PATENT SPECIFICATION

377,514

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COMPLETE SPECIFICATION.

Improvements in Planimeters.

I, LESLIE HAYWOOD HOUNSFIELD, 3, Durrington Park Road, Wimbledon, London, S.W. 20, British, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to planimeters and has particular reference to that type of instrument used for measuring the areas of figures or spaces on drawings, plans, maps, graphs, etc., enclosed by boundary lines.

The object of this invention is to provide an instrument which though cheap to produce, easy to manipulate and not readily de-ranged will give results sufficiently accurate for most purposes.

The invention relates more particularly to planimeters of the type known as "hatchet." Planimeters wherein the shaft or stem of each instrument has at one end a point which is caused to follow the boundary of the area to be measured and at the other end of the shaft a hatchet-like edge or a wheel hereinafter called the blade which permits movement over the paper freely in the direction of its edge but resists movement in any other direction.

As the point is in the same plane as the blade, movements of the latter are limited to the direction of the line joining the blade and the point towards and away from the point.

The plane of the area to be measured must be arranged substantially horizontally.

According to this invention means are provided which prevent the instrument from leaning sideways and which prevent the operator from imposing any force acting sideways on the blade which might constrain it to leave its proper direction of travel.

This is effected by the provision of gimbals or the equivalent between the tracing point and the stem the centre of the said gimbals being maintained in the same vertical axis as the tracing point.

Means are also provided which enable the paper to be punctured with a needle point at the beginning and at the end of the operation of making a measurement. The distance apart of these points can be measured more accurately than the distance apart of two lines or grooves, made by the blade which lines are at an angle to one another.

In the accompanying drawings Fig. I represents an elevation of one form of the instrument and Fig. II represents a plan.

Fig. III is an enlarged section of the blade end and Fig. IV represents a transverse section through Fig. III viewed in the direction of the arrow 12.

The following description indicates one way only of carrying out this invention and in this description the same numbering applies to all the figures.

An open-work frame 1 with a smooth flat ring-shaped base can slide freely over the paper, this frame carries a pointer 2, the point of which just clears the paper. 3 is a universal joint or gimbal mechanism or the equivalent which allows the shaft 4 to move freely sideways and up and down but prevents rotation which would cause the blade to lean.

At the other end of the shaft 4 is the blade 5 which is pressed on the paper by the weight 6, a push 7 is connected to a needle 8 the point of which is normally held just clear of the paper by the spring 9.

In Figs. III and IV it will be seen that the blade is flat one side and bevelled the other, similarly the needle is made of half round material i.e. semi-circular in section right to the point.

In this way the needle point and the blade practically coincide. As Fig. III is a mid-section the needle 8 should not appear—strictly speaking—in this view.

The gimbal member 3 consists preferably of a thin ring of springy material with four small holes drilled at right angles to one another in a plane at right angles to the axis of the ring.

This construction enables all the four points or centres of the joint to be adjusted to their proper tension and free from shake by screwing one point or centre in or out by the screw 10 which can be locked with the nut 11.

The method of operation is as follows:—

Presuming that the paper containing the area to be measured is secured to the drawing board in the ordinary manner, the centre of gravity of the area is estimated and a line is drawn from this point to a boundary line of the figure.

The point of the pointer 2 is started at this estimated centre of gravity with the blade 5 resting on a smooth piece of paper —such hard surfaces as glass or surfaces of varying hardness such as wood are unsuitable—and the push 7 is depressed.

The frame 1 is then moved so that the pointer travels along the line to the boundary, all round the boundary and back along the line to the starting point when the push 7 is again depressed.

The distance apart of the two punctures thus made, when multiplied by a suitable constant, gives the area of the figure.

As the point of the pointer 2 is held just clear of the paper by the frame 1 it can be quite sharp instead of being ball pointed as is usual.

Instead of an actual pointer a spot or " crosslines " may be marked on a celluloid or transparent base in the same vertical axis as the gimbal joint or pivots.

If the outside of the base is circular and concentric with the tracing point or spot, then the latter may be caused to move in a straight line where required by moving the frame in contact with a straight edge and similarly the point may be caused to move in a predetermined curve if the frame is moved in contact with a suitably curved edge.

The foregoing description is by way of example only and it will be obvious that details may be varied in accordance with various well known methods, also the length of the stem 4 may be either adjustable to any length within limits or may be capable of being set to two or more definite positions for specific purposes.

For example if the virtual length is 4 inches then, a distance apart of the dots puncturing the paper of $\frac{1}{4}$ inch will denote an area of 1 square inch and if the virtual length is reduced to 10 centimetres then a distance apart of the dots of 1 millimetre will indicate an area of 1 square centimetre.

Having now particularly described and ascertained the nature of my said Invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. In " hatchet " Planimeters the provision of gimbals or the equivalent between the tracing point and the stem so as to eliminate the possibility of imposing side forces on the blade, while not affecting the constant vertical force due to the loading of the blade the centre of the said gimbals being maintained in the same vertical axis as the tracing point.

II. In " hatchet " Planimeters the provision of a frame for carrying the pointer, the base of the frame being sufficiently large to enable the frame to be moved about freely over a plane surface without altering the angle of the pointer, the stem being connected to this frame by means of gimbals or the equivalent substantially as described and in such a manner that the frame can be moved about over a plane surface without any inclination and without any side force being transmitted to the blade end.

III. In Planimeters as claimed in Claim I or II the provision of a black spot or of " cross-lines " on a celluloid or transparent base to the frame instead of an ordinary needle-pointer.

IV. In Planimeters as claimed in Claim II, making the outside of the base of the frame circular and concentric with the pointer, to enable the frame to be held against and moved along straight or curved edges where the figure is partly or wholly bounded by straight lines or lines of known curvature.

V. In Planimeters as claimed in Claim I or II, the provision of a gimbal ring of flexible or springy material so that a single adjusting screw may be used to adjust all the pivot bearings of the gimbal joint simultaneously.

VI. In Planimeters as claimed above the provision of a needle closely adjacent to the blade where the latter contacts with the surface on which it slides or skates, the said needle being held clear of the surface but capable of being depressed so as to mark the surface at the beginning and at the end of each tracing operation.

VII. In Planimeters as claimed in Claim VI the provision of a blade which is bevelled on one side only against the flat side of which moves the flat side of a needle which is semi-circular in section, so that the point of the needle is practically coincident with the blade.

VIII. In Planimeters as claimed above means for setting the length of the stem to two or more predetermined positions, so that the instrument may give results suitable for more than one unit of dimension, such for instance as inches and centimetres.

IX. Planimeters substantially as described with reference to the accompanying drawings.

Dated the 28th day of October, 1931.

LESLIE H. HOUNSFIELD.

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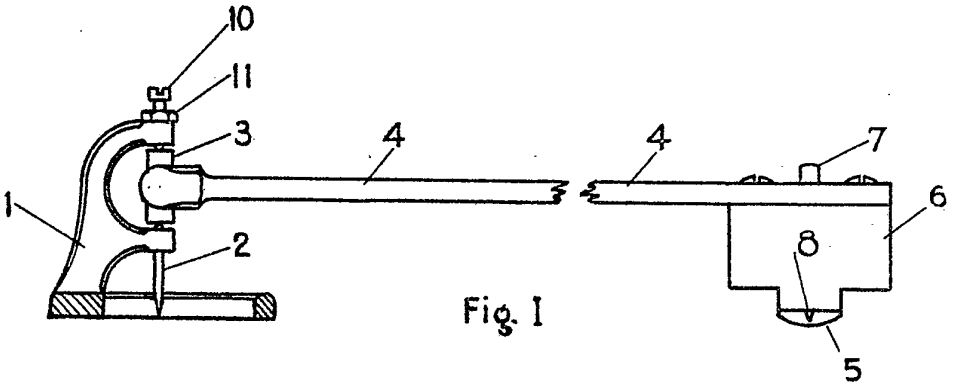

Fig. I

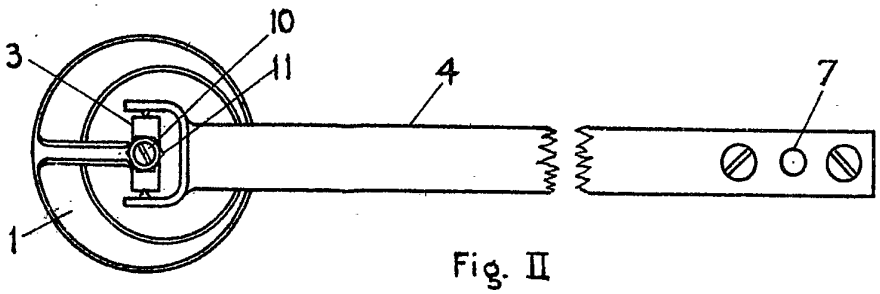

Fig. II

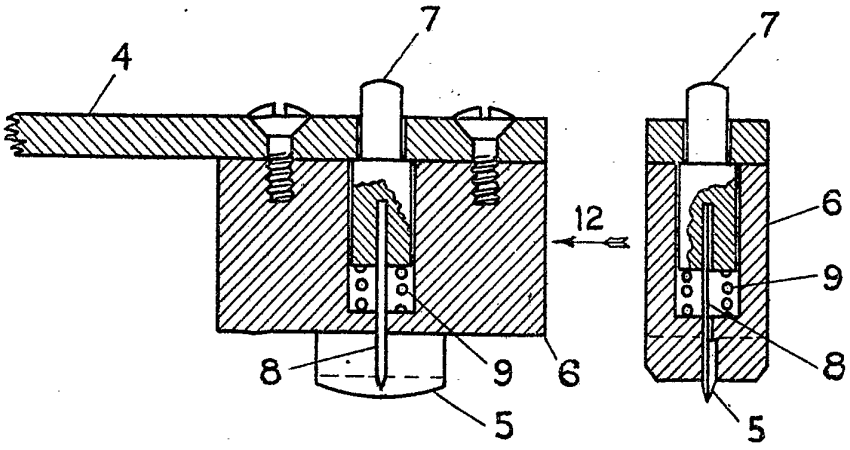

Fig. III Fig. IV

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