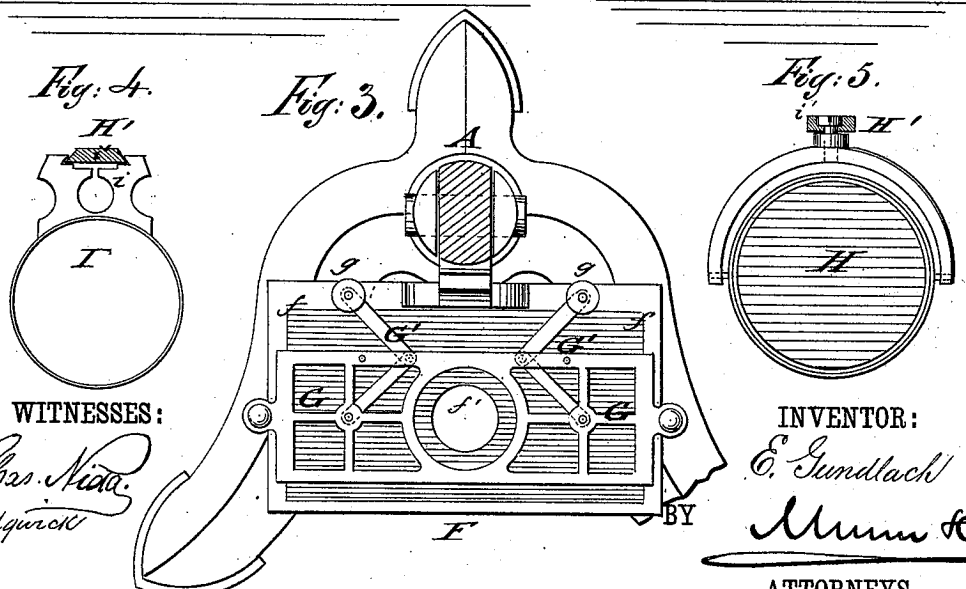
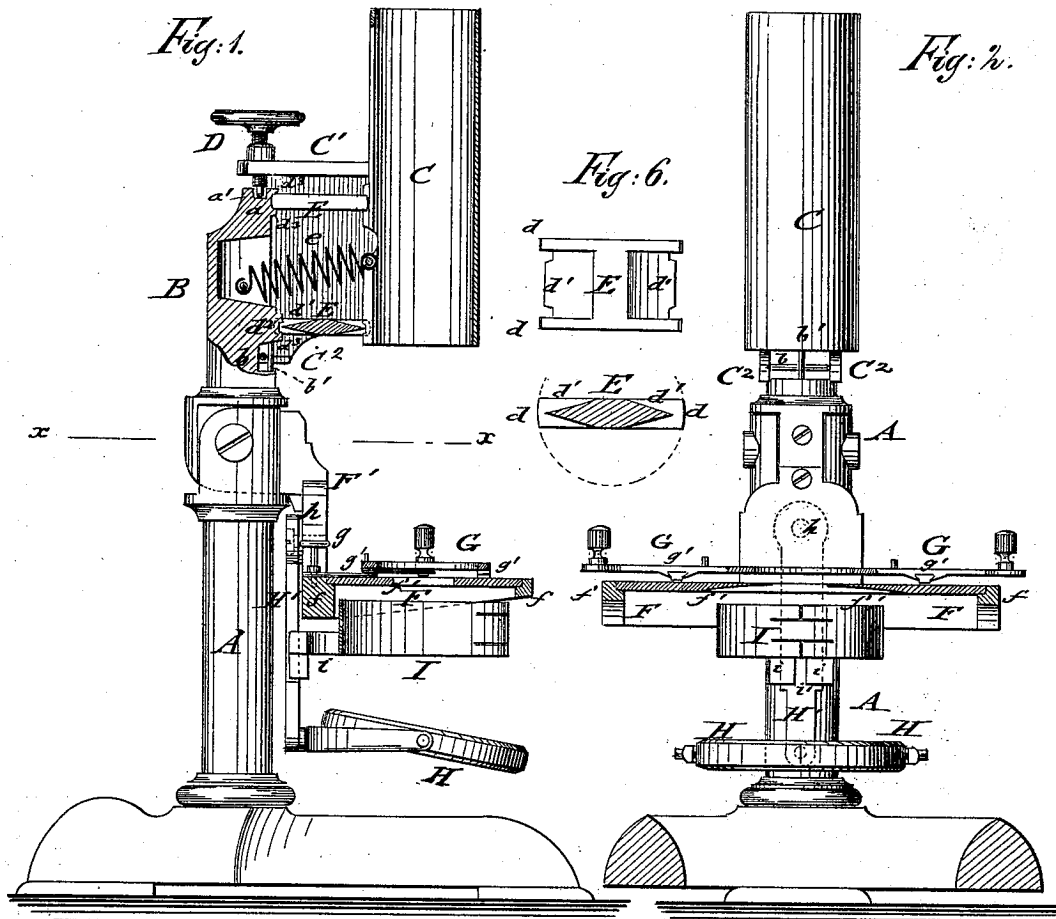


E. GUNDLACH.  
Microscope.

No. 211,507.

Patented Jan. 21, 1879.



WITNESSES:

*Chas. Nida.*  
*C. Sedgwick*

INVENTOR:

*E. Gundlach*  
*Munn & Co*

ATTORNEYS.

# UNITED STATES PATENT OFFICE.

ERNST GUNDLACH, OF ROCHESTER, NEW YORK.

## IMPROVEMENT IN MICROSCOPES.

Specification forming part of Letters Patent No. **211,507**, dated January 21, 1879; application filed August 27, 1878.

*To all whom it may concern:*

Be it known that I, ERNST GUNDLACH, of Rochester, in the county of Monroe, State of New York, have invented a new and Improved Microscope, of which the following is a specification:

In the accompanying drawings, Figure 1 represents a sectional side elevation, Fig. 2 a sectional front elevation, and Fig. 3 a top view, partly in horizontal section, on line *x x*, Fig. 1, of my improved microscope; Fig. 4, a detail horizontal section, showing adjustment of sub-stage on the mirror-bar; Fig. 5, a detail top view of the mirror, showing swivel-connection with the mirror-bar in section. Fig. 6 is a detail top view and a vertical longitudinal section of the guide-rollers for adjusting the tube on the pillar.

Similar letters of reference indicate corresponding parts.

This invention relates to improvements in microscopes, by which the tube is not only adjusted parallel to the supporting-post, but always retained during the adjustment at equal distance therefrom, so that the position of the optical axis is not changed, but kept in line with the axis of the illuminating apparatus. The stage and object-carrier are so arranged that an improved oblique illumination is permissible, a permanent position of the glass plate obtained, and the convenient attaching, adjustment, and removal of the object-carrier rendered possible. The mirror and sub-stage are suspended in superior and readily-adjustable manner.

The invention consists of the connection of the tube and pillar by a micrometer-screw, pressure-spring, and guiding-roller sections, that not only secure the rigid connection of tube and pillar, but also admit the adjustment of the tube parallel thereto without changing the position of the optical axis. The point of the micrometer-screw works in a socket-recess of the pillar, while the tube is retained by a bottom cross-pin of its casing on a fixed vertical pin of the pillar. The roller sections have depressed middle parts, that taper toward the tube and pillar and enter grooves of the pillar, while the arc-shaped portions of the roller-sections are laterally retained by raised intermediate portions of the pillar.

The invention consists, further, of the stage, being made of a frame inclosing the glass plate, and of a sliding and detachable object-carrier, that rests thereon by whalebone points, and is adjusted by pivoted arms; and it consists, finally, of an improved suspension of the mirror-bar; and of the vertical adjustment of the sub-stage on the mirror-bar.

Referring to the drawing, A represents the supporting-stand of my improved microscope; and B, the pillar, that is pivoted thereto and arranged for supporting the different parts of the microscope. The tube C is connected by a rigid arm, C<sup>1</sup>, and by side walls, forming a casing, C<sup>2</sup>, with the pillar B, and adjusted thereon by a micrometer-screw, D, which turns in a nut of the arm C<sup>1</sup> on the top of the pillar, the lower pin-shaped part or point, *a*, of the micrometer-screw being set into a socket-shaped recess, *a'*, of the pillar, without, however, touching the sides of the same. This, in connection with a cross-pin, *b*, of the casing C<sup>2</sup>, and with a fixed vertical pin, *b*<sup>1</sup>, of the pillar at the lower part of the casing, serves to connect the pillar and tube, and secures the regular working of the guide-mechanism of the tube. The micrometer-screw, in connection with the guide mechanism, serves for the fine adjustment of the tube to the object-to be observed.

The guide mechanism consists of two roller-sections, E, which are obtained by cutting from a roller symmetrical segments, so that a middle section of certain  $\times$  thickness, with arc-shaped ends, is left. This section is furthermore depressed in the middle portions and tapered toward the ends, so as to form between the arc-shaped end or corner portions *d* pointed portions *d*<sup>1</sup>, as shown clearly in Fig. 6, whose edges project into grooves *d*<sup>2</sup> of the pillar, but without touching the bottom of the grooves. The pillar B has raised portions *d*<sup>3</sup> between the arc-shaped portions *d*, and above and below the grooves, that prevent the lateral motion of the roller-sections and tube, while the pointed portions of the rollers and the grooves of the pillar secure the roller-sections in position, without any possibility of their changing their position by careless or forcible handling of the instrument.

The pillar and tube are furthermore con-

nected by a strong spiral spring, *c*, by which the intimate connection of the roller-sections with pillar and tube is secured. The spring is, however, not applied centrally between the roller-sections, but hung in such a manner that its point of connection with the pillar is somewhat below, while its point of connection with the tube is above, a center line drawn between the roller-sections. This transmits a part of the power of the spring from the horizontal into the vertical direction, so as to act against the micrometer-screw, and keep up the proper action of the same without loss of motion.

The connection of the tube and pillar by the roller-sections has the advantage that not only the parallelism of tube and pillar is retained at any points of the tube, but that, furthermore, owing to the swinging of the roller-sections around the center of their axis, the distance between tube and pillar remains always the same. This facilitates the setting of the tube into focus, and does away entirely with any change in the position of the optical axis of the tube, so as to avoid thereby the annoying horizontal motion of the microscopic image, and retain throughout the optical axis of the tube in line with the axis of the illuminating apparatus, (sub-stage.)

The stage F is composed of a frame, *f*, that incloses entirely the glass plate *f'*, which is cemented or otherwise fastened to an interior seat of the frame, so as to be flush therewith. The glass plate is thereby protected in a superior manner against injury and breakage, and does not require to be as thick as the glass plates commonly employed. This, in connection with the reduced thickness of the frame, admits of a more oblique illumination than in common microscopes.

The object-carrier G is retained on the glass plate by means of two jointed arms, G', which are pivoted to the object-carrier, and by thumb-screws to the top of the frame of the stage F. This arrangement throws the entire object-carrier above the glass plate, so as to be entirely out of the way of the illuminating-rays.

The object-carrier may be conveniently removed by unscrewing its thumb-screws, and the object then placed directly on the glass plate. The pivoted object-carrier has also the advantage that it can be used in connection with a rotating stage. It rests on the glass plate by four studs, *g'*, of whalebone or similar material, which do not scratch the plate, and admit the easy and noiseless motion of the object-carrier. The object-carrier is made light and ornamental by being cast with open portions, as shown in Fig. 3.

The mirror H is suspended from the supporting-arm F' of the stage by a bar, H', that is secured by a pivot-screw, *h*, to the back of the supporting-arm F'. The sub-stage I is guided along the mirror-bar, and, jointly with the mirror, swung into desired position.

As the supporting-arm F' of the stage F connects with the stand A above the point of

the suspension of the illuminating apparatus, and as the mirror-bar is hung back of the stage, the mirror and sub-stage have full lateral play for oblique illumination, without being interfered with by the stage or other parts.

The sub-stage I is moved by a split guide-piece, *i*, with dovetail groove along the dovetailed middle portion of the mirror-bar, whose lower portion is made narrower, so that the sub-stage may be readily removed from the mirror-bar by sliding it down on the narrower portion of the same.

By replacing the sub-stage it may be adjusted on the mirror-bar with great facility.

My improved construction of microscope furnishes thus a more reliable connection of tube and pillar, a more accurate adjustment of the tube in the line of the optical axis, and an improved construction of stage, object-carrier, and illuminating apparatus, so that the parts are more easily adjusted and better adapted for oblique illumination than the microscopes at present in use.

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

1. The combination, with the pillar of a microscope, of a tube adjusted by micrometer-screw, and roller-sections parallel to the pillar, and in the line of the optical axis of the tube, substantially as described, and for the purpose set forth.

2. The combination of the supporting-pillar of a microscope, having top socket-hole and vertical guide-pin, with a tube having connecting arm and micrometer-screw entering by smaller point into the socket-hole, and having a casing with lower cross-pin, substantially as set forth.

3. The combination of the supporting-pillar of a microscope, and of a tube adjusted by micrometer-screw and axially-swinging roller-sections, with a retaining-spring, that is attached to pillar at a point below, and to tube at a point above, a center line drawn between the roller-sections, substantially as specified.

4. The combination, in a microscope, of the supporting-pillar B, having raised portions *d<sup>2</sup>* and transverse grooves *d<sup>2</sup>*, with the tube C and guiding-roller sections E, having outer arc-shaped ends, *d*, and intermediate tapering or pointed portions, *d<sup>1</sup>*, substantially as described.

5. In a microscope, a stage made of a frame having seat for and encircling the glass plate, substantially as described.

6. In a microscope, the combination of the stage F with an adjustable and detachable object-carrier, G, arranged entirely above the stage, substantially as set forth.

7. In a microscope, the combination of a stage, F, with an object-carrier, G, having jointed and pivoted arms G' and thumb-screws *g*, substantially as described.

8. In a microscope, an object-carrier having studs of whalebone or equivalent material to

prevent scratching of glass plate, substantially as set forth.

9. The combination, in a microscope, with the stage F and its supporting-arm F', of a mirror-bar, H, pivoted to the arm F' back of the stage, to swing into any position for oblique illumination, substantially as set forth.

10. In a microscope, the combination of the mirror-bar, having middle dovetailed portion

and lower narrower portion, with a sub-stage having a guide-piece sliding on mirror-bar and being adjustable and detachable therefrom, substantially as specified.

ERNST GUNDLACH.

Witnesses:

WM. GRAEBE,  
M. F. PROPPING.