No. 718,166. PATENTED JAN. 13, 1903.

L. T. SNOW.

PLANIMETER.

APPLICATION FILED AUG. 18, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

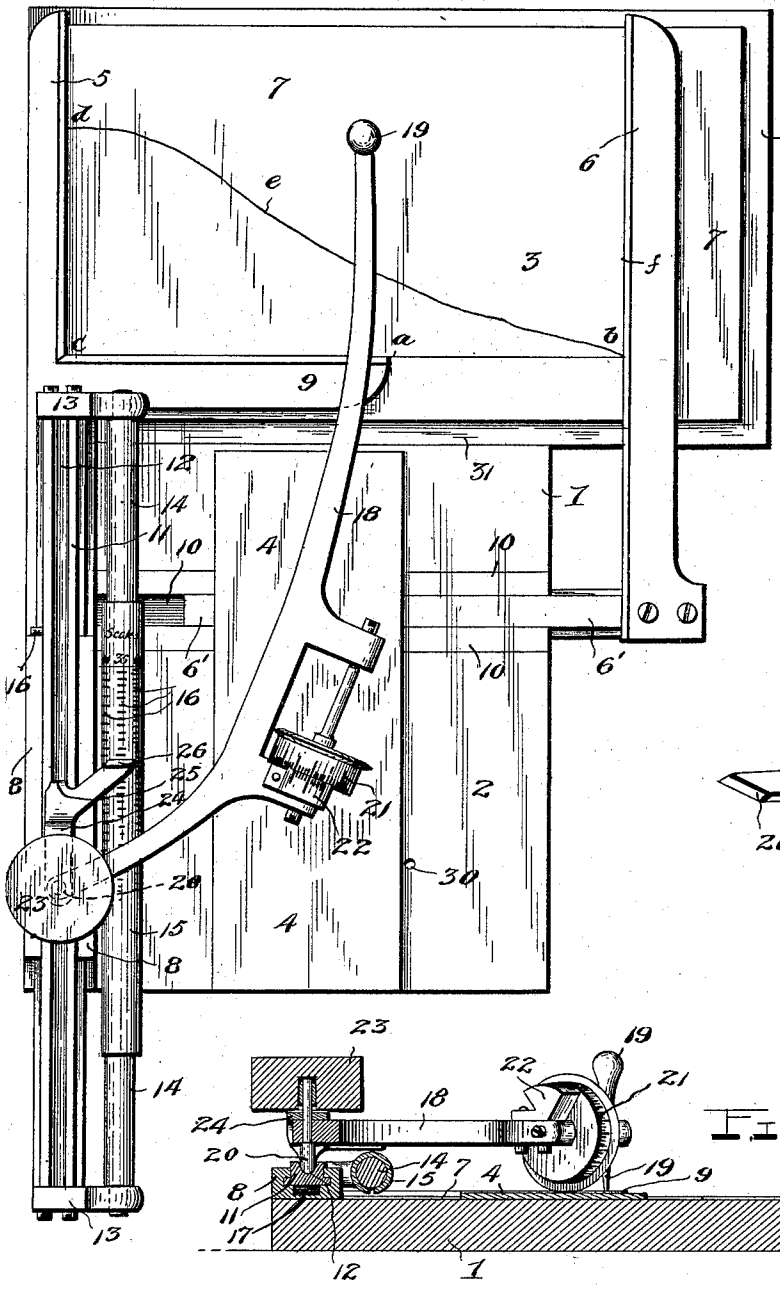

FIG. 1

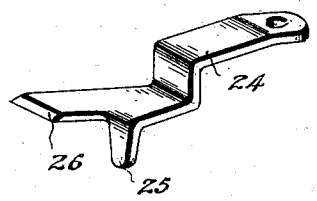

FIG. 5

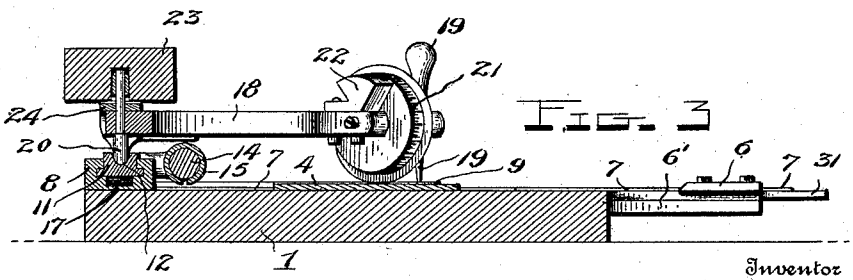

FIG. 3

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NO MODEL. 2 SHEETS—SHEET 2.

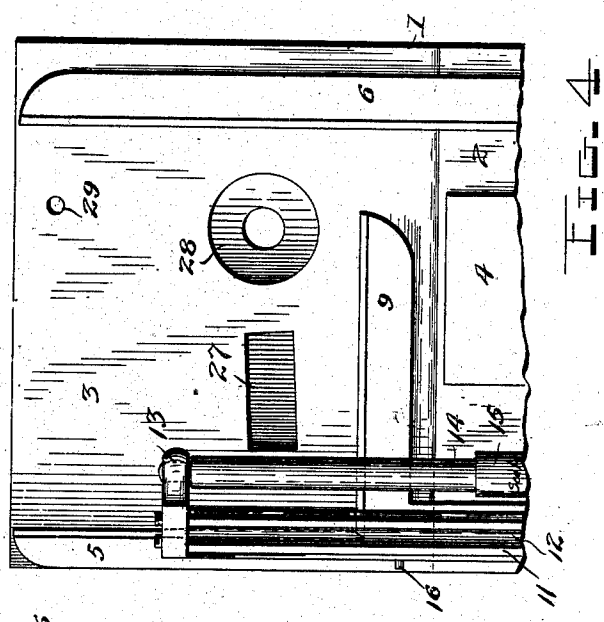

FIG. 4.

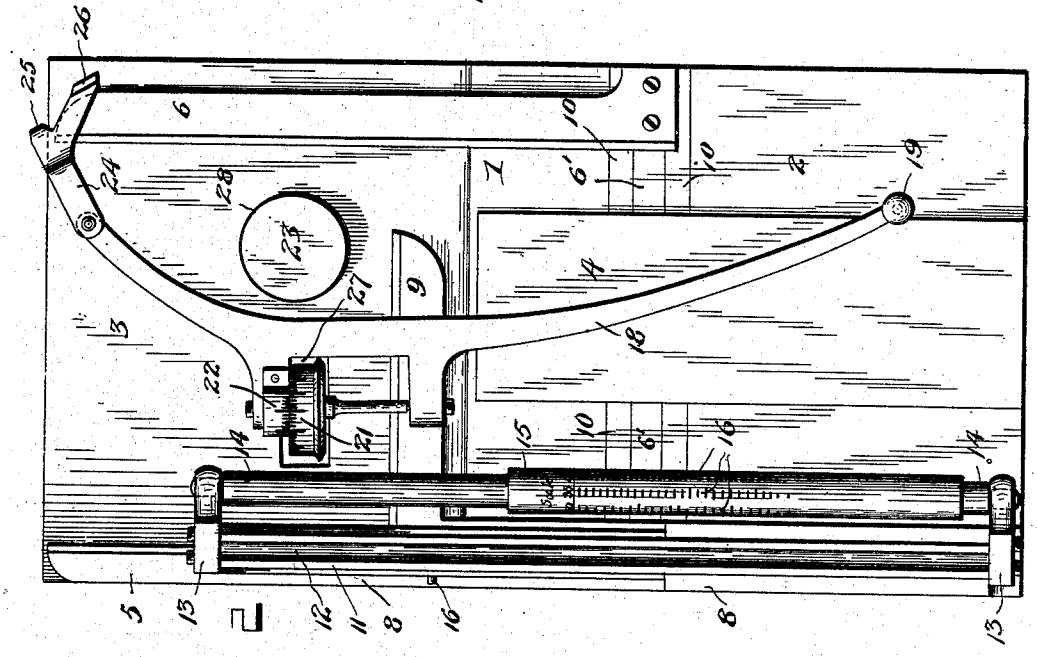

FIG. 2.

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UNITED STATES PATENT OFFICE.

LEVI T. SNOW, OF NEW HAVEN, CONNECTICUT, ASSIGNOR TO THE JOHN S. BUSHNELL COMPANY, OF NEW YORK, N. Y.

PLANIMETER.

SPECIFICATION forming part of Letters Patent No. 718,166, dated January 13, 1903.

Application filed August 18, 1902. Serial No. 120,144. (No model.)

To all whom it may concern:

Be it known that I, LEVI T. SNOW, a citizen of the United States, residing at New Haven, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Planimeters; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in planimeters of that type more especially designed for measuring the mean height or pressure of indicator-diagrams.

The object of the invention is to provide a compact form of instrument which is adjustable to a wide range of work and obviates the necessity of making calculations and which also is simple of construction, effective in use, and inexpensive of production.

With this and other objects in view the invention consists of certain novel features of construction, combination, and arrangement of parts, which will be hereinafter more fully described, and particularly pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a top plan view of a planimeter embodying my invention, showing the parts adjusted for use. Fig. 2 is a similar view showing the parts folded and adjusted for packing. Fig. 3 is a cross-section on line 3 3 of Fig. 1. Fig. 4 is a fragmentary plan view of the base or table. Fig. 5 is a detail view of the pointer and guide member.

Referring now more particularly to the drawings, the numeral 1 represents a portable base or table provided with two surfaces 2 and 3, one to support the measuring-wheel and scale members and the other the diagram to be measured. The surface 2 is provided with the usual soft-paper strip 4, on which the measuring-wheel moves. On the base are steel or other resilient metallic clamps 5 and 6, serving also as rulers. These clamps may be lifted from the surface 2 to allow the diagram-paper 7 to be applied beneath them, as shown in Fig. 1, and are adapted to form guides for the scribing-point at the opposite sides or edges of the diagram. The clamp 5 is fixed to a grooved guide-bar 8, secured at one side of the surface 3, and has an inwardly and laterally projecting ruler 9, which forms a guide for the "air-line" of the diagram. The clamp 6, on the other hand, is adjustable toward and from and in parallel relation to the bar 5, being carried by a head 6′, adjustable transversely of the base in a grooved guideway 10, preferably metallic, let into the surface 3.

Slidable on the bar 8 is a guide and scale frame consisting of a bar 11, formed in its upper face with a longitudinal groove 12 and flanged to slide in the groove in the bar 8, said bar 11 having secured thereto at its ends brackets 13, in which is journaled a rod or tube 14, located on the inner side of the bars 8 and 11 and extending parallel therewith. This rod or tube 14 carries a tube 15, which carries a series of scales 16, corresponding to the various pressures under which the diagrams are made and which is revolubly and slidably mounted on the rod, so that any scale may be brought uppermost for use. The tube is split, as shown in Fig. 3, and made of spring metal, so that it will exert sufficient friction on the rod 14 to prevent it (the tube) from casually turning or sliding out of the position to which it has been adjusted, and yet not enough to prevent it from being freely moved by hand. The guide and scale frame is made adjustable on the base, so that it may be moved to the position shown in Fig. 2 to be within the confines of the base to insure close compass in packing and so that it may be moved back from the surface 2 when the instrument is to be used. This backward movement of the frame is limited by a stop-pin 16, provided on the bar 11 to contact with the bar 8, and the frame is held from sliding out of adjusted position by the pressure upon the bar 11 of a spring 17 on the bar 8, which spring exerts sufficient pressure to hold the frame fixed against movement until positively adjusted by the operator.

The tracer-arm 18 is provided at one end with a scribing-point 19 and at its other end with a guide-pin 20, which fits and slides in the groove 12 in the bar 11, allowing the arm to reciprocate longitudinally of the bar and to swing in a curved path in a plane at right

angles to the bar. Between the point 19 and pin 20 the bar carries a measuring-wheel 21, which is graduated in the usual way and coöperates with a fixed point or scale 22 on the arm.

The pin 20 is held seated in the groove of the bar 8 by a removable weight 23, having a socket by which it is fitted upon the upper end of the pin. Below this weight and pivotally mounted on the pin is an arm 24, provided with a finger 25, to traverse the groove in bar 8, and a pointer 26 to coöperate with the scales on the tube 15. This mode of mounting the arm 24 allows the tracer-arm 18 to reciprocate longitudinally of the base or table on the bar 8 and to also swing in an arc transversely to the base and bar. The weight 23 holds the pin 20 and finger 25 seated in the groove 12, thus adapting the tracer-arm 18 to be moved without liability of displacement, while at the same time detachably mounting said arm, so that it may be removed whenever it is desired to fold and adjust the parts to adapt the instrument to be fitted snugly in a case small enough to be conveniently carried in the pocket.

Fig. 2 shows the parts of the instrument as arranged to allow the instrument to be packed snugly within its case, from which it will be seen that the sliding guide and scale frame is adjusted so as to project over upon surface 3, whereby it is disposed within the boundaries of the base 1, or, in other words, is moved inward, so as not to project beyond the base. The tracer-arm is also detached from this frame and is supported against displacement upon the base. For this purpose I provide the base with sockets 27 and 28 to receive the wheel 21 and weight 23, which latter is removed from the pin 20 in this position of the tracer-arm, and I also provide the base with sockets 29 and 30 to respectively receive the pin 20 and scribing-point 19, the sockets 27, 28, and 29 being formed in surface 3 and socket 30 in surface 2. This seating of the parts in sockets holds the tracer-arm and weight in proper position against any but an upward movement, which is prevented by the case when the instrument is placed therein. The pivotal connection of the arm 24 with the pin 20 permits said arm 24 to be adjusted to the position shown in Fig. 2, in which the finger 25 projects slightly beyond surface 3, but not sufficiently to interfere with the packing of the instrument within a case of a length but little exceeding that of the base 1.

A rectangular plate 31 is provided to be slid beneath the clamps 5 and 6 and cover the sockets in the surface 3 when the instrument is in use. This plate forms a bed or support for the diagram 7 and is of a width approximating the length of surface 3, but of a length greater than the width of said surface, so that the plate when applied, as shown in Fig. 1, will project at one end beyond the clamp 6, forming an extended support along which clamp 6 may be adjusted outwardly to allow diagrams of a greater width than the base to be applied thereto for measurement.

The operation is as follows: In using the instrument the parts are first connected and set up for use, as shown in Fig. 1, and then the diagram-slip is laid upon the plate 31 and beneath the clamps 5 and 6, with the air-line *a* of the diagram parallel or coincident with the edge of ruler 9 and the ends or side edges of the diagram touching the edges of the ruler-clamps 5 and 6. The scribing-point 19 is then applied at the point *b* on the diagram, the wheel 21 adjusted to the zero-point, and the tracer-arm operated to cause the scribing-point to follow the outline of the diagram, the course taken being from the point *b* along the line *a* to the point *c*, then up to the point *d*, and finally along the irregular line *e* back to point *b*, the scribing-point being guided between the points *a c* and *c d* by the rulers 9 and 5, as will be readily understood. This movement of the tracer-arm causes the wheel 21 to turn in one direction, and at the completion of such movement—*i. e.*, at the end of the traverse of point 19—the indication on the wheel may be observed and noted down, if desired, in order to enable the operator to determine if exactitude has been attained after the mean height of the diagram has been given by the instrument. Now if at the beginning of the tracing the measuring-wheel has been so adjusted that the zero-mark of its scale registers with the fixed index or zero-mark 22, the final reading of the scale after the tracing of the diagram has been completed will give the superficial contents of the diagram. If then with the wheel in its last adjusted position the tracer-arm is moved upwardly from point *b* along the edge of ruler 6, the wheel will be caused to rotate in the reverse direction until its zero-mark again registers with the point or zero-mark of scale 22 and a point *f* will be obtained, which is marked by forcing or pricking the scribing-point 19 into the paper of the diagram. The distance between points *b* and *f* thus obtained will give the mean height of the diagram, and such distance multiplied by the measured scale of the diagram will give the mean effective pressure in pounds per square inch. The necessity of making mathematical calculations, however, is avoided by the provision of the adjustable scale 15 and traveling pointer 26. As stated, the scale-tube 15 or cylinder carries a series of scales which correspond to the various pressures under which the diagrams are made. Either of these scales may be brought into position for use by the adjustment of the tube 15. If prior to or after the diagram is traced the proper scale 16, corresponding to the pressure under which the diagram was made, is brought into position for use and then the arm is operated to move the point 19 from *b* to *f*, the pointer 26 will be caused to traverse the scale and when the movement is completed register with a number on the scale giving the exact mean

effective pressure of the diagram. By this means a direct sight-reading is obtained, which facilitates and renders easier the operation of taking the mean effective pressure of the diagram. Proof of the reading may be obtained, if desired, by a mathematical calculation, which the operator may desire to make at times to determine the accuracy of the instrument.

From the foregoing description, taken in connection with the accompanying drawings, it is thought that the construction, mode of operation, and advantages of my improved planimeter will be readily apparent without requiring a more extended explanation.

Various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a planimeter, a base or table, diagram-clamps thereon, one of said clamps being fixed upon the base and the other adjustably connected to the base so as to be movable thereon toward and from the fixed clamp and laterally beyond a side of the base, and a detachable bed-plate adapted to be held upon the base by the clamps and to project beyond said side of the base to form an extension over which the adjustable clamp projects when adjusted beyond the base, substantially as set forth.

2. In a planimeter, the combination of a base or table provided with a guideway, a scale parallel with said guideway, a tracer-arm carrying a measuring-wheel and provided at one end with a scribing-point and at the other end with a pin traversing the guideway, and an arm pivoted to the pin and having a finger moving in the guideway and a pointer coöperating with the scale, substantially as specified.

3. In a planimeter, the combination of a base or table provided with a guideway, a scale parallel with said guideway, a tracer-arm carrying a measuring-wheel and provided at one end with a scribing-point and at the other end with a pin traversing the guideway, an arm pivoted to the pin and having a finger moving in the guideway and a pointer co-operating with the scale, and a weight for holding the pin and finger seated in said guideway, substantially as set forth.

4. A planimeter having a guideway, a scale carried thereby, and a tracer-arm having a guide member traversing the guideway and provided with a pointer traversing the scale, substantially as specified.

5. A planimeter having an adjustable guide-bar, a support carried by the bar, a scale-cylinder revolubly mounted on said support, a tracer-arm detachably connected to the guideway, and a pointer carried by the arm to coöperate with the scale-cylinder, substantially as set forth.

6. A planimeter having a slidable guideway with means for securing the same in adjusted position, a scale carried by and movable with the guideway, and a tracer-arm having a guide member traversing the guideway and a pointer traversing the scales, substantially as described.

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

LEVI T. SNOW. [L. S.]

Witnesses:
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MAUDE L. BEECHING.