F. C. BLANCHARD, E. B. CROCKER & P. G. DARLING.

PLANIMETER.

APPLICATION FILED APR. 10, 1909.

961,836.

Patented June 21, 1910.

3 SHEETS—SHEET 1.

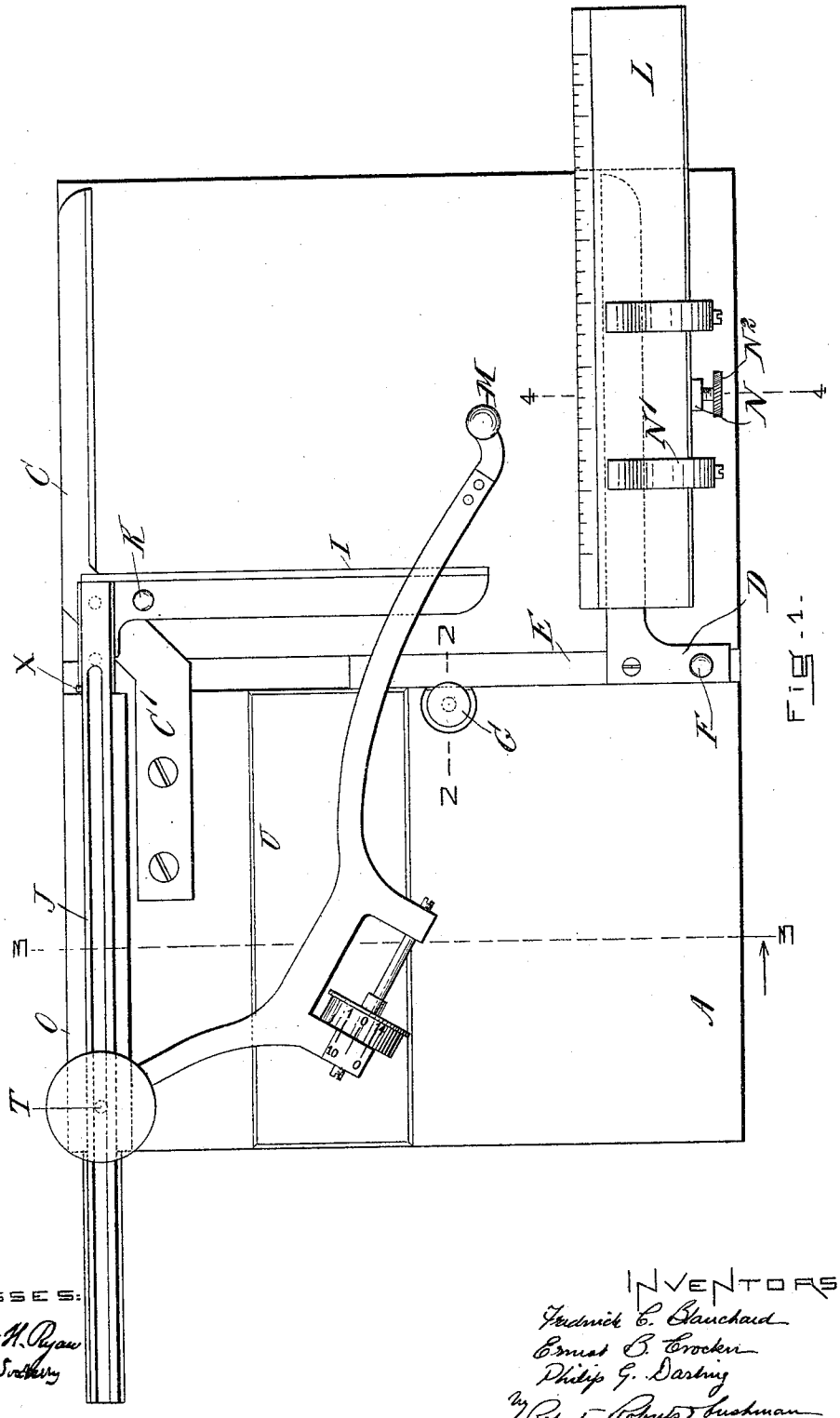

Fig. 1.

WITNESSES:

Josephine H. Ryan

Charles S. Wortley

INVENTORS:

Frederick C. Blanchard

Ernest B. Crocker

Philip G. Darling

By Roberts Roberts & Cushman

Attorneys

F. C. BLANCHARD, E. B. CROCKER & P. G. DARLING.

PLANIMETER.

APPLICATION FILED APR. 10, 1909.

961,836. Patented June 21, 1910.

3 SHEETS—SHEET 2.

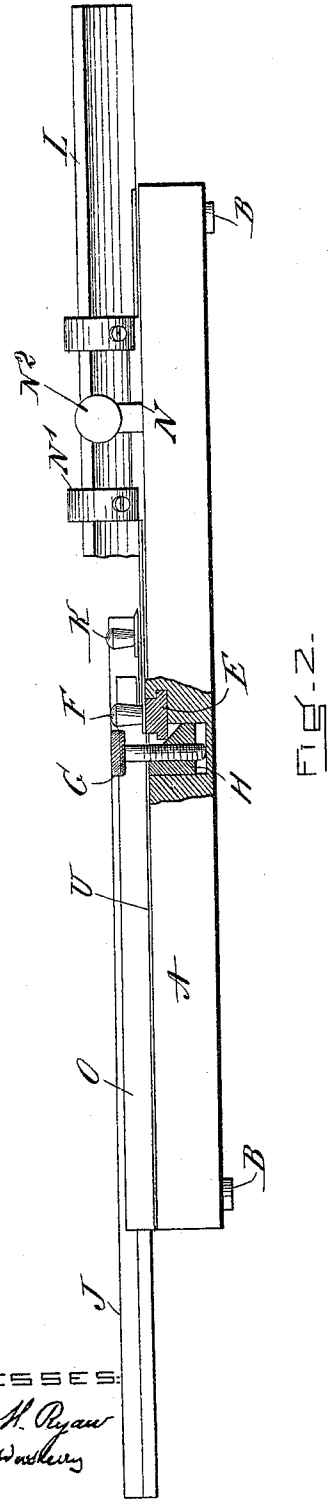

Fig. 2.

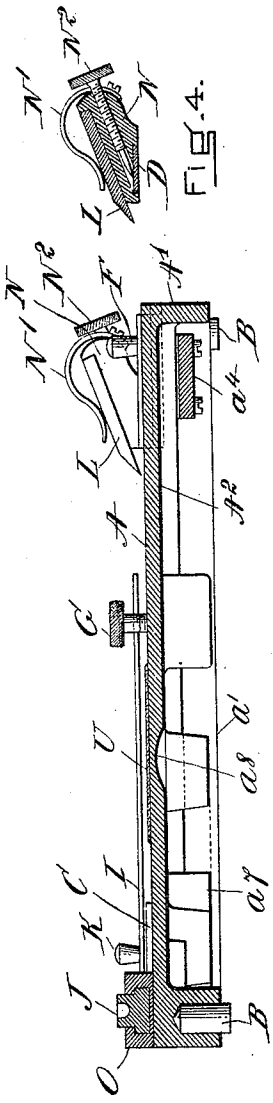

Fig. 4.

Fig. 3.

WITNESSES:

Josephine M. Ryan

Charles S. Wadleigh

INVENTORS:

Frederick C. Blanchard

Ernest B. Crocker

Philip G. Darling

By Roberts Roberts & Cushman

Attorneys

F. C. BLANCHARD, E. B. CROCKER & P. G. DARLING.

PLANIMETER.

APPLICATION FILED APR. 10, 1909.

961,836. Patented June 21, 1910.

3 SHEETS—SHEET 3.

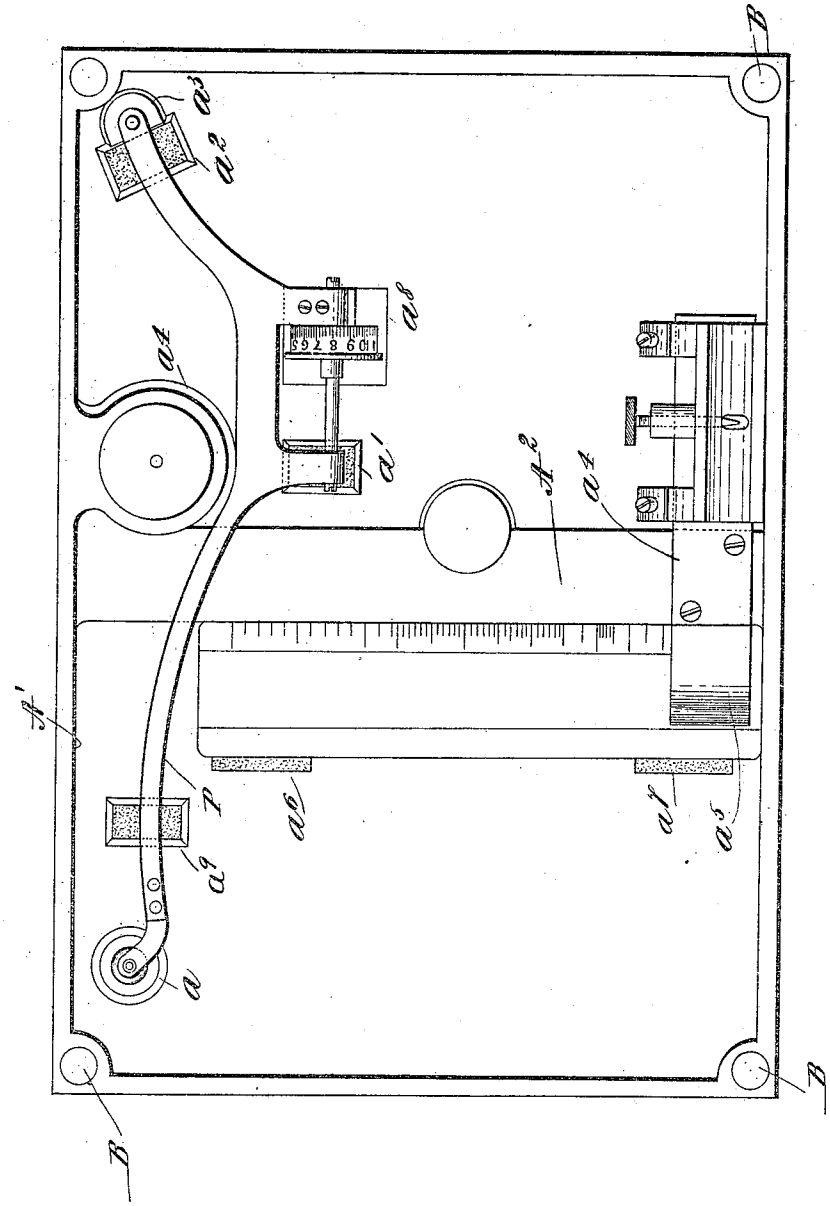

Fig. 5.

WITNESSES:

Josephine H. Ryan

Charles S. Woolsey

INVENTORS:

Fredrick G. Blanchard

Ernest B. Crocker

Philip G. Darling

By Roberts Roberts & Cushman

Attorneys

UNITED STATES PATENT OFFICE.

FREDERICK C. BLANCHARD, ERNEST B. CROCKER, AND PHILIP G. DARLING, OF BRIDGEPORT, CONNECTICUT, ASSIGNORS TO ASHCROFT MANUFACTURING COMPANY, OF BRIDGEPORT, CONNECTICUT, A CORPORATION OF CONNECTICUT.

PLANIMETER.

961,836. Specification of Letters Patent. **Patented June 21, 1910.**

Application filed April 10, 1909. Serial No. 489,130.

To all whom it may concern:

Be it known that we, FREDERICK C. BLANCHARD, ERNEST B. CROCKER, and PHILIP G. DARLING, citizens of the United States, and residents of Bridgeport, in the county of Fairfield and State of Connecticut, have invented new and useful Improvements in Planimeters, of which the following is a specification.

Our invention relates to the construction of planimeters and consists in improvements which relate to the application and adjustment of diagram to the planimeter table, the averaging of the ordinates of the diagram curves and the employment of the planimeter either on its special table, or separate therefrom.

The object of these improvements is to facilitate the miscellaneous operations of the planimeter, to insure the greatest possible accuracy in taking planimeter readings, and to make an averaging planimeter in such a way that the beam and guide may be removed from the complete instrument and used to measure areas upon extended sheets or drawings.

In the drawings hereto annexed which illustrate our improvements, Figure 1 is a plan view of an averaging planimeter; Fig. 2 is a side elevation partly broken away to show a section at the line 2—2 in Fig. 1; Fig. 3 is an end elevation at the line 3—3 of Fig. 1; Fig. 4 is a detail in section at line 4—4 of Fig. 1, showing the scale block and its mode of attachment; and Fig. 5 is a bottom plan view of the instrument.

The planimeter table A is preferably a metal casting accurately machined and finished, and is provided with four rubber legs B (Fig. 2) which afford a secure support for the table A. That portion of the table A upon which diagrams are to be supported is located between the fixed diagram clamp C (Fig. 1) and the movable clamp D, and, in the structure shown the fixed diagram clamp C is offset so that the portion C′ secured by screws to the table A lies inside the track guide O, while the outer diagram clamping portion stands near the edge of the table. The diagram clamp C is sufficiently resilient to permit its being slightly raised for the insertion of a diagram under it. On being released, the clamp C descends upon the diagram and holds it pinched against the table A with sufficient security.

The movable diagram clamp D is parallel to the fixed clamp C and is secured to a slide E which fits loosely in a slide-way which extends transversely of the table A. About midway of this slide-way and lodged in a cylindrical recess in the table, there is provided the binder H, (Fig. 2) this being shown as a cylindrical plug centrally bored and screw threaded to admit the binding screw G, and diagonally slabbed on the side toward the slide E against which the slabbed surface of the binder H bears more or less tightly according to the setting of the screw G. When it is desired to move the movable clamp D the screw G is turned anti-clockwise causing the binder H to relax its hold upon the slide E which, being loosely fitted in its guide, moves very easily to the right or left carrying the movable diagram clamp D with it. This movement is facilitated by the handle screw F which is of suitable dimensions to be grasped by the fingers of the person operating the instrument. When the movable clamp has been slid to the desired point over a diagram, the screw G is turned clockwise and raises the binder H which in turn presses against the lower edge of the slide E cramping and slightly tilting it so as to press the movable clamp D down tightly upon the diagram. The ease with which the movable clamp may be shifted when the binder H has been relaxed facilitates the quick and accurate adjustment of the clamp and the fixing of the clamp by means of the binder H is instantaneously accomplished. While the slide E is being moved, the diagram clamp D is naturally lifted free of the diagram paper on the table and thus its movement does not tend to displace the diagram.

When engine indicator diagrams are being measured by this instrument, it is of great importance that the atmospheric line be adjusted accurately upon the table at right angles to the clamps C and D, and to the track J upon which the guide pin of the planimeter beam travels. To facilitate this adjustment of the diagram, we provide the bottom guide I whereof the edge is at right angles to the track way for the guide pin of the planimeter beam and mount this

bottom-guide so that it may be slid up and down over the table in a direction at right angles to the edge of the guide I itself, or, in other words, parallel to the guide pin track. For the sake of simplicity in construction, we preferably secure the beam guide I to the track piece J and mount the track piece in a slideway O. A small handle K affixed to the beam guide I facilitates handling this part of the instrument.

The arrangement and movability of the bottom guide I enables the user to aline the indicator diagram accurately, no matter where the atmospheric line may be located, and, if the atmospheric line is located within the indicator diagram, as is the case with diagrams for low pressure cylinders, the bottom guide I may be slid downward clear of the diagram after it has been used to bring the atmospheric line to true position; thus the entire diagram surface is left unobstructed for measuring purposes.

A stop pin, x, (Fig. 1) secured to the track piece J, limits the downward movement of this track piece and of the guide I, so that the planimeter beam may not be moved too far downward. The tracing point will strike against the bottom guide I before the planimeter wheel can move off the pad U.

In order to conveniently equip the planimeter with averaging instruments, we provide a scale block N which may be mounted so as to slide upon the movable diagram clamp D. Springs N′ which constitute means for attaching a scale as L to the scale block are suitably secured to the block. The scale block N is shown in detail in Fig. 4. The movable clamp D is beveled, and the block N milled to form a groove to slide over the clamp D. The block N is also drilled diagonally to receive the clamping screw N^2, which is tapered at its lower end, and, when turned downward bears against the upper side of the diagram clamp D, and binds the block N securely in any desired position.

When a scale as L is mounted in sliding relation upon the movable guide D as by means of the scale block N, the edge of the scale should stand at substantially the same level as the bottom of the movable diagram clamp D; when this arrangement is employed the scale itself may act either solely or with the clamp D to hold the diagram paper securely upon the table A.

The instrument may be equipped with a suitable number of removable scales L each graduated in correspondence with a standard spring of an engine indicator, or a single scale may be graduated on different sides or edges with graduations corresponding with different standard springs, so that one member may carry the graduations for several springs. The operation of this feature of our improvements is as follows: The scale L which corresponds to the indicator spring with which a diagram has been taken is placed upon the scale block N and held thereto by the springs N′ and the scale block slid onto the movable diagram clamp D. When the diagram is placed upon the table under the clamp C and its atmospheric line properly adjusted parallel to the beam guide I, the starting point on the diagram is selected and the scale L, carried by the scale block N and clamp D, is moved until the zero mark on the scale is brought to the starting point on the diagram. When the scale block is in the desired position it is clamped by means of the screw N^2 (Fig. 4). Then after tracing around the diagram in a right handed direction in the usual manner, the tracing point arrives at the starting point on the diagram and the zero point on the scale. Then the tracing point is carried vertically upward being guided by the edge of the scale until the zero reading on the planimeter wheel is obtained. The distance of the tracing point from the zero point of the scale then measures the mean effective pressure of the diagram and may be read off directly from the scale. When it is not needed the scale block N may be removed from the clamp D and the instrument used in the ordinary manner. The track piece J may be slid entirely out of its guide O and may then serve as a planimeter guide for measuring curve areas upon any drawing. Referring to Fig. 3 it will be observed that the lower surfaces of the track piece J, the upper surface of the wheel pad U and the table surface whereon a diagram is laid, are all in substantially the same plane; slight allowance may be made for the average thickness of the paper on which the diagram is drawn. When, therefore, the track piece J is removed from the instrument and the planimeter beam with the track piece placed upon the sheet of paper upon which any drawing may be made, the relationship of the planimeter guide pin T (Fig. 1) and planimeter wheel and the tracing point M is substantially the same as when the planimeter beam is used with the assembled instrument as shown in Fig. 1. With the planimeter thus properly leveled, areas may be measured upon the drawing board with facility and accuracy and the necessity for cutting out or tracing portions of a drawing for the purpose of measurement upon the planimeter table is obviated.

In Fig. 5 there are illustrated those features of our improved planimeter which relate to the secure and convenient stowage of its several movable and detachable parts. The table A is formed with a peripheral flange A′, and a suitable number of projections or bosses project from the body of the table A into the shallow recess included with-

in the peripheral flange. Bosses a and a^3 are bored out to form cups, bosses a' a^9 and a^2 are plain blocks, preferably padded with bits of velvet; the boss a^4 is cupped and lined with soft material. A shallow recess is formed at a^8.

When the instrument is to be packed in a case, the planimeter beam is removed, the table laid bottom up in the case, the beam weight placed in the cupped boss a^4, and the beam (shown at P) is placed with its arms resting on the padded blocks a', a^9 a^2, its wheel lying clear of the table A, in the recess a^8, the tracing point knob in the recess in boss a, and the guide pin in the similar recess in boss a^3.

On the ridge A^2 the flat bar a^4 and clip spring a^5 are secured. The spring a^5 holds the scale L on the soft pads a^6 and a^7, while the bar a^4 is spaced from the under surface of the table A so as to admit the springs N' of the scale block N, which slips over the bar a^4 just as it does in use over the scale L. When the instrument is thus packed in a shallow box or case, the box cover turns down upon the planimeter beam P and weight, stowed as above described, and holds them in place. The instrument is thus arranged for convenient packing and is secure for purposes of transportation.

What we claim and desire to secure by Letters Patent is:

1. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor, and a scale mounted to slide on one of the diagram clamps.

2. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor, a scale block mounted to slide on the movable diagram clamp, and means to secure a scale to said block.

3. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor loosely fitted in a slideway, a binder bearing against the slide to cramp it in any desired position in the slideway, and a scale mounted to slide on one of the diagram clamps.

4. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor looesly fitted in a slideway, a binder bearing against the slide to cramp it in any desired position in the slideway, a scale block mounted to slide on the movable diagram clamp, and means to secure a scale to said scale block.

5. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor loosely fitted in a slideway, and a binder bearing against a lower edge of the slide to cramp it in any desired position in the slideway and at the same time to press the diagram clamp against the table.

6. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor loosely fitted in a slideway, a binder bearing against a lower edge of the slide to cramp it in any desired position in the slideway and at the same time to press the diagram clamp against the table, and a scale mounted to slide on one of the diagram clamps.

7. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor loosely fitted in a slideway, a binder bearing against a lower edge of the slide to cramp it in any desired position in the slideway and at the same time to press the diagram clamp against the table, a scale block mounted to slide on the movable diagram clamp, and means to secure a scale to said scale block.

8. In a planimeter, a table, diagram clamps thereon, a track piece adapted to receive the guide pin of the planimeter beam, said track mounted to slide on the table and parallel to the diagram clamps, a bottom guide extending over the table at right angles to the track piece and movable in a direction parallel to the said track piece.

9. In a planimeter, a table, diagram clamps thereon, a track piece adapted to receive the guide pin of the planimeter beam, said track piece mounted to slide on the table and movable parallel to the diagram clamps, and a bottom guide extending over the table, mounted on and at right angles to the track piece.

10. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor loosely fitted in a slideway, said slideway a binder bearing against the said slide to cramp it in any desired position in the slideway, a scale mounted to slide on one of the diagram clamps, a track piece adapted to receive the guide pin of the planimeter beam, said guide pin said track piece mounted to slide on the table and parallel to the diagram clamps, and a bottom guide extending over the table at right angles to the track piece and movable in a direction parallel to said guide piece.

11. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor loosely fitted in a slideway, a binder bearing against the said slide to cramp it in any desired position in the slideway, said slideway a scale block mounted to slide on the movable diagram clamp, and means to secure a scale to said scale block, a track piece adapted to receive the guide pin of the planimeter beam, said guide pin said track piece mounted to slide on the table and parallel to the diagram clamps, a bottom guide extending over the table at right angles to the track piece and movable in a direction parallel to said track piece.

12. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor loosely fitted in a slideway,

said slideway a binder bearing against said slide to cramp it in any desired position in the slideway, a track piece adapted to receive the guide pin of the planimeter beam, said guide pin said track piece mounted to slide on the table and movable parallel to the diagram clamps, and a bottom guide extending over the table mounted on and at right angles to the track piece.

13. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor loosely fitted in a slideway, said slideway a binder bearing against said slide to cramp it in any desired position in the slideway, a scale mounted to slide on one of the diagram clamps, a track piece adapted to receive the guide pin of the planimeter beam, said guide pin said track piece mounted to slide on the table and movable parallel to the diagram clamp, and a bottom guide extending over the table mounted on and at right angles to the track piece.

14. In a planimeter, a table, a fixed diagram clamp, a movable diagram clamp, a slide therefor loosely fitted in a slideway, said slideway a binder bearing against said slide to cramp it in any desired position in the slideway, a scale block mounted to slide on the movable diagram clamps, and means to secure a scale to said scale block, a track piece adapted to receive the guide pin of the planimeter beam, said guide pin said track piece mounted to slide on the table and parallel to the diagram clamps, and a bottom guide extending over the table mounted on and at right angles to the track piece.

15. A planimeter, comprising a table, a planimeter beam, the beam weight, diagram clamps, a scale block adapted to slide on one of the clamps, and a scale; the table provided with a peripheral depending flange, forming a shallow recess on the under side of the table, and having also a planimeter weight socket, blocks to support the planimeter beam, a bar adapted to receive and hold the scale block, a spring clamp for the scale, all within the shallow recess formed by the said flange, whereby the removable parts of the instrument may be stowed for securement in a case.

16. In a planimeter, a fixed diagram-clamp, a movable diagram-clamp, a slide therefor loosely fitted in a slideway, the slideway, a binder bearing against the slide to cramp it in any desired position in the slideway, a track-piece adapted to receive the guide pin of the planimeter beam, said guide pin, said track-piece mounted to slide on the table, and parallel to the diagram clamps, a bottom-guide extending over the table at right angles to the track-piece, and movable in a direction parallel to said track-piece.

Signed by us at Bridgeport, Connecticut this 8th day of April 1909.

FREDERICK C. BLANCHARD.
ERNEST B. CROCKER.
PHILIP G. DARLING.

Witnesses:
JAMES P. O'NEIL,
W. R. CLARKE.