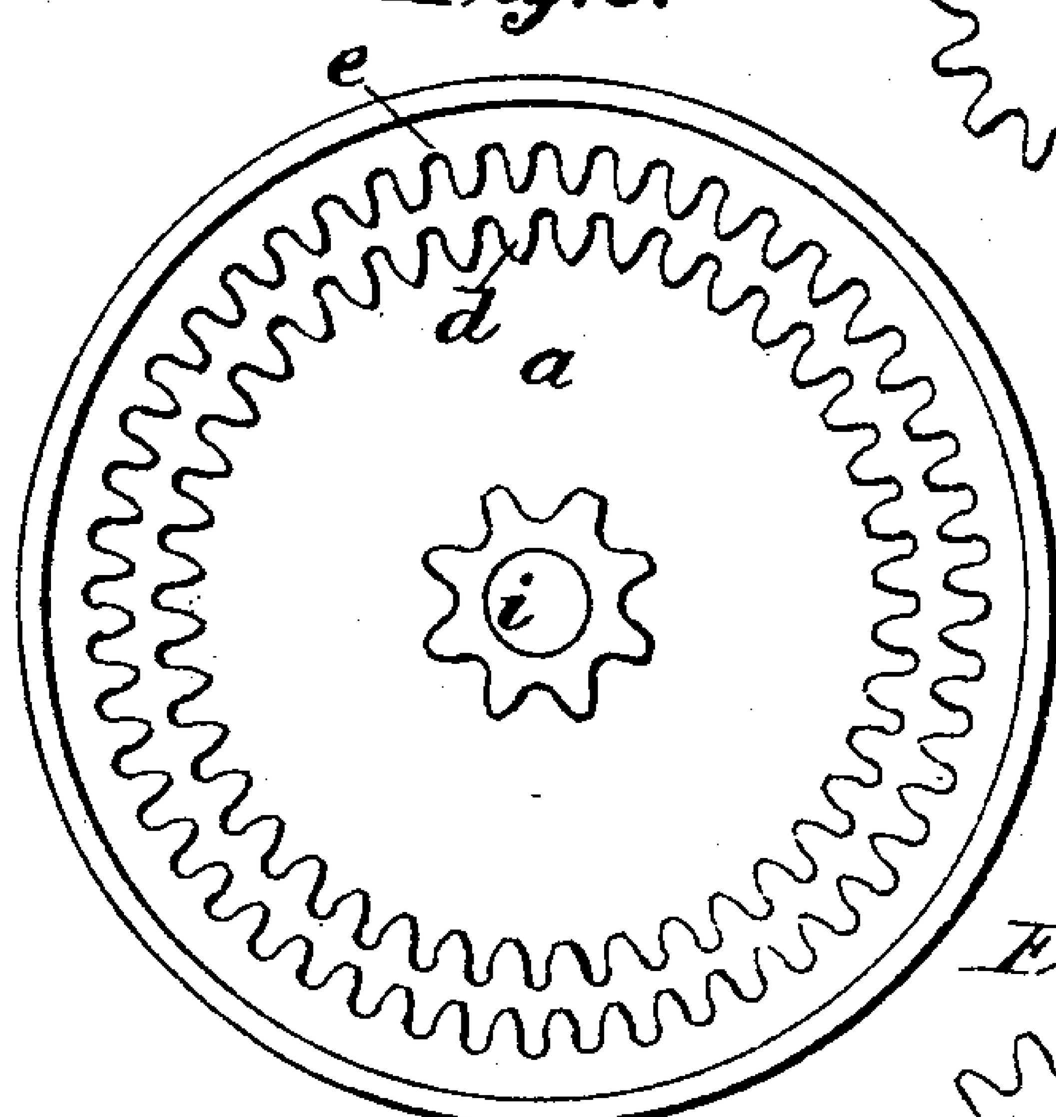


Fig. 5.

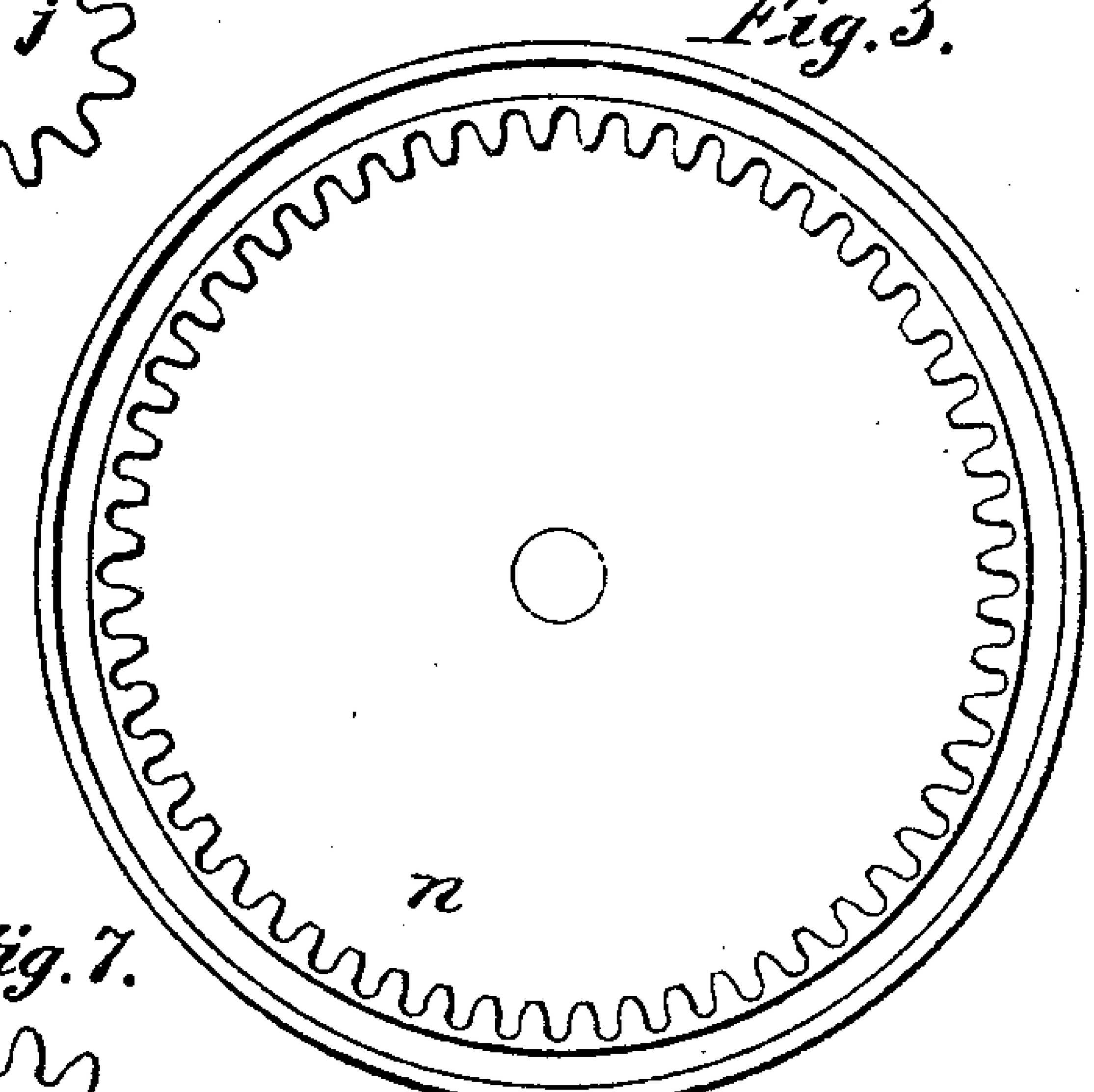


Fig. 7.

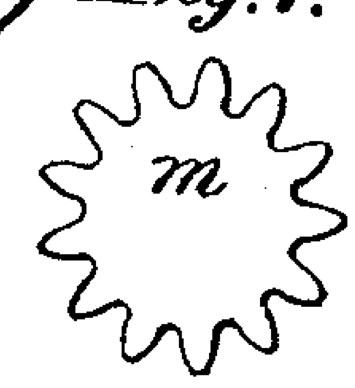


Fig. 6.

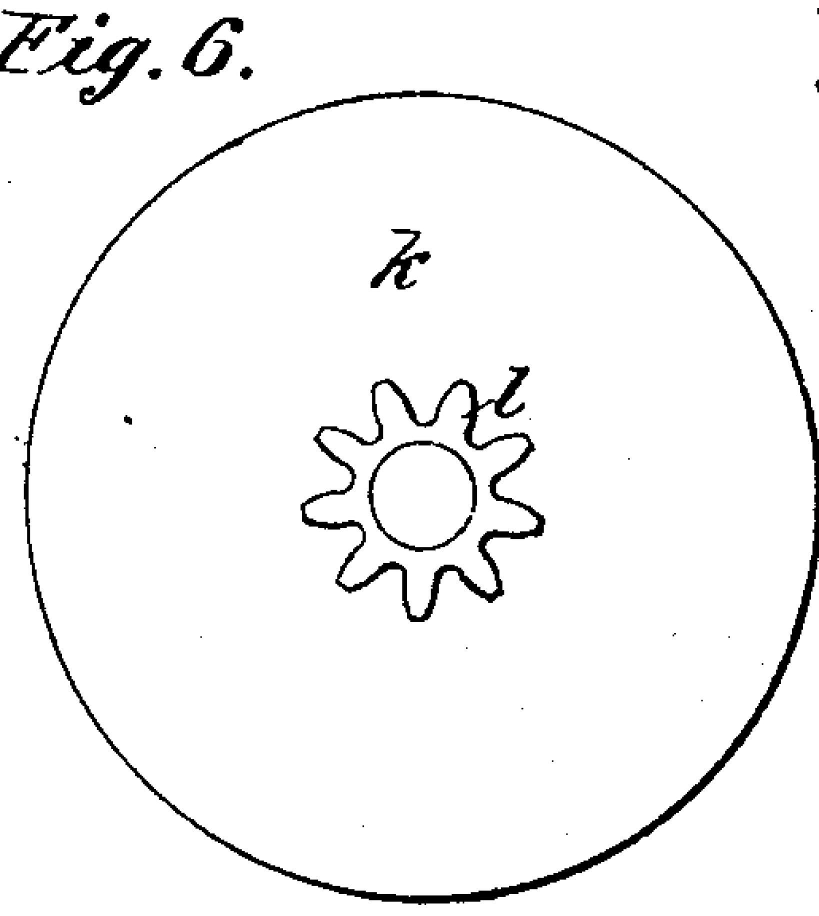
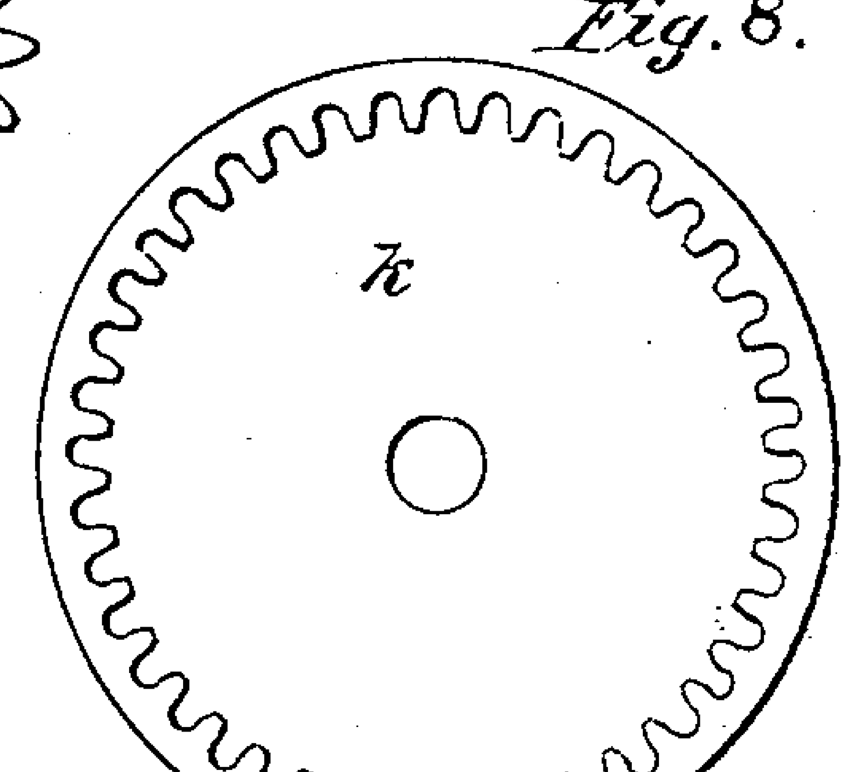


Fig. 8.



Witnesses:

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United States Patent Office.

GEORGE RICHARDSON, OF LOWELL, MASSACHUSETTS.

Letters Patent No. 75,196, *dated March* 3, 1868.

IMPROVEMENT IN MACHINE-CLOCKS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, GEORGE RICHARDSON, of Lowell, in the county of Middlesex, and State of Massachusetts, have invented new and useful Improvements in Machine-Clocks; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The nature of my invention consists in providing a machine-clock, with its entire mechanism enclosed in a case or shell, consisting of the requisite differential or reducing gears; the object of which is, when the motion from any given machine or vehicle is imparted to the clock, by a worm attached to the driving-shaft, it will at sight accurately indicate the amount of revolutions or work performed.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

Figure 1 represents a plan of my improved machine-clock.

Figure 2 represents a vertical section of the same.

Figure 3 represents a plan of the case or shell, with the pinion *i* and shaft *h* in position.

Figure 4 represents a plan of the travelling-gear *j*.

Figure 5 represents a plan of the under side of the dial-plate, showing the internal gear *n*.

Figure 6 represents a plan of the top of the internal revolving gear *k*, with its pinion *l*.

Figure 7 represents a plan of the travelling-gear *m*.

Figure 8 represents a plan of the internal revolving gear *k*.

In the different figures the same letters refer to identical parts.

a represents the case or shell, its outside being round, its inside being formed with a partition or division, *b*, sufficient above the bottom to receive and enclose the worm-gear *c* flush and even with the bottom. Above this partition *b*, and cast with the case *a*, are the internal gears *d* and *e*, also the projections *f* and *g*. Through the centre of this partition *b* a hole or bearing is made for the reception of the shaft *h*, to which the worm-gear *c* is cast on. The shaft *h* being placed in the bearing, the pinion *i* is placed on and over the shaft *h*, close down to the partition *b*, and firmly secured to the shaft *h*. The travelling-gear *j* is then placed down on to the partition *b*, its teeth connecting or gearing into the pinion *i* the full length of the teeth, and connecting or gearing into the stationary internal gear *d* one-half the length of teeth. The internal revolving gear *k*, with its pinion *l* attached, is then placed, with its finished bearing through its centre, over and on to the shaft *h*, the ends of the teeth resting on the stationary internal gear *d*, and connecting or gearing into the pinion *j*. The travelling-gear *m* is then placed on the upper or top surface of the plate of the internal gear *k*, its teeth gearing into and connecting with the pinion *l* the full length of the teeth, and with the stationary internal gear *e* one-half the length. The dial-plate being finished and marked off as desired on the one side, and finished bearing through the centre, on its under side is attached or cast on, the internal gear *n*, which is then placed over and on the shaft *h*, its teeth gearing into the travelling-gear *m*, and is held in its place by the screw *o*. On one side of the case *a* is attached the pointer or finger P. On its opposite side a recess, *q*, is cut into the case *a* sufficient for the reception of a worm or the first driver which intersects with the gear *c*. From the shaft to which the worm or first driver is attached motion is imparted. The clock being thus prepared and secured to the required machine, receiving its motion from a worm connecting with the worm-gear *c*, this imparts motion to the pinion *i*, which is fastened to the shaft *h*; this gives motion to the travelling-gear *j*, the gear *j* connecting with the internal revolving gear *k* and the internal stationary gear *d*. The gear *k* having one tooth more or less than the gear *d*, gains or moves one tooth only while the travelling-gear *j* is traversing the entire circumference of the gear *d*. This imparts reduced motion to the travelling-gear *m* from the pinion *l*, communicating with the internal dial-gear *n*, which dial-gear *n*, having one tooth, more or less, than the internal stationary gear *e*, the gear *m* has to traverse the entire circumference of the stationary gear *e* to gain or move the dial-gear *n* one tooth.

In order to illustrate the operation and results here obtained more clearly, I will proceed to explain. The worm-gear *c* to have sixty-three teeth, the pinion *i* eight teeth, the stationary internal gear *d* twenty-six teeth, the internal revolving gear *k* twenty-five teeth, the pinion *l* nine teeth, the stationary internal gear *e* thirty-three teeth, and the internal gear *n* thirty-two teeth. In order to ascertain the number of revolutions the pinion *i* makes in moving the gear *k* one tooth, by dividing the stationary gear *d* by the pinion *i* and adding the ratio of one tooth, that being the difference of teeth between the gears *k* and *d*. Then, by multiplying the number of revolutions that the pinion *i* makes in moving the gear *k* one tooth by the number of teeth in the gear *k*, that product will be the number of revolutions that the pinion *i* has to make while the gear *k* makes one; thus: $26 \div 8 = 3.25 + 1 = 4.25 \times 25 = 106.25$. Then, to ascertain the number of revolutions the pinion *l* will make while the revolving gear *n* is making one, the same rule is applied; thus: $33 \div 9 = 3.66 + 1 = 4.66 \times 32 = 149.12$. These two products multiplied into each other will give the number of revolutions the pinion *i* will make while the dial makes one; thus: $106.25 \times 149.12 = 15844.0000$. This product being multiplied by the number of teeth in the worm-gear *c*, will give the number of revolutions that the worm or worm-shaft makes while the dial makes one; thus: $15844.0000 \times 63 = 998172$.

I do not confine myself to any particular number of teeth the stationary gears *d* and *e* have, as similar results would be obtained if these gears *d* and *e* have an indefinite number of teeth, more or less than the revolving gears *k* and *l*. This augmented reduced motion being communicated to the dial, the pointer *p*, being fixed or stationary to the case *a*, accurately and positively indicates, by aid of the figures on the dial-face, at sight, the amount of revolutions or work performed at any given period of time. I prefer a stationary finger, P, fastened to the case *a*, for the reason the figures on the dial, passing under the finger P, are always exposed to the view of the observer in their natural position, although the same results can be accomplished by a stationary dial and a movable finger. By continuing and increasing the sets of gears, this principle of progressive reduction in speed can be carried out to such an extent that the revolutions of the worm or first driver may be almost infinite to one revolution of the dial.

What I claim as my invention, and desire to secure by Letters Patent, is—

The application of the stationary internal gears *d* and *e*, travelling-gears *j* and *n*, and pinions *i* and *l*, when arranged to operate substantially as described and for the purposes fully set forth.

GEORGE RICHARDSON.

Witnesses:

GEO. E. PEVEY,
ABIEL PEVEY.