H. F. & G. F. SHAW.

Pendulum-Scales.

No. 153,460. Patented July 28, 1874.

Fig. 1.

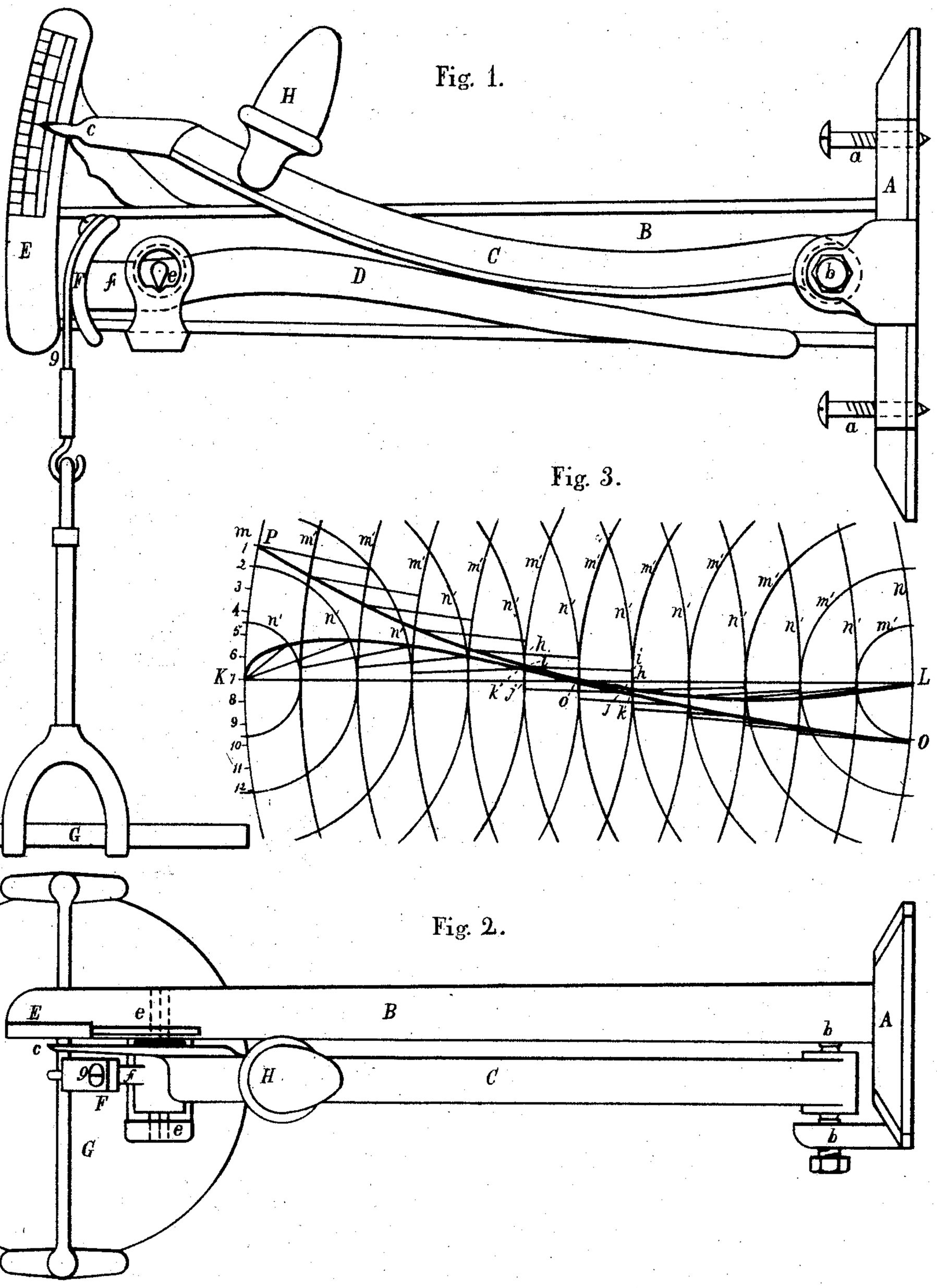

Fig. 3.

Fig. 2.

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UNITED STATES PATENT OFFICE.

HENRY F. SHAW AND GEORGE F. SHAW, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN PENDULUM-SCALES.

Specification forming part of Letters Patent No. **153,460**, dated July 28, 1874; application filed June 1, 1874.

To all whom it may concern:

Be it known that we, HENRY F. SHAW and GEORGE F. SHAW, of Boston, State of Massachusetts, have invented an Improvement in Balance-Scales, of which the following is a specification:

Our invention relates to balance-scales which have two curved bars or levers, each pivoted at one end, and the one lever resting upon the other. The object of the first part of our invention is to so form the surfaces, which bear against each other, of the two levers of such curves that, while the levers shall roll and not slide upon each other, the point of contact or bearing-point shall always be in a straight line, connecting the two centers at which the levers are pivoted, and also that said bearing-point shall pass through equal distances, while the indicator on one of the levers shall pass through equal spaces. The object of the second part of our invention is to hang the pan by a band, which shall pass over a segment connected with one of the levers, for the purpose of maintaining a constant leverage on that side of the pivot.

Figure 1 is an elevation, and Fig. 2 a plan, of a balance scale which illustrates our invention. Fig. 3 is to illustrate a geometrical demonstration of the construction of the necessary curves for the levers.

The form of scale shown is that of one to be fastened to an upright support, A being the plate to be held to such support, in any suitable manner, as by the screws *a a*. B is an arm for supporting the two levers C D and index-plate E, as shown. The lever C is pivoted at one end on the points at *b*, and carries at the other end the index-finger *c*. The index-plate E is marked off into suitable, but equal, spaces. The lever D is pivoted on a knife-edge at *e*, and has an extension, *f*, carrying the segment F. Fastened to this segment, as shown, is the band *g*, which sustains the pan G to contain the articles to be weighed. The weight H being fixed rigidly on the lever C at such point as may be suitable in the movement of this lever, the horizontal distance from the weight H to the center at *b* varies slightly. This variation may be compensated for by slightly changing the form of the segment F. Instead of the fixed weight H, a pan for carrying various weights, hung on a segment similar to F, might be attached to the lever C.

The manner of operation of these scales is obvious. The demonstration of the manner of forming the only curves to produce the effect hereinbefore set forth is as follows: Let K L be the centers of motion of the levers C D. We divide the straight line K L into any number of equal parts, and through the points of division and the centers K L we describe the arcs of circles *m m′ m′*, &c., and *n n′ n′*, &c. Having determined the distance through which we wish the index-finger to pass, we divide a suitable portion of the arc *m* into the same number of parts, equal to each other, as we did the line K L. It is convenient to regard the levers in contact at the middle *o* of the line K L; consequently equal portions of the arc *m*, above and below K, are taken. We then draw radiuses from the points of division 1, 2, 3–12 to the center L, and through the points of intersection of these radiuses with the arcs, in the order as shown, we draw the curve P L.

It will be readily seen that a curve constructed on the principle of P L is the only one which, swinging about end L as a center, will pass through equal spaces on arcs described from said center, while the point of contact with line K L passes through equal spaces. The curve P L is a spiral much used in machinery when an equable rectilinear is to be derived from an equable circular motion.

The curve O K is so constructed from the curve P L that the levers will keep their point of contact on the line K L, and that the levers will roll upon each other, but have no sliding contact. Supposing the point of contact to be at *o*, this will be one point for curve O K. To obtain another point we take the distance *h i* between two radiuses, and on the arc *m′* next to, and either right or left of, point *o*, and make the distance *j k* equal to it, the space *j k* being set off from the radius *o* K on the arc *n′*, adjacent to the arc *m′* taken, *k* being the desired point. Thus working above and below the line K L, we find points on the arcs *n n′ n′*, &c., through which to draw the curve O K, which points, supposing corresponding arcs of *m m′ m′*, &c., and *n n′ n′*, &c., to revolve

about their centers, and cross the line K L equal distances in equal times, would be points in the curve P L.

It will be noticed that the line O K, which is the form of the bearing-surface of lever D, is an ogee curve, while the line P L, which is the form of the bearing-surface of lever C, curves all in one direction.

We claim as our invention—

1. The levers C D, the nearer surface of C being convex, and that of D an ogee curve, arranged substantially as and for the purpose hereinbefore set forth.

2. The combination of the segment F, band *g*, and levers C and D, substantially as and for the purpose hereinbefore set forth.

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Witnesses:
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