

A. SPRINGER.  
MOLECULAR PIVOT BALANCE.

No. 340,012.

Patented Apr. 13, 1886.

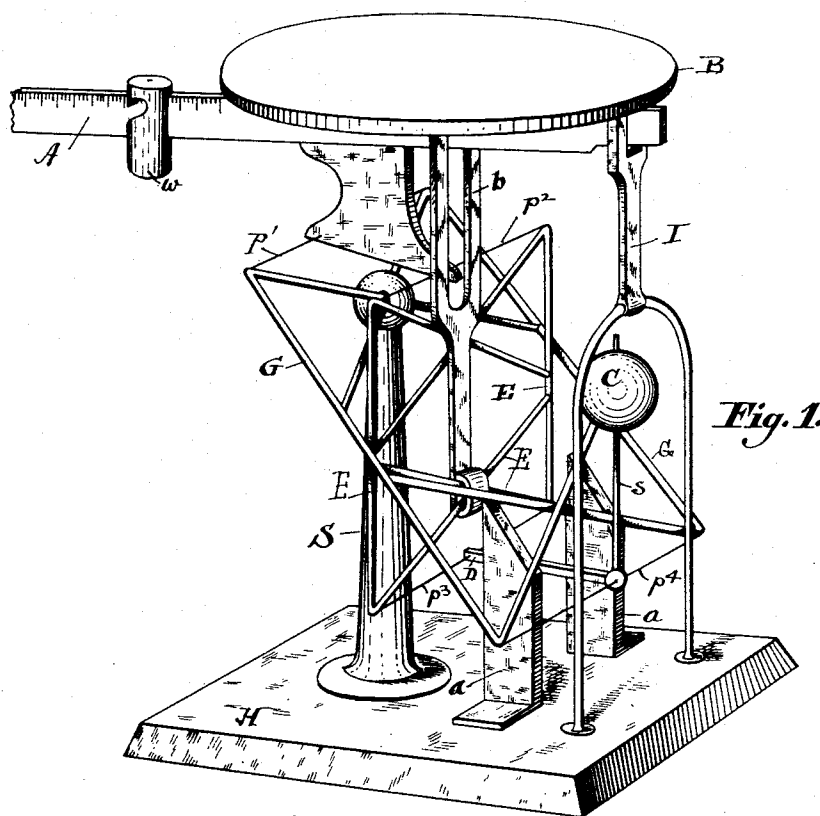


*Fig. 1.*

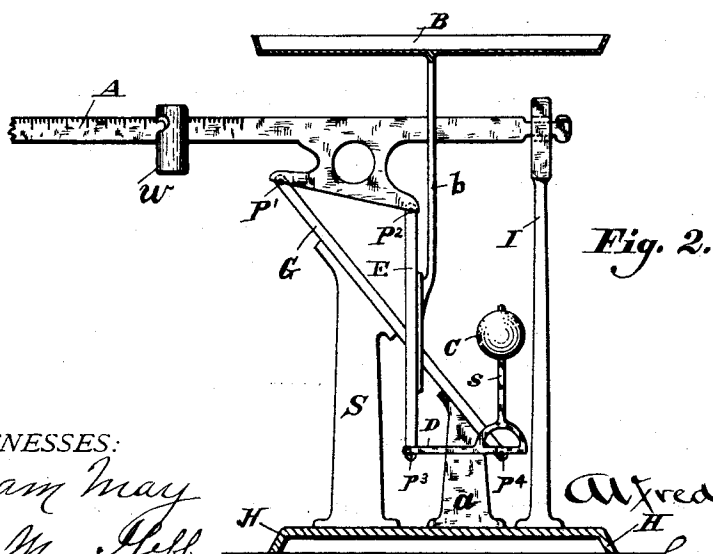


*Fig. 2.*

WITNESSES:

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INVENTOR

*Alfred Springer*

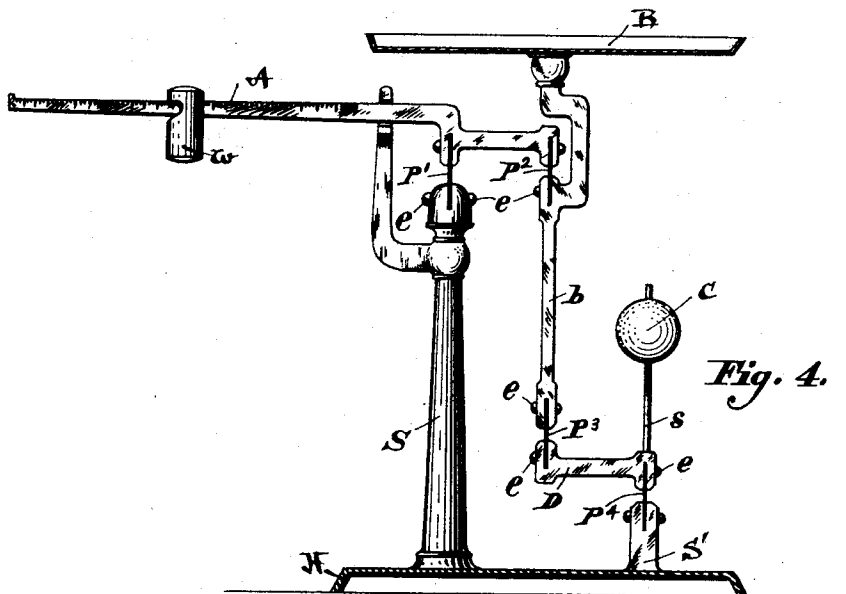
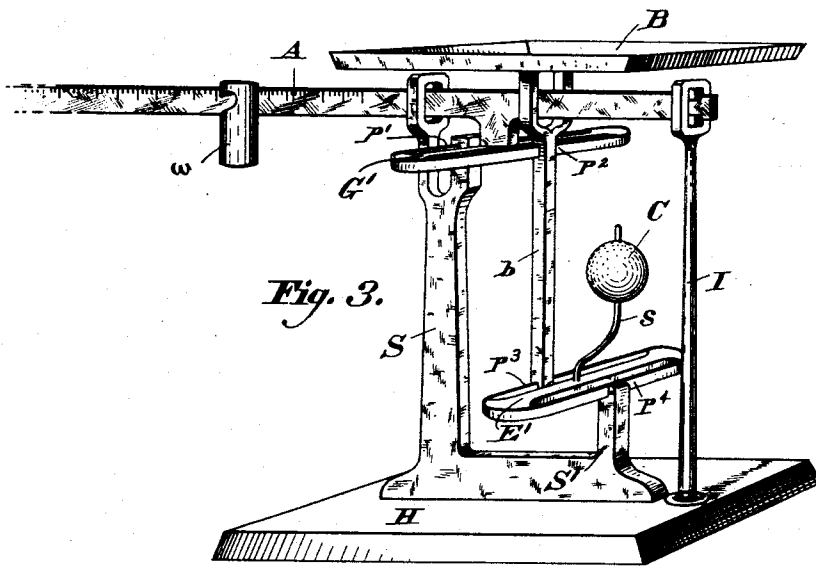
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# UNITED STATES PATENT OFFICE.

ALFRED SPRINGER, OF CINCINNATI, OHIO.

## MOLECULAR PIVOT-BALANCE.

SPECIFICATION forming part of Letters Patent No. 340,012, dated April 13, 1886.

Application filed June 12, 1885. Serial No. 163,450. (No model.)

*To all whom it may concern:*

Be it known that I, ALFRED SPRINGER, a citizen of the United States, residing at Cincinnati, Ohio, have invented new and useful Improvements in Molecular Pivot-Balances, of which the following is a specification.

My invention relates to molecular pivot-balances, its object being to produce in compact, convenient, and economical form a practicable weighing-balance adapted to ordinary commercial uses; and it consists in the construction of a molecular pivot-balance, as hereinafter pointed out and illustrated in the drawings, in which—

Figure 1 is a perspective view of a torsional pivot-balance embodying my invention. Fig. 2 is a side elevation of the same; Fig. 3, a perspective view of a torsional balance slightly differing in form, but embodying the same principles, and Fig. 4 a side elevation of a flexion-balance embodying the same principles of construction.

My present invention is the outgrowth of the fact that in all molecular pivot-balances wherein a counterpoise is employed to counterbalance the molecular resistance of the pivots the difficulty of maintaining the true horizontal position of the scale structure is a serious impediment to the ordinary and practical use of such balances.

My invention is designed to embody a principle of construction by which this difficulty is overcome, and certain other advantages relating to compactness, cheapness, and utility also obtained.

To this end it consists in a weighing-balance embodying two oscillating beams, whose proximate ends, provided with elastic pivots, oscillate in opposite arcs in a common vertical plane, said beams having independent fulcrums at different elevations and respectively below the centers of gravity of the beams, and a rigid connection between such elastic pivots, carrying the weight-receptacle.

Referring now to the drawings, A designates the scale-beam; B, the scale-pan; S, the main supporting-standard; C, the auxiliary poise; s, the standard upon which said poise is supported; D, the auxiliary beam or lever-arm, to which said standard s is rigidly attached, and E a rigid connection between the terminal

pivot  $p^2$  of the beam A and the terminal pivot  $p^3$  of the auxiliary arm D.

In the construction shown in Figs. 1 and 2 of the drawings, I have shown the "torsion-frame" heretofore described in patents granted to the late Dr. F. A. Roeder and myself, consisting, essentially, of a system of diagonal braces, around which the torsional pivot, consisting of a wire or band of metal, is stretched. In said figures one of such frames, G, constructed double, is attached to and supported in an inclined position, as shown, upon the main supporting-standard S and smaller supports  $a$ , both upon the base-frame H. A single wire or band being stretched around said frame, or upon a boxing inclosing the lower working parts, its upper horizontal portion constitutes the fulcrum-pivot  $p'$  for the beam A, while its lower horizontal portion constitutes the fulcrum-pivot  $p^1$  of the auxiliary beam or lever-arm D. In this case the rigid connection E is also one of such torsion-frames, which has a single wire or band stretched upon it, the upper horizontal portion constituting the terminal pivot  $p^2$  of the scale-beam A, and its lower horizontal portion constituting the terminal pivot  $p^3$  of the auxiliary beam or lever D. The torsion-frame E is made small enough to play inside of the torsion-frame G, and the scale-pan B is rigidly connected with the torsion-frame E by the standard  $b$ , rising therefrom and bifurcated to permit the passage and play of the forward extension of the scale-beam, which in this case is carried forward and passed through a suitable yoke, I, to limit the oscillations of the beam. Incidentally said yoke serves as a protection to the other parts from injury. The auxiliary beam or lever-arm D and its standard s constitutes, in effect, a bell-crank lever, as will be seen, the horizontal portion of which performs the function of a radius-arm to preserve the perpendicularity of the scale-pan support.

In the cases illustrated in the present drawings the fulcrum-connection of the beam is below the longitudinal axis of the beam. The beam, therefore, is its own counterpoise as against molecular resistance of the pivots. It is found desirable, also, that the terminal pivot  $p^2$  of the beam should be arranged in a

lower plane than the fulcrum-pivot  $p'$ . As thus constructed, it will be seen more clearly by reference to Fig. 2, that if the scale structure rests upon an uneven basis, the statical moment of the beam counterpoise is counteracted by the statical moment of the auxiliary poise C, so that in whatever position the scale is placed its beam action remains unimpaired.

The structure shown in Fig. 3, while differing slightly in form, involves no change in principle of construction. In such case the two torsion-frames are arranged horizontally, the upper one, G', being attached to and constituting part of the beam A, one of its wires or bands constituting the fulcrum-pivot  $p'$  of the beam, the other the terminal pivot  $p^2$  of the beam. The lower torsion-frame, E', constitutes the auxiliary beam or lever. (Marked D in Figs. 1, 2, and 4.) It carries the standard S and the auxiliary poise C and performs all the functions of the auxiliary beam or lever D. In this case the standard  $b$ , supporting the scale-pan B, is extended downward and forms a rigid connection between the pivots  $p^2$  and  $p^3$ , the pivot  $p^4$  being rigidly secured to a supplemental standard, S', rising from the base H. In short, the changes of structure are only such as result from attaching the pivots directly to the beam instead of to separate torsion-frames, as in Figs. 1 and 2, this change being already fully described in pending applications for Letters Patent.

Fig. 4 exhibits the same structure as shown in Fig. 3, excepting the substitution of 'flexion-pivots' for 'torsion-pivots.' In this case the flexion-pivots, consisting of thin metal plates, are preferably disposed vertically in a plane transverse to the longitudinal axis of the beam. The connection or fastening of said plates to the parts is made by inserting the same in suitable slits formed therein and clamping by set screws  $e$ .

The description heretofore given of the relative arrangement of the parts applies, and to avoid unnecessary repetition is not given here.

In all these cases it will be seen that the ac-

tion of weight upon the scale-pan is transmitted to the standard  $b$  and pulls downward upon the pivot  $p^2$ . The auxiliary beam or lever D being depressed, the poise C is thrown to the left, and its statical moment opposes the molecular resistance of the pivots as does also the center of mass of the beam. The sliding weight  $w$  may be used or a suspended weight-pan, as in other cases, to indicate the mass weighed.

I claim as my invention and desire to secure by Letters Patent of the United States—

1. In a weighing-balance, the combination of two beams having independent fulcra below their respective centers of gravity, and arranged in a common vertical plane at different elevations; so that their proximate ends oscillate in opposite vertical arcs, in combination with elastic pivots secured to the said proximate beam ends, and a rigid connection between said pivots carrying the weight-platform, substantially as set forth.

2. In a molecular pivot weighing-balance, the combination of a steelyard balance-beam fulcrumed below its center of gravity, a radius-arm fulcrumed below and in the vertical plane of the balance-beam in such relation that it oscillates in an arc opposite to that of the pivot end of the balance beam, an oscillating poise-weight carried by said radius-arm vertically above its fulcrum, and a pan support rigidly connecting the terminal pivots of the radius-arm and balance-beam, substantially as set forth.

3. The combination, in a weighing-balance, of a weight-beam, A, auxiliary beam D, elastic pivots  $p'$   $p^2$   $p^3$   $p^4$ , rigid connecting-link  $b$ , a weight-pan, standard S, and weight C, arranged and operating substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ALFRED SPRINGER.

Witnesses:

L. M. HOSEA,  
ABRAM MAY.