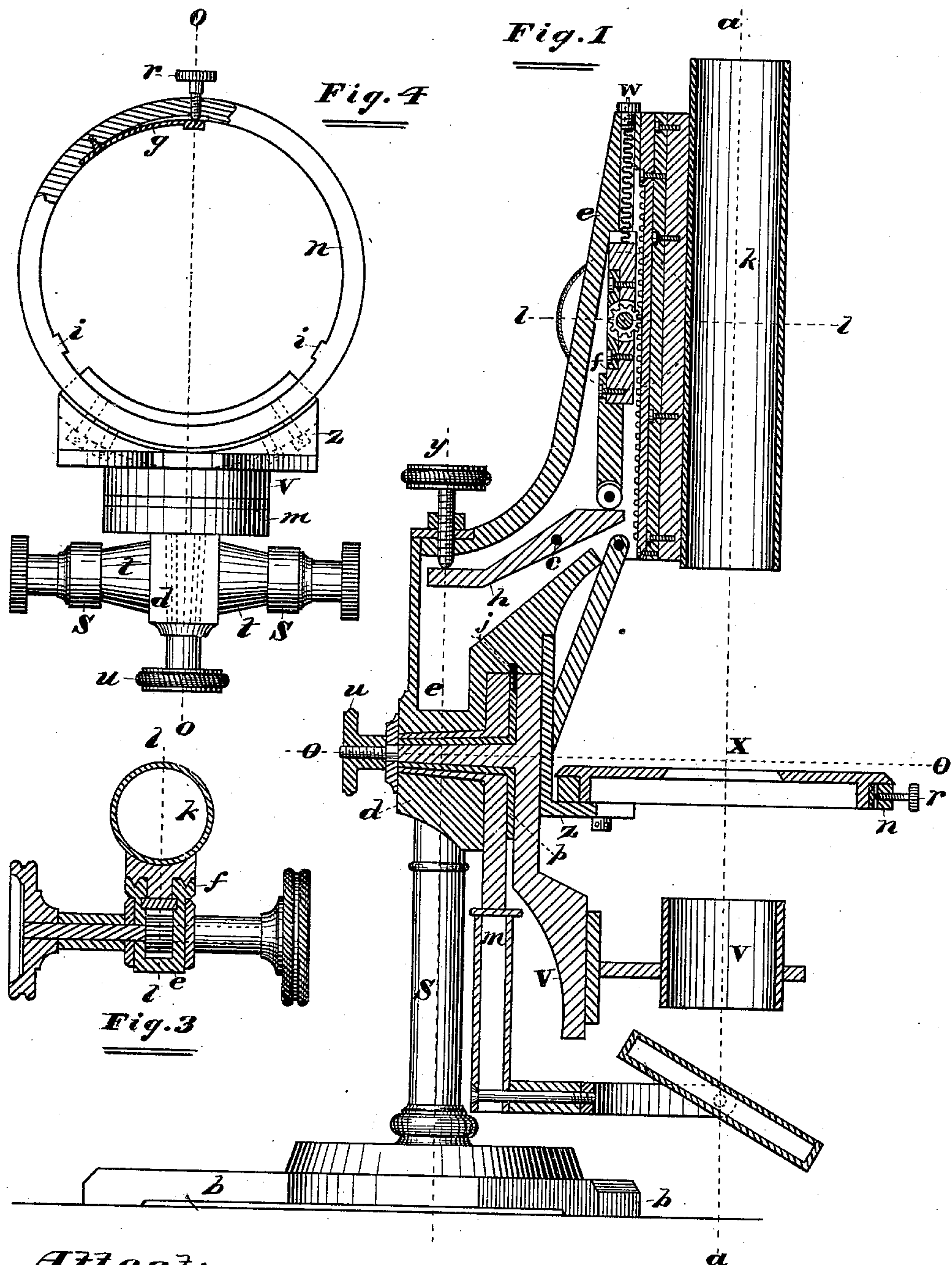


W. H. BULLOCH.  
Microscope.

No. 215,878.

Patented May 27, 1879.



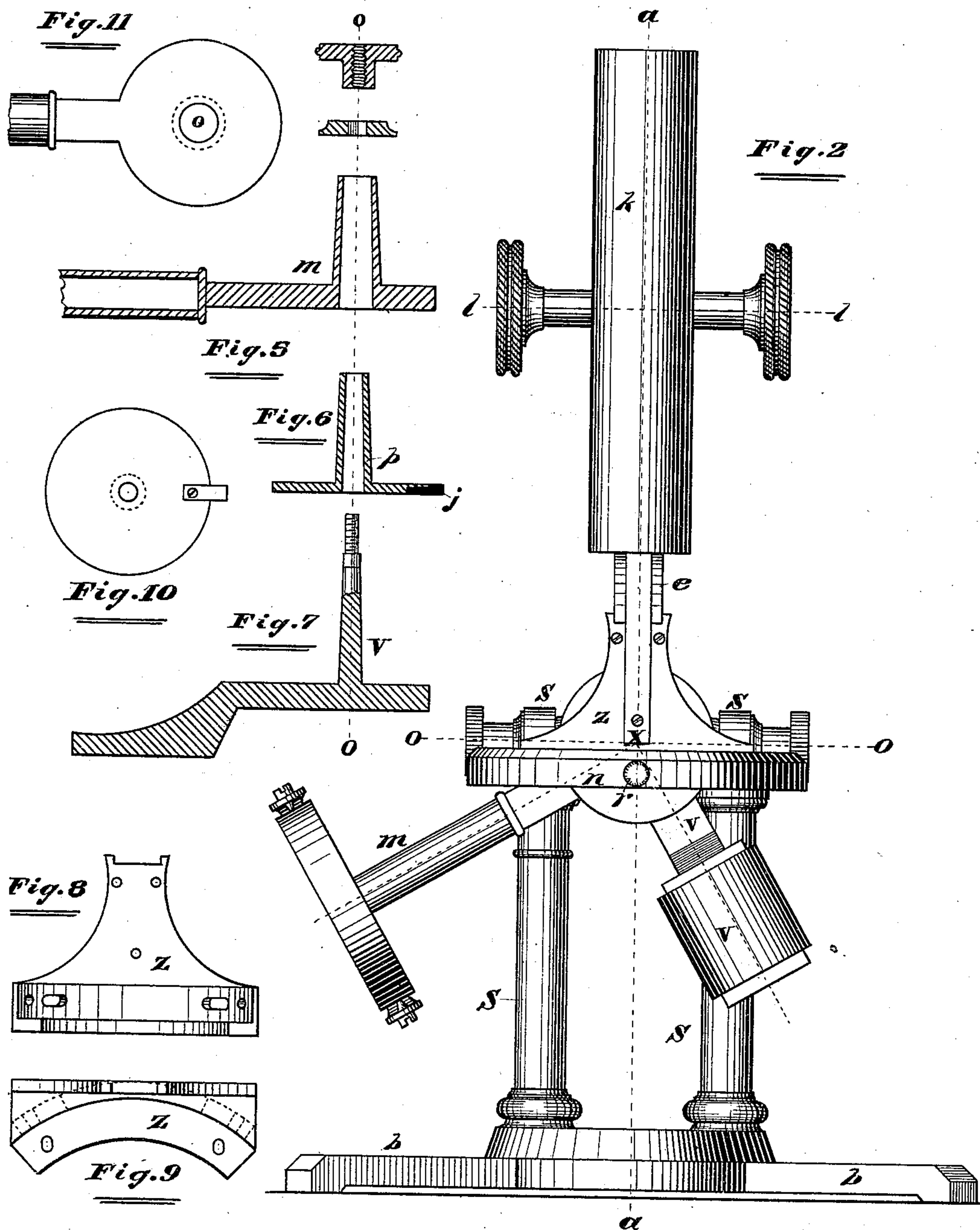
*Attest:*  
James Feltham  
Chas. J. Davis

**INVENTOR:**  
Walter H. Bulloch

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# UNITED STATES PATENT OFFICE.

WALTER H. BULLOCH, OF CHICAGO, ILLINOIS.

## IMPROVEMENT IN MICROSCOPES.

Specification forming part of Letters Patent No. 215,878, dated May 27, 1879; application filed March 27, 1879.

*To all whom it may concern:*

Be it known that I, WALTER H. BULLOCH, of the city of Chicago, Cook county, Illinois, have invented new and useful Improvements in Microscopes, of which the following is a specification.

The object of my invention is, first, to simplify and provide more efficient means for using the mirror and sub-stage with its accompanying accessories; second, to provide a more efficient method of perfecting the fine adjustment; third, in simplifying the adjusting of the stage to the optical axis.

It is evident that in the construction of microscopes, to obviate as much as possible the defect of the slightest lateral movement in the sliding fittings, the line of motion should be placed as near as possible to the optical axis.

In the accompanying drawings, forming part of the specification, Figure 1 is a side elevation, in section, through the line *a a*, showing pinion-box and lever-bar connecting with micrometer-screw; also, sub-stage and mirror and revolving stage in position. Fig. 2 represents a front elevation, with the mirror and sub-stage in different positions working independent of each other. Fig. 3 is a cross-section through the body of the instrument, showing pinion-box on line *L l*. Fig. 4 is a cross-section through the line *o o*, showing mirror, partition, sub-stage, stage carrier or support, and stage-ring, with the clamp-screw *R* and spring *g*. Figs. 5, 6, 7, 10, and 11 are details of sub-stage, partition, and mirror; Figs. 8 and 9, stage carrier or support.

Similar letters of reference indicate the same parts in all figures.

*S S* are two standards upon the ordinary tripod-base *B*, whose upper portions are perforated for the trunnions *t*, by which the instrument can be inclined to any angle desired.

The frame *e* or limb is preferably of the form shown, supporting at the lower end the sub-stage and accessories, and at the upper end the body with its accompanying slow motion. The limb *e* is perforated with a taper hole, *d*, which is perpendicular to the optical axis of the body, which is indicated by the line *a a*. In the taper hole is fitted the hollow center of the mirror *m*, through which passes the hollow center of the partition-piece

*p*, that separates the sub-stage and mirror. At the upper part of disk of partition *p* is a piece that acts as a key, *j*, Figs. 6 and 10, which prevents it from turning or communicating any motion between the sub-stage and mirror. Through the hollow center of the partition passes the long center of the sub-stage.

By this method of fitting, the sub-stage and mirror have greater steadiness and freedom of motion around the axis *o o*, or they can be clamped in any position by the milled head *u*. The upper part of limb *e* is slotted in the usual manner. Part of the frame is cut away and another piece fitted in the same position, and slotted the same as the limb *e*. This latter piece is marked *f*.

The usual pinion, with its accompanying milled heads, is fitted to connect with the rack on the body-tube for the coarse motion. By this mode of fitting there is only one slide, with less chance of getting out of order.

The under part of *F* is provided with friction-pulley, which connects with end of lever *h*, which is pivoted at *c*, and at the back end of *h* with micrometer-screw *y*. The upper end of the limb is perforated with a hole, in which is inserted spiral spring *w*, which keeps a constant pressure on top of pinion-box *f*.

When the micrometer-screw is turned to the right the lever *h* is depressed, thus elevating the pinion-box *f*, carrying the body-tube with it, at the same time compressing spiral spring *w*. When the screw is turned the contrary direction the spring assists in carrying the body-tube downward.

Heretofore in centering the stage to the optical axis it has been done by a ring inside of an outside ring, in which the screws operate to either draw or push the interior ring into position. By this method the stage, in order to use it for oblique light, has to be made unnecessarily large.

By my method, in place of a whole ring, I use a segment, or what might be called a "saddle-piece," to which the stage-ring is attached, and adjusted by means of push and draw screws to the optical axis. When it is not desirable to revolve the stage the front of ring is provided with clamp-screw *r*.

In order to lessen the friction the adjusta-

ble stage-ring  $n$  is divided in three places. In two positions are fixed rests, and in front spring rest or clamp, so that the stage can be clamped in any position by screw  $r$ .

I claim as new in my microscope—

1. The swinging sub-stage independent of the mirror provided with a center passing through the limb, and having for its axis of revolution a line which intersects the optical axis  $a$  of the body at a point in the plane of the object-slide, substantially as herein shown and described.

2. The mirror-stem provided with tubular axis passing through the limb, made to receive the tubular partition inclosing the sub-stage center, substantially as described and shown.

3. The combination of segment or support with push and draw screws for centering stage-ring, substantially as herein shown and described.

4. The combination of clamp-screw  $r$  with adjustable concentric stage  $n$  and spring  $g$ , substantially as herein shown and described.

5. The combination of sliding pinion-box with the main slide, micrometer-screw, lever  $h$ , and spiral spring  $w$ , substantially as herein shown and described.

WALTER H. BULLOCH.

Witnesses:

JOHN LILLEY,  
CHAS. J. DAVIS.