No. 866,383. PATENTED SEPT. 17, 1907.

H. N. OTT.

FINE ADJUSTMENT MECHANISM.

APPLICATION FILED JULY 31, 1906.

Fig. 1.

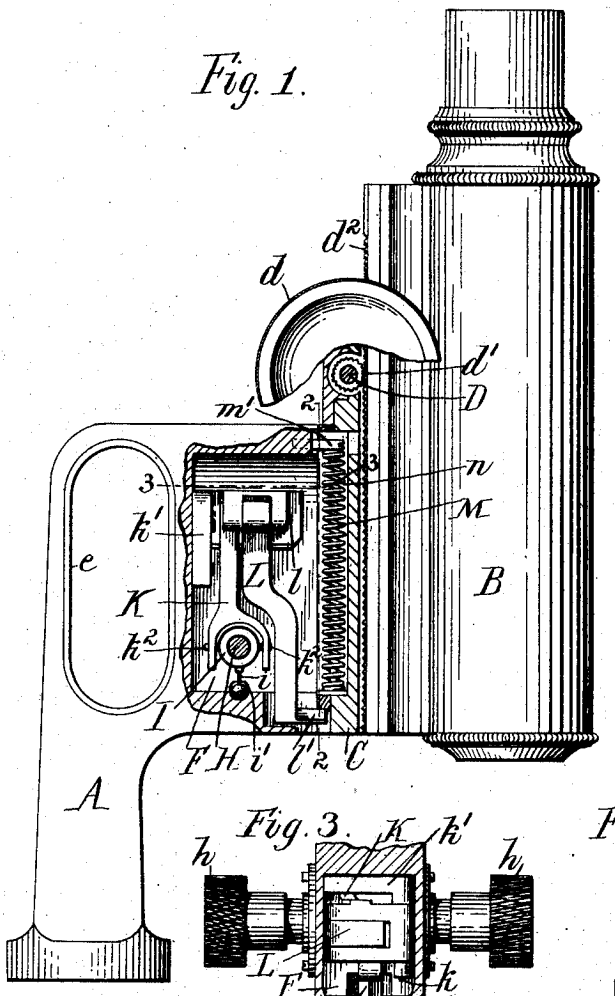


Fig. 2.

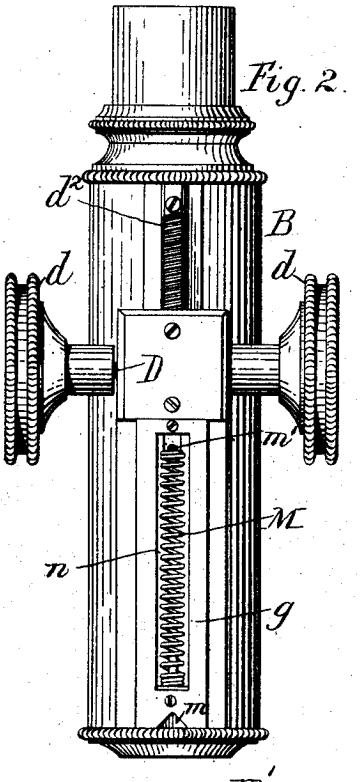


Fig. 3.

Fig. 4.

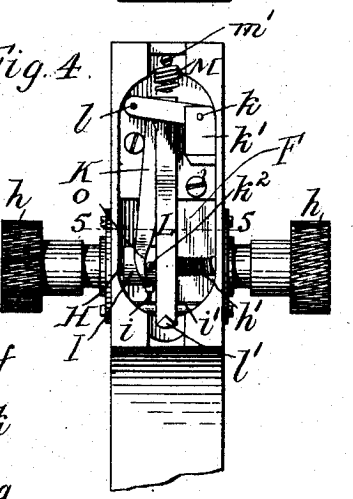


Fig. 5.

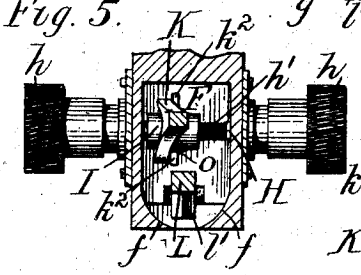
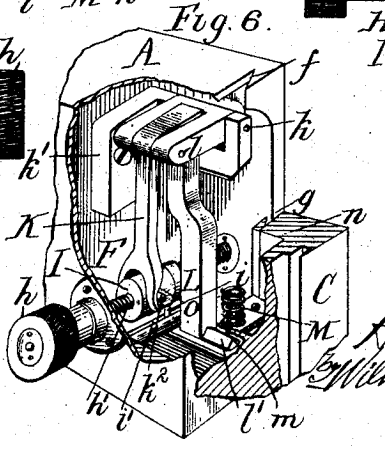


Fig. 6.



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FINE-ADJUSTMENT MECHANISM.

No. 866,383. Specification of Letters Patent. Patented Sept. 17, 1907.

Application filed July 31, 1906. Serial No. 328,560.

To all whom it may concern:

Be it known that I, HARVEY N. OTT, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Fine-Adjustment Mechanisms, of which the following is a specification.

This invention relates more particularly to fine adjustments for microscopes of that type in which the operating knobs or buttons are arranged at the sides of the arm to turn about a horizontal axis, similar to the usual arrangement of the coarse adjustment knobs or buttons. The adjustment is not, however, restricted in application to microscopes but can be used in other instruments or mechanisms where it is desired to effect micrometer adjustments of a movable part. This type of fine adjustment is recognized to be of superior value because, among other reasons, the horizontal arrangement of the adjustment knobs or buttons, is more convenient for operation; because the arm can be made more solid and affords a more substantial support for the body tube, and also provides a handle for carrying the microscope. Several different forms of this type of adjustment have been produced, but none of them are free from objectionable features. For instance, there is considerable lost motion in most of these fine adjustments, the movement of the body tube is not smooth, even and positive, there is lateral displacement of the tube because of the lateral thrust thereon of some part of the adjustment, and because successive like movements of the adjustment knobs or buttons do not always produce like movements of the tube.

The primary object of this invention is to produce a fine adjustment which is reliable, strong, durable, rigid and simple in construction, and which eliminates all of the objectionable features to the known adjustments of this type.

The following may be mentioned as specific objects of the invention: To prevent all lost motion in the fine adjusment so that a predetermined movement of the operating knob or button in either direction will produce a positive and definite movement of the body tube, and this regardless of wear in the parts of the adjustment; to make the movement of the body tube smooth and even and to apply the forces for raising and lowering the tube in a nearly vertical direction or substantially parallel with the direction of movement of the tube, thereby minimizing the lateral thrust on and displacement of the tube with the consequent shifting of the image of the object; to insure corresponding movements of the tube by successive equal rotary adjustments of the operating knob or button and micrometer in either direction; and to prevent alteration of the direction of movement of the tube by continued movements of the operating knob or button in the same direction.

A further object of the invention is to improve fine adjustments for microscopes or other instruments in the respects hereinafter described and set forth in the claims.

In the accompanying drawings: Figure 1 is a side elevation, partly in section, of the supporting arm and body tube of a microscope provided with a fine adjustment embodying the invention. Fig. 2 is a transverse sectional elevation thereof in line 2—2, Fig. 1. Fig. 3 is a fragmentary horizontal sectional plan thereof in line 3—3, Fig. 1. Fig. 4 is a front elevation of the supporting arm and fine adjustment. Fig. 5 is a fragmentary horizontal sectional plan of the supporting arm and fine adjustment, in line 5—5, Fig. 4. Fig. 6 is a fragmentary sectional perspective view of the supporting arm, tube slide and fine adjustment

Like letters of reference refer to like parts in the several figures.

A represents the supporting arm, B the body tube, C the tube slide having guide-ways in which the body tube is movable and is adjusted vertically by the coarse adjustment, consisting in the present instance of the usual transverse shaft D journaled in the slide and provided at opposite ends with operating knobs or buttons d and carrying a pinion d' which meshes with a rack d^2 secured to the body tube. The slide C is also movable vertically, as usual, in suitable guideways on the supporting arm, and is adjusted vertically by the fine adjustment. These parts, with the exception of the fine adjustment, are all common to the ordinary microscope and may be of the construction shown in the drawings or of any other suitable construction and arrangement. The supporting arm shown is provided in front of the usual handle opening e with a chamber F in which the fine adjustment mechanism is located and which is open at the front side of the arm, as shown in Fig. 4. The upper and lower ends of the front portion of the arm are provided with undercut or dovetailed guideways f to receive a similarly shaped bar g on the back of the tube slide C, which closes the front opening of the chamber F.

The fine adjustment is constructed as follows: H represents a horizontal screw shaft which passes transversely through the chamber F and is journaled in suitable bearings on the sides of the arm, preferably having operating knobs or buttons h at its opposite ends. One of these knobs can be provided with the usual sleeve (not shown) bearing micrometer graduations to indicate the degree or rotation of the shaft in use. The portion of the shaft within the chamber F

is provided with a screw thread h' which works in the screw-threaded hole of a nut I. The nut is held from rotation but permitted to move longitudinally on the threaded portion of the shaft in any suitable manner, for instance, a pin i, Figs. 1 and 4, is fixed to and depends from the nut into a guide groove i' in the bottom of the chamber F parallel with the screw shaft, the groove being preferably semi-circular in cross section and the pin having a spherical foot engaging in the groove. The nut can be slid freely in either direction in the chamber, by turning the screw shaft in the proper direction.

The described construction of the screw shaft and nut is simple and efficient, but any other siutable screw arrangement or means for reciprocating a nut or a corresponding device could be employed.

K represents a lever, which is preferably of T-shape, having a head or lateral portion and a substantially upright limb. The lever is located in the chamber F and one end of its head is pivoted in any suitable way at one side of the chamber F, for example, by a pin k to a bracket k' which is screwed or otherwise detachably secured within the upper portion of the chamber F. The upright limb of this lever K extends downwardly and the lower portion thereof is preferably forked to straddle the nut I and bear against pins k^2 which project laterally from the opposite side of the nut.

L represents an upright link or lever which is pivoted at its upper end by a pin l or in any other suitable manner to the free end of the head or lateral portion of the lever K. The link L preferably has a laterally projecting upper end or portion which is pivoted to the head of the lever K, so that the body of the link occupies always a substantially upright position in the median line of the microscope, regardless of the position and inclination of the lever K. The head of the lever is preferably slotted to receive the link as the latter is thereby provided a better support. The link L is connected at its lower end to the tube slide C, conveniently by a horizontal foot l' on the link which extends into a A-shaped notch or seat m in the lower end of the tube slide, and has a knife edge on which the slide bears. This connection is simple and nearly frictionless. The tube slide rests on the knife edge and will be held in place thereon by the weight of the slide and tube, but this is preferably supplemented by a spring M which is located in an upright position in a cavity n in the tube slide with its lower end bearing upon the bottom of the cavity and its upper end bearing against a rigid pin or projection m' projecting into the cavity n from the upper portion of the supporting arm. This spring is slightly compressed at all times and always insures a proper bearing of the tube slide on the knife edge of the link L. This arrangement of the spring in the cavity in the tube slide is desirable because thereby its pressure is applied directly over the point of bearing of the slide on the knife edge of the link and the cavity in the supporting arm can be made smaller as space does not have to be provided therein for the spring.

When the screw shaft H is turned in one direction, for instance, in a right-hand direction, the nut I will be moved toward the right on the shaft and its pins bearing against the forked end of the leg of the lever K will carry the leg also to the right, thereby elevating the free end of the head of the lever and shifting the link L, together with the tube slide and tube which are supported thereby. The weight of the tube slide and tube supplemented by the pressure of the spring M tends to lower the link L and press the lower end of the leg of the lever K firmly against the pins of the nut I, so that when the screw shaft is turned in the opposite direction, or in a left-hand direction, the nut will be moved to the left and the leg of the lever K will follow the nut and allow the descent of the tube slide and tube. The downward pressure on the knife edge is transmitted by the link to the free end of the head of the lever K, and the lower end of the leg of the lever is thus always held firmly against the pins of the nut, and the latter pressed firmly against the threads of the screw shaft, and this will always be the case notwithstanding wear in the parts of the adjustment, so that a movement or rotation of the screw shaft in either direction will always produce an immediate and positive upward or downward movement of the tube slide and tube, depending upon the direction of rotation of the screw shaft. There is very little side thrust upon the tube slide by reason of the upright central arrangement of the link L and its length as compared with the length of the supporting head of the lever K, and the tube slide will therefore move smoothly in its guide-ways and without appreciable lateral displacement. A side bearing for the free end of the link L on the supporting arm, or other means can be provided, if necessary, for entirely eliminating side thrust on the tube slide. As the nut engages the longer limb of the lever K, a comparatively coarse thread can be used on the screw shaft and micrometer movements of the tube slide and tube produced. The adjustment is therefore strong and durable.

There is a slight variation in the leverage of the leg of the lever K between the extreme upper and lower limits of the excursion, and to compensate for this the forked end of the lever leg is provided with curved faces n to bear upon the pins of the nut I, the curvature being such that successive equal movements of the nut will produce corresponding vertical movements in the link L notwithstanding the different angles assumed by the lever K.

I claim as my invention:

1. In a fine adjustment, the combination with a part to be moved, of a link connected to said part and arranged substantially parallel to the direction of movement of said part, a lever to which said link is connected, an operating device, and connections between said device and said lever for oscillating the latter, substantially as set forth.

2. In a fine adjustment, the combination with a part to be moved, of a link connected to said part, a pivoted lever upon which said link is hung, an operating device, and connections between said operating device and said lever for oscillating the lever, substantially as set forth.

3. In a fine adjustment, the combination with a vertically movable part, of a link connected at its lower end to said part, a pivoted lever to which said link is connected at its upper end, a rotatable operating part, and connections between said operating part and lever for oscillating said lever, substantially as set forth.

4. In a fine adjustment, the combination with a part to be moved, of a link arranged to move endwise of itself and connected to said part, a pivoted lever to which said link is connected, a rotatable part having a screw thread, and a device which has a threaded engagement with said screw thread and is moved thereby and oscillates said lever, substantially as set forth.

5. In a fine adjustment, the combination with a part to be moved, of a link which is arranged to move endwise of itself and is connected to said part, a pivoted lever to which said link is connected, a rotatable screw, and a nut which is moved by said screw and moves said lever, substantially as set forth.

6. In a fine adjustment, the combination with a vertically movable part, a link which supports the weight of said part, a pivoted lever upon which said link is hung, a rotatable screw, and a nut which is moved by said screw and moves said lever, substantially as set forth.

7. In a fine adjustment, the combination with a vertically movable part, of a link having a part with a reduced portion upon which said vertically movable part bears, a pivoted lever upon which said link is hung, a rotatable screw, and a part which is moved by said screw and moves said lever, substantially as set forth.

8. In a fine adjustment, the combination with a vertically movable part, of a substantially upright link which supports the weight of said part and is provided with a lateral portion, a pivoted lever having a lateral arm to which the lateral portion of said link is pivoted and a substantially upright limb, a rotatable operating part, and connections between the same and the leg of said lever for oscillating said lever, substantially as set forth.

9. In a fine adjustment, the combination with a vertically movable part, of a substantially upright link which supports the weight of said part and which is provided with a lateral portion, a pivoted lever having a lateral arm to which the lateral portion of said link is pivoted and a depending leg, and operating means for oscillating said lever, substantially as set forth.

10. In a fine adjustment, the combination with a vertically movable part, of a substantially upright link upon which said part bears, a pivoted lever upon which said upright link is hung, an operating part, connections between the same and said lever for oscillating the lever, and a spring for holding said vertically movable part in contact with said link, substantially as set forth.

11. In a fine adjustment, the combination with a movable part, an endwise movable link which is connected to said part, a pivoted lever to which said link is connected, an operating part, and a device which is moved by said operating part and bears against said lever, said lever having a curved face engaged by said device, substantially as set forth.

Witness my hand, this 26th day of July, 1906.

HARVEY N. OTT.

Witnesses:

C. W. PARKER,

A. L. MCGEE.