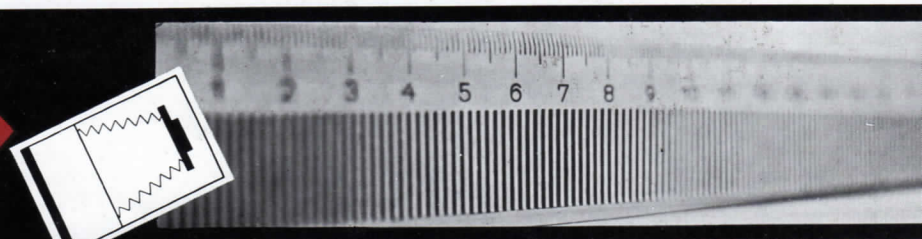
THE LINHOF TECHNIQUE

Data Sheet No. 1

Depth of Field with the Swing Back

To photograph an inclined subject plane, considerable depth of field is required. As shown at right, the region of sharp focus is very limited. (Taken at f/6.8)



When stopping down to f/22 the depth of field is doubled, however, still not sufficient. The exposure time has to be increased 16 times!

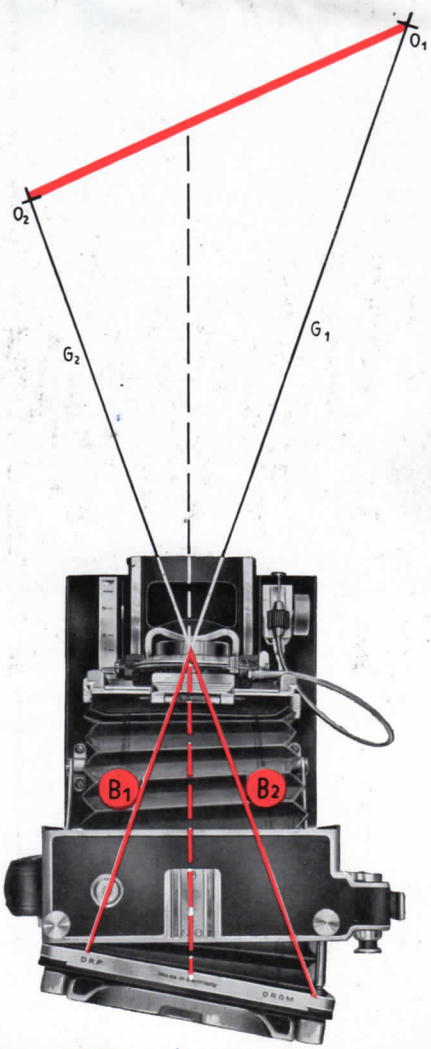
When using the Swing Back the area of sharp focus extends over the entire subject, thus making it possible to work at full opening. No loss of exposure time! (Taken at f/6.8)

The LINHOF TECHNIKA with its Swing Back gives the photographer the possibility to increase the depth of field. This method will be applied when the subject has considerable depth, and is at an angle to the camera.

IN THEORY

In order to understand just where in the subject region sharpest focus may be obtained, let us consider how a photographic lens forms an image of a plane. The image of any plane is always a plane! If the subject plane is inclined to the lens axis, the image plane is inclined also. The inclination of these two planes is such that, at the line in the space where they would intersect, the plane through the lens at right angles to the axis would also intersect these other two. This means, that, when a subject, which lies roughly in an inclined plane, is photographed, the film position for the foreground subject O_2 is farther from the lens then for the background subject O_1. If the camera back is swung out, as shown at the right, the entire subject will be in sharp focus.

Every lens-to-subject distance has its particular lens-to-film distance. These distances are in inverse ratio to each other, as for example G_1 to B_1 and G_2 to B_2. — A non-adjustable camera can either be focused on subject O_1 or O_2; by stopping down the lens, a certain depth of field can be obtained. The Swing Back of the LINHOF TECHNIKA makes it possible to get O_1 as wells as O_2 and all subjects in the plane between these two points in focus. With the Swing Back flush against the camera, the farthest subject O_1 first is brought into focus; while observing the groundglass, the back is swung out until subject O_2 also appears in focus. This at full aperture!



IN PRACTICE

It is really not as difficult as it looks! Three points should be observed: Always check the ground glass image; Do not hesitate to experiment; Lock the camera back after the desired position is found.

THIS, AND MUCH MORE CAN BE ACHIEVED WITH THE TECHNIKA

APPLICATION IN PRACTICE

The photograph above shows how the technique described on the opposite page is applied in industrial photography. — Assembly line in the Volkswagen automobile plant, taken with TECHNIKA 9 × 12 cm and 15 cm Xenar lens by H. Luther.

Further LINHOF Data Sheets will follow in the coming issues of GROSSBILD-TECHNIK! Please collect them for future references!

THE LINHOF TECHNIQUE

Data Sheet No. 2

Correction of Vertical Lines

Wherever objects with predominant vertical lines are photographed from slightly above, they will be reproduced in untrue perspective, i. e. all vertical lines will diverge if the camera itself is tilted downwards. — In commercial, industrial, and in scientific photography, however, it is often necessary to obtain a slight oblique view of the subject-matter, at the same time requiring all vertical lines to be parallel. The TECHNIKA and KARDAN with their Swing Back, Drop Bed, and Adjustable Lens Standard give the photographer the possibility to accomplish such photographic tasks in a perfect way.

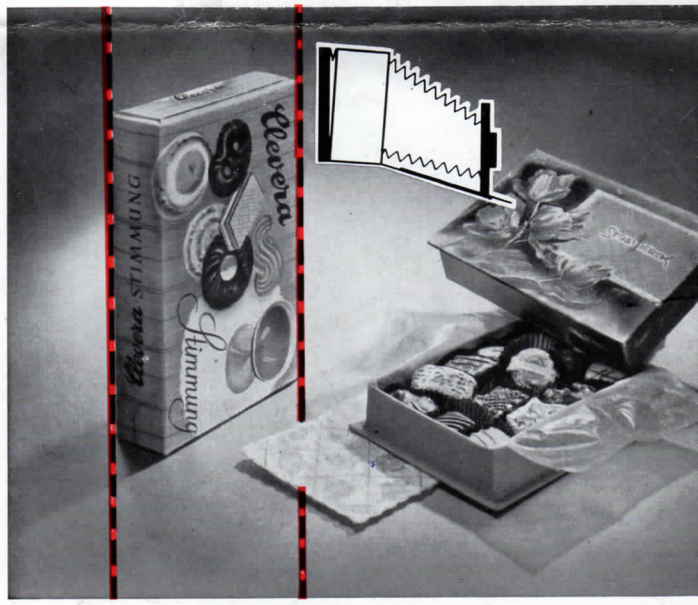
If one or more vertical objects are to be reproduced vertical, and parallel to each other, the film plane of the camera must be kept vertical. As a result, the image of any vertical rectangle in the object which is parallel to the film plane will have an image in the film plane which is a similar rectangle.

The latter way of adjusting the camera is achieved as follows:

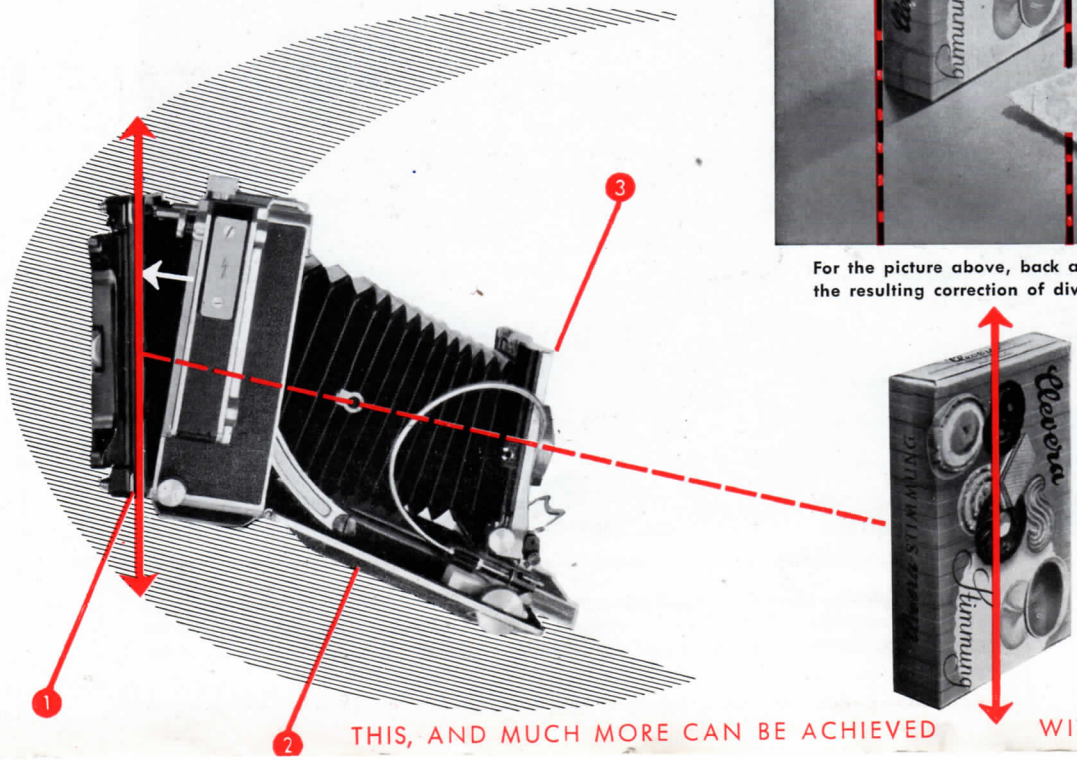
- Incline drop bed (2) until the struts rest into the second notches.
- Tilt back lens standard (3) all the way.
- Swing out camera back (1) until it is parallel to the subject.
- Compose and focus on the groundglass.

The film can be kept parallel to the plane being photographed in either of the two ways: the lens itself may be lowered by means of the drop bed in conjunction with the adjustable lens standard. In some cases this will not be sufficient, and the entire camera may be tilted and the swing back adjusted to restore the film plane to the vertical.

When photographed with a non-adjustable camera from slightly above, candy box will be reproduced in a very distorted manner.



For the picture above, back and front of the camera were adjusted. N the resulting correction of diverging lines



True perspective in an oblique view can be obtained only if the film plane of the camera is kept vertical.

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The above picture shows a typical photograph as used for advertising. Note that despite of the extreme oblique view all vertical lines are parallel. This was achieved by using the swing back and the front adjustment of the camera, as described on the front page.

Photograph: Curtesy Rosenthal

Printed in West-Germany

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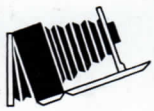
THE LINHOF TECHNIQUE

Data Sheet No. 3

Parallel Lines from Low Angles

1



2

wrong

right

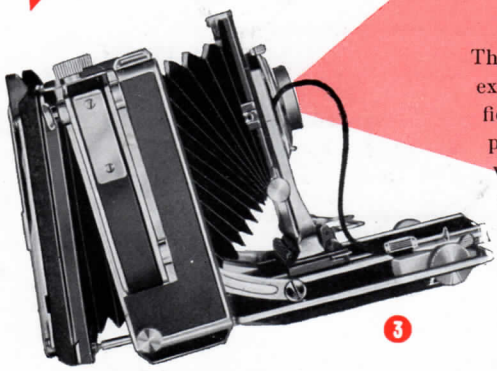
All buildings or superstructures often have to be photographed from low angles in order to get the entire subject on the negative. This is especially true if the location does not permit pictures to be taken from a greater distance. An identical situation arises when photographing sculptures, paintings, etc. which are located high above the ground, and are not easily accessible. To get the highest point of the subject in the picture, the camera has to be tilted upwards. As a result, all vertical lines converge as shown in the upper left illustration. In many cases, especially in architectural and scientific photography, such a perspective is not desired. The LINHOF-TECHNIKA with its Swing Back, Drop Bed and adjustable Lens Standard enables the photographer to correct converging lines before he takes the picture. — This is most important in colour photography! —

Vertical lines in a subject will be reproduced vertical and parallel to each other only if the film plane of the camera is vertical. (See also Data Sheet No. 2). If the subject has to be photographed from a low angle, this can be achieved with the LINHOF TECHNIKA in three different ways:

By raising the lens standard while the optical axis of the camera remains horizontal. The camera back is flush against the camera housing. (Fig. 1)

By tilting the camera upwards until the entire subject appears on the ground glass image. To correct converging lines the camera back has to be swung out until parallelism is restored. (Fig. 2). In order to obtain an even sharpness over the entire film plane, it is necessary to stop down the lens.

In extreme cases the first and second method may be combined:
Camera back swung out 15°, the camera is then tilted upwards until the film plane is vertical; the lens standard is then raised until the entire subject appears on the ground glass image. Again the lens has to be stopped down. (Fig. 3).



3

The method of correction described first should be applied only to a certain extent depending on the lens used. Since each lens covers only a specific field, vignetting may occur when raising the lens standard above a certain point. Tele- and high speed lenses are not recommended for this type of work. Photographers who specialize in architecture should choose a wide angle lens designed for the next larger format in order to be able to use maximum camera adjustments. (A 120 mm wide angle lens which fully covers a 5 × 7 "negative should be used with a 4 × 5" camera in the aforementioned cases).

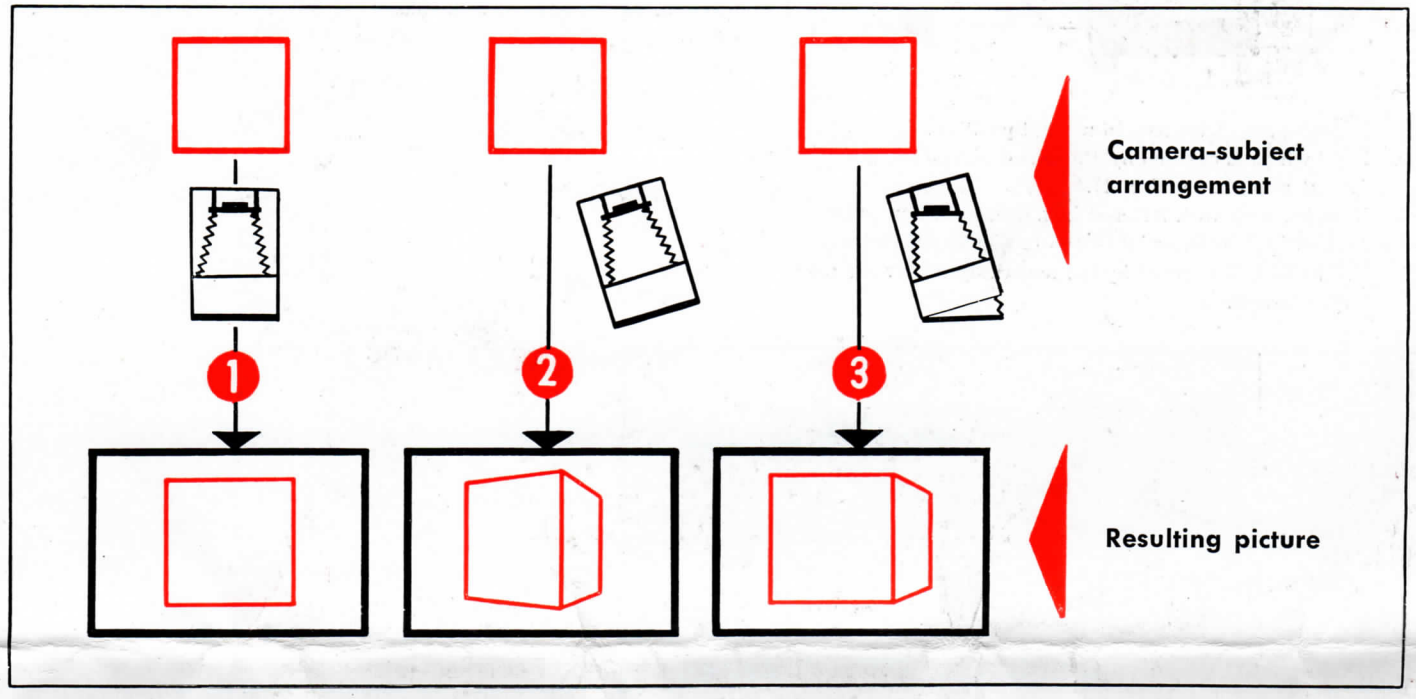
Photographed by Hermann Heyer

The technique described on the reverse side can be applied to great advantage when photographing people from a low angle. Thus correct proportion between head and feet is ensured.

THE LINHOF TECHNIQUE

Data Sheet No. 4

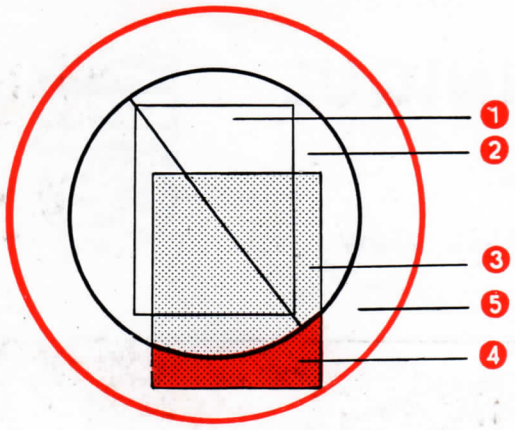
Combination of Front and Side View



A correct rendering of perspective is of decisive importance when photographing a rectangular subject, in order to obtain a three-dimensional effect. In commercial photography, the man behind the camera often is confronted with problems which at first glance appear impossible to solve, yet are relatively easy overcome by using the camera adjustments correctly.

Frequently, a rectangular, three-dimensional subject is to be photographed in such a way that its front must be rendered rectangular, i. e. free from distortion 1 ; at the same time, the three-dimensional nature of the subject must be retained by also showing one side of it 3 . Such problems quite often arise also in architectural, industrial and scientific photography. For example, a photograph of a store window is wanted from directly in front of it, its frame being parallel to the edges of the negative, yet the subject in the window (merchandise) has to show its front and one side. Tasks as this one are quite common in commercial photography, especially when furniture is to be photographed. How are they solved?:

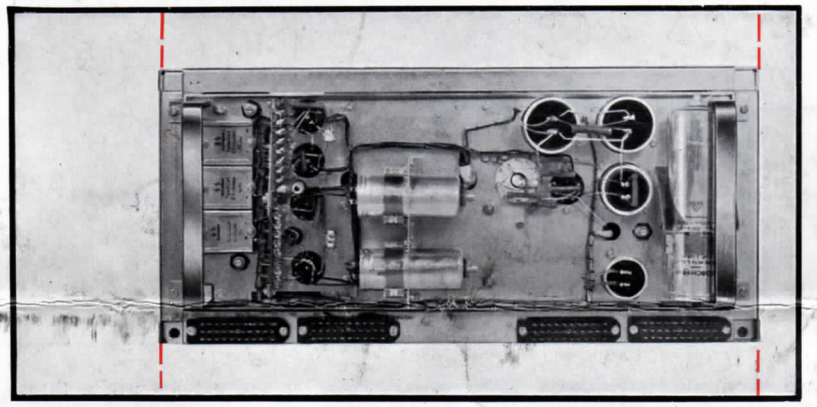
If the front of a rectangular subject, e. g. of a cube, has to appear rectangular in the picture, the film plane has to be parallel to the subject plane (compare Data Sheet Nos. 2 and 3). Normally, if the above rule is followed and the subject is in the center of the picture, the position of the camera is directly in front of the subject 1 . In this case, none of the sides of the subject is visible. To obtain a side view, the camera must therefore be placed slightly to one side. It is then aimed so that the subject image is centered on the ground glass. In this camera position, the film plane no longer is parallel to the front of the subject, the image of which becomes distorted 2 . The adjustable camera back is now swung out until parallelism to the front plane of the subject is restored. As a result, a rectangular image of the front of the subject will be obtained; at the same time, it will appear almost as though it had been photographed from the side, i. e. one side of the subject is shown also 3 . This would mean the solution of the problem. Due to the swung out camera back, however, one side of the subject image always will be out of focus. To bring back the entire subject into focus — without stopping down the lens — the lens standard is swung into a position parallel to the film plane. Viewed from above, the front plane of the subject, the lens standard and the film plane are now parallel to each other 3 . In extreme cases, where one side of the subject is more emphasized, and where the camera position therefore is further to the side, the lens standard must be slid laterally towards the subject, in addition to the aforementioned camera adjustments.



1. Negative area with lens in normal position.
2. Field which is covered by the lens designed for the format as shown under (1).
3. Negative area with lens not in normal position (adjusted).
4. Area which is rendered unsharp (optically inferior zone).
5. Field which is covered by the lens desigend for the next larger format.

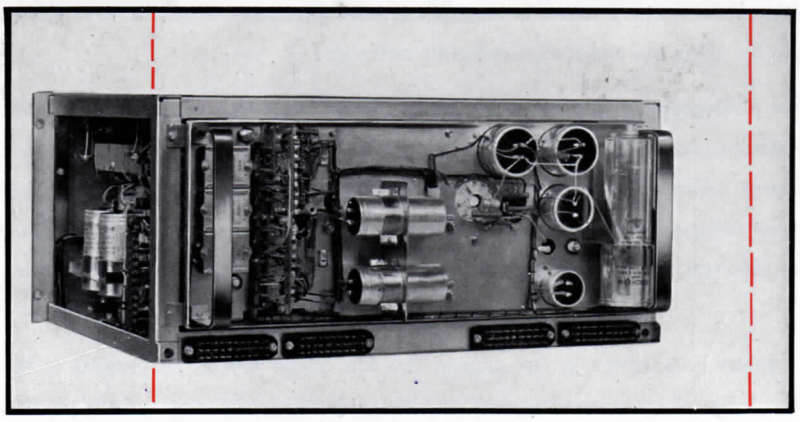
When using the adjustments of the camera, especially those which move the optical axis out of the center, it is essential to have a lens which has sufficient coverage, as otherwise unsharp corners or vignetting will occur. Every lens covers only a certain circular field, the diameter of which usually is not much longer than the diagonal of the negative size for which this lens is designed. In order to be able to use all camera adjustments to a maximum extent, it is therefore recommendable to use a lens which has sufficient covering power i. e. which has a longer than normal focal length or a larger than normal angular field, or both. Usually, a lens for the next larger format as the one being used is sufficient (e. g. a wide angle or normal lens which is designed for a 5 × 7" negative should be used with a 4 × 5" camera). The new Schneider Symmar, on account of its large angular field, also is very suitable when using camera adjustments. True telephoto lenses are not recommendable.

EXAMPLES:



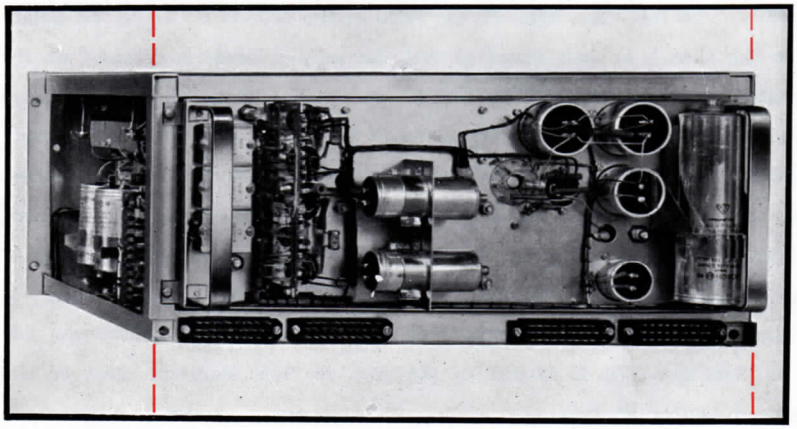
PLAIN FRONT VIEW OF A RECTANGULAR SUBJECT

The front of the subject is rendered rectangular, and thus the image shape is similar to the subject shape. This type of picture therefore is suitable for scale work, however it gives no indication as to the three-dimensional nature of the subject.



COMBINED FRONT AND SIDE VIEW WITHOUT CAMERA ADJUSTMENTS:

This photograph clearly shows that the subject also extends in depth (three-dimensional).
Despite the fact that the perspective is pleasing, the picture is not suitable for taking measurements, since the ratio of length and width of the subject image does not correspond to that of the subject.



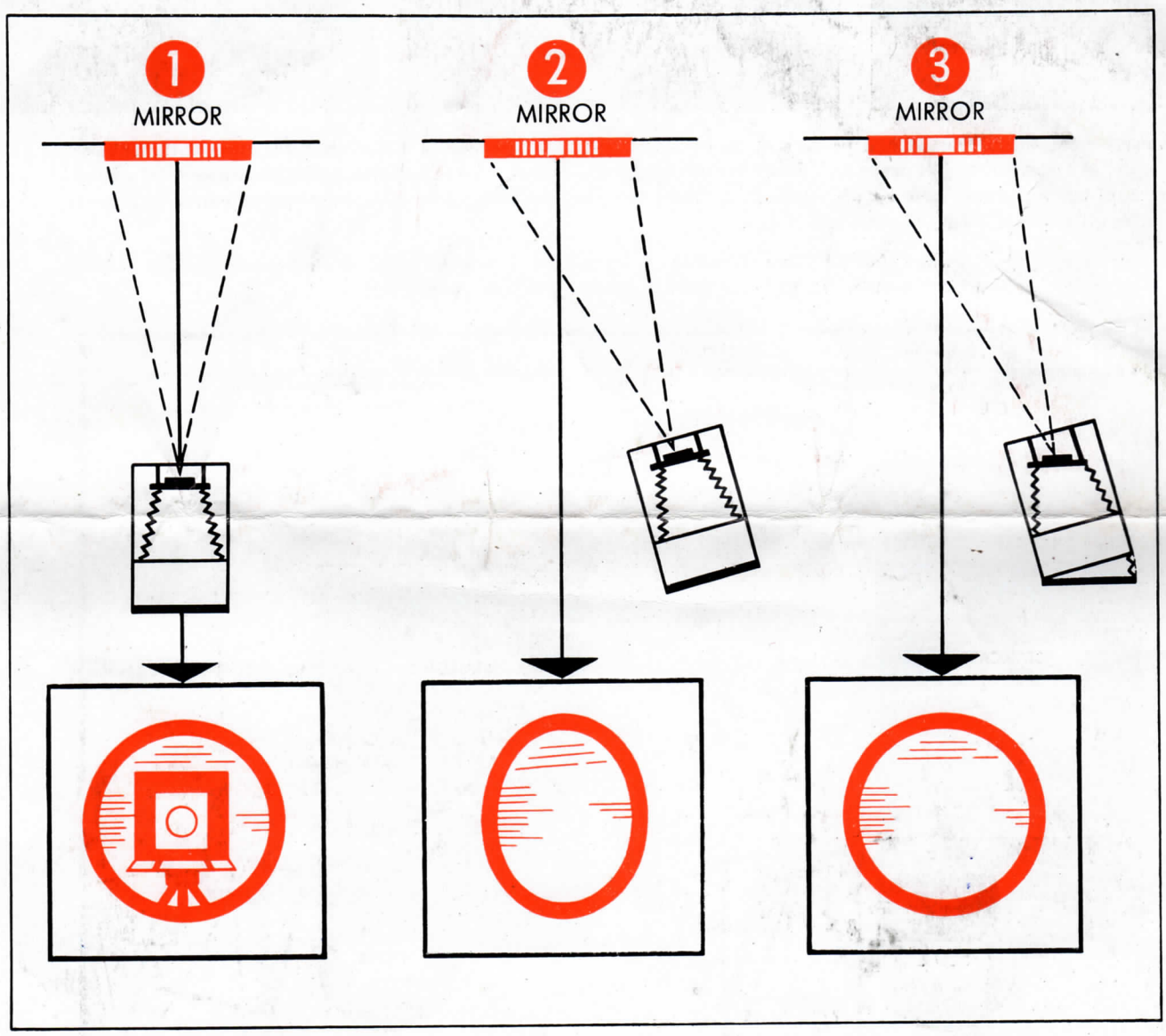
COMBINED FRONT AND SIDE VIEW WITH CAMERA ADJUSTMENTS:

By means of the camera technique described on the opposite page, the front plane of the subject is rendered as a rectangle and proportionally true, while one side of it is visible also. The advantages of the two aforementioned examples are combined.
Although in many instances the eye will tolerate subject distortion of diverging lines, it is quite frequently necessary to adhere strictly to the "parallel back rule" in technical and industrial photography.

THE LINHOF TECHNIQUE

Data Sheet No. 5

Front View from Oblique Camera Position



It sometimes happens that a subject must be photographed without its front surface being perpendicular to the camera axis. The reason for this may be a strongly reflecting surface of the subject, or lack of space. In both cases, the camera must be placed to one side, thus producing a distorted image of the subject. As a result, the picture looses its front view appearance.

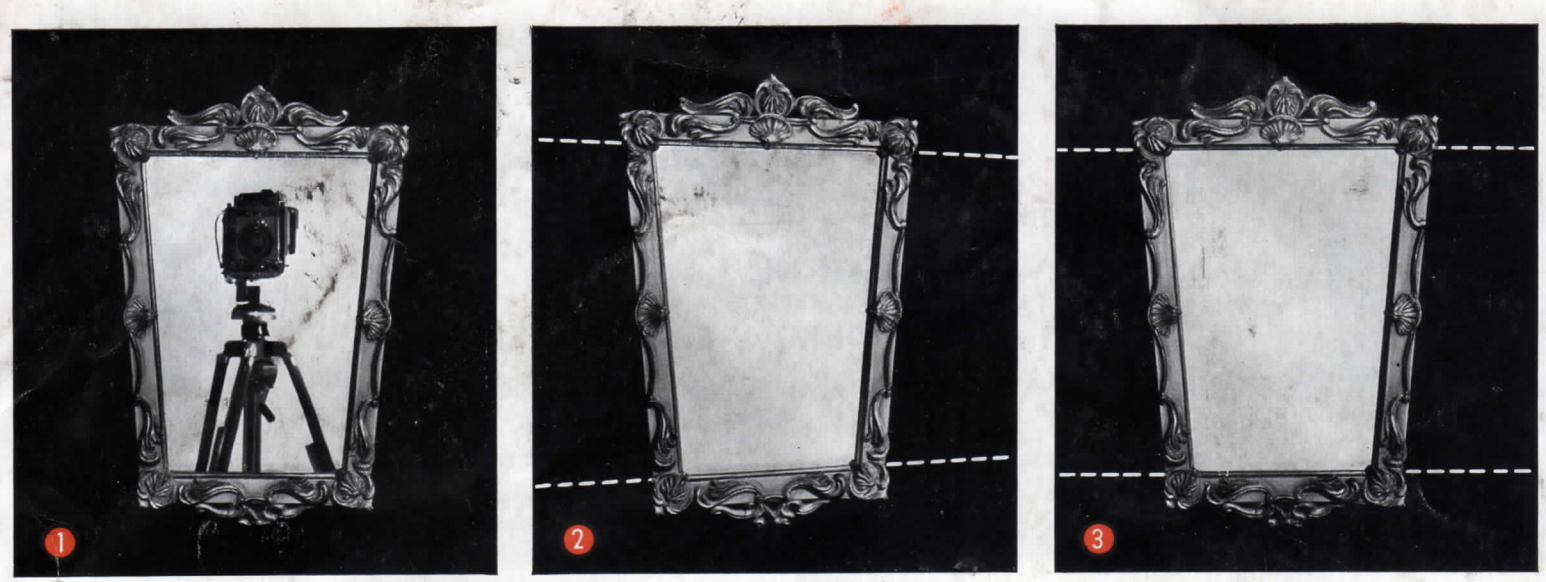
The above diagram shows a practical example:

1 Front view of a mirror. The camera was placed directly in front of the subject and thus was reflected in the mirror. In order to exclude the reflected image from the picture, the camera has to be moved to an oblique position.

2 The picture shows the mirror without camera, its shape, however, is strongly distorted.

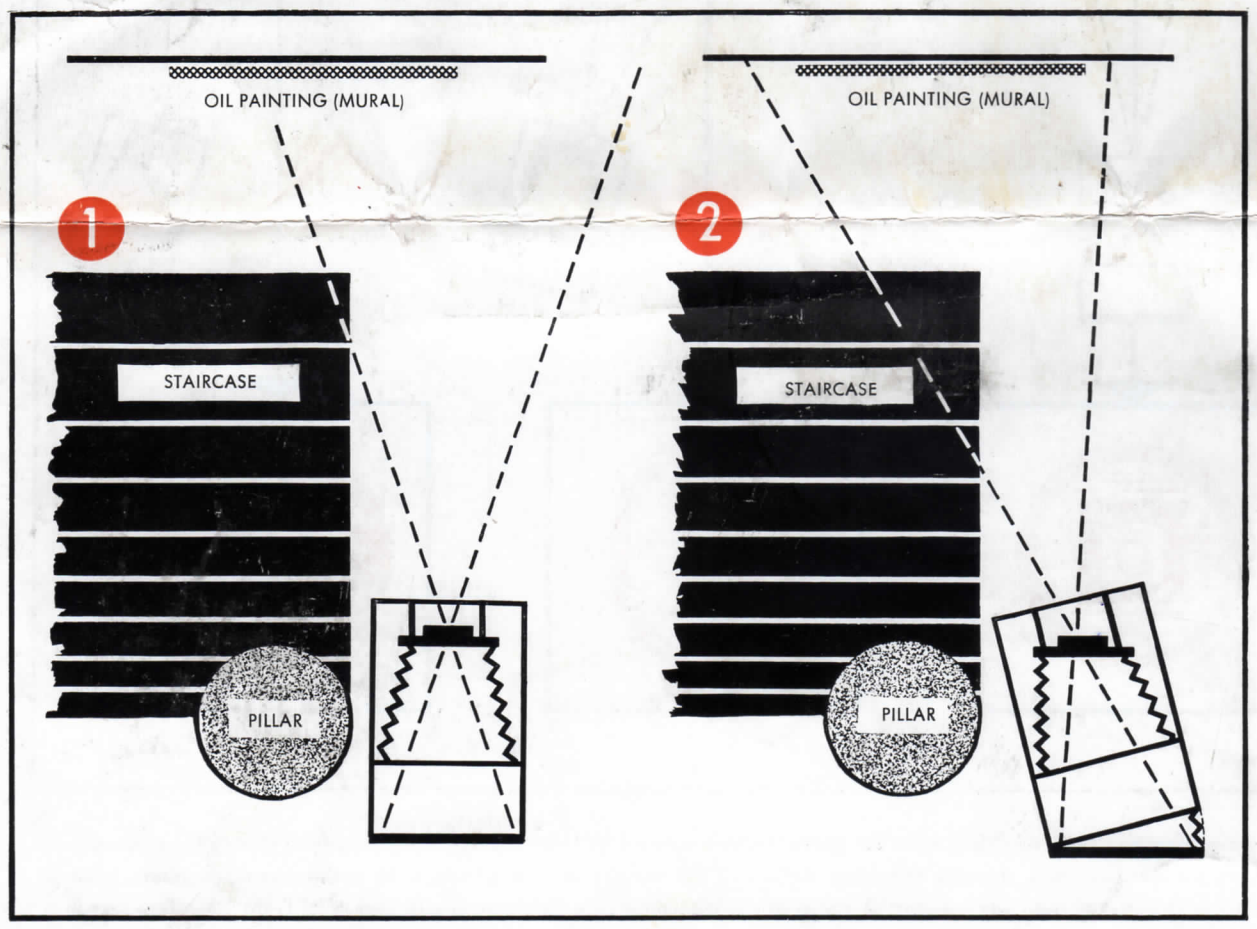
3 By adjusting the swing back of the camera horizontally, so as to be parallel to the front plane of the mirror, the image of the same will appear as though it had been photographed directly from the front (compare Data Sheet No. 2, 3, and 4). Finally, the lens standard also is swung in a position parallel to the film plane and to the front of the mirror, in order to provide sharp focus over the entire picture.

Linhof Precision Camera Works · Munich 25 · Rupert-Mayer-Strasse 45



In cases where an extreme oblique position of the camera is required, the lens is shifted laterally towards the subject, in order to bring the subject image into the center of the picture. This is done in addition to the aforementioned adjustments of lensboard and camera back. It should be noted that the lens must have sufficient covering power to prevent cutting-off corners (refer to Data Sheet No. 4).

Similar conditions exist when photographing oil paintings, framed pictures under glass or shop windows. The camera technique applied to achieve correct results is the same as described on the opposite page.



Quite often, an oblique camera position is unavoidable due to architectural structures, such as posts, pillars or staircases interfering with the viewpoint. Again the swing back is adjusted so as to be parallel to the front of the subject. Sharp focus is provided by swinging the lens into parallel position to the film plane.

Upon comparing the above with the camera technique described in Data Sheet No. 4, it will be noted that the adjustments are basically the same, only the subject matter and the requirements are different.

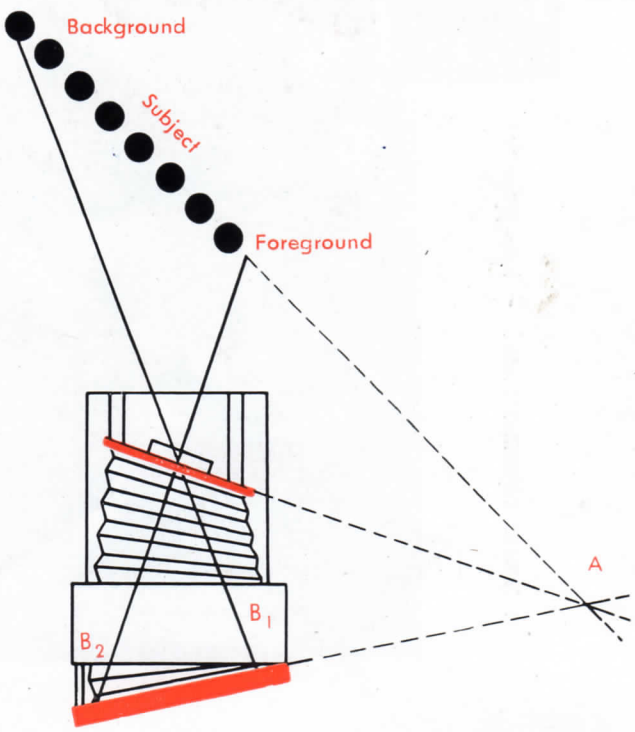
THIS AND MUCH MORE CAN BE ACHIEVED WITH THE TECHNIKA

Further LINHOF Data Sheets will follow! Please collect them for future references. Missing copies will be supplied upon request.

THE LINHOF TECHNIQUE

Data Sheet No. 6

Control of Perspective with the Swing Back

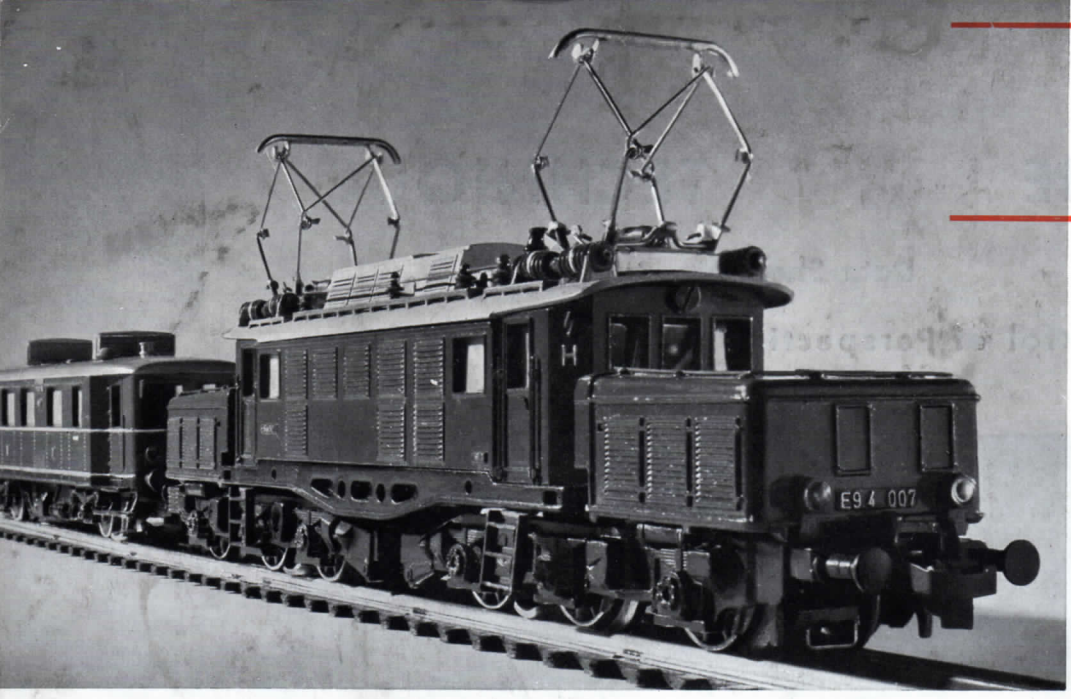


SPECIAL EFFECTS OF PERSPECTIVE,

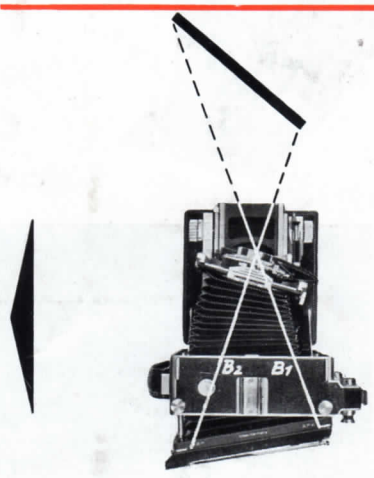
as for example intentional exaggeration (see above and on reverse page) often successfully employed in advertising and illustrative photography.

How can such dramatic perspektives be achieved by using camera adj ments? — In cases where perspective is to be rendered exaggerated, the sub should be photographed from an oblique position. The camera back is sw out at an angle opposite to that of the subject (see diagram). The degree adjustment depends upon the depth of the subject, i. e. on its extension towa the background, and is checked on the ground glass. The camera is prope adjusted when the part of the subject closest to the camera as well as the m distant part both appear in sharp focus. Sometimes even the maxim movement of the swing back alone is not sufficient to obtain a highly dram perspective with objects at a very acute angle. In such cases it is necessary also adjust the lens standard. This is indicated in the diagram at the It can be seen that the subject plane and the image plane are both incline the lens axis. They intersect the plane through the lens at right angles to lens axis at a common point A. The focal length of the lens used has als considerable influence on perspective. The shorter it is, the easier it is achieve intentional distortion with a sharp rendering of the entire subjec subjects. Wide-angle lenses are therefore especially suited for this type of w

Further LINHOF Data Sheets will follow! Please collect them for future references. Missing copies will be supplied upon request.

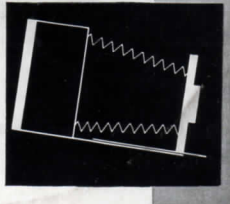


A toy train appears more attractive and quite impressive in exaggerated perspective — it looks almost like a real one. This effect is often used in modern advertising and helps to give a more favourable illustration of certain subjects.

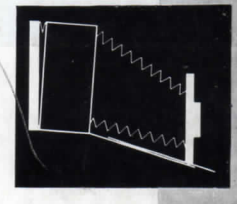


How can exaggerated perspective be explained? We know by experience: the longer the bellows extension, the greater the image size, provided of course that the focal length of the lens remains the same. Therefore, if we swing out the camera back, one side of the film plane will be farther away from the lens than the other, and hence the image size on the one side will be greater. As our diagram shows, the farthest subject will be rendered small (lens-to-film distance B 1), and the subject which is nearest to the camera is rendered proportionately larger (lens-to-film distance B 2). These different image sizes add to the effect already created by the normal perspective. In other words, we are creating exaggerated perspective. A further advantage of the camera technique described above is that the entire subject is in sharp focus (see Data Sheet No. 1).

In figure photography, especially with lenses of short focal length, a distorted perspective will result from camera positions higher or lower than waist level where the camera has to be tilted (see example on the left). To avoid this the camera back must be vertical. The lens must then be raised or lowered to accommodate the subject. To retain all-over sharpness without stopping down the lens, the lens standard should be set parallel to the camera back. In the event of extremely high or low camera positions, both the camera back and lens should be adjusted (see example on the right). Here it is essential to use a lens with sufficient coverage (see Data Sheet No. 4).



With non-adjustable camera - wrong proportions



With camera adjustments used - true proportions