## *FOCUS, APERTURE, FOCAL DEPTH, DOUBLE EXTENSION*

There is a decided relationship between photography and the human vision. If you will consider this relationship it will make it easier for you to understand the many technical expressions which may at first confuse the beginner and seem to make the choice of a camera a difficult matter.

The camera is nothing more than an artificial eye of glass, metal and leather. Photography and vision are both kindred phenomena. Vision is controlled at will by opening and closing the eyelid. The camera takes a photograph by opening and closing the shutter.

In the human eye, the rays of light first pass through the pupil which contracts or expands automatically, adapting itself to the volume of light. The rays are then directed through the lens forming the image that is projected upon the retina — the human photographic plate.

In the camera, the arrangement is somewhat different. The lens usually consists of several sections between which the shutter (the camera eyelid) and the diaphragm or stop (the camera pupil) are mounted. The image is projected upon a specially prepared film or plate.

In both cases, the image must be developed and rendered visible. In the case of the human eye we become conscious of the image through the brain, which also performs the trick of reversing the image, which according to optical laws is turned upside down by the lens.

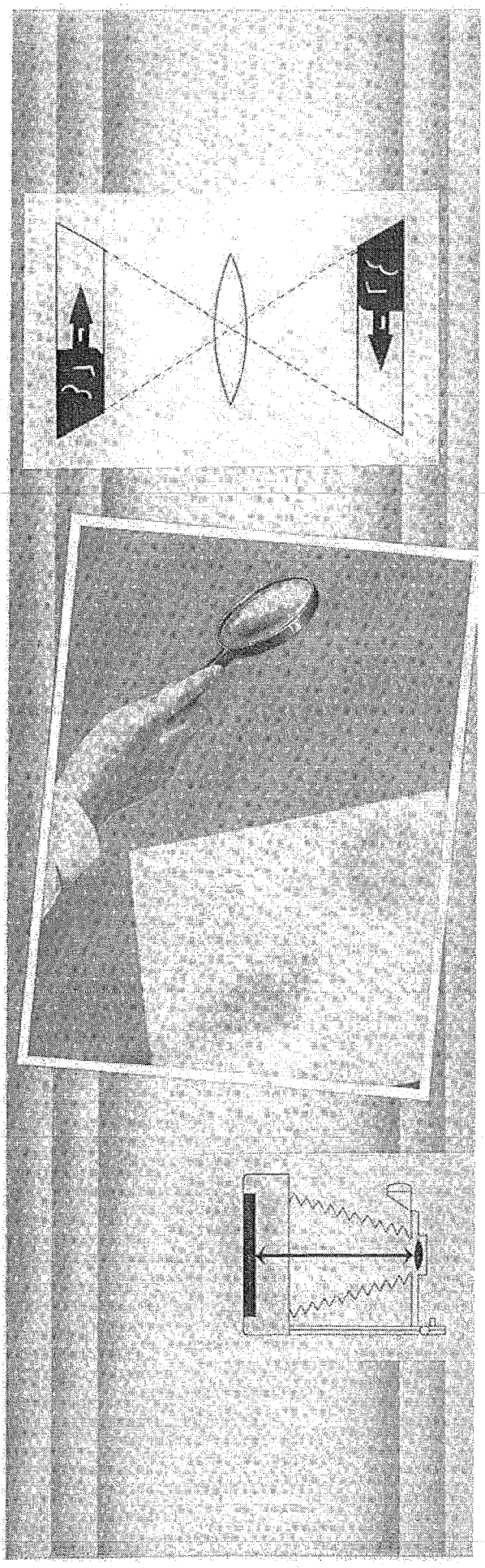
In the human body, the retina represents a plate or film that can be used over and over again for new impressions just like a black-board. But the photographic film or plate must be subjected to a chemical treatment and the image fixed once and for all and then copied on special paper.

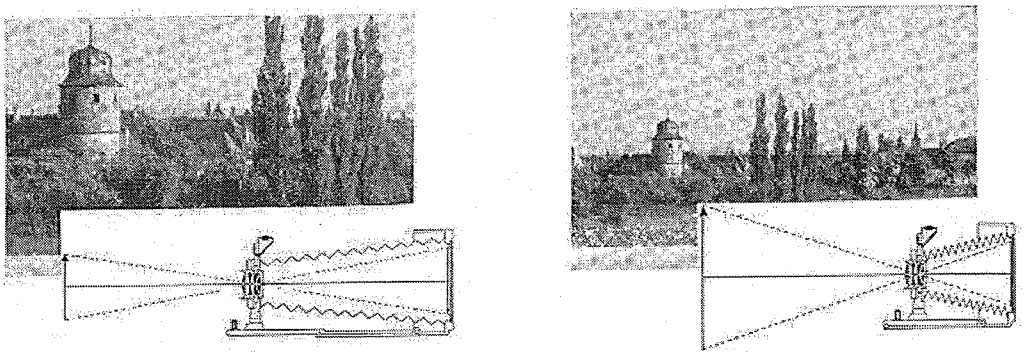
## *Focus*

If you take a magnifying glass and hold it so as to concentrate the sun's rays on a piece of paper, you find that there is one position of the glass in which the light spot on the paper is most intense. If you now measure the distance from the magnifying glass to the spot of light (which is in reality an image of the sun) you will have found the focal length of the magnifying glass.

You can now understand what is meant by the focus of a camera lens. If you set the camera so that the lens throws a clear image of a distant object on the focusing screen, the camera will be said to be in focus, and the distance between the center of the lens and the ground glass back is termed "the focal length". Incidently, the lens will throw an inverted image, as the illustration at the top of this page shows, the rays of light from the extreme ends of the object crossing in the center.

The focus of a camera lens is always engraved on the lens mount. A long focus lens will give a larger image of the object than a short focus lens. This is clearly shown by comparative pictures on pages 10, both taken from the same point, but with a long and short focus lens respectively. The diagrams beneath the pictures also show that a short focus lens has a very much wider angle of vision. The rays of light are like a pair of scissors opened wide. It follows therefore, that the short focus lens, while giving a smaller image of an object, will take in a wider view than the long focus lens.





Long focus Short focus

Effect of long and short focus lenses

This fact is made use of when it is desired to take large photographs of a distant object or to obtain as wide as possible an angle of vision.

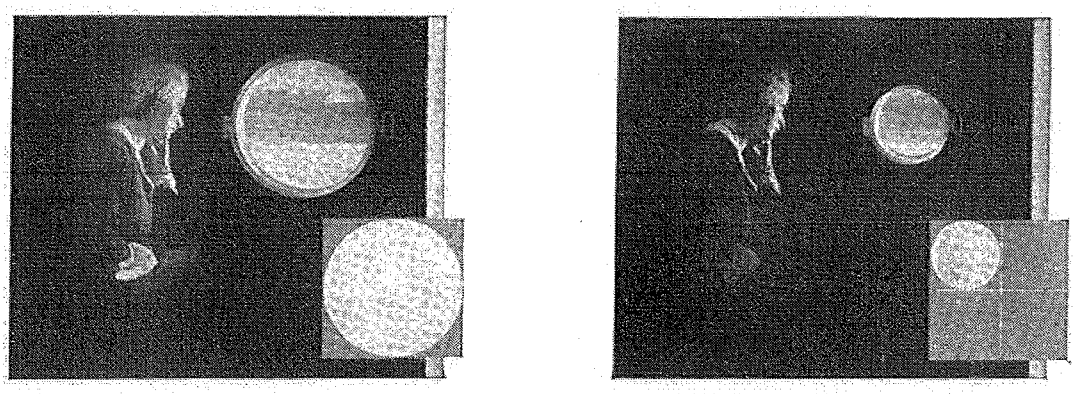
For long distance photography, special Telephoto Lenses of exceptional long focal lengths are employed. Naturally their angle of vision will be small. If however, the camera is to cover as wide a stretch of space as possible, as may be required for panorama, interior or architectural photographs, a special so-called wide-angle lens of very short focus must be used. For normal purposes, the focal length of a lens should about correspond with the diagonal of the desired picture size, whereas the focal length of a wide-angle lens should be about equal to the shortest side of the picture.

The same effects can be obtained by using the camera lens in combination with Zeiss Distar and Proxar Supplementary Lenses which are moderate in price and within the reach of all.

## *Lens Aperture*

It is obvious that a large window will let more light into a room than a small one and the objects behind the large window will be better illuminated than those behind a small window. Similar conditions rule in the case of lenses. The sensitive surface of the plate or film requires a certain amount of light in order to obtain sufficiently clear definition also in the shadows of the image. A lens with small aperture calls for a larger exposure than a large aperture lens.

The rapidity of a lens is, however, not dependent upon its diameter but upon the ratio of the diameter to the focal length. If, for example, the focal length is 8″ and the diameter $1^3/_4$″, the rapidity or effective aperture of the lens will be $1^3/_4 : 8 = 1/4.5$ or F/4.5.



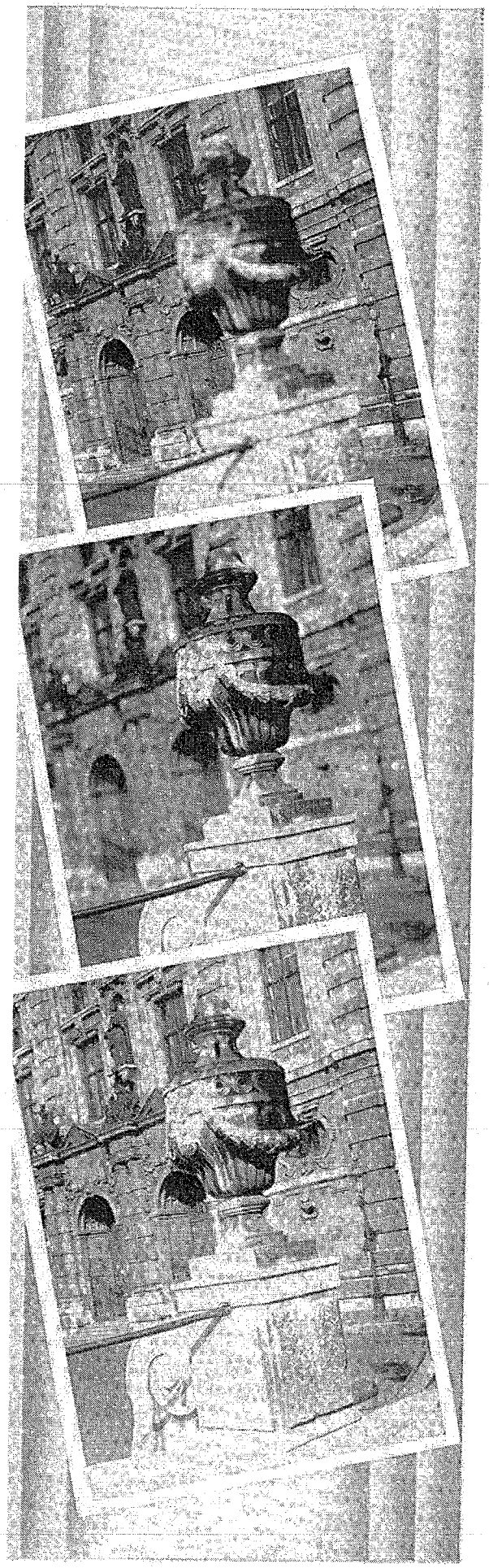
Large aperture lens (rapid) Small aperture lens (slow)

Effect of large and small aperture lenses

## *The Diaphragm*

The diaphragm consists of a series of thin sections so arranged as to form a circular opening in their center, the diameter of which can be varied within certain limits. The effective aperture can be varied with a corresponding variation of the time of exposure. The diaphragm not only serves to regulate the amount of light, but also to widen or narrow the rays of light, thus affecting the depth of focus (see next page on focal depth). Diaphragm apertures are designated in exactly the same manner as the effective aperture of the lens, that is, by the relationship of their diameters to the focal length of the lens. The scale according to which the diaphragm (stop) is set, is usually engraved so that each progressive change of aperture calls for double or half the exposure. For instance, the diaphragm aperture 4.5 is followed by 6.3. If the aperture is reduced from 4.5 to 6.3, double the exposure necessary for the first noted stop will be required. The top left hand picture on this page shows the ratio between the lens aperture and the light volume in the case of a lens of 13.5 cm focal length and an effective aperture of 3 cm., giving a rapidity of 3:13.5 = F/4.5. The right hand picture shows the same lens with diaphragm set so as to reduce the effective aperture diameter to 1.5 cm giving a rapidity of 1.5:13.5 = F/9. If the time of exposure necessary in the first case was 2 seconds, for the second case a four-fold exposure will be necessary, $4 \times 2 = 8$ seconds. This is due to the fact that the halving of the diameter of the effective lens aperture reduces the area through which the light passes to $^1/_4$ of the original area (see above illustrations).

Long exposures are naturally only used for still pictures. Moving objects necessitate short exposures which will generally only be possible with the full aperture of the lens. The more rapid the motion of the object to be photographed, the shorter the exposure necessary for obtaining non-distorted pictures. The large aperture also gives a very plastic relief.



# Zeiss Ikon Cameras

## *Something about focal depth*

If you look at a distant object you will notice that, while you can see near-by objects, clearly defined vision is only obtained at a certain distance. And when looking at close objects you will also notice that only the object upon which our eyes are focused are seen clearly, whereas objects in front or behind the point of focus will not be sharp. The conclusion to be drawn from this is that the focus has a certain depth, in front of or behind which images are not clear.

If you extend your camera bellows until you hear the snap of the infinity catch, the camera lens will be focused at infinity, which in the case of a 9×12 cm. camera means that all objects beyond 60 feet will be clearly defined. As the distance from object to camera decreases, so the depth of clear definition is also decreased. If two lenses of equal rapidity and focal length are focused on points at different distances, the greatest area of clear definition or focal depth will be obtained in the case of the lens focused on the most distant point.

It is usually advisable to focus on the center of the subject. To obtain a clearly defined fore-and background, the diaphragm of the lens should be stopped down until all objects appear sufficiently clear and sharply defined.

Reducing the aperture increases the focal depth and increasing the aperture will reduce it. Of two lenses of equal focal lengths, but of different aperture, the less rapid lens will have the greater depth of focus. Of two lenses of equal aperture, but different focal length, the depth of focus will be greatest with a lens of short focal length.

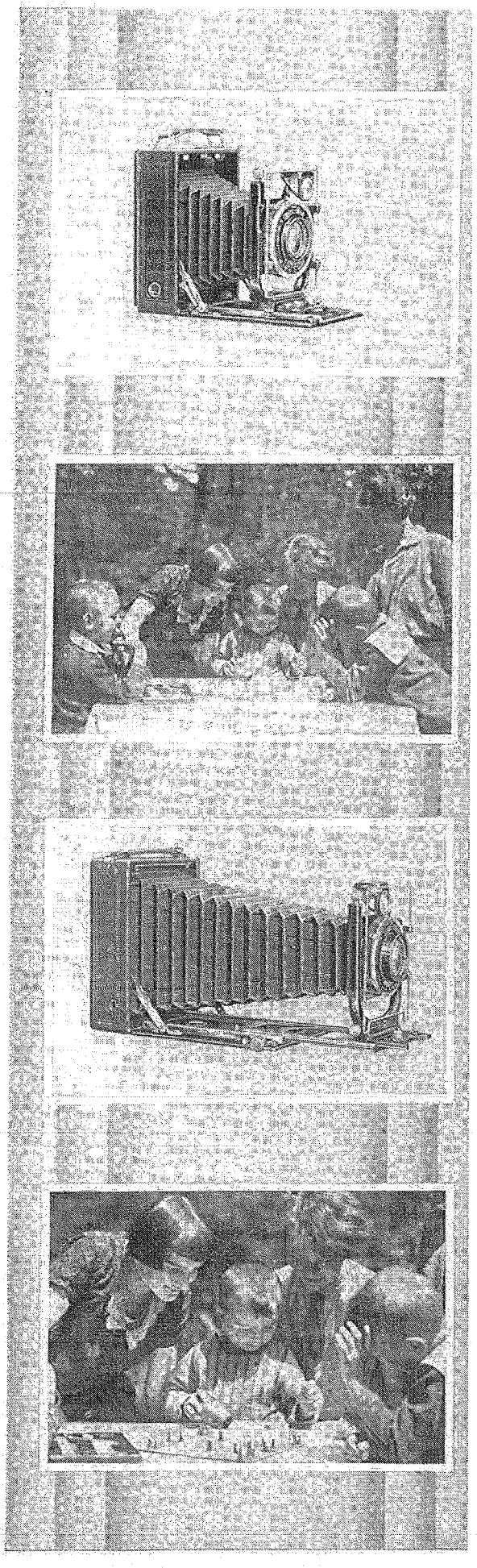
# Zeiss Ikon Cameras

## *Single or double extension bellows?*

Double extension bellows, enabling close-ups to be taken, are valuable features in some models of Zeiss Ikon Cameras.

For the purposes of the average amateur, a single extension camera permitting close-ups at about 6 feet distance will be satisfactory, especially since supplementary portrait lenses can often be employed which allow close-ups of 3 feet. The double extension bellows are really only indispensable for plate cameras, where it is intended to use varying focal lengths with the assistance of supplementary lenses. The advanced amateur will be primarily interested in having a camera with double extension bellows which are necessary in taking long distance or wide angle photographs or else for taking natural size pictures of very small objects.

The double extension bellows are of sufficient length to enable three to five different focal lengths to be obtained when using Distar or Proxar supplementary lenses (see page 27).



# Zeiss Ikon Cameras

## *Size of picture and type of camera*

The choice of the size of the picture is dependent, to a large extent, upon the uses to which a photographer will put his camera.

Miniature cameras such as the Baby Ikomat, and the Kolibri, both making pictures $1^1/_4 \times 1^5/_8''$ are ideal companions for the traveler and tourist who wants to reduce the bulk of his photographic equipment to a minimum. And when you do your own enlarging with a Zeiss Ikon enlarger, the joys of miniature photography are still further enhanced.

Rollfilm cameras such as the Ikomats, Icarettes, and Nixe, which take the popular rollfilm picture sizes are preferred by many amateurs because of their convenience and ease of manipulation. And there are also models (Icarette L and Nixe) which can be used for rollfilms, plates and filmpacks.

Plate and filmpack cameras such as the Maximar, Trona and Ideal, are the choice of amateurs who take a more serious view of their hobby, for these cameras are constructed to meet the requirements in almost every field of photography. For the advanced amateur who is interested in sports and press photography, the Orix and Miroflex are recommended. For interior and architectural photography the Ideal and Juwel models are unsurpassed.

On the pages 16 and 17 are shown the various picture sizes of Zeiss Ikon cameras.

## LENS EQUIPMENT

The beginner in photography usually prefers to start with a less expensive camera. It is this reason which prompts us to offer our Junior Cameras with Novar Anastigmat F/4.5 or F/6.3 lenses. These lenses are excellent anastigmats and are appreciated for the good quality of their all-round work.

However, for the amateur who appreciates superior quality, greatest versatility and inherent value as well as the amateur who takes a more serious view of his hobby, there are Zeiss Ikon Cameras fitted with the internationally famous Carl Zeiss Tessar lens. It has been truly said that no camera can be better than its lens and the excellent definition and brilliance of the Zeiss Tessar certainly proves the soundness of this statement. For consistently high quality and uniform performance and reliability the Zeiss Tessar is unsurpassed.

Here are a few of the Zeiss Tessars used on the most popular Zeiss Ikon Cameras:

Tessar F/4.5 makes exquisitely sharp and brilliant pictures over a wide angle and the resulting negatives can be enlarged considerably.

Tessar F/3.5 is a truly universal and very rapid lens with sharp definition over the whole plate.

Bio-Tessar F/2.8 and Tessar F/2.7 are still more rapid. Their extremely large aperture will permit exposures even under very unfavorable light conditions.

Tele-Tessar F/6.3 can be used in an equivalent focal length considerably larger than the camera extension required. Thus it is possible to use a Tele-Tessar of an equivalent focal length of 10″ on a camera the extension of which does not exceed 6″.

All Zeiss Ikon cameras with double extension bellows and equipped with Zeiss Tessar lenses may be used with Zeiss supplementary "Distar" or "Proxar" lenses. They greatly increase the usefulness of the camera. See pages 25 to 27.

# *Rollfilm Sizes*






*Plate Sizes*