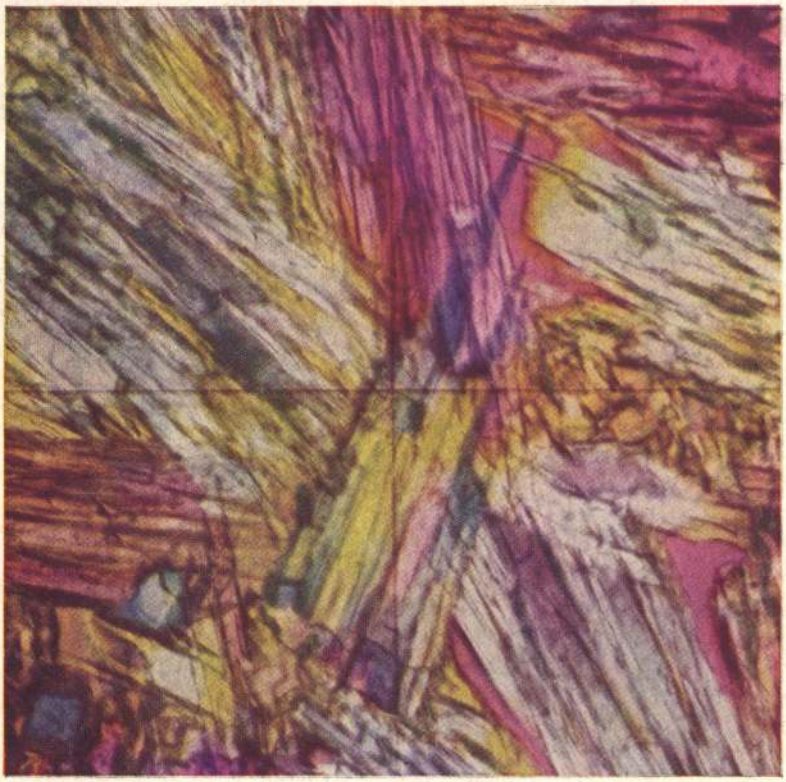

BAUSCH & LOMB
PHOTOMICROGRAPHIC
EQUIPMENT AND ACCESSORIES

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Photomicrographic Equipment & Accessories

BAUSCH & LOMB OPTICAL CO.

ROCHESTER, NEW YORK

New York, Boston, Chicago, San Francisco,
Frankfurt a/M, London

Photomicrography in Practice

BECAUSE photomicrographs made of specimens of material serve as indisputable, permanent records for any future reference, a photomicrographic camera can be used to advantage wherever a microscope is required. Prints or negatives furnish an easily accessible record, while lantern slides made from these negatives offer a convenient method of projecting the pictures, enlarged many times, upon the screen for educational purposes.

Realizing the importance of complete knowledge of raw and finished products, modern industry was quick to take advantage of scientific tests and inspections. In the textile, paper and metal industries, particularly, much dependence is placed upon what the microscope reveals. Accustomed as they are to system and efficiency, the industries were quick to take advantage of the photomicrographic records which the photomicrographic camera makes possible.

Photomicrographic apparatus is divided into two groups:

1. That for use with transmitted light as is required for examining biological and pathological materials, textiles, paper, pulp, etc.; and

2. That for use with reflected light as is necessary in the examination of opaque materials, such as iron, brass and other similar material.

This publication deals with the first group.

Much of this sort of equipment offered in the past has been rather cumbersome and complicated as well as difficult to operate. The Bausch & Lomb Scientific and Technical Bureau, therefore, has devoted considerable time and thought to obtaining the greatest possible simplification in all of the instruments described herein.

Illumination is one of the greatest problems in photomicrography. Therefore, a great deal of attention has been devoted to this feature, and an illuminant with a greatly simplified support and housing and much higher efficiency has been developed. This illuminant has all of the adjustments necessary for accurate centering and focusing of the light.

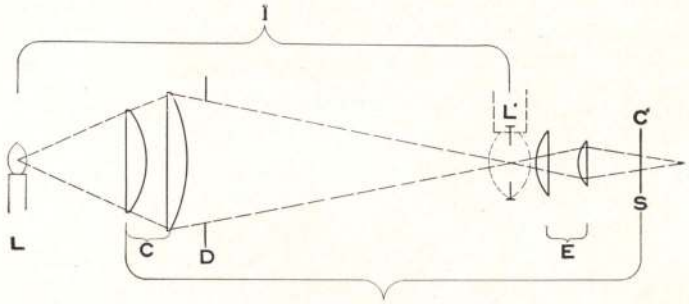
The lamp used is a 6-volt 108 watt Mazda having as a filament a Tungsten ribbon which provides a homogeneous light source, of plane surface and even intensity. This will be found highly satisfactory as an illuminant for drawing, for projection at relatively short distances and for photomicrographic work in all powers, including the oil immersion objective. The Mazda lamp is recommended for use on alternating current when available, as it can be used in conjunction with a transformer and connection made to the regular lighting socket. If used on direct current, provision must be made for wiring and connecting socket of 18 ampere capacity and the lamp used in connection with a resistance.

If direct current is available, the clock feed arc lamp is a very satisfactory source of light and in many instances where dense specimens are to be photographed or where it is desired to project at longer distance, it will be required because of the high

intensity of its illumination. A very complete illuminating system is offered with type R and GBP camera equipment. Either the ribbon filament Mazda lamp or the arc lamp can be used, as the housings for these lamps are interchangeably adaptable to the holder.

The condenser, consisting of two plano convex lenses, is of very short focal length and therefore intercepts a cone of light of wide angle; it is well corrected for spherical aberration, producing a well defined image of the light source in the plane of the substage condenser diaphragm. The image is of sufficient size to fill approximately the full aperture of the substage condenser. With this arrangement the specifications of the ideal illuminating system for micro projection and photomicrography, as developed by Kohler, are fully complied with. (See illustration.)

Ample provision is made for centering and aligning any standard make or model of research microscope with the camera parts. Hence, any microscope with a substage condenser can be used for photomicrographic work. It is desirable, however, if doing considerable photomicrographic work, to set aside or obtain a microscope especially for that purpose, since one of the most important things is the accurate alignment of the microscope with the camera and the illuminating system.



I, Aperture Illumination; II, Field Illumination;
L, Light Source; C, Condensing Lenses; D, Field Diaphragm; E, Substage Condenser of Microscope; S, Object Slide;
L, Image of Light Source Produced by C in plane of Aperture Diaphragm;
C, Image of C in Plane of Specimen

Apochromatic objectives and compensating eyepieces are, of eourse, to be preferred, particularly if photographing stained objects, as these objectives are corrected chromatically for three colors and spherically for two. Very good results can be achieved, however, with the fluorite or regular achromatic objectives, used in conjunction with the Hyperplane or compensating eyepieces, by using approximately monochromatic light. This light is obtained by means of one or more filters, passing approximately that portion of the spectrum for which they are corrected.

The selection of the proper objectives, depending on the nature and

construction of the specimen to be photographed and the magnification required, should receive very careful consideration. By referring to the magnification table (page 22) one can readily determine the magnification that can be secured with different combinations of objectives, eyepieces and bellows draw, but the objectives should be selected on the basis of the numerical aperture necessary to show the finest details of the specimen, considering also whether depth of focus is preferred to maximum resolution.

The resolving power of an objective is the property by which it shows distinctly separated two small particles in the structure of an object which are only a short distance apart, and the measurement for the resolving power is the numerical aperture (N. A.). The higher the numerical aperture rating the higher is the resolving power, and as the shorter focus objectives have greater magnifying power and higher numerical aperture, they are usually to be selected when both high magnifications and maximum resolving power are required. For practical purposes we may use the rule that the numerical aperture multiplied by 100,000 will give the number of lines per inch which can be theoretically resolved by a given objective.

Depth of definition, sometimes called depth of focus, is an important factor when penetration is concerned. It depends on the N. A. and the magnification and is inversely proportional to both. The higher the N. A. and the magnification, the less the depth of definition or penetrating power. Any arrangement designed to increase the depth of definition sacrifices resolving power in proportion. When inserting diaphragms in the objectives or reducing the diameter of the illuminating pencil of light entering the condenser to less than that required to fill the back lens of the objective, depth of definition is enhanced.

Flatness of field is another factor that often puzzles the beginner in photomicrography. The diameter of the area of flatness or that portion of the image which is sharply in focus varies directly according to the focus and inversely according to the N.A. of the objective and the magnification at which one is working.

Consequently, if flatness of field is of prime importance, one should select an objective with the lowest N.A. that will resolve the details of the structure of the object, and secure the magnification desired by increasing the power of the eyepiece or lengthening the bellows draw. We recommend the use of medium power eyepieces (7.5 or 10) combined with an increased bellows draw. The magnification, however, should never exceed 1000 times the numerical aperture of the objective used.

Focusing—Because of the sensitiveness and the limited depth of focus of short focus objectives, extreme care must be taken to see that the important part of the object is as sharply focused as possible. We recommend the use of a focusing glass (page 23). The ground glass focusing screens on all of the cameras are provided with a clear center, so that one may sharply focus the image without any possible doubt, due to the diffusing effect of the ground glass. This is desirable in determining the general focus of the image and evenness of illumination.

The observation eyepiece described on page 17 will facilitate focusing.

Alignment—One of the most important things in successful photomicrography is the absolute alignment of all parts of the illuminating and optical systems. The light source must be accurately centered with the condenser lens, both vertically and laterally; the beam of light entering the substage condenser must be parallel to its axis in both planes; and the substage condenser must be centered with the objective. Ample provisions are made on our illuminating units for centering with the microscope, while our special photomicrographic microscope and the GGDE are provided with a centering mount for the condenser for high power objectives. This condenser should be of aplanatic correction.

Vibration—Vibration is fatal to good photomicrography. All units or parts going to make up the equipment should preferably be permanently fastened to a common base, or extreme care taken to see that they are not jarred out of alignment. If there is considerable vibration in the building, it will be necessary to provide some means for absorbing this vibration. The most satisfactory method of accomplishing this is by the use of our shock absorbers. These consist of a small standard for each foot of the equipment, each provided with a single coil spring, a sponge rubber damper and an adjusting screw for regulating the tension on the rubber cushion.

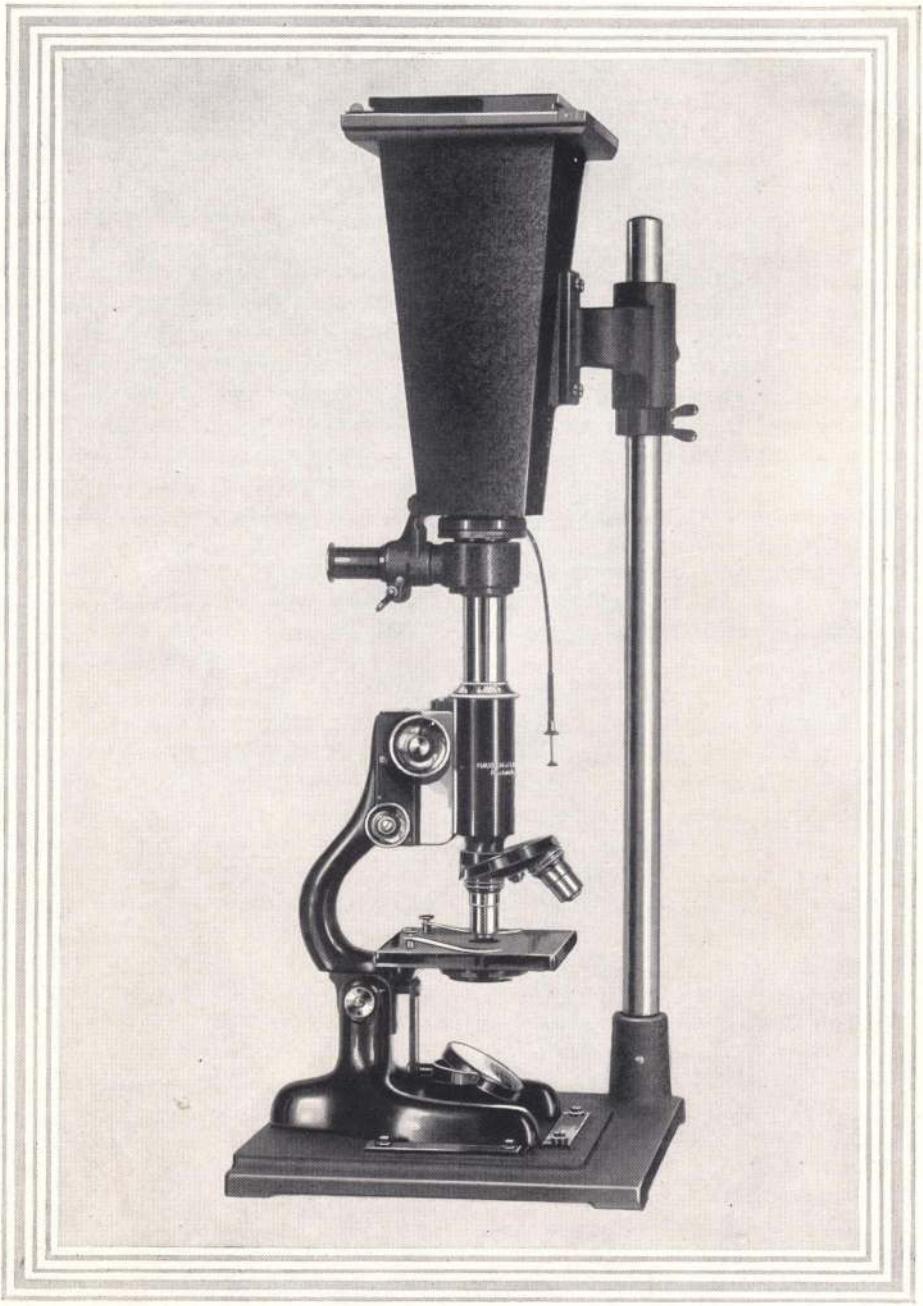
Exposure—The exposure is a matter that will have to be determined by each worker, since it is dependent upon a number of factors, such as kind of illumination, magnification, N.A. of objective, density of object (stained or unstained), kind of stain, kind of plate and filter used. If one is to do considerable work, it would be desirable to establish definite factors; for instance, starting with an unstained preparation of medium density, a given intensity of light source and a certain range of magnifications, and then multiplying these by the increase necessary for variation in stains, filter, magnification, etc.

An exposure shutter, which can be set for fractions of a second or for a time exposure, is included with the larger equipments, and can be secured, at an additional charge, with the smaller ones. Exposure can be made, however, without a shutter. While the dark slide is being removed from the plate holder, a cardboard may be placed between the light and the microscope.

In general, any standard Orthochromatic, Isochromatic or Panchromatic plate of medium speed and fine grain emulsion will be found satisfactory for this work.

In order to produce negatives showing proper contrast with stained material, filters complementary to the stain will have to be used. Practically all plate manufacturers make a wide variety of such filters, which are suitable for use with their plates.

NOTE: For methods of standardizing exposure for various plates, filters and specimens of different densities, see articles by Prof. Alexander Petrunkevitch, of Yale University, in The Anatomical Record, Vol. 19, No. 5, October 1920; The American Naturalist, Vol. LV, March and April, 1921; and The American Naturalist, Vol. LV, September and October, 1921.



Type K Camera

Type K Camera

(*Vertical*)

THIS equipment has been developed, having in mind the need of the routine microscopist who frequently wishes to make a photographic record of observations.

The Type K Camera may be used in conjunction with any standard microscope and light source.

A noteworthy feature of the camera is the observation eyepiece, which permits the specimen to be examined and photographed without change of position of the operation.

The camera has a projection distance of 25 cm (10 in.), the distance of most distinct vision for details for adults, and gives magnification values found in the table of magnifications for the microscope.

The base is of cast iron, about 9 x 10″ in extent. It is supplied with three cleats to hold the microscope firmly in position.

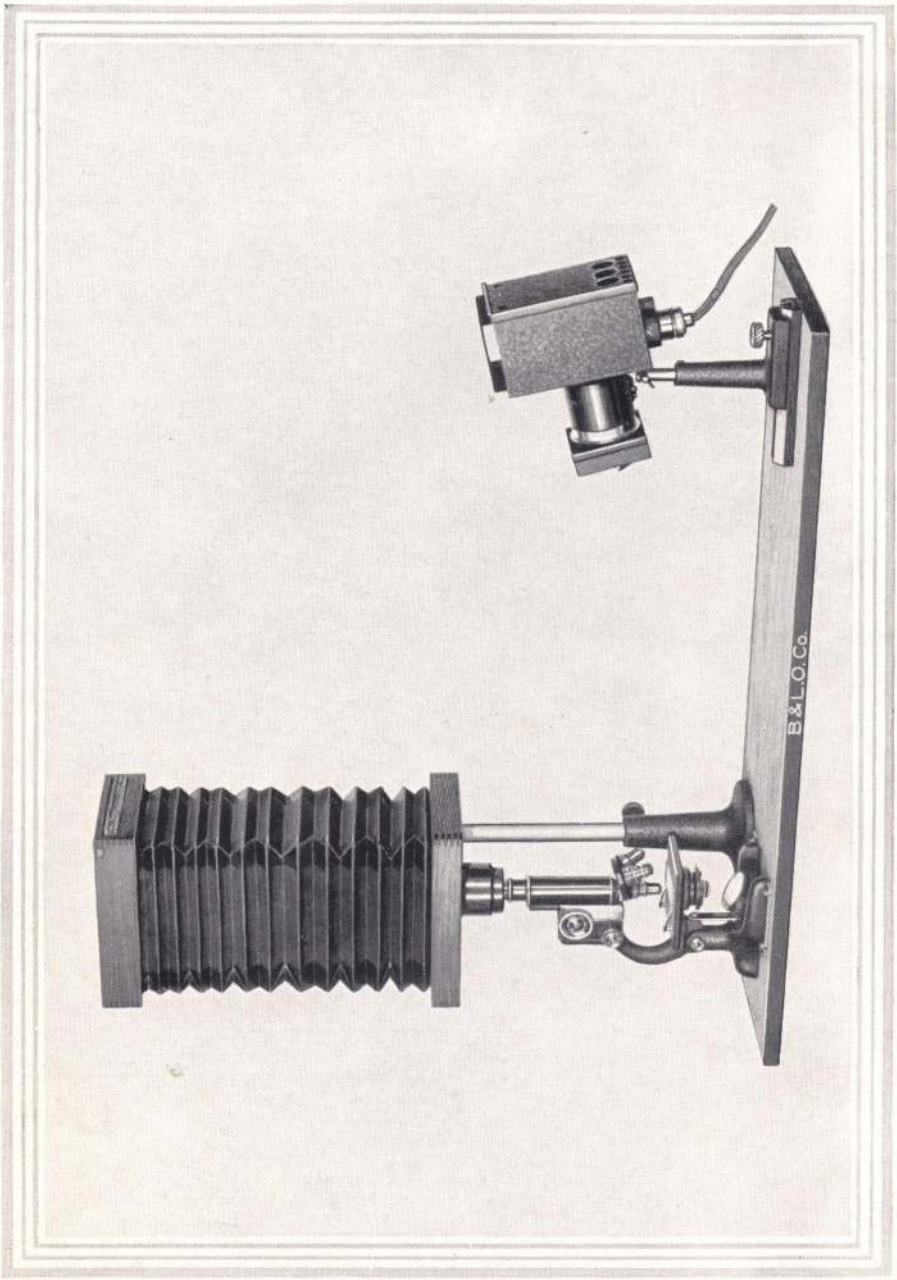
The standard consists of a steel rod ⅞″ in diameter, carefully turned and chromium plated throughout its length, to permit the easy adjustment of the camera support and stop. The stop is a clamping collar, which bears the weight of the camera and is adjustable along the standard and set in position by a clamping screw. The camera can be swung aside for adjustment or for regular eyepiece observation.

The camera support is adjustable along the standard and may be locked into position by means of a knurled screw. The camera support consists of a heavy cast iron sleeve about 3″ long which is carefully fitted to the standard to prevent chatter or vibration in making adjustments and an arm, cast intregal with the sleeve.

The camera, 10″ in length, consists of a tapered metal box. The camera back is of standard form and takes a 3¼ x 4¼″ double plate holder, a cut film holder, film pack adapter or roll film holder. Ground glass has clear center.

Mounted at the lower aperture of the camera is a shutter of standard design with time, bulb and instantaneous exposure stops, iris diaphragm and automatic release.

Code Word	Cat. No.	Specifications	Price
Cases	K	*K Camera*, as described above, with double plate holder, light tight connector, shutter, observation eyepiece	$105.00
Casit	4539	*Cut Film Holder* M. C. P. net	2.75
Casov	4538	*Film Pack Adapter* M. C. P net	5.50
Casuw	4537	*Roll Film Holder* M. C. P. net	12.50
Catas	4597R	*Microscope Lamp* with adjustable support, spherical condenser in rack and pinion focusing mount, 6-volt, 108-watt ribbon filament Mazda lamp and transformer for 110 volt, 60 cycle current (see page 73)	39.50
Catet	4563A	*Ray Filter and Corning Daylite Glass Holder*	2.50
Cativ	1771	*Mechanical Feed Arc Lamp* (without rheostat) with base, inclination joint and condenser	55.00
Catow	4452	*Fixed Form Rheostat* for 110 volts, 4.5 amp	11.50
		Wratten Filters, each M. C. P. net	1.35



Type J Camera

Type J Camera

(*Vertical*)

THE Type J Camera is a simple, upright or vertical camera having a bellows with various extensions up to 24″ and takes 5 x 7″ plates. The instrument is mounted on a 36 x 12″ base board and the illuminant is fitted to an optical bed mounted at one end to facilitate and assure permanency of alignment.

This camera can be used with any standard microscope.

The bar supporting the camera parts consists of a highly polished chromium plated steel rod, 25″ long x 1″ in diameter. The camera parts are attached to the bar by means of two accurately machined supports, closely fitted to move freely on the bar. A hand clamp on each of these supports holds the camera in place.

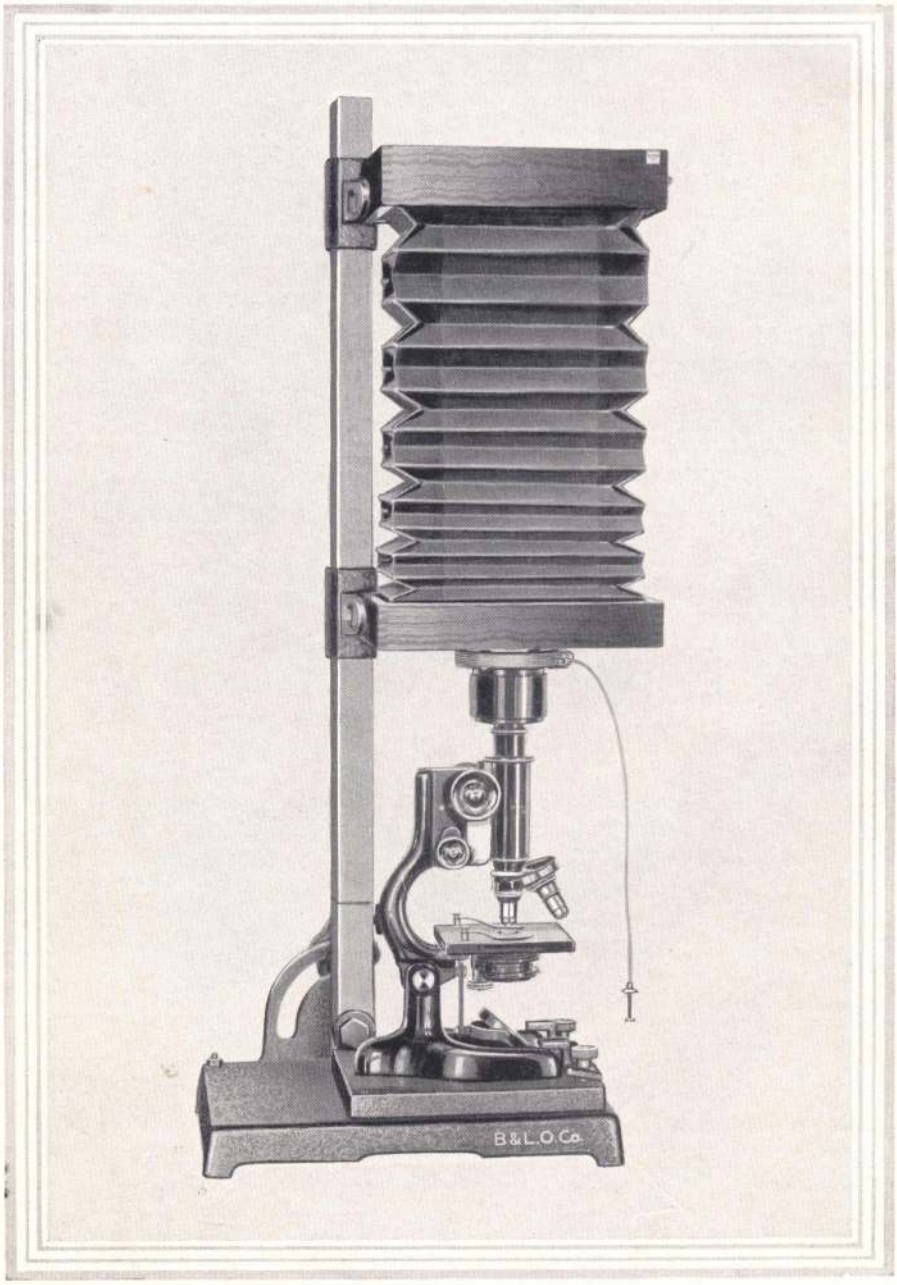
The rod is mounted in a base which permits the camera to be swung aside for direct observation through the microscope, also for gross photography. The front board of the camera is fitted with a light tight collar for connection with the microscope. A double plate holder for 5 x 7″ plates and with kits for smaller sizes and a ground glass focusing screen with clear center are supplied. Shutter No. 4570 can be supplied if desired.

The illuminating unit is a simplified form, having a ribbon filament Mazda lamp as the light source. It has a spherical condenser 60 mm in diameter with rack and pinion focusing mount and 6 volt, 108-watt, ribbon filament Mazda lamp with transformer for 110 volt, alternating current.

For those desiring the simplest type of camera we are offering this camera with vertical support and pedestal base as a separate unit which the user may mount on a laboratory table or base board such as he might require for his own particular uses. This camera may be used in conjunction with a separate illuminating unit such as our 4597R. (p. 7).

Code Word	Cat. No.	Specifications	Price
Caacp	JR-7	*Photomicrographic Camera*, as described, including illuminating unit with spherical condenser 60 mm in diameter in rack and pinion focusing mount and 6-volt, 108-watt, ribbon filament Mazda lamp with transformer for 110-volt, alternating current	$160.00
Calim	J	Camera same as above but without base board and illuminating unit	100.00
Caajw	4570	*Compound Shutter*	25.00

NOTE: An aspheric in place of the spherical condenser can be supplied for $7.50 extra.



Type H Camera

Type H Camera

(*Vertical and Horizontal*)

BECAUSE of its adaptability to different styles and makes of microscopes, the possibility of using a microscope in either a vertical or horizontal position and its sturdy construction, the Type H Camera has been recognized as standard among workers who need a camera for general photomicrographic work.

This camera is attached to the base by an inclination joint which permits the camera to be used in either a vertical or horizontal position. When the camera is used in a vertical position, it can be swung aside to permit direct observation through the microscope eyepiece or for gross photography.

It is used for taking stereo photomicrographs with the textile specimen mount or with the Binocular Microscope.

The camera consists of a front and rear wooden frame and a bellows connecting the frame and having an extreme extension of 24″ which can be fully utilized with the microscope in a horizontal position and approximately 20″ used in a vertical position.

The rear frame is supplied with a hinged door with spring to facilitate placing a plate in position without jarring the camera. A double plate holder, taking 5 x 7″ plates, with reducing kits for smaller sized plates, and a ground glass focusing screen with a clear center are included with each equipment.

The front frame of the camera is fitted with a light tight sleeve for connecting with the microscope. The front frame, as well as the rear frame, is movable, thereby enabling the camera to be centered with any standard microscope.

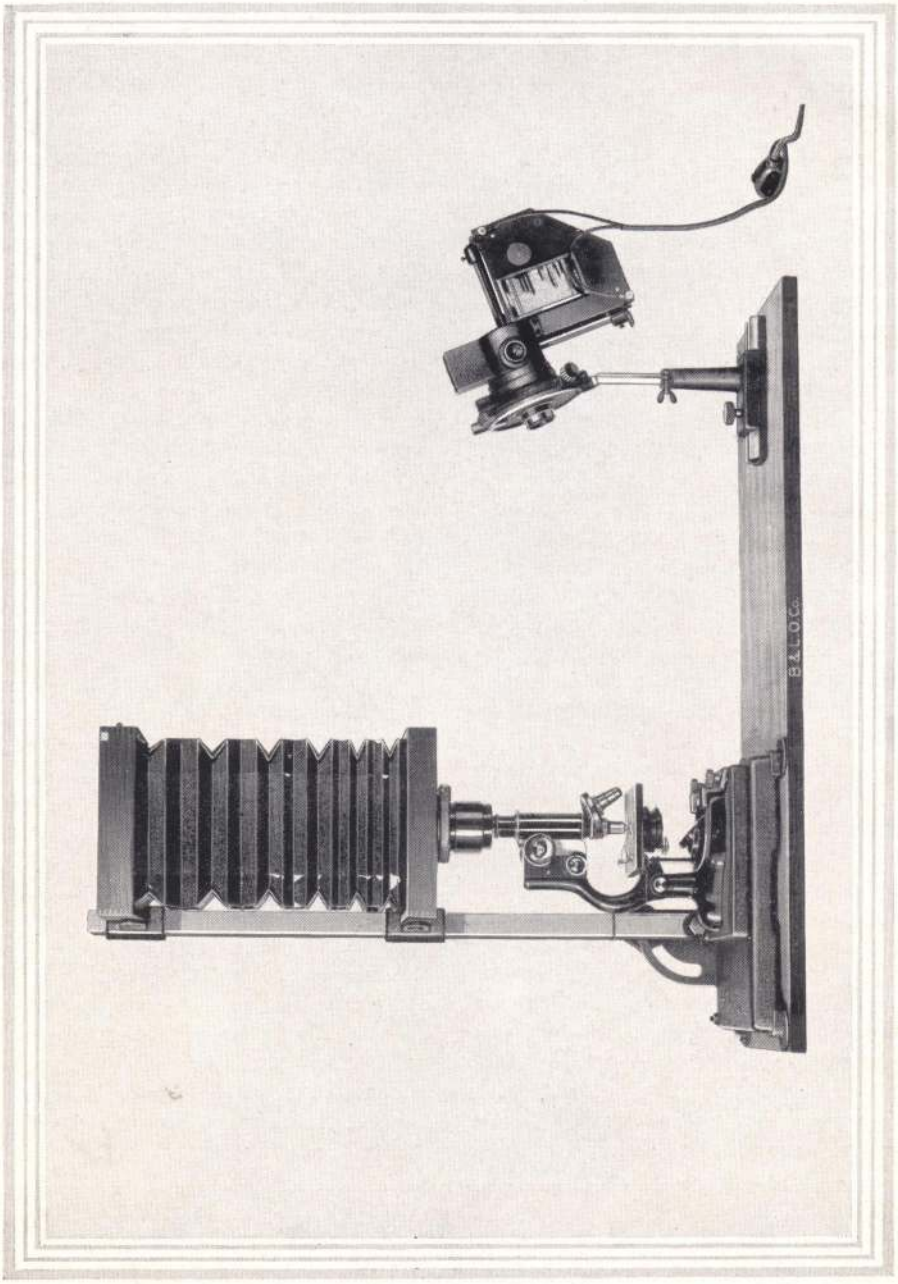
The base consists of 10 × 13″ heavy cast iron plate upon which is attached the microscope platform with clamp for holding the microscope so that it can be aligned with the camera and firmly locked into place.

The compound shutter (see page 13) can be supplied to facilitate exposure, if desired.

The H Camera will also be found very satisfactory for gross photography at low magnification using a Micro Tessar lens. A rack and pinion focusing mount, either with or without compound shutter, may be used in connection with the Micro Tessar lenses for convenience in manipulation.

Satisfactory results can be obtained with our camera such as the H type having a separate illuminating unit. Accuracy and permanency, however, of the alignment of the component unit of any photomicrographic equipment is an important factor, especially where quantity of routine work is being handled.

Code Word	Cat. No.	Specifications	Price
Caard	42-14-14-07	*Photomicrographic Camera*, as described, with camera parts for 5 × 7″ plates and smaller sizes	$140.00
Caajw	42-16-32	*Compound Shutter* (see page 62)	25.00
Caopg	42-44-97-66	*Illuminating Unit* (see page 49)	39.50



Type R Camera

Type R Camera

(*Vertical and Horizontal*)

IN some instances it is very desirable to have a camera and illuminating unit mounted on a common base so that all of the parts of the equipment may be properly and permanently aligned.

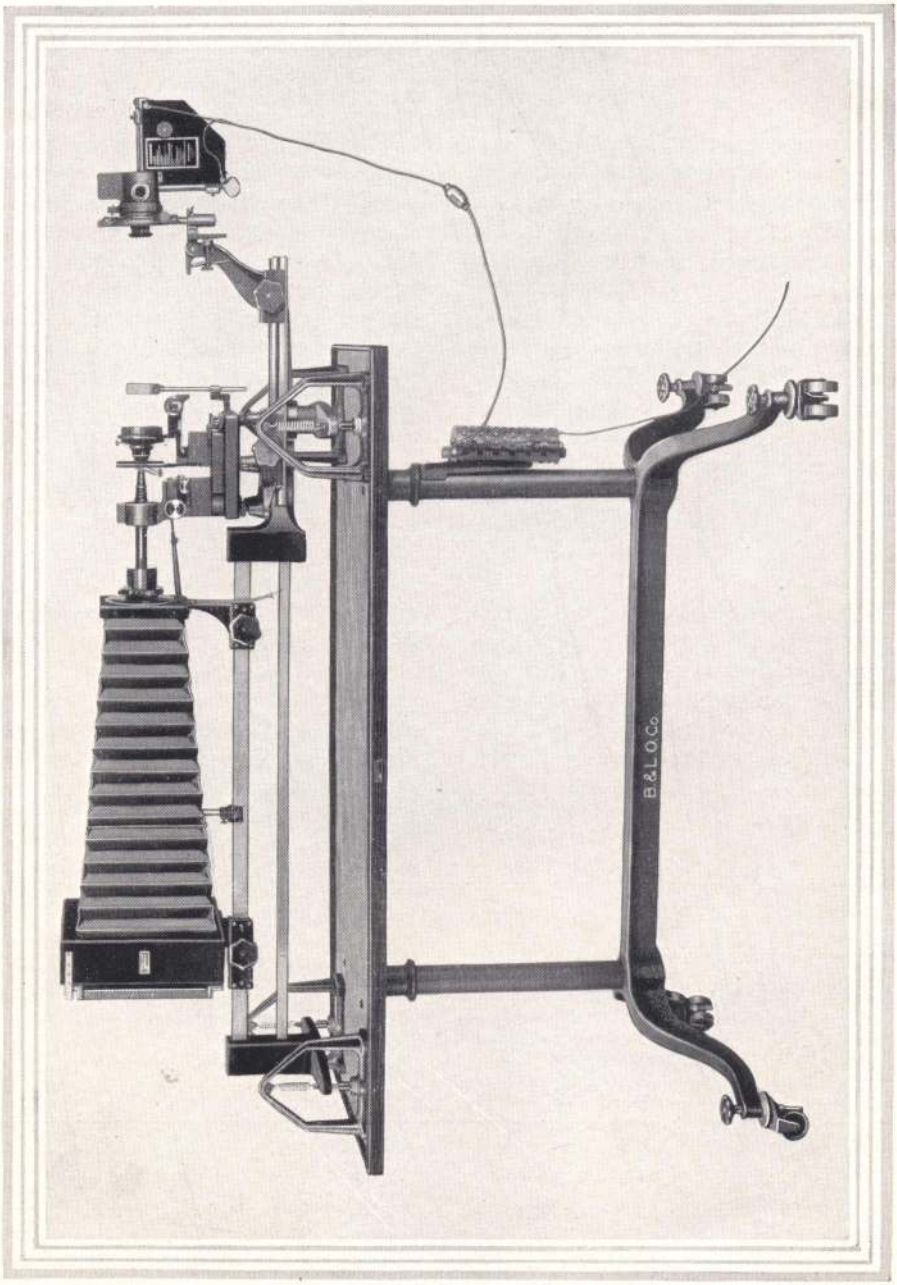
With the parts thus mounted as an integral unit, certain advantages are obtained. Much time is saved, as the instrument is always ready for use without realigning. Adjustments are more easily made, as the parts are always in the proper relative position. Better results are assured, as there is less chance of making an error in the set-up.

The R Camera is of this type. It is a complete photomicrographic equipment consisting of the type H camera described on page 11 attached to one end of the base board by four brackets and the complete illuminating unit fitted to the optical bed mounted at the other end.

The illuminating unit consists of a double lens condenser, diaphragm and support for lamp attachment, having an adjustment for quickly centering the light source with the condenser. It is mounted on a section of optical bed so that the height and tilt of the lamp can be readily adjusted to meet the requirements of the work being done. The illuminant may be either a 6-volt ribbon filament Mazda lamp or the electric arc lamp with clock feed mechanism. The clock feed mechanism operates the carbon holder by means of an endless chain drive and maintains an exceedingly steady and uniform arc—an essential feature where the best photomicrographic results are to be obtained.

Six-inch carbons are used, and the carbon holders travel at sufficient distance to consume the entire length of the carbon with only one setting, giving nearly two hours of steady light.

Code Word	Cat. No.	Specifications	Price
Caavh	RR-7	*Photomicrographic Camera*, consisting of Type H camera, base board, 36 × 12″, illuminating unit with double lens condenser and 6-volt, 108-watt, ribbon filament Mazda lamp with transformer for use on 110-volt alternating current, focusing glass	$255.00
Caaxk	RAA-7	*Photomicrographic Camera*, same as above but with automatic arc and resistance for 110-volt current	275.00
Caajw	4570	*Compound Shutter* (see page 23)	25.00



Type GBP Photomicrographic Equipment

GBP Photomicrographic Camera

STABILITY, one of the most important factors in photomicrography, especially when working with high magnification, is assured with the Bausch & Lomb GBP Photomicrographic Camera. This equipment is designed to eliminate all vibration so that a well defined negative can be obtained. Because of the excellent results which this equipment gives, it is used in laboratories of the leading educational institutions, hospitals, and industrial plants throughout the country.

The many new features which have resulted in the favorable reception of this instrument are described in the following paragraphs.

The camera consists of a tapering 40-inch extension bellow with a center support which prevents the bellows from sagging when collapsed. One new feature of the camera, the metal back, is an innovation in camera design. This back, with a reversible support for the plate holder, adds to the durability of the camera.

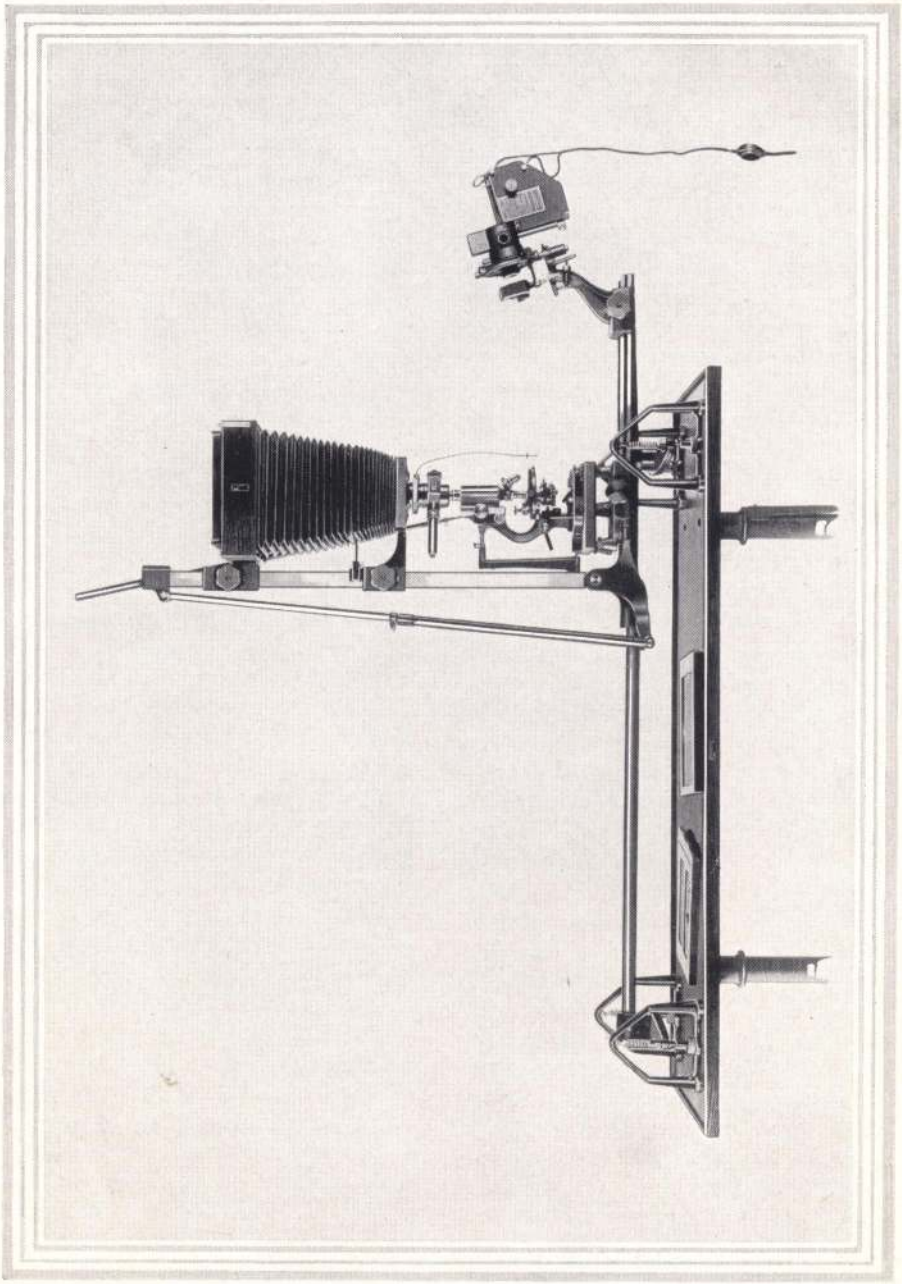
The camera itself is supported by a precisely milled rectangular graduated bar—rectangular so that the camera remains in the upright position even when the clamps are not tightened. The camera supports have two extra long bearing surfaces which ride the bar, and can be moved back and forth easily and without chatter. Included with the camera is an 8 x 10 inch plate holder with reducing kit for smaller standard sizes, one ground glass focusing screen with clear center, one clear glass focusing screen with graduated cross line, exposure shutter, light-tight connector for connecting with the microscope and one focusing glass.

The illuminating unit is made up of a heavy cast iron support, lamp and condenser and water cell with combination cover and Wratten filter holder. The condenser consists of two plano convex lenses of short focal length, well corrected for spherical aberration. The image is well defined and of sufficient size to fill the entire aperture of the substage condenser. The condenser is equipped with a rack and pinion focusing mount and an iris diaphragm on the front of the condenser mount.

An adjusting mechanism permits the adjustment of the light beam in three planes. Two means of aligning the illuminating unit are provided as follows: On the side of the cast iron support is an indicator. When the illuminating unit is tilted until this indicator points to a hair line on the support, the unit is horizontal and parallel to the axis of the camera. When the unit is lowered so that it comes in contact with a correction collar on the support, its axis is in coincidence with the axis of the camera.

The illuminating unit is mounted on the same bed which carries the microscope plate. Thus, the illuminating unit and microscope plate are an integral part, and permanency of the alignment between the two units is assured. Both of these parts move backward and forward on the bed and can be clamped into any position desired on the bed.

The microscope plate, adjustable



Type GBVP Photomicrographic Equipment

for height and provided with screws for leveling, includes a clamp and guide plates for holding the microscope in position, and an extension focusing device for focusing the microscope from the back of the camera.

The GBP is made in two types, the GBP which is fixed for working in a horizontal position, and the GBVP having an inclination joint which permits the camera to be used in the vertical as well as horizontal position.

With the GBP Model we recommend our special Photomicrographic Microscope, No. 4148, (see page 19) which is adaptable to a wide assortment of eyepiece and objective combinations, and is designed to hold any of our regular substage equipment.

For use with the GBVP we recommend one of our larger microscopes, such as the GGDE, an instrument especially designed for this work, having a body tube 39 mm in diameter for the purpose of eliminating all possible stray light and internal reflection.

While this equipment has been developed primarily for Photomicrographic Cameras, it is readily adaptable for general laboratory use, such as copying and enlarging as well as for macro-photography.

For work of this kind, either our anastigmatic photographic lens or Micro Tessar lens should be used. For macro-photography the instrument should be used in either the vertical or horizontal position. (See page 18 for accessories for macro-photography.) Complete information and recommendations as to the proper lens to use, as well as the arrangement for holding the material to be photographed, will gladly be furnished upon receipt of information concerning the size and nature of the material and the magnification required.

The Observation Eyepiece

A No. 4617 observation eyepiece (illustrated on page 19) is obtainable as an accessory. Attached to the frontboard of the camera, or, if a shutter is used, to the front of the shutter, this observation eyepiece has several distinctive features. It is supported entirely independent of the microscope, so that its weight is not carried by the fine adjustment of the microscope.

With this observation eyepiece the specimen may be observed while the exposure is being made.

This feature is particularly advantageous when photographing living specimens which may pass in and out of the field of view.

The eyepiece covers the entire field that will be seen on the ground glass, whereas the telescope of the camera focusing back covers only a small portion of the entire field and must be swung on its fulcrum to view the limited portion of the image that can be seen with it.

This device can also be used to determine the focus in the plane of the ground glass so that after a setting has been made to suit a particular bellows draw, one need not observe or refer to the ground glass.

The eyepiece can be readily attached to any of our cameras without the necessity of a special fitting. In or-

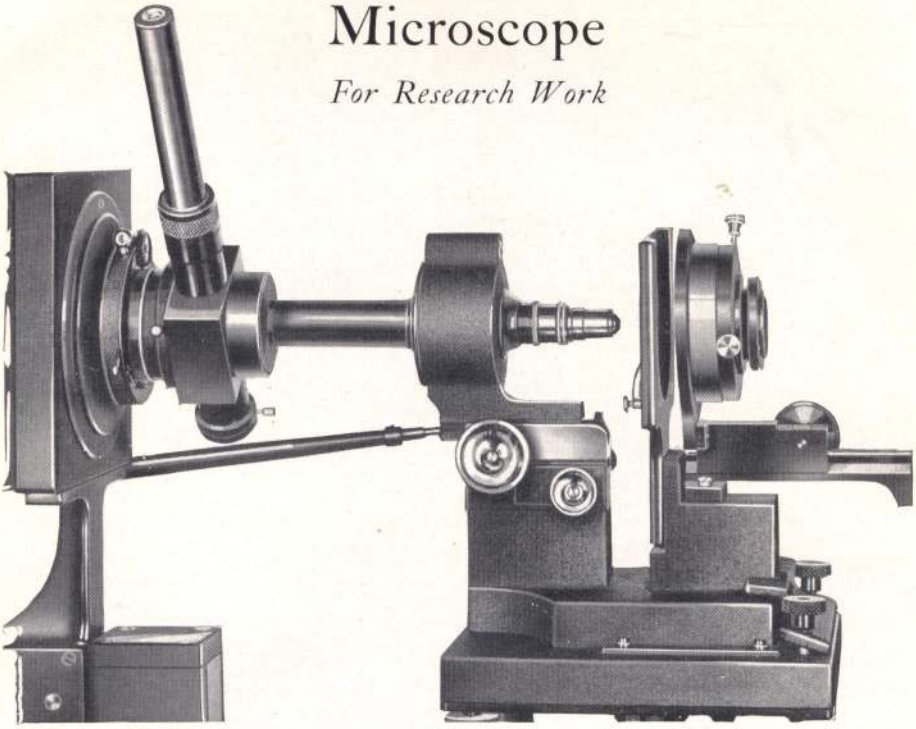
dering, however, specify whether it is to be attached directly to the front board of the camera or to the front of the shutter.

Code Word	Cat. No.	Specifications	Price
Caorh	GBPAA	*Photomicrographic Outfit*, as described and illustrated, with optical bed, camera parts, microscope plate and illuminating unit with mechanical feed arc lamp and rheostat for use on 110-volt current	$560.00
Detum	4453	*Rheostat* for 220 volts, 4½ amperes	*extra* 2.00
Caosj	GBVPAA	*Photomicrographic Outfit.* Same as above but with adjustable camera support so that microscope may be used in either vertical or horizontal position	640.00
Caotk	GBPR	*Photomicrographic Outfit.* Same as GBPAA, but with 6-volt, 108-watt, ribbon filament Mazda lamp and transformer for 110-volt, 60 cycle alternating current in place of arc lamp	540.00
Caovl	GBVPR	Same as GBVPAA, but with 6-volt, 108-watt, ribbon filament Mazda lamp and transformer for 110-volt, 60 cycle alternating current, in place of arc lamp	620.00
Dicuh	4497-A	*Transformer* for 220-volt, 60 cycle alternating current	*extra* 3.50
Cairg	4665	*Supporting Stand* with heavy cast-iron base, leveling screws, casters and wooden table top	120.00
Cajik	4661	*Set of Shock Absorbers*, consisting of four units, each having single coil spring, sponge rubber cushion and screw take-up to adjust pressure on cushion	40.00
Calon	4617	*Observation Eyepiece.* (See description p. 19)	50.00
		MACRO ACCESSORIES	
Caihx	4650	*Cone Adapter*, fitting on front of camera with right angle prism and adapter to take 72 mm Micro Tessar	30.00
Caimc	4655	*Reducing Adapter* for attaching 32 or 48 mm Micro Tessar	3.00
Canen	4616	*Specimen Support* with rack and pinion for focusing	30.00
Canip	4571	*Illuminating Unit*, consisting of triple condensing system 4½" diameter, in mounting with clamping base and supporting column having adjustment for height and inclination. Without illuminant	40.00

NOTE: For lenses and other low power accessories see page 21.
For plate holders see page 24.

No. 4148 Photomicrographic Microscope

For Research Work



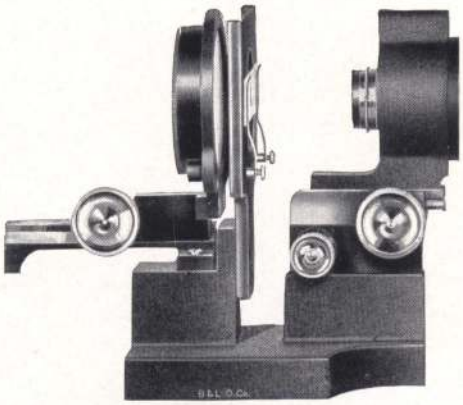
No. 4148 Photomicrographic Microscope and No. 4617 Observation Eyepiece

EVERYONE engaging extensively in photomicrographic work recognizes the necessity of a microscope having extreme rigidity and a wide range of flexibility in regard to the objectives that can be used with it. To meet such a need we have designed this Photomicrographic Microscope, which has the body tube, stage and carrier for substage condenser separately supported by the heavy cast-iron base.

The body tube is 2½ inches in diameter and $1\frac{9}{16}$ inches long, specially designed to make possible the utilization of the full available field of the Micro Tessars; it is supplied with an eyepiece adapter by means of which an eyepiece can be used with the regular high power objectives.

The stage is 4½ x 3¾ inches, with a removable section giving an opening of 3⅜ inches, to be used with the 72 mm Micro Tessar when an exceptionally large field is to be covered. The side attaching Mechanical Stage, No. 2116, can be used with this stage.

The substage consists of a large, heavy condenser ring taking a condenser 3 inches in diameter. This condenser is used in conjunction with the MicroTessar lenses and can be interchanged with a mounting, with centering screws, carrying the aplanatic



No. 4148 Photomicrographic Microscope with Eyepiece Adapter Removed and Micro Tessar in Place for Low Power Photography and Projection.

condenser, which has a graduated iris diaphragm showing the diaphragm opening in millimeters. The substage condenser is adjustable by a heavy rack and pinion with a long range. By means of a graduated scale the exact location of the condenser with each objective can be recorded.

The microscope with plain stage and substage as described should be used when it is desirable to use the Micro Tessar lenses and to utilize their full available field, as it is not possible to supply a revolving mechanical stage with a sufficiently large opening for this purpose. We are prepared, however, to furnish this microscope with a revolving mechanical stage and complete substage, such as that supplied with the GGDE Microscope, to those desiring such an arrangement. The series of condensers for the Micro Tessar lenses can be used with this arrangement.

This Photomicrographic Microscope will also be found very useful for projection or drawing.

Code Word	Cat. No.	Specifications	Price
Caduh	4148	*Photomicrographic Microscope* as described, including plain rectangular stage, large condenser for Micro Tessars, aplanatic condenser with graduated diaphragm for use with high power objective	$170.00
Caebp	4151	Same as above, but with revolving mechanical stage and complete substage, aplanatic condenser with graduated iris diaphragm for use with high power objectives; without condensers for use with Micro Tessars	255.00
Chaso	4568	*Special Light Tight Connector* for use with Photomicrographic Microscope when using Micro Tessars	12.50

Micro Tessar Lenses

THE Micro Tessar lenses, specially corrected for photomicrography, will be found satisfactory for photographing a comparatively large area of a specimen at low magnification. The lenses are corrected for use without an eyepiece and cover an angular field of approximately 55°. The 16, 32 and 48 mm lenses are provided with society screw thread, and may be used interchangeably with the regular microscope objectives. The 72 mm focus lens, supplied in a regular photographic lens mount, may be attached to the front board or shutter of the camera. It can be used also on special microscopes such as the No. 4148 Photomicrographic Microscope. For low power work and large areas we recommend our regular Photographic Tessars, and will make recommendations upon being advised regarding the requirements.

In order to facilitate focusing the Micro Tessar lenses when used for low power work, we recommended that they be used in conjunction with a rack and pinion focusing mount.

Code Word	Cat. No.	Equivalent Focus	Price
Dheft	4401	72 mm (2⅞″)	$44.00
Dhegv	4402	48 mm (2″)	36.00
Dhehw	4403	32 mm (1¼″)	36.00
Dodox	4398	16 mm (⅜″)	25.00

When the Micro Tessar Lens or combined lens and shutter are used on the camera, we recommend that they be mounted on a rack and pinion focusing mount.

Focusing Mount and Adapters

Code Word	Cat. No.	Specifications	Price
Caasf	4588	*Rack and Pinion Focusing Mount*, fitting front board of camera, and accommodating shutters or adapters for photographic lenses	$15.00
Carer	4590	*Adapter* for fitting 72 mm Micro Tessars and photo lenses to front of shutter or focusing mount	3.50
Caeds	4589	*Adapter* for use with 4590 adapter to fit 16, 32 or 48 mm Micro Tessars to shutter or focusing mount	2.50

Table of Magnifications of Photomicrographic Outfits

Tube length – 160 mm.

Objectives		Distance from Eyepiece to Ground Glass				
		Eyepieces	25 cm.	50 cm.	75 cm.	100 cm.
Initial Magnification	E. F. in mm.					
2	48	5	10	20	30	40
		6.4	12.8	25.6	38.4	51.2
		7.5	15	30	45	60
		10.0	20	40	60	80
		12.5	25	50	75	100
4	32	5	20	40	60	80
		6.4	26	52	78	104
		7.5	30	60	90	120
		10.0	40	80	120	160
		12.5	50	100	150	200
10	16	5	50	100	150	200
		6.4	64	128	192	256
		7.5	75	150	225	300
		10.0	100	200	300	400
		12.5	125	250	375	500
21	8	5	105	210	315	420
		6.4	134	268	402	536
		7.5	157	314	472	628
		10.0	210	420	630	840
		12.5	263	526	789	1052
43	4	5	215	430	645	860
		6.4	276	552	828	1104
		7.5	320	640	960	1280
		10.0	430	860	1290	1720
		12.5	537	1074	1611	2148
45	4	5	225	450	675	900
		6.4	288	576	864	1152
		7.5	338	676	1014	1352
		10.0	450	900	1350	1800
		12.5	562	1124	1686	2248
60	3	5	300	600	900	1200
		6.4	384	768	1152	1536
		7.5	450	900	1350	1800
		10.0	600	1200	1800	2400
		12.5	750	1500	2250	3000
97	1.9	5	485	970	1455	1940
		6.4	621	1242	1863	2484
		7.5	727	1454	2181	2908
		10.0	970	1940	2910	3880
		12.5	1212	2424	3636	4848
100	1.8	5	500	1000	1500	2000
		6.4	640	1280	1920	2560
		7.5	750	1500	2250	3000
		10.0	1000	2000	3000	4000
		12.5	1250	2500	3750	5000

Stage Micrometers

The micrometers consist of slides, measuring 75 x 25 mm, upon which scales are mounted.

They will be found useful in determining the exact magnification upon the ground glass.

Code Word	Cat. No.	Specifications	Price
Acowk	1861	*Glass;* ruled to 0.1 and 0.01 mm	$7.00
Acoxl	1862	*Glass;* ruled to 0.01 and 0.001 inches	8 00
Acoym	1867	*Metal;* ruled to 0.1 and 0.01 mm	12.00

Focusing Glass

WHEN focusing upon images of very fine structures, the eye requires some assistance in order to determine the sharpest point. For this purpose a focusing glass should be used.

The focusing glass we recommend is a Ramsden construction, consisting of two plano convex lenses which give a well defined image at 3.5× magnification. This focusing glass was designed particularly for photomicrography to give a large field, actually 1″ in diameter, and a suitable magnification for an already highly magnified image as formed by the microscope. They are substantially mounted in a dull black metal tube.

Code Word	Cat. No.	Specifications	Price
Caris	4619	*Doublet Focusing Glass,* as described	$5.00

Carbons

Code Word	Cat. No.	Specifications	Price
Dezep	4472	8 mm diameter, 6″ long, soft cored	$0.06
Daibv	4481	7 mm diameter, 6″ long, soft cored	.06
Dezir	4473	6 mm diameter, 6″ long, soft cored	.06

Compound Shutter

With the Compound Shutter, instantaneous, bulb or time exposures can be made. It has steel leaves with a maximum opening of 40 mm.

Code Word	Cat. No.	Specifications	Price
Caajw	4570	*Compound Shutter,* as described	$25.00

Single Plate Holders

Code Word	Cat. No.	Specifications	Price
Caizp	4632	For 8 x 10″ plates, including kits for 5″ x 7″, 4″ x 5″ and 3¼″ x 4¼″ plates, book form. M. C. P. *net*	$16.30

Double Plate Holders

Code Word	Cat. No.	Specifications	Price
Cajol	4542	For 4 x 5" plates.....M. C. P. *net*	$3.00
Cajum	4544	For 5 x 7" plates.....M. C. P. *net*	2 75
Cakek	4546	For 5 x 7" plates, with kits for 4 x 5.....M. C P. *net*	3.55
Cakil	4547	For 5 x 7" plates, with kits for 4 x 5 and 3¼ x 4¼.....M. C P. *net*	4.25
Cakom	4548	For 8 x 10" plates.....M. C. P. *net*	5.50
Cakum	4549	For 8 x 10" plates, with kits for 5 x 7.....M. C. P. *net*	6.70
Calak	4553	For 8 x 10" plates, with kits for 5 x 7 and 4 x 5.....M. C. P. *net*	7.50
Calel	4554	For 8 x 10" plates, with kits for 5 x 7, 4 x 5 and 3¼ x 4¼M. C. P. *net*	8.20

Rheostats and Transformers

Code Word	Cat. No.	Specifications	Price
Detol	4452	*Rheostat* for 4½ amperes, 110 volts.....	$11.50
Detum	4453	*Rheostat* for 4½ amperes, 220 volts.....	13.50
Detah	4493	*Rheostat* for 8 amperes, 110 volts.....	13.75
Diepg	4497	*Transformer* for 6-volt, 18 ampere (108-watt) lamp, 110 volts, 60 cycles, alternating current.....	10.00
Dicuh	4497A	*Transformer*, same as above, but for 220 volts.....	13.50
Dewup	4491	*Transformer* for 110 volt, 25 cycles.....	12.50

Filters

For those desiring filters, we suggest one or more of the Wratten "M" filters as listed below. These are composed of gelatin sheets stained with appropriate dyes cemented between glass plates 2 inches square.

Code Word	Name of Filter	Visual Color	Spectral Transmission	Price
Caobs	A	Scarlet	From 5800 to Red End.....M. C. P. *net*	$1.35
Caoct	B	Green	From 4600 to 6000.....M. C. P. *net*	1.35
Caodw	C	Blue-Violet	From 4000 to 5100.....M. C. P. *net*	1.35
Caofw	D	Purple	From 3800 to 4600 and from 6400 to Red End .....M. C. P *net*	1.35
Caohy	E	Orange	From 5600 to Red End.....M. C. P. *net*	1 35
Caojz	F	Pure Red	From 6100 to Red End .....M. C. P *net*	1 35
Caokb	G	Strong Yellow	From 5100 to Red End.....M. C. P. *net*	1.35
Caolc	H	Blue	From 4200 to 5400.....M C. P. *net*	1.35
Caomd	K	Pale Yellow	Luminosity Screen for Orthochromatic reproduction with artificial light.....M. C. P. *net*	1.35

Caonf, complete set of "M" filters as listed above, in case, *net* $16.00

M C. P.—Manufacturer's Current Price

Without further notice the prices herein are subject to increase for taxes and charges now or hereafter imposed by federal, state or other authorities applicable to the sale of articles covered by this price list.

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