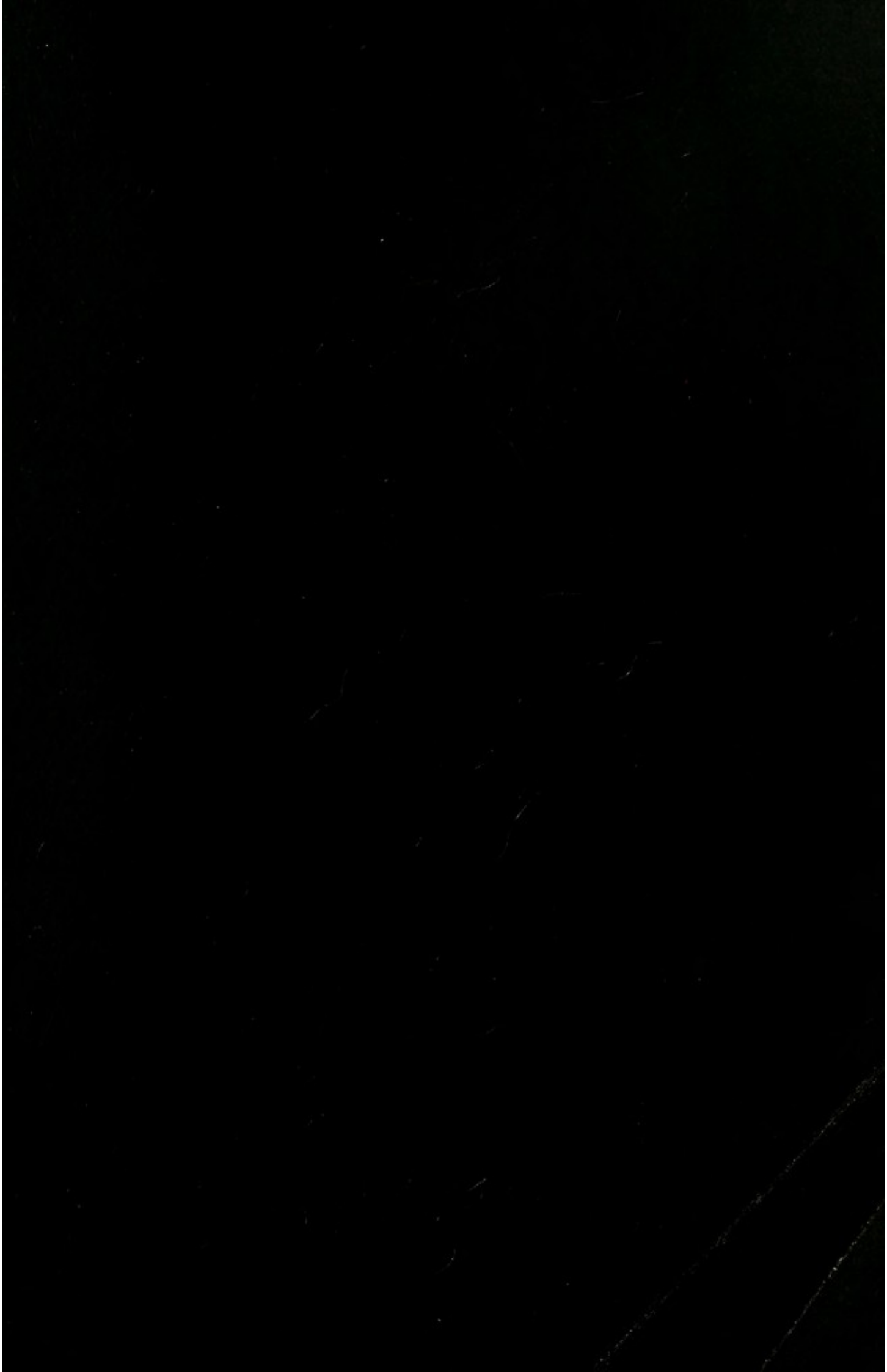
Microscopes and accessory apparatus / Ernst Leitz.

MICROSCOPES AND MICROSCOPICAL ACCESSORIES

ERNST LEITZ

WETZLAR



CATALOGUE No. 38.

Microscopes and Accessory Apparatus.

ERNST LEITZ

WETZLAR

GERMANY.

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BRANCH-OFFICES:

BERLIN NW.
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1899.

„Highest award“ Worlds Columbian Exhibition ***Chicago 1893.***

Contents.

Notice.

All previous editions of this catalogue are superceded by the present one, which should be exclusively used in ordering.

All prices are net, payable, without discount, at Wetzlar, Germany, or New York.

All orders will be filled within a week after their receipt.

In ordering care should be taken to give the ***number*** *of each article desired.*

Goods are forwarded at the expense and risk of the purchaser.

Our instruments for use in ***Universities, Colleges, Schools*** *&c. of the* ***United States*** *are by law free of duty and we shall be pleased to make specially low quotations for such orders.*

Ernst Leitz.

Preface.

In this edition of our catalogue more descriptive text will be found and a larger number of illustrations representing the accessory apparatus.

We shall be glad to lend the electrotypes of the illustrations to authors desiring to make use of them in their works.

It will perhaps be well to make brief mention of the most important additions to the present catalogue.

As the result of long and exhaustive calculations we have constructed a series of *photographic objectives,* the manufacture of which has become a special branch of our firm. These objectives are characterized by an excellent definition, very high resolving power and great light transmission.*) Photographic objectives of short focal distance find employment in photomicrography.

A *revolving eye-piece* (see p. 15) has been devised which serves to quickly change the ocular powers without removal of the ocular from the microscope tube after it is once adjusted. By inserting a micrometer scale this ocular serves as a micrometer eye-piece one adjustment of the scale is sufficient for all the combinations.

A new large *stand after Dölken* has been added distinguished by an unusually large stage (see p. 46) but othervise not essentially different from our other microscopes.

Two *travelling microscopes* have been introduced, of different sizes, which fit conveniently in small cases. Both can be used for bacteriological examinations.

*) A special catalogue of photographic objectives will be published.

A *binocular stereoscopic microscope* (p. 63) affords beautiful stereoscopic pictures of suitable objects.

The *sliding microtomes* (p. 83) have been much improved by the addition of arrangements for automatically raising the specimen and for moving the knife carrier by a wheel and chain device.

A *large projection apparatus* to be used with electric arc light permits the direct projection of pictures of objects obtained by all powers of the microscope including the oil immersion lenses. It is also available for the projection of lantern slide pictures, a special projection lens of 300 mm focal distance having been prepared for this purpose (see p. 79).

We would also call attention to

The *Horizontal Microscope* (p. 49).

The *Demonstration Lens-holder* (p. 61).

The *large Edinger Apparatus* for plates 24×30 cm (p. 77).

The arrangement of the photomicrographic apparatus to permit the photographing of opaque objects (pp. 75×78).

The *Erecting Eye-piece*, erects the image and thus assisting stage dissections, »fishing«, etc.

In the manufacture of these new articles neither time nor pains have been spared to make them as perfect as possible and all instruments and lenses have been subjected to the most careful tests.

Ernst Leitz.

In presenting to our patrons this fourth edition of our English catalogue we would call their attention to the fact, that we have now manufactured **50,000 microscopes** and **20,000 oil-immersion lenses.** These are distributed over the whole civilized world, wherever scientific investigation is being carried on, and the report which reaches us from all quarters is that they yield most excellent satisfaction in every particular. As far as the United States is concerned, the establishment of our **branch in New York** has been productive of the most gratifying results, materially facilitating the importation of our goods for educational institutions, laboratories, hospitals, etc. and enabling us to make any repairs or alterations which may be desired with a minimum loss of time and at greatly diminished expense for transportation.

This cordial reception is the more significant and gratifying since in competing with instruments of American manufacture we have been forced to contend with a very high import duty. But notwithstanding this, the solidity and convenient size and arrangement of our stands and the unsurpassed excellence of our objectives have obtained for our instruments the general acceptance above referred to.

The management of our New York house is still in the hands of Mr. WILLIAM KRAFFT, who is thoroughly acquainted with every detail of the construction of our instruments. Duplicate parts of all instruments of our manufacture are kept constantly in stock, and every facility is at hand for as careful and accurate workmanship as at Wetzlar.

We would also announce that **Mr. KRAFFT is our Sole Agent for the United States,** and that we can fill no orders, which are not transmitted to us through him.

As heretofore, microscopes, bacteriological apparatus and all other scientific instruments expressly imported for use in educational institutions are exempt from duty.

Catalogues may be had on application.

Address:

WILLIAM KRAFFT

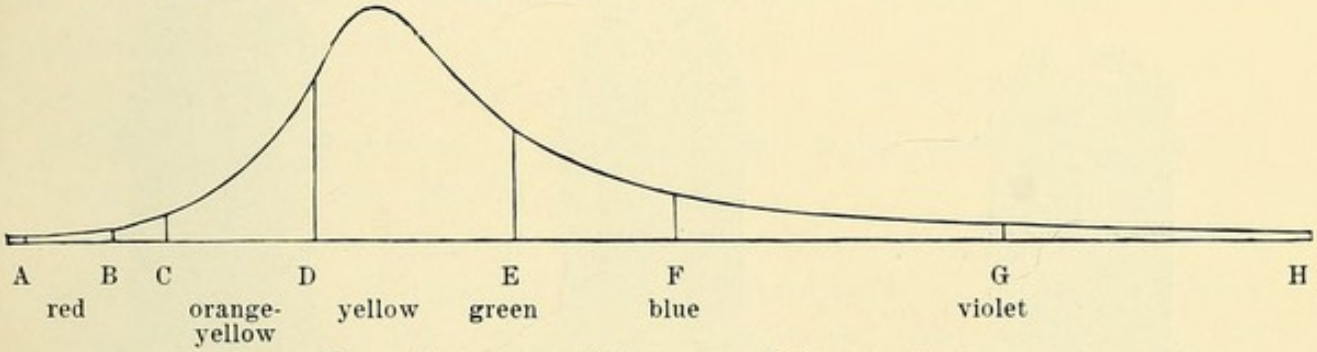
411 West 59th Street

NEW YORK CITY.

Objectives and Eye-pieces.

In the manufacture of our objectives only such glass is employed as has been subjected to the most rigid scientific tests. By these the exact index of refraction and the exact degree of dispersion of the glass are determined, and with these data available it is possible to very perfectly correct both spherical and chromatic aberrations while still making use of wide angular apertures in the objectives.

The following curve shows the brightness of the various parts of the spectrum, and it will be noted that the greatest light intensity is in the yellow near the line D.



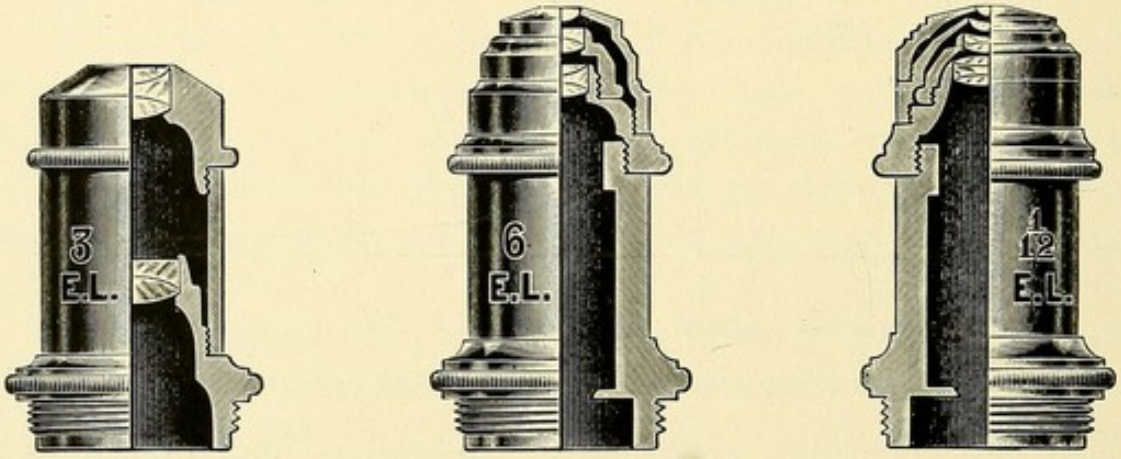
Intensity curve of the rays of the spectrum.

In the correction of spherical aberration, our objectives are corrected for light coming from the yellow-green portion of the spectrum, thus insuring correction for the light of greatest intensity; and, similarly, in correcting chromatic aberration, three different corrections are made, for light from parts of the spectrum, represented by the lines C, D and F. When these various corrections are combined the resultant is an objective transmitting a maximum of light and still of the most perfect achromatism.

We would also direct attention to the fact that every objective before leaving our hands, is subjected to the most careful test and that only such objectives as are of the highest grade are sent out. We can therefore assure our patrons that our objectives are all of equal and excellent quality.

For the past twelve years we have used exclusively glass manufactured by Schott & Co. of Jena. This glass has many points to recommend it for the construction of optical instruments, and has

gradually come into very general use for such purposes. We believe it to be the best glass now to be had for the manufacture of microscope lenses. The difficulty at first experienced resulting from deterioration of the glass and which for a time prejudiced microscopists against the Jena glass, has been entirely overcome in our objectives by careful selection of the glass, no glass beeing used which has not been thoroughly tested as to its durability. In consequence we have for many years had no trouble due to clouding of the glass in our objectives. That we have confidence in these representations is shown by the fact that we fully guarantee all our objectives, and will gladly repair any defect in them which may develop at any time, provided only that it has not arisen as the result of abuse.



The three illustrations given above afford an idea of the plan of construction of our achromatic objectives.

The first figure represents the plan of our law power objectives, and it will be noted that they consist of two doublets, each carefully corrected.

The central figure represents the plan of our high power dry objectives. A hemispherical front lens is combined with two doublets. The front lens is the chief magnifier of the combination, while the other lenses serve to correct the various aberrations.

The oil-immersion, represented by the last figure, consists of a front lens, hemispherical, behind which is a meniscus, which is in turn followed by a doublet and a triplet, these latter acting as the correcting lenses of the combination.

We manufacture both **Achromatic** and **Apochromatic objectives.** They differ in that the glasses made use of in the apochromatics

and the manner in which they are combined permit a more perfect correction of chromatic aberration. This advantage is not gained without a certain sacrifice of simplicity in construction, as the result of which the apochromatic is in consequence somewhat more liable to suffer from careless handling and from atmospheric changes than is the more simple achromatic.

As regards sharpness of definition and brightness of field there is little choice between the two classes of objectives of the same magnification. The apochromatics as a matter of fact do resolve the fines markings of test objects (butterfly scales and diatomes) somewhat more clearly than the achromatics, but the difference is slight and in ordinary stained microscope preparations is hardly detectable.

The correction of both achromatics and apochromatics is complete. The ordinary Huyghenian eye-pieces are consequently well adapted for use with the objectives of either construction. Only with the highest powers is it desirable to make use of the so-called "compensation" eye-pieces.

The achromatics and Huyghenian eye-pieces are also well adapted to the requirements of photomicrography, special objectives being unnecessary for this purpose. This statement is substantialed by the excellence of the results obtained by the use of our achromatic objectives, a sample of which may be seen in the photomicrographs which accompany our brochure on Photomicrography — "Anleitung zur Mikophotographie, mit vier Mikrophotogrammen" — which we shall be glad to send to any one who may be interested.

In making use of the higher power objectives — from No. 5 on — it should be remembered, that the lenses are corrected for cover glasses of 0,17 mm in thickness and for a microscope tube-length of 170 mm. When using the oil-immersion objectives it is particularly desirable, that this exact tube length should be employed. With a view to facilitate the adjustment of the tube-length the draw tubes of all our larger stands are graduated in millimeters, the scale indicating the exact length of the microscope tube in any given position of the draw tube. In this connection it should be remembered, that the width of the collar of the nose-pieces is ten millimeters, and that consequently, when a nose-piece is attached

to the tube the reading of the draw tube scale should be 160 mm instead of 170 when the adjustment is proper.

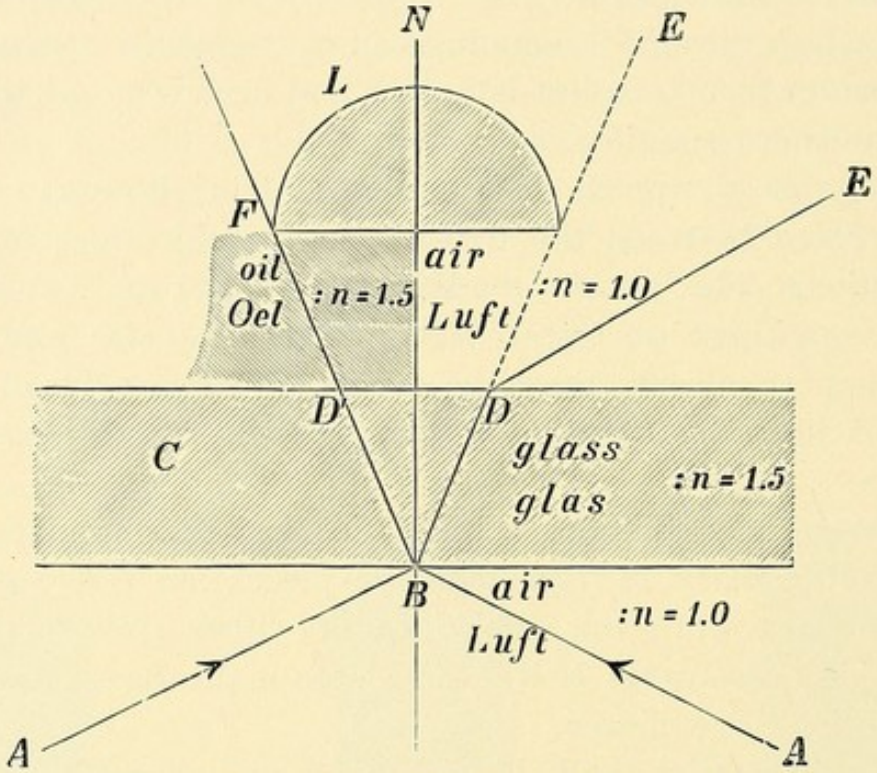


Figure comparative merits of the dry and immersion systems.

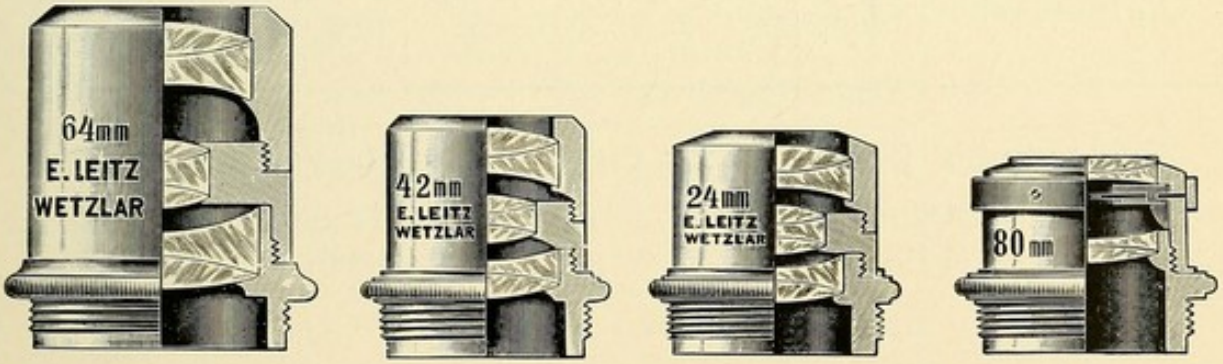
The above sketch may serve to make clear the advantages of the immersion objectives over those of the dry series. It is intended to represent diagrammatically a section through a cover-glass and the front lens of an objective, one half of the figure representing the conditions present in the case of the oil-immersion, the other those which are present in the dry objectives. It will be noticed that by the interposition of a drop of oil of the same index of refraction as the glass between the cover-glass and the objective the refraction which occurs in the dry system when the light leaves the upper surface of the cover-glass is done away with. Since this second refraction is attended with much loss of light it must be evident, that in the immersion system a much greater quantity of light enters the objective than is possible, other things being equal, in objectives of the dry system.

If we let u represent one half the angular aperture of an objective, represented in the diagram by $D'BN$ in the case of the immersion, and n the index of refraction of the medium interposed between the coverglass and the objective we have in the formula

n sin. u a mathematical expression of the optic power of the various systems of lenses, or in other words for what is designated the numerical aperture.

The following table gives the numerical apertures of objectives of the various systems and of various angular apertures. In the dry system $n.$, representing the index of refraction of air is taken as 1.00; in the immersion systems n equals 1.33 for water, 1.52 for cedar oil and 1.66 for monobromnaphthalin. A glance at the table will suffice to show the great advantage which the immersion objectives have over those of the dry series.

Angular aperture $2u$	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°
Numerical apertures.														
Dry series $n = 1.00$	0.09	0.18	0.26	0.34	0.42	0.50	0.57	0.64	0.71	0.77	0.82	0.87	0.91	0.94
Water-Immersion $n = 1.33$	0.12	0.24	0.35	0.46	0.56	0.66	0.76	0.85	0.94	1.02	1.09	1.15	1.20	1.25
Homogeneous Oil-immersion $n = 1.52$	0.14	0.26	0.40	0.52	0.64	0.76	0.87	0.98	1.07	1.16	1.24	1.32	1.38	1.43
Monobromide of Naphthaline-Immersion $n = 1.66$	0.15	0.29	0.43	0.57	0.70	0.83	0.95	1.07	1.17	1.27	1.36	1.44	1.50	1.56



The objectives designed for the Edinger apparatus of 64, 42 and 24 mm focal distance and the 80 mm Projection objective have been found to be very useful for a number of purposes and have come into great favor. In manufacturing these objectives we have made use of the principles involved in the construction of our new Photographic objectives, thereby gaining much in the size of the picture.

Achromatic Objectives.

No. of Objective		Focal length	Numerical Aperture (num.aper.)	Micrometer Values	Price $
Low power Dry Series	1*	44 mm ($1^3/_4$")	0.09	0.054 mm = 54 μ	**3.25.**
	1	44 mm ($1^3/_4$")	0.09	0.054 mm = 54 μ	**6.—.**
	2	30 mm ($1^1/_4$")	0.14	0.028 mm = 28 μ	**6.—.**
	3	18 mm ($^3/_4$")	0.28	0.015 mm = 15 μ	**6.—.**
	4	13 mm ($^1/_2$")	0.45	0.012 mm = 12 μ	**10.—.**
High power Dry Series	5	5.8 mm ($^1/_4$")	0.77	0.0048 mm = 4.8 μ	**10.—.**
	6	4.4 mm ($^1/_6$")	0.82	0.0034 mm = 3.4 μ	**12.—.**
	7	3.2 mm ($^1/_8$")	0.85	0.0026 mm = 2.6 μ	**12.—.**
	8	2.5 mm ($^1/_{10}$")	0.87	0.0020 mm = 2.0 μ	**16.—.**
	9	2.1 mm ($^1/_{12}$")	0.87	0.0017 mm = 1.7 μ	**24.—.**
Water-Immersion	10	2.2 mm ($^1/_{12}$")	1.10	0.0018 mm = 1.8 μ	**26.—.**
Homogeneous Oil-Immersion	$^1/_{10}$	2.5 mm ($^1/_{10}$")	1.30	0.0022 mm = 2.2 μ	**30.—.**
	$^1/_{12}$	2.1 mm ($^1/_{12}$")	1.30	0.0018 mm = 1.8 μ	**40.—.**
	$^1/_{16}$	1.7 mm ($^1/_{16}$")	1.30	0.0014 mm = 1.4 μ	**60.—.**

Photographic Objectives for the Edinger Projection Apparatus.

Focal Distance:	80 mm	64 mm	42 mm	24 mm
Price:	**$ 16.—.**	**$ 20.—.**	**$ 16.—.**	**$ 16.—.**

Huyghenian Eye-pieces.

Number	0	I	II	III	IV	V
Focal distance mm	50	40	35	30	25	20

Price of each Eye-piece: **$ 2.—.**

Magnification

of the Achromatic and Apochromatic Objectives in combination with the Huyghenian Eye-pieces.

Tube-length 170 mm. Distance of image 250 mm.

Objectives		Eye-pieces						Objectives
		0	I	II	III	IV	V	
Low Power Objectives	1*	15	20	24	28	34	43	Achromatics
	1	15	20	24	28	34	43	
	2	25	33	40	47	57	72	
	3	46	60	70	85	105	130	
	4	58	78	90	110	135	165	
High Power Objectives (Cover-glass thickness 0.17 mm)	5	150	190	235	280	345	420	
	6	210	275	330	390	480	595	
	7	270	370	440	525	625	770	
	8	360	490	570	650	800	990	
	9	430	560	670	770	960	1200	
Water-Immersion	10	395	515	615	720	860	1070	
Homogeneous Oil-Immersion	1/10	330	430	510	600	730	870	
	1/12	435	570	680	800	1000	1250	
	1/16	540	710	820	980	1220	1500	
Dry Lenses	16	56	67	90	102	116	159	Apochromatics
	8	86	110	138	158	186	250	
	4	220	260	310	350	430	540	
Oil-Immersion 2		420	510	620	700	820	1100	

Apochromatic Objectives.

Objectives		Focal length mm	Numerical Aperture	Micrometer Values	Price $
Dry Series	16	16	0.30	0.016 mm	**24.—.**
	8	8	0.65	0.008 mm	**32.—.**
	4	4	0.95	0.004 mm	**48.—.** with correction collar
Homogeneous Oil-Immersion	2	2	1.30	0.002 mm	**100.—.**

Compensation Eye-pieces

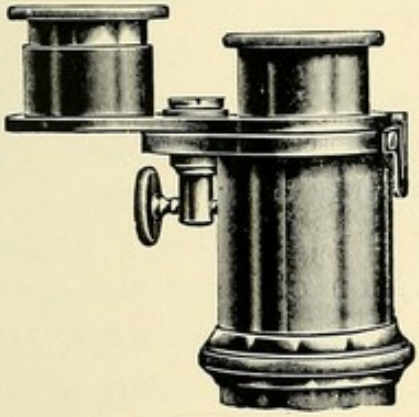
for Apochromatic Objectives.

Eye-pieces	4	6	8	12	18
Price . . . . . $	**6.50.**	**6.50.**	**10.—.**	**10.—.**	**8.—.**

Magnification

of the Apochromatic Objectives in combination with the Compensation Eye-pieces.

Objectives		Eye-pieces 4	6	8	12	18
Dry Series	16	62	93	125	187	280
	8	124	190	250	370	560
	4	250	375	500	750	1120
Oil-Immersion . .	2	500	750	1000	1500	2250



Double revolving Eye-piece.

Triple revolving Eye-piece.

Until very recently we have manufactured no arrangement for changing oculars on the microscope. This was due in part to the fact that there was no great demand for such an accessory and in part to the clumsiness of all those revolving eye-pieces which changed the entire ocular. The latter of these difficulties has been overcome in our present revolving eye-piece by such an adjustment of the collecting or lower lens of the eye-piece that it may remain permanently in position, the eye lens of the combination alone moving in the revolver. So accurati is the construction of the revolver and so carefully are the lenses adjusted that the eye-pieces may he changed while a specimen is in focus on the microscope stage without a readjustment of the focus.

The revolving eye-piece is also particularly well adapted to use as a micrometer ocular, for when the eye lens is turned aside a micrometer scale may be inserted and rests upon the diaphragm of the eye-piece. Once adjusted in this way the micrometer values are the same for all the eye lenses of the combination.

		$
Prices:	**Double revolving Eye-piece,** without eye lenses	**4.—.**
	Triple revolving Eye-piece, without eye lenses.	**6.—.**
	Each eye lens	**1.25.**
	Eye-piece Micrometer, No. 77	**2.—.**

Stands.

For the past twenty-five years division of labor has been employed to the utmost possible extent in the manufacture of our microscopes. This principle has been applied to our machinery as well as to our workmen, with the result that we have gradually accumulated a large plant of special machinery of the most accurate construction, each machine especially adapted to the manufacture of some particular part of our microscopes. By this development of mechanical appliances for microscope manufacture two ends have been attained: — The greatest accuracy and uniformity of construction of our microscopes has been made possible, while at the same time it has been possible to cheapen the cost of manufacture. Instruments which are the product of delicate machinery must always be more uniform, more accurate and should be less costly than those manufactured by hand.

In the following remarks we refer more particularly to the larger microscope stands of our manufacture and draw attention to those parts which should be present in every well equipped microscope.

The elements of these microscopes are:

1. **The foot and upright support with joint for inclination,**
2. **The stage,**
3. **The sub-stage, with condenser, iris diaphragm and mirror,**
4. **The body with the adjustments,**
5. **The tube, carrying eye-piece, nose-piece and objectives.**

1. The foot and upright support are solid and are of such weight and shape as to permit inclination of the body of the microscope to a horizontal position. The foot is horse-shoe shaped and is made to touch the table at three points, thus insuring stability even on a surface which is not entirely level. Inclination of the body of the microscope is permitted by a joint in the upright, which joint may be fastened in the larger stands by a set-screw operated by

a lever. Stands Ia and IIb are also made with the English foot. Abundant space is left under the stage for the various attachments of the sub-stage.

2. **The stage** of Stands I and Ia is round, revolving and centering. Stands Ib, IIa and IIb have square immovable stages. The centering arrangement consists of two small thumb-screws so situated at the sides of the stage as to controll motion of the stage in all directions, thus to a limited extent serving the purpose of a mechanical stage. The stage is pierced in the optical axis by an opening, through which the illuminating apparatus of the sub-stage projects to the level of its upper surface, and is as large as possible so as to permit the examination of large objects such as plate cultures of bacteria, etc.

3. **The sub-stage** carries a plane and concave mirror, the condenser and the diaphragm for regulating the illumination of the object.

The Condenser is so adjusted as to concentrate the rays of light about 2 mm above its surface, which is the average thickness of the microscopic slides under an angle equal to the angular aperture of the highest power objective, which is 120°.

In the lower power objectives the angular aperture is to be reduced by the iris diaphragm.

To focus the Condenser properly it is adjustable by rack and pinion movement on Stands I, Ia, Ib, and by side screw on Stands IIa and IIb.

4. **The body** of the microscope carries the tube and is fitted with two adjustments for focussing; a coarse adjustment and a fine adjustment. The smooth working of these adjustments is one of the chief requirements of a good microscope.

The coarse adjustment consists of rack and pinion and moves the tube of the microscope in a vertical groove with the least possible friction. The teeth of the rack and pinion are set obliquely to the axis of the tube and are so adjusted that two teeth of each are always interlocked, thus avoiding all possibility of slipping or loss of motion in the movement.

The fine adjustment consists of a micrometer screw which moves the tube and arm of the microscope supporting the coarse adjustment vertically upon a triangular column. This column is virtually a

continuation upward of the upright support of the base of the microscope. Around his column there is a broad collar so accurately adapted to the column that is moves smoothly upon it with a minimum of friction and still without lateral motion, the movement being controlled by means of a micrometer screw at the top of the column. The head of this micrometer screw, a section of which is shown in the accompanying figure, is milled and is graduated in such a way as to indicate the exact degree of motion of the microscope tube which is accomplished by turning the micrometer screw, each division of the graduation corresponding to a motion of the tube through $^1/_{100}$ millimeter, and a complete revolution of the screw corresponding to a motion of the tube through $^1/_2$ millimeter. The accuracy of this adjustment and the smoothness of its motion must be conceded to be a triumph of mechanical skill.

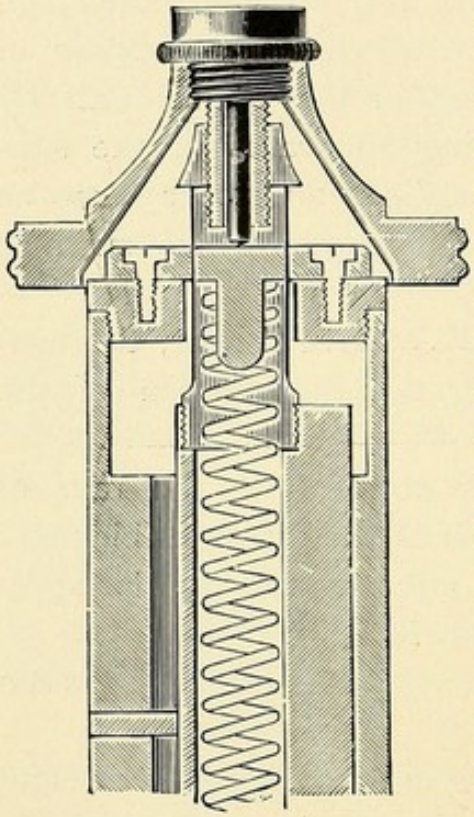


Figure of the Micrometer-screw of the fine adjustment.

5. **The tube** of the microscope enclosed a second tube, or draw-tube, which latter carries the eye-piece, and is so graduated as to indicate the exact length of tube in use at any time. The lower end of the tube is provided with a thread into which the various objectives or a nose-piece screw. For this purpose we make use of the broad English screw, the so-called "Society screw".

The nose-piece has now become an almost indispensable part of a working microscope. It can, however, be used to best advantage only on such stands as are provided with a coarse adjustment by rack and pinion. Aside from the advantage derived from the rapid changing of objectives, which it permits, it is so accurately made and centred as to materially facilitate the focussing of the various objectives. It is only necessary to focus with the fine adjustment to obtain a view of the same microscope field which had been under observation before the change was made.

As it is necessary for this purpose that the objectives should be accurately adjusted to the nose-piece it is very desirable that in ordering an instrument its nose-piece should be ordered at the same time if one is to be used, as subsequent ordering may necessitate the return of the stand and objectives to us.

Stands I, Ia, Ib, IIa and IIb are those which are best suited to fine microscopical investigations. Among them the physician and bacteriologist will find an instrument entirely suited to his particular needs.

Stand III is smaller and is without rack and pinion adjustment, being consequently less well adapted to the attachment of a nose-piece.

Stands IV and V are small instruments, which serve nevertheless many purposes where the more elaborate outfits are unnecessary. They make excellent laboratory stands for elementary courses in microscopy.

In **Stands III, IV and V** the coarse adjustment is by means of sliding tube instead of by rack and pinion. They are all provided with fine adjustment by micrometer screw.

Stand VI is provided with rack and pinion adjustment only, but has a large stage, and is particularly intended for searching for trichinae and for similar examinations where a very strong durable stand is desired and where the use of very high power objectives is unnecessary. It may also be useful as an auxiliary stand for purposes of demonstration in laboratories.

Stands III, IV, V, VI have no joint for inclining the body.

Stands I, Ia, Ib, IIa, IIb, III have mahogany cases provided with a nickelled handle, in which the microscopes stand.

Stands IV, V and VI are laid in mahogany boxes.

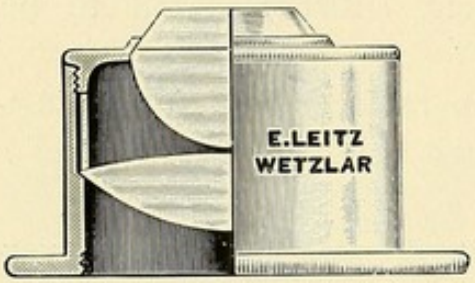
These cases are furnished with the microscopes without extra charge when a complete outfit, including oculars and objectives is purchased.

Object clamps and test objects accompany every microscope.

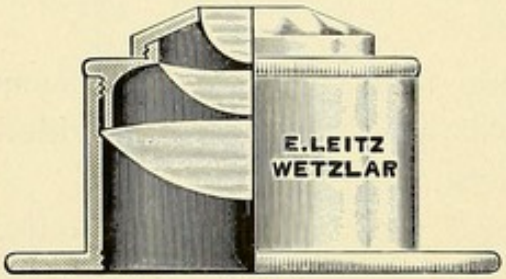
The objectives to Stands I, Ia, Ib, IIa, IIb and III are in brass boxes; those for Stands IV, V and VI are in leather cases.

Illuminating Apparatus.

In order to avoid the necessity of repeating the description of the illuminating apparatus with the description of each microscope outfit, it has seemed best to bring together here illustrations and descriptions of all our appliances for sub-stage illumination.



Condenser of 1.20 num. apert.



Condenser of 1.40 num. apert.

The condenser furnished with Stands I, Ia, Ib, IIa and IIb is as a rule the double combination of 1.20 num. apert. here figured. This condenser is sufficient for all ordinary purposes, but with the large polarization microscope we furnish the triple condenser, which has been found somewhat better adapted to use with convergent rays of light.

a. Illuminating Apparatus of Stand No. I.

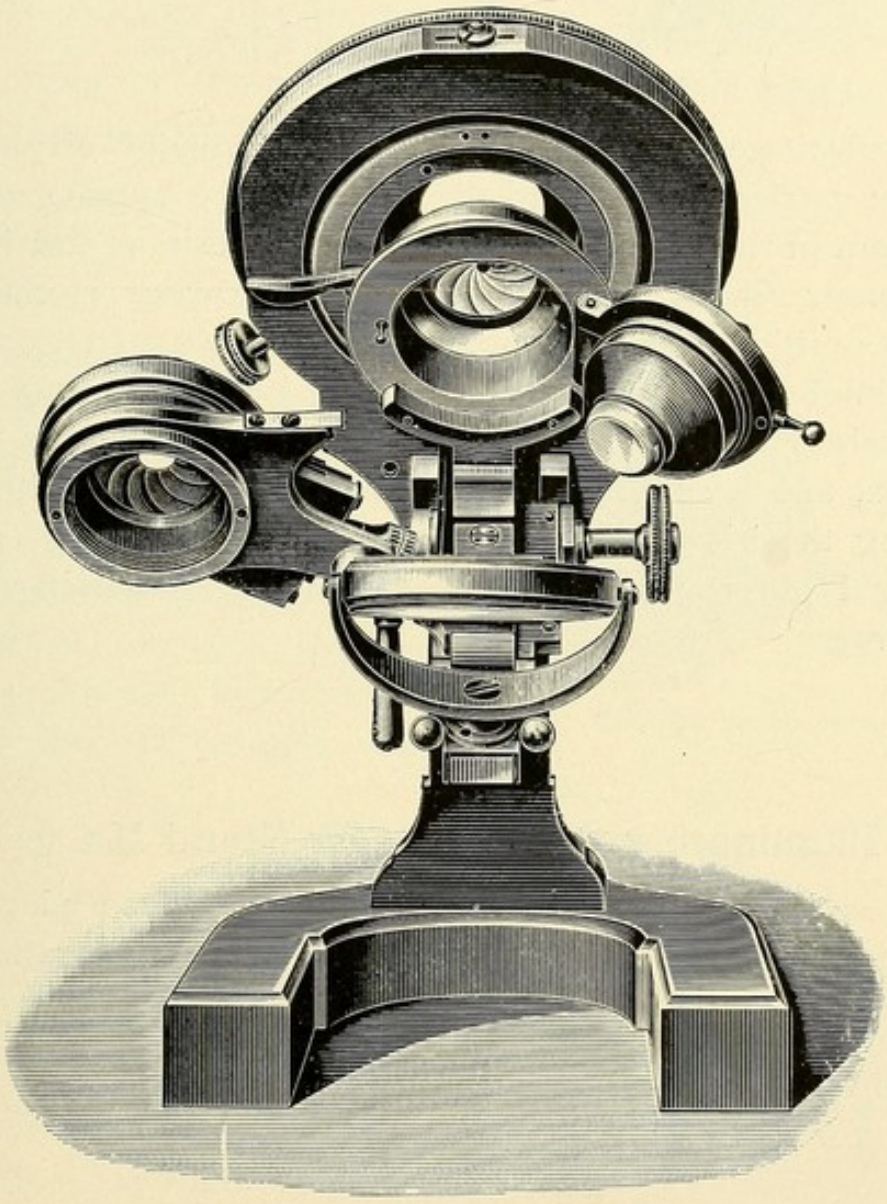
The apparatus includes the following parts:

Cylinder iris diaphragm.
Swing-out condenser.
Diaphragm carrier with iris diaphragm.
Plane and concave mirror.

The cylinder iris diaphragm comes into play when the condenser is swung out of position. To do this the diaphragm carrier is turned to the side as shown in the diagram, a small knob is pressed, which liberates the condenser, and the latter is swung out to the side.

The regulation of the cylinder iris diaphragm is accomplished by means of a lever. Before the condenser is swung back into position the cylinder iris should be opened to its fullest extent.

The lower iris diaphragm is for use in connection with the condenser only. It is regulated by means of a small knob. A horizontal rack and pinion arrangement permits oblique illumination, and a vertical rack and pinion permits adjustment of the whole substage. By these means a most perfect controll of the illumination



Abbe's Illuminating Apparatus for Stand I.
Swing-out Condenser.
Cylinder Iris Diaphragm.

of the object is assured. Ground or colored glass discs may be inserted above the iris diaphragm if modification of the light is desired.

This illuminating apparatus may also be fitted to Stands Ia and Ib.

b. Illuminating Apparatus of Stands Ia and Ib (p. 26).

The following are the parts of this apparatus:

Cylinder diaphragm with 3 stops of different apertures.
Condenser.
Diaphragm carrier with iris diaphragm.
Plane and concave mirror.

To substitute the condenser for the cylinder diaphragm the diaphragm carrier is turned to the side and the cylinder diaphragm is drawn out of the sleeve which holds it in position and into which the condenser readily fits. The diaphragm carrier is then turned back into position and the amount of light regulated by manipulating the knob controlling the size of the iris. The whole sub-stage may be raised or lowered in the optical axis by means of a rack and pinion, and a similar arrangement permits lateral illumination by moving the iris diaphragm in the horizontal plane.

Ground glass and colored plates may be inserted above the iris diaphragm.

c. Illuminating Apparatus for Stand IIa (p. 32).

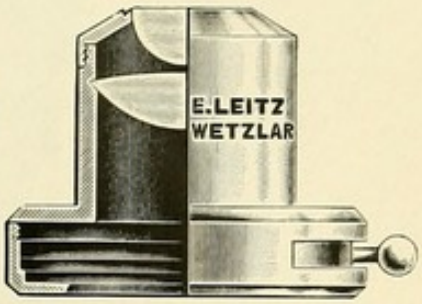
The condenser and iris diaphragm form one piece, giving central but no oblique illumination. The whole apparatus may be raised and lowered in the optical axis by means of a screw. The cylinder diaphragm may be inserted in place of the condenser. A ring below the iris diaphragm permits the insertion of glass discs for the purpose of modifying the light.

d. Illuminating Apparatus for Stand IIb (p. 34).

The condenser and iris diaphragm are also in one-piece, fitting into a fixed collar in the stage of the microscope, thus permitting the substitution of the cylinder diaphragm. A ring under the iris diaphragm permits the insertion of glass discs to modify the light.

e. Small Illuminating Apparatus.

The small illuminating apparatus consists of a somewhat smaller condenser with iris diaphragm and can be adjusted to the Stands III and IV, when these stands have the ordinary cylinder diaphragm.

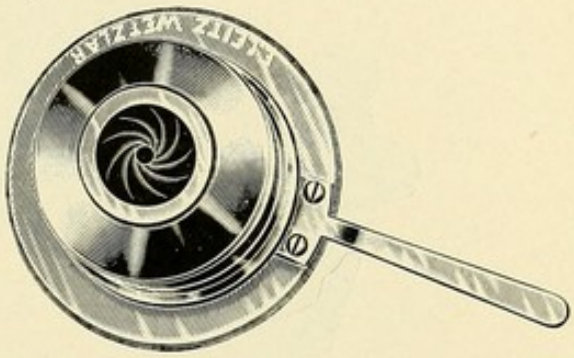


Small Illuminating Apparatus.

The prices of these various forms of illuminating apparatus are as follows:

	a	b	c	d	e
$	30.—.	24.—.	12.—.	10.—.	8.—.

A cylinder iris diaphragm can be furnished in place of the ordinary cylinder diaphragm of Stands IIa and IIb at an additional cost of $ 4.—, and a similar iris diaphragm can be fitted to the ordinary cylinder diaphragms of the smaller microscopes for the same price. All that is necessary is to send the old cylinder diaphragm.


Cylinder iris diaphragm.

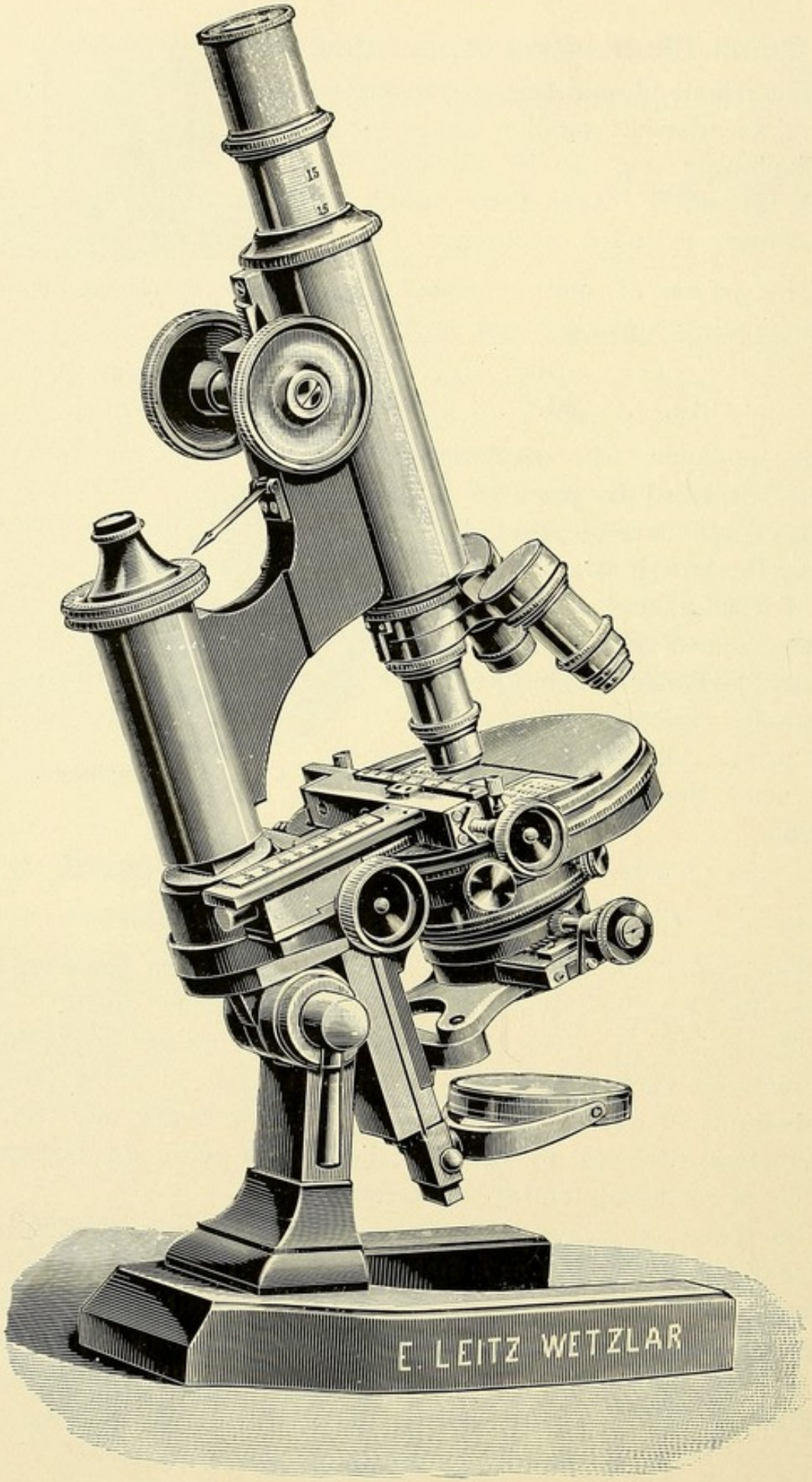
Complete Microscope Outfits.

The outfits comprised in the following pages are made up with achromatic objectives, which suffice for all ordinary needs.

These lists are given for the aid of those intending purchasers who, without such experience as enables them to know the best combinations of eye-pieces and objectives for every day use, are nevertheless desirous to provide themselves with an instrument capable of rendering entire satisfaction.

To those of larger experience and desirous to select other combinations, we would say that we are glad to supply any outfit which may be preferred. The price of each outfit may be readily computed by adding together the cost of its various items.

Microscope stands, without objectives, will not be sold separately.



Stand I.

Stand I.

No. $

1. **Large microscope,** inclinable, with hinged joint and clamping lever and fitted with round revolving centering stage. Coarse adjustment by rack and pinion, fine adjustment by micrometer-screw, the head of which is gratuated (each division = $^1/_{100}$ mm). Draw-tube with millimetre scale. Large illuminating apparatus with swing-out condenser and cylinder iris diaphragm. (Cf. p. 21, a).

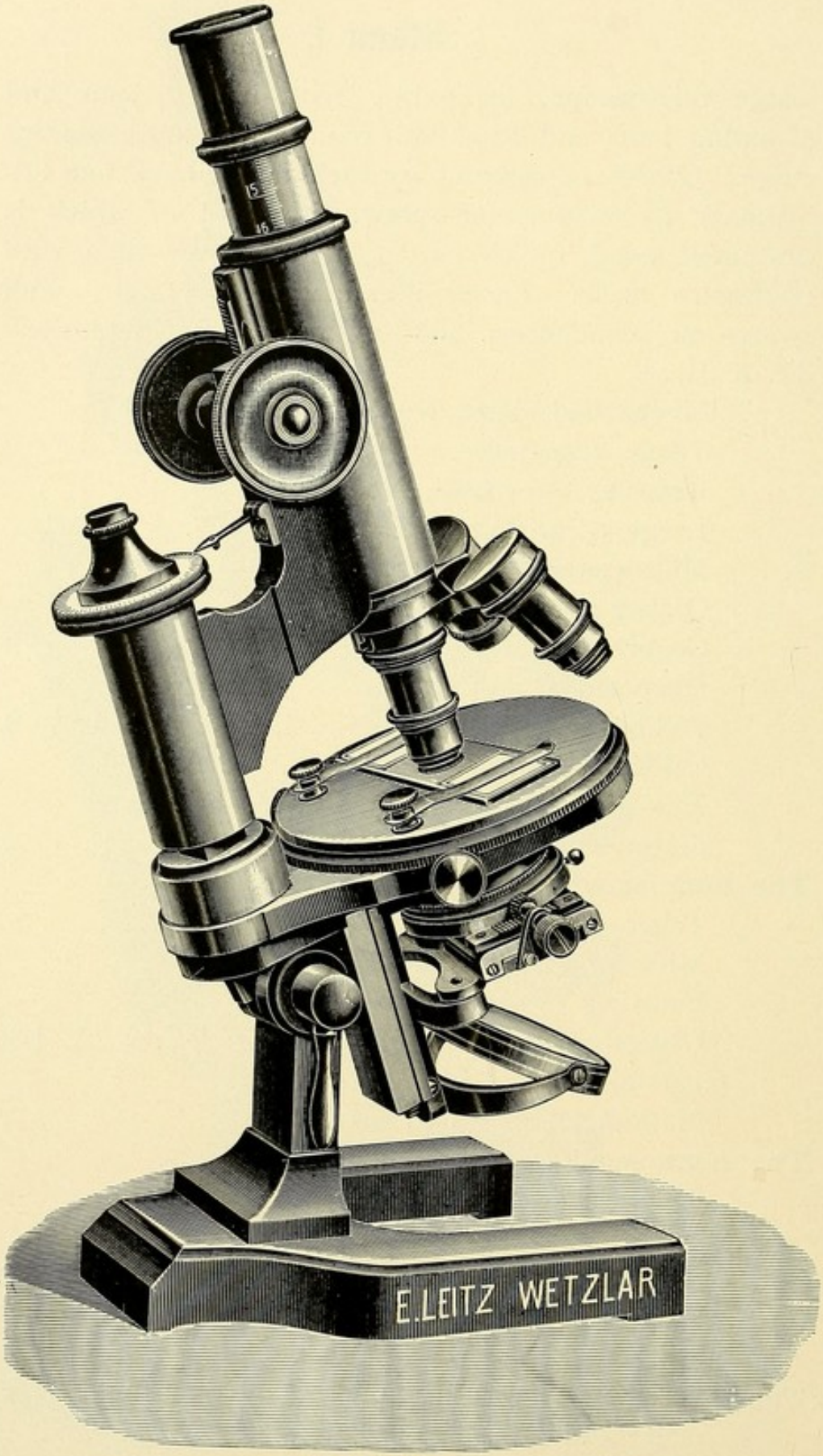
   Mechanical stage, No. 88.
   Triple nose-piece.
   Drawing eye-piece, No. 84.
   Large polarizing apparatus No. 126.
   Micrometer eye-piece, No. 75.
   Object micrometer, No. 79.
   Cover glass tester.
   Glass slides and covers.
   Achromatic objectives Nos. 1, 2, 3, 4, 5, 6, 7, 8.
   Oil-Immersions $^1/_{10}$, $^1/_{12}$, $^1/_{16}$. N. A. 1.30.
   Eye-pieces 0, I, II, III, IV, V.
   Magnifications 15—1500 . . . . . **400.—.**

2. **The same** stand and illuminating apparatus.
   Triple nose-piece.
   Micrometer eye-piece No. 75.
   Drawing eye-piece No. 84.
   Objectives 2, 4, 6, Oil-immersion $^1/_{12}$, N. A. 1.30.
   Eye-pieces I, III, IV, V.
   Magnifications 33—1250 . . . . . **202.—.**

3. **The same** stand and illuminating apparatus.
   Triple nose-piece.
   Micrometer eye-piece, No. 75.
   Objectives 1, 3, 6, Oil-immersion $^1/_{12}$. N. A. 1.30.
   Eye-pieces I, III, IV.
   Magnifications 20—1000 . . . . . **186.—.**

The stand and illuminating apparatus without objectives, oculars and nose-piece . . . . . **104.—.**

Regarding the adjustment of an ocular-revolver see p. 15.



Stand Ia.

Stand Ia.

No. $

4a. **Large Microscope,** of smaller size than Stand I, fitted with horseshoe foot. The stand is inclinable and fitted with revolving centering stage, coarse adjustment by rack and pinion, fine adjustment by micrometer screw with scale. Draw-tube with millimetre scale. Large Illuminating Apparatus (Cf. p. 22, b) with rack and pinion, and iris-diaphragm with oblique movement. The cylinder-diaphragm and condenser may be readily substituted for one another.

Triple nose-piece.
Objectives 2, 4, 6, Oil-immersion $^1/_{12}$, N. A. 1.30.
Eye-pieces I, III, IV, V.
Magnifications 33—1250 . . . . . **160.—.**

4b. **The same** with Illuminating Apparatus.

Triple nose-piece.
Objectives 3, 6, Oil-immersion $^1/_{12}$, N. A. 1.30.
Eye-pieces I, III, IV.
Magnifications 60—1000 . . . . . **148.—.**

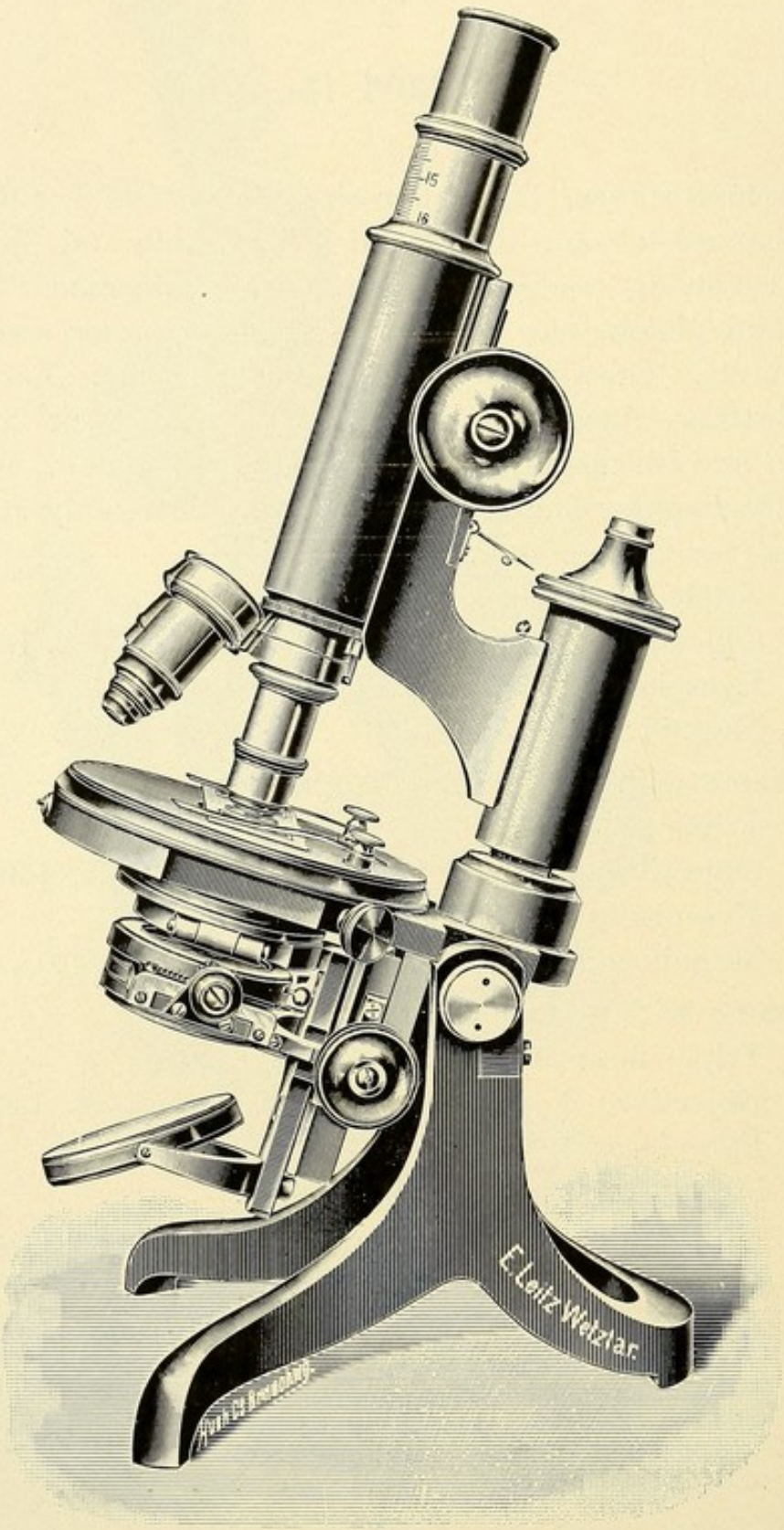
4c. **The same** with Illuminating Apparatus.

Triple nose-piece.
Objectives 3, 6, Oil-immersion $^1/_{10}$, N. A. 1.30.
Eye-pieces II and IV.
Magnifications 70—730. . . . . **136.—.**

Stand with Illuminating Apparatus, but without objectives, eye-pieces and nose-piece . . . . . **76.—.**

The same with Illuminating Apparatus, Swing-out Condenser and Cylinder Iris-diaphragm (p. 21, a) . **82.—.**

Mechanical stage No. 88 can be fitted to this stand; price . . . . . **28.—.**



Stand Ia
with English foot.

Stand Ia

with English Foot.

No. $

4d. **Large Microscope** differing from the foregoing (Ia) stand only in being provided with an English foot, which makes the stand somewhat steadier and lighter. The prices and combinations are otherwise the same.

Dr. P. G. Unna of Hamburg uses this microscope in his laboratory.

The stage revolves and centres. The illuminating apparatus is that described on p. 22, b.

Triple nose-piece.
Objectives 2, 4, 6, Oil-immersion $^1/_{12}$, N. A. 1.30.
Eye-pieces I, III, IV, V.
Magnifications 33—1250 . . . . . **160.—.**

4e. **The same** with the illuminating apparatus.

Triple nose-piece.
Objectives 3, 6, Oil-immersion $^1/_{12}$, N. A. 1.30.
Eye-pieces I, III, IV.
Magnifications 60—1000 . . . . . **148.—.**

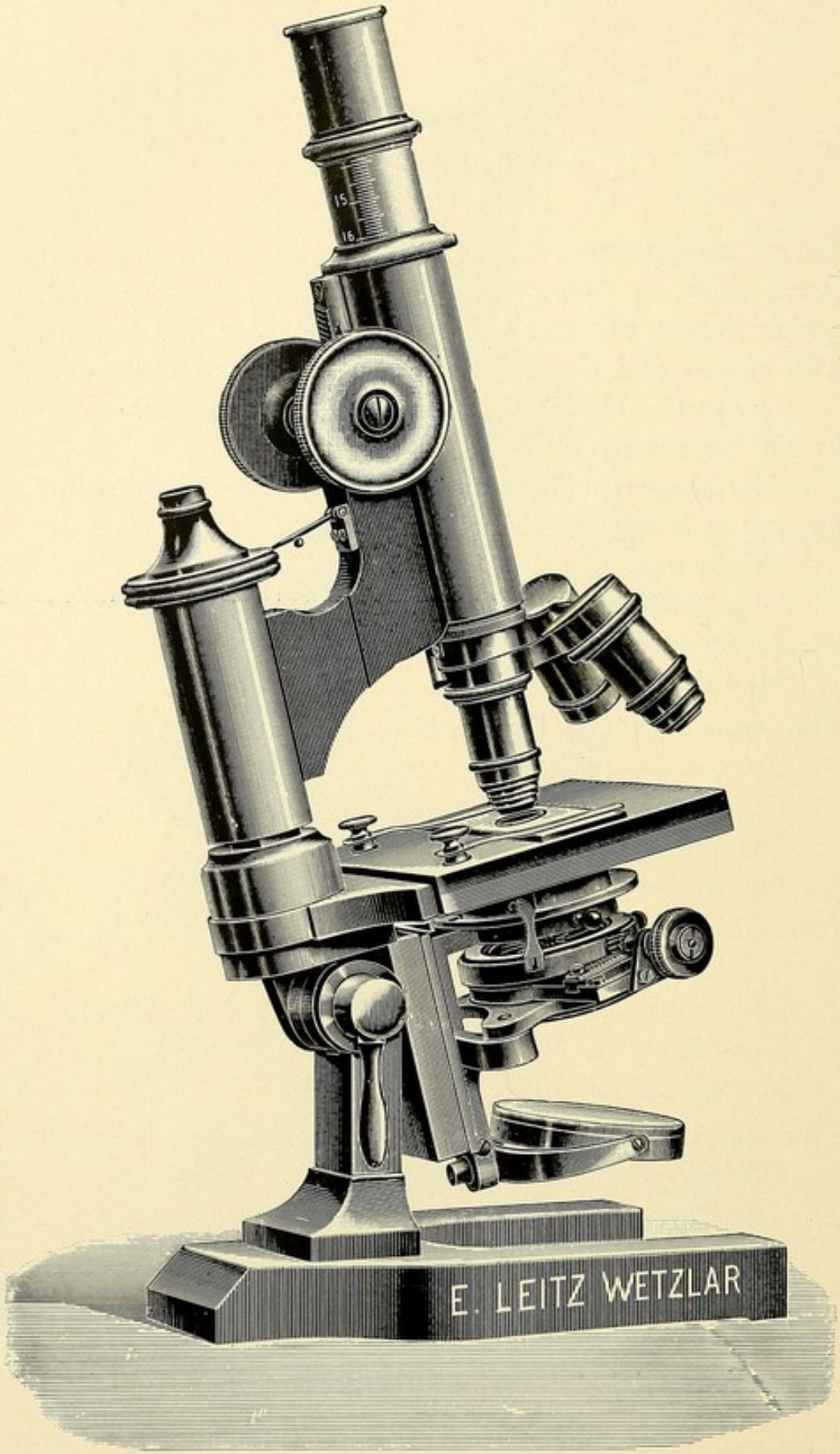
4f. **The same** with illuminating apparatus.

Triple nose-piece.
Objectives 3, 6, Oil-immersion $^1/_{10}$, N. A. 1.30.
Eye-pieces II, IV.
Magnifications 70—730. . . . . **136.—.**

The stand with illuminating apparatus, but without objectives, oculars and nose-piece . . . . . **76.—.**

The stand with swing-out condenser (p. 21, a) . . . **82.—.**

Mechanical stage No. 88 can be fitted to this stand; price . . . . . **28.—.**



Stand Ib.

Stand Ib.

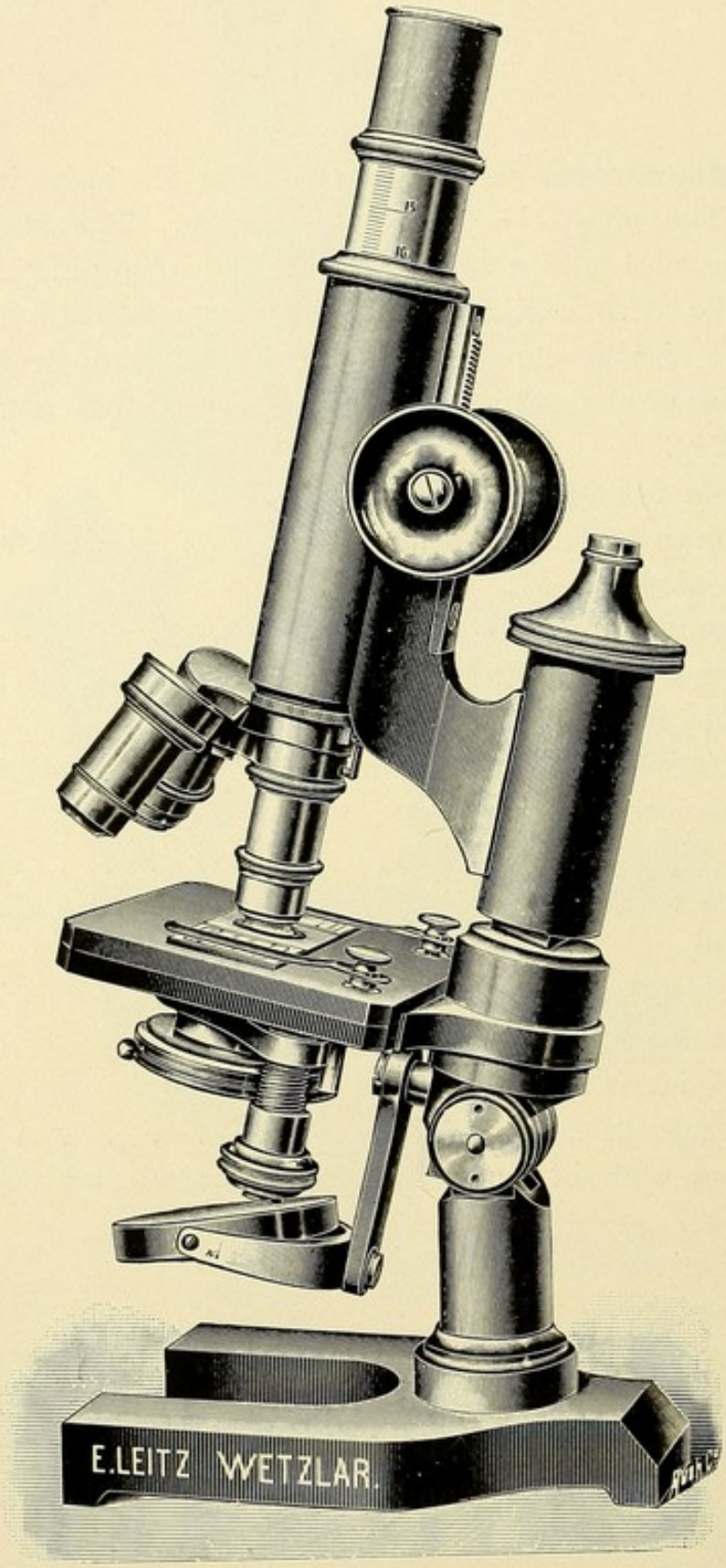
No. §

5. **Large Microscope,** which differs from Ia only in the stage. The stage is fixed and square. The stand is inclinable and has a hinged joint and clamping lever. Draw-tube with millimetre scale. Coarse adjustment by rack and pinion, fine adjustment by micrometer screw with graduated head. Illuminating Apparatus, same as Ia (p. 22, b).
   Triple nose-piece.
   Objectives 3, 6, Oil-immersion $^1/_{12}$, N. A. 1.30.
   Eye-pieces I, III, IV.
   Magnifications 60—1000 . . . . . **142.—.**
6. **The same** with simplified Illuminating Apparatus (p. 22, c).
   Triple nose-piece.
   Objectives 3, 6, Oil-immersion $^1/_{10}$, N. A. 1.30.
   Eye-pieces I, III, IV.
   Magnifications 60—730. . . . . **120.—.**
7. **The same** without Illuminating Apparatus, with Cylinder-diaphragm.
   Double nose-piece.
   Objectives 3, 7.
   Eye-pieces I, III.
   Magnifications 60—525. . . . . **74.—.**
8. **The same** without Illuminating Apparatus and without nose-piece.
   Objectives 3, 7.
   Eye-pieces I, III.
   Magnifications 60—525. . . . . **68.—.**

Stand without objectives and eye-pieces, without illuminating apparatus and without nose-piece . . . . **46.—.**

Stand without objectives and eye-pieces, with illuminating apparatus, without nose-piece . . . . . **70.—.**

The same with illuminating apparatus, with swing-out condenser and cylinder iris-diaphragm (p. 21, a) . **76.—.**



Stand IIa.

Stand IIa.

No. §

9. **Medium Size Microscope,** inclinable, coarse adjustment by rack and pinion, fine adjustment by micrometer-screw. Draw-tube with millimetre scale. Illuminating apparatus and iris-diaphragm with lateral screw for raising and lowering. A ring under the iris diaphragm serves to hold a ground glass or colored disc. The illuminating apparatus and cylinder diaphragm are easily interchangeable.
   Triple nose-piece.
   Objectives 3, 6, Oil-immersion $^1/_{12}$, N. A. 1.30.
   Eye-pieces I, III, IV.
   Magnifications 60—1000 . . . . . **120.—.**

10. **The same** with Illuminating Apparatus.
   Triple nose-piece.
   Objectives 3, 6, Oil-immersion $^1/_{10}$, N. A. 1.30.
   Eye-pieces II, IV.
   Magnifications 70—730 . . . . . **108.—.**

11. **The same** without Illuminating Apparatus.
   Triple nose-piece.
   Objectives 3, 6, 8.
   Eye-pieces I, III.
   Magnifications 50—650 . . . . . **82.—.**

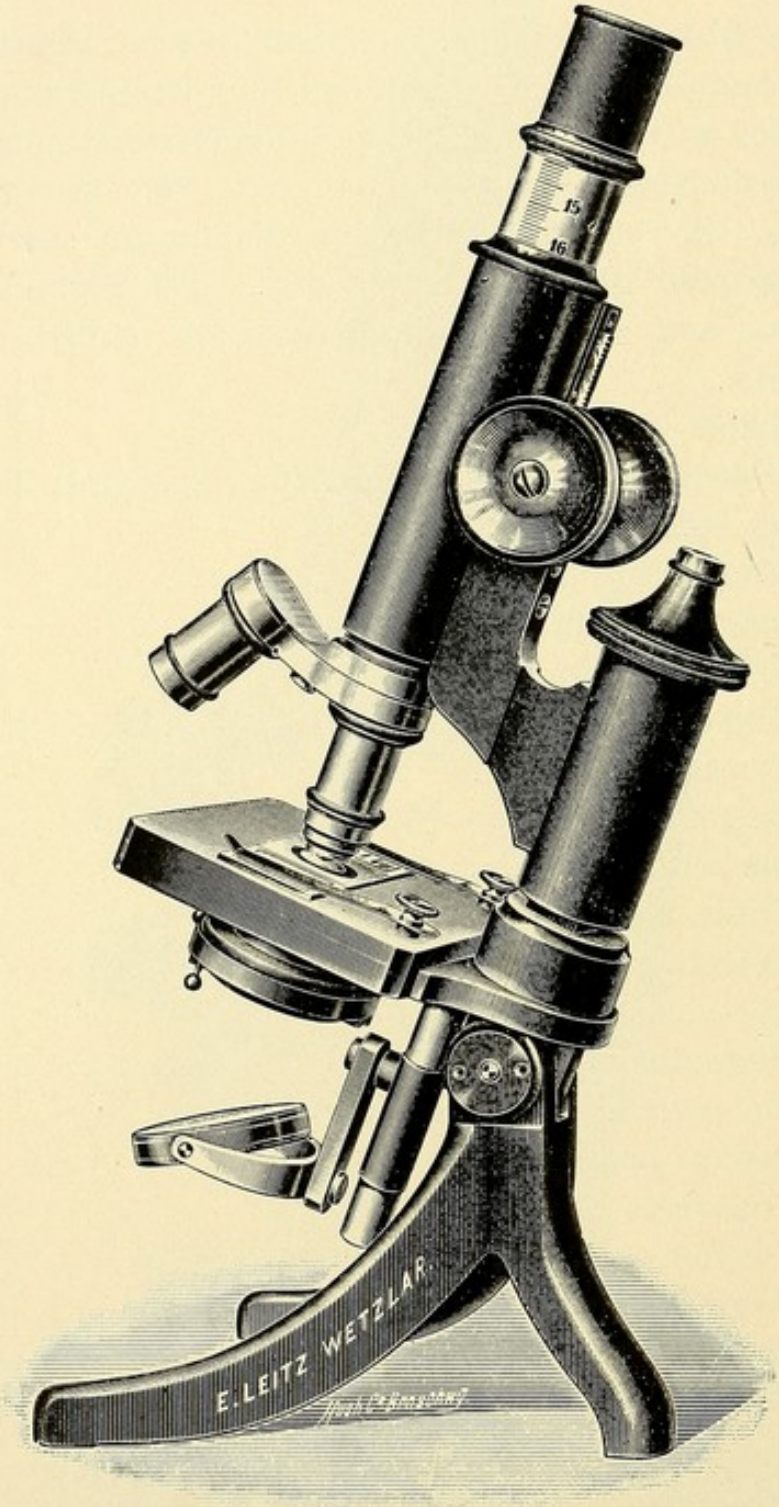
12. **The same** without Illuminating Apparatus.
   Double nose-piece.
   Objectives 3, 7.
   Eye-pieces I, III.
   Magnifications 60—525 . . . . . **64.—.**

13. **The same** without Illuminating Apparatus and nose-piece.
   Objectives 3, 7.
   Eye-pieces I, III.
   Magnifications 60—525 . . . . . **58.—.**

Stand with Illuminating Apparatus and Iris-diaphragm, without objectives, eye-pieces and nose-piece . . . **48.—.**

The same stand with Cylinder Diaphragm . . . . . **36.—.**

Cylinder iris-diaphragm (Cf. p. 23) . . . . . **4.—.**



Stand IIb.

Stand IIb.

No. $

14 a. **Medium Size Microscope,** stand inclinable to the extent of 45°, tripod foot, coarse adjustment by rack and pinion, fine adjustment by micrometer screw. Draw-tube with millimetre scale. Illuminating Apparatus and Iris-diaphragm permanently connected and sliding in a sleeve underneath the stage. The cylinder-diaphragm is used in the same manner. A ring below the iris-diaphragm serves to hold aground glass or colored disc

Triple nose-piece.
Objectives 3, 6, Oil-immersion $^1/_{12}$, N. A. 130.
Eye-pieces I, III, IV.
Magnifications 60—730 . . . . . **104.—.**

14 b. **The same** with Illuminating Apparatus.

Double nose-piece.
Objectives 3, 6, 8.
Eye-pieces II, IV.
Magnifications 70—480 . . . . . **78.—.**

15 a. **The same** without Illuminating Apparatus.

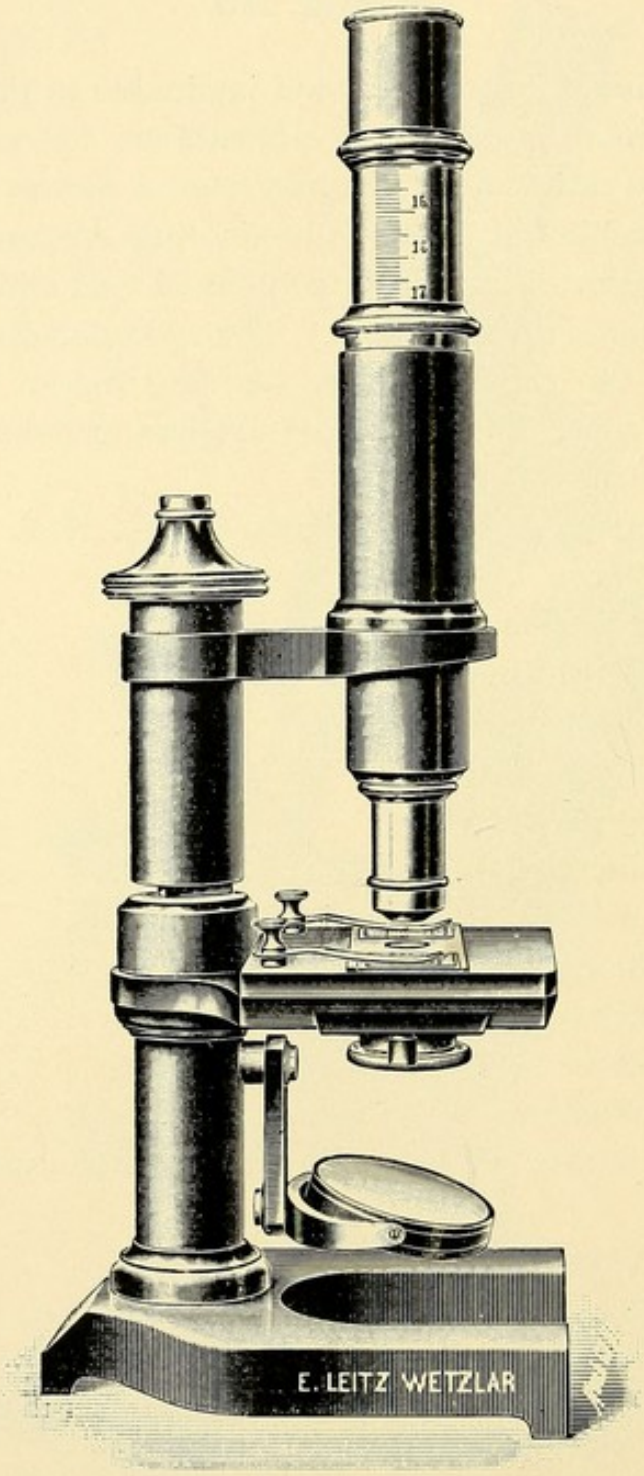
Double nose-piece.
Objectives 3, 7.
Eye-pieces I, III.
Magnifications 60—525 . . . . . **50.—.**

15 b. **The same** without Illuminating Apparatus and nose-piece.

Objectives 3, 7.
Eye-piece III.
Magnifications 85—525 . . . . . **42.—.**

Stand with Illuminating Apparatus and Iris-diaphragm **32.—.**
Stand with Cylinder or Wheel-diaphragm . . . . . **22.—.**
Cylinder iris-diaphragm (p. 23) . . . . . **4.—.**

For the addition to this microscope of a lateral screw for raising and lowering the illuminating apparatus as on Stand IIa, an extra charge of $ 2.— is made.



Stand III.

Stand III.

No. $

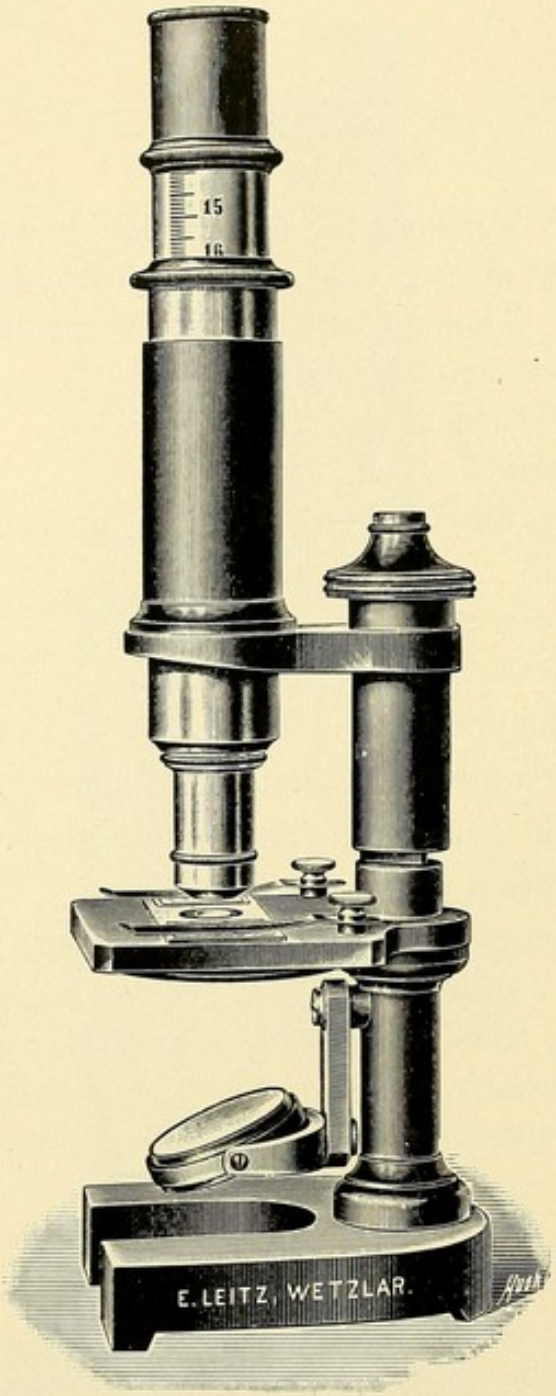
16. **Medium Size Microscope,** non-inclinable stand, coarse adjustment by sliding tube, fine adjustment by micrometer-screw. The draw-tube has a millimetre scale. Plane and concave mirrors.
Objectives 3, 6, 8.
Eye-pieces I, III.
Magnifications 60—650 . . . . . **60.—.**

17. **The same.**
Objectives 3, 7.
Eye-pieces I, III.
Magnifications 60—525 . . . . . **44.—.**

Stand without objectives and eye-pieces . . . . . **22.—.**

Stand without objectives and eye-pieces, inclinable, with hinged joint . . . . . **26.—.**

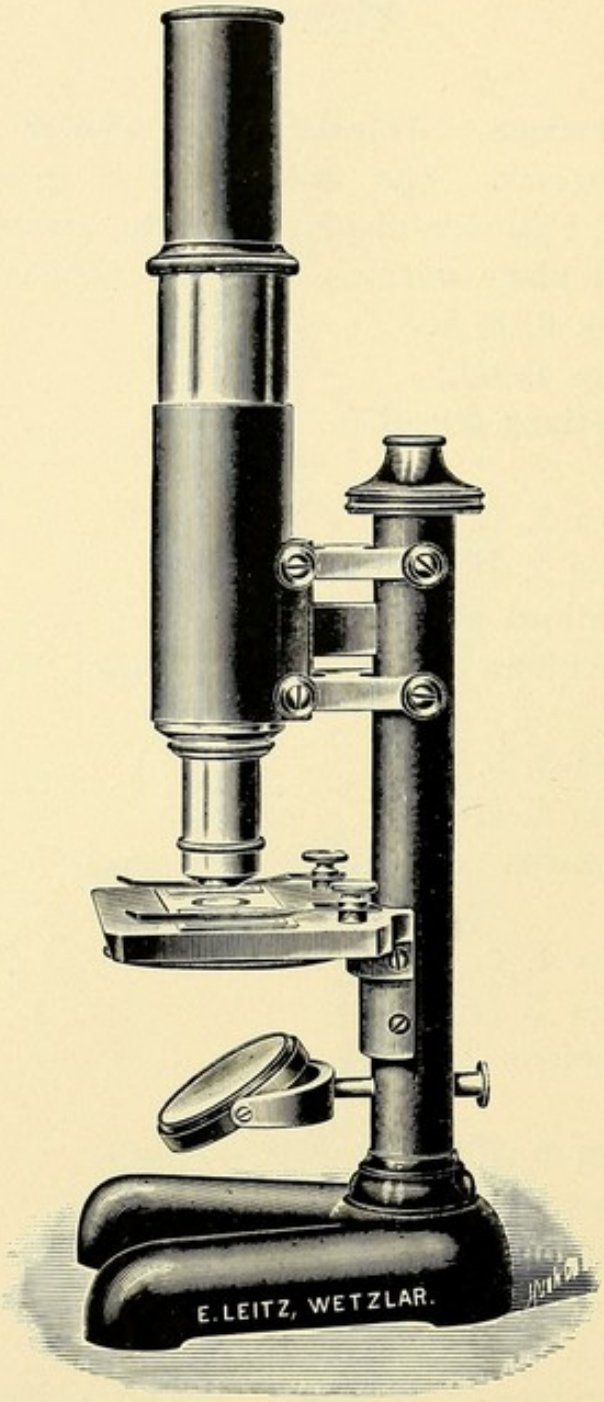
These Stands can be provided with the small condenser (p. 23 $ 8.—). They are not adapted for all kind of work, the stage being too small, and it is not expedient to attach a nose-piece, owing to the absence of a coarse adjustment by rack and pinion.



Stand IV.

Stand IV.

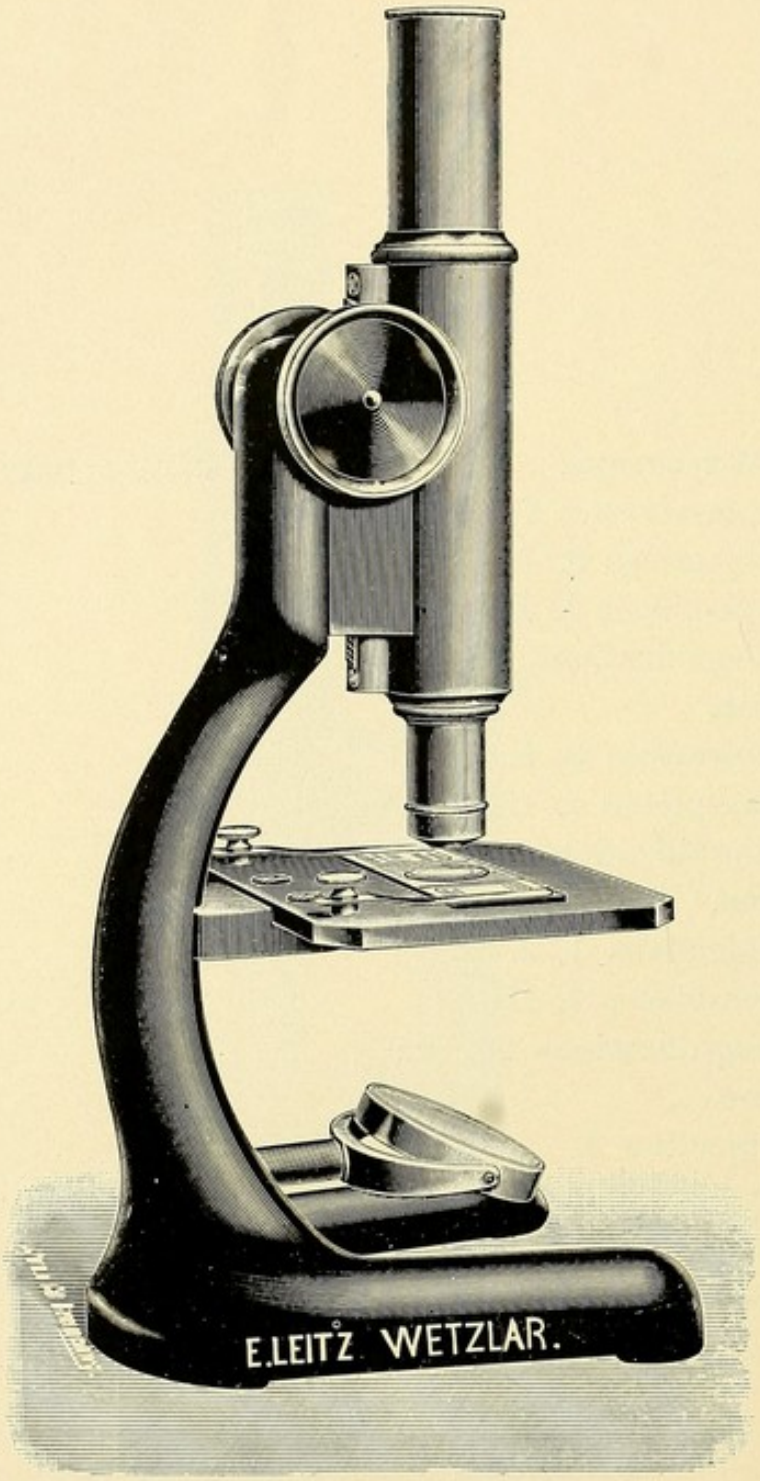
No.		$
18.	**Small Microscope.** Adjustable by sliding tube and micrometer-screw. The draw-tube is graduated in millimeters. Cylinder-diaphragm with sliding sleeve. Concave and plane mirrors, obliquely adjustable. Objectives 3, 6, 8. Eye-pieces I, III. Magnifications 60–650	50.—.
19.	**The same.** Objectives 3, 7. Eye-pieces I, III. Magnifications 60—525	36.—.
20.	**The same** without Cylinder Diaphragm, with Wheel Diaphragm. Objectives 3, 5, 7. Eye-pieces I, III. Magnifications 60—525	42.—.
21.	**The same.** Objectives 1, 3, 7. Eye-pieces I, III. Magnifications 20—525	40.—.
22.	**The same.** Objectives 3, 7. Eye-pieces I, III. Magnifications 60–525	34.—.
	Stand with cylinder-diaphragm, without objectives and eye-pieces	14.—.
	Stand with wheel-diaphragm, without objectives and eye-pieces	12.—.



Stand V.

Stand V.

No.		$
23.	**Small Microscope.** Adjustable by sliding tube and micrometer-screw. Concave mirror. Objectives 3, 7. Eye-pieces I, III. Magnifications 60—525	**28.—.**
24.	**The same.** Objectives 3, 5. Eye-pieces I, III. Magnifications 60—280	**26.—.**
25.	**The same.** Plane mirror. Objectives 1, 3. Eye-pieces I, III. Magnifications 20—85	**24.—.**
26.	**The same.** Objective 3. Eye-pieces I, IV. Magnifications 60—105	**18.—.**
27.	**Stand** without objectives and eye-pieces	8.—.

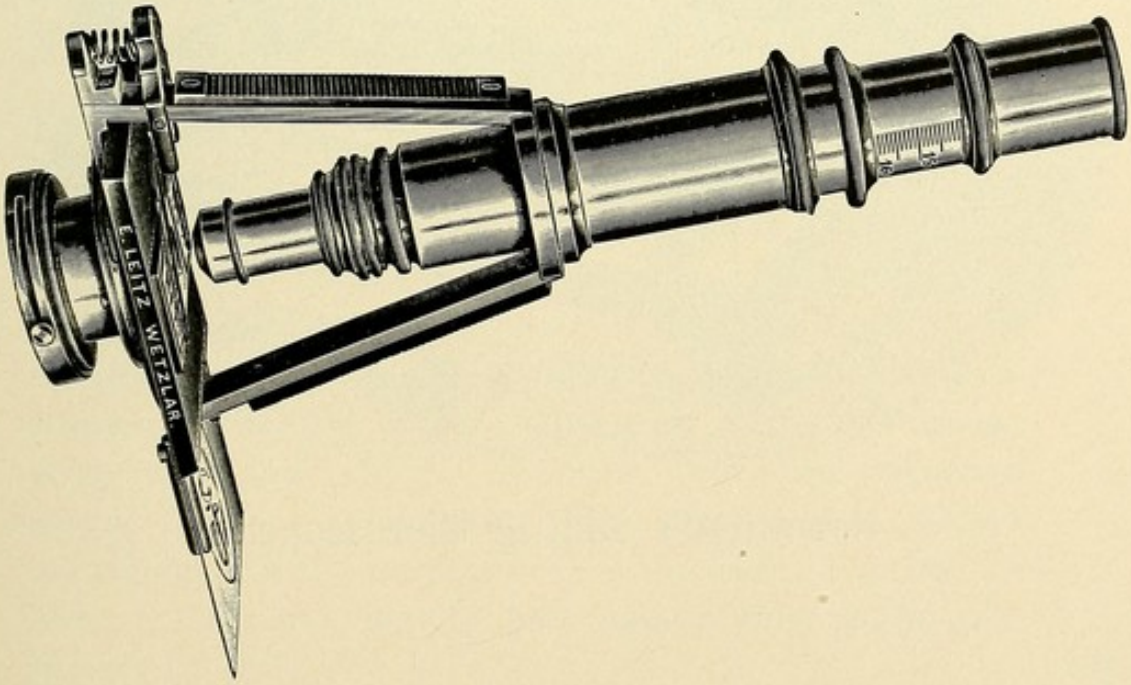


Stand VI.

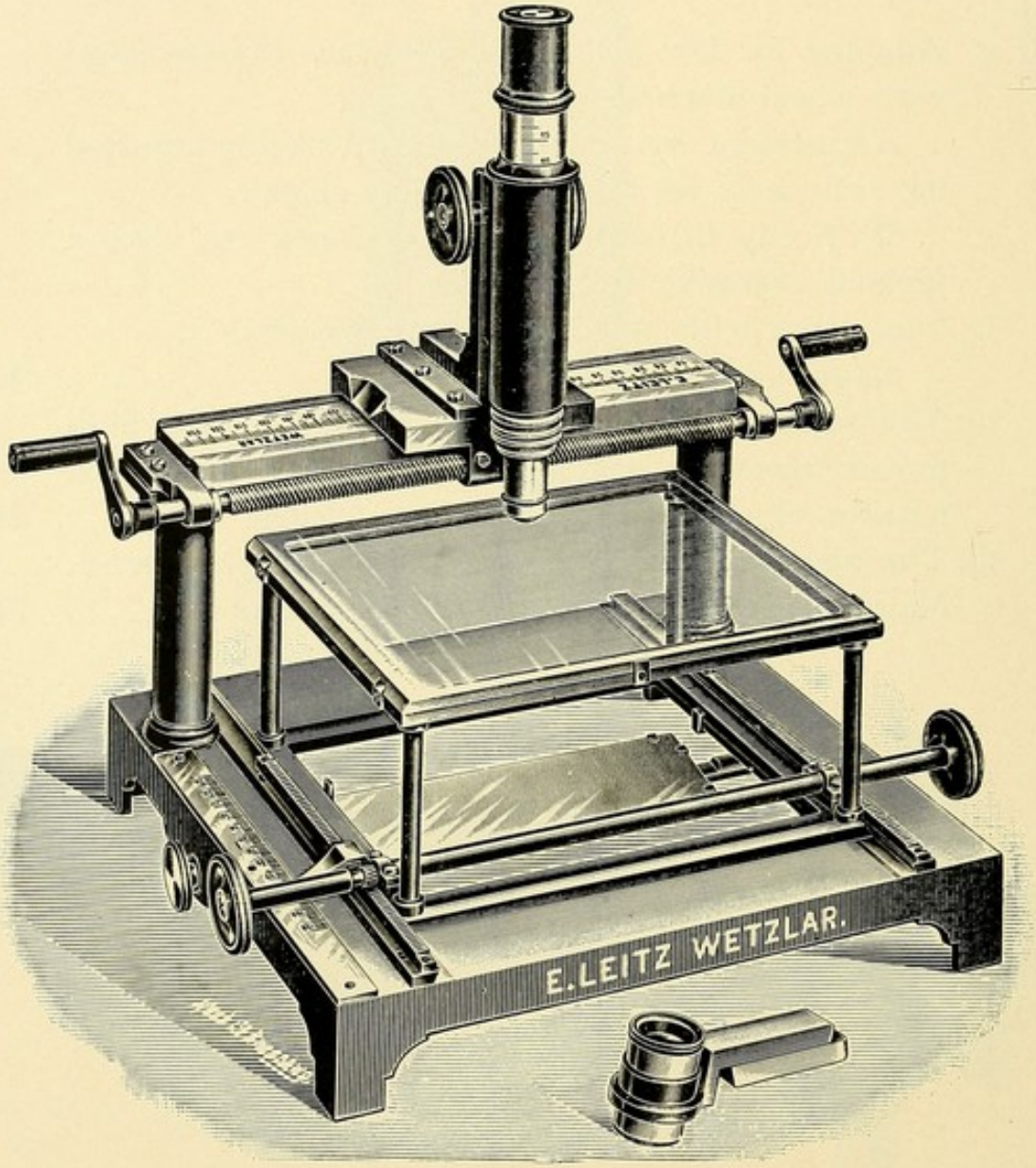
No.		$
28.	**Auxiliary Laboratory Stand**, for the examination of trichinae. Very large stage ($3^1/_2 \times 4$ in.). Adjustable by means of a carefully constructed rack and pinion, rendering it possible to focus objectives of fairly high power.	
	Stand, without eye-pieces, objectives or case . . .	8.—.
29.	This stand fitted with objective 3, eye-pieces I and IV. Magnifications 60 to 105, in mahogany case fitted with lock	18.—.
	Glass compressor with graduation	—.80.
	Glass compressor without graduation, per pair . . .	—.40.

Demonstration microscope.

No.		$
30	a) Adapted for low and medium power. Square stage with wheel-diaphragm. Adjustment by sliding tube; after being adjusted the tube may be fixed by a ring clamp. With clip to hold a sketch or label, etc. Stand without objective and eye-piece	6.—.
	b) **The same** with objective 3 and eye-piece I, magnifying 60 times	14.—.
	c) **The same** with adjusting screw for focussing high power objectives, with condenser and iris-diaphragm, without objectives and eye-pieces	18.—.
	d) **The same** with objectives 3 and 6 and eye-piece I. Magnifications 60 and 275	38.—.



Demonstration microscope with condenser.



Nebelthau's Sliding Microscope.

Nebelthau's Sliding Microscope.

(Cf. Zeitschrift für wissenschaftliche Mikroskopie, XIII, 1896.)

No. $

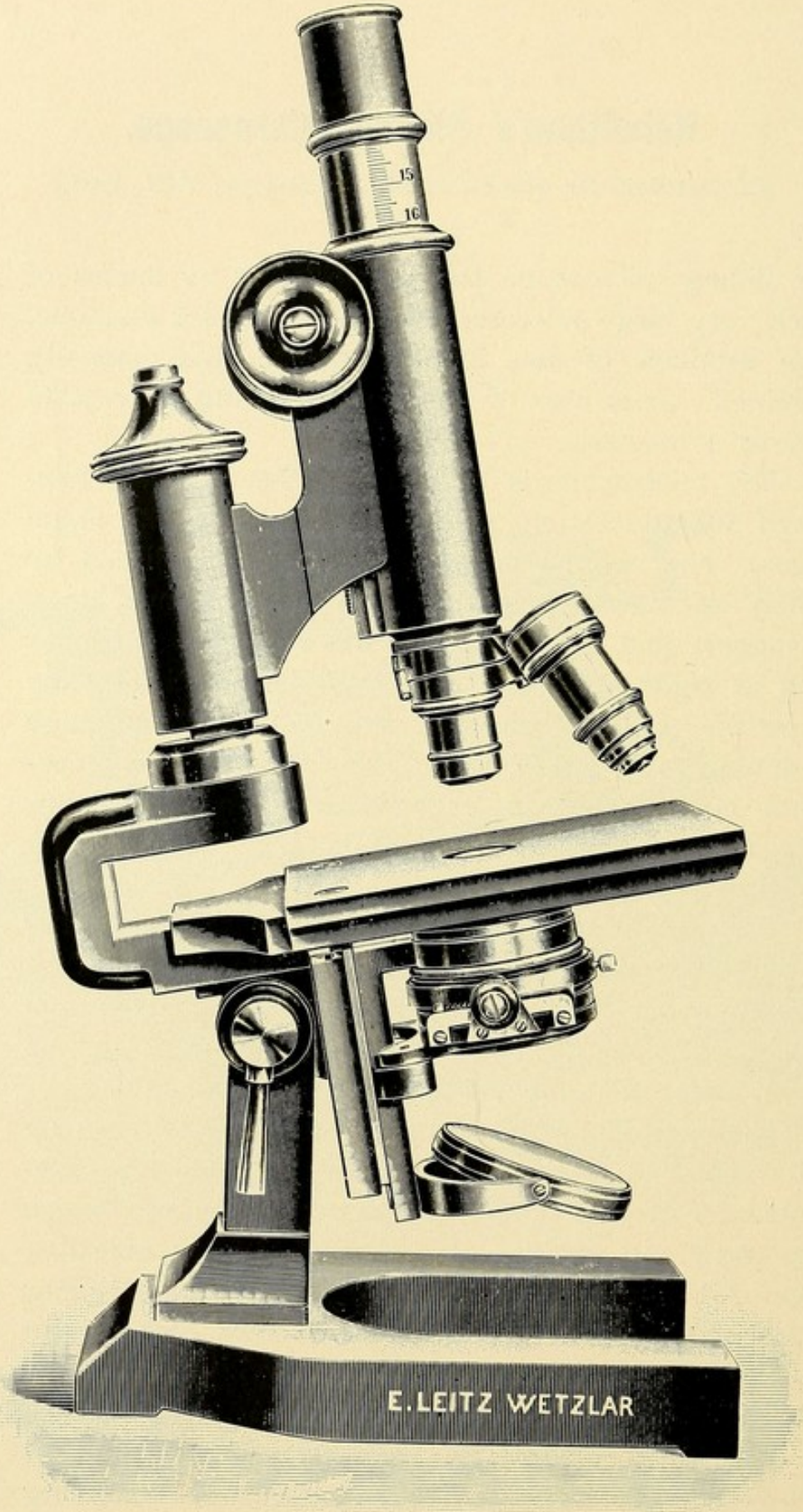
31. The sliding microscope is an instrument by means of which very large microscope sections, as, for example, large sections of the brain, can be systematically examined. It is also of service in looking over plate cultures of bacteria.

The microscope is carried on a heavy beam supported by two stout pillars under which the stage moves. The various movements are accomplished by motion of the microscope on a lateral track upon its support and by motion of the stage on a similar track at right angles to the first. The motion of the microscope is by means of a screw, that of the stage by double rack and pinion. The extent of the movements is indicated in each case by a scale, thus permitting the systematic examination of the entire specimen.

The stage consists of a glass plate, measuring 16×20 cm, which is carried in a frame supported on four columns. The tracks permit a motion of the microscope of 18 cm and of the stage of 13.5 cm. A mirror under the stage affords ample illumination.

The microscope tube is so arranged that it can be easily removed from the stand and a simple lens substituted for it. The coarse adjustment of the microscope is by rack and pinion. A screw above the objective serves for fine adjustment. The price of this sliding microscope, without objectives or oculars, but with a lens holder and simple lens magnifying eight diameters is . . . . . 80.—.

Plat glass dish of the same size as the stage to hold very large sections for the purpose of examining them while in clearing fluid . . . . . 1.25.

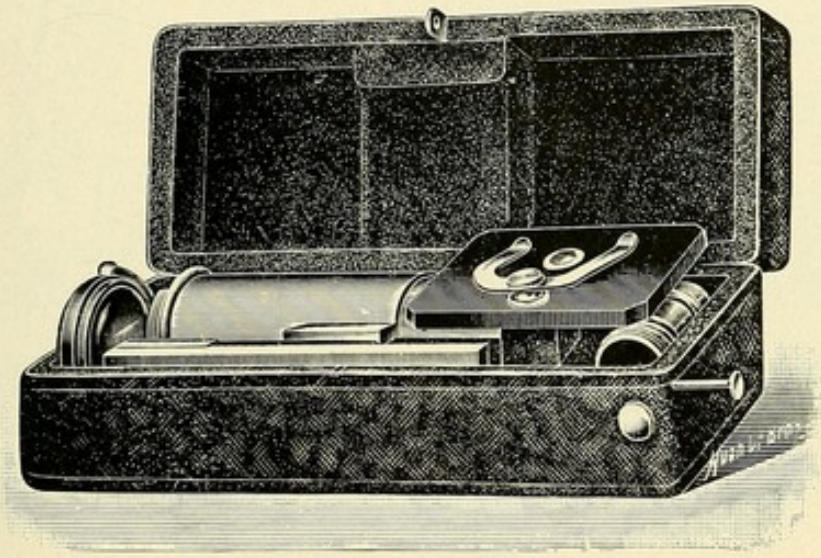


Dölken's Microscope stand.

No. $

32. **Dölken's Stand.** The stand is of the same size as Stand No. I, but is modified as shown in the cut so as to permit the examination of unusually large preparations. It is provided with the illuminating apparatus b (p. 22) and with all the adjustments necessary to the use of high powers.

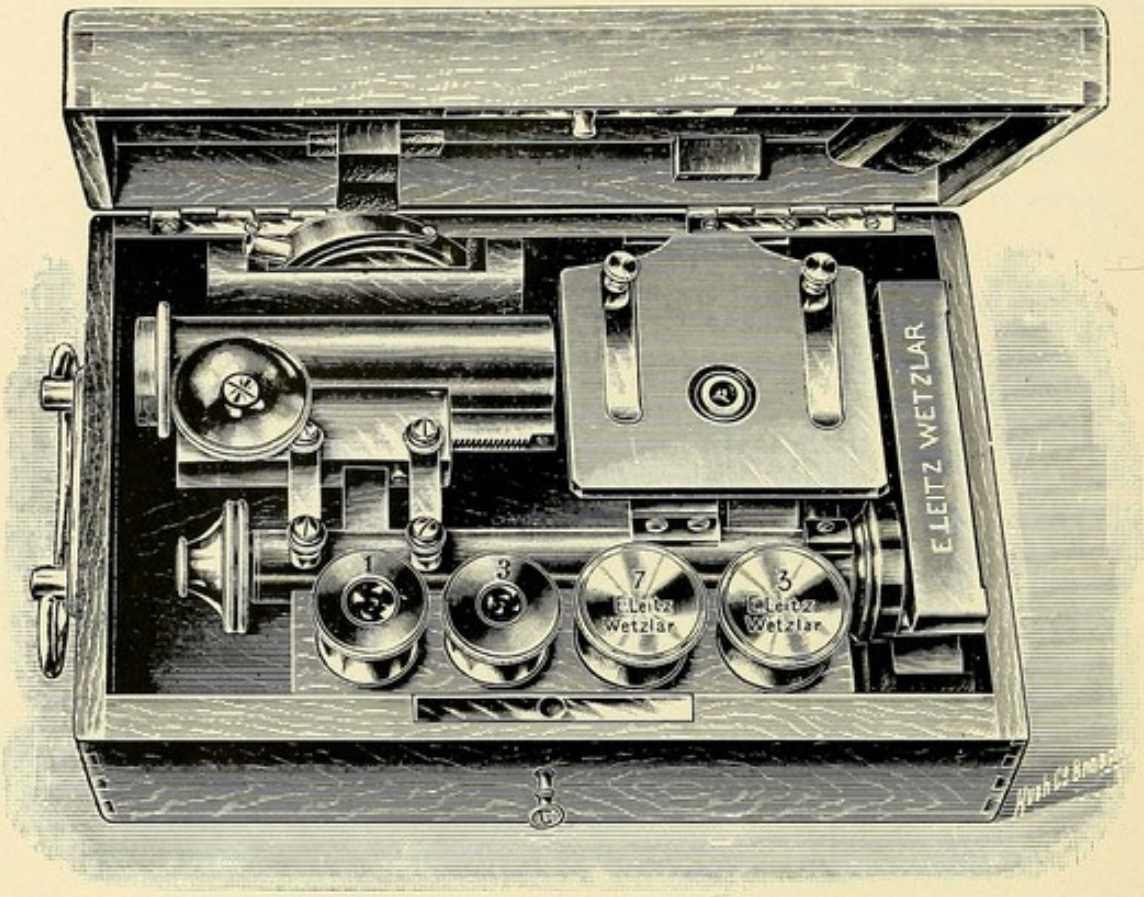
The stand and illuminating apparatus . . . . . **80.—.**



Travelling Microscope after Stricker.

33. **Stricker's Travelling Microscope** is intended for use on excursions. It measures when packed in its case, $15 \times 5^1/_2 \times 6$ cm. A flat movable metal piece is fastened to the bottom of the microscope case and the latter serves the purpose of a base. The pillar of the stand is screwed to it and receives the mirror, stage and tube. The stage has a small condensing lens and revolving disc diaphragm. The coarse adjustment is by sliding tube and for fine adjustment serves a focussing screw fitted into the lower end of tube just above the objective. The weight of this instrument is 2 pounds. Price . . **20.—.**

A small case with bottles for staining fluids and room for slides and coverglasses may be furnished in connection with the above, both fitting in a third leather case with shoulder strop. Price . . . . . **24.—.**



Large Travelling Microscope.

No. $

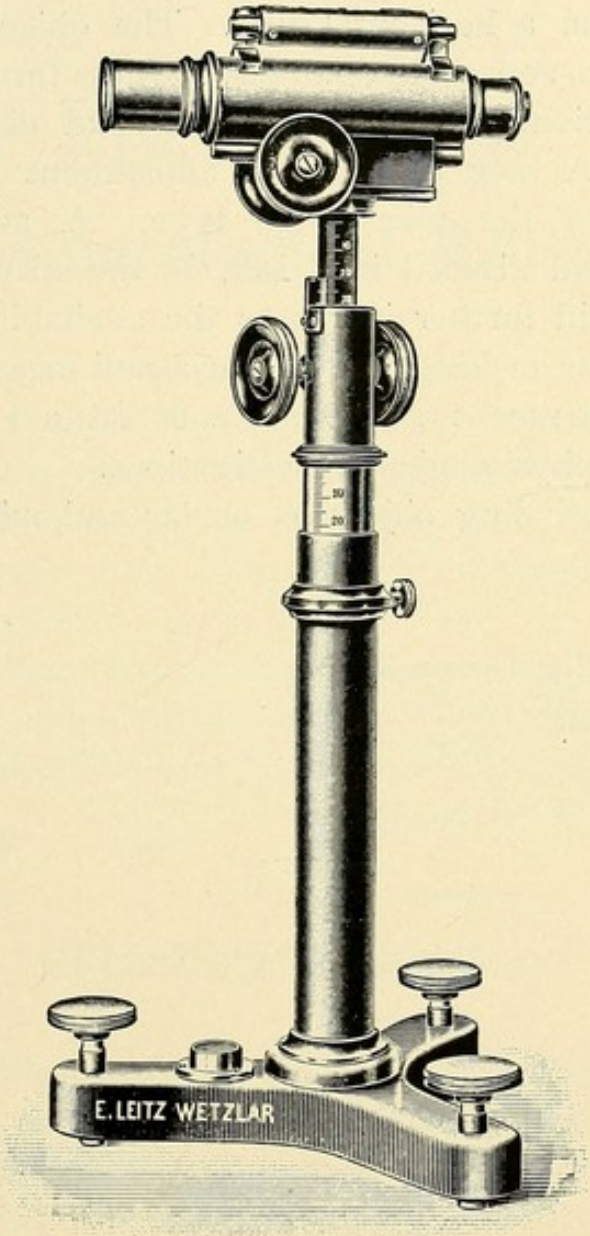
34. **Large Travelling Microscope.** This microscope is ready for use after spreading the foot, unscrewing the two parts of the tube and setting the mirror and stage in position. It is provided with all the adjustments of Stand No. V consisting of fine adjustment by micrometer-screw, coarse adjustment by rack and pinion and illuminating apparatus e (p. 23). The box is arranged so as to accommodate two objectives and two oculars. It locks, has a handle, and measures 21×14×7 cm, the whole apparatus weighing 4 pounds.

Price of this microscope with illuminating apparatus, but without objectives or oculars . . . . . **32.—.**

The same, without illuminating apparatus . . . **24.—.**

No. $

35. **Horizontal Microscope.** This instrument consists of a microscope tube placed horizontally on a long extensible column, supported in turn by a tripod base provided with levelling screws and a round spirit level.



Horizontal-Microscope.

The extension of the upright supporting column is accomplished by two sliding motions, the lower, controlled by a set screw only, being intended for coarser adjustments, the upper, controlled by rack and pinion,

$

for finer adjustments. A millimeter scale and a vernier, serve to indicate the degrees of the various motions, so that vertical motion of the microscope tube to the extent of $^1/_{10}$ mm may be accomplished.

The microscope tube carries a spirit level and revolves upon a horizontal disc. The objective, consisting of two separable doublets, permits three degrees of magnification of 5, 9 and 48 cm focal distance respectively. A rack and pinion adjustment serves as adjustment of the microscope tube. A micrometer, 1 cm long and divided into 100, in the diaphragm of the ocular still further increases the availability of the instrument for making fine and accurate measurements.

The instrument serves as a useful aid in many physical an physiological investigations.

Price, including objective, ocular and micrometer **40.—.**

Microscopes
for Mineralogical Research.

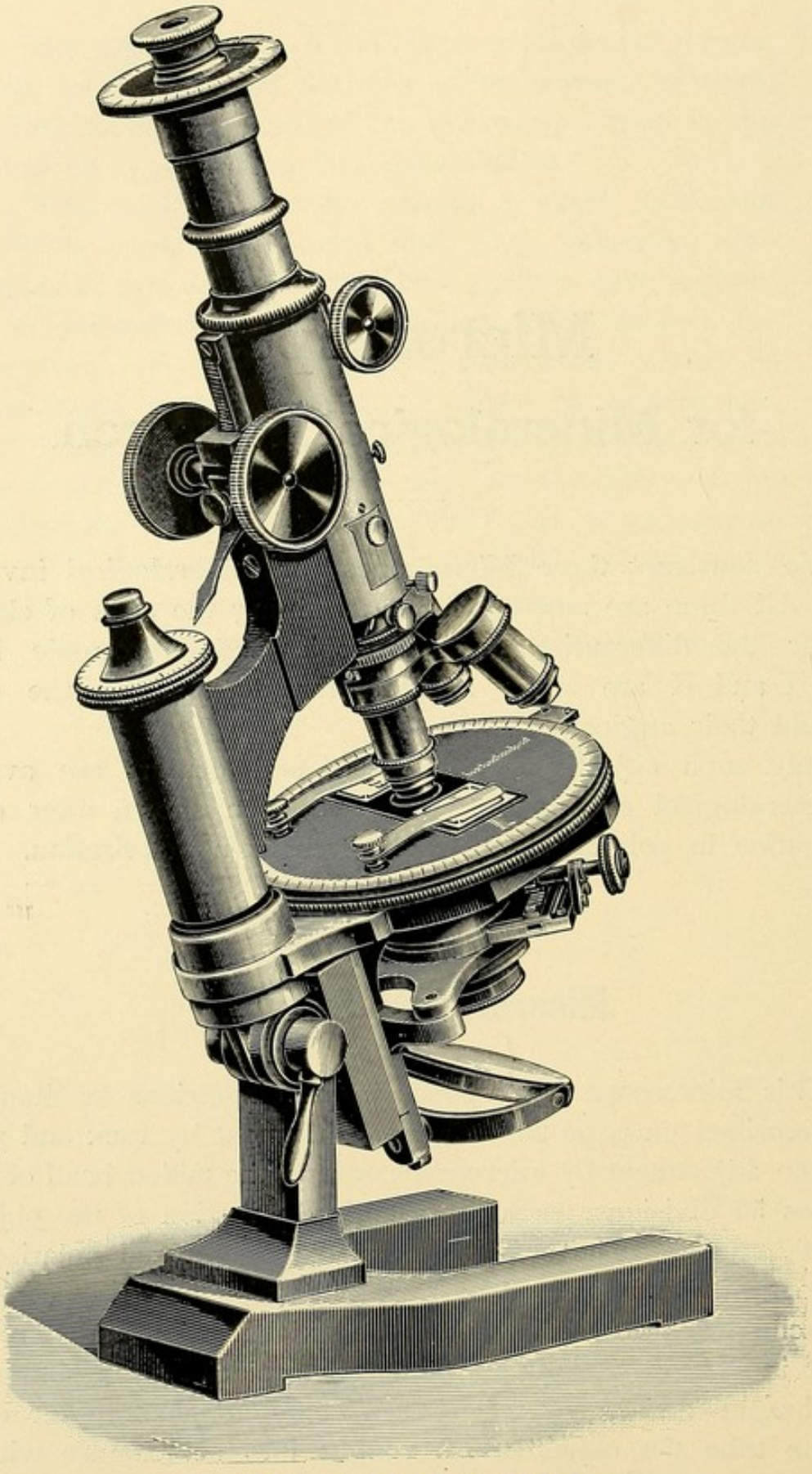
We construct three Microscopes for mineralogical investigations. All three are adapted for determining the axes of elasticity and for the differentiation of isotropic and anisotropic bodies. Stands I and II are alone adapted for determining the optical axes and their angles.

Only such objectives, condensers and oculars are available for mineralogical examinations as have been shown after careful examination in polarized light to be free from polarization.

Mineralogical Stand I.

No.

36. This microscope corresponds in its dimensions to Stand I as described on page 25. Coarse adjustment by rack and pinion, fine adjustment by micrometer-screw, the milled head of which has 50 divisions, each representing a motion of the objective of $^1/_{100}$ mm. The condenser, iris-diaphragm and polarizer can be raised and lowered by rack and pinion. A triple condenser facilitates the observation of the axial lines in the microscope. It is so arranged as to be easily replaced by a simple diaphragm-carrier. By means of a collar attached to the end of the tube the objective is brought into coincidence with the centre of the revolving stage. This revolving stage is divided



Mineralogical Stand I.

No. $

into 360 degrees and fitted with a vernier and index. Two scales on the stage, at right angles to each other, permit accurate location of specimens. The Nicol prism, which serves as a polarizer, can, after turning the iris-diaphragm aside, be drawn out from under the latter. The zero position of the Nicol prism is indicated by a line, as well as the angles 90, 180, 270°. The analyser is mounted in metal and is firmly fixed above the eye-piece. The analyser rotates on a disc graduated to 360 deg. The front of the tube has a movable window which provides access to the inner tube. In the latter is an opening for the introduction of a Bertrand lens. This lens serves the purpose of magnifying the interference figures produced by the converging rays of polarized light. This lens and the eye-piece can be raised or lowered by rack and pinion. In the analyzer is a slide for the insertion of gypsum and quartz plates at an angle of 45 degrees.

In many investigations it is advisable to employ an analyzer introduced laterally into the tube, instead of the one mentioned above.

The following are supplied to complete the stand:

Triple nose-piece.

Eye-piece 0, with Bertrand's quartered quartz plate.

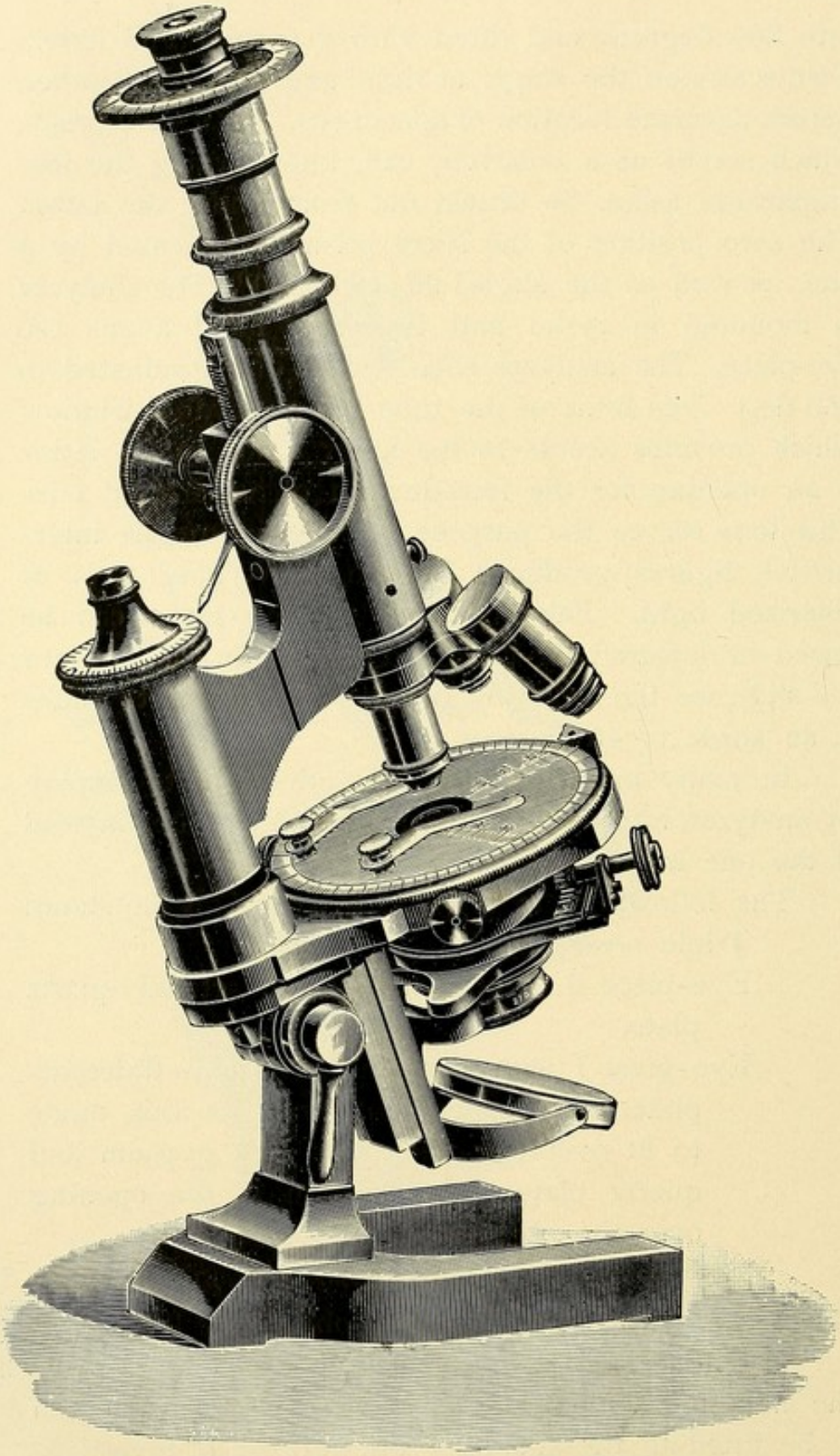
Eye-piece I with cross-lines, Brezina's Calcspar-plate, cleft perpendicularly to its axis, made to fit over eye-piece I, Klein's gypsum and quartz plates for insertion in the opening over the objective.

Price of the stand with these accessoires . . . **184.—**.

37. **The same** with eye-piece III, objectives 1, 3, 5, 7. $^1/_{12}$ Oil-immersion, magnifications 15—800 . . . **260.—**.

The new mechanical stage No. 88 (See page 71) can be fitted to the stand for the purpose of investigating large preparations and serial sections.

Price . . . . . **28.—**.



Mineralogical Stand II.

Mineralogical Stand II.

No. $

38. Although in some particulars this stand is somewhat simpler and smaller in size than Stand I it serves essentially the same purposes. The description of the coarse and fine adjustments, of the condenser and iris-diaphragm just given apply equally to the corresponding parts of this stand. (Cfr. Ia p. 26.)

The centering of the object for various combinations of objectives and eye-pieces is accomplished in this stand by centering the stage, which is controlled by two centering screws at the side. This revolving stage is graduated into 360 degrees, an index on the stage serving to facilitate the readings.

The polarizer and analyzer are fitted and arranged in the same manner as those of Stand I. The Bertrand lens fits into the tube like an ordinary eye-piece. The tube can be drawn out and raised and lowered at will.

In the analyzer, at 45^0 to its axis, is a slit for the insertion of gypsum and mica plates.

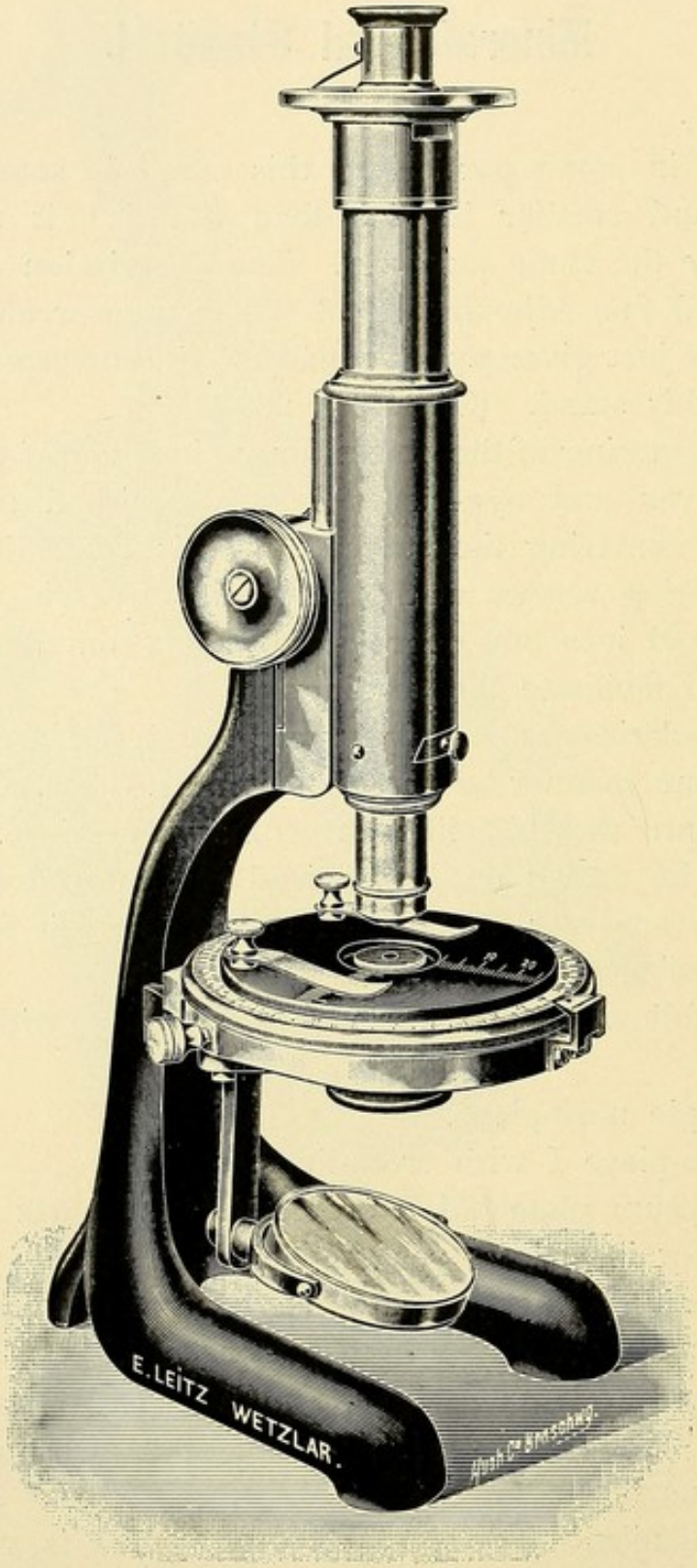
The following accessories are supplied with this stand:

Triple nose-piece.
Eye-piece I with cross-lines.
Gypsum plate red I. order, Klein's quartz plates for insertion over the objective.
Brezina's calcspar-plate, cleft perpendicularly to the axis, fitting over eye-piece I.

Price of the stand with the above accessories . . **120.—**.

39. The same with eye-piece III, objectives 3 and 7, magnifications 60—525 . . . . . **140.—**.

The mechanical stage No. 88 (See p. 71) is readily adaptable to this stand.



Mineralogical Stand III.

Mineralogical Stand III.

No. $

40. The tube is mounted upon an upright iron foot and is movable by rack and pinion, the accurate construction of which admits of focussing high powers.

The stage revolves and is capable of being centred. It is graduated on the edge into 360 deg. The amount of rotation is indicated by a pointer.

The polarizer is inserted in the diaphragm-holder, which is held in a metal collar.

The analyzer is the same as that of the two other stands.

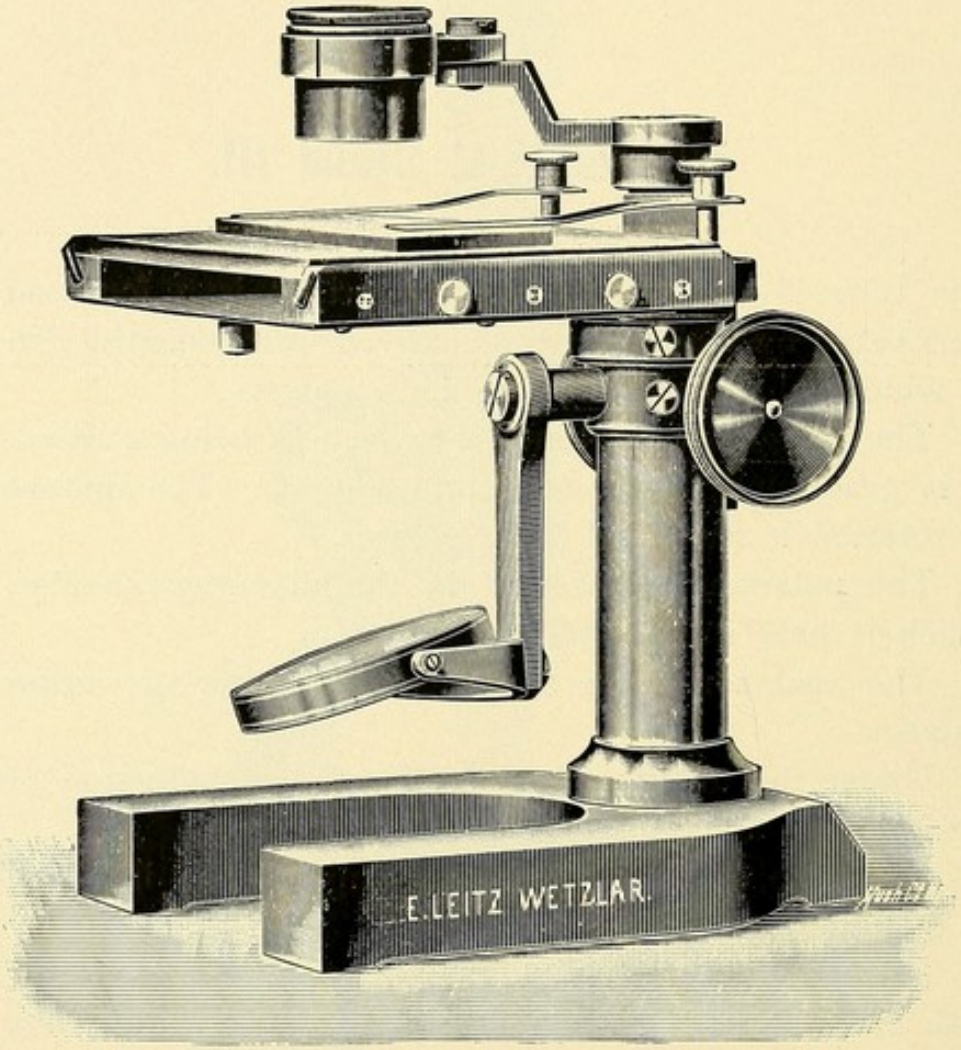
Under the analyzer is a slit for the introduction of the gypsum and mica plates.

Over the objective is an opening for the insertion of quartz, gypsum plates, etc.

Price of this polarizing microscope with eye-piece I with cross-lines, Klein's quartz plate and gypsum plate, red, I. order . . . . . **40.—.**

41. The same with eye-piece III and objectives 3 and 6. Magnifications 60—390 . . . . . **60.—.**

Dissecting Microscopes and Hand Lenses.



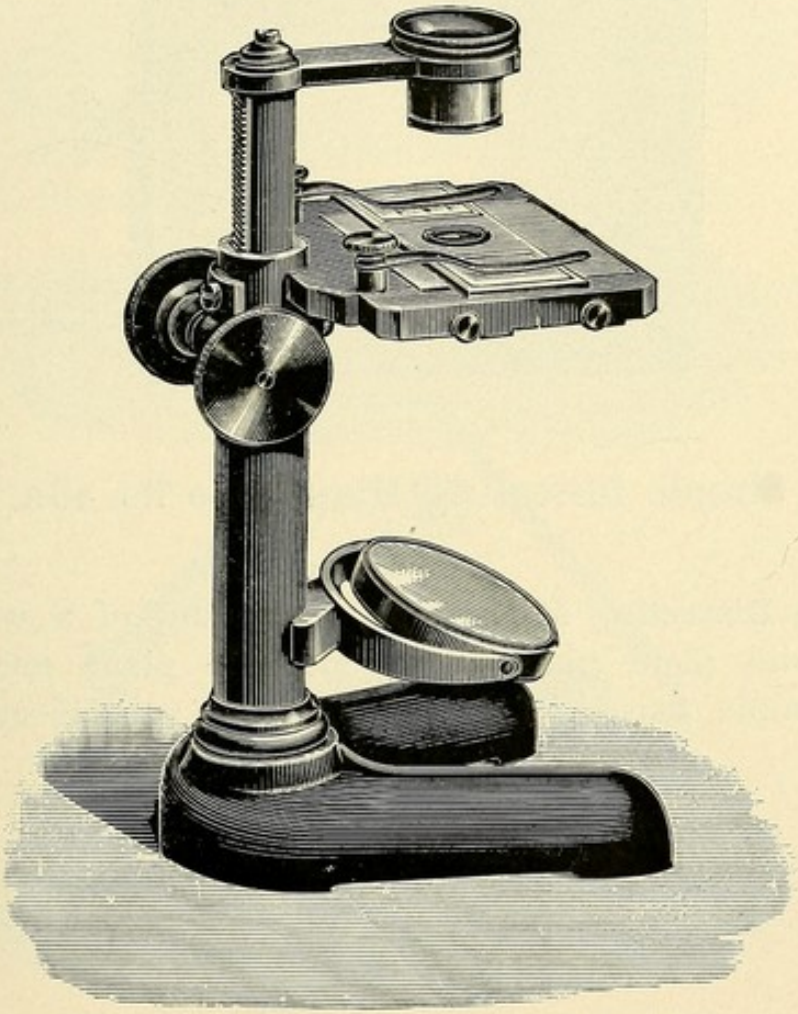
Large Dissecting Microscope No. 38.

No.		$
42.	**Large Dissecting Microscope** for biological and bacteriological purposes. Stand on heavy horse-shoe base, large stage with glass plate, adjustment by rack and pinion. The lens-carrier is movable for examining large plates. Illumination by movable plane mirror and white glass plate. Three aplanatic lenses magnifying 8, 16, and 20 diameters. Hand-rests may be attached to the sides of the stage by means of thumb-screws	28.—.
43.	**The same** with Abbe's drawing apparatus	40.—.

No. $

44. **The same stand** with two aplanatic lenses (Nos. 57 and 59) of 10 and 20 magnification respectively and with ocular-lens No. 53, magnifying 100 diameters . **32.—.**

45. **Stand** without lenses . . . . . **16.—.**

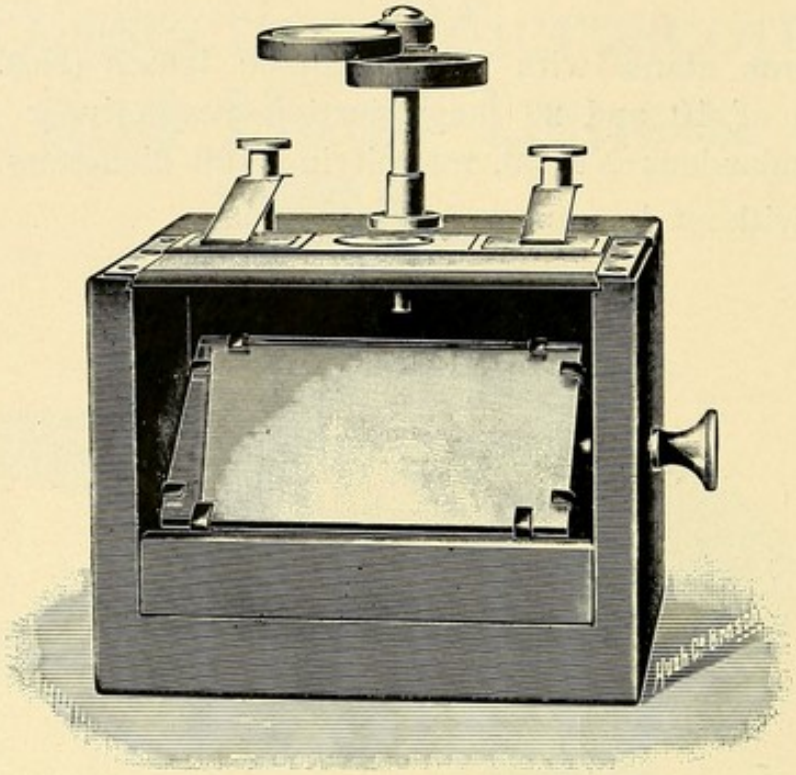


Simple Dissecting Microscope No. 46.

46. **Simple Dissecting Microscope,** with adjustment by rack and pinion, movable plane mirror and white glass plate, glass stage in metal frame, two aplanatic lenses magnifying 10 and 20 diameters, with hand-rests . . . . **16.—.**

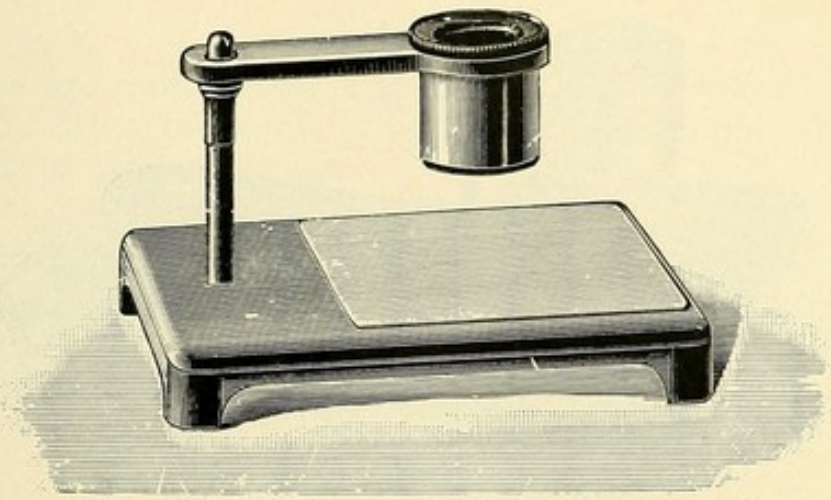
47. **The same stand** with ocular lens No. 53 magnifying 100 diameters . . . . . **16.—.**

48. **Stand** without lenses . . . . . **8.—.**



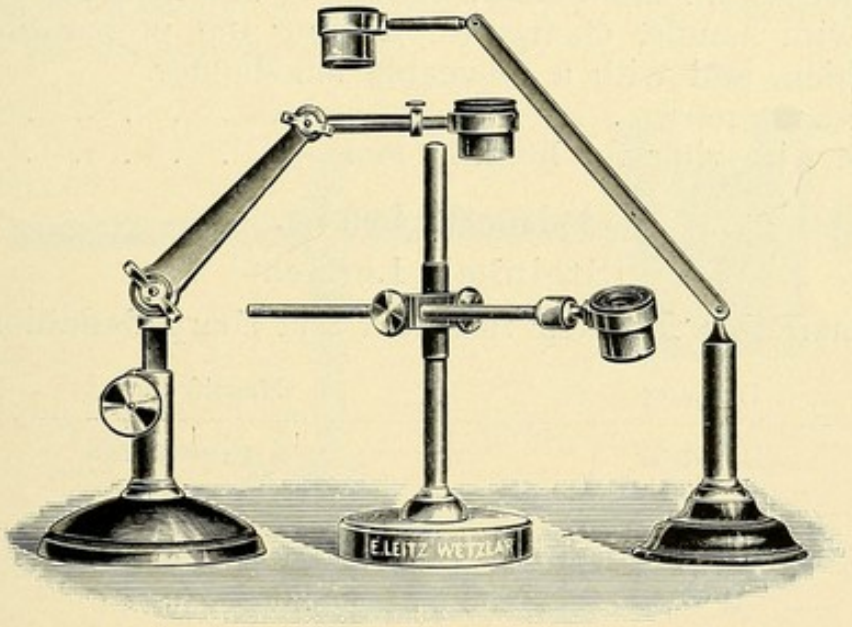
Simple Dissecting Microscope No. 48a.

No.		$
48a.	**Simple Dissecting Microscope**, consisting of a wood case with plate glass stage, movable plane mirror, two simple lenses of 4 and 8 times magnification. Price	**1.75.**



Dissecting Stage with Lens No. 49.

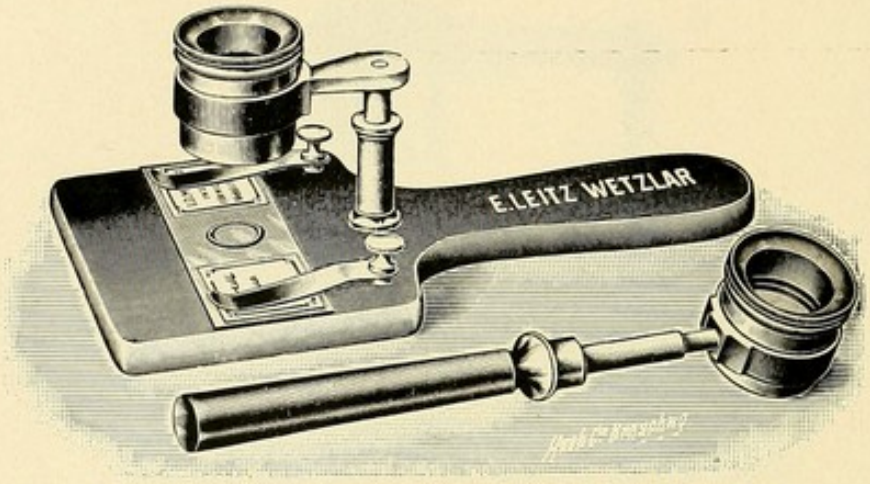
No.		$
49.	**Dissecting Stage** with white glass plate and moveable lens-holder — without lens	2.—.



No. 50. No. 51. No. 52.

Lens-holders.

50.	**Lens-holder** on iron foot with moveable arms the joints of which may be fixed by thumb-screws, rack and pinion adjustment — without lens	7.20.
51.	**Lens-holder**, nickel-plated stand with attachment of the collar holding the lens by ball and socket joint	4.—.
52.	**Lens-holder** on heavy iron foot, ball and socket joints, adjustable to any position — without lens	3.25.
53.	**Ocular Lens** for dissecting — Two achromatic doublets with negative adjustable eye-lens, magnification 100 diameters — Applicable only to stands with rack and pinion adjustment, as stands Nos. 42, 46 and 50 . .	8.—.



Demonstration Lens-holder No. 54.
Handle No. 55.

No.		$
54.	**Demonstration Lens-holder,** consisting of a hard rubber stage with handle, clamps for holding the preparation in position, and with a moveable lens-holder. Without lens	**2.40.**
55.	**Handle** with ring for holding lens	**1.25.**

Aplanatic Lenses.

(Steinheil Lenses)

remarkable for their flat field and sharp definition.

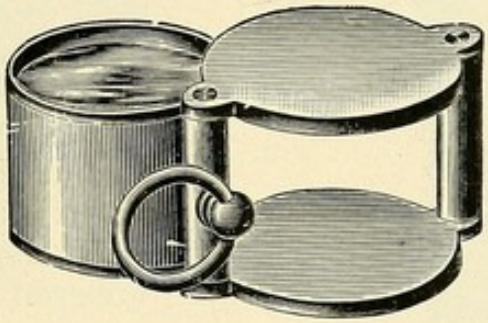
	Diameter	Magnification	
56.	24 mm	8 diameters	4.—.
57.	15 „	10 „	4.—.
58.	15 „	16 „	4.—.
59.	6 „	20 „	4.—.
60.	5 „	30 „	4.—.
61.	4 „	40 „	4.—.
	Achromatic Doublets.		
62.	20 „	8 „	**3.25.**
63.	12 „	10 „	**2.50.**
	Simple Lens.		
64.	15 „	6 „	**1.25.**

These lenses are all so made as to fit any of the lens-holders. The higher power lenses (Nos. 58—61) are suitable for such stands only as have rack and pinion adjustment.

No. $

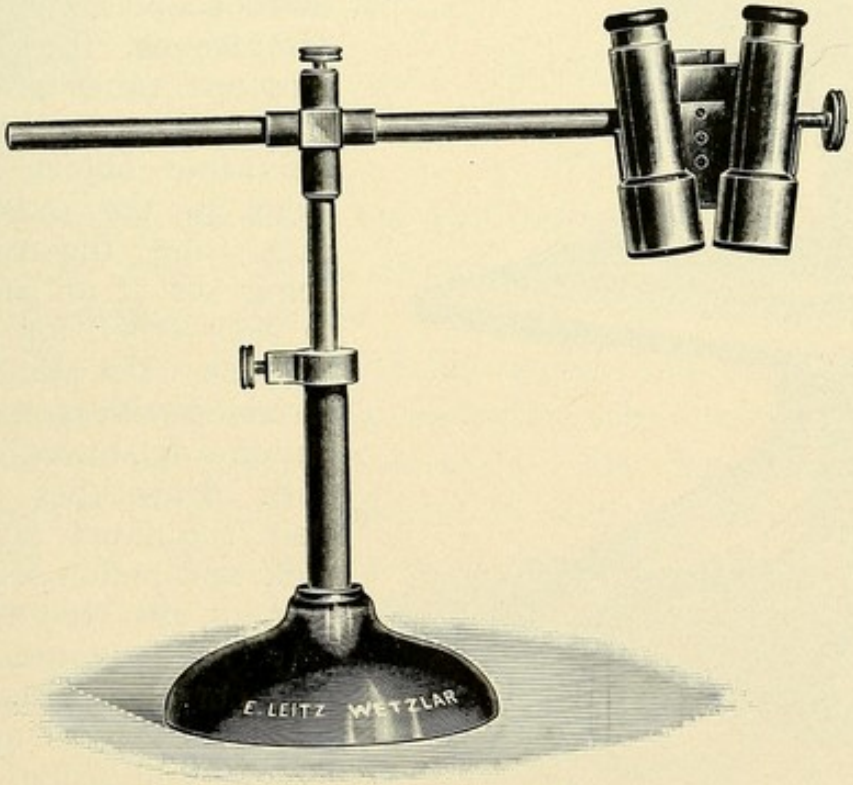
The aplanatic lenses Nos. 56, 57 and 58 are also to be had with a moveable cover and ring adapting them for use as pocket lenses.

Price, when thus mounted . . . . . **4.75.**



Pocket Lens.

65. **Pocket Microscope** — The size of an objective, in box **3.25.**
66. **Lens** for examining Algae . . . . . **1.25.**

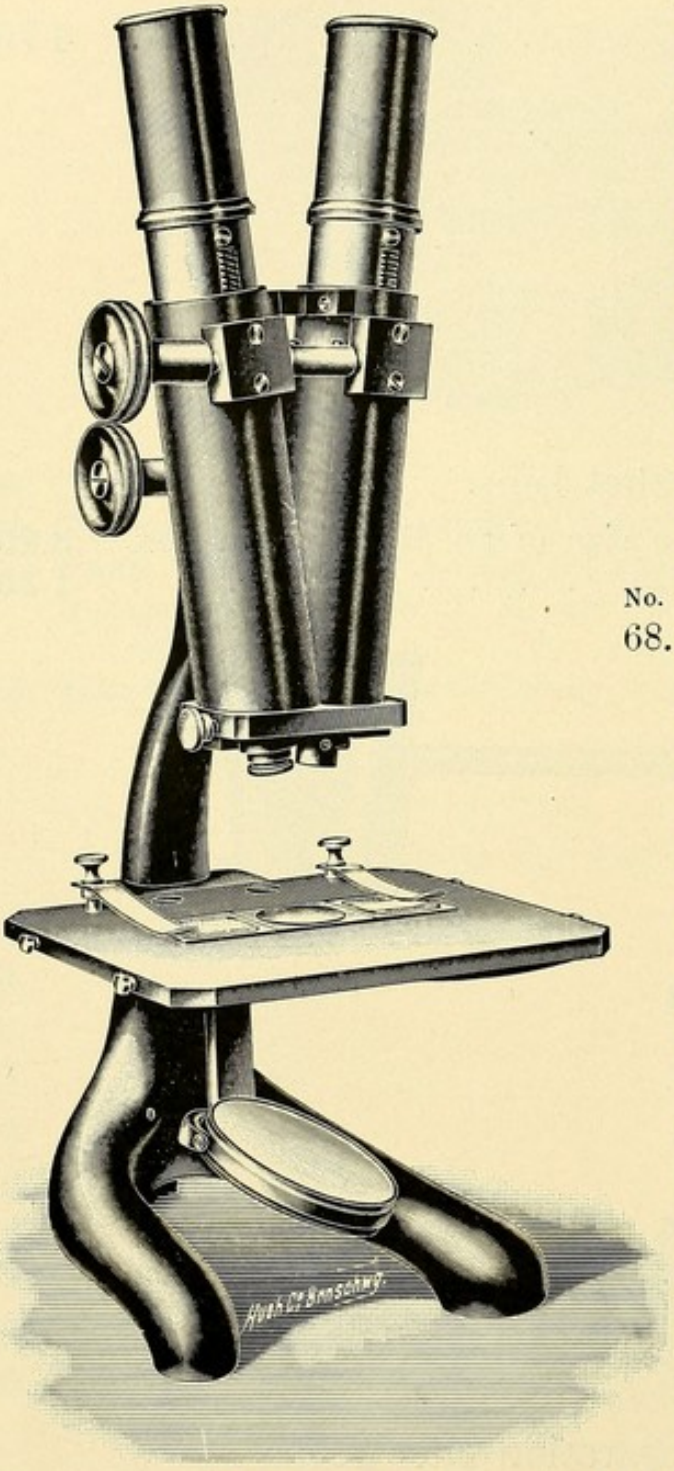


Binocular Preparation Microscope.

67. **The Binocular Preparation Microscope,** after the model of Eilhard Schulze permits the convenient use of both eyes in dissecting small anatomical and botanical preparations. It consists of two Brücke lenses, adjusted to an accurate focus.

$

Both tubes are moveable on a joint and are adjustable to various distances between the observers eyes. The distance of the eye from the preparation is about 250 millimeters; the field of vision is large and flat; the magnification, four diameters. lenses are adjustable to either vertical or horizontal position and may be raised and lowered on the vertical support, thumb-screws fixing them in the desired position. A rack and pinion serves as fine adjustment . **24.—**.



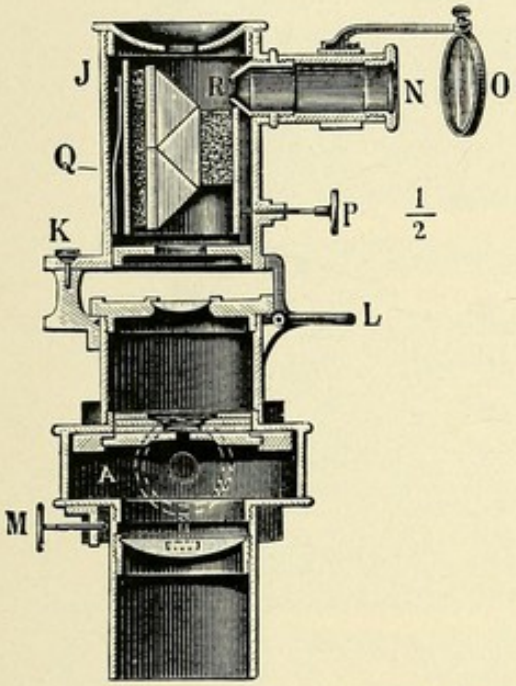
Stereoscopic Binocular Microscope.

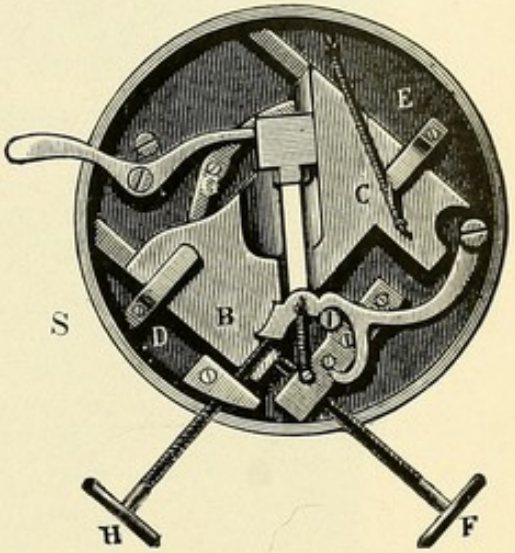
No. 68. **Stereoscopic Binocular Microscope.** Two microscope tubes are so arranged as to bring the same object into focus in the axis of each tube, the tubes being set at an angle to each other for this purpose. The stand is provided with rack and pinion adjustment and both draw-tubes are also regulated by a rack and pinion arrangement, so that they may be adapted to the correct distance of the observers eyes.

Magnification, 20 diameters . . . . . **60.—**.

68a. **Greenough's Binocular Microscope.** By interposition of prisms the image is rendered errect, the instrument is otherweise similar to the forgoing . . . . . Price **80.—**.

Apparatus for Blood Examinations.





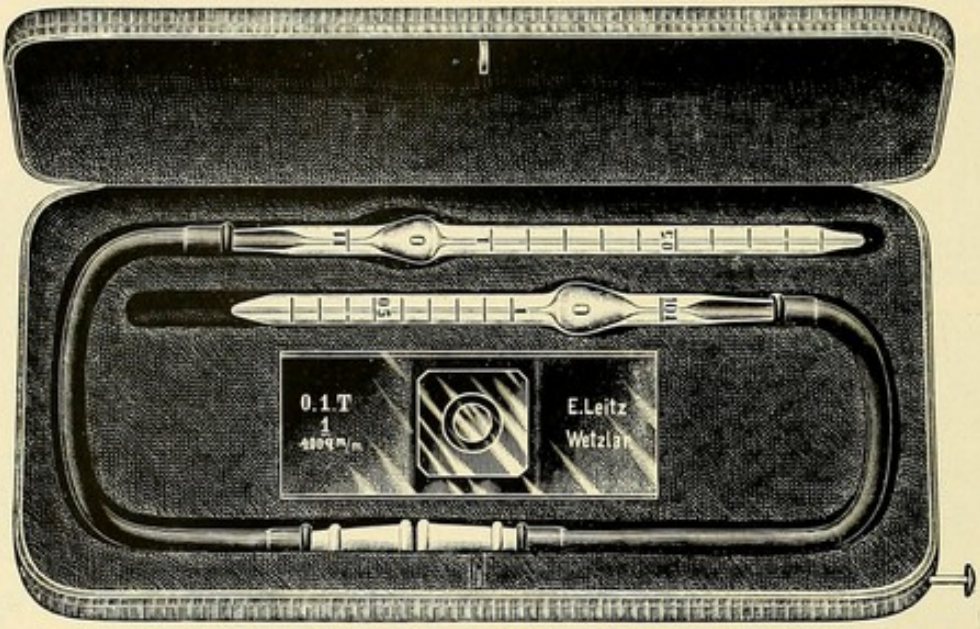
Micro-Spectroscope.

No.		$
69.	The Micro-Spectroscope fits into the tube of the microscope like any ordinary eye-piece and may be fixed in any desired position by means of the thumb-screw M. The position of the bright and dark lines of the spectrum and their respective wave lengths are ascertained by means of a scale. The flat drum A, the interior of which is shown in section, contains the slit and the comparison prism. The slit is regulated by the screws F and H. The lever T moves the comparison prism across one half of the slit. The cylinder Q above the eye-piece contains the Amici prism. At the point N of the horizontal tube RN is the micrometer scale, illuminated by the mirror O. After raising the spring-catch L the upper part of the spectroscope may be turned round the pivot K, thus allowing of the adjustment of the eye-piece . .	**66.—.**

(A full description accompanies each instrument.)

No. $

70. **Hand Spectroscope,** Browning's, for spectroscopic examination of the blood . . . . . **12.—.**



Thoma's Haemacytometer.

71. **Thoma's Haemacytometer** consists of an object glass with carefully constructed cell, a ground absolutely plane coverglass and two pipettes for mixing the blood and saline solution used in the examinations. One of these pipettes, for estimating the number of red corpuscles is so graduated as to permit dilution of the blood 100 or 200 times as required; the other, for counting the white corpuscles, (leucocytes), is graduated for dilution of the blood 10 or 20 times.

(A full description with each instrument) . . . . **15.—.**

Mixing-Pipette for white corpuscles . . . . . **3.75.**

Mixing-Pipette for red corpuscles . . . . . **3.75.**

Slide with coverglass . . . . . **5.75.**

The volume contents of the pipettes are most carefully determined and the depth of the cell is established by accurate micrometric measurment, thus permitting very exact observations by means of this instrument.

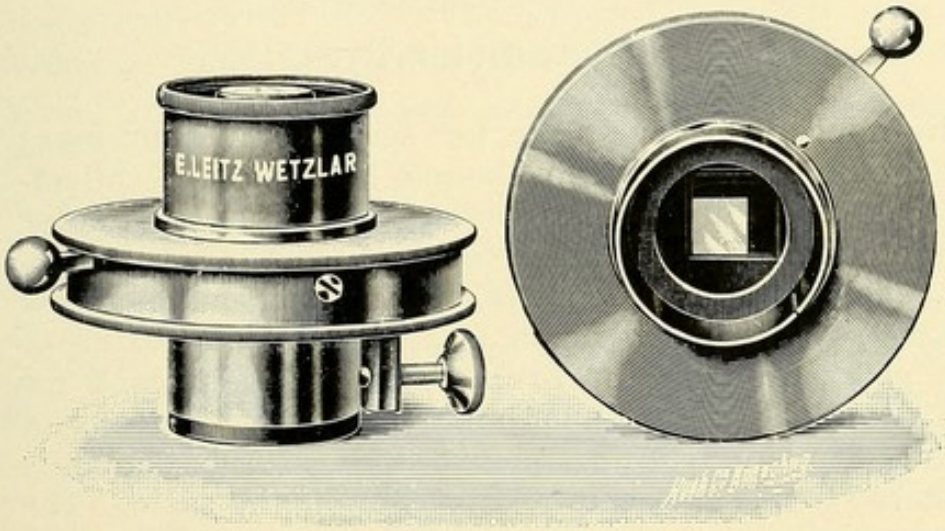
72. **Apparatus for the clinical determination of the alcalinity of the blood.** (After C. S. Engel — a modification of the method of Löwy and Zuntz).

No. $

The following parts compose the apparatus:

1. a capillary pipette so graduated as to permit the dilution of 0,05 cc. blood from the finger up to 5 cc. with distilled water,
2. a beaker, for the reception of the diluted blood,
3. a burette of 10 cc. capacity, mounted on a stand, each cubic centimeter having 20 divisions on the scale.

Full directions for the use of this apparatus accompany each outfil. Price in box . . . . . 8.—.



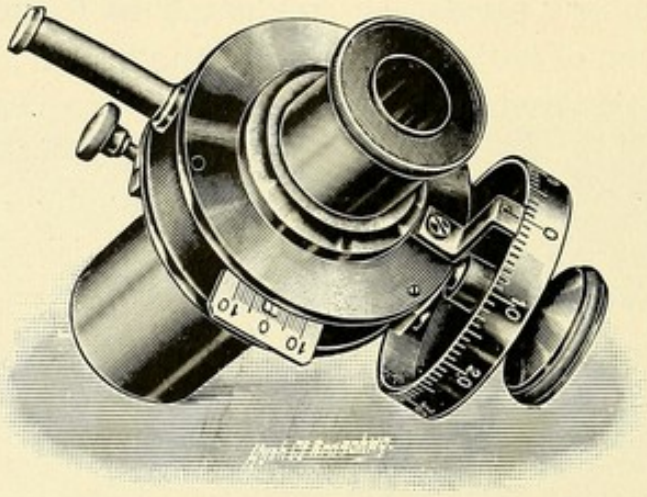
Ehrlich's Eye-piece.

73. **Ehrlich's Eye-piece** is provided with a diaphragm having a square opening, the size of which is regulated by a small lever.

This eye-piece is designed to facilitate the estimation of the relative numbers of red and white blood corpuscles in dry preparations.

Full directions accompany each instrument . . . 12.—.

Micrometers.



Screw Micrometer Eye-piece.

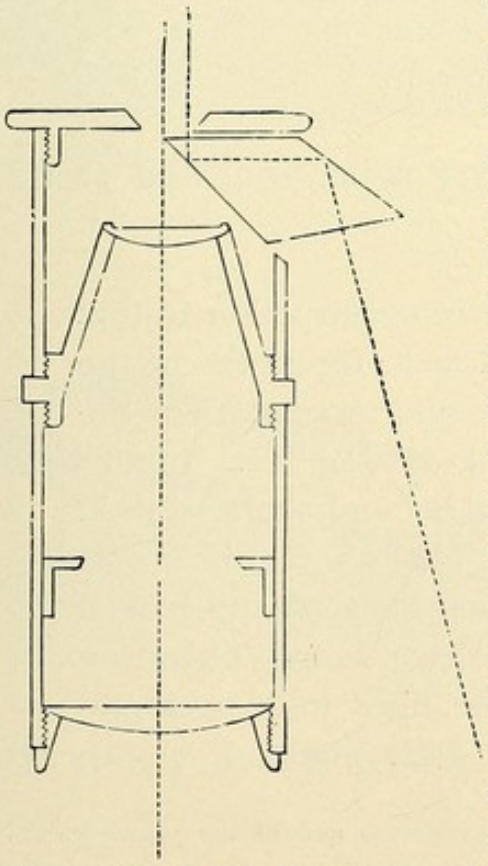
No.		$
74.	**Screw-micrometer eye-piece** for accurate measurement of large objects. Between the eye lens and the collecting lens of a Huyghenian ocular there is a millimeter scale etched on glass, above which is a moveable indicator whose position is controlled by a micrometer screw to which a graduated drum is attached. The value of each graduation on the drum must be determined for each combination of ocular and objective by means of the stage micrometer. The eye lens of the ocular is moveable to permit accurate focus upon the scale. The apparatus slips into the tube of the microscope like any ordinary eye-piece and is fixed in position by a thumb-screw at the side.	20.—.
75.	**Micrometer Eye-piece.** The mount unscrews in the centre to permit the introduction of the micrometer scale. The eye lens is moveable to permit of accurate focus on the scale	4.—.
76.	**Glass-Micrometer for the eye-piece,** to drop on the diaphragm of the eye-piece. Scale of 5 mm divided into 100 parts	2.50.
77.	**The same,** 5 mm divided into 50 parts	2.—.
78.	**Stage-Micrometer,** 1 mm divided into 100 parts etched on glass	3.75.
79.	**Stage-Micrometer,** photographed on glass, 2 mm divided into 200 parts.	1.40.
80.	**Eye-piece Micrometer,** divided into squares for counting scattered objects in the field. Mounted. Distance between the lines 0.5 mm	2.—.
81.	**Glass slide with cell** $^{2}/_{10}$ mm deep, with ocular micrometer No. 80, in box	3.25.
82.	**Glass slide with cell** whose floor is divided into squares, $^{1}/_{400}$ square mm each, in box	4.—.

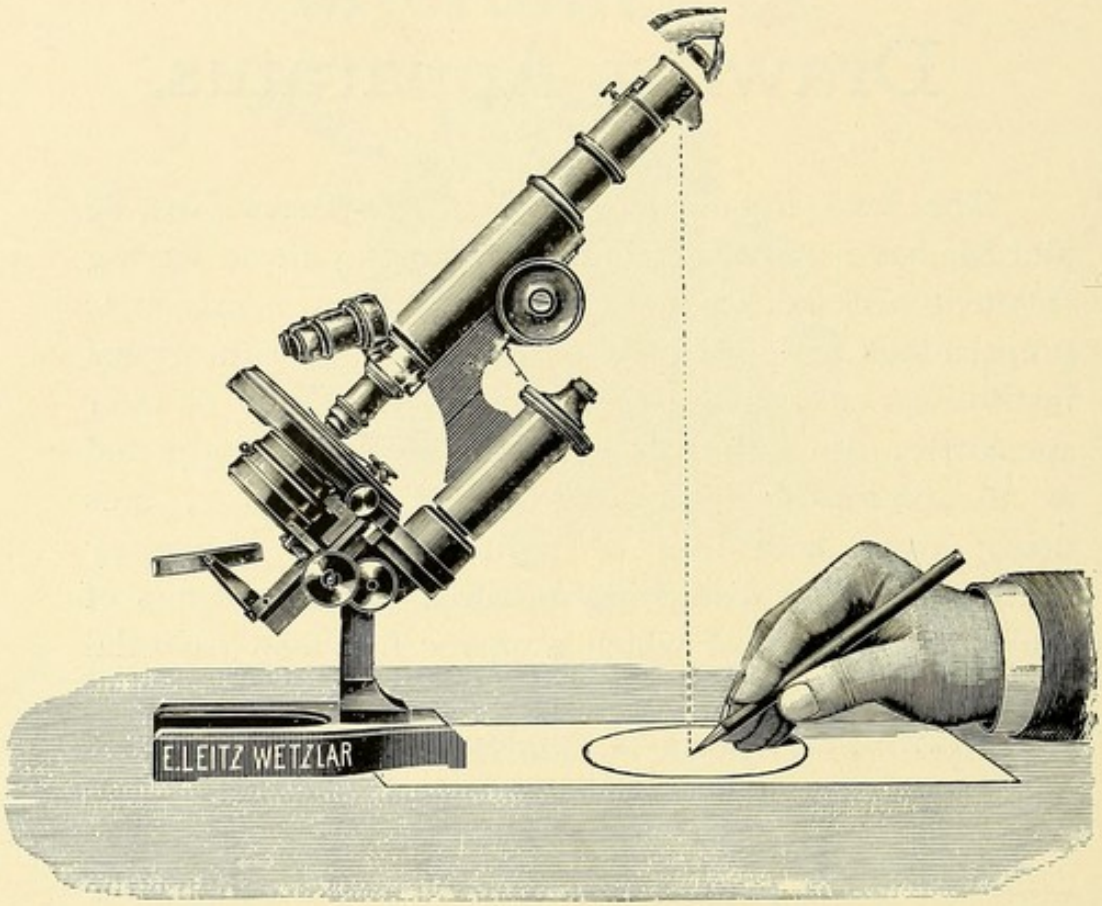
Drawing Apparatus.

No. $

The two following **drawing eye-pieces** Nos. 83 and 84, have quickly found favor among those having frequent occasion to make drawings from microscopic preparations and are now largely used in educational institutions as an aid to students in the study of their specimens. In both eye-pieces the prism is so adjusted as to accomplish total reflection of the image, thus doing away with lose of light and with secondary reflections, such disturbing features of those forms of drawing apparatus of which a mirror forms an essential part.

83. This **drawing eye-piece** is employed with the stand in the vertical position. The reflected image lies at the side of the microscope, the rays passing off at an acute angle from the reflecting prism near the top of the eye-piece. The eye-piece slips into the tube of the microscope like any ordinary eye-piece and is held in position by a thumb-screw. The drawing field is at once visible without further adjustment, and the picture is clear and sharp. The brightness of the drawing field may be regulated by the insertion of smoked glass plates just beneath the reflecting prism . . . . . 8.—.



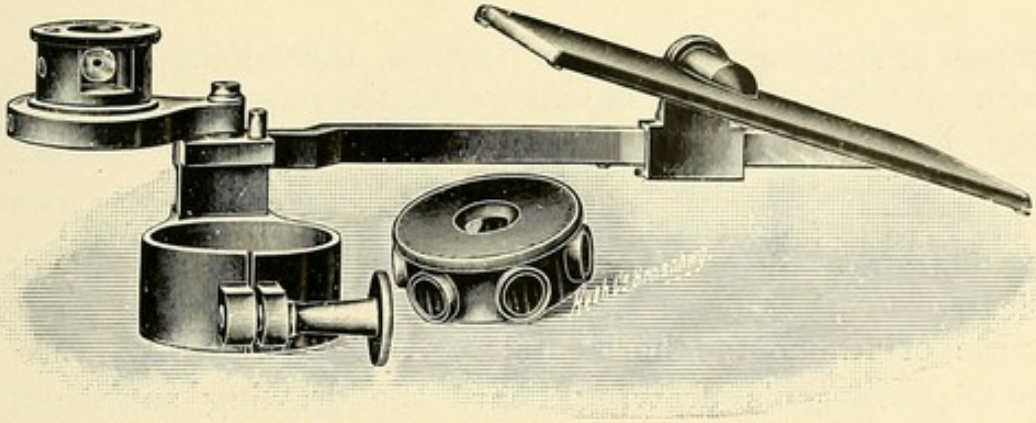


Drawing eye-piece for drawing with inclined stand.

No. $

84. This **drawing eye-piece** is similar in construction to that just described, but is so arranged as to throw the image vertically downwards behind the microscope when the latter is inclined at an angle of 45 degrees. In this case also the picture reflected is clear and sharp, devoid of all disturbing secondary images. As the image is reflected vertically downwards upon the table, no special drawing stand is necessary as there is no distortion of the picture. The intensity of the light may be modified by the insertion of smoked glass plates . . . . **10.—**.

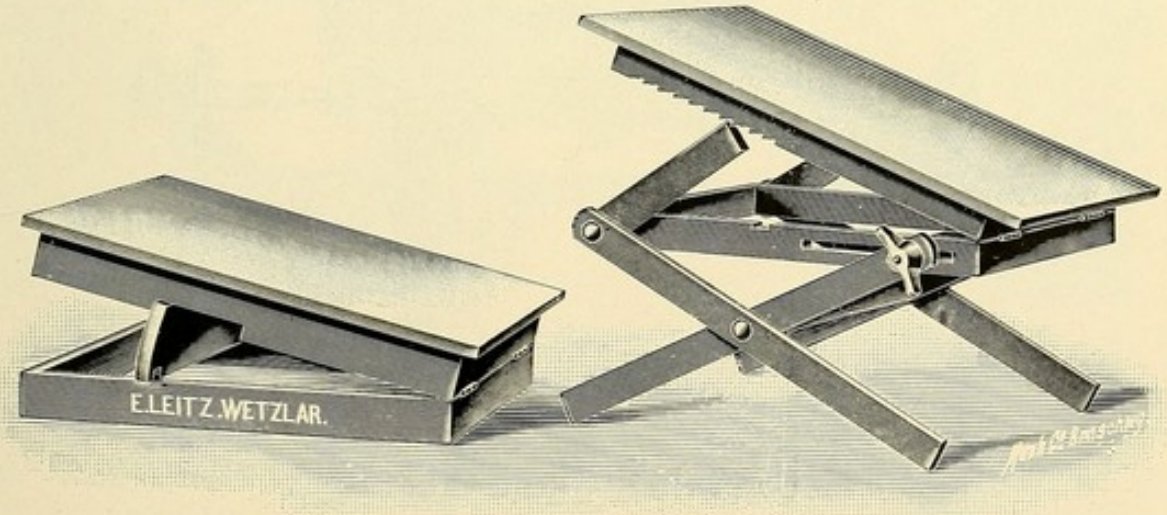
For a description of these drawing eye-pieces and of the principles involved in their construction reference may be had to the Zeitschrift für wissenschaftliche Mikroskopie, XII, 1895.



Abbe's Drawing Apparatus.

No. $

85. In **Abbe's Drawing Apparatus** the drawing field is reflected by a mirror at the side of the instrument and by a prism which fits over the eye-piece of the microscope. The prism is supported on a vertical hinge so that it may be readily turned out of the axis of the microscope without disconnecting the whole apparatus from the stand. It is shown turned to the side in the figure. A cylindrical cap accompanies the apparatus which fits over the prism holder and has six lateral windows in which are smoked glasses of various intensity, serving to regulate the lightness of the reflected drawing field . . . . . **12.—.**



Drawing Board No. 86.

Drawing Board No. 87
after Giesenhagen.

The **Drawing boards** serve two purposes. They afford a smooth plane surface for the drawing paper and they are so arranged that they may be inclined at such an angle as to receive the rays of the reflected

No. $

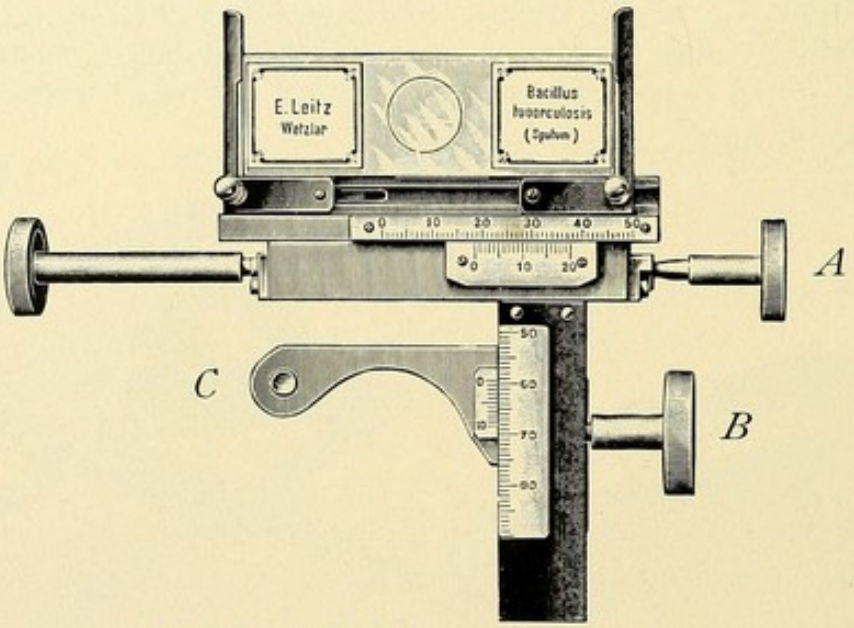
image at right angle to their surface, thus doing away with any distortion of the image on the paper. Giesenhagen's drawing board also provides for the raising or lowering of the drawing surface.

86. This **drawing board** is especially adapted for use with drawing eye-piece No. 83. When in the position indicated in the figure its drawing surface forms an angle of 12° to the horizontal . . . . . **2.—.**

87. In **Giesenhagen's drawing board** the drawing surface may be adjusted at various angles and may be raised and lowered . . . . . **4.—.**

Drawing eye-piece No. 84 and the Abbe drawing apparatus require no drawing board, as the adjustment is such as to permit drawing upon a horizontal surface.

Mechanical Stages.



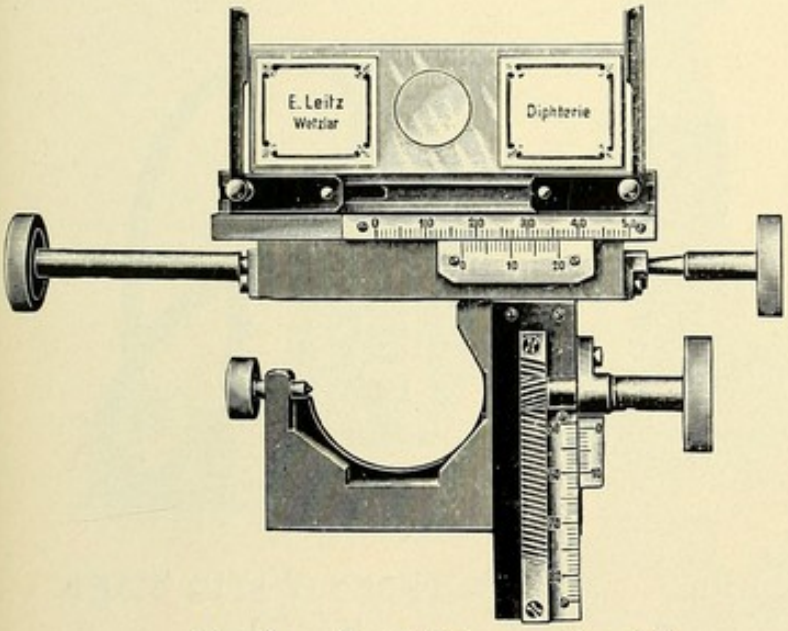
Mechanical Stage No. 88.

88. **Mechanical Stage** adapted to Stands I, Ia and Ib. The stage is readily attached to the microscope by means of a small screw, *C*, which screws into a thread in the microscope just behind its stage, and binds the mechanical stage firmly in position and always in the same position. It may be again removed by simply unscrewing this set screw.

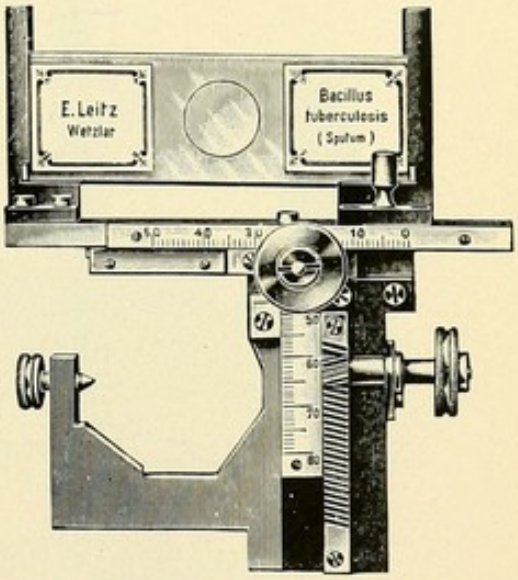
No. $

The movements of the stage are at right angles to one another, are accomplished by carefully constructed rack and pinion adjustments and the exact position of each adjustment is indicated by vernier scales. The extent of the lateral movement is 50 mm; that of the other 30 mm.

This stage permits the careful and systematic examination of large specimens and its construction is so perfect that by means of the vernier scales the most minute objects may be readily replaced in the field of vision, even after removal and readjustment of the stage, provided only that their location when in the field of vision as indicated by the scales had been noted **28.—**.



Mechanical Stage No. 89.



Mechanical Stage No. 89a.

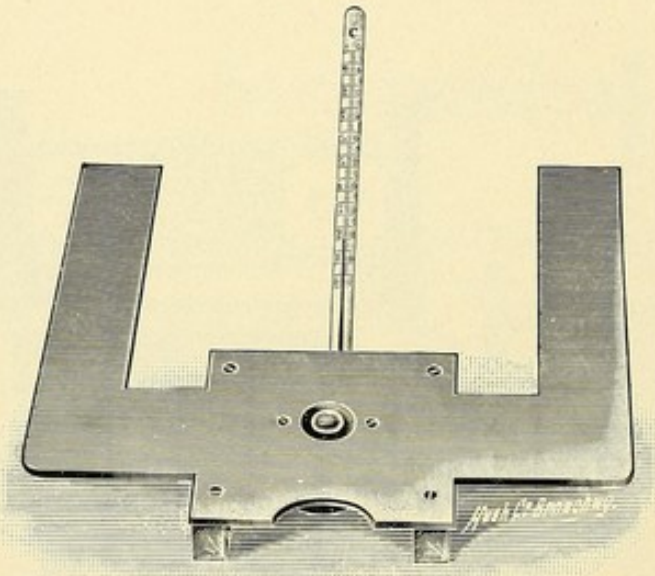
89. **Mechanical Stage No. 89.** When a mechanical stage is ordered subsequently to a microscope outfit and under such circumstances that its correct adjustment to the stand by a skillful mechanic is impossible we advise the purchase of this more readily adjusted mechanical stage, which may readily be attached to Stands I, Ia, Ib, IIa and IIb by means of a thumbscrew. It is as carefully constructed as Mechanical

No. $

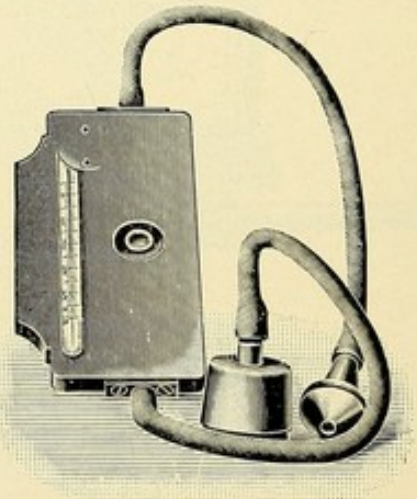
Stage No. 88 and serves the same purpose in every particular . . . . . 28.—.

89a. **New Mechanical stage,** simplified form . . . . . 18.—.

90. **Warm Stage** after Schultze. This consists of a metal stage to which long lateral arms are attached through which the heat from one or more small lamps is conducted to the central part of the stage and the object. The apparatus is also provided with a condenser, which affords illumination sufficient for the use of high power objectives, and with a thermometer indicating the exact temperature of the centre of the stage, which may be carried as high as 100° C. . . . . 12.—.



Schultze's Warm Stage
No. 90.



Stricker's Warm Stage
No. 92.

91. **Warm Stage** after Pfeiffer. It consists of a glass chamber through which warm water may be made to flow. A small cell is ground in its surface thus permitting its use as a moist chamber . . . . . 6.—.

92. **Warm Stage** after Stricker. This stage consists of a metal chamber, through which warm water is made to flow when in use, and is provided also with a condenser and thermometer. It may be screwed firmly to any of the square microscope stages . . . . . 14.—.

Photo-micrographic Apparatus.

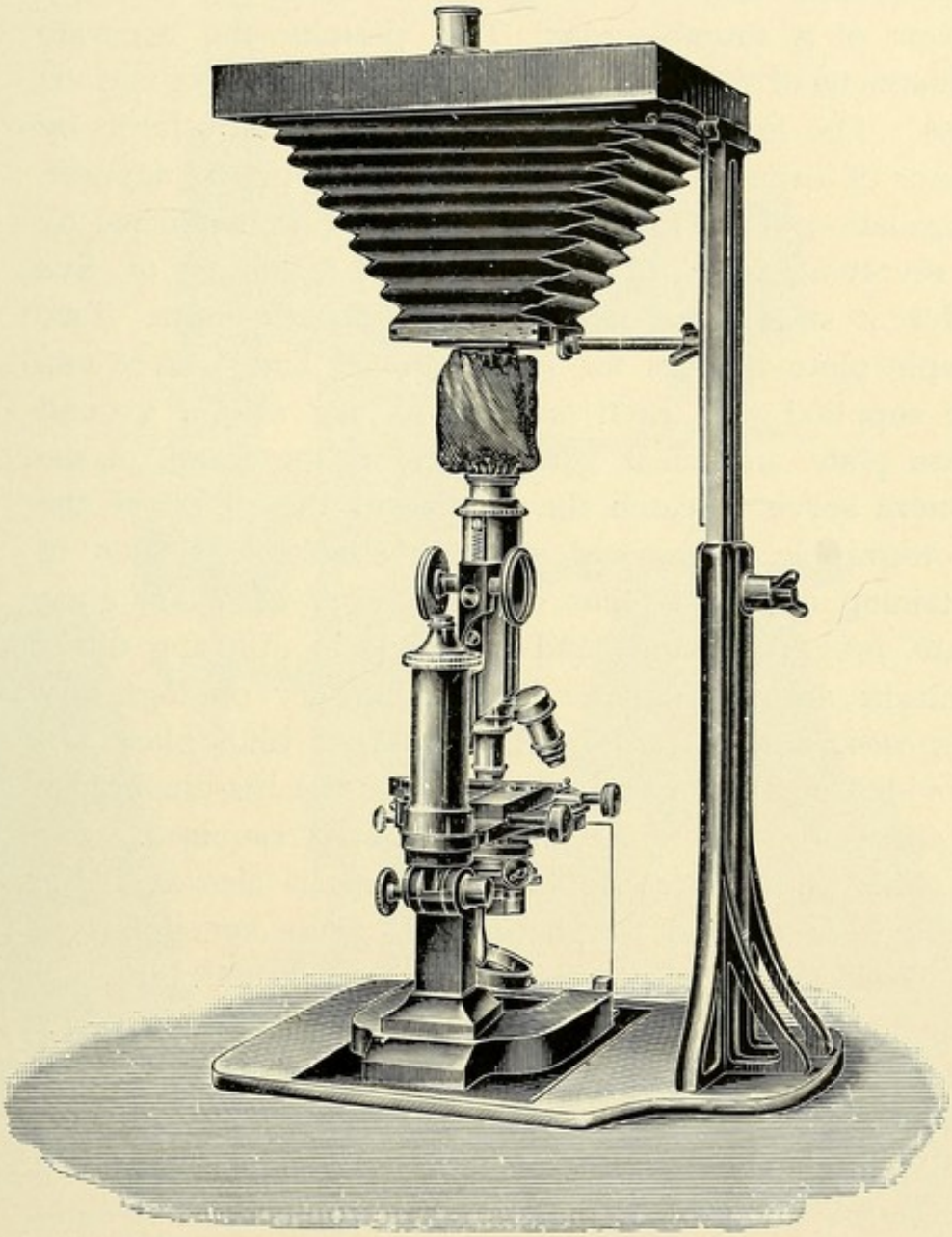


Photo-micrographic Apparatus. No. 93.

The method of employing this apparatus and the general technique of photo-micrography are treated of in a separate pamphlet, containing also four photo-micrographs taken with this apparatus. This little work is furnished with each apparatus.

No. $

93. **The Photo-micrographic Apparatus** consists of a heavy iron foot supporting a stout column in which another iron support moves vertically. This latter holds the camera and may be firmly fixed at any height by means of a thumb-screw. This permits the accurate adjustment of the camera to microscope stands of various sizes. The length of the camera is also adjustable by means of a thumb-screw sliding in the upright support. Regulation of the field of the camera is accomplished by a revolving disc diaphragm with openings of five different sizes situated in the neck of the camera. Two simple plate-holders for plates 9×12 and 13×18 cm. are supplied with each camera, as are also a ground glass plate and clear glass plate in the frame of the camera serve to catch the picture in the plane of the photographic plate, and a small simple lens aids in obtaining a correct focus of the image. A white glass plate, mounted on a stand is of use in diffusing direct sunlight so as to make it available for photographic purposes, and plates of yellow and of blue glass are provided which may be inserted over the iris-diaphragm of the condenser when colored light is required.

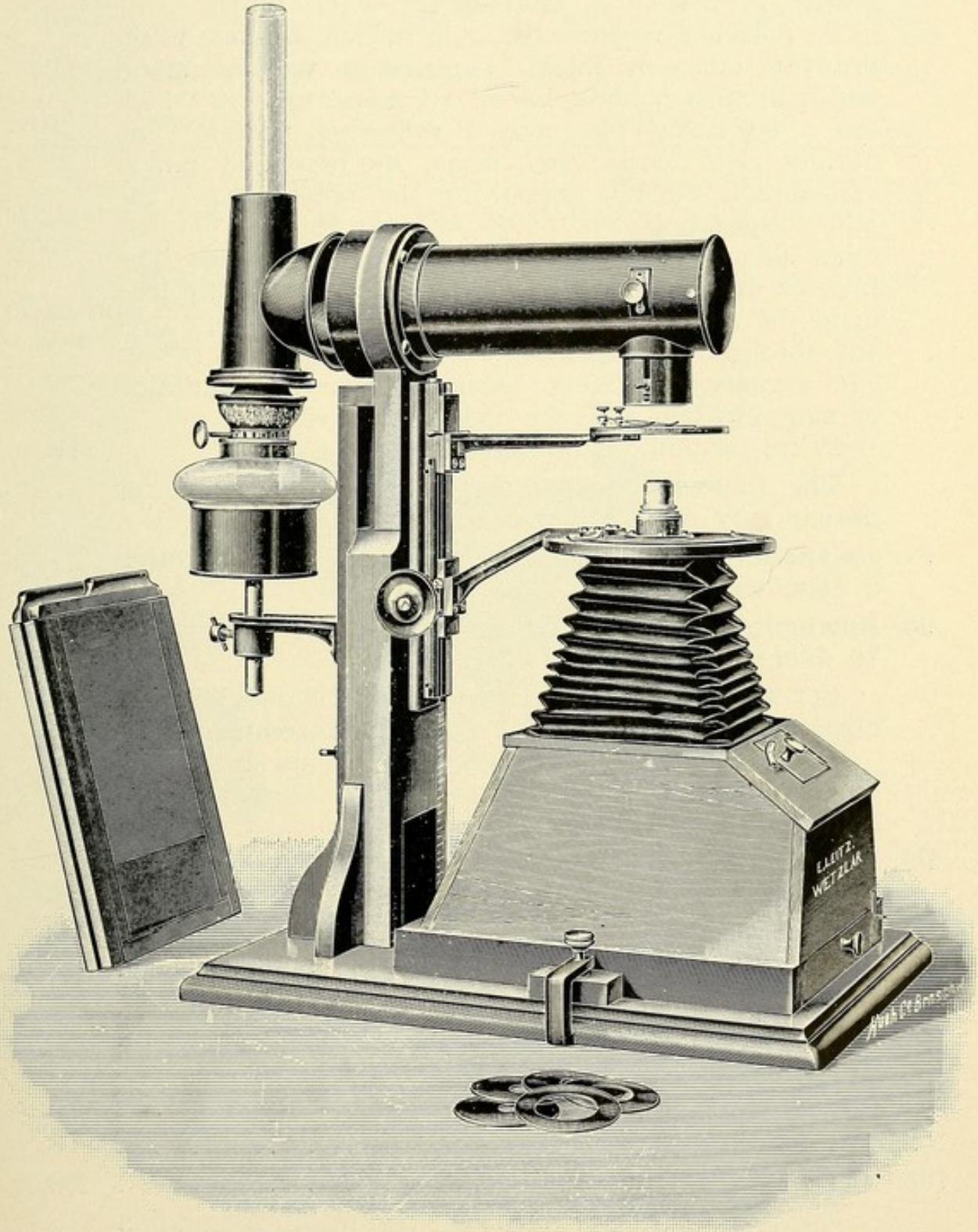
This photo-micrographic apparatus is also available when it is desired to photograph gross specimens of small size, as, for example, embryos, insects, etc., by reflected light, as is represented in the figure on p. 78. The photographic objective No. 103, of 64 mm. focal distance, is best adapted to this purpose. It fits in a collar in the neck of the camera and yields a magnified image of about 3 diameters. The object is brought into proper focus by means of a small stand, the table of which may be raised or lowered as required.

Price . . . . . **40.—.**

94. **Small stand for supporting specimens** to be photographed by reflected light as mentioned above . . . **4.75.**

95. **Reflector** for use with incandescent light . . . . . **6.—.**

Edinger's Projection Apparatus.



Edinger's Projection Apparatus with
Nieser's Photographic Camera.

No. $

96. **Edinger's Projection Apparatus** — For projecting and drawing large objects slightly magnified. (Cf. Zeitschrift für wissensch. Mikroskopie, VIII, 1891.)

A polished wooden base, in which a lime wood drawing tablet is inlaid, supports a wooden stand which in turn holds a horizontal metal tube in which are a collecting lens and a reflecting mirror. The upright also carries, two arms, by rack and pinion adjustment, the one supporting the object stage, the other regulating the lengt of the camera. On the other side of the upright is a support for a lamp. The rays of this lamp are converged by the collecting lens upon the mirror, are reflected downward to the object and through the objective to the drawing board below. The various adjustments permit considerable variation of magnification with the same objective.

Price, including lamp . . . . . **18.—.**

The following lenses are specially designed for drawing by means of this apparatus.

97. **Aplanatic Lens with iris diaphragm** — Magnification 8 diameters . . . . . **10.—.**

98. **Aplanatic Lens with iris diaphragm** — Magnification 16 diameters . . . . . **10.—.**

For sharp pictures of large objects the photographic objectives Nos. 101 to 103 are to be recommended.

For photographic purposes this same apparatus may be had with Nieser's photographic camera, plate holders, &c.

99. **Edinger's Projection Apparatus with Camera** for plates 9×12 cm and 13×18 cm . . . . . **38.—.**

100. **Larger Projection Apparatus with Camera** for plates 9×12, 13×18, 18×24 and 24×30 cm . . . . . **56.—.**

The following Objectives of 24, 42 and 64 mm focal distance respectively may be used in connection with this apparatus for photographic purposes.

101. **Photographic Objective** of 24 mm focal distance . . **16.—.**

102. **The same,** 42 mm focal distance . . . . . **16.—.**

103. **The same,** 64 mm focal distance . . . . . **20.—.**

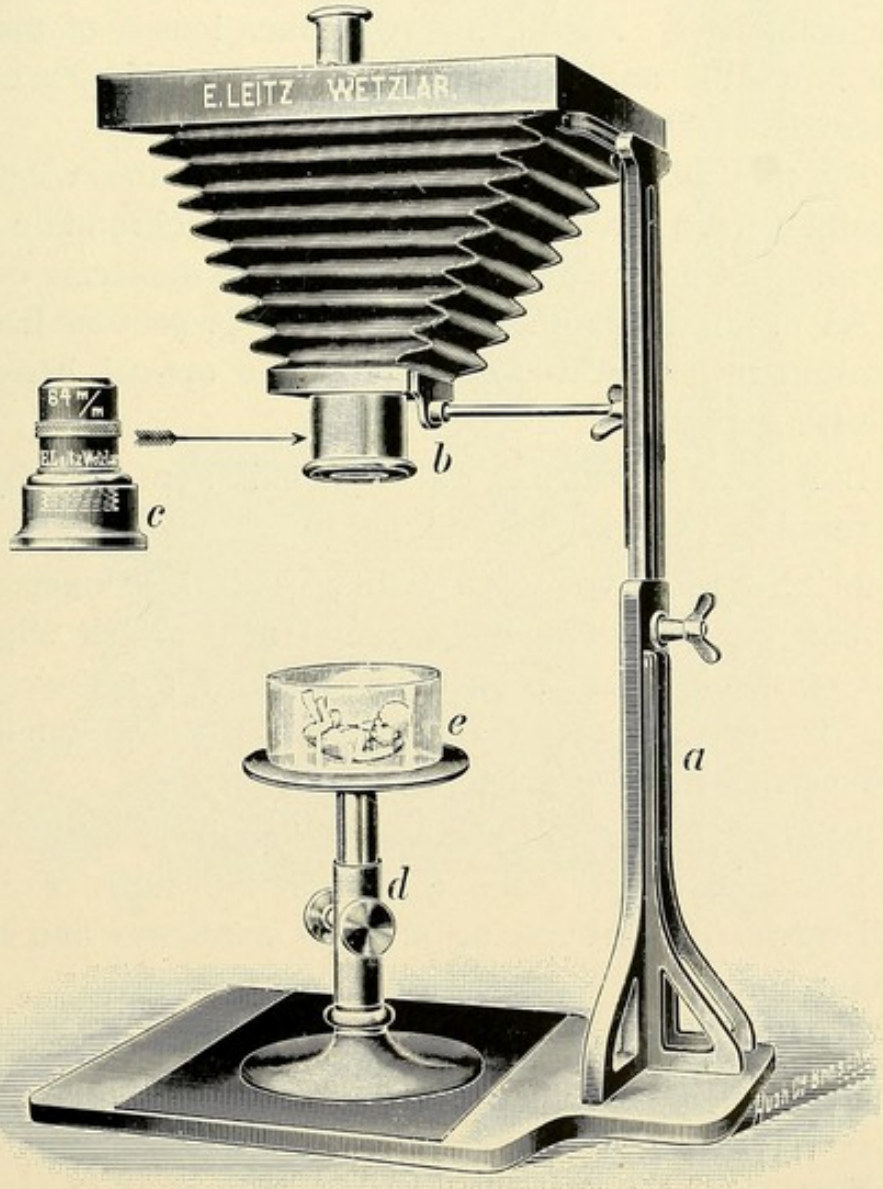
The following table shows the size of the preparation which may be resolved by each one of these objectives and the magnification with the smaller and with the larger Edinger Projection Apparatus.

No.	Objective Focal lenght	Size of the Preparation Maximum	Magnification	
			Smaller Apparatus	Larger Apparatus
101	24 mm	8 mm	7—15 diam.	13—25 diam.
102	42 mm	20 mm	3— 9 diam.	6 –13 diam.
103	64 mm	32 mm	2— 4 diam.	3 – 8 diam.

The time required for exposure in photographing with this apparatus is from 5 to 20 seconds according to the magnification and character of the specimen.

The following figure shows a further use for the Objective of 64 mm focal distance (No. 103).

(Cf. Description of No. 93 on p. 75.)



Large Projection Apparatus.

No.

104. In this projection apparatus the Schuckert electric projection lamp is made use of the lamp being available for electric currents of from 12 to 20 Ampères. The lamp requires the constant current.*) Connected with the lamp is a triple condenser of 150 mm diameter.

Various adjustments permit very accurate adjustment of the lamp and condenser. For example, two thumb-screws controll the position of the carbons of the lamp so that the luminous point may be readily brought into the exact optical axis of the condenser. Again, the two inner lenses of the condenser are moveable and are controlled by two Knobs conveniently situated as shown in the illustration.

By this adjustment of the lenses of the condenser it is possible to do away with disturbing chromatic aberration. The rays of light leave the condenser in moderate convergence.

As ordinarily employed for direct projection from the preparation the apparatus consists of the optical bench with the following parts:

1. A large cooling cell which is kept cool by a current of running water.

2. The bellows with tube. This is connected with the cooling cell by means of a metal ring which slips over the end of the cell and is held in place by a screw. The metal ring is attached to one end of the bellows, while the other end carries a large tube.

3. The microscope condenser and diaphragm holder. A larger tube fits over the tube of the bellows and carries on a revolving arm the condenser and the cylinder diaphragm.

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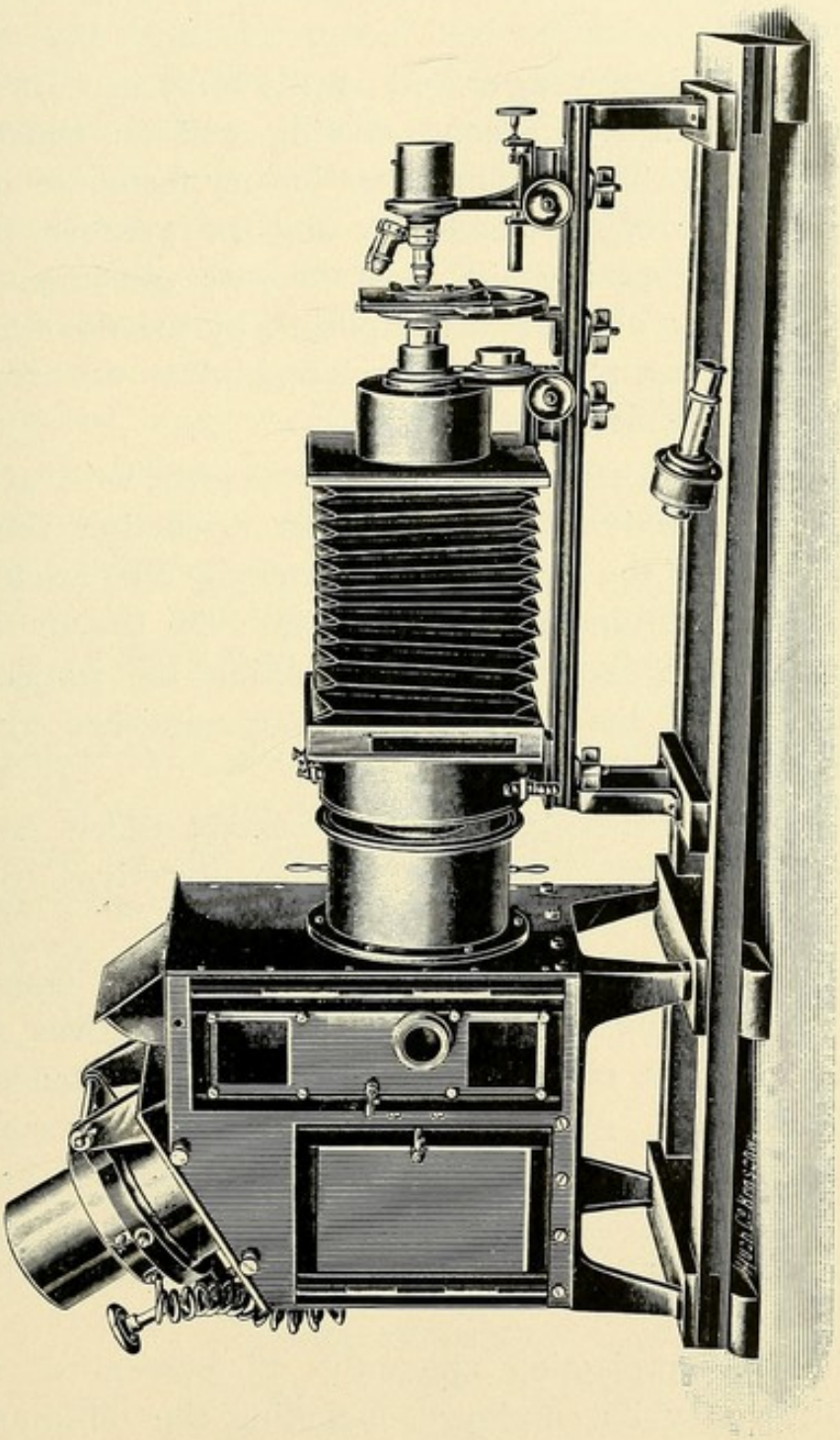
*) In ordering it is well to state the strength of the available electric current so that a lamp of proper strength may be sent. Lamp and rheostat are furnished at the factory prices.

The apparatus can also be furnished for lime light.



Large Projection Apparatus No. 104.

The condenser is especially needed when high powers are employed (Objectives 5 to $^1/_{12}$). The ordinary cylinder diaphragm suffices for low power work. A small rack and pinion arrangement serves for the adjustment of condenser and diaphragm.

4. The object stage and small cooler. The stage has connected with it a second cooling cell on which the preparation rests. This arrangement is very fortunate and permits prolonged use of the condenser and the greatest intensity of light without burning the most delicate specimens. The adjustment of the object is accomplished by means of an arrangement which permits any particular point to be brought accurately into the field.

5. The objective carrier is provided with a nose-piece for three objectives, with a broad projection tube, with a diaphragm for the purpose of narrowing the broad tube and with a narrow tube which screws into the broad one, in case it is desired to used oculars in making the projection. The adjustments of the objectives are accomplished by rack and pinion and by micrometer screw.

6. Wooden cover with cloth curtain which fits over the diaphragm carrier, the stage and the objectives to sheet off any light which may escape at the sides.

For the projection of large preparations of from 20 to 50 millimeters diameter our photographic objectives of 64 and 90 mm and the objective of 42 mm focal distance are best adapted (p. 77). When making use of these low powers the projection tube of the objective carrier should be removed. This tube serves to cut off some of the light and so to limit the field, an arrangement which is necessary with the high powers.

With this projection apparatus all powers of microscope objectives may be employed, including the oil-immersion $^1/_{12}$.

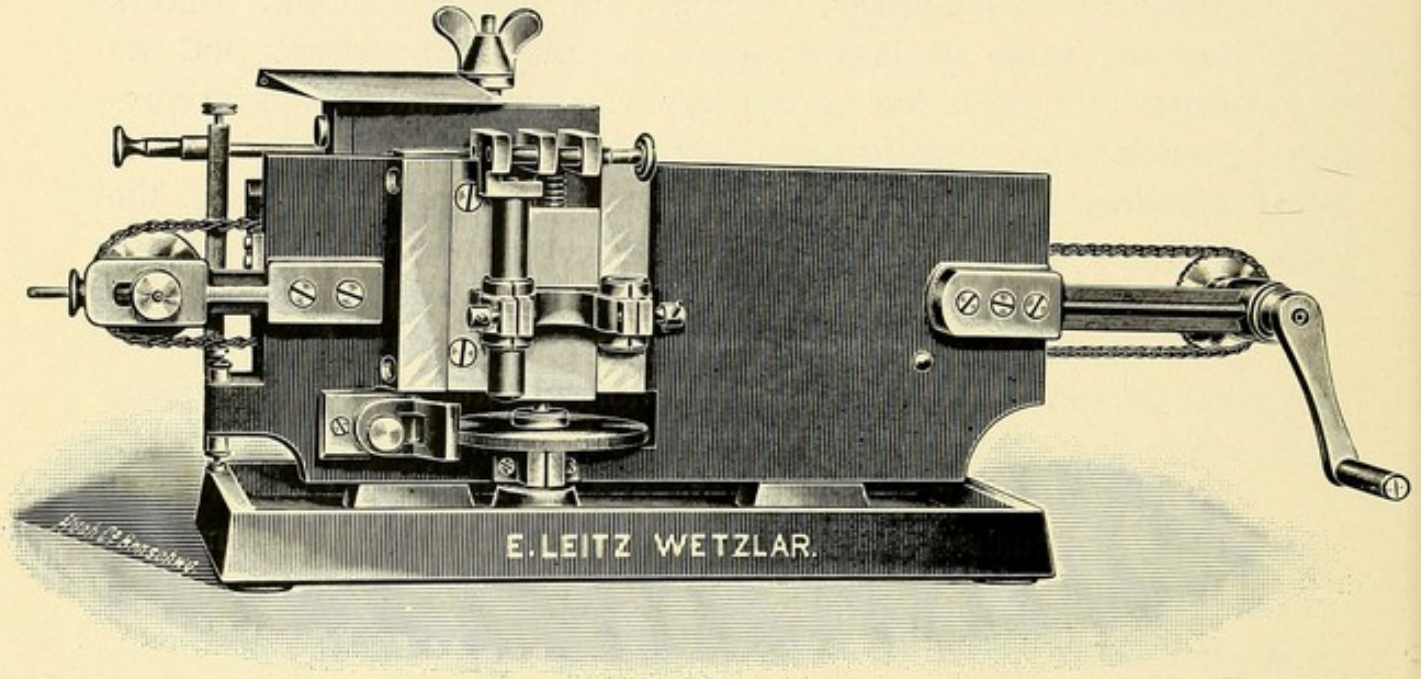
The picture, even when the highest powers are made use of and the screen is at a distance of twelve feet from the apparatus, is of sufficient clearness and brightness to be available for demonstration to a large audience.

For the projection of lantern slides or of large sections of tissue a somewhat different arrangement of the apparatus is necessary. Lamp, condenser, cooler and bellows are the same as in the above described apparatus, but the stage and objective carrier are removed, and a special projection lens of 300 mm. Focal distance is screwed into the diaphragm holder. A slide carrier slips into the frame of the bellows, which is sufficiently large to accommodate lantern slides 9×10 and 9×12 cm in size. The slide carrier has a catch at both ends which facilitate its adjustment in the axis of the instrument, and is arranged for the simultaneous reception of two slides, so that while one is being projected it may be charged with a second which may then without delay be pushed into the optical axis as the first is removed. In this way series of pictures may be thrown on the screen without interruption.

When so arranged the projection can be made upon a screen 30 felt from the apparatus, over the heads of an audience.

Prices:	$
Schuckert Projection-lamp for current of 20 Ampères with centering arrangement	84.—.
Rheostat for this lamp (Voltage 110)	32.—.
Triple collecting lens of 150 mm aperture	60.—.
Outfit for projection of lantern slides Large cooling cell Bellows Plate holder Lens carrier, with adjustment	40.—.
Projection lens of 300 mm focal distance .	20.—.
Outfit for projection of microscopic preparations Cooling cell, bellows &c. as above Cylinder diaphragm and condenser Object stage with cooler, &c. . . Objective carrier with large and small tubes and nose-piece for 3 objectives Wooden covering	48.—.
Projection ocular	4.—.
Complete outfit	288.—.

Microtomes.



Large Sliding-Microtome.

Our larger microtomes are heavy and all their adjustments are of the most accurate construction, the result being that they are very steady when in use and permit the cutting of very thin and uniform sections.

They are to be had in three different sizes. The larger two are slightly different in construction from the third. The two former microtomes are provided with an automatic feed attachement. A heavy knife-carrier slides smoothly and rapidly on a horizontal track and is so arranged that it may be manipulated by the hand of the operator alone or by a wheel and chain device, which tends to assure a perfectly uniform stroke of the knife.

The objectclamp is raised vertically by a micrometer screw. This motion is accomplished by turning a large disc having theeth cut into its periphery and a turn of one tooth being equal to an elevation of 0.0025 mm.

The automatic feed is arranged as follows: With each return of the knife-carrier to the end of its track pressure is made upon an adjustable lever which regulates the motion of the micrometer wheel. This device may be so adjusted as to move the micrometer disc any number of teeth from one to ten with each sweep of the knife.

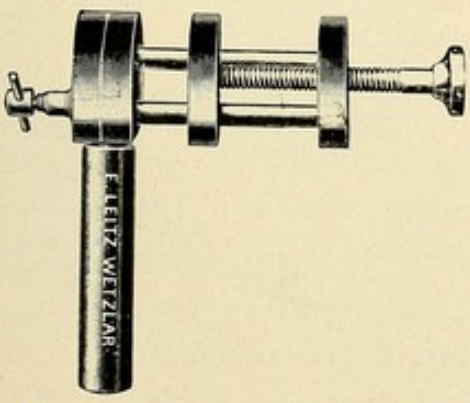
Three different forms of clamps may be had for these microtomes and freezing apparatus as well as paraffin tables can also be fitted.

The Fixed clamp, No. 110, represented in the figure of the large sliding microtome, serves to clamp the specimen in position and does not allow any further adjustment.

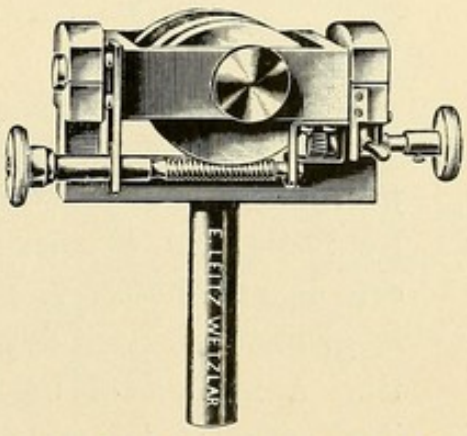
The Ball and Socket clamp permits the adjustment of the specimen after it is held in the clamp by means of a ball and socket joint — see figure of No. 111 — a set-screw then holds it firmly in position.

The Naples clamp permits the accurate adjustment of the specimen at any level the clamp being supported on two horizontal axes at right angles to each other, the one controlled by rack and pinion, the other by endless screw.

No.		$
106.	**The Large Sliding Microtome** has a track 42 cm long. Its price with automatic feed attachement, wheel and chain arrangement for the knife carrier, and fixed clamp, No. 110 without knife	58.—.
107.	**The same,** but without the wheel and chain arrangement for the knife carrier	46.—.
108.	**Medium size Sliding Microtome** — Track 32 cm long; automatic feed attachement; wheel and chain motion of knife carrier and fixed specimen clamp, No. 110 — without knife	52.—.
109.	**The same,** but without wheel and chain motion. . .	40.—.
110.	**Fixed Specimen Clamp**	4.—.
111.	**Ball and Socket Clamp**	6.—.
112.	**Naples Clamp**	12.—.



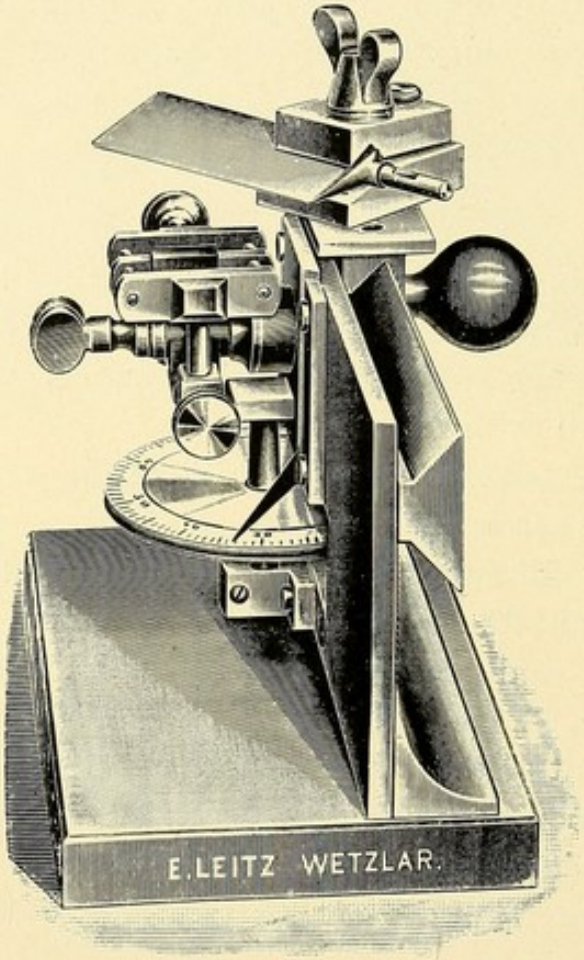
Ball and Socket Clamp No. 111.



Naples Clamp No. 112.

No. $

113. **The Small Sliding Microtome** has a track 19 cm long. The knife-carrier slides on a double flanged support and is moved by means of a large knob. The motion is smooth and quick. The specimen is held in a clamp supported on two adjustable axes at right angles to



Small Sliding Microtome No. 113.

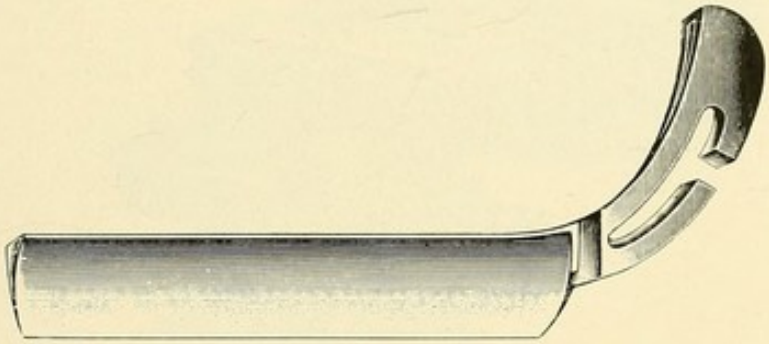
each other, thus permitting its adjustment in any position. The specimen carrier is moved vertically by means of a micrometer screw to which a large disc is attached. The edge of this disc is milled and is graduated, each degree of the graduation representing a motion of the specimen carrier of 0,005 mm. The price of this microtome without box or knife is **34.—**

No. $

Microtome knives.

(Made by W. Walb.)

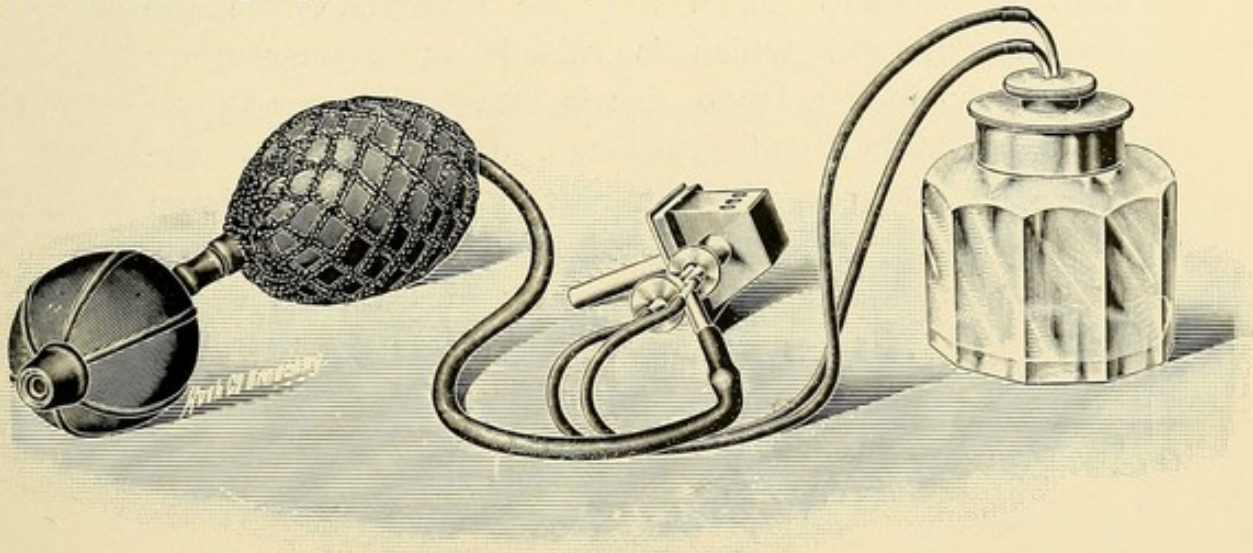
A. Thoma's Model, plano-concave, with handle adapted for clamping immediately to the knife carrier of the microtome in box.



114.	Length of cutting edge 36 cm	**24.—.**
115.	„ „ „ „ 24 cm	**12.—.**
116.	„ „ „ „ 16 cm	**8.—.**
117.	„ „ „ „ 12 cm	**5.—.**

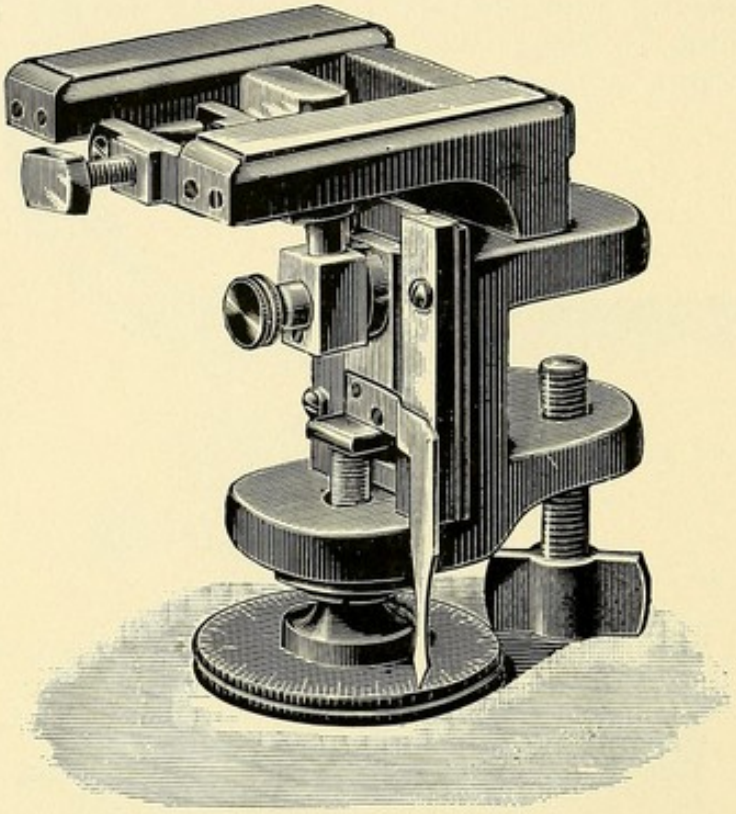
B. Jung's Model — plano-concave — requires knife-holder No. 121 — in box.

118.	Length of cutting edge 24 cm	**10.—.**
119.	„ „ „ „ 16 cm	**6.—.**
120.	„ „ „ „ 12 cm	**4.75.**
121.	**Knife-holder** designed for Jung's Microtome knife . .	**3.25.**
122.	**Freezing apparatus** for Microtomes	**8.—.**



Freezing apparatus No. 122.

Hand Microtomes.

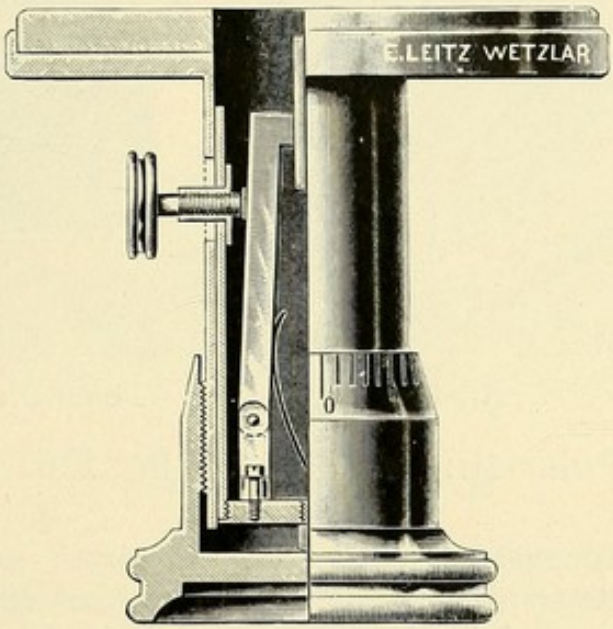


No. 123.

No.		$
123.	This **Hand Microtome**, shown in the figure above, screws to the edge of the table. The specimen is held in a clamp which may be removed from the instrument, and which is raised by a micrometer screw to which a large disc is attached, the edge of which is milled and graduated, each degree of the graduation representing an elevation of the specimen of $^1/_{100}$ mm. The knife is manipulated by hand and in cutting slides over two narrow glass plates which serve as a track for it. The length of this track is 7 cm	12.—

No. $

124. **Cylinder Microtome.** The specimen is held by means of a clamp-screw in a hollow cylinder. This entire cylinder is raised within another cylinder which bears the cutting table by means of a screw with milled

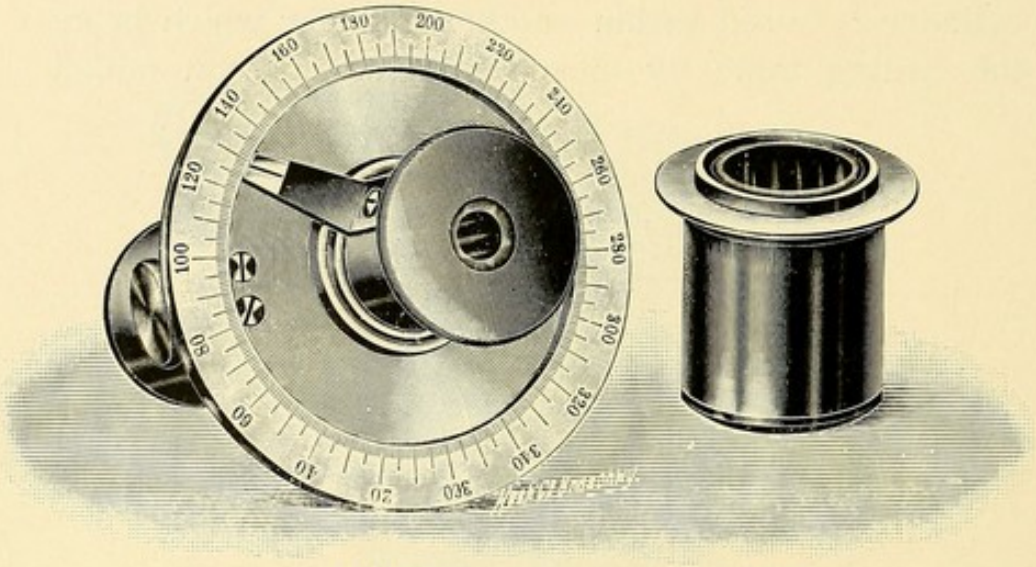


Cylinder Microtome.

and graduated head. Each division of the graduation represents a motion of the inner cylinder of $^1/_{100}$ mm. In cutting the edge of the knife is made to pass over the surface of the glass cutting table, the diameter of which is 7 cm . . . . . **6.—.**

125. **Microscopic section-cutter** — razor form — of best quality . . . . . **1.25.**

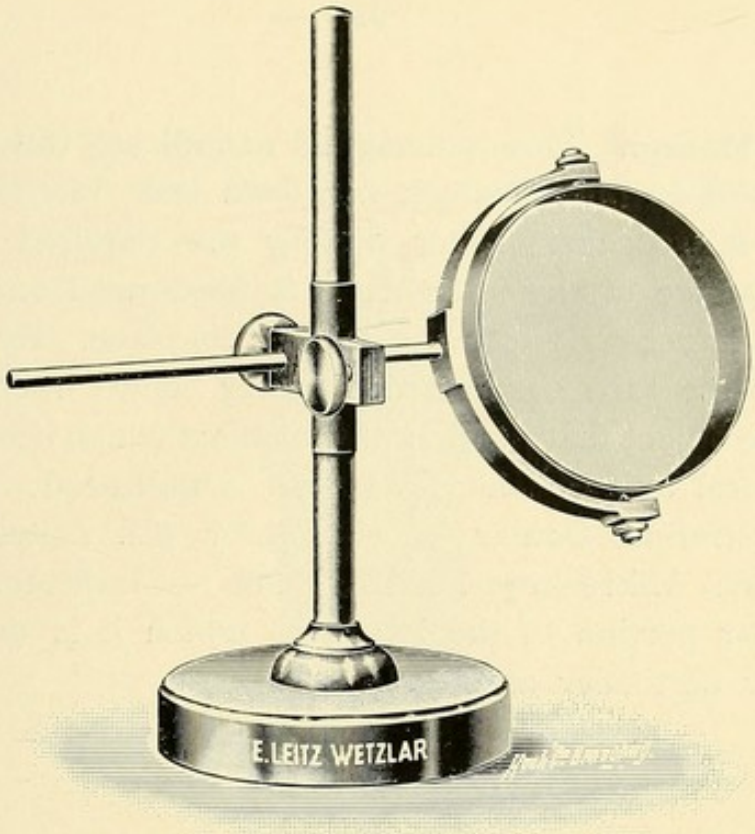
Miscellaneous Accessories.



Analizer. Polarizer.

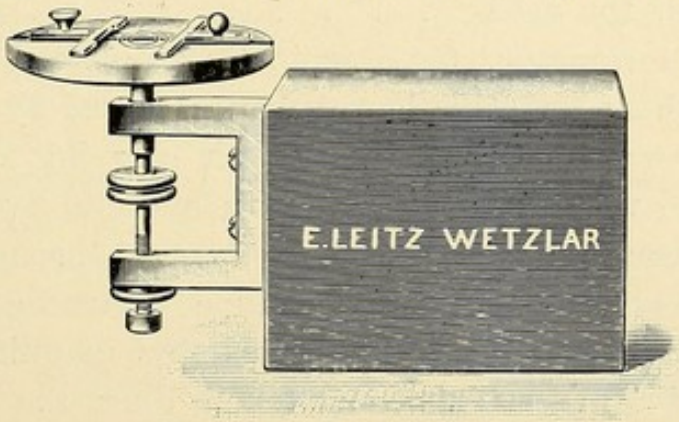
Polarizing Apparatus No. 126.

No.		$
126.	**Polarizing Apparatus** for Food Analysis. The analizer forms part of an ocular which fits into the tube of the microscope and is provided with a graduated disc and index. It is fixed in any desired position by means of a thumb-screw. The polarizer, when used in connection with stands fitted with a substage condenser and iris-diaphragm, is hung in the carrier of the iris diaphragm; when used on other stands it takes the place of the cylinder diaphragm, and if desired may be furnished with a condenser. Price	**20.—.**
127.	**Simpler Polarizing Apparatus.** The analizer is without an ocular and has no graduated disc. The polarizer is as described above	**12.—.**
128.	**Gypsum** and **Mica plates** — set of 8	**3.75.**
129.	**Coverglass Tester,** for measuring the thickness of coverglasses	**3.75.**
130.	**Nose-piece** for two objectives — Double nose-piece .	**6.—.**
131.	**Nose-piece** for three objectives — Triple nose-piece .	**8.—.**
132.	**Nose-piece** for four objectives — Quadruple nose-piece	**10.—.**
	Nose-pieces can be adjusted to our stands at any time without charge. Cf. p. 19.	
133.	**Iris-diaphragm**	**6.—.**



Illuminating Lens.

No.		$
134.	**Illuminating Lens on stand,** 80 mm diameter . . .	12.—.
135.	**Illuminating Lens on stand,** 60 mm diameter . . .	8.—.
136.	**Glass slides,** hollow, per doz	2.—.
137.	**Glass slides,** English form 3×1", of plate-glass with polished edges, per gross.	1.25.
138.	**Glass slides,** with well, for moist chambers	—.40.
139.	**Cover-glasses,** squares, 15×15 mm, per 100 . . .	—.60.
140.	**Cover-glasses,** squares, 20×20 mm, per 100	—.85.
141.	**Cover-glasses,** circles, 15 mm diameter, per 100 . .	—.85.
142.	**Cover-glasses,** circles, 20 mm diameter, per 100 . .	1.—.



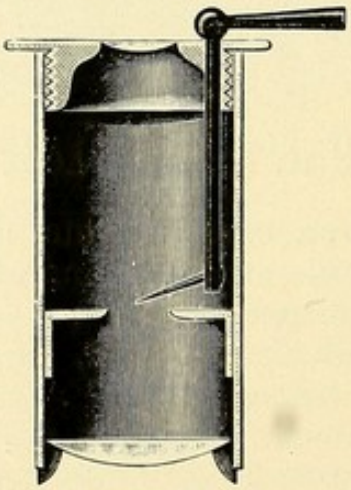
Turn-table No. 143.

143.	**Turn-table,** for ringing, with adjustable slide clips .	4.—.
144.	**Thickened Cedar Oil** for oil-immersion lenses, 1 oz .	—.40.

No. $

145. **Object Marker.** This is designed to indicate the exact portion of an object which has been seen in the field of the microscope. After finding the required field, the objective of the microscope is unscrewed and the marker is screwed into the tube in its place. By then moving the tube so that the marker comes in contact with the object that portion of the object which occupied the optical axis of the microscope is indicated . . . **1.25.**

146. **Demonstration Ocular** of Kuznitzky (Cf. Zeitschr. f. wissensch. Mikroskopie, XIII, 1896). — Indicates any particular portion of the image to which it is desired to draw particular attention.



A small lever at the top of the ocular moves an indicator just above the diaphragm of the ocular to any part of the field . . . . . **3.25.**

147. **Opaque Illuminator,** for illuminating polished pieces of metal whose structure is to be investigated by means of high power objectives — A collar, carrying a prism, screws into the tube of the microscope, and by means of the prism sufficient light is thrown through the objective upon the otherwise opaque object to permit of its examination up to 1000 diameters magnification **6.—.**

148. **Erecting Prism** — This is fastened over the ocular and erects the image received from the compound microscope, thereby materially assisting any dissection or other operation on the stage of the microscope . **7.25.**

No. $

149. **Preparation Eye-piece** — Serves the same purpose as the foregoing, but here the prism is fastened to the ocular 10.—.

Preparation Ocular.

150. **Objective** of 25 mm focal distance. This objective, which has been made at Prof. Koch's suggestion, is exceedingly well adapted for "fishing" bacteria from plate cultures and for dissections on the stage of the microscope because of its long focal distance and its relatively great magnifying power. It may be used with advantage in connection with the preparation ocular No. 149 6.—.

Microscopical cases.

151. **Case** containing a razor, spatula, two small knives, straight and curved scissors, forceps, two needles, two lancet-shaped needles . . . . . 8.—.

152. **Case,** containing a razor, spatula, a small knife, two needles, small scissors, and forceps . . . . . 6.—.

153. **Case,** containing a small knife, small scissors, forceps and two needles . . . . . 3.25.

154. **Botanical Outfit** in case, containing a small knife, forceps, self-closing forceps with horn handle, two scissors, two needles and two lenses . . . . . 8.—.

155. **Outfit for Sputum Examinations,** after Kaatzer, consisting of a platinum needle, blower, cover-glass forceps, and a small rubber plate . . . . . 4.—.

156. **Leather Microscope** case to protect the mahogany case when travelling . . . . . 8.—.

Any of the following publications will be sent on application:

1. Catalogue of microscopes etc., which has been issued in three editions, viz. in
   a) English,
   b) German and
   c) French.
2. Anleitung zum Gebrauch des Microscops.
3. Instructions pour l'emploi des microscopes.
4. Directions for using the Microscope.
5. On the method of counting red and white corpuscles with Thoma's Apparatus.
6. Instructions pour l'emploi de l'hématimètre de Thoma.
7. Anleitung zur Mikrophotographie, mit vier Mikrophotogrammen.
8. Anleitung zum Gebrauch des Mikrospektroskops.
9. Anleitung zum Gebrauch des Oculars nach Ehrlich.
10. Anleitung zum Gebrauch des grossen Projectionsapparates.

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