BAUSCH & LOMB

Polarizing Microscopes

Research Polarizing Microscopes · Series LR

Model LR microscope.

The Bausch & Lomb LR Research Polarizing Microscope is a fresh, new design from top to bottom. By making a new approach to the problem, B&L scientists have produced an instrument which is assured of a long, long life of consistently satisfactory performance.

Eyepieces are large diameter, Huygenian with authentic spiderweb crosshairs and focusing eyelenses, in magnification powers of 5×, 7.5× and 10×. An adapter permits using standard diameter eyepieces, including a micrometer eyepiece such as the Filar (Catalog No. 31-16-50).

Body tube is generally rectangular to provide room for the optical and mechanical elements. Within the body tube, safely sealed from dust and dirt is a focusable, accurately pre-centered Bertrand lens and an adjustable diaphragm on a flip-in mount. Focusing the Bertrand lens is done with a rack and pinion activated by an exterior knob on the left side of the tube. A graduated scale allows accurate repeats of conoscopic image observations. The iris is adjusted by a knurled knob to isolate interference figures of small crystals.

Also within the body tube, at the lower end, is a flip-in Polaroid Analyzer, rotatable through 94° and graduated in 5° from 0 to 90. The use of highest grade Polaroid material for the analyzer cancels the need for the stigmatizing lenses used in prism instruments.

The accessory slot in the body tube is fitted with a tight, dust proof sliding cover.

A quick-change bayonet adapter carries either the centerable type nosepiece or a vertical illuminator. The adapter permits the attachment of these devices with much greater rigidity than has been possible with previous types. It also greatly simplifies and speeds up the interchange of objectives and vertical illuminators and makes possible the use of any standard B&L nosepiece, including the quadruple rotating nosepiece (Catalog No. 31-19-20) with individually centerable objective mounts.

The high quality, ball-bearing stage is graduated in single degrees with a vernier reading to 6′ and a clamp for arresting the rotation of the stage. This clamp can also be used as an adjustable brake to make the stage rotation more or less free, thus preventing slippage. The stage is drilled and tapped to receive

BAUSCH & LOMB RESEARCH POLARIZING MICROSCOPE, SERIES LR with coarse focusing adjustment by rack and pinion; fine focusing by ball-bearing mechanism, with one micron divisions on right knob which is concentric with the inclination joint; extensible slide with clamp, on body tube, to provide added clearance between stage and objective; quick change bayonet adapter for nosepieces and vertical illuminator; centerable nosepiece.

Large diameter tube; reducing adapter for standard diameter eyepieces; body tube completely enclosing Bertrand lens and analyzer; accessory slot; Bertrand lens with iris diaphragm on flip-out mount focused by rack and pinion with scale; Polaroid analyzer on flip-out mount, rotatable from −2° through +92° and graduated each 5°.

Graduated circular stage, ball bearing, 130mm diameter, 2 stage clips, clamp for braking rotation, vernier reading to 6′.

Substage condenser, 5 lens elements, 1.25 N.A. with swing-out

the attachable mechanical stage. The arm is designed to permit full 360° rotation of the stage even when fitted with the mechanical stage (Catalog No. 31-59-47).

Condenser, polarizer, and iris for LR microscope.

Substage is focusable by rack and pinion. The condenser is made up of five elements; with the upper element in place the numerical aperture is 1.25, providing a better interference figure than condensers with a lower N.A. The upper element is in a rugged swing-out mount actuated by a convenient knob. Removing this element from the optical path provides orthoscopic illumination with 0.25 N.A., allowing full field illumination of the 2.6× objective, even with the 5× eyepiece.

Two iris diaphragms lie in the correct plane for aperture control, one for high power objectives, the other for low. All air-to-glass surfaces are Balcoted. The working distance of the condenser allows full aperture illumination when using slides of normal 1.2mm thickness.

The substage mount will receive most standard B&L condensers, such as phase contrast (with long working distance), dark field, etc. Because of this and other features, the instrument is ideally suited to the dispersion staining method of identification, pioneered by G. C. Crossmon, Bausch & Lomb Microscopist. (Reprints on this method, with suggested equipment requirements are available upon request. See also listing at end of catalog.)

At the suggestion of Dr. R. C. Emmons of the University of Wisconsin, the conventional "Becke Lever" has been left off the substage, but he has added a flip-in quarterwave plate as a means of improving conoscopic observations. This plate is so mounted that, when in the optical path, its slow ray is perpendicular to the slow ray of a conventional quarterwave plate as normally used in the accessory slot. Thus, the specimen is viewed in circularly polarized light. Observation of the conoscopic interference figure will reveal that the isogyres have been removed and that the points of emergence of the optical axes of a biaxial crystal are clearly indicated. Whereas two observations would normally be required to locate these axes, with the auxiliary quarterwave plate only one observation is necessary.

The polarizer is the best selected Polaroid material in a rotatable mount with a protective heat absorbing glass. Rotation is through 360°, graduated at each 45°.

A large plano-concave mirror in mount is regularly supplied for use with a separate light source. As an optional accessory the Optilume integral light source may be used instead of the mirror. The Optilume Illuminator (Catalog No. 31-33-93) is recommended. It has a blue glass filter to produce a white background to permit better color identification in the specimen. Optilume illumination is adequate, even with high power objectives.

For photomicrography, in both the orthoscopic and conoscopic modes, a special adapter (Catalog No. 31-99-89-80) permits the attachment of the Model N 35mm eyepiece camera. This camera, as well as other photomicrographic equipment adaptable to B&L polarizing microscopes, is described in brochure 42-21, available on request. With the combination of the LR microscope, N camera and the special adapter, one can switch immediately from orthoscopic to interference figure observation and photography by simply flipping the Bertrand lens control, just as for visual observation. Since an eyepiece is used at all times, the possibility of adding reticles and measuring scales which are imaged at the same time that the specimen is, greatly enhances the versatility and value of this equipment.

top lens to give 0.25 N.A., 2 iris diaphragms, Polaroid polarizer in rotatable mount graduated at 45° intervals, with heat protecting filter, circular polarizer plate on swing-out mount; plano-concave mirror; ¼ wave plate; pinhole cap.

Wood cabinet with compartments for accessories, with lock and key; with either of the following recommended equipments:

- Model LR-2 Polarizing Microscope with two achromatic strain-free objectives 10X (16mm) 0.25 N.A. and 45X (4mm) 0.85 N.A.; two objective holders; two large diameter Huygenian eyepieces (7.5X and 10X) with spiderweb crosshairs and focusing eyelens; instruction manual. Catalog No. 31-28-71-02.
- Model LR-4 Polarizing Microscope with three achromatic strain-free objectives, 2.6X (40mm) 0.08 N.A., 10X (16mm) 0.25 N.A., and 45X (4mm) 0.85 N.A.; three objective holders; three large diameter Huygenian eyepieces (5X, 7.5X, and 10X) with spiderweb crosshairs and focusing eyelens; instruction manual. Catalog No. 31-28-71-04.

BALCOTED OPTICS

Better interference colors with high contrast reveal bi-refringence colors more accurately, make low bi-refringent materials easier to see, define figures and images more clearly. Balcoted optics in condenser and objectives reduce the depolarization normally occurring when plane polarized light strikes these surfaces at high angles of incidence.

SWING-IN CIRCULAR POLARIZER

Facilitates determination of dispersion in interference figures and sharpens observer's sense of optic axis, which are time saving factors.

1.25 N.A. CONDENSER OF ROBUST CONSTRUCTION

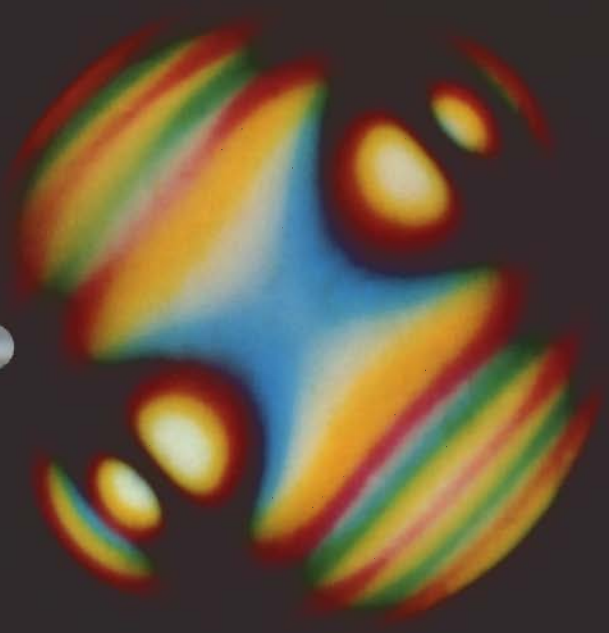
Gives years and years of accurate, precise "new-instrument," factory-fresh operation.

LR Microscope

Biaxial Interference Figures

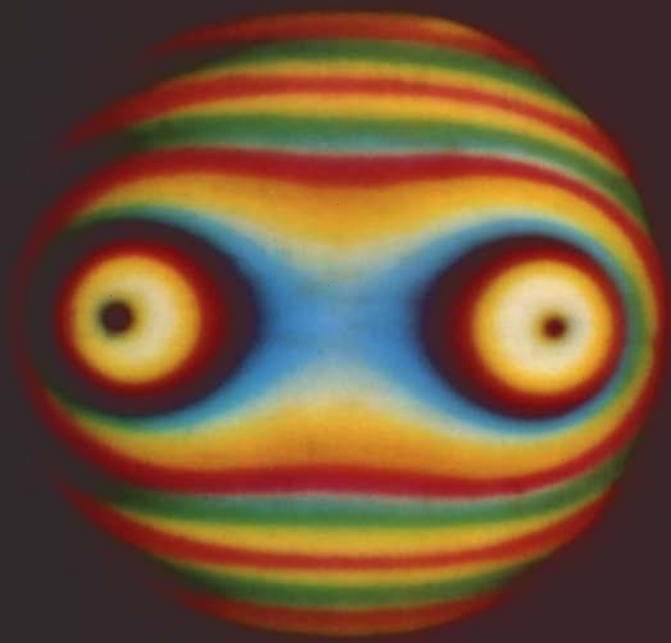
Advantage of circularly polarized over plane polarized light. Using the substage quarterwave plate and a quarterwave plate in the body tube, the biaxial, bisectrix interference figure is modified by the elimination of the isogyres and reduction of optic axes to two dark spots. The isochromes are not affected. The observer is helped in two operations: (1) He has a keener sense of the optic axis and is thereby enabled more easily to measure 2V, and (2) it is much easier to determine dispersion in interference figures. Only one observation, instead of two, is needed. The symmetry of the color fringes is clearly shown in the absence of an isogyre.

LIGHT



45° Position

CIRCULARLY POLARIZED LIGHT



The Intermediate Series
Models LI-2 and LI-4

These are complete Polarizing Microscopes, designed for comprehensive work in advanced student instruction, petrography, and, industrially, for precise quality-production control. A comparison of the cost of these fine instruments with any others available will convince you that nowhere can you get more for your money. Note these quality features:

Eyepieces—Huygenian, 5×, 7.5× and 10×, keyed, with crosshairs and focusing eyelenses.

Bertrand Lens—Fixed focus, for examination of interference figures with the 45× objective. Flip-in, dustproof and accident proof.

Centerable Nosepiece—Assures repeat centration of objectives with optimum precision.*

Objectives—Achromatic, strain-free, and parfocal; available in range of magnifications.

Stage—Ball-bearing, graduated in 1 degree, precentered, rotatable; clamping screw; vernier reading to 6′ of arc. Drilled and tapped for attachable mechanical stage.

Condenser-Polarizer Substage—Iris diaphragm, heat-absorbing filter, Polaroid polarizer and two condensing lenses. Instantly Variable Focus from 0.08 N.A. to 1.25 N.A. without inconvenience of removing or swinging-out upper lens element. No auxiliary lens or additional condenser is required to increase the numerical aperture for oil immersion objectives. Polarizer is rotatable through 360 degrees, and graduated each 45 degrees.

Plus—Bausch & Lomb standard coarse adjustment; Dynoptic design fine adjustment; dustproof, flip-in analyzer; dustproof slot for retardation plates, and wedge, on modern design Dynoptic Stand. Other accessories begin on page 9.

**Other nosepieces available optionally. See accessories listing.*

SPECIFICATIONS

Model LI-2 Dynoptic Polarizing Microscope. Rack and pinion coarse adjustment; ball bearing and roller, low position fine adjustment, graduated in one micron divisions; ball bearing graduated, precentered, rotatable stage with vernier reading to 6′ of arc; stage clamping screw; stage clips.

Monocular tube, centerable nosepiece; slot for retardation plates, etc.; flip-in, dustproof, fixed Polaroid analyzer; flip-in, dustproof, fixed Bertrand lens.

Variable Focus Condenser, 0.08 N.A. to 1.25 N.A. with iris diaphragm; graduated and rotatable Polaroid polarizer; one 10X, 16mm, 0.25 N.A., and one 45X, 4mm, 0.85 N.A. achromatic strain-free objectives; two objective holders; one 7.5X and one 10X Huygenian eyepiece with crosshair and focusing eyelenses; plano-concave mirror with fork mount. In wood cabinet. Catalog No. 31-28-60-02.

Model LI-4 Dynoptic Polarizing Microscope. Same as Model LI-2 above, but with one 2.6X, 40mm, 0.08 N.A., one 10X, 16mm, 0.25 N.A., and one 45X, 4mm, 0.85 N.A. achromatic, strain-free objectives; three objective holders; one 5X, one 7.5X, and one 10X Huygenian eyepieces with crosshairs and focusing eye lenses. In wood cabinet. Catalog No. 31-28-60-04.

The microscopes shown on pages 6, 7, and 8 will accept the 35mm Model N camera directly without the need for special adapters. Conoscopic photomicrography, however, cannot be easily done with such an arrangement. For this application, the Series LR with N camera and photo adapter is recommended. The quadruple nosepiece with individually centerable apertures (Catalog No. 31-19-20) can be supplied instead of the standard revolving and single centering nosepieces listed. See price list.

For Chemical Microscopy · Model LM-4

Primarily designed for chemical microscopy the Series M is the same as the Series I except for the body tube and nosepiece. No Bertrand lens is included and the nosepiece is ball-bearing, triple, and revolving. The listed Model LM-4 is the suggested equipment for most chemical microscopy. The Series M with proper accessories can also be used for metallography, biology, textile, and paper analysis, particle size determination, photomicrography and many other applications in quality-production control.

Optical and mechanical equipment can vary according to specific application. Variations in the Series M can consist of furnishing it with the Series S rotatable stage, having a single index line and without clamp; double or quadruple nosepiece; or centerable nosepieces.

The optical and mechanical equipment should be selected to suit the particular use to which the instrument will be put. Give Bausch & Lomb full information about the intended application and you will receive expert recommendations as to specific equipment. Your microscope can be "tailor-made" to the required application. For wedge, plates, and attachable illuminator please see Accessories, beginning on page 9.

SPECIFICATIONS

Model LM-4 Dynoptic Polarizing Microscope. Rack and pinion coarse adjustment; ball-bearing and roller, low position fine adjustment, graduated in one micron divisions; ball-bearing, graduated, precentered*, rotatable stage with vernier reading to 6′ of arc; stage clamping screw, stage clips.

Monocular tube; ball-bearing, revolving, triple nosepiece†; slot for retardation plates, etc.; flip-in, dustproof, fixed Polaroid analyzer.

Variable Focus Condenser, 0.08 N.A. to 1.25 N.A. with iris diaphragm, graduated rotatable Polaroid polarizer; one 4X, 32mm, 0.10 N.A., one 10X, 16mm, 0.25 N.A., and one 21X, 8mm, 0.50 N.A. achromatic, strain-free objectives; one 5X, one 7.5X, and one 10X Huygenian eyepieces with crosshairs and focusing eyelenses. In wood cabinet. Catalog No. 31-28-65-04.

**Centering knurled head screws can be supplied instead of the factory-set, slotted-head centering screws (at additional cost). See price list.*

†Other nosepieces available optionally. See accessories listing.

The Standard Series
Model LS-2

This Series is especially designed for routine student instruction in geology, basic crystallography, paleontology, and microchemistry.

Now, because of the extremely low cost, schools can own several polarizing microscopes of recognized, standard design, with features found only on more expensive instruments.

These features make this the best Student Polarizing Microscope buy:

Eyepiece—Keyed Huygenian 10×, durable crossline reticle. Easily cleaned. Focusing crosshair eyepieces can be substituted at additional cost.

Coarse Adjustment—Standard design, same as on the most expensive laboratory type microscopes.

Fine Focusing Adjustment—Dynoptic design. Friction-free, effortless focusing. One micron graduations, most precise focusing obtainable. Low-position knob permits resting the hand on the table for fatigue-free operation.

Analyzer—Polaroid, flip-in type, dustproof. Just turn the knob a quarter turn. Saves time, no exposed, greasy slideways to catch dust. Fully enclosed.

Slot for Accessories—With dustproof shutter, for acceptance of standard retardation plates, wedge, and compensator.

Nosepiece—Ball-bearing design for long life and assured parcentricity. Ball-stop insures accurate positioning of objective. Compensator distributes pressure to all bearing points, cancelling effects of possible wear. Centerable type nosepiece can be substituted at added cost (either the single centering or quadruple centering type).

Objectives—10× achromatic, strain-free 0.25 N.A. color coded to assist beginner in easy identification, and 45× achromatic, strain-free, 0.85 N.A. Additional objectives are available.

Stage—Series S, ball-bearing, graduated in 1 degree, precentered and rotatable, with index line. Permanently lubricated, with built-in wear compensator. Drilled and tapped for attachment of mechanical stage.

Simplified Substage—Fixed Polaroid Disc with iris diaphragm. Plano-concave mirror in fork mount. Can be furnished with Optilume integral substage illuminator instead of mirror at added cost.

Accessories—For optional equipment please see Accessories, page 9.

SPECIFICATIONS

Model LS-2 Dynoptic Polarizing Microscope. Rack and pinion coarse adjustment; ball-bearing and roller, low position fine adjustment, graduated in one micron divisions; ball-bearing, graduated, precentered*, rotatable stage, with index line; stage clips.

Monocular tube; ball-bearing, revolving, double nosepiece†; slot for retardation plates and wedge; flip-in, dustproof, fixed Polaroid analyzer.

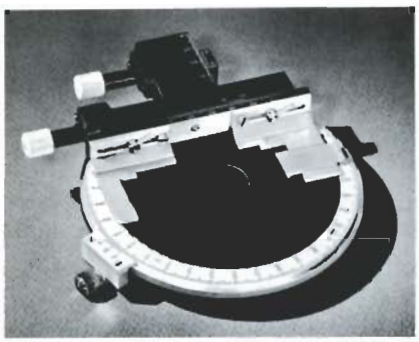
Fixed Polaroid polarizer with iris diaphragm, one 10X, 16mm, 0.25 N.A., color-coded, achromatic, and one 45X, 4mm, 0.85 N.A., achromatic strain-free objectives; keyed 10X Huygenian eyepiece with cross wires; plano-concave mirror with fork mount. Cabinet *not* included. Catalog No. 31-28-59-02.

**Centering knurled head screws can be supplied instead of the factory set, slotted-head centering screws (at additional cost). See price list.*

†Other nosepieces available optionally. See accessories listing.

Accessories For Polarizing Microscopes

MECHANICAL STAGE

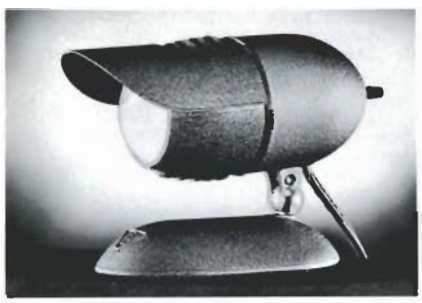


This versatile Mechanical Stage is readily attachable to all Bausch & Lomb Polarizing Microscopes of recent manufacture. Standard petrographic 26 x 45mm, as well as biological 25 x 75mm slides can be accommodated by fingertip adjustment. Can also be supplied as a Point Counting Stage (Chayes' Method), the knobs being provided with ratchet wheels which move the slide 0.31mm per each click in the east-west direction, and 0.51mm per each click in the north-south direction.

No. 31-59-47, Mechanical Stage, attachable, graduated.

No. 31-59-47-99, Point Counting Stage.

MICRO-LITE ILLUMINATOR



This is a separate light source which provides abundant substage illumination. The 60-watt lamp is standard commercial type available wherever lamps are sold. A finely ground convex daylight filter is provided for balanced, evenly diffused light. Built-in switch and 6' of cord are included. Stable base has felt pads to protect table surface.

No. 31-33-01, Micro-Lite.

No. 31-33-01-125, Renewal Lamp, 60-w.

OPTILUME ILLUMINATOR

For the utmost in convenience these microscopes can be supplied with the new Optilume Integral Illuminator. This compact, efficient source with its bracket replaces the mirror and furnishes a strong light of uniform intensity over the full field. Its aluminized reflector and spherical condenser give three times the light delivered by older illuminators of this type. Louvers provide ventilation and assure the cool stage so necessary for Becke Line Tests. If desired, the Optilume can be easily

detached and used with a mirror as a separate light source. Plugs into any 115-volt, 60-cycle line. See listing below for mirror.

No. 31-33-94, Optilume Illuminator with ground glass filter, clear condenser and clip-on metal reflector.

No. 31-33-93, Same but with daylight filter.

No. 31-58-20, H-Bracket for attaching Optilume in place of mirror.

If, on any Dynoptic Polarizing Microscope, the Optilume Illuminator is desired in place of the mirror, deduction may be made for the mirror and fork bracket, and the cost of the Optilume Illuminator and H-Bracket added. Please see price list.

No. 31-31-15, Renewal 15-w. lamp.

No. 31-50-21, Mirror, plano-concave.

No. 31-58-19, Fork mount for mirror.

PROFESSIONAL TYPE ILLUMINATORS

The PG-26 and PR-27 Illuminators are ideal for providing Köhler type illumination. Light is quickly and easily directed to the microscope mirror. A readily accessible knob actuates a cam mechanism to tilt the illuminator through an angle of 25 degrees.

PG-26

Has a 100-w, 120-v, clear lamp with a concentrated filament. Can be supplied with an iris diaphragm, filter holder, neutral filters and heat absorbing glass. Ideal for visual and photomicrographic work.

PR-27

Has a 108-w., 6-v, ribbon filament lamp most practical for critical work. The variable focus condenser lens completely fills the field of low power objectives. The condenser is parabolic to provide correction for spherical aberration.

No. 31-33-26-11, Model PG-26 Professional Illuminator, 100-w., 120-v, concentrated filament lamp, blue and ground glass filters.

No. 31-33-26-12, Same as above but with iris diaphragm.

No. 31-33-26-13, Same as above but with 3 neutral filters, filter holder, and iris diaphragm.

No. 31-33-27-21, Model PR-27 Professional Illuminator, 108-w., 6-v, ribbon filament lamp, adjustable transformer, one daylight and 3 neutral filters, filter holder, and iris diaphragm.

No. 31-34-56, Filter holder.

No. 31-34-57, Iris diaphragm, used on 31-33-26 and 31-33-27 illuminators.

No. 31-34-58, Daylight filter, polished both sides, 3" diameter.

No. 31-34-66, Neutral filter, 0.7 density, 20% transmission, 3" diameter.

No. 31-34-67, Neutral filter, 1.0 density, 10% transmission, 3" diameter.

No. 31-34-68, Neutral filter, 1.3 density, 5% transmission, 3" diameter.

No. 31-34-76, 2x2 Filter adapter for 31-33-26 and and 31-33-27, illuminators.

NOSEPIECES

No. 31-19-01, Single Nosepiece.

No. 31-19-14, Quick change Bayonet Adapter for quick change of nosepiece or vertical illuminator on LR microscope.

No. 31-19-20, Quadruple Nosepiece, with individually centering apertures.

No. 31-19-22, Double Nosepiece, revolving.

No. 31-19-23, Triple Nosepiece, revolving.

No. 31-19-24, Quadruple Nosepiece, revolving.

No. 31-19-31, Centering Nosepiece, tube part (used with 31-19-32).

No. 31-19-32, Objective carrier, one for each objective (used with 31-19-31).

HUYGENIAN EYEPIECES

No. 31-15-21, 5X keyed, focusing eyelens, crosshairs.

No. 31-15-23, 7.5X keyed, focusing eyelens, crosshairs.

No. 31-15-25, 10X keyed, focusing eyelens, crosshairs.

No. 31-15-29, 10X keyed, with cross wires.

No. 31-15-17, 7.5X, with focusing eyelens, to take disc.

No. 31-15-18, 10X, with focusing eleyens, to take disc.

No. 31-15-31, 5X, keyed, focusing eyelens, crosshairs, for LR microscope.

No. 31-15-32, 7.5X, keyed, focusing eyelens, crosshairs for LR microscope.

No. 31-15-33, 10X, keyed, focusing eyelens, crosshairs for LR microscope.

No. 31-16-05, Micrometer Disc, 5mm, ruled to 0.1mm. Fits all 23mm ø eyepieces.

No. 31-16-11, Net Micrometer, 196 squares, 0.5mm, every second line numbered. Fits all 23mm ø eyepieces.

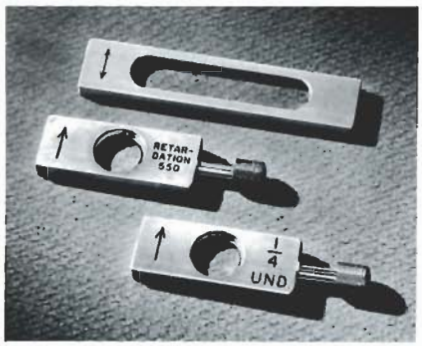
No. 31-16-50, Filar Micrometer eyepiece, 12.5X. 23mm ø.

No. 31-16-90, Stage Micrometer, glass, ruled to 0.01mm for transmitted or reflected light.

No. 31-16-99, Precision stage micrometer, 0.2mm in 0.01mm ± 0.05mμ per division.

No. 312871-160, Reducing adapter (to use 23mm ø eyepieces on 30mm ø LR microscope eyepiece tube.

RETARDATION PLATES AND QUARTZ WEDGE



These polarizing accessories which fit into the tube slot of the Dynoptic Polarizing Microscopes, are required to determine the characteristics of any optically active crystal. The quarter-wave retardation plate is generally used to determine the sign of birefringence, i.e., whether the crystal is positive or negative. The quartz wedge may also be used for this purpose. To increase the intensity of color of weakly birefringent crystals, the first order red or full wave plate is used. With the quartz wedge the amount of birefringence is estimated.

No. 31-51-54, Retardation Plate, quarter-wave, 147mμ, (mica).

No. 31-51-56, Combination Quartz Wedge, 0 through III order.

No. 31-51-60, Retardation Plate, full wave, first order red, 550mμ, (quartz).

FOCUSING TELESCOPE AND PINHOLE CAP

The focusing telescope is used for most efficient viewing of interference figures with the Series S and Series M Dynoptic Polarizing Microscopes when a Bertrand lens is not supplied. The pinhole cap can be used with the 45× objective for interference figure observation when both the Bertrand lens and focusing telescope are unavailable.

No. 31-50-78, Focusing Telescope.

No. 31-50-24, Pinhole Cap, 23mm ø.

ACCESSORIES FOR INCIDENT LIGHT

For examination of opaque ore minerals, metallurgical samples, etc., with polarized light a vertical illuminator is required. Either the full and half aperture or the full aperture model is quickly attached to any Dynoptic Polarizing Microscope.

No. 31-34-82-11, Vertical Illuminator, full and half aperture illumination, centering nosepiece with one objective holder, field and aperture diaphragms, Polaroid polarizer, compensating lens for 160mm tube length microscopes.

No. 31-34-82-12, Vertical Illuminator, same as No. 31-34-82-11, above, and with 6.5v., 2.75-amp., integral light source, adjustable transformer for 115-v., 60-cycle, A.C.

No. 31-34-82-13, Vertical Illuminator, same as No. 31-34-82-12, above, except with fixed transformer.

No. 31-34-90-22, Vertical Illuminator, full aperture illumination, centering nosepiece with one objective holder, field and aperture diaphragms, Polaroid polarizer, compensating lens for 160mm tube length microscope, 6.5-v., 2.75-amp. integral light source, adjustable transformer for 115-v., 60-cycle, A.C.

No. 31-34-90-23, Vertical Illuminator, same as No. 31-34-90-22, above, except with fixed transformer.

No. 31-34-92, Blue filter for 31-34-42, -43, -82, -90 vertical illuminator.

No. 31-34-94, Green filter for 31-34-42, -43, -82, -90 vertical illuminator.

No. 31-34-95, Polaroid polarizer for 31-34-42, -43, -82, -90 vertical illuminator.

No. 31-34-64-21, Tri-Vert illuminator and objectives for bright field, dark field, and polarized light incident illumination.

No. 31-34-96, Yellow filter for 31-34-64-21.

No. 31-34-97, Green filter for 31-34-64-21.

No. 31-34-98, Blue filter for 31-34-64-21.

No. 31-34-99, Polaroid filter for 31-34-64-21.

No. 31-34-85, Supplementary Lens to fit No. 31-34-82-11 illuminator for use with separate light source.

No. 31-34-86, Compensating lens for 31-34-82-11, -12, or -13 illuminators used with 160mm transmitted light microscope (standard equipment on these illuminators).

No. 31-34-87, Compensating lens used with 31-34-90-22, or -23 illuminators on polarizing microscopes with single centering nosepiece (supplied as standard equipment on these illuminators).

No. 31-31-79, Lamp for vertical illuminator, 6.5-v. 2.75-amp.

No. 42-33-53, Strain-free, Balcoted achromatic objective, corrected for use at 215mm tube length without cover slip, 10X, 0.25 N.A.

No. 42-33-56, Same as No. 42-33-53, above, except 40X,0.65 N.A.

For a complete listing of objectives corrected for use without cover with above vertical illuminators, see catalog 31-1053.

PHASE CONTRAST AND DARK FIELD ACCESSORIES

No. 31-58-88-01, Set of Phase Contrast Accessories, complete with long working distance phase condenser, four phase objectives (10X, 21X, 43X, 97X oil), four condenser annular stops, centering telescope, immersion oil, green Filter*, in case. For use with LR models only.

* This set is supplied with a 2-inch *round* green filter. A 2-inch *square* green filter is available at an increase in cost of $3.00 over the round filter. Order catalog number 42-47-61 green filter in place of 31-35-06 green filter. The square filter will fit the 31-34-76 2″ x 2″ filter adapter used with the PG-26 and PR-27 illuminators.

No. 31-58-50-21, Paraboloid Dark Field Immersion Condenser and funnel stop for 31-09-69-02 objective. In centering mount.

No. 31-58-60, Cardioid Dark Field Immersion Condenser, in centering mount (no funnel stop supplied).

No. 31-50-15, Funnel stop for 31-09-69-02 objective.

ACCESSORY SLOT COMPENSATOR

Provides precise measurement of birefringence. Can save time in industries concerned with the manufacture of glass containers, "wrap around" windshields, textiles, glass-to-metal bond products, and wherever phase difference (birefringence) plays an important part. Simplifies determinations in petrography

and provides quicker, easier solutions to many problems in research by rapidly measuring birefringence as well as determining optical character or sign. Readings are correct to ±2% without calibration.

No. 31-51-53, Accessory Slot Compensator; 0 to 2700 millimicrons direct reading, with easy to read scale magnifier; first through fourth order interference colors: with case.

No. 44-79-58, Interference filter, 589 millimicrons, 2″ x 2″. (Sodium "D" line).

VERTICAL, WOOD, STORAGE CABINETS

No. 31-39-96, Standard, for Model LS Dynoptic Polarizing Microscope, handle, lock and key.

No. 31-39-78, Deluxe, for Models LI and LM Dynoptic Polarizing Microscopes, fitted with accessory container for retardation plates, wedge, extra objectives and eyepieces, handle, lock and key.

No. 31-40-78, For LR Research Polarizing Microscopes.

ADDITIONAL ACCESSORIES

For the precise determination of refractive indices, B&L offers a complete line of instruments which can be used in conjunction with its polarizing microscopes.

REFRACTOMETERS

Can be used with both transparent and opaque samples, either liquid or solid.

The Abbe 3-L Refractometer offers extreme ease of manipulation and permits quick determination of dispersion in addition to its capability as a routine refractometer. It has built-in light source and a system of compensating prisms which permits precise readings (to ±0.0001) with white light. The range is 1.30 to 1.70n^D.

EYEPIECES, HUYGENIAN

for Polarizing Microscopes (All Eyepieces Keyed for Crosshair Orientation)

Catalog No.	Eyepiece Size (dia. in mm)	Magnification	Field (dia. in mm)	Crosslines	Focusing Eyelens
31-15-21	23*	5×	19.1	Yes	Yes†
31-15-23	23*	7.5×	16.3	Yes	Yes†
31-15-25	23*	10×	14.2	Yes	Yes†
31-15-29	23**	10×	14.7	Yes**	No
31-15-31	30***	5×	22.0	Yes	Yes††
31-15-32	30***	7.5×	21.8	Yes	Yes††
31-15-33	30***	10×	18.0	Yes	Yes††

NOTES:
**For LS model.
*For LI and LM models (can also be used on LS model)
***For LR models only.
†Push-pull sliding mount.
††Spiral thread focusing mount.

The Precision Refractometer provides extreme accuracy (to approximately 0.00003n^D) and has its own sodium-vapor lamp. A mercury arc lamp can also be used. Total range covered is 1.20 to 1.70n^D. A National Bureau of Standards certified test piece is available on special order for maximum accuracy.

For complete information on B&L Refractometers, request catalog 33-202.

MONOCHROMATORS

All are supplied with certified diffraction gratings and are calibrated so that wavelength can be read directly in millimicrons.

The High Intensity Grating Monochromator offers interchangeable gratings to cover a range from 200mμ to 3.2μ. Several light sources are available to cover this range. With

a xenon lamp, typical radiant flux output is 15 milliwatts at 455 mμ at 19.2mμ bandpass.

The 250mm and 500mm Monochromators are also available, offering extreme precision and wide dispersion. Wavelength drums are calibrated directly in millimicrons and are easily legible to ½mμ. Three light sources are available (mercury arc, tungsten filament, and deuterium arc) as standard components. A fourth (xenon) is available on a special order basis.

For complete information on B&L Monochromators, request catalog 33-2098.

SODIUM LAMP

A sodium-vapor lamp with lamp housing and power supply is also available. This is the same light source normally supplied with our Precision Refractometer and is quite suitable for use in refractive index determinations with petrographic microscopes when a narrow-emission high-intensity light source is desired.

334504-249ND — Sodium Lamp Assembly LM-35 and Power Supply

No. 33-33-82, Sodium Lamp, NA-1, (spare for above).

DISPERSION STAINING REFERENCES

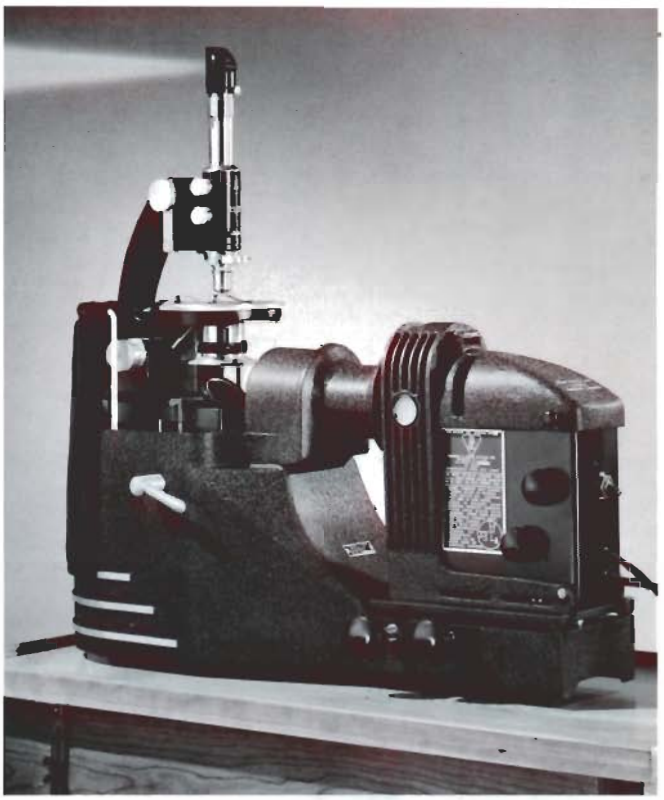
1. Chamot, E. M., and Mason, C. W., "Handbook of Chemical Microscopy," 3rd edition, 488 pp. Wiley, New York, 1958.
2. Crossmon, G. C., "Optical staining" of tissue. *J. Opt. Soc. Am. 38,* 417 (1948).
3. Crossmon, G. C., The "dispersion staining" method for the selective coloration of tissue. *Stain Technol. 24,* 61-65 (1949).
4. Crossmon, G. C., Dispersion staining with phase contrast microscope accessories. The microscope identification of quartz. *Science 110,* 237-238 (1949).
5. Brown, K. M., and McCrone, W. C., Dispersion staining. Part I. *Microscope and Crystal Front 13,* 311-322 (1963).
6. Brown, K. M., McCrone, W. C., Kuhn, R., and Forlini, L., Dispersion staining. Part II. *Microscope and Crystal Front 14,* 39-54 (1963).
7. Crossmon, G. C., and VandeMark, W. C., Microscopic observations correlating toxicity of beryllium oxide with crystal structure. *Arch. Ind. Hyg. Occup. Med. 9,* 481-487 (1954).
8. Crossmon, G. C., New developments in phase and dispersion staining microscopy for the examination of dust samples. *Am. Ind. Hyg. Assoc. J. 25,* 25-27 (1964).
9. Crossmon, G. C., Microscopic identification of toxic dusts. *Occup. Health Rev. 16,* 3-7 (1964).
10. Crossmon, G. C., Macroscopic dispersion staining. Paper presented at the 1964 Symposium on Microscopy, Chicago, Ill.

STRAIN-FREE ACHROMATIC OBJECTIVES

Corrected for use at 160mm Tube Length, and With 0.18mm Cover Slips.

Cat. No.	Mag.	E.F. (mm)	N.A.	Free Working Distance (mm)	Influence of departure from cover slip thickness of 0.16mm to 0.18mm	Used For
31-09-07	2.6×	40	0.08	43.5	None	Scanning, birefringence, refractive index
31-09-09	4×	32	0.10	38.0	None	Scanning, birefringence, refractive index
31-09-18	6×	22.7	0.17	15.5	Negligible	Scanning, birefringence, refractive index
31-09-16	10×	16	0.25	6.2	Negligible	Isotropy, anisotropy, refractive index
31-09-17	10×	16	0.25	7.7	None	Isotropy, anisotropy, refractive index
31-09-27	21×	8	0.50	1.6	Noticeable	Interference figures, signs of birefringence
31-09-31	45×	4	0.85	0.3	Pronounced	Interference figures, signs of birefringence
31-09-69-02	97×	1.8	1.25	0.13	Negligible	High magnification, high resolving power, and high numerical aperture (maximum coverage of interference figures).

Polarizing Micro-projector



With a Polarizing Micro-projector you can project onto a screen magnified images of thin sections of rocks, minerals and the like under polarized light. Instructors report an immediate response in the classroom where students can see a graphic demonstration of specimen characteristics. Properties of refractive index, orientation, extinction and interference phenomena are vividly portrayed and the lessons longer retained. The differentiation between isotropic and anisotropic minerals is readily shown; interference figures are clearly projected, both uniaxial and biaxial.

The projector is an LI-4 *Dynoptic* Polarizing (petrographic) Microscope on the Model 48 Basic Electronic Illuminator. The *Dynoptic* stand clamps to the illuminator in proper alignment optically. When not being used with the illuminator for projection the microscope can be used for visual work in the conventional manner.

A minimum of attention is required to operate the electronic-feed illuminator . . . it is almost automatic. One full hour of uninterrupted, dependably uniform illumination is assured. As the carbons burn the electronic feed system automatically keeps them at the proper setting.

Full significance of specimen detail is immediately recognized because the image appears in its true colors. A highly efficient, glass, heat-absorbing filter provides adequate protection from heat. No time is consumed in filling and re-filling a water cell and preparing coolant solutions—solutions which always impart a definite color cast to the image.

The microscope clamping device and fixed mirror are built-in, and a Balcoted reflecting prism and a light shield are standard equipment.

SPECIFICATIONS

No. 31-28-60-04, *Dynoptic* Polarizing Microscope, Model LI-4, as listed on page 6.

No. 42-63-48-01, Model 48 Basic Electronic Illuminating Stand. Balcoted reflecting prism, light shield, built-on mirror, clamps for positioning microscope, fixed focus condensing system, heat-absorbing filter, 10-amp. automatic electronic feed arc illuminator, and variable resistor ballast.

No. 42-65-97, Projection Eyepiece, 3X, Balcoted.

No. 41-42-65, Copper Coated Carbons, 5.6mm dia., 6 in. long, 50 included with illuminator.

No. 424465-161ND, Thyratron Tube for Ballast.

No. 424465-160ND, Fuse for Ballast.

No. 41-30-15, Projection Table, 44¾ in. high, tilting top, 32½ in. x 16½ in., shelf, 29 in. x 14 in., two rubber-tired wheels.

NOTE: The Model LI microscope will provide adequate micro-projection when used orthoscopically with the above illuminating stand. For projection of interference figures the Model LR is recommended because of its better condenser and focusing Bertrand lens. An adapter is in preparation to use the standard right angle prism and mount on the extra large LR eyepieces.

INTERFERENCE FILTERS

An inexpensive way of obtaining narrow-band monochromatic light for use in polarized light microscopy is available by using B&L Interference Filters in conjunction with a tungsten illuminator (such as the PR-27 or PG-26). These filters provide second-order interference filtering with peak transmittances of about 35% at half widths varying between 8 and 20mμ, depending on wavelength transmitted. Nominal wavelength tolerances are +5mμ, −2mμ. Size: 2" x 2" x 3/16". Each engraved with nominal wavelength value. Available in 10mμ steps between 380 and 800mμ.

Catalog No.	*Interference Filter, 2" x 2"*	*Catalog No.*	*Interference Filter, 2" x 2"*
44-78-38	380mμ	44-78-60	600mμ
44-78-39	390mμ	44-78-61	610mμ
44-78-40	400mμ	44-78-62	620mμ
44-78-41	410mμ	44-78-63	630mμ
44-78-42	420mμ	44-78-64	640mμ
44-78-43	430mμ	44-78-65	650mμ
44-78-44	440mμ	44-78-66	660mμ
44-78-45	450mμ	44-78-67	670mμ
44-78-46	460mμ	44-78-68	680mμ
44-78-47	470mμ	44-78-69	690mμ
44-78-48	480mμ	44-78-70	700mμ
44-78-49	490mμ	44-78-71	710mμ
44-78-50	500mμ	44-78-72	720mμ
44-78-51	510mμ	44-78-73	730mμ
44-78-52	520mμ	44-78-74	740mμ
44-78-53	530mμ	44-78-75	750mμ
44-78-54	540mμ	44-78-76	760mμ
44-78-55	550mμ	44-78-77	770mμ
44-78-56	560mμ	44-78-78	780mμ
44-78-57	570mμ	44-78-79	790mμ
44-78-58	580mμ	44-78-80	800mμ
44-78-59	590mμ		

44-79-58, 589 mμ (Sodium "D" line).

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