No. 675,189. Patented May 28, 1901.

C. L. BERGER.

VERNIER FOR SURVEYING INSTRUMENTS.

(Application filed Feb. 18, 1901.)

(No Model.)

Fig. 1.

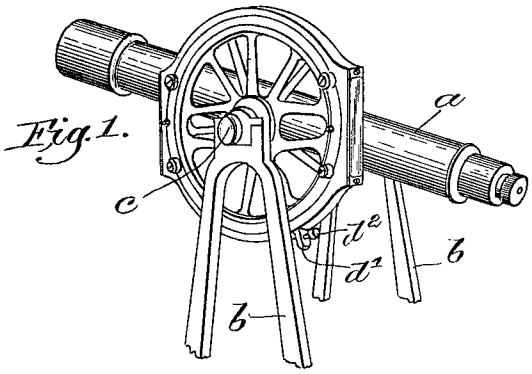


Fig. 2.

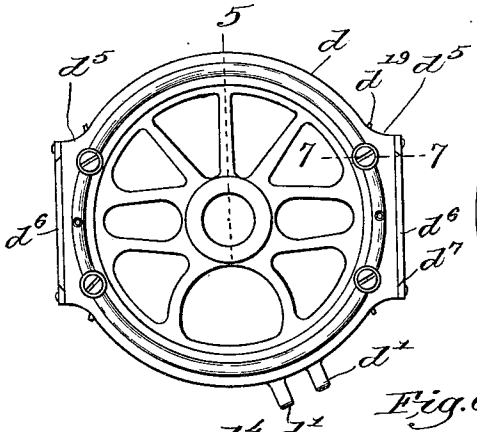


Fig. 3.

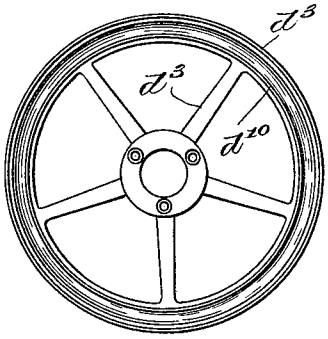


Fig. 4.

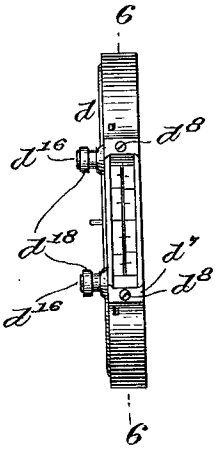


Fig. 5.

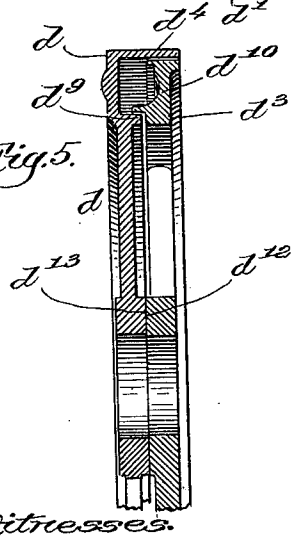


Fig. 6.

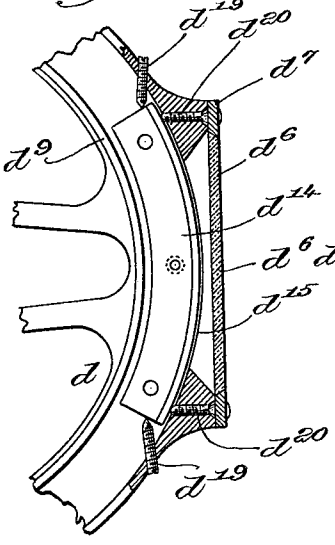


Fig. 7.

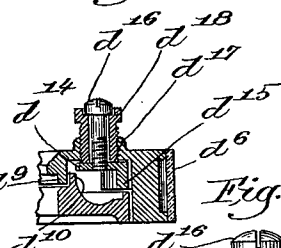


Fig. 8.



Witnesses.
Thomas J. Drummond.
Edward F. Allen.

Inventor.
Christian L. Berger,
by Crosby & Gregory
Atty's.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHRISTIAN L. BERGER, OF BOSTON, MASSACHUSETTS.

VERNIER FOR SURVEYING INSTRUMENTS.

SPECIFICATION forming part of Letters Patent No. 675,189, dated May 28, 1901.

Application filed February 18, 1901. Serial No. 47,717. (No model.)

To all whom it may concern:

Be it known that I, CHRISTIAN L. BERGER, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Verniers for Surveying Instruments, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My present invention is an improvement in the construction of the graduated limb or circle in connection with the vernier of a surveying instrument, and is particularly adapted for mining-transits, although capable of advantageous use elsewhere.

As is obvious, no accuracy of results in surveying can be had if the readings at the circle of the vernier are incorrect, and accordingly the most delicate work in adjustments is required at this point in the instrument, and it is the purpose of my present invention to provide means for insuring the accuracy required and accomplishing the same by simple and readily-understood means. The constructional details will be more fully set forth and the various advantages and operation thereof pointed out in the course of the following description, reference being had to the accompanying drawings, in which a preferred embodiment of my invention is shown, and the latter will be more fully described in the appended claims.

In the drawings, Figure 1 is a perspective view of a portion of a transit or other instrument having its graduated circle provided with my invention. Fig. 2 is an enlarged side elevation of the circle and adjacent parts. Fig. 3 is a similar view of the graduated circle. Fig. 4 is an edge elevation of Fig. 2. Fig. 5 is a fragmentary view in cross-section on the dotted line 5, Fig. 2. Fig. 6 is a fragmentary view, in vertical longitudinal section, on the line 6 6, Fig. 4. Fig. 7 is an enlarged sectional detail on the line 7 7, Fig. 2. Fig. 8 is an enlarged detail of Fig. 7.

It will be understood that the telescope a, supports b, and axis c may be of any usual kind and are herein shown merely for the purpose of a clear understanding of the invention. The outer casing d is secured in a stationary manner by any suitable means, as by the usual lugs d' and set-screw d^2, while the graduated circle d^3 is mounted in usual manner on the axis c or other movable part of the field instrument to which the invention may be applied.

As herein shown the apparatus is arranged to be read at opposite sides, and the casing is of a special construction, having an overhanging ledge d^4 and a projecting portion d^5 at the side openings, which are closed by glass d^6, held in a frame d^7 by screws d^8, while on the inner side I provide a flange d^9, which is overlapped by a corresponding frame d^{10} on the circle d^3, these various details of construction being provided for the purpose of protecting the delicate parts of the circle in the vernier from drippings in the mine and from dust and other foreign matter, as it is extremely essential that this part of the instrument should at all times be in condition to be depended upon.

The circle, as will be observed viewing Fig. 5, is out of contact with the casing at all peripheral points, being held in place by having its hub d^{12} contact with the hub d^{13} of the casing.

The vernier proper is shown in the form of a plate d^{14}, having the vernier-graduations on its outer circumferential flange d^{15}. The plate is held rigidly at its opposite ends by a screw d^{16} against the inner shoulder or end d^{17} of a finely-threaded screw d^{18}, mounted in the casing. By reason of this construction the vernier may be moved into absolute parallelism with the reading edge of the graduated circle and yet remain out of rubbing contact therewith, as it will be readily understood that for proper precision there must be no friction and indeed no contact between the moving circle and the stationary vernier, and yet they must be brought into absolute alinement and as close to each other as possible without rubbing contact. Adjacent its opposite ends the vernier-plate d^{14} is engaged by longitudinal screws or adjusting means d^{19} and transverse screws or adjusting means d^{20}, the latter being concealed beneath the frame d^7. The purpose of the former set of screws d^{19} is for bringing the opposite verniers into position exactly one hundred and eighty degrees apart, and the latter set of screws d^{20} is for bringing the vernier-plate d^{14} into iden-

tically the same circumference with the graduated circle, as it is necessary not only that the vernier and circle should be in parallelism, as explained above, but it is equally or more important that they should be the same radial distance from the center, as otherwise corresponding distances thereon would measure unequal angles. The screws d^{16} have lateral play in all directions within the hollow screws d^{18}, as is clearly shown in Fig. 8, so that the vernier can be shifted by the respective pairs of screws d^{19} d^{20}.

It will be understood that my invention is applicable to edge graduation, as shown, or to flat or beveled graduation and either vertical or horizontal.

From the above description it will be seen that by the simple means provided the vernier can be quickly adjusted at the shop or by the engineer with the utmost accuracy and entirely without machine-work or special skill, as all that is necessary for lateral adjustment is to turn the screws d^{18}—one or both of them, as the case may be—inwardly or outwardly, and for radial adjustment the screws d^{20} are turned inwardly or outwardly, the screws d^{19} meanwhile being loosened or tightened simultaneously to correspond with the adjustment required of the screws d^{20}, and so likewise for movement of the vernier up or down the screws d^{19} are turned in opposite directions, thereby correspondingly shifting the vernier-carrying screws d^{16} in their smooth-bore sockets or screws d^{18}.

Various minor details of construction may be changed without departing from the spirit and scope of my invention.

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

1. In a surveying instrument, a support, a graduated circle or arc movable therein, a vernier movably carried by said support, and adjusting means in said support for adjusting said vernier laterally and means for adjusting it radially for bringing the reading edge thereof into coinciding parallelism in all respects with the reading edge of the circle.

2. In a surveying instrument, a support, a graduated circle or arc movable therein, a vernier movably carried by said support, hollow screws having a threaded engagement through said support transversely of said vernier and circle, and supporting-screws loosely held by said hollow screws and engaging said vernier for holding the latter against the inner ends of the hollow screws, adjustment of the latter serving to adjust the vernier toward and from the circle.

3. In a surveying instrument, a support, a graduated circle or arc movable therein, a vernier movably carried by said support, and adjusting-screws mounted in said support and engaging said vernier for moving the latter radially of said circle for bringing the reading edges of the vernier and circle into one and the same circumferential plane.

4. In a surveying instrument, a support, a graduated circle or arc movable therein, a vernier movably carried by said support, and adjusting-screws mounted in said support and engaging the vernier for adjusting said vernier along said support in the direction of the circumference of the circle.

5. In a surveying instrument, a casing, a graduated circle or arc, and a vernier inclosed within said casing, the casing being provided with an aperture for reading said vernier and circle, said casing having an overhanging flange provided adjacent said opening with a projecting portion, a frame mounted on said projecting portion, and a glass carried by said frame and inclosing said opening.

6. In a surveying instrument, a casing, and a graduated circle or arc within said casing, the two having hubs contacting with each other and holding the peripheral or graduated portion of the circle out of contact with said casing, said casing and circle adjacent the peripheral portion of the latter having overlapping flanges for the exclusion of dust from said contacting hubs.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHRISTIAN L. BERGER.

Witnesses:
GEO. H. MAXWELL,
GEO. W. GREGORY.