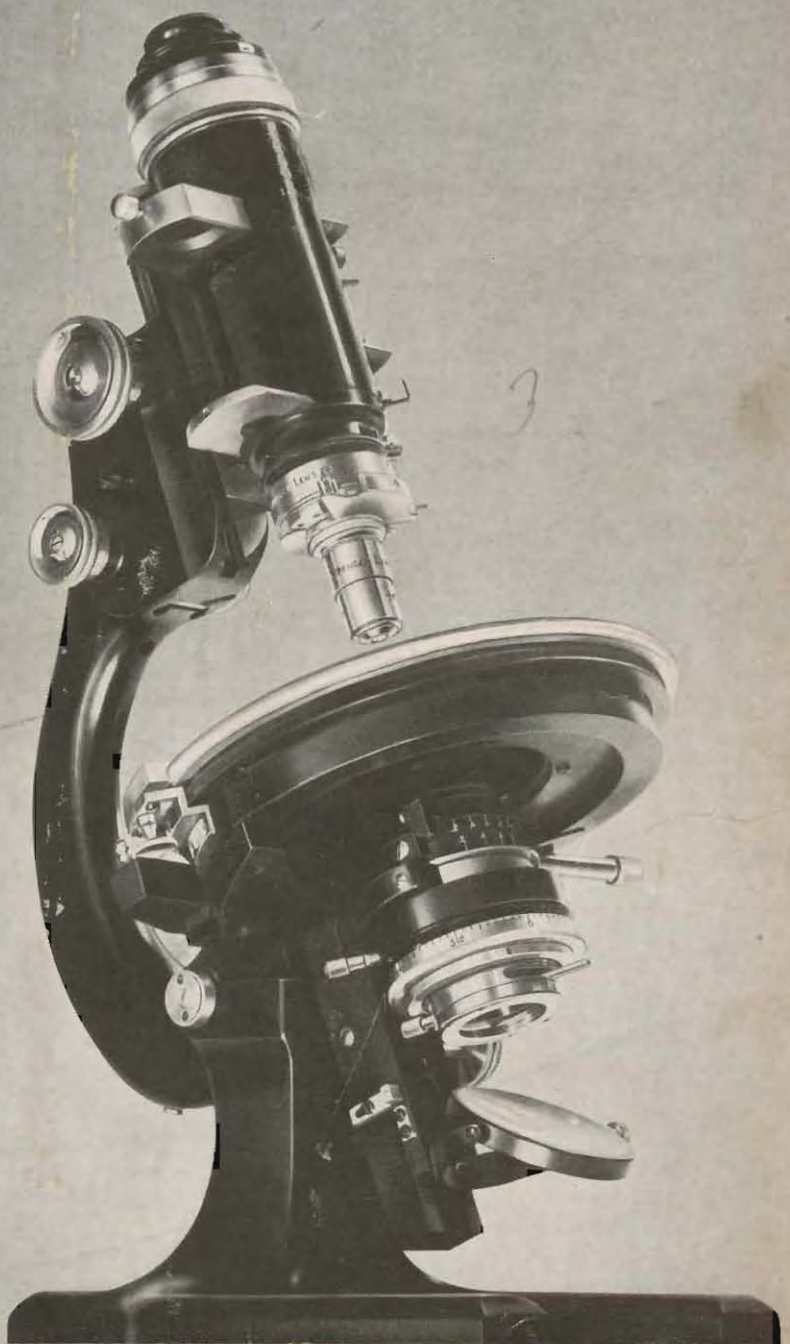








Spencer
POLARIZING MICROSCOPES



PRICE LIST

SPENCER POLARIZING MICROSCOPES

Catalog M75-1047

Effective August 23, 1948

Page	Cat. No.	Price
11	37A	$1328.00
	37B	1302.00
	537	14.00
13	39A	1090.00
	39B	1064.00
	537	14.00
15	40AC	844.00
	40BC	818.00
	40AD	832.00
	40BD	806.00
17	41AC	824.00
	41BC	798.00
	41AD	812.00
	41BD	786.00
19	42AC	564.00
	42BC	538.00
	42AD	552.00
	42BD	526.00
21	43AC	520.00
	43BC	494.00
	43AD	508.00
	43BD	482.00
22	1270	15.00
	1271	15.00
	1272	15.00
	1274	22.00
	1275	22.00
	1280	22.00
	1284	31.00
	1287	$33.00
	1290	33.00
	1291	42.00
	1295	62.00
	447	15.00
	448	15.00
	449	15.00
	451	19.00
	453	19.00
	454	19.00
	456	25.00
	457	25.00
	550	2.00
	551*	2.00
	546	4.00
	547	5.00
	450	12.00
	455	15.00
	460	18.00
	462	22.00
	463	9.00
23	528	436.00
	529	218.00
	530	218.00
	532	436.00
	533	99.00
	534	39.00
	526	16.00
	555	220.00
24	495	97.00
	540	12.00
	542	55.00
	544	9.00
	545	30.00

*Adapter for No. 555 Graduated Quartz Wedge on Large Diameter Body Tube.

All prices, deliveries, and terms of sale are subject to change without notice. Orders are subject to final acceptance by the Sales Office at Buffalo, N. Y., at prices prevailing at the time of shipment. Federal, State, City, or other taxes imposed on the sale, lease, or other transfer, use, or consumption of any article listed herein are to be added to the prices quoted.

American Optical
COMPANY
Scientific Instrument Division
Buffalo 15, New York

Printed in U.S.A.

THE MICROSCOPE shown on the cover is Spencer Research Polarizing Microscope No. 37A. The illustrations on the left margin of the cover were made from Kodachrome photomicrographs taken with a No. 37A Microscope and standard Spencer photomicrographic equipment.

Polarizing Microscopes

The Polarizing Microscope, long an indispensable aid of the petrographer, has come into its own in many branches of science in recent years. Micro techniques in chemistry, employing polarized light, have effected significant economies of time and material. The metal, petroleum, plastics, and synthetic fibers industries find this instrument of increasing importance in fundamental research and process control. The biologist has found a steadily increasing number of applications for it. The optical activity of various materials is adding daily to our knowledge of life, disease, and death.

Because of the many different uses for Spencer Polarizing Microscopes, several variations of each model are listed. Simple designations of these optional features are described in the following paragraphs.

Each microscope is available with either a rotatable or a non-rotatable analyzer in the body tube. This is indicated by the use of one of the following letters immediately after the model number:

A. Designates a Rotatable Analyzer.

B. Designates a Non-Rotatable Analyzer.

Research Polarizing Microscopes are listed only with the centerable quick-change nosepiece, but Standard Polarizing Microscopes may be ordered with a non-centerable revolving nosepiece. These differences in the Standard Polarizing Microscopes are indicated by a second letter following the catalog number.

C. Designates a centerable Quick-Change Nosepiece and a non-centerable stage.

D. Designates a non-centerable Triple Revolving Nosepiece and a centerable stage.

All Spencer Polarizing Microscopes have the same type of focusing adjustments, inclination joint, mirror, and finish. They are characterized by Spencer sturdiness, precision of movement, and fine appearance.

The rack and pinion coarse adjustment consists of a diagonal rack and spiral pinion. The bearing surfaces are provided with oil grooves, and different metals are used in the two contacting surfaces to provide smooth, easily-controlled motion.

The fine adjustment, the most important mechanical feature in a microscope, as on other Spencer microscopes, consists of a micrometer screw working in conjunction with a bell-crank lever, thereby providing a degree of precision found only in the finest measuring instruments.

Since the action of the screw is applied only in moving the body tube upward, the possibility of breaking the cover glass is greatly reduced.

The inclination joint works with exceptional smoothness, yet holds the instrument at any desired angle.

All stands are provided with a 50mm. substage mirror, plane on one side and concave on the other.

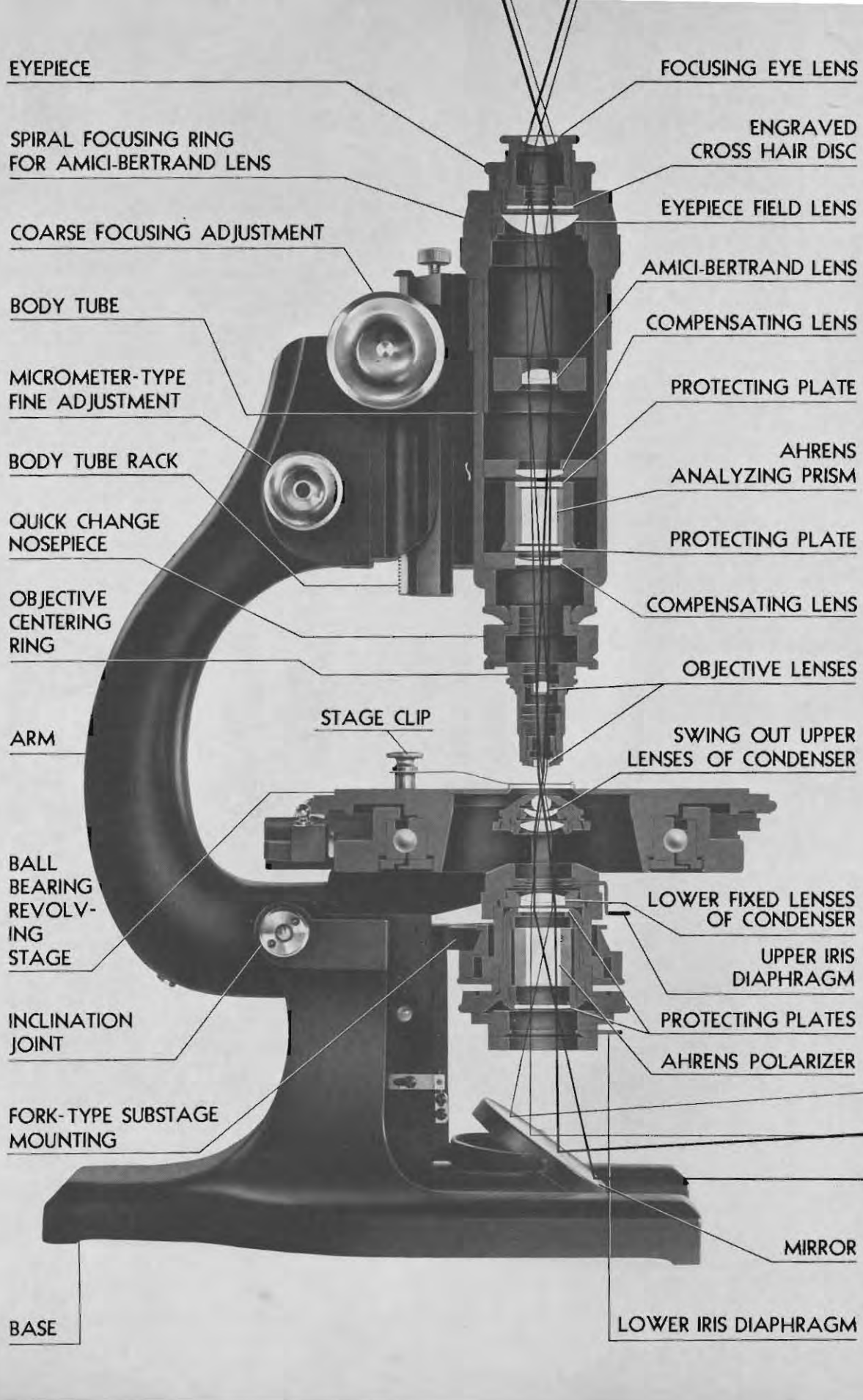
The lines on all graduations are distinct and easily read.

The instruments are finished in satin black enamel, and the graduated circles, verniers, and adjustment buttons are chromium plated to resist the fumes of reagents commonly used in chemical microscopy and petrography.

Stands

Microscopes Nos. 37 and 39 have the same heavy rigid stand, designed to meet the critical needs of the petrographer, whose work is of the most exacting nature, and are fully adapted to all types of microscopical research in polarized light. The stands will accommodate the largest universal stages. The top of the stage is 145mm. from the table, providing ample space for substage manipulation. The distance from the inside curve of the arm to the optical axis is 116mm. The body tube has a dovetail slide which provides 32mm. excursion in addition to the 80mm. range of movement available in the rack and pinion adjustment. The fine adjustment is graduated in units of 1 micron.

On Spencer Polarizing Microscopes Nos. 40, 41, 42, 43, a slightly smaller stand is supplied. The model numbers indicate differences in body tube and substage assembly. These are described fully in the list-


EYEPIECE
SPIRAL FOCUSING RING FOR AMICI-BERTRAND LENS
COARSE FOCUSING ADJUSTMENT
BODY TUBE
MICROMETER-TYPE FINE ADJUSTMENT
BODY TUBE RACK
QUICK CHANGE NOSEPIECE
OBJECTIVE CENTERING RING
ARM
STAGE CLIP
BALL BEARING REVOLV-ING STAGE
INCLINATION JOINT
FORK-TYPE SUBSTAGE MOUNTING
BASE
FOCUSING EYE LENS
ENGRAVED CROSS HAIR DISC
EYEPIECE FIELD LENS
AMICI-BERTRAND LENS
COMPENSATING LENS
PROTECTING PLATE
AHRENS ANALYZING PRISM
PROTECTING PLATE
COMPENSATING LENS
OBJECTIVE LENSES
SWING OUT UPPER LENSES OF CONDENSER
LOWER FIXED LENSES OF CONDENSER
UPPER IRIS DIAPHRAGM
PROTECTING PLATES
AHRENS POLARIZER
MIRROR
LOWER IRIS DIAPHRAGM

ing of each microscope. The stand is heavy and built for critical work. It will accommodate the smaller universal and integrating stages, and is so adaptable that, except for advanced research work, it will satisfy the requirements of the petrographer, mineralogist, biologist, and chemist. The distance from the optical axis to the arm is 103mm., and the stage height is ample. Body tube construction permits great latitude of adjustments for the observation of all types of material. The fine adjustment is graduated in units of 2.5 microns.

Circular Revolving Stages

The precision of the revolving stages is due to careful centering and fitting. They are free from play or "creeping". The peripheries of the stages are graduated in single degrees, with the vernier reading to three minutes of arc.

A centerable stage, with conical bearings, is supplied whenever a non-centerable revolving nosepiece is ordered. On all stages provision is made for locking the stage at any desired position of rotation.

Two sizes of stage are used on Spencer Polarizing Microscopes. Microscopes Nos. 40, 41, 42, and 43 are equipped with a plain bearing stage, either centerable or non-centerable, which is 125mm. in diameter. Microscopes Nos. 37 and 39 are equipped with a non-centerable, ball-bearing stage 150mm. in diameter. A slow motion adjustment will be supplied with the ball-bearing stage at a slight additional cost. The stages are drilled and tapped to accommodate all universal stages in addition to the No. 495 Mechanical Stage.

Crystal Optics

The Ahrens prism has long been accepted as the most satisfactory means for polarizing light. The finest quality calcite prisms



The basic stands for all Polarizing Microscopes.

are used in Spencer Research (Nos. 37 and 39) and Standard (Nos. 40 and 41) Polarizing Microscopes. Improvements in cementing and mounting methods developed by Spencer insure a maximum period of service.

New opportunities in the design of optical instruments have been presented by the recent scientific achievements in the synthesis of crystalline polarizing materials and in the development of new plastics. Scientists of American Optical Company who have been testing these materials for several years have enjoyed splendid cooperation from the manufacturers.

The Spencer Simplified Polarizing Microscopes (Nos. 42 and 43) employ these new materials. These instruments use polarizers of the most advanced type Polaroid material. Outstanding petrographers have examined them and expressed their satisfaction. Thorough tests indicate the permanence of these materials under adverse conditions. They were found to resist vapors and fumes in concentrations far beyond what can be tolerated by the user. Heat resistance has also been carefully investigated and it has been shown that the

Spencer Circular Revolving Stage: left, verniers; right, slow-motion adjustment for ball-bearing stage.





materials are unaffected by temperatures well in excess of the limits of climatic variations. (Note: As with calcite prisms, focusing a concentrated light source in the plane of the polarizer should be avoided.)

The optical characteristics of the synthetic crystal system have been found to parallel closely calcite equipment. The sensitivity of the extinction point is found to compare favorably with calcite, and there is remarkable freedom from residual color. Furthermore the shorter length of the polarizing unit and the elimination of several glass-air surfaces reduce the amount of stray light. A noticeable increase in contrast in the image results. This is particularly important in the added crispness apparent in interference figures.

Spencer research, in cooperation with the plastics industry, has also developed retardation plates for determining the nature of double refraction. Careful tests indicate that they are stable under extremes of temperature and resistant to fumes. The manufacturing process used to produce these plates is capable of more accurate control than can be achieved through the cleavage of natural crystal. As a result the retardation is more accurately controlled. A quartz wedge, designed to give a true zero order, is also available. See following pages for listing of these accessories.

Body Tubes

The body tubes on all Spencer Polarizing Microscopes are exceptionally large, (45mm. in diameter) in harmony with the large stands. Special attention has been given to achieve convenience and smooth operation of the body tube accessories. Dovetailed slideways for analyzers are chromium against brass to assure lasting precision. Small knurled heads are located at both ends of the sliding parts so that they may be operated with either hand.

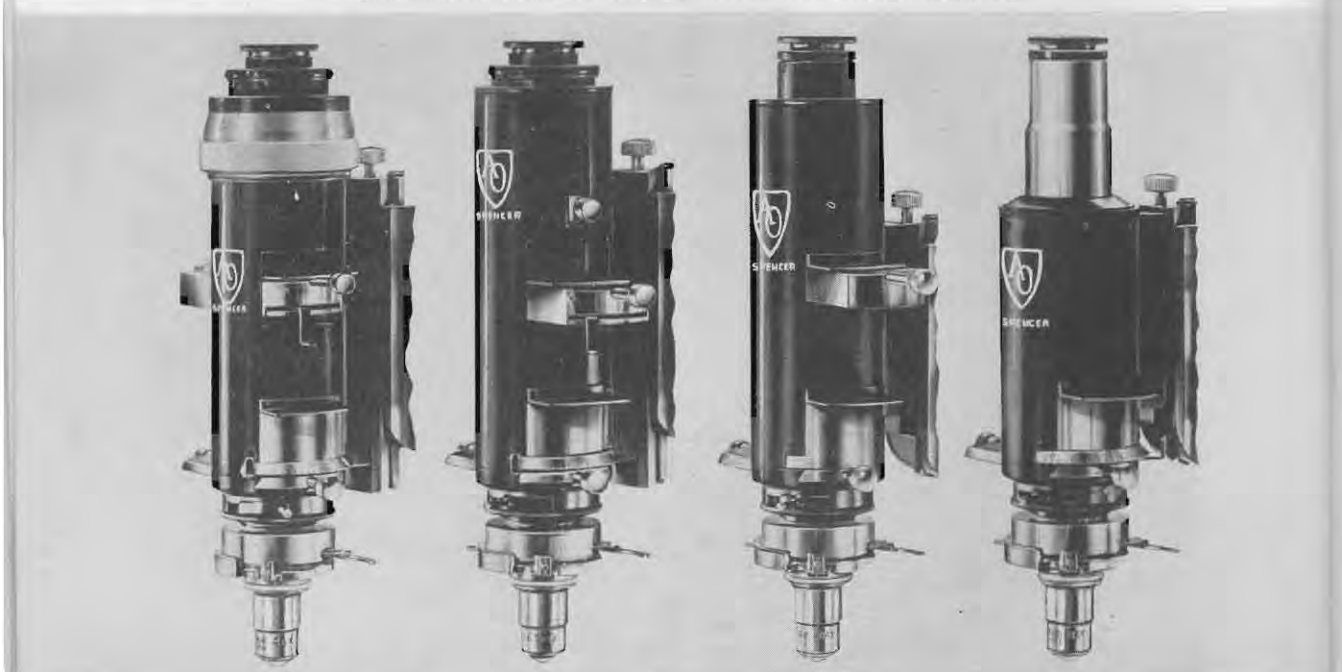
All body tubes, of which there are four, are equipped with a built-in body tube analyzer. Two are equipped with 12 millimeter Ahrens prism analyzers and accommodate large diameter eyepieces. Two are equipped with high grade Polaroid analyzers and accommodate standard diameter eyepieces. The analyzer may be mounted in either a fixed mount or a rotatable one having graduations from 0° to 90°. The terminal positions of this range are indicated by a click; however, an additional 5° is available beyond the 0° and 90° positions.

Focusable Amici-Bertrand lenses are available in the two body tubes having Ahrens prism analyzers. In these body tubes the Bertrand lens is centerable in its mount and is equipped with an iris diaphragm.

The spiral focusing Bertrand lens, as supplied on the body tube for the Nos. 37 and 40 Microscopes, is actuated by a graduated knurled ring at the top of the body tube.

The hand sliding, focusing Bertrand lens, as supplied on the body tubes of the Nos. 39 and 41, is focused by means of a knob extending from a slot in the side of the body tube.

Body tubes (left to right) for: Nos. 37 and 40, Nos. 39 and 41, No. 42, No. 43.



Body tubes having Polaroid analyzers are available with a fixed focus Amici-Bertrand lens, adjusted at the factory, as offered on the No. 42 Microscope, or without Bertrand lens, as offered on the No. 43 Microscope. The fixed focus Bertrand lens is precentered at the factory and is not equipped with an iris diaphragm.

Quick-Change Nosepiece

The Spencer Quick-Change Centering Nosepiece, with three objective centering rings, is available for all instruments. The quick-change equipment consists of two parts: the nosepiece, which remains permanently attached to the body tube, and the objective centering ring, to which the objective is attached. The nosepiece has an ingenious spring clamp for holding the objective in positive alignment by applying tension to the objective centering rings. The convenient lever releases the tension for removing or replacing objectives. Each objective should be equipped with an objective ring and carefully centered for subsequent use. Two keys are supplied for turning the centering screws. If the most critical centering of objectives is not essential, a revolving nosepiece is a real convenience and time saver. The Nos. 40, 41, 42, and 43 Microscopes are listed with revolving nosepieces as well as with the quick-change. A centerable stage is provided when the non-centerable revolving nosepiece is supplied. The revolving nosepiece is not recommended for use on the research stands, Nos. 37 and 39, and a centerable stage is not available on these models.

Substage Equipment for Polarizing Microscopes

Because of the construction of the Spencer substage equipment and the method of attaching it to the microscope, this equipment may be used in a variety of ways. For example, the condenser may be used without the polarizer; the polarizer may be used without the condenser; the lower fixed lens may be used entirely alone; or the entire substage may be removed easily from the fork-type support. There are two general types of substage equipment for Spencer Polarizing Microscopes.

Biological Style: This type of condenser has been designed so that the source of illumination, when placed at a distance of approximately 10 inches from the substage mirror, is focused on the object.

Petrographical Style: This type represents the more conventional form of petrographic substage condenser. Instead of the light source, either the lower iris diaphragm or the lower face of the polarizing prism (in case no lower iris is used) is focused on the specimen. In using this equipment, the concave side of the substage mirror is used to condense the light from the source at the position of the lower iris diaphragm.

Spencer quick-change nosepiece and objective centering ring.



The velvet lined accessory case, standard equipment with all Polarizing Microscopes.





Substage Condenser No. 532, standard equipment on No. 37. It can also be used on No. 39.



Substage Condenser No. 530 with swing-out unit tilted.

Becke Line: A shutter is provided on each condenser for Becke line effect.

Catalog No. 532: This substage equipment (Petrographical Style), which is standard equipment on the No. 37 and which may also be used on the No. 39, has a five-lens condensing system with a numerical aperture of 1.40. The entire system is achromatic. The three-lens, swing-out unit may be replaced by a unit providing a numerical aperture of 1.0.

When only the lower fixed unit of the condensing system is used, a numerical aperture of 0.28 is provided. This lower unit is fully achromatic. The condenser is equipped with both upper and lower iris diaphragms. A feature of this condenser is that the lower iris may be locked at any desired opening by means of a lock screw. A 15 millimeter Ahrens polarizer is used.

Catalog No. 530: This substage equipment (Petrographical Style) is standard equipment for the Nos. 39, 40, and 41 Microscopes. It is a three-lens combination with a numerical aperture of 1.0. When the two upper lenses are swung out as a unit, the lower fixed lens provides a numerical aperture of 0.28. An upper condenser unit having sufficient numerical aperture for use with the oil immersion objective is available. It replaces the N.A. 1.0 swing-out unit in the stirrup mount. If a lower iris diaphragm is desired, No. 526 is used. The polarizing prism is a 12 millimeter Ahrens.

Catalog No. 533: This substage equipment (Petrographical Style), which is standard equipment on Nos. 42 and 43 Microscopes, is a three-lens combination with a numerical aperture of 1.0. Optically it is identical with the No. 530 Condenser, except that Polaroid is used as a polarizer instead of a calcite prism.

Catalog No. 528: This substage equipment (Biological Style) is designed for use on the Nos. 37 and 39 Microscopes. The condenser consists of a six-lens system having a numerical aperture of 1.30. It is suitable for use with most oil immersion objectives. The condenser is aplanatic and fully achromatic. The upper three-lens unit is mounted in a stirrup support which permits swinging it in and out of the path of light. When only the lower fixed lens system is used, a numerical aperture of 0.28 is provided. The mechanical equipment includes both upper and lower iris diaphragms. The three-lens, swing-out unit may be replaced by a unit providing a

numerical aperture of 1.0, which is also supplied. A 15 millimeter Ahrens polarizing prism is used. This unit may be ordered in place of the No. 532 if desired

Catalog No. 529: This substage equipment (Biological Style), which may be used with the Nos. 39, 40, and 41 Polarizing Microscopes, has a numerical aperture of 1.0. It has a three-lens condenser with the two upper lenses, as a unit, mounted on a stirrup, which can be swung out of the optical axis. The fixed lower lens has a numerical aperture of 0.28.

The condenser is regularly provided with an iris diaphragm located between the condenser and the polarizer. A second iris diaphragm, placed below the polarizer, is available as optional equipment. A 12 millimeter Ahrens polarizing prism is used. This unit may be ordered in place of No. 530 when desired.

Optical Parts

The objectives and eyepieces for Polarizing Microscopes, like other Spencer optical parts, are carefully computed to give the finest results in the work for which they are intended. Long experience in manufacturing, the most modern and efficient equipment, and the skill of experienced workmen are combined to produce the finest optical parts for work with polarized light.

Each element in a Spencer objective is carefully mounted and centered in its cell, and the optical centers of the elements are permanently secured at proper distances from each other in one straight line, which is the optical axis of the objective. In addition to the correction required in standard achromatic objectives, those for use with Polarizing Microscopes must be mounted strain-free. Each objective is plainly marked with its initial magnification. The strain-free objectives listed for Polarizing Microscopes are corrected for use with an 0.18mm. cover glass and 166.4mm. tube length. See pages of accessories for listing of objectives, eyepieces, and accessories.

Compensators of high optical quality are available for studying the nature of birefringence. These compensators are mounted in metal plates which fit into a slot in the body tube. All Spencer Polarizing Microscopes are provided with a slot, properly oriented, so that the compensators can only be inserted with the slow ray in the proper relation to the polarizer and analyzer.

Three compensators are made from stressed plastic material which can be controlled in manufacture more accurately than the natural crystal sections generally used for this purpose.

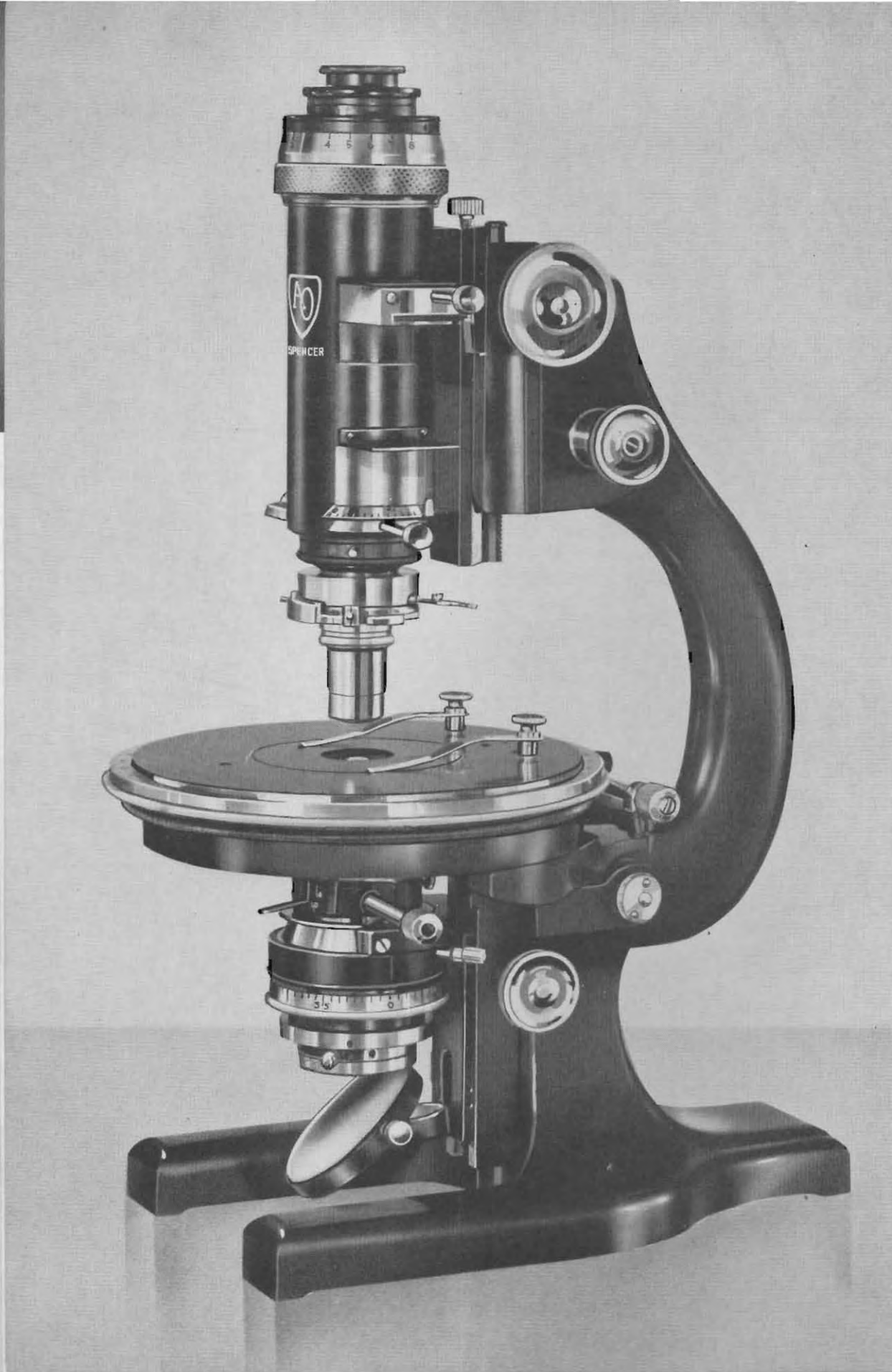
The quarter-wave plate and full-wave plate are useful in routine determinations of birefringence and optical signs.

The Becke aperture plate consists of two diagonal apertures at right angles to each other, a clear circular aperture, and a full-wave plate. This accessory is particularly useful in determining refractive index by means of the Becke line method.

In addition to the compensators already mentioned, a quartz wedge is available for use in the body tube slot. It provides compensation from a true zero order to the third order.

A graduated quartz wedge, complete with upper analyzer, is also available. It is more fully described on the accessories pages.




SPENCER

Research Polarizing Microscope No. 37

Spencer Research Polarizing Microscope No. 37 offers great convenience and adaptability to the petrographer. It has features of precision ample for practically any measurements and is suitable for many different types of work. This is the instrument usually selected for advanced crystallographic work in government laboratories, and for microscopical research with polarized light in all types of laborarories. It will accommodate the integrating srages and universal stages.

STAND

The stand is large, 116mm. from optical axis to arm, 145mm. from table to stage, and 74mm. above the stage.

The coarse adjustment, by diagonal rack and pinion, provides a movement of 80mm. A dovetail slide permirs 32mm. additional excursion.

The micrometer screw-type fine adjustment is graduated ro show .001mm. of movement.

BODY TUBE

A large sized body tube with large eyepiece tube and pinhole eyepiece is included.

The analyzer, a 12 millimeter Ahrens prism, is available in either a fixed or rotatable graduared mount.

The spiral focusing Bertrand lens is in a cenrerable mount with iris diaphragm. A quick-change centerable nosepiece with rhree objective cenrering rings is standard equipment.

STAGE

The 150mm. ball-bearing, revolving stage has the periphery graduated in degrees with a vernier reading to three minures of arc. A slow motion adjustment is available ar slight additional charge.

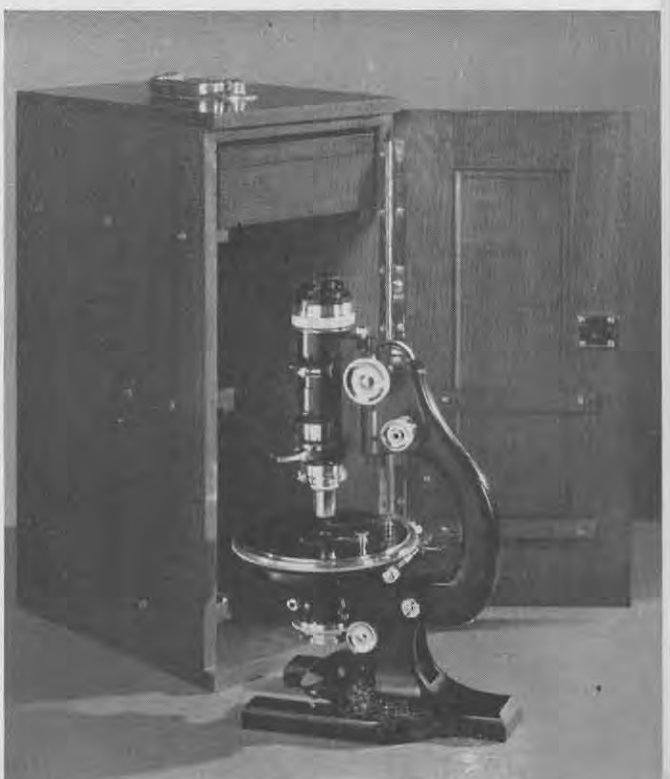
SUBSTAGE EQUIPMENT

No. 532 combined condenser is supplied. It has interchangeable front elements providing N.A. 1.40 and N.A. 1.0, complete with 15 millimeter Ahrens prism polarizer in graduated rotatable mount with lower iris diaphragm.

CABINET

The microscope comes in a polished hardwood cabinet with velvet-lined accessory case, lock, and key.

Cat. No.	Description	Price
37A	Spencer Research Polarizing Microscope as described, having spiral focusing Bertrand lens, pinhole eyepiece, combined condenser N.A. 1.40 and N.A. 1.0, with 15 millimeter Ahrens polarizing prism and graduated rotatable analyzer, in cabinet, but without objectives, eyepieces, or compensators.....	
37B	Spencer Research Polarizing Microscope, same as above, but with nonrotatable analyzer.....	
537	Slow Motion Attachment.....	



Spencer Polarizing Microscope No. 37A.


SPENCER

Large Polarizing Microscope No. 39

Spencer Large Polarizing Microscope No. 39 provides a large, rigid, stable stand with adequate distance below the stage for any illuminating accessories, and sufficient space above the stage to accommodate any of the universal stages. This instrument differs from No. 37 only in body tube and condenser equipment and is included to meet the requirements of those who do not need the high aperture condenser and the convenience of the spiral focusing Bertrand lens.

STAND

The stand is large, 116mm. from optical axis to arm, 145mm. from table to stage, and 74mm. above the stage.

The coarse adjustment, by diagonal rack and pinion, provides a movement of 80mm. A dovetail slide permits 32mm. additional excursion.

The micrometer screw-type fine adjustment is graduated to show .001mm. of movement.

BODY TUBE

A large sized body tube with large eyepiece tube and pinhole eyepiece is included.

The analyzer, a 12 millimeter Ahrens prism, is available in either a fixed or rotatable graduated mount.

The hand focusing (sliding) Bertrand lens is in a centerable mount with iris diaphragm.

A quick-change centerable nosepiece with three objective centering rings is standard equipment.

STAGE

The 150mm. ball-bearing revolving stage has the periphery graduated in degrees with verniers reading to three minutes of arc. A slow motion adjustment is available at a slight additional charge.

SUBSTAGE

The No. 530 combined condenser is supplied. It has a numerical aperture of 1.0. The 12 millimeter Ahrens prism polarizer is in a graduated rotatable mount.

CABINET

The microscope comes in a polished hardwood cabinet with velvet-lined accessory case, lock, and key.

Cat. No.	Description	Price
39A	Spencer Large Polarizing Microscope as described, having hand focusing Bertrand lens, pinhole eyepiece, N.A. 1.0 condenser with 12 millimeter Ahrens polarizing prism and graduated rotatable analyzer, in cabinet, but without objectives, eyepieces, or compensators.....	
39B	Spencer Large Polarizing Microscope, same as above, but with non-rotatable analyzer.....	
537	Slow Motion Attachment.....	

Body tube showing quartz wedge in place.



Spencer Polarizing Microscope No. 39A.


SPENCER

Polarizing Microscope No. 40

Spencer Polarizing Microscope No. 40 is a complete instrument for work in polarized light. This instrument, and No. 41 described on the following pages, are widely used in industrial laboratories. It will accommodate the integrating stages and the smaller universal stages. The convenience of the spiral focusing Bertrand lens is a real advantage during extensive routine examination of interference figures. The plain bearing stage is adequate for all but the most critical work. The wide field afforded by the large diameter eyepieces is another feature appreciated where a large volume of work is handled regularly.

STAND

The stand is standard in dimensions. 103mm. from optical axis to arm, 132mm. from table to stage, and 64mm. above the stage.

The coarse adjustment, by diagonal rack and pinion, provides a movement of 70mm. A dovetail slide permits 32mm. additional excursion.

The micrometer screw-type fine adjustment is graduated to show .0025mm. of movement.

BODY TUBE

A large sized body tube with large eyepiece tube and pinhole eyepiece is included.

The analyzer, a 12 millimeter Ahrens, is available in either a fixed or rotatable mount.

The spiral focusing Bertrand lens is in a centerable mount with iris diaphragm. A quick-change nosepiece with three objective centering rings or a non-centerable, triple revolving nosepiece may be specified.

STAGE

The 125mm. plain bearing, non-centerable, revolving stage has the periphery graduated in degrees with a vernier reading to three minutes of arc. A centerable stage is supplied when a non-centerable revolving nosepiece is specified.

SUBSTAGE EQUIPMENT

The No. 530 combined N.A. 1.0 condenser includes a 12 millimeter Ahrens prism polarizer in a graduated rotatable mount.

CABINET

The microscope comes in a leatherette covered hardwood cabinet with a velvet-lined accessory case, lock, and key.

Cat. No.	Description	Price
40AC	Spencer Polarizing Microscope as described, having spiral focusing Bertrand lens, large eyepiece tubes, pinhole eyepiece, rotatable analyzer, quick-change centerable nosepiece with three objective centering rings, in cabinet, but without objectives, eyepieces, or compensators.....	
40BC	Spencer Polarizing Microscope, same as above, but with non-rotatable analyzer.....	
40AD	Spencer Polarizing Microscope, same as No. 40AC, but with a non-centerable, triple revolving nosepiece and centerable stage.....	
40BD	Spencer Polarizing Microscope, same as above, but with non-rotatable analyzer.....	

Spencer Polarizing Microscope No. 40AD.



Spencer Polarizing Microscope No. 40AC.


PENCER

Polarizing Microscope No. 41

Spencer Polarizing Microscope No. 41 is identical with No. 40 described on the preceding page, except that the sliding focusing Bertrand lens is supplied instead of the spiral focusing feature.

This microscope, like other Spencer Polarizing Microscopes, can be equipped with any of the objectives, eyepieces, or compensators for either routine or advanced work.

STAND

The stand is standard in dimensions: 103mm. from optical axis to arm, 132mm. from table to stage, and 64mm. above the stage.

The coarse adjustment, by diagonal rack and pinion, provides a movement of 70mm. A dovetail slide permits 32mm. additional excursion.

The micrometer screw-type fine adjustment is graduated to show .0025mm. of movement.

BODY TUBE

A large sized body tube with large eyepiece tube and pinhole eyepiece is included.

The analyzer, a 12 millimeter Ahrens prism, is available in either a fixed or rotatable mount.

The sliding focusing Bertrand lens is in a centerable mount with iris diaphragm. A quick-change centerable nosepiece with three objective centering rings or a non-centerable triple revolving nosepiece may be specified.

STAGE

The 125mm. plain bearing, revolving stage has the periphery graduated in degrees with a vernier reading to three minutes of arc. A centerable stage is supplied when a non-centerable revolving nosepiece is specified.

SUBSTAGE EQUIPMENT

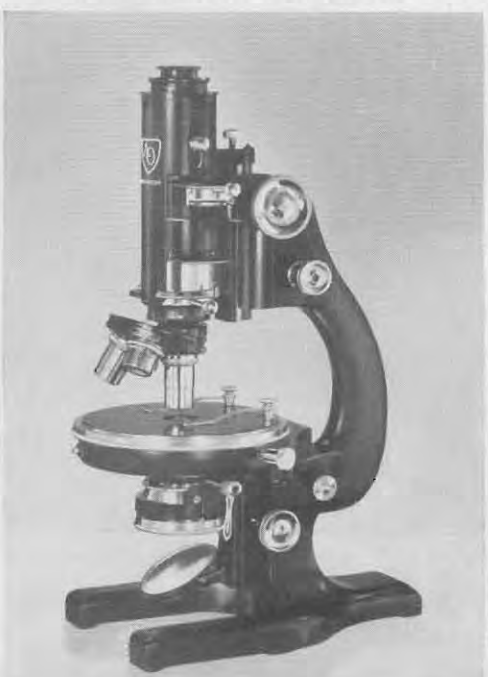
The No. 530 combined N.A. 1.0 condenser includes a 12 millimeter Ahrens prism polarizer in a graduated rotatable mount.

CABINET

The microscope comes in a leatherette covered hardwood cabinet with a velvet-lined accessory case, lock, and key.

Cat. No.	Description	Price
41AC	Spencer Polarizing Microscope as described, having hand focusing Bertrand lens, large eyepiece tubes, pinhole eyepiece, rotatable analyzer, quick-change centerable nosepiece with three objective centering rings, in cabinet, but without objectives, eyepieces, or compensators.....	
41BC	Spencer Polarizing Microscope, same as above, but with non-rotatable analyzer.....	
41AD	Spencer Polarizing Microscope, same as No. 41AC, but with a non-centerable, triple revolving nosepiece and centerable stage.....	
41BD	Spencer Polarizing Microscope, same as above, but with non-rotatable analyzer.....	

Spencer Polarizing Microscope No. 41AD.



Spencer Polarizing Microscope No. 41AC.


PENCER

Polarizing Microscope No. 42

Spencer Polarizing Microscope No. 42 is a complete microscope for work in polarized light at a minimum price. The use of Polaroid of precision optical quality instead of Ahrens prisms, the fixed focus Bertrand lens, and the standard diameter eyepieces make significant economies possible. Optically and mechanically the instrument is capable of the finest work. It is particularly well suited to satisfy the need for a complete instrument for students. It is also well adapted to the needs of the industrial control laboratory.

STAND

The stand is standard in dimensions: 103mm. from optical axis to arm, 132mm. from table to stage, and 64mm. above the stage.

The coarse adjustment, by diagonal rack and spiral pinion, provides a movement of 70mm. A dovetail slide permits 32mm. additional excursion.

The micrometer screw-type fine adjustment is graduated to show .0025mm. of movement.

BODY TUBE

A large sized body tube with standard diameter eyepiece tube and pinhole eyepiece is included.

The analyzer, a synthetic crystal (Polaroid), is available in either a fixed or rotatable mount.

The prefocused Bertrand lens is in a sliding mount.

A quick-change centerable nosepiece with three objective centering rings or a triple revolving nosepiece may be specified.

STAGE

The 125mm. plain bearing, revolving stage has the periphery graduated in degrees with a vernier reading to three minutes of arc. A centerable stage is supplied when a non-centerable revolving nosepiece is specified.

SUBSTAGE EQUIPMENT

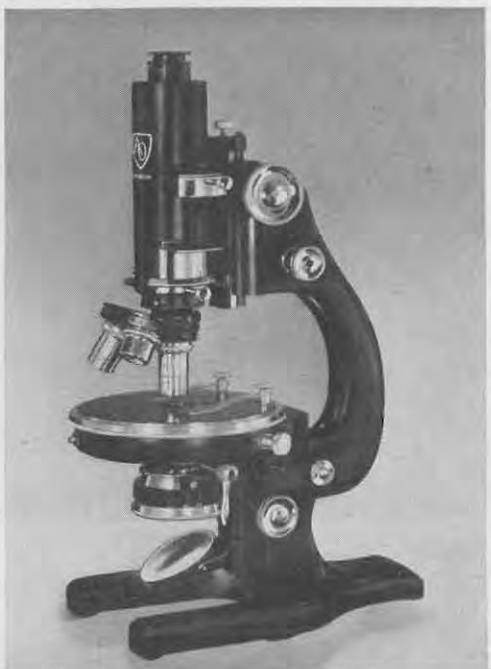
The No. 533 combined N.A. 1.0 condenser includes a Polaroid polarizing filter in a graduated rotatable mount.

CABINET

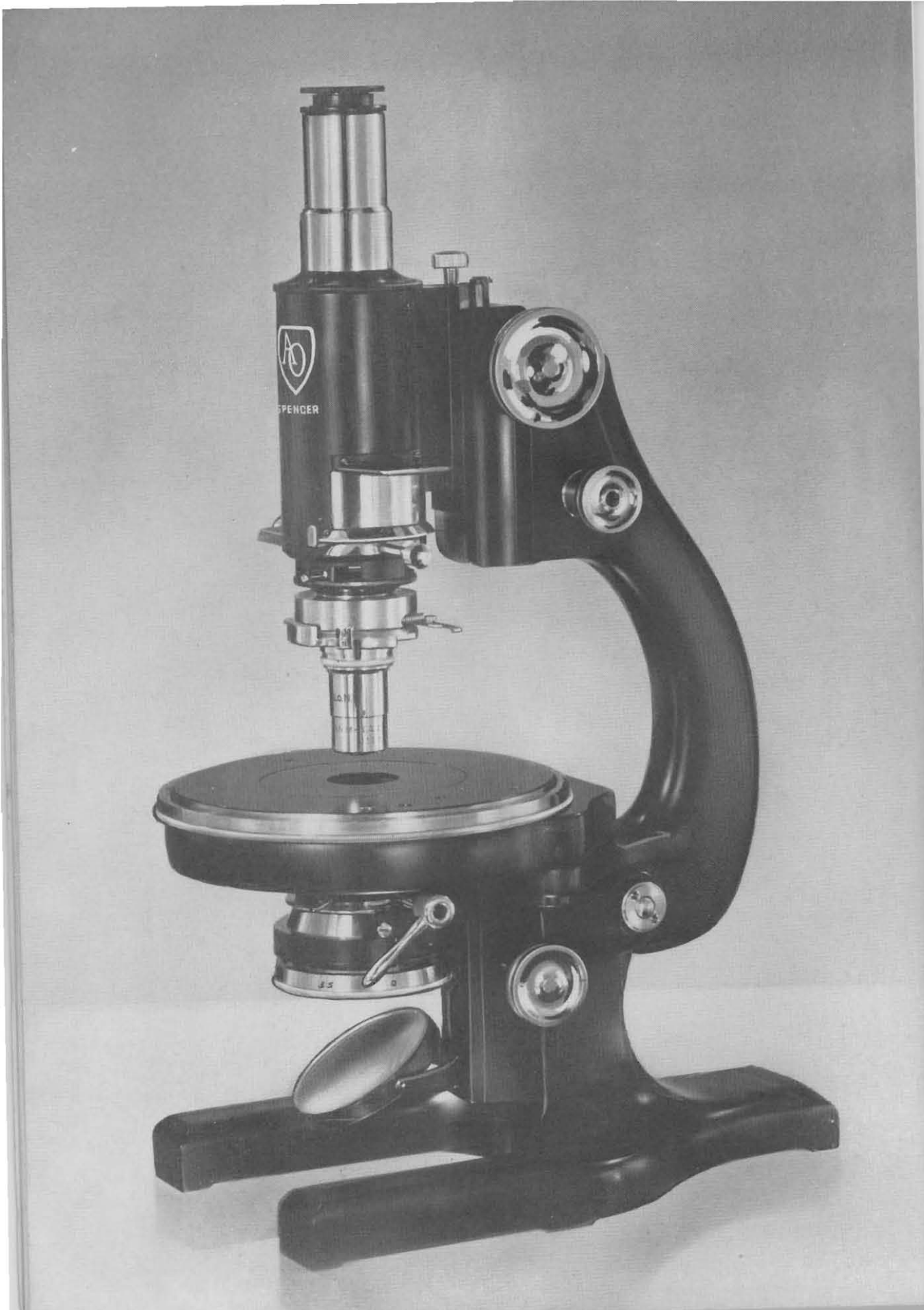
The microscope comes in a leatherette covered hardwood cabinet with a velvet-lined accessory case, lock, and key.

Cat. No.	Description	Price
42AC	Spencer Polarizing Microscope as described, having Polaroid polarizer and analyzer, prefocused Bertrand lens, standard eyepiece tubes, pinhole eyepiece, rotatable analyzer, quick-change centerable nosepiece with three objective centering rings, in cabinet, but without objectives, eyepieces, or compensators.....	
42BC	Spencer Polarizing Microscope, same as above, but with non-rotatable analyzer.....	
42AD	Spencer Polarizing Microscope, same as No. 42AC, but with a non-centerable, triple revolving nosepiece and centerable stage.....	
42BD	Spencer Polarizing Microscope, same as above, but with non-rotatable analyzer.....	

Spencer Polarizing Microscope No. 42AD.



Spencer Polarizing Microscope No. 42AC.


SPENCER

Polarizing Microscope No. 43

Spencer Polarizing Microscope No. 43 represents a distinct advance over the conventional "chemical" microscope. The analyzer in the body tube affords a considerably larger and more usable field than the cap analyzer, and eliminates the very low eyepoint. This instrument offers the same optical and mechanical features as the No. 42, except that no Bertrand lens is supplied. Where examination of the interference figure with the pinhole eyepiece only will suffice, the No. 43 Microscope offers a low cost instrument of a quality fully comparable with the other Spencer Polarizing Microscopes.

STAND

The stand is standard in dimensions: 103mm. from optical axis to arm, 132mm. from table to stage, and 64mm. above the stage.

The coarse adjustment, by diagonal rack and pinion, provides a movement of 70mm. A dovetail slide permits 32mm. additional excursion.

The micrometer screw-type fine adjustment is graduated to show .0025mm. of movement.

BODY TUBE

A large sized body tube with standard diameter eyepiece tube and pinhole eyepiece is included.

The analyzer, a Polaroid disc of optical quality, is available in either a fixed or rotatable mount.

A quick-change centerable nosepiece with three objective centering rings or a triple revolving nosepiece may be specified.

STAGE

The 125mm. plain bearing, revolving stage has the periphery graduated in degrees with a vernier reading to three minutes of arc. A centerable stage is supplied when a non-centerable revolving nosepiece is specified.

SUBSTAGE EQUIPMENT

The No. 533 N.A. 1.0 condenser includes a Polaroid disc in a graduated rotatable mount.

CABINET

The microscope comes in a leatherette covered hardwood cabinet with a velvet-lined accessory case, lock, and key.

Cat. No.	Description	Price
43AC	Spencer Polarizing Microscope without Bertrand lens, as described, having Polaroid polarizer and analyzer, standard eyepiece tube, pinhole eyepiece, rotatable analyzer, quick-change centerable nosepiece with three objective centering rings, in cabinet, but without objectives, eyepieces, or compensators.....	
43BC	Spencer Polarizing Microscope, same as above, but with non-rotatable analyzer.....	
43AD	Spencer Polarizing Microscope without Bertrand lens, same as No. 43AC, but with a non-centerable, triple revolving nosepiece and centerable stage.....	
43BD	Spencer Polarizing Microscope, same as above, but with non-rotatable analyzer.....	

Spencer Polarizing Microscope No. 43AD.



Spencer Polarizing Microscope No. 43AC.

Accessories for Polarizing Microscopes

Strain-Free Achromatic Objectives

All Spencer Strain-Free Objectives are plainly marked with the equivalent focus, the numerical aperture, and the initial magnification. They are corrected for a tube length of 166.4mm. The magnification resulting from any combination of objective and eyepiece is always the product obtained by multiplying together the initial magnification of the objective and that of the eyepiece. The Spencer objectives, eyepieces, and condensers are designed to work together and, when used in proper combination, will give the finest results.

All Spencer Strain-Free Objectives listed are corrected for a cover glass thickness of 0.18mm.

Cat. No.	Equiv. Focus in mm.	Initial Magnification	Type	Numerical Aperture	Working Distance in mm.	Price
1270	48	2.2	dry	0.08	52.5	
1271	40	2.8	dry	0.08	35.2	
1272	32	4.0	dry	0.10	21.0	
1274	30.2	3.5	dry	0.09	24.1	
1275	25	5.1	dry	0.17	21.0	
1280*	16	10.0	dry	0.25	4.5	
1284	8	20.0	dry	0.50	1.44	
1287	4	44.0	dry	0.66	0.63	
1290	4	45.0	dry	0.85	0.20	
1291	3	60.0	dry	0.85	0.20	
1295	1.8	95.0	oil imm.	1.25	0.13	

*This objective is separable. When the front system is removed, the back system becomes a 32mm.

Cross Hair Eyepieces

Cross Hair Eyepieces for Spencer Polarizing Microscopes have focusing eye lenses. They are made in large diameter, 30.00mm., for microscopes having the large diameter eyepiece tube, as well as in standard diameter, 23.22mm. An adapter is listed to fit the large diameter eyepiece tubes so that standard diameter eyepieces may be used.

Cat. No.	Description	Price
447	Cross Hair Eyepiece, 6X standard size	
448	Cross Hair Eyepiece, 8X standard size	
449	Cross Hair Eyepiece, 10X standard size	
451	Cross Hair Eyepiece, 5X large size.	
453	Cross Hair Eyepiece, 8X large size.	
454	Cross Hair Eyepiece, 10X large size.	
456	Cross Hair Eyepiece, 15X large size.	
457	Cross Hair Eyepiece, 20X large size.	
550	Adapter for standard size eyepieces in large eyepiece tubes	

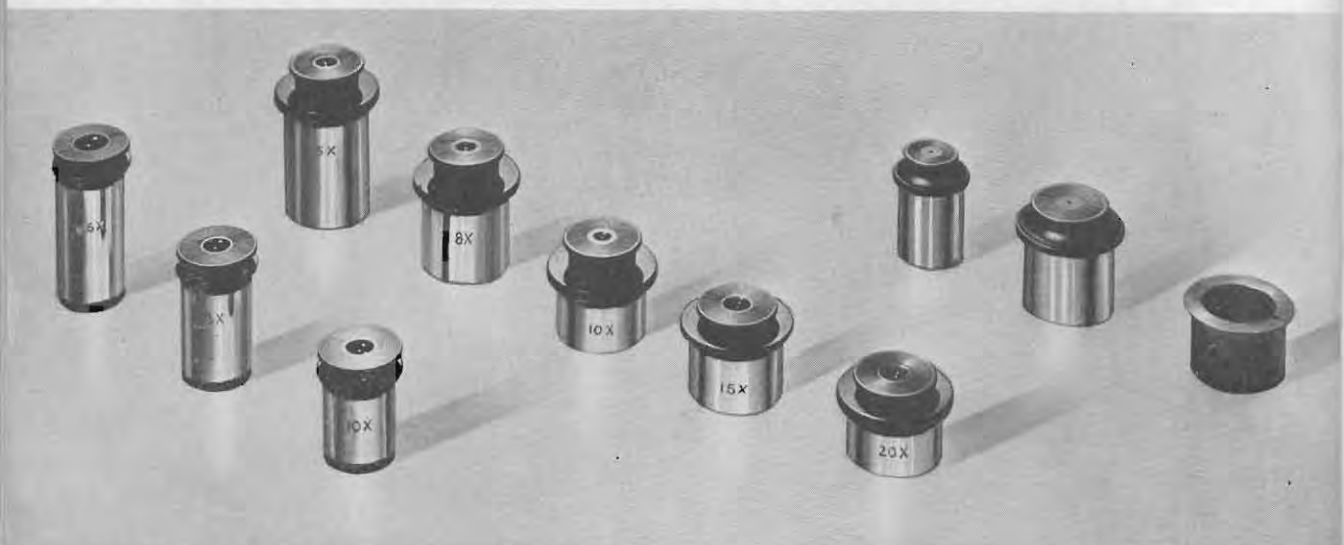
Pinhole Eyepieces

Cat. No.	Description	Price
546	Pinhole Eyepiece (standard diameter, 23.22mm.)	
547	Pinhole Eyepiece (large diameter, 30.00mm.)	

Nosepieces

Cat. No.	Description	Price
450	Double Revolving Nosepiece (non-centerable)	
455	Triple Revolving Nosepiece (non-centerable)	
460	Quadruple Revolving Nosepiece (non-centerable)	
462	Quick-Change Nosepiece	
463	Objective Centering Ring	

Eyepieces: left, standard diameter; center, large diameter; right, pinhole and No. 550 adapter



Substage Equipment

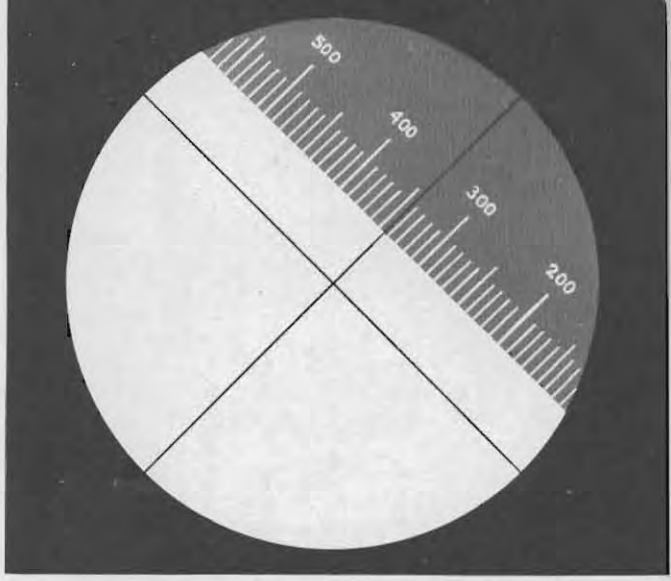
Substage equipment is described completely in the introductory material. The following chart shows the microscopes on which they may be used.

Substage Cat. No.	Microscope Cat. No.
528	37, 39
529	39, 40, 41
530	39, 40, 41
532	37, 39
533	42, 43

Cat. No.	Description	Price
528	Combined Condenser N.A. 1.30 with 15 millimeter Ahrens prism polarizer, Biological Style, with extra N.A. 1.0 top element and upper and lower iris diaphragms	
529	Combined Condenser N.A. 1.0 with 12 millimeter Ahrens prism polarizer, Biological Style	
530	Combined Condenser N.A. 1.0 with 12 millimeter Ahrens prism polarizer, Petrographical Style	
532	Combined Condenser N.A. 1.40 with 15 millimeter Ahrens prism polarizer, Petrographical Style, with an extra N.A. 1.0 top element and upper and lower iris diaphragm	
533	Combined Condenser N.A. 1.0 with Polaroid polarizer, Petrographical Style	
534	Upper Condenser Element N.A. 1.25 for use with Nos. 530 and 533 Condensers	
526	Iris Diaphragm mounted below polarizer (for Nos. 529 and 530)	

Graduated Quartz Wedge

The Graduated Quartz Wedge consists of three principal parts: a quartz wedge with a scale on the top surface mounted in a slide; a holder which clamps over the top of the body tube and contains the cross line disc and a Polaroid disc; and a special Ramsden eyepiece which may be focused on the scale and cross lines.



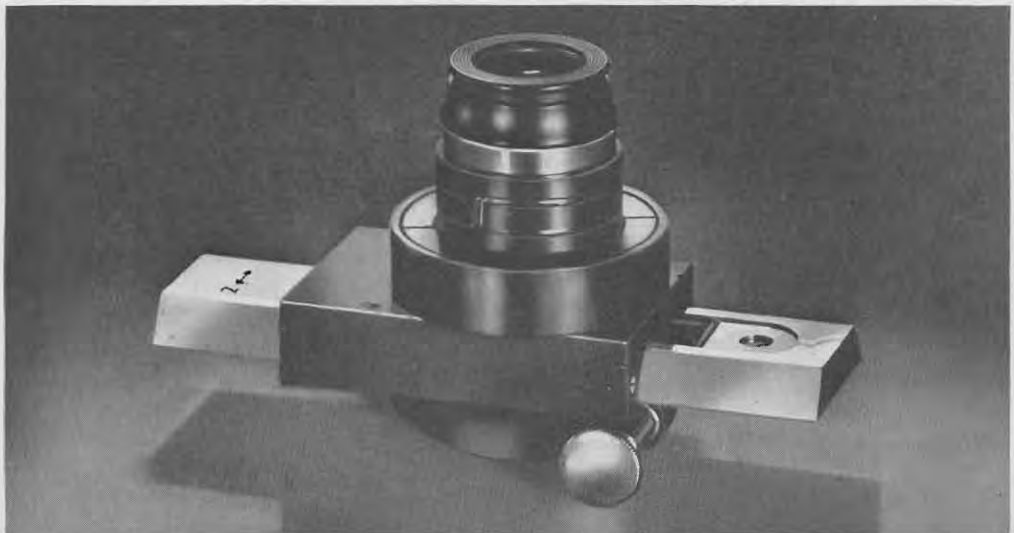
Appearance of field using graduated quartz wedge.

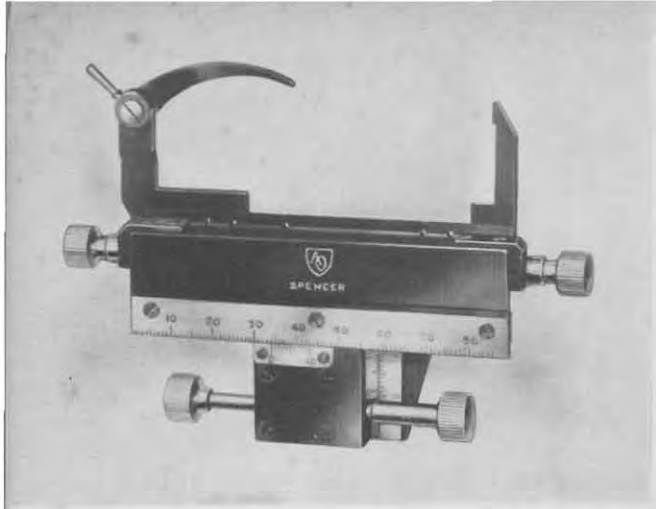
The graduations on the quartz wedge are from −500 to +2500mμ. with lines at 10mμ intervals. Estimates can be made to 2mμ. The lines and numerals are engraved through a semittansparent metalized surface. After the engraving, the metal is fused to the quartz so that the engraving is permanent.

The graduations appear bright on a semitransparent area at the edge of the field. This construction contributes materially to the comfort and ease of making accurate quantitative measurements of birefringence.

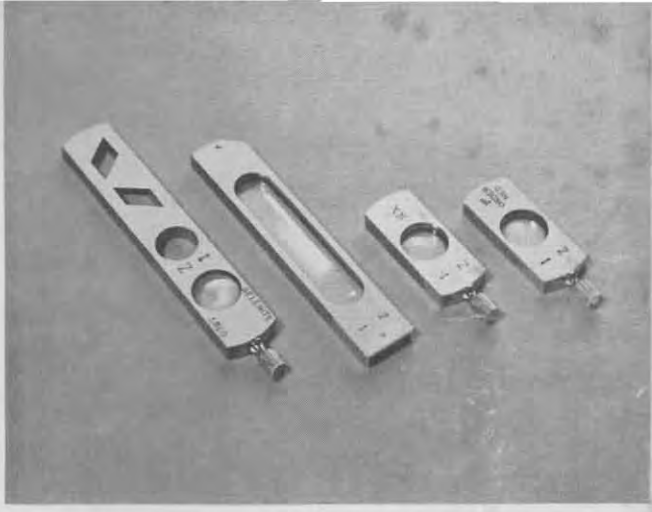
Cat. No.	Description	Price
555	Graduated Quartz Wedge complete as described above	

No. 555 Graduated Quartz Wedge.





No. 495 Mechanical Stage.



Compensators: left to right, Nos. 545, 542, 544, 540.

Mechanical Stage

All Spencer Polarizing Microscope Stages are drilled and tapped to take the Mechanical Stage No. 495. It is easily attached, revolves with the stage, and when removed, leaves a clean, even surface. This stage has a lateral excursion of 75mm. and a to-and-fro movement of 25mm. It is graduated in millimeters with verniers reading to 0.1mm. There are operating buttons on either side of the microscope, available for either hand.

Cat. No.	Description	Price
495	Mechanical Stage for Spencer Polarizing Microscopes. In leatherette case.....	

Compensators

Below are listed accessories for determining the nature of bitefringence. These are in metal mounts fitting the slot in the lower end of the body tubes of all Spencer Polarizing Microscopes. The mount is marked with an arrow to indicate the direction of the retarded or so-called slow ray.

Cat. No.	Description	Price
540	Full-Wave Plate, 1st. order red.....	
542	Quartz Wedge, I to III order.....	
544	Quarter-Wave Plate.....	
545	Becke Aperture Plate.....	

STOCKED AND DISTRIBUTED BY

CENTRAL SCIENTIFIC COMPANY

OF CALIFORNIA

Scientific CENCO Apparatus

SAN FRANCISCO BRANCH

16 Beale Street San Francisco 5, Cal.

New York Boston Chicago Newark San Francisco
Los Angeles Washington Toronto Montreal

American Optical

COMPANY

Scientific Instrument Division

Buffalo 15, New York

Branch Offices: New York, Chicago, San Francisco, Washington, Boston, Los Angeles, Dallas, Columbus, St. Louis, Philadelphia, Atlanta, Pittsburgh.

M75-1047

PRINTED IN U.S.A.