THE TEN CONTAX LENSES

Photo Breuer-Courth Top light, June, 1 p. m. with Sonnar *f*/2 2 ins focus, $^1/_{25}$ sec.

Preface

Among people not especially interested in scientific and technical matters the properties and action of lenses are things that are not generally understood. For this reason it is almost necessary, for the exposition of the Contax lenses to be given in this booklet, to begin by dealing briefly with the optical matters which enter into the question and so to enable an adequate understanding to be obtained of the properties and excellent qualities of these lenses. It will be taken for granted that the reader is fully familiar with the Contax camera from the booklet "The Connoisseur and the Contax" which has already been published.

Here we deal solely with Contax lenses, and therefore it must be borne in mind that a part of what is said is limited in its significance to the system of "miniature photography". Many of the statements could not be applied to lenses in general without qualification.

One fact may be emphasised at the outset. It is that "miniature photography" has made greater demands on the performance and behaviour of lenses. It was found necessary to calculate every lens for the Contax entirely afresh, since the customary lenses, employed for taking photographs with other cameras, had not the especial characteristics essential for "miniature photography". It will be readily understood that a firm of the long establishment and wide optical knowledge of Carl Zeiss of Jena should have the best technical resources at its

disposal. A whole series of the most excellent lenses for the Contax are now produced by the well-known Zeiss Works and possess practical qualities not previously obtainable.

Those unfamiliar with the subject may at first feel surprised at the large number of Contax lenses and be inclined to regard it as a weak point in miniature photography, inasmuch as it has been customary to use not more than one lens (or perhaps, two) for cameras of larger size. But the exact opposite is the case. The large number of lenses is, in fact, one of the strong features of the Contax and of the system of miniature photography, for it determines the adaptation of the camera to circumstances and thus renders it an instrument for universal use. Moreover the small size permits the use of very rapid lenses of short focus which are much less expensive to make than those for cameras of larger size. Imagine, for example, two lenses of *f*/1.5 aperture, one (for the Contax) of 2 ins focal length and the other of $6\frac{1}{2}$ ins focus for a camera of $4\frac{3}{4} \times 3\frac{1}{2}$ ins size. The $6\frac{1}{2}$-ins lens would have a diameter of about $4\frac{1}{2}$ ins and would weigh several pounds; the price would hardly bear thinking of. The little Contax *f*/1.5 Sonnar, on the other hand, is only $1\frac{1}{2}$ ins in diameter and actually weighs $6\frac{1}{2}$ ozs, including the cap. The essential advantage of miniature photography as regards optical equipment can scarcely be better illustrated.

A further consideration of a general kind must be mentioned. For its full effect, every miniature picture must be enlarged, and so the system of miniature photography has provided the incentive for the photo-chemist and the manufacturer of film to improve the "enlargeability" of the film negatives. Practice shows what great advances have been made in this respect. With the previous cinema film, enlargement to 4 diameters was about as much as

it would stand. Now, enlargement of 10 diameters is thought to be nothing out of the ordinary for the modern Contax film. The limit to the degree of enlargement is set by the grain of the negative (fig. 1). Beyond this limit, you can make a larger "picture", but you cannot bring out further and finer details.

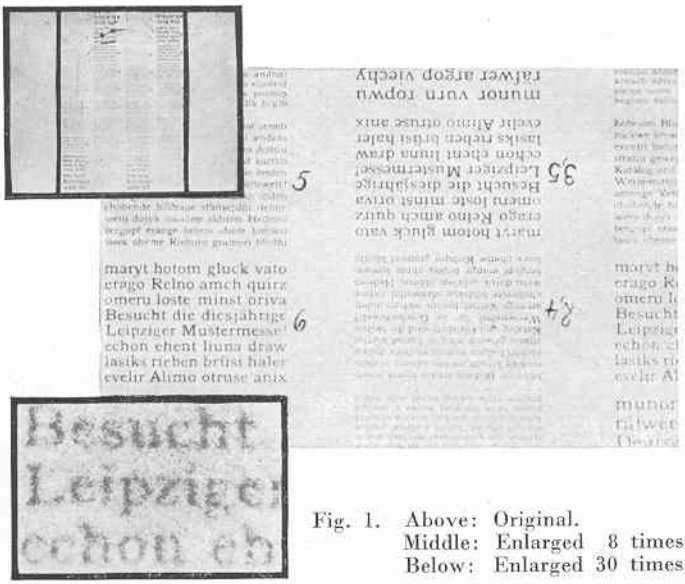


Fig. 1. Above: Original.
Middle: Enlarged 8 times.
Below: Enlarged 30 times.

For release from the limitation of the so-called "resolving power" of the photographic emulsion, the procedure must be to take the subject larger in the first instance and so obtain the required size of picture by a lesser degree of enlargement. As everybody knows, this may be done by the use of long-focus lenses, as, in fact, employed at times for cameras of quarter-plate size.

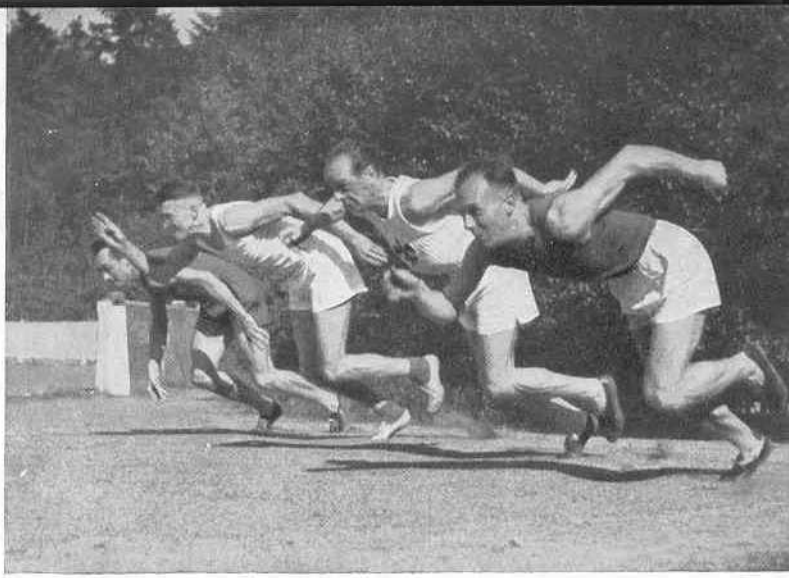


Photo Weygandt May, 5 p. m. in sun with Tessar *f*/3.5 2 ins focus, $^1/_{1000}$ sec.

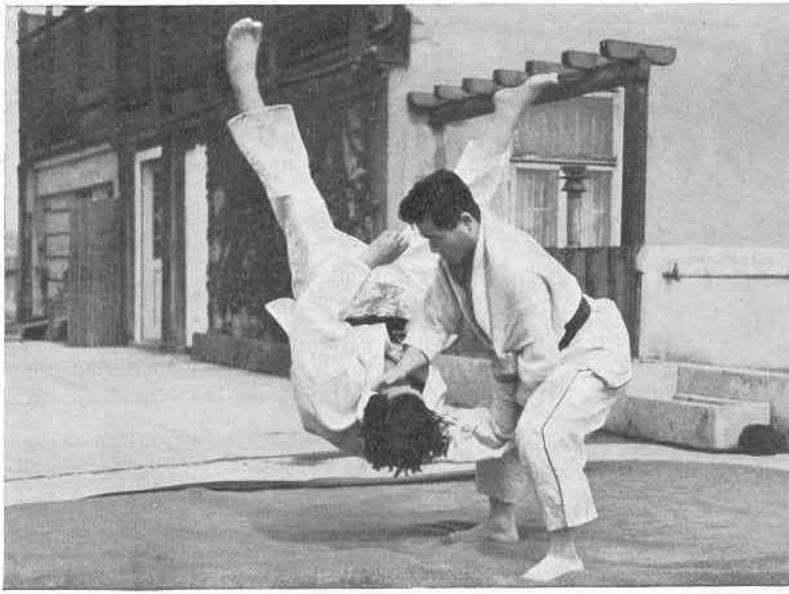


Photo Rübelt June, 11 a. m. with Sonnar *f*/2 (at *f*/2.8) 2 ins focus, $^1/_{1000}$ sec.

Photo Niedecken Brightly lighted room, with Sonnar *f*/2 ins focus, $^1/_{50}$ sec.

Hence the question is often asked:

Are several lenses really necessary for the Contax?

By no means. The *f*/3.5 Tessar of 2 ins focus (5 cm) answers fully for all average subjects with the Contax, just as one lens is found sufficient as a rule for a camera of $3\frac{1}{2} \times 2\frac{1}{4}$" or quarter-plate size.

But, on the other hand, anyone who frequently takes special subjects, whether as an amateur or professional, will very soon discover that other lenses are invaluable and are in fact the only means of getting perfect results. Snapshots of stage scenes call for a lens of extreme speed; interior architectural studies, for the wide-angle Tessar; animals and sports subjects for lenses of long focus. It should not be overlooked that the Contax is known throughout the world as the universal camera and that its ability to take pictures of every variety of subject —including the most difficult—is essentially based on what we may call its "optical versatility". This is the reason for the range of Contax lenses.

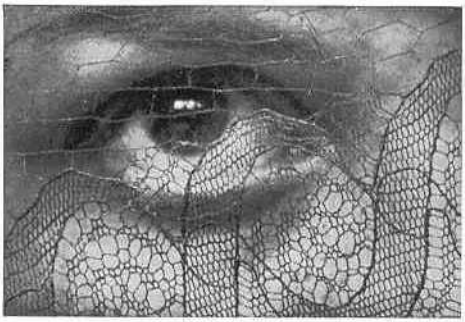


Photo Fiedler — June in sun with Sonnar *f*/4 (at *f*/36) $5^{3}/_{8}$ ins focus, 1-2 sec.

Some Optical Principles

We will first take a rapid glance at the principles which relate to the use of lenses in so far as they are necessary to a proper understanding of the Contax lenses.

Action of a Lens

The simplest form of lens such as a reading glass forms an image (picture) of a somewhat distant object on a

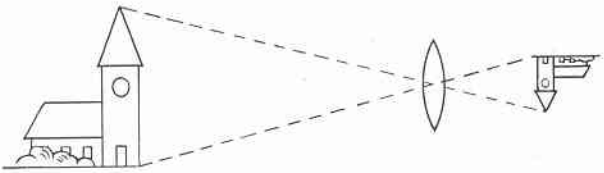


Fig. 2. Formation of image by a single lens.

greatly reduced scale (fig. 2). Such an image, however, is useless for photographic purposes, because only the central part of it is sharp; the margins are completely unsharp. Moreover lenses of this kind, consisting of only one piece of glass, suffer from many optical defects, known as curvature of field, astigmatism, coma, distortion, spherical and chromatic aberration etc. These defects can only be removed by combination of several glasses (fig. 3). These glasses or elements are arranged, some separately, others cemented together. Such combination of glasses in a mount is a "lens" in the photographic sense.

Lenses

The difficulties to be overcome in the construction of lenses arise in the mode of arranging the various glasses and in the choice of the different kinds of glass of which they are made. Frequently years have to be spent in the calculations and preparations for a lens of the highest quality such as the Contax Sonnar and Contax Biotar. All Contax lenses are combinations of several component glasses, ranging in number from three to seven.

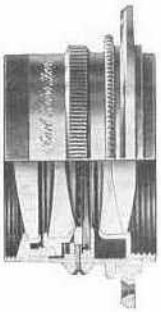


Fig. 3. Glasses as mounted to form a lens.

Focal Length

The focal length (usually called "focus") of a lens determines the size of the image of the object which is formed on the ground glass or on the film (figs. 4 and 5). If it

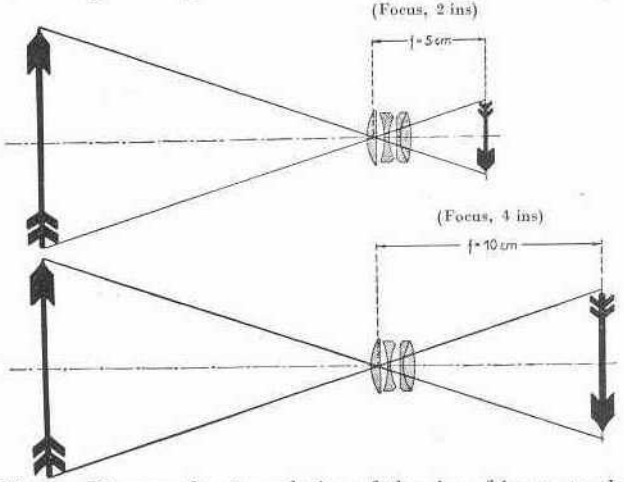


Fig. 4. Diagram showing relation of the size of image to the focal length of the lens.

Taken with 2-inch lens.

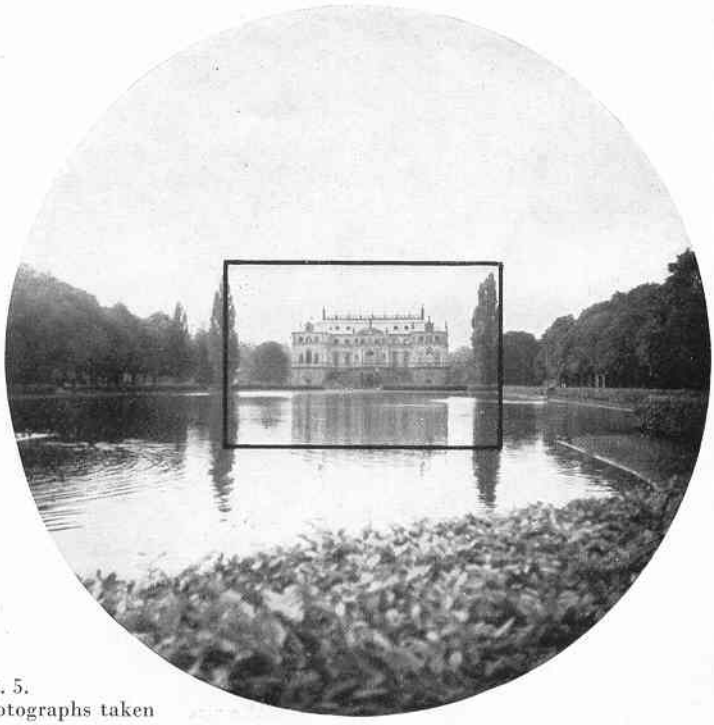


Fig. 5.
Photographs taken
with lenses of different focal lengths.

Taken with 4-inch lens.

is required to represent very small objects large in the picture, lenses of long focus must be selected. Such lenses are also needed for avoidance of exaggerated perspective in taking subjects at close quarters.

But the size of an object is dependent not only on its actual dimensions but also on the distance from which it is viewed. The further away it is, the smaller it looks. Hence, when using a camera and wishing to bring up very distant objects (representing them of sufficient size), we use long-focus lenses, usually known as "telephoto".

Angle of View

The size of the picture actually taken in the Contax is fixed, namely $^{15}/_{16} \times 1^{3}/_{8}$ ins. Hence it naturally follows that when using lenses of different focal length the angle of view alters (fig. 6), also the amount of the subject included in the picture.

In fig. 5 are two photographs taken with lenses of different focal lengths and including the same amount of subject — within the circumferences of the circles. The two spaces included in the black lines are, however, of the actual dimensions of the Contax picture, from which it will be seen that the long-focus lens gives the details on a much larger scale but includes correspondingly less of the subject.

This question of angle of view may be looked at from another (purely optical) standpoint. When using a short-focus lens, the rays of light must pass very obliquely through the lens in order to form the picture over the whole of the film (fig. 6). But the optical defects, previously mentioned, become much greater with oblique rays, and hence the construction of such lenses involves great difficulties, particularly when the lens is also one of large aperture.

The conditions are more favourable in the case of telephoto

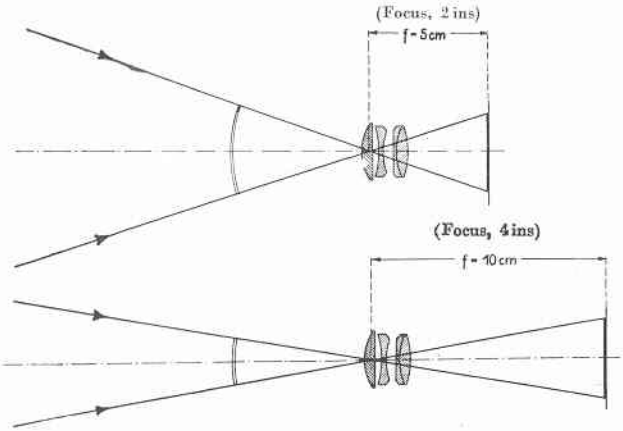


Fig. 6. Angle of view with lenses of different focal lengths.

(long-distance) lenses, which are required to form a picture over only a small angle. Use has been made (for the sake of simplicity) of the lenses of somewhat long focus which are fitted to cameras for $3\frac{1}{4}\times 2\frac{1}{4}$ ins and $4\frac{3}{4}\times 3\frac{1}{2}$ ins pictures. But long-distance lenses have been worked out for the Contax from new points of view, and types of lenses have, for the first time, been made available, which give a picture of only the Contax size but with perfectly uniform sharpness from the centre to the corners.

Perspective

It is a common but erroneous belief that the perspective of a picture is affected by the focal length of the lens. But the perspective effect is solely determined by the distance between the lens and the subject. For the same distance of subject, it is immaterial whether the focal length is long or short; the perspective is the same (see the comparative photographs, fig. 13).

Fig. 7.

Taken with lens of $1^1/_8$ inch focal length at 33 ft distance.

Taken with lens of $5^3/_8$ inch focal length at 160 ft distance.

The comparison is unfavourable to the short-focus lens only when a particular part of the subject is deliberately made the same size in each picture, for which purpose one is compelled to come much too near to the subject when using the short-focus lens (fig. 7). But this is a special case which has no bearing on taking photographs in the ordinary way.

Central and Marginal Brightness of Image.

Owing to the fact that every lens consists of several glasses, its construction must extend over a certain length. Consequently, in accordance with optical laws, the margins of the image receive less light than the central part (fig. 8). It is easy to see that this is the

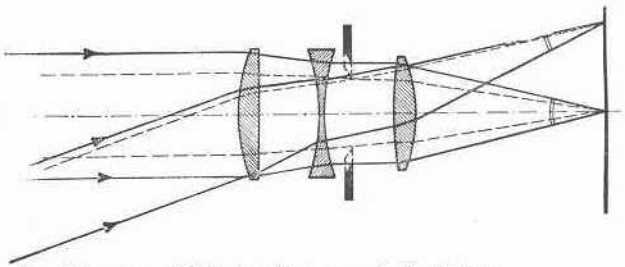


Fig. 8. Diagram of illumination over field of lens.

case by looking towards the lens (with the stop at full aperture) at various angles through the opened back of the camera. When looking straight through, the lens is seen as a complete circle but appears of partly oval shape when viewed obliquely (fig. 9). All lenses behave in this way but to a greater or lesser degree according

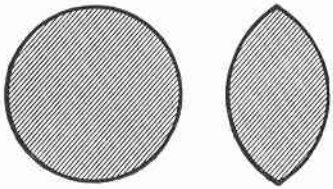


Fig. 9. Distribution of illumination. at centre at edge

to their construction. Lenses which exhibit the least difference in the brightness of the image at the centre and at the margins are to be preferred. It will be clear that lenses of the most compact construction from end to end and made with glasses of the largest diameter show this "cut- off" action to the least degree.
When using a smaller stop, this difference in the brightness of the image at the centre and at the margins largely disappears (fig. 8, rays shown in dotted lines), since this stopping down chiefly affects the central rays.

Lens Aperture (Speed)

When the aperture is enlarged (without alteration of the focal length), the speed of a lens, which depends on the size of the aperture relatively to the focal length, becomes greater. The angle of the bundle of the rays which form each point in the image becomes progressively more obtuse (fig. 10).
But, unfortunately, the diameters of the glasses of a lens cannot be increased as one would wish, since this

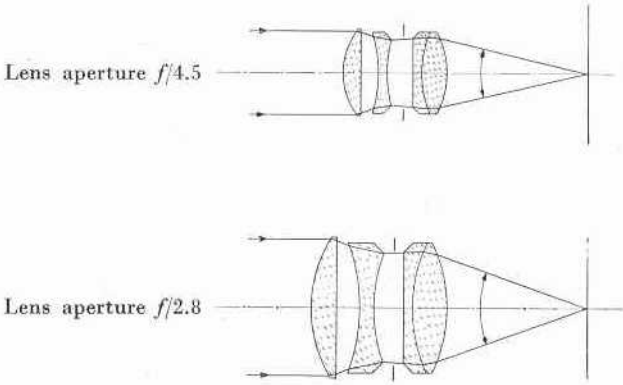


Fig. 10. Diagram of lens speed (relative aperture)

affects the quality of the image, particularly for oblique rays. Practicable means consist chiefly in using new combinations of glasses by which the required sharpness of the margins of the image is obtained. The production of large-aperture (rapid) lenses giving images of even sharpness from centre to margins is a problem that taxes the skill of the designer to the utmost — and of the actual maker as well.

Brilliance

By "brilliance" is understood the clear unhalated definition of the image. It is determined by the ability of the lens to give critically sharp definition, and this, in turn, depends on the design of the lens (that is on the removal of optical defects) and on the number of glass-air surfaces i. e. surfaces at which light passes from glass into air or vice versa. A lens works more "brilliantly" the better the degree of its correction and the fewer the number of glass-air surfaces.

Photo Fiedler

Taken with copying attachment
Daylight April with Tessar *f*/2.8 (at *f*/22) 2 ins focus, 6 secs.

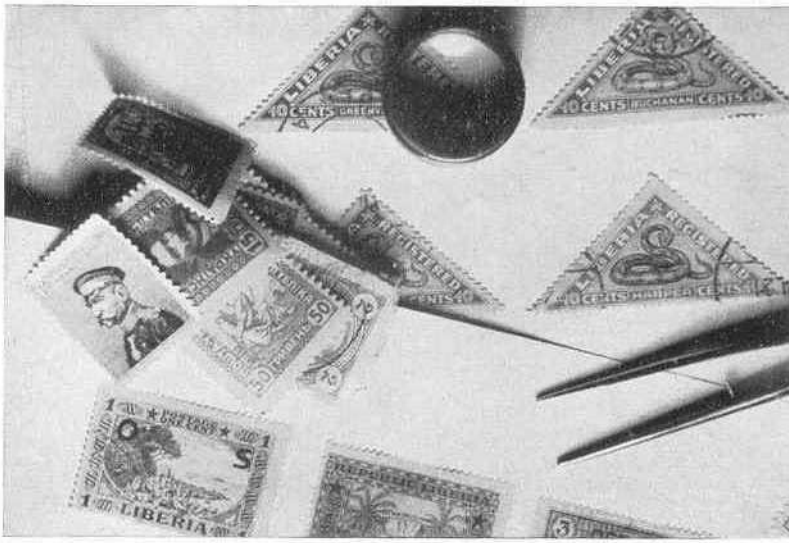


Photo Kammerer

With copying attachment
Home lamp at 3 ft with Tessar *f*/2.8 (at *f*/11) 2 ins focus, $^1/_2$ sec.

Resolving Power

For satisfactory rendering of detail in a picture the lens must possess good "resolving power", which is the ability to render exceedingly fine adjoining lines sharply separated in the image on the tiny area of film even though the lens is of large aperture. This important property is realised, to a degree hitherto unattained, in the Contax Sonnar and Biotar lenses.

Air-bubbles in Glass

The foregoing optical qualities are obtained in their perfection only by the use of expensive special glasses, in the manufacture of which it is not yet possible to avoid the occurrence of air-bubbles. These minute air-bubbles, where they occur in greater or less number, however, do not affect the quality of the lens in the slightest, and there is no detectable loss of light.

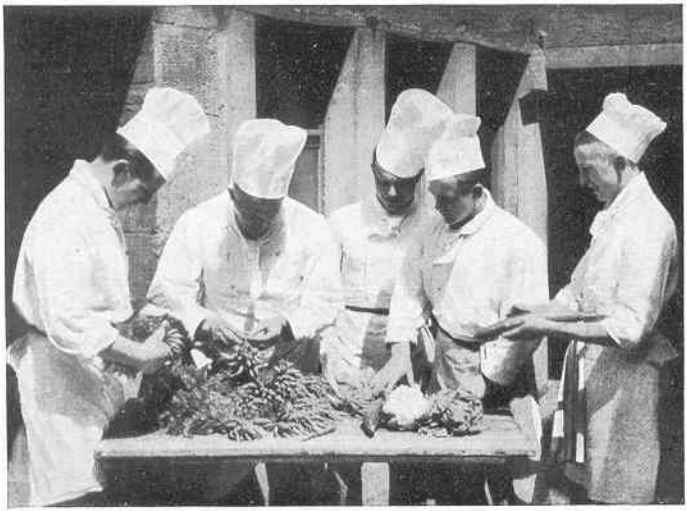


Photo Breuer-Courth

In sun, June, 11 a. m. with Sonnar *f*/2 2 ins focus (at *f*/5.6), light yellow filter, $^1/_{100}$ sec.

Photo Breuer-Courth — Artificial light with Sonnar *f*/2 2 ins focus, $^{1}/_{25}$ sec.

Photo Breuer-Courth — Morning July with Sonnar *f*/1.5 (at *f*/5.6) 2 ins focus, $^{1}/_{50}$ sec.

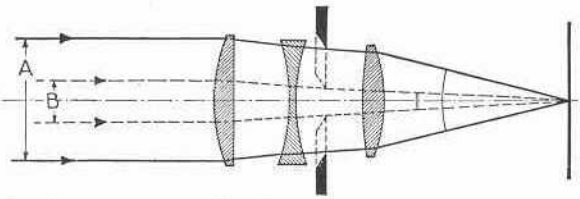
Stops (Diaphragms)

In every lens is an iris diaphragm for regulating the size of the lens-opening. This "stopping down" modifies the optical conditions under which a picture is made and exercises an effect on:

Brightness (general speed)
Brightness (centre and margins)
Depth of focus
Sharpness of image.

Brightness

As shown in fig. 11, a smaller stop reduces the diameter of the bundle of rays which forms each separate point in the image. Consequently the image is less bright, and correspondingly longer exposure is required. The influence of the stop on the brightness of the image at the centre relatively to that at the margins has already been discussed on page 13.



A = Large stop. B = Small stop.

Fig. 11. Diagram of effect of lens aperture on brightness of image.

Depth of Focus

By depth of focus is understood the distance between the nearest and most distant objects which can both be sharply rendered in the picture formed by a lens.

It is dependent on:

(1) Distance of objects from camera.
(2) Relative lens-aperture (*f*/No.).
(3) Focal length of lens.

From (1), it follows that depth of focus is greater the greater the distance (from the lens) of the objects which form the picture.

As regards (2), depth of focus becomes greater as the lens is stopped down. But the speed is thereby reduced.

The effect of (3) is that the range of depth of focus is greater the shorter the focal length of the lens.

Data respecting depth of focus, which is a subject which cannot be discussed here at length, are based on an arbitrary standard. This is the permissible "circle of confusion" by which an object-point appears in sharp focus and which, for Contax lenses, is taken as $^1/_{20}$ mm ($^1/_{500}$ inch) for average requirements, and as $^1/_{30}$ mm ($^1/_{750}$ inch) for subjects where extreme sharpness is required. These standards have been found entirely satisfactory in practice. Depth of focus is not connected with the particular design of a lens but is dependent only on the focal length and the aperture of stop used for the exposure.

Sharpness of Pictures

The definition given by lenses of lower grade of quality is improved by stopping down. At full aperture such lenses frequently possess defects such as coma, astigmatism to a small degree, and these aberrations are of course more pronounced the greater the speed (lens aperture). For this reason all the Contax lenses have been subjected to rigorous calculation by which the maximum sharpness of picture has been obtained at the full aperture.

Taken with $f/4.5$ stop, focus $5^3/_8$ ins

$5^1/_2$ ft $4^1/_2$ ft $3^3/_4$ ft

Taken with $f/32$ stop, focus $5^3/_8$ ins

$5^1/_2$ ft $4^1/_2$ ft $3^3/_4$ ft

Fig. 12. Effect of lens aperture on depth of focus.

Contax Lenses

In the foregoing pages we have obtained a fairly clear idea of the general optical principles of lenses, such as is necessary for a proper understanding of the description of the properties of the Contax lenses, as regards their optical quality and performance, which will now be given. Altogether there are ten lenses for the Contax, all supplied in mounts which dispense with special fitting. Inasmuch as this is a relatively large number of lenses, we include here a list of their names and optical properties, and also a classification of them according to their most appropriate uses, before entering upon a description of their special features and of their employment for the various purposes of miniature photography.

Fig. 13. From negatives taken from the same standpoint with lenses of different focal lengths.

SUMMARY I

Lens	Focal length ins	Focal length cm	Maximum aperture	Angle of view	Relative Speed f/3.5=100
(1) Zeiss Tessar	$1^1/_8$	2.8	f/8	75°	19
(2) Zeiss Biotar	$1^9/_{16}$	4	f/2	55°	306
(3) **Zeiss Tessar**	**2**	**5**	**f/3.5**	**45°**	**100**
(4) Zeiss Tessar	2	5	f/2.8	45°	156
(5) Zeiss Sonnar	2	5	f/2	45°	306
(6) Zeiss Sonnar	2	5	f/1.5	45°	544
(7) Zeiss Sonnar	$3^3/_8$	8.5	f/2	28°	306
(8) Zeiss Triotar	$3^3/_8$	8.5	f/4	28°	77
(9) Zeiss Sonnar	$5^3/_8$	13.5	f/4	18.4°	77
(10) Zeiss Tele-Tessar K.	$7^1/_8$	18	f/6.3	13.6°	31

SUMMARY II

Universal Lenses

Tessar f/3.5 2 ins (5 cm) Sonnar f/2 2 ins (5 cm)

Tessar f/2.8 2 ins (5 cm) Sonnar f/1.5 2 ins (5 cm)

Long-distance Lenses

Triotar f/4 $3^3/_8$ ins (8.5 cm) Sonnar f/4 $5^3/_8$ ins (13.5 cm)

Sonnar f/2 $3^3/_8$ ins (8.5 cm) Tele-Tessar K f/6.3 $7^1/_8$ ins (18 cm)

Wide-angle Lenses

Tessar f/8 $1^1/_8$ ins (2.8 cm)

Biotar f/2 $1^9/_{16}$ ins (4 cm)

Universal Lenses

Let us now turn to consider the Contax lenses. We have decided to get a Contax: the first question is—which lens shall we have?

Needless to say it should not be one of the definitely special lenses but a universal lens of 2 ins (5 cm) focal length. There are four lenses of this focal length, namely two Tessars and two Sonnars of different aperture (see Summary I). In making a choice, many people, of course, must take price into consideration as well as the capacity of the lens.

Zeiss Tessar *f*/3.5 2 ins (5 cm)

From these two standpoints, the choice for first consideration is the Contax with 2-inch Zeiss Tessar *f*/3.5 (fig. 14), with which the user is well equipped for landscapes, portraits, street scenes, sports events etc., in short for all the subjects which occur in everyday photography. It is seldom necessary to stop down, as the Tessar covers sharply to the corners at full aperture. This property, although one that is obviously essential, is not possessed by all lenses for miniature cameras. It is, however, realised in the Contax lenses. Even the Contax Tessar represents a recent re-development of the previous Tessar types and is specially adapted to the $^{15}/_{16} \times 1^{3}/_{8}$ ins (24 × 35 mm) size.

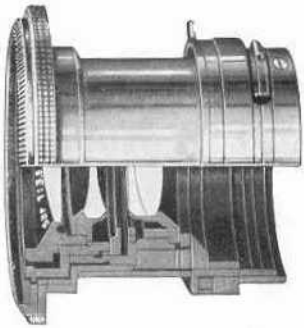


Fig. 14.
Zeiss Tessar *f*/3.5 2 ins focus.

The Tessar is a type of lens which was originated by Carl Zeiss of Jena and has been widely imitated on account of its exceptional qualities. It comprises only 6 glass-air surfaces and thus gives exceedingly brilliant pictures (see "Brilliance" page 15). The lens is of small build and weight, and is supplied in sunk mount, thus making the Contax to which it is fitted most compact and light.

Zeiss Tessar *f*/2.8 2 ins (5 cm)

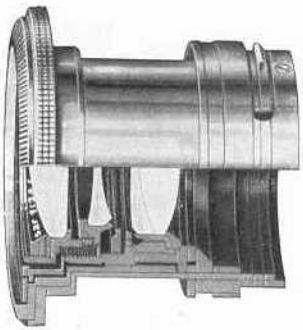


Fig. 15.
Zeiss Tessar *f*/2.8 2 ins focus.

This Tessar (fig. 15) is similar to the preceding 2-inch *f*/3.5 in its excellent optical qualities at the same aperture. Owing to its greater maximum aperture, it is, of course, somewhat more expensive. The sharpness of the definition which it gives up to the margins of the picture is also all that can be desired. The short length of the 2-inch *f*/2.8 Tessar relatively to the diameter of the glasses gives a still further improved illumination of the field from centre to margin. This property is a factor in recent use of these lenses for pictures on lenticular colour film. Their behaviour in this respect is such that the most beautiful colour pictures are obtained.

Zeiss Sonnar *f*/2 2 ins (5 cm)

When fitted with the universal Zeiss Sonnar *f*/2 (fig. 16), the Contax is suitable for the same purposes as with the Tessars. Moreover its much greater speed — three times that of the Tessar *f*/3.5 — greatly extends the scope of the camera. In conjunction with ultra-rapid panchromatic film, the *f*/2 aperture of the Sonnar allows of exposures by artificial light (at home, at theatres and music-halls, public dinners etc.), and thus creates a new and fascinating branch of photography.

The scientific specialist and student can also make valuable use of the Contax with Sonnar *f*/2, as he can take copies of what is shown on the screen at lantern lectures. Giving exposures of about $^1/_{25}$ sec, he is able, in this way, to obtain facsimiles of diagrams, tables or pictures for subsequent study.

The Press photographer too, when using the Contax and a lens of extreme aperture, is made practically independent of the lighting conditions in following his occupation and can, for example, take sports subjects of the satisfactory sharpness which can be obtained at the large aperture of the Sonnar in the $^1/_{500}$ or $^1/_{1000}$ sec which the shutter of the Contax allows.

Fig. 16.
Zeiss Sonnar *f*/2 2 ins focus.

The entirely new design of the Sonnar lenses has allowed of overcoming the disadvantages which hitherto have been inseparable from most lenses of extreme aperture. The six glasses of the lenses are so combined that there

are only six glass-air surfaces (fig. 17), resulting in pictures of excellent brilliance. The sharpness of definition so necessary for great enlargement is exceedingly good in the margins as well as in the centre of the image, and it should be especially emphasised that the Sonnar is also excellent in respect to the brightness at the margins relatively to that in the centre.

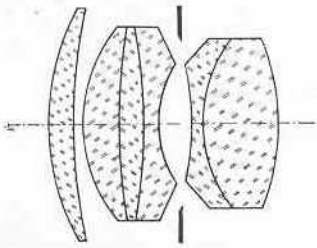


Fig. 17. Section through Zeiss Sonnar $f/2$ ins focus.

A characteristic feature of the Sonnars is the large diameter of the glasses in conjunction with short length of the lens. We would repeat that both these properties, as discussed in the section "Brightness of Image in Centre and Margins" (p. 13), conduce to good illumination, and its fine performance in this respect is one of the notable qualities of the Sonnar. Moreover the relatively short extension allows the lens to be supplied in a mount of non-sunk pattern. It projects only slightly when attached to the camera and does not require to be drawn out for taking a picture. It is in sharp focus on ∞ (infinity) when in its normal position.

At full aperture the sharpness of the picture is so fully obtained that stopping down makes no material improvement except, of course, in greater depth of focus. It is frequently maintained that when a lens of large aperture is stopped down it does not give the same sharpness as one having a maximum aperture equal to that of the more rapid objective when used at the smaller stop. It is certainly true that this is a very difficult problem for the lens designer, but there are rapid lenses, among which is the Sonnar $f/2$, which give excellent sharpness at all apertures equally with those of smaller maximum aperture.

This valuable feature is obtained by the favourable shape of the curve of spherical aberration, the high degree to which curvature of field is removed and the freedom from coma.

At such a large aperture as *f*/2 the depth of focus is of course less, yet does not call for special care, since the Contax lenses are of the short focal length adapted to the miniature size and also are coupled with the long-base distance-meter of the Contax. The value of the long base is especially marked under these circumstances, since the greater accuracy of focus which it affords allows full advantage to be taken (and with certainty) of the large aperture of the lens.

For special subjects, the Sonnar *f*/2 can be stopped down very considerably, e. g. for landscapes where a small stop is often required.

Zeiss Sonnar *f*/1.5 2 ins (5 cm)

The summit of achievement in large-aperture lenses is the ultra-rapid 2-inch Sonnar *f*/1.5 (fig. 18), which is $5^1/_2$ times as rapid as the 2-inch Tessar *f*/3.5 and represents the perfection of objectives of this type. It must be emphasised that this extreme speed is not obtained by the sacrifice of any of the above-mentioned qualities of the 2-inch Sonnar *f*/2. Even at its full aperture, the Sonnar *f*/1.5 gives pictures sharp to the edges, is excellent in its even illumination of centre and margins and is a compact lens. Even this lens is supplied in a rigid (fixed) mount. For optical reasons, it cannot be stopped down further than *f*/11.

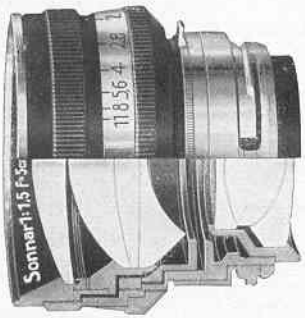


Fig. 18.
Zeiss Sonnar *f*/1.5 ins focus.

Enlarging and Projection

All the Contax lenses of 2 ins (5 cm) focal length—the 2-inch Sonnar *f*/1.5 somewhat less so—are suitable for use with the Contax enlargers, copying cameras and projectors. For this reason these instruments are supplied without lens, unless expressly ordered otherwise. The photographer can use his camera lens for all the other branches of Contax photography.

When it is considered how much can be done with the universal focal length of 2 ins (5 cm) it will be seen that practically every kind of average subject comes within the scope of this focal length. There are, however, Contax lenses of other focal lengths which serve more or less special purposes and extend the capacity of the camera 100 per cent by suitable choice of the focal length.

Photo Siedentopf — Photo-micrograph with Contax

Take portraiture, for example. In this branch of work a relatively great focal length has always been preferred on account of the power it provides for using the camera at a sufficient distance and so obtaining more pleasing perspective.

Zeiss Triotar *f*/4 $3^3/_8$ ins (8.5 cm)

A very suitable lens for this purpose is the Zeiss Triotar *f*/5 (fig. 19) of $3^3/_8$ ins focus (8.5 cm) which is of light build and admirably adapted for the majority of exposures with the camera in the hand on account of its ample speed.

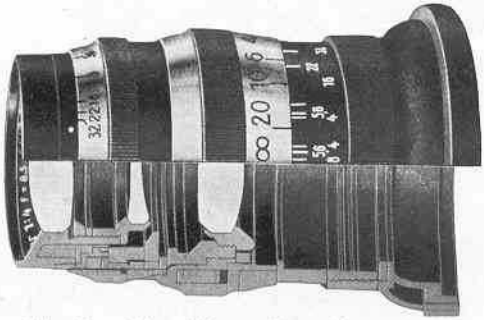


Fig. 19. Zeiss Triotar *f*/4 $3^3/_8$ ins focus.

The larger scale of the pictures makes this lens very suitable for studies of children and animals at a distance, and it renders valuable service to the landscape worker as an extra lens.

Zeiss Sonnar *f*/2 $3^3/_8$ ins (8.5 cm)

A further lens of $3^3/_8$ ins (8.5 cm) focal length is the Zeiss Sonnar *f*/2 (fig. 20) of speed four times that of the Triotar.

This lens is a distinctive special lens for subjects under unfavourable conditions of light, for theatre and sports subjects, Press photography etc. In many respects it is

Phot. Breuer-Courth August 2 p. m.
with wide-angle Tessar *f*/8 $1^1/_4$ inch focus, $^1/_{50}$ sec.

Phot. Breuer-Courth. In sun, August, with Sonnar *f*/2 2 ins focus, $^1/_{50}$ sec.

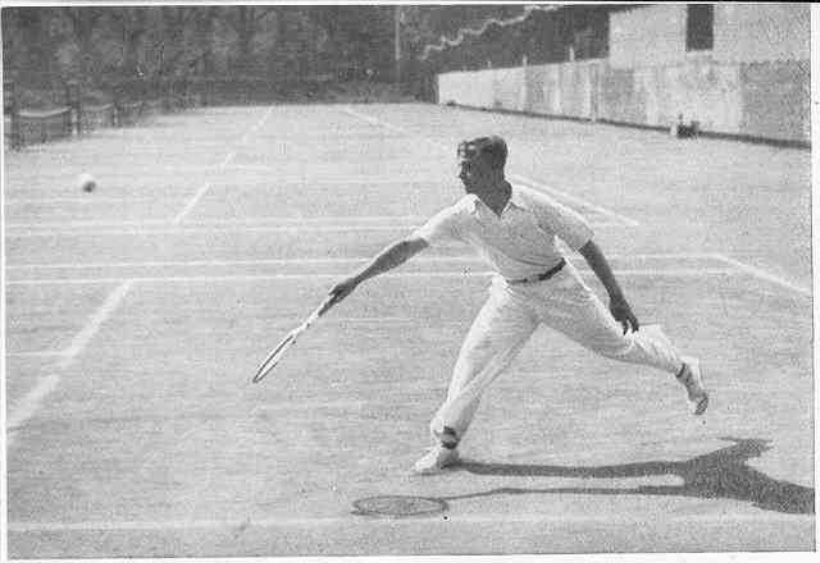


Photo Bergemann

In sun June 4 p. m.
with Sonnar $f/2$ 2 ins focus at $f/4$ $^1/_{500}$ sec.

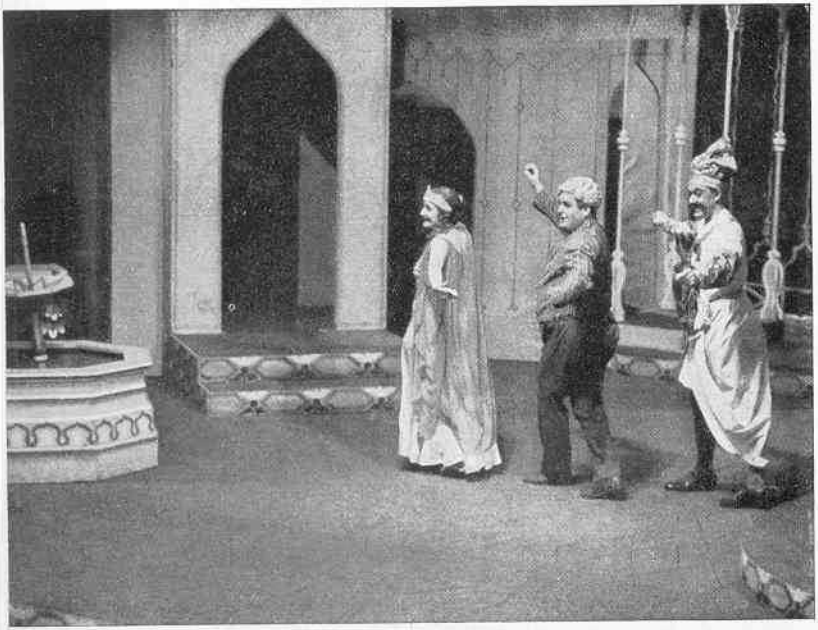


Photo Heyne With Sonnar $f/2$ $3^3/_8$ ins focus, $^1/_{25}$ sec. under ordinary stage lighting.

similar to the 2-inch Sonnar *f*/2 but in consequence of its 70 per cent longer focal length enables pictures to be taken of subjects at much greater distances while rendering parts on a larger scale and so yielding full detail very much better.

Fig. 20.
Zeiss Sonnar *f*/2 $3^3/_8$ ins foc.

These lenses of $3^3/_8$ ins (8.5 cm) focal length may be fairly described as a development of the universal lenses, since, between them, the instruments of the two kinds cover the whole field of work. The next two lenses, on the other hand, viz those of $5^3/_8$ ins (13.5 cm) and $7^1/_8$ ins (18 cm) focal length, are definitely special long-distance objectives.

Zeiss Sonnar *f*/4 $5^3/_8$ ins (13.5 cm)

In consequence of its long focus the Zeiss Sonnar *f*/4 of $5^3/_8$ ins (13.5 cm) renders objects nearly 3 times the size, or $7^1/_2$ times the area, as the 2-inch Tessar. Needless to say, this is an invaluable advantage for distant subjects such as mountain scenery, animals, architectural detail, Press photography. Explorers and others will appreciate the boon of being able to take snapshots unobserved at a great distance. These advantages are further facilitated by the large aperture (*f*/4) of the lens.

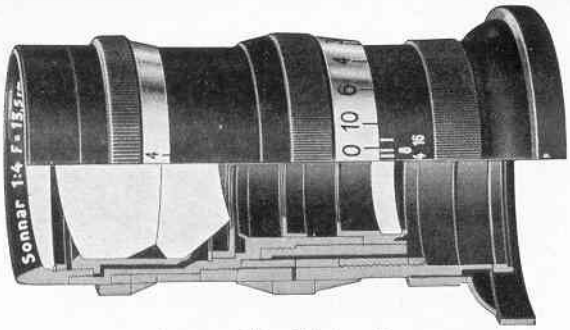


Fig. 21. Zeiss Sonnar *f*/4 $5^3/_8$ ins focus.

The $5^1/_4$-inch Sonnar *f*/4 is not the ordinary type of lens of this focal length as commonly fitted to cameras of $4^3/_4 \times 3^1/_2$ ins size. If it were, it would not come up to the claims which we make for it. The $5^3/_8$-inch Sonnar *f*/4 is, in fact, a telephoto lens of such high quality that the use of a smaller stop does not improve its sharpness of definition. This result has been obtained by calculating it expressly for the small angle of view of the Contax size. The advantage of the short length of the Sonnar type of construction becomes specially marked in this long-focus lens. The distance between the film and the front glass of the lens is only nine tenths of the focal length and thus is not much greater than in the case of the Triotar of $3^3/_8$ ins (8.5 cm) focal length.

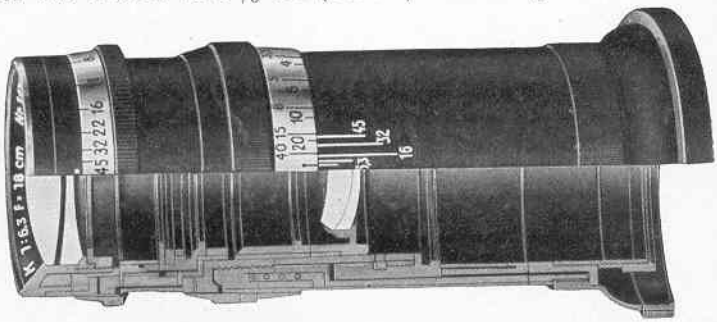


Fig. 22. Zeiss Tele-Tessar K *f*/6.3 $7^1/_8$ ins focus.

Tele Tessar K *f*/6.3 $7^1/_8$ ins (18 cm)

The longest-focus Contax lens which is coupled with the distance meter is the Zeiss Tele-Tessar of *f*/6.3 aperture and $7^1/_8$ ins (18 cm) focal length (fig. 22). The long-focus effect is very greatly enhanced with this lens. The most distant objects are, so to speak, "brought up" in full detail as though seen through a field glass. Exposures with the camera in the hand are not very easily made; it is advisable to use a tripod.

Yet in some circumstances the desire is expressed for a longer focus than $7^1/_8$ ins (18 cm). Explorers and zoologists will wish to take series pictures of shy animals in their natural habitat or of birds at a distance of about 100 yards. Botanists and geographers often need to obtain photographs of natural objects or phenomena which they could not otherwise record.

Special Long-focus Lenses *f*/8

For such occasions there are the long-focus lenses of 12 ins (30 cm) and 20 ins (50 cm) focal length made by Carl Zeiss, Jena.

These must be screwed firmly to a tripod, and the Contax attached to them by means of the bayonet joint, as shown in fig. 23a. Sharpest focus and placing of the subject, free from any error of parallax, are ensured by use of the interchangeable adapter for the focussing screen (fig. 23b) which can be put into position in place of the Contax for this purpose. The quick-action bayonet mount is of special advantage in these circumstances.

Fig. 23a. Zeiss Tele-objective 12 ins focus with Contax.

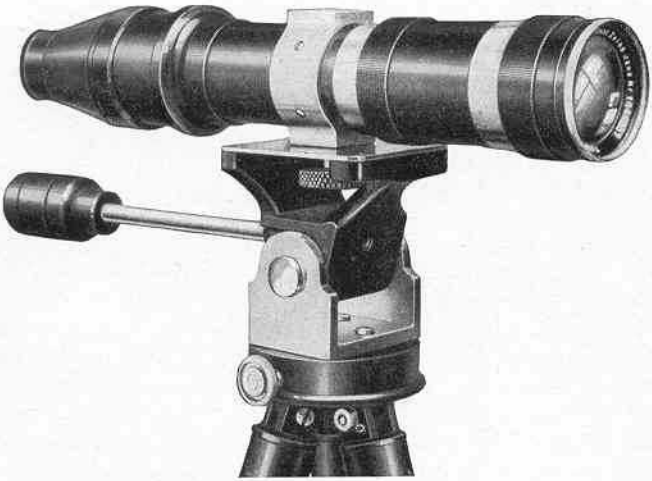


Fig. 23b. Zeiss Tele-objective 12 ins focus with focussing screen adapter.

We have just considered lenses for the Contax of relatively gigantic focal length. We now turn to lenses of the opposite kind.

Lenses of very short focus have their good points, inasmuch as they render valuable service when the subject is not at a great distance but is quite close e. g. in rooms, in narrow streets, when taking architectural detail or when photographing in museums, engineering shops and other places. Thus not only those who take such subjects as these, but also specialists, find a wide-angle lens a valuable item of the optical equipment in addition to the lens of normal focus.

Zeiss Tessar *f*/8
$1^1/_8$ ins (2.8 cm)

Fig. 24. Zeiss Tessar *f*/8 $1^1/_8$ ins focus.

The Zeiss Tessar *f*/8 (fig. 24) of $1^1/_8$ ins focus (2.8 cm) is a wide-angle lens covering an angle of 75 deg (see Summary I). It can be said that it is a triumph of construction as regards angle of view although the maximum aperture has had to be limited to *f*/8. Nevertheless this moderate aperture is not a serious drawback now that films of such sensitiveness may be obtained that instantaneous exposures may readily be made out of doors with the camera in the hand at apertures of *f*/8, *f*/11 and *f*/16.

The Tessar *f*/8 of $1^1/_8$ ins (2.8 cm) is the only Contax lens the focussing mount of which is not coupled to the distance-meter. The depth of focus, due to the short focal length, is, however, so great that pictures of critical sharpness are obtained, even at full aperture, when judging distances quite roughly. In exceptional cases the distance may be measured with the Contax distance-meter and focus then exactly obtained by means of the scale on the lens.

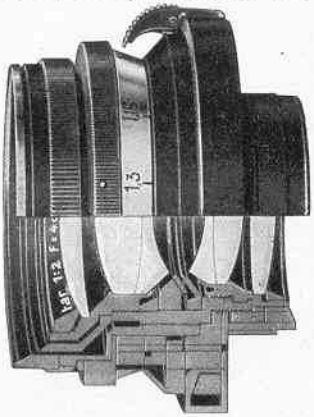


Fig 25. Biotar *f*/2 $1^9/_{16}$ ins focus.

Zeiss Biotar *f*/2 $1^9/_{16}$ ins (4 cm)

The amateur is also able to combine large aperture with short focal length, namely by the use of the Zeiss Biotar *f*/2 (fig. 25) of $1^9/_{16}$ ins (4 cm) focal length. The angle of view is considerably greater than that of the 2-inch Tessar *f*/3.5, namely 55 deg as against 45 deg, so that the Biotar may be regarded as an ultra-rapid univeral lens enclosing a wider angle of view. Although of such exceptionally large aperture and covering power, the definition of the pictures obtained with this lens is excellent. Focussing, however, cannot be done by means of the disc of the distance-meter, as the Biotar, like the long-distance lenses, is supplied in an external bayonet mount provided with separate means for focussing.

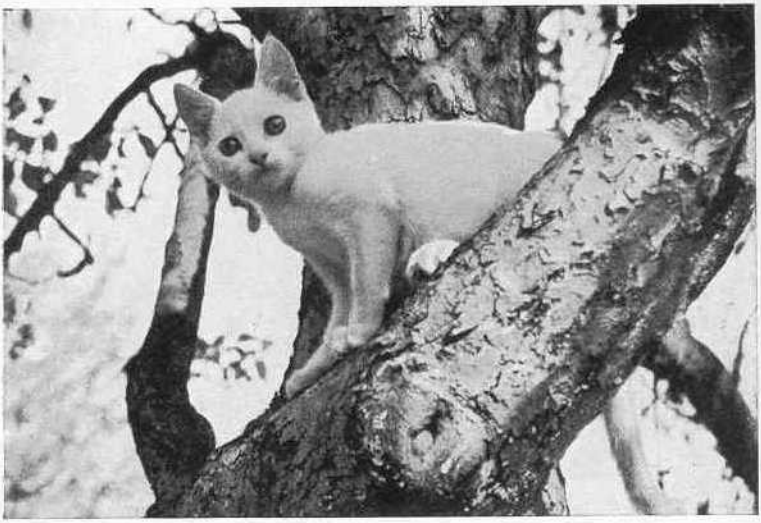


Photo Breuer-Courth — August, with Sonnar *f*/2 2 ins focus, $^1/_{150}$ sec.

Photo Flury — June, 8 a. m., in sun, with Sonnar *f*/4 $5^3/_4$ ins focus, $^1/_{25}$ sec.

Supplementary Lenses, Colour-filters and Lens-hoods

For use with all the Contax lenses there are also small but important accessories such as supplementary lenses, colour filters and lens-hoods. Here we must be content to refer briefly to the use of these attachments, since special descriptive circulars may be obtained.

Zeiss Proxar Supplementary Lenses

These attachments are for the purpose of shortening the focal length of the ordinary lens and thus allowing of taking pictures at closer quarters than is provided by the focussing scale. The proper settings are given in a special table. When using a supplementary lens of 1 diopter the distance of the subject may be from 20 to 40 ins, whilst with 2 diopters it may be 20 to 12 ins.

Green and Yellow Filters

For better tone-rendering of colours it is usual to employ yellow screens which are available in three degrees of depth, namely light, medium and deep. There are also the so-called "ultra-violet" filters (of special service for Alpine subjects) which do not require any increase in exposure.

For those who employ orthochromatic and panchromatic films in frequent alternation there is an advantage in employing the yellow-green filters (recently introduced) in place of yellow filters. With orthochromatic film the effect is that of the usual yellow filter. With panchromatic film the somewhat excessive red-sensitiveness is

Photo Fiedler

September afternoon in sun
Tessar *f*/2.8 (2 ins focus) at *f*/11 with Proxar 2 × 27, $^{1}/_{25}$ sec.

usefully corrected by the green colour. For correct tone-rendering on panchromatic film there are also two special green filters, light and deep.

Red Filter

A branch of work which has aroused great interest of late is infra-red photography. By this method pictures may be taken by the infra-red rays which penetrate mist and fog and thus render detail in the distance which cannot be seen by the eye. Also moonlight effects may be taken in bright daylight by infra-red, the blue rays being cut out by a filter which passes infra-red. Another fascinating use of infra-red photography is the taking of pictures in total darkness by means of the heat-rays. For this purpose the I. G. Farbenindustrie (Agfa) supply the R-film, a cine film of the standard perforation which

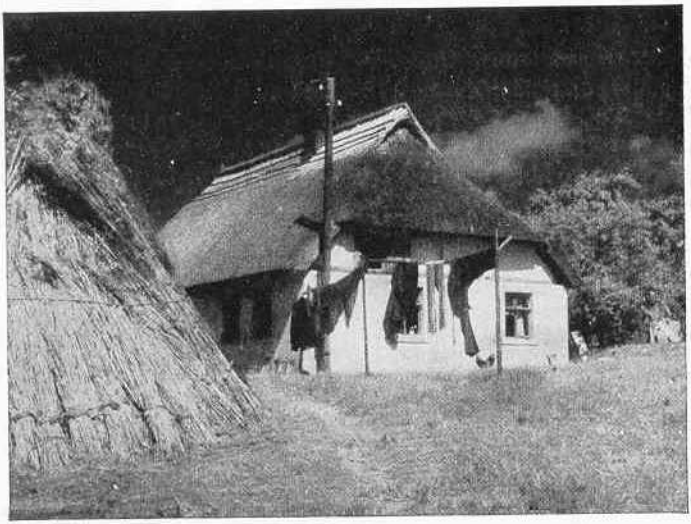


Photo Kammerer

August, 11 a. m., in sun, on Agfa R-Film with red filter. Sonnar $f/2$ ($3^3/_8$ ins focus) at $f/22$, $^1/_2$ sec.

is sensitised to the long deep-red rays and short-wave infra-red. Pictures taken through red-filters on this film exhibit highly distinctive effects. Light and medium red filters are used for this purpose.

For distinctive infra-red photography only the special plates can be used. A plate adapter will therefore be supplied for the Contax and will allow of making single exposures on plates of the size $1^1/_4 \times 1^{11}/_{16}$ ins (3×4.5 cm). Filters for use in this work are the dark red filter R 20 and the "black" filter R 30.

A hood (fig. 26) for the lens is an accessory which is unfortunately far less frequently used by amateurs than it should be. The improved results, as regards brilliance and clearness of the pictures, are astonishing.

The outer bayonet mount of the Contax serves for the attachment of a fixed lens-hood (with rectangular mask) which does not turn as the lens is rotated. By means of this hood any description of against-the-light subject may be taken, provided care is exercised that the light-source itself is not included in the picture in the finder. The lens-hood fits any lens of 2 ins (5 cm) focal length. For convenient carrying, the hood is made telescopic; for the large-aperture Sonnars the length of the hood can be reduced so as to avoid cut-off. For all other lenses there are corresponding special hoods.

Fig. 26. Contax with telescopic lens hood for 2-inch lens.

Colour Pictures

It will not be long before the Contax user will be able to take colour pictures by means of the Agfacolor film. The basis of the process is a film of lenticular formation. The pictures can only be shown by projection. Lenses adapted for taking are the Zeiss Sonnar *f*/2 of $3^3/_8$ ins (8.5 cm) focus and, the Zeiss Tessar *f*/2.8 of 2 ins focus (5 cm), both of which are specially made for colour pictures. They are used in conjunction with a three-colour filter in a mount which pushes straight on. Further particulars of this attractive branch of work are given in a special prospectus.

Fig. 27

Agfacolor Filter for Zeiss Tessar *f*/2.8 2 ins focus.

Agfacolor Filter for Zeiss Sonnar *f*/2 $3^3/_8$ ins focus.

Photo Kammerer

In sun, August, 9 a. m., Sonnar *f*/2 (2 ins focus) at *f*/11 $^1/_{25}$ sec.

Finders for the Contax Lenses

A finder for use with the standard lenses of 2 ins (5 cm) focal length is part of the construction of the Contax. When using a different focal length, the finder must of course be one of different angle of view, and this point must not be overlooked when purchasing a second lens.

For somewhat longer focal lengths a simple means is provided in the finder mask (fig. 28), which is mounted in front of the Contax finder and reduces the field of view. This method suffices for a moderate range of focal length.

Fig. 28. Contax finder mask.

But when making much use of long-focus lenses, it is preferable to employ a special finder which gives an enlarged finder image by optical means. In the case of finders for use with focal lengths shorter than 2 ins (5 cm), a special type becomes absolutely necessary, since the angle of view of the finder which forms part of the Contax cannot be increased.

Owing to the proper placing of the finder on the camera there is, as a rule, no effect of parallax, since the slight separation (2 ins = 5 cm) between the axes of the lens and finder is negligible. It is only when subjects are taken very close to the camera that parallax needs to be taken into consideration. For use of the long-distance *f*/8 lenses of the long focal lengths of 12 ins (30 cm) and 20 ins (50 cm) no finders are provided, as the only suitable method is to focus on a ground glass screen.

For subsequent fitting of any finder to the Contax the camera is provided with an attachment piece or "shoe" into which the finder is inserted. This shoe is accurately adjusted to the lens axis, thus ensuring correspondence between the finder image and the film aperture of the camera.

A considerable number of finders are available for use with the Contax according to requirements. These are:

(1) Universal finder
(2) Special finders
(3) Finders for special purposes.

The Universal finder is adjustable for all focal lengths and thus requires to be of extreme accuracy of workmanship, with the result that its cost is considerably greater than that of finders of simpler construction.

The Special finders are of this simpler type and are available for almost all the lenses, either for one focal length or several.

The finders of Class (3) are fully described on a later page.

Photo Breuer-Courth Top light June, 1 p. m. Contax with Sonnar *f*/2 2 ins focus, $^{1}/_{25}$ sec.

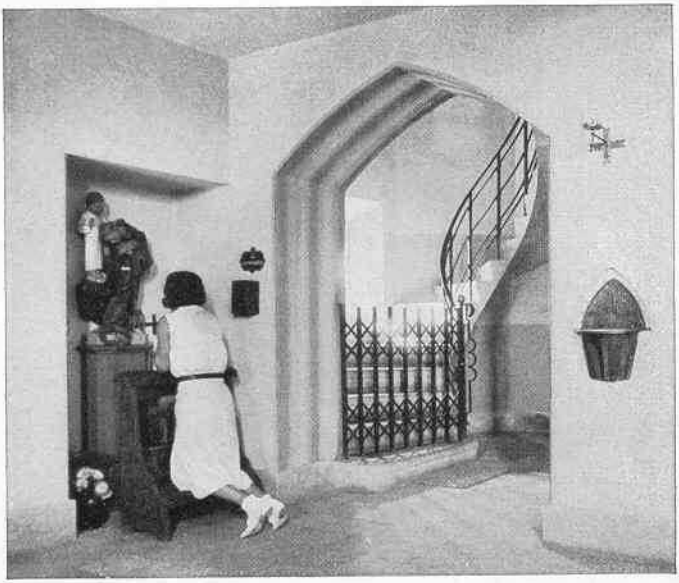


Photo Breuer-Courth Subdued daylight, August, Tessar *f*/8 $1^1/_8$ ins focus, 25 secs.

Photo Breuer-Courth August, 11 a. m., sultry weather.
Yellow filter with Sonnar *f*/2 (2 ins focus) at *f*/5.6, $^1/_{100}$ sec.

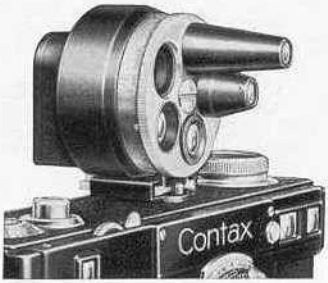


Fig. 29. Contax Universal Finder.

This universal finder (fig. 29) represents a new and most efficient device which is constructed of rotating pattern. It is adapted for Contax lenses of all focal lengths from $1^1/_8$ ins (2.8 cm) to $5^1/_4$ ins (13.5 cm). In the case of a precision finder it is important that the finder image presented to the eye should regularly appear under the same angle of view independently of the focal length of the lens. With the Universal finder this is done in an admirable manner. The finder image, which is erect (the right way up) and correct as regards right and left, is reduced for the focal lengths of $1^1/_8$ ins (2.8 cm), $1^9/_{16}$ ins (4 cm) and 2 ins (5 cm) and is slightly enlarged for the focal lengths of $3^3/_8$ ins (8.5 cm) and $5^3/_8$ ins (13.5 cm). The readiness with which the detail of a distant subject can be seen is improved by the enlargement. The boundaries of the subject are plainly indicated.

Contax Wide-angle Finder

Contax Wide-angle Finder

Optically this finder is constructed similarly to that in the Contax and has only a correspondingly larger angle of view. The finder likewise consists of a reversed

galilean telescope and gives a bright, reduced and erect picture, which is correct as regards right and left. It is supplied in two models viz for the $f/8$ Wide-angle Tessar of $1^1/_8$ ins (2.8 cm) focus and for the $f/2$ Biotar of $1^9/_{16}$ ins (4 cm) focus (fig. 30).

Fig. 30. Contax Wide-angle Finder.

Contax Albada Finder

This finder (fig. 31) represents the application, for the first time for photographic use, of an entirely new principle. It is an optical finder which shows an erect image unreversed and in natural size. The front glass is slightly silvered on the inside. By reflection of a white line which encloses the rectangular viewing aperture the exact amount of the subject which is being taken is projected so that, when looking through the finder, the user appears to see the white frame suspended in space and including the subject he will get on the film. A perfectly sharp indication of the amount of subject is thus obtained by relatively simple means (figs. 32a and 32b).

Fig. 31. Contax Albada Finder.

The advantages of this finder which deserve to be emphasised are: The field of view is large and clear; the finder image is erect and unreversed. The subject is viewed in its natural size with both eyes, thus showing it in relief and allowing of excellent judgment of distance.

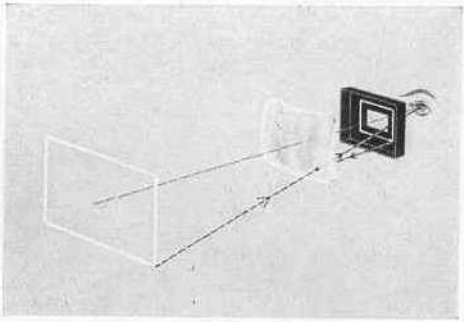


Fig. 32a. Diagrammatic sketch of Albada Finder.

These features render the Albada finder specially suitable for sports subjects, whilst it will be obvious that this finder also fulfils all the functions which can be required for subjects of any kind whatever. It is supplied in three forms as single and as "double-field" finder:

(a) For the focal length of 2 ins (5 cm)
(b) For the focal lengths of 2 ins (5 cm) and $3^3/_8$ ins (8.5 cm)
(c) For the focal lengths of 2 ins (5 cm) and $5^3/_8$ ins (13.5 cm).

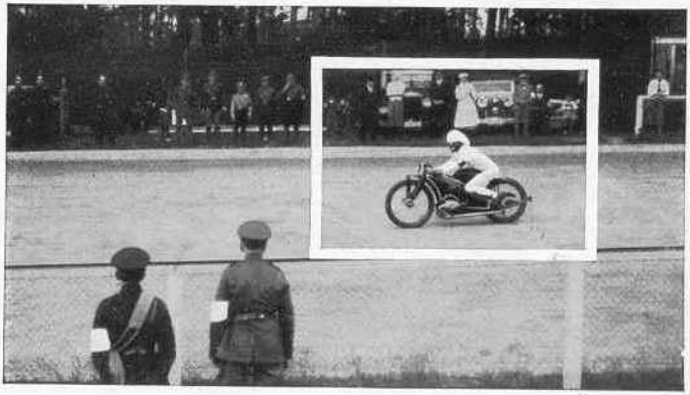


Fig. 32b. Field of view of Albada Finder.

Contax Multiple Finder

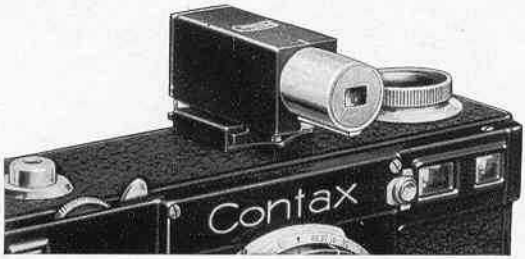


Fig. 33.
Contax-Multiple Finder.

This finder (fig. 33) is a telescope finder for the focal lengths of 2, $3^3/_8$, $5^3/_8$ and $7^1/_8$ ins (5, 8.5, 13.5 and 18 cm). It gives an unreversed erect image with clearly marked boundaries. The projecting tube allows of the finder being adapted to any of the above focal lengths.

Contax Tele Finder

A simple finder of tube form is supplied solely for use with the Tele-Tessar K of $7^1/_8$ ins focal length (18 cm). The finder (fig. 34) gives an unreversed image in natural size.

Fig. 34.
Contax Tele Finder.

Finders for Special Subjects

Occasions arise when the best effect is not obtained with the Contax used at eye level; many striking snapshots are secured by using the camera at an angle to the direction in which the subject is viewed. In these special cases the two following finders are of service.

Contax Waist-level Finder

This finder (fig. 35) is a small telescope finder which gives an unreversed image showing the margins of the picture plainly and is intended for lenses of 2 ins (5 cm) focal length. When taking oblong pictures, e. g. of children or animals, the finder is useful by enabling one to hold the camera at a lower level. In taking upright pictures many remarkably good snaps are secured, since the exposure is made at right angles to the direction in which the camera appears to be held. Since subjects of this kind are usually figures, the "upright" shape of picture is what is required.

Fig. 35.
Contax Waist-level and Angle Finder.

Contax Brilliant Finder

This is a finder of a simple type by aid of which the camera may be used at a low level and oblong pictures also taken at a right-angle. The finder must be held at a distance from the eye suitable for distinct viewing. It can be brought near to the eye by fitting a finder magnifier.

Fig. 36.
Contax Brilliant Finder.

Contax Oblique Viewer

This is a prism attachment by which the finder of the Contax and the distance-meter may be employed at an

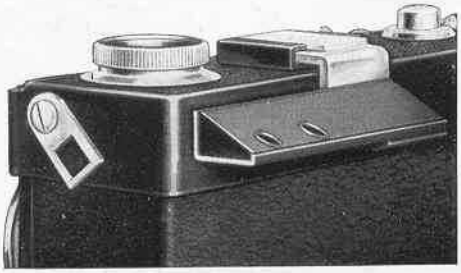


Fig. 37.
Contax Oblique Viewer.

angle of 60 deg instead of looking straight through them (fig. 37). In this way exposures may be made unobserved at an angle, and the camera can likewise be held at a lower level when taking oblong pictures. Also, for exposures with the camera pointed upwards, e. g. for air and other sports subjects, the apparatus can be held better against the head.

The device for this oblique viewing can also be employed, even with lenses of long focus, when using the finder mask (fig. 28 page 45). And it should not be overlooked that the distance-meter can at the same time be operated with the oblique viewer.

Photo Heyne

January, 7 p. m. Sonnar *f*/1.5 2 ins focus, $^1/_{25}$ sec.

Holder
for mounting sight-correcting lenses

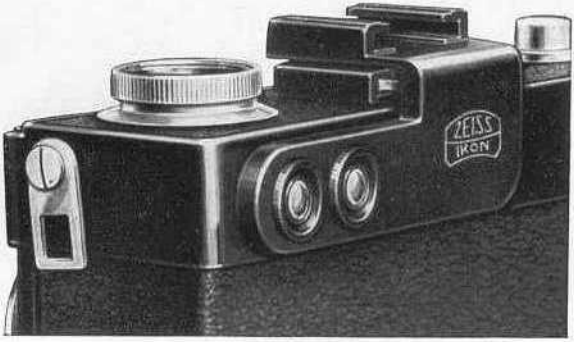


Fig. 38. Contax Holder for sight-correcting lenses.

For those who wear spectacles, it is more convenient to leave them off when making observations in the distance meter and finder. The camera can then be held close to the eye and thus firmly against the head. The holder (fig. 38) allows of the insertion of correcting glasses adapted for individual eyesight, the Contax being thus entirely suitable for those who wear glasses as well as for persons of normal sight.

In conclusion the many friends of the Contax (or those to become so) are also referred to the booklet "The Connoisseur and the Contax", obtainable from any photographic dealer of repute. It is also proposed to publish further comprehensive booklets dealing with scientific accessories and copying appliances for the Contax; also with filters and with the finders which, in the present pages, have been somewhat briefly considered. The projection of Contax transparencies will also be the subject of a booklet.

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Tessar 1:4,5 f=8,5cm
Sonnar 1:2,8 f=5cm

ZEISS IKON