# PART III

# COMPOUND MONOCULAR

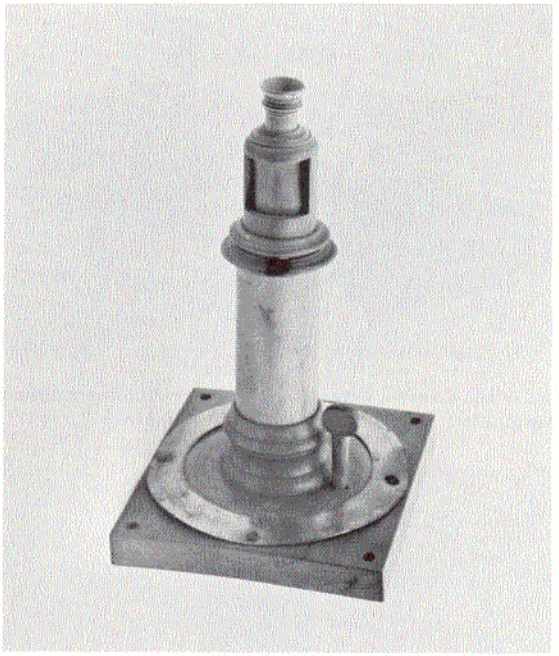

Fig. 395. Junker, Magdeburg, Germany; Nuremberg solar; 1791. (AFIP 706850 - 68-8625-7)

Made almost entirely of wood and cardboard, this instrument (Fig. 395) has a wooden base 4-1/2 x 4-3/4 inches to which is screwed a thin, 4-1/2-inch-diameter, 5/8-inch-wide copper rim. A 2-3/4-inch circular wooden disc fits into the base. A 1-3/8-inch-high wooden pillar housing the condensing lens at its terminal point is inserted into the wooden disc.

The 4 x 1-1/8-inch cardboard body tube is covered with a bluish-green paper. The projection lens is in a wooden mount and screws into a hollow wooden casing 2-1/2 x 1-1/8 inches, cut away in the front and back. Enclosed in the casing is a 3/4-inch hollow tube on a spiral spring to permit insertion of a slide. Focusing is effected by screwing the projection lens backward or forward. It is 8 inches in height.

From the description accompanying the instrument, it is assumed that it was constructed by Junker in 1791 at Magdeburg, Germany and presented to the Kalkstein Regiment by its field chaplain. Instructions explain how it may be used as either a solar or simple microscope or as a camera obscura. ■

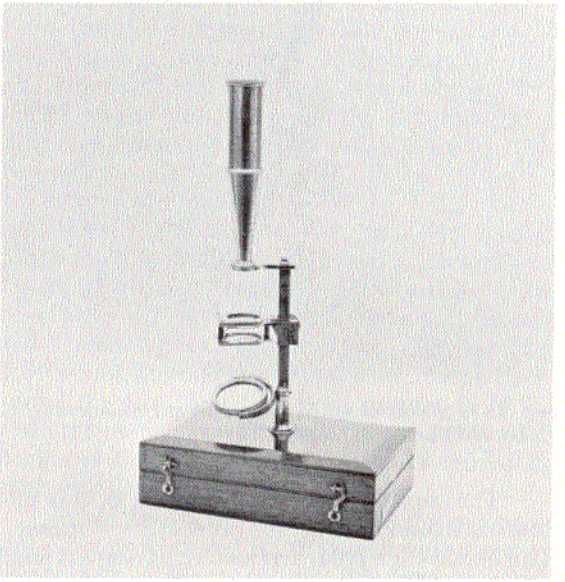

Fig. 396. I. Newman, London, England; compound monocular; C. 1820. (AFIP 710340 - 68-8625-8)

This Cary-type microscope (Fig. 396) screws to the top of a box, 6-7/16 x 4-1/2 x 1-3/4 inches, that serves as a base. The rectangular pillar is 3-1/4 x 1/4 x 5/16 inches, and has a rack cut at the back which is welded to the 1 x 5/16-inch portion of the pillar that screws into the box. The gimbal which holds the 1-1/4-inch single mirror fits into the pillar with a pin. The 1-5/8 x 1-1/8-inch stage is fixed to a pinion casing, with a similar plate beneath and a spring fitting between the plate and the stage. There is a 7/8-inch aperture in both the stage and the plate beneath. The stage is activated by rack and pinion and has openings for forceps and condenser.

The body tube is 4-5/8 inches long and 1 inch in diameter and the lower 2-3/8 inches is cone shaped; it screws into a 1-3/4-inch arm which is screwed to the top of the pillar. The eyepiece and objective screw in; there is a field lens. Height is

9-1/4 inches.

Accessories are 3 objectives, a 1-inch arm that fits into an opening in the stage, condensing lens, a live-box, stage forceps, and 3 ivory sliders; it is signed, "I. Newman, 122 Regent St." ■

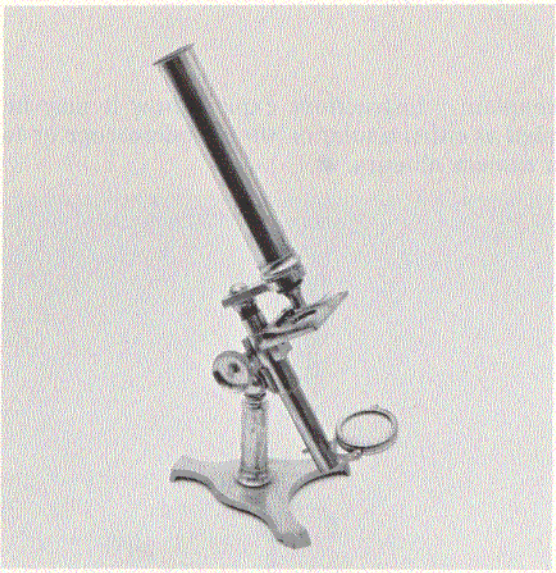

Fig. 397. Maker unknown; compound monocular; C. 1820. (AFIP 518997 - 68-5827-3)

The modified claw-footed base of this all-brass instrument (Fig. 397) is 4-1/2 x 4 inches. The 2-inch-high pillar screws into a compass joint which is screwed to the limb. The 4-1/2 x 1/2-inch tubular limb, attached to the 2-1/4-inch arm with a key adjustment, has a rack and pinion; the gimbal for the 1-1/4-inch single concave mirror slides into the limb. The 2-1/8 x 1-5/8-inch stage is screwed to the limb, has a 5/8-inch aperture, two slide holders screwed to the rear, and two openings for forceps.

The 5-7/8-inch body tube screws into the 2-1/4-inch arm, has an eyepiece and screw-in objective; it is 11-3/8 inches high when closed.

The instrument is a student model, either English or French, of a type that was made over a period of many years. ■

This "Universal" achromatic horizontal microscope (Fig. 398) is similar to, but smaller than, those by the same maker pictured in Figures 61 (AFIP 19488) and 67 (AFIP 49081).

It is signed "Microscope Achromatique Universal Invente par Charles Chevalier, Palais National, 158, Paris." (Donated by Dr. Arnold J. deVeer as a gift of Dr. Philip Graeme Cabaud)

Note: Charles Louis Chevalier, 1804-1859, began making his large horizontal microscopes in 1827. ■

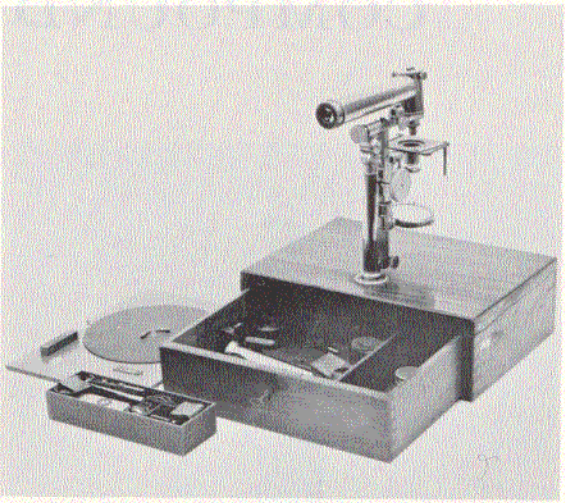

Fig. 398. Charles Chevalier, Paris, France; compound monocular; 1835. (AFIP 758135 - 68-10063)

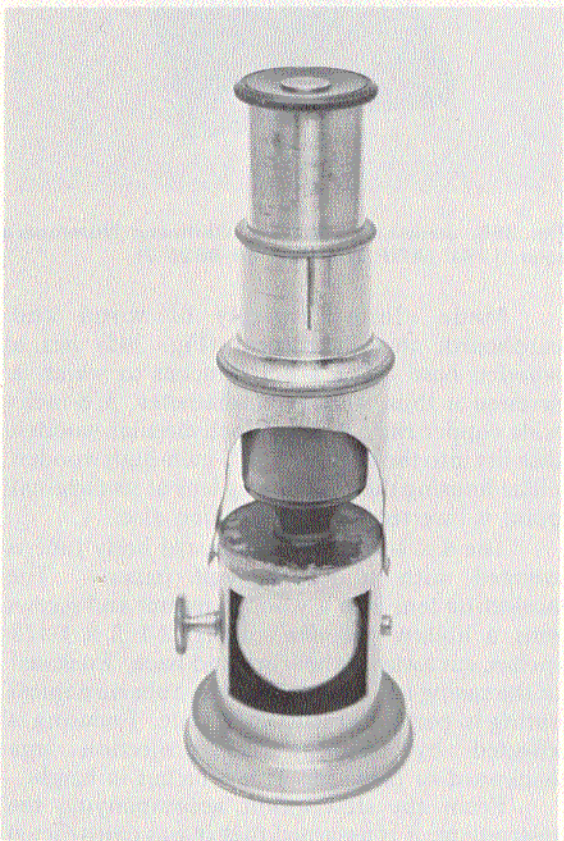

Fig. 399. Maker unknown; compound monocular; C. 1840. (AFIP M-031038 - 74-6717)

The base of this brass instrument (Fig. 399) is 1-7/8 inches in diameter with a 1-1/2 x 1-1/4-inch tube, cut away in the front to house the 1-inch-diameter single mirror. The top of the tube forms the stage. Fixed to the stage is a 1-5/8-inch tube cut away front and back, into which slides the 2-1/2 x 15/16-inch body tube with an attached objective. The 1-1/2-inch compound ocular screws into the body tube; height is 7 inches. It is marked "Made in France." (Donated by Captain Robert S. Pearsall, Jr.) ■

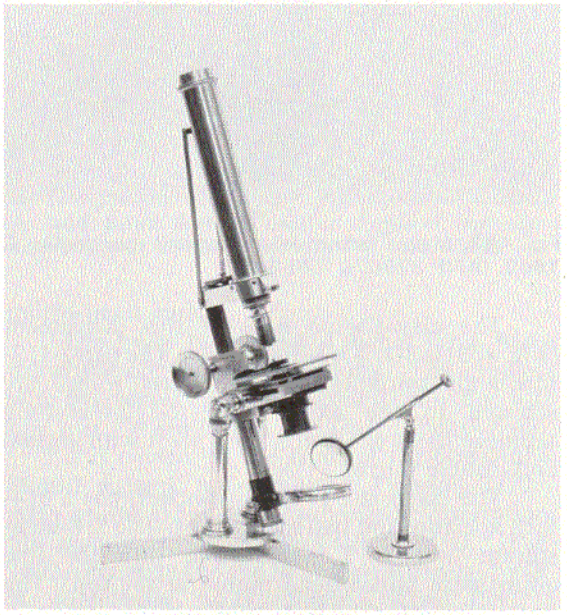

**Fig. 400. James Smith, London, England; compound monocular; 1846. (AFIP 379059 - 69-10805)**

This all-brass "Improved Achromatic Microscope" (Fig. 400) has a folding tripod base attached to a 3-3/8-inch circular plate from which extend two 4-1/8-inch-high cylindrical pillars with compass joint. A 3-7/8-inch-long, 3/4-inch-diameter tubular tailpiece is inserted into the base of the 1-inch-square x 2-1/2-inch-long housing which holds the triangular rack and two milled-head pinions. The 2-inch-diameter mirror is concave on one side and plain on the other, with two actions, is supported by a cylindrical bar, and may be moved on it vertically or horizontally. The 2-3/4-inch-square stage has two steady rackwork motions at right angles to each other and to the axis of the body by means of two milled heads. It also has a sliding and revolving plane with a ledge for objects and a sliding piece with springs for clamping them. A removable diaphragm is fixed under the stage with a dovetail fitting, and the quantity and direction of light may be varied by the different size holes in its revolving plate.

The 7-1/4-inch-long body tube fits into a 4-inch arm which is screwed to the top of the rack. The fine adjustment is located in the center of the arm. The body tube is braced by two 6-1/4-inch-long x 1/4-inch-wide flat bars which extend from either side of the rear of the arm for 5-1/2 inches where they are connected to a 1-inch circular crossbar screwed to the outer body tube which has an objective and a 1/4-inch ocular attached; there is a sliding body. Additional accessories: condenser on stand, 1 ocular, 4 objectives: 1/8-, 1-, 2-, and 3-inch (marked, "Baker, London"), live-box, 3 prisms, and a mahogany carrying case. When closed it is 16-1/2 inches high. It is signed on the front, "Jas. Smith, London, 141," and was supplied by the maker to a Dr. Thompson in November 1846.

James Smith, the founder of R. & J. Beck, Ltd., began making microscopes in the 1820's and constructed J. J. Lister's microscope for William Tulley in 1826. Smith established his own business in 1829 and in 1847 formed a partnership with Richard Beck, the beginning of the famous firm of Smith and Beck. About 1851 Joseph Beck joined the firm and became a partner in 1857, when the name of the firm was changed to Smith, Beck and Beck. When James Smith retired in 1866, the firm became R. & J. Beck.

James Smith, the maker of this microscope, and Andrew Ross and Hugh Powell were directly responsible for most of the progress in microscopes and optics in England in the mid-19th century. ■

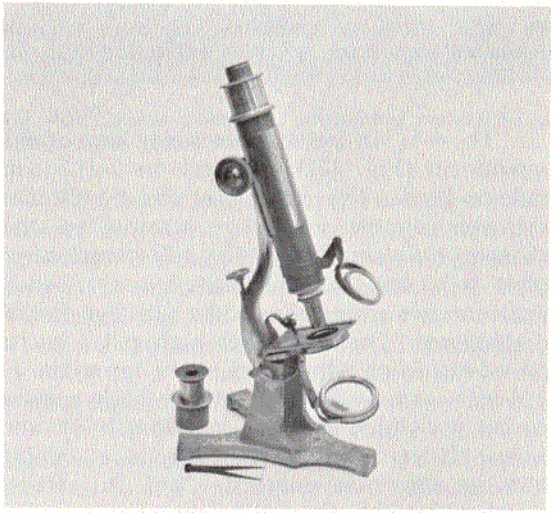

**Fig. 401. Maker unknown; compound monocular; C. 1850. (AFIP 379081 - 70-10721)**

The reversed claw-footed base of this all-brass instrument (Fig. 401) has a spread of 5 x 7 inches. The two 3-1/4-inch uprights are cast with the base. The gimbal for the 2-inch double mirror is attached to a swinging tailpiece; the 2 x 2-7/8-inch stage has a 1-1/4-inch aperture. The curved limb carries the milled-head fine adjustment, a 3-5/8-inch-long casing, into which the 7-1/2-inch-long body tube fits, and the rack and double milled-head pinion. A condensing lens, an objective and an ocular are attached to the body tube.

When closed it is 14 inches high; it is not signed. There is an additional unmarked ocular, a collection of glass slides and a specimen forceps. ■

**Fig. 402. Ross & Company, London, England; compound monocular; C. 1850. (AFIP 758133 - 68-10060)**

The 4-11/16-inch diameter ring base of this instrument (Fig. 402) supports the 2-1/2-inch tubular limb. The gimbal for the 1-1/2-inch-diameter double mirror is screwed to the swinging tailpiece. The 4-1/2 x 3-7/16-inch stage plate is incurved at the back, has a 1/2-inch aperture, two spring clips and a substage disc of diaphragms. The 3-1/4-inch-high pillar has a milled-head fine adjustment at the top and a 1-1/4-inch arm with a 2-1/4-inch-high sprung casing into which the 5-7/8-inch-long body tube slides. It has a calibrated drawtube, an ocular and an objective marked, "2/3 in., Ross, London, 21637." Overall height when closed is 10-3/4 inches. It is signed, "Eclipse, Ross, London, 5498." ■

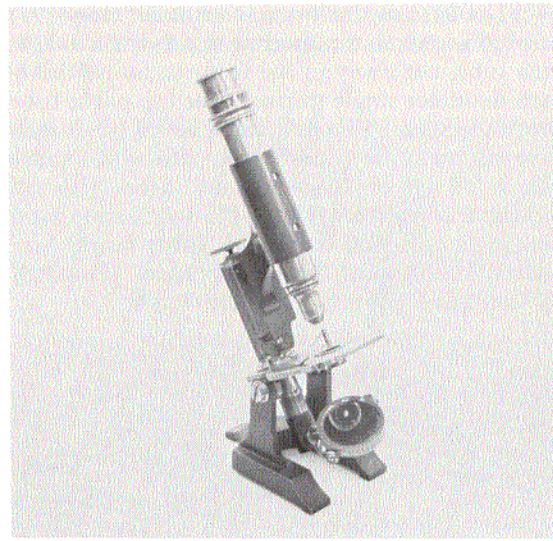

**Fig. 403. Maker unknown; compound monocular; C. 1850. (AFIP 379070 - 70-6269)**

The claw-footed base of this instrument (Fig. 403) is 3-1/4 x 4-3/4 inches. The two 2-1/2-inch-high uprights with compass joints are screwed to the base. The 2-1/2-inch-long tailpiece has a short arm on a pivot with gimbal and double mirror.

The stage is 2-11/16 x 3 inches, has a 3/4-inch aperture and two spring clips. The 5/8-inch-square limb is 3 inches long with the fine adjustment milled-head pinion at the top. The outer casing for the body tube and the angle arm are cast in one piece and slide into a grooved fitting on the pillar.

The 1-inch-diameter body tube is 5-1/2 inches long, has a double milled-head fitting into which the ocular slides and screws to the top of the tube; when closed it is 11 inches high. It is not signed, but the walnut carrying case bears a metal tag engraved, "Clarkson's Optical Stores, 338 High Holborn (Opposite Gray's Inn Rd. (London, W.C. 1))." ■

The reversed claw-footed base of this instrument (Fig. 404) has a spread of 7 x 5-5/8 inches, with two 4-1/4-inch-high uprights attached by screws. The stage plate is 5 x 2-3/4 inches, is incurved at the back, and has flanges to which the 4-3/8-inch-high uprights are attached; the fine adjustment is at the rear of the plate. A tubular tailpiece, 4 x 3/8 inches, carries the gimbal for the 2-1/2-inch double mirror on a revolving arm. To the rear of the stage plate is a tubular limb, 4-1/2 x 7/8 inches long, with angular arm. The stage is adjustable by means of

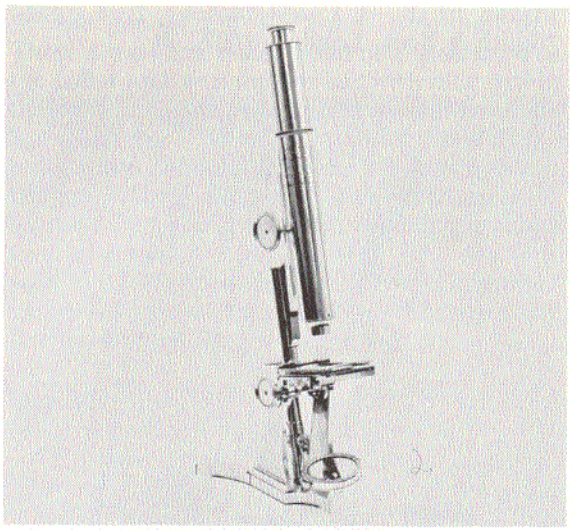

Fig. 404. Smith & Beck, London, England; compound monocular; C. 1850. (AFIP 389498 - 70-1620)

milled-head pinions.

The body tube is 8-1/4 inches long, has a drawtube and rack and pinions. The eyepiece with two lenses fits into a second drawtube with one lens. When closed it is 18-1/2 inches high.

It is signed on the front of the body tube, "Smith & Beck, 6 Coleman St., London, 2270." Also on the front of the tube is the inscription, "In memoriam, C. R. McClellan, M.D., 1846-1852. Presented to the Brooklyn Hospital by W. A. Pierrepont, M.D., Interne, April 1882 to October 1883." (Donated by Dr. Arnold J. deVeer) ■

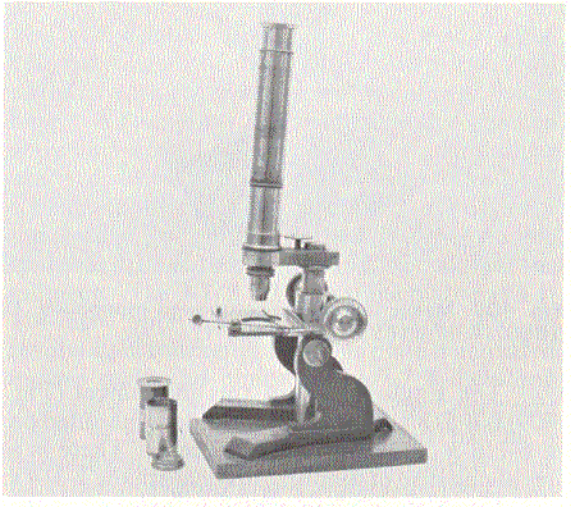

Fig. 405. R. Field & Son, Birmingham, England; compound monocular; C. 1855. (AFIP 709643 - 68-8625-6)

The cast iron base of this brass and black-colored instrument (Fig. 405) has a spread of 5-1/4 x 5-1/2 inches and is mounted on a wooden base 5-1/8 x 6-1/8 inches. The 2-9/16 x 3-1/2-inch stage has a 1-inch aperture, is incurved at the back, and is attached to the 2-3/4-inch-high uprights by pivot screws. The 3-1/2 x 3-1/4-inch tubular limb carries the rack and pinions; the mirror is missing. The 2-7/8-inch arm has a milled head fine adjustment. The 5-1/2 x 1-inch body tube is in two sections, the upper section, 3-7/8 inches long, screws into the lower section; an ocular and objective are attached. There are stage forceps, a live-box, and an extra eyepiece. It is 11-1/2 inches in height. It is signed, "R. Field & Son, Birmingham." The number is 502. ■

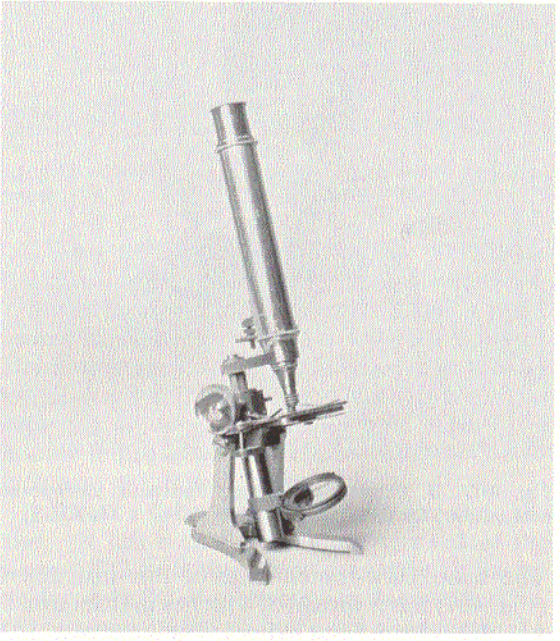

Fig. 406. Maker unknown; compound monocular; C. 1860. (AFIP 388684 - 73-3904)

The claw-footed base of this brass and black-colored instrument (Fig. 406) has a spread of 5-1/4 x 4-1/2 inches; two 3-1/4-inch uprights are screwed to the base. The stage plate is 2-1/2 x 2-1/2 inches, has two flanges and a 1-inch collar. There is a substage revolving disc of diaphragms. A 3-1/8 x 3/4-inch tubular limb carries the sliding casing for the 1-7/8-inch single mirror.

The 2 x 3-1/2-inch stage is incurved on one side and connected by a 5/8-inch pin to a fixture attached to and protruding from the base of the stage plate. There is a milled-head pinion (one missing) on the collar and a triangular bar with rack within the limb. A 2-5/8-inch arm is screwed

to the top of the bar.

The 6-1/2 x 1-1/8-inch body tube screws into the arm; the fine adjustment is screwed to the lower portion of the body tube. There are two objectives and one ocular. When closed it is 12 inches high. ■

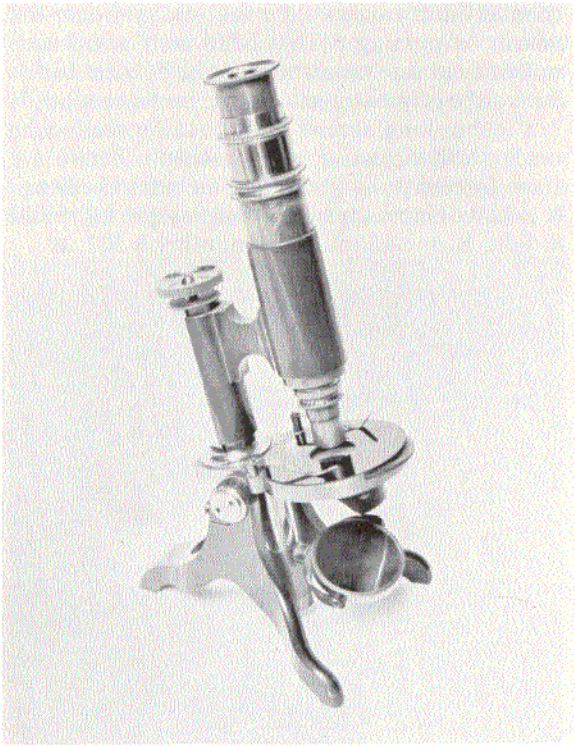

Fig. 407. J. Brown, Glasgow, Scotland; compound monocular; C. 1860. (AFIP M-004047 - 74-7353)

The bent, claw-footed base of this instrument (Fig. 407) has a spread of 4 inches in front and 5-1/2 inches from front to back. The stage plate is 2-1/2 inches in diameter and the mirror has a diameter of 1-3/4 inches.

The hexagonal limb is 3 inches long and has a fine adjustment screw at the top. The brass body tube is 4-3/4 inches long with a single nosepiece; when closed it is 10 inches high. It is signed, "J. Brown, 76 Vincent Street, Glasgow."■

This instrument (Fig. 408) is identical to Figure 105 (AFIP 49111) with the exception it is all brass except the uprights, and the substage condenser slides into a cylinder affixed to the trunnions; there is no mirror. Accessories include an additional eyepiece, one diaphragm, an achromatic condenser and a prism. The overall height is 13-3/4 inches. It is signed, "Smith & Beck, London, 1609." ■

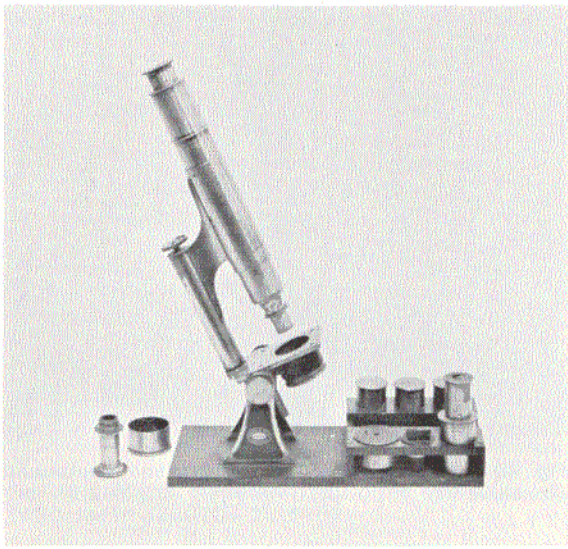

Fig. 408. Smith & Beck, London, England; compound monocular; C. 1860. (AFIP 738597 - 69-8755)

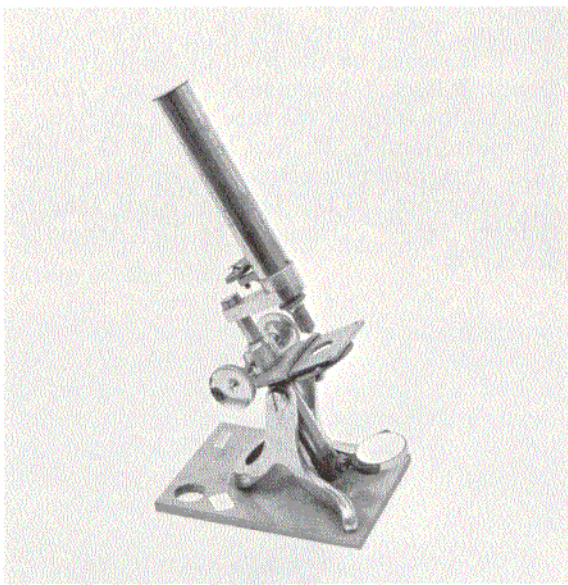

Fig. 409. Maker unknown; compound monocular; C. 1860. (AFIP 518999 - 68-5827-1)

The English base of this instrument (Fig. 409) is 4-5/8 x 5 x 4-1/8 inches and is mounted on a 6-7/8 x 5-1/4-inch wooden base. There is a revolving disc of diaphragms beneath the 2-3/4 x 3-3/4-inch stage plate, which is incurved at the back and cast with the collar and flanges. The 4 x 3/4-inch tubular limb has a sprung sliding casing

for the gimbal and 1-5/8-inch single mirror. There is a double milled-head pinion screwed to the collar and a triangular bar with rack within the limb. The 3-inch-long arm is screwed to the triangular bar. The 7 x 1-1/8-inch body tube screws into the arm and has an objective and ocular. The milled-head fine adjustment is screwed to the lower portion of the body tube. Overall height is 12-1/2 inches. The ocular is signed, "J. H. Steward, 54 Cornhill, London," and the number "8" is on the body tube below the fine adjustment. ■

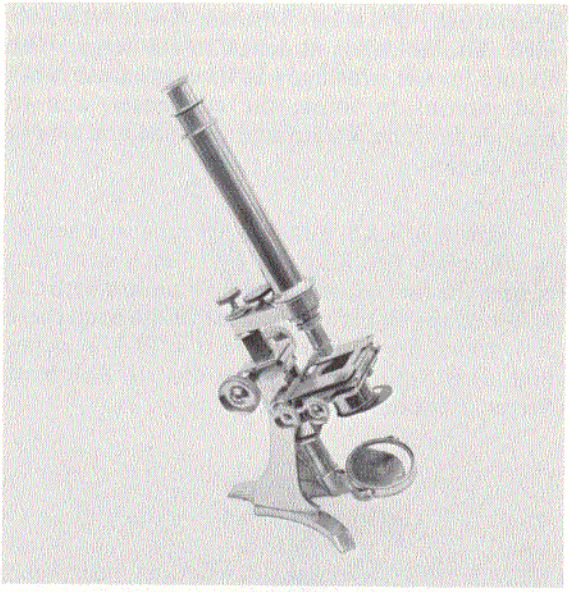

**Fig. 410. Charles Baker, London, England; compound monocular; C. 1860. (AFIP 518996 - 68-5827-2)**

The claw-footed base of this instrument (Fig. 410) measures 6 x 5-1/2 inches. Two 5-inch-high uprights with compass joints are screwed to the base. A triangular bar with rack is contained within a 3-1/4 x 1-5/8-inch box-like casing and is activated by two milled-head pinions. The 2-1/2 x 1-inch tubular tailpiece is screwed to the base of the casing. The gimbal for the 2-1/2-inch double mirror is affixed to a sprung sliding collar on the tailpiece. The 3-1/2 x 3-inch stage plate has a 1-1/4-inch aperture and a substage disc of revolving diaphragms; the stage plate is activated by two racks and pinions. The 7-7/8-inch-long body tube with drawtube fits into the 5-inch arm which is attached to the triangular bar by a milled-head pinion. A milled-head fine adjustment is on the arm; an ocular and objective are attached. When closed it is 16-1/2 inches high. It is signed, "Baker, 244 Holborn, London." ■

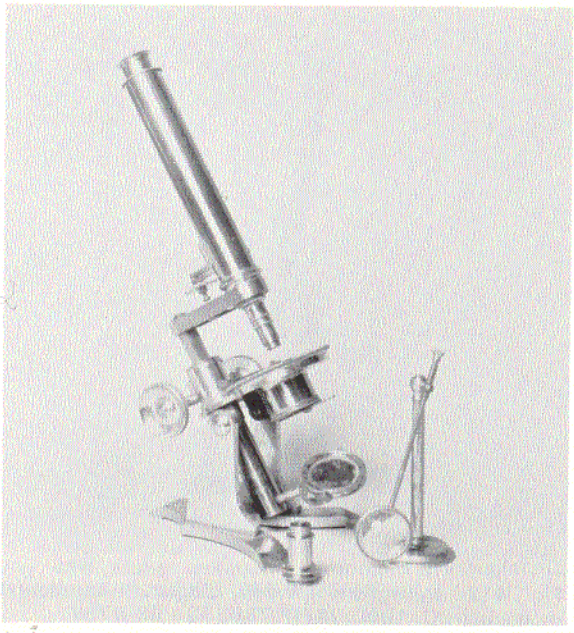

**Fig. 411. Charles Baker, London, England; compound monocular; C. 1860. (AFIP 388682 - 73-3911)**

This all-brass instrument (Fig. 411) has a flat claw-footed base to which are screwed two 4-7/8-inch uprights. The circular stage is 3-1/2 inches in diameter, with a 1-1/2-inch aperture and a substage disc of diaphragms. The tubular tailpiece is 4 x 7/8 inches and has a single 1-1/2-inch mirror on a gimbal and pin. There is a double milled-head pinion and rack; the 3-1/2-inch arm is screwed to the rack.

The 7 x 1-1/8-inch body tube screws to the arm. It has a fine adjustment screwed at the lower 1-1/2 inch; there is no drawtube. It has an ocular and a 3-1/4-inch screw-in Baker objective. Accessories include a bull's-eye condenser on a stand, an ocular and a 1-inch objective. It is 15 inches high, and is signed, "Baker, 244 Holborn, London." ■

The claw-footed base of this all-brass instrument (Fig. 412) has two 4-1/4-inch uprights attached. The 2-7/8 x 4-1/2-inch stage is cast with two flanges and a 1-inch collar, is incurved at the back, and attached to the uprights by pivot screws. The 3-5/8 x 7/8-inch tubular limb carries a 1-1/2-inch sprung casing for the gimbal and a 2-inch single mirror. The stage has a sliding bar, openings for condenser and forceps and a 1-1/2-inch central aperture; there is a fitting for a substage condenser.

There is a double milled-head pinion at the rear of the collar, and a triangular bar with rack

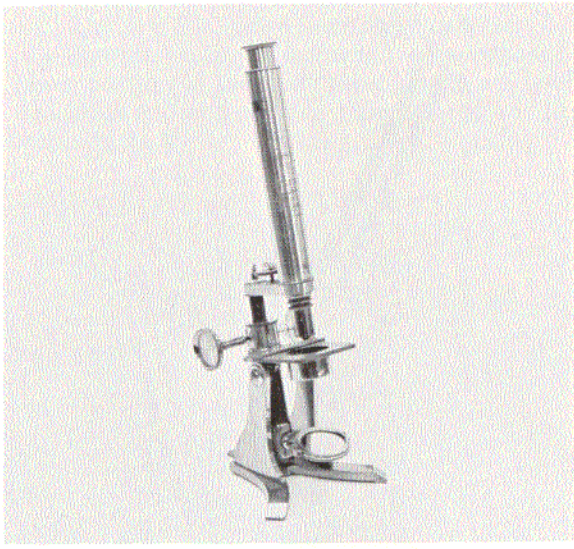

Fig. 412. Callaghan, London, England; compound monocular; C. 1860. (AFIP 739233 - 69-8757)

that slides into the limb. The 3-1/2-inch arm is attached to the top of the triangular bar. The 8 x 1-1/8-inch body tube screws into the arm and has an objective and ocular. The fine adjustment on the arm activates a projecting 1 x 3/8-inch bar which extends from the rear of the body tube. Overall height is 15-1/2 inches. It is signed, "Callaghan, 23a New Bond St., London." ■

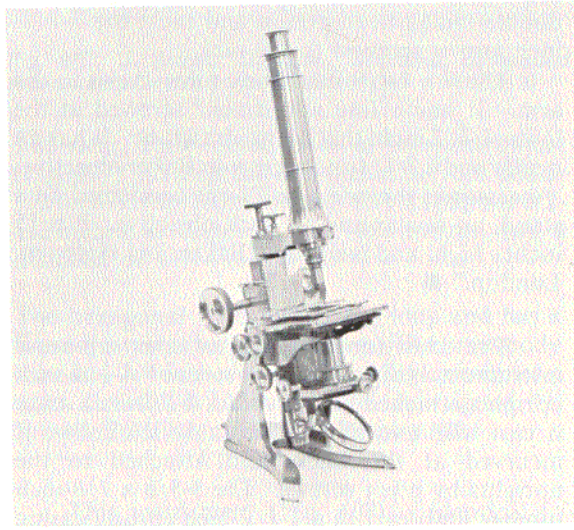

Fig. 413. Salmon & Company, London, England; compound monocular; C. 1860. (AFIP 740080 - 69-8759)

The flat tripod base of this all-brass instrument (Fig. 413) has a spread of 10 x 7-1/2 inches; the two 7-inch-high uprights with compass joints are screwed to the base. The 1-5/8 x 7/8-inch rectangular limb with rack at the back fits into a 4-1/4 x 2-1/2-inch box-like casing and is activated by two 2-3/8-inch milled-head pinions which have a spread of 6-1/2 inches. The 4-5/16 x 1-1/4-inch tubular tailpiece is affixed to the lower end of the casing. The gimbal for the 3-inch double mirror is affixed to the tailpiece by a sprung sliding collar. The 4-1/2 x 6-1/2-inch mechanical stage has a chain drive for backward and forward motion and a Turrell-type screw for side to side motion. The rectangular stage aperture is 1-3/4 x 2-3/8 inches. A 4-1/8 x 3-3/4-inch slide holder is attached to the stage. The fixture for the substage has three separate racks and pinions to rotate the condenser, and to provide both backward and forward and side to side motion.

The 9-3/4 x 5/8-inch body tube with screw-in objective fits into the 5-1/2-inch arm that carries the fine adjustment and a pinion with a 1-3/8-inch shank for adjustment of the arm; there is a drawtube. When closed it is 19-1/2 inches high. It is signed, "Salmon & Co., 18 Lombard Street, London." ■

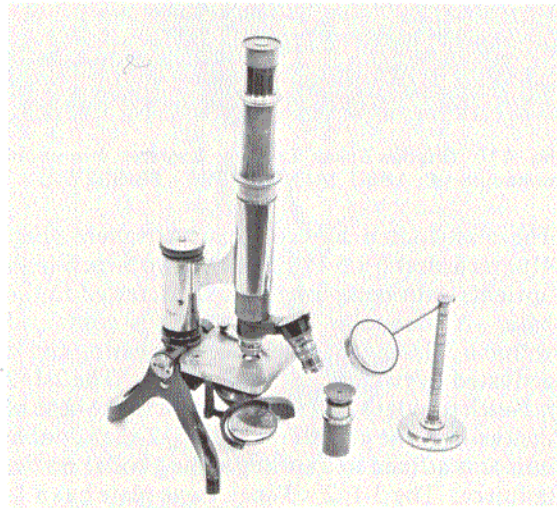

Fig. 414. Henry Crouch, London, England; compound monocular; C. 1860. (AFIP 379072 - 70-6266)

The black japanned English base of this instrument (Fig. 414) is 5-3/4 x 5-1/4 x 3-3/4 inches. The 2-7/8-inch-long by 1-1/4-inch-diameter tubular limb is on a trunnion and has a top fine adjustment. The 1-1/4-inch single mirror is on a pivot arm and gimbal and attached to a 1-

1/4-inch swinging tailpiece.

The stage is 2-7/8 inches square, is fixed to the limb, and has a 1/2-inch off-center aperture with a substage revolving disc of diaphragms. The outer split casing for the body tube is 3 x 1 inch and is connected to the limb by a 2-3/8 x 1-5/8-inch angular arm.

The body tube is in two sections with an overall length of 8 inches; the upper 3-1/2-inch section screws into the top of the lower section and has a milled head. A Brooke's double nosepiece with two objectives and an ocular is attached. There is an additional ocular and a bull's-eye condenser on a stand. When closed it is 13-1/2 inches high. It is signed on the base, "Henry Crouch, London, 5464." ■

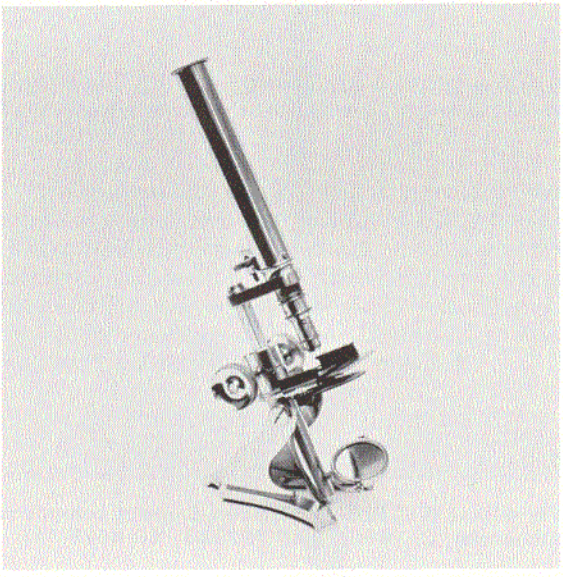

**Fig. 415. M. Phelps, London, England; compound monocular; C. 1860. (AFIP 389500 - 69-11187)**

The claw-footed base of this all-brass instrument (Fig. 415) is attached to two 3-1/4-inch curved uprights. The 3 x 3-3/4-inch stage has a 3/4-inch central aperture and a revolving disc of diaphragms. The gimbal for the 1-1/2-inch-diameter single mirror is inserted into the lower portion of the limb. Coarse adjustment is by rack and double milled-head pinion. The 2-3/4-inch bar is screwed to the top of the triangular rack. The 7 x 1-inch body tube screws into the arm and has a fine adjustment at the rear. An ocular and objective are attached. Height is 14 inches.

Accessories are a clip-on vulcanite slide holder with an oval-shaped aperture and a live-box. It is signed on the base, "M. Phelps, Maker." ■

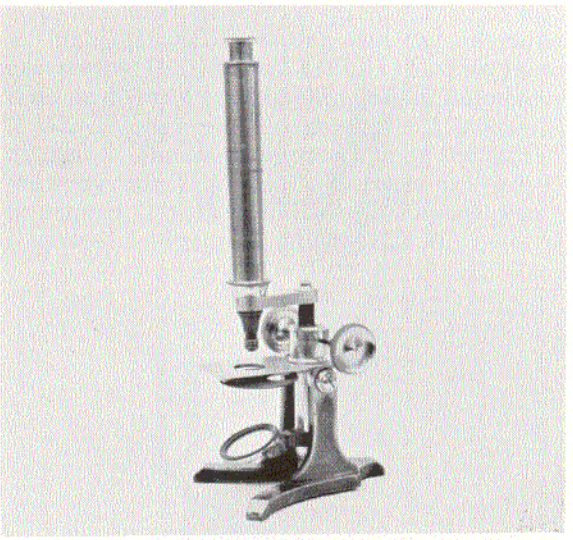

**Fig. 416. Maker unknown; compound monocular; C. 1860. (AFIP 707773 - 68-8625-4)**

The claw-footed base of this instrument (Fig. 416) and the two 3-inch uprights are cast in one piece. The stage is 3-1/2 x 2-1/4 inches, cut away at the back, is cast with two flanges and a 1-inch-high collar, and is attached to the uprights by pivot screws. The 3-1/2 x 1/2-inch tubular limb carries a slide casing for the 1-1/2-inch single mirror and is attached to the stage collar. The stage has a 7/8-inch aperture and a substage revolving disc of diaphragms.

There is a double milled-head pinion attached to the collar and a triangular bar with rack within the limb. The arm is 2-3/4 inches long and is screwed to the triangular bar. The body tube is 6 x 1 inches, has a screw-in cone nose, and screws to the arm. There is an ocular and screw-in objective.

Overall height when closed is 12-1/2 inches. It is similar to instruments made by Andrew Ross of London. A label in the carrying case reads, "Mary Grace Whitaker, Jan. 29, 1860." ■

This instrument (Fig. 417) is similar to Figure 117 (AFIP 138) with the following exceptions: The base is 2-3/4 inches in diameter; the stage is 1-7/8 x 1-5/16 inches with a 3/8-inch aperture; there is a single milled-head pinion and a condensing lens is attached to the body tube; there is an accessory ocular. When closed it is 7-1/2 inches in height. (Donated by Edward C. Pallette) ■

Fig. 417. Maker unknown; compound monocular; C. 1860. (AFIP 388669 - 73-3901)

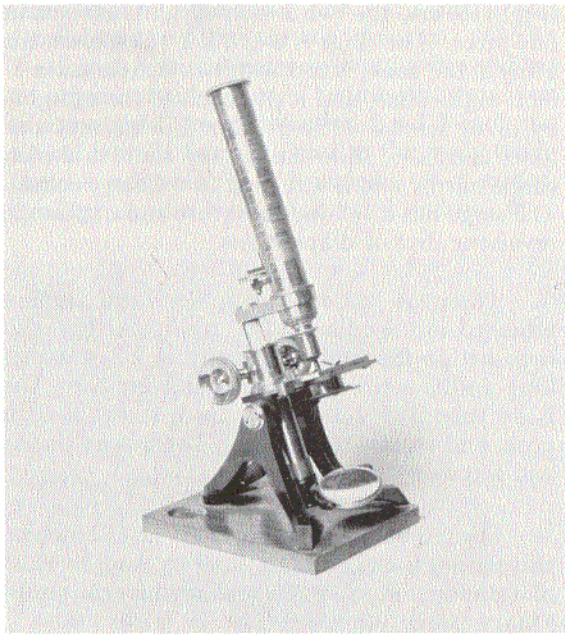

Fig. 418. Maker unknown; compound monocular; C. 1860. (AFIP 388683 - 73-3913)

The black japanned English base of this instrument (Fig. 418) is 5-1/4 x 5-3/8 x 3-1/2 inches, and is mounted on a wooden base, 6-1/4 x 5-1/4 inches. The 3-3/4 x 2-3/8-inch stage plate, cut away at the back, has a 7/8-inch aperture and is cast with two flanges and a 1-inch collar. The 3-1/4 x 3/4-inch tubular limb, that carries the slide casing for the 1-3/4-inch single mirror, is attached to the stage collar. The stage has a 4-1/8 x 1-1/2-inch clip-on slide holder. There is a substage revolving disc of diaphragms.

There are two milled-head pinions on the collar and a triangular bar with rack within the limb; a 3-inch-long arm is attached to the bar. The 7-1/4 x 1-inch body tube screws into the arm and a milled-head fine adjustment is screwed to the lower portion of the body tube. There is one objective and one ocular. When closed it is 12 inches high. ■

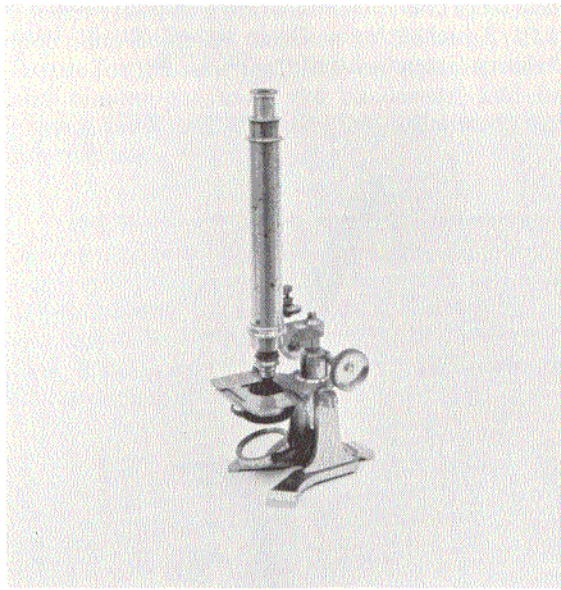

Fig. 419. J. & C. Robbins, London, England; compound monocular; C. 1860. (AFIP 707083 - 68-8625-11)

The claw-footed base of this all-brass instrument (Fig. 419) is 5-1/4 x 4-1/2 inches; two 3-1/2-inch-high uprights are screwed to the base. The collar, stage plate and flanges are cast in one piece. The tubular limb carries the slide casing for the gimbal and 2-1/4-inch double mirror. The 4-1/4 x 2-3/8-inch stage plate, cut away in the back, has a 1-1/4-inch aperture and a substage disc of diaphragms. The stage has a 3-3/4 x 2-1/8-inch sliding slide holder.

There are two milled-head pinions on the collar and a triangular bar with rack within the limb; a 3-inch-long arm is screwed to the bar. The 7-inch body tube screws into the arm. A milled-head fine adjustment is screwed to the lower portion of the body tube; an ocular and an objective are attached. When closed it is 14-1/4 inches high. It is signed, "J. & C. Robbins, Bartholomew Close, London, Serial No. 209." ■

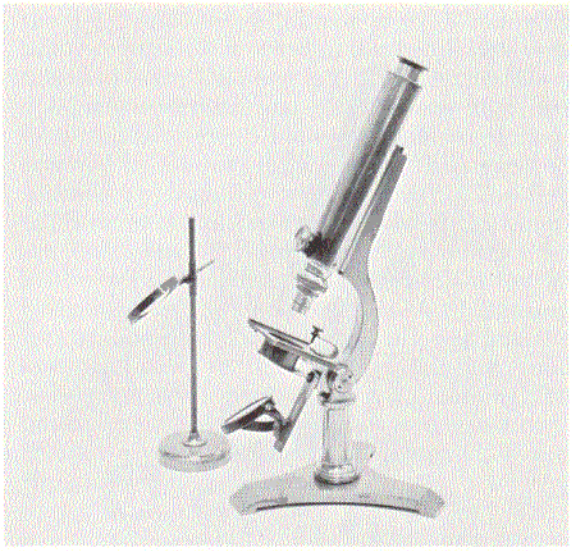

Fig. 420. Joseph Zentmayer, Philadelphia, Pennsylvania; compound monocular; C. 1862. (AFIP 722250 - 69-3285)

This instrument (Fig. 420) is essentially the same as that shown in Fig. 102 (AFIP 49108). There is a bull's-eye condenser on a stand, two accessory oculars and two additional objectives, one marked, "Gundlach Optical Co., Rochester, N.Y." When closed it is 13-1/2 inches high. It is signed, "J. Zentmayer, Philadelphia." ■

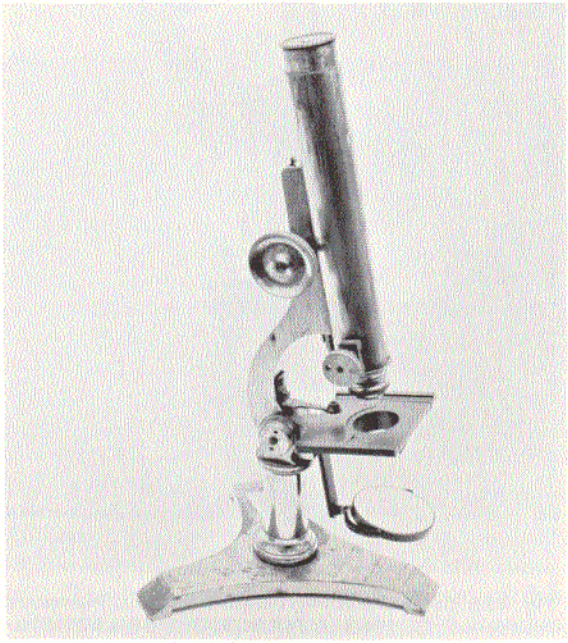

Fig. 421. Joseph Zentmayer, Philadelphia, Pennsylvania; compound monocular; C. 1862. (AFIP 767276 - 67-7142)

This instrument (Fig. 421) is similar to that in Fig. 102 (AFIP 49108) with the following exceptions: The stage is 2-7/8x2-1/2 inches, there is no revolving disc of diaphragms, the tailpiece is 2 inches long, and the mirror is 2 inches in diameter. The fine adjustment is on the side of the body tube; height is 13 inches when closed. It is signed, "Jos. Zentmayer, Philadelphia." (Donated by Philip R. Cosminsky) ■

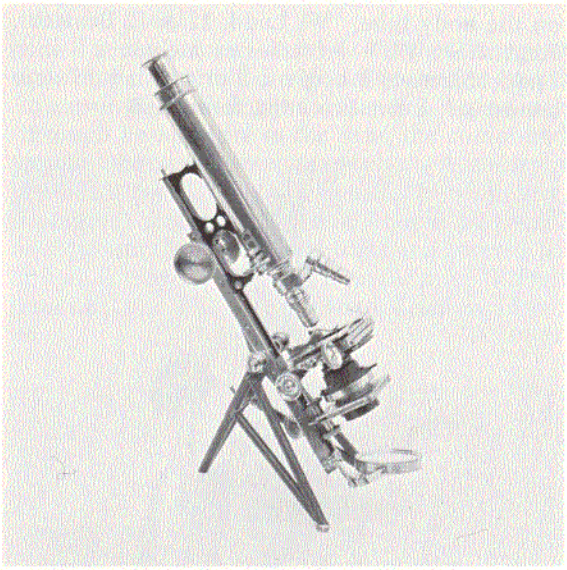

Fig. 422. W. Ladd, London, England; compound monocular; 1864. (AFIP 712105 - 69-3442)

All elements of this brass instrument (Fig. 422) are attached to a flat dovetailed supporting bar, 11 inches high and 1-1/8 inches wide. The tripod foot is constructed of a framework of blackened brass tubes securely braced together and attached midway to the bar. A 2-1/2-inch double mirror encased in a brass frame is screwed to a movable double pivot which in turn is screwed to the lower 1/2-inch of the bar; the stage plate slides into the dovetail on the bar.

The 2-3/4-inch-square stage has two milled-head pinions, one for vertical and one for horizontal movement. A disc of diaphragms slides into the base of the stage plate. The substage condenser is attached to the supporting bar with a milled-head adjustable screw, and its fittings may be accurately centered to the axis of the body tube by means of adjusting milled-head pinions.

The body tube is 7 inches long, has a draw-tube with lenses, and a Brooke's double nosepiece with two objectives. It is attached to a 5-inch-long handle-type arm that slides up and down on

the dovetail supporting bar. Coarse adjustment is by two milled-head pinions that activate a chain working around a spindle. This arrangement was designed to permit smooth movement of the body tube and was considered to have an advantage over the rack and pinion in that its action would not become weakened by wear; the chain may be tightened by a small screw at the top.

When closed it is 17 inches high. It is signed on the body tube, "W. Ladd, 11 & 12 Beak St., Regent St. W." Accessories include a 1-inch Ladd objective, 3 oculars, 2 prisms, a bull's-eye condenser, a live-box, and forceps. ■

**Fig. 423. Smith, Beck and Beck, London, England; compound monocular; 1864. (AFIP 379082 - 70-10722)**

This instrument (Fig. 423) is a duplicate of Fig. 101 (AFIP 49112) but carries a lower serial number. One objective and one eyepiece are attached; there are two additional eyepieces. It is signed, "Universal Microscope, Smith, Beck & Beck, London, 3698." ■

The English-type base of this black and brass instrument (Fig. 424) and the 4-inch-high uprights are cast in one piece. The gimbal for the 1-5/8-inch diameter single mirror is inserted in the tailpiece. The 3-3/8 x 2-3/4-inch stage has a 1-inch aperture, two spring clips and a fitting for a substage condenser. Two milled wheel pinions are attached to the rectangular limb and the rack is enclosed within the limb. The Hevelius-type

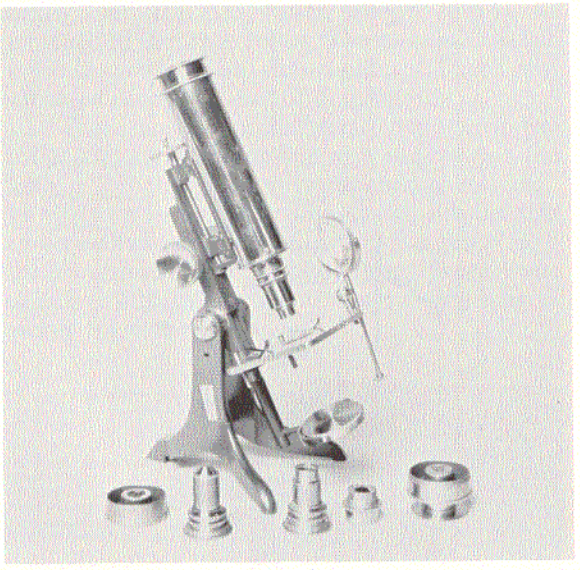

**Fig. 424. Charles Collins, London, England; compound monocular; C. 1865. (AFIP 712229 - 73-3906)**

fine adjustment is on the top of the handle-limb and arm, which is screwed to the 6-inch-long body tube.

There are 2 substage condensers, 1 ocular, 3 objectives, a bull's-eye condenser, and a Nicol prism that screws into the base of the body tube. When closed it is 10 inches high. It is signed, "C. Collins, Optician, 157 Gt. Portland St., London." ■

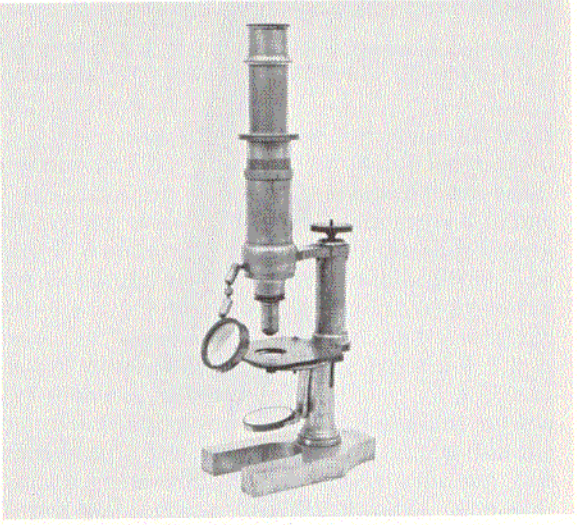

**Fig. 425. John Browning, London, England; compound monocular; C. 1865. (AFIP 707306 - 68-8625-3)**

The horseshoe base of this instrument (Fig. 425) is 4-7/8 x 2-7/8 x 3/4 inches. The gimbal for

the 1-1/2-inch single mirror is on a swinging tailpiece which is screwed to the 2-3/4-inch-high tubular pillar. The stage is 2-1/2 x 3 inches, has a 7/8-inch aperture and a substage disc for diaphragms. The 3-inch-long tubular limb is screwed to the rear projection of the stage and extends 1/2-inch beyond the pillar. The fine adjustment is a milled-head pinion at the top of the limb. The 2-inch-long arm fits over the limb at one end and encircles the sprung casing for the body tube on the opposite end. A condensing lens on a ball and socket joint is inserted into the lower section of the outer casing. The body tube is 7-1/2 inches long and is in two sections; the upper section screws into the lower section. Overall height is 13 inches. It is signed, "John Browning, 146 Strand, London." ■

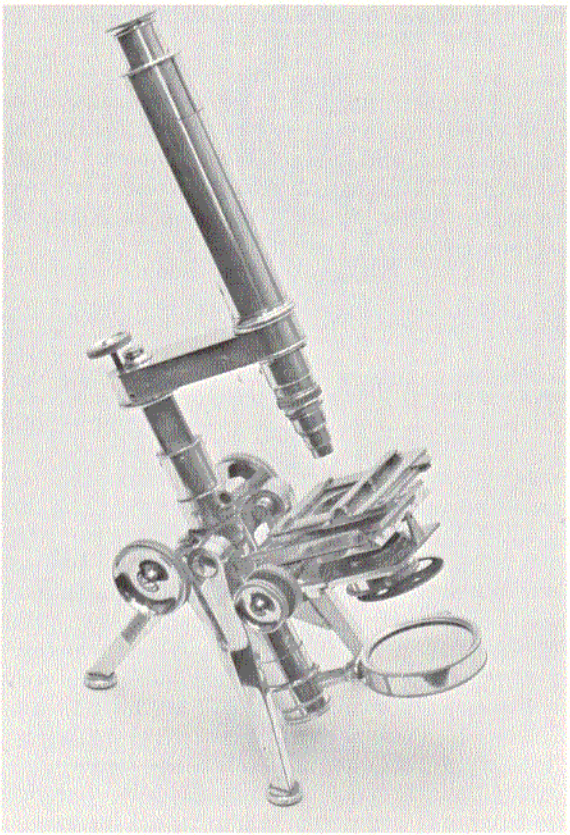

**Fig. 426. Powell & Lealand, London, England; compound monocular; 1865. (AFIP 379060 - 69-10806)**

The back leg of the upright tripod of this silver-plated instrument (Fig 426) is 4-5/8 inches high; the two front legs are 5-7/8 inches high and slightly bent with trunnions at the top; the legs and 4-1/4-inch connecting bands are cast in one piece. The 6-7/8-inch-long tubular limb has an inner triangular bar with rack and a double milled-head pinion. The 2-1/2-inch double mirror is on a half gimbal and short arm.

The stage plate fits over the limb. The stage is 3-3/8 x 2-1/4 inches, has a 1-1/2-inch central aperture, a Turrell mechanical stage, a dovetail slide, and rack and pinion motion. The 4-3/4-inch-long arm is attached to the top of the triangular bar with the fine adjustment at the rear.

The body tube is 6 x 1-1/4 inches, is sprung at the top, has a milled-edge drawtube and screws to a spring nose fitting that extends 3/4 of an inch through an aperture in the arm; the compound ocular slides into the drawtube. Accessories include a 1-inch objective signed, "M. Pillischer, London," and an animacule. Height is 17-1/2 inches, and the entire instrument and accessories are silver plated. It is signed on the arm, "Powell and Lealand, 170, Euston Road, London, 1865." ■

**Fig. 427. Maker unknown; compound monocular; C. 1870. (AFIP 518980 - 68-2629-4)**

The reversed claw-footed base of this instrument (Fig. 427) has a spread of 5-1/8 x 6 inches; two 3-1/4-inch-high curved uprights are screwed to the base. The stage measures 4 x 3-1/4 inches and has a 1-inch aperture; beneath the stage is a revolving disc of diaphragms. The stage plate is attached on one side to the stage by a spring plate. Beneath the stage is an adjustment screw for the stage plate.

The arm is slightly curved, is screwed to the

body tube and has an attached brass cylindrical tailpiece. The brass body tube is 6-3/8 inches long, has a drawtube, an unmarked ocular and an objective marked "1". Overall height is 13-1/2 inches. (Donated by Hobart & William Smith Colleges through Mr. Richard L. Freeman) ■

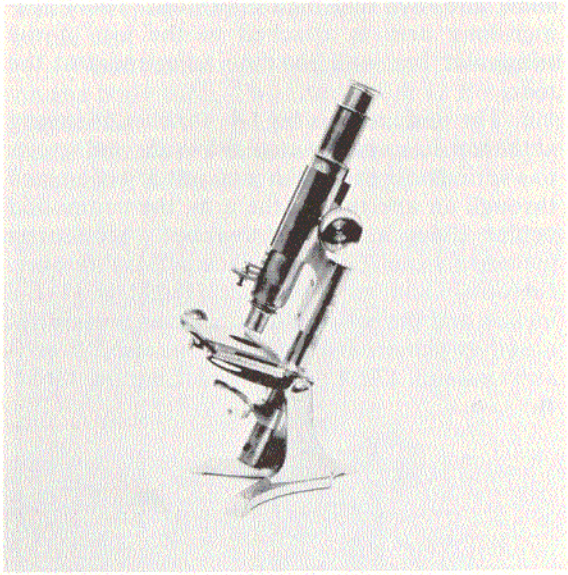

**Fig. 428. Maker unknown; compound monocular; C. 1870. (AFIP 389499 - 69-11188)**

The flat, claw-footed base of this all-brass instrument (Fig. 428) has a spread of 4-1/2 x 5-1/4 inches and supports two uprights, each 3-3/8 inches high which are screwed to the base. A 7-1/8 x 7/8-inch-long tubular limb on a trunnion is slotted 3/8-inch from the base, has a sliding band for the pivot gimbal, and a 1-3/4-inch-diameter mirror.

The 2 x 3-inch stage plate fits around the limb, has a 1-inch aperture, a milled-head pinion for left to right motion and a rack and pinion for backward and forward motion. There is a substage revolving disc of diaphragms. The angular arm, screwed to the limb, and the casing for the body tube are cast in one piece which is slotted for the rack attached to the body tube, and has two milled-head pinions. The body tube is 6-3/4 inches long and has a short cone nose, with the fine adjustment screwed to the front; an objective and eyepiece are attached.

Accessories include a bull's-eye condenser on stand, two Leitz objectives, and an ocular. When closed it is 12-1/2 inches high. The mahogany carrying case is labeled, "E.G. Wood, 117 Cheapside, London." ■

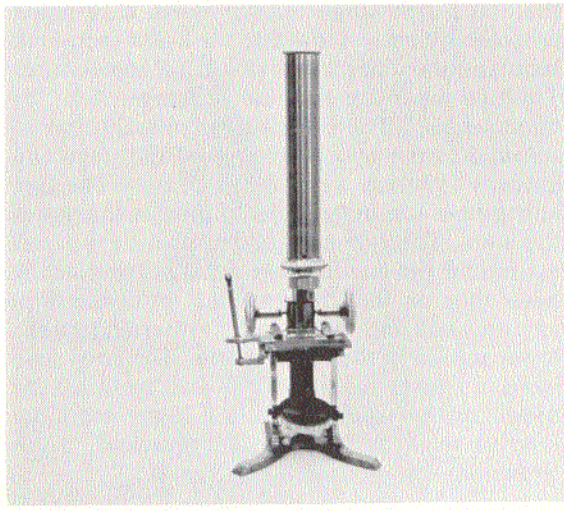

**Fig. 429. Maker unknown; compound monocular; C. 1870. (AFIP 738897 - 69-8756)**

This instrument (Fig. 429) is similar to Fig. 110 (AFIP 517554). It has a substage disc of diaphragms and a 1-1/2-inch-diameter single mirror. The objective is missing but it has two oculars. When closed it is 12 inches in height. (Donated by Dr. Dan Morse) ■

**Fig. 430. Carl Zeiss, Jena, Germany; compound monocular; 1873. (AFIP 707244 - 68-8625-2)**

This all-brass instrument (Fig. 430) has a horseshoe base; a half-circle pillar is screwed to the base and to the stage. The gimbal for the 1-1/2-inch double mirror is attached to a 2-1/4-inch swinging arm screwed to the base of the stage. The 3 x 4-inch stage, incurved at the back,

has a 1/2-inch aperture, two spring clips and a substage disc of diaphragms. The 2-inch-long limb is screwed to the rear of the stage and carries a substage milled wheel fine adjustment.

The 6-inch sliding body tube fits into a sprung casing attached to a 4-inch arm; an ocular, marked "2" and a "Zeiss F" objective are attached to the body tube. When closed it is 11-1/2 inches high. It is signed, "1138, 1993, Carl Zeiss, Jena." It is Zeiss' "Microscope I" model. ■

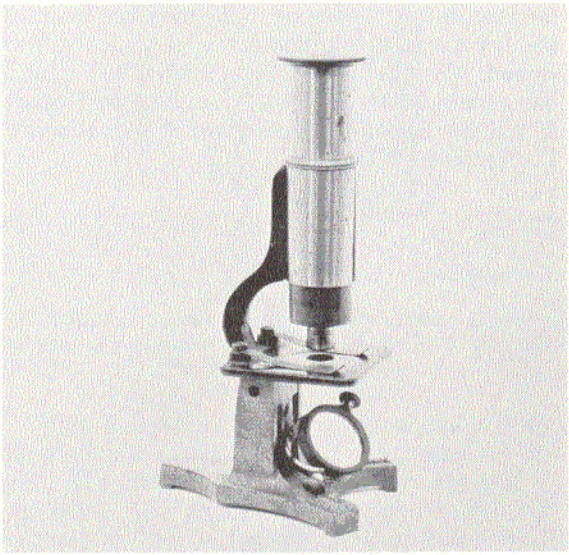

**Fig. 431. James W. Queen & Co., Philadelphia, Pennsylvania; compound monocular; C. 1875. (AFIP 518983 - 68-6563)**

The claw-footed base and the two uprights of this instrument (Fig. 431) are cast in one piece. The stage is 2-3/8 x 2-1/4 inches with a 7/16-inch central aperture and is cast to the uprights. The stationary tailpiece for the 1-inch single mirror is also cast to the pillars and to the stage. The curved arm is 3 inches long. The body tube is 3-7/8 inches long and slides into a 1-1/2-inch-long casing attached to the arm. There is an attached objective, eyepiece and field lens.

When closed it is 7 inches high. It is signed, "James W. Queen & Co., Philadelphia, Universal Household Microscope." (Donated by Mr. Larry James) ■

The horseshoe base of this brass microscope (Fig. 432) is 3-1/2 x 2-7/8 inches and is curved at the back. Screwed to the rear of the base is the 3-1/4-inch-high tubular pillar. The gimbal for the 1-1/2-inch double mirror is attached to a swinging tailpiece. The 2-7/8 x 2-3/4-inch stage plate, covered with black vulcanite, is incurved at

**Fig. 432. E. Hartnack, Potsdam, Germany; compound monocular; C. 1875. (AFIP 518981 - 68-2629-7)**

the back, is fitted to the pillar, and has a 1/2-inch central aperture. There is a substage condenser and iris diaphragm. Arising from the pillar is a triangular bar with tubular outer casing 2-1/4 inches long, with a milled-head micrometer screw fine adjustment at the top. The body tube is 4-1/4 inches long, has a short cone nose, and a drawtube.

There are three oculars marked "2", "3", "4"; an objective marked "Hom. 1mm, N. 1"; and a double nosepiece. Height is 9-3/4 inches. It is signed on the drawtube, "Dr. E. Hartnack, Potsdam." The wooden carrying case has a brass plate engraved, "E. O. Otis, M.D." (Donated by Hobart & William Smith Colleges through Mr. Richard L. Freeman) ■

This brass and black instrument (Fig. 433) has a 2-7/8-inch-high tubular pillar attached to the solid tripod base with a compass joint at the top. There is a Lister limb with a double milled-head pinion, to which is attached a 3-1/4-inch circular stage, with a glass stage plate 3-5/8 inches in diameter. Beneath the stage is a revolving disc of diaphragms. The brass tubular swinging tailpiece is 3 inches long and holds a 2-inch-diameter double mirror on a gimbal.

The brass body tube is 8-1/2 inches long, has a 1/2-inch cone nose and carries the rack. There is a drawtube and a front fine adjustment. Overall height is 15 inches. It is signed, "No. 274, James W. Queen & Co., Philadelphia and New

York." (Donated by Hobart & William Smith Colleges through Mr. Richard L. Freeman) ■

Fig. 433. James W. Queen & Co., Philadelphia, Pennsylvania; compound monocular; C. 1875. (AFIP 518979 - 68-2629-5)

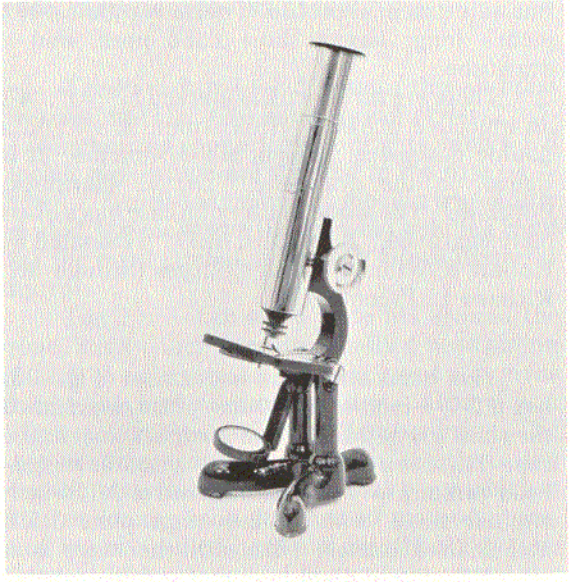

Fig. 434. Geneva Optical Co., Geneva, New York; compound monocular; C. 1875. (AFIP 518976 - 68-2629-6)

The claw-footed base of this instrument (Fig. 434) has a spread of 3 x 3-1/2 inches; the base and the 2-inch-high uprights are cast in one piece. The 2-3/8 x 1-3/8-inch stage fits into a groove at the base of the arm and is held firm by a screw. The central aperture is 5/16 inches. A revolving disc of diaphragms is screwed to the under surface of the stage. The 1-1/2-inch swinging tailpiece is screwed to the lower section of the arm, and has a gimbal and 1-inch-diameter single mirror. The curved arm is 3 inches long with two milled-head pinions.

The 3-1/2-inch-long nickel body tube carries the rack and has a short cone nose with a screw-on button-type objective. The eyepiece fits into the drawtube. Overall height is 7-1/2 inches. It is signed, "Geneva Optical Co., Geneva, N.Y.," and has a walnut carrying case. (Donated by Hobart & William Smith Colleges through Mr. Richard L. Freeman) ■

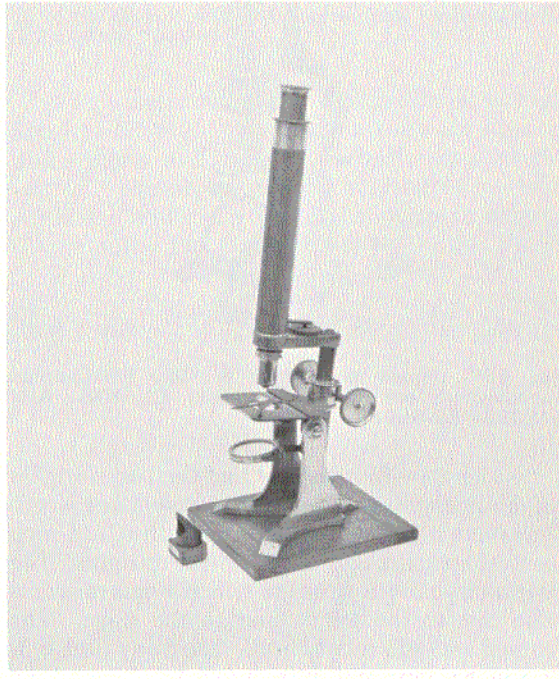

Fig. 435. Charles Baker, London, England, compound monocular; C. 1880. (AFIP 709202 - 68-8625-10)

This all-brass instrument (Fig. 435) mounted on a 6 x 7-1/4-inch wooden base is similar to that shown in Fig. 411 (AFIP 388682). However, it has a 4 x 3-1/4-inch stage, incurved at the back and a 2-inch-diameter mirror. There is a specimen forceps mounted on the stage mirror, and an attached ocular and objective. Accessories are a bull's-eye condenser on a stand and a prism. Overall height when closed is 15 inches. It is signed, "Baker, 244 High Holborn, London, England." ■

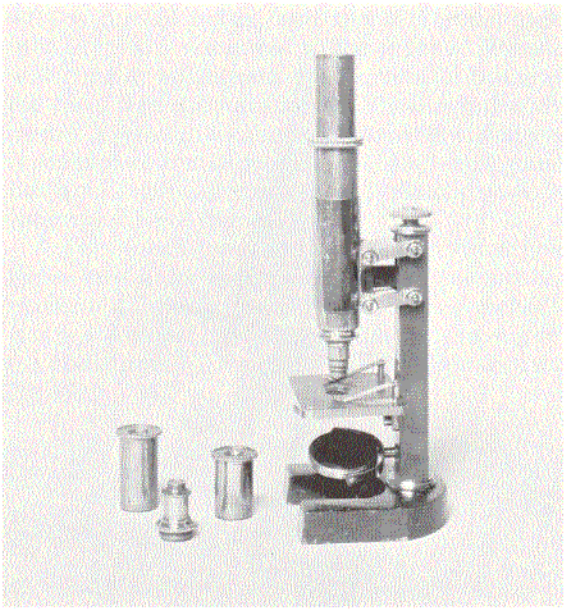

**Fig. 436. J. Parkes & Son, Birmingham, England; compound monocular; C. 1880. (AFIP 711748 - 73-3907)**

The horseshoe base of this instrument (Fig. 436) is 3-5/8 x 3-3/4 inches. The 3/8-inch square pillar is 6 inches high and arises from the rear of the base. The gimbal for the double mirror is inserted in the lower portion of the pillar. The 2-1/2 x 3-1/8-inch stage is screwed to the pillar, has a 5/8-inch aperture, two spring clips and a substage disc of diaphragms.

The 6-7/8-inch-long body tube slides into a sprung casing attached to the pillar, and has an objective and ocular; there is also an accessory objective and an ocular. When closed it is 11-1/8 inches high. It is signed, "J. Parkes & Son, Patentees, Birmingham." (Donated by Dr. Irving I. Laskey) ■

The claw-footed base of the all-brass instrument (Fig. 437) has a spread of 7 x 5-3/4 inches; the two 4-inch-high pillars are screwed to the base. The gimbal for the 2-1/2-inch double mirror is attached to the 3-1/2-inch-long swinging tailpiece. The 3 x 4-inch stage plate carries a rack and two milled-head pinions to provide motion for the Turrell mechanical stage.

The collar carries a triangular bar with rack at the back, and two milled wheel pinions. The 8-1/2-inch-long body tube screws into the front of the 4-inch arm which is attached to the top of the triangular bar. The fine adjustment is at the rear of the body tube; an ocular and objective are attached. When closed it is 17-1/2 inches in height. It is signed, "J. Parkes & Son, 5 St. Mary's Row, Birmingham." ■

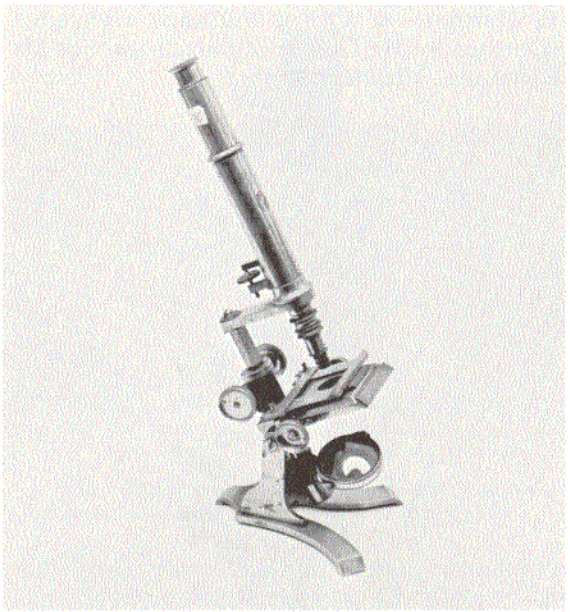

**Fig. 437. J. Parkes & Son, Birmingham, England; compound monocular; C. 1880. (AFIP 518998 - 68-5827-4)**

**Fig. 438. Maker unknown; compound monocular; C. 1880. (AFIP 518992 - 68-3877)**

This all-brass instrument (Fig. 438) is similar to Fig. 432 (AFIP 518981). There is a dovetail slide beneath the stage, but no substage condenser. The objective and eyepiece are not

marked. The stem of the fine adjustment bears the figures "32". Overall height is 10-1/4 inches. While not signed, it appears to have been made by E. Hartnack & Co. of Potsdam, Germany. (Donated by Mr. Godfrey Zumbach through Mr. Richard L. Freeman) ■

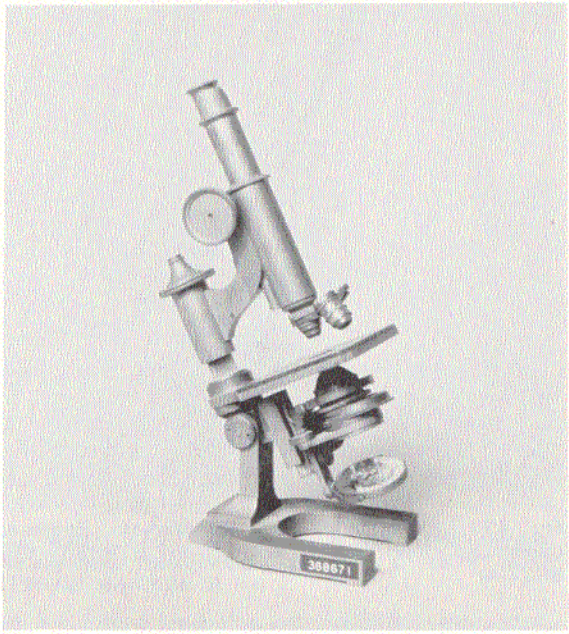


**Fig. 439. E. Leitz, Wetzlar, Germany; compound monocular; C. 1880. (AFIP 388671 - 73-3903)**

The base of this all-brass instrument (Fig. 439) is 6 x 4-1/4 inches; the 3-1/4-inch-high rectangular pillar is screwed to the base. The gimbal for the 2-inch-diameter double mirror is on a fixed tailpiece. The 3-7/8 x 3-1/2-inch stage has a 3/4-inch aperture and a substage condenser with rack and pinion.

Rising from the stage plate is a collar and triangular bar with a 2-1/2-inch-high tubular casing with a milled wheel fine adjustment at the top. The fixed arm carries the rack and pinion for the 3-1/2-inch-long body tube which has a calibrated drawtube and a triple nosepiece. Two objectives are attached; there is no ocular. When closed it is 11 inches high. It is signed, "E. Leitz, Wetzlar, No. 6547." ■

The black japanned English base of this instrument (Fig. 440) is 5 x 5-1/4 x 3-1/2 inches. The gimbal for the 1-1/2 single mirror is on a swinging tailpiece. The 3 x 2-13/16-inch stage has a 13/16-inch aperture and a cylinder for a substage condenser. The 2-3/8-inch-long brass limb has a milled wheel fine adjustment at the top

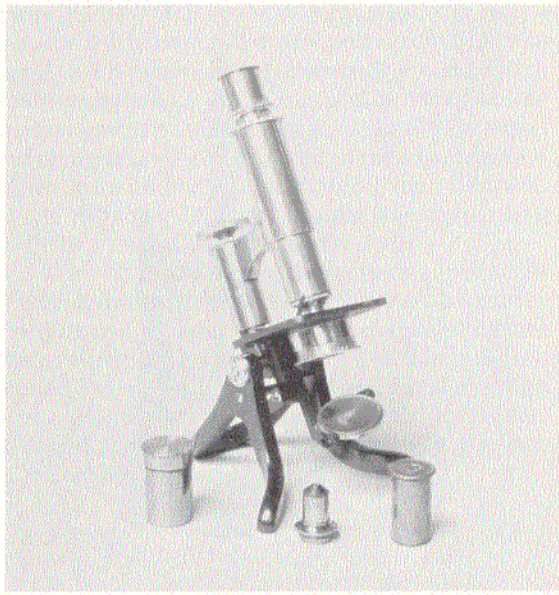

**Fig. 440. Henry Crouch, London, England; compound monocular; C. 1885. (AFIP 388670 - 73-3910)**

and a 1-1/2-inch arm.

The 5-3/4-inch brass body tube has a drawtube, an objective and ocular, and fits into a sprung casing on the arm; accessories are 2 objectives and an ocular. It is 11 inches high when closed. It is signed, "Henry Crouch, London, 4761." ■

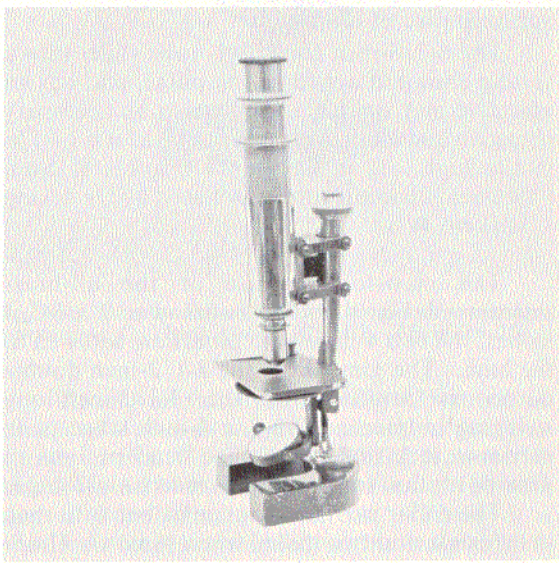

**Fig. 441. C. Reichert, Vienna, Austria; compound monocular; 1888. (AFIP 708897 - 68-8625-9)**

The horseshoe base of this instrument (Fig.

441) is 3 x 3 inches, and the 6-1/8-inch-high tubular pillar is screwed to the rear of the base with the fine adjustment by micrometer screw at the top. The gimbal for the 2-1/4-inch double mirror is screwed to a swinging arm which in turn is screwed to the pillar. The 2-1/4 x 3-inch stage has a 1/2-inch aperture, two stage clips and a substage disc of diaphragms.

The 4-inch-long body tube with drawtube slides into a sprung casing, and has an ocular marked "4" and an unmarked objective attached. It is 9-3/4 inches high when closed. It is signed on the body tube, "C. Reichert, VIII Bez Bennogasse 26, Wien." ■

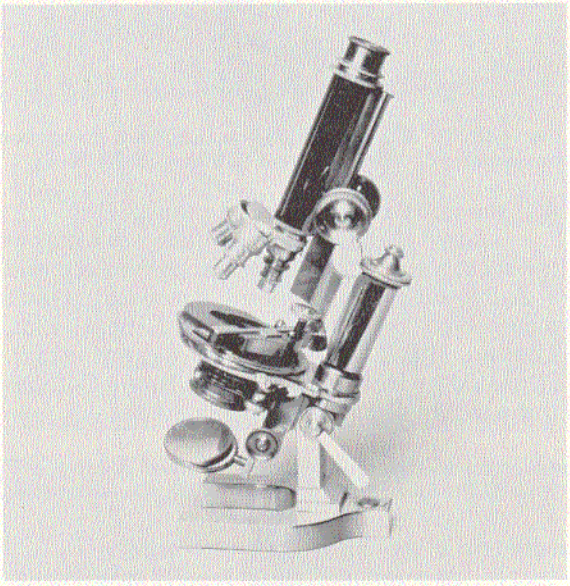

**Fig. 442. Bausch & Lomb Optical Co., Rochester, New York; compound monocular; C. 1895. (AFIP 711657 - 73-3908)**

This instrument (Fig. 442) is essentially the same as that shown in Fig. 192 (AFIP 49190) with the exception that the stage plate is round, there is a mechanical stage and a triple nosepiece. It is signed, "Bausch & Lomb Optical Co., Rochester, N.Y. 18202; Chas. Lentz & Sons, Philadelphia, Pa." (Donated by Mrs. Edward C. Sawyer) ■

The 6-1/2 x 5-inch horseshoe base and the 2-1/2-inch-high pillar of this black and brass instrument (Fig. 443) are cast in one piece. The 4-1/4-inch-diameter stage has a 7/8-inch-diameter aperture, and a mechanical stage with rack and pinion motion. The substage condenser is on a fixed tailpiece and has double racks and pinions. The gimbal for the 2-inch double mirror slides

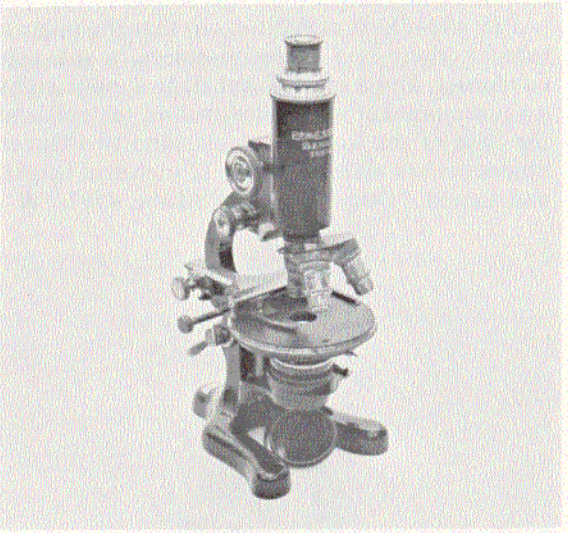

**Fig. 443. Ed. Messter, Berlin, Germany; compound monocular; C. 1895. (AFIP 766257 - 69-6116)**

into the tailpiece. The 6-inch-long curved limb has a side fine adjustment and double milled-head pinion. The rack is attached to the rear of the 4-inch-long body tube. There is a calibrated sliding drawtube, a triple nosepiece with three objectives and an ocular. When closed it is 12-1/4 inches high. It is signed, "Ed. Messter, Berlin, 38516." ■

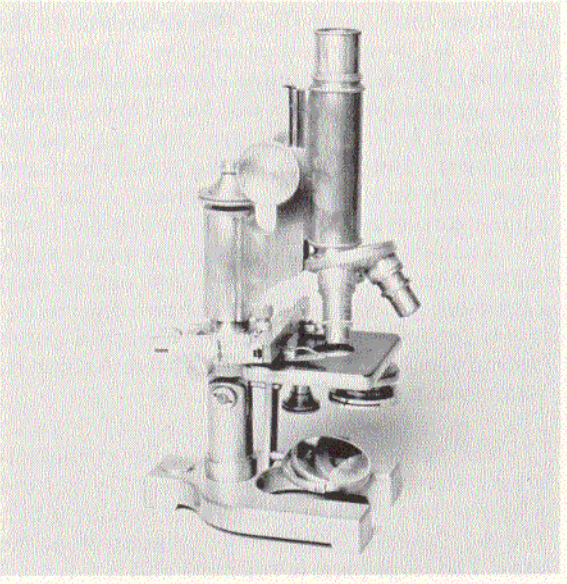

**Fig. 444. Queen & Co., Philadelphia, Pennsylvania; compound monocular; C. 1895. (AFIP M-031300 - 73-3902)**

This all-brass instrument (Fig. 444) is similar

to, but slightly larger than that shown in Fig. 199 (AFIP 49147). It also differs in that the pillar is tubular, there is a triple nosepiece, a substage condenser, and a mechanical stage supported by a square bracket which fits around the collar at the base of the limb; an ocular and two Queen objectives are attached. It is 12 inches in height, and signed, "Queen & Co., Philada, 4597." ■

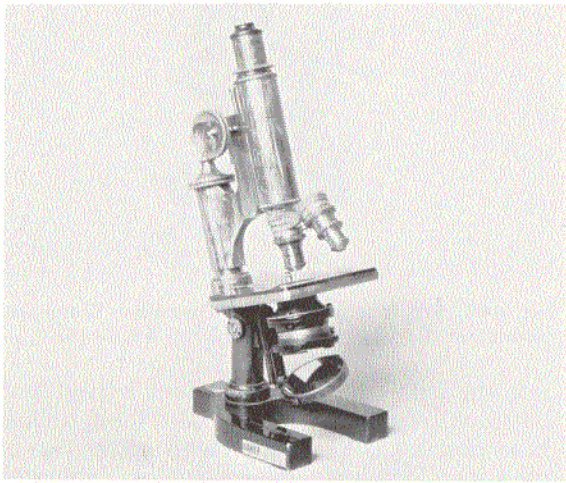

**Fig. 445. Bausch & Lomb Optical Co., Rochester, New York; compound monocular; C. 1895. (AFIP 388681 - 73-3905)**

The 3-inch-high tubular pillar of this black and brass instrument (Fig. 445) is screwed to the 5-7/8 x 4-1/8-inch horseshoe base. The gimbal for the 1-15/16-inch double mirror is attached to a swinging tailpiece. The 3-3/4 x 3-3/8-inch stage has an 1-1/4-inch aperture and a substage condenser. The 3-1/2-inch-long tubular limb and angle arm are cast in one piece. The fine adjustment micrometer is at the top of the limb.

The 4-inch-long body tube has a rack at the back, a calibrated drawtube, an ocular, and a Brooke's double nosepiece with two objectives. It is 12 inches high, and signed, "Bausch & Lomb Optical Co., Rochester, N.Y., 48466, Arthur H. Thomas Co., Philadelphia, Pa." ■

The continental horseshoe base of this all-brass instrument (Fig. 446) is 5 x 3-1/4 inches and supports the 2-1/4-inch-high rectangular pillar. The 4-1/2 x 3-1/4-inch stage is incurved at the back. The stage plate is vulcanite and is 3-1/4 x 3 inches, has a 1-inch aperture, and a substage iris diaphragm. The gimbal for the 1-1/2-inch double mirror is screwed to a swinging tailpiece. The 3-inch-long tubular limb with angular arm has a double milled-head pinion. The fine

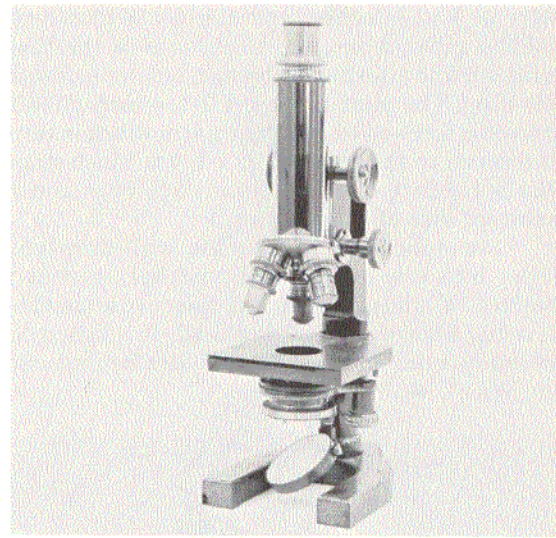

**Fig. 446. R. & J. Beck, London, England; compound monocular; C. 1895. (AFIP 518978 - 68-2629-3)**

adjustment is at the top of the limb.

The 4-1/2-inch-long body tube has a rack at the back, a graduated drawtube, an eyepiece, and a double nosepiece with two objectives. It is 11 inches high and is signed, 'R. & J. Beck, Ltd., London, 24622," and has a wooden carrying case. (Donated by Hobart and William Smith Colleges through Mr. Richard L. Freeman) ■

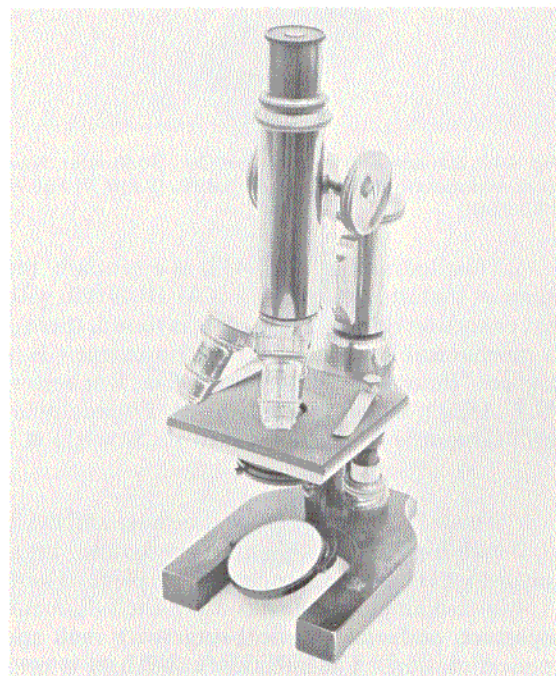

**Fig. 447. E. Leitz, Wetzlar, Germany; compound monocular; C. 1898. (AFIP 518725 - 67-7141)**

This black and brass instrument (Fig. 447) is similar to Fig. 196 (AFIP 49144) with the following exceptions: The base is 5-1/2 x 4 inches, the mirror is 2 inches in diameter, the stage plate is 3-3/8 x 3-1/4 inches, and when closed it is 12 inches high. There is an extra objective marked, "3, E. Leitz, Wetzlar," and an ocular marked "2". It is signed, "E. Leitz, Wetzlar, Nr. 48252"; There is a wooden carrying case. (Donated by Dr. Anthony Ambrose) ■

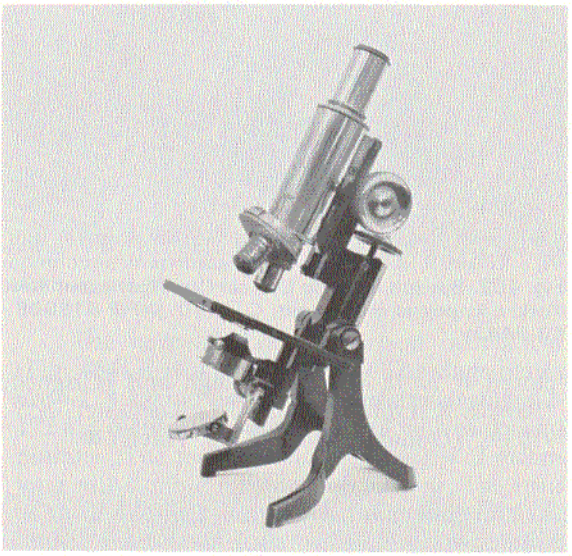

**Fig. 448. J. Swift & Son, London, England; compound monocular; C. 1900. (AFIP 709200 - 68-8625-5)**

The bent claw base of this black and brass instrument (Fig. 448) is 5 inches high. The 3-inch-long limb and arm are screwed on the trunnion. The milled wheel fine adjustment is at the top of the limb. The stage is 4-11/16 x 3-11/16 inches cut away to fit over the top of the base, and has a 1/2-inch aperture. Beneath the stage is a vertical plate with rack and pinion substage condenser and a swinging arm for the gimbal and 1-11/16-inch double mirror. The brass body tube is 4 inches long, has a rack at the back, a calibrated drawtube, and a triple nosepiece. An ocular and two objectives are attached. When closed it is 12 inches high, and is signed, "J. Swift & Son, London." ■

This black and brass instrument (Fig. 449) has a 4-1/4 x 5-1/2-inch horseshoe base, 2-1/2-inch-high tubular pillar, a handle arm, 3-7/8 x 5-1/4-inch stationary stage with vulcanite top, and a screw substage with double mirror attached by gimbal to a swinging tailpiece. It has a rack and pinion coarse adjustment and a side arm fine

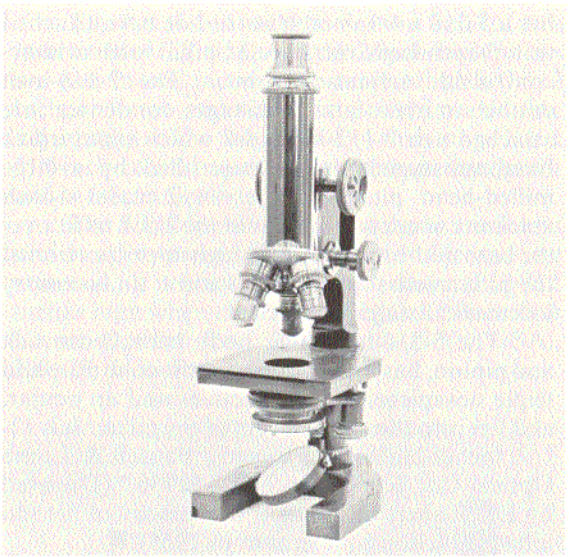

**Fig. 449. Spencer Lens Co., Buffalo, New York; compound monocular; C. 1905. (AFIP 518982 - 68-2629-2)**

adjustment. The limb is 4 inches long and the 4-1/4-inch-long brass body tube has a nickel graduated drawtube. The ocular is marked "4x." There is a triple nosepiece labeled, "R. & J. Beck, Ltd.," and there are three Bausch and Lomb objectives; overall height is 12 inches. The stand is a No. 26, and it is signed, "Spencer Lens Co., Buffalo, New York, 3501." (Donated by Dr. John Gallagher) ■

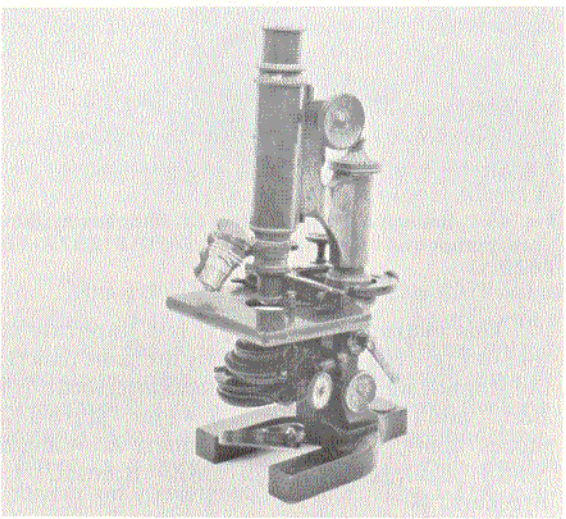

**Fig. 450. Bausch & Lomb Optical Co., Rochester, New York; compound monocular; 1906. (AFIP 389198 - 70-1621)**

This black and brass instrument (Fig. 450)

has a 5-5/8 x 4-1/8-inch horseshoe base attached to a 3-inch-high rectangular pillar with a lever-controlled inclination joint. The 2-1/8-inch double mirror and substage condenser are attached to a 2-1/2-inch rack which slides into a fixed substage tailpiece controlled by a large milled-head pinion. The 4-1/2 x 3-3/4-inch vulcanite stage is incurved at the back to fit over the base of the round 3-inch high upper portion of the pillar with top fine adjustment; an accessory mechanical stage is attached.

The 5-3/4-inch-long body tube, with rack and pinion, has a drawtube, a short cone nose and triple nosepiece, three objectives and an ocular, and fits into the angular arm of the pillar. It is 12-1/2 inches high and is signed, "Bausch & Lomb Optical Co., Rochester, N.Y., 56956." (Donated by Dr. Robert O. Emmett in memory of his son killed in action in Vietnam in 1968) ■

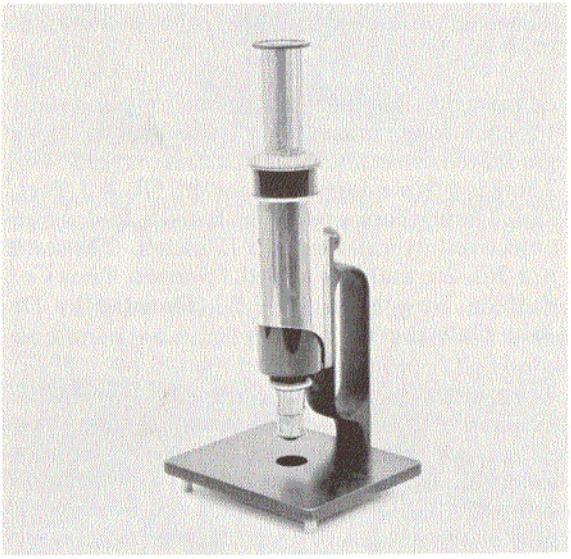

**Fig. 451. Bausch & Lomb Optical Co., Rochester, New York; compound monocular; 1908. (AFIP 518977 - 68-2629-1)**

This instrument (Fig. 451) is a duplicate of that in Fig. 230 (AFIP 49145) by the same maker, but it is not signed. The eyepiece is inscribed, "7.5 B&L", and the objective, "32 & 4 mm." It is 8-1/2 inches high. (Donated by Hobart & William Smith Colleges through Mr. Richard L. Freeman) ■

This black and brass instrument (Fig. 452) is essentially the same as that shown in Fig. 235 (AFIP 49448). There is no mechanical stage. Attached are 3 objectives and an ocular. When

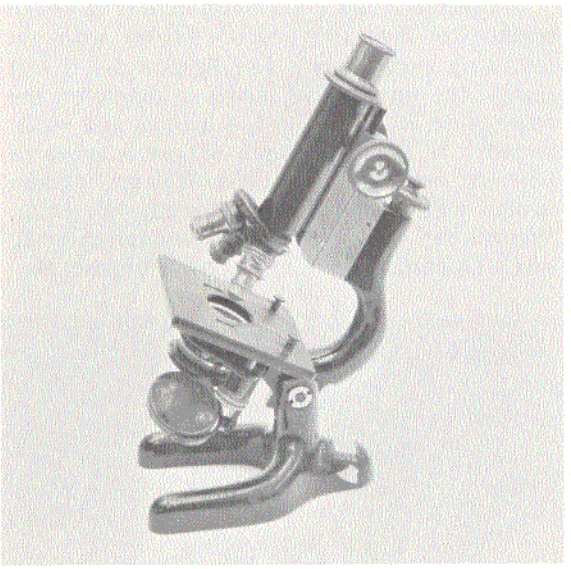

**Fig. 452. Bausch & Lomb Optical Co., Rochester, New York; compound monocular, C. 1910. (AFIP 518968 - 69-3443)**

closed it is 11-3/4 inches high and is signed, "Bausch & Lomb Optical Co., Rochester, N.Y. 93939." (Donated by Dr. D. J. Davis) ■

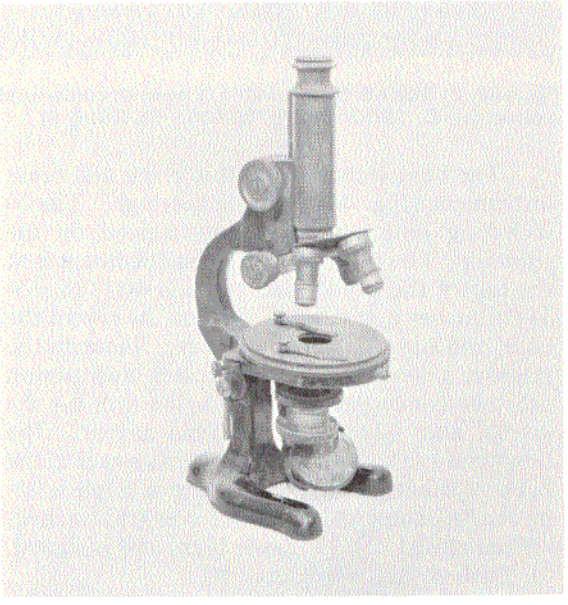

**Fig. 453. Otto Himmler, Berlin, Germany; compound monocular; C. 1920. (AFIP 518510 - 67-6578)**

This instrument (Fig. 453) is identical to Fig. 247 (AFIP 8307). It is signed, "Otto Himmler, Berlin N, 14168." (Donated by Daniel G. Chvilicek) ■

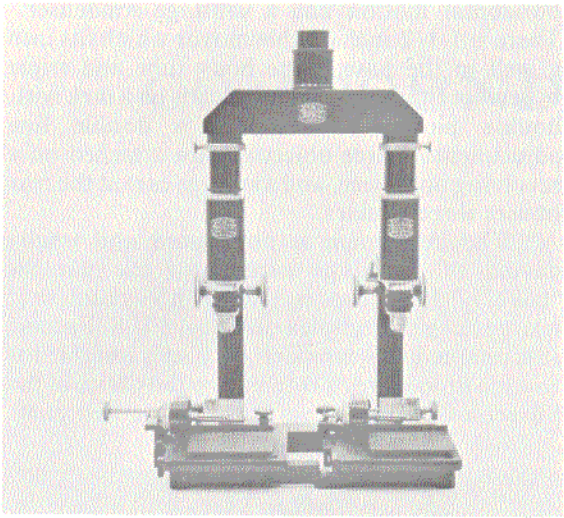

Fig. 454. Spencer Lens Co., Buffalo, New York; compound monocular; C. 1930. (AFIP 709657 - 68-8625-1)

The base of this comparison instrument (Fig. 454) is 10 x 5-3/4 inches. The stage plates are 4-1/4 x 4 inches and the mechanical stages 2-1/2 x 3 inches; they are equipped with racks and pinions. The rectangular limbs are 6-1/2 inches long with double, milled wheel pinions. The arms of the 3-1/4-inch-long body tubes slide into the limbs. Each body tube has a calibrated sliding tube, an ocular and an objective. A horizontal casing 7-1/2 x 1-1/2 x 1-5/8 inches with a central ocular slides on to the top of the single oculars. It is signed, "Spencer, Buffalo, U.S.A." ■

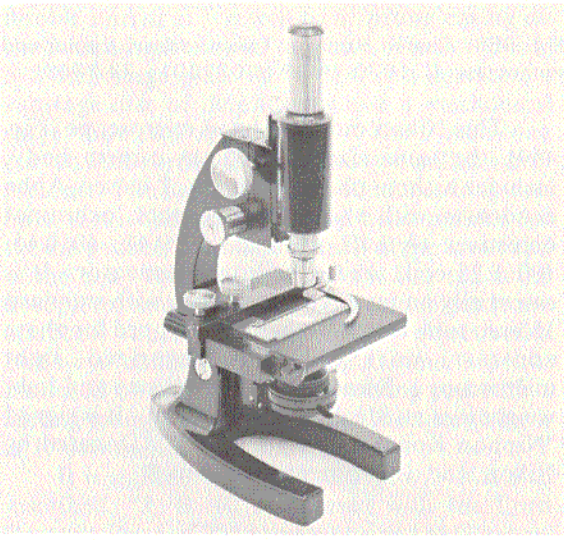

Fig. 455. Bausch & Lomb Optical Co., Rochester, New York; compound monocular; C. 1940. (AFIP 758134 - 68-10061)

The 8 x 4-1/4-inch horseshoe base of this instrument (Fig. 455) and the 2-inch-high pillars are cast in one piece. The curved limb is 7-1/2 inches long and has a double side fine adjustment. The 5-1/8 x 4-1/4-inch stage has a 3/4-inch central aperture, a substage condenser and a mechanical stage.

The 5-1/2-inch-long body tube has rack and pinion adjustment; an ocular and objective are attached. It is black with nickel trim, and 12-1/2 inches high when closed. It is signed, "Bausch & Lomb Optical Co., Rochester, N.Y., USA., 309528; U.S. Pat. 2,093,811." ■

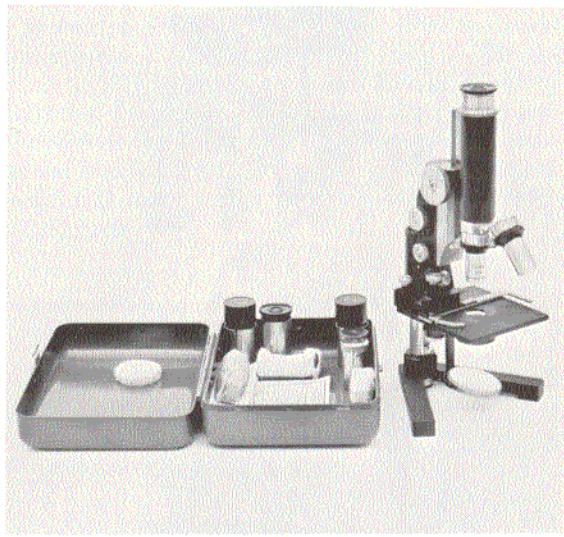

Fig. 456. Tiyoda, Tokyo, Japan; compoung monocular; C. 1945. (AFIP 712064 - 68-10062)

This instrument (Fig. 456) is essentially the same as that shown in Fig. 457 (AFIP 518967). It has 2 oculars and 2 objectives, and is signed, "Tiyoda 16745." (Donated by Colonel Albert E. Minns, Jr.) ■

This portable microscope (Fig. 457) has a folding 4-1/8-inch V-shaped base which supports the 4-1/2-inch limb and arm with a double milled-head pinion and fine adjustment. The stage is 3 x 3-5/16 inches, is fixed to the limb, has a 1/2-inch aperture and substage condenser. There is a gimbal with a 1-1/2-inch double mirror on a swinging tailpiece. The 3-1/4-inch-long body tube has a rack at the back, and a double nosepiece.

There are 2 oculars (5X and 10X), 3 objectives (40-0.65, 10-0.30, and 90-1.25). When closed it is 6 inches high, and is signed on the body tube, "Tiyoda, Tokyo, No. 7699," and on

the arm, "Tiyoda, Tokyo, MKH Pat. 213050." (Donated by Lt Gen Kenneth E. Pletcher, USAF, MC) ■

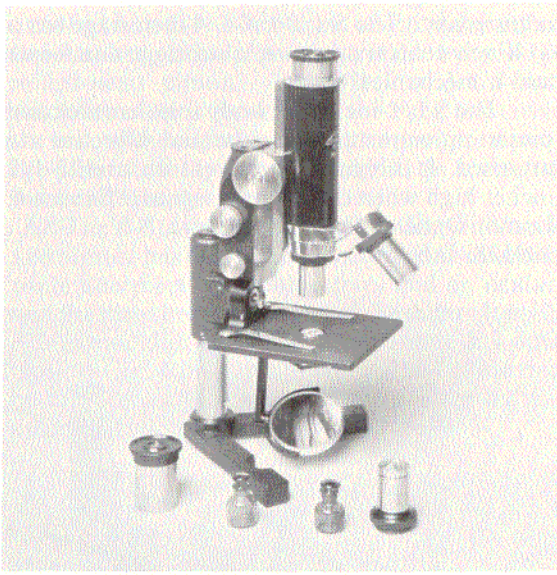

Fig. 457. Tiyoda, Tokyo, Japan; compound monocular; C. 1945. (AFIP 518967 - 73-3900)

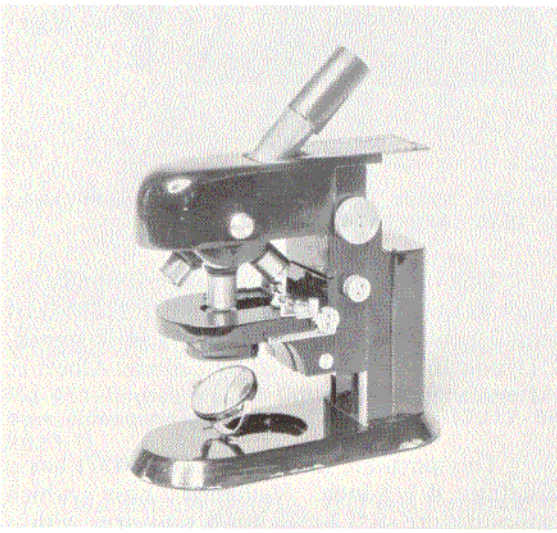

Fig. 458. Maker unknown; compound monocular; C. 1960. (AFIP 518969 - 73-3899)

The oval-shaped base of this portable field microscope (Fig. 458) is 7-1/2 x 3-1/4 inches. The stage is 3 x 2-3/4 inches, has vertical and horizontal motion and a substage condenser. There is 1-1/2-inch double mirror which fits into a well in the base. The body tube and triple nosepiece fit into a casing which is on a rack with double pinions. There is a double fine adjustment. Three objectives are attached on a revolving nosepiece, and a storage case at the rear houses three oculars.

The instrument is not signed and totally devoid of markings except for the number "660271." It was used by the North Vietnamese in a large hospital complex overrun by U.S. Forces. It is unique in its compactness and is suitable for routine procedures. (Donated by the Office of the Surgeon General, Department of the Army) ■

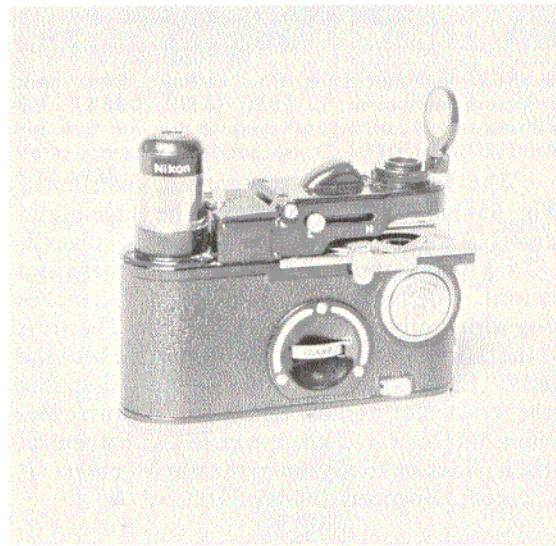


Fig. 459. Nippon Kogaku, Tokyo, Japan; compound monocular; C. 1970. (AFIP M-031301 - 73-3909)

This Nikon model H hand microscope (Fig. 459), the same size as a 35mm camera body, includes a three-place nosepiece, 2 lenses, Abbe condenser with sliding top element, achromat objectives (4/0.10, 10/0.25, 20/0.40, 40/0.65, 100/1.25 coil), and a built-in illuminator. It is essentially an inverted microscope with standard 160mm tube length. It can be equipped for phase contrast, darkfield and polorized light microscopy. Because of its small size and light weight it is an ideal field instrument. It is signed "Nippon Kogaku, Tokyo, 32801." (Donated by Nikon, Inc. Instrument Division) ■

# COMPOUND BINOCULAR

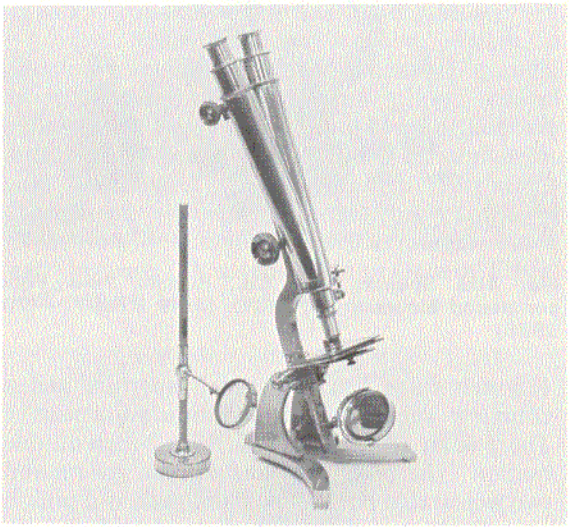

Fig. 460. James White & Sons, Glasgow, Scotland; compound binocular; C. 1860. (AFIP 740437 - 69-8758)

The claw-footed base of this all-brass instrument (Fig. 460) is 6-3/4 x 7 inches; the two 3-1/2-inch-high curved uprights are screwed to the base. The gimbal for the 2-inch-diameter double mirror is screwed to a sprung casing on the 3-inch-high tubular tailpiece. The 2-1/2 x 3-5/8-inch stage plate has a 3/4-inch aperture, a substage disc of diaphragms and a mechanical stage with two spring clips. The 7-inch-long curved limb carries the rack and two milled wheel pinions. The body tubes are 10 inches long and have racks and double milled-head pinions for the drawtubes; fine adjustment is at the lower end of the body tubes. A prism box is inserted in the nosepiece, and two oculars and one objective are attached. There are two accessory objectives, a bull's-eye condenser on a stand, and a prism mounted on a 2-inch-long revolving rod with a sprung casing for attachment to the nosepiece; it is 17-3/4 inches high when closed.

It is signed, "J. White, Glasgow." It is also inscribed, "J. B. R. Purchased with the Lord Rector's Prize of 25 (guineas) gained at Glasgow University, May 1, 1861." "J. B. R." (James Burn Russell) received this special prize for an essay on China. Dr. Russell later became health officer for Glasgow and was the author of numerous books. A bust of Dr. Russell stands in the Town Clerk's Office in the Glasgow Municipal Building.

James White & Sons began business in 1849 as electrical and marine instrument makers in Cambridge Street, Glasgow. In 1902 the firm amalgamated with a relative of Lord Kelvin to become Kelvin & White. Lord Kelvin, the first Baron of Largs, and a famous physicist, invented the Kelvin temperature scale and the mirror galvanometer. In 1950 the firm concentrated on industrial instruments and in 1958 went into liquidation. ■

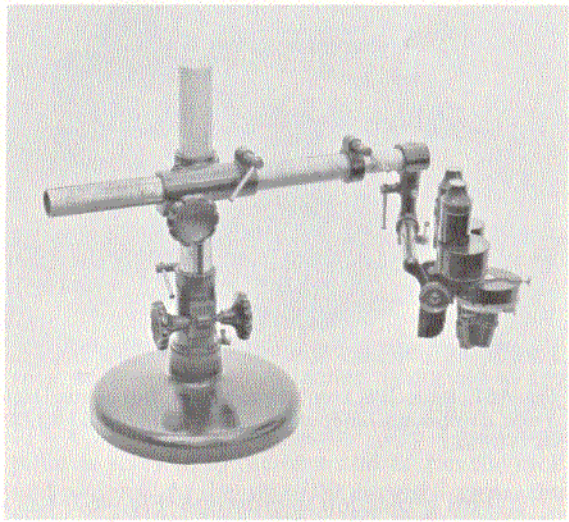

Fig. 461 Spencer Lens Co., Buffalo, New York; compound binocular stereoscopic; C. 1900. (AFIP 379076 - 70-9924)

The 10-inch-diameter circular base of this instrument (Fig. 461) and the 13-inch-high pillar are cast in one piece. A rack and pinion movement in the base raises the vertical pillar, which carries the 17-3/4-inch-long horizontal arm, also equipped with rack and pinion. The binocular body tube slides onto the horizontal arm. A regular microscope rack and pinion permits vertical movement in focussing; objectives and oculars are attached. There are

six-clamps for fixing the instrument in any position. It is signed, "Spencer, Buffalo, N.Y., U.S.A."

This instrument was used for many years by Dr. Peyton Rous, famed American pathologist, and was donated to the Museum by the Rockefeller Institute following Dr. Rous' death in 1970. ■

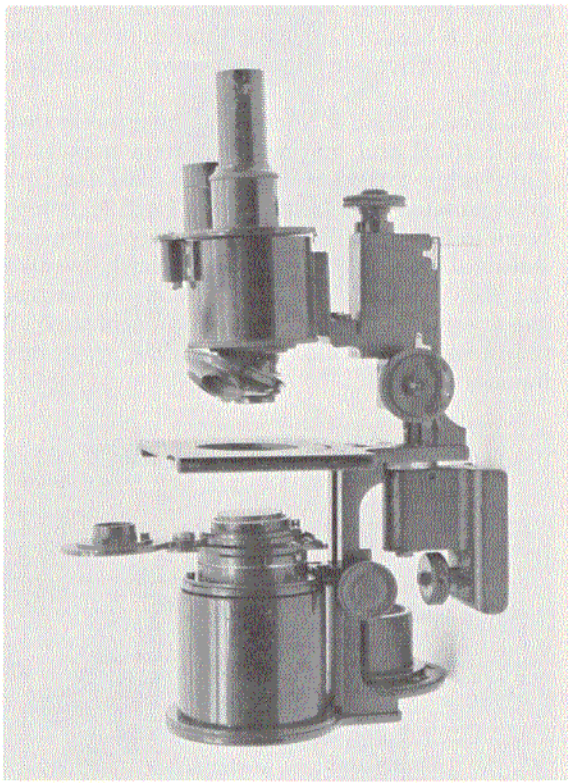

Fig. 462. Bausch & Lomb Optical Co., Rochester, New York; compound binocular, C. 1905. (AFIP 518971 - 67-10992)

This projection microscope (Fig. 462) has a 4-inch-diameter circular base, a 4 x 4-1/4-inch stage and a revolving double substage condenser with rack and pinion. The coarse adjustment is by diagonally cut rack and pinion; the fine adjustment is of the prism type. The body tube is 2-1/2 inches in diameter and has a triple nosepiece. The eyepiece is mounted on a revolving arm. It is signed, "Bausch & Lomb Optical Co., Rochester, N.Y., 582." (Donated by Dr. Oscar W. Richards) ■

The horseshoe base of this instrument (Fig. 463) is 7 x 4-1/8 inches and is cast in one piece with the pillar. The curved limb is 6 inches long and has a side fine adjustment. The 4-1/4 x 4-1/8-inch stage has a 5/8-inch aperture and a complete substage with a pinion adjustment. There is an attached gimbal with 2-inch double mirror. The body tube has a prism system and two adjustable parallel oculars, rack and pinion coarse adjustment, and a triple nosepiece with three objectives.

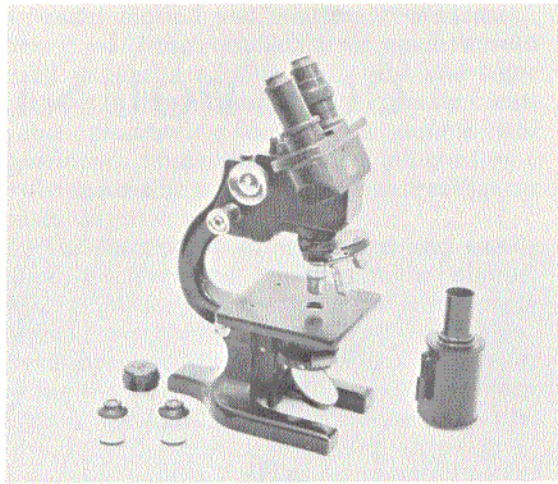

Fig. 463. Spencer Lens Co., Buffalo, New York; compound binocular; C. 1920. (AFIP 379077 - 70-9925)

It is signed, "Spencer, Buffalo, U.S.A." When closed it is 11-3/4 inches high and has a wooden carrying case. Accessories include a monocular body tube; two blue glass discs; two oculars; and a B & L objective marked "Oil 1.8mm 1.25, 97X." This instrument was owned and used by Dr. Peyton Rous. ■

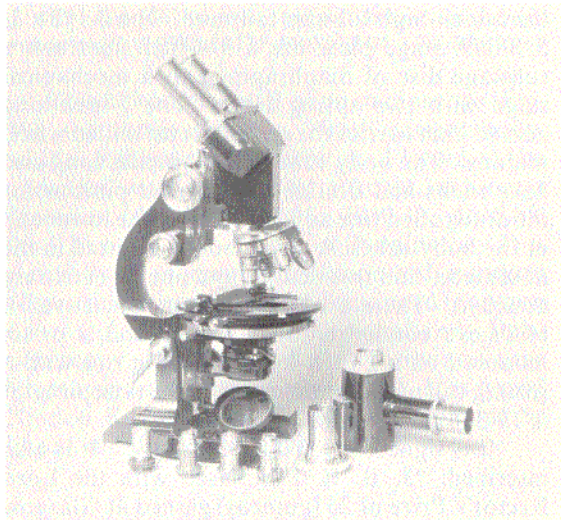

Fig. 464. E. Leitz, Berlin, Germany; compound binocular, C. 1922. (AFIP M-31037 - 73-3912)

The 6-1/2 x 4-1/2-inch horseshoe base of this black and brass instrument (Fig. 464) supports a 3-inch-high rectangular pillar that has a lever-controlled inclination joint. The 6-1/4-inch-long curved limb has a double side fine adjustment. The 2-inch double mirror is on a stationary tailpiece. The 4-1/2-inch-diameter stage plate has a mechanical stage and a complete substage condenser with rack and pinion.

The body tube has a prism system, a quadruple nosepiece, two adjustable parallel ocular tubes, and rack and pinion coarse adjustment; four objectives and two oculars are attached. When closed it is 13-1/2 inches high, and is signed, "Ernst Leitz, Wetzlar." Accessories include a single body tube, 4 objectives, 4 oculars, a circular stage, and a carrying case. (Donated by Major General Elbert DeCoursey, MC, USA) ■

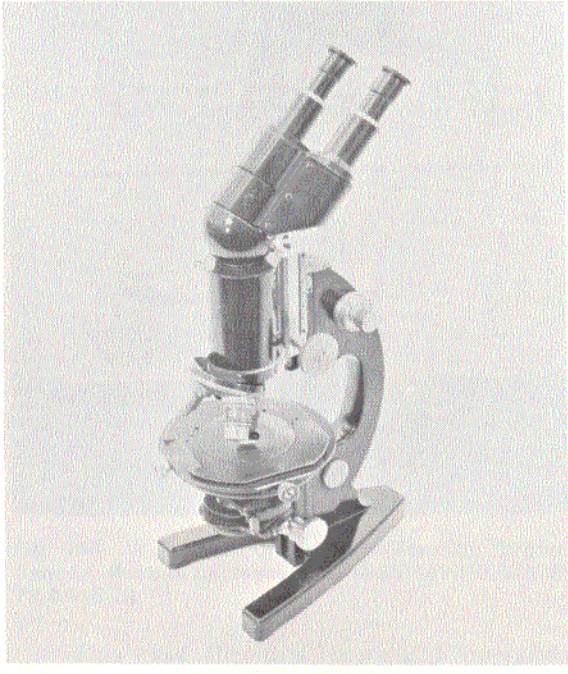

**Fig. 465. Carl Zeiss, Jena, Germany; compound binocular; 1928. (AFIP 701042 - 67-5272)**

The V-shaped base of this instrument (Fig. 465) is 8-1/4 inches with a spread of 5-1/2 inches. The curved limb is 9-1/2 inches long and moves on a compass joint; the fine adjustment is on the limb. The stage plate is 4-1/2 inches in diameter and has a circular revolving stage squared off on two sides with micrometer adjustments. There is a swingout Abbe condenser and a stationary condenser below the stage. The body tube is 3-5/8 inches long and 2 inches in diameter and has rack and pinion coarse adjustment; the adjustable binocular eyepiece revolves. Each ocular is marked K10X, Bitukni. The quadruple nosepiece has three Zeiss objectives and a Leitz oil immersion. Overall height when closed is 16 inches. The serial number is 185151; the binocular is marked, "Carl Zeiss, Jena, Nr. 5010, Germany"; and the body tube, "Carl Zeiss, Jena." The microscope is of the series Model F, and was sold to Messrs. Bennett, N.Y., 26 September 1928. ■

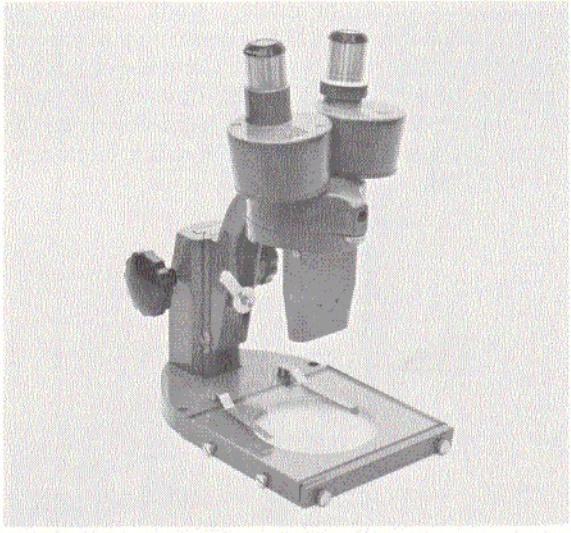

**Fig. 466. Bausch & Lomb Optical Co., Rochester, New York; compound binocular; C. 1940. (AFIP 763434 - 69-6115)**

The flat base of this stereoscopic microscope (Fig. 466) is 5-1/4 x 8 inches, is curved at the back, has a 3-3/8-inch-diameter aperture and a 4-5/8 x 5-1/8-inch glass plate. The 4-inch-high pillar is screwed to the base and carries the rack and pinions. At the top of the curved limb are the binocular tubes each with a 10X wide F ocular. There are three interchangeable objectives, marked 1, 2, and 3, and two additional oculars marked 15 X wide F. When closed it is 10-1/2 inches high, and is signed "Bausch & Lomb Optical Co., Rochester, N.Y., U.S.A., JB278." This "Stero-Zoom" microscope assists the user in combining a 3-dimensional examination of opaque and transparent medical fields. ■

The smooth-surface stand of this Ortholux microscope (Fig. 467) is of noncorroding metal. The widely curved, torsion-free tube carrier is turned away from the observer, to permit a clear unobstructed view of the stage. The coarse

focusing and micrometer screw with graduated drumhead is set low. Both focusing mechanisms mounted on ball bearings act on the square object stage. The low-set controls for the coarse and fine focusing, for the mechanical stage, and for the aperture and field of view diaphragms of the condenser, are arranged within convenient reach. The controls for the two directions of motion of the mechanical stage are mounted coaxially.

There is a substage two-diaphragm bright field condenser with rack and pinion, and the monocular and binocular body tubes are interchangeable. There is a quadruple nosepiece and interchangeable eyepieces, and also a built-in illumination. The lamp housing is well ventilated, detachable, and is located outside the stand. It is signed "E. Leitz, Wetzlar, Germany, 414518." ■

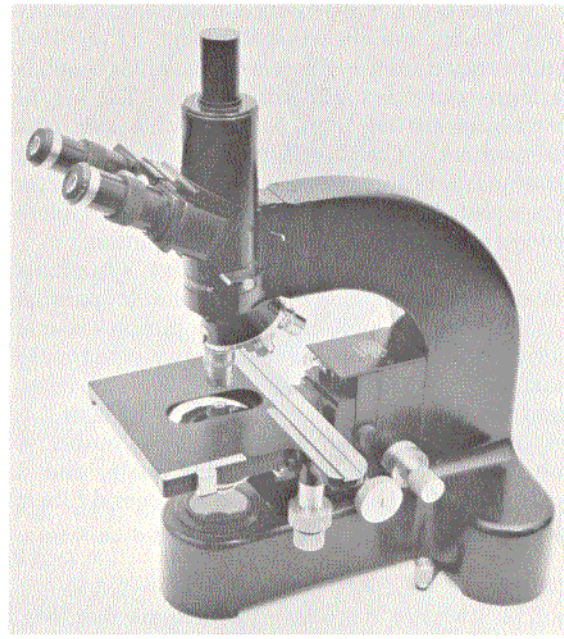

Fig. 467. E. Leitz, Wetzlar, Germany; compound binocular; 1950. (AFIP 518724 - 67-7149

# ELECTRON MICROSCOPES

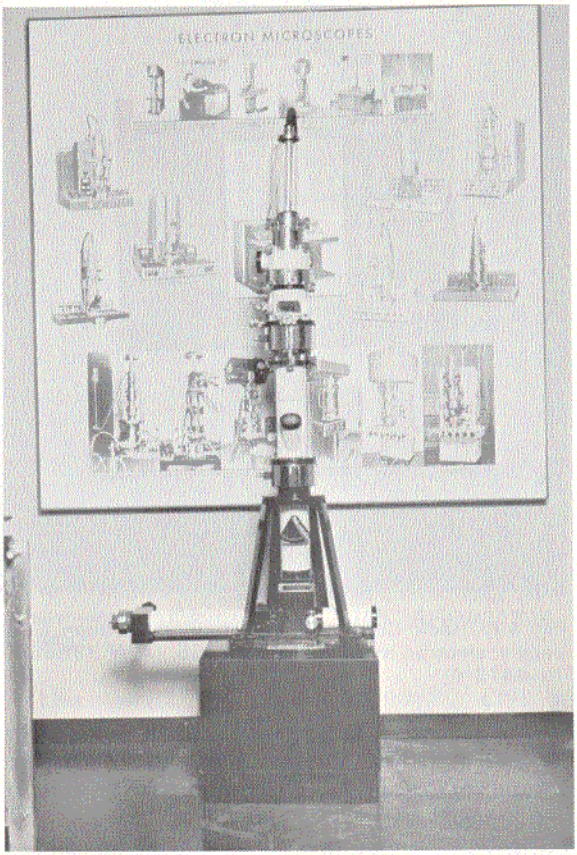


Fig. 468. W.A. Ladd, University of Toronto, Toronto, Canada; electron microscope; C 1935. (AFIP 378999-73-4413-3)

This was the first successful operating electron microscope (Fig. 468) in the United States. It was built by W. A. Ladd who was working under a Columbian Carbon Fellowship. It was sent to Columbian's Research Laboratory in 1940 but was never placed in production. (Donated by the Columbian Carbon Company) ■

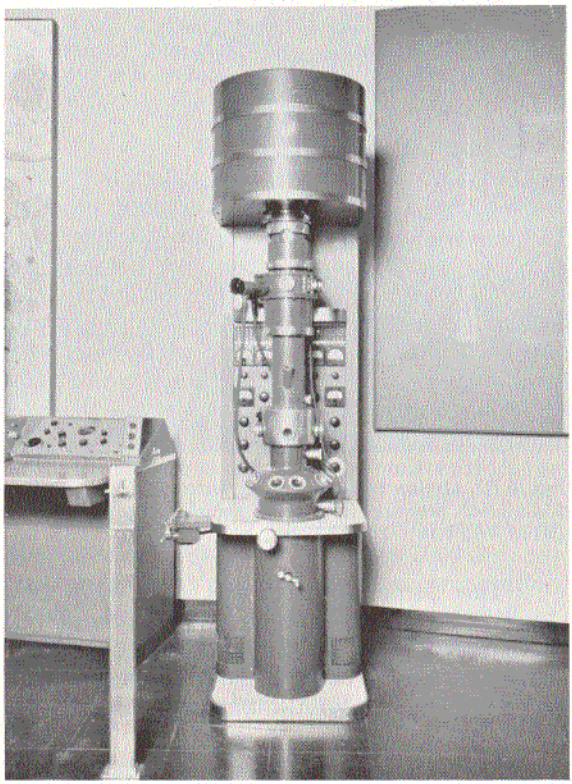

Fig. 469. Radio Corporation of America, Camden, New Jersey; electron microscope; 1948. (AFIP 518973-73-4413-2)

This was the first commercially produced electron microscope (Fig. 469) in the United States; it was designated the EMB model. ■

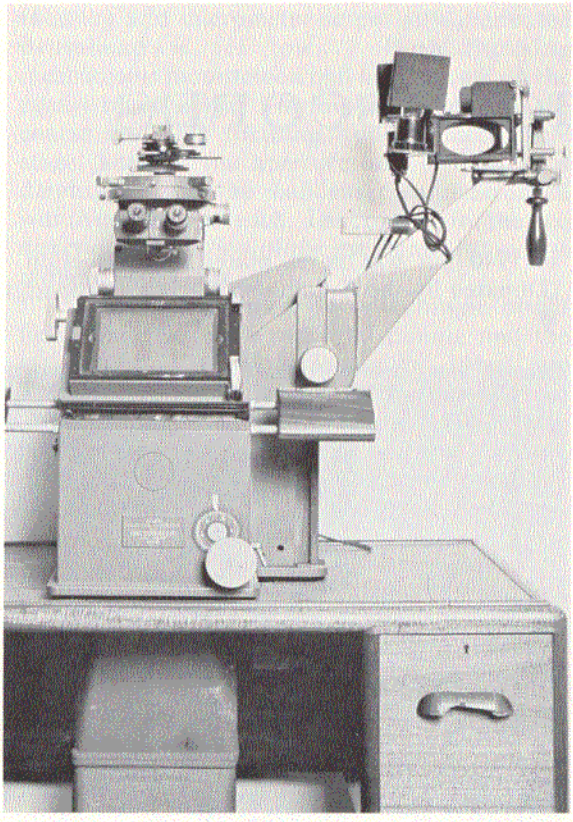

Fig. 470. Lovins Engineering Company, Silver Spring, Maryland; plenary (electron) microscope; C. 1955. (AFIP 762401 - 74-6379)

This plenary microscope (Fig. 470) is a modification of the Vickers projection microscope. It was made by the Lovins Company for use in tissue culture, particularly for time-lapse studies. Its serial number is 51183. ■

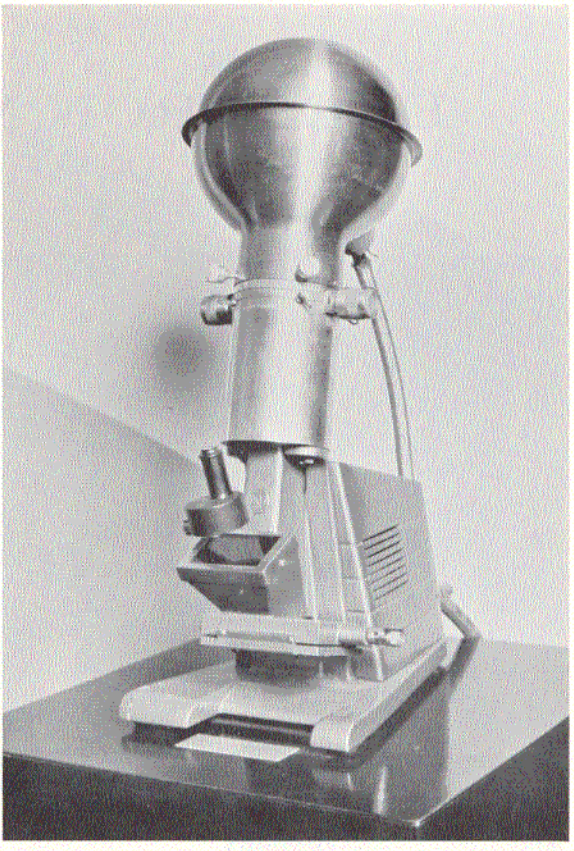

Fig. 471. Radio Corporation of America, Camden, New Jersey; electron microscope; C. 1955. (AFIP 388865 - 73-4413-4)

This was the first desk model electron microscope (Fig. 471) manufactured in the United States by RCA. (Donated by Jerome J. Wolken) ■

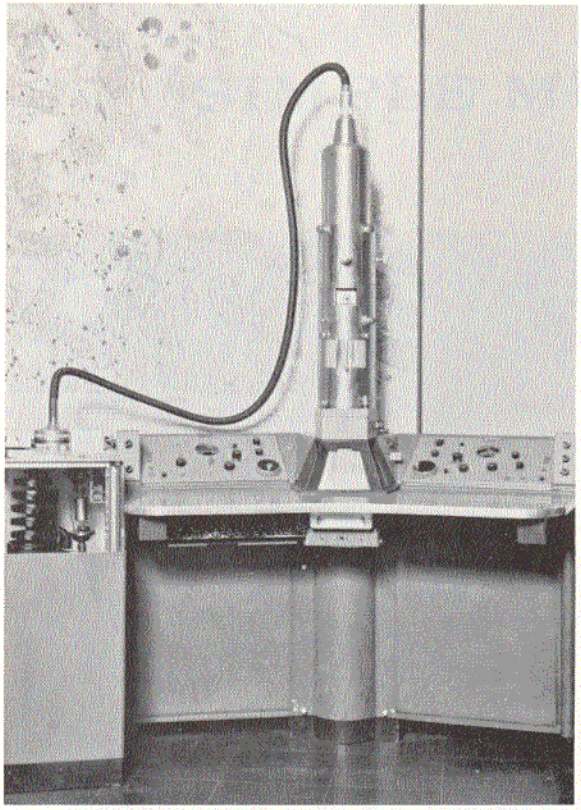

Fig. 472. Radio Corporation of America, Camden, New Jersey; electron microscope; C. 1955. (AFIP 031304 - 73-4413-1)

This was RCA's EMU3F model (Fig. 472). ■

The Stereoscan scanning electron microscope (Fig. 473) based on research by Dr. Oatley at Cambridge University, was developed and commercialized by Cambridge Scientific Instruments, Ltd. in 1963. The instrument illustrated was delivered to the DuPont Fiber Surface Research Section in 1965 and donated by the E. I. DuPont de Nemours & Company, Inc., to the Armed Forces Medical Museum in 1973.

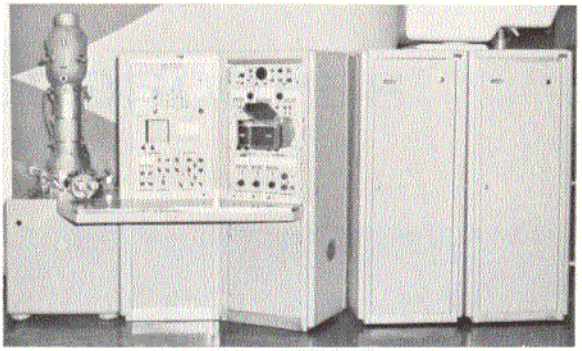

Fig. 473. Cambridge Scientific Instruments, Ltd., Cambridge, England; prototype Stereoscan scanning electron microscope; 1963. (AFIP M-000-198 - 73-94-1)

The Stereoscan was chosen for textile fiber research because of its great depth of focus, up to 300 times that of light microscopes, and its ability to detect infinitesimal surface details on solid bulk specimens. With resolution down to 200 angstroms (.020 micron), it provides direct reading magnifications from 50 to 50,000 diameters. Unlike electron transmission images, the three dimensional stereoscopic image is provided by differential analysis of scintillation from the electrons reflected and emitted from the specimen. The focussed electron beam is moved by scanning coils in the final lens across the specimen covering areas from 2 to 2000 microns square. Objects require little or no preparation or can be metal coated, are not subjected to strong heat and specimens up to 12 mm in diameter and several millimeters thick can be manipulated while being observed.

As shown in Fig. 473 the major components are the electron-optical column on the left; control rack, display screens and camera in the center; and additional power supply to the right. Many ancillary units such as X-ray microanalysis can be integrated into the system. ■

# SIMPLE MICROSCOPES

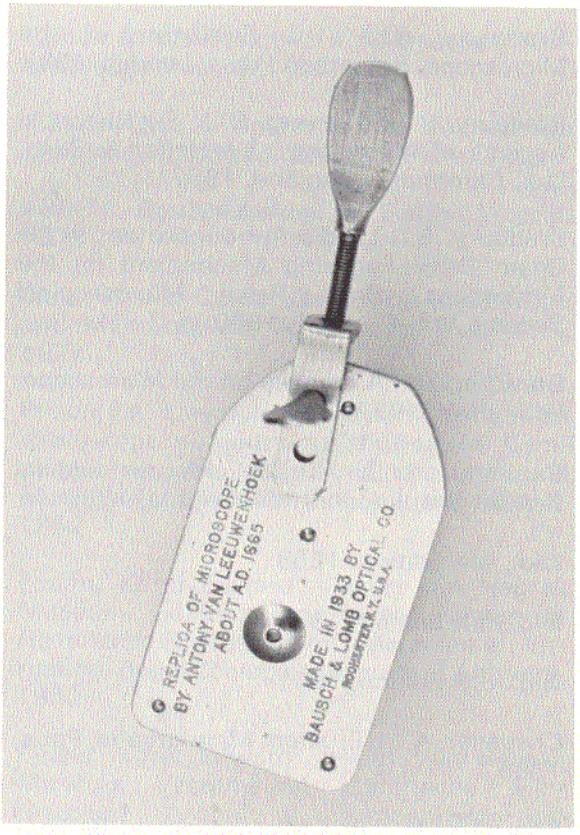


**Fig. 474. Bausch & Lomb Optical Co., Rochester, New York; simple microscope; 1933. (AFIP 701651 - 74-6716)**

This microscope (Fig. 474) is a replica of an original simple microscope made about 1673 by Antoni Van Leeuwenhoek of Leyden, Holland. It is similar to that pictured on page 153, Fig. 284 (AFIP 49150). (Donated by Dr. Stanhope Bayne-Jones) ■

The horseshoe base of this instrument (Fig. 475) is 5-1/4 x 3-1/4 inches, and supports the 3-1/4-inch-high tubular pillar; a triangular bar with rack at the back slides within the pillar by pinion control. A 2-inch-long swinging arm is attached to the top of the bar, and screwed to one end is another arm, 3 inches long, which ends in a 1-inch-diameter aperture into which fits the ocular.

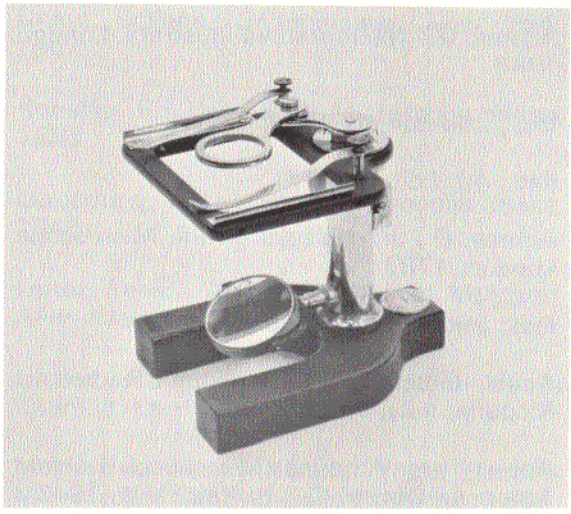

**Fig. 475. Bausch & Lomb Optical Co., Rochester, New York; simple dissecting; C. 1900. (AFIP 379073 - 70-6267)**

The stage plate is 4 x 3-1/4 inches with attached metal grooves on each side into which the glass stage slides. The 1-5/8-inch mirror, concave on one side and white translucent on the other, fits into a gimbal inserted into the lower portion of the pillar.

When closed, it is 5 inches high, and is signed, "Bausch & Lomb Optical Co., Rochester, N.Y. 39824, Arthur H. Thomas Co., Philadelphia, Pennsylvania." Accessories include 2 Bausch & Lomb oculars; a glass stage, 3-7/8 x 2-3/8 inches; a black shield, 2-7/8 x 2-5/8 inches; and a wooden carrying case. ■

# REFERENCES


Adams, G.: Micrographia Illustrata, London, 1746

Ibid., 2nd Edition, 1747

Ibid., 4th Edition, 1771

Adams, G., Jr.: Essays on the Microscope, London, 1787

Ibid., 2nd Edition, 1798

Amici, G.B.: Dei Microscopi Catadiottrici, Modena, Italy, 1818

Anon.: Three American Microscope Builders, American Optical Co., Buffalo, N.Y., 1945

Bachmann: Microscopes, Munich, 1883

Baker, H.: The Microscope Made Easy, London, 1742

Ibid., 2nd Edition, 1743

Ibid., 3rd Edition, 1744

Ibid., 4th Edition, 1754

Ibid., 5th Edition, 1769

Baker, H.: Employment For the Microscope, London, 1753

Beale, L.S.: How to Work With the Microscope, Philadelphia, 1868

Back, Richard: A Treatise on the Construction, Proper Use, and Capabilities of Smith, Beck, and Beck's Achromatic Microscopes, London, 1865

Bedini, Silvio A.: Giuseppi Campani, Pioneer Optical Inventor. Ithaca, 26 VIII - 2 IX, 1962

Bedini, Silvio A.: Seventeenth Century Italian Compound Microscopes, Physis, Rivista di Storia Della Scienza, Vol. V, Fasc. 4, 1963

Bradbury, S.: The Evolution of the Microscope, Pergamon Press, London, 1967

Bradbury, S. and Turner, G. L. E.: Historical Aspects of Microscopy, W. Heffer & Sons, Ltd., Cambridge, England, 1967

Bradbury, S.: Ladd's Announcement of his Chain Drive Focusing Mechanism for the Microscope, Proc. Royal Microscopical Society, Vol. 4, part 1, 1969, p. 7-9.

Brewster, D.: A Treatise on the Microscope, Edinburgh, 1837

Carpenter, W.B.: The Microscope and Its Revelations, London-Philadelphia, 1856

Ibid., 4th Edition, 1868

Ibid., 6th Edition, 1883

Ibid., 8th Edition, 1901

Chevalier, A.: L'Etudiant Micrographe, Paris, 1865

Chevalier, C.: Des Microscopes et de Leur Usage, Paris, 1839

Clay, R.S. and Court, T.H.: History of the Microscope, London, 1932

Clay, Reginald S.: A Review of the Mechanical Improvements of Microscopes in the Last Forty Years. J. Royal Microscopical Society, Mar. 1938, Vol. LVIII, series III, p. 1-29.

Czapski, S.: Binoculares Cornealmikroskop, Graefe's Arch. Ophth., 48:229-235, 1899

Descartes, R.: La Dioptrique, Leyden, 1637

Disney, A.N., Hill, C.F., and Baker, W.E. Watson: Origin and Development of the Microscope, London, 1928

Dobell, Clifford: Antoni van Leeuwenhoek and His 'Little Animals', 1958.

Donne, M.: Comp. Rend. Ac. Sci., Paris, 21:388, 1841

Fabri, H.: Synopsis Optica, etc., Lugduni, 1667

Fisher & Waldheim: Le Microscope Pancreatique, Moscow, 1841

Fresnel, M.: Rapport sur le Microscope Achromatique de M. Selligue, Paris, 1824

Frey, H.: Das Mikroskop, 4th Edition, Leipzig, 1871

Frey, H., and Cutter, G.R.: The Microscope and Microscopical Technology, New York, 1872

Frison, Ed.: L'evolution de la partie optique du microscope au cours du XIXe siecle, Communication No. 89 from the National Museum for the History of Science, Leyden, 1954

Frison, Karel Edward: Henri van Heurek Museum, Geillustreerde Inventaris van de Historische Microscopen Onderdelen en Vitrusting, Royal Zoological Society of Antwerp, 1966.

Frison, Karel Edward: Henri Van Heurek Museum Verzameling Historische Microscopen. A study of the magnifying and resolving power of nonachromatic simple and compound microscopes of the 18th and 19th centuries. Royal Zoological Society of Antwerp, 1972.

Gage, Simon Henry: Microscopy in America (1830-1945). Edited by Oscar W. Richards, Trans. Amer. Microscopical Soc., Vol. LXXXIII, No. 4, Supplement, Oct. 1964

Hannover, A.: On the Construction and Use of the Microscope, Translation by J. Goodsir, Edinburgh, 1853

Harris, John: Lexicon Technicum, London, 1704

Harting, P.: Das Mikroskop, Braunschweig, 1886

Hogg, J.: The Microscope, London, 1883

Hooke, Robert: Micrographia, London, 1665. Reprinted by Dover Publications, New York, 1961

Kellert, Ellis and Clark, Leonard B.: The Microscope Collection at Union College. Union College, Schenectady, New York, 1967.

Koristka, F.: Use of the Microscope, Milan, 1883

Lerebours, N.P.: Les Microscopes, Paris, 1846

Letter Book: Archives, Medical Museum, AFIP, Washington, D.C., 1878

Lyonet, P.L.: Traite Anatomique de la Chenille, La Haye, 1762

Marton, L.: Early History of the Electron Microscope. San Francisco Press, Inc., 1968.

Mayall, John, Jr.: The Microscope, Cantor Lectures, London, 1886; J. Soc. Arts, 34:987, 1886

Ibid., 34:1007, 1886

Ibid., 34:1031, 1886

Ibid., 36:1149, 1888

Mayall, John, Jr.: Personal Letters, Archives, Medical Museum, AFIP, Washington, D.C., 1890

Montucla, J.E.: History of Mathematics, London, 1802

Nachet, A.: Collection Nachet, Paris, 1929

Nageli, C., & Schwendener, S.: Das Mikroskop, Theorie und Anwendung Desselben, Leipzig, 1867

Passemant, C.S.: Description et Usage Telescopes, Microscopes, Paris, 1786

Photomicrography with the Vickers Projection Microscope, 4th edition n/d., Cooke Troughton & Simms, Ltd., York, England.

Pritchard, A., & Goring, C.R.: Microscopic Illustrations, London, 1830

Purtle, Helen R.: History of the Microscope. Encyclopedia of Microscopy and Microtechnique, Van Nostrand Reinhold Co., N.Y., 1973.

Quekett, E.J.: Practical Treatise on the Use of the Microscope, London, 1848

Reichert, Charles, Vienna, Austria: Catalogue Illustre des Microscopes, Microtomes, etc., No. XV, 1888.

Robinson, Harry W. and Adams, Walter: The Diary of Robert Hooke, 1672 - 1680, Wykeham Publications (London) Ltd., 1968.

Rooseboom, Maria: Microscopium Leiden, 1956

Ross, Andrew: Microscope: Penny Cyclopaedia, Vol. 25, pp 177-188, London, 1839

Smith, H.L.: The Inverted Microscope, etc., Am. J. Sci. Arts, 14:233-234, 1852

Smith, James: Description of the Improved Achromatic Microscope, London. Edward Couchman Publications, 10 Throgmorton Street, 1840.

Smith, R.: A Compleat System of Optiks, Cambridge, England, 4 vols, 1738

Spitta, E.J.: Microscopy, New York, 1907

Trutat, E.: Traite Elementaire du Microscope, Paris, 1883

Turner, G.L. E.: Decorative tooling on 17th & 18th century microscopes and telescopes. Physis. Rivista Internazionale di Storia Della Scienza, Vol. 8, 1966, pp 99-128.

Turner, G.L.E.: Micrographia Historica. The Study of the History of the Microscope. Quckett Lecture. Proc. Royal Microscopical Society, 7:2, 1972, pp 120-149.

Turner, G.L.E.: The History of Optical Instruments. A brief survey of sources and modern studies. History of Science. An annual review of literature, research and teaching, Vol. 8, 1969.

Van Cittert, P.H.: Descriptive Catalogue of the Collection of Microscopes in charge of the Utrecht University Museum, Holland, 1934

Van der Star, P.: Descriptive Catalogue of The Simple Microscopes in the National Museum of the History of Science at Leyden, 1953

Van Heurck, Henri: The Microscope, London, 1893

Watkins, F.: L'Exercice du Microscopes, Paris, 1754

West, Graham: A brass Culpeper-type microscope made by Wm. Harris. Proc. Royal Microscopical Society, Vol. 3, part 2, 1968, p. 72-76.

Wild, Heerbrugg: Fifty Years, Jubilee Volume Microscopy, 1921-1971.

Wise, F.C., Ockendon, F.E.J., and Sartory, P.K.: The Binocular Microscope, Its Development, Illumination and Manipulation, Monograph No. 5 of the Quekett Microscopical Club, Williams and Norgate, Ltd., London, 1950.

Woodward J.J.: A Simple Device for the Illumination of Balsam-Mounted Objects, etc., Mon. Micr. J., 18:61-64, London, 1877

Woodward, J.J.: Letter Book, Archives, Medical Museum, AFIP, Washington, D.C., 1879

Zahn, J.: Oculus Artificialis, etc., 2nd Edition, Norimberge, 1702

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