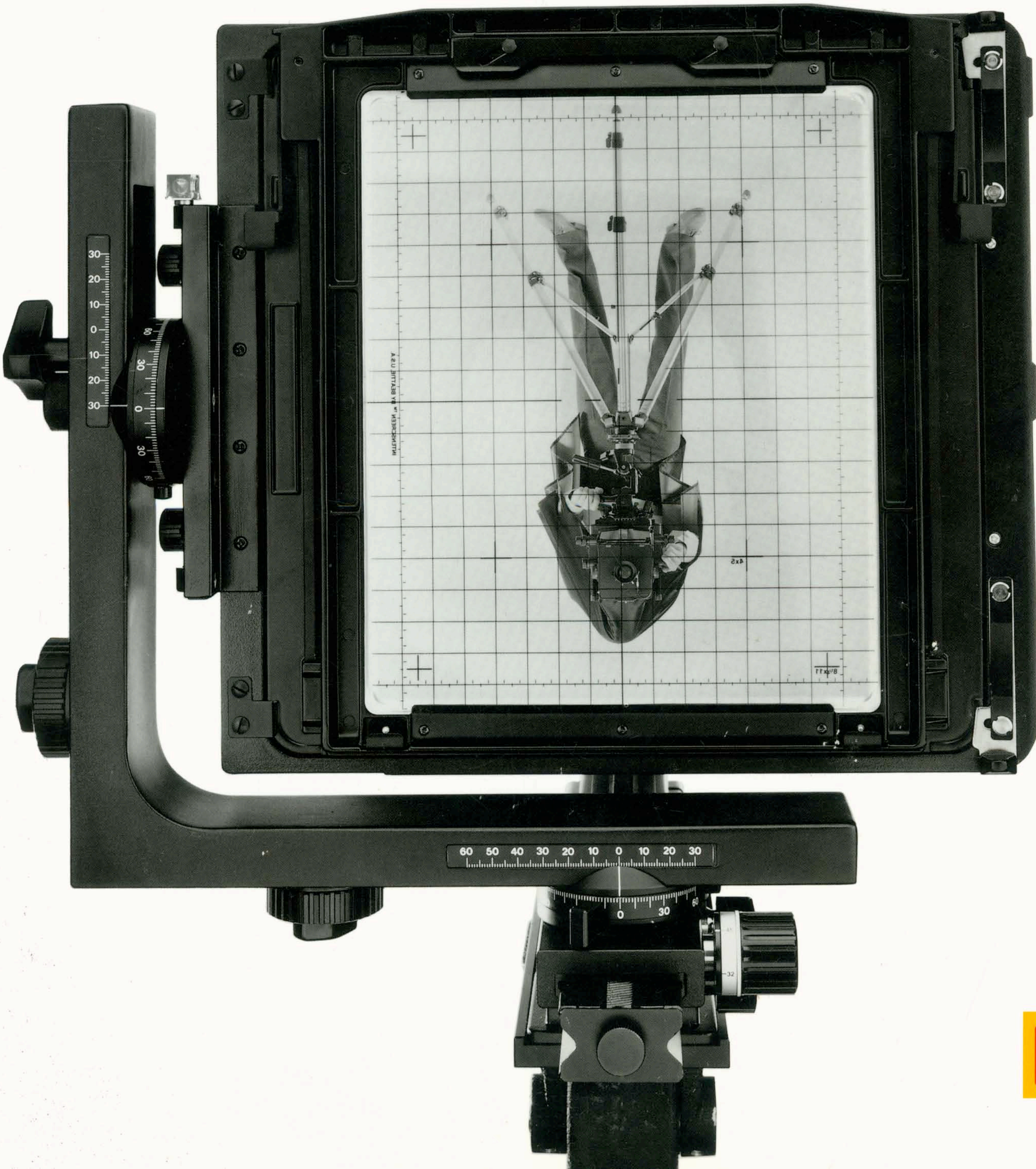
Photography With Large-Format Cameras

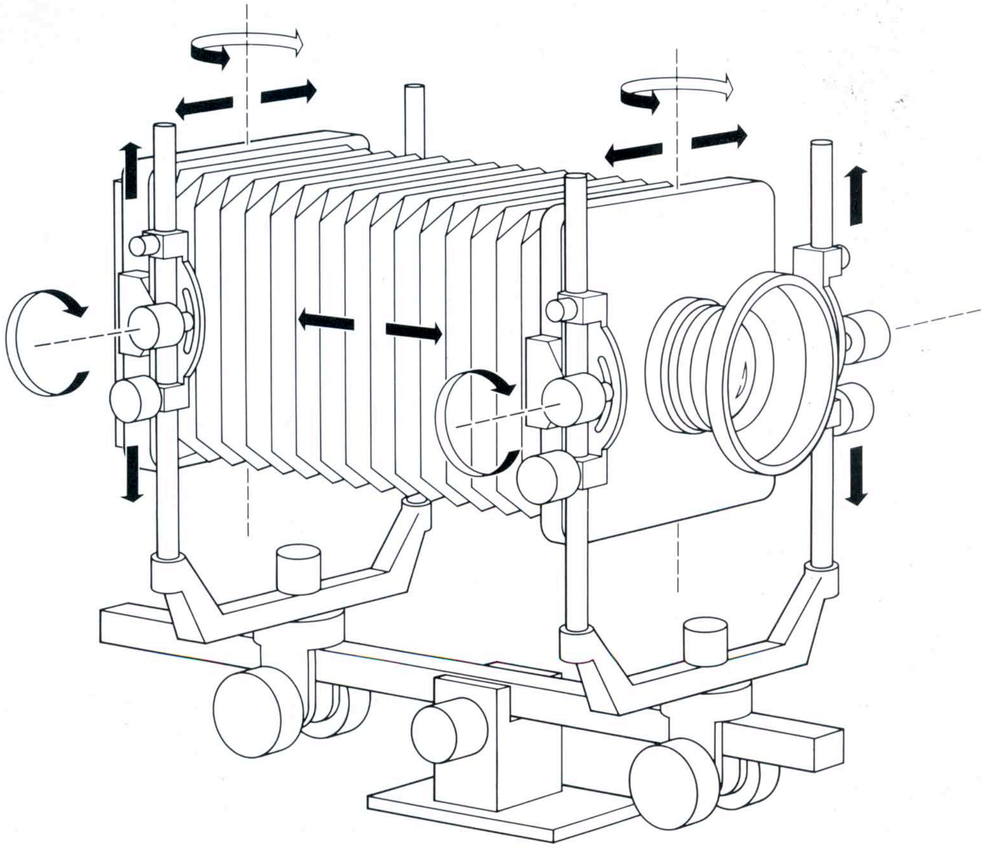


2 View Camera Movements

The principal features that set view cameras apart from all nonadjustable cameras are the camera movements. In a nonadjustable camera, the relationship of the lens to the film plane is fixed and permanent; other than switching from one lens focal length to another, or changing your camera position, fixed cameras offer you little actual control over image manipulation.

A view camera, on the other hand, allows you to change virtually every aspect of the lens/film relationship, including: lens-to-film distance, vertical and horizontal displacement, and angular relationship. Because of this flexibility, you have almost limitless control over the ground-glass image. Image size, shape, sharpness, depth of field, and apparent perspective: You can enhance, change or exaggerate each. In addition, you can shift the placement of the main subject within the borders of the ground glass without having to move the camera, allowing you to fine-tune composition even after the camera position has been established.

Unfortunately, the fear of learning how to manipulate these many adjustments is probably the single biggest reason many photographers (even experienced ones) avoid learning to use a view camera. Learned one step at a time, however, operating a view camera becomes (like everything else you've learned that seemed hard at first) almost second nature. And once you've mastered the various movements and can anticipate their effects on your subjects, you'll have earned a degree of technical and creative image control that no other camera can equal—and few photographers share.



The basic view camera movements are:

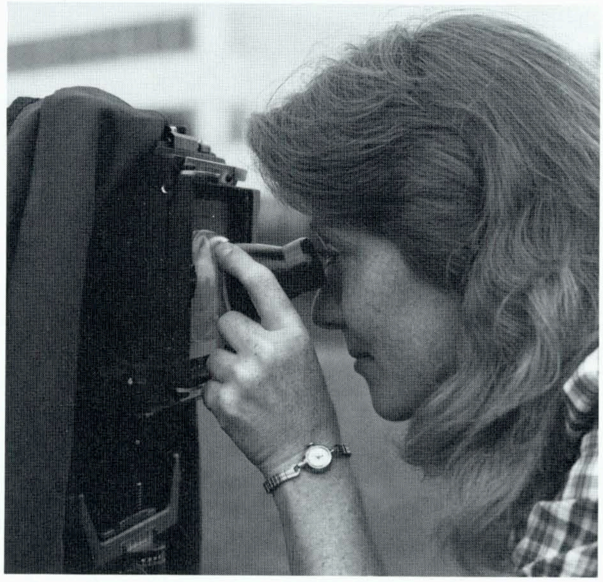
- Changing the distance between the lens and film.
- Lowering and raising the front and rear standards.
- Laterally shifting the front and rear standards.
- Tilting and swinging the rear standard.
- Tilting and swinging the front standard.

As mentioned earlier, not all cameras have all of these movements (or offer the same degree of adjustment), but because there is some redundancy, the absence of one adjustment is generally not critical. In most cases, the effect of any one adjustment that is not provided for can be duplicated by combining other movements.

The demands of architectural photography require the versatility and precise image control that are the hallmarks of the view camera. Photographer Rick Alexander used a 90 mm lens on a 4 x 5 camera for this interior shot.

Lens-to-Film Distance

Focus: The most basic view camera movement is the bellows adjustment—changing the distance between lens and film. The primary function of adjusting this distance is to allow you to focus the image. By gently sliding the front or rear standard forward or back, you can find the lens' critical focus for a particular subject plane. However, while you can focus most view cameras by adjusting either the lens or the ground glass, focusing with the rear standard is usually preferable since the distance from lens to subject (and therefore the subject's magnification) can change dramatically when the front standard is moved. Many view cameras have both "rough" and "fine" focusing adjustments, the latter allowing you to make critical focusing adjustments after the main focus has been set.

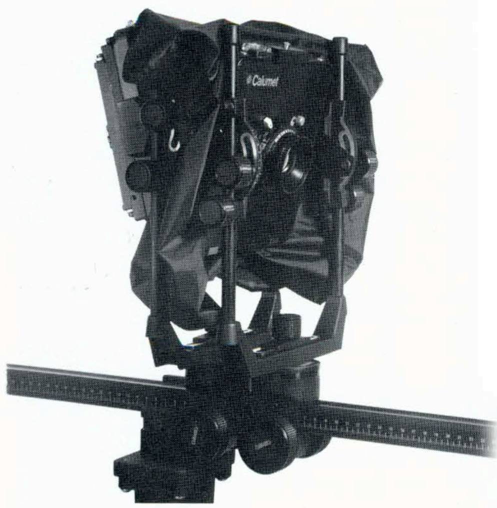


To obtain critical focus, examine the ground-glass image with a four-to-six power magnifier as you adjust focus with the *rear* control knob. The focusing cloth which would normally cover the back of the camera has been moved aside for this picture.

Focal Length: Another important function of a variable lens-to-film distance is that it allows you to use lenses of different focal lengths. A view camera lens can only be focused at infinity if the maximum bellows draw is at least equal to the focal length of the lens you're using. The longer a lens' focal length, the longer the bellows that's needed. An 8-inch lens, for example, must have at least an 8-inch bellows to focus on infinity. Similarly, if you were to change to an even longer focal length lens, the bellows would have to extend to cover its focal length—you can't focus a 12-inch lens on infinity with only 8 inches of bellows.

Shorter focal length lenses require a shorter bellows draw, but this can be a problem if the bellows is stiff and won't compress enough to focus the image or if it resists the necessary camera movements. You can usually solve this problem by mounting the lens on a recessed lensboard, or if the camera allows, by substituting a bag bellows for the conventional accordion bellows.

Short focal length lenses frequently require recessed lens boards that allow positioning the lens close enough to the film for proper focus.



Replacing the conventional bellows with a supple, lighttight bag bellows unit allows for a wide range of adjustments when working with short focal length lenses.

Image Size: Bellows adjustment also affects image size on the ground glass. Because the lens-to-film distance must increase as the lens focuses on closer subjects, moving closer to get a bigger image is limited by the extension of the camera bed and/or the bellows for a given lens. For example, to achieve a 1-to-1 scale of reproduction, the lens-to-film distance must be two times the focal length. For an 8-inch (203 mm) focal length lens, the lens-to-film distance would have to be 16 inches (406 mm).

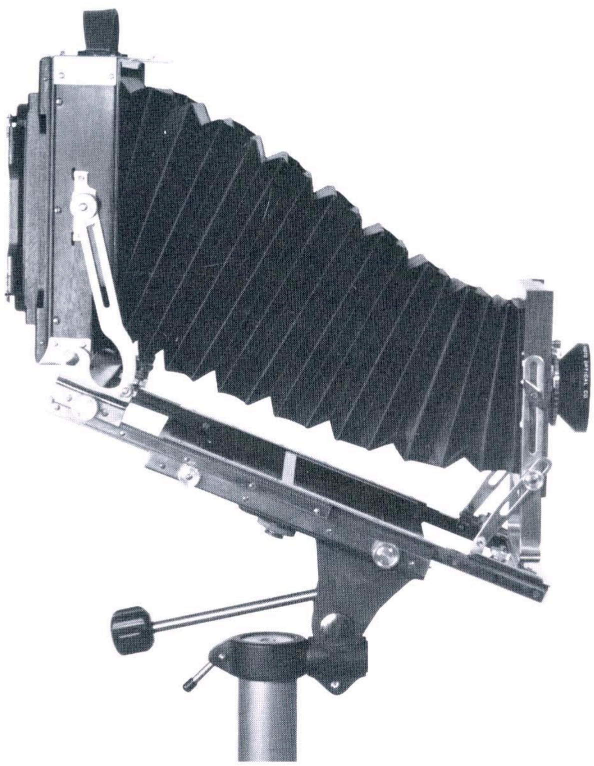
You can also get a larger image size by switching to a longer-focal-length lens. For distant objects, image size is directly proportional to focal length. With the camera in a fixed position, substituting a 16-inch focal length lens for an 8-inch lens would double the image size. Again, the length of the bed and/or bellows will dictate how long a focal length lens you can use—and thus the maximum image size of a distant subject. See chapter 3 for more information about lenses.

Rising and Falling Movements

The rising and falling adjustments of the front and rear standards have a comparable effect: they move the position of the image relative to the film without having to tilt the entire camera up or down. In effect, these movements place the film nearer to the edge of the circle of illumination (see page 37), or field, of the lens. Therefore, the extent of the vertical movement depends on the covering power of the lens (page 37). Definition and light intensity often falls off at or near the edge of the field, particularly with short focal length lenses.

In cameras with limited vertical adjustment, you can often use movements to augment one another when one alone does not give the desired result. For example, if the lens board cannot be moved down vertically from the central position, you can duplicate the adjustment indirectly by tilting the camera bed, or base, downward, and then restoring the lens board and back to the vertical position. Because the film and lens planes remain parallel, regardless of how much up or down shift you use, no change in the shape or geometry of the image occurs—only its relative position on the ground glass is altered. The *shape* of the subject changes only when the plane of the film and the subject are *not* parallel.

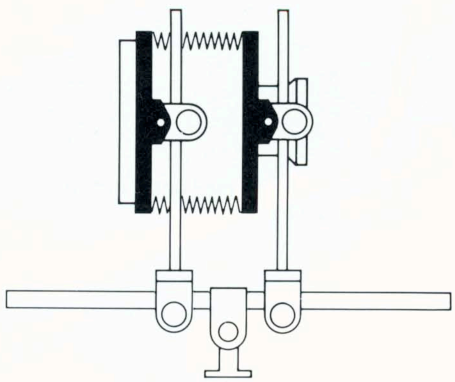
What does all this mean in terms of controlling the image? On a minor scale, such movements allow you to hone your compositions after the camera position has been set—a kind of in-camera cropping device. But more importantly, rise and fall movements allow you to control the convergence of vertical lines within a scene—in photographing a tall building, for example.



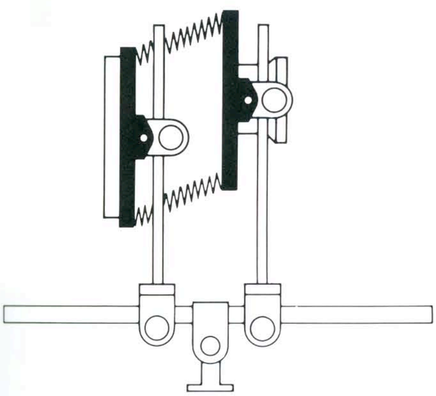
Combining a rear tilt with a front tilt—and changing the camera tilt—produces the same effect as a rise and fall adjustment.

If you've ever aimed a 35 mm camera straight up at a tall building, you know how dramatically the verticals appear to converge—the building seems to be leaning backwards in space. This effect is called keystoning, and it occurs whenever the film plane and subject plane are not parallel. (In real life, even though our eyes may detect the apparent convergence, our brain ignores it because we know from experience that the lines of the building are, in fact, parallel.) With a view camera, on the other hand, you can raise the lens (or lower the back) and take in the top of the building while still keeping the lens and film planes parallel to the building. The result is a tall building that goes straight up, with no convergence.

Of course, buildings aren't the only subjects you can correct—still-life subjects can be photographed geometrically correct using the rise and fall movements. Rising and falling can also be useful in eliminating distracting foregrounds where restricted mobility might prevent you from using a better vantage point. By raising the lens, for example, you might be able to include an overhanging tree limb as a compositional element at the top of the frame.



Starting with the camera level and perpendicular keeps the vertical lines of the subject parallel but cuts off the top of the building.



With the camera level and perpendicular, simply elevate the front lens standard (a rise adjustment) to bring the top of the building into view—this keeps the vertical lines parallel. The lens must have adequate covering power to prevent vignetting when using this adjustment.

Lateral Shift

The lateral shifts of the front and rear standards have an almost identical effect as rise and fall, except that the image moves sideways on the ground glass rather than up and down. Again, as with the rising and falling movements, you must be concerned with the covering power of the lens and the loss of definition and illumination at the side of the negative nearest to the edge of the lens field. Be sure to examine the ground-glass image very carefully for vignetting.

You can use lateral shifts in two ways that have similar advantages to the effects of vertical movements. First, you can shift the lens board right or left to change the placement of the image on the ground glass after the camera position has been set. Second, you can use the back shift to control convergence—in this case, the convergence of horizontal lines in the subject.

Situations where these adjustments can be helpful would include a setup where it is necessary to photograph the front of a subject but a straight-on camera position is impossible or undesirable. In interior photography, for example, you might have to photograph a room with a mirror or other reflective surface in front of the camera. If you place the camera directly in front of the mirror, the camera will appear in the image. However, by setting up to one side of the mirror, with the lens board and back zeroed and parallel to the subject plane, the reflection will be eliminated. Then, to recenter the image *and* control the convergence of horizontal lines in the scene, shift the front and back laterally in opposite directions.

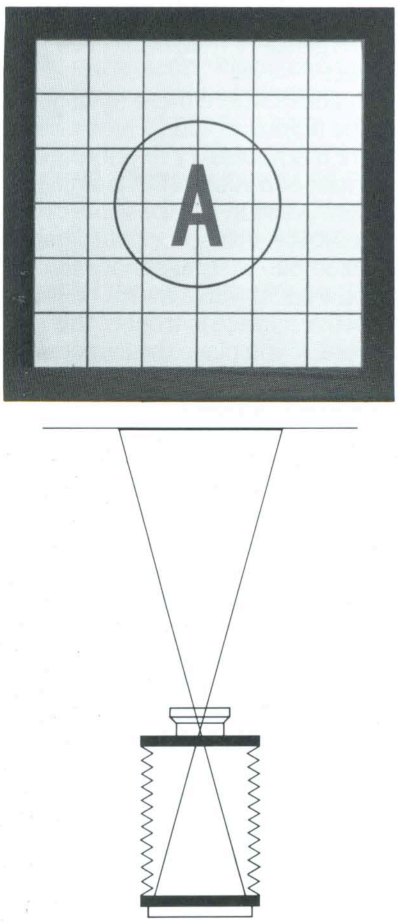
One important aspect to remember about both rising/falling and shifting is that while in many situations it may not seem to matter whether you move the front or rear standard, it is important to some degree. Moving the back of the camera (up or down or sideways) moves the image across the ground glass, and it has no effect on subject shape or the camera's point of view. Moving the lens, on the other hand, does alter the camera's viewpoint slightly—the spatial relationship between near and far subjects changes as the lens moves. The shift in viewpoint may be minimal, but you should be aware that it is happening.

Swing and Tilt

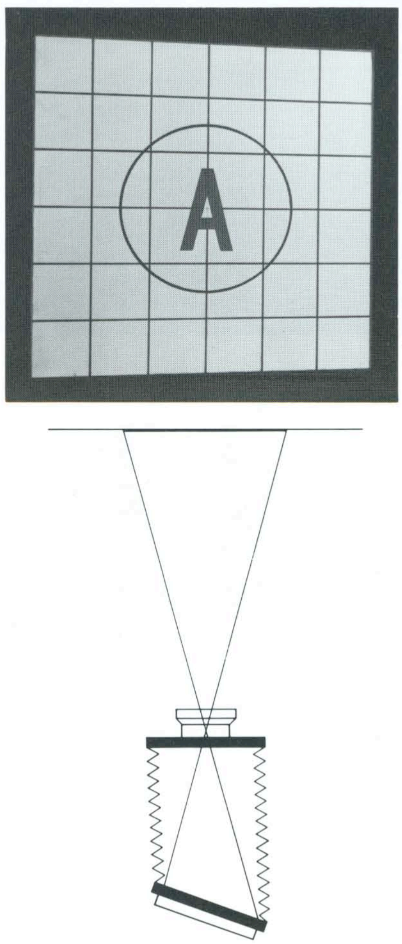
In addition to moving up and down and sideways, the front and rear standards on most view cameras can also be tilted on both their horizontal and vertical axes. Rotation on the vertical axis is called "swing," and on the horizontal axis it's called "tilt." But unlike the vertical and horizontal sliding movements, swing and tilt do not have the same effect for the front and the rear standards—in fact, in most cases the results are quite different. The most important difference between the two is that pivotal movements at the *lens* plane affect only image sharpness, while movements at the *film* plane change both image sharpness and shape.

Rear Swing and Tilt: The reason the swinging and tilting motions of the rear standard affect the shape of a subject is because such movements change the lens-to-film distance. If you've ever tilted one end of the paper easel under an enlarger, you've seen how drastically the geometry of the projected image can be altered: the image on the side of the easel that is closest to the lens becomes smaller and the image on the side farthest away becomes bigger.

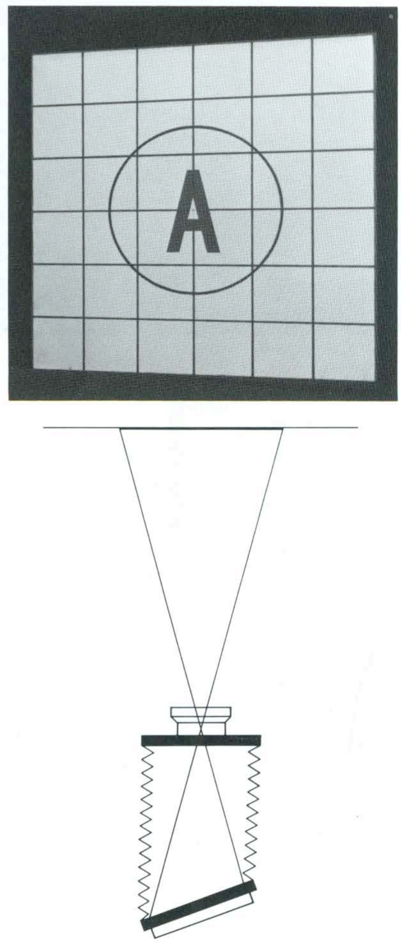
The change in image shape and size that results from angling the camera back is most obvious when the subject has well-defined parallel lines. As an example, if you were to position the camera so it was straight-on to a rectangular building with both the lens board and the camera back parallel to the front of the building, both ends of the building would be of equal height and the shape of the building would be correct on the ground glass. But if you were to swing the back of the camera so that it was no longer parallel to the front of the building, one edge of the ground glass would be closer to the lens than the other. The effect would be to change the building's shape, making one end look taller than the other.



Top view
With all adjustments on the camera "zeroed," this twelve-inch square appears symmetrical. (The photographs represent the finished print, *not* the image on the ground glass.)



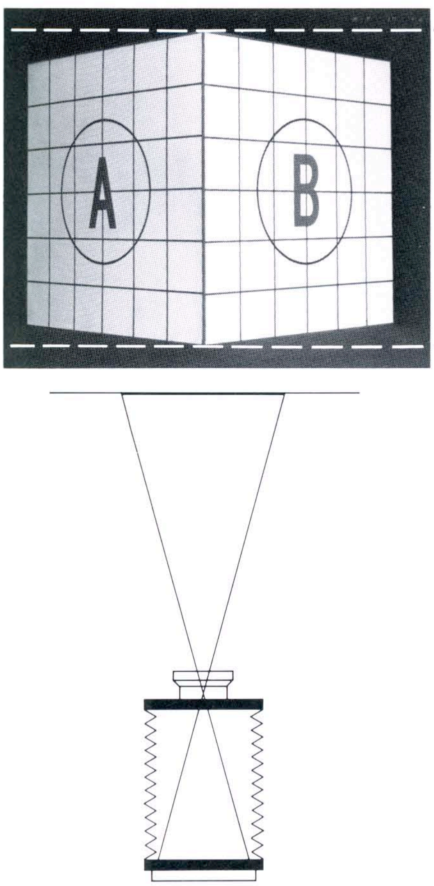
Swinging the rear standard of the camera clockwise makes the left side of the square larger.



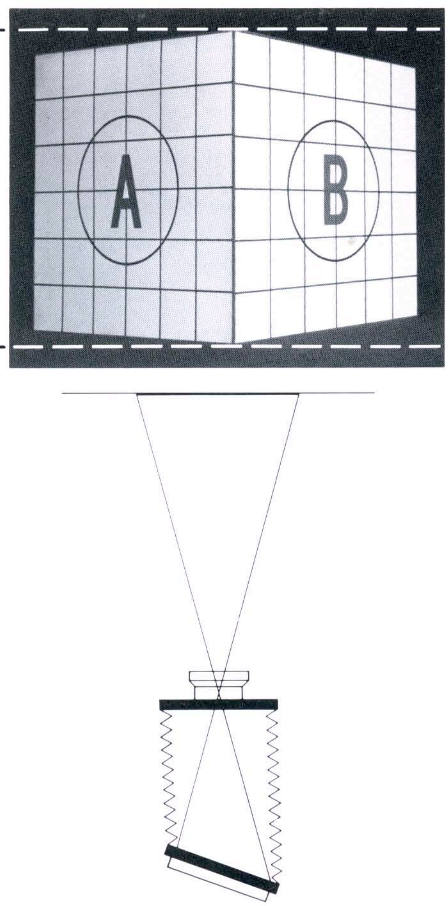
By swinging the rear standard of the camera counterclockwise, the right side of the square becomes larger (its image is formed farther from the lens).

You can visualize the change that rear swings and tilts will have if you remember this: objects on the ground glass that are closer to the lens will be smaller, and those farther away will be bigger. Also, tilting or swinging the back affects the film's relationship to the lens by changing the location of the plane of sharpness. As we'll see later, the area of sharpness can also be affected by stopping down the lens to increase depth of field, or by tilting or swinging the lens. Changing the lens-to-film distance with the swings or tilts can also drastically alter the amount of light reaching the film from the near and far points. Most lenses (even the best) show some illumination fall-off as the adjustment is made.

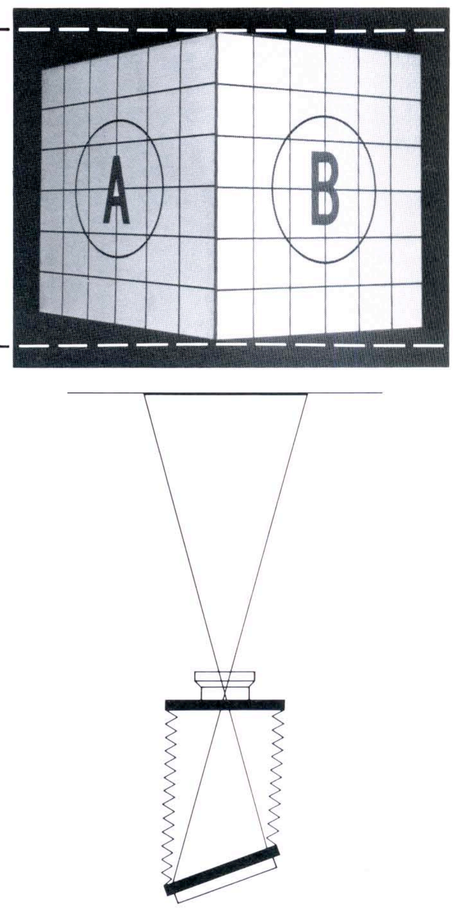
The most practical use of rear swings and tilts is to control the convergence of either vertical or horizontal subject lines (or both). As was discussed in the rising/falling section, for parallel lines in the subject to remain parallel in a photograph, the film plane must be kept parallel to the subject plane. However, controlling the convergence of parallel horizontal lines gets a bit more complicated when you're photographing a subject from an angle so that it shows two sides with parallel lines converging in different directions—in a three-quarter view, for instance. The problem is that when you swing the back to correct for the convergence in one plane, you exaggerate the convergence in the other.



If you view the cube from the corner, and all camera adjustments are "zeroed"—both sides of the cube appear normal.



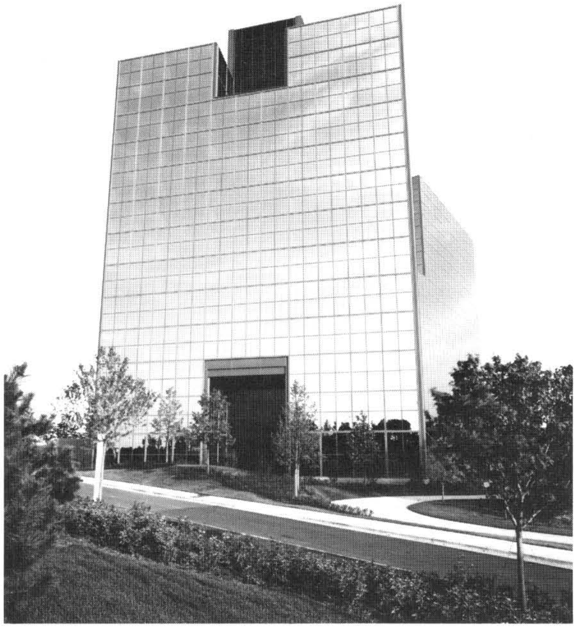
Swinging the rear standard clockwise decreases the normal convergence of the left side—and increases the convergence of the right side (the left side becomes larger).



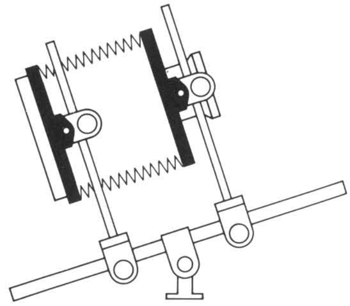
Swinging the rear standard counterclockwise decreases the normal convergence of the right side—and increases the convergence of the left side (the right side becomes larger).

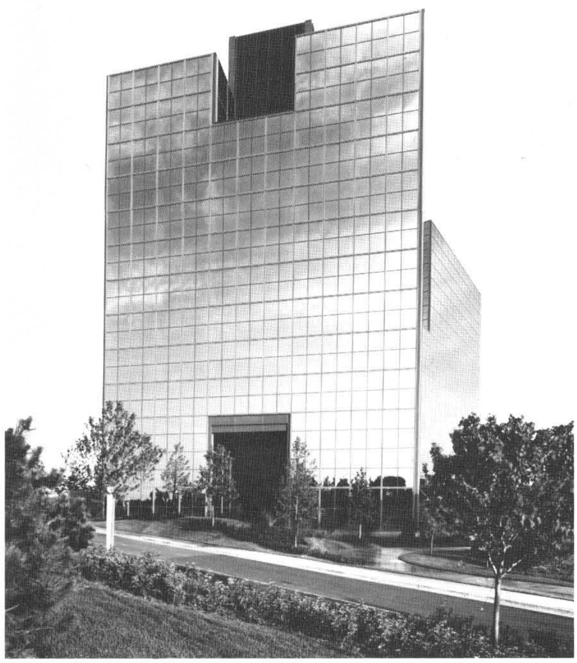
Fortunately, a certain amount of horizontal convergence enhances the three-dimensionality and depth of the subject, so the effect may not be objectionable. If correction is desired, it's usually easier and more appealing visually to correct the plane that contains less convergence. In any case, horizontal convergence is usually not as noticeable as vertical convergence and is often overlooked. In fact, it's interesting to note that when a subject in which we normally expect to see some convergence (either horizontal or vertical) is perfectly corrected with camera movements, the corrected image can be more distracting than the uncorrected image.

Many photographers use the swinging/tilting back to exaggerate, rather than correct, the convergence of horizontal or vertical lines and thus enhance the illusion of distance (or height) within a scene. A long city block, for example, can appear to stretch even farther into the distance if you swing the back away from the dominant parallel plane—just as a tall skyscraper appears all the taller when the film plane is tilted out of its true vertical position.

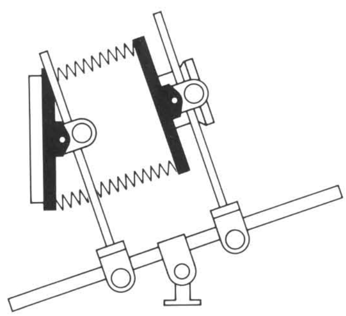


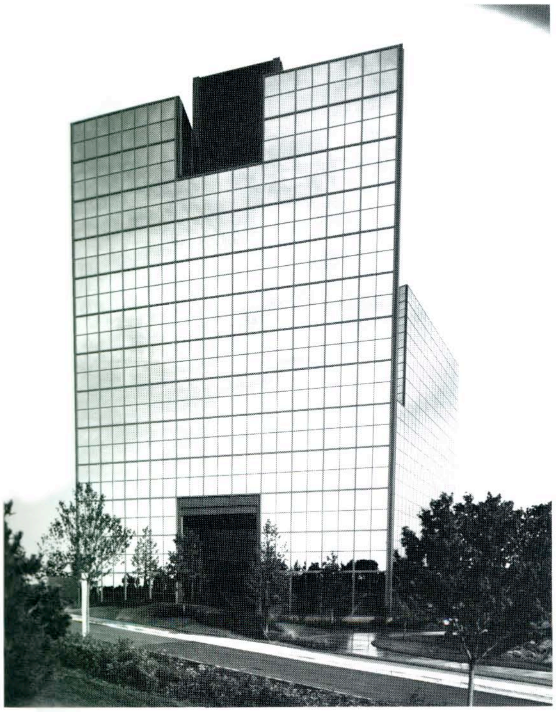
Tilting the camera upward so that the entire building can be seen produces the normal effect of convergence. Cameras with no front or back movements will produce a photograph similar to this.



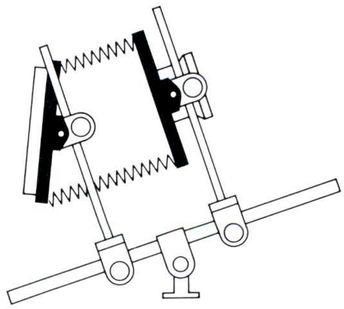


When tilting the camera upward, also tilting the camera back forward so that the film plane becomes parallel with the plane of the building corrects the converging vertical lines.





By tilting the camera back forward even more toward the building, the verticals become over-corrected. This causes a divergence of the building's lines (and possible vignetting).

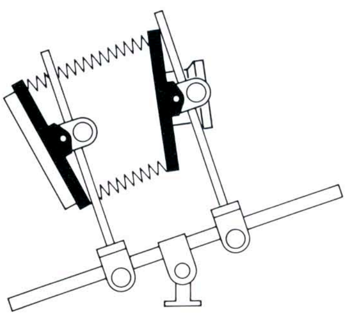


Finally, although it's easier to visualize the effect that tilting and swinging the camera back will have on a subject's shape when the subject contains distinct parallel lines, these movements will also noticeably alter more irregularly shaped objects. Apples and oranges, for example, can be strangely elongated, or a tall wine bottle shrunk down into a disquieting squat shape. Still-life photographers frequently use such adjustments to enhance the drama of their subjects—creating perfume bottles that soar toward majestic heights or silverware place settings that are elongated elegantly.

The effects of tilting and swinging the film plane on image shape can be summarized in two statements:

1. Tilting the film plane controls the convergence of vertical subject lines and image size from top to bottom.
2. Swinging the film plane controls the convergence of horizontal subject lines and image size from side to side.

Tilting the camera back *away* from the subject plane exaggerates the convergence.

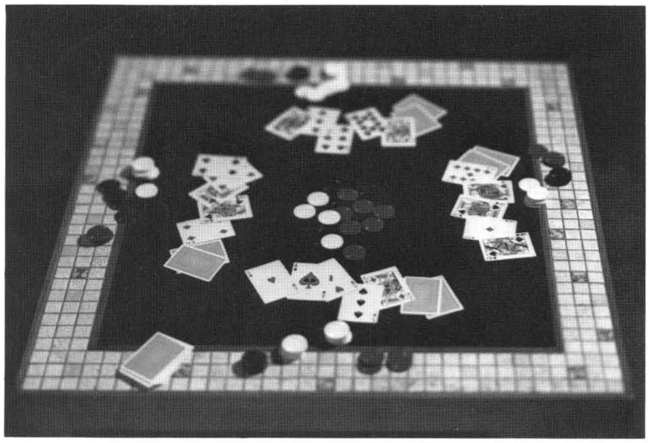


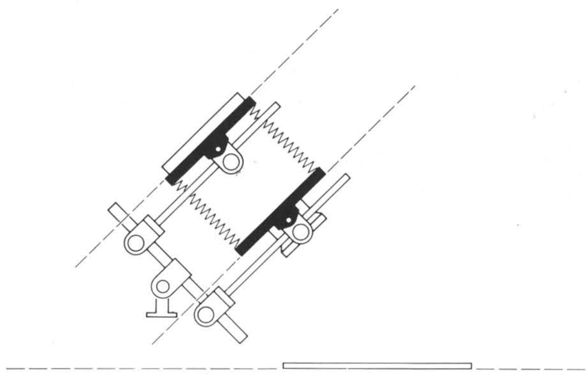
Front Swing and Tilt: The only reason for tilting and/or swinging the plane of the lens is to reposition the plane of sharp focus within a scene—the shape of the subject does not change. You can also control the plane of sharp focus by swinging or tilting the camera back, but as we've seen, any angular movement of the back standard also alters the shape of the subject.

Depending on where the lens pivots, the lens-to-film distance may or may not be altered. If the lens pivots on its horizontal axis, the lens-to-film distance doesn't change (only the angle of the lens' image changes). However, if the lens pivots at its base, there will be a definite change.

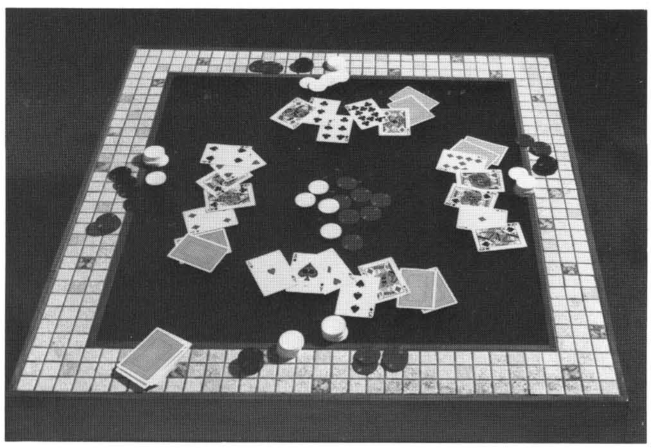
Visualizing the concept of specific zones of focus is easy if you remember that a lens can only focus sharply on one plane at a time. When a view camera is set up with both front and rear standards in their normal or zero positions, for example, the plane of sharp focus is a plane in space that is exactly parallel to them (just where in space that plane falls depends on where you've focused the lens). Now, if you tilt or swing the lens that plane of sharp focus moves. Tilt the lens forward and the plane of sharp focus also tilts forward (to an even greater extent than the tilt of the lens). Swing the lens left or right, and there is a similar swing in the plane of sharp focus. Since few subjects are perfectly flat and perpendicular to the lens axis (other than paintings or walls) this ability to change the angle of the plane of focus can be a very useful control for the view camera user.

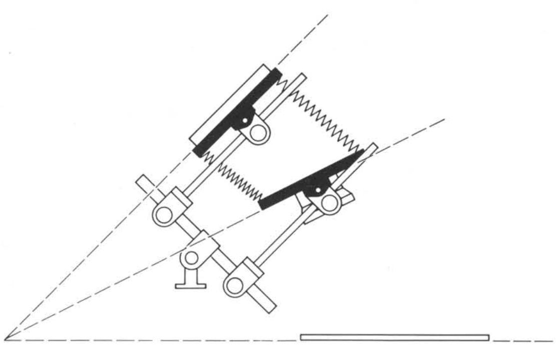
Interestingly, if you stand facing the side of the camera and draw an imaginary line through each of the planes of the subject, lens, and film, you will find that these three planes meet along a common line. This relationship of the convergence of the three planes is known as the Scheimpflug rule—named after Theodor Scheimpflug, the Austrian surveyor who first discovered the principle in 1894. Scheimpflug observed that when these three planes met on a common line, the entire image was sharp from near to far, even at full aperture. Keeping this principle



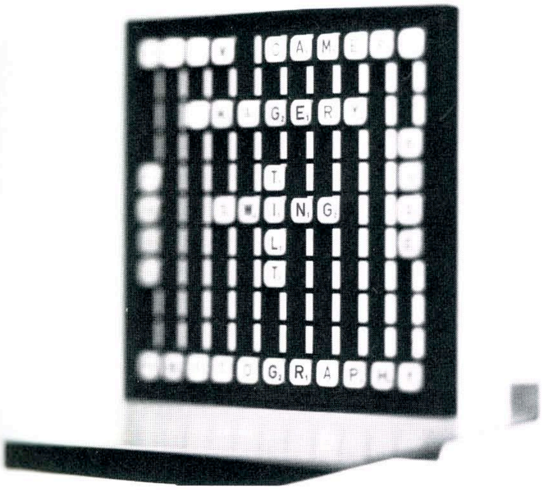


With the aperture set at *f*/8, the plane of focus is very shallow when there are no camera corrections.

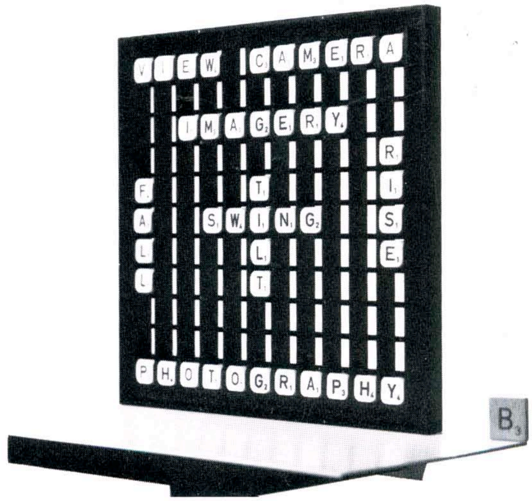




Tilting the front lens standard toward the plane of the table surface aligns the plane of focus with the subject. The *f*/8 aperture, and a slight rise adjustment, produces an image that is sharp from front to back.



When the subject is photographed at an angle, the shallow plane of focus at $f/5.6$ becomes apparent.

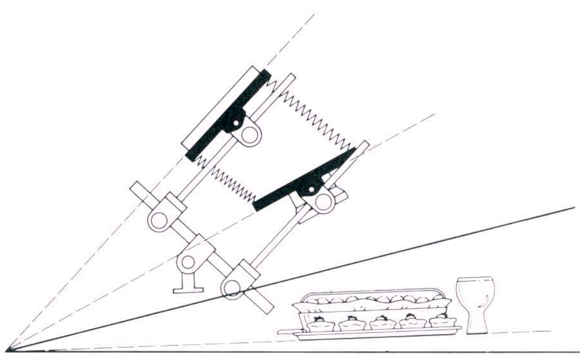


Without changing the aperture, swinging the lens plane parallel to the subject plane corrects the plane of focus. A slight lateral shift is required in the rear to center the image.

in mind can be very useful in finding the proper amount of lens and back tilt needed to give maximum sharpness for a given scene.

In one sense, a photograph made using the tilts and swings necessary to satisfy the Scheimpflug rule seems to reveal great depth of field. In the second image of the card table, for example, the plane of sharp focus extends from the near edge of the table to the far side. But don't confuse a long plane of sharp focus with great depth of field. Although the image is sharp from near to far, the depth of field is not equally wide throughout its placement in the scene. Technically, depth of field increases by the square of the subject distance. In other words, depth of field increases dramatically with increasing distance from the lens, and as you can see in the accompanying diagram, it actually forms a funnel-shaped pattern expanding outward from the camera.

© Kraft Inc.



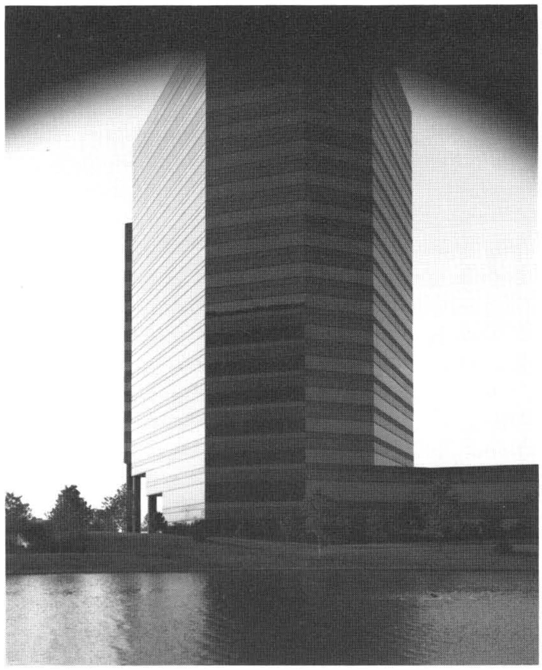
The maximum possible sharpness results when the planes of the subject, lens, and film meet along a common line. Notice that the area of sharpness (indicated by the solid lines) is not even—it expands as the distance from the camera increases.

In situations where you might consider swinging or tilting the camera back to control the plane of focus, keep in mind that the required direction of movement will be opposite to the direction of movement needed to correct the convergence of parallel lines. Therefore, use the back adjustments to control image sharpness only when the accompanying change in image shape isn't important (or when an exaggerated linear perspective is aesthetically acceptable).

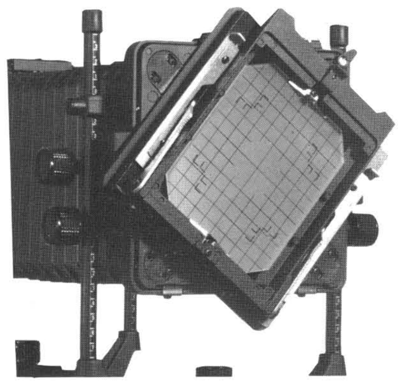
When you want to control both image shape and the angle of the plane of sharp focus, you must use the back adjustments to control image shape and use the lens swings or tilts to control the focus. It's important though to adjust the back first and then the lens, since changing the back affects both image shape and focus; changing the lens board position affects only the focus.

One caution to be aware of with all camera movements—but particularly with excessive tilting and swinging the lens—is that such camera movements shift the lens axis away from the center of the film. As a result, the evenness of the image illumination on the film is affected. In extreme cases, or where the lens doesn't have adequate covering power, vignetting is also a potential problem. It's a good idea to check the ground glass frequently—particularly at the edges—when using lens tilts.

Reversing and Rotating Backs: One last camera adjustment that's unique to view cameras is the revolving or reversing camera back. With a handheld camera, changing your composition from horizontal to vertical (or vice versa) means turning the entire camera on end. But with a view camera, you can simply rotate the groundglass. Some view cameras allow you to position the ground glass anywhere in a 360-degree revolution ("revolving" backs), while others can only be rotated to 90-degree intervals. Most backs stay attached during repositioning, but some models, particularly older field cameras, may require you to remove and re-attach the back.



An example of vignetting resulting from excessive corrections or the limited covering power of a lens. Vignetting is no always apparent on the ground glass, especially when the aperture is wide open. Some lenses show a gradual loss of covering power with a drop-off in illumination towards the extremes of their coverage.



A rotating camera back allows you to produce properly aligned images without tipping or tilting the camera. To move the entire camera body generally calls for additional corrections.

Summary of View Camera Movements

A long bellows draw is required for long focal length lenses and for close-up work.

The full use of view camera adjustments requires a lens with adequate covering power.

The swing or tilt of the camera back alters the shape of the image and controls perspective.

The swing or tilt of the lens board controls sharp focus when the principal plane of the subject and the camera back are not parallel.

Horizontal and vertical lens board adjustments help to center the imag on the film.

The revolving back adjusts the place ment of the subject on the negative without the necessity of moving the camera.