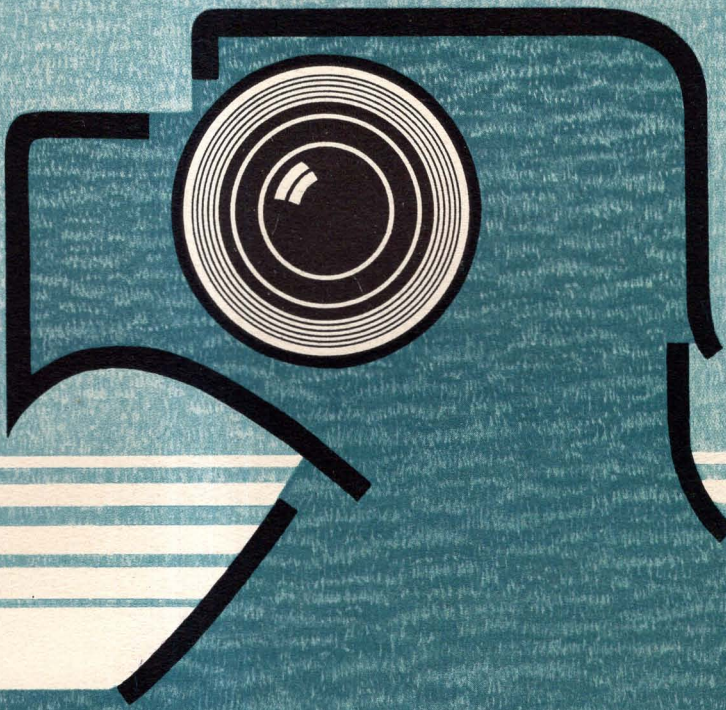
THE EAGLE EYE OF YOUR CAMERA



ZEISS OBJECTIVES

CARL ZEISS JENA

Ph 333 e.

ZEISS

PHOTO LENSES

CARL ZEISS
JENA

Ph 333 e.

CONTENTS

General Survey of the Zeiss Objectives together with their Accessories and their Principal Ranges of Application

(Detailed Particulars will be found on p. 7 et seq.)

Further Particulars in this Catalogue Page

Tessar F/4.5, — 7, 23

the most popular rapid universal photo lens:

The short foci for pocket cameras, cinematograph cameras and stereo cameras;

The intermediate foci for hand cameras, including folding cameras as well as focal plane and reflex cameras;

The long foci for portraits and groups with stand and studio cameras, also for aerial photography and special work.

Tessar F/3.5, — 9 15, 23, 27

a universal objective of greater rapidity:

The short foci mainly for miniature cameras and cinematograph cameras;

The intermediate foci primarily for focal plane and reflex cameras, but also for folding cameras;

The long foci for portraiture with studio and stand cameras, for aerial photography and special work.

Biotessar F/2.8, — 14, 24

an extra rapid objective:
for focal plane and reflex cameras.

Tessar F/2.8, — 11, 24

an extra rapid objective:
for miniature cameras.

Biotar F/2, — 12, 24

an objective of extreme rapidity:
for miniature cameras.

Sonnar F/1.4 to F/4, — 13

an objective of extreme rapidity:
for cinematograph and miniature cameras.

	Further Particulars in this Catalogue Page
Tessar F/6.3, **a universal objective:** The short foci for miniature and stereo cameras: The intermediate foci mainly for folding cameras: The long foci for portraiture and special group photographs with stand and studio cameras.	7, 22
Dagor F/6.8, symmetrical double anastigmat, **a universal objective with a large field of view;** for folding stand cameras with long extension; the back component can be used stopped down as a long focus lens.	11, 28
The **Double Protar** and	11, 25
Sets of Convertible Protars, of which the individual components, the Protar lenses, can be used independently at full aperture as long focus lenses; **rapid universal equipment for folding cameras, especially stand cameras with long extension.**	12, 26
Biotar F/1.4, **of universal application for cinematograph work** owing to its extreme rapidity and extraordinarily good definition,	15, 27
Tessar F/2.7, very rapid objective with field of view of moderately wide angle: **a special objective, therefore, for cases where the chief consideration is the full utilization of the very wide aperture of this lens,** for cinematograph cameras.	14, 27
Kino-Tele-Tessar F/4, **a rapid special objective of long focus for obtaining large scale pictures in cinematography.**	16, 27

	Further Particulars in this Catalogue Page
Tele-Tessar F/6.3, **a rapid special objective of long focus but short extension for obtaining large scale pictures,** for all types of hand cameras.	14, 24, 41, 42
Magnar F/10 f = 45 cm., **a special objective of long focus for obtaining large scale pictures,** which can be used on 12×9 cm. or ¼-plate hand cameras with an extension of about 15 cm. (6 in.).	41, 43
Tele Attachment, **for obtaining large scale figures at long ranges,** available for use with any camera from which the objective with its mount or shutter may be readily detached.	41, 43
Dagor F/9,	14, 28
Protar F/18,	17, 28
Hypergon F/22, **for wide angle work with folding and stand cameras.**	17, 28
Tessar F/5 f = 50 cm. and	16, 28
Tessar F/5 f = 70 cm., **rapid objectives for portraits and groups as well as for aerial photography and special work.**	16, 28
Triplet F/4.8 f = 50 cm. and	16, 28
Triplet F/5 f = 70 cm., **rapid objectives for portraiture as well as for aerial photography and special work.**	16, 28
Quartz Anastigmat F/4.5, **mainly for criminological and scientific photography, particularly with ultra-violet light.**	17, 28
Distars, **attachable front lenses for increasing the focal length and the size of the image.**	31, 36

Further Particulars in this Catalogue Page

Proxars, 33, 36
attachable front lenses for decreasing the focal length, enlarging the field of view, and for close-up photographs on a large scale.

Yellow Glass Filters, 38, 39
filters compensating for the difference between the colour impression upon the eye and upon the isochromatic plate.

Ducar and A-Ducar Filters, 40
filters for taking colour photographs on colour screen plates, with small spherical curvature compensating for the plate thickness.

Optical Equipment for Process Work: 17, 29
Apo-Tessars and Apo-Planars, objectives for Process Work,
Prisms and Mirrors as reversing systems,
Revolving Collars,
Filter Cells, R Yellow Filters and R Colour Filters,
Focusing Microscope and Focusing Magnifiers.

"Flycatcher, feeding a young cuckoo"
Taken with F/4.5 Tessar f = 18 cm. Jaspar v. Oertzen

Taken with F/4.5 Tessar f = 18 cm. by Gerhard Riebicke

On the Choice of a Suitable Lens

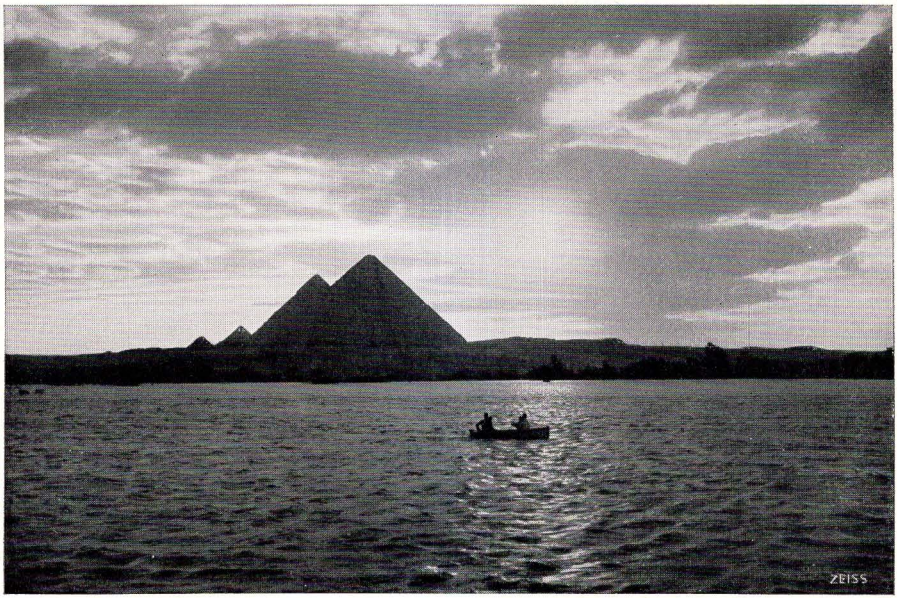
1. Universal Lenses

The photographer, whether amateur or professional, when choosing a lens does not as a general rule require it for one purpose only, but for as wide a range of photography as possible. It should serve for instantaneous photographs of every kind, for sport, nature study, portraits, groups, landscapes of every description, both in summer and in winter, seascapes, mountain views, photographs from aircraft, architecture, interiors and natural colour photographs. Occasionally it may be required for enlarging and projecting, and perhaps as the positive component if a tele-photo negative attachment should be purchased at a later date. The following are to be considered as universal lenses in this sense. Each of them has some special characteristic which renders it more particularly adapted for one main purpose, so that in every case it is practicable to arrive at a definite choice of the most suitable universal lens.

Tessars F/4.5 and F/6.3. These are rapid lenses giving, over a large angle, exquisitely sharp and brilliant pictures, in consequence of which negatives obtained with them admit of being considerably enlarged. The Tessar is not of

the symmetrical type, and consequently no attempt was made in its inception to render the front and back lenses even roughly adapted for independent use. The Tessar was computed with the sole aim of making the performance of the complete lens as perfect as possible without a thought of ever separating its components. It will be readily appreciated that this restriction of the resources of the objective left the computer far greater freedom in the choice of the incidental elements, such as the curvatures of the lenses and the kinds of glass which could be employed, than would have been possible were the front and back lenses required to be available within certain limits for independent use. In consequence of this simplication of the problem and the wider scope of available elements of construction the objective embodies an exceptionally high degree of correction in a comparatively simple combination made up of four lenses, two of which are cemented.

The Tessar is therefore pre-eminently the lens for hand cameras with single extension. In the course of recent years it has more and more taken the place of symmetrical and semi-symmetrical lenses in cameras with double extension, thanks to the introduction of our **Distars** and **Proxars**. These are single attachable front lenses whose curvatures are so computed as to increase or decrease the focal length of the objective within certain limits. They form, therefore, with the Tessar a very comprehensive convertible set, so that it can be used on hand cameras with single extension, and to a still greater extent on cameras with double extension, with a new range of applications (further particulars on pp. 30—37).



"Twilight". Taken with Tessar F/4.5 f = 16.5 cm. by Herant Mahilian

The choice between Tessar F/4.5 and Tessar F/6.3 is determined by the following considerations. Tessar F/4.5 is twice as rapid as Tessar F/6.3. On the other hand the latter embraces a wider angle than Tessar F/4.5 working at the same stop (see columns 3, pp. 22, 23). – It is, however, a complete error to ascribe to one or the other type superiority in the matter of depth of focus. When stopped down to F/6.3, the Tessar F/4.5 has the same rapidity and hence exactly the same depth of focus as the Tessar F/6.3 or, for that matter as any other lens of similar relative aperture and focal length.

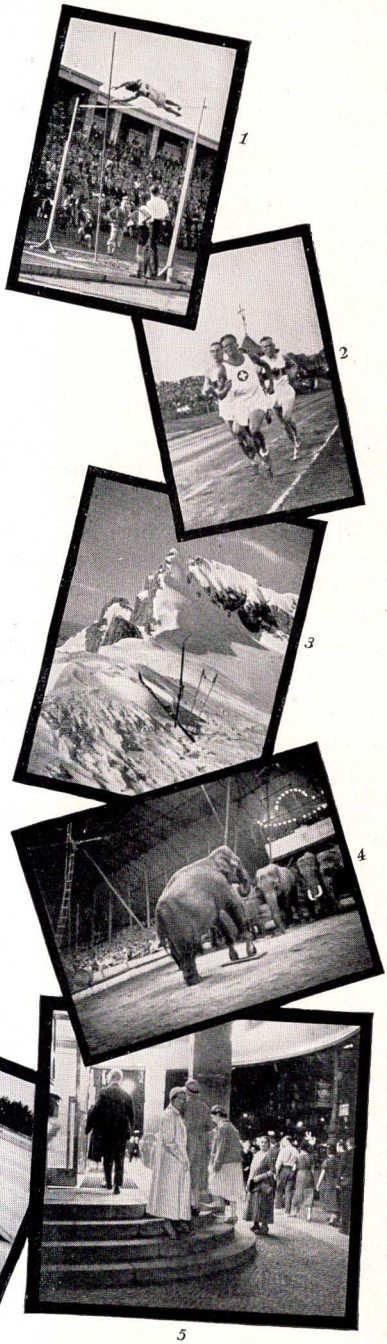
Where rapidity is more important than any other quality, possessors of a sufficiently steady camera fitted with a front or shutter admitting of the attachment of the somewhat heavier Tessar F/4.5 will do well to let their choice fall on this lens. Preference may, however, be given to Tessar F/6.3 where it is more important that the camera should be as compact and light as possible and where incidentally a lens with a slightly shorter focus, i. e. a larger field of view, is required.

Tessar F/3.5. This objective is a type of Tessar computed a few years ago which fully satisfies the demands made on a universal objective in respect of field of view. It should not be confused with the older special Tessar F/3.5 for cinematograph work which is still included in this list, page 27. In the quality and range of its performance this **universal Tessar** is comparable to the Tessar F/4.5, assuming both lenses to be stopped down in like manner; its rapidity, however, at full aperture is 65 per cent greater than that of the latter. At this large aperture the lens covers the plate uniformly and with beautiful definition. In order to secure the depth of focus obtained with the Tessar F/4.5 or Tessar F/6.3 it is only necessary to stop the lens down to the respective aperture of either lens.

Taken with Tessar F/3.5 f=15 cm., full aperture F/3.5, in February. Photo: G. Riebicke

Photographs taken with the Tessar F/3.5 will bear enlargement to a very considerable extent, provided, of course, that the photography has been technically good. Since at full aperture the Tessar F/3.5 covers an image field of 55° with sufficient sharpness, the 5 cm. focus is recommended for use on 3.6×2.4 cm. and 4×3 cm., the 7.5 cm. focus on 6×6 cm., and lenses of 10.5 and 12 cm. foci on 9×9 cm. cameras. With small stops the lens covers an image circle of almost 65°.

The great rapidity of the Tessars F/3.5, combined as it is with the fine qualities of the less rapid high-class lenses, renders these lenses pre-eminently adapted for taking pictures which demand an extremely short exposure, for example sports and press photographs, portraits, or exposures made in a bad light or with colour screen plates, where a lens of smaller rapidity would need an unduly prolonged exposure.



Figs. 3 and 6, taken with Tessar F/3.5 f=5 cm. by C. J. Luther

Fig. 5, taken with Tessar F/2.8 f=6 cm. by Dr. W. Kross

Figs. 1 and 2, taken with Tessar F/2.8 f=5 cm.
Fig. 7 with Tessar F/2.8 f=6 cm.
Fig. 4 with Biotar F/2 f=4.5 cm.
by C. Kirschner

Our various front-lens attachments and filters may be used with the new Tessar F/3.5 to the same extent as with Tessars F/4.5 and F/6.3.

The Tessar F/2.8 has been manufactured for some time under the protection of the patents taken out a few years ago for new types of Tessars; of these the F/3.5 Tessar already referred to, with its large image field, has already become widely used, particularly for miniature cameras.

By producing this F/2.8 Tessar the Zeiss factory has gone a long way to meet the wishes of the users of miniature cameras for increased rapidity. The objective covers an angle of fully 50° at full aperture, with very great and uniform sharpness and the brilliance characteristic of all Tessars.

The rapidity of the F/2.8 Tessar at full aperture is fully 50% greater than at F/3.5, and fully 150% greater than at F/4.5, and with miniature cameras there are many opportunities of actually utilizing this great rapidity, for the depth of focus, thanks to the short focus of the objectives used in such cameras, entirely suffices in many cases. Where this is not the case, or where, by reason of the brilliance of the light, it is necessary in any case to stop down, this can of course be done by means of the iris diaphragm (see also special leaflet Ph 289).

The Dagor F/6.8 is a symmetrical double anastigmat with a large image field. Its component halves can be used in the same way as the Protar lenses — see next section — as long focus lenses, although, in contradistinction to the Protars, they need to be considerably stopped down — more or less, according to the character of the photograph in question. The focal lengths of the separate components are equal to one another and about 75% longer than the focal length of the complete objective. The Dagor (which is also supplied as a rapid wide angle lens with an aperture of F/9, see p. 14) was manufactured, until a few years ago, by Messrs. C. P. Goerz, of Berlin. Since the absorption of the Goerz factory into the Zeiss Ikon A. G. of Dresden, and the consequent cessation of the manufacture by them of photographic lenses, it has been produced by the Zeiss factory in Jena.

The Double Protar has relative apertures of F/6.3, F/7 and F/7.7, according as to whether it is made up of two Protar lenses of the same or of different focus. Its most rapid combinations accordingly come very near to the Tessar F/6.3. It possesses, moreover, the advantage of being made up of components which may be used independently as long-focus lenses and which give sharp images at F/12.5. In many cases they are rapid enough for shapshots, and there is the further advantage that as a rule their components have different focal lengths*).

Those who wish to be able to secure the best composition of the picture, whatever the subject, and who insist on a faultless perspective and at the same time wish to take snapshots, cannot do better than provide themselves with a good camera of the selected size with double or triple extension, and furnish it with a

*) Column 1 on page 25.

Double Protar made up of two component lenses of dissimilar foci together with a Compur shutter. The Double Protar may then at the time of purchase or on any subsequent occasion be expanded into a veritable universal equipment by adding Protar lenses of neighbouring focal lengths and supplementing the resulting **Convertible Protar Set** by a wide-angle lens proper, say a Protar F/18 and, for long range work, a telephoto attachment, together with suitable yellow glass filters. Such an outfit will enable its owner to secure the most perfect results under the widest possible range of conditions (see p. 26).

2. Special Lenses

In certain cases the all-round lenses described in the preceding section may well be employed for specialised purposes. Obviously, however, photographic lenses, like all tools which are capable of highly developed specialisation for particular purposes, may have *one* or the other quality specially developed at the expense of others which do not affect the given purpose. Thus, it may be a decided advantage in one case specially to increase the rapidity, in another to extend the covering power, in a third to shorten the camera extension by the employment of the telephotographic principle, or in a fourth case to simplify the construction of the objective in order to reduce its weight or its price.

a) Special Lenses with a Wide Range of Uses

This group includes series of lenses embracing a field which is not so extensive as that of the preceding universal lenses proper. On the other hand, some of the lenses of this group are considerably more rapid than the universal lenses and others furnish a means of shortening the camera extension on the telephotographic principle. At the same time the size of the field of view and the other properties of the lenses as well as the focal lengths in which they are made are yet such as to cover a comparatively wide range of uses, They occupy in fact, an intermediate position between the universal lenses proper and the special lenses in a narrower sense. They comprise the following series:

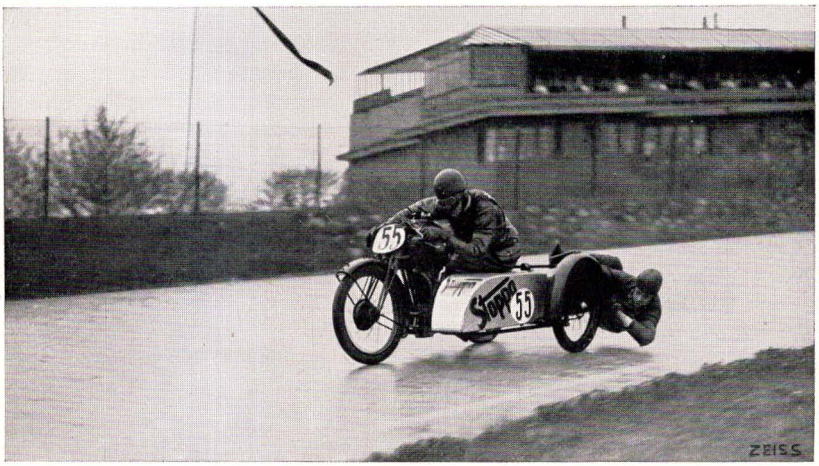
The Biotar F/2. Notwithstanding the fact that the sensitivity of photographic material has lately been so increased that useful results can be attained even with objectives of moderate rapidity and under unfavourable lighting conditions, the demand for objectives of the greatest possible apertures continually grows. Shortly after we had brought out our Tessar with the relative aperture of F/2.8 for miniature cameras, about a year ago, with the object of meeting this demand, we went still a step further and produced an objective of our Biotar type with an aperture of F/2. The F/2 Biotar is a six-lens unsymmetrical objective with three lenses — two of them cemented — in each of the front and back components. In a focal length of 4.5 cm., as first produced by us, it can be mounted direct into the smallest Compur shutter C 24. Notwithstanding its large aperture it covers an image field of about 55° with good de-

finition, so that it may be used not only for the picture size of the miniature camera, 3.6×2.4 cm., but even for 4×3 cm. pictures, since it still covers sharply the 47 mm. diagonal of the actual picture surface of this size. Despite the unusually great demands made on the F/2 Biotar in respect of aperture ratio and angle of field, the sharpness of definition attained by it is remarkable. The relative aperture F/2 corresponds to a rapidity about twice as great as that of the aperture F/2.8 and about four times as great as the rapidity of the relative aperture F/4. The aperture F/2 is guaranteed within our usual close manufacturing tolerances.

The Sonnar: F/1.4 to F/4. The Sonnar is an objective of a new type admitting of very great rapidity with a moderately wide field, up to about 45°, and giving short camera extensions in relation to the focal length. The Sonnar, in those types so far available, consists of from four to seven lenses, cemented in three separated components, thus having six free air-glass surfaces. All corrections, including chromatic corrections, have been very well carried out, so that its various types give excellent performance for their respective purposes, even for colour photography.

The Sonnar is at present made in the following apertures and focal lengths, for the time being only in special mounts:

F/1.4 f = 2.5 cm., F/2.8 f = 5 cm., F/4 f = 7.5 cm.
for 16 mm. cinematograph film (diagonal 12.8 mm.)
F/1.5 f = 5 cm., F/2 f = 5 cm., F/4 f = 13.5 cm.
for miniature cameras 3.6×2.4 cm. (diagonal 43 mm.).



Motor Cycle race: 75 miles per hour
Taken in the rain with Biotessar F/2.8 f = 16.5 cm., full aperture F/2.8
Photo by G. Riebicke

The Biotessar F/2.8 was constructed in response to the repeated demands for a hand camera lens of very great rapidity but of more universal application than the F/2.7 Tessar. Compared with the latter the F/2.8 Biotessar marks a considerable advance in the field of very rapid yet universal objectives, for even at full aperture it gives excellent definition over the whole field, whilst when stopped down to F/3.5 and F/4.5 repectively it is not inferior in definition to the Tessars of these maximum apertures. The angle of field for which the F/2.8 Biotar is recommended measures fully 40°.

F/2.7 Tessar will continue to be manufactured in the shorter focal lengths, suitable for cine cameras. The new constructions of this lens permit the maximum of correction for each focal length and the corresponding image field of standard or sub-standard cine film.

The Tele-Tessar F/6.3, in common with other so-called telephotographic lenses, has focal lengths considerably longer than the required camera extension. Thus a quarter-plate folding camera with an extension of six inches can be fitted with a Tele-Tessar of a focal length of 25 cm. (10 in.), whereas the focal length of a standard lens, such as a Tessar, may not exceed 15 cm. (6 in.). In consequence of this property the Tele-Tessar working with the same camera extension and at the same distance from the object as the standard lens furnishes figures in the picture which are three-fifths as large again, whilst the width of the scene which it is able to include in the picture is two-fifths less. Its covering power conforms to these conditions (see columns 2 and 3 on page 24). — Its greatest rapidity is the same as that of Tessar F/6.3 and half that of Tessar F/4.5. It gives sharp and uniform definition up to the edge. Notwithstanding its great length, the illumination of the marginal portions of the field is likewise uniform, thanks to the large diameter of the back lens. The Tele-Tessar is therefore of special value as a means of taking with the hand camera snapshots showing large figures in the picture. It serves admirably for photographing small living creatures and animals, as well as for portraiture. More especially, when fitted to a reflex camera, it overcomes the special difficulties of sport and press photographers, in that these frequently have to contend with inconveniently distant objects and hence are compelled to work with long-focus lenses. It is likewise to be recommended to portrait photographers for outdoor use away from the studio, who are thereby provided with a conveniently portable outfit including a sufficiently rapid long focus lens. (A few further particulars respecting the Tele-Tessar will be found on pages 41 and 42 and in our separate pamphlet.

The Dagor F/9 is a rapid wide angle lens. Like the F/6.8 Dagor it is a symmetrical double anastigmat. Its field of view is still greater than that of the F/6.8 Dagor. By stopping down, the useful angular field can be increased to almost 100° notwithstanding the high aperture ratio of F/9, thus allowing easy focusing on the ground glass screen. For the actual exposure, in order to ensure greater sharpness over the whole field, it is advisable to stop down to F/18 or less,

according to the angle which it is desired to embrace. The F/9 Dagor is particularly suitable for use as a wide angle lens for indoor work, architecture, panoramas and also, by reason of its freedom from distortion at wide angles, for photogrammetric work.

b) Special Objectives of limited Application

The objectives belonging to this class are arranged below according to the special purposes for which they are required:

1. For **Cinematography** we recommend especially the

Biotars F/1.4
Tessars F/2.7 of short focal lengths
Tessars F/3.5 of short focal lengths

the 3.5 and 5 cm. lenses being particularly suitable for standard film and the 1.5, 2 and 2.5 cm. lenses for sub-standard film for amateur cameras.

For long shots and large scale pictures we recommend the

Kino-Tele-Tessar F/4

and also the

Tele-Tessars F/6.3.

The Biotar F/1.4 is the latest of our cine camera objectives, and as such, by reason of its extreme rapidity and extraordinarily fine definition, it is of universal application. Its aperture ratio gives about

	2×	4×	6×	10×
as great rapidity as an objective with an aperture ratio of	F/2	F/2.7	F/3.5	F/4.5

This increased rapidity has been attained without any sacrifice whatever of definition. Even at full aperture the image field, which is large considering the great aperture, its diagonal amounting to some three-quarters of the focal length, is covered with excellent definition. Not only is this perfection of definition at its full aperture unequalled, but even at smaller stops the definition is at least as good as that of the best objectives of corresponding smaller apertures. Thus the Biotar not only has the advantages of a special large aperture lens, but also comprises so to speak the best objectives of F/2, F/2.7, F/3.5, F/4.5 etc. aperture. It gives optimum performance for all the aperture ratios principally used in cinematography, and has the further advantage that from about F/3 downwards the vignetting from which every photographic objective suffers at full aperture disappears within the image size for which the objective is recommended.

Only in cases where the large image field of the Biotar is not sufficient, for example when a focal length considerably shorter than 4 cm. is to be used for standard film, is it necessary to use some other objective on the cine camera.

The Biotar is simple in construction considering its high optical performance, having only two air-glass surfaces more than the Tessar. In the comparatively short focal lengths of this cine objective the light is still not noticeably diminished by absorption as it passes only short distances through the glass.

The Kino-Tele-Tessar F/4. With the increasing popularity and perfection of the cine cameras, especially those using 16 mm. film, increased demands have been made upon the rapidity of their optical equipment. For "long shots" and for large scale pictures the 12 and 18 cm. F/6.3 Tele Tessars were generally used, apart from the longer focus F/3.5 and F/4.5 Tessars, which have the focal lengths, but not the short camera extensions of the Tele Objectives. Our new F/4 Kino-Tele-Tessar now offers a relatively large aperture and the long focal lengths of 7.5, 10 and 15 cm. The focal lengths of 7.5 and 10 cm. are intended for the 10.5×7.5 mm. picture of the 16 mm. sub-standard film, and the 15 cm. focal length for sub-standard and also for standard 24×18 mm. film.

The Kino-Tele-Tessars are supplied in narrow cylindrical focusing mounts so that they can be employed even in those cine cameras which are equipped for the simultaneous accommodation of several, usually three, objectives (revolving lens turret).

Further details on p. 27 and in special leaflet.

2. For **Portraiture,** apart from long-focus Tessars F/6.3 and F/4.5 and Tele-Tessars, we recommend

Long-focus Tessars F/3.5,
Tessars F/5, f = 50 cm. and f = 70 cm.,
Triplets F/4.8, f = 50 cm. and F/5, f = 70 cm.

These four lenses are lower in price than the corresponding Tessar F/4.5. In the case of Tessar F/5 this is achieved at the expense of rapidity; in the case of the Triplet at the expense also of the field of view (see columns 2 and 3 on page 28). The Triplet, which is made up of three lenses, has a smaller field of view than the Tessar, which has four lenses, but its field meets the requirements of the professional photographer for head and shoulder and single figure work.

3. For **Aerial Photography**, apart from long-focus Tessars F/4.5, we recommend

Tessars F/5, f = 50 cm. and f = 70 cm.,
Triplets F/4.8, f = 50 cm., and F/5, f = 70 cm.

4. For **wide-angle architectural work and interiors,** we manufacture, besides the Dagor F/9 and for certain cases the F/6.8 Dagor and the Double Protars,

Protars F/18 and
Hypergon F/22.

The Hypergon is recommended for use in those cases only where an angle of more than 100° (even up to 140°) is required (further particulars of the Hypergon on page 28 and on request).

5. For **Process Work,** for which the F/6.3 Tessar in the long foci can also be used in certain cases, we manufacture

Apo-Tessars and Apo-Planars (further particulars on page 29 and in special leaflet).

6. For **Tele Photography** we manufacture, apart from the long focus Protar lenses, the

Tele-Tessars F/6.3,
Magnar F/10 and
Telephoto Combinations (see pages 41—46 of this catalogue)

7. For **Photography with short wave ultra-violet light** we make the

Quartz Anastigmat F/4.5

primarily intended **for criminological and for scientific photography.**

The objectives of this class transmit not only the visible but also the ultra-violet light down to extremely short wave lengths — about 200 mμ. We make these objectives in two types. One is entirely of quartz, and is therefore not corrected for colour; the other type contains an additional lens of another material for the purpose of chromatic correction. Both types are supplied with a relative aperture of F/4.5 and focal lengths of 12 and 25 cm. The objective is corrected in such a manner that it gives the best performance at a scale ratio of about 1 : 5 and can be used for a field of view of about 35°. Both types of objectives are unsymmetrical anastigmats consisting of three separate elements. In the case of the chromatically corrected quartz anastigmats the centre element consists of three component lenses. (Further details on page 28 and in special leaflet).

Taken with Tessar F/4.5 f = 21 cm. by G. Riebicke

Choice of a Suitable Focal Length

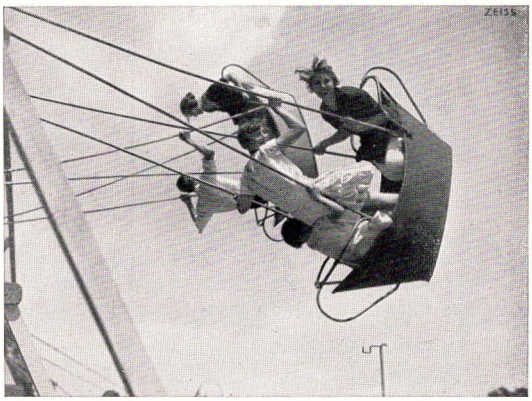
Once the size of the plate or film has been decided upon, the choice of the focal length becomes more or less limited. For all ordinary purposes it is a useful rule to make the focal length equal to the diagonal of the plate. Thus the diagonal of a quarter-plate is a little over $5\frac{1}{4}$" long. By the above rule this should also be the focal length of the lens, and bears to the width of the plate ($4\frac{1}{4}$") the approximate ratio 5 : 4. The same ratio obtains between the width of the scene showing on the plate and its distance from the camera. For example, at a distance of five yards, a scene four yards wide will appear on the plate; whilst at ten yards the plate will show a scene 8 yards wide, and at thousand yards a scene 800 yards wide.

This rule, *"Focus equal to diagonal"*, cannot always be adhered to. Portraits, groups and photographs of small living creatures are best taken with long-focus lenses to secure better perspective. The studio cameras, field cameras and reflex cameras generally used for these purposes are sufficiently large to admit of being fitted with lenses of the required size. On the other hand, in many cases, especially when photographing buildings, machinery, and interiors, it is necessary to employ lenses embracing a very wide angle, in which case the focal length of the required lens becomes very much shorter than would follow from the rule.

These considerations have been taken into account in compiling the tables, given below, of plate sizes for lenses of the various sizes and focal lengths.

The scheduled plate sizes do not by any means exhaust the resources of the respective lenses. In the majority of cases the limits of uniform sharpness extend beyond the figures given, even when the lenses are used with large stops. To indicate how far these plate limits may be extended the diameter of the largest sharply defined image circle which is obtainable with small stops is given in a separate column in the tables on pp. 22 to 28.

As regards the exactness of the focal lengths, as stated in the tables, the reader need scarcely be reminded that it is quite immaterial to the user whether the focal length conforms to the reputed value within a fraction or not, nor is it practicable in manufacture invariably to conform with meticulous precision to the scheduled values. We have therefore for some years ceased to state the focal lengths in terms of millimetres as this would tend to suggest a higher degree of exactness than actually obtains, while the mounts themselves have engraved upon them the focal lengths in terms of centimetres.



"The Swings"
Taken with F/4.5 Tessar, f= 18 cm.
by Tibor Hegyei

Zeiss Lens Mounts

The Zeiss Lens Mounts are fitted with Iris Diaphragms; the Apo-Tessars and Apo-Planars are in addition provided with Sliding Diaphragms.

Compur Shutter for folding cameras, gives time and instantaneous exposures, the latter from one second up to $^1/_{200}$, $^1/_{250}$, and $^1/_{300}$ second. In the most popular sizes this shutter is provided with delayed action (self-releasing) mechanism.

Compound Shutter* for the larger sizes of objectives, permitting time and instantaneous exposures.

"A" Mount for collapsible and other hand cameras with fixed extension.

The A mount projects into the camera and is provided with a focusing adjustment. A scale on the mount enables the objective to be focused to any distance by means of the helical motion with which the mount is provided, the cameras with fixed extension for which this mount is intented having no means of focusing.

Sunk "B" Mount for reflex and collapsible folding cameras with variable extension.

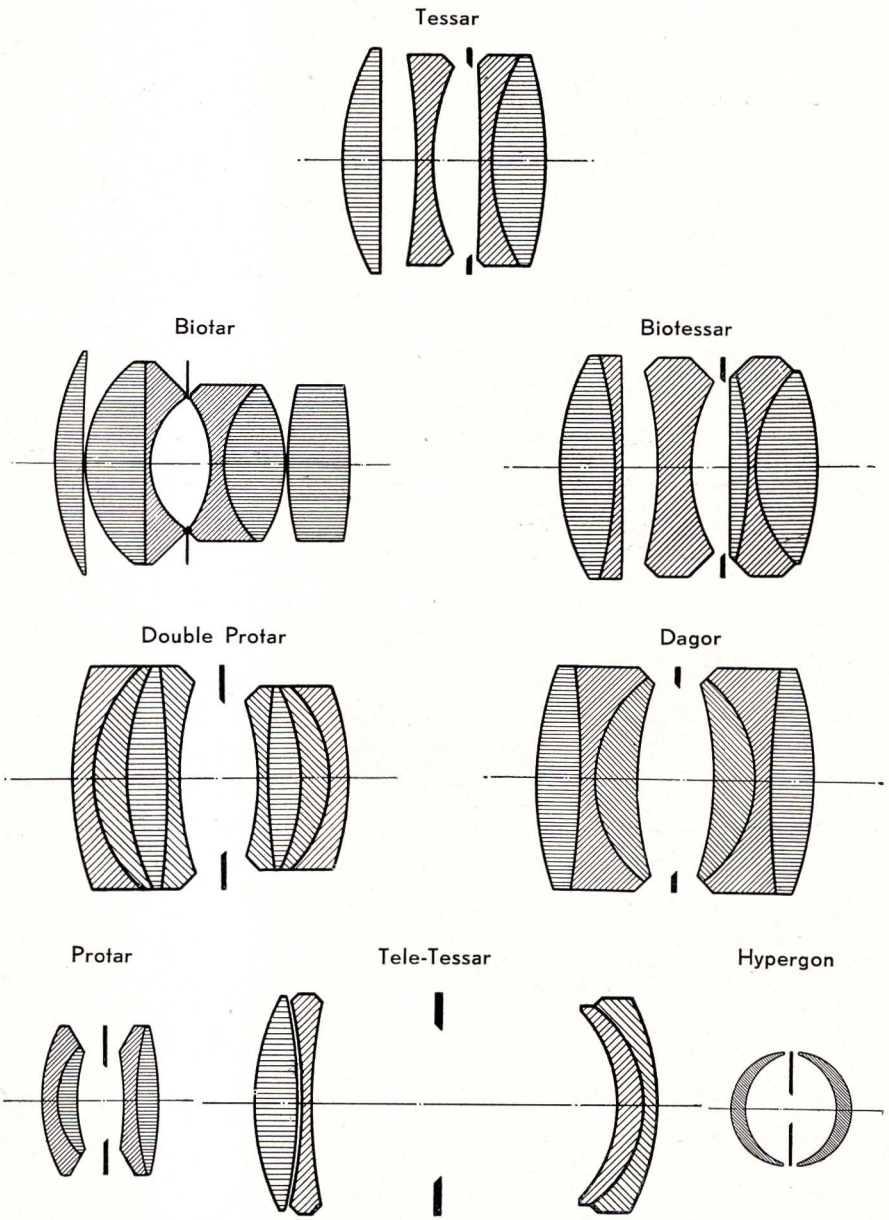
Mount B protrudes into the camera but has no focusing adjustment.

Standard "N" Mount for travelling and large stand cameras with bellows extension.

Zeiss Lenses are supplied completely mounted only, i. e. either in one of the above mounts or in a shutter, as it is only under these conditions that we can vouch for their good performance.

** We shall be pleased to supply on request particulars of the Compur and Compound Shutters in the various sizes. Which lenses are supplied in Compur, and which in Compound shutters will be seen from the price list.*

Types of Zeiss Lenses



NOTE

on the use of the following tables.

The plate sizes given in columns 2 and 3 are based on a high standard of performance for the principal applications of the objective; where the requirements are less stringent our lenses can as a rule be used for still larger plate sizes.

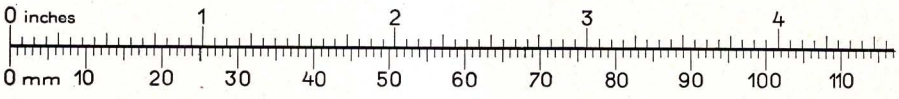
Taken with F/4.5 Tessar = 13.5 cm., by W. H. Adgey-Edgar

Table of Zeiss Objectives

giving focal lengths, sharply covered plate sizes, and slip-over diameters

Focal length cm.	Focal length in.	Plate size for which recommended in.	Diameter of circle covered at small stops in	in Standard "N" Mount	in sunk "B" Mount	in focusing "A" Mount	with "Compur" or "Compound" Shutter	Slip-over Diameter mm.[1]
				Codewords				
Tessar F/6.3								
Universal Lens for Amateur and Professional Photographers								
7.5	3	$2\frac{3}{8}\times2\frac{3}{8}$	$4\frac{1}{8}$	*Fodissent*	*Foliolum*	*Foedabam*	*Foggiatore*	24 or 21
9	$3\frac{1}{2}$	$3\frac{1}{4}\times2\frac{1}{4}$	$4\frac{3}{4}$	*Fodit*	*Foliomër*	*Foedabant*	*Foggiava*	24 „ 21
10.5	$4\frac{1}{8}$	$3\frac{1}{2}\times2\frac{1}{2}$	$5\frac{1}{2}$	*Foltrisch*	*Foluz*	*Foluzes*	*Folyoca* †	24 „ 21
12	$4\frac{3}{4}$	$3\frac{1}{2}\times2\frac{1}{2}$	$6\frac{1}{4}$	*Foditis*	*Foliosa*	*Foedabis*	*Foggier* †	32 „ 27
13.5	$5\frac{1}{4}$	$4\frac{1}{4}\times3\frac{1}{4}$	$7\frac{1}{4}$	*Foditur*	*Foliosame*	*Foedabor*	[2] *Fogginess* †	32 „ 27
15	6	5×4	$7\frac{7}{8}$	*Fodivano*	*Folioses*	*Foedae*	*Foggiolla* †	32 „ 28.5
16.5	$6\frac{1}{2}$	6×4	$8\frac{3}{4}$	*Fodoli*	*Foliosim*	*Foedamus*	*Foggun* †	42, 37 or 32
18	7	$6\frac{1}{2}\times4\frac{3}{4}$	10	*Fodorum*	*Foliosior*	*Foedandi*	*Fogless* †	42
21	$8\frac{1}{4}$	7×5	$11\frac{1}{2}$	*Fodrai*	*Foliosum*	*Foedandos*	*Foglia*	42
25	10	8×5	14	*Fodrammo*	*Forcella*	*Forceller*	*Fogliamo*	51
30	12	$8\frac{1}{2}\times6\frac{1}{2}$	$16\frac{1}{2}$	*Fodrando*	–	–	*Fogliasti*	69
36	14	10×8	20	*Fodrarium*	–	–	*Fogliatura*	69
50	20	12×10	27	*Fodrati*	–	–	–	106.5
60	24	15×12	32	*Fodravano*	–	–	–	115.5

[1]) **The particulars of the slip-over diameter (outside diameter of the front lens mount) should in general serve to determine the correct size of attachment lens or filter to fit the objective. It is advisable, nevertheless, when ordering attachment lenses and filters, to state both the outside diameter of the front lens mount and also the manufacturing number of the objective in question, since in the case of certain types of cameras the diameter of the lens fitted may deviate from the figure given here.**



[2]) In Compur shutter, also f = 13 cm.: *"Foggieremo"*.

†) These Tessars may also be supplied in Ibsor shutters, which automatically rewind when released for exposure and which are a little lower in price than the Compur shutters.

Focal length cm.	Focal length in.	Plate size for which recommended in	Diameter of circle covered at small stops in.	in Standard "N" Mount	in sunk "B" Mount	in focusing "A" Mount	with "Compur" or "Compound" Shutter	Slip-over Diameter mm [1]
				Codewords				

Tessar F/4.5

Rapid Universal Lens for Amateur and Professional Photographers

4	$1\frac{9}{16}$	$1\frac{3}{16}\times1\frac{3}{16}$	$1\frac{3}{4}$	*Fodicari*	–	–	–	20 or 19.2
5	2	$1\frac{9}{16}\times1\frac{9}{16}$	$2\frac{1}{4}$	*Forcellino*	*Forcelluto*	*Forcement*	*Forcena*	24 . 21
5.5	$2\frac{1}{4}$	$1\frac{3}{4}\times1\frac{3}{4}$	$2\frac{1}{2}$	*Fodicas*	*Forcenais*	*Folicetur*	*Fondeado*	24 . 21
6.5	$2\frac{1}{2}$	$2\times1\frac{3}{4}$	3	*Fodicassem*	*Foliforme*	*Folleatos*	*Fogbank*	24 . 21
7.5	3	$2\frac{3}{8}\times2\frac{3}{8}$	$3\frac{3}{8}$	*Fodicate*	*Foliga*	*Fodico*	*Fogbell*	24 . 21
8	$3\frac{1}{8}$	$2\frac{1}{2}\times2\frac{1}{2}$	$3\frac{1}{2}$	*Forcenant*	*Forcenasse*	*Forcener*	*Forceniez*	24
9	$3\frac{1}{2}$	$3\frac{1}{4}\times2\frac{1}{4}$	$4\frac{1}{8}$	*Fodicatior*	*Foligno*	*Fodiebat*	*Fogdog*	24 . 27
10.5	$4\frac{1}{8}$	$3\frac{1}{2}\times2\frac{1}{2}$	$5\frac{1}{8}$	*Fodicatis*	*Folilet*	*Fodiemus*	*Fogeler* †	32 . 28.5
12	$4\frac{3}{4}$	$3\frac{1}{2}\times2\frac{1}{2}$	$5\frac{1}{2}$	*Fodicato*	*Folimort*	*Fodienda*	*Foggage* †	32 . 30
13.5	$5\frac{1}{4}$	$4\frac{1}{4}\times3\frac{1}{4}$	$6\frac{1}{4}$	*Fodicatum*	*Folinaha*	*Fodiendus*	*Foggetta* †	42 . 37
15	6	5×4	7	*Fodicatura*	*Folio*	*Fodiens*	*Foggettino*†	42
16.5	$6\frac{1}{2}$	6×4	$7\frac{7}{8}$	*Fodicavere*	*Folioing*	*Fodientem*	*Foggia*	51 . 42
18	7	$6\frac{1}{2}\times4\frac{3}{4}$	$8\frac{3}{4}$	*Fodicavi*	*Foliolado*	*Fodientia*	*Foggiammo*	51
21	$8\frac{1}{4}$	7×5	10	*Fodicem*	*Foliolas*	*Fodina*	*Foggiante*	60 . 57
25	10	8×5	12	*Fodicemur*	*Foliolate*	*Fodinarum*	*Foggiarono*	70 . 69
30	12	$8\frac{1}{2}\times6\frac{1}{2}$	14	*Fodicent*	*Foliole*	*Fodinis*	*Fondeara*	84.5
36	14	$8\frac{1}{2}\times6\frac{1}{2}$	17	*Fodicentur*	–	–	–	106.5
40	16	$8\frac{1}{2}\times6\frac{1}{2}$	19	*Fodicere*	–	–	–	115.5
50	20	12×10	24	*Fodicet*	–	–	–	133.5

Tessar F/3.5*)

Extra Rapid Universal Objective for Amateur and Professional Photographers

5	2	$1\frac{9}{16}\times1\frac{3}{16}$	$2\frac{1}{4}$	*Forcenons*	*Forceps*	*Forcera*	*Forcerais*	24 or 27
6	$2\frac{3}{8}$	$1\frac{9}{16}\times1\frac{9}{16}$	$2\frac{3}{4}$	*Forcerent*	–	–	*Forcerie*	28.5
7	$2\frac{3}{4}$	$2\frac{5}{16}\times1\frac{3}{4}$	$3\frac{1}{8}$	*Forcerons*	*Forces*	*Forceta*	*Forcettes*	24, 27 or 32
7.5[2])	3	$2\frac{3}{8}\times2\frac{3}{8}$	$3\frac{3}{8}$	*Forche*	–	–	*Forchetta*	24, 28.5 or 32
10.5	$4\frac{1}{8}$	$3\frac{1}{2}\times2\frac{1}{2}$	$4\frac{3}{4}$	*Foracaria*	*Foragida*	*For*	*Forabilium*	42 or 37
12	$4\frac{3}{4}$	$3\frac{1}{2}\times2\frac{1}{2}$	$5\frac{1}{8}$	*Foracasen*	*Foragidos*	*Foraba*	*Forabos*	42
13.5	$5\frac{1}{4}$	$4\frac{1}{4}\times3\frac{1}{4}$	$6\frac{1}{8}$	*Foradado*	*Foraginem*	*Forabile*	*Forabunt*	51
15	6	5×4	$6\frac{3}{4}$	*Foradar*	*Foraging*	*Forabilia*	*Foracad*	51
16.5	$6\frac{1}{2}$	6×4	$7\frac{1}{2}$	*Foraged*	*Foragini*	*Forabilior*	*Foracamos*	60 or 57
21	$8\frac{1}{4}$	7×5	$9\frac{1}{2}$	*Foragers*	*Forago*	*Forabilis*	*Foracando*	70 or 69
25	10	8×5	11	*Folderols*	*Forchina*	*Forciador*	*Forciamos*	84.5
30	12	$8\frac{1}{2}\times6\frac{1}{2}$	$13\frac{1}{2}$	*Folding*	–	–	–	106.5

[1]) **See footnote [1]) on page 22.**

[2]) Relative aperture F/3.8, since with F/3.5 it cannot be fitted in the smallest Compur Shutter, which is essential for these small cameras.

*) Apart from the focal lengths for hand-cameras the Tessars F/3.5 are made with focal lengths of 2.8 cm. and 3.5 cm. for standard film and are of a new type embracing a larger image angle whereas for the longer cinematograph foci, viz. 4 cm., 5 cm. and 7.5 cm. the older type has been retained in view of its suitable qualities for these longer foci.

†) **See footnote †) on page 22.**

Focal length cm.	Focal length in.	Plate size for which recommended in.	Diameter of circle covered at small stops in.	in Standard "N" Mount	in sunk "B" Mount	in focusing "A" Mount	with "Compur" or" Compound" Shutter	Slip-over Diameter mm.[1]
				Codewords				
Biotessar F/2.8								
Extra Rapid Objective for Focal Plane and Reflex Cameras								
13.5	$5\frac{1}{4}$	$3\frac{1}{2}\times2\frac{1}{2}$	$5\frac{1}{8}$	*Foras*	*Foratia*	*Forataime*	–	60 or 57
16.5	$6\frac{1}{2}$	$4\frac{1}{4}\times3\frac{1}{4}$	$6\frac{1}{4}$	*Forata*	*Foratel*	*Foraterra*	–	70 „ 69
Tessar F/2.8								
Extra Rapid Objective for miniature Cameras								
5	2	$1\frac{9}{16}\times1\frac{3}{16}$	–	*Forcian*	*Forcible*	*Forcido*	*Forciere*	24 or 27
6	$2\frac{3}{8}$	$1\frac{9}{16}\times1\frac{9}{16}$	–	*Forcilla*	–	–	*Forcillans*	28.5
7.5	3	$2\frac{5}{16}\times1\frac{3}{4}$	–	–	–	–	*Forcillare*	37
Biotar F/2								
Objective of Extreme Rapidity for miniature Cameras								
4.5	$1\frac{3}{4}$	$1\frac{9}{16}\times1\frac{3}{16}$	–	–	–	–	*Forcillata*	32
Tele-Tessar F/6.3								
Rapid Special Long-focus Objective for Use with Short Camera Extensions								
12	$4\frac{3}{4}$	$2\frac{5}{16}\times1\frac{3}{4}$	3	*Foralite*	*Forame*	*Fopling*	*Foramente*	27
18	7	$3\frac{1}{4}\times2\frac{1}{2}$	$4\frac{3}{8}$	*Fondait*	*Fondare*	*Fondatare*	*Fondation*	37
25	10	$4\frac{1}{4}\times3\frac{1}{4}$	6	*Fondament*	*Fondarono*	*Fondateur*	*Fondator*	51
32	$12\frac{1}{2}$	6×4	$7\frac{7}{8}$	*Fondan*	*Fondasses*	*Fondatie*	*Fondatore*	60 or 57
40	16	7×5	10	*Fondante*	*Fondassim*	–	*Fondatoris*	69

[1]) **See footnote [1]) on page 22.**

Auerbachs Keller, Leipzig
Biotar F/2; 4.5 cm.
$\frac{1}{2}$ sec. exposure, 9 p.m.

Automat Restaurant
Biotar F/2; 4.5 cm.
$\frac{1}{5}$ sec. exposure, 9 a.m.

Focal length cm.	Focal length in.	Rel. Ap.	Plate size for which recommended in.	Diameter of circle covered at small stops in.	Without Mount†)	in Standard "N" Mount	with "Compur" or "Compound" Shutter	Slip-over Diameter mm.[1])
					Codewords			
18	7	12,5	5×4	$6\frac{7}{8}$	*Foetal*	*Foeneos*	*Folle*	37 or 27
22	$8\frac{3}{4}$	"	6×4	$8\frac{1}{2}$	*Foeteam*	*Foeniculi*	*Folleam*	37, 32 or 27
29	$11\frac{1}{2}$	"	7×5	$11\frac{1}{2}$	*Foetebas*	*Foenile*	*Folleant*	42 or 37
35	14	"	9×7	$13\frac{1}{2}$	*Foetebimus*	*Foenilium*	*Folleare*	42
41	16	"	12×10	$15\frac{3}{4}$	*Foetebo*	*Foenisex*	*Folleata*	57
48	19	"	14×11	$18\frac{1}{2}$	*Foetebunt*	*Foenoris*	*Folleatir*	57
59	23	"	15×12	23	*Foetemus*	*Foenus*	*Fonghi*	69
69	27	"	17×14	27	*Foetendos*	*Foesne*	*Fongia*	84.5

Protar Lens F/12.5

Single Lens with Front Stop for Landscapes and Portraits

Focal length of the single lenses cm.	Focal length of the single lenses in.	Focal length of the combination cm.	Focal length of the combination in.	Rel. Ap.	Plate size for which recommended in.	Diameter of circle covered at small stops in	in Standard "N" Mount	with "Compur" or "Compound" Shutter	Slip-over Diameter mm.[1])
						Codewords			
18/18	7/7	10.5	$4\frac{1}{8}$	6.3	$3\frac{1}{2}\times2\frac{1}{2}$	$6\frac{1}{4}$	*Foetens*	*Fogonero*	37 or 27
22/18	$8\frac{3}{4}$/7	11.5	$4\frac{1}{2}$	7	$4\frac{1}{4}\times3\frac{1}{4}$	$6\frac{3}{4}$	*Foetenti*	*Fogones*	37, 32 or 27
29/18	$11\frac{1}{2}$/7	13	$5\frac{1}{8}$	7.7	$4\frac{3}{4}\times3\frac{1}{2}$	$7\frac{7}{8}$	*Foetere*	*Fogonillo*	42 or 37
22/22	$8\frac{3}{4}$/$8\frac{3}{4}$	13	$5\frac{1}{8}$	6.3	$4\frac{3}{4}\times3\frac{1}{2}$	$7\frac{7}{8}$	*Foetescit*	*Fogos*	37, 32 or 27
29/22	$11\frac{1}{2}$/$8\frac{3}{4}$	14.5	$5\frac{3}{4}$	7	5×4	$8\frac{3}{4}$	*Foetescunt*	*Fogisidade*	42 or 37
35/22	14/$8\frac{3}{4}$	15.5	$6\frac{1}{8}$	7.7	6×4	$9\frac{1}{2}$	*Foetet*	*Fogring*	42
29/29	$11\frac{1}{2}$/$11\frac{1}{2}$	17	$6\frac{3}{4}$	6.3	$6\frac{1}{2}\times4\frac{3}{4}$	$10\frac{1}{4}$	*Foetida*	*Fogsmoke*	42 or 37
35/29	14/$11\frac{1}{2}$	18.5	$7\frac{1}{4}$	7	7×5	11	*Foetidabo*	*Fogueado*	42
41/29	16/$11\frac{1}{2}$	20	$7\frac{7}{8}$	7.7	7×5	12	*Foetidans*	*Fogueamos*	57
35/35	14/14	20.5	8	6.3	7×5	$12\frac{1}{2}$	*Foetidem*	*Foguease*	42
41/35	16/14	22	$8\frac{3}{4}$	7	8×5	13	*Foetidor*	*Fogueen*	57
48/35	19/14	23.5	$9\frac{1}{4}$	7.7	$8\frac{1}{2}\times6\frac{1}{2}$	14	*Foetor*	*Foguero*	57
41/41	16/16	24	$9\frac{1}{2}$	6.3	$8\frac{1}{2}\times6\frac{1}{2}$	14	*Foetoribus*	*Fohismus*	57
48/41	19/16	26	$10\frac{1}{4}$	7	9×7	16	*Foetosi*	*Foible*	57
59/41	23/16	28	11	7.7	9×7	$16\frac{1}{2}$	*Foetosorum*	*Fongiez*	69
48/48	19/19	28	11	6.3	9×7	$16\frac{1}{2}$	*Foetosos*	*Follebas*	57
59/48	23/19	31	12	7	9×7	$18\frac{1}{2}$	*Foetutina*	*Fongiform*	69
69/48	27/19	33	13	7.7	10×8	20	*Fofinho*	*Fongipore*	84.5
59/59	23/23	34	$13\frac{1}{2}$	6.3	10×8	$20\frac{1}{2}$	*Fofos*	*Fonica*	69
69/59	27/23	37	$14\frac{1}{2}$	7	12×10	22	*Fog*	*Fonicor*	84.5
69/69	27/27	40	16	6.3	12×10	24	*Fogaban*	*Fonil*	84.5

Double Protar F/6.3 to F/7.7

Universal Objective made up of two Protar Lenses

†) Like the lenses of our other series, Protar Lenses are not supplied indiscriminately without mounts. They are only supplied for a Zeiss mount or for a shutter adapted by us, as it is only in this way that we can accept responsibility for the good performance of the lenses. The cost of adapting the lens varies according to circumstances.

[1]) **See footnote [1]) on page 22.**

Selected Convertible Protar Sets

Protar Set	Plate Size in.	Available Focal Lengths in cm. Components	Available Focal Lengths in cm. Combinations	Standard Mount N Codewords	Compur or Compound Shutter Codewords	Slip-over Diameter mm.[1])
Bo	5×4	29 22 18	14.5 13 11.5	*Foliatim*	*Foliatume*	37
C	7×5	35 29 22	18.5 15.5 14.5	*Foliatiora*	*Folichom*	42
D	9×7	48 41 35 29	26 23.5 22 20 18.5	*Foliatorum*	*Folicula*	57

Usual Accessories to the Protar Sets

Protar Set	Wide Angle Protar F/18 (see p. 28) Codewords	Telephoto Attachment (see p. 43 et seq.) Codewords	Yellow Filters (see p. 38 et seq.) light Codewords	Yellow Filters (see p. 38 et seq.) dark Codewords
Bo	*Foederamus*	*Folaria*	*Fonsa*	*Fonsadera*
C	*Foederans*	*Folaria*	*Fogaria*	*Fogarizeis*
D	*Foederat*	*Folatre*	*Fonsoir*	*Fontab*

[1]) **See footnote [1]) on page 22.**

Two photographs taken from the same standpoint

Protar F/12.5, f = 22 cm. without stopping down

Mainz

Reduced reproduction

Double Protar F/7, f = $^{29}/_{22}$ = 14.5 cm. without stopping down

Focal length cm.	Focal length in.	Film size for which recommended in.	Film size for which recommended mm.	in Standard "N" Mount	in Focusing "A" Mount	Cylindrical Focusing Mount with about 4 mm.†) thread	Cylindrical Focusing Mount with about 6 mm.†) thread	Slip-over Diameter mm.[1])
				Codewords				
Biotar F/1.4								
Objective of Extreme Rapidity for Cinematography								
[2]) 2	¾	½×¼	10×7	*Forcadel*	*Forcais*	–	–	see footnote 1a
2.5	1	½×¼	10×7	*Forcado*	*Forcames*	–	–	
4	1 9/16	1×¾	24×18	*Forcase*	*Forcant*	–	–	
[3]) 5	2	1⅛×1	30×25	*Forcat*	*Forcadores*	–	–	
7	2¾	1⅝×1⅜	40×35	*Forcage*	*Forcadura*	–	–	
Tessar F/2.7								
Very Rapid Objective for Cinematography								
1.5[0])	⅝	½×¼	10×7	–	–	–	–	see footnote 1a
[2]) 2[0])	¾	½×¼	10×7	–	–	–	–	" " "
2.5	1	½×¼	10×7	*Fontanaria*	*Fontecica*	–	–	19.2 or 24
3.5	1⅜	1×¾	24×18	*Fontaneros*	*Fonteio*	–	–	24 " 19.2
[3]) 4	1 9/16	1×¾	24×18	*Fontanesia*	*Fonteiora*	–	–	24 " 27
5	2	1×¾	24×18	*Fontanetta*	*Fontema*	–	–	27
Tessar F/3.5								
Rapid Short-focus Lens for Cinematography								
2,8 *	1⅛	1×¾	24×18	*Forandi*	–	–	–	19.2 or 20
3.5 *	1⅜	1×¾	24×18	*Folcemmo*	*Folcire*	–	–	19.2
[3]) 4	1 9/16	1×¾	24×18	*Fonditoi*	*Fongate*	–	–	24
5	2	1×¾	24×18	*Folcenti*	*Folciremmo*	–	–	27
7.5	3	⅛×1⅛	30×30	*Folcette*	*Folciuto*	–	–	27 or 32
Kino-Tele-Tessar F/4								
Rapid Special Long-Focus Lens for Cinematography								
[2]) 7.5	3	½×¼	10×7	–	–	*Forbese*	*Forbice*	L×24 i K see footnote 1b
10	4	½×¼	10×7	–	–	*Forbi*	*Forbendo*	L×30 i K
[3]) 15	6	1×¾	24×18	–	–	*Forbida*	*Forbicia*	L×40 i K

[1]) **See footnote [1]) on page 22.**

1 a) When ordering yellow filters please state the manufacturing number of the lens.

1 b) Designation of the appropriate yellow filters in sun shade mount.

*) See footnote *) on page 23.

†) Standard mount for 16 mm. film.

[0]) Only in special mount.

[2]) For 16 mm. film.

[3]) For Standard cinematograph film.

Dagor F/6.8

Universal Lens with large field of view

Focal length cm.	Focal length in.	Plate size for which recommended in.	Diameter of circle covered at small stops in.	Standard "N" Mount Codewords	Compur or Compound Shutter Codewords	Slip-over Diameter mm.[1]
18	7	7×5	10½	*Forcillom*	*Forcina*	42 or 37
21	8¼	8½×6½	12½	*Forcinel*	*Forcing*	51 or 42
24	9½	9×7	14	*Forcions*	*Forcipal*	51
30	12	12×10	18	*Forcipeal*	*Forcipem*	57
36†)	14	15×12	21	*Forcir*	*Forcirea*	57

Dagor F/9[2]

Rapid wide angle lens

Focal length cm.	Focal length in.	Plate size for which recommended in.	Diameter of circle covered at small stops in.	Standard "N" Mount Codewords	Compur or Compound Shutter Codewords	Slip-over Diameter mm.[1]
7.5	3	3½×3½	6¾	*Forcirias*	*Forcise*	24
10	4	5×4	8¾	*Forclore*	*Forcola*	27 or 32
12.5	5	6½×4¾	10½	*Forcolom*	*Forconale*	32
15	6	8×5	13	*Forconata*	*Forcone*	42 or 37
18	7	9×7	15½	*Forcoso*	*Forculi*	42
21	8¼	10×8	18	*Forcura*	*Forcuto*	42 or 51
24	9½	12×10	21	*Forcuzza*	*Forda*	51

Hypergon F/22

Special lens for extreme wide angle work

Focal length cm.	Focal length in.	Recommended for plate sizes from in.	Recommended for plate sizes to in.	Special mount with star diaphragm Codeword
6	2⅜	4¼×3¼	9×7	*Fordable*
7.5	3	6×4	12×10	*Fordam*
12	4¾	9×7	18×16	*Fordarum*

Full particulars and directions for use on request

Tessar F/5

Rapid lens for groups, portraiture and aerial photography

Focal length cm.	Focal length in.	Plate size for which recommended in.	Diameter of circle covered at small stops in.	Standard "N" Mount Codeword	Slip-over Diameter mm.[1]
50	20	12×10	16½	*Fongees*	115.5
70	28	15×12	21½	*Fongeons*	153.5

Triplet F/4.8

Rapid lens for portraiture and aerial photography

Focal length cm.	Focal length in.	Plate size for which recommended in.	Diameter of circle covered at small stops in.	Standard "N" Mount Codeword	Slip-over Diameter mm.[1]
50	20	7×5	10	*Fonger*	115.5
70[3])	28	9×7	12½	*Fongerai*	153.5

Protar F/18

Wide angle lens for panoramas, architecture and interiors

Focal length cm.	Focal length in.	Plate size for which recommended in.	Diameter of circle covered at small stops in.	Standard "N" Mount Codeword	Slip-over Diameter mm.[1]
4	1 9/16	2 5/16×1¾	3½	*Foedent*	19.2
6	2⅜	3½×2½	5½	*Foederabo*	19.2
8.5	3⅜	4¼×3¼	7½	*Foederamus*	27
11	4⅜	6×4¼	9½	*Foederans*	27
14	5½	7×5	12	*Foederat*	32
18	7	9×7	16	*Foederatio*	32
21	8¼	10×8	18½	*Foederem*	32
27	10½	12×10	23	*Foederent*	37

Quartz-Anastigmat F/4.5

Rapid special lens for criminological and scientific photography particularly with ultra-violet light

Focal length cm.	Focal length in.	For fine detail 1:∞	1:5	1:2	1:1	For coarse detail 1:∞	1:5	1:2	1:1	not corrected for colour mounted in "Compur" or "Compound" Shutter Codewords	corrected for colour mounted in "Compur" or "Compound" Shutter Codewords	Slip-over Diameter mm.[1]
		Diameter of circle covered at full aperture in in.										
12	4¾	2½	3	3¾	5⅛	3⅜	4⅝	5⅛	6¾	*Forded*	*Fordere*	37
25	10	5¼	6¼	7⅞	10½	7	8⅝	10½	14	*Fordeum*	*Fordid*	69

[1]) **See footnote [1]) on page 22.**

†) Relative aperture F/7.7.

[2]) **To obtain a good uniform sharpness from the centre to the edge of the sizes given it is advisable to stop down to F/18 (see particulars of the Dagor F/9 on page 14).**

[3]) Relative aperture F/5.

Equipment for Process Work

Separate booklet containing detailed particulars on request

The **Apo-Tessars** are well corrected with respect to all those qualities which affect their performance as process lenses, and their residual errors are reduced to within very narrow limits.

With the **Apo-Planars** which afford still more possibilities of correction — six lenses and eight exposed surfaces as against the four lenses and six exposed surfaces of the Apo-Tessar — the errors can, in certain directions, be reduced still further. This superiority is, however, appreciable only in extremely fine work carried out with the most meticulous care and with the most meticulous care and with the utmost accuracy of the complete process equipment.

The plate sizes given are for a high standard of definition, as obtained with the lens alone — without reversing system — when stopped down to from F/22—F/32.

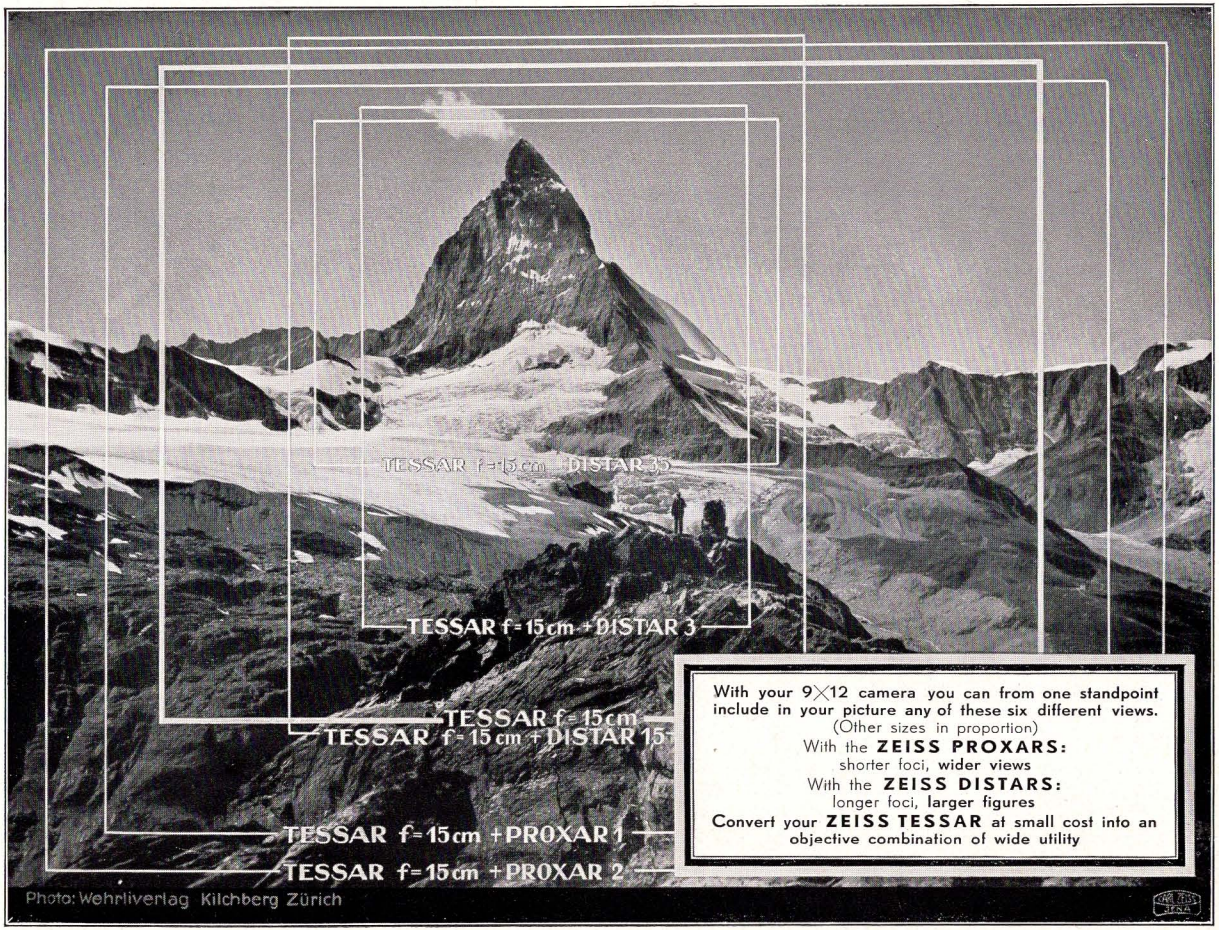
The mounts of the Apo-Tessars and Apo-Planars are provided with iris diaphragms and square sliding diaphragms.

	Lens							To fit the lens					
								Reversing System with Revolving Collar					
Lens in "N" Mount	Relative Aperture	Focal length		Size of Plate in inches sharply covered at a scale ratio of			Codeword	Prism cathetus length	Revolving collar inside thread	Mirror oval dimensions	Revolving collar inside thread	Filter cell slip-over diameter	R. Yellow or R colour filters (3 in case) Slip over diameter
		cm.	in.	1 : 1	1 : 2	1 : 10		cm.	mm.	cm.	mm.	mm.	mm.
Apo-Tessar	F/9	24	$9\frac{1}{2}$	12×10	9×7	7×5	*Forantsa*	5.5	77	7.5×12	130	55	55
	F/9	30	12	15×12	12×10	$8\frac{1}{2}$×$6\frac{1}{2}$	*Forandos*	5.5	77	7.5×12	130	55	55
	F/9	45	18	24×20	16×13	12×10	*Foramini*	7	95	7.5×12	130	74.5	74.5
	F/9	60	24	36×24	24×18	16×13	*Foraminoso*	10	125	10×15.5	175	93.5	93.5
	F/9	75	30	40×31	27×24	21×16	*Foraneo*	12.5	175	12×18.5	200	114	114
	F/9	90	36	45×36	36×24	26×20	*Foranol*	12.5	175	14×21.5	*)	145	145
	F/9	120	48	60×48	45×36	36×24	*Forantis*	—	—	20×28.5	*)	180	180
	F/15	180	72	60×48	40×35	29×24	*Foculabam*	—	—	14×20	193	153.5	153.5
Apo-Planar	F/7.5	41	16	20×16	14×10	11×9	*Foculabunt*	7	95	7.5×12	130	74.5	74.5
	F/9	59	23	24×20	17×14	12×10	*Foculamini*	10	125	10×15.5	175	93.5	93.5
	F/10	80	32	36×24	24×18	15×12	*Foculamur*	12.5	175	12×18.5	200	114	114
	F/10	105	42	36×30	28×25	20×16	*Foculans*	12.5	175	14×21.5	*)	145	145
	F/12.5	130	52	40×35	36×24	24×18	*Foculantia*	12.5	175	14×21.5	*)	145	145
	F/12.5	170	68	60×48	40×35	29×24	*Foculare*	—	—	20×28.5	*)	182	182

Focusing Microscope: Magnification 24× for fine process work. Codeword: *Fodaturum*

Focusing Magnifier A mounted in sliding sleeve 6 or 10×	Magnification	Focal length cm.	Focal length in.	Diameter mm.	Codeword
	6×	4	$1\frac{9}{16}$	21	*Fodaveras*
	10×	2.5	1	11	*Fodavero*

*) Revolving Collar on housing.



With your 9×12 camera you can from one standpoint include in your picture any of these six different views.
(Other sizes in proportion)
With the **ZEISS PROXARS:**
shorter foci, **wider views**
With the **ZEISS DISTARS:**
longer foci, **larger figures**
Convert your **ZEISS TESSAR** at small cost into an objective combination of wide utility

CARL ZEISS JENA

Fig. 1
taken with Tessar F/4.5 f = 15 cm. from the same standpoint as Fig. 2 on page 32 and Fig. 3 on page 34

The Rococo castle of Dornburg

Tessars F/4.5 and F/6.3 combined with Distars and Proxars to form Convertible Sets of wide range

The Distars are single-lens components of small *diverging* power (see Table p. 37). When placed in front of the camera lens they increase its focal length with corresponding increase of the camera extension. They thus add to the scope of camera lenses, especially those of an unsymmetrical type, since these, from their very nature, are only adapted for use on cameras with single extension in that their components are not corrected independently for use as long-focus lenses. **In conjunction with the Tessars the Distars form wide-range sets of convertible lenses.** The lens curvatures of the Distars, when these are used in combination with an anastigmatic lens, notably with a Tessar, ensure a uniformly good image within a large field of view, and a moderate degree of stopping down suffices in order to obtain with a Tessar+Distar combination the requisite

quality of sharpness for portraits, street scenes, landscapes, architecture, etc. — Over separate components of symmetrical or hemisymmetrical objectives the Tessar+Distar combination has *the following advantages:*

Greater freedom in the choice of focal lengths: Symmetrical objectives furnish only *one* long focus, the *two* component lenses being alike. In the case of hemisymmetrical objectives, the front and back components give respectively two different long foci. By means of Distars it is possible to obtain with a Tessar within certain limits a choice of considerably more long foci.

Less distortion at the edge of the image field: All component lenses of symmetrical and hemisymmetrical objectives are subject, as every user of these knows, to an appreciable amount of distortion, which becomes very disturbing when buildings are being photographed. This distortion is "barrel-shaped" when the lenses are behind the stop and "cushion-shaped" when they are in front.

Fig. 2
Taken with Tessar F/4.5 f = 15 cm. + Distar 3×42 from the same standpoint as Fig. 1 on page 31 and Fig. 3 on page 34.

When the focus is lengthened by attaching a Distar to the front of a Tessar the barrel-shaped distortion is on the contrary so slight as to be permissible even for fairly wide-angle pictures of buildings.

Shorter camera extension: The back lens of symmetrical and hemisymmetrical objectives focused for distance requires the camera extension to be fully one-tenth longer than the focal length f, whereas with the "Distar+Tessar" combination it is only roughly equal to f. For example, with a focus 25.5 cm. the camera extension for the combination is 25.5 cm., whereas for the required equivalent back lens it is 29 cm. The result is that the camera becomes available for taking nearer objects than would be practicable under otherwise similar conditions (see Table of Distar on p. 37).

Greater convenience: In order to obtain a longer focus a Distar is simply slipped over the front mount of the Tessar after the manner of a yellow filter. To realize the convenience of this one need only recall the operations which have to be performed in order to transfer the front lens component of a hemisymmetrical objective to the rear of the shutter diaphragm of a roll-film camera with double extension.

Possibility of expansion: An existing Tessar may at any time be supplemented by one or several Distars to form a set of convertible lenses.

PROXARS are lenses of small *converging* power (see table on p. 37). When attached in front of the camera lens, they produce an effect opposite to that of the Distars in that they shorten the focal length. Thus, Tessar F/4.5, f = 13.5 cm. has its focal length reduced to about 13 cm., 12.5 cm., 12 cm., or 11.5 cm. according to the converging effect of the Proxar selected. *The range of uses of the Tessar is thereby widely extended in a twofold direction,* viz:

For obtaining large figures of near objects: Hand cameras with a barely sufficient extension and fitted with a standard camera lens, such as a Tessar, cannot, as a rule, be focused upon objects nearer than two yards, or in the case of small cameras nearer than 1½ yards, or possibly one yard, whether this be accomplished by bodily displacing the lens carrier on the baseboard or with the focusing lens mount of collapsible cameras. By attaching a Proxar to the front of the Tessar a camera with an ordinary focusing range of two yards can be made to take objects within distances ranging from 2 up to 1 yard, 1 to ⅔, ⅔ to ½ and ½ to ⅓ yard, according as a weaker or a stronger Proxar is attached.

In the case of hand cameras with double extension, with which it is possible, with the Tessar alone, to approach the object sufficiently closely to enable full size photographs to be obtained, the use of a Proxar enables the object to be approached still closer, so that with the most powerful Proxar photographs up to almost twice natural size can be obtained.

For taking wide-angle photographs at greater distances, e. g. from 2 yards to infinity: whether in a room, in the street, in the open country or in the mountains the amateur ultimately finds himself in a position where, either to the right or to the left, above or below, he would like to include in his picture something more than the Tessar will embrace on the image field of the camera from the selected and maybe the only possible standpoint. A Proxar, slipped over the Tessar, will fulfill this desire by shortening the focal length of the Tessar and so making it possible to include a wider view on the same size plate. The higher the power of the Proxar chosen, the wider the field of view, as is shown by the figures on pages 30 and 31 and below on this page. Further particulars of Proxars will be found on page 37 and on the card supplied with each lens (see the top of page 37).

Fig. 3, taken with Tessar F/4.5 f = 15 cm. + Proxar 2×42 from the same standpoint as Fig. 1 on page 31 and Fig. 2 on page 32

The illustrations on pp. 30, 31, 32 and 34 show the extent to which the scope of a Tessar may be extended with the aid of a few inexpensive Proxars and Distars, which may be added at any time. From the particulars respecting the camera extensions given in the lists on p. 37 the following inferences are to be drawn:

With *collapsible cameras having a fixed extension* the Distars may scarcely ever be used, whereas Proxars can be

used for close-up work, but not for wide-angle photographs at distances exceeding about two yards, because these cameras do not allow even a comparatively short extension, since their focusing range lies only in the inward and outward movement of the lens mount.

In the case of *cameras with single baseboard extension* the Distars may be used within a restricted range only, while fullest use can generally be made of the Proxars in the two ways explained above.

Cameras with double extension admit of Proxars and Distars being used throughout their entire range of application.

Unmagnified reproduction of a photograph taken with a camera pointed vertically downward on a 12×9 cm. plate with Tessar F/4.5, f = 13.5 cm. supplemented by a Proxar 2×37, the focal length being thereby shortened to f_c = 11 cm. Tessar stopped down to F/12.5; resulting rel. aperture F/10. Distance 17 cm; double camera extension 30 cm. **Red Admiral**, natural width 52 mm., taken therefore 1$\frac{3}{4}$ actual size.

The **Distars** and **Proxars** are made in the sizes specified below (vertical column 1). They are suitable for use not only with Tessars but also with other photographic lenses. When ordering Distars and Proxars for use with an existing lens the photographic dealer should be furnished with the whole of the inscription engraved on the lens mount, the outside diameter of its front lens mount, and the range of the camera extension measured from the lens stop to the ground glass focusing screen.

Distars and Proxars

For Objectives having an outside diameter of mm.	Distar Designation †) D[1])	Tube	D[1])	Size[2])	Codeword	Proxar Designation †) D[1])	Tube	D[1])	Size[2])	Codeword
mm.										
21.0	—		1	21	*Forainer*	—		1	21	*Foraida*
	—		2	21	*Forainol*	—		2	21	*Forain*
24.0	—		1	24	*Fording*	—		1	24	*Fore*
	—		2	24	*Fordior*	—		2	24	*Foreab*
27.0	2	C_o	2	27	*Fodiam*	0.5	C_o	0.5	27	*Fopa*
	3	C_o	3	27	*Fodiamus*	1	C_o	1	27	*Fopake*
	3.5	C_o	3.5	27	*Fodiatis*	1.5	C_o	1.5	27	*Fopali*
						2	C_o	2	27	*Fopalos*
28.5	2	C_o*	2	28.5	*Fodica*	0.5	C_o*	0.5	28.5	*Fopalu*
	3	C_o*	3	28.5	*Fodicabam*	1	C_o*	1	28.5	*Fopalys*
	3.5	C_o*	3.5	28.5	*Fodicabant*	1.5	C_o*	1.5	28.5	*Fopama*
						2	C_o*	2	28.5	*Fopame*
30.0	2.5	C_{oa}	2.5	30	*Fodicantor*	0.5	C_{oa}	0.5	30	*Fopamir*
	3.5	C_{oa}	3.5	30	*Fodicare*	1	C_{oa}	1	30	*Fopamol*
	4.5	C_{oa}	4.5	30	*Fodicarent*	1.5	C_{oa}	1.5	30	*Fopamus*
						2	C_{oa}	2	30	*Fopanai*
32.0	1/II		1	32	*Fordis*					
	1.5/II		1.5	32	*Fodicabare*	0.5/II		0.5	32	*Fopanal*
	2/II		2	32	*Fordo*	1/II		1	32	*Fopaname*
	2.5/II		2.5	32	*Fodicabis*	1.5/II		1.5	32	*Fopanasi*
	3/II		3	32	*Fodicabo*	2/II		2	32	*Fopanea*
	3.5/II		3.5	32	*Fordoing*					
	4/II		4	32	*Fordone*					
37.0	1.5/III		1.5	37	*Fommeling*	0.5/III		0.5	37	*Fopanei*
	2/III		2	37	*Fodicabunt*	1/III		1	37	*Fopania*
	2.5/III		2.5	37	*Forametti*	1.5/III		1.5	37	*Fopanide*
	3/III		3	37	*Fodicamini*	2/III		2	37	*Fopanifi*
	3.5/III		3.5	37	*Fodicamur*					
42.0	1.5/IV		1.5	42	*Fomitale*	0.5/IV		0.5	42	*Fopanigu*
	2/IV		2	42	*Fodicanda*	1/IV		1	42	*Fopaniko*
	2.5/IV		2.5	42	*Fomitibus*	1.5/IV		1.5	42	*Fopanire*
	3/IV		3	42	*Fodicandis*	2/IV		2	42	*Fopanita*
	3.5/IV		3.5	42	*Fodicandum*					
51.0	1/VI		1	51	*Fomitum*					
	1.5/VI		1.5	51	*Fodicans*	0.5/VI		0.5	51	*Fopanivo*
	2/VI		2	51	*Fonacion*	1/VI		1	51	*Fopanizu*
	2.5/VI		2.5	51	*Fodicantem*	1.5/VI		1.5	51	*Fopanoare*
	3/VI		3	51	*Fodicanti*					
57.0	1/VII		1	57	*Fomiter*					
	1.5/VII		1.5	57	*Fomitorus*	0.5/VII		0.5	57	*Fopano*
	2/VII		2	57	*Fonasum*	1/VII		1	57	*Fopanoam*
	2.5/VII		2.5	57	*Fonazione*					
60.0	—		1	60	*Fordorum*					
	—		1.5	60	*Fordre*	—		0.5	60	*Foreba*
	—		2	60	*Fordum*	—		1	60	*Forebod*
	—		2.5	60	*Fordusa*					

†) Both designations relate to the same size and for the present will be given together.

[1]) D = power of the lens in dioptres.

[2]) The number represents the outside diameter of the lens mount on to which the attachment lens fits.

The following tables show **approximately the focal length** f_c cm. which results from the combination of a Distar (or Proxar) of a power D with a lens of a focal length of f cm. They also state the camera extension K which must be available in order that it may be possible to focus the objective + Distar (or Proxar) combination to the distances stated in the table.

Further useful particulars respecting the changes in the scale of the picture, in the relative aperture and the exposure times effected by the Distars and Proxars are given in the small cards supplied with the Distars and Proxars and will be sent to enquirers on application. These cards are small enough to be accommodated, as a rule, in the cases provided with the Distars and Proxars.

DISTARS

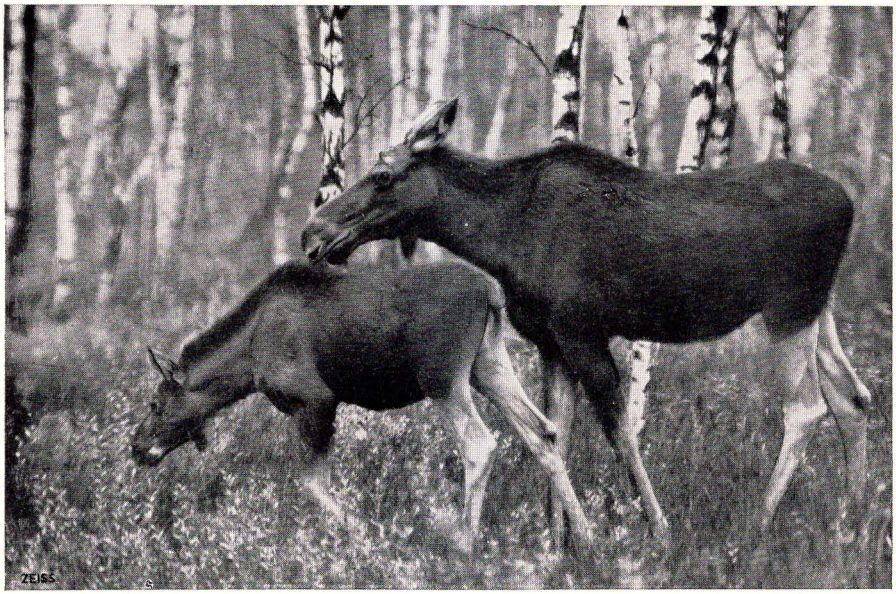
D →	1			1.5			2			2.5			3			3.5			4.5		
focused on →		K* ∞	K* 2 m.		K* ∞	K* 2 m.		K* ∞	K* 2 m.		K* ∞	K* 2 m.		K* ∞	K* 2 m.		K* ∞	K* 2 m.		K* ∞	K* 2 m.
f	f_c			f_c			f_c			f_c			f_c			f_c			f_c		
cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
9	—	—	—	—	—	—	10	10	10.5	—	—	—	11	11	12	12	12	12.5	—	—	—
10.5	—	—	—	12.5	12	13	13	13	14	14	14	15	15	15	16	16	16	17.5	—	—	—
12	—	—	—	14	13.5	14.5	15	14.5	15.5	15.5	15.5	17	17	17	18.5	18.5	18.5	20.5	21.5	22	25
13.5	—	—	—	17.5	17	19	18.5	18.5	20.5	20.5	20.5	23	22.5	23	25.5	25	25.5	29	—	—	—
15	—	—	—	19	19	21	20.5	20.5	23	23.5	23.5	26.5	26	26	30	29	30	35	—	—	—
16.5	20	20	22	22	22	24.5	24.5	24.5	28	28	28.5	33	32	32.5	38.5	—	—	—	—	—	—
18	22.5	22	25	25	25	28.5	28	28	32	32	32.5	38.5	37.5	38.5	47	—	—	—	—	—	—
21	26	26	30	30	30	35.5	34	35.5	42.5	42	43	54	—	—	—	—	—	—	—	—	—

PROXARS

D →			0.5							1							
focused on →		K* ∞	K* 2 m.	K* 1 m.	K* 50 cm.	K* 40 cm.	K* 30 cm.	K 20 cm.		K* ∞	K* 2 m.	K* 1 m.	K* 50 cm.	K* 40 cm.	K_* 30 cm.	K* 20 cm.
f	f_c								f_c							
cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
9	8.25	7.8	8.3	8.5	9.5	10	11	14	8	7.5	7.8	8.3	9	9.5	10.5	13
10.5	10.25	9.5	10.5	11	12.5	13.5	15	20.5	10	9	9.5	10.5	11.5	12.5	14	18.5
12	11	10.5	11	12	13.5	15	17	24.5	10.5	10	10.5	11	13	13.5	15.5	22
13.5	13	12.5	13.5	14.5	17	19	22.5	—	12.5	11.5	12.5	13.5	16	17.5	20.5	32
15	14.5	13.5	15	16	19.5	21.5	26.5	—	13.5	12.5	13.5	14.5	17.5	19.5	23.5	—
16.5	15.5	15	16.5	18	22.5	25.5	33	—	14.5	14.5	15	16.5	20	22.5	28	—
18	17	16.5	18	20	25.5	29	38	—	16	15	16.5	18	22.5	25.5	33	—
21	19.5	18.5	20.5	23	30.5	36.5	54	—	18	16.5	18.5	20.5	26.5	31	42.5	—

D →			1.5							2							
focused on →		K* ∞	K* 2 m.	K* 1 m.	K* 50 cm.	K* 40 cm.	K* 30 cm.	K* 20 cm.		K* ∞	K* 2 m.	K* 1 m.	K* 50 cm.	K* 40 cm.	K* 30 cm.	K* 20 cm.
f	f_c								f_c							
cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
9	7.75	7.3	7.5	7.8	8.5	9	10	12.3	7.5	7	7.3	7.5	8.3	8.8	9.5	11.5
10.5	9.5	8.5	9	9.5	11	11.5	13	17	9	8.5	9	9.5	10.5	11	12.5	16
12	10	9.5	10	10.5	12	13	14.5	20	9.5	9	9.5	10	11.5	12	13.5	18
13.5	12	11	11.5	12.5	14.5	16	18.5	28	11	10.5	11	12	13.5	14.5	17	24.5
15	12.5	11.5	12.5	13.5	16	17.5	20.5	32.5	12	11	11.5	12.5	14.5	16	18.5	28.5
16.5	14	13	14	15	18	20	24.5	—	13	12	13	14	17	18.5	22.5	—
18	14.5	14	15	16.5	20	22.5	28	—	13.5	13	13.5	15	18	19.5	24	—
21	16	15	16.5	18.5	23	26.5	34.5	—	15	14	15	17	20.5	24	29.5	—

*) Exact focusing is effected on the ground glass focusing screen with the lens set to its working aperture.



Elks in the Kurische Nehrung. Photo by Kühlewindt. Taken with Tessar F/4.5 f=25 cm.

Yellow Glass Filters

It is a well known fact that photographic plates and films do not render the intensity values of different colours in the same way as they are seen by the eye. Their predominant response to ultra-violet, violet, and blue light is in many cases inadequately compensated by the isochromatisation of the sensitive coating. Our yellow glass filters serve to complete this compensation. They are manufactured with great accuracy so as not to affect adversely the high optical qualities of our objectives. The material of which they are made is a special kind of yellow glass which is impervious to ultra-violet but transmits violet and blue rays sparingly and the other coloured rays of longer wave-lengths with almost undiminished intensity. This material is entirely different from the common yellow glass screens which are still widely sold and which transmit more short-waved light and less long-waved light than is done by our glass, and hence are inferior in both respects.

Yellow Glass Filter to slip on

Our yellow filters are supplied in two degrees of density, listed respectively as *"light"* and *"dark"*. The *"light"* filters generally suffice for landscapes without snow, especially for distant views and for aerial photography. The *"dark"* variety is preferable for taking sea views, snow landscapes and other views of vividly coloured scenes or objects.

Our yellow filters are mounted in two ways to suit the mount of the lenses with which they are to be used, viz, either in such a manner that they may be pushed into the hood of the lens mount (with velvet lining) or so that they

may be slipped over the outer rim of the lens mount, the ring being sprung to retain it in position, as shown in the annexed figure. The latter kind should be given preference wherever practicable. Further particulars of our yellow filters will be found in the fully descriptive leaflet Ph 283 and in the table Ph 283a "Exposure Factors for Zeiss Yellow Filters".

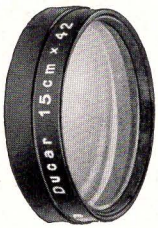
Yellow Filters

To slip over				To slip in			
Designation †			Codeword	Designation †			Codeword
—		L×16	*Foramina*	**oo**	light	L×17.5*i*	*Foldnet*
—		D×16	*Foraminata*	**oo**	dark	D×17.5*i*	*Folgaras*
C^{00}	light	L×19.2	*Follebise*	**P$_{00}$**	light	L×18*i*	*Folderaar*
C^{00}	dark	D×19.2	*Follegio*	**P$_{00}$**	dark	D×18*i*	*Fomenting*
C$^{00}_{a}$	light	L×21	*Follebita*	**I**	light	L×23.5*i*	*Folego*
C$^{00}_{a}$	dark	D×21	*Folleiro*	**I**	dark	D×23.5*i*	*Folgaria*
C^{00*}	light	L×24	*Folta*	**II**	light	L×28.5*i*	*Foleria*
C^{00*}	dark	D×24	*Foment*	**II**	dark	D×28.5*i*	*Folgaron*
C^{0}	light	L×27	*Follebo*	**III**	light	L×33.5*i*	*Folette*
C^{0}	dark	D×27	*Folleme*	**III**	dark	D×33.5*i*	*Folgaz*
C^{0*}	light	L×28.5	*Follebunt*	**IV**	light	L×38.5*i*	*Folga*
C^{0*}	dark	D×28.5	*Follemos*	**IV**	dark	D×38.5*i*	*Folgazano*
C$^{0}_{a}$	light	L×30	*Folleg*	**VI**	light	L×47*i*	*Folgabais*
C$^{0}_{a}$	dark	D×30	*Follenda*	**VI**	dark	D×47*i*	*Folgazei*
B	light	L×31	*Fonomi*	**VII**	light	L×53*i*	*Folgado*
B	dark	D×31	*Fononu*	**VII**	dark	D×53*i*	*Folidandra*
P^{0}	light	L×31.5	*Foltamento*	**X**	light	L×65*i*	*Follendir*
P^{0}	dark	D×31.5	*Fomentar*	**X**	dark	D×65*i*	*Follendos*
C$_{1}$	light	L×32	*Fonda*	**XII**	light	L×80*i*	*Fondaccio*
C$_{1}$	dark	D×32	*Fondable*	**XII**	dark	D×80*i*	*Fondaco*
III	light	L×37	*Fonsa*				
III	dark	D×37	*Fonsadera*				
IV	light	L×42	*Fogaria*				
IV	dark	D×42	*Fogarizeis*				
VI	light	L×51	*Fonsado*				
VI	dark	D×51	*Fonsario*				
VII	light	L×57	*Fonsoir*				
VII	dark	D×57	*Fontab*				
—		L×60	*Foreca*				
—		D×60	*Forecabin*				
X	light	L×69	*Fontaine*				
X	dark	D×69	*Fontala*				
—		L×70	*Forecast*				
—		D×70	*Forecit*				
XII	light	L×84.5	*Forecrag*				
XII	dark	D×84.5	*Foreculis*				

† Both designations relate to the same size, and for the present both will be given together. The letters L and D refer to the colour of the yellow filter: **L** indicates "**light**" and **D** "**dark**". The number gives, in the case of the slip-over yellow filters, the outside diameter in millimetres of the objective mount on to which the yellow filter fits, and in the case of slip-in filters, which are distinguished by the letter *i* after the number, the inside diameter in millimetres of the mount into which the yellow filter is inserted.

When ordering Filters for Zeiss lenses purchased on a previous occasion the **manufacturing number engraved on the mount** should be stated in every instance since the diameters of the lens mounts frequently deviate from the standard dimensions to suit the dimensions of shutters and cameras.

Ducars for Autochrome Plates
A-Ducars for Agfa Colour Screen Plates



In these filters the purely chromatic effect required to rectify the colour values is associated with a very slightly diverging effect. The latter is such that a Ducar slipped over the front of the objective shifts the plane of the sharp image back exactly by the thickness of the plate into the plane of the emulsion at the back of the colour screen plate. This does away with the necessity when taking colour photographs for any special adaptation of the camera, focusing scale, dark slide or ground glass focusing screen. All that is needed is to defer putting on the Ducar until the image has been focused on the ordinary ground glass focusing screen having its dull side facing the objective. This has the incidental advantage that, during the act of focusing, the picture is seen in its natural colours. The Ducars are mounted to slip over or into the lens mount.

When ordering a Ducar, the focal length f of the objective should be taken into account as well as the diameter of the mount.

Ducars and A-Ducars

Slip-over Designation †		Ducar Codeword	A-Ducar Codeword
P/ 6.5	6.5 cm×21	*Fondava*	*Fonder*
Ca/ 7.5	7.5 cm×21	*Foliabo*	*Fondeur*
—	7.5 cm×24	*Foredock*	*Foregoes*
P/ 7.5	7.5 cm×30	*Fondazi*	*Fonderom*
B/ 7.5	7.5 cm×31	*Fondea*	*Fondeva*
—	9 cm×24	*Foregame*	*Foredate*
P/ 9	9 cm×31.5	*Foltezza*	*Fondia*
C/10.5	10.5 cm×28.5	*Foltissimo*	*Fondime*
B/10.5	10.5 cm×31	*Fondeen*	*Fondill*
P/10.5	10.5 cm×31.5	*Foliacion*	*Fondig*
—	10.5 cm×32	*Foredoing*	*Foregoing*
—	10.5 cm×37	*Foredone*	*Foregone*
—	10.5 cm×42	*Foredoor*	*Forehold*
C/12	12 cm×30	*Foltado*	*Fondoir*
—	12 cm×32	*Foreface*	*Forehood*
VI/12	12 cm×51	*Footgeld*	*Footiron*
C/13.5	13.5 cm×27	*Foliages*	*Fondria*
—	13.5 cm×42	*Forefacio*	*Foreira*
—	13.5 cm×51	*Forefeel*	*Foreirol*
—	13.5 cm×57	*Forefend*	*Foreking*
—	13.5 cm×60	*Forefield*	*Forel*
VII/14.5	14.5 cm×57	*Footglove*	*Footkey*
C/15	15 cm×28.5	*Foliaguda*	*Fonduk*
—	15 cm×42	*Foreflow*	*Foreland*
VI/15	15 cm×51	*Footgnaw*	*Footless*
—	16.5 cm×57	*Forefoot*	*Foreleg*
X/16.5	16.5 cm×69	*Footguard*	*Footliker*
—	16.5 cm×70	*Forefront*	*Foredoam*
T/18	18 cm×37	*Footpace*	*Footplate*
VII/18	18 cm×57	*Footgrain*	*Footlevel*
X/21	21 cm×69	*Foothald*	*Footline*
T/25	25 cm×51	*Footpad*	*Footplow*
T/32	32 cm×57	*Footpage*	*Footpost*
T/40	40 cm×69	*Footpicker*	*Footpote*

Slip-in Designation †		Ducar Codeword	A-Ducar Codeword
C/ 6.5	6.5 cm×18*i*	*Folhoso*	*Fonderia*
I/ 6.5	6.5 cm×23.5*i*	*Folgorano*	*Fonderal*
I/ 7.5	7.5 cm×23.5*i*	*Folgorata*	*Fondest*
II/ 7.5	7.5 cm×28.5*i*	*Footrule*	*Footsore*
III/ 8	8 cm×33.5*i*	*Footfall*	*Fothanded*
C/ 9	9 cm×18*i*	*Foliabamos*	*Fondeza*
I/ 9	9 cm×23.5*i*	*Folgorino*	*Fondevir*
I/12	12 cm×23.5*i*	*Folguin*	*Fondire*
II/12	12 cm×28.5*i*	*Folgura*	*Fondle*
IV/12	12 cm×38.5*i*	*Forego*	*Foredid*
II/13.5	13.5 cm×28.5*i*	*Folhado*	*Fondon*
III/13.5	13.5 cm×33.5*i*	*Follhastro*	*Fondose*
IV/13.5	13.5 cm×38.5*i*	*Folhame*	*Fondre*
II/15	15 cm×28.5*i*	*Folharia*	*Fondsa*
III/15	15 cm×33.5*i*	*Foliamos*	*Fondsen*
IV/15	15 cm×38.5*i*	*Folhea*	*Fondua*
II/16.5	16.5 cm×28.5*i*	*Foliance*	*Fondule*
III/16.5	16.5 cm×33.5*i*	*Folheador*	*Fondusi*
VI/16.5	16.5 cm×47*i*	*Folhearas*	*Fonebo*
IV/18	18 cm×38.5*i*	*Folhease*	*Fonet*
VI/18	18 cm×47*i*	*Folheatura*	*Fonetir*
IV/21	21 cm×38.5*i*	*Folheca*	*Fonfara*
VII/21	21 cm×53*i*	*Folhenda*	*Fonfone*

† Both designations relate to the same filter, and for the present will be given together. The number expressed in centimetres indicates the focal length of the objective for which the Ducar or A-Ducar is intended; the significance of the number after the sign × is explained in the footnote on page 39 under yellow filters.

The Ducars and A-Ducars may also be used on other objectives whose focal length does not deviate by more than 3% from the Tessar focal length given here. When ordering subsequently it is advisable to give us the full description engraved upon the lens as well as the diameter of the mount. If not of our manufacture, send us the lens itself, for fitting the Ducar. In this case special fitting charges may be incurred.

3 Photographs
taken with a
ZEISS TESSAR

in natural colours

without yellow filter

with yellow filter

Telephotographic Objectives

The term "telephotographic lens" has been applied to that kind of optical combination in which the image formed by a converging front component is magnified, before it can fall on the ground glass screen, by a diverging back component situated a considerable distance from the converging lens. As a result of this mode of forming the ultimate image the necessary camera extension is shorter — under certain circumstances very much shorter — than the focal length of the image-forming combination. Consequently *telephotographic combinations furnish larger figures in the picture than standard objectives with two close-mounted components,* such as the Tessars, *other conditions being equal, and with the same camera extension.* The further this advantage of the telephotographic objective is pushed, the greater is the sacrifice that has to be made in other directions (rapidity, field of view, weight and length of the objective itself). This is particularly the case when, instead of being satisfied with a fixed separation of the front and back component, as in a standard unsymmetrical objective, giving only one focal length for the complete system, it is desired, by varying the separation between the front and back components, *to vary the focal length of the complete system within wide limit.* This object is attained in the case of the telephoto combinations by correcting each component, the converging as well as the diverging system, as far as possible independently, — as a rule the converging system takes the form of a standard photographic objective, e. g. a Tessar or a Double Protar.

We make three distinct types of telephoto lenses. Enumerated in the order in which they were brought out, they are the following: —

The **Telephoto Combinations**, consisting of a standard objective (e. g. a Tessar, Double Protar, etc.) and a *Tele Negative*, the latter being joined to the positive member by means of a *Tele Tube* of fixed length (Nos. I, Ia), or of variable length (Nos. II, III).

The **Magnar F/10,** for use only as an inseparable whole with greatly shortened camera extension.

The **Tele Tessar F/6.3,** for use only as an inseparable whole with moderately shortened camera extension.

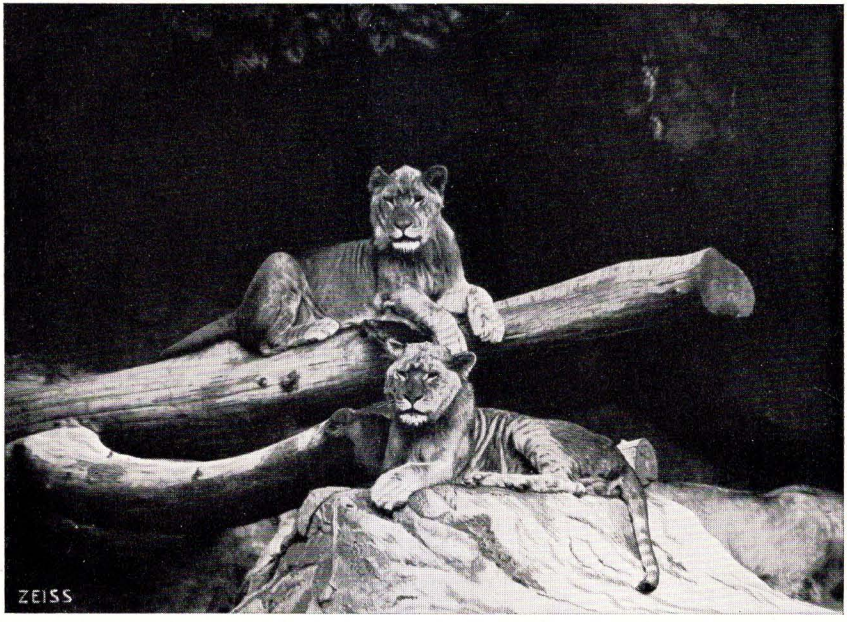
The following tables and descriptive notes may serve to compare the performances and data of the above types of telephoto lenses with those of the Tessar F/4.5, which we have selected as representing a standard objective. It is further assumed that the camera is of 12×9 cm. (roughly quarter-plate) size.

12×9 cm. camera lenses		Tessar	Tele-Tessar	Magnar	Telephoto Combination Tube No. I	Telephoto Combination Tube No. II
Focal length	f=	15 cm.	25 cm.	45 cm.	50 cm.	90cm.*
Extension (Camera front to focusing screen) . .	A=	15 „	15 „	15 „	15 „	30 „ *
Relative aperture		F/4.5	F/6.3	F/10	F/30	F/54 *
Comparative rapidities (F/4.5 being taken as 100)		100	50	20	2	0.7 *
Angular field $2w$ included on the 12×9 cm. plate	Diagonal 15 cm.	53°	33.5°	19°	17°	9.5° *
	Long side 12 cm.	43.5°	27°	15°	13.5°	7.5° *
Size of objects included lengthwise on the plate	at 100 metres .	80 m.	48 m.	26.5m.	24 m.	13.5m.*
	at 3 metres .	2.3 „	1.3 „	0.7 „	0.6 „	0.3 „ *
Size in picture of a house 10 metres high, at 100 metres		1.5cm.	2.5cm.	4.5cm.	5 cm.	9cm.*
Size in picture of head 25 cm. high at 3 metres		1.3cm.	2.3cm.	4.4 „	5 „	10.7 „ *

*) Variable within wide limits.

The Tele-Tessar F/6.3 does not differ, in the manner in which it is used, from any ordinary camera lens in N. B, or A mount or fitted to a Compur shutter. The particulars given on page 41 show that the Tele-Tessar is not primarily designed for taking photographs from a distance. Thanks to its rapidity and long focus it is especially adapted *for photographing small living creatures and animals, for taking portraits, and for the use of press and sports photographers.* Full particulars will be found on pp. 14 and 24.

Taken with Tele-Tessar F/6.3 f = 32 cm. by Klemens Söding



In Carl Hagenbeck's Zoological Park at Hamburg
Hand snapshot with 12×9 focal-plane camera and Magnar F/10, f = 45 cm.

The Magnar F/10

is a foreunner of the Tele-Tessar. It resembles the latter and differs from the older Telephoto Combinations (then alone in use) in that its positive and negative members are not corrected independently and therefore form a good image only within a very small range of variation in the distance between the two members and in the camera extension. The adequacy of its rapidity for a good deal of hand-camera work and its long focus coupled with a short camera extension (see p. 41) mark it as specially adapted *for photographing wild animals, for taking detail photographs from aircraft,* as well as for photographing small living creatures and for taking portraits showing exceptionally large heads or figures. We make only one size of this objective, viz:

Magnar F/10, f=45 cm. in focusing mount for 12×9 cm. (quarter plate) folding camera with about 6 in. extension . . . . . *Foiselle*
in Comp. Shutter for cameras with baseboard extension of about 6 in. *Fontanal*

Telephoto Combinations

These are formed by screwing a standard camera lens, such as a Tessar, Double Protar, etc., together with its N, B or A mount or its Compur shutter*) into the front end of a **"Tele Tube"** to the back end of which the appropriate **"Tele Negative"** is fitted by us. The resulting Telephoto Combination screws into the lens flange, which remains attached to the camera front. According to the camera extension the focal length of the primary lens is increased thereby from about 3½ to 8×, and hence the figures in the picture are similarly enlarged (see Table on page 45). This combination is therefore primarily adapted *for photographing very distant objects, for taking details of architecture and landscapes,* and such like. Moreover, where the camera extension is variable, it admits of its focal length being varied within wide limits. — In order to ensure that the combination as a whole may give good definition, the front component should be stopped down to at least F/9. This will cause the rapidity to diminish to F/30 or even less, and hence, generally speaking, the combination is suitable for time exposures only.

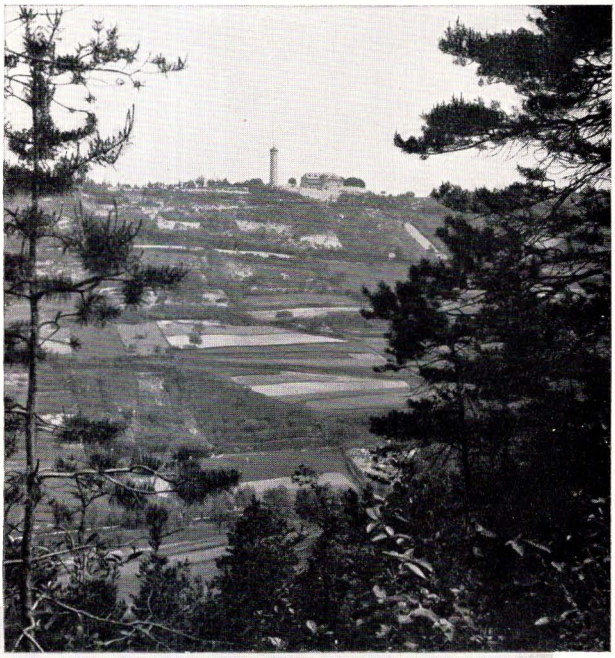
Tele Tubes Nos. I and Ia are intended for lenses in focusing "A" mounts, that is to say for folding cameras with fixed extension. The magnification V due to the tele-combination as compared with the camera lens alone is then invariable, being as a rule 3 to 4×. The telephoto combination is focused for near and distant objects by means of the scale of distances on the "A" mount of the front component just as with an ordinary lens.

Tele Tubes Nos. II and III are intended for objectives in standard or "B" mounts or shutters, i. e. for cameras with variable extension. They are provided with a focusing screw having a scale which reads the value in millimetres of the interval Δ occurring in the annexed tables. This enables the operator to set the combination, with any camera extension which he may be using, to the required magnification V and the distance of the object.

The Tele Negatives, consisting of two cemented lenses, are made with *focal lengths* of f=4½ cm. (1¾ inch.), 6 cm. (2⅜ inch.) and 7½ cm. (3 inch.). The focal length of the *Tele Negative* should preferably not be less than about one third that of the camera lens.

The **Telephoto Supplement**, consisting of the Tele Tube and the Tele Negative, requires to be accurately adjusted to suit each individual camera lens in order that the front and back screw threads may fit exactly and that the negative lens may be fixed at a proper position within the tube. For this purpose it is advisable to send the lens to the works for adaptation. At the very least the whole of the inscription engraved on the objective should be quoted.

*) Assuming that the lens with its shutter may be unscrewed or detached from the camera.



The Fuchsturm, Jena. Taken with Tele Tube No. II, Tessar f=15 cm. and Tele Negative f=6 cm. Above: The size of picture obtained with the ordinary focal length of 15 cm. of the Tessar

Tele-Tubes

Tube No.	Tube Length variable by mm.	Tube Length variable for example for Δ*)	Suitable for *Tele Negative* f_2 cm.	Suitable for *Camera Lenses* such as Tessar F/4.5 f_1 cm.	Suitable for *Camera Lenses* such as Tessar F/6.3 f_1 cm.	Suitable for *Camera Lenses* such as Double Protar f_1 cm.
I	—	—	4½ and 6	up to 15	up to 18	—
Ia	—	—	6 and 7½	16.5 to 21	—	—
II	12	5 to 17 or 10 to 22	4½ and 6	up to 18	up to 18	29/22
III	20	5 to 25 or 10 to 30	6 and 7½	up to 21	up to 21	35/35

*) According to limits imposed by the camera extension and the Tele Negative (see two last tables).

Usual Supplements for Hand Cameras

For *Focal Length* of Lens cm.	*Fixed Camera Extension* Lens in 'A' mount Tele Attachment Tube/Negative	Codeword	*Variable Camera Extension* Lens in 'N' or 'B' mount, or in Comp.**) Tele Attachment Tube/Negative	Codeword
10.5 and 12	**I** / 4½	*Foladina*	**II** / 4½	*Folaga*
13.5 and 15	**I** / 6	*Foland*	**II** / 6	*Folaria*
16.5 and 18	**Ia** / 6	*Folaro*	**II** / 6	*Folaria*
18 and 21	**Ia** / 7½	*Folatrant*	**III** / 7½	*Folatre*

**) Assuming that the camera lens together with shutter in use may be unscrewed or detached from the camera.

Optical Interval Δ[1]), Camera Extension K[2]), Exposure Increase Factor B

The magnification V being given: $\Delta = f_2 : V$; $K = (V-1)\, f_2$; $B = V^2$.

Tele Negative f_2 →		4½ cm.		6 cm.		7½ cm.	
V	B	Δ mm.	K cm.	Δ mm.	K cm.	Δ mm.	K cm.
3	9	15	9	20	12	25	15
3½	12	13	11.5	17	15	21.5	19
4	16	11.3	13.5	15	18	19	22.5
4½	20	10	16	13.5	21	16.5	26
5	25	9	18	12	24	15	30
6	36	7.5	22.5	10	30	12.5	37
7	49	6.5	27	8.5	36	11	45
8	64	5.5	31.5	7.5	42	9.5	52

[1]) To be set by the scale on Tubes Nos. II and III. [2]) The value of K is reckoned from the centre of the Tele Negative. In Tubes Nos. I, Ia, II the Tele Negative is situated approximately in the plane of the screw collar but in the case of Tubes Nos. III it is placed towards the interior of the camera 4 to 8 cm from the screw collar, so as to obtain a better balance of the weight. The requisite camera extensions will accordingly be greater by this amount than the values of K stated in the table.

Diameter, in centimetres, of the image attainable with the Tele Combinations

Anastigmatic Front Component f_1 (e. g. Tessar, Double Protar) →		9	10.5	12	13.5	12	13.5	15	16.5	18	18	21
Tele Negative f_2 →		$4^1/_2$ cm.				6 cm.					$7^1/_2$ cm.	
Set to Δ*)		Diameter of Image Circle**)										
K = 9 cm.		9	—	—	—	—	—	—	—	—	—	—
K = 12 „		11.5	11.5	11	10.5	12.5	12	11.5	11	11	—	—
K = 15 „		14	14	14	13	15	14.5	14	13	13	13	—
K = 18 „		17	17	16	15	17	16.5	16	15	15	15.5	10.5
K = 21 „		19.5	18.5	18.5	17	20	19.5	18	17.5	17	18	12
K = 24 „		21.5	21	21	19.5	22.5	21.5	21	20	19	20	13.5
K = 27 „		24	23.5	23	21.5	26	24.5	23	21.5	21	23	15
K = 30 „		26.5	26.5	25.5	23.5	27.5	26.5	25.5	23.5	23	25.5	17
K = 36 „		30	29	28	26	33	31.5	30	28	27	30.5	20
K = 42 „		—	—	—	—	38	36	34.5	33.5	31.5	35.5	23
K = 48 „		—	—	—	—	43	41	39	36.5	35	40	26
K = 54 „		—	—	—	—	—	45.5	43	40.5	39	44	29.5
K = 60 „		—	—	—	—	—	50	49.5	44.5	43.5	49	33

*) See the preceding table. **) These image circles are attainable by stopping the front lens down to about F/25. When larger stops are employed (it is not advisable to excede F/9) the diameter of the image circle increases, but the circle within which the definition is perfectly sharp diminishes.

Taken with Tessar F/4.5 f = 21 cm. Photo by G. Riebicke

Suitable Optical Equipments for various Types of Cameras †)

Camera	as standard objective	as supplement to the standard objective*)	as an additional special objective**)
Miniature camera	**Tessar F/2.8,** also **F/3.5** or **F/3.8,** F/4.5 and F/6.3 Biotar F/2, Sonnar F/2 or F/1.5 in Compur shutter or special mount	Proxar, Yellow filter, Ducar	
Folding hand camera with single extension	**Tessar F/4.5** also F/3.5 and F/6.3 in Compur shutter	Proxar, Yellow filter, Ducar, Tele Supplement	Tele Tessar F/6.3 Magnar F/10 Dagor F/9 Protar F/18
Folding hand camera with double extension	**Tessar F/4.5,** also F/3.5 and F/6.3 or Double Protar F/6.3 – F/7.7 or Protar set or Dagor F/6.8 in Compur shutter	Distar, Proxar, Yellow filter, Ducar, Tele Supplement Yellow filter, Ducar or plane parallel Autochrome filter, Tele Supplement	Tele Tessar F/6.3 Magnar F/10 Dagor F/9 Protar F/18
Focal plane Camera	**Tessar F/4.5,** also F/3.5 Biotessar F/2.8 in A or B mount	Proxar, Yellow filter, Ducar	Tele Tessar F/6.3 Magnar F/10
Reflex camera	**Tessar F/2.8** or **F/3.5** or **F/3.8,** F/4.5 Biotessar F/2.8 in Compur shutter or A or B mount	Proxar, Yellow filter, Ducar	Tele Tessar F/6.3 Magnar F/10
Universal camera	Tessar F/4.5, also F/6.3 and F/3.5 or **Double Protar F/6.3 — F/7.7** or Protar set or Dagor F/6.8 in Compur shutter or N mount	Distar, Proxar, Yellow filter, Ducar, Tele Supplement Yellow filter, Ducar or plane parallel Autochrome filter, Tele Supplement	Dagor F/9 Protar F/18 Hypergon F/22
Stereo camera	**Tessar F/4.5,** also F/6.3 and F/3.5 in Compur shutter or A or B mount or special mount	Distar, Proxar, Yellow filter, Ducar	
Reflex Stereo camera	**Tessar F/4.5,** also F/3.5 in A or B mount or shutter	Proxar, Yellow filter, Ducar	
Studio camera	**Tessar F/4.5,** also F/3.5, F/5 and F/6.3 or Triplet F/4.8, also F/5 in N mount or Compur shutter	Yellow filter	
Aerial camera	**Tessar F/4.5,** also F/3.5 and F/5 or Triplet F/4.8, also F/5 in N mount	Yellow filter	
Cine camera for standard and sub-standard film	**Biotar F/1.4,** **Tessar F/3.5** or **F/2.7,** also F/4.5 in A mount or special mount	Yellow filter	Kino Tele Tessar F/4
Process camera	**Apo-Tessar F/9 — F/15** or Apo-Planar F/7.5 – F/12.5 in R mount with Iris and sliding diaphragms	Reversing Prisms and Mirrors, revolving collars, filter cells, R-yellow filters and R-colour filters	

†) These equipments comprise only the photographic optical equipments most generally used, and make no pretence of completeness. We or the camera makers will always be pleased to furnish information regarding the choice of suitable types of objectives, focal lengths and mounts in individual cases.

*) For yellow filters for photography with orthochromatic plates see p. 38.
For Ducars or A-Ducars for colour screen-plate photography see p. 40.
For Proxars for use on cameras with fixed extension for large scale close-up work, and on all other cameras for photographs also at wider angles, see p. 33 et seq
For Distars see p. 31 et seq. and Tele supplements p. 41 et seq for obtaining larger scale pictures; the Tele supplements are primarily intended for specially long-distance photography, and their use necessitates easy removal of the objective and shutter from the camera.

**) The employment of a special objective requires either that the complete standard lens and shutter should be easily removable or that the shutter of the standard lens can be used also for the special objective.
Tele Tessar F/6.3 (see pp. 14, 24, 41 et seq) and Magnar (see p. 41 et seq.) for larger scale pictures; Magnar only for cameras with an available extension of about 15 cm.
Dagor F/9, Protar F/18 and Hypergon F/22 for wide angle work (see pp. 14, 17, 28).
Kino-Tele-Tessar (see pp. 16, 27) for larger scale pictures.

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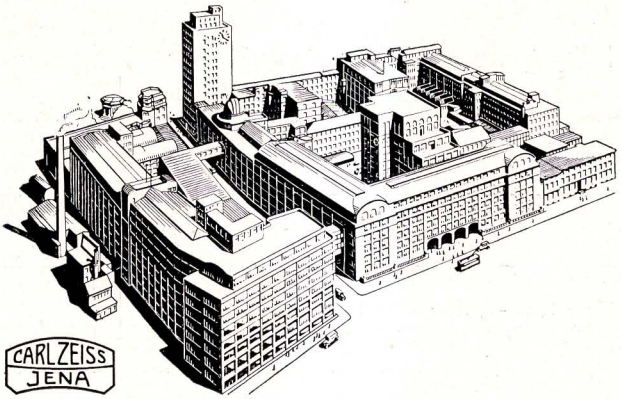

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Author P. E. Sohm