

# WERRA

SUPPLEMENT TO JENA REVIEW

In many letters addressed to VEB Carl Zeiss JENA professional and amateur photographers using the 35 mm WERRA camera ask time and again for information on the principles applied in the development and construction of the 35 mm camera series WERRA, about the differences in design and the special features of the individual WERRA models, about the WERRA lenses and the production of this 35 mm camera. Greatly impressed by the excellent performance of each of these WERRA models, the owners would like to know more about this type of camera and the reasons for its obvious advantages. In order to answer these questions in a general and expertly competent manner, the following contributions are brought to the knowledge of a wider circle. The leading designers of the WERRA, an executive of the optical department for the design of the WERRA lenses and the head of the respective production shop explain exhaustively the design of this camera type, the special features and differences of its individual models, their optical data and the imaging-performance of the WERRA lenses as well as the course of manufacture of the various models of the WERRA camera. We hope that the WERRA enthusiasts, as well as those interested in it, be it amateur or professional photographers, will thus have a possibility to acquaint themselves and become familiar with the individual models.

Meeting numerous suggestions and wishes of WERRA photographers the Works Management of VEB Carl Zeiss JENA has decided to invite for an INTERNATIONAL PHOTO CONTEST under the heading:

"Photographs taken with the JENA-Zeiss WERRA-Camera" with a great number of prizes and tokens and with the possibility of our purchasing the photographs which have not been awarded a prize. The announcement of this photo contest with the conditions of entry is enclosed as a special sheet to this issue. May the entries prove how excellently the WERRA photographers understand to exploit the outstanding features of this 35 mm camera and its fast lenses.

The great number of letters received from WERRA photographers from all over the world, suggesting this contest, ensures already in advance a wide response.

We hope that this supplement will be of service to photographers. It may furthermore serve as a guide for many an amateur photographer who wishes to acquire a modern and versatile 35 mm camera at a moderate price, to decide upon the WERRA model best suited for his purposes.

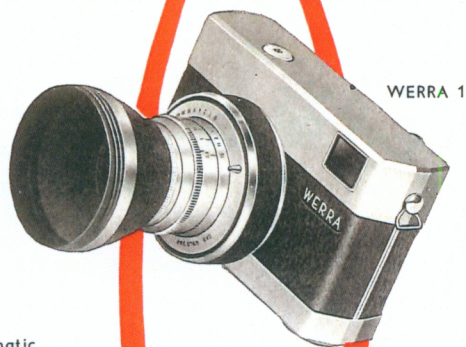
The Editor

Frontispiece: Radiograph of the WERRA-mat; yellow = components of automatic exposure device, red = parts for film transport and shutter winding, blue = lenses and prisms of photolens and rangefinder, green = release button.

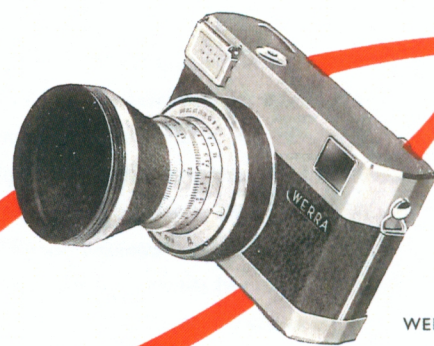
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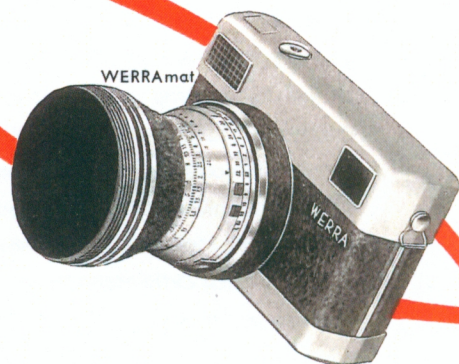
WERRA 1



WERRA 2



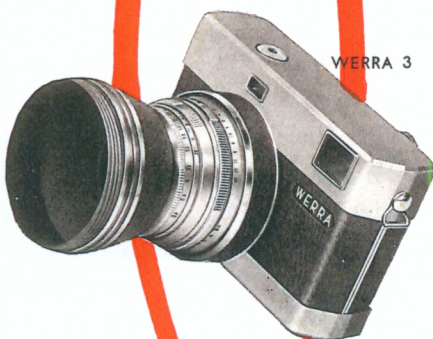
WERRA 4



WERRA 3



WERRA 1



WERRA 2

# WERRA

the modern

amateur 35 mm camera

for exacting demands

**Helmut Scharffenberg and**

**Hermann Friebe**

It is a well known fact that for many decades excellent lenses have left the Zeiss Works in Jena but that the factory has never before manufactured photographic cameras for general photography. At the end of 1953 it was decided to manufacture a miniature type of camera for a 24×36 mm format with central shutter, which was to be marketed by the name of "WERRA".

The design team entrusted with this task had to find new methods to produce a camera meeting all the requirements of the amateur, that would be economic to manufacture and that due to simplicity of operation and other technical features would be so attractive and convincing that it would provide favourable sales arguments and recommend itself. The world renowned Zeiss quality made it imperative to provide an equally good mechanical design and to find the best optical solution for the individual components of the camera. This meant simple and safe operation, high quality photographic lenses and an excellent viewfinder.

A brief glance at the camera products on the world market in 1953 showed that there were already camera shapes with features which had become traditional. The easily visible transport and operating knobs, attachments for viewfinder and other levers, characterised the appearance of almost every type of camera. Did this not make photography appear rather complicated in the eyes of the amateur? Rewinding and transport knobs must not interfere with the appearance of the camera, everything must be inconspicuously provided for. Under the motto "smooth and smart" the first

design was produced. The first model was constructed within a few weeks. Essential features of the present-day WERRA already existed in the design, also the uncluttered external shape. In particular it succeeded in accommodating all operating and indicating devices at the base of the camera. It was probably one of the most ingenious ideas to place the winding ring concentric with the axis of the lens, providing rapid transport of the film and cocking of the shutter at the same time. Soon several production models were available of the second design. Subsequently extensive co-operation with technologists commenced to ensure from the very beginning that the most modern technical ideas were embodied in the design. After hardly a year the WERRA 1, the initial model of the WERRA type series, was exhibited at the 1954 Autumn Fair in Leipzig. Development however did not stop with the first WERRA model. It was an incentive to the designers to develop further the first construction in order to meet the more exacting demands of amateurs with an even increased convenience of operation. Soon designs were prepared for the WERRA with a rangefinder. As soon as preparations had commenced in our factory to produce a manual exposure-meter, new suggestions for a built-in exposure-meter were submitted.

With regard to further development the designers set themselves the task of producing a powerful coupled rangefinder, a top product of its kind, as well as a trouble-free exposure-meter.

Although ideas for further development were manifold a good camera series could only prove success-

ful when a clear aim was set. This aim meant in this instance standardising not only components, but also units. Various parts in the camera body were defined for certain functional purposes and were closely limited with regard to size, for instance, the viewfinder, the rangefinder and the exposure-meter. In the upper part of the camera it was possible to provide from the very beginning sufficient space underneath a covering cap.

It becomes immediately obvious that only by maintaining these resolutions could it be possible to produce within a few years a WERRA series which is economic in manufacture. Without changing the shape of the camera one model followed another, almost naturally, whilst maintaining the basic function. It is almost at any time possible to substitute individual components by better ones. This principle has given good results in recent years. All improvements could, due to the far-reaching typification, be transferred to all other WERRA models.

In addition to the entire outlay of the WERRA series the designers had to put a number of details into reality. For the quality of the camera itself the well known basic requirements are decisive: high-speed lenses with as wide a distance setting range as possible, excellent flatness of the film, a wide range of exposure times, double exposure prevention device and film transport lock, film counting unit, easy rewinding, accurate exposure, taking into consideration the film speeds, sturdy and weather-proof design. The WERRA is a camera which is easy to operate and is also light-weight, which however, had to be designed in such a manner as not to be too light because with too small a weight the feeling of a secure position in the hand is lost when looking for subjects and exposing. Easily and quickly attachable ancillary equipment should widen the range of application: flash, stereo attachment, attachment lenses, filters, lens hoods, interchangeable lenses, cable release, etc. By easy connection of two WERRA models it is possible under the same operating conditions – a very important factor – to use in one camera a colour film and in the other a black-and-white film. This meets the requirements

of a two-film camera which can be selected from the WERRA series according to one's own wishes, e. g. WERRA 1 and WERRAmatic or WERRA 3 and WERRA 4, etc.

It is matter of course that when realising all these requirements numerous standards and international specifications had to be taken into consideration to permit and ensure from the very beginning sales all over the world.

Continuous rational operation was taken into consideration in designing every single detail, in close co-operation with technologists. Components of simple appearance and reliable function permit the use of simple devices and tools. Under the heading: non-cutting shaping, pressing, drawing, stamping, automatic parts, pressure-cast parts, use of plastic parts, each WERRA component was thoroughly discussed. The tolerances required in the manufacture of components were clearly determined to ensure complete functioning after assembly without subsequent working. Testing methods were designed in good time in order to permit not only the finished product to be tested after acceptance and according to the inspection regulations, but also to eliminate immediately during intermediate inspection, any errors which might possibly infiltrate. Working tests of cameras taken at random from production are carried out continuously under various climatic conditions, as well as inspection of their "light-tightness". The provision to rationalise manufacture and to standardise facilitated the development of the WERRA series to a considerable extent and even permits the manufacture of models which will perhaps only be required in small numbers.

The clearly arranged design of all models of this series basing on the original model makes it possible to explain them clearly. Simple shape, easy operation and clearly arranged design facilitate publicity. This acquaints the public more quickly with the camera and facilitates the selection of any particular model. The designers of the WERRA thought immediately of all requirements and wishes which amateur photographers have for an efficient and economic miniature camera.



# WERRA 1

The data of the **WERRA 1** (Fig. 1) and the basic characteristics are incorporated in all other WERRA models, which merely differ in respect of their greater operating comfort. All specifications refer to the most recent stage of development. Where necessary the former position is briefly indicated. It will be seen that even with the WERRA 1 not only high quality technical characteristics were taken into consideration, but all convenience as well, which is of interest to a versatile amateur photographer.

**APPEARANCE AND SHAPE:** Starting with the basic idea that simple shapes lead to simple and economic manufacture, the well known attractive appearance of the WERRA was designed in co-operation with institutes for industrial design. Projecting operating knobs were carefully avoided.

The proportions of the dimensions conform to the classical "Golden Section" (Fig. 2). Camera body with lens, central shutter, cocking ring and top

cover form one unit, the removable back with lower cover, the other (Figs. 8 and 9). On the upper cover there is only the release allowing connection of the cable release, as well as an entrance and exit aperture for the viewfinder (Fig. 3b to a). On the lower part of the camera all operating buttons and indicating devices are clearly arranged, such as the film-counting disc, rewind device and locks for both halves of the camera. This lock is arranged to occupy minimum space concentric with the camera thread for the tripod (Fig. 3a).

**WEIGHT AND OPERATION:** The WERRA 1 weighs 500 grams and thus fulfils the demands for a light-weight camera. Nothing is more characteristic for easy handling of the WERRA than the fact that the release knob, as the sole operating element on the top of the camera, can be found easily without even glancing at it and that with the winding ring the demand for safe, quick winding has been solved in an attractive and technically elegant manner.

**LENS:** The WERRA 1 has a highly efficient non-interchangeable and antireflection-coated lens, viz., the world-famous new Tessar f/2.8, 50 mm, a four-element asymmetrical lens system. The diaphragm is accommodated between the two separated front lenses and the cemented rear elements. All advantages of this lens and also the better resolving power in the outer parts of the image field can however only be fully utilised if the lens is in perfect position relative to the surface of the film. The distance setting on the lens extends down to 0.9 m. This distance is calculated from the object to the film plane, which in all WERRA models is 5 mm. from the back. In the usual manner the lens system is provided with a depth of focus scale. The diaphragm can be easily set from 2.8 to 22 on the front of the lens. The thread M 30×0.5 serves for attaching the lens hood, filters or attachment lenses (Figs. 3a and 3d).

**CENTRAL SHUTTER :** Behind the lens there is a high quality central shutter: the Prestor 00. This shutter, with exposure times from 1 sec. to  $\frac{1}{750}$  sec. and "B" is a rotary blade shutter of excellent efficiency, manufactured by VEB Kamera- und Kinowerke Dresden. With the extremely short exposure time of  $\frac{1}{750}$  sec. the WERRA is also the ideal camera for shooting rapidly-moving objects. The shutter has a delayed action device and the possibility of synchronising for flash with electronic flash equipment and flash bulbs, for which purpose the X or M contact setting on the base of the camera is provided.

**PLANE POSITION OF FILM AND CAMERA ADJUSTMENT:** The full utilisation of the lens qualities are only ensured if the position of the lens relative to the surface of the film is perfectly adjusted. Special attention is therefore paid to maintaining this position of the lens relative to the film; this is supervised during manufacture with very accurate mechanical and optical testing methods and is put into effect with the maximum accuracy. In order for the film to be in the best possible plane position, the contact plate is very accurately ground (Fig. 9). During the film transport the outer part of the film slides along the film guiding ledges, accommodated next to the gate. These film guiding ledges have small inclined bridges which exert a lateral tension on the film during transport (Fig. 8). This ensures optimum utilisation of the optical qualities of the lens. The strong pressure cast casing ensures perfect adjustment even in changing climates and over a wide temperature range.

**MECHANICAL UNIT:** The cocking ring which is provided with a rubber coating and can be turned concentrically around the shutter, drives by extremely simple components such as pin, gear rack and

Fig. 1: WERRA 1, protective lens cap used as lens hood

Fig. 2: Proportions of the Golden Section, a) WERRA 1, b) WERRA 2, c) WERRA 3, d) WERRA 4, e) WERRamat, f) WERRAmatic, g) Twin-WERRA

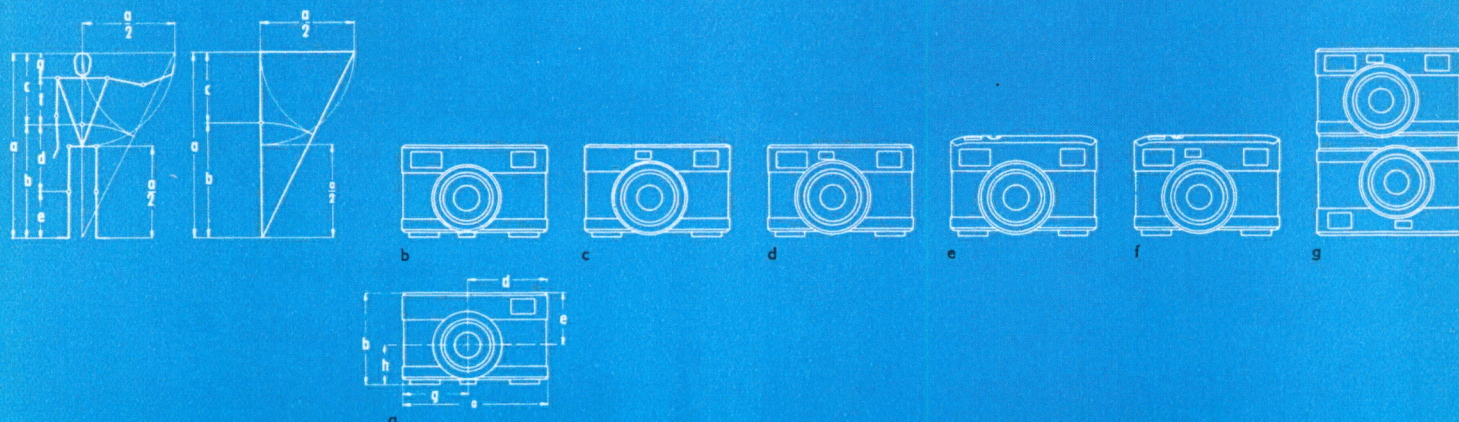




Fig. 3: Views of the WERRA, a) view from below, b) rear view, c) front view, d) view from above

Fig. 4: The reflex-frame finder

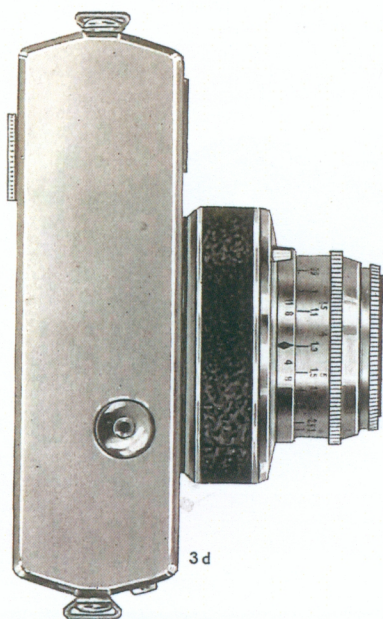
Fig. 5: Schematic representation of the film-feeding mechanism

gear wheels, the film transport roller and the winding spool, cocking at the same time the shutter and controlling the frame counter (Fig. 5). The WERRA has the locking devices usual with a good camera to prevent double or no exposure. The winding-ring which can be rotated through  $60^\circ$  in a clockwise sense represents a very elegant solution for being ready to shoot quickly; this differs very pleasantly from winding levers of other cameras which are frequently cumbersome to use. A radio-graph shows most clearly the simplicity of the mechanical construction.

**VIEWFINDER:** The new bright large-image prismatic viewfinder with the large field of view in which the image area for the exposure is clearly visible is an optical marvel (Fig. 4). Parallax marks for distances of less than 1.7 m are provided (Fig. 14). It should be mentioned that with this viewfinder it is possible to provide individual adaptation for myopic eyes by setting the eyepiece lens over a range of  $\pm 2$  diopters. As the exit pupil is approx. 12 mm behind

the eyepiece, even people wearing spectacles can see the entire image field without any effort. The new viewfinder is at the same time a component of the optical rangefinder of the other WERRA models with interchangeable lenses (Fig. 10). The technically mature design permits economic manufacture of the viewfinder which is basically designed as a high quality telescope with roof edge prism. (With the models supplied so far simpler viewfinders were also used, amongst them one with a bright frame according to the well known Albada principle).

**LENS HOOD, LENS COVER AND FILTER:** Of extremely simple shape the lens hood simultaneously becomes a protective cover for the lens (Fig. 6). The lens hood can either be screwed into the winding ring or be used as lens hood proper on screwing it into the M 30.5  $\times$  0.5 thread on the front of the lens (Fig. 1). It is always recommended to take photographs with the lens hood, as according to experience the brilliancy of the image is thereby increased. Between the lens and the lens hood any of the filters supplied with the camera can be screwed in. To save the worry of accommodating the most frequently used filter, the green filter, for example, can be left on the lens hood. During transport the filter is screwed in between the lens hood and the covering cap, so that with this design of lens hood the filter is also



protected against damage. The lens hood is made of impact-proof polystyrene so that damage or deformation of the screwing thread is eliminated.

**THE WERRA AS RAPID SHOOTING CAMERA:** Cameras have been known for a long time where two or three adjustments have to be set. These settings are selected in such a way that under average exposure conditions no changes of diaphragm, exposure time and distance have to be carried out to obtain satisfactory exposures on black-and-white film. For this purpose three figures on the scales of the WERRA are marked red, i. e. 6 m distance, diaphragm 8 and  $\frac{1}{60}$  sec. shutter speed. Having set these values the lens hood can be screwed as protection in front of the lens. The front cover is removed and it is possible to photograph immediately as with a box camera in case of suddenly occurring situations (Fig. 7). Furthermore it is possible to operate the rapid winding ring without changing the settings on the lens.

**INSERTING AND TAKING OUT FILMS:** All film materials manufactured at home and abroad, as long as they are packed in miniature cartridges, can be inserted into the camera according to the Directions for Use. Just as quickly as the film transport can be effected with the winding ring, it is also possible to rewind the exposed film into the cartridge. For this purpose

a rewind handle is fixed at the bottom of the camera, an improvement of the rewind knob of previous models (Fig. 11).

**UNIVERSAL TRIPOD SCREW:** Tripods sometimes have a  $\frac{3}{8}$ " thread, sometimes the  $\frac{1}{4}$ " thread usual in English speaking countries. With the universal tripod screw both threads can be used. The universal tripod screw has furthermore the M 30.5×0.5 thread on to which filters and lens hood protective covers can be screwed so that important ancillary equipment is always at the camera and does not have to be carried separately in the pocket.

Captions for pages 10 and 11

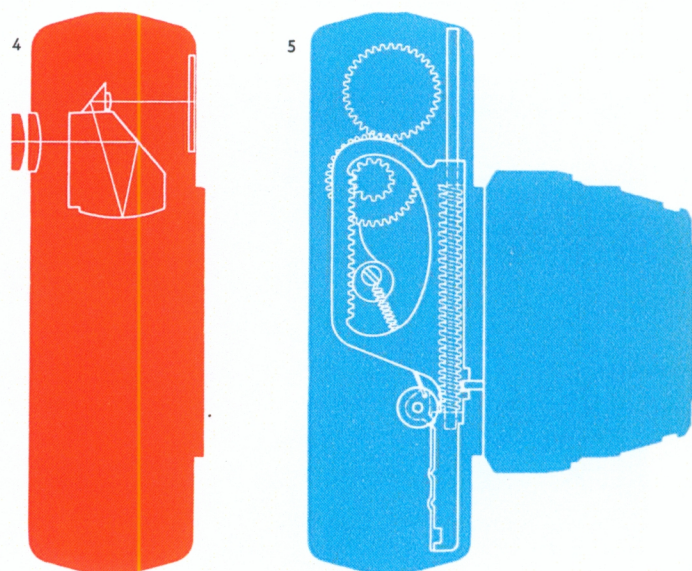
Fig. 6: WERRA 1 with protective lens cap

Fig. 7: WERRA 1 with the protective lens cap guarding the fixed-focus setting

Fig. 8: Camera-back detached, film gate and feed spools. Fig. 9: Camera-back of the WERRA 1

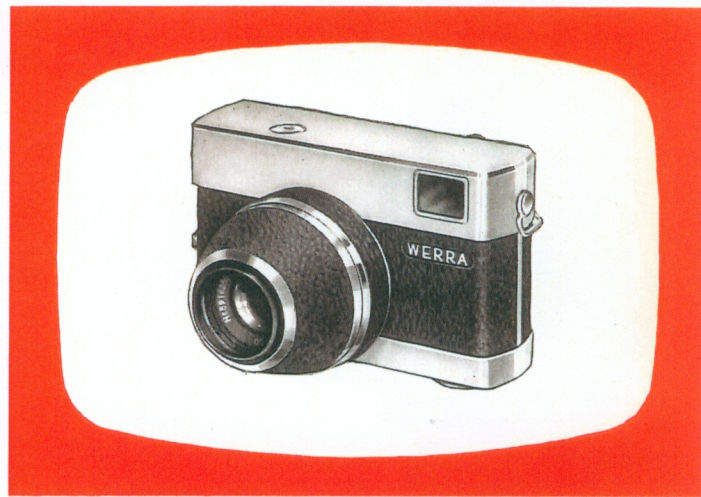
Fig. 10: Sub-assembly unit reflex-frame finder, a) WERRA 1 and 2, view from above, b) WERRA 3 and 4, view from above, c) WERRA 3 and 4, view from below, d) WERRA mat, view from above, e) WERRA mat, view from below, f) WERRA mat, view from below, g) WERRA mat, view from below

Fig. 11: WERRA 1 with rewinding crank swung out

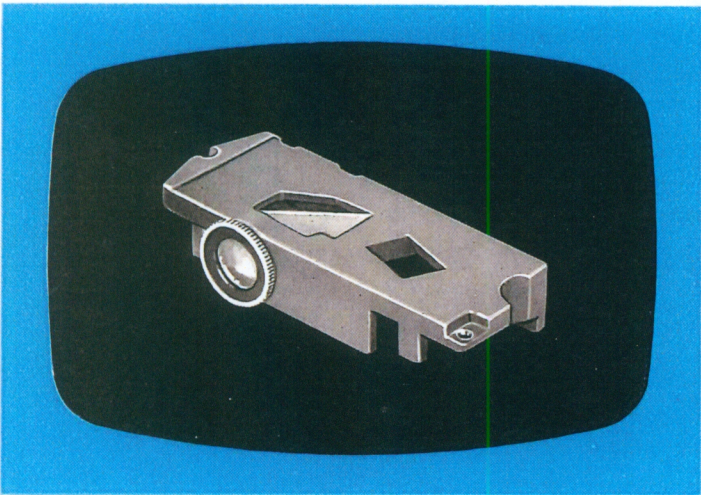




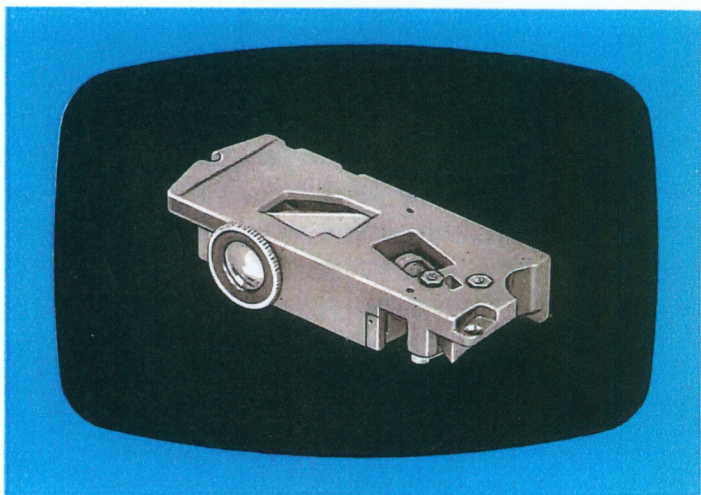
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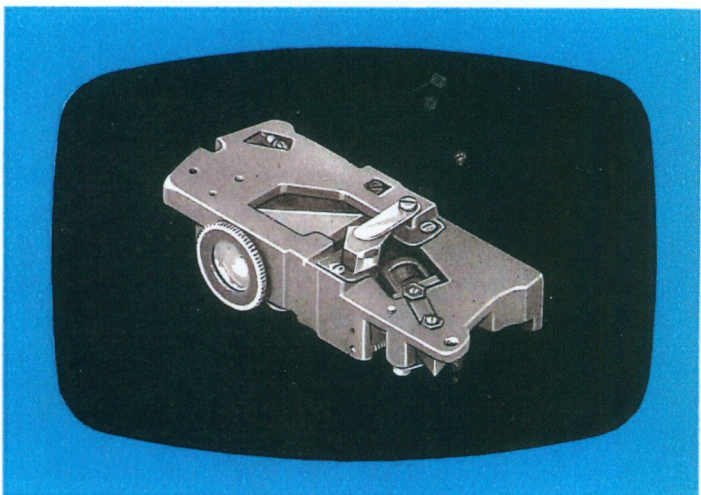
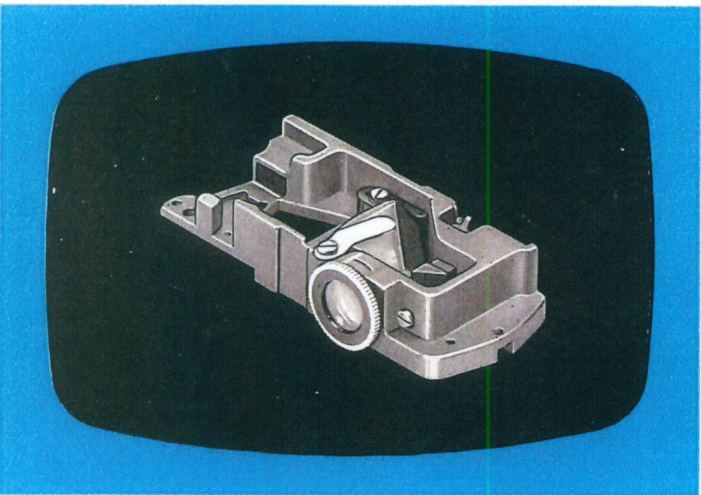
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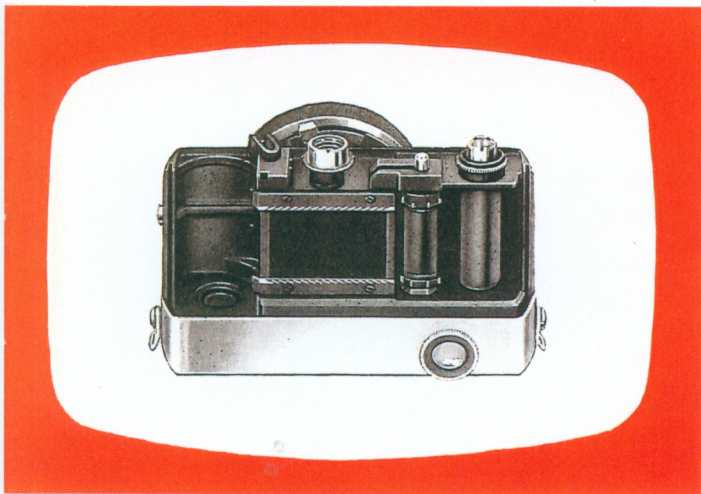


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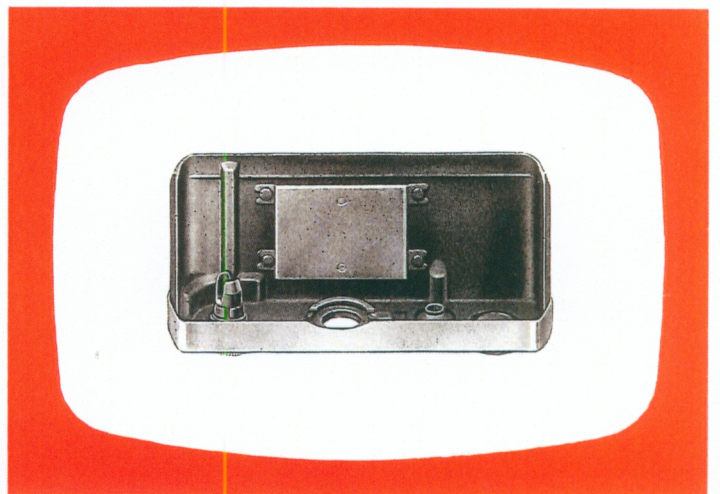
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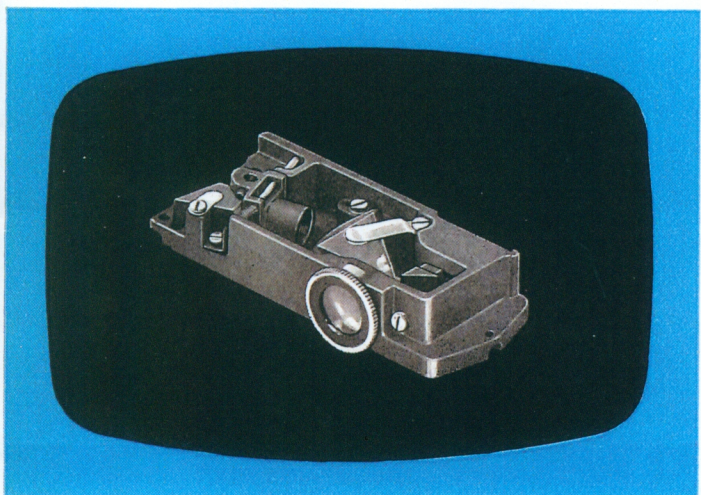




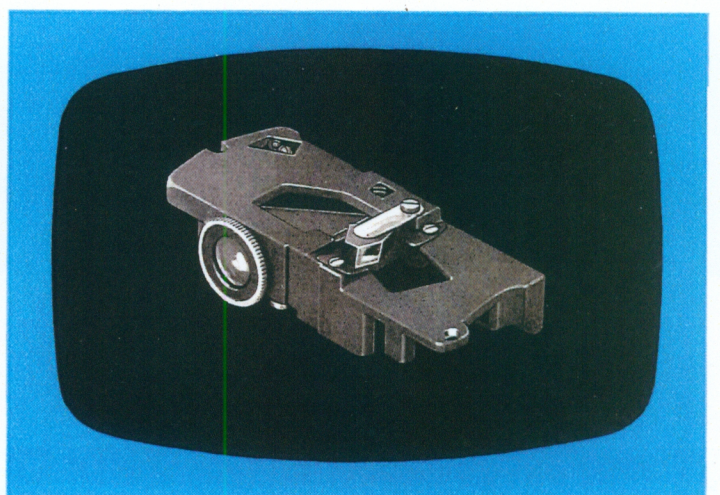
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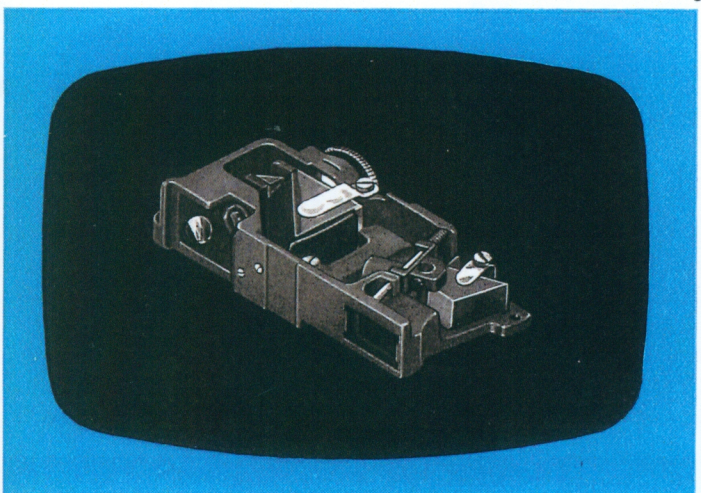
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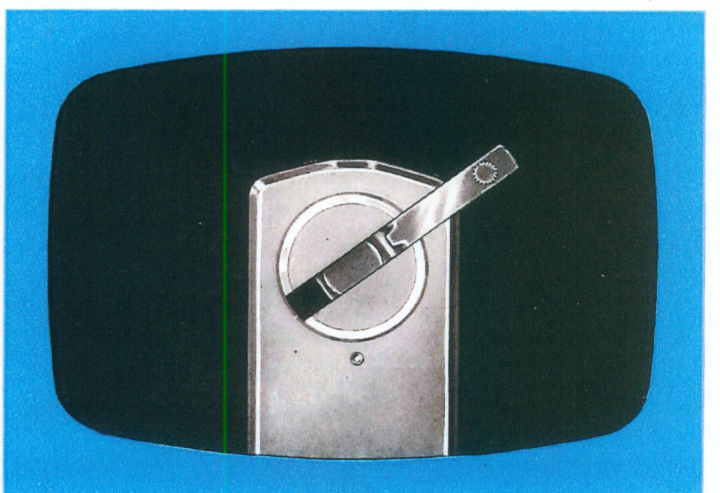
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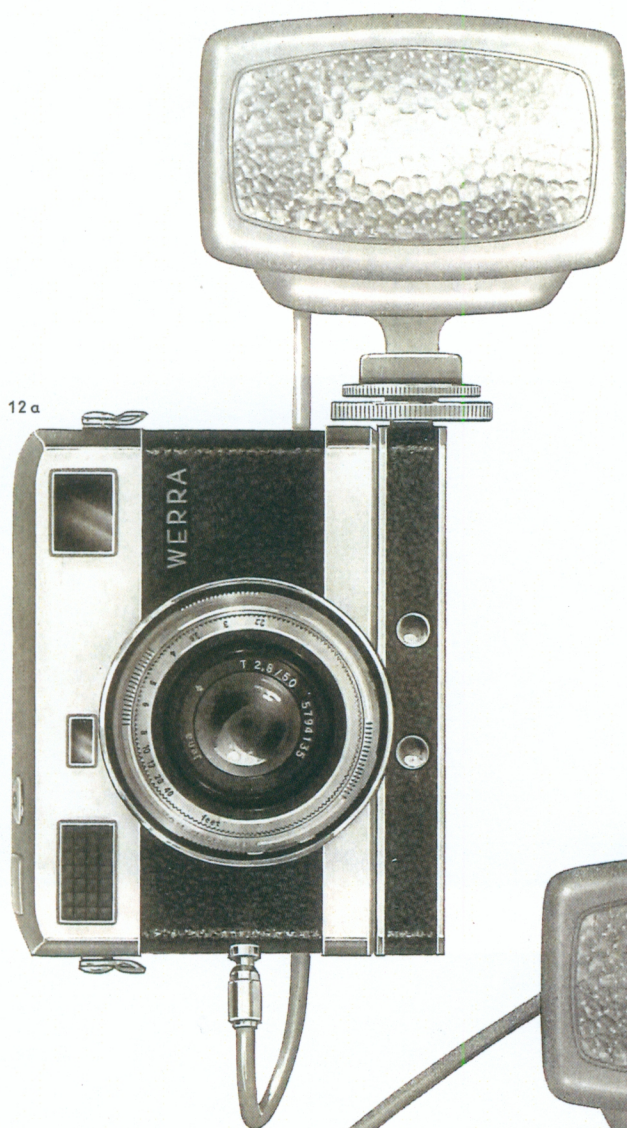


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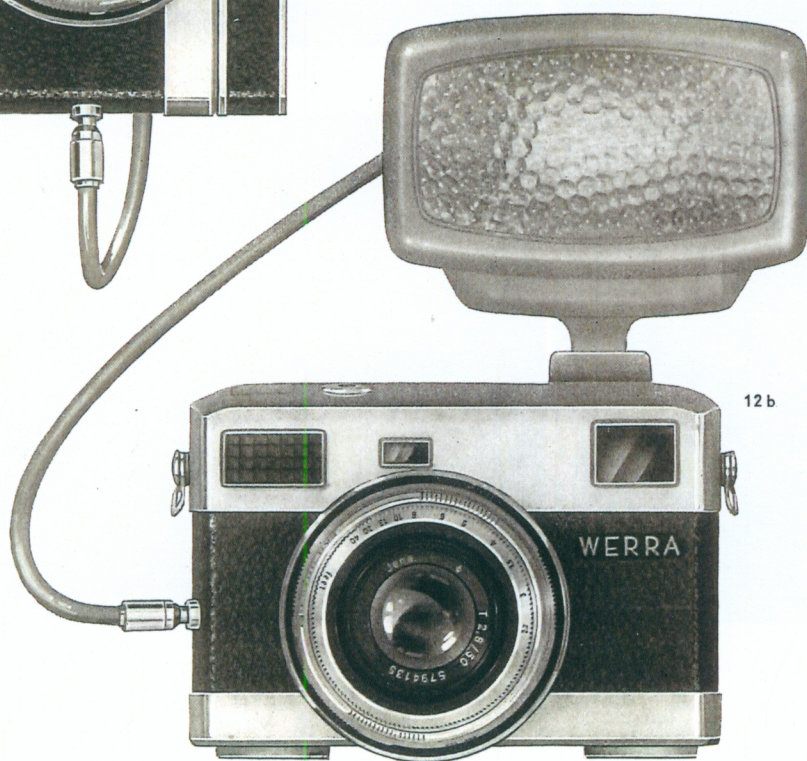
12 a



# WERRA

Accessories

12 b



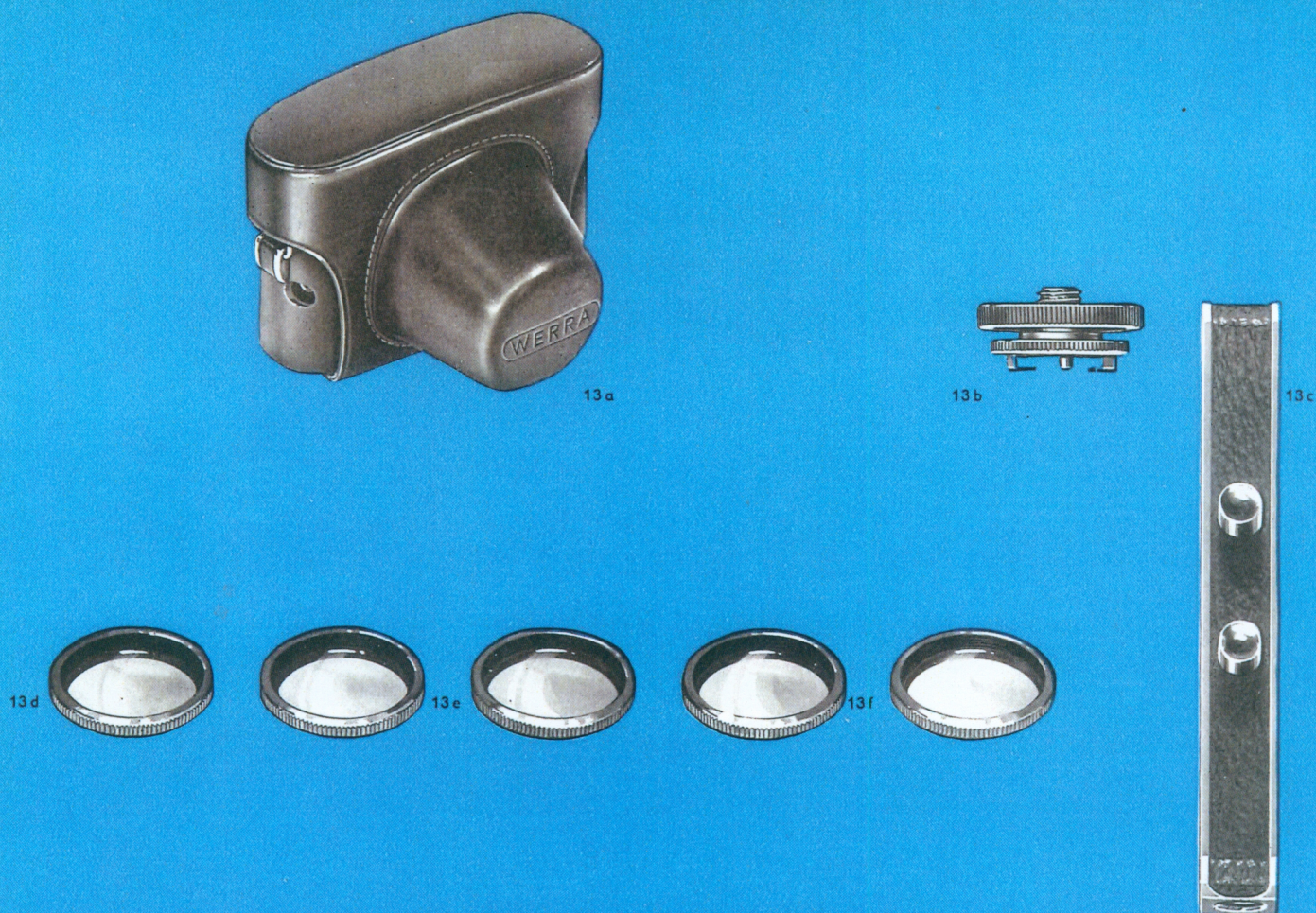


Fig. 12: WERRA with flash gun, a) attached to the link of the Twin-WERRA, b) to the accessory-shoe  
 Fig. 13: WERRA-accessories a) leather case, b) adaptor-piece with accessory-shoe, c) link for the Twin-WERRA d) filters, e) conversion filters, f) attachment lenses

#### ATTACHMENT LENSES, FILTERS AND CONVERSION FILTERS:

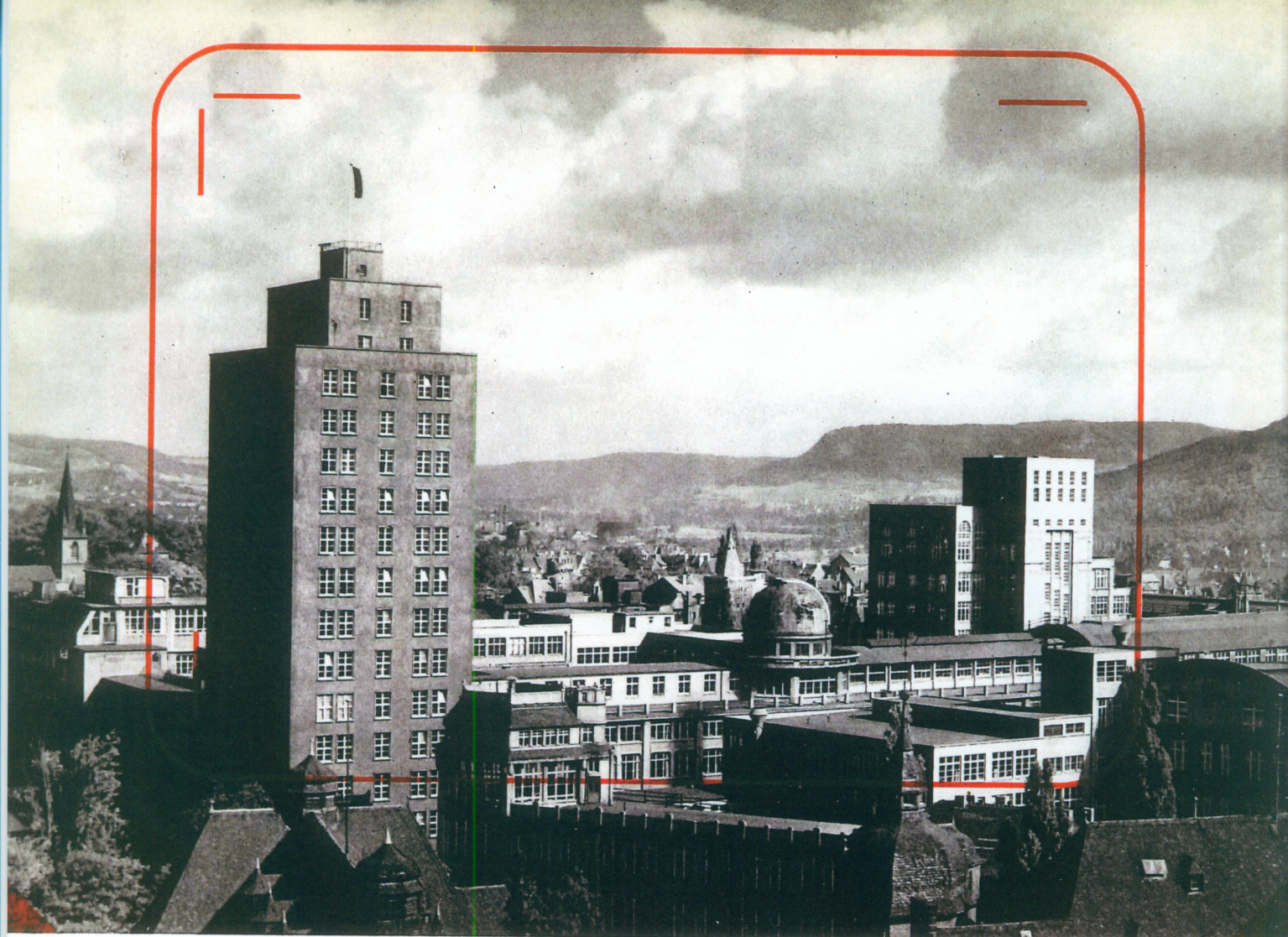
A wide range of filters is available for the WERRA for black-and-white photography; yellow-green, orange, red and ultra-violet absorbing filters (Fig. 13d).

For colour photography three types of conversion filters can be used. With a bluish filter the daylight reversal colour film is adapted to conditions of artificial light. A reddish filter should be used for

artificial light reversal colour film when wishing to take photographs in daylight. For the very frequent case when at noon the blue sky has a particular effect, it is recommended to prevent a blue tinge by using a slightly reddish-brown filter for colour photographs on daylight reversal film (Fig. 13c).

Attachment lenses of 1.25 and 2.5 diopters increase the setting range of the WERRA from 0.8 to 0.4 or from 0.4 to 0.3 m. If both attachment lenses are available the camera has a continuous setting range from 0.25 m to infinity (Fig. 13f).

FLASH LIGHT TECHNIQUE: Into the tripod thread a connecting piece with plug can be screwed, on which the flash light can be fixed (Fig. 13b). If the connecting piece for the double WERRA is available the intermediate piece with plugs can also be fixed



there, so that the flash light is at the side of the camera (Fig. 12a). Naturally any required bars can also be fixed on the tripod thread by inter-connecting a flash apparatus with connecting piece. For fixing flash lights on top of the WERRA a special device is provided which is fixed above the viewfinder (Fig. 12b).

**EVER-READY CASES:** Although the camera with its vulcanised grained coating on the camera body and winding ring has a resistant weather-proof cover, which has been adapted from binoculars on the basis of wide experience, leather cases for the camera with carrier straps or containers of soft leather with two zip fasteners can be obtained (Fig. 13a). It is of course also possible to carry the camera without ever-ready case on the camera

strap supplied, fixed on the lugs provided. This carrier strap is in two parts and can, after unbuttoning one part, be used for carrying over the arm.

## WERRA 2

All features of the WERRA 1 are found in the WERRA 2 (Fig. 15). From the consideration that a built-in exposure-meter increases the readiness to take a photograph, the second WERRA model was produced in 1957. The exposure-meter which is enclosed as a unit by itself is on the right side of the camera. This is manufactured by the VEB Fein-gerätewerk Weimar, a factory with great experience in the manufacture of exposure-meters. The measuring unit with the Zeiss photoelectric cell is accommodated in a small plastic casing (Fig. 16). It is a



# WERRA 2

two-range exposure-meter non-sensitive to temperature, the photoelectric cell of which is behind the flap. The indicated value – figure values between 1 and 7 – are read through an aperture on the top of the cover (Fig. 18). The robust but sensitive core magnet measuring unit permits measurements up to 6 lux. With the flap closed the light is incident through 8 small holes on to the photoelectric cell

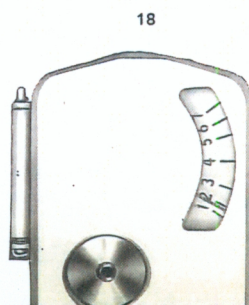
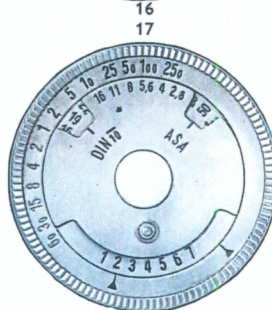
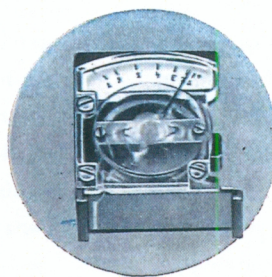
Fig. 14: A scenery as seen through the finder of WERRA 1 or 2

Fig. 15: WERRA 2, protective lens cap used as lens hood

Fig. 16: The building-in exposuremeter for WERRA 2

Fig. 17: The "ready reckoner" of the WERRA 2

Fig. 18: The scale of the WERRA 2 exposure-meter





# WERRA 3

giving a measuring range for high object brightness, at which the majority of exposures are probably made. The incident angle is approx.  $42^\circ$  corresponding to the image angle of the built-in Tessar f/2.8, 50 mm. An integral part of the exposure-meter is the calculating aid which, contrary to the hitherto usual arrangement on top of the camera, is affixed at the back of the WERRA (Fig. 17). This arrangement has the advantage that settings of the calculating aid can be easily made using both thumbs without essentially changing from the normal position for exposing. After transferring the figure read on the exposure-meter, the result of the calculation is set on the shutter and the lens. The exposure-meter is carefully checked with special light-testing instruments.

## WERRA 3

The most important mechanical functions of the film transport are incorporated in the WERRA 3 (Fig. 19).

To improve the convenience of operation and widen the field of application the WERRA 3 has the following special features compared to the WERRA 1:

The range of application is extended by interchangeable lenses and the convenience of operation is improved by positive setting of the correct distance by means of a high-quality coupled rangefinder. As interchangeable lens of the basic equipment, the well-known Tessar f/2.8, 50 mm is used again with a distance setting range from infinity to 0.8 m. The lens is fixed on the camera by bayonet fitting and held securely with a rotatable clamping ring. After attaching, coupling with the rangefinder is automatic. The diaphragm is adjusted by turning the diaphragm ring. The basic lens can be interchanged for a wide-angle lens, the Flektogon f/2.8, 35 mm or a tele-lens, the Cardinar f/4, 100 mm (these lenses are discussed separately in this issue). Special filters are available for these lenses with a M 58×0.75 lens thread and an intermediate

M 49/M 48 W ring. For quick and accurate focusing with all lenses as well as for accurate determination of the field limits serves the split-image rangefinder which is based on modern principles (Fig. 20). It has already been stated above that a bright large-image viewfinder is used in the WERRA. This viewfinder consists of a built-in lens and an eyepiece allowing adjustment for people with faulty vision over a range of  $\pm 2$  diopters. To produce an erect image prisms are arranged between these lenses. Special value has been attached in design to the brightness and brilliance of the viewfinder image. The black image field boundaries for the individual interchangeable lens are not reflected by an auxiliary ray path resulting in light losses, but instead are clearly outlined under all light conditions in the field of view of the telescopic viewfinder, as they are directly in the path of the rays proper. In the centre of this large-image prismatic viewfinder there is a small measuring field to which the image area is led via the ray path of the rangefinder with a base of 58 mm. On focusing, using the photographic lens, the measuring image is allowed to pass along the window until it fits completely in the viewfinder image. The WERRA thus possesses a symmetrical rangefinder based on the principle of the split-image field.

The clear contours of this split-image field in place of the usual mixed images ensure greater safety in setting and increase the measuring accuracy. This

results from the property of the human eye of differentiating in mixed image setting details which subtend an angle of  $1'$ , while recognising the continuation of a contour even at a deviation of  $10''$  in split-image setting.

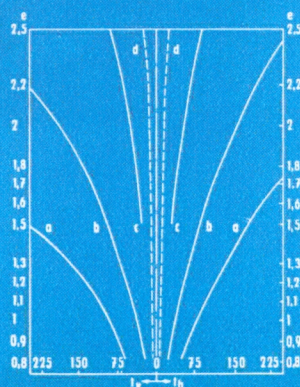
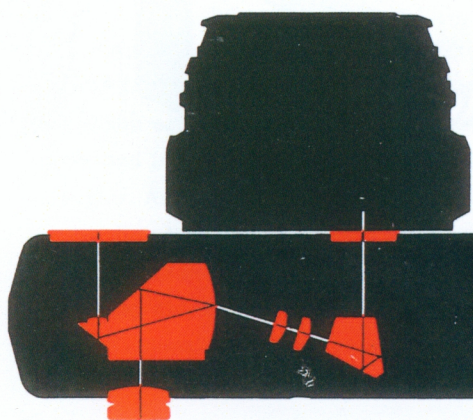
The symmetrical design of the rangefinder of the WERRA is also important for the setting accuracy. With asymmetrically built rangefinders a difference in magnification occurs between the viewfinder and the measuring image. This difference results in different settings at measurements in the centre compared to measurements at the edge of the measuring field. The WERRA rangefinder therefore provides a correct distance setting irrespective of whether set to the centre or the edge of the measuring field.

Fig. 21 illustrates the extremely high setting accuracy of the WERRA rangefinder as compared to the depth of focus of its interchangeable lenses. (In the figure,  $t_v$  and  $t_h$  characterise the front and rear divisions

Fig. 19: WERRA 3, protective lens cap used as lens hood

Fig. 20: Schematic representation of the WERRA 3 rangefinder

Fig. 21: Diagram illustrating the accuracy of the rangefinder: a) lens F 2.8/35 mm, aperture value 2.8 b) standard lens, aperture value 2.8 c) lens F 4/100 mm, aperture value 3.5 mm, d) measuring accuracy of  $30''$  e) distance



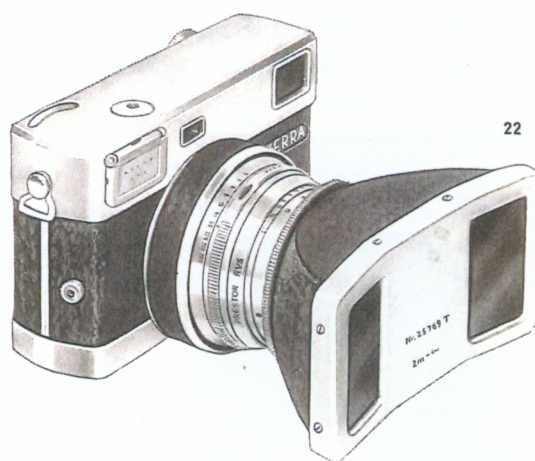
of the depth of focus range respectively. To calculate the setting accuracy a parallax angle of 30" was taken as basis. A tolerance of 10" was therefore estimated compared to the above mentioned value). The WERRA rangefinder permits quick and sharp setting even at a minimum brightness of the subject, especially when photographing with flashlight and at home. Special viewfinders can be dispensed with by the owner of a WERRA rangefinder as the image boundaries for the three interchangeable lenses are marked in the viewfinder image field. The lines appearing within the three fields of view are parallax marks for close distances.

It need not be mentioned specially that the built-in and coupled rangefinder with all its components has been designed in such a manner that the measured value is independent of temperature. Furthermore the rangefinder is shock-proof.

As a further convenience in operation the time/diaphragm coupling has been introduced. After having determined the light values by means of the manual exposure-meter, it is possible after depressing the knob on the diaphragm ring to turn the diaphragm ring until the determined exposure and diaphragm figures are opposite each other. After releasing the knob the exposure and diaphragm rings are coupled. By simultaneous turning of both rings the most favourable coupling of exposure time and diaphragm can be set whilst maintaining the light value, when rapidly moving objects necessitate a change in exposure time or the need for a large depth of focus requires a change in the diaphragm setting.

It is usual to set the film speeds of the inserted film on the film marking discs. Visible and adjustable from the base of the camera there is concentric with the diaphragm and exposure setting rings a small lever which can be set on the DIN or ASA figure of the inserted film material. It must not be forgotten to mention that for enthusiasts of stereo-photography the basic lens Tessar f/2.8, 50 mm can be used in conjunction with the Zeiss Stereo Attachment (Fig. 22). The Zeiss stereo system divides the miniature format 24×36 into two stereo halves of upright size.

# WERRA 4



22

23





#### WERRA 4

This WERRA model (Fig. 24) has all the features of the WERRA 1 to 3. The new feature of this model is a built-in but not coupled exposure-meter with two measuring ranges. It is on the right-hand side of the camera and is the same exposuremeter with the same measuring unit as that on the WERRA 2. With the WERRA 4 it should be possible to obtain in addition to the coupled rangefinder a further simplification and improvement, even in setting the exposure data. As the setting of the exposure times and the aperture is right next to the shutter and the lens it was obvious to use these scales simultaneously as a calculating aid, especially as they are scales with linear divisions. The film speed is set as on the WERRA 3 on the base of the scale rings. With this

setting two small coloured indices (black and green) are shifted simultaneously between the rows of the exposure times and diaphragm values. According to which measuring range is used, either one or the other index is set opposite the diaphragm figure, which the indicator of the measuring unit shows in the exposure measurement. Due to the fact that in the exposure-meter the diaphragm values 2.8 to 22 are used, it is possible to dispense with the otherwise usual series of exposure values – light values – (Figs. 23 and 24). As the scales provided are used

Fig. 22: WERRA 4 with Stereo-Attachment

Fig. 23: The scale of the WERRA 4 exposure-meter

Fig. 24: WERRA 4, protective lens cap used as lens hood

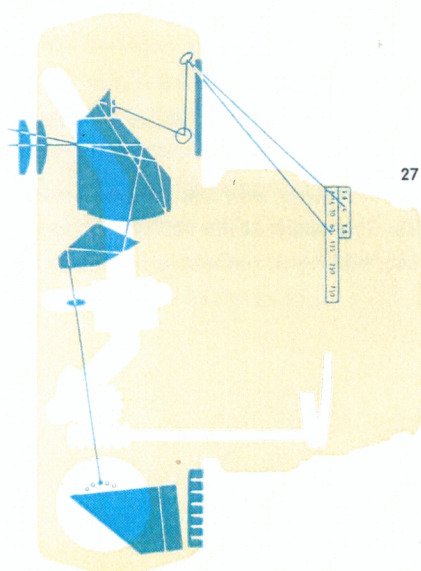


25

# WERRA<sup>mat</sup>



26



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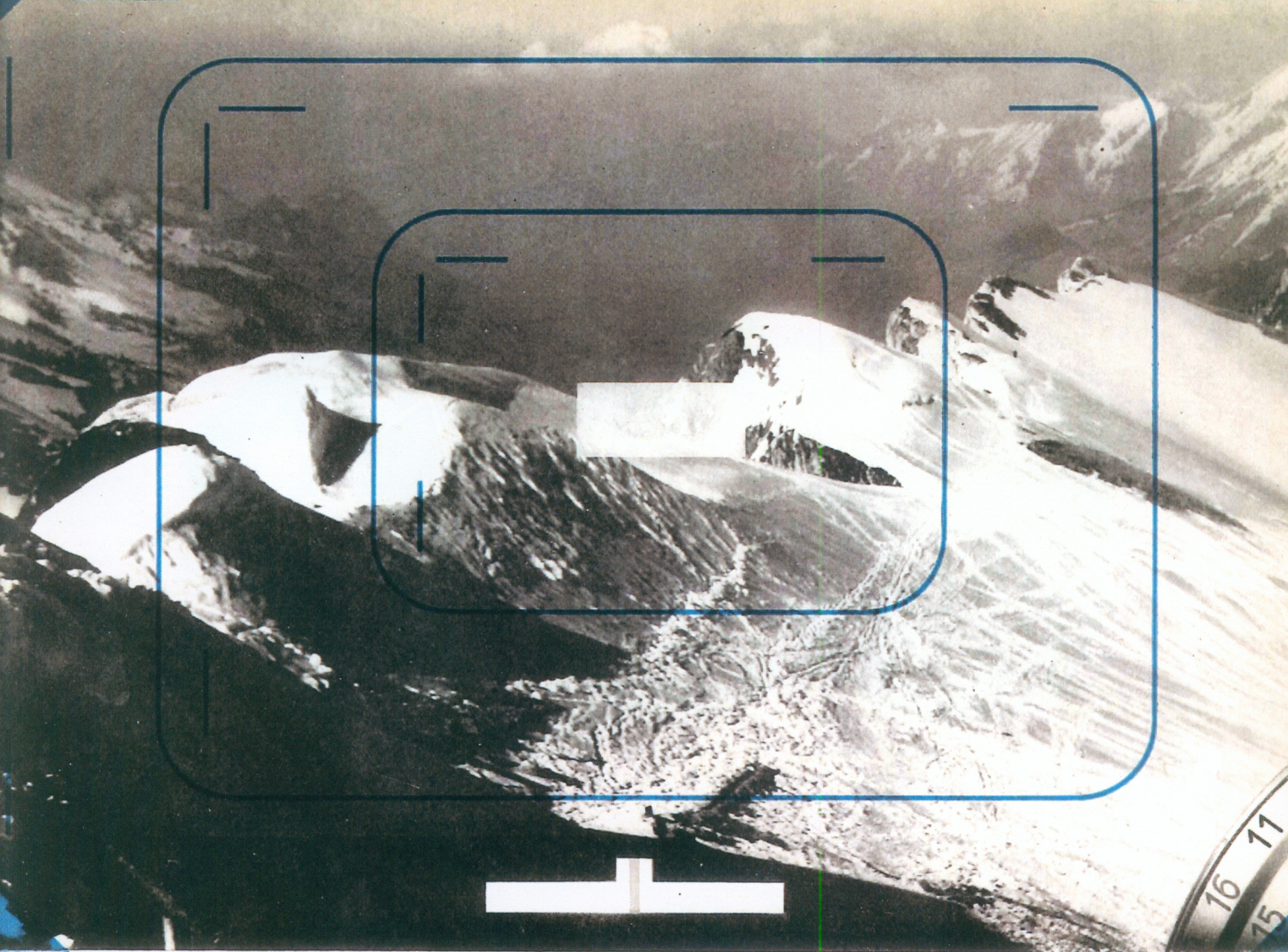
anyhow for setting, they result, after transferring from the exposure-meter, immediately and automatically in the correct exposure value setting on the camera. This exposure-meter is also carefully checked with light testing instruments.

In the well-known manner it is then possible to set simultaneously diaphragm and exposure time which are coupled together, as described already in the case of the WERRA 3.

Stereo exposures with the Zeiss Stereo Attachment are possible as with the WERRA 3 (Fig. 22).

## WERRA<sup>mat</sup>

It is natural that this WERRA model brought out in 1961 (Fig. 25) incorporates all the essential features of the WERRA 1. Compared to the WERRA 2 with



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built-in exposure-meter, the WERRamat is a further development in the direction of automation. The non-coupled exposure-meter of the WERRA 4 was replaced by an exposure-meter, the indication of which is seen in the field of view of the large-image prismatic viewfinder (Fig. 28, bottom centre). In order to obtain the optical imaging of the indicator of the measuring unit the upper cap was slightly curved. The measuring unit is the same as that of the WERRA 2 and 4. The exposure measuring system is temperature-compensated. The linear scales around the lens (Fig. 26) and the film speed which can also be set there are connected via an additive gear to a single-range exposure-meter (Fig. 27). All that has to be done is to turn the diaphragm ring until the indicator of the exposure-meter appears

at the correct setting in the field of the viewfinder (Fig. 28, bottom centre). This meets the requirements for certain and rapid exposure-settings, voiced by a large circle of amateurs who are increasingly turning to colour photography. The exposure indication in the viewfinder alone would however not be perfect if the user had to take the camera away from his eye to see the exposure value he has set in order to read as usual the diaphragm and exposure time values. Therefore the WERRamat has,

Fig. 25: WERRamat

Fig. 26: Lens with scales for the WERRamat

Fig. 27: Schematic representation of the WERRamat

Fig. 28: A scenery as seen through the WERRamatic-viewfinder



at the bottom right corner of the image field of the finder, scales with the set exposure data, which are made visible via two small hidden mirrors (Fig. 28, bottom left).

This puts the user in a position to recognise immediately whether due to some accident he has perhaps set too long an exposure time when taking rapidly moving objects. By simultaneous setting of diaphragm and exposure time it is possible to change over immediately to a shorter exposure time with a corresponding increase of diaphragm without having to take the camera away from the eye.

It is also possible without taking the camera from the eye to carry out diaphragm corrections if, for instance with colour photography the detail of the subject requires a larger diaphragm according to

the Instructions for Use on colour film. In order to preserve the characteristics of a rapid shooting camera with this model also, and to be certain with distance setting that the taking of the photographs is within the depth of focus range, it is also possible to see in the field of view of the viewfinder the yellow marking of the diaphragm figures 2.8, 4 and 5.6, as with these stops the distances must be set more accurately than at small diaphragm where distance-setting to 6 m always ensures well-defined pictures. The camera permits stereo exposures with the Zeiss Stereo Attachments.

#### **WERRAmatic**

The change-over to interchangeable optical systems in the WERRA considerably increases the range of

Fig. 29: WERRA<sup>matic</sup>, protective lens cap used as lens hood

Fig. 30: Lens with scales for the WERRA<sup>matic</sup>

application. The rangefinder increases the convenience of operation.

On transferring these two changes to the WERRA<sup>matic</sup> one knows immediately that the WERRA<sup>matic</sup> (Fig. 29) is a camera with still further automation of the distance and exposure setting. The same interchangeable lenses can be used for the WERRA 3 or 4. Stereo exposures according to the Zeiss stereo system are possible with the Tessar f/2.8, 50 mm.

The amateur acquainted with photography finds in this camera all the features of modern photography techniques. He can consciously correct exposure data according to the subject without having to take the camera away from the eye. Without having to keep strictly to the automatic exposure device he does not have to dispense with the precision of the distance setting by means of the rangefinder. Standing up against the white background the values for exposure time and diaphragm (Fig. 30) can be easily read in the rangefinder, which also shows the frame limits and parallax markings corresponding to the various interchangeable lenses.

#### The Twin-WERRA - a two-film camera

The secret of this camera combination (Fig. 31) is actually only its simple connecting piece by which

# WERRA<sup>matic</sup>





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# DoppelWERRA

one WERRA is closely connected to the second one. With two push-buttons on the connecting piece a coupling is quickly effected (Fig. 13 c). Every photographer knows that not every scene is suitable for colour and black-and-white photography. Also illuminating conditions do not always suit colour photography. The thought: "If I had instead of colour film, black-and-white film or vice versa", characterises the situation which is bridged only with a Twin-WERRA. It is not necessary to get used to another camera system, it is not necessary to have any other photographic techniques. With every combination selected by oneself for a Twin WERRA the scene is always evaluated under the same conditions in the viewfinder image: same scale, same brightness. In addition it is also possible to make stereo exposures. Although not all features of a stereo camera are present – it is not immedi-

ately possible to couple the shutters – one can easily use, for instance, a double cable release. Stereo images are however obtained in the full miniature upright size  $24 \times 36$  mm.

## Standardization of the WERRA-family

The WERRA series fulfils all requirements. We have acquainted ourselves with the individual WERRA models starting from the basic model and have seen how simple the series has developed up to the most perfect model at present on the market, the WERRA-matic. The elaborations on the technical characteristics correspond entirely to the units of this camera series built to the unit assembly system. Thus it is also understandable that the components of the individual units are repeated in the various WERRA models. The following survey shows the use of the parts in the various WERRA models:

The six WERRA models consist therefore altogether of 1086 components and 227 standard parts. It is

Fig. 31: Twin-WERRA

# RA

however only necessary to design and make devices and tools for only 336 original parts in order to produce all WERRA models.

The favourably selected set of original parts and the high percentage of repetition and standardised parts facilitate not only manufacture but also servicing.

According to production processes 20.5% of these original parts are purely stamped parts, 39.3% purely turned or milled parts, 23.8% parts of mixed production, for instance, stamping and milling or drawing, stamping etc., 8% plastic and rubber parts, 5% optical parts, 3.4% pressure cast parts. For the purely turned and purely milled parts of those from mixed manufacture 80% of all processes are carried out by automatic machines.

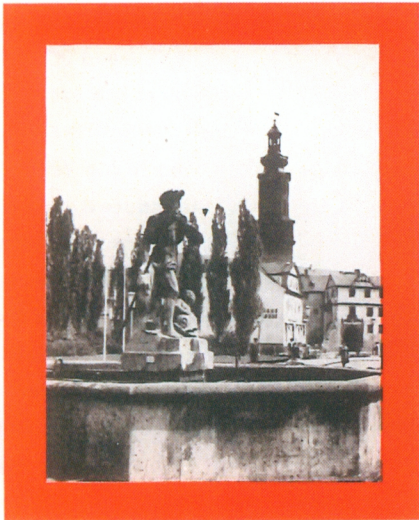
The above mentioned figures and data confirm clearly that one can speak rightly of a typified camera series and that the design aiming consciously at uniformity also ensures favourable prerequisites for a rational manufacture. The lenses are not contained in these figures. It is however natural

with this far-reaching standardising that with the WERRA 1, 2 and the WERRA mat the same lens is used, whilst with the WERRA 3, 4 and WERRA matic the same interchangeable lenses are used.

In conclusion it may be stated that with the well-planned design of the WERRA 1 up to the WERRA matic all the features combining to produce a good camera have been taken into consideration and that everything has been thought of which is of interest and importance to the versatile amateur; thus the prerequisite for an economic manufacture exists and due to the clear design of this camera series and the special technical features, a camera range is put on the market which also meets the requirements of the trade.

In the course of a few years the WERRA has gained world-wide fame. An increasing number of amateur photographers have turned towards it. This is the most wonderful compensation for all those who have assisted in the design of the WERRA series, its technological conception and its manufacture.

Model	Quantity of all parts	Original parts	Parts taken over from WERRA 1	Parts taken over from WERRA 2	Parts taken over from WERRA 3	Parts taken over from WERRA matic	Standardised parts in addition
WERRA 1	123	123	-	-	-	-	21
WERRA 2	145	29	116	-	-	-	24
WERRA 3	182	92	90	-	-	-	43
WERRA 4	198	2	89	16	16	-	45
WERRA matic	240	76	90	10	10	-	59
WERRA mat	198	14	111	2	2	51	35



1a



1b

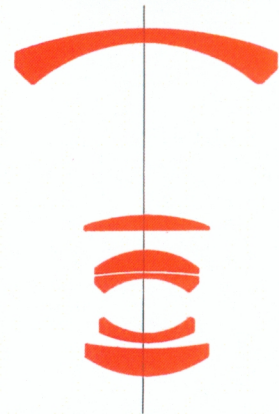
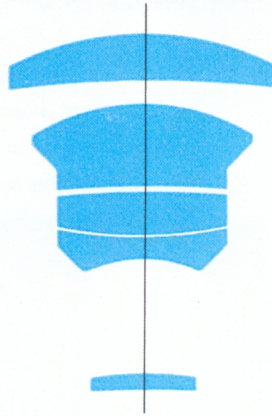


1c

# The Interchangeable Optics for the WERRA



Hermann E. Fincke



The most recent development in the field of photographic lenses is largely determined by the requirements placed on modern camera designs. The coupling between diaphragm and exposure time on the one hand, and the progressive automation of the entire photographing process on the other hand, and last but not least the synchronisation of the varying flash-systems with the shutter release, lead us back to the central shutter. New central shutters, which with swinging-through lamellae achieve exposure times up to  $\frac{1}{750}$  sec., have displaced in many instances the focal-plane shutter which has been primarily used so far in cameras with interchangeable optics. This brought about new mechanical and optical problems in the design of lens systems. One of the most efficient solutions is the incorporation

of the shutter lamellae directly behind the image-side vertex of the last lens-component.

For the design of interchangeable lenses this results in two optically difficult requirements:

Maintenance of a constant rear focal intercept of all lenses irrespective of the focal length;

Limitation of the diameter and the exit height of oblique pencils on the image side by the shutter lamellae acting as masking diaphragms.

Both conditions have to a great extent a determin-

Fig. 1: The exposure distances referred to the fountain-figure are proportional to the focal lengths  
a) Flektogon f 2.8/35 mm, b) Tessar f 2.8/50 mm, c) Cardinar f 4/100 mm. Fig. 2: Flektogon f 2.8/35 mm. Fig. 3: Tessar f 2.8/50 mm. Fig. 4: Cardinar f 4/100 mm

ing effect on the construction of interchangeable optics. It amounts to a redesigning of already existing lens types and the development of new ones. These were the facts to be envisaged when designing lenses for the individual WERRA models. In principle only a high quality photographic system could warrant the technical expenditure and ensure to the user a maximum image quality. It also was quite clear that only the possibility of changing the focal length would give the user of the WERRA a free choice regarding this photographing distance and hence a choice of the perspective as a means of pictorial composition independent of the imaging scale (Fig. 1). It was furthermore understood that a set of lens systems should be created which would be suitable for all WERRA models.

As standard lens for all WERRA models the TESSAR f/2.8, 50 mm was the obvious choice (Fig. 3). By using highly refractive dense barium crown and new super flint glasses in this world-renowned lens, contrast, resolving power and image qualities could again be increased.

When normally reckoning with the focal intercept to be 70 to 80% of the focal length, the adaption of a wide-angle lens to the WERRA models with interchangeable optics require a focal intercept extended to approx. 110%, i. e. the rear principal plane must be on the image side beyond the lens system. This extreme position can be realized by shifting the collective power in direction of the rear part of the system, which is achieved by attaching a diverting meniscus in front of the basic lens system (Fig. 2). As basic lens system the Biometar type was used which is known for its excellent definition. Thus a powerful WIDE-ANGLE LENS f/2.8, 35 mm was created which had already become known as the FLEKTOGON. Ingenious selection of glasses, and a suitable arrangement with respect to the refractive powers helped to

create a lens with excellent correction of the spherical, chromatic and astigmatic aberrations and an image angle of approx.  $61^\circ$ . For this purpose altogether six lenses were required, the arrangement and shape of which is illustrated in Fig. 2.

As long-focus-lens the CARDINAR f/4, 100 mm was specially designed for the WERRA (Fig. 4). The conditions mentioned above in the second paragraph require, because of the longer focal length of this objective, an extremely short rear focal intercept of approx. 38% of the focal length. For the diameter, especially of the oblique pencils, the maximum shutter aperture is decisive. The latter determines the maximum aperture ratio considering the luminous coverage of the corners of the format and the location of the aperture diaphragm. Despite these unusual requirements on the design a correction was attained with five lens-components only, which give well defined and brilliant pictures in black-and-white as well as in colour photography. With regard to their resolution the three lenses of the WERRA are designed according to the standard-film size  $24 \times 36$  mm, i. e. despite different focal lengths, uniform and identical scales can be obtained with subsequent enlargement. This can be illustrated most clearly by the curve of the relative resolving power inherent to the three lenses in the format diagonal (image centre = 0), attention to which is drawn instead of the nowadays usual factor of contrast fidelity (Figs. 5 and 6). The reciprocal adjustment extends furthermore to the colour reproduction. Due to a colour-corrective T-coating, a coincidence of the relevant colour positions was obtained which brings about a natural and uniform colour reproduction by all three lenses. For this an even luminous coverage of the format is a prerequisite. The WERRA together with its interchangeable optics thus represents an entity harmonizing in every detail.

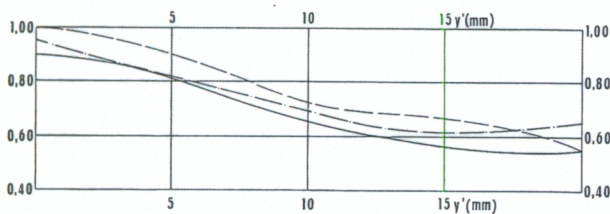


Fig. 5: Relative resolution. Tessar f 2.8/50 mm —, Flektogon f 2.8/35 mm --, Cardinar f 4/100 mm -.-.-.

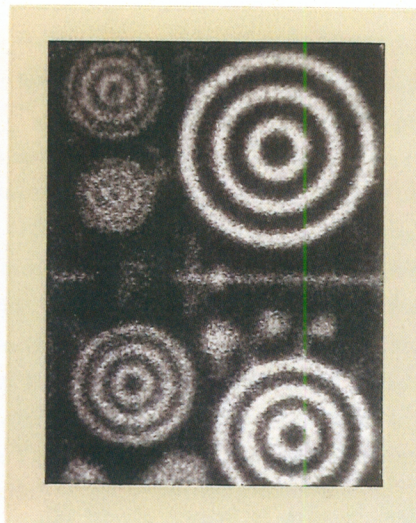
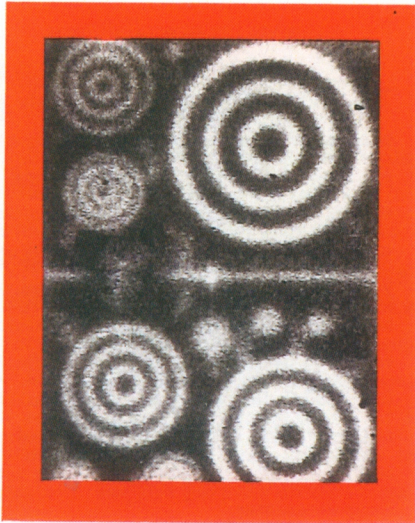
Fig. 6: Test exposures, the diameter of the largest circle on the negative is 0.3 mm.

Flektogon

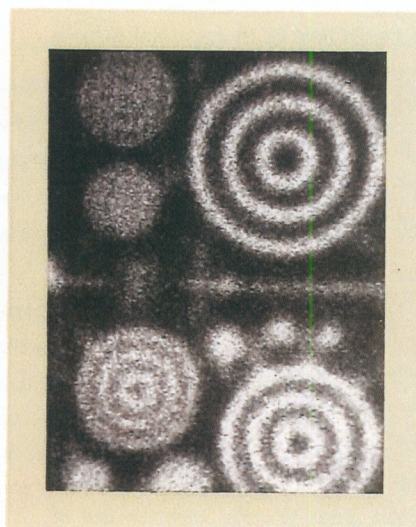
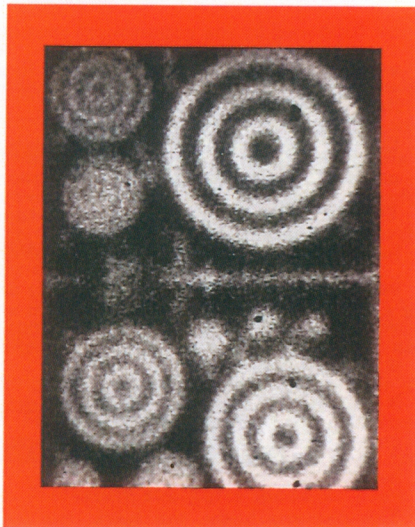
Tessar

Cardinar

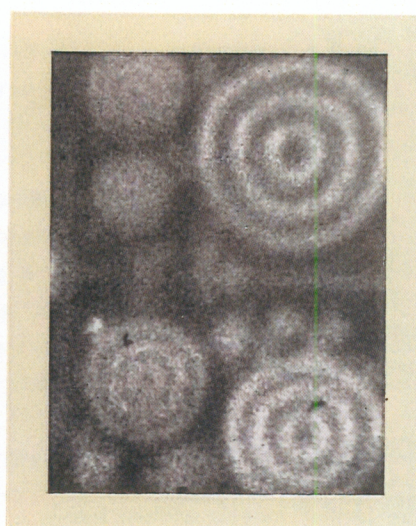
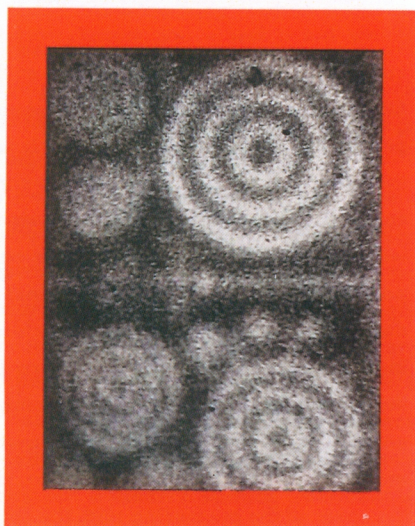
Linear distance  
from centre of  
negative  $y' = 0$  mm



Linear distance  
from centre of  
negative  $y' = 10$  mm



Linear distance  
from centre of  
negative  $y' = 20$  mm



Flektogon

Tessar

Cardinar

# The manufacture of the WERRA Miniature Camera

Paul Oswald

The WERRA 35 mm camera is known almost all over the world. It is outstanding for its distinctive shape and pleases its owners by its excellent picture quality. Every enthusiast of photography knows to-day that the WERRA is a product of VEB Carl Zeiss JENA. It is probably not so well known that the modern 35 mm camera is not manufactured in the main works but in a special factory in Eisfeld on the Werra.

Eisfeld is a little town on the southern slope of the Thuringian forest, through which flows the young Werra which subsequently joins the Fulda and the Weser at Hannoversch-Minden. In Eisfeld the Werra has travelled hardly 13 km. from its source. The WERRA camera derives its name from this river.

In this small town the Zeiss Works, with the aid of local labour, rebuilt in 1952 a factory: "VEB Carl Zeiss JENA, Eisfeld Works".

The JENA Zeiss Works soon succeeded in introducing a sense of precision and quality in this new branch of production. Since 1955 the main product of this young part of the works has been the WERRA miniature camera. At this time all prerequisites for the camera production had been provided. Many skilled men and women, and a team of capable engineers, technologists and foremen did everything in their power to continuously improve the quality of "their" camera.

It testified to the foresight and skill of the designers that the WERRA 1 resulted in the meantime in the development of five further models without hav-

ing to change the overall dimensions of the camera. The WERRA 2 has a built-in electric exposuremeter. The WERRA 3 has interchangeable lenses and coupled with these a new type of wide-angle rangefinder. The WERRA 4 is furthermore equipped with a new simple light-value transmission on to the time and diaphragm collars. After adjusting the light-values both collars can be coupled with each other so that the set light-value is maintained even when selecting another diaphragm (or time). The hitherto last model, the WERRAmatic has all the advantages of the WERRA 4 and one additional one, namely the semi-automatic diaphragm setting controlled by the exposuremeter.

At the 1961 Technical Fair in Leipzig this model will be followed by the economical semi-automatic camera without rangefinder and with fixed lens system: the WERRAmat.

Despite this variety of WERRA models the basic camera has remained the same for everyone of them. This fact results in a great advantage in manufacture and has enabled the young WERRA factory to very quickly reach world standards and to keep step with developments on the photographic market on a world-wide scale.

It is obvious that for the manufacture of such a camera highly productive manufacturing processes have to be applied.

The camera body, the back, the baseplate of the rangefinder, the lens carrier, the film stage – to name but a few – are manufactured by pressure casting. In order to manufacture the important fittings and connections with the required accuracy, processing of the pressure casting is required. With the camera body this processing is carried out by a conveyor system. This conveyor system is equipped with single purpose machines. The camera body is passed via lathes and milling machines to the drilling department and thread-cutting machine. After passing the conveyor system the camera body is tested thoroughly. Plastic is used for a number of camera parts. Thus, for instance, the following parts are made of plastic: film transport roller, the casing and the cover of the measuring unit, the covering mould-

ing for flash contact and last, but not least, the protective cap which can also be used as a lens hood.

It is natural that prior to using certain plastics conscientious tests have to be carried out in order to determine the material best suited to a certain task. Thus, for instance, the film transport roller is made of polyamide, a very tough and resistant plastic.

Pressure cast and plastic parts are supplied to the WERRA factory from the Central Department of the main Jena works. The manufacture of the other camera parts is carried out exclusively in the Eisfeld factory. For this purpose an extensive mechanical department equipped with modern machines is available.

Most of the turned parts are made on automatic lathes. As far as camera parts have to be processed on standard lathes, special devices are used which facilitate the operator in maintaining the required narrow tolerances. In milling, manufacture is partly carried out on single-purpose machines and partly on semi-automatic milling units.

In the metal processing industry and thus also in the WERRA factory in Eisfeld, cutting and non-cutting shaping without any waste plays an ever increasing part. The upper and lower chromium covers of all WERRA models are drawn exclusively from brass plate. Naturally the parts made of plate are also cut and bent in the pressing department. On hydraulic presses the broaching method is applied.

In order to repair when necessary special devices and to produce any new dies and tools required at short notice, the Eisfeld works have also got a small but highly efficient tool shop.

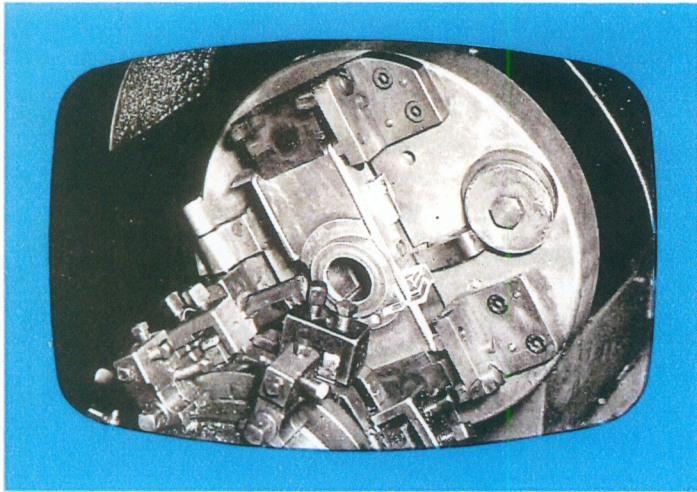
The system of quality control has been especially conscientiously organised. The quality control department is equipped with modern testing and measuring devices and with special gauges. All prerequisites have been provided to ensure that only parts which are efficient and safe in operation are passed on from preliminary manufacture.

In addition to the mechanical department the WERRA factory has a modern surface treatment workshop. All light metal parts are oxidised electrolytically and

dyed black. The light metal parts are thus protected against corrosion. Steel and brass parts are nickel-plated in the electro-plating shop: where effective appearance is required they are chromium-plated. To give certain parts inside the camera body and at the back a pleasing appearance the surface is provided with a lacquer-coating. For this purpose a synthetic resin and nitro-lacquer processing shop is attached. In addition the surface treatment shop is equipped with a polishing department to provide everything required for high-gloss chromium-plated parts. Matt chromium-plated parts are treated prior to chromium-plating in modern sand-blasting equipment. The sand-blasting equipment is used also where a particularly good adhesion for subsequent varnish treatment is to be provided.

The camera bodies and the backs of all WERRA models are also outstanding in their plastic coating which is particularly wear-resistant. This plastic coating is also applied in the surface treatment department and subsequently hardened under precise conditions in an autoclave so that it remains elastic despite its great resistance. The cocking ring is also provided with this coating. The plastic coating of the WERRA is in the true sense of the word "impact and shock-proof" and in addition absolutely resistant to tropical climate. In spite of the simplicity of shape of the individual WERRA models great stress was laid on a pleasing appearance for the cameras. Thus certain surfaces on the cocking ring, on the protective cap (lens hood), on the individual parts of the lens adaptation, on the rewinding device, on the counting ring and on the tripod nut are precision turned by means of diamonds. As they are almost exclusively light metal, these parts are provided after diamond turning with a transparent hard varnish coating as protection against corrosion. Also in the surface treatment department quality control plays an important part. Each part is inspected carefully prior to being passed on to the assembly shop with regard to its surface consistency and quality of the work carried out.

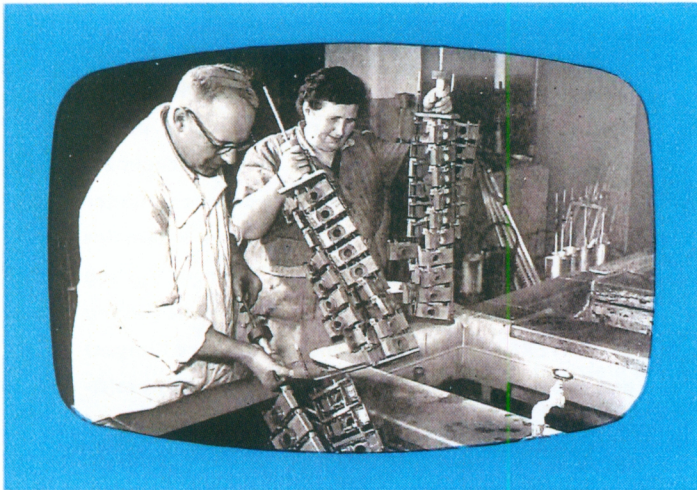
These parts, the making of which in the mechanical departments and in the surface treatment workshop



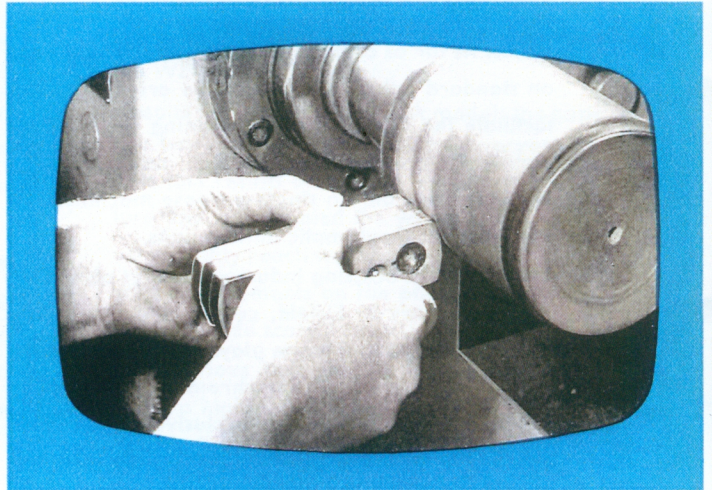
1



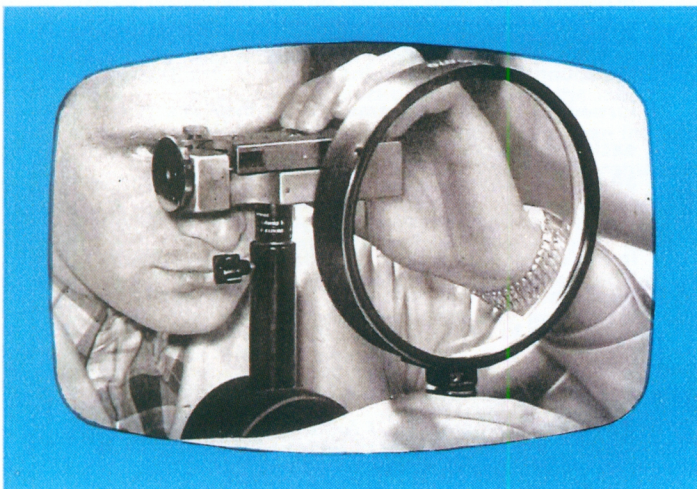
4



2



5



3



6



has been described above, finally reach the assembly shop via intermediate stores. The camera is almost exclusively assembled by skilled women. Experienced foremen and section leaders assist them in their work and are at the same time charged with supervision and maintenance of the maximum quality of the working processes carried out. The assembly of the camera takes place basically in two stages. In the so-called group assembly, units are assembled to such a stage that they can later be incorporated without any great difficulty into the camera body or back during the final assembly. In this group assembly, for instance, the film drive with the film transport roller are completely assembled. Also the new prismatic large-image viewfinder for the WERRA models 1 and 2 and the wide-angle rangefinder are assembled. Subsequent to assembly the basic adjustment is made to the prismatic large-image viewfinder and the wide-angle rangefinder. By means of ingenious adjusting devices the height adjustment of the rangefinder and the setting of the magnification of the two partial images is carried out. The two partial images must show no parallax. It is remarkable that a good co-operation between the JENA designers and the Eisfeld technologists achieved an extremely simple assembly. Nevertheless even the sub-assemblies are inspected prior

Fig. 1: Turning the camera body to fitting dimensions on a specially equipped lathe

Fig. 2: For corrosion-proofing all light-metal parts, including the camera body, are electrolytically oxidized

Fig. 3: Pre-adjustment of the wide-angle rangefinder

Fig. 4: Inspecting the camera bodies

Fig. 5: Finishing the chromium-plated caps

Fig. 6: Partial view of the WERRA assembly-work shop, conveyor belts for final assembly

Fig. 7: Final touches to the WERRAmatic

Fig. 8: Optical inspection with an autocollimator

Fig. 9: Completion of the WERRA-outfits and packing. From here the cameras are sent to photo-enthusiasts in all corners of the world

to being passed on to the final assemblies and any defective units are rejected.

The final assembly of the camera is designed as line-production. Camera body and back are fed in pairs in containers of five pairs each. On a conveyor belt which is attached to the work-benches these containers are transported from one working place to the other. In this respect also it is a great advantage that the basic camera of all WERRA models and thus all processes at the assembly conveyor belt remain the same until the special features of each model have to be mounted. This has the advantage that the belt can at very short notice be switched over from one model to another. On the assembly belt the sub-assemblies are first built into the back. Subsequently the camera body is prepared for final assembly. Calibrations of particularly important fittings are carried out, the bore-hole for the flash contact is fixed and the camera body provided with the film stage. Subsequently the so-called focus measure, the distance from the lens flange to the film stage is produced with a tolerance of  $\pm 0.01$  mm on a milling unit standing in the production line. Each camera body has already been marked on a stamping machine with the number of manufacture. Then at well organised work places there are incorporated one after the other: the winding spool, the film drive, the gear system of the release lever and the double-exposure prevention. Subsequently the models WERRA 1 and WERRA 2 are provided with their lenses, the well known Tessar f/2.8, 50 mm with central shutter. After this process there follows a control point. Here particularly experienced women workers test the processes carried out so far. At this inspection station the camera is still open and all parts accessible. The function of the parts and their movement can be easily observed. Furthermore it is possible to check whether all screws are tight and whether the prescribed protective varnishes have been affixed. If the work carried out so far does not give rise to any complaint the prismatic large-image viewfinder is built-in at the next stage and if the camera passing through production or assembly is the WERRA 2 the photo-

electric exposuremeter is incorporated at the same time. At the next station the upper chromium cap is attached. When assembling the WERRA 2 the calculator is then attached at the back. With a high voltage testing instrument the insulation of the line of the flash contact is tested in specially protected places as to its dielectric strength at a voltage of 500 V. This concludes the final assembly operations of the WERRA 1 and 2.

At the end of the assembly belt the camera which is now complete is once again conscientiously inspected. At first the surface of the camera is inspected for visual defects. The engravings on the scales of the lens must be clean and inlaid red or black. The plastic coating must not have any bubbles and the grain must be even. All movements must be carried out without any strain. After these purely visual tests, functional tests are carried out. Thus, for instance, the shutter is inspected for proper working when set at each speed. The film must be feeding easily and without drift. Finally the cocking process is tested, namely, whether the synchronisation between shutter, winding and film transport is actually ensured. Subsequent to these inspections the camera is passed on to final inspection and acceptance.

The assembly of the models WERRA 3 and 4 and the WERRAmatic is somewhat different. At the work place where the WERRA 1 and 2 are equipped with their lens and shutter, the shutter with the lens adaptor is assembled with other camera models.

Only during final inspection is the standard lens (Tessar f/2.8, 10 mm) fitted into these models. Subsequent to assembly of the lens mounting and after inspection has been carried out the cameras are passed on to their adjusting stands which are arranged directly in the production line. Here the wide-angle rangefinder, assembled and pre-adjusted as a unit, is fixed on to the camera and adjustment completed; it must be adjusted in such a manner that all distances coincide with the distance graduation on the lens. Under certain circumstances a correction of the basic adjustment is required. After adjustment has been completed the

photo-electric exposuremeter is built into the WERRA 4. Subsequently the WERRA 3 and 4 can receive the top chromium caps and pass through final inspection and acceptance.

With the WERRAmatic a number of special processes are required subsequent to final adjustment. First the photoelectric single-range exposuremeter is inserted. Subsequently an absolutely precise function of the automatic device is ensured by means of specially designed measuring instruments, permitting the setting of five different intensities of illumination determining the light values and the compensating elements.

Then the optical parts for the imaging of the time and exposure values in the field of viewfinder are mounted and adjusted. Only after carrying out these processes can the assembly of the WERRAmatic be terminated by attaching the top chromium cap.

In acceptance all camera models have got to pass once again through inspection points where a thorough inspection of all functions of the camera is effected with measuring instruments. All cameras pass a testing instrument by means of which the accurate synchronisation of the flash contact with the shutter movement can be controlled. Likewise all cameras must pass an autocollimation instrument. On this instrument the focus measure of each camera must be measured once again. Nevertheless the measurement is effected with the lens incorporated. After these tests the WERRA 1 has only got to be checked with regard to coincidence of the viewfinder image with the film image. The WERRA 2 must pass the same test. With this camera the measuring unit and the calculating aid is once again examined on specially designed measuring instruments. The wide-angle rangefinder of the WERRA models, 3, 4 and the WERRAmatic is re-measured on a test stand at the final inspection, to ensure in each instance the maintenance of the required tolerances. The WERRAmatic has then got to pass yet another special test stand for a comprehensive examination of the efficiency of its automatic device. Only after the cameras have passed all the prescribed tests are they passed on by the final inspection. In

the pre-despatch department the cameras are prepared for despatch. They are thoroughly cleaned outside, the Instructions for Use and Guarantee are enclosed and the camera itself packed with its carrying strap into a box for despatching.

Each camera is accompanied by a card prior to final assembly. On this card the processes to be carried out, including the inspections, are marked. Each member of the staff taking part in the assembly of the camera marks the process he has carried out. If during assembly any complaints occur these too are marked by the inspector with a stamp and respective entry according to a coded error list. These faulty items are returned to their respective working places to eliminate the complaint. After the camera has been supplied by the quantity control to the despatch department the accompanying card is filed. Even after years it is still easily possible to follow the course of this camera through the works.

The WERRA 1 and 2 can be equipped optionally with a VEBUR shutter or PRESTOR shutter. On the other hand the WERRA 3 and 4, the WERRAmatic and also the WERRAmatic are supplied with the PRESTOR shutter. The VEBUR shutter is a very economical and reliable central type of shutter. The PRESTOR shutter is a high quality central shutter with through-swinging shutter blades. This peculiarity of design permitted the obtaining of a much shorter shutter time of  $\frac{1}{750}$  sec.

The close co-operation of all members of the staff engaged in the production of the WERRA produced an instrument of high quality. This fact is recognised by the top quality mark of the German Democratic Republic being given to all WERRA models. Since 1958 VEB Carl Zeiss JENA undertake to give a two years' guarantee for each WERRA they supply.

It goes without saying that the WERRA works attach great importance to their service to clients. In the German Democratic Republic there is a network of recognised contract workshops. The factory itself has in addition a service station and repair department. As a rule repairs or even complaints are dealt with within two to three weeks.



WERRA models equipped with Tessar 2.8/50  
24 mm X 36 mm Camera  
Interchangeable Lenses FLEKTOGON 2.8/35 and  
CARDINAR 4/100

