

ZONE VI STUDIOS INC
Newfane, Vermont 05345-0037

"A construction is a new organization of the world and life."

The Myth of the Eternal Return, Eliade.

How to Build a Camera,
by Fred Picker

In 1972, when Zone VI started up, I drew up a wish list of products that some day I hoped to manufacture. These included a better cold light than was available, a better print washer than my East Street, a more friendly and accurate meter than the SEI and, while dreaming, why not dream up a camera? In the ensuing years, Zone VI has developed many of these products and several others. The things we made were helpful in processing art. A camera is more serious; a camera is for making art.

People who share a common passion tend to find each other. In June of 1985 I met Ron Wisner, president of the Wisner Classic Manufacturing Co. of Marion, Massachusetts. Ron is an active, exhibiting photographer. He also has an extensive background in engineering, is an expert on the properties and characteristics of metals and woods, and is a master machinist and wood craftsman. He knows enough about lenses to buy old ones, rebuild, re-cement, and re-calibrate them and then get them back together. He was, and is, a designer and builder of harpsichords, organs, and fine cameras. I went to Marion to see his headquarters. The plant is new and bright,

spacious and clean, and there is a lot of very elegant and expensive-looking machinery. The people were extremely impressive. You got a clear impression of a proud, lean, efficient operation.

After several exploratory discussions followed by a week together at our workshop, it became apparent that Ron possesses, according to a Doctor at the workshop who specializes in that sort of thing, "an obsessive compulsive perfectionist personality." Perfect; building anything is an adventure into the unknown and to reduce the odds against failure, you had better have a great partner. We shook hands on our decision to join forces to create an extraordinary camera. It would be a classic, and that's what we would name it.

It must work flawlessly. It must last. It must be beautiful. It must be the best of its kind. We would compromise on nothing. We would use the finest materials available and assemble a camera to standards of strength and precision usually found only in musical instruments. We agreed at the start that if we couldn't create a better field camera than the best available (the Deardorff) we would drop the project. We never discussed the camera's appearance; there was a tacit understanding that if we dedicated ourselves to the function of photographing as naval architects dedicate themselves to the function of speed in designing an America's Cup yacht, the camera, like the yacht, could not help but achieve beauty of form. Nor were we concerned with cost. Meticulous design and organized manufacture by skilled personnel using precision machines in an efficient environment are compatible with reasonable cost. In

addition, our low overhead operation, which avoids distributors overhead and profits, salesman's commissions, high rent retail store markups, etc. would further hold down costs. And finally we agreed that if we didn't believe strongly enough in our camera to do something no one else would consider; unconditionally guarantee it for the life of the purchaser, we'd drop the project.

If you ask a Vermonter, "Howse your husband?" she will probably reply, "Compared to what?" We also needed something to compare to as we went along and you need something to compare to in making this very important choice. We acquired a new Deardorff camera to use both as a benchmark and a point of departure. I'd like to state, right off the bat, that the comparisons I will describe are in no way designed to demean the Deardorff. They have been used by photographers as great as Paul Strand and they enjoy a long tradition of building great cameras. Thousands of marvelous pictures have been made with them. Those who asked me during the past years what 8x10 or 5x7 camera to consider know that I always recommended the Deardorff as my first choice.

We started with a clean sheet of paper and designed our camera from scratch. A monorail camera consists of front and back standards sliding on a rail and there are few constraints of design, but the classic folding camera encompasses baffling geometry. We got invaluable help from Richard Ritter of our office. Richard is an accomplished photographer with extensive camera repair as well as woodworking and machine shop experience. Ron's plant manager, Brian Darling, added another dimension and came up

with, among other things, a brand new, embarrassingly simple, and absolutely perfect way to mount a bellows. During the design stage a healthy competition developed. We each found we were losing sleep trying to figure out the best way to solve a problem before one of the others could think of a solution. You lost points if someone else could improve on your improvement. Each of us lost often, but the camera always won.

In three months, every detail had been discussed, argued over, accepted, drawn, changed, argued over, revised, settled on, and re-drawn. Parts were made up even during the design stage. To give you an idea of the intensity level, the relatively unimportant hooks that hold the camera closed were hand made to four different designs before we got it just so. Finally, the drawings were complete. Did you read Tracy Kidder's "The Soul of a New Machine?" If you did, you may have some idea of the excitement we shared at the start of production of the two prototypes.

Most field cameras, such as the Zone VI Field Camera (modified Wista) Nakoaga, etc. have 12 inch bellows and can only handle lenses up to about 8 inch (210mm) with full movements. I wanted enough bellows extension to allow, with full movements, the use of a 12 inch (300mm) lens, which is considered extreme for a 4x5. Ron did better; he achieved 16 inches of bellows so that even a 14 inch (400mm) lens with movements, when focused at infinity, is usable. Note: Though I have 14 and 19 inch lenses, which will work for either 4x5 or 8x10, I have never had occasion to use a lens longer than 12 inches on a 4x5.

The long bellows is advantageous for close-ups, too. For example, with an 8 inch

(210mm) lens and 16 inches of bellows you can get a 1-1 image on the ground glass. With a 5 inch (120mm) lens you can get more than 1.5-1. But though long bellows are necessary for long lenses and helpful for close-ups, they scrunch up when focusing short lenses at infinity. With a 3 inch (75mm) lens focused at infinity the lens board is only 3 inches from the ground glass, etc. and even a 5 inch (120mm) lens with radical displacement can be a problem. If 75mm and 65mm lenses can be used at all with a 16 inch bellows, they would require the abominable recessed lens boards. Because the Deardorff 4x5 is actually a 5x7 camera with reducing back, it has a 20 inch bellows. (A 5x7 requires longer lenses to cover the same subject area as a 4x5, so a 5x7 requires proportionately longer bellows to do the same job.) Needless to say, any difficulties focusing short lenses with a 16 inch bellows are magnified when using a 20 inch bellows. The Deardorff bellows is different from ours in that it is square for half its length while ours is tapered from end to end. This even taper allows a bellows to compress further which aids it not only in focusing short lenses but permits a smaller package of the folded camera. In addition, our bellows has tapered (angle-folded) corners which allows it to fold more compactly than the square-cornered Deardorff bellows. The angle folds also ease the crease angle and replace the vulnerable 90 degree points at each fold with 45 degree points. You get longer wear and, I think, a much more refined appearance.

To solve the bellows compaction problem completely, Ron designed the first field camera with interchangeable bellows. An

alternate short, baggy, bellows for use with wide angle lenses is available. It will handle lenses as short as 45mm (if there was such a lens) to 120mm and allows unrestricted movements. In addition, if you tear or wear out a bellows, we can send you another by overnight air and if you're off to Patagonia, you can take a spare. You can change from one bellows to the other in seconds.

With a selfish eye to the future, I specified controls that could be operated by a possibly arthritic 80-year-old wearing mittens in ten degree weather. Because of the way it folds, the Deardorff must use small thin wing nuts to control the lens board rise and fall and front tilt. When the wing nuts are in alignment with the standards, they are difficult to grasp, even without gloves. We use knobs that are very wide and easy to find and hold on to for the rise and fall movement. Where the Deardorff does use knobs, they are smaller than the ones we decided on. For example, Deardorff focusing knobs are 3/4" diameter; ours are 1", etc.

The Deardorff has two other difficult to reach and operate controls. We felt that the swing controls for both the front and especially the back -they are under the bellows and behind the back support struts- could be greatly improved, not only in position but in form. (The unusual configuration of the Deardorff rear struts is to help you get at the knobs.) Our rear swing knobs are large diameter flat knurled wheels positioned outboard. Though set into the camera body for protection against damage, they are accessible and easy to operate with one finger.

Though it's difficult to design in a

field camera, Ron thought a lateral shift was a convenience worth including and worked out an elegant solution. The Deardorff has no lateral shift.

I wanted the lens stage to tilt from the base and gave Ron five reasons: it's consistent with the back tilts, it allows for greater movements, it's steadier and more controllable because the tilted lens stage is supported by the front tilt struts, it's faster and easier to focus (I think) and, most important, it avoids using one knob for two functions. The Deardorff uses the wing nuts for both the lens stage tilt and the rise and fall. That's bothersome because when you raise the lens just so and then tilt the front, the lens slips down or tilts out of focus, etc. This is not quite, but almost as annoying as the devilish ball joint tripod heads. (They penalize you for attempting to achieve lateral level by destroying the fore and aft level you just fought so hard for.) Ron Wisner, however, prefers the axis tilts for the lens stage, so (naturally) we have them in addition to my base tilts. The Deardorff has Ron's beloved axis tilt, but has no forward base tilt.

The Deardorff has no detents on the front standard and when you raise or lower the lens, the lens board can tip forward or back along its horizontal axis. If you wish to return the lens to alignment with the back you must do it either by eye or by feel. The Classic has spring-loaded detents so that as you raise or lower the lens it stays in line with the back (unless you deliberately tilt it) and, when you first set up or want to return the lens to zero, it snaps into alignment with authority.

The Deardorff has no indicators (witness

marks) to show whether the front is swung or squared up; you check it by eye or feel. It also has no marks to show whether the lens is centered horizontally on the ground glass. We include witness marks.

The weakest point of all field cameras is the focusing track. The Deardorff has the best. They use a 1/2" track mounted on top of a 1/4" wood strip. We use a 7/8" brass plate mounted on top of a 7/8" stationery rail and we set it flush so it is also supported from the sides. The Deardorff back won't focus forward and the front won't focus back so, to focus short lenses, the camera needs a third track on which the back can move forward. Our design allows the front to go back and the back to go forward. We not only achieve closer focusing for short lenses, we save weight, cost, and a third focusing knob. And, most important, the whole assembly is simpler and sturdier. All the Classic tracks and gears are inside for maximum protection and we think it's nice to keep the machinery out of sight. Nevertheless, we use brass for gears and focusing tracks. Brass is as strong as steel and in addition is self-lubricating in this application. Unlike steel, it can't rust. The Deardorff uses steel gears and focusing tracks and their cameras last and last, so perhaps we are overly conservative here. Our focusing rods are .187 thick, the Deardorff, though a bigger camera, uses .155 rods. Nothing on our camera catches, grinds, or skips. The focusing, for example, is so silky that you can slide -like a trombone- the front or back into rough focus without touching the knobs. The effect of working with such an elegant camera is remarkable. I field tested the prototype over a period of several months

and was quite surprised to find a pleasant relationship in the making. Everything seems to fit in with your way of thinking in a logical manner and operating the camera soon becomes automatic. Things are just where you assume they will be.

Part of the smoothness of the controls is due to the overall strength and rigidity of the whole camera. Our wooden bed pieces are substantially thicker in every case. Typical are the differences between the two rear pieces. The Classic's measures $3/4" \times 3/4"$ compared to the Deardorff's $3/8" \times 3/8"$. That's not twice the cross section; it's four times.

The Deardorff utilizes a fixed track at the top and a slide at the bottom of the lens board opening to hold the lens board in place. To insert the lens board you slip it up behind the fixed track and then push the slide up to hold the bottom. We put the fixed track at the bottom so that even if our slide, which is located at the top, is open, the lens is not apt to fall.

The Deardorff back is a bit shaky. This is noticeable in the 5x7-4x5, very noticeable in the 8x10. (By the way, we expect to have an 8x10 by March, 1987.) The Classic back is solid. Our hinges are massive. They wrap right around the camera body, are set in flush, and are fastened by five long screws. The hinge pins are brass machine screws that go straight through the camera body and are captured by nuts that can't turn; they are actually set into the wood. Here, as in all other places where a moving part joins a stationary one, brass bushings (sleeves around the screw) are used. They allow fastenings to be through fastened and torqued down hard against the bushing without interfering with free movement

of the parts. The ends of all bolts and rods are "staked" (punched to spread them out.) The knobs or fastenings can be removed with moderate force, if necessary for repair or replacement, but they can't fall off by mistake.

Several years ago, Polaroid built a new 4x5 back called the 550. It handles the new film pack (as opposed to the old envelope type material which fit the 545 back.) Our camera accommodates all Polaroid backs; the 550 can not be used with the Deardorff.

Prints exhibiting converging trees, Eifel-tower-shaped buildings, and tipped horizons look amatuerish. These effects appear whenever the camera is pointing slightly up or down or is tilted left to right. On a precision camera, I think levels are essential. (I think it would be advantageous if even hand cameras had at least left-to-right levels in the viewfinder. They've got about everything else in there!) I determined to get the best designed, best arranged and best installed set of levels ever put on a camera, no matter what. "No matter what" has to do with the closest thing to divorce that Ron and I experienced during a year of nearly daily conversations. He told me what I wanted was impossible. I was adamant. He finally worked it out beautifully and, like so many other baffling problems, the solution became obvious only in retrospect.

The Classic has a fore and aft spirit level, a spirit level for left to right use when the back is in horizontal position, and another for left to right use when the back is in vertical position. For copy work, the three levels are so arranged that when you aim the camera straight down, you can read the levels

to be sure the camera is plumb and parallel to the work. Most field camera levels, if present at all, are bubble levels mounted on top of the camera. They are often impossible to read unless you brought a ladder. (To read a bubble level, you have to look straight down.) All of our levels are placed so that if you can see the ground glass at all, even from below (when you have elevated the camera to a very high position,) you can read them. Our levels are flush mounted (set into the camera body) so that they can not be knocked off and they are further protected by heavy brass escutcheon plates. The Deardoff has no levels.

We use nylon and teflon washers or spring washers where appropriate on all surfaces of metal-to-metal or metal-to-wood contact. They are very tough, provide silky operation, protect the hardware finish from scraping, and reduce wear. Brass spacers are used where friction is desired.

The Deardorff uses a flat steel fitting which serves the dual purpose of holding the camera closed and holding the back in place. The center is screwed to the camera body and there are holes drilled into the outer ends. The holes fit over brads (small nails.) In manufacture, if the pin is too close, the back will rattle; if it is too far, it won't go into the hole. There is no tolerance and once the brad is placed, it can not be repositioned. Even if the brad is perfectly placed at the factory, inevitably wear on the hole will loosen the fit. The part of the strap that holds the camera closed projects when the camera is in use and might be vulnerable to breakage from catching on the focusing cloth, etc. We wanted to find a better solution. We finally decided on

substantial brass slides to positively lock the back. They are consistent with the quality, appearance, and strength of the other fittings of the camera, are flush mounted and therefore less vulnerable to breakage, and they slide progressively at slight angles to automatically compensate for any humidity changes or wear.

The Deardorff uses self tapping screws designed for sheet metal. These screws have a chisel face which drills its own pilot hole. They can be installed quickly with a special pneumatic driver. The trouble is that the flute (chisel face) tears the wood so that when you unscrew the sheet metal screw, the sawdust comes out and the hole is then too large to hold the screw. Using a machine, especially with these screws, you also run the risk of going a little too far and grinding out the hole at the outset.

Ron installs screws in a camera exactly as he installs screws in a harpsichord or organ: he has made a chart that lists every screw he uses and the proper drill to cut a clean, tight, pilot hole for it. The proper depths of the pilot holes are also listed so that stops can be put on the drill bits at those points. The drills are in increments of .007 of an inch. A jig is used to insure the position as well as the straightness of the pilot holes and the holes are drilled. The screws are then installed by hand.

The Deardorff uses aluminum knobs with a diamond pattern knurling. Aluminum has advantages. It's light, easy to machine, and inexpensive. It has the disadvantages of poor thread wear, it corrodes readily, especially near salt water, and is, according to Ron, "lousy stuff." The diamond pattern is usually

seen on machine tools rather than precision instruments. Ron told me that the finest early instruments such as Leitz microscopes, telescopes, transits, and the lovely old brass portrait lenses in barrel all used very fine straight knurling and were usually scalloped (dished) to show off the manufacturer's skill. He made our knobs in solid brass to the old designs. No other camera has fittings like them.

The Deardorff uses a large aluminum plate with a 3/8" tripod socket and supplies an adapter so that it can also be used with the 1/4" American thread. We decided to install two tripod fittings; one for the American 1/4" thread, the other for the 3/8" European thread. Two fittings make sense because if you only have one 3/8" fitting, you might need an adapter for a 1/4" tripod head and no one has ever been able to remember where he put the thing or even if he ever had one. A second reason for two fittings; you can select either one to balance the camera properly for both long and short lenses. But suppose you want to use the front fitting to balance a long lens and find that it's the 1/4" and you have the 3/8" or vice versa? The problem: devise a scheme that will allow either fitting to be used for either screw and that would not require you to find a wandering adapter. Try to figure out how Ron did it. (The answer comes later on.) Rather than follow the usual procedure of screwing the plate to the bottom of the camera, Ron installs both tripod fittings from the inside out through brass plates. It's the sturdiest setup I've ever seen. Note: the pictures enclosed are of the prototype camera. Because sometimes you might have to feel

around to align the tripod screw with the camera fitting, production cameras will have areas of brass around each tripod screw to prevent the wood from getting scratched.

The Classic is made of Mahogany and all fittings and screws are brass except the two stainless steel springs that press the ground glass back against the film holder. The Deardorff is also of mahogany with brass fittings, but uses aluminum knobs, steel latches, and steel focusing track and gears as well as screws. The Classic wood is finished natural (gold colored) with brushed-on carriage varnish. Ron says that if He wanted His wood stained, He would have stained it. Carriage varnish has been around since the 18th century and many carriages made that long ago still retain a fine finish. Oil varnish is also used on yachts because it is flexible, tough, resists ultraviolet, is easy to touch up or replace and is beautiful. Deardorff uses a dark stain and sprays on polyurethane, we believe. Plastic finishes are not flexible and are subject to cracking. Deardorff nickel plates its brass, which is consistent with the steel screws, track, back fastening piece, and aluminum knobs and base plate but, though a much higher standard of preparation is required if you are not going to plate, we are not comfortable with the idea of plating (what goes on might come off.) Also, we much prefer the appearance of polished brass. Still following the old traditions, after polishing to a high luster, the brass is shellacked. Ron's experience with musical instruments shows in the beauty of the satin finish. These cameras glow.

The Deardorff folded measures 4" by 9 3/4" by 9". (351 cubic inches.) It weighs 7

pounds. The Classic folded measures 3 3/4" by 8 7/8" by 7 3/4". (257 cubic inches.) It weighs five pounds. The movements of both cameras go beyond the ability of any lens to cover and exceed any imaginable photographic requirement. The Classic has all the movements of the Deardorff plus a lateral shift and base tilts at the lens stage.

The list price of the 5x7 Deardorff with 4x5 reducing back is \$1,815.00. It was available from New York discount stores for about \$1,650.00 plus \$30.00 per lens board on August 25, 1986. The introductory price of the Classic is \$850.00 plus \$21.00 per lens board.

You will get a certificate signed by me and Ron Wisner with the camera which promises that we will repair or replace it if it ever fails to perform as well as it did the day you got it. (Exceptions are broken ground glass and torn or worn-out bellows -both of which are easily owner installed- which we will replace at cost.)

The Classic is 100% made in the U.S. All parts are in stock at the plant at all times and repairs will be made promptly. This is a great camera and we intend to give it and its owners the best possible support. You won't have to deal with a store clerk or wait endlessly for incompetent and expensive repairs; both Ron Wisner and I are available by mail or phone. If you have any questions about the camera either now or later, don't hesitate to call. I'm at 802-257-5161 most Mondays and Thursdays; he's at 617-748-0975 every day. (I told you he was a great partner.)

I almost forgot. The answer to the tripod fitting riddle: Ron scored hugely with this one: "install two 3/8" fittings. Utilize the unused one as a storage place for a 1/4" adapter."

