LENSES

for Photography.

MANUFACTURED BY

TAYLOR, TAYLOR & HOBSON, LTD.

LEICESTER, LONDON & NEW YORK.

Taylor, Taylor, & Hobson, Ltd.,

Scientific Instrument Makers,

Stoughton Street Works, Leicester, England.

Telegrams: "Lenses, Leicester." National Telephone 134.

For LONDON business only—18, Berners Street, Oxford Street, W.

Telegrams: "Illiquo, London." Telephone 4591 Gerrard.

Also at 1135 Broadway, New York, U.S.A.

1906.

Twenty-third Edition.

Cancelling all previous Lists.

CONTENTS.

TERMS.

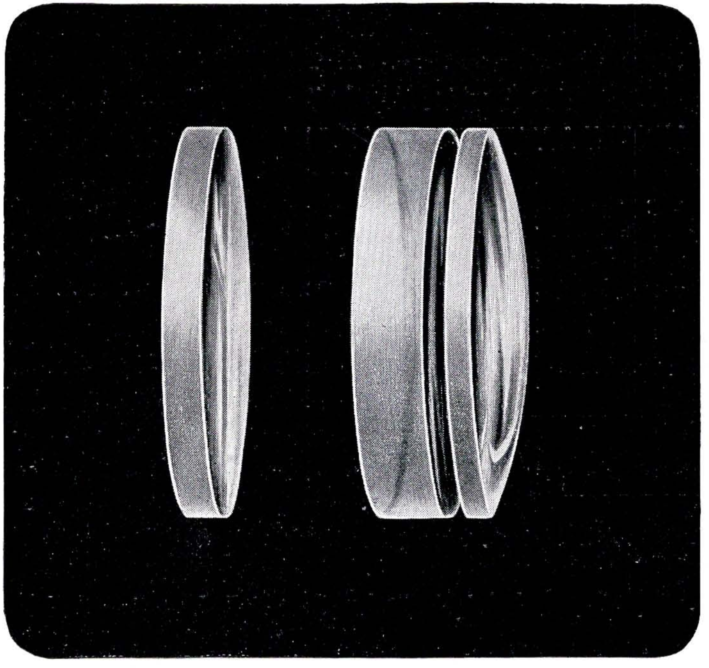
OUR instruments may be had either direct from ourselves, or from photographic dealers everywhere.

In all cases the list prices are subject only to a uniform discount of five per cent. for cash with order.

We pay carriage to any part of the United Kingdom on orders exceeding 5/- in value.

For prices in other countries, customers should enquire of our special agents, whose names will be found on page 48.

Dimensions in this catalogue are in inches, but can be converted to millimeters by multiplying by 25.4. Focal lengths are engraved in millimeters when so ordered.



THREE
SIMPLE
GLASSES.

COOKE LENSES

H. D. TAYLOR'S PATENTS.

As may be seen on the opposite page, Cooke lenses have only three thin glasses, uncemented, and obviously transmit more light than do any of the usual complex forms. By means of delicate screw adjustments the component glasses are accurately adjusted at the factory to produce with full aperture sharp definition evenly throughout the plate.

This unique construction thus insures a uniform excellence which has hitherto been impossible among lenses having such large apertures.

The remarkable properties which are inherent in this type of lens construction have led other opticians to copy the design as closely as possible, and to divide or compound one or other of the three simple glasses which alone are necessary.

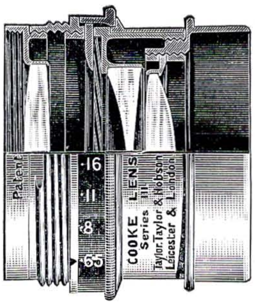
With full apertures, Cooke lenses will give sharp definition at any part of the plate, and with proportionate smaller apertures will cover larger plates for use as wide angle lenses. They are truly rectilinear and free from all traces of flare, ghost, and other common defects of lenses, and are more compact and weigh much less than other anastigmats. Briefly, they are universal lenses, suitable especially for all accurate and rapid work requiring uniformly fine definition.

COOKE LENSES

These lenses are designed for general photography, for landscapes, street scenes, interiors, copying and enlarging, as well as for rapid work or work in poor lights.

Series III.

Aperture f/6·5.



With Iris Diaphragm.

Dimensions are in inches					Prices.	
Approximate equivalent focus.	Focus measured from flange shoulder.	With large apertures to cover plates.	Diameter of flange screw.	Diameter of hood.	Lens without flange	Standard flange extra.
4¼	3·9	3¼ × 3¼	1¼	1·15	**£3 12 0**	**2/-**
5	4·62	4¼ × 3¼	1¼	1·25	**4 0 0**	**2/-**
5½	4·95	4¼ × 3¼	1½	1·40	**4 5 0**	**2/-**
6	5·25	5 × 4	1½	1·40	**4 10 0**	**2/-**
7½	6·6	6½ × 4¾	1½	1·65	**5 10 0**	**2/-**
8¼	7·5	7 × 5	1¾	1·9	**6 1 0**	**2/-**
11	9·6	8½ × 6½	2¼	2·5	**10 10 0**	**2/3**
13	12·0	10 × 8	2½	2·8	**15 0 0**	**2/6**
Five per cent. discount for cash with order.						

GAUGE BARS.—To facilitate very exact adjustment of Cooke lenses in hand cameras, we furnish, when desired, a gauge bar of the exact length required between the sensitive film and the face of the lens flange. One shilling extra is charged for the gauge bar and instructions which accompany it.

LENSES FOR STEREOSCOPIC WORK.—An extra charge of 5/- is made for adjusting a pair of Cooke lenses to identical focus.

Cooke Lenses

These lenses are suited for the same work as the Series III, and give the same results except that they are less rapid. They are perfectly suited for stationary subjects, such for example as machinery for which a reduced aperture is necessary to secure "depth," and brief exposures are not needed.

Series V.

Aperture f/8.

With Iris Diaphragm.

Dimensions are in inches.					Prices.	
Approximate equ valent focus	Focus measured from flange shoulder.	With large apertures to cover plates	Diameter of flange screw.	Diameter of hood.	Lens without flange	Standard flange extra.
4¼	3·8	3¼ × 3¼	1¼	1·15	**£2 18 0**	**2/-**
5	4·5	4¼ × 3¼	1¼	1·15	**3 3 0**	**2/-**
5½	5·	4¼ × 3¼	1¼	1·15	**3 8 0**	**2/-**
6	5·5	5 × 4	1¼	1·15	**3 12 0**	**2/-**
7½	6·9	6½ × 4¾	1½	1·40	**4 10 0**	**2/-**
9	8·3	8 × 5	1½	1·65	**5 10 0**	**2/-**
11	10·	8½ × 6½	1¾	1·9	**7 15 0**	**2/-**
13	11·95	10 × 8	2	2·5	**10 0 0**	**2/-**
16	15·	12 × 10	2½	2·8	**15 0 0**	**2/6**
18	16·45	15 × 12	3	3·3	**18 10 0**	**3/-**
24	22·35	18 × 16	4	4·25	**30 0 0**	**4/-**

Larger sizes made to order.
Five per cent. discount for cash with order.

COOKE LENSES

Series IV.

Aperture f/5·6.

With Iris Diaphragm.

This series is designed specially for high-speed photography, and for difficult subjects under poor conditions of lighting.

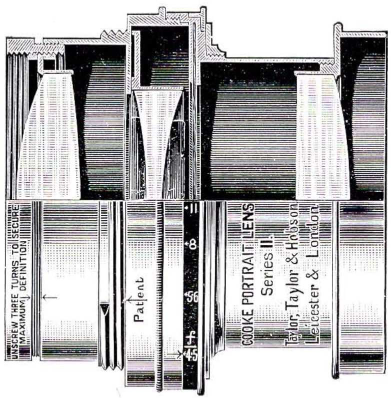
DIMENSIONS ARE IN INCHES.				PRICES.	
Approximate equivalent focus.	Size of plate.	Diameter of flange screw.	Diameter of hood.	Lens without flange	Standard flange extra.
5	$4\frac{1}{4} \times 3\frac{1}{4}$	$1\frac{1}{2}$	1·40	**£4 15 0**	**2/-**
6	5×4	$1\frac{1}{2}$	1·65	**5 0 0**	**2/-**
8	$6\frac{1}{2} \times 4\frac{3}{4}$	$1\frac{3}{4}$	1·90	**7 15 0**	**2/-**
11	$8\frac{1}{2} \times 6\frac{1}{2}$	$2\frac{1}{2}$	2·80	**12 10 0**	**2/6**
13	10×8	3	3·30	**17 0 0**	**3/-**
Five per cent. discount for cash with order.					

COOKE LENSES

FOR PORTRAITURE.

Series II.

Aperture f/4·5.



With Iris Diaphragm.

These lenses are designed for the finest portraiture and for subjects demanding extreme speed. Like other Cooke lenses, they give definition at the margins of the plates equal to that at the centre, and quite free from that peculiar streakiness of marginal definition which is familiar to the professional photographer.

The 8 and 13 inch lenses are provided with the means for moving the back glass shown in the illustration.

This enables the photographer to secure at will uniform sharp definition, or to introduce any required softness evenly throughout the plate.

DIMENSIONS ARE IN INCHES.				PRICES.	
Approximate equivalent focus.	Size of plate.	Diameter of flange screw.	Diameter of hood.	Lens without flange.	Standard flange extra.
4	$3\frac{1}{4} \times 3\frac{1}{4}$	$1\frac{1}{2}$	1.60	**£5 0 0**	**2/-**
5	$4\frac{1}{4} \times 3\frac{1}{4}$	$1\frac{1}{2}$	1·65	**6 0 0**	**2/-**
6	5×4	2	1·90	**7 15 0**	**2/-**
8	$6\frac{1}{2} \times 4\frac{3}{4}$	$2\frac{1}{4}$	2·5	**10 10 0**	**2/3**
13	$8\frac{1}{2} \times 6\frac{1}{2}$	4	4·0	**21 0 0**	**4/-**

Five per cent. discount for cash with order.

Cooke Extension Lenses

By removing the usual back glass of a Cooke lens, and substituting one of these extension glasses, the focus of the combination can be lengthened.

Thus, from the same point of view, the photographer can vary the *scale* of his photographs.

The standard extension lenses shown in the list are designed to increase the scale of the normal lens about fifty per cent. ; so that, for example, an object taken with the normal lens, and two inches long in the photograph, can without changing the position of the camera, be made three inches long by using the extension lens. See illustrations on page 44.

Extension lenses are not intended to cover larger plates than those which their respective normal lenses cover with large apertures, nor must they be expected to do work equal to that of a normal Cooke lens of the increased focal length.

They may be adapted to Cooke lenses already issued, but it is necessary to send the original lens when ordering, both to have the extension lens properly adjusted, and to have its separate index scale engraved upon the iris diaphragm.

Cooke Extension Lenses

Dimensions are in Inches.			PRICE.
Equivalent focus of normal lens Series III. f/6·5.	Approximate focus with standard extension lens. Equivalent focus f/11	Approximate focus with standard extension lens. Focus measured from flange shoulder.	
4¼	6·6	5·9	£0 18 0
5	7·8	7·0	1 0 0
5½	8·5	7·5	1 2 0
6	9·4	8·2	1 3 0
7½	12·	10·3	1 7 0
8¼	13·	11·2	1 10 0
11	17·5	15·2	2 12 0
13	19·9	17·5	3 15 0
Series IV f/5·6.	f/11		
6	9·5	8·5	1 5 0
8	12·3	11·0	2 0 0
11	16·7	14·6	3 3 0
13	19·5		4 5 0

H. D. Taylor's Patents

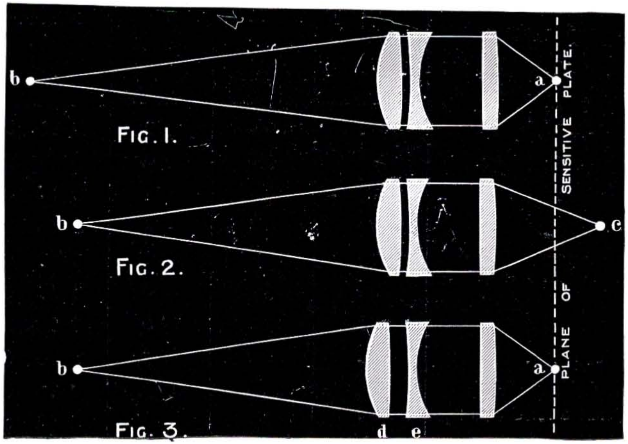
Pairing Extension Lenses for Stereoscopic Work costs 5/- extra for the pair.

Dimensions are in Inches.			PRICE.
Equivalent focus of normal lens Series V. f/8.	Approximate focus with standard extension lens. Equivalent focus f/16.	Approximate focus with standard extension lens. Focus measured from flange shoulder	
4¼	6·6	5·9	£0 15 0
5	7·8	7·0	0 16 0
5½	8·5	7·5	0 17 0
6	9·4	8·2	0 18 0
7½	12·	10·1	1 2 0
9	13·9	12·0	1 7 0
11	17·.	15·0	1 18 0
13	20·2	18·3	2 10 0
16	25	22·3	3 15 0
18	28		4 15 0

Five per cent. discount for cash with order.

FOCUSSING COOKE LENSES

FOR HAND CAMERAS



are a development of the well-known Cooke lens, and provide a means of focussing objects at any distance within their range, while they themselves are kept at one fixed distance from the sensitive plate.

The principle upon which they act is shown by the accompanying diagram.

Fig. 1 represents in section the three simple glasses of a Cooke lens, which forms at the point **a** an image of the distant object **b**.

In Fig. 2 the object **b** is shown nearer to the lens, so that with any ordinary lens the image would fall at **c**, and would be out of focus on the sensitive plate.

In Fig. 3 however, it is shown that by increasing the separation of the glasses **d** and **e** of the Cooke lens, the focus of the entire lens is altered sufficiently to bring the image of the near object **b** to focus at **a** upon the sensitive plate.

The movement of the glass for this purpose is effected by rotating the right hand graduated ring of the lens mount which is illustrated on the next page.

The finest effects of definition which modern anastigmats can yield are seldom obtained in hand cameras of ordinary construction, owing to the want of rigidity and truth of the lens supports.

This improvement which results in a rigid fixing of the lens is, from this point of view alone, especially valuable, while it also effects a considerable reduction in the cost and weight of cameras.

FOCUSSING COOKE LENSES

FOR HAND CAMERAS.

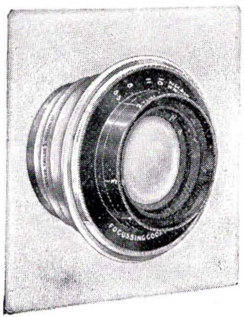
FOCUSSING COOKE LENS
Series III. $f/6 \cdot 5$

H. D. & W. TAYLOR'S PATENTS.

SERIES.	Dimensions are in Inches.				PRICES.	
	Approximate equivalent focus.	With large apertures to cover plates.	Diameter of flange screw.	Diameter of hood.	Lens without flange.	Standard flange extra.
III. f. 6·5	**4¼**	3¼ × 3¼	1·25	1·15	**£3 17 0**	**2/-**
	5	4¼ × 3¼	1 25	1·25	**4 5 0**	**2/-**
	5½	4¼ × 3¼	1·5	1·40	**4 10 0**	**2/-**
	6	5 × 4	1·5	1·40	**4 15 0**	**2/-**
V. f 8	**4¼**	3¼ × 3¼	1·25	1·15	**3 3 0**	**2/-**
	5	4¼ × 3¼	1·25	1·15	**3 8 0**	**2/-**
	5½	4¼ × 3¼	1·25	1·15	**3 13 0**	**2/-**
	6	5 × 4	1·25	1·15	**3 17 0**	**2/-**
Five per cent. discount for cash with order.						

Cooke Lenses of modern ordinary type and of any of the sizes included above can be altered by the addition of this patent focussing movement, for the sum of Fifteen shillings.

Focussing Cooke Lenses

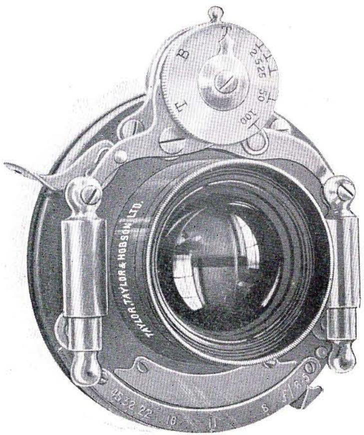


may also be obtained with the special mount and sunk flange here illustrated. This form of mounting has been designed to reduce the projection in front of the lens-board, the projection in the case of the 6-inch lens being only $\frac{7}{16}$ths of an inch. The graduated rings for operating the iris diaphragm and focussing motion are readily accessible and convenient for use.

Focussing Cooke Lenses thus mounted are supplied in the same sizes and at the same prices as the ordinary Focussing Cooke Lenses listed opposite. The price of the special flange necessary is 4/6.

The $7\frac{1}{2}$ inch Series III. Focussing Cooke Lens for half-plates is also made with this mounting. Price, **£6,** including sunk flange.

Cooke Lenses with SHUTTERS.



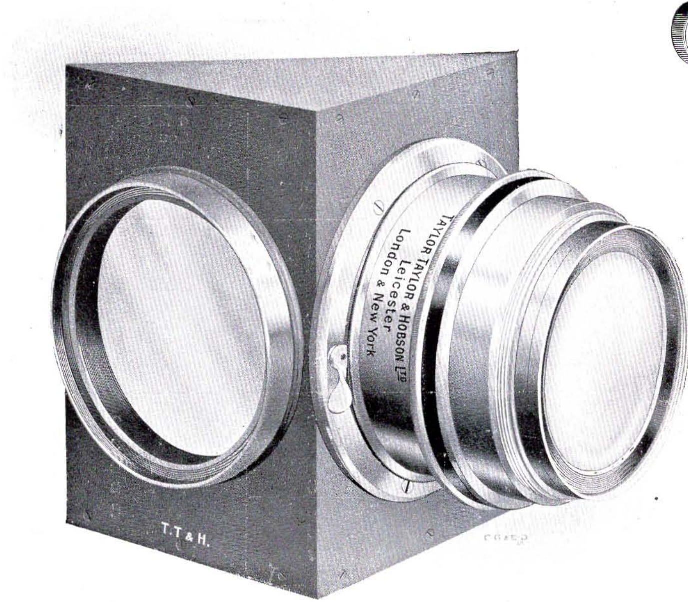
COOKE lenses can be fitted to most of the well-known shutters, but we would emphasise the need of this being done by us to secure the proper adjustment of the lenses.

We supply "Volute," "Automat" and "Unicum" shutters, with Cooke lenses complete, at the following prices. We also fit such combinations to customers' own Kodaks and other cameras.

COOKE LENSES WITH SHUTTERS COMPLETE.

	Approximate equivalent focus.	Size of Plate.	UNICUM. PRICES. Lens and Unicum Shutter complete. Standard Flanges 2/- extra.	AUTOMAT. PRICES. Lens and Automat Shutter complete. Standard Flanges 2/- extra.	VOLUTE. PRICES. Lens and Volute Shutter complete. Standard Flanges 2/- extra.
SERIES III. f/6·5.	*4¼	3¼ × 3¼	£4 17 0	£5 0 0	£7 4 0
	*5	4¼ × 3¼	5 5 0	5 8 0	7 12 0
	*5½	4¼ × 3¼	5 10 0	5 13 0	7 17 0
	*6	5 × 4	5 15 0	5 18 0	8 2 0
	7½	6½ × 4¾	7 7 6	7 15 0	9 2 0
	8¼	7 × 5	8 11 0	8 18 6	9 18 6
SERIES V. f/8.	*4¼	3¼ × 3¼	£4 3 0	£4 6 0	£6 10 0
	*5	4¼ × 3¼	4 8 0	4 11 0	6 15 0
	*5½	4¼ × 3¼	4 13 0	4 16 0	7 0 0
	*6	5 × 4	4 17 0	5 0 0	7 4 0
	7½	6½ × 4¾	5 15 0	5 18 0	8 2 0
	9	8 × 5	7 7 6	7 15 0	9 7 6
	11	8½ × 6½	10 5 0	10 12 6	11 12 6

If desired, the Cooke lenses marked (*) can be supplied with the patent focussing movement described on pages 12-15 for an extra charge of 5/-.



COOKE LENSES

FOR PROCESS WORK

are used by leading process workers throughout the world.

They give for this work uniformly well defined images, free from distortion, from fog, and other common defects of lenses; while for three-colour work they have the unique property of being adjustable so that in their final testing we can secure equality in the size of the various colour-images.

In England, we have found it convenient to supply Cooke Process lenses and accurately worked right-angle prisms with special mechanical conveniences through Messrs. A. W. Penrose & Co., Ltd., 109, Farringdon Road, London, E.C., who will gladly furnish further particulars.

FOR AGENTS IN OTHER COUNTRIES, SEE PAGE 48.

ON BUBBLES IN OPTICAL GLASS.

It might be thought that a material so expensive as is modern optical glass, should be free from all defects. But many of the difficulties of manufacture are serious and inevitable. In order that the various glasses shall possess the necessary refractive and dispersive powers, a large variety of materials are employed by the makers to modify or temper the fusible earths which form the chief constituents of the glass. The perfect incorporation of these materials by melting and stirring them in a crucible, and the avoidance of discolouration and dirt, is a highly delicate task.

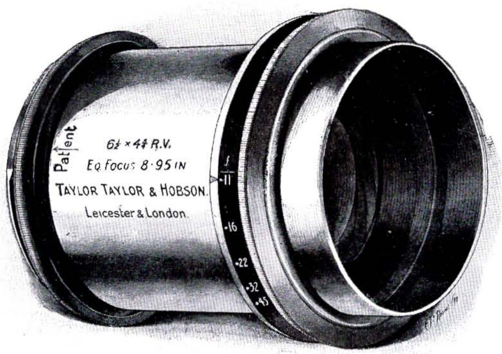
When by these means the optical glass maker has prepared a mass of glass, it is allowed to cool and then broken into fragments. Of these, the cleanest and most perfect only are selected for re-melting to make the final cast. But in melting, peculiar difficulty is experienced. As the pieces fuse together, bubbles of air become imprisoned in the viscous mass, and only the largest of these quickly rise to the surface and escape. The smallest bubbles remain suspended, and can be removed only by patiently waiting until their feeble force carries them to the surface.

But in the course of waiting, more serious harm frequently arises. For the same force of gravity which expels the bubbles, works other changes within the body of the glass. Its heavy constituents sink, and the resulting lack of homogeneity, although invisible to the eye, is far more hurtful to the action of a lens than is the presence of tiny bubbles, which do not in themselves affect the defining power of the lens in the slightest degree. Like the uncut leaves of a book, which are a guarantee of the book being new or unused, bubbles in certain optical glasses are proof that the glass has not been spoiled by long continued heating; and the really wise accept a moderate number as the inevitable accompaniment and mark of good quality.

VIEW LENSES.

These simple achromatic lenses are quite well suited for landscapes and subjects which can be photographed with small apertures.

With aperture f/8 they yield a softness of definition which renders them especially suitable for large head portraiture.



Single Combination.

Code R.V.P. **Aperture f/8.**

Approximate equivalent focus.	Size of plate.	Diameter of flange screw.	Diameter of hood.	PRICES.
Dimensions are in Inches.				
8	4¼ × 3¼	1½	1·45	**£1 18 0**
10½	6½ × 4¾	2	1·8	**2 11 0**
12	8 × 5	2	2·	**3 0 0**
15	8½ × 6½	2½	2·5	**3 13 0**

Five per cent. discount for cash with order.

RAPID RECTILINEAR LENSES.

The Rapid Rectilinear, among low-priced lenses, remains the best for general purposes, and is recommended to the amateur for landscapes, architectural subjects, copying, reducing, or enlarging. When sufficiently stopped down it will produce results equal to those which the more expensive lenses give with their large apertures.

In the design, construction, and finish of these lenses every care is taken to render them as perfect as possible. Each lens is separately tested and adjusted, and all are supplied with the standard flange fittings and flanges, and improved iris diaphragms.

Double Combination.

Code R.R. Aperture f/8.

Dimensions are in Inches.				PRICES.
Approximate equivalent focus.	Size of Plate.	Diam. of flange screw.	Diam. of hood.	
5	4¼ × 3¼	1¼	1·15	**£2 16 0**
7	6½ × 4¾	1½	1·6	**3 7 0**
9	8 × 5	2	1·8	**3 18 0**
11	8½ × 6½	2	2·1	**5 0 0**
13	10 × 8	2½	2·5	**6 10 0**
16	12 × 10	3	3	**8 13 0**
18	15 × 12	3	3·3	**10 5 0**

Five per cent. discount for cash with order.

WIDE ANGLE RECTILINEAR LENSES.

For many subjects which must be photographed from a limited distance, lenses are required which include a larger angle of view than do other lenses.

For such uses the W.A.R. lenses are necessary to the professional photographer, and form a valuable addition to the amateur's outfit, enabling him to secure many fine pictures which longer focus lenses would not include.

Great care is taken to secure with these lenses the finest effects of which the type is capable.

Each is separately tested and adjusted, and all are supplied with the standard flange fittings and flanges, and improved iris diaphragms.

Double Combination.

Code W.A.R. Aperture f/16.

Dimensions are in Inches.				PRICES.
Approximate equivalent focus.	Size of Plate.	Diameter of flange screw	Diameter of hood.	With iris diaphragm.
3	$4\frac{1}{4} \times 3\frac{1}{4}$	$1\frac{1}{4}$	1·15	**£3 1 0**
4	$6\frac{1}{2} \times 4\frac{3}{4}$	$1\frac{1}{2}$	1·45	**3 10 0**
5	$8\frac{1}{2} \times 6\frac{1}{2}$	2	1·8	**4 0 0**
6	10 × 8	2	2	**5 0 0**
7	12 × 10	2	2·3	**6 3 0**

Five per cent. discount for cash with order.

IMPROVED PORTRAIT LENSES.

These portrait lenses are designed for general work in the studio, including groups, and with their smaller apertures are useful for outdoor work, and for copying and enlarging.

Work done with these lenses received first awards at the World's Fair, Chicago, at Vienna, Leeds, Newcastle, at recent exhibitions of the Royal Photographic Society, and elsewhere.

With Iris Diaphragm.

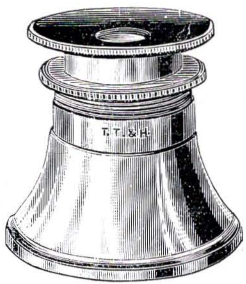
Code E.R.R.

Dimensions are in Inches.					
Approximate equivalent focus.	Aperture.	Size of plate.	Diam. of flange screw.	Diam. of hood.	PRICES.
12	f/5·6	Cabinet	3	3·3	**£9 0 0**
18	f/8	Panel, etc. 12 × 10	3	3·3	**10 5 0**
24	f/8	15 × 12	4	4·25	**16 17 0**

Five per cent. discount for cash with order.

FOCUSSING MAGNIFIER.

Code F.M.



A

B

Price, 4/-

THIS magnifier, for examining the definition of an image on the camera screen, is arranged to close like a telescope for compactness.

The screw ring **B** forms an adjustable stop to limit the withdrawal of the eyepiece **A** to suit the sight of the user.

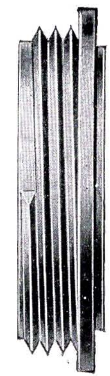
T. T. & H. STANDARD SCREW FITTINGS.

FOR ATTACHING LENSES TO CAMERAS.

This improved screw, which is supplied with all our lenses and flanges, adds greatly to the convenience and comfort of using them, by abolishing all the trouble usual in putting two such screws together.

As shown in the illustration, the screw on the lens (like that on the flange) is formed with the thread commencing abruptly at a point which is plainly marked upon each by an arrow.

To screw the two together, the arrow marks are placed in line, and "the engagement is effected with perfect smoothness and without a hitch." Exactly three turns bring the lens home; while, in removing it, as three turns release it, there is no fear of dropping the lens through uncertainty in this respect.



A further improvement lies in the fact that any number of T. T. & H. lenses fitting the same flange will screw home with their diaphragm indexes in one position convenient for use.

The sizes of the screws used are of the following simple diameters :—$1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, 2, $2\frac{1}{4}$, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, 4, 5, 6 inches (the Standards of the Royal Photographic Society), and as great care is taken in making and gauging the screws, we guarantee all our work to be interchangeable with other fittings of our make.

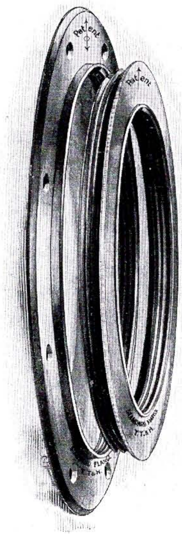
To encourage the universal adoption of standard interchangeable fittings, we re-model the fittings of other lenses, at nominal prices.

See "The construction of interchangeable lens screw fittings," by Wm. Taylor, *Journal of the Photographic Society of Great Britain*, Volume XVII., New Series No. 9.

"You have accomplished really the most simple (and therefore admirable) thing in the world. Photographers have been crying out for it for nearly half a century."

H P Robinson

Tunbridge Wells.



STANDARD FLANGES.

For attaching lenses to cameras.

R. P. S. STANDARDS.

These flanges possess the important advantages described on the previous page. Their screws are formed within one to two thousandths of an inch above the normal sizes, and are thus freely interchangeable.

Except where it is otherwise stated, all lenses in this list are supplied with these flanges.

Diameter of Screw in inches	1¼	1½	1¾	2	2¼	2½	3	3½	4	5	6
Full Diameter of flange ..	2·05	2·3	2·6	2·95	3·3	3·6	4 2	4·9	5·55	6·7	7·85
PRICE	**2/-**	**2/-**	**2/-**	**2/-**	**2/3**	**2/6**	**3/-**	**3/6**	**4/-**	**5/-**	**6/-**

STANDARD ADAPTERS.

To carry lenses in flanges larger than their own.

R. P. S. STANDARDS.

These adapters all contain the improved facilities for engagement and release, with the advantage of holding all lenses with their diaphragm indexes in one position convenient for use.

They are guaranteed interchangeable with other T. T. & H. lens fittings.

Diameter in inches. External screws ..	1½	1¾	2	2	2¼	2½	2½	3	3½	4	5	6
Internal screws ..	1¼	1½	1½	1¾	2	2	2¼	2½	3	3½	4	5
PRICE	**2/-**	**2/-**	**2/-**	**2/-**	**2/6**	**2/6**	**3/-**	**3/-**	**3/6**	**4/-**	**5/-**	**6/-**

T. T. & H. SPIRIT LEVELS

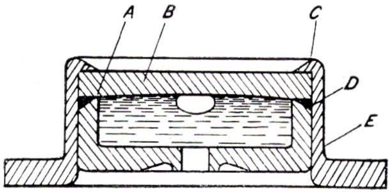
For cameras and other purposes.

A SPIRIT level on the camera is always useful and often necessary. Buildings and other objects must be upright in the photograph, and to secure this, the plate must be vertical during exposure. The spirit level instantly shows when it is so. Mere guessing is fatal to good work.

On a hand camera it is best to place levels beside the finders, one for vertical and one for horizontal views. On a stand camera the level should be fixed to the swing back.

PATENT CIRCULAR SPIRIT LEVEL.

THE design of this level prevents the leakage which occurs in the course of time with ordinary levels.



As shown by the sectional view, the glass **B** is united to the chamber **A** by the elastic ring **D**, and the outer jacket **E** which holds these parts together may be subjected to ordinary rough usage without affecting the vital parts.

All levels are tested for leakage under high pressure, as a precaution against leakage.

The cases are of brass, either bright or bronzed, and are attached to the camera by small screws provided.

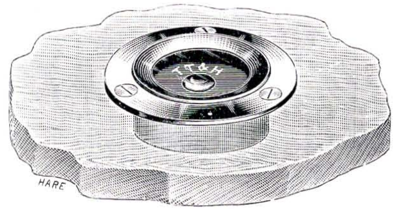
CIRCULAR LEVELS.

To project outside the Camera.

No. 1. Finished Bright.
No. 1b. ,, Black.

Full Size.

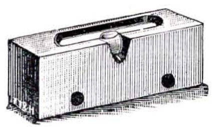
Price, 1/-



To lie flush with the outside.

No. 1F. Finished Bright.
No. 1F b. ,, Black.

TUBE LEVELS.

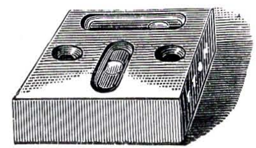


SINGLE TUBE LEVEL.

1in. × $\frac{3}{8}$in. × $\frac{1}{4}$in.

To be screwed to face or side of swing back.

No. 5. Brass .. **1/6.**



DOUBLE TUBE LEVEL.

$1\frac{1}{4}$in. × 1in. × $\frac{1}{4}$in.

No. 4. Brass .. **3/-**
No. 4a. Aluminium **3/6**

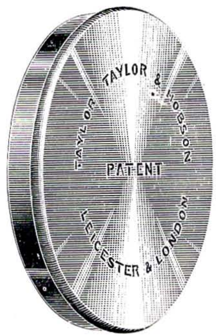
STANDARD LENS CAPS.

The cap fittings of all lenses in this list are made to standards, and extra caps, covered with Morocco leather, are supplied at the following prices.

In case of doubt as to the size, it is best to send a narrow strip of paper, cut to fit round the hood with its ends meeting nicely.

Diameter of hood or fitting in inches.	1·1	1·15	1·25	1·3	1·35	1·40	1·45	1·6	1·65	1·8	2	2·1	2·3	2·5	2·8	3	3·3	4	4·25	5	6
PRICE	**1/2**	**1/2**	**1/3**	**1/3**	**1/3**	**1/3**	**1/3**	**1/4**	**1/4**	**1/4**	**1/6**	**1/8**	**1/10**	**2/-**	**2/2**	**2/4**	**2/6**	**2/8**	**3/-**	**3/6**	**4/-**

Caps of other sizes are charged according to cost.



STANDARD DUST CAPS.

These caps are for covering the back glasses of lenses when not in use, to protect them from dust and injury. Having the standard screws, they will fit any of the lenses which have similar flange screws. When ordering, say what lenses the caps are to fit, as the depths vary.

Diameter of screw in inches.	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	3
PRICES	**2/-**	**2/-**	**2/-**	**2/-**	**2/3**	**2/6**	**3/-**

THE PRINCIPLES OF A LENS ACTION.

(COPYRIGHT.)

By William Taylor, F.R.P.S.

It is impossible to use a photographic lens to best effect without a knowledge of its action ; and while only a few photographers have opportunity to seriously study optics, all may at least gain for themselves some clear conception of the action of a lens in forming images. The purpose of this essay is to explain in a simple way the principles which govern the formation of images by lenses.

Light, the agent by which we see, and the power which effects certain chemical changes utilised in photography, consists like sound, essentially of motion.

And as sound is transmitted by wavelike motion of the air, so is light transmitted by the wavelike motion of certain *ether* filling universal space.

A source of light, such as the sun, sends off continuous series of waves, which, bouncing back from the surface of objects, and being affected by them in the bouncing, convey to us impressions of things seen.

As with sound the pitch or height of any note depends upon the frequency of its vibrations ; so with light, colour depends upon the frequency of the wave motion, upon what is termed the wave length.

Waves of certain lengths are those which most affect our sight ; these and others have power to produce the chemical changes with which photography deals.

As many sounds uttered at one time influence the same air with their *distinct* vibrations, so that we may recognise each sound among the others ; so sunlight is composed of lights of different colours, of waves of various lengths, travelling through the same medium, while each wave retains its characteristic form and length.

The light reflected by the surfaces of objects is the agent by which we see them. Some surfaces reflect most of the light which reaches them ; others absorb most, and reflecting but little to make them visible, appear to us dark or black. Some have powers of selection to absorb waves of certain lengths and to reflect others. This power constitutes the colour of a surface, for it is seen by the light which it reflects.

A surface capable of being seen must be to some extent rough. The roughness acts in this way :—Waves of light meeting the surface and reflected from it, are broken up by the rough particles, and each projecting particle becomes a centre from which reflected waves of light spread out again in all directions. An eye, receiving such light from every point of an object, condenses the waves to other corresponding points, and re-arranges them upon the retina to form an image of the object. In this way we see the object. A photographic lens also, receiving waves of light from every point of an object, condenses the waves and similarly re-arranges them to form an image. The ground glass screen, placed where the image exists, renders it visible. Each particle of the rough glass surface becomes a centre of re-formation of the waves which fall upon it, and our eyes receiving light in this way from each point of the image, see the image as they saw the object.

The simple purpose of a photographic lens is to condense to a corresponding point in the image the light which reaches it from each point of the object.

Refraction.—The power of a lens to condense light depends upon the fact that the velocity of light varies with the nature of the medium through which it passes, being greater in air than in glass.

The diagram on page 32 shows the way in which light is condensed by a simple form of view lens, a case sufficiently representative of others. **L** is the lens shown in section. **P** is a point from which light waves pass in the direction of the lens ; the portion of a wave which reaches the lens being shown at intervals along its course. (*To render the diagram compact, the size of the lens is out of reasonable proportion to the distance of the object* **P**, *but the principle is equally apparent*). It will be seen that the form of the light wave is changed as it enters the lens. The centre portion of the wave in entering the glass first is retarded more than the outer portions, and thus the wave is flattened. On leaving the lens the outer portions of the wave are free to advance some time before the centre becomes free, and the wave thus curved in reverse direction passes again to a point. Beyond this point, if not obstructed, the portions of the wave continuing their straight course open out again.

We have followed here the passage of a light wave from one point **P** of an object to the corresponding point **I** of its image, those points being shown for convenience as situated on the axis of symmetry or *principal axis* of the lens. But the entire image may be considered as built up of many such points of light condensed precisely in this way.

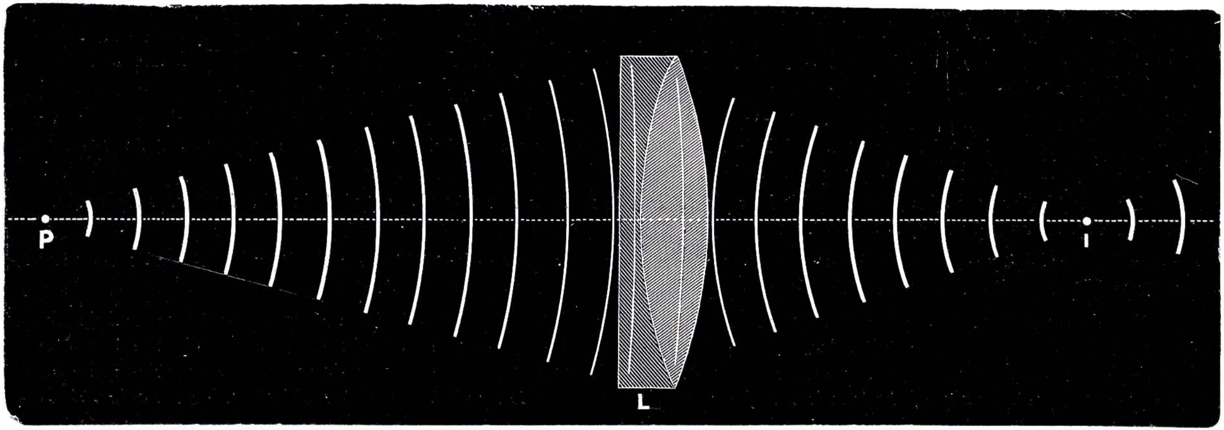


Fig. 1.

A diagram indicating the way in which light is condensed by a lens.

Spherical Aberration.—It will be obvious that the sharpness of definition in such an image depends upon the power of the lens to condense light accurately to a *small* point. Once more referring to the diagram, it will be seen that *unless the wave leaving the lens be truly spherical in form, its parts, not having one common centre, will not converge precisely to one point.* If, for example, the margin of the wave is bent too much in passing through the lens, that part will close together and separate again before the centre portion is condensed, and the image at the point I will not be sharply defined, but will appear as a shaded spot. To secure such form and relation of the glasses as will preserve the true sphericity of the waves which pass, is a great object in designing and making lenses. Error in this respect is known as spherical aberration.

The outer portions of a wave, being most bent, suffer the most from any error of this sort, and a stop, by cutting off such outer portions, will reduce the spherical aberration of a lens and improve its power of definition.

The wave may be distorted not merely by insufficient or excessive bending of its outer margin, but by irregular bending of the whole of it. If, for instance, the lens itself is bent by pressure of an untrue mount, the waves which pass it suffer similar distortion ; and it will easily be seen how much the power of definition of a lens depends upon the careful grinding of its surfaces.

Astigmatism.—In dealing with light passing through the lens along the axis of symmetry, it is comparatively an easy matter for the optician so to construct any lens that the light waves leaving it shall be truly spherical in form ; but in dealing with light which has to pass obliquely through the lens, towards the margins and corners of the picture, it is by no means a simple matter to secure this desirable sphericity of the light waves. All lenses except some of the most recent types, impress on the light waves which pass through them obliquely, a form which is represented approximately by the Figs. 2 and 3. Instead of being truly spherical the wave here is of a peculiar ellipsoidal form, its curvature in the direction **A B** being relatively much flatter than in the direction **C D** at right angles to it, while the parts lying between **A B** and **C D** are curved in degrees which vary between these two extremes.

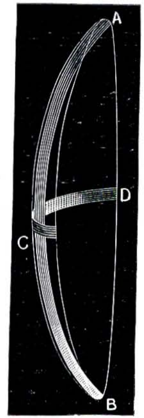


Fig. 2.

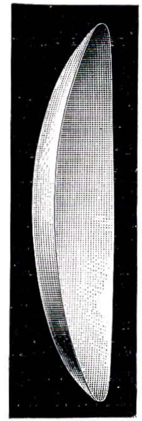


Fig. 3.

The effect of this is that the oblique images formed by such lenses are built up, not of fine circular points, but of blurred lines of light which overlap and cause that peculiar streakiness of marginal definition which is noticeable in many photographs.

The defect in a lens which imparts this ellipsoidal form to light waves passing through it obliquely is termed astigmatism, and the effect is strikingly displayed in the series of concentric circles, Fig. 4, which are magnified from a portion of a photograph taken with a lens of the Rapid Rectilinear or Symmetrical type.

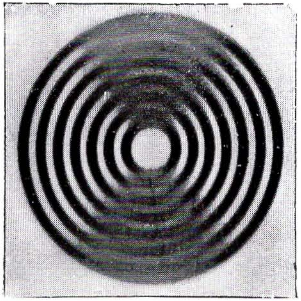


Fig. 4.

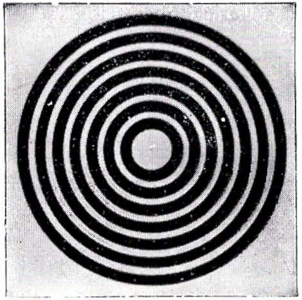


Fig. 5.

Fig. 5 is the same series of circles which were photographed under exactly similar conditions, but with a Cooke lens, and exhibit the freedom of that lens from Astigmatism.

Achromatism.—The amount of refraction or bending of light waves which occurs in their passage through the lens, depends partly upon the colour of the light, or its wave length ; and a lens consisting of one piece of glass alone is unable to bring together in one focus all the variously coloured lights which together compose ordinary white light. By combining in one lens two or more glasses of different properties, the optician is enabled to render his lenses achromatic and free from this defect.

Focus.—It will be understood from Fig. 1 that the light passing from the lens to a point of the image is a cone whose apex is the point, and that beyond the point, if not obstructed, another cone is formed in the reverse direction. It follows that if the focussing screen be placed anywhere on either side of the point, it will receive, not a point, but a spot or disc of light, a section of a cone. And an image built up of such discs of light which overlap is ill defined, and is said to be out of focus.

Focal Length.—Referring to the diagram it will be seen that a lens relatively thicker in the middle than the one shown, would still more retard the centre of the wave, and, by thus enhancing its reversed curvature, condense it to a point nearer to the lens. Glasses of greater density would effect a similar result.

It will be seen also that if the point **P** be further from the lens, that portion of a wave from it which meets the lens surface, being part of a sphere of greater radius, will be less curved, and the reversing action of the lens will produce on the other side, greater reversed curvature. Thus the point to which the wave becomes condensed is nearer to the lens.

When the distance of the point **P** is very great, the wave surface meeting the lens is practically flat, and further increase in the distance of **P** makes no practical difference in the position of the point **I**, to which such waves are condensed.

The point to which light from a source at a great distance is condensed is called the principle focus of the lens, and the distance between this point and a certain *centre* of the lens is its equivalent focus.

Conjugate Foci.—It has been noted that, as the lens and object **P** become separated, the image **I** approaches the lens. There is for every distance of the object a corresponding distance of its image depending on the equivalent focus of the lens. Such relative distances are called conjugate foci. In the tables on pages 39-41 these particulars will be found for lenses of various equivalent focal lengths.

Depth of Focus.—We have seen that the position or distance of an image, as measured from the lens, varies with the distance of its object, and it will be evident that with a view formed of objects at various distances, their images cannot be equally well defined upon the *plane* surface of the camera screen. Some points of the image will be out of focus, the camera screen being not at the point **I**, Fig. 1, but somewhere on either side of that point, so that it receives, not points of light, but discs of light, sections of cones.

It is a common mistake to suppose that one lens can perform better than another in respect of its defining, in one plane, objects at various distances from the camera. The truth is that this quality, which is called depth of focus, depends intrinsically upon the focus of the lens and the relative size of its aperture, and upon nothing else.

The position of an image formed by a short focus lens is not so much influenced by varied position of the object as is that of an image formed by a lens of long focus. A short focus lens, therefore, has greater ability to define in one plane objects both far and near.

When, however, any object of fixed depth is to be photographed on any required scale, a short focus lens used at a short distance has no greater depth, *as regards that object,* than a long focus lens used at a greater distance.

In such a case the longer focus lens is much better, as giving better perspective. This is always the case in portraiture.

In any given lens, however, want of definition arising in this way can only be remedied by reducing the lens' aperture, thus reducing the diameter of each cone of light passing to the image and sharpening those points which are out of focus on the screen.

It should be pointed out that one judges sharpness of definition in any part of the image largely by comparison with the definition of neighbouring parts ; so that by degrading the entire power of definition of a lens, the lack of definition in particular parts of its image may be rendered less noticeable. Such spurious depth of focus is sometimes introduced of deliberate purpose, as in the case of portrait lenses.

Curvature of Image.—It is evident that unless the entire image which a lens forms is practically flat, it cannot appear well defined upon the plane surface of a focussing screen or sensitive film.

With all the old and well-known types of lens, the true image even of a flat surface is more or less curved or dished, as in Fig. 6, so that it cannot be focussed sharply all over on a flat plate. This curvature of image, combined with astigmatism, occasions the well-known falling-off in sharpness of definition at the margins and towards the corners of photographs. The Cooke lenses, described in this catalogue, are remarkably free from these defects.

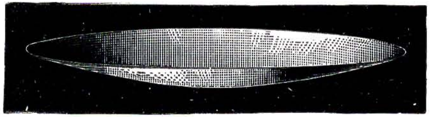


Fig. 6.

Size of Image.—The relation between the size of an image and that of its object depends simply upon their respective distances from the optical centres of the lens. If, for example, the distance of the object is ten feet, and that of its image one foot, the image is one-tenth the size of its object. In photographing any object whose distance from the camera is fixed, the size of the image is directly proportionate to the focus of the lens employed.

Intensity or Rapidity.—The intensity or brilliance of an image obviously depends upon the amount of light gathered by the lens, and the area of the image over which it is spread. The light-gathering capacity of a lens is proportional to the area of its working aperture, and the area of an image is proportional to the square of the lens focus. So that the rapidity of a lens varies directly as the area of its working aperture, and inversely as the square of its focal length.

This dual consideration is simplified by the usual system of numbering the diaphragms of lenses with direct reference to their focal lengths.

Thus f/4 means that the diameter of the lens aperture is one quarter of its focal length; and all lenses of whatever focus, having diaphragms similarly made and marked, are of the same rapidity.

By making the aperture of each successive diaphragm in a series half the *area* of the one preceding it, so as to necessitate exactly double the exposure, the following series of diaphragm numbers is obtained, f/4, f/5.6, f/8, f/11, f/16, f/22, f/32, f/45, f/64, etc. These are the numbers chosen as the standards of the Royal Photographic Society, and now in general use.

The true working aperture of a lens is not the actual aperture of its stop or diaphragm, excepting only in the case of single lenses which have their stops in front.

In the case of compound lenses having stops between their elements, the light which reaches such a stop is already partially condensed by its passage through the front lens; and the aperture of the stop is smaller than the true aperture of the lens in proportion to this condensation. Such stops are marked, not with their own absolute apertures, but with the corresponding, larger effective apertures of the lenses with which they are used.

The Centre of a lens' field.—In viewing an image formed by a lens, it is observed that the centre of its field, or, in other words, that portion of the image which is near to the lens axis, is the best defined and most brilliantly illuminated. This central portion of the image is formed by waves which meet the lens more or less in the way and the direction indicated in the diagram. The outer portions of the image are formed by waves which, though they are condensed in a similar way, meet the lens from a direction at an angle to its axis ; a condition not so favourable to good definition as has been explained, and one necessarily accompanied by a reduction of the amount of light which can pass through the lens.

These causes combine with others to render definition less useful toward the margins of an image ; and it is therefore of great importance in using a lens, to keep it as central with the plate as possible, avoiding *injudicious use* of swing or sliding camera fronts.

Camera Swing-backs and Swing and Sliding Fronts.—It is a mechanical condition of things, probably self-evident, that to copy any surface as that of a map or plan, by photography and without distortion, the surface copied must be parallel to that which receives its image. This principle in application leads to a most important use of the camera swing-back :—

Vertical lines in an object appear vertical in the image only when the surface receiving the image is vertical. If, therefore, such lines of much importance occur in any object to be photographed, as generally they do, the back frame of the camera must be vertical, whatever tilt or inclination be given to the camera or to the lens. In some cases, as for example in photographing a high building, when much tilting of the camera is necessary, great difficulty is found in focussing the top and bottom of the view together. And for this reason :—The top of the building is further from the lens, and its image therefore nearer to the lens than that of lower portions of the building. But in being vertical, the plate is in a bad position to receive the true image, for the bottom of the image is the nearer to the lens, and the bottom of the plate the further from it. This condition of things cannot in such a case be entirely obviated. Stopping the lens to reduce the diameter of the cones of light is a partial remedy. The fault may be further reduced by the proper use of a swing or sliding camera front. If the lens axis be not so much inclined, neither will the image be. If, therefore, a swing front be used to reduce the upward inclination of the lens, or what is practically the same thing, if the camera be less tilted and the lens pushed higher in its front, though the lens is out of centre with the plate, the disadvantage is compensated by the nearer coincidence of the true image and the vertical plate.

In order to ensure the proper setting of a swing-back, a **T** or circular spirit level should be used upon its frame. Such a level indicates the true vertical position of both the face and the edges of the plate, and no camera is properly complete without one.

Angle of view.—The angle of view of any lens is determined by the relation of its focal length to the measurement of the image which it can usefully define. This latter element varies with the aperture employed, and to some extent with mere opinion ; but as lenses are usually designed for use on plates of specified dimensions, it is convenient to express their angles of view in relation to the longer sides of those plates.

TABLE OF CONJUGATE FOCI.

(COPYRIGHT.)

As explained on page 35, this table shows for lenses of various focal lengths the respective distances of the image and object for various ratios of reduction or enlargement. These ratios of reduction are given in the first vertical column, the focus of lens being given on the top horizontal line, and any pair of conjugate distances may be found by tracing the intersections, thus :—

EXAMPLE I.—Suppose we have a lens of 5 inches equivalent focus, and we wish to photograph an object half full size, we find where the horizontal line beginning " Ratio 1/2 " intersects the vertical column headed " 5," that the distance of the object from the lens will be 15 inches, and the distance of the focussing screen $7\frac{1}{2}$ inches.

EXAMPLE II.—Suppose we have a hand camera, with a lens of 6 inches focus, and we wish to know what movement of the lens is necessary to enable it to focus any object from infinite distance down to 5 feet. We find that in the vertical column headed " 6 " an object distant 60 inches from a 6 inches lens has its image 6.66 inches from the lens ; from which it is seen that the movement of the lens necessary for this purpose is between 6 and 7 tenths of an inch.

EXAMPLE III.—Suppose we have a lantern slide 3 inches square, and with it we want to fill a screen 10 feet square. The ratio of this enlargement is 1 to 40. If the objective available is of 6 inches focus, we find from the table where the line 1/40 intersects the column " 6," that the lantern must be 246 inches or about 20 feet away from the screen ; or if we want to place the lantern 50 feet or about 600 inches away from the screen, we find that a lens of 15 inches focus will be necessary.

The figures in the table may be taken as representing inches, feet, millimeters, centimeters, or any other unit as may be convenient, and as they are given in decimal notation the range of the table may be extended in either direction to apply to lenses of longer or shorter focus by moving the decimal point one or more places to the right or left, as may be convenient. Or instead of multiplying or dividing by 10 in this way, the figures may be multiplied or divided by any other constant, thus : If we divide by 2 all the figures in the vertical column headed " 11," we get information concerning a lens of 5.5 inches focus.

The figures heading these columns represent equivalent focal lengths of lenses, and the pairs of figures below are conjugate foci.

Ratios.	2	3	4	5	6	7	8	9	10
1/1	4·00 4·00	6·00 6·00	8·00 8·00	10·00 10·00	12·00 12·00	14·00 14·00	16·00 16·00	18·00 18·00	20·00 20·00
1/2	6·00 3·00	9·00 4·50	12·00 6·00	15·00 7·50	18·00 9·00	21·00 10·50	24·00 12·00	27·00 13·50	30·00 15·00
1/3	8·00 2·66	12·00 4·00	16·00 5·33	20·00 6·66	24·00 8·00	28·00 9·33	32·00 10·66	36·00 12·00	40·00 13·33
1/4	10·00 2·50	15·00 3·75	20·00 5·00	25·00 6·25	30·00 7·50	35·00 8·75	40·00 10·00	45·00 11·25	50·00 12·50
1/5	12·00 2·40	18·00 3·60	24·00 4·80	30·00 6·00	36·00 7·20	42·00 8·40	48·00 9·60	54·00 10·80	60·00 12·00
1/6	14·00 2·33	21·00 3·50	28·00 4·66	35·00 5·83	42·00 7·00	49·00 8·16	56·00 9·33	63·00 10·50	70·00 11·66
1/7	16·00 2·28	24·00 3·42	32·00 4·57	40·00 5·71	48·00 6·85	56·00 7·99	64·00 9·14	72·00 10·28	80·00 11·42
1/8	18 00 2·25	27·00 3·37	36·00 4·50	45·00 5·62	54·00 6·75	63·00 7·87	72·00 9·00	81·00 10·12	90·00 11·25
1/9	20·00 2·22	30 00 3·33	40·00 4·44	50·00 5·55	60·00 6·66	70·00 7·77	80·00 8·88	90·00 9·99	100·00 11·11
1/10	22·00 2·20	33·00 3·30	44·00 4·40	55·00 5·50	66·00 6·60	77·00 7·70	88·00 8·80	99·00 9·90	110·00 11·00
1/12	26·00 2·16	39·00 3·25	52·00 4·33	65·00 5·41	78·00 6·50	91·00 7·58	104·00 8·66	117·00 9·75	130·00 10·83
1/14	30·00 2·14	45·00 3·21	60 00 4·28	75.00 5·35	90·00 6·42	105·00 7·49	120·00 8·56	135·00 9·64	150·00 10·71
1/16	34·00 2·12	51·00 3·18	68·00 4·25	85·00 5·31	102·00 6·37	119·00 7·43	136·00 8·50	153·00 9·56	170·00 10·62
1/18	38·00 2·11	57·00 3·16	76·00 4·22	95·00 5·27	114·00 6·33	133·00 7·38	152·00 8·44	171·00 9·49	190·00 10·55
1/20	42·00 2·10	63·00 3·15	84·00 4·20	105·00 5·25	126 00 6·30	147 00 7·35	168·00 8·40	189·00 9·45	210·00 10·50
1/25	52·00 2·08	78·00 3·12	104·00 4·16	130·00 5·20	156·00 6·24	182·00 7·28	208·00 8·32	234·00 9·36	260·00 10·40
1/30	62·00 2·06	93·00 3·10	124·00 4·13	155·00 5·16	186·00 6·20	217·00 7·23	248·00 8 26	279·00 9·30	310·00 10·33
1/40	82·00 2·05	123·00 3·07	164·00 4·10	205 00 5·12	246·00 6·15	287·00 7·17	328·00 8·20	369·00 9·22	410·00 10·25
1/50	102·00 2·04	153·00 3·06	204·00 4·08	255·00 5·10	306·00 6·12	357·00 7·14	408·00 8·16	459·00 9·18	510·00 10·20
1/75	152·00 2·02	228·00 3·00	304·00 4·05	380·00 5·06	456·00 6·08	532·00 7·09	608·00 8·10	684·00 9·12	760·00 10·13
1/100	202·00 2·02	303·00 3·03	404·00 4·04	505·00 5·05	606 00 6·06	707·00 7·07	808·00 8·08	909·00 9·09	1010·00 10·10
1/150	302·00 2·01	453·00 3·02	604·00 4·02	755·00 5·03	906·00 6·04	1057·00 7·04	1208 00 8·05	1359 00 9·06	1510·00 10·06
1/200	402·00 2·01	603·00 3·01	804·00 4·02	1005·00 5·02	1206·00 6·03	1407·00 7·03	1608·00 8·04	1809·00 9·04	2010·00 10·05
1/300	602·00 2·00	903·00 3·01	1204·00 4·01	1505·00 5·01	1806·00 6·02	2107·00 7·02	2408·00 8·02	2709·00 9·03	3010·00 10·03

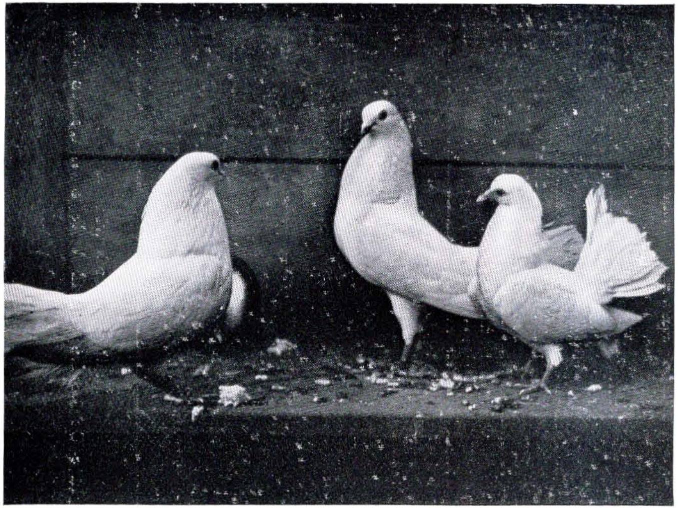
The figures heading these columns represent equivalent focal lengths of lenses, and the pairs of figures below are conjugate foci.

Ratios.	11	12	13	14	15	16	17	18	19
1/1	22·00	24·00	26·00	28·00	30·00	32·00	34 00	36·00	38·00
	22·00	24·00	26·00	28·00	30·00	32·00	34·00	36·00	38·00
1/2	33·00	36·00	39·00	42·00	45·00	48·00	51·00	54·00	57·00
	16·50	18·00	19·50	21·00	22·50	24·00	25·50	27·00	28·50
1/3	44·00	48·00	52·00	56·00	60·00	64·00	68·00	72·00	76·00
	14·66	15·99	17·33	18·66	20·00	21·33	22·66	24·00	25·33
1/4	55·00	60·00	65·00	70·00	75·00	80·00	85·00	90·00	95·00
	13·75	15 00	16·25	17·50	18·75	20·00	21·25	22·50	23·75
1/5	66·00	72·00	78·00	84·00	90·00	96·00	102·00	108·00	114·00
	13·20	14·40	15·60	16·80	18·00	19·20	20·40	21·60	22·80
1/6	77·00	84·00	91·00	98·00	105·00	112·00	119·00	126·00	133·00
	12·83	13·99	15·16	16·33	17·50	18·66	19·83	21·00	22·16
1/7	88·00	96·00	104·00	112·00	120·00	128·00	136·00	144·00	152·00
	12·57	13·71	14·85	15·99	17·14	18·28	19·42	20·56	21·71
1/8	99·00	108·00	117·00	126·00	135·00	144·00	153·00	162·00	171 00
	12·37	13·50	14·62	15·75	16·87	18·00	19·12	20·25	21 37
1/9	110·00	120·00	130·00	140·00	150·00	160·00	170·00	180·00	190·00
	12·22	13·33	14·44	15·55	16·66	17·77	18·88	19·99	21·11
1/10	121·00	132·00	143·00	154·00	165·00	176·00	187·00	198·00	209·00
	12·10	13·20	14·30	15·40	16·50	17·60	18·70	19·80	20·90
1/12	143·00	156·00	169·00	182·00	195 00	208·00	221·00	234·00	247·00
	11·91	13·00	14·08	15·16	16·25	17·33	18·41	19·50	20·58
1/14	165·00	180·00	195·00	210·00	225·00	240·00	255·00	270 00	285·00
	11·78	12·85	13·92	14 99	16·07	17·13	18·21	19·28	20·35
1/16	187·00	204·00	221·00	238·00	255·00	272·00	289·00	306·00	323·00
	11 68	12·75	13·81	14·87	15·93	17·00	18·06	19·12	20·18
1/18	209·00	228 00	247·00	266·00	285·00	304·00	323·00	342 00	361·00
	11·61	12·66	13·72	14·77	15·83	16·88	17·94	18·99	20·05
1/20	231·00	252·00	273·00	294·00	315·00	336·00	357·00	378·00	399·00
	11·55	12·60	13·65	14·70	15 75	16·80	17·85	18·90	19 95
1/25	286·00	312·00	338·00	364·00	390·00	416·00	442·00	468·00	494·00
	11·44	12·48	13·52	14·56	15·60	16·64	17·68	18·72	19·76
/30	341·00	372·00	403·00	434·00	465·00	496·00	527·00	558·00	589 00
	11·36	12·40	13·43	14·46	15·50	16·53	17·56	18·60	19·63
1/40	451.00	492·00	533·00	574·00	615·00	656·00	697·00	738·00	779·00
	11·27	12·30	13·32	14·35	15·37	16·40	17·42	18·45	19·47
1/50	561·00	612·00	663·00	714·00	765·00	816·00	867·00	918·00	969·00
	11·22	12·24	13'26	14·28	15·30	16·33	17·34	18·36	19·38
1/75	836·00	912·00	988·00	1064·00	1140·00	1216·00	1292·00	1368·00	1444·00
	11·14	12·16	13·17	14·18	15·20	16·21	17·22	18·24	19·25
1/100	1111·00	1212 00	1313·00	1414·00	1515·00	1616·00	1717·00	1818·00	1919·00
	11·11	12·12	13·13	14·14	15·15	16·16	17·17	18·18	19·19
1/150	1661·00	1812·00	1963·00	2114·00	2265·00	2416·00	2567·00	2718·00	2869·00
	11·07	12·08	13·08	14·09	15·10	16·10	17·11	18·12	19·12
1/200	2211·00	2412·00	2613·00	2814·00	3015·00	3216·00	3417·00	3618·00	3819·00
	11·05	12·06	13·06	14·07	15·07	16·08	17 08	18·09	19·09
1/300	3311·00	3612·00	3913·00	4214·00	4515·00	4816 00	5117·00	5418·00	5719·00
	11·03	12·04	13·04	14·04	15·05	16·05	17'05	18·06	19·06

STOUGHTON STREET WORKS.

Offices and North Wing. Main Factory Building behind.

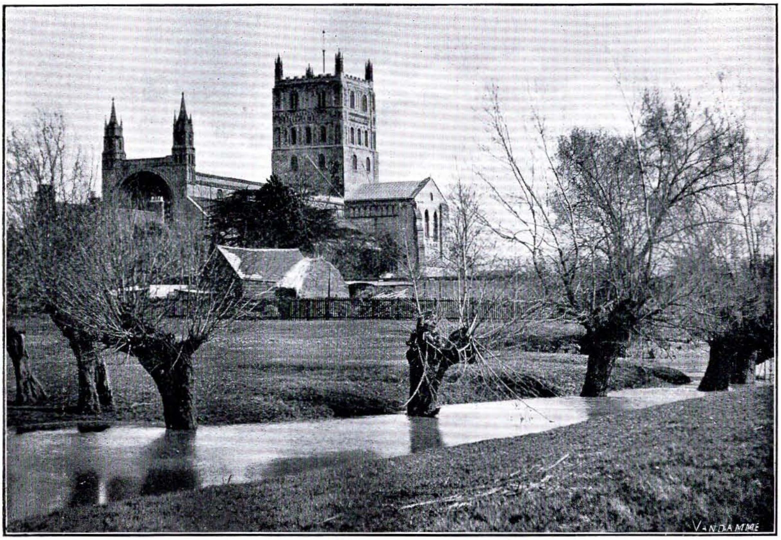
These works were built and equipped for the production of high-class photographic lenses.



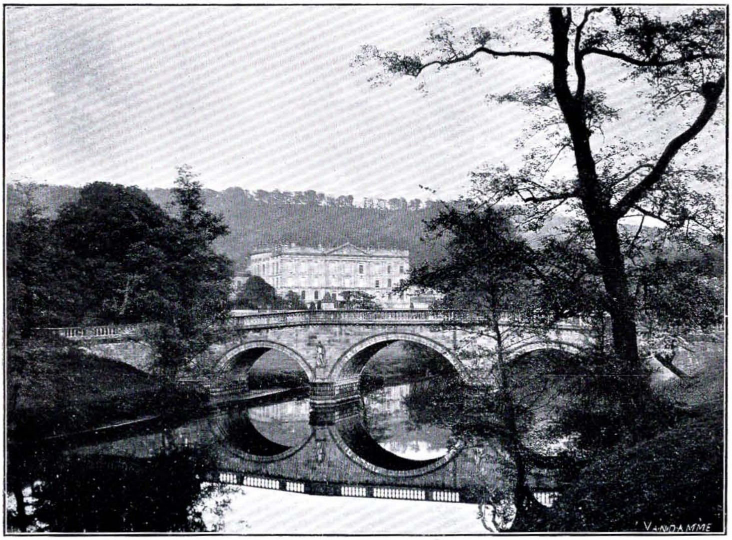
Photographed with a
5 × 4 Series III. Cooke Lens at f/6·5.

Photographed with a
¼-Plate Series III. Cooke Lens at f/6·5.

Photographed with a
½-Plate Series III. Cooke Lens at f/6·5.



Photographed with a
½-Plate Cooke Lens and Extension Series III.



Photographed with a
½-Plate Series V. Cooke Lens.

Photographed with a
1/1-Plate Series V. Cooke Lens.

Photographed with a
Series IV. Cooke Lens.

Photographed with a
Series II. Cooke Portrait Lens.
By Y. BURNS, Blackpool.

Photographed with a
Series II. Cooke Portait Lens.
By W. P. VARNEY, Alton, Hants.

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