# ZEISS



# CONTENTS



## ZEISS PRISM BINOCULARS

For more than a century JENA has been the traditional centre for optical research and production. Thousands of Jena instruments supplied in this period contributed to the advancement of research in many scientific, engineering and industrial fields and played in many countries an important part in the preservation of public health. They also provided the means for domestic, recreational and cultural entertainment.

The ZEISS Prism Binocular represents the classical form of prismatic double telescope as originated by Ernst Abbe, the spiritus rector of the Jena ZEISS Works. While practically preserving the original form as far as the exterior appearance goes, no effort has been spared to incorporate into the modern ZEISS Prism Binocular the advanced knowledge, skill and experience accumulated in all these years. These improvements, combined with a progressingly refined system of controls through which the approximately 120 components of a binocular must pass, ultimately resulted in a final product which comes as near to perfection as is humanly possible.

In confining the range of ZEISS Prism Binoculars to those comparatively few models which in course of time have been shown to satisfy classes of specific needs, the manufacturers, besides facilitating users' choice, at the same time manifest their intention to serve buyers' interests by completely concentrating the creative powers of the Jena ZEISS Works upon a well-balanced programme of production.

Ever since their first appearance in the nineties, ZEISS Prism Binoculars proved to be a source of satisfaction and enchantment to a multitude of owners in all parts of the world. Changing the charm of distance into the delight of nearness they intimately acquaint ramblers and hunters with animal life and impart to explorers and mountaineers the tranquil grandeur of nature's beauty and secrets of the earth's architecture, while realistically placing race-goers and sportsmen into the very midst of thrilling episodes and events. There is, in fine, the endless list of professional uses where ZEISS Prism Binoculars are indispensable in discerning detail which otherwise would be lost to the unaided eye.

Users' wishes and suggestions, which may be of help to us in keeping abreast of present-day requirements, are sincerely invited. They are gratefully accepted as an effective assistance towards encouraging and stimulating our continuous quest for further advancement.

Zeiss Prism Binoculars for professional use:

**Forresters**
**Fishermen**
**Pilots**
**Sailors**
**Watchmen**
**Architects**
**Surveyors**
**Engineers**
**Students**
**Supervisors**
**Ornithologists**
**Meteorologists**
**Geologists**
**Art Historians**
**Archaeologists**
**Explorers**
**Reporters**
**Life-saving stations**

as also for:

**Nature lovers**
**Ramblers**
**Mountaineers**
**Hunters**
**Holiday makers**
**Sport fans**
**Theatre-goers**
**Lovers of Art**

# FROM THE GALILEAN TELESCOPE TO THE ZEISS PRISM-BINOCULAR

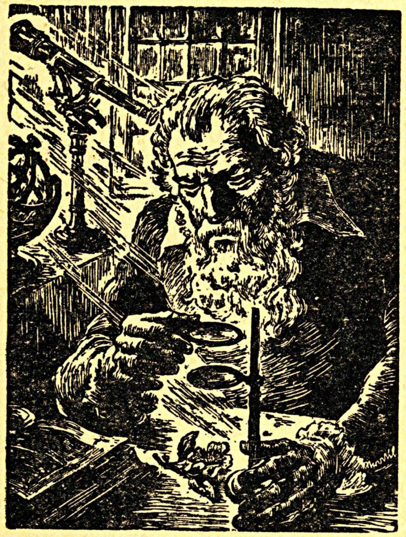


Fig. 1. Galileo Galilei



The first telescope dates back to the beginning of the 17th century when John Lipperhey, spectacle grinder of Middleburg, applied for patent protection, which was not however granted by the Netherland government until he succeeded in completing the instrument for binocular use. On learning about this, Galilei, the great Italian astronomer is said to have constructed a telescope which he used with good results in astronomical research.

However it was not until in the first half of the 19th century that these telescopes became general in their binocular form. Since finding employment in the Crimean War in 1854/1855, they were referred to as "Crimean Field Glasses". Their characteristics were the low magnification and the small field of view in the form of overlapping circles (Fig. 2).

J. Porro, the Italian surveyor and optician, was as early as in 1849 aware of the fact that by an appropriate arrangement of prisms in the telescope

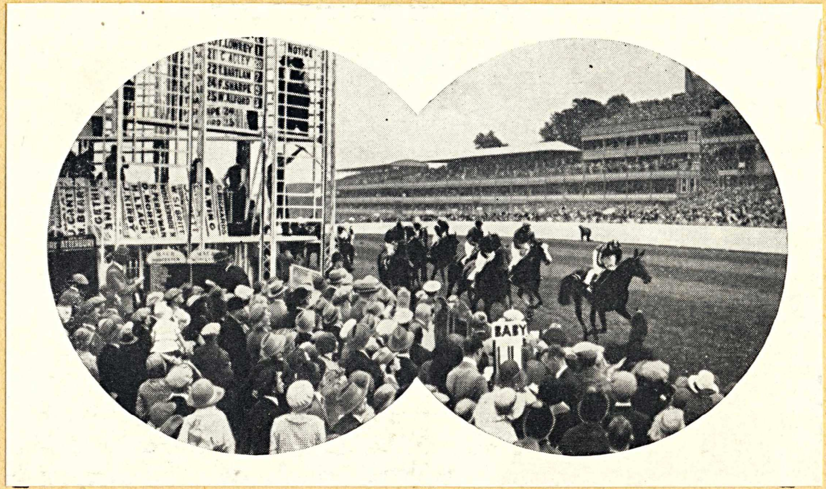


Fig. 2. Visual field as seen in "Crimean" type of field glass

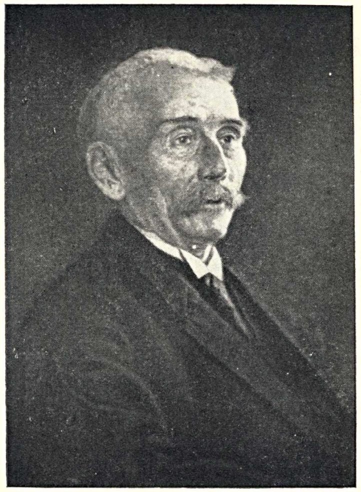


Fig. 3. Dr. Otto Schott

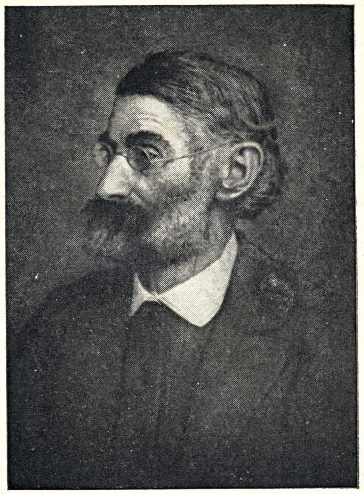


Fig. 4. Prof. Ernst Abbe

it would be possible to obtain an upright image and at the same time considerably to reduce the size of the instrument.
He accordingly constructed a monocular prism telescope in 1849, whereas it did not occur to him to build a double telescope. Yet the working methods conventional at that time and the unsatisfactory quality of the available optical glass left much to be desired, so that Porro's invention soon fell into oblivion.

It was only after Dr. Otto Schott succeeded in producing in the Jena Glassworks a type of crown glass of perfect purity and transmitting power that in the Zeiss-Works, founded by Carl Zeiss in 1846, Ernst Abbe —unaware of Porro's experiments—was in a position to construct the first practically useful type of prism binoculars as the forerunner of the present-day ZEISS Prism Binocular.

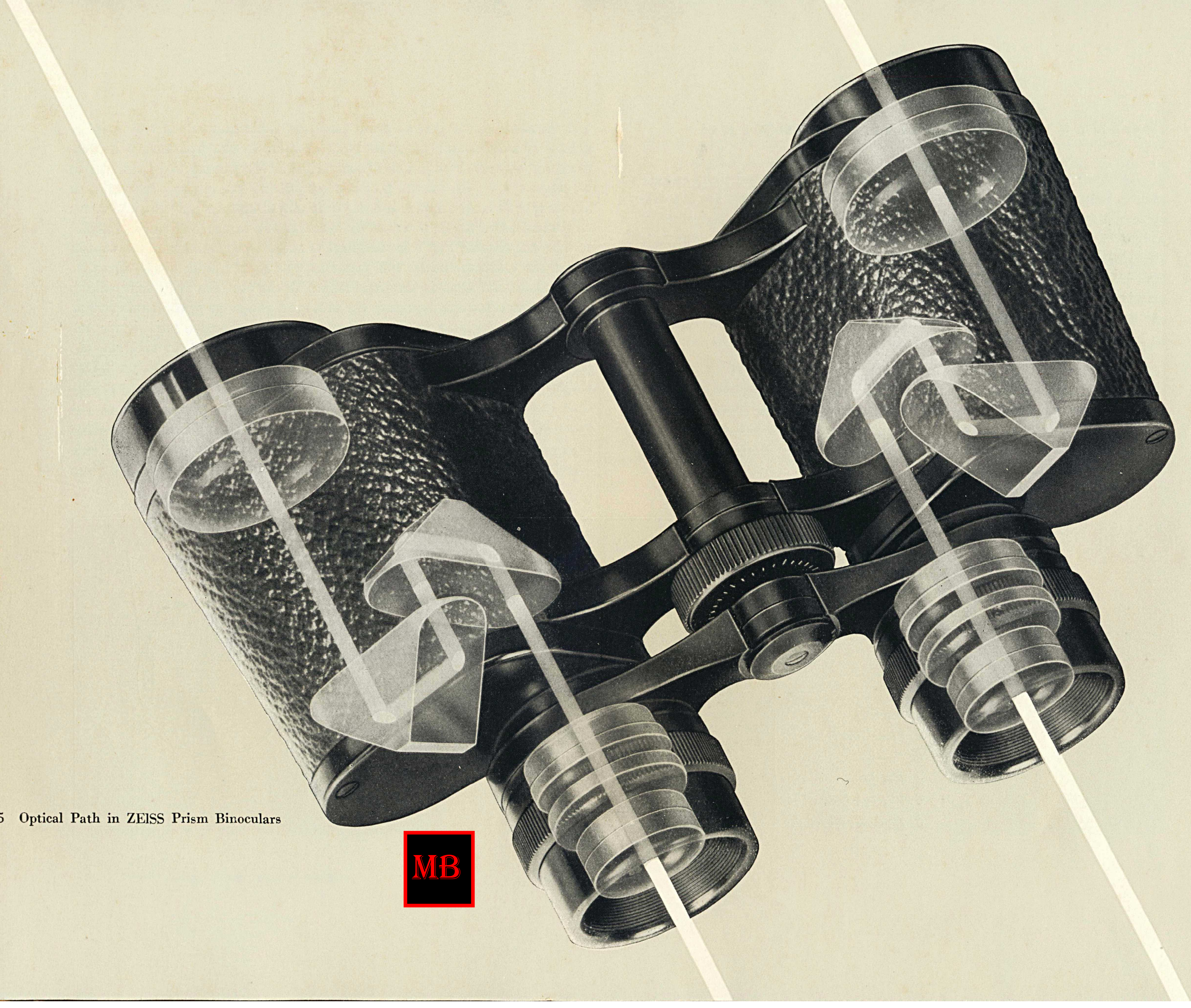


Fig. 5 Optical Path in ZEISS Prism Binoculars

## POINTS WORTHWHILE KNOWING

When selecting a pair of binoculars, prospective buyers naturally enquire about the performance the glasses will give them. Yet, there are few who actually appreciate the factors that are responsible for such performance. There seems to be a tendency of leaving these problems to the experts to deal with and of ignoring the fact that such knowledge may be of considerable help to the buyer in making his choice. We shall accordingly try to present as briefly and simply as possible what facts the buyer should be aware of regarding prism binoculars.

### *Magnification*

By the term "magnification" the apparent enlargement of an object is understood, as seen through a lens. This definition is often, and rightly so, expressed by users when they wish to "bring the object up close". The user manifests in this way that he correctly grasped the fundamental effect of a telescope, in that he is bound to see more detail the closer the object is brought up to him.

Yet, in order to be able to draw practical conclusions from the mode of action of a telescope, we shall have to refer to the human eye in first place (cf. Fig. 6). The power of resolution of the human eye is known to be limited, i. e., the eye no longer distinguishes the separate parts of an object if the visual angle is smaller than one minute of arc. Thus, in order to discern more detail it would be necessary to increase the visual angle. In the diagram of Fig. 7 an attempt is made to demonstrate the way in which the telescope solves this problem. The focal length of the telescope being about the same as the focal length of the eye, the eye when looking through the telescope perceives the observed object as of the same size as the object is depicted in the focal plane of the objective lens. Since the focal length of the objective lens is longer than that of the eye, the object appears to be larger than seen by the naked eye. This larger image would thus represent an "enlarged eye" as it were (it goes without saying that the distance between eye and object is longer than drawn in the illustration 7 — as the dash-lined optical path is to indicate). Supposing that with the naked eye we were just about able to recognise a hen at a certain distance, we would also — if viewing that hen through an ×8 bino-

*1 Object*
*2 Visual angle*
*3 Pupil*
*4 Eye lens*
*5 Vitreous body*
*6 Image on the retina*

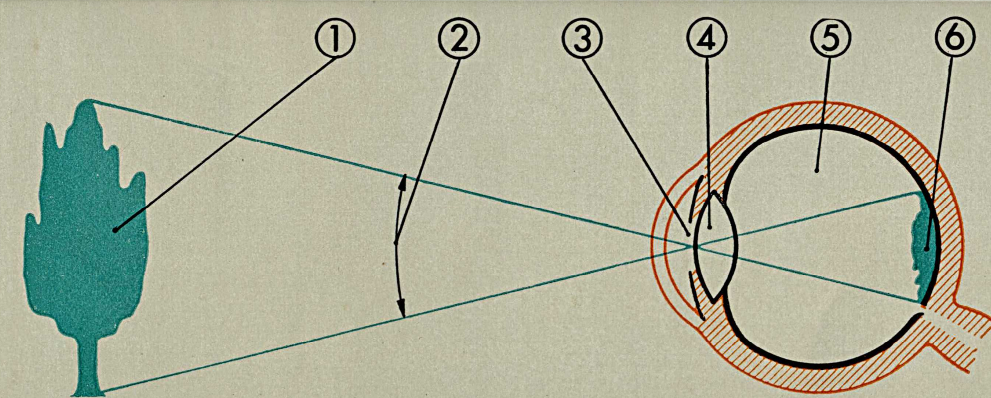



Fig. 6. Visual process with unaided eye

cular — discover the presence of a chick which is, say, one eighth the size of the hen and which the naked eye was unable to make out at the distance in question. In other words, with the aid of an ×8 telescope we should be able to make out an object which is but one eighth the size of the object the naked eye is just about able to see. Yet, simple as this appears at a glance, there are some physiological processes which have a definite bearing on the final performance of a binocular and which would have to be introduced into such calculation in terms of corrective elements (cf. page 12).

*Visual Field* The angular field of a telescope presented on the side facing the object is referred to, professionally, as the "object-side field of view". When using medium power binoculars this field covers about 8.5°. The diameter of the object-side field, expressed in terms of metres, may be calculated for any distance if the angular value is known. In the review on page 16 the sizes of field are shown for a distance of 1000 metres. Besides the object-side field reference is occasionally made to the field on the ocular side. The latter is referred to when one intends to characterize the optical performance of the eyepiece. The dimensions of the field on the ocular side will be approximately arrived at by multiplying the field on the object-side with the magnification of the telescope. The field on the ocular side of the telescope is considerably larger than the field on the object-side and with medium power binoculars would amount to approximately 62°. It should be noted however that angular values as high as this will be achievable only with prism binoculars and not with the Galilean type of field glasses (cf. illustration 8 on the next page).

*1 Object*
*2 Image of object*
*3 Objective lens*
*4 Visual angle of eye*
*5 Visual angle of telescope*
*6 Focal plane of objective lens*
*7 Eyepiece*
*8 Ocular pupil and exit pupil of telescope*
*9 Eye*
*10 Focal length of eyepiece (same as that of the eye)*
*11 Focal length of objective lens*
*12 "Enlarged Eye"*

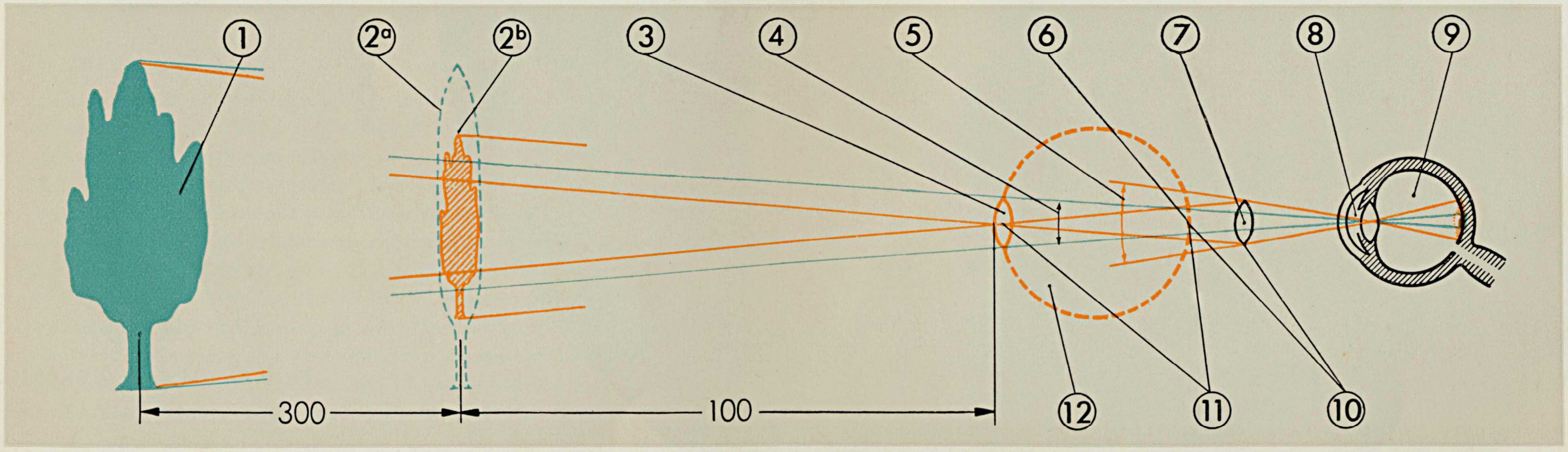
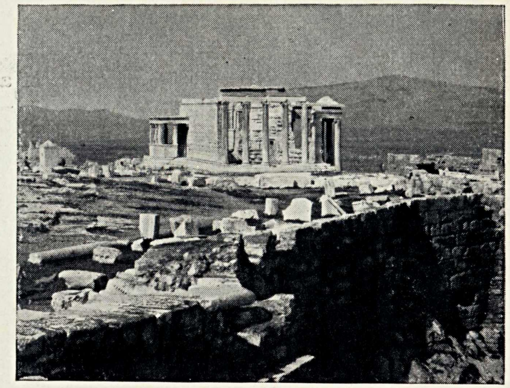



Fig. 7. Visual process when using binoculars



*As seen by the naked eye*

*The area within the small inscribed circle represents the visual field presented by a Galilean type of field glass of the same power*

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Fig. 8. Visual field of an 8 × 30 binocular

## *Image Brightness*

Holding the binoculars at arm's length from the eyes against the light, a circle of bright light will be seen in each eyepiece, referred to as the "exit-pupil". This circle represents the light emerging from the eyepiece. By squaring the diameter of this circle we arrive at the geometrical luminosity of the glasses. The diameter of the exit pupil may be obtained by dividing the numbers (magnification and lens diameter) engraved on the body of the binoculars. Thus, the figures "$6 \times 30$" would indicate that the glasses magnify six times and that the diameter of the objective lens is 30 mm. The geometrical luminosity of a pair of $6 \times 30$ binoculars would accordingly amount to 25 (cf. pages 16 and 19 to 27) in that the diameter (5) of the exit pupil, viz: $(30:6 = 5)$ is squared. It should be noted however that the term "geometrical luminosity" designates an ideal case since, reduced to practice, a loss of light is inevitably occasioned in every optical system. The loss is due to part of the light incident upon the glass-to-air surfaces of lenses and prisms not being transmitted by them, but being reflected instead. In the older models of binoculars the resulting loss of light amounted to about 40%. Deducting this amount from the geometrical luminosity we obtain the physical luminosity, which in the case of the former $6 \times 30$ model of binoculars would thus only have amounted to 15 compared with 25 of the new models.

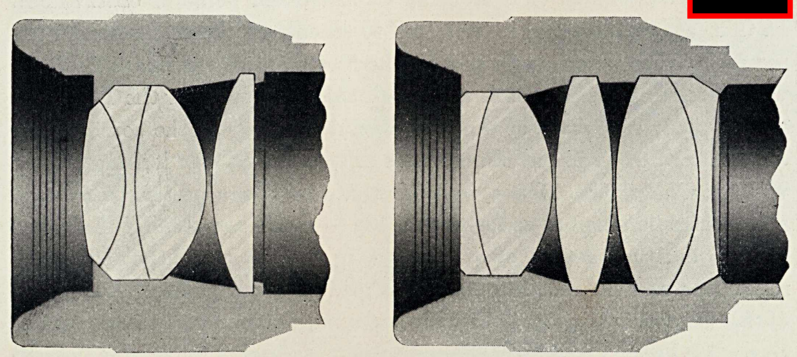
## *ZEISS Coated Optics*

Reduction of the considerable difference between geometrical and physical luminosity as outlined above, represents one of the notable achievements associated with the advent of the now generally adopted anti-reflexion treatment of optics initiated by the Jena ZEISS Works a number of years ago. This treatment consists in the application of an extremely thin film of a highly resistant and waterproof substance onto the highly polished surfaces of lenses and prisms. Optics thus treated are referred to as ZEISS Coated Optics. Hence, by suppressing undesirable reflections to a minimum, but in the same measure increasing the light transmitting capacity of the optics, the anti-reflection treatment results in the production of images which are not only brighter, but are richer in contrast and of greater fidelity in the reproduction of colours. Binoculars treated in this way have a light-transmission of about 80% compared with 60% of those with untreated optics, thus correspondingly increasing the physical luminosity by one third.

## *Quality of Image*

Much as the coating process has been shown to improve the optical performance of binoculars, there are additional factors which have an important bearing on the image-forming quality. The elimination of imaging defects assumes a particular importance in this respect. There are two conspicuous phenomenae which it will be worthwhile to discuss. One of them is rather familiar to all those amateur astronomers who in their observations have to use a reliable pair of binoculars, viz.: Distant points of light are known to be depicted by optical telescope systems in the shape of small or large patches of light. These patches are referred to as the "circle of confusion" or "blur circle" and represent a continuous puzzle to optical computers in all parts of the world. Combatting it, the ZEISS Works developed a new form of eyepieces for binoculars (cf. Fig. 9), at the same time intensifying the conditions and processes

Fig. 9. Ocular of the Binocular DELTRINTEM $8 \times 30$



*1946 Model* *New model*

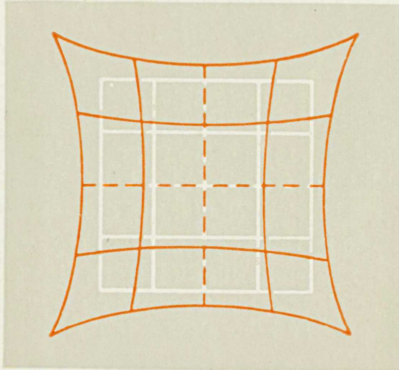


Fig. 10
Cushion-shaped distortion

governing their manufacture and subjecting them to testing methods of extraordinary severity. The ZEISS Works in this way succeeded in reducing the circle of confusion to an extent not so far attained in any other make of binocular. In order to bring about an additional reduction of the residual error when observing stars and similar objects, a correction of only about —1.5 D need be effected in the usual setting of the eyepiece of ZEISS binoculars when looking at distant objects in daylight. The amount of accommodation thus involved can be easily compensated also by those observers whose power of accommodation is decreasing with advancing years.

The second imaging error will be noticed when the binoculars are used in taking a roundabout view from an unobstructed point of observation. In this case the observer is subjected to an optical illusion caused by the increase of the image-angle and by the limitation of the image field. He will be under the impression as though the foreground of the landscape shifts past him in front of the background similarly as the scenery does on the stage. He will not observe this phenomenon when looking around without a binocular. Hence, in order that the image presented through a binocular be adapted as far as possible to the image seen by the naked eye, we designed a type of eyepieces (Fig. 9) which slightly distort the rectilinear and intersecting lines of a grid. An exaggerated illustration of this distortion is given in Fig. 10. The remarkable merits of this optical correction become strikingly apparent when comparing the former Deltrintem model with the present 8×30 ZEISS prism binoculars.





## *Index for Visual Capacity in Twilight*

From the aforegoing it will be apparent that there are several properties which are of particular benefit to users of ZEISS prism binoculars also in all those cases where useful results are to be achieved when observing under rather adverse lighting conditions.

In binoculars, same as in all optical instruments, a distinction must be made between the geometrical luminosity (determined merely by the size of the pupils) and the effective luminosity which takes into consideration the losses of light occasioned by reflection and absorption. The performance of a binocular depends upon the luminosity, be it in daytime or at night, yet besides this luminosity the magnification plays a principal part in the daytime or night performance of any telescope.

Generally speaking, the following statement may be made: Of two binoculars having the same luminosity, the one with higher magnification will be superior be it in daytime, at dusk or at night. This statement is equally applicable in reversed order, viz., if two telescopes be of equal magnification, the one with the greater luminosity will be superior, especially at dusk or at night.

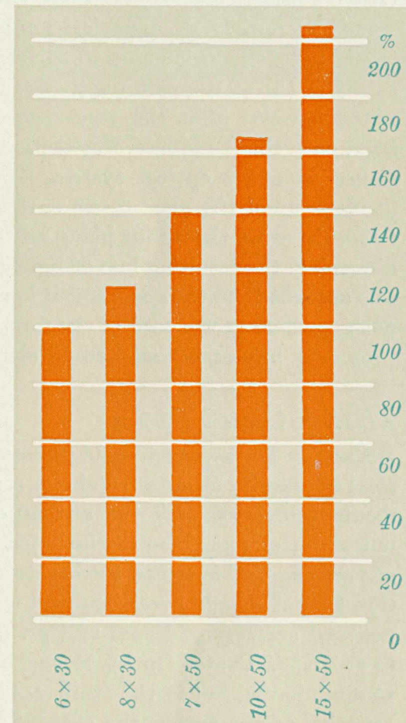



Fig. 11
Differences in twilight visual performance

The geometrical luminosity is determined by the square of the exit pupil. The effective luminosity is a fraction of the latter and becomes the greater the less light is lost by reflexion and absorption. While in former types of binoculars the loss of light amounted to about 50%, it now amounts to only 25 % and less.

Anyone owning binoculars of more than average twilight capacity will readily find that under adverse lighting conditions greater detail can be made out with them than with glasses of high luminosity but lower resolving power. This fact has been definitely manifested by a large number of experiments. On the occasion of a recent test carried out at sea, where it is particularly important to make out not only the presence, but still more so, also the colour of signal lights, the superiority of ZEISS prism glasses over Galilean types of glasses was convincingly demonstrated.

Whereas the performance of binoculars, in daylight or at dusk, may be in first place determined by their luminosity and magnification, there are additional factors which play a part, such as those optical and mechanical qualities, as are their definition, centration, contrast and resolving powers.

For observation at dusk or at night one will generally use glasses having an exit pupil not smaller than 4 mm., since in the dark the pupil of the human eye dilates up to 7 mm. and more.

The rules of thumb which are in use for the twilight performance of binoculars represent only a rather rough indication, which in particular applies to the primitive and most recently introduced rule where the twilight performance of a binocular is directly compared with the product of the magnification and the diameter of the objective-lens, as engraved on binoculars.

Large-size exit pupils inevitably lead to the construction of unnecessarily heavy glasses. They are of advantage mainly when making observations from moving ships and other vehicles, as it is easier in that case to keep the exit pupil within vision. It should be noted however that with exit pupils larger than 5 mm., the resolving power of the eye does not increase but diminish. It is for this reason that the exit pupils of the most current types of binoculars, including those for use at dusk, usually lie below a diameter of 7 mm.

## HOW TO USE BINOCULARS

To obtain the full viewing benefit the image seen must be free from vibration. It should be borne in mind that the glasses magnify not only the observed object, but the tremor of the observer's hand as well. Hence, the higher the magnification the greater will be the vibration of the image. Observers not possessing very steady hands should lean against a wall or tree, etc., or else support their elbows as shown in Fig. 13.

In the absence of any such support it will be advisable to press the arms against the body (Fig. 14), take a deep breath and hold it while observing. In this way it will be possible to use any binocular magnifying up to 8 times without resorting to any outside support.

Skilful observers will be in a position to use 10 × glasses in the same manner. For more extended observations from one singular point of view, a tripod should be used.

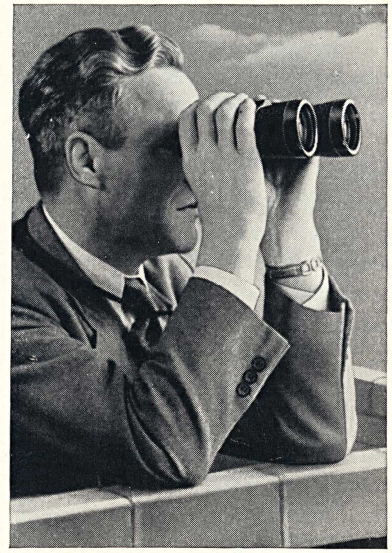


Fig. 13

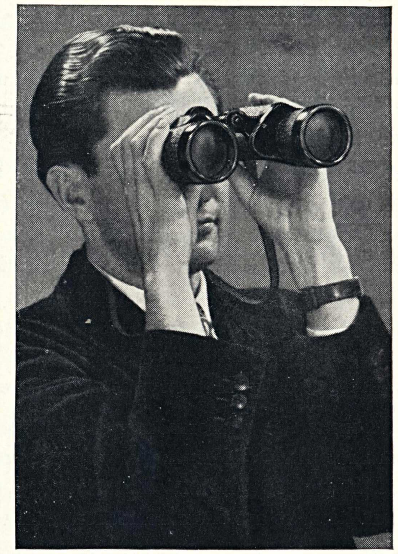
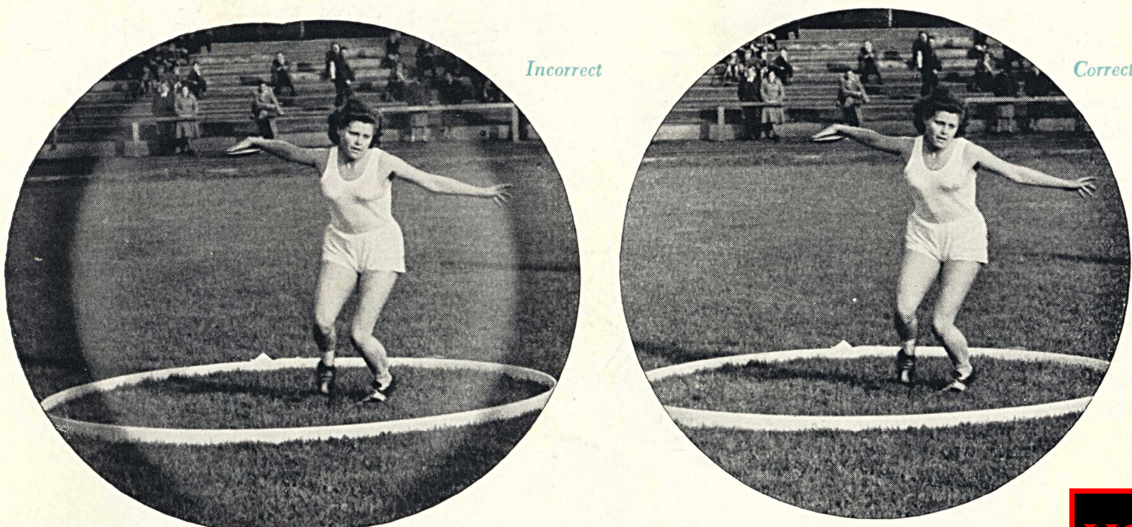


Fig. 14

Fig. 12. Setting the interocular distance




### *Interocular distance*

In order to obtain the large-size circular field, which is one of the advantages of the prism binocular over the Galilean type, the oculars are either moved nearer to each other or spaced farther apart by bending the hinges until the two fields coincide perfectly (Fig. 12). Observer's proper interocular distance is then shown by the scale engraved on the axial disc of the hinge joint (cf. 1 Figs. 15 and 16).

## *Setting for definition and distance*

Central focusing type: By means of the central focusing wheel (*3* Fig. 15) the two oculars can be simultaneously adjusted. This proves of advantage in all those cases where the distance between the observer and the object varies rapidly, as on race courses and sports grounds, for instance, or when the binocular is being used by several observers.

Normal-sighted observers will see remote objects distinctly as soon as the scales on the central focusing wheel (*3* Fig. 15) and on the right-hand ocular (*2* Fig. 15) are at "O". Short-sighted or long-sighted observers to set the wheel in the "minus" (—) or "plus" (+) direction, respectively. Where the sight differs in the two eyes, the central focusing wheel, starting from the zero-position, is set for the left eye, whereupon the ocular adjustment is used in correcting for the right eye.

Individual focusing type: Binoculars of the individual focusing type are practically immune against dust, rain and spray water. They are recommended for marine use and under adverse climatic (tropical) conditions. The oculars of this type may be individually adjusted (*2* Fig. 16). Closing the right eye, the left eyepiece is set to suit the visual power, whereupon the left eye is closed and the right eyepiece corrected according to requirements.

## *"Close-up" observations*

While being essentially a telescope for observing distant objects, binoculars may also be focused upon comparatively near objects by turning the central focusing wheel or the eyepieces in the plus (+) direction. Figures given in the following table show the distance at which normal-sighted observers may use binoculars for obtaining a sharply defined image of near objects:

| Binoculars | 6×30 | 7×50 | 8×30 | 10×50 | 15×50 |
|---|---|---|---|---|---|
| Distance in metres | 4.0 | 5.5 | 4.5 | 5.5 | 8.5 |

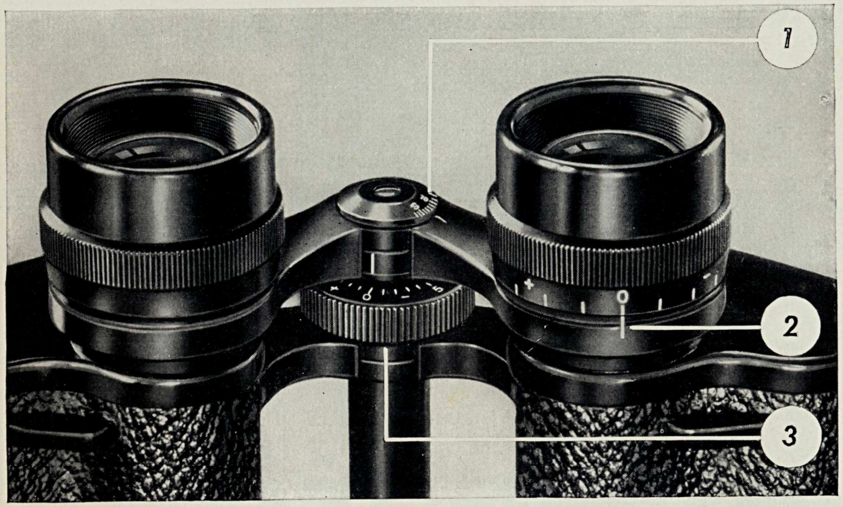


Fig. 15. Central focusing type of binocular

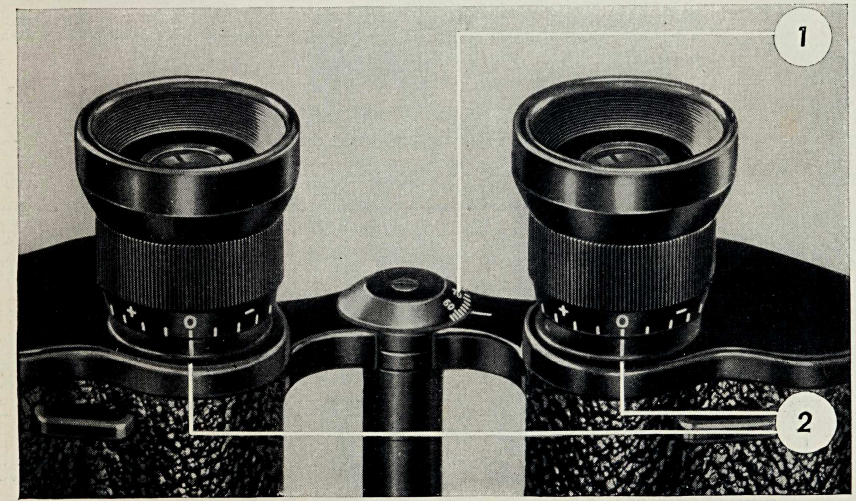


Fig. 16. Individual focusing type of binocular

## WHAT MODEL TO SELECT

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In shaping our manufacturing programme we were guided by the long years of experience gained in the building of prismatic binoculars and by keeping in close touch with users and their specific requirements.

To facilitate user's choice the two following tables were compiled, the first one displaying by concrete figures the optical performance of each model, while the second one affords a review over the leading uses.

| Designation | Magnification | Diameter of objective lens mm. | Diameter of exit pupil mm. | Geometrical luminosity | Visual field | | Index for twilight performance |
|---|---|---|---|---|---|---|---|
| | | | | | angular measure | linear at a distance of 1 Km. in metres | |
| SILVAREM<br>SILVAMAR<br>SIMPSILV | × 6 | **30** | 5 | 25 | 8.5° | 150 | 180 |
| BINOCTEM<br>BINOCTAR<br>BINOCTARMO | × 7 | **50** | 7.1 | 50.4 | 7.3° | 128 | 350 |
| TURMON | × 8 | **21** | 2.6 | 6.76 | 6.3° | 110 | 168 |
| DELTRINTEM<br>DELTRENTIS<br>DELTRINTMO | × 8 | **30** | 3.75 | 14.06 | 8.5° | 150 | 240 |
| DEKAREM<br>DEKARIS<br>DEKARISMO | × 10 | **50** | 5 | 25 | 7.3° | 128 | 500 |
| PENTEKAREM<br>PENTEKAR<br>PENTEKARMO | × 15 | **50** | 3.33 | 11.1 | 4.6° | 81 | 750 |

| LEADING USES | Binocular Models | | | | | Monocular Models | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6×30 | 7×50 | 8×30 | 10×50 | 15×50 | 8×21 | 6×30 | 7×50 | 8×30 | 10×50 | 15×50 |
| Industry and Town Planning | | | ■ | ■ | ■ | | | | | | |
| Bridge and Hydraulic Engineering | | | ■ | ■ | | | | | | | |
| Surveying | ■ | ■ | | | | | ■ | ■ | | | |
| Open-work Mining and Quarry Work | | | ■ | ■ | | | | | | | |
| Checking of Power Lines, etc. | | | ■ | ■ | ■ | | | | | | |
| Supervision of stockyards, etc. | ■ | ■ | ■ | | | | | | | | |
| Agricultural Supervision | | | ■ | ■ | | | | | | | |
| Forestry, Hunting, Game Preservation | | ■ | ■ | ■ | | | | ■ | ■ | ■ | |
| Astronomy | ■ | | | ■ | ■ | | ■ | | | | ■ |
| Exploration, Expeditions | | ■ | ■ | ■ | ■ | ■ | | | | ■ | ■ |
| Ornithology | | | | ■ | ■ | | | | | ■ | ■ |
| Deep-sea Fishing | | ■ | | ■ | | | | ■ | | ■ | ■ |
| Navigation (incl. river pilotage) | | ■ | | ■ | ■ | | | ■ | | ■ | ■ |
| Weather Service | | | ■ | ■ | ■ | | | | ■ | ■ | ■ |
| Life-guard Services | | ■ | | ■ | ■ | | | | | | |
| Mountaineering, Racing | ■ | ■ | ■ | | | ■ | ■ | ■ | ■ | | |
| Football, etc. | | | ■ | ■ | | ■ | | | | | |
| Yachting, Walking | ■ | ■ | ■ | | | ■ | ■ | ■ | ■ | | |
| Nature Study | ■ | | ■ | | | ■ | ■ | | ■ | | |

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## SILVAREM

Central Focusing Type

*Magnification* ×**6**

*Diameter of object lens* **30** *mm.*

The 6×30 models are a high-class type of general purpose prism binoculars, conspicuous for their large and brilliant field of view with excellent definition up to the edge. Thanks to the remarkable increase in luminosity resulting from the anti-reflection treatment a high visual performance has been achieved even under conditions of poor visibility. There are innumerable opportunities for using and enjoying these models. They will be found of valuable assistance in the supervision of dockyards and large store houses, where they afford a saving in steps, and prove equally useful in surveyors' aligning work as in a capacity of finder telescopes for astronomers. Students are often using them in lecture halls and nature lovers derive every benefit from them be it for studying or recreational purposes.

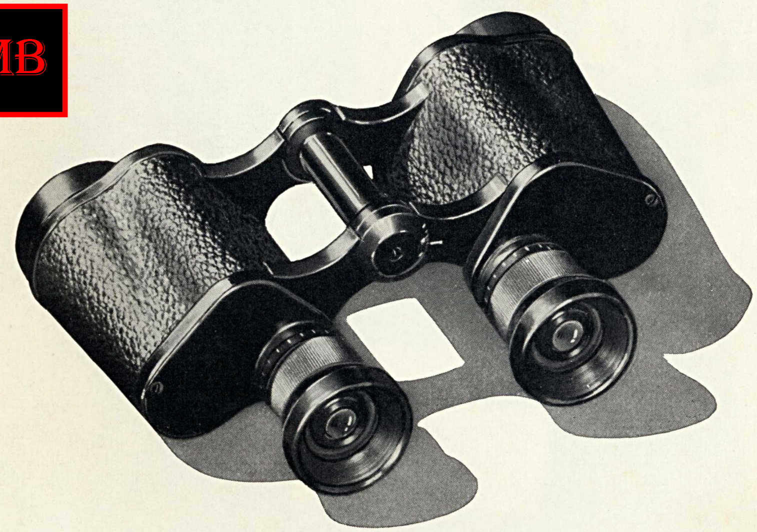
## SILVAMAR

Individual Focusing Type

*Magnification* ×**6**

*Diameter of object lens* **30** *mm.*

| Exit pupil | Geometrical luminosity | Visual field angular measure | Diameter of visual field at 1000 m. distance |
|---|---|---|---|
| 5 mm. | 25 | 8.5° | 150 m. |
| Index for twilight capacity: 180 | | | |



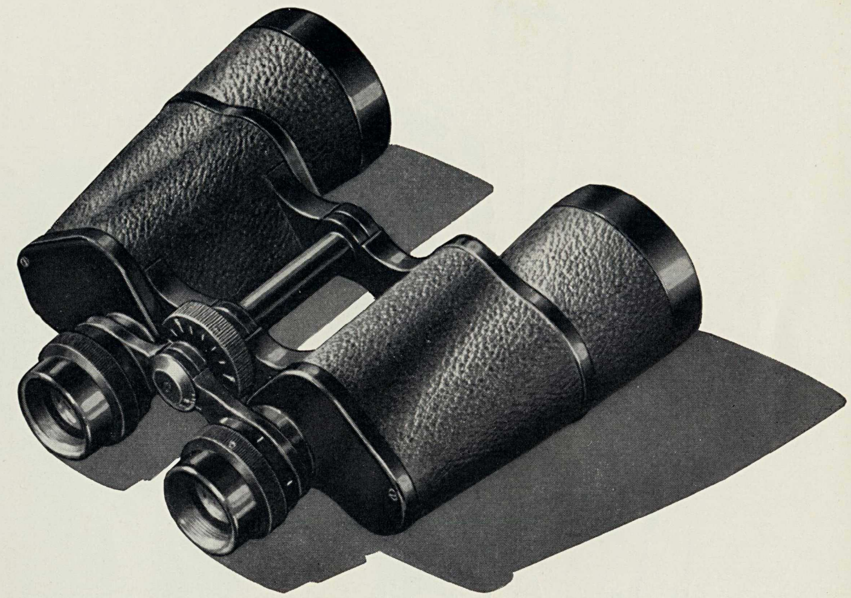
## BINOCTEM

Central Focusing Type

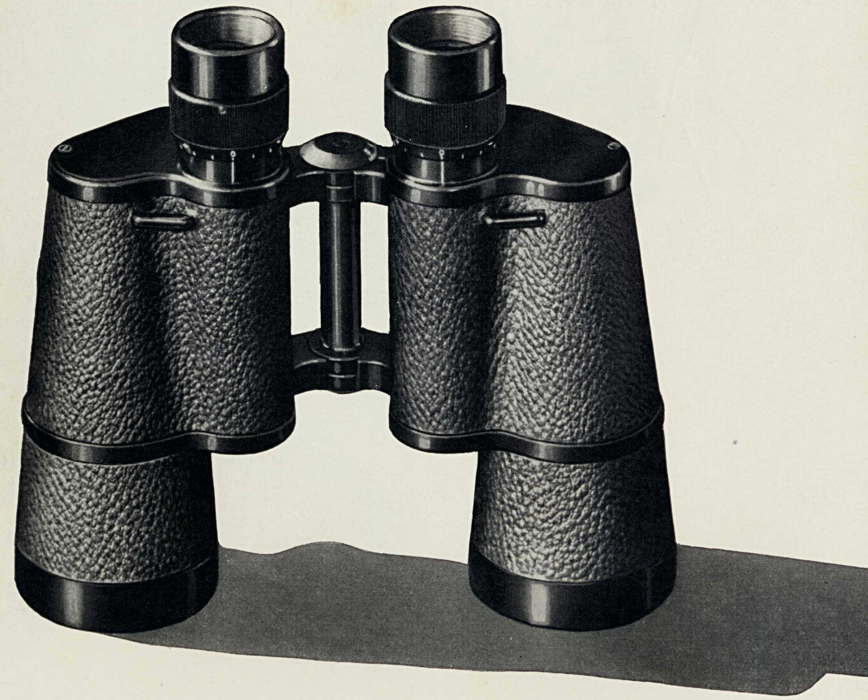
*Magnification* ×**7**

*Diameter of object lens* **50** *mm.*

These prism binoculars are known the world over as the two ZEISS models enjoying the highest geometrical luminosity. Their popularity is attributable to the strikingly bright images they furnish at dusk or on moon-lit nights. They are preferred in all those cases where rapid and reliable orientation must be established under adverse lighting conditions without thereby calling for any extremely high magnification. These models will be particularly useful for hunting and navigation purposes. Those who have had a chance of witnessing the magnificence which unfolds of a moon-lit landscape when observed through these binoculars, will never forget it and appreciate the full meaning of high geometrical luminosity.







## BINOCTAR

Individual Focusing Type

*Magnification* ×**7**

*Diameter of object lens* **50** *mm.*

| Exit pupil | Geometrical luminosity | Visual field angular measure | Diameter of visual field at 1000 m. distance |
|---|---|---|---|
| 7.1 mm. | 50.4 | 7.3 ° | 128 m. |
| Index for twilight capacity: 350 | | | |


P
28
P
155

**DELTRINTEM**

Central Focusing Type

*Magnification* ×**8**

*Diameter of object lens* **30** *mm.*

These 8×30 Wide-Angle Glasses are the most popular of ZEISS prism binoculars. The new models, by correcting the scenery-like shift mentioned on page 12, reproduce the natural perspective of objects distributed in depth in a way familiar to the naked eye. This feature is responsible for the continuously rising demand for these models, which, to a growing extent, are now being used also in industrial and engineering quarters, as by planning engineers, architects, superintendents of construction, as also in open work coal mining. The established favourite on the race-course, stadions and on travels, the new models also are the delight of hunters and mountaineers.

**DELTRENTIS**

Individual Focusing Type

*Magnification* ×**8**

*Diameter of object lens* **30** *mm.*

| Exit pupil | Geometrical luminosity | Visual field angular measure | Diameter of visual field at 1000 m. distance |
|---|---|---|---|
| 3.75 mm. | 14.06 | 8.5 ° | 150 m. |
| Index for twilight capacity: 240 | | | |

## DEKAREM

Central Focusing Type

*Magnification* ×**10**

*Diameter of object lens* **50** *mm.*

These models are preferred in all those cases where increased resolving power combined with high light-gathering capacity are required. With but little skill observers may dispense with a tripod or other support in order to obtain a steady view. The twilight index being as high as 500, these two models find particular favour with meteorologists, naturalists, navigators, big-game hunters and journalists. In modern engineering they are reliably used for supervising high-voltage lines, cable railroads, ropeways, bridges and agricultural tracts and cattle farms. Owing to their high light-transmitting capacity these glasses are very well suited also for astronomical observations.

## DEKARIS

Individual Focusing Type

*Magnification* ×**10**

*Diameter of object lens* **50** *mm.*

| Exit pupil | Geometrical luminosity | Visual field angular measure | Diameter of visual field at 1000 m. distance |
|---|---|---|---|
| 5 mm. | 25 | 7.3° | 128 m. |
| Index for twilight capacity: 500 | | | |

## PENTEKAREM

Central Focusing Type

*Magnification* ×**15**

*Diameter of object lens* **50** *mm.*

Despite their high magnification these models are neither larger in size nor heavier in weight than our 7×50 binoculars. The optical correction of the scenery-like aberration (cf. page 12) is particularly efficient for achieving natural perspective. The twilight index is most remarkable, amounting to 750. Whilst the geometrical luminosity of these models is lower than that of the BINOCTEM for instance, the PENTEKAREM yields considerably more detail in twilight and under conditions of poor visibility. High resolving power makes these binoculars particularly suitable for observing objects at great distances. Scientists and ornithologists as also amateur astronomers consider the 15×50 models as the ideal binoculars for their purposes. A tripod or other support should be used when the maximum visual performance is to be utilized.

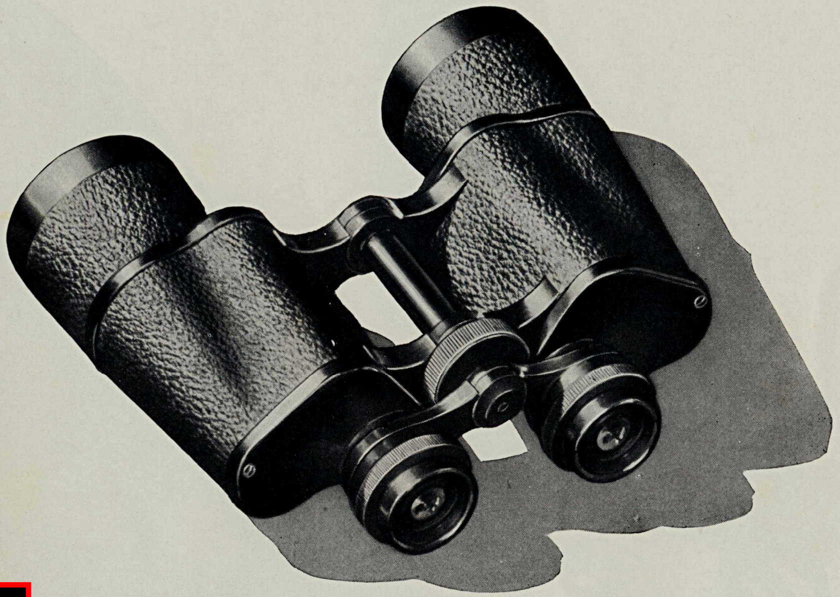
## PENTEKAR

Individual Focusing Type

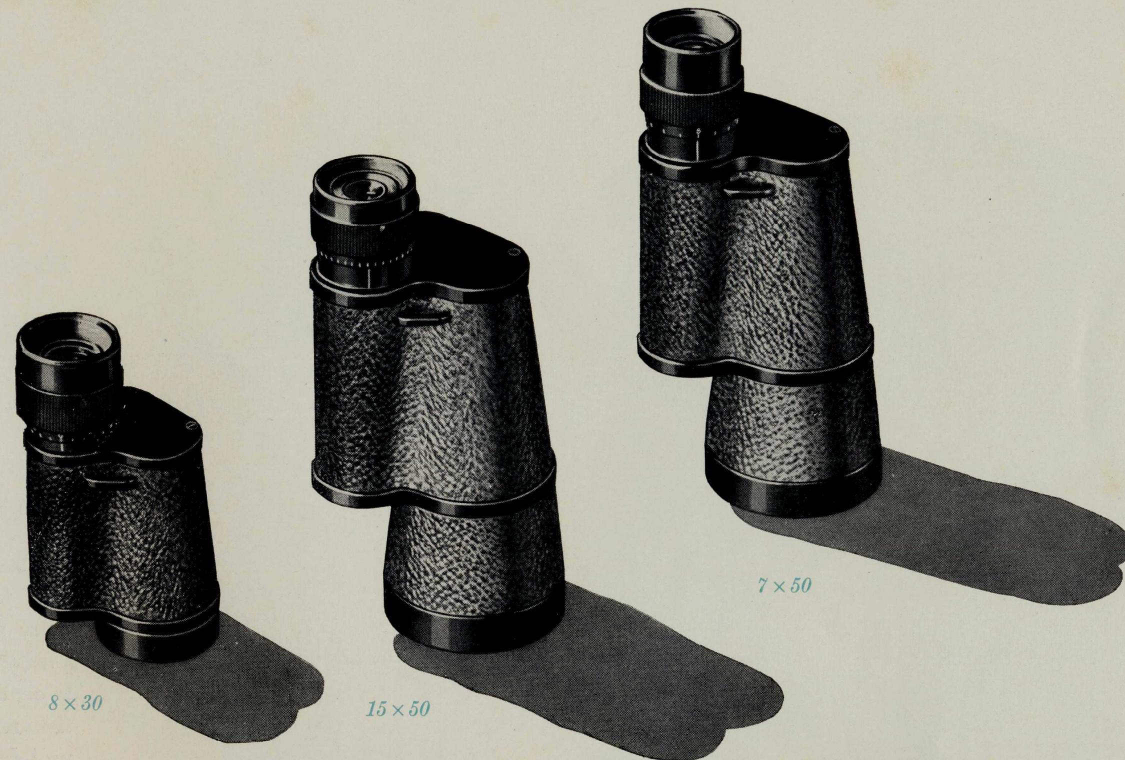
*Magnification* ×**15**

*Diameter of object lens* **50** *mm.*

| Exit pupil | Geometrical luminosity | Visual field angular measure | Diameter of visual field at 1000 m. distance |
|---|---|---|---|
| 3.33 mm. | 11.1 | 4.6 ° | 81 m. |
| Index of twilight capacity: 750 | | | |



| | |
|---|---|
| **SIMPSILV** | **6×30** |
| **BINOCTARMO** | **7×50** |
| **DELTRINTMO** | **8×30** |
| **DEKARISMO** | **10×50** |
| **PENTEKARMO** | **15×50** |



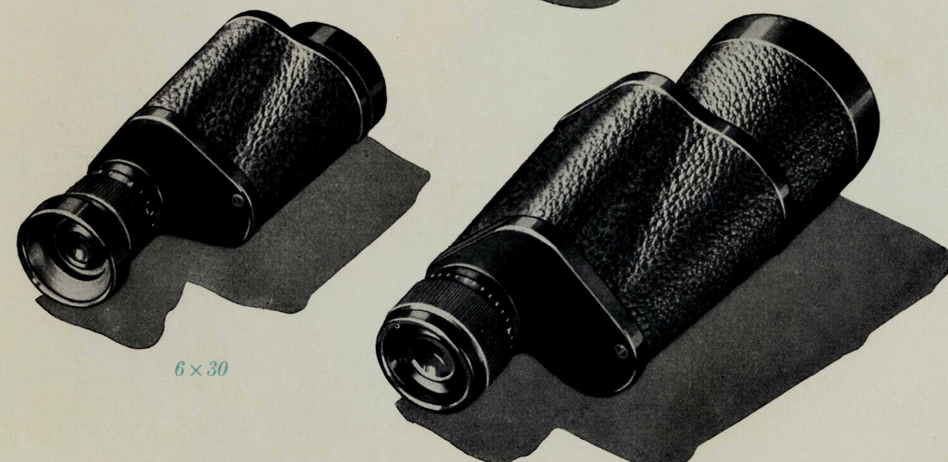
8 × 30

15 × 50

7 × 50

## *Monoculars*

For mountaineers, alpine hunters, painters and all those tourists interested in limiting the weight and dimensions of their outfits, or who prefer monocular observations, be it for aligning purposes or when laying out pipe lines, etc., ZEISS models are also carried in monocular form at prices ranging slightly above half those of the binocular models.



6 × 30

10 × 50

## TURMON

Monocular Type

*Magnification* ×**8**

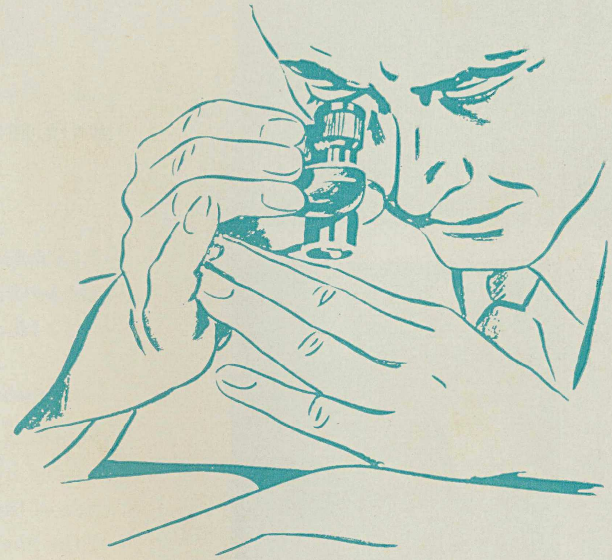
*Diameter of object lens* **21** *mm.*

Within the range of ZEISS monoculars the TURMON assumes an exceptional position. Just a little larger than a matchbox and weighing but 125 g, it may be taken along on all those excursions where low weight and small dimensions are imperative.

The TURMON, same as all ZEISS binoculars, is easily adaptable to the observer's ocular refraction. Its eyepiece affording an extraordinary range of focal adjustment in the "plus" (+) direction, the 8×21 is readily available as a telescopic magnifier for viewing objects at close range. This feature, which played a part in popularizing the 8×21, is still more accentuated by the possibility of using front attachment lenses producing magnifications up to ×32. The latter facility is of equal benefit to oculists when giving ambulant treatment to patients, as to the patients themselves. The large visible field this model affords remains distinct and well defined from the centre up to the margin, while at the same time a comfortable working distance is preserved when the high powers are added.

When using the TURMON as a telescopic magnifier it should be held in one hand using the fingers of the other hand as a support, as indicated in the illustration. A table-stand for the TURMON is in course of construction.

| Exit pupil | Geometrical luminosity | Visual field angular measure | Diameter of visual field at 1000 m. distance |
|---|---|---|---|
| 2.6 mm. | 6.76 | 6.3° | 110 m. |
| Index of twilight capacity: 168 | | | |



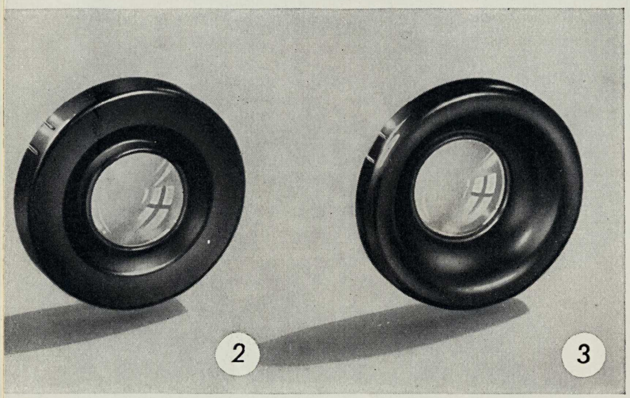


## TELLUP

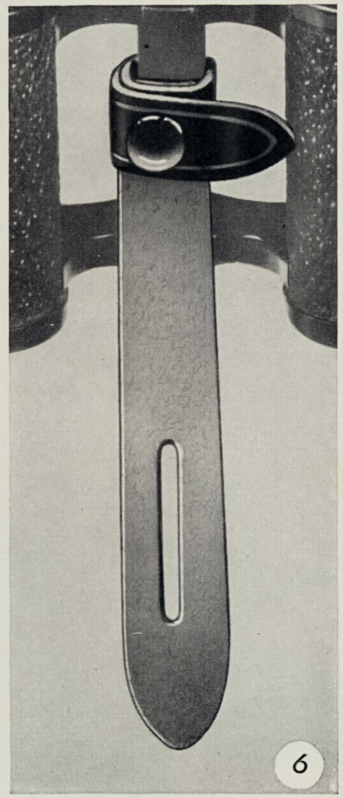
Galilean Pocket

*Type of Telescope* ×**2.5**
*Available as a* ×**6** *Magnifier*

Used as a telescope the Tellup proves very handy to nature lovers and on walking tours. It is equally practical for looking into the distance as for near distance observations. Removed from the body, the object-lens is readily available as a ×6 magnifier. The popularity of the Tellup is attributable to its versatility and low price. It is supplied in a leather or wooden case.




## ACCESSORIES

The following accessories may either be supplied together with the binoculars or subsequently, if so required. In the latter case the series number of the binocular should be stated when ordering such accessories.

### *Rainguards (1)*

protecting eyepieces from rain and dust. On having removed the double buttons by which the shoulder strap is attached to the binocular, both ends of the strap to be threaded through the respective lugs on the body of the binocular and to be buttoned to the buttons on either side of the rainguard. When now suspending the binoculars the rainguard lies closely upon the eyepiece cups and affords an effective protection.

### *Sight-Correcting Lenses (2) (3)*

for spectacle wearers. These lenses make it possible for highly near-sighted and long-sighted users to take off their spectacles when observing. Orders should be accompanied by an oculist's prescription.

### *Eyecups (4) (5)*

For spectacle wearers a shallow type of eyecup will be supplied, if so requested. Attached to the eyepieces these eyecups facilitate observation for spectacle wearers and enable them to enjoy the benefit of utilizing the full size visual field. Lost or broken eyecups of the normal or flat type may be readily replaced.

### *Button Straps (6)*

These straps are very practical for buttoning the binoculars to the observer's clothing. They are a help in protecting the binoculars from damage when making quick movements or when stalking.

### *Yellow Filter Glasses, Umbrals (7) (8)*

are effectively used in glaring light. They increase contrasts and facilitate distinguishing details which otherwise would be absorbed in a flood of excessive light.

### *Sun Glasses (7) (8)*

These are moderating glasses of a dense neutral tint permitting observation of the sun's surface and solar eclipses. They are made in two grades of density.

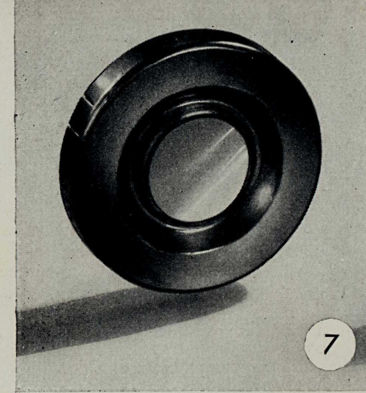
### *Front Attachment Lenses (9)*

for using the binocular as a monocular telescopic magnifier. They attach to the front of the object lens and take the function of a magnifier for observing near objects, thus opening wide avenues for the application of binoculars in scientific and other examinations. The salient features of front attachment lenses are the large working distance they afford and the ease with which they may be interchanged when varying the magnification. For particulars please consult pamphlet "50-041-2" supplied upon request.

### *Stockheads (10) for binoculars*

The stockheads we supply fit the standard pin of any good type of wooden or metal tripod. They grip the binoculars by the hinge and admit of the glasses being freely pointed in all directions and clamped in any desired position.

Tripods prove very useful when using high-power binoculars for extended periods of observation.



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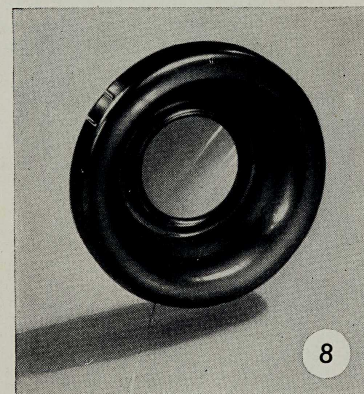

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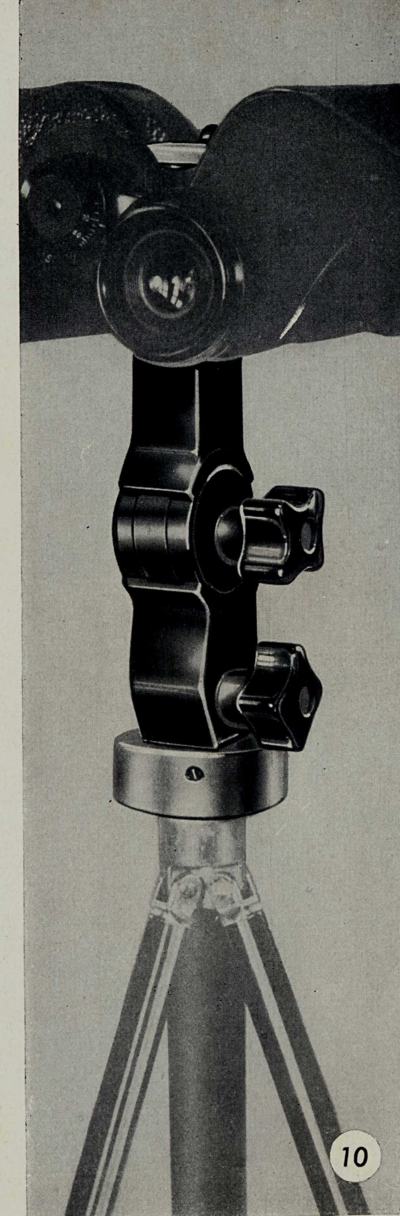

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## CASES

ZEISS binoculars are supplied in leather cases with shoulder straps.

### *Flat leather cases (1)*

for 6×30 and 8×30 models.

### *Stiff upright leather cases (2)*

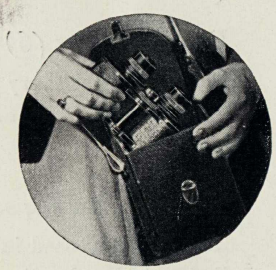
for models 7×50, 10×50 and 15×50 (also for 6×30 and 8×30, if so required).

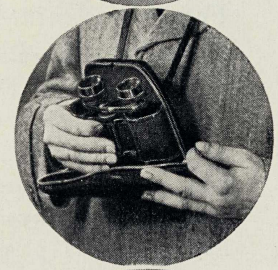
### *Ever-ready cases (3)*

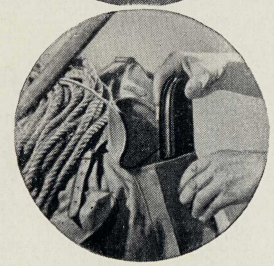
(soft leather with zip-fastener) preferred for their low weight. These cases may be supplied with all prism binoculars if so requested. They are very practical in that the glasses are ready to hand as soon as the zip-fastener is opened. The lanyard for the larger models of binoculars is adjustable and serves at the same time as a shoulder strap for the Ever-ready case.

### *Leather cases for Monoculars (4)*

There are two models, a light-weight one of soft leather with zip-fastener and a stiff case.








ZEISS
Theatis
MB

**THEATIS**

*Magnification* × **3.5**

*Diameter of object lens* **15** *mm.*

Specially designed for theatregoers, the "Theatis" is a convenient and efficient means affording a close-up view of the stage and the actors. Notwithstanding its elegant and dainty form, the glass lacks none of the substantial qualities of ZEISS binoculars and will be a continual source of pleasure to its owner. Its three outstanding characteristics are the large field of vision, excellent optical definition and uniform brightness throughout the field.

Thanks to its small size (3 × 6 × 10 cm.) the "Theatis" may be conveniently carried in the pocket or in a ladies' bag.

CARL ZEISS JENA

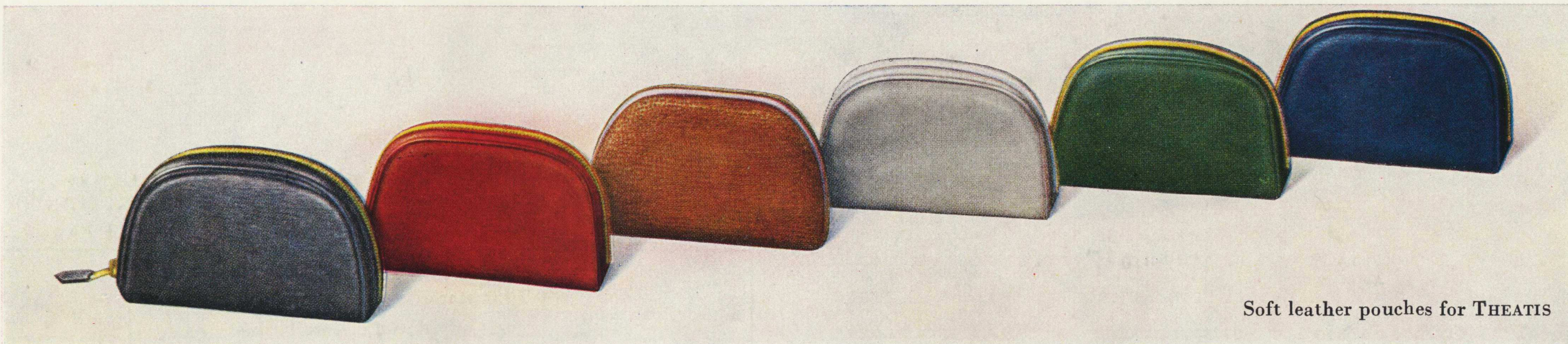
MB

Matching the elegant glasses we supply a variety of soft and stiff leather cases meeting a wide range of requirements. Thus the "THEATIS" proves useful not only in the theatre, but equally well in concert halls as also in vaudeville shows, fashion displays and in indoor sport halls. Yet, in addition to serving recreational purposes these glasses are also of daily help for a number of professional purposes. Students are known to use them in large auditoriums observing surgical operations or physico-chemical experiments, whereas in libraries they are useful in finding volumes situated on high shelves. In short, they will be found of service wherever details are to be discerned be it in museums, exhibitions or picture galleries, etc.

| Designation | Diameter of exit pupil mm. | Geometrical Luminosity | Visual Field angular measure | Visual Field at 100 metres distance m. |
|---|---|---|---|---|
| THEATIS, black<br>THEATIS, silver<br>THEATIS, gold | 4.3 | 18.5 | 11° | 19.2 |

Cases illustrated on page 40 may be obtained in black, grey, green, dark-green, blue, red-brown, and dark-brown. They are available in stiff leather, as soft leather pouches with zip-fastener and as fancy cases with mirror.

Stiff leather cases for THEATIS



Soft leather pouches for THEATIS

Fancy cases with mirror

Special features of our Department for Terrestrial Telescopes:

## RIFLE SIGHT TELESCOPES

ZIELVIER — light-weight    ZIELSECHS — light-weight

Thanks to the anti-reflection treatment applied to the optics, their luminosity has been remarkably increased so that these rifle sights may be used for all branches of hunting.

ZEISS Rifle Sight Telescopes are being exclusively supplied through rifle makers, gunsmiths and arms dealers.

Please ask for special pamphlet.

## OBSERVATION TELESCOPE

Binocular type Observation Telescope with two-component object lens 80 mm. in diameter, 500 mm. focal length and with semi-pancratic oculars.

Magnifications $\times 20$ and $\times 40$.

Prices and delivery terms upon request.

# PRODUCTION PROGRAMME

Microscopes
Projection Microscope "Lanameter"
Photomicrographic Apparatus
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Opto-mechanical Instruments for Measuring and Checking of Lengths, Screw-Threads and Profiles

Instruments for Checking Angles, Angular Divisions, and Alignments
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Double Prismatic Squares
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Theodolites
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Mirror Stereoscope with Tracing Stereometer
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Stereoautograph
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Film Developing Tank

Prism Binoculars
Opera Glasses
Sighting Telescopes
Telescopic Magnifiers

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Transit Instruments
Spectrographs
Coordinate Measuring Apparatus
Blink Comparator
Domes
School and Amateur Telescopes
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Infrared Protective Lenses
Umbra-tinted Sun-Glasses
Aspherical Cataract Lenses
Bifocal Lenses
Contact Lenses
Telescopic Spectacles
Magnifier Spectacles

*Please apply for literature*



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