No. 849,418. PATENTED APR. 9, 1907.

W. E. NICKERSON.

FLEXIBLE SUSPENSION.

APPLICATION FILED AUG. 14, 1906.

Fig. 1.

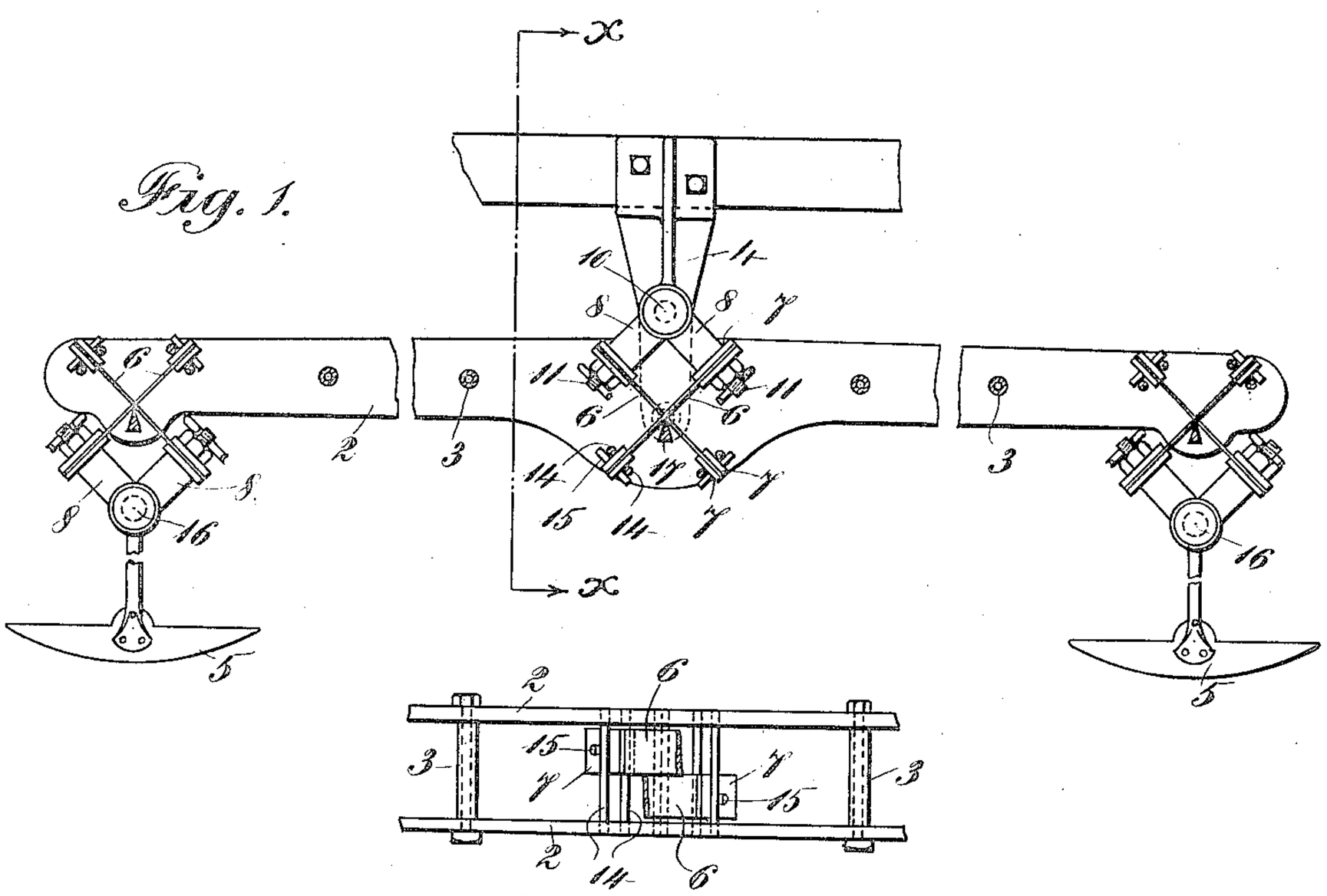

Fig. 2.

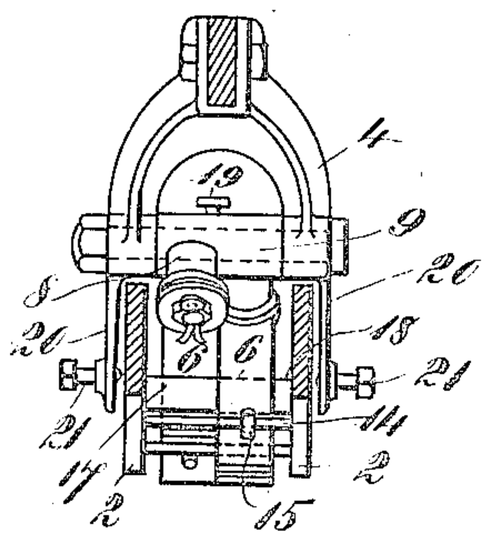

Fig. 3.

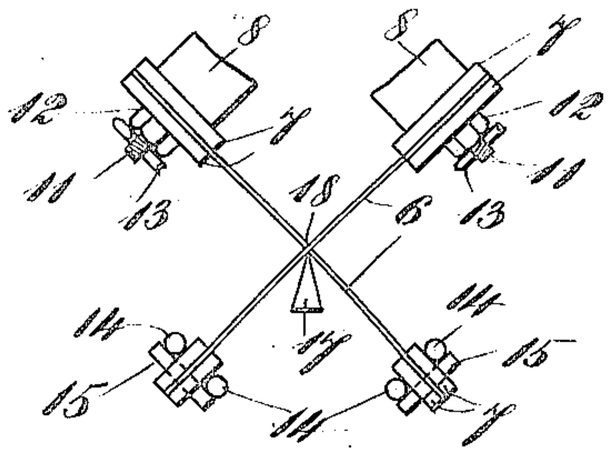

Fig. 4.

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UNITED STATES PATENT OFFICE.

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FLEXIBLE SUSPENSION.

No. 849,418. Specification of Letters Patent. Patented April 9, 1907.

Application filed August 14, 1906. Serial No. 330,567.

To all whom it may concern:

Be it known that I, WILLIAM E. NICKERSON, a citizen of the United States, and a resident of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Flexible Suspensions, of which the following is a specification.

My invention is intended to provide an arrangement for suspending a scale-beam from its support or a scale-pan, weighing-bucket, weighing-weight, or the like from a scale-beam, which will take the place of the knife-edge suspension commonly employed heretofore and will be free from the disadvantages attendant upon the use of such knife-edge suspensions—such, for example, as result from wear, rubbing friction, liability to displacement, and clogging with accumulated dust and dirt.

My improved suspension, briefly described, comprises two or more flexible strips or laminæ, each connected at one end to the scale-beam and at its other end to the part which supports or is supported by said beam, said strips being crossed at a substantial angle between their points of attachment and arranged edgewise at the point of crossing—*i. e.*, in planes which intersect in a line perpendicular to the plane of movement of the beam. Thus the supporting and supported members are not only connected, but also made capable of a relative turning movement in the latter plane by reason of the flexibility of the strips, other movements being prevented by the rigidity of the strips in the directions of their length and width, and the axis of the said turning movement is confined to the point of crossing of the strips, preferably by means of an additional part hereinafter described.

My suspension is particularly adapted for use in automatic weighing apparatus, the parts of which are subjected in use to more or less shock or jar and are covered sooner or later with accumulated particles of the material handled; but it may be applied to any kind or type of scale-beam and, in fact, to many other kinds of apparatus in which a pivotal movement has to be provided for, being herein illustrated and described as applied to a scale-beam of elementary form having arms of equal lengths and carrying similar scale-pans at its ends.

In the accompanying drawings, Figure 1 is a side elevation of a scale-beam and scale-pans embodying my improvements in their preferred form, one of the side bars of the scale-beam being removed in order to illustrate the construction more clearly. Fig. 2 is a plan view of the central portion of the beam, the suspension-strips being shown in transverse section. Fig. 3 is a section on the line *x x* in Fig. 1 looking toward the right, and Fig. 4 is a detached view of the suspension proper on an enlarged scale.

In the drawings, the scale-beam is shown as composed of two side bars 2, connected and spaced apart by means of tie-rods 3 and as suspended at its center from a fixed support 4 by means of my suspension. This beam carries at each end a scale-pan 5, also connected with the beam by means of my suspension.

Referring first to the connection between the beam and the support 4, the numerals 6 6 designate two similar flexible and elastic strips usually made of thin spring-steel, each strip being connected at its upper end with the support 4 and at its lower end with the scale-beam and having its width perpendicular to the plane in which the beam is designed to turn. Said strips are located between the side bars 2 and are crossed between their ends, being thus brought close together and arranged edge to edge at the point of crossing, and their attached ends are preferably strengthened, as by riveting small metallic plates 7 to the opposite sides thereof. The upper ends of said strips are shown as clamped, respectively, to the flat outer ends of two arms 8 8, extending downwardly from a collar 9, which is carried by a pin 10, projecting laterally from the support 4, said arms 8 being located at different points on the collar 9 with respect to its length, so as to provide for the crossing of the strips 6 in edgewise relation, as described, and the flat ends of said arms are made to form the same angle with each other as do the strips themselves, which is preferably a right angle. In order to secure the strips 6 to said flat ends, each of the latter may be provided with a pin 11, adapted to pass through a perforation in the upper end of the corresponding strip and provided with a nut 12, between which and said arm the strip may thus be clamped tightly.

13 13 represent cotter-pins passed, respectively, through the ends of the pins 11 to prevent the nuts 12 from becoming unscrewed after they have been set up. The lower ends of the strips 6 are secured to the beam, according to the construction shown in Figs. 1 to 4, inclusive, by passing the stiffened lower end of each strip between two parallel rods 14, extending horizontally from one of the side bars 2 to the other and located in the proper position to receive said strip, and then inserting a pin 15 through the end of the strip beneath said rods 14 in position to engage the same on both sides of the strip. The connection between each end of the beam and the corresponding scale-pan is constructed in a precisely similar manner, except that the upper ends of the strips 6 carry the pins 15, which are thus supported by the rods 14, and their lower ends are clamped to the ends of the arms 8 8 of the collar 9, which collar is inverted so that its arms point upwardly instead of downwardly and receives a pin 16, carried by the hanger of the corresponding scale-pan 5.

In order to locate with exactness the fulcrum-axis of each suspension, I prefer to provide a bar 17, extending from side to side of the beam and located in the lowermost quadrant formed by the crossed strips 6, said bar having inclined sides forming with each other a less angle than that formed by the strips 6 and intersecting to form a sharp edge 18 at the point of crossing of said strips. This bar is preferably so arranged as to cause each strip to bow upward slightly, as shown in Fig. 4, so that contact between each strip and the upper edge of said bar is always assured.

The bars 17 are so located that the edge 18 of the bar at the center of the beam is slightly above a straight line joining the edges 18 of the other bars, just as with the usual knife-edge suspension, the elevation of the central edge 18 being greater or less, according to the intended stability of the beam, and after the parts are assembled, as above described, they are allowed to come to rest in their normal position, and each collar 9 is then locked to the pin 10, which it contains, as by means of a set-screw 19, Fig. 2. All turning movements except such as result from the flexibility of the strips 6 are thus prevented. As thus constructed the weight of the suspended part or parts is supported by and divided between the crossed strips 6, and while either strip by itself could bend at any point in its length between its stiffened ends, and thus provide for a turning movement of the suspended member about a variety of axes, both coincident and non-coincident with the width of the strip, yet the only axis coincident with the width of both strips about which said turning movement can occur is the one defined by their point of intersection. No other movement could occur without resulting in a bodily displacement of the bar 17, and as such displacement is effectively prevented by the engagement of the edge 18 of said bar with both of the strips 6, acting in conjunction with the tension of said strips and the weight of the suspended parts, the result is that the fulcrum-axis of the suspension is accurately limited to the point of crossing of the flexible strips. Any tendency to lateral movement of the suspended member is resisted by the rigidity of the strips 6 against edgewise movement; but as a further precaution against such lateral movement the construction best shown in Fig. 2 may be employed, in which are shown two fingers 20, carried by and projecting downward from the support 4, one on each side of the scale-beam, to a point opposite the axis of turning of the beam and provided exactly opposite said axis with fine-pointed screws 21, which are adjusted so that they are normally just out of contact with the side bars 2 of the beam, thus limiting any possible lateral play of the latter in an obvious manner. It will be evident that the bar 17 in any one of the suspensions may be located in either the upper or the lower quadrant formed by the crossed strips; but it is best located in the lower quadrant, as shown, so as to present its sharp edge uppermost and prevent the accumulation of dust and dirt upon it.

It is to be understood that the constructional details herein described may be greatly modified without departing from my invention, particularly in respect to the number of flexible strips employed and the manner in which they are connected with the supporting members.

I claim as my invention—

1. In a flexible suspension, the combination with supporting and supported members, of flexible strips connected at their ends with said members respectively and crossed in edgewise relation between their ends and means for confining the bending of said strips to a predetermined axis.

2. In a flexible suspension, the combination with supporting and supported members of flexible strips connected at their ends with said members respectively and crossed in edgewise relation between their ends, and means for locating the fulcrum-axis of the suspension at the point of crossing of said strips.

3. In a flexible suspension, the combination with supporting and supported members of flexible strips connected at their ends with said members respectively and crossed in edgewise relation between their ends, and forming substantially a right angle with each other at the point of crossing.

4. In a flexible suspension, the combination with supporting and supported members of flexible strips connected at their ends with said members respectively and crossed in

edgewise relation between their ends, and a bar having a sharp edge in contact with said strips at their point of crossing.

5. In a flexible suspension, the combination with supporting and supported members of flexible strips connected at their ends with said members respectively and crossed in edgewise relation between their ends, and a bar having a sharp edge in contact with said strips in their point of crossing, said strips being bowed slightly away from said bar.

6. In a flexible suspension, the combination with supporting and supported members of flexible strips connected at their ends with said members respectively and crossed in edgewise relation between their ends, and means for limiting lateral play of said members with respect to each other.

7. In a flexible suspension, the combination with supporting and supported members of flexible strips connected at their ends with said members respectively and crossed in edgewise relation between their ends, a bar having a sharp edge in contact with said strips at their point of crossing, and arms carried by the supporting member and having bearing-points located on opposite edges of and adjacent to the supported member and in line with the sharp edge of said bar.

8. The combination with a scale-beam of a collar comprising divergent arms having flat outer ends forming an angle with each other, flexible strips each secured at one end to one of said flat ends, said strips being crossed in edgewise relation between their ends, and connections between the other ends of said strips and said beam.

9. The combination with a scale-beam of a collar comprising divergent arms having flat outer ends forming an angle with each other, flexible strips each secured at one end to one of said flat ends, said strips being crossed in edgewise relation between their ends, connections between the other ends of said strips and said beam, and a bar carried by said beam and having a sharp edge in contact with said strips at their point of crossing.

10. The combination with a scale-beam comprising two side bars spaced apart, of a coöperating member in suspensional relation with said scale-beam, and a suspension connecting said beam and member and comprising flexible strips each secured at one end to said coöperating member and its other end to said beam, said strips being located between said side bars and crossed in edgewise relation between their ends.

11. The combination with a scale-beam provided with horizontal cross-rods arranged in pairs, of a coöperating member in suspensional relation with said scale-beam, and a suspension connecting said beam and member comprising flexible strips having reinforced ends and each secured at one end to said coöperating member and provided at its other end with a transverse pin engaging a pair of said cross-rods, said strips being crossed in edgewise relation between their ends, and a bar located in one of the angles formed by the crossing of said strips and having a sharp edge in contact with the latter at their point of crossing.

12. The combination with a scale-beam comprising two side bars spaced apart and provided with horizontal cross-rods arranged in pairs, of a coöperating member in suspensional relation with said scale-beam, and a suspension connecting said beam and member and comprising flexible strips each secured at one end to said coöperating member and provided at its other end with a transverse pin engaging a pair of said cross-rods, said strips being located between said side bars and crossed in edgewise relation between their ends, and a bar located between said side bars and in one of the angles formed by the crossing of said strips, said bar having a sharp edge in contact with said strips at their point of crossing.

In testimony whereof I have hereunto subscribed my name this 8th day of August, 1906.

WILLIAM E. NICKERSON.

Witnesses:
E. D. CHADWICK,
OLIVER MITCHELL.