

Unlikely lenses on 2¼ x 3¼ Graphics

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Dedicated to the memory of Charlie Barringer (1943-2010) [1]

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1 Introduction: Speed Graphic cameras and barrel lenses

One of the reasons I bought a 2¼ x 3¼ Pacemaker Speed Graphic instead of another 2¼ x 3¼ or 2¼ x 2¾ [2] camera was that Ken Ruth of Photography on Bald Mountain advised me it was the most useful relatively inexpensive camera for macro work with roll film. He explained that thanks to its focal plane shutter the Speed Graphic could use inexpensive enlarging lenses, which he said work well close up, as macro lenses. So when a good opportunity turned up at a camera show, I acted on Ken's advice.

My Speed, made in 1947, came with an uncoated 101/4.5 Ektar that shoots very well. The next lens I bought for it was a 65/6.8 Raptar, not an enlarging lens. This lens' back focus [3] was too short for it to focus to infinity on the Speed, so I got a Century Graphic, made in 1951, at another camera show. Since then I've found other lenses for my Graphics, many in barrel and some of them, at last, macro lenses. More recently I've bought a 2x3 Crown Graphic, made in 1953, with 105/3.7 Ektar at a camera show, for the lens and have acquired another 2x3 Crown, made in late 1949 or early 1950 at a camera show to use as a parts camera. This last is too good to break up for parts, so I'll have to find a use or a new home for it.

Likely lenses for these cameras, the ones most commonly used on them, were made primarily by Kodak and Wollensak and were sold for out-and-about use at normal distances. They are all in shutter, usually Kodak Supermatic or Wollensak Rapax, sometimes Compur. They include: 65/6.8 Raptar and Angulon; 80/6.3 Wide Field Ektar; a variety of ~100 mm Tessars for pre-WWII cameras; 101/4.5 Ektar and Raptar; ~103/4.5 Graflar and Graftar; 105/3.7 and 107/3.7 Ektars; 127/4.7 Ektar and Raptar; and 203/5.6 and 250/5.6 TeleRaptars. Wollensak Raptars and TeleRaptars were also sold in Graflex clothing as, respectively, Optars and TeleOptars. I've seen a variety of triplets and Tessar clones, perhaps taken from 6x9 folding cameras, on 2x3 press cameras. Of the more-or-less standard issue lenses, I've owned and eventually sold a 65/6.8 Raptar, 103/4.5 Graftar, 105/3.7 and 107/3.7 Ektars, and 250/5.6 TeleOptar. I now have 80 WF Ektar, 101 Ektar, another 103/4.5 Graftar and another 105/3.7 Ektar. At normal distances I've taken more pictures with my 101/4.5 Ektar than with all of my other lenses combined. Other focal lengths are useful, clearly not absolutely necessary.

When I began to look for lenses to use on my Graphics I wasn't sure I could afford good ones. With few exceptions, though, my unlikely lenses have been inexpensive lucky finds at camera flea markets, from dealers on the Internet, and on eBay. Their low cost has usually reflected their obscurity, not their low quality. Perfectly usable equipment need not cost terribly much. In fact, with luck and care in buying and subsequent selling I've been able to amass a heap of gear, some of it normally very expensive, for very little money.

The auction site eBay has been a great help, and in two ways. Interesting gear can sometimes be bought there at low prices. And I can be reasonably sure that if I want to get rid of a lens that I don't like or don't need I can recover much of its cost, and sometimes more, by selling it there.

Here's an account of the unlikely ones. Any lens that is rarely used on 2¼ x 3¼ press cameras qualifies as unlikely. In what follows, unless I say that a lens is uncoated, it is coated. Unless I mention a shutter, the lens is in barrel [4]. If the lens' source is not reported, I bought it through eBay. I no longer own the lenses whose names are followed by **[sold]**.

2 Limits due to the 2x3 press camera?

2¼ x 3¼ Pacemaker Graphics are very useful tools but have limits. One is bellows draw. The Speed's maximum film-to-flange distance is 225 mm, the Crown/Century's is 195 mm. It would

appear that these limit them to using lenses no longer than 200 mm and around 180 mm respectively. This isn't the case. Mounting a lens in front of a shutter or putting an extension tube between lens and shutter (or board) will add extension. At some focal length, however, the shutter or front standard will cut off the outer part of the image the lens projects on the film plane. I use a simple geometric model -- similar triangles -- to determine whether a lens mounted in front of a shutter (Crown/Century) or on extension tubes in front of a board (Speed) will cover $2\frac{1}{4} \times 3\frac{1}{4}$ without vignetting by, respectively, shutter or tubes/board.

In fact, the longest lens I use on my 2x3 Pacemaker Speed is a 305/9 Apo Nikkor, which sits on ~ 60 mm of LTM extension tubes and adapters in front of a #1 shutter on the camera's lens board. Vignetting isn't a problem with it.

With the Century Graphic, the most extension that can be added in front of a #1 shutter without vignetting is around 77 mm at maximum draw. With a 100 mm macro lens, the highest magnification attainable with a Century is roughly 1.9:1. The 2x3 Pacemaker Speed is longer and can use around 90 mm of tubes and adapters at maximum draw; the highest magnification it can get with a 100 mm lens is about 2.3:1. The longest non-telephoto lens that will make infinity on a Century mounted far in front of a #1, cover $2\frac{1}{4} \times 3\frac{1}{4}$, and have useful focusing travel is about 260 mm; on a 2x3 Speed, around 300 mm.

Another major limit is the front standard's lens throat, a 48 mm square. This restricts the use of fast lenses and modern wide angle lenses on 2x3 Graphics. When contemplating getting either, check dimensions before ordering. Although removing a lens' rear cell and screwing it back in after the board is on the camera works for some short lenses, it can't be done for all because some lenses' rear cells won't even clear the gate. Longer barrel lenses that are too fat to pass through the front standard, e.g., the 4" and 12" Taylor Hobson and 6" Dallmeyer lenses mentioned above, can be mounted entirely in front of the board or, like my 210 Konica, in front of a leaf shutter. Neither setup is entirely comfortable, each works for some lenses.

Frustration with these limits and the desire to use long process lenses led me to seek ways around them. One way is a tandem Graphic rig. It consists of my 2x3 Pacemaker Speed and my Century Graphic on a rail (1.5" x 1.5" t-slotted aluminum) with a coupler between them to keep the dark in. There's another rail, made of 1.5" right angle wood molding (light, inexpensive) that connects to the two cameras' side tripod sockets. The two rails keep the cameras' optical axes aligned.

With the lens on or in front of the front camera's lens board and the film in the usual place on the rear camera, I've calculated that the longest lens that will cover $2\frac{1}{4} \times 3\frac{1}{4}$ and focus usefully close on a tandem rig built from my Speed and Century is around 480 mm. I'm not sure it is the longest lens that will work on the tandem, but my 480/9 Apo Nikkor works well on it. A 600 mm lens should cover at least $2\frac{1}{4} \times 2\frac{1}{4}$ and focus usefully close if mounted on extension tubes in front of the tandem rig. These limits are set by the size of the rear camera's lens throat.

3 Adapters?

I started acquiring Tominon macro lenses with the idea of using them on a Nikon bellows as well as on my Graphics. The obvious way to attach them to anything Nikon is with a female #1-to-male T adapter [5] and a female T-to-male Nikon adapter. SRB Film Services, now SRB-Griturn, (<http://www.srbfilm.co.uk>) made a #1-to-T adapter for much less than a #1-to-Nikon adapter would have cost. A #1-to-T doesn't tie me permanently to Nikon since there are adapters for putting T-mount lenses on nearly every SLR.

I soon realized it would make sense to add extension tubes to the bellows. I had an LTM-to-Nikon adapter. The least expensive way to get a lot of extension that I could find was a Vivitar

TA-11 female T-to-male LTM adapter plus a stack of used E. Leitz New York tubes. ELNY extension tubes are usually quite inexpensive. T-to-LTM adapters are supposed to be very rare, but they show up on eBay and in camera flea markets from time to time. At the bellows end I took advantage of the Novoflex NIKLEI-K (female LTM-to-male Nikon bayonet) I've had since 1975.

When I ran up against 2x3 Graphics' limited bellows draw, putting extension tubes in front of the shutter was the obvious approach to getting more. All that was needed was a female LTM-to-male #1 adapter. Steve Grimes made one for me, and it has been very useful.

When I started to acquire macro lenses in RMS thread, I was back in trouble. I had all those adapters with T-mount at one end, so I got an RMS-to-T adapter from Edmund Industrial Optics, their item number NT52-301. It is easier to use turned around and connected via a male T-to-male T extender, also from Edmund, their NT52-298. I might have been better off with a custom RMS-to-LTM adapter from SRB or Mr. Grimes. I've since got a Linhof female RMS-to-male 25 mm enlarging lens adapter and an unbranded conical plastic female 25 mm-to-LTM adapter. The combination works no better than the Edmund adapter, but is prettier.

Adapters for using barrel lenses on 2x3 Graphics? SKGrimes has made cup-shaped adapters to #1 shutter for several of my lenses. These have male #1 threads at the rear and female threads at the front that accept the lens. A similar adapter, but with M39 threads at the rear, came with my Industar-51. SKGrimes has also made adapters for me with male threads at the rear to accept retaining rings and male threads at the front to screw into the back of the lens for attaching lenses to boards; these last could equally well have had female threads at the front, but making the adapter to screw into the lens saves material. All work well.

I've mentioned Steve Grimes several times here. He died in April, 2003, but his firm continues. His successors can be found at www.skgrimes.com. They've made adapters and done other work for me. I expect to continue sending work to them.

4 Mounting barrel lenses on boards

Modern lenses for large format cameras are usually mounted in shutter [6]. Older, process, and aerial camera lenses are, however, sometimes mounted in barrel. In both cases, attaching the lens to a camera is in theory straightforward. One obtains a lens board that will fit the camera, drills a hole in it to accept the rear of the shutter or barrel, and uses a retaining ring to hold the shutter or barrel to the board. The only complication is setting up a shutter, usually behind but sometimes in front of the lens, to get timed exposures with a lens in barrel.

Mounting large or unconventionally mounted, as from an aerial camera, lenses on a camera whose lens board is small, e.g., a 2x3 press camera, is not always as simple as this. There are three situations. The first two involve lenses that can't be mounted in front of a leaf shutter because of short back focus or because of vignetting.

The third, front-mounting, is much preferable if possible:

the rear of the barrel is threaded (internally or externally) **and won't pass through the camera's front standard.** It may be larger than the lens board. Approaches that work in this case include, if the camera has a focal plane shutter:

a cup-shaped adapter with female threads at the front to accept the barrel and male threads at the rear to accept a retaining ring. The board is clamped between the retaining ring and the back of the adapter. This is how my 100/5.6 S.F.O.M. is held to its board.

an adapter with male threads at the front to screw into the rear of the lens' barrel (if it is threaded for a filter and the threading is deep enough) or to replace the retainer that holds the lens' rear element in place and male threads at the rear to accept a retaining ring. Depending on the barrel's size, the adapter may have to be stepped. The board is clamped between the retaining ring

and the rear of the barrel. My two Taylor Hobson aerial camera lenses (4"/2, 12"/4) are mounted this way; the 12"/4's adapter is stepped, the 4"/2's is not.

an adapter as above with a flange at the rear to be held to the front of the board by a number of small screws. This approach *may* be necessary for lenses whose back focus is so short that they just make infinity with the bellows fully compressed. The flange may have to be trimmed or relieved to allow room for the sliders that hold the board to the front standard. My Uran-27 is mounted this way.

the rear of the barrel is not threaded internally or externally.

Approaches that work:

if the lens' cells can't be put in a shutter and the camera has a focal plane shutter and the lens' barrel will pass through the front standard, it can be secured to the board by a clamp that goes around the barrel and is held to the board by a screw. My 1.75"/2.8 Elcan is mounted this way.

otherwise, if the lens' back focus is long enough to allow mounting it entirely in front of the front standard, the rear of the barrel can be held in a cup-shaped adapter that attaches to the board. Radial setscrews or a slotted cup with a clamp will do. This may be the relatively economical way to put my 100/2.8 Era-7 on a board, if I ever convince myself that the lens has to be tried out.

the camera does not have a focal plane shutter. 6x9 press and view cameras are too small to allow use of a behind-the-lens shutter, e.g., Packard or Sinar. To use a lens in barrel on such a camera, the solution is:

a cup-shaped adapter – sometimes the “cup” is very flat – threaded female at the front to accept the lens' barrel and male at the rear to go into the front of a leaf shutter, e.g., #1. I use a number of lenses in such adapters. The shortest lens I've mounted on a 2x3 Graphic this way for shooting 2x3 is a 4.75"/7.7 Aldis Uno, whose adapter is very flat indeed. My other cup-shaped adapters, for longer lenses, are deeper. Vignetting is not a problem with any of them in front of a #1 shutter on my 2x3 Graphics. It may, however, be a problem on larger formats.

Whether going to this much trouble to use a lens in barrel is worth the expense depends on how much the lens will cost, how much the adapter will cost, how good the lens is, and how much the easily-mounted alternative will cost. A rational person who wants a good lens ready-to-use for the least money possible will do the calculations, and with care. That's sometimes me.

But I've often bought an unknown lens to find out what it was and then not done the calculations. Even worse, I've sometimes given in to curiosity about what a lens can do and had it mounted up even though I already had a perfectly good equivalent ready to shoot. That's why I bought an adapter to mount my 260/10 Nikkor-Q in front of a #1 shutter even though I had a 10.16"/9 Taylor Hobson Copy Lens that is very good, much smaller, lighter, and easier to use. And that's why I had my 100/2.5 Uran-27 put on board even though I knew it couldn't be better than the 4"/2.0 Taylor Hobson Anastigmat I already had on board. Curiosity is a vice.

A process lens whose cells won't go directly into shutter is rarely worth putting into a shutter. A lens of the same focal length already in shutter will almost always cost less than process lens plus machining plus shutter. But when the choice is between a process lens plus an adapter to front-mount it for use on a 2x3 camera and a lens of the same focal length already in shutter, the process lens plus adapter *can* be the better buy. A cup-shaped adapter is often less expensive than a shutter in good order. Remember that used shutters are presumed unusable until proven good and that a CLA will cost from \$50 to \$125, depending on the shutter and repair shop.

Front-mounting becomes especially attractive when a single adapter will fit more than one lens. A few examples: I have one female LTM-to-male M40x0.75 adapter. It fits my 6" and 10.16" f/9 TTH lenses, 135 and 180 f/10 Apo Saphirs, 210/7.7 Beryl S, and 150/6.3 Tessar. Similarly, I have a female M53x0.75-to-male M40x0.75 adapter for my 240, 300, and 360 f/10 Apo Saphirs; a female M72x1-to-male M40x0.75 adapter for my 210/9 Konica Hexanon GR II, 250/6.8 Beryl, 305/9 Apo Nikkor and 450/10 RF-5; and a female M90x1-to-male M40x0.75 adapter for my 420 and 480

f/9 Apo Nikkors. The more lenses per adapter, the better the economics of front-mounting. All of these lenses go in front of the same #1 shutter. Sharing one shutter among many lenses also improves the economics.

I buy adapters from SKGrimes. The price depends somewhat unpredictably on the size of the adapter; I've paid from \$35 (female LTM-to-male M40x0.75) to \$185 (female M113x1-to-male M40x0.75) for adapters for front-mounting. I've had five aerial camera lenses put on board; the charges have run from \$75-\$100. Today's prices may be higher than the ones I paid.

The aerial camera lenses (1.75"/2.8 Elcan, 4" and 12" TTHs, Uran-27, 100/5.6 S.F.O.M.) went on boards because there was no other way to use them; where front-mounting is possible I prefer it. #1 shutters give timed speeds below 1/30, the slowest timed speed my Speed Graphic's focal plane shutter offers.

5 Macro lenses first, since they were the inspiration for getting my Speed Graphic

5.1 Origin and test of macro lenses

I report on these by focal length, from shortest to longest. None of my shorter ($< \sim 100$ mm) macro lenses is easily used in the field. With all of them aiming and focusing are very difficult; and after focusing it takes much effort, no matter how tightly everything is clamped down, not to shift the point of aim when inserting or attaching a roll holder. The higher the magnification the more difficult working is. Practically speaking, lenses much shorter than 100 mm are usable close-up on Graphics only on copy stand.

All of my macro lenses for large format are in barrel [4]. In my experience close-up photography with ambient darkness isn't very practical; electronic flash almost always gives better results. To use a barrel lens with flash it must be mounted in or in front of a leaf shutter. Front-mounting works and can be more economical than putting a lens in shutter.

I initially bought Tominon lenses made for the Polaroid MP-4 camera because they're abundant, inexpensive, and adequate, then discovered alternatives. If I'd known how inexpensive the alternatives could be I'd have pursued them sooner.

Tominon macro lenses for the Polaroid MP-4 camera are threaded to screw into a #1 shutter [7]; all cover 4x5 at their recommended working magnifications. My other macro lenses need adapters for front-mounting on a shutter.

My Speed Graphic's focal plane shutter won't sync with electronic flash, so all of my macro lenses go in front of a leaf shutter. I hang them on a Copal #1. Copal #1 Press shutters for the Polaroid MP-4 system seem to be the best value among used #1s; I prefer the MP-4 version to other Polaroid #1s because it has an open shutter lever. The cock-and-shoot Copal 1, with speeds to 1/400, is better still. Although a #1 shutter fits easily on a 2x3 Pacemaker board it won't clear the front standard's shutter tripper; to mount one on a 2x3 Pacemaker the front shutter tripper must be removed.

I've tested nearly all of my macro lenses to determine which ones not to use. My first test procedure for magnifications $\geq 2:1$ used an Olympus Stage Micrometer with 100 marks/mm as a target; I photographed it transilluminated by flash. The flash unit used was a Vivitar 283 with VP-1; flash-to-subject distance and VP-1 setting were set using guide number arithmetic with an adjustment for magnification. The camera was a Nikon FM2n with a K screen and a 2x eyepiece magnifier. The target was centered in the field. For magnifications $\leq 1:1$, the target was an Edmund NT38-710; this target's finest group is 8 lp/mm [8]. Films used were Kodak TMX and Ilford Delta 100. Negatives were read at up to 40x under a Unitron MSFN stereo microscope.

For magnification $\geq 2:1$, I assessed lenses' ability to separate adjacent tick marks on the stage micrometer and ranked them by pairwise comparisons. Lenses that separated the tick marks most cleanly were rated highest. Lenses that couldn't separate them at all flunked. For magnifications $\leq 1:1$, depending on magnification I either measured resolution on film (for example, at 1:10 I could measure resolution up to 80 lp/mm) or assessed the width of the light areas between dark bars on the target; again, lenses were ranked by pairwise comparisons. These are not formal tests of resolution but their results are repeatable and allow ranking lenses and separating them into "ok" and "not ok."

Since I ran the first tests I've obtained the use of Edmund's target NT38-257, a USAF 1951 target on glass that goes from group -2, element 1 (0.25 lp/mm) to group 7, element 6 (228 lp/mm). It offers a somewhat more easily ranked measure of performance but has generally given results consistent with those obtained with the stage micrometer. At high magnification, instead of burning film I simply look for the finest group and element for which I can discern three bars clearly on the FM2n's K screen. The USAF target has a pair of sets of three bars at right angles to each other at each size; this is to detect astigmatism. My eyes are astigmatic so I score a group and element as visible if I can discern three bars in either orientation. At low magnification, both targets are hard to focus on, but the USAF is easier. Visual discrimination works poorly at low magnifications so I didn't expect to be able to discriminate visually between lenses' performance at low magnifications. I'm very surprised that this turned out to be possible.

I looked at the target through 75 mm and shorter macro lenses with the lenses wide open to at most two stops down. Most were best wide open. I looked at the target through my ~ 135 mm macro lenses wide open, at f/11, f/16, and f/22. All were better at f/11 than wide open and worse at f/16 and f/22 than at f/11. Rankings were the same wide open and at f/11. Shooting film instead of looking through the lenses would give more precise information about degradation below f/11, but looking answered the practical question of which ones not to use.

5.2 Description of macro lenses

5.2.1 5/8" to 1-7/8" (15 mm to 48 mm)

15/2.5 Cine Ektar in C-mount. Shot reversed. Not very good as a photomacrographic objective on my early tests, but with better lighting for focusing and stopped down a little to f/2.8, at 30:1 it let me discern the 181 lp/mm group of Edmund's USAF 1951 target.

16/2.5 Zeiss Luminar in Royal Microscopical Society (RMS) thread [9] [sold]. An eBay booby prize. It appears to have been baked in an oven. Elements 3 and 4 were cemented and still are, a little, but there are voids. The balsam whose departure created those voids is now on the front element's periphery. Amazingly, the lens passes light and forms an image. A good 16/2.5 Luminar resolved the 228 lp/mm group at 27:1. My dog topped out at 144 lp/mm at 30:1. Returned to vendor.

17/0.95 Schneider Xenon in C-mount. Made for a TV camera with a 2/3" CCD. Field of view, reversed, about 10 mm. Minimum working distance, around 8 mm. Bought to try reversed. Its enormous aperture offers, in theory, high resolution; what it delivers is an empirical question to be answered.

17/4 Tominon in #1 thread [sold]. A fine lens for high magnification (10x to 34x on the MP-4) photomacrography. I shoot as high as 15x with it on the Graphics, as high as 30x on a Nikon with a lot of extension tubes. Its only drawback is modest working distance. Front of lens-to-subject distance is roughly 10 mm. To use it on my Graphics I screw it into a Copal #1 shutter. To get more magnification I add extension tubes using a series of adapters, which are described below (see section 3). The lens gives best image quality wide open. Since there's no depth of field even

when it is stopped down, I shoot it only wide open. This lens was also sold for the Polaroid CU-5 camera. The only difference between the MP-4 and CU-5 versions is that the CU-5 version's barrel is shorter. Better than 170 lp/mm on the USAF target from 15:1 to 25:1. Like all MP-4 Tominons, this lens has no serial number.

19.5/3.85 Bausch & Lomb microfiche projection lens. Fixed aperture. Not easily used on my Graphics, better used on 35 mm at magnifications above 20:1. In that range it does as well as a good 16/2.5 Luminar wide open. Bought from an internet vendor, and an outstanding value at \$6.00 plus postage.

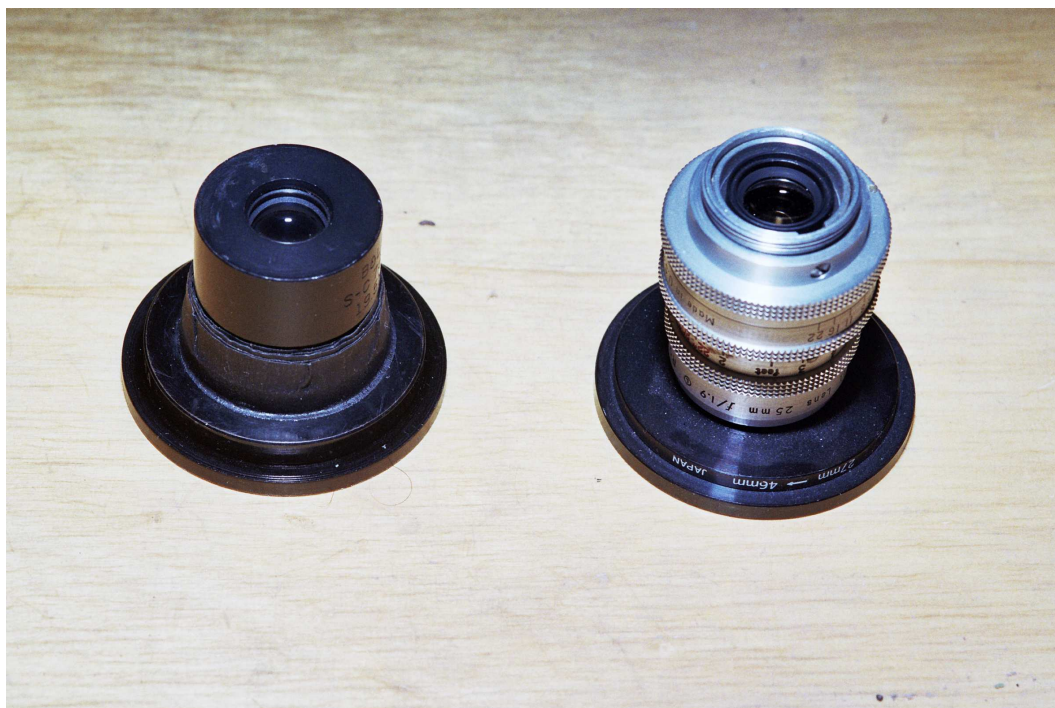


Figure 1: Inexpensive high performance macro lenses: 19/3.85 B&L lens from a microfiche reader and 25/1.9 Cine Ektar II, both crudely mounted. These very inexpensive lenses – the B&L cost only \$US 6 plus postage – are very competitive with, e.g., 16/2.5 and 25/3.5 Luminars. Anyone who wants to do relatively high magnification photomacrography should consider them seriously.

20/1.9 Boyer Saphir in unknown thread mount. Stops to f/8. The mounting thread is 18.70 mm in diameter, i.e., it goes in a 19 mm hole. The lens came on a C-mount adapter whose length is slightly adjustable. On its adapter the lens gives magnifications from 2:1 to 3:1. I mounted the assembly on a Beaulieu cine camera and looked through it. The image quality on the camera's ground glass at 2:1 was awful. Wide open at 15:1 it barely separated features 10 microns apart. Not a very usable lens. It is a six element/four group double Gauss type.

25/1.9 Cine Ektar II in C-mount. This is one of the sharpest normal lenses for 16 mm motion picture cameras. Kodak's Publication N-12B "Photomacrography" reports that it performs well at high magnifications when reverse mounted. I mount it on the Graphics with a couple of filter step rings and a 52 mm male filter thread-to-male #1 adapter made for me by SKGrimes (www.skgrimes.com). It makes a fine macro lens; the 25/3.5 Luminar was hardly better in my first tests. On my second tests, at 10:1, 15:1, and 26:1 best at f/2.8, not wide open, a surprise; 161 lp/mm at f/2.8 at all three magnifications. This is better than the two 25/3.5 Luminars I've tried. Not quite as much working distance as expected; the C-mount flange-to-film distance is 17.56 mm but the lens' rear element protrudes several mm beyond the flange, leaving around 15 mm working

distance. If magnifications of 10:1 or so are needed and the camera at hand is a 2x3 Graphic or a 35 mm SLR this lens is very cost-effective.



Figure 2: Three Luminars and a Summar: Luminars are regarded as the ne plus ultra of lenses for photomacrography but Macro Nikkors are at least as good. My 25/2.8 Summar, extracted from a YELUU micro-projection attachment for a Prado projector, is, I think, very competitive with the 25/3.5 Luminar.

25/2.8 Leitz Summar in RMS thread. This fixed aperture lens was made to be used in a Leitz YELUU microprojection attachment for a Prado slide projector. Immediately it arrived I asked the sages on sci.technique.microscopy about it. Their consensus was that it was not usable as a taking lens. This may be, but I saw 170 lp/mm through it at 15:1. It was worse at lower magnifications. Barely usable on a 2x3 Graphic because its too long – it won't quite make 15:1 on a 2x3 Speed -- but quite usable on cameras that offer more extension.

25/3.5 Zeiss Luminar in RMS thread. The 25/3.5 Luminar is a high-performance macro lens designed for use at magnifications of 6.3x to 25x. At those magnifications it covers 4x5. Mine is an early one that isn't engraved with the word "Luminar." It is marked, simply, "Zeiss-Winkel" and unlike most Luminars is in chrome, not black enamel, livery. I can use it at magnifications up to 11x or so on my Graphics. It is attached to the camera with adapters, see below, section 3. Working distance is short, around 18 mm from front of barrel to subject. Like all high-performance macro lenses, best wide open. A fine lens, but not much better on my first test than my 25/1.9 Cine Ektar II. Worse than the CE II on my second test. A second newer 25/3.5 Luminar was no better.

32/4.5 Bausch & Lomb Micro Tessar in RMS thread [returned to its owner with thanks]. Borrowed from a friend. Uncoated, in a narrow black barrel; later coated ones are in wider stainless barrels. Micro Tessars are mentioned with respect in Graphic Graflex Photography and on Usenet. Usable at 10:1, but not as good as my 35/4.5 Tominon. I suspect it would work better at higher magnification.

35/4 Rodenstock Eurygon in #1 thread [sold]. Serial number, maker's name, and lens' iden-

tification are engraved on the front of what appears to be a wide, flat lens hood. It was sold for use on Polaroid MP-3 and MP-4 cameras. Diaphragm not click-stopped, indicator moves beyond f/4; the aperture scale is engraved on the barrel. Found mounted on a Prontor Press #1. Marginally usable at 10:1. The old 32 Micro Tessar is better, the 35/4.5 Tominon is much better. Bought at a camera show.

And another, bought at a camera show as a speculation. Stops to f/16, diaphragm is click-stopped, indicator does not move beyond f/4. This lens doesn't have the other one's hood and lacks a serial number. Maker's name, lens' identification, and aperture scale are on a metal strip. The hood isn't misplaced, the front cap fits properly on the front of the barrel. In a box labeled "Polaroid MP-3 Camera Accessory 35mm Macro Lens & Bellow Extension Unit." The extension unit is a focusing helical, minimum extension 2³/₄", maximum extension 3 7/8", with a 3¹/₄" x 3¹/₄" lens board at one end and a board with sliders etc. and a recess to accept the same size board at the other.

I can't be absolutely sure, but the two may have different optical as well as mechanical designs. Both have rear element larger than the front. I think – can't be sure – that the first one's rear element was larger than the second's.

35/4.5 Tominon in #1 thread [sold]. On the MP-4 it is used at magnifications from 5x to 14x. On my little Speed, attached like the 17/4, it gives no more than about 8x. Mine is very sharp at 10:1, best wide open. Working distance? More than enough. Surprisingly, best resolution at 17.6:1, not tested at higher magnification. A second example was worse. With Tominons, acceptance testing is necessary. Bought from an internet vendor who thought it was an enlarging lens. MP-4 lenses are not enlarging lenses.

38/3.5 Olympus apparently cemented into an M42x1 threaded barrel [sold]. Stops to f/8. Olympus made two 38/3.5 macro lenses, one for the Pen F system and another in RMS thread. I bought this lens hoping it would be one of them and because it wasn't too expensive. It doesn't seem to be either of Olympus' mainstream 38/3.5 macro lenses or their 38/3.5 enlarging lens for half frame negatives. It has an uncommon optical formula, apparently three single elements in front of the diaphragm and two more behind it. Best from 6:1 to 10:1. Not used yet, and not likely to be because of short working distance and because I have lenses that are better at its best magnifications.

4 cm 1:4.5 Zeiss Tessar in RMS thread [given to Mr. Barringer]. An uncoated pre-WWI mystery lens. Not coated. Normal tessar, not reversed. Intended range of magnifications unknown. Aperture scaled in mm, from 00 to 10. The lens' smallest aperture is actually 1 mm. In a light metal (aluminum?) cup that is intended to screw into something. Usable above 1:1, not as good as the 40/4.5 Luminar.

40/4.5 Zeiss Luminar in RMS thread [sold]. A high-performance macro lens designed for use at magnifications of 4x to 16x. At those magnifications it covers 4x5. I've had an early one that wasn't engraved with the word "Luminar." It was marked, simply, "Zeiss-Winkel" but unlike my 25/3.5 was in black enamel. This focal length can be used at magnifications up to 6x or so on my Graphics. It came below market, but was still expensive. I bought it with speculation in mind, never got around to using it, and eventually sold it with regret when bills had to be paid. It came with a Linhof female RMS-to-male 25 mm (an enlarging lens standard) adapter that I kept.

I later bought another 40/4.5 Zeiss-Winkel even farther below market from a vendor on eBay France who had made four classic mistakes. He offered four "enlarging lenses," three Boyer Saphir <> and the Luminar, as a bundle. He spelled the Luminar's maker's name "zeisswinkel," making it invisible to most reasonable searches. He didn't identify his zeisswinkel as a Luminar. And he announced in his listing that he'd ship only to France, thereby scaring off foreign bidders; I asked him if he'd ship to the US before bidding, on the off chance that he might, and he agreed to do so. The postal system ate the lenses, and disgorged them long after I'd given them up for

lost. This lens' serial number is 32 higher than my first one's. It came with a Linhof female RMS-to-male # 0 shutter adapter. It shoots well.

I've looked through two newer 40/4.5 Luminars that belong to a friend. The view through them is outstanding; wide open at lowish – 5:1 – 6:1 -- magnifications they're a little better than a reversed 55/2.8 MicroNikkor (see below). From 10:1 up my better 35/4.5 Tominon at least matches them. And my zeisswinkel, clearly a keeper, matches the newer ones.

45/4.5 Carl Zeiss Jena Mikrotar in RMS thread, uncoated [sold]. A triplet. The diaphragm scale indicates the aperture's diameter in mm. Optimized for 4x - 8x. As shot, a very fine lens wide open @ 4:1 and 8:1. Worse stopped down. On a 2x3 Speed Graphic the highest magnification attainable is around 5:1, the lowest is about 2:1. This last is lower than the Mikrotar and most 45-60 mm "micro" lenses should be used. Probably pre-WWII. Bought at a camera show.

Marc James Small and Charlie Barringer have terrible examples of this lens. Marc's turned out to be missing an element. It isn't clear what's wrong with Charlie's. Not, I fear, to be bought without the right of return.

48/4.5 Bausch & Lomb Micro Tessar in RMS thread, uncoated [sold]. Engraved "Micro Tessar." Usable at 4:1 and 8:1, not the best. I believe this lens performs better at higher magnifications. There is a very nice shot taken at 20:1 with one in the first edition of Graphic Graflex Photography.

48/4.5 Bausch & Lomb Macro in RMS thread [sold]. Engraved "Macro." In a barrel with significantly more chrome than the 48/4.5 Micro Tessar mentioned above. This lens isn't worth the trouble of using.

5.2.2 2" to 3-1/2" (50 mm to 90 mm)

50/3.5 Reichert Neupolar in RMS thread and chrome livery, no information about best magnification. A triplet. The diaphragm scale indicates the aperture's diameter in mm. Reichert is now part of Leica Microsystems, who could give very little information about the lens. They suggested it could be used between 4:1 and 30:1. David Paschke, of Paschke Micro-Optics, the New England repair center for Leica microscopes, tells me "The Neupolar lenses are very decent objectives, as you probably are aware. They are the equivalent of the Leitz Summar computations, not quite as fine as the Leitz Photars or the Zeiss Luminars, but much better than the Leitz Milar lenses." In test 1, not quite as good wide open as the 45/4.5 Mikrotar at 4:1 and 8:1 but still very usable. Test 2 gave the same results. The view through it wide open is marginally better than the view through a 50/4.5 Tominon, worse than the reversed 55/2.8 MicroNikkor at f/4. I have acquired a second example whose serial number is 79 higher than the first's. Its performance exactly matches the first's.

There is also a 50/4.5 Neupolar. I've seen one in black enamel, apparently uncoated, on eBay. I think it is a predecessor of the 50/3.5.

50/3.5 Boyer Saphir B. An enlarging lens in 30 mm thread. One of the bundle of lenses that came with my second 40/4.5 Luminar. Saphir Bs are six element plasmat [10] types.

50/4 Wollensak Enlarging Pro Raptar. Stops to f/22. I bought this lens because my 4"/5.6 Enlarging Pro Raptar and 160/5.6 Pro Raptar, both discussed below, are so good. This one, though, is somewhat of a disappointment. Marginally usable at 1:1 and higher magnifications mounted normally, gets worse as magnification increases. The 50/4.5 Tominon is better.

50/4.5 Enlarging Ektar in ~ 1" thread [sold]. This lens is recommended highly for photomacrography in Kodak Publication N-12B. It is very usable mounted normally (back towards film) at 4:1 and 8:1 but isn't as good as my 55/2.8 MicroNikkor. All things considered, this lens is probably the best bargain in ~ 50 mm lenses for photomacrography. Bought at a camera show. This lens, the 63/8 MicroFile Ektar, 75/4.5 Enlarging Ektar, 100/3.5 Ektar and 105/3.7 Ektar are

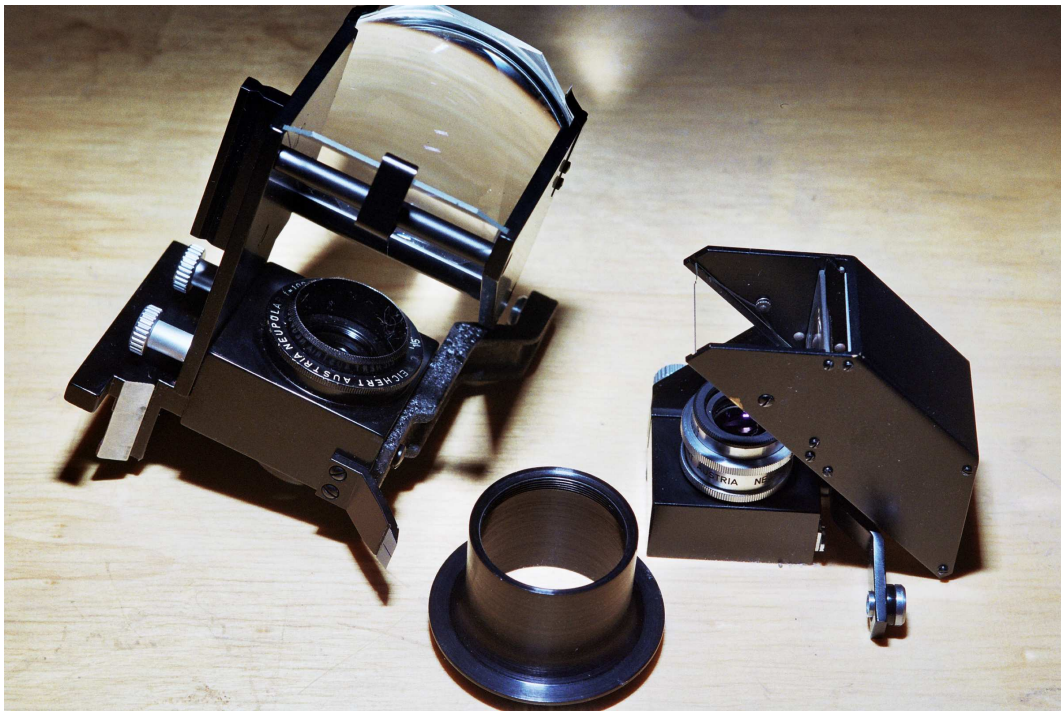


Figure 3: Two Neupolars in their dovetails: I think these were made for the Reichert MeF-2 metallograph. Note the beamsplitters, used for axial illumination of the subject. The 50/3.5 Neupolar is ok, but there are better lenses of that focal length (\pm) for photomacrography. The 100/6.3, on the other hand, really is the ne plus ultra in its focal length. The black tube is an adaptor for mounting the 100/6.3 on a #1 shutter; Steve Grimes made it.



Figure 4: US-made lenses good for macro: Pro Raptars were 6/4 plasmat [10] types and were Wollensak's answer to, e.g., Sironar and plasmat type Symmar taking lenses. Enlarging Pro Raptars were Wollensak's answer to Componon and Rodagon enlarging lenses, were made in focal lengths from 50 mm to 190 mm. The 4"/5.6 Enlarging Pro Raptar, show front-mounted on a Copal #1 shutter, is competitive with the 100/6.3 Luminar for magnifications from 1:8 to 4:1.

all Heliar types.

And another, bought at a camera show because it was so pretty and so inexpensive. Also sold.

50/4.5 Micro Raptar in ~ 1" thread (same diameter as, different pitch than, the 50/4.5 Enlarging Ektar). Stops to f/22. Usable, improves as magnification increases; best at 12:1, the highest magnification tried. Better than the 48/4.5 MicroTessar. I've seen slower 50 mm Micro Raptars without diaphragms and have no idea what they are.

50/4.5 Tominon in #1 thread [sold]. On the MP-4 best from 2x - 9x. Usable, not the best, at 4:1 and 8:1, at 8:1 better at f/5.6 than wide open. Another despised lens that performs adequately and is a very good value. Better at higher magnifications.

55/2.8 AIS MicroNikkor. Used reversed and wide open this is the best more-or-less 50 mm macro lens I own. A little better at f/4 than at f/2.8. I understand it is diffraction limited by f/4. To fit it on a Graphic, I use a male 52 mm filter-to-male #1 thread adapter made by SKGrimes. With this adapter it can be used from 2:1 to 5:1 on the Graphics. A superb lens. At today's prices used ones are great values. Bought new from a dealer.



Figure 5: Outstanding macro lens: The 55/2.8 MicroNikkor AIS is a superb lens and can be used, reversed, for photomacrography on formats larger than 24x36. It is at least the equal of the 63/4.5 Luminar and much less expensive.

55/8 Schneider ReproClaron in 25 mm enlarging lens thread [sold]. Stops to f/32. Bought at a camera show. The Lens Collector's Vade Mecum[11], a compendium of lore about lenses published on CD by some very serious Englishmen, says it optimized for magnifications in the range 1:4-4:1, but Schneider's archives give coverage and distances for 1:10-10:1. On test it did well wide open at 4:1, but not as well as my faster ~ 50 mm lenses. In this class of lenses, aperture makes a difference, larger is sharper. Mounted on the shutter using a 25 mm-to-LTM[12] and other adapters; the cells will go into a #00 shutter. Too short to use much below 1:1 on my Speed Graphic, and at 1:1 it doesn't quite cover 2¼ x 3¼. This lens' outer elements are radioactive and appear to have yellowed.

60/1.4 Boyer Saphir in 61 mm x 1 thread [sold]. A six-element Gauss type, stops to f/16.

Offered on eBay as an enlarging lens. The Vade Mecum says the f/1.4 Saphirs were intended for cine cameras and 35 mm still. This one has with no focusing mount, so can't have been meant for either application. A complete mystery, heavy enough to work well as a paperweight. I never found a way to use it. Its barrel won't clear a 2x3 Pacemaker front standard and its back focus – rear element-to-film distance -- is too short to allow it to focus to infinity when mounted entirely in front of the lens board. It will, however, make infinity in front of a Century Graphic front standard. I've looked through it that way. It nearly illuminates 6x6 at infinity, but suffers severe barrel distortion. The distortion seems much less bad with near subjects.

60/4.5 Staebble Katagon in Leica Thread Mount (LTM) [sold]. Sold by Novoflex, said to be best from 1:2 to 2:1. Not a keeper at 2:1, although focusing on my stage micrometer at that low magnification was very difficult. Bought at a camera show.

63/4.5 Luminar in RMS thread. Bought because no one outbid me. So-so cosmetics, and the front element has scratches. Still, the view through it is quite good. It is as sharp as a prettier one I borrowed.

72/4.5 Micro Tessar in 34 mm thread [sold]. A modern one in stainless barrel. Reversed Tessar. Usable, but not a keeper at 2:1 or 4:1.

And another, engraved "Macro," not "Micro Tessar," bought at a camera show for resale. Also a reversed Tessar. And another Micro Tessar, also bought at a camera show for resale, traded for some lens boards. Haven't sold "Macro" yet.

75/3.5 Boyer Saphir B in LTM. Stops to f/22. I got this lens, which is rated highly by the French, hoping it would be useful for photomacrography. It was very inexpensive, always an inducement to gamble. Wide open and at f/5.6 it is worse mounted normally than the 75/4.5 Tomionon at 2:1 and 4:1. It is, however, quite good from f/11 to f/22 between 1:8 and 1:1; not quite as good in that range as the 100 Neupolar or 4" Pro Raptar, better than the 80/5.6 Minolta. Very usable up to 1:1, not usable much above 1:1.

75/4 Rodenstock Apo Rodagon DM 1:1 in LTM [sold]. Bought at the urging of Vivek Iyer, who insists it is one of the best lenses made. This is possible, but it doesn't cover 2x3.

75/4.5 Enlarging Ektar. Stops to f/22. This lens is recommended highly for photomacrography in Kodak Publication N-12B. Not tried yet. A gift from Vivek Iyer.

And another, bought at a camera show because it was so pretty and so inexpensive. Sold this one to, believe it or not, Vivek Iyer.

75/4.5 Tomionon in #1 thread [sold]. On the MP-4 it gives magnifications from 2x to 4x. I have two, have tried one at normal distances to see if could be used as a wide angle lens on 2¼ x 3¼. Users of 2x3 Graphics would be delighted to have a \$25 wide angle lens. At infinity and f/16 it illuminates the frame but image quality is terrible. I mention it here mainly to point out its unsuitability for use as a wide angle lens. On test 1, it is usable, not great, at 4:1, better at f/5.6 than wide open, and in my opinion not usable at 2:1. A similar lens in Copal #0 press, rather than in front of a Copal 1, was sold for the Polaroid CU-5. A few people have reported on photo.net that it covers 2x3 at infinity and produces good image quality. On test 2, both of mine were middling.

75/4.5 Comparon in Prontor Press #00 shutter. Stops to f/22. This tessar type enlarging lens was on a Sirchie Fingerprint Laboratories fingerprint camera that shot 4x5. Sirchie sells equipment, including cameras and fingerprint powder, to law enforcement agencies. I bought it not for the lens, which should perform well as a macro lens, but for the shutter. The price was right even though the shutter needs to be cleaned.

3"/1.9 Oscillo-Paragon 1:0.85x in Ilex Universal #3 shutter. Stops to f/16. Extracted from a Tektronix C-27 oscilloscope camera. The cells are fine paperweights. I bought the lens for its shutter.

80/5.6 C.E. Minolta Rokkor-X in LTM [sold]. A highly regarded six element enlarging lens

for 2¼ x 2¼. Stops to f/45. I got it for close-up photography at magnifications from 1:4 to 1:1. It isn't bad from f/11 to f/22, but the 100/6.3 Neupolar, 4"/5.6 Enlarging Pro Raptar, and 75/3.5 Saphir B are better.

85/3.5 Boyer Saphir B in LTM. Stops to f/22. Another of the bundle of enlarging lenses that came with my second 40/4.5 Luminar. Untried, probably will do much the same as the 75/3.5 Saphir B.

90/6.3 Zeiss Jena M in 26.5 mm thread [sold]. Bought from an internet vendor. Sort of a reversed tessar; "sort of" because the diaphragm is between the two single elements, not between the pair of singlets and the cemented pair as in most tессars. The diaphragm scale seems to indicate the aperture's diameter in mm; the smallest number is 1, corresponding to f/90. According to Charlie Barringer, "M" stands for Mikrotar. Doesn't cover 2x3 at infinity. A good lens, in the same class as the 100/6.3 Luminar and Neupolar.

5.2.3 4" to 6-1/2" (100 mm to 160 mm)

100/5.6 Componon-S in M32.5x0.5 [sold]. Bought because the price was right and it is supposed to be a better lens than that 105/5.6 Componon I'd bought less than a month earlier. Both lenses were bought in the hope that at least one would be good enough to use close up and easier to use with flash than my 100 Neupolar and 4"/5.6 Enlarging Pro Raptar. In the end I broke down and had SKGrimes make an adapter for front-mounting the Enlarging Pro Raptar on a #1. I should have done that sooner and not bothered with other enlarging lenses.

100/6.3 Neupolar. Stops to f/20. I've bought three: one early, uncoated, two late, coated, and have sold the uncoated one and one of the coated ones. Recommended range of magnifications unknown. A reversed Tessar. The diaphragm scale indicates the aperture's diameter in mm; the smallest number is 5, corresponds to f/20. It screws into a #1 via an SKGrimes adapter; to get magnifications much above 1:1 I put the same string of adapters and extension tubes I use for the Tomions between lens and shutter.

I use my first late one out-and-about with my Speed on tripod with focusing rail. Stopped down to f/11 or smaller it forms a good but vignetted image at infinity; it would do well on 2¼ x 2¼. A 101/4.5 Ektar is therefore a better choice for general photography, but for close-up work the Neupolar is great. It is the best lens I have from 1:8 to 1:1 at f/11 to f/20 and wide open from 1:1 to 4:1. On my Graphics it can be used from 1:8 to around 2:1. The second late one, whose serial number is over 35,000 higher than the first's, shoots as well as the first.

100/6.3 Luminar [sold]. Recommended range of magnifications 0.8x - 8x, covers 4x5 across the range. Another flea market (camera show) find, not badged "Luminar." The vendor didn't know what it was nor did the other people who walked by his table. Bargains will probably exist as long as ignorance. This one has problems. It was kept in a plastic bag that seems to have worn a spot in the front element's coating. I've shot it against my coated 100/6.3 Neupolar. The Neupolar is much better, so I never sent the Luminar out to be recoated or had an adapter to #1 shutter made for it. In fact, my 100 Luminar is terrible; it can't be focused at 4:1. Comparison with a borrowed 100/6.3 Luminar known to be good makes it clear that mine has bad problems. The good one, though, isn't quite up to the Neupolar. This is unexpected.

4"/5.6 Enlarging Pro Raptar. Stops to f/32. 6/4 plasmat type [10]. I got this lens from an internet vendor with Ken Ruth's advice in mind and because my 160/5.6 Pro Raptar is so good. I initially bodged it onto a #1; the result was ugly, but more than good enough for light use. More recently I've had a proper mount adapter made. From 1:1 to 1:8 it is very good indeed from f/11 to f/22. From 1:1 to 4:1 it is nearly as good wide open as the 100 Neupolar. At f/16 at normal distances it forms an image but my 101/4.5 Ektar is much better. The 100 Neupolar is a treasure



Figure 6: Great and bad macro lenses: the 100/6.3 Neupolar is in an adapter to #1 shutter made by Steve Grimes. The 35/4 Eurygon will screw into the front of a #1.

not to be parted with but the 4"/5.6 Enlarging Pro Raptar is the lens I use for close-up work in the field. Ease-of-use is very important.

105/4.5 Comparon in #0 Copal Press. Stops to f/32. Tessar type enlarging lens. Lens made in 1978. Bought for the shutter. And then I read Schneider's propaganda, which claims that the Comparon gives better image quality enlarging from 2x to 6x (1:2 to 1:6 taking) than Componon and Componon-S. So much for the 100/5.6 Componon-S and 105/5.6 Componon I already had. For use above 1:1, the cells can be swapped front to back in the shutter. As expected, shoots well close up, but the enlarging Pro Raptar is better. Even so, I can't bring myself to toss the glass and find another lens for the shutter.

And another in cock-and-shoot Copal 0. Aperture scale not calibrated. Lens made in 1976. Also bought for the shutter. Both 105 Comparons came from Sirchie mug shot cameras.

105/5.6 Schneider Componon in barrel. Stops to f/32. 6/4 plasmat [10] type enlarging lens. Bought at a camera show to satisfy curiosity. There have been many discussions in photography forums on the wisdom of using enlarging lenses as taking lenses. The consensus is that Componons work quite well as taking lenses. I've verified that the cells go properly into my spare Synchro Compur #0. Not good enough closeup to replace my 100/6.3 Neupolar and 4"/5.6 Enlarging Pro Raptar. Not good enough to replace my 101/4.5 Ektar and 4"/2 Taylor Hobson at distance.

105/5.6 El-Nikkor in M39x1. Stops to f/45. 6/4 plasmat [10] type. Bought a few weeks after the 100/5.6 Componon-S because the price was right and the El-Nikkor is much easier to use reversed than either it or the 105/5.6 Componon. As with them, my goal was to shoot not far from 1:1 more easily than can be done with 100 Neupolar or 4" Enlarging Pro Raptar. The Enlarging Pro Raptar is better.

105/4.5 D.O.Industries in Copal #0 Press shutter. Stops to f/32. This tessar type lens made for an unknown application (taking? enlarging? Either is possible.) was on a Sirchie Fingerprint



Figure 7: Two Comparons: Schneider's Comparons are essentially Xenars optimized for relatively small enlargements, perform very well as macro lenses. Cheap and cheerful.

Laboratories identification (mug shot) camera. D. O. Industries is a successor to Elgeet, made lenses in Rochester and imported them from Japan. D.O.I. now does business as Navitar. This lens may have been made in Rochester; it is not marked Made in Japan. I bought it for the shutter.

135/4.5 Tominon in #1 thread [sold]. Tessar type. Works from 1x-3x on the MP-4. Polaroid's recommended magnifications for the MP-4 Tominons are, miraculously, exactly the magnifications attainable with them on a standard MP-4. I got it with an MP-4 shutter when I needed a shutter; the package was too inexpensive to pass up just because the lens was included. I've never shot it close up because the 100/6.3 Neupolar does what I need. Polaroid describes the 135/4.5 Tominon as a general purpose lens. I've shot it at normal distances and don't like the results it gives; much less sharp than the 101/4.5 Ektar. Bought from an internet vendor.

I've since got another, later sold, as part of a package from eBay. Looking through both at the USAF 1951 target on glass at 1:2 made it clear that not all Tominons were created equal.

135/4.5 Boyer Saphir B in 45 mm thread. Another of the enlarging lenses that came with my second 40/4.5 Luminar. Terrible at distance regardless of aperture. At 1:2, second-best of my ~ 135 mm lenses suitable for closeup work, very usable.

135/5.6 Enlarging Pro Raptar. Stops to f/32. Another Wollensak 6/4 plasmat [10] type enlarging lens. A gift from Vivek Iyer. The best of my ~ 135 mm "macro" lenses. Better at distance than the 135/4.5 Boyer, almost usable.

And another, bought at a low price because the first one's diaphragm is very stiff. Replacing the lens cost less than repairing it.

138/4.5 Graphic Raptar in unknown thread. Stops to f/32. A tessar type bought because the price was right and because there are two reports on Usenet that it works well as a macro lens. At 1:2, as good as my better 135/4.5 Tominon. Usable, not the best. I have no idea of its intended use. Richard Knoppow has commented on Usenet that Graphic Raptars are simply rebadged enlarging Raptars and not very good. He's reported that all tessar type Raptars suffer severe coma,

an aberration that is worst at the edges of the field and that can be reduced by stopping down. Closeup photography uses only the center of the image, so this lens' coma, if present, should not be a major problem.

150/5.6 Comparon in barrel. Stops to f/45. Another tessar type enlarging lens, bought because I'm happy with how the 105/4.5 Comparon shoots and because the price was very, very right. Not tried yet.

6 3/8" (162 mm)/5.6 Enlarging Pro Raptar in barrel. Stops to f/32. One more Wollensak 6/4 plasmal [10] type enlarging lens. Bought at a camera show because the price was very right. Not tried yet.

5.3 Other enlarging lenses for photomacrography

In addition to the lenses mentioned above I've tried a 35/4.5 Spiratone [**sold**] and a 60/4.5 Dallmeyer at magnifications above 1:1. I found the Spiratone completely unusable and the Dallmeyer worse than the roughly equivalent Tominons. Ken Ruth's advice notwithstanding, I've stopped trying enlarging lenses for high magnification work. Short ones aren't practical for work on a Speed Graphic at magnifications below 1:1. Lenses around 100 mm are probably best for working below 1:1 with a 2x3 camera.

5.4 Which macro lenses should I use on my Graphics?

It depends on magnification and desired working aperture. Remember that usable magnification is limited by extension. With the Speed and a #1 shutter, I can count on no more than 300 mm without vignetting.

As a practical matter, the 90/6.3 Mikrotar, 100/6.3 Neupolar, and 4"/5.6 Enlarging Pro Raptar are as good as any of my shorter lenses at magnifications from 1:8 to 2:1. At those magnifications at f/11 to f/22 with TMX or EPP, these three give the same results as the shorter lenses **and** better working distance. The Neupolar is ever so slightly the best, but the Enlarging Pro Raptar is much easier to use. End of that discussion. From 2:1 to 4:1 the reversed 55/2.8 AIS MicroNikkor at f/4 is my best lens, but the 63/4.5 Luminar is somewhat easier to use. From 4:1 to 6.6:1, my 40/4.5 Luminar wide open is probably it. From there to 11:1, the reversed 25/1.9 Cine Ektar II at f/2.8 is the lens to use; the 25/3.5 Luminar is, however, easier to travel with and to use. From there to 16.5:1 the 17/4 Tominon (that I no longer have) wide open is it. Getting higher magnifications on a 2x3 Graphic doesn't seem practical; in the field, around 4:1 is the practical limit.

6 Lenses useful out-and-about at normal distances

6.1 Testing, manufacturers, process lenses and military surplus

6.1.1 Testing?

I check my lenses out informally but not that subjectively. My test target is a patch of lawn about thirty feet from the camera, sometimes my back fence. I shoot them at the apertures at which I expect to use a lens, f/11, f/16, and sometimes f/22. I rate lenses on how well they separate blades of grass or show wood grain in the fence and, especially for long ones, how well they resolve the blades' structure.

I try long lenses out by photographing the stop sign at the end of my street, somewhat more than 200 m from my shooting position. There is a “Children Playing” sign about 15 m from the stop sign. I check the image of the stop sign to see how sharp its edges and lettering are and check the “Children Playing” sign for legibility of text. My goal is to identify lenses that perform poorly at distance. The long lenses I get for my Graphics all have much more coverage than my little 2x3 cameras can use, so I hang them in front of a Nikon for testing and shoot on EB or EPP. This economizes on film and processing, still allows comparison of the lenses’ central resolution.

My test procedures are not substitutes for formal resolution testing but are informative. Their results are repeatable and allow me to sort lenses into “good enough” and “not good enough.” Their goal is not to determine which lens is in any sense best, but to help me decide which lenses not to use.

6.1.2 Manufacturers?

The modern LF lenses most commonly on offer seem to have been made by just four manufacturers, in alphabetical order Fuji, Nikon, Rodenstock, and Schneider. Most of the lenses I’ve acquired were made by other manufacturers. The big four’s lenses are very good, well-known, and therefore in high demand. This is true even of their process lenses, many of which are expensive to put in shutter. I’ve tried to buy relatively inexpensive lenses of good quality, therefore have sought lenses that are, for whatever reason, undervalued.

6.1.3 Process lenses?

Many of my longer lenses are relatively slow process or copy lenses. Since I normally shoot at apertures no larger than f/11, process lenses’ small maximum apertures are no handicap. They are usually offered in barrel and few will easily go into shutters. For this reason they’re often quite inexpensive even though good. For use on my 2x3 cameras, front mounting on a small inexpensive shutter is practical; on larger formats, though, this may not work because of vignetting by the shutter.

6.1.4 Military surplus?

Some of the very good lenses that were used on little-known military, mainly aerial, cameras can be adapted to 2x3 Graphics. I’ve bought ten or so, of which I use five; all were great values. Longer lenses for aerial cameras, though, are usually too big or long or heavy to work on my little cameras. Two of the attractive shorter ones I bought turned out to be unusable on my little Graphics because their barrels are too large to clear the front standard and their back focus’ too short to allow the lenses to be mounted entirely in front of the lens board.

6.2 Description of lenses

6.2.1 1-3/8” to 3-3/4” (35 mm to 95 mm)

35/4.5 Apo Grandagon in Copal #0. Bought used from an internet vendor. The lens mounts on the Century and focuses through infinity on it. Mounting it requires removing the rear cell and reattaching it from the rear.

2x3 Ektachromes shot with it show less darkening in the corners than I’d expected. Others may disagree, but I find it quite usable without a center filter, also not quite as sharp as I’d hoped.

After having had prints made from several Ektachromes shot with it, I bought a used center filter. The Ektachromes showed good detail to the corners, but the printer couldn't cope with the reduced illumination.



Figure 8: The shortest lens that covers 2x3: So far, the 35/4.5 Apo Grandagon is the shortest commercially available lens that covers 2x3. Its only competitor is the 38/5.6 Super Angulon XL.

38/4.5 Zeiss Biogon in Copal #0. Bought from an internet vendor who had an ex-RAF A.G.I. F135 camera that held a pair of 38 Biogons in inoperable solenoid-actuated shutters. The F135 uses 5" film, has forward motion control and autoexposure; the two shutters fire alternately, i.e., even though it has two lenses it is *not* a stereo camera. It was used on several aircraft types, including Nimrod, Harrier, Jaguar, and F4 Phantom.

The late Steve Grimes charged \$500 for putting one of my two Biogons in a new Copal #0. As mounted, it stops to f/32; the Hasselblad version stops only to f/22. Mine covers an 84 mm circle so it vignettes on 2¼" x 3¼" but nearly fills 2¼" x 2¾". It goes on my Century from the front -- the rear cell is small enough to clear the front standard -- and focuses easily to infinity. It doesn't make infinity on my 2x3 Speed. The kit -- Century Graphic, lens, and Adapt-A-Roll 620 -- cost much less than the least expensive Hasselblad SWC and is more useful. I recovered some of my outlay by selling the second lens of the pair.

Using my Biogon on the Century is slightly problematic. The lens makes infinity with the front standard on the inner bed rails. With the front standard on the inner rails, it is difficult to avoid unintended swing without a "chinaman" (see discussion of 4"/2.0 Taylor Hobson below). SKGrimes made one to fit my Century; the chinaman Fred Lustig made for my Speed won't do because the Century's bed rails are narrower than the Speed's.

The 38 Biogon has a wonderful reputation that it fully deserves. I couldn't make myself use any other lens for two months after it came back from SKGrimes. It took a truly horrible shot of the Mono Lake basin, all foreground and atmospheric haze, to bring me back to earth. At the moment, subject to change, the 35 Apo Grandagon has displaced the 38 Biogon from my travel kit. The Apo Grandagon puts useful image in the corners, the Biogon puts darkness.

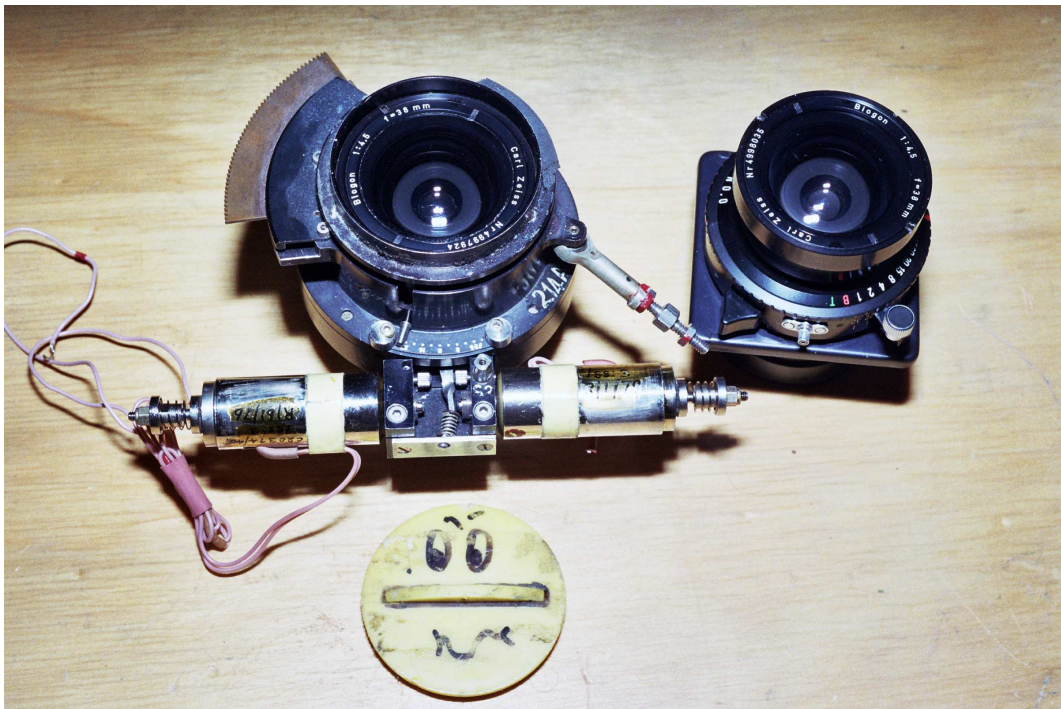


Figure 9: A pair of 38 Biogons with an RAF lens cap: My 38 Biogons came in AGI F135 shutters, which are actuated by a pair of solenoids that extend when energized, one to open the shutter and the other to close it. The little yellow lens cap fits the F135 shutter's barrel; someone in the RAF has a sense of humor. My 38 Biogon in Copal #0 uses custom lens caps front and rear, courtesy of the late Steve Grimes.

1.75"/2.8 Elcan. Stops to f/22. Bought from Vinten's former Engineering Manager's son. He offered a Vinten F95 aerial camera with 98/1.4 Falconar on eBay and indicated in his listing that he had more F95 parts and lenses to sell. I inquired, we discussed, and now I have it. The rear of its barrel is stepped; its rear section is 47 mm in diameter and 32 mm long. It just clears the 2x3 Pacemaker Graphic front standard's lens throat. Back focus is approximately 50 mm. Since my 2x3 Speed's minimum flange-to-film distance is 2 7/16" (62 mm), this lens will easily focus to infinity on the camera. I believe it is the shortest lens that can be used on a 2x3 Speed. It, like my other two ex-F95 Elcans (see below), can be used on a 4x5 Speed Graphic.



Figure 10: Two ridiculous wide angle aerial lenses: The 1.75"/2.8 Elcan covers 6x6, isn't competitive with the 38/4.5 Biogon, which also covers 6x6, or the 47/5.6 Super Angulon, which covers 2x3. The 100/5.6 S.F.O.M. was made to cover 114 mm x 114 mm on 5" film, is normal, not wide, on 2x3.

This lens was in use as early as 1965.

<http://www.pinetreeline.org/metz/otherm1/otherm1-40.html> reports that 1 Wing, RCAF received one for field trials in October, 1965. According to

<http://www.dfrc.nasa.gov/Research/AirSci/ER-2/history.html>, these lenses flew on U-2c aircraft in 1971-2 "to acquire small scale, low resolution, multispectral photography over selected representative ecosystems to simulate the Return Beam Vidicon (RBV) data system which would be aboard the future Earth Resources Technology Satellite (ERTS; Landsat1)."

The Vade Mecum says "It covers 6x7 very well, is sharp and contrasty but does not cover the whole of 6x9 format. It is a really desirable item and the one which is easy to reuse." Mine illuminates an 87 mm circle, i.e., not quite 6x7, with a sharp cutoff. The image, however, gets very dim a few mm inside the cutoff. Not quite a 6x7 lens, still usable on 6x9 when losing the corners can be tolerated. On the whole, I prefer my 47/5.6 Super Angulon, which covers all of 6x9.

47/5.6 Schneider Super Angulon in #00 Prontor Press. Stops to f/22. An early one, single-coated. Makes infinity on my Century, not on my Speed. Its shutter's top speed is 1/125, so using

large apertures outside requires an ND filter. Setting it up on the Century requires a chinaman. A well-known lens of very high quality.



Figure 11: Wide angle aerial lenses on their boards: The Elcan is a retrofocus lens, can be used on a 2x3 Speed Graphic because of that and its mechanical design. The S.F.O.M. is of "normal" construction, neither retrofocus nor telephoto, and just makes infinity on a 2x3 Speed Graphic.

Mine came from a Shackman Automatic Dial Recording Camera. Shackman's current owner, the Unitek Group, informed me that "the camera was used by the Royal Navy for recording the results of gunnery practice by photographing a panel of dials and the camera was linked electrically to the firing of the guns. The camera was fixed to a bulkhead about 2 metres from the panel, hence the wide-angle lens. When the camera was first produced, it had a Dallmeyer lens and specially made film spools, which had to be returned to Ilford Photographic for re-loading. When this service was discontinued by Ilford, the cameras were modified to accept standard 220 roll-film, but as the film is advanced by rotation of the take-up spool, approximately the first 8 frames overlapped, but the frame spacing on the rest of the film gradually increased to give full-frame negatives. Around the same time, an expensive new Prontor shutter with Schneider Super-Angulon Lens was fitted."

58/5.6 Rodenstock Grandagon in #00 Synchro Compur. Stops to f/32. Graflex XL lens. Both cells have, unfortunately, separations in the inner – facing the diaphragm -- group. In the rear cell, they show as silvery spots with no connection to the elements' periphery. In the front cell, they show as an irregular silvery rim that goes all of the way around the elements. Rodenstock lenses of its era (s/n 5 664 858, probably made in 1964) were prone to separations.

The lens came set up for a Graflex XL, i.e., in a shutter with no cable release socket, no "T" setting, and no press focus. The rear cell, 51 mm in diameter, does not clear the 2x3 Pacemaker Graphic front standard but can be inserted from the rear. The lens will focus to infinity on a 2x3 Pacemaker Speed Graphic. It was a gift for which I was asked to pay postage and a token fee.

After mounting it quite poorly and taking some trial shots with it, I had it put it on a lens board so I could give it a fairer trial. The results were promising enough to justify having a spare #00

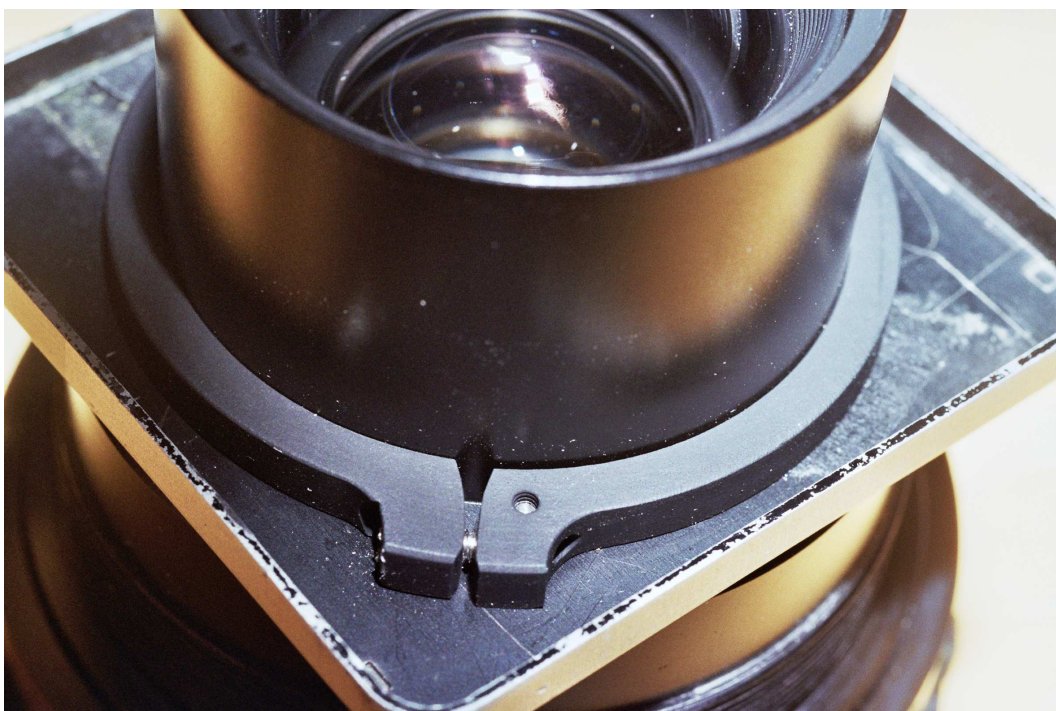


Figure 12: How the Elcan is held to its board: I'd originally intended to glue the Elcan to its board. Adam Dau of SKGrimes, to whom all credit is due, persuaded me that a clamp would be better. The clamp is held to the board by a screw that passes through the board from the front.



Figure 13: More wide angle lenses for 2x3: 47/5.6 Super Angulon, 58/5.6 Grandagon, 60/5.6 Hexanon, and 65/8 Ilex. All very usable.

Synchro Compur rescaled and the lens' cells put in it. This to be able to use a locking cable release with the "B" setting for focusing. The XL's focusing mount incorporates a cable release socket, so there's no need for one in the shutter. And since the XL is a rangefinder camera there's no need for a "T" speed or press focus.

60/5.6 Hexanon to fit Koni- and Rapid-Omega 6x7 cameras. In Copal #0 shutter, speeds B, 1, ½, . . . , 1/500, stops to f/32. The front cell has a very useful integral sliding lens hood. Bought in a junk shop.

Lenses for the Koni-Omega can't easily be used on other cameras because their shutters are fired by the Koni-Omega body. The release lever protrudes from the rear of the shutter, connects to a linkage in the body. Their shutters have neither an accessible release lever nor provision for a cable release. Their cells have to be put in a conventional #0 shutter before they can be used on any camera but a Koni-Omega.

Reshuttering the the 60/5.6's cells seemed problematic. The rear cell barely clears the diaphragm, the front cell barely clears the shutter. I tried the rear cell in a #0 Synchro Compur P and a #0 Copal that were on hand, convinced myself that the rear cell hit their diaphragms. Greg Weber, a specialist repairer of Konica cameras and lenses, told me that the threads at the rear of the 60/5.6 Hexanon's shutter are not cut as deep as usual. This can't be true since the rear cell has a step that butts against the rear of the shutter tube when screwed all the way in.

Dean Williams overhauled a #0 Synchro Compur for me and checked the Hexanon's fit in it. He reported that the lens fit properly and that its native shutter is a perfectly normal Copal 0. He's right; the lens fits the Synchro Compur. While Dean had my equipment I acquired another Copal 0; the lens fits it too.

My misconception is not new. See a discussion at <http://nelsonfoto.com/SMF/index.php/topic,5457.0.html> that doesn't give full detail. The problem there may be due to differences between the diaphragm's position in press (self-cocking) and cock-and-shoot shutters.

This problem, real or not, and the similar one I had with putting my 65/8 Ilex's cells in a new shutter (see below) make clear the importance of checking cell spacing or, equivalently, the lens' total length when moving cells from one shutter to another. Although there are standard shutter sizes there are no standards for cells' positions in shutters.

Another difficulty: the front cell's barrel obscures the front of a Synchro Compur, making it nearly impossible to read the speed and aperture settings. Other lenses for the K-O (58/5.6, 90/3.5, 135/4.5, 180/4.5) all have the fat front cell problem. The solution is a shutter whose aperture and speed scales are on its side; this is why I bought that Copal #0, which came from an on-line auction (not eBay) at an absurdly low price.

The 60/5.6 has six elements in four groups in the same layout as the original f/8 Super Angulon. For a cross-section, see p. 15 of

http://www.cameramanuals.org/prof_pdf/koni-omega_rapid.pdf. It is only superficially similar to the 58/5.6 Hexanon/Omegon later made for Koni- and Rapid-Omega cameras, which has eight elements in four groups, rather like the f/5.6 Super Angulon. For a cross-section, see p. 20 of http://www.cameramanuals.org/prof_pdf/rapid_omega_100-200.pdf.

Chris Perez' tests – http://www.hevanet.com/cperez/MF_testing.html – of three examples of the 58/5.6 Hexanon show it to be a very fine lens that probably covers 2x3. I suspected the 60/5.6 would also work on 2x3. The first test of this hope was to put the cells in a #0 (diaphragm fully open); the lens focuses to infinity on a 2x3 Pacemaker Speed Graphic with the front standard inside the box.

First test shots with the 60/5.6 were inconclusive. Consistently underexposed and hard to read, possibly misfocused as well. A second series of test shots was much better. When the first test shots are poor, suspect the operator, not the lens, and retest.

The 60/5.6 Hexanon is a little better than the 65/8 Ilex and it covers 6x9. Coverage still unknown, but enough for shooting 2x3 without movements.

60/14 SOM Berthiot Périgraphe VIa in barrel, with wheel stops, also called rotary disk stops. I bought it in a Charlie Barringer moment from a vendor who offered it and a 90/14 Périgraphe on leboncoin.com and ebay.fr's petites annonces. The 60 fascinated me and I had to have it. I've wanted such a lens since I tried out Charlie's 62/18 Protar Ser. V; seeing the little Périgraphe's picture crystallized the desire. By P-H Pont's Berthiot chronology, probably made in 1951.

Henri Gaud has posted a page from a 1912 Établissements Phillippe Tiranty catalogue – <http://trichromie.free.fr/trichromie/index.php?post/2011/01/27/PERIGRAPHE> – listing f/14 and f/6.8 Lacour-Berthiot Périgraphes. It says that both are convertible, claims that the f/14s cover 115° and the f/6.8s cover 95°. f/14s were offered in focal lengths of 45, 60, 75, 90, 120, 135, 150, 200, 250, 300, 350, 400, 450, and 500 mm. Recommended formats at f/25 are consistently between 100° and 110° without movements. If I ever come across a 45/14 Périgraphe I may have another Charlie moment.

The 1912 coverage estimates may be inflated. An undated SOM Berthiot catalog published between the wars

(see http://www.collection-appareils.fr/accesnotices/html/lire_repertoire?repert=som_berthiot&marque=Som%20berthiot&modele=Catalogue&PHPSESSID=333965b3c0b5e4652c9d3802b532215d) says that f/14 Périgraphes cover 106°, illuminate 112°. I have a SOM Berthiot brochure from, probably, the late 1940s that claims 100° for the 90/14 Périgraphe VIa and doesn't mention convertibility; in it SOM Berthiot's convertible Dagor type is the Eurygraphe. Georges Laloire has sent me undated data from Berthiot, probably published between the wars, that also claims 100° for f/14 Périgraphes. Coverage is a sometime thing.

My little Périgraphe is somewhat of a poisoned gift. It is too short to focus to infinity on a 2x3 Pacemaker Speed Graphic when mounted on the standard metal lens board. A fragile wooden recessed board is possible. The lens focused through infinity on a crude prototype. The Pacemaker Speed's limited range of slow timed speeds 1/50, 1/30 is, however, very constraining.

The lens makes infinity on a Century Graphic with nearly 25 mm to spare but needs a shutter. It is too large to be stuffed into the front of a Compur/Copal/Prontor #1 but can be mounted completely in front of one. Unfortunately a #1 shutter's rear tube hides the exit pupil from 2x3's corners. The Périgraphe screws into the front of an Ilex #3 but mechanical vignetting by the rear tube is a problem. The least costly way to use it with a useful range of timed shutter speeds is to sacrifice an Ilex #3; cut off most of the shutter's rear tube, attach it to the board, and screw the lens into it.

Adam Dau of SKGrimes has advised me very strongly against using glue to hold a shutter to a board, much prefers drilling holes in the shutter body so it can be held to the board by small screws. His approach's only drawback is cost; the shutter has to be disassembled completely before the holes can be drilled safely.

As things turned out, the Ilex #3 I extracted from a Tektronix C-27 oscilloscope camera had a diaphragm that opened to only 28 mm full aperture should be 34.6 mm – so it had to be removed. Extracting it required dismantling the shutter, so Adam was spared the discomfort of knowing that someone had glued a shutter to a lens board.

The result is a tight fit on a Century Graphic. The lens makes infinity with millimeters to spare. The shutter is considerably larger than the board; when it is on the camera the front standard can't be unlatched. To mount the lens on the camera, one puts the front standard in approximately the right place as far back as possible on the inner rails is correct and then tightens the latch and attaches the board with shutter and lens.

The lens mounting threads are approximately the diameter of the shutter's threads. The pitches



Figure 14: How to attach a mutilated Ilex 3 to a 2x3 Pacemaker board. The shutter's rear tube has been cut off so the usual way of holding a shutter to a board – a retaining ring that screws on to the shutter's rear tube – is impossible. Screws that go through the board and into the shutter do the job.

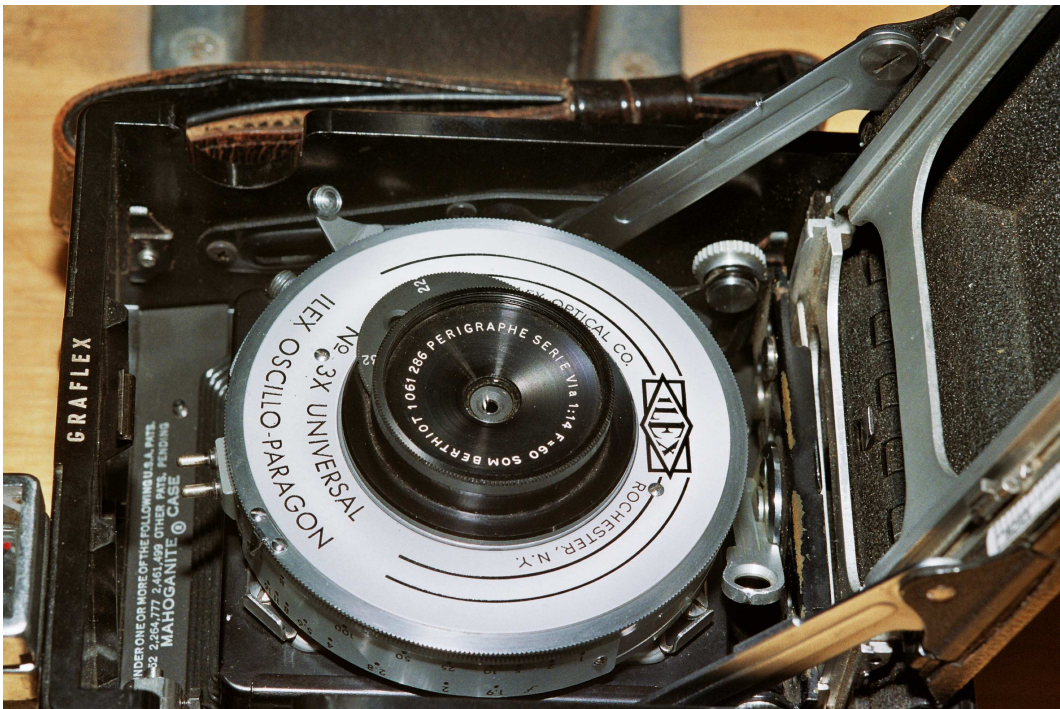


Figure 15: Small lens, large shutter. The 60/14 Périgraphe is a tiny lens whose barrel can be stuffed into an Ilex #3 shutter. The shutter will just fit a Century Graphic.

differ considerably. Simply inserting the lens into the front of the shutter and turning until it can't be turned more leaves it insecurely in place. A bit of darkroom tape (black masking tape) inside the shutter gives the lens threads something to bite and makes for more secure attachment. Mr. Barringer would have approved.

I've shot my 60/14 Périgraphé against my 60/5.6 Konica Hexanon (ex-Koni-Omega). At f/16 and f/22 the Périgraphé is noticeably better. I now understand why David Goldfarb, who uses a 120/14 on 8x10, and Chauncey Walden, who uses a 75/14 on 4x5, are so enthusiastic about their Périgraphés.

65/6.8 Raptar in Rapax [sold]. This was the standard shortest lens for Century and 2x3 Crown Graphics. It will not focus to infinity on a 2x3 Speed Graphic. 4/4 double Gauss type. I never got a satisfactorily sharp shot with mine, replaced it as soon as I could. Mine may have been a bad example. Bought from a dealer who advertised it in Shutterbug magazine.

A **65/8 mystery** lens received in an electric mystery shutter. Stops to f/22. The only markings on the assembly are on the shutter, whose face plate says "Opto Dynetics Inc Rochester NY Syncnetic Model 20C." The aperture scale on the side of the shutter runs from f/8 to f/45. The lens resembles a Super Angulon.

I didn't know who made it or what equipment it came from; Mr. Grimes said it was made by **Ilex**, who made a 65/8 **Acugon**. That's probably what it is. It makes infinity on my 2x3 Speed Graphic and is much sharper than the 65/6.8 Raptar that it replaced.

Remounting it in a usable shutter shouldn't have been too costly, thanks to an inexpensive new old stock #00 Compur Rapid shutter that turned up at just the right time, but the shutter needed an overhaul in addition to some light machining. The cells screwed right in but the spacing was wrong. All that work put costs up appreciably. Still less expensive than buying a used 65/8 Super Angulon or properly badged Acugon, but a lot dearer than I'd hoped. There were three sizes of Acugons, 47, 65, and 90, all f/8 and badged Acugon, AcuVeriwide, AcuWide, and Ilex-Caltar. All have been spoken of highly on Usenet. I've seen a very similar Ilex lens in #1 Ilex Universal and badged Wide Field Paragon offered on eBay.

75/2.8 Anastigmat, with no maker's name or serial number. Engraved "Anastigmat 1:2,8 / 75 Germany." In M39x1, stops to f/32. A complete mystery. Sold as an enlarging lens, which seems unlikely. Unexpected lens design, essentially a Tessar but with three singlets in front of the diaphragm. Seems much like the Vade Mecum's lens diagrams Sc 004, described in text as a 50/2.8 Schneider S-Xenar; Sc 047 and Ste 023, neither described in text. Vignettes on 2x3 at 40 feet.

3"/2 Elcan [sold]. Unmarked aperture scale. Ex Vinten F95. Bought with a 6"/2.8 Elcan from the internet vendor who earlier sold me a 6"/1.9 Dallmeyer Super Six and a 14"/5.6 Aviar. Seems to cover at most 2¼ x 2¾.

The rear of its barrel is 61.5 mm in diameter, so will not pass through my 2x3 Speed's 48 mm x 48 mm lens throat. Back focus is approximately 50 mm and my Speed's minimum flange-to-film distance is 2 7/16" (62 mm), so mounting the lens entirely in front of the lens board is not practical. The flange to end of barrel distance is approximately 53.5 mm. The lens can be used on a 4x5 Speed Graphic, whose minimum flange-to-film distance of 2 5/8" (67 mm) is much shorter than the lens' flange-to-rear of barrel distance plus back focus. It seemed a good opportunity, but I can't use it.

76/2.8 Elgeet Militar. Bought because I've been curious about these things for too long. Its glasses are tea-colored, its diaphragm is operated by a pin that sticks out through a slot in the side of the barrel. There is no aperture scale. Seems to cover 6x6, doesn't even illuminate 2x3 at infinity.

This lens is somewhat of a puzzle. One of my friends bought one, a 76/2.8 Ektar, and a 76/2.8 General Scientific Finitar from Surplus Shack. All three are in identical barrels. He understands

that they came from a camera used on helicopters. I've seen Gordon KB-16 cameras offered on eBay with Ektar, Finitar, and Miltar; apparently it shot 70 mm film. My friend reports that his three lenses are identical on the surface but that each has a different design. This is consistent with USAF lens data sheets.

3"/4.5 Series II Velostigmat in Rapax. This uncoated lens is a complete mystery. After I bought it as new old stock still in the original box, I asked about it on rec.photo.equipment.large-format. Richard Knoppow reported that according to Wollensak it covers 2x3. I've seen Wollensak catalogs that claimed that coverage for 3.5"/4.5 Velostigmat Ser. II and Raptar Ser. II, but none that even mention a 3", so perhaps Mr. Knoppow was mistaken. I've put my 3" on an improvised board and shot it on the Speed using the camera's focal plane shutter. At f/16 and f/22 it indeed covered, i.e., the corners were as sharp as the center; uniformly soft everywhere. Not as sharp as my 65/8 Acugon or 80/6.3 WF Ektar, but no worse than my 65/6.8 Raptar. It is usable, but for me not worth the expense of having its shutter overhauled. Bought at a camera show.

80/2.8 Planar, loose cells. Gift from Charlie Barringer. Normal lens for 6x6, 5/4 double Gauss type [13]. These cells are waiting for a shutter. The rear cell won't go into an ex-CU-5 Copal Press #1 or a Prontor Press #1 because it hits the diaphragm before fully seated. It will go into a cock and shoot Copal #1 and into a #1 Synchro Compur P.



Figure 16: Two answers to the same question: fast normal lenses for 6x6 from Schneider and Zeiss.

80/2.8 Xenotar in Synchro Compur P #0. Stops to f/22. Bought at a camera show. Normal lens for 6x6, 5/4 double Gauss type. Front and rear surfaces badly scratched, shutter gummy. It passes light and forms an image but the image in the GG with the lens wide open is very bad. Unusable at f/8, severe veiling flare. Early one, later 80/2.8 Xenotars are in #1 shutters. There have been disagreements about whether an 80 Xenotar covers 2x3. Schneider doesn't make this claim and I don't think mine is good for 2x3, but since the lens seems to have been redesigned perhaps a later one will cover. I bought it for the shutter, which has been resurrected.

80/6.3 Wide Field Ektar in Flash Supermatic. Stops to f/32. This was the shortest standard issue lens for 2x3 and 3x4 Speed Graphics. It is a well-known and well-respected four element double Gauss type moderate wide angle (80°) lens. I've had two. The first, which I still use, was bought through Compuserve's Photoforum's swap area. I bought the second at a camera show with resale in mind and have sold it.



Figure 17: The incomparable 80 mm Wide Field Ektar: The original issue wide angle lens for 2x3 Graphics and a very good lens. Less coverage than, e.g., the similar Cooke Ser. VIIb from TTH and Weitwinkel Aristostigmat from Meyer, but probably sharper.

84/6.3 Krauss Tessar in barrel, with focusing helical. Not coated. Bought out of curiosity from a vendor on eBay.fr. If anyone else had wanted it, I'd have been outbid. Its aperture scale runs 0,4 0,5 1 2 4 8 16. According to P-H Pont (Les Chiffres Clés, 3^{ème} edition) [14], this is the Congrès 1889 scale and corresponds to f/6.3, f/7, f/10, f/14, f/20, f/28, and f/40. Pont dates the lens to between 1905 and 1910, most likely 1906, so this may be my oldest lens. It probably came from a Gaumont Stereo Spido that shot pairs on 6x13 plates; an after-market roll film back was also available. Some Stereo Spidos fitted with 84/6.3 Tessars allowed one of the taking lenses to be centered for taking panoramic shots, so these lenses may cover considerably more than 6x6.5. The VM says that f/6.3 Tessars cover 70°; if true, an 84 mm lens will cover 117 mm, way short of 6x13's diagonal but comfortably more than needed for 2x3. Mine covers 2x3 at f/11, is a bit soft in the corners wide open.

3 11/32"/6.3 B&L Zeiss Kodak Anastigmat in Compound, stops to f/32. Not coated. Not clear when it was made, but probably pre-1916; the words "Zeiss Kodak Anastigmat" last appeared in the 1915 Kodak catalog. Extracted from a Premo #12 that shoots 2¼" x 3¼". As purchased the shutter worked, ran slow, and the piston tube wasn't securely attached. In addition, the cells wouldn't unscrew and needed to be cleaned. CLA'd by SKGrimes. The lens' serial number is painted on the side of the rear cell, can be seen only by unscrewing the cell from the shutter. Other identification - maker, name, patent date and maximum aperture but not focal length - is engraved around the outside of the front cell.

Tiny tiny lens; I have to use it, if only *pour épater les bourgeois*. Unfortunately although in tests it covered 2x3 from f/11, it isn't very good; the 80/6.3 WF Ektar is much better. For that reason the little B&L will usually stay home.

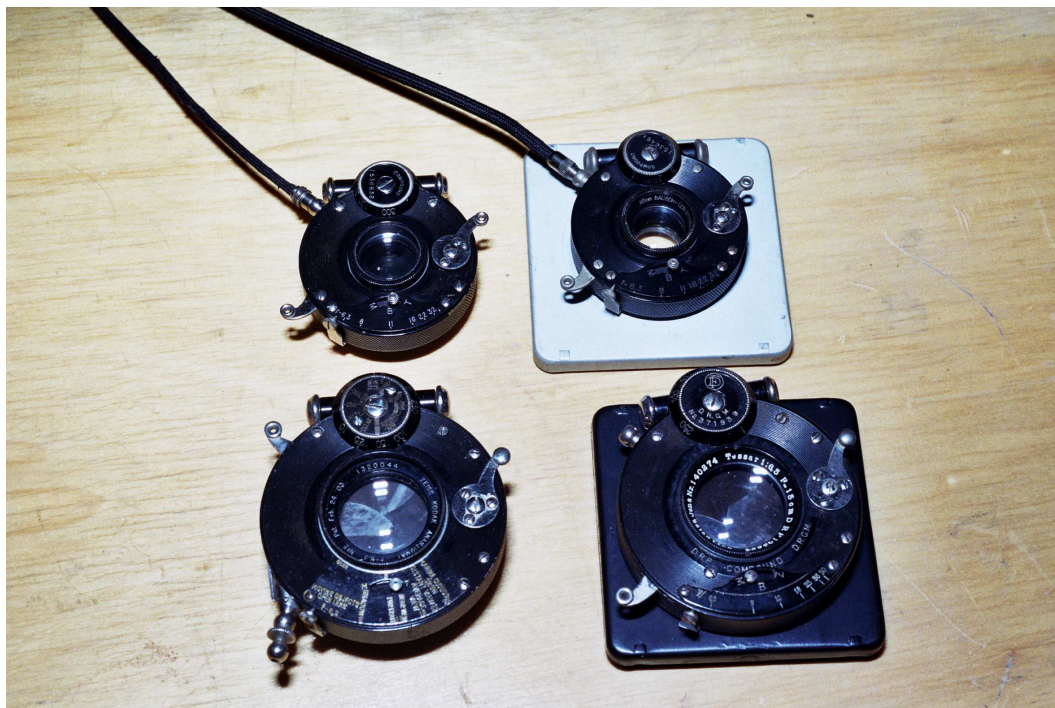


Figure 18: Four ancient Tessars in ancient Compurs: Two 85/6.3s, both made by B&L, and two "five inchers" made by B&L and CZJ respectively. I use the 130/6.3, intend to use the better of the two 85s after its shutter has been overhauled.

A second later example of a very similar lens, also from a Premo #12, also not coated, engraved "85 mm Bausch & Lomb Tessar Series IIb" that was made after 1915. Its identification - focal length, name, patent date, serial number - is engraved on the front cell's trim ring. The two lenses are engraved with the same patent date but are not identical. The older one's front and rear elements are larger than the newer one's. I've tried to swap the newer lens' cells into the older one's shutter, which is in good order. The rear cells interchange, the older front cell will go into the newer shutter, but the newer front cell won't go into the older shutter.

The newer lens' shutter works, runs slow. The two lenses are in identical tiny Compound shutters whose serial numbers differ by about 10,400; the lenses' serial numbers, however, differ by about 775,000. B&L probably sold relatively few 85/6.3 Tessars; all of the longer ones I've seen in Compound were in larger shutters than the 85s.

The newer lens shoots much better - exposures timed with my Speed's focal plane shutter, not with the Compound it is in - than the older one. It is quite usable even though worse than the 80 WF Ektar, so when I have the money I'll have its shutter overhauled. I should have tried both lenses on the Speed before selecting one to have its Compound overhauled. Another instance of "too soon old, too late smart."

Premo #12s were also offered with 3½" (89 mm) f/4.5 Tessars - the most expensive option - and with less expensive lenses as well. That the Premo #12 was sold with lenses shorter than normal for 2x3 is surprising. Interestingly, the contemporary #1 Autographic Kodak Special, which also shot 2x3, was offered with 4 3/8" (110 mm) f/6.3 Tessars but with 3½" (89 mm) f/4.5 Tessars.

90/6.8 Boyer Béryl in straight barrel without diaphragm. Convertible, a single cell is 160/13.

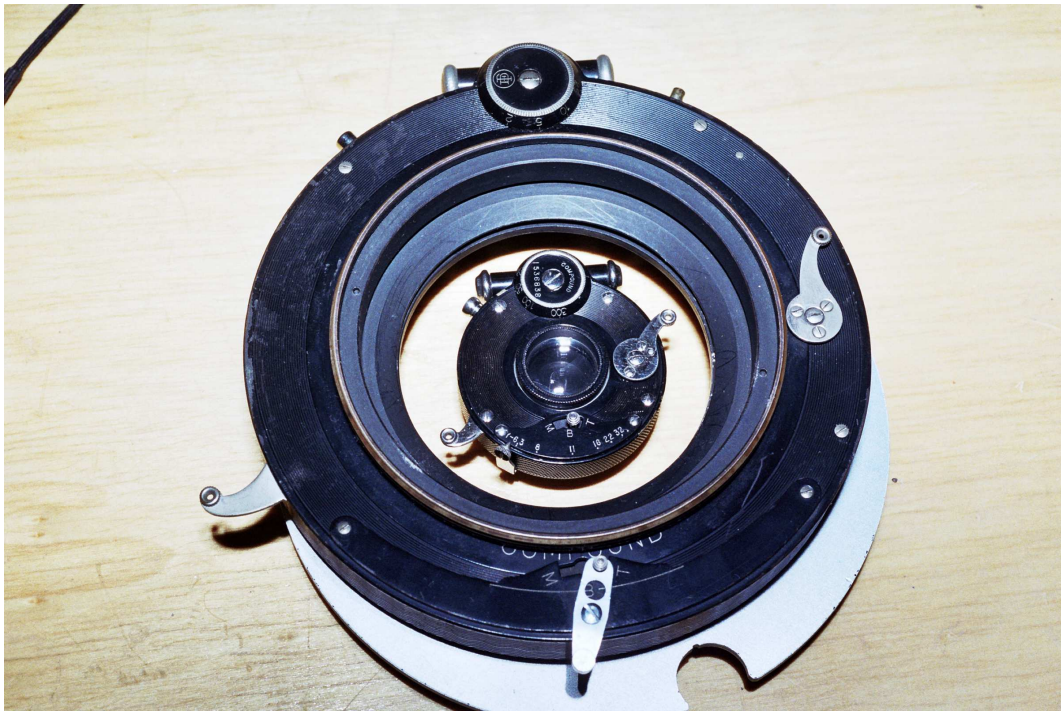


Figure 19: The large devour the small: Compound shutters were made in many sizes. The largest, #5, is too big to attach directly to a 2x3 Pacemaker Graphic lens board.

I removed it from a Chevet Wild Endoscopographe, an endoscopic camera patented by CNRS (*the French National Research Centre*) that takes six small circular images on a sheet of Polaroid pack film. The lens cells are, as indicated in CEDIS-Boyer's fiches techniques, direct fits in a #00 shutter. SKGrimes engraved an aperture scale on one of my Prontor Press #00 shutters for it. Bought because I've become interested, for no particularly good reason, in Bérlyls. Or, if you will, Dagors.

It shoots well but central image quality isn't quite up to a 101/4.5 Ektar's. The Ektar is, however, worse in the corners.

95/2.8 Boyer Saphir in barrel, rear threads M39x1. The barrel stops to f/16. 6/4 double Gauss type bought to see what it is and how well it will shoot. Offered on eBay.fr as an enlarging lens but made to be used as a taking lens. The cells go into a #1 shutter. Convertible lens, the rear cell alone is 133/5.3. Eric Beltrando has one, tells me that it won't cover 2x3. I think mine does, but not wide open, also that we have different minimum standards for image quality. I've put the lens in a Prontor Press #1.

6.2.2 4" to 4-3/4" (100 mm to 120 mm)

100/2.5 Uran-27 in barrel. Mixed aperture scale, 2.5, 3.5, 6.3, 8, 11, 16. Soviet (GOI design, 1952; KOMZ, Kazan Optical-Mechanical Factory, see Industar-51 below) lens for Zenit AFA-39 and RA-39 aerial cameras. These shot 70 x 80 mm on 80 mm film, flew on a variety of MIG and Sukhoi aircraft of east bloc air forces. An AFA-39 went into space in 1957. Lens is bulky, fits in a 3" cube. Not clear how to put cells in shutter; they are held in the barrel by radial setscrews that seem to be glued in.

I've discussed this lens with another owner on photo.net. He reported that his put such a fuzzy image on the ground glass wide open that he never tried to use it. Mine isn't that bad. The 1963 G.O.I. catalog says that the lens resolves 48 lp/mm centrally and 8 lp/mm at the corner wide open.



Figure 20: Latest acquisition and its new home: That 90/6.8 Boyer Béryl was extracted from a Chevet Wild Endoscopographe. It is in a plain barrel, so can be used only at full aperture. The cells, however, go directly into a #00 shutter. Before I can use the lens I'll have to have the shutter's aperture scaled for it.



Figure 21: Two rare fast normal lenses for 2x3: The 100/2.5 Uran-27 and the TTH 4 Inch f/2 Anastigmat (2 1/4x 2 1/4) were made for aerial cameras but can be used on 2x3 Speed Graphics. Both cover 2x3, both are heavy, and neither is superior to good slower lenses. But if one needs the speed, there are few alternatives.

Not, on the face of it, completely unusable.

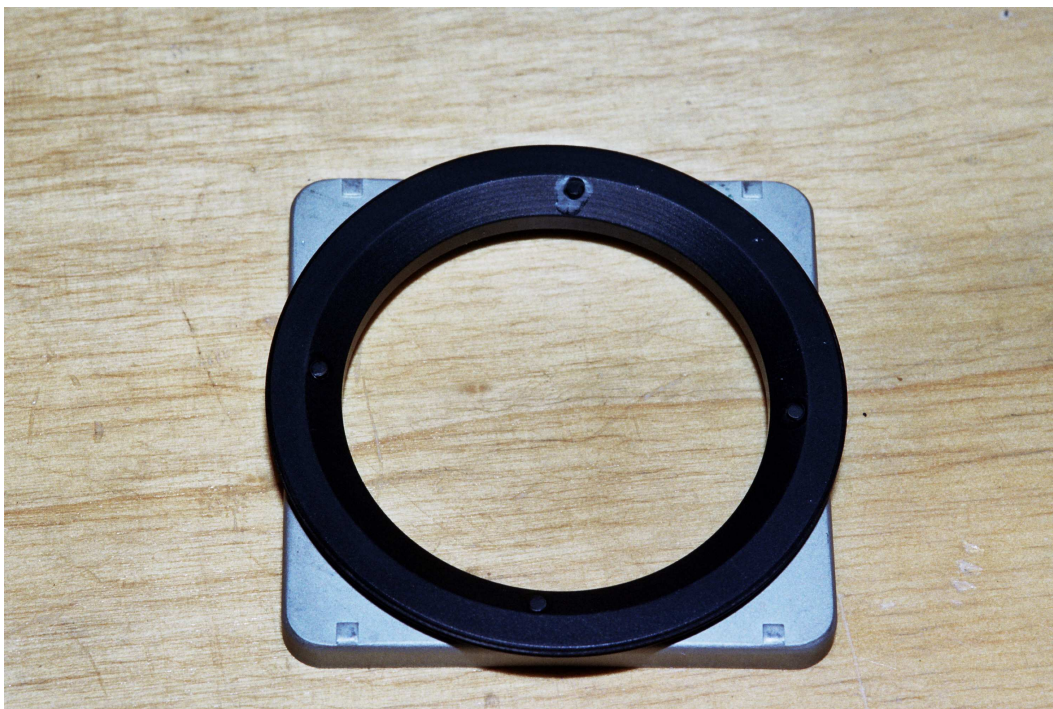


Figure 22: Uran-27 mount adapter front: the adapter is held to the lens board by four screws, screws into the back of the lens

The lens has been put on board by SKGrimes and will focus a very few mm through infinity on the Speed if the camera is set up carefully with the front standard as far back as possible. The lens is more than sharp enough from $f/8$ down, but in some of the test shots the ends of the frame are vignetted. I've seen this with my $12\frac{3}{4}$ TTH telephoto, blame both problems on the bellows' front frame.

100/5.6 S.F.O.M. in barrel, serial number 59. I think it is uncoated, could be mistaken. No S.F.O.M. chronology is available, but I believe it was made in the early '50s. Société Française d'Optique et Mécanique was a French manufacturer of optical goods, including slide projectors, lenses, aerial cameras and bombsights. S.F.O.M. was bought by Matra, may still exist as a part of EADS. I believe that the 100/5.6 S.F.O.M. was fitted to the S.F.O.M. 680 and 681 and some Omera (see <http://caea.free.fr/fr/coll/vautour2b.php>) aerial cameras. The lens is a Metrogon type, covers at least 160 mm (114 x 114). Its weight makes me wonder whether l'Armée de l'Air flew battleships. Mine came from a vendor on eBay.fr, was very inexpensive. Its cone is not for a S.F.O.M. 680/1.

I couldn't extract it from its cone; getting it out required removing a deep red filter that was jammed on. SKGrimes did that for me. Once it was out of the cone, I could see that the cone is light alloy; the lens itself is quite heavy, ~ 750 g.

I eventually paid SKGrimes to mount the lens on a 2x3 Pacemaker board and engrave an aperture scale on its barrel. It was originally delivered with an aperture scale engraved on the lens cone; in the cone, which is very wide, it won't fit on a 2x3 Graphic. As mounted, it focuses to infinity on the Speed with a few mm to spare.

On 2x3 it is very usable. Not quite as sharp, perhaps, as a 101/4.5 Ektar and it is much heavier, larger, and in barrel. For these reasons I'll continue to use a smaller lighter 100 mm lens in leaf shutter and the S.F.O.M. will stay in the drawer.



Figure 23: Uran-27 mount adapter rear: the adapter is held to the lens board by four screws, screws into the back of the lens



Figure 24: Fast normal lenses on their boards: Lenses too fat to pass through a 2x3 Graphic's front standard must be mounted entirely in front of the lens board. The Uran-27 stands out a little - no more than necessary - to allow room for the sliders that hold the board to the front standard.



Figure 25: 100/5.6 S.F.O.M. mount adapter: the lens screws into a stepped cup-shaped adapter that is held to the lens board by a normal retaining ring

I'm not sure how the 100/5.6 S.F.O.M. can be used on formats larger than 2x3. Its back focus is too short for it to be used to shoot, e.g., 6x12 mounted in front of a 4x5 Speed Graphic's lens board. Its barrel is, I think, too large - outside diameter 80 mm - to pass through a 4x5 Speed's front standard. And I don't see how it can be put in shutter.

100/6.3 Meyer Weitwinkel Aristostigmat in barrel. Stops to f/32. A coated lens made in the late 1950s. 4/4 double Gauss. Very light. Cells won't go into a standard shutter. f/6.3 is certainly for focusing, not for shooting. Not my sharpest ~ 4" lens from f/11 down, but usable. There are better normal lenses for 2x3, best used as a wide angle lens on a larger format. Camera show find.

4"/2.0 Taylor Hobson Anastigmat (2 1/4" x 2 1/4"), stops to f/16. The Lens Collector's Vade Mecum says it is "a high quality lens" used on Vinten F95 and Agiflite aerial cameras. Both shoot 2 1/4" x 2 1/4" on 70 mm film. Some models of F95 and Agiflite have forward motion control. My 4"/2.0 came from an ex-RAF F95. The F95 could be handheld but was usually mounted in reconnaissance pods attached to a variety of aircraft types including Swift, Hunter, Buccaneer, Canberra, Nimrod, F4 Phantom, F16, Harrier, Fiat G.91, and Jaguar. Both cameras were used by many air forces. After Taylor Hobson stopped making lenses for them, Vinten bought Elcan lenses and the 38/4.5 Biogon for F95s, and AGI bought Zeiss lenses for Agiflites.

I bought my 4"/2.0 from an individual who advertised an F95 camera with two lenses on an internet bulletin board run by Warton Parfitt. I intended to use it as a fast normal lens on my 2x3 Speed. Mr. Grimes mounted it entirely in front of the board; it focuses to infinity with the front standard on the inner bed rails. It covers 2 1/4 x 3/4 wide open. Putting it in shutter doesn't appear practical and anyway its rear cell won't clear a 2x3 Graphic's front standard. Focusing at f/2 is very easy thanks to the bright image and shallow depth of field; image quality is marginal wide open, noticeably better by f/5.6. Mine wasn't very expensive.

Setting up the camera's rangefinder for it required an additional part. There is room for only one infinity stop on the inner bed rails, so to make it easy to use the lens with the RF Fred Lustig



Figure 26: Not really a normal lens for 2x3: covers 100°, according to Meyer propaganda. Use f/6.3 to focus, shoot at f/11 or smaller.

made a spacer -- he calls it a chinaman -- that sits between the front standard and a pair of stops on the outer rails. One erects the stops, puts the spacer in place, pulls the front standard to it, then mounts the lens on the front standard. This squares up the front standard and positions the lens properly for the RF.

A good lens; better than the 101 Ektar, especially in the corners, but much heavier. I rarely use it because of its size and weight.

4"4.5 Aldis Anastigmat Uno in barrel, stops to f/32. Not coated. Bought to find out what it is. It is a triplet, apparently from an Ensign Autospeed or an Ensign Focal Plane Rollfilm Reflex, later called Speed Reflex. The Autospeed is a 2 ¼ x 3 ¼ folding camera with a focal plane shutter. The Focal Plane Rollfilm Reflex is, as its name indicates, a 2x3 SLR. Both cameras seem to use the same focal plane shutter. So Uno is a trade name as well as a design.

101/4.5 Ektar in Flash Supermatic. Stops to f/32. Uncoated. Bought at a camera show with my 2x3 Speed. Graflex offered a range of normal lenses with 2x3 Pacemaker Graphics. In order of reputation, worst to best, these are: triplets, e.g., Graflar and Graftar; 101/4.5 Optar, a Wollensak-made tessar type; 101/4.5 Ektar, a Kodak tessar type; and 105/3.7 Ektar, a Kodak Heliar type. I've had two 105/3.7 Ektars, found that I preferred pictures taken with the 101/4.5 Ektar that came with my camera to pictures taken with them, and have sold the first. In any case, my 101/4.5 Ektar shoots so well that it is the standard against which I compare my other lenses.

Another, coated, in broken Flash Supermatic. I've put it into the uncoated one's shutter, don't think it is quite as good. This one was a gift from Steve Herman, accompanied by a 2x3 Busch Pressman that I later sold.

101/4.5 Optar in Graphex. Bought on a 2x3 Pacemaker board at a camera show for less than the going price for a board. I didn't buy a lens, I bought a lensboard. Also a 101/4.5 Raptar in Rapax, same lens in same shutter, with Wollensak's trade names rather than Graflex' trade names. This one is on board, was on my second Crown when it came back to me from a friend who'd

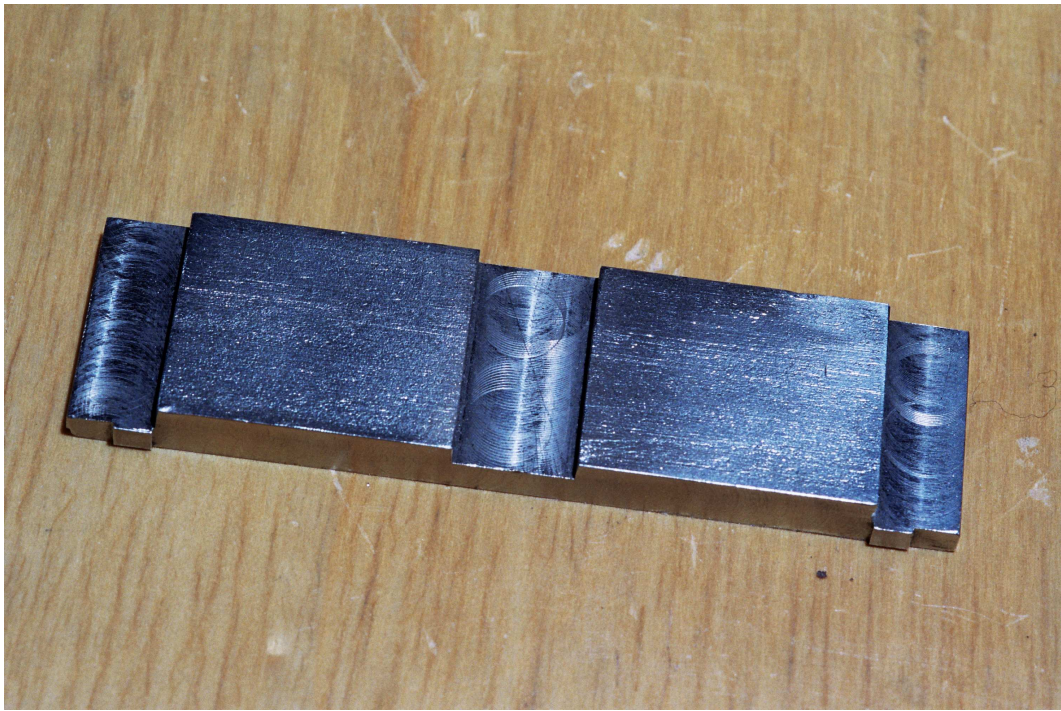


Figure 27: Mr. Lustig's spacer

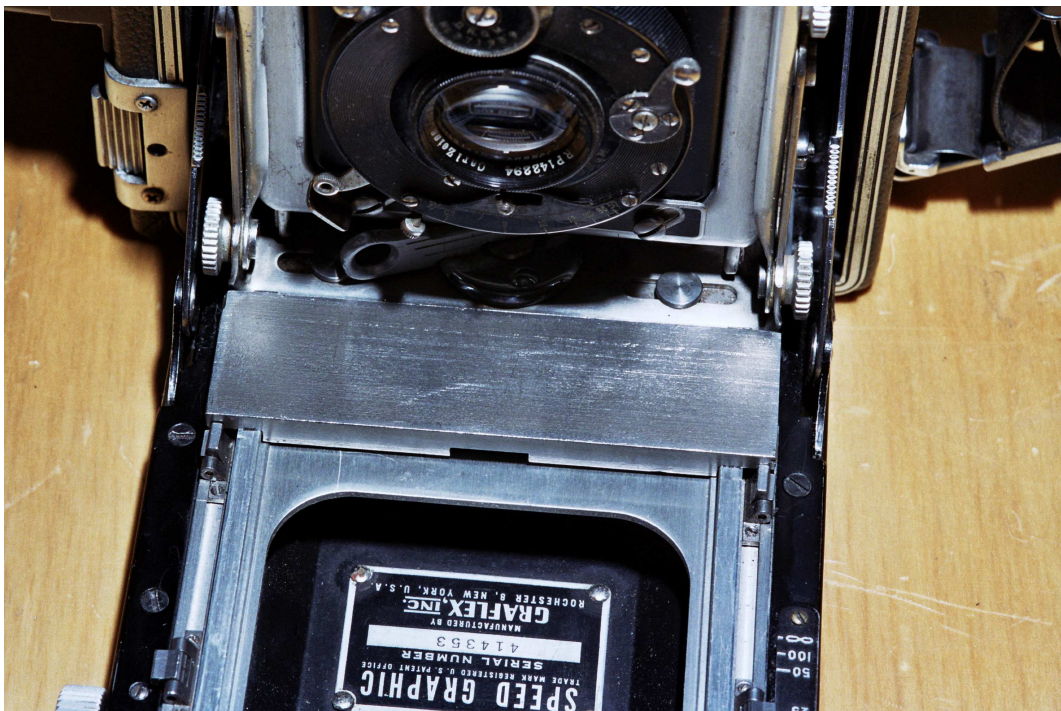


Figure 28: Mr. Lustig's spacer in place: the spacer fits between the infinity stops and the front standard, keeps the front standard parallel to the film plane and allows the rangefinder to be calibrated for the lens.

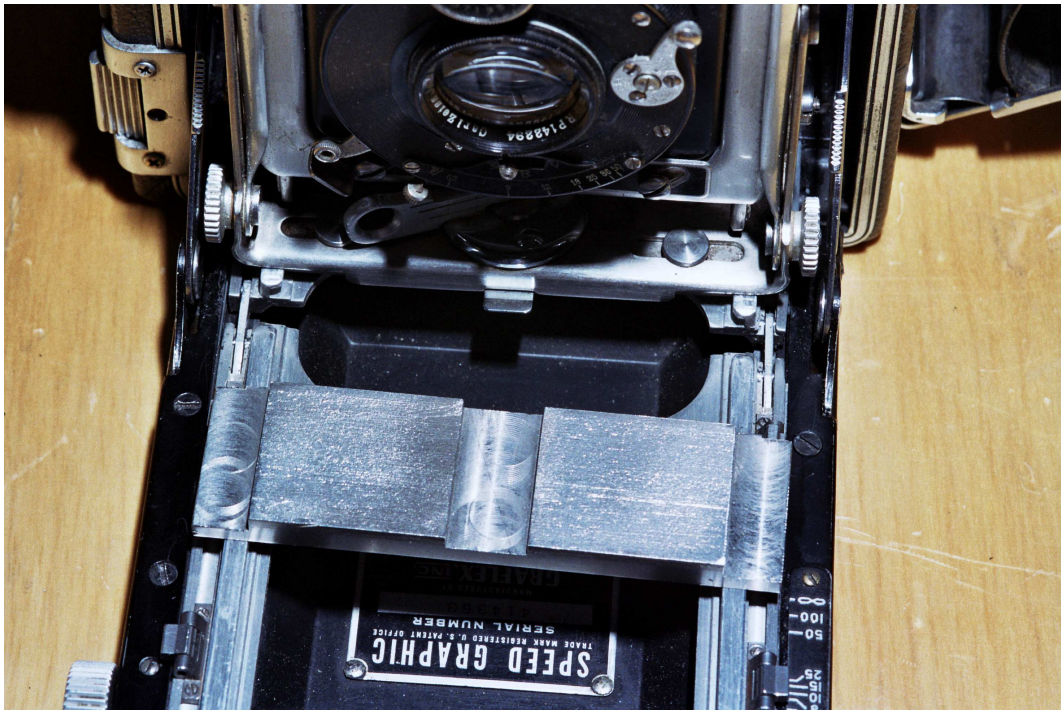


Figure 29: Mr. Lustig's spacer, key details: the slot in the middle of the spacer prevents it from interfering with the tab that locks the front standard in the centered position.



Figure 30: Mr. Lustig's spacer, intended use: the spacer was made to allow the rangefinder to be calibrated for the 4"/2.0 Taylor Hobson Anastigmat

pressured me into giving him the camera. Another lens board.

Some posters on www.graflex.org swear by this lens, others say firmly that it isn't up to the 101/4.5 Ektar. I have no opinion, don't want to know, and intend to sell both of my 101/4.5 Wollensak lenses. I can use the boards, have more normal lenses for 2x3 than makes sense.

103/4.5 Graftar in Century. Stops to f/32. The Century shutter was made by Wollensak, is a press shutter. One, since sold, came with the Century Graphic I bought at a camera show. I never used it.

A second one also bought at a camera show. The dealer thought he was selling a lens, I thought I was buying a lensboard. I've tried it out; it is very competitive with my 101/4.5 Ektar from f/11 down.

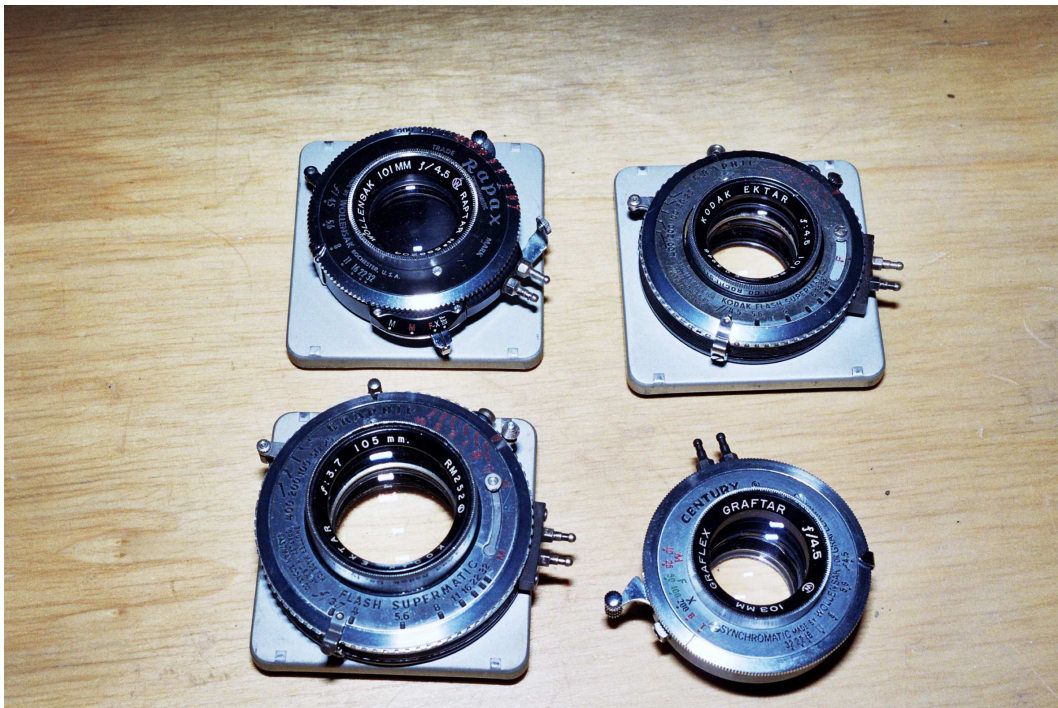


Figure 31: Original normal lenses for 2x3 Graphics: These are the lenses that Graflex offered with the cameras. In my experience the 103/4.5 Graftar, a triplet made by Wollensak, is the best. Don't reject it without trying it.

105/2.8 ERA-7. In barrel, threaded M75x1. Stops to f/16. Made by the Kazan Optical-Mechanical Factory (KOMZ). According to Eugene Kulikov, "It's an original design made by Professor Volosov, a famous Russian optician - six components in five groups, nonsymmetric anastigmatic lens. These lenses were made in very small series, and are rare even in Russia. ... Your lens should be a very high-quality high-resolution process lens, dedicated for process work and delivering about 300 lpm on 1:1000 mira contrast. It shares the optical design with its small relative Era-6, but it's a specialty lens. The most probable format is 6*9, though I'm not sure about it."

I'm not as sure as Zhenya is that my Era-7 is a scaled-up Era-6. The Era-6 is a 50/1.5 that covers 24 x 36, the -7 is f/2.8. He directed me to <http://www.zenit.istra.ru/catalog/lenseslist.html>, which mentions a number of Era lenses. The longer ones are all narrow angle.

Against this, Vivek Iyer says "this monster is a >200 lp/mm lens (within about 20mm circle). Not color corrected." Vivek, however, has a 125/4 Era-12. Again, not simply a scaled-up Era-6 or -7.



Figure 32: Era-7: pretty lens, very hard to use



Figure 33: Era-7b: its mounting threads are very far forwards and its rear won't pass through a 2x3 Graphic's front standard. A cup-shaped mount adapter can be made for it but would be very expensive.

Vivek was at least partially correct. The lens doesn't come near to covering 2x3 at infinity; 6x6 at best. I see no inexpensive way to mount it for use on any of my cameras.

105/3.5 Voigtländer Helomar in Compur Rapid. Stops to f/22. Uncoated triplet bought at a camera show for the shutter. Probably ex-Bessa. Not tried.

105/3.7 Ektar in Flash Supermatic [sold]. 5/3 Heliar type. Stops to f/32. I bought this lens at a camera show because it is supposed to be the best normal lens offered for 2x3 Graphics. It had a considerably shorter flange-to-film distance than the 101/4.5 Ektar it was going to replace, so short that on my Speed the front standard's infinity position was on the hinge. This was unexpected but, I later learned, correct. I usually shot it hand-held, was never entirely satisfied with the results and went back to using the 101/4.5. I sold the 105 because I wasn't using it, have since decided that perhaps I should have kept it.

This evil thought led to purchase of a 2x3 Crown Graphic with a 105/3.7 at a camera show. The price was very right. This example also gives worse image quality than my uncoated 101/4.5.

105/5.6 Rodenstock Rodagon-G in Prontor [sold]. 6/4 plasmat [10] type enlarging lens intended for making murals (recommended range of enlargements 10:1 – 40:1, optimized for 20:1). Lent by Vivek Iyer, who reports that it shoots very well at infinity. Didn't work well for me, so I returned it.

105/5.6 Boyer Saphir BX in barrel [returned to its owner with thanks]. 6/4 plasmat [10] type sold for enlarging. Borrowed from Phillippe Cas to see how well it shoots at distance. His lens' cells wouldn't come out of the barrel; trying it wasn't easy.

I've since got one of my own whose cells come out easily from a seller on eBay.fr. They go right into a #1. Shoots quite well, as it should since it is just a rebadged Zircon. From f/5.6 down it is no worse than the 101/4.5 Ektar and 4"/2.0 TTH, so I've retired them. Convertible lens, the rear cell alone is 178/12. One small problem with it; a 2x3 Graphic will mount a #1 shutter but won't close on one.

105/6.3 Leitmeyr in #0 Prontor II. Stops to f/16. Uncoated. Classic four element double Gauss WA. Shutter, a cock-and-shoot Prontor, in poor condition. Bought for \$10 to satisfy curiosity. Its cells will go into the Helomar's shutter; the spacing is correct and I believe the aperture scale is too.

107/3.7 Ektar uncoated and in unsynced Compur [sold]. I believe it is a tessar type. This lens came with a Miniature Speed Graphic I bought for its Graflok back. Camera show find. Never used, sold with the Mini Speed after I swapped its back with my 2x3 Pacemaker Speed Graphic's Graphic (spring) back.

12 cm/4.5 Zeiss Tessar [given to Mr. Barringer]. Stops to f/32. Uncoated. An old lens – made in 1912 -- bought to be given to Charlie Barringer, but I may try to borrow it back from him.

4.75"/7.7 Aldis Uno. Uncoated, stops to f/32. The VM says it was made to cover 3¼" x 3¼", covers up to 80°. "Uno is a very nice contrasty sharp lens and fully usable today if used with care and was a real bargain." Tiny thing that passes light and forms a not-too-bad image. Better than acceptable at f/16 and f/22, a surprisingly useful lens on 2x3. Not quite as sharp, though, as my best lenses.

6.2.3 5" to 7" (127 mm to 180 mm)

5"/4 Ross Wide Angle Xpres [sold]. Uncoated, stops only to f/11. According to the Vade Mecum, this is a "very high quality lens" and "the f4/5in lens for the MoD is apparently an f3.1 lens, as the front glass is some 28% oversize and actually bigger than a normal 6in. It covers an enormous field really well, most of 1/1 plate in fact [15]." Its glasses are fairly clean but there are



Figure 34: Satisfying curiosity: I'll never use this Leitmyer wide angle lens, but now I know what it is. 4/4 double Gauss, for those who want to know.

some marks on the rear element that won't come off. Of interest, the rear cell is easily unscrewed but the front cell is prevented from unscrewing by a lock screw that's easy to remove, hard to replace. The flange is integral with the barrel so mounting it will be problematic. The Vade Mecum warns of separations but mine has none. It seems to be, as the Vade Mecum says, a six element wide angle Plasmal [10]. Bought in a store. Test shots with it on 35 mm film were not very sharp at any aperture and were quite flary. For me, unusable, but not a bad \$10 gamble.

5"/4.5 Cooke Aviar. Another Taylor Hobson lens. Stops to f/32. In M39x1. The Aviar is a dialyte type lens with four air-spaced elements, two in the front cell and two in the rear. The eBay vendor from whom I bought this one characterized its condition as "very good apart from a couple of slight flats on the back lens ring and some brassing around the edges. A nice piece for the collector of vintage camera accessories." When the lens arrived, its glasses, including the interior surfaces, were filthy, the diaphragm was quite stiff, and the rear of the barrel, into which the rear cell screws, was dented. The dents make unscrewing the rear cell difficult. I've got both cells out of the barrel and have opened them to clean the elements' inner surfaces. There's haze that normal gentle cleaning methods won't remove; under the microscope, I see that the glass is etched. This lens looks like unusable junk, not what one normally thinks of as "very good." It is clearer to me now than it used to be that I should query eBay vendors about their wares' fitness for use before bidding.

Damage notwithstanding, I've shot it from f/5.6 @ 1/1000 to f/32 @ 1/30 on a dull, overcast day and at f/11 and f/16 on a brighter day. It is acceptably sharp from f/8 through f/22, marginally usable at f/32. The Speed's focal plane shutter is indeed useful. At f/16 it produced a shot slightly less sharp and snappy than a parallel one taken with the 127/4.5 Tominon. It wasn't, after all, completely unusable, until the diaphragm control ring stopped working.

127/4.5 Tominon in a Copal #1 Press. Stops to f/45. From a Polaroid CU-5 camera, intended to be used around 1:1. Bought for the shutter even though the only way to keep the shutter open

for focusing is to set it on "T." I haven't been able to bring myself to try it closer than 1:5. From there to infinity it gave unexpectedly good results at f/11 and f/16, so it is now in my out-and-about kit.

And another, bought for the shutter.



Figure 35: Five inches or so: Three lenses with focal lengths around 5". All are usable, on 2x3 the 127/4.7 Tominon seems to be the best.

130/6.3 CZJ Tessar in Compound. Stops to f/50. Extracted from a Folding Pocket Kodak #3 Model G. Made in early 1912. Bought at a camera show because my other f/6.3 Tessars shot so well. In a smaller shutter than the Zeiss Kodak Anastigmat #2 mentioned above, but the two lenses' focal lengths are very close. Also not coated.

Its shutter was overhauled in 2008 by Carol Miller. A very fine lens.

13 cm/6.8 Goerz Doppel Anastigmat in dial-set Compur [16] [sold], uncoated.

Bought from a seller on a bulletin board, who offered it as a Dagor. The price was very right. The lens is a dialyte type, not a Dagor as described, and bears no name or serial number. The seller thought it had come from a Tenax camera. According to the Vade Mecum, Tenaxes were offered with a variety of 13 cm f/6.8 lenses, including Dagor, Tenastigmat (sometimes triplet, sometimes dialyte, perhaps the Vade Mecum's authors are confused), Tenaxiar (triplet), Kalostigmat (dialyte), and Syntor (dialyte). I'm confused. Not as sharp as I'd like, a little flary.

135/4.8 Wray Lustrar in Synchro-Compur-P. I bought two of these tessar type lenses as a package in considerable ignorance. The vendor's text in the eBay.co.uk listing didn't identify them and the text on their trim rings couldn't be read in the picture. Their shutters, though, could be recognized as some flavor of Synchro-Compur so I bid low in the hope that the shutters would be usable.

The lenses arrived mounted on mysterious cylinders that turned out to be focusing helicoids for the Peckham Wray camera. Both shutters are gummy; one has since been resurrected. Each lens has a bad rear cell; their front surfaces look mottled and feel a little rough. Pigs in pokes don't always work out as hoped. The better of the two isn't that horrible but shots taken with it are a



Figure 36: Classic lens, classic shutters: The 127/4.7 Ektar was made to fit Supermatic and Graphex (= Rapax) shutters, both US-made, and the #1 Compur. Kodak, who made Supermatics, and Wollensak, who made Rapaxes (= Graphexes), never agreed on shutter dimensions and both disagreed with Deckel. All three types of shutter work well if in good condition.

little soft and somewhat flary. Usable, but I'm not going to bother. The 127 Tominon is much better.

135/5.6 Symmar, convertible to 235/12. When I bought this lens it was in barrel. I've transferred the cells to an overhauled Synchro-Compur-P from one of the 135/4.8 Lustrars mentioned above. The shutter's diaphragm is scaled for the 135/4.8, is close enough for the Symmar. The Symmar was offered on eBay as an enlarging lens, possibly because it was in barrel. It shoots approximately as well the 127 Tominon, not obviously better or worse. I expect it would be better on 4x5 than the Tominon.

135(?) / 7.7 Aldis Uno in broken Lukos II shutter, uncoated. Bought for very little because the 4.75"/7.7 Uno is useful. This one can be used too, thanks to my Speed's focal plane shutter. Usable, not outstanding. Focal length is not engraved on the lens, hence my uncertainty about it. Aldis Uno lenses are a little telephoto, so their focal lengths can't be approximated by flange-to-film distance at infinity.

135/10 Apo Saphir in barrel threaded M39x1, stops to f/64. Bought from a seller on eBay.fr because the price was right and because I'd wanted one for some time. Glass fairly clean, diaphragm working, paint in poor condition as claimed in the eBay.fr listing. Shoots well.

135/6.8 Boyer Beryl in barrel. Stops to f/32. Convertible, a single cell is 250/13. I bought it from an Italian dealer's site after staring at it for more than a year. More Beryl mania. All of the other coated Boyer lenses I've seen have blue coating; this one has amber. It was offered as an enlarging lens and is in a wider than usual version of the flared mount (monture rentrante) that Boyer often used for enlarging lenses. The diaphragm has click stops as is normal for enlarging lenses.

CEDIS-Boyer's fiches techniques say that the cells will fit a #0 shutter. My 135 Beryl's cells

won't; older Boyer lenses don't always conform to CEDIS-Boyer documentation. SKGrimes made an adapter for front-mounting it on a #1 shutter, more of a stepped disk than a cup.

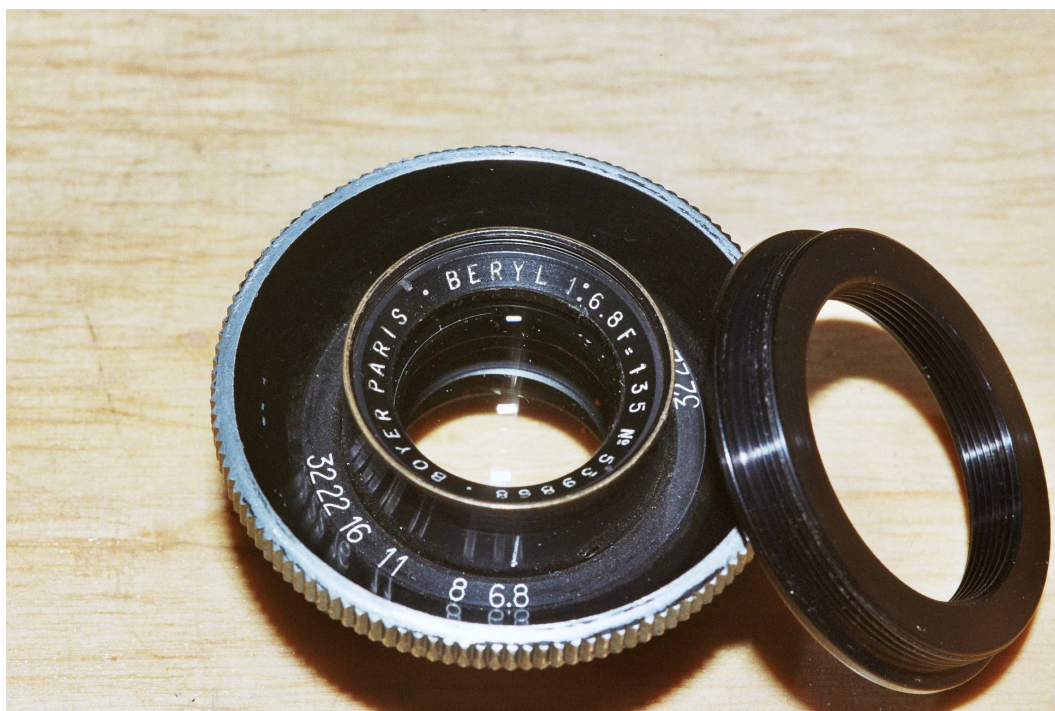


Figure 37: 135 Beryl with its thin cup-shaped adapter to #1. When the rear of the lens' barrel is smaller than the front of the shutter it is to be mounted on, the cup can be very flat indeed.

Eric Beltrando believes that this is a CEDIS-Boyer lens. He reports that CEDIS-Boyer's owner M. Kiritsis took some time to learn how to use the firm's new coating chamber. His initial efforts produced amber coatings, not the desired blue. Boyer's previous owners had sent lens elements to Berthiot to be coated.

I don't agree with Eric. My 135 Beryl's serial number is 539868. I have a 240/10 Apo Saphir s/n 689511 whose quality control card is dated 28 October 1964. Boyer numbered lenses sequentially, so my 135 Beryl must be from the Lévy era, i.e., pre-CEDIS.

It shoots well but 135/10 Apo-Saphir shoots better. This is not to denigrate the Beryl; when f/10 is the largest aperture needed Apo-Saphirs are excellent.

135/6.8 SOM Berthiot Périgraphe in barrel. Stops to f/32. Not so marked, but it is a Series VIb. Bought from a seller on Marktplaats.nl who offered it as an enlarging lens. Another f/6.8 dagor type, bought for the same reason and at the same time as the 135 Beryl. The price was right. The cells are identical, will not fit a #0 or #1 shutter. The barrel seems to be threaded M37x1. By P-H Pont's Berthiot chronology, perhaps made in 1948. Seems to be coated a very pale blue.

This lens doesn't seem to be quite as sharp as the 135/6.8 Beryl I tried out with it. Still very usable.

As mentioned in the discussion of f/14 Périgraphes, Henri Gaud has posted a page from a 1912 Tiranty catalog on his site. It offers convertible Lacour-Berthiot f/6.8 Périgraphes at 54, 85, 95, 110, 135, 180, and 350 mm. The claimed 95° coverage is much larger than the recommended formats; their sizes consistently imply 75° without movements. A between-the-wars SOM Berthiot catalog claims around 70° degrees wide open, 85° at small apertures, for f/6.8 Périgraphes.

In my post-WW-II SOM Berthiot brochure the f/6.8 Périgraphe isn't offered as a convertible. Another difference between the f/6.8 Périgraphe and the Beryl is claimed coverage. Boyer claims



Figure 38: Fast (they say) Périgraphe. In 1912 the f/6.8 Périgraphe was advertised as “Extra-Rapide.” Our concept of “fast lens” has changed a little since then . . .



Figure 39: Another way to attach a lens to a Leica extension tube. My little 135/6.8 Périgraphe will fit inside a Leica extension tube that in turn fits an M39x26 tpi-to-#1 adapter. To make the lens stay put I wrapped its threads with darkroom tape. Looks untidy, works.

85°, the post-war SOM brochure only 65°. Berthiot's convertible dagor type is badged Eurygraphe; its maximum aperture with both cells ranges from f/6 to f/6.4 depending on focal length.

150/4.5 Boyer Saphir in M45x1. Stops to f/32. Unlike the f/3.5 Saphir B enlarging lenses, a tessar type. Bought because it was pretty and inexpensive. I bought it thinking it was a taking lens and was surprised when the vendor stated on the customs form that it was an enlarging lens. When the same name is used for both types, ask which the lens is before buying. It doesn't have a built-in hood like all of the Boyer enlarging lenses I've seen and one French source reports a Boyer catalog with only the 150/4.5 Saphir taking lens listed. Rolyn's f/4.5 Saphir data sheet says that it should be threaded M39x1 at the rear; mine is in fact threaded ~ M45x1. In my first trial, this lens did very poorly at distance so I concluded that it must be an enlarging lens. When tried again, however, it shot acceptably at ~ 5m and a ~ 200 m. It turns out that *all* tessar type Saphirs are optimized for distance regardless of packaging or labels.

150/5.6 Boyer Saphir BX in M39x1. The cells go straight into an ex-Polaroid CU-5 #1 Press shutter that is about .3 mm too long; in that shutter it shoots well at ~ 50 focal lengths. The Saphir BX is a rebadged Zircon, is not optimized for enlarging. Convertible lens, the rear cell alone is 250/12. Like my 105/5.6 Saphir BX, a fine lens.

And another, also in barrel, also bought from a seller on eBay.fr. I bid low, lightning struck.

150/6.3 Zeiss Tessar in barrel, with adapter to M39x1, stops to f/36. Gift from Vivek Iyer. Uncoated. Made no later than 1912. Aperture scale interval one stop, starting from f/6.3. The diaphragm control ring is marked A II. Offered on eBay.de as an enlarging lens. Hung in front of a Nikon it shot much better than acceptably at ~ 5m and at ~ 200 m. A good lens.

150/6.3 Zeiss Tessar in M34x0.75, stops to f/45. Uncoated. Made in 1936 to a 1911 design. According to Arne Cröll, the 1911 redesign of the original 1902 f/6.3 Tessar was to improve ease of manufacturing, did not affect quality. Engraved Vergrößerung at the rear so one would think it was an enlarging lens. Scale engraved on both sides of the aperture control ring, mounting threads on both sides. Arne suggests that it is intended to be used for taking at magnifications up to 1:1 and for normal enlarging mounted normally, and for taking above 1:1 and reductions mounted reversed. Gift from Jim Galli. Very flary in first trials, but the flare seems to have been caused by the mount adapter.

150/9 Konica Hexanon GR II [sold]. A copy camera lens, stops to f/45. Another lens bought at a camera show because of a nice combination of beauty and low price. It languished in a drawer because my 160/5.6 Pro Raptar is more than good enough and it isn't smaller or lighter than the Pro Raptar. Putting it in shutter is likely to be very expensive. The best way to use it seems to be via an adapter that will hold it in front of a #1. Its rear is threaded M46 x 0.75. Sharp but a little flary at distance. I interpret lower color saturation than in slides of the same subject shot with another lens at approximately the same time and in the same conditions as evidence of flare. Sold to recover my investment and because the 6"/9 Cooke Copying shoots better.

150/9 Eskofot Ultragon [sold]. Another copy camera lens. Bought as an alternative to the 150 GR II in case it didn't work out. Also requires an adapter to put in front of a shutter. I never shot with it, eventually sold it to recover my investment. These lenses are also sold as Staebler Ultragon, Helioprint, and Repromaster. Reports about Ultragons' performance on rec.photo.equipment.large-format and photo.net are wildly inconsistent, ranging from "nothing to write home about" to "superb." Bought from an internet vendor.

150/9 Rodenstock Apo Ronar. Stops to f/64. Came screwed into a heavy black-painted brass disc threaded M72x1. Camera show find. The disc screws directly into the mount adapter Steve Grimes made for my 210/9 Konica Hexanon GR II. Shoots very well and as adapted covers 2x3 at infinity; I believe it is slightly sharper than my 6"/9 Cooke Copying Lens at apertures larger than f/16.

And another, gift from Vivek Iyer. Doesn't seem to be quite as sharp as the first, still very

good.

150/9 Schneider G-Claron [sold]. Stops to f/64. The cells go into a #0 shutter. Gift from Vivek Iyer. Not quite as sharp as either of my 150/9 Apo Ronars.

6"/1.9 Dallmeyer Super Six [sold]. Stops to f/16. According to the Vade Mecum, "The Super Six seems to have been issued from about 1930 . . . and became a workhorse lens for taking, recording, and projecting where a fast lens was wanted. . . . A comparison of Opic and Super Six 4in lenses suggested they were fairly alike in performance at full aperture, and also matched the Pentac f2.9, all being fully useable at full aperture. . . . It was said at Dallmeyers that they were still made in the 1970's to the original design. Using an uncoated 4in and a coated 5in lens the value of coating is quite apparent, the image being much more contrasty and clear. . . .

Super Six was still in production late in the London period (1980) to meet at least one customers specific orders." The 6" is a monster, the front of its barrel is 90 mm in diameter and at 3½ pounds its almost too heavy for a 2x3 Graphic. Probably better used as a fast normal lens on a 4x5 Speed than on a 2x3. The Super Six was made in a variety of focal lengths, usually f/1.9; the longest is 8"/2.0. While I was dithering about having my 6" Super Six put on board -- the estimate from SKGrimes was \$125 -- one sold on eBay for \$1,475. Mine had cost slightly less. In truth, I'd bought it more to be outrageous than because I seriously intended to use it. I didn't value it that highly, so I sold it to someone who did. Bought from an internet vendor.

6"/2.8 Elcan. Stops to f/22. Ex Vinten F95. Bought with a 3"/2 Elcan from the internet vendor who earlier sold me a 6"/1.9 Dallmeyer Super Six and a 14"/5.6 Aviar. It appears to cover slightly more than 2¼ x 3¼.



Figure 40: Six inch Elcan: pretty lens

The rear of its barrel is 61.8 mm in diameter, so will not pass through my 2x3 Speed's front standard. Its back focus is approximately 50 mm, so mounting it entirely in front of the lens board, like my ex-F95 4"/2.0 Taylor Hobson, is not practical. Since, however, its flange-to-end of barrel distance is 55.0 mm, it can, like my 3"/2 Elcan, be used on a 4x5 Speed Graphic. Another apparently good buy that didn't work out as hoped. Like the 3" Elcan I bought with it, it is an

affordable mistake. The two cost \$39.11 delivered.



Figure 41: You can have her: The Too Fat Polka (lyrics, in English, at <http://lyricsplayground.com/alpha/songs/t/toofatpolka.shtml> [17]) describes this lens well. Its back focus is so short that it won't focus to infinity mounted on a 2x3 Graphic board, it won't pass through a 2x3 Graphic's front standard, and, alas, it covers only 6x6.

6" / 9 Cooke Copying. A copy camera lens made by Taylor Hobson, stops to f/90. The Vade Mecum says of it: "Copying f9.0 This was seen as f9.0 lenses at 6in, 12in. It seems to be a 4-glass Q15 [Tessar] type, brown coated and giving very high quality, and is also a useful compact lens so can be used on many big format cameras. It does not seem to be in shutters. In fact it may be near an Apotal perhaps being a less elaborately mounted version of it. ... The 6in seems an attractive item and can be low priced."

A tiny lens, indeed a tessar type with brown coating. Its barrel is engraved "Supplied by Photostat Limited London." SKGrimes made an adapter for front-mounting it on a #1. I believe that at least one of the elements in the lens' rear cell is radioactive; the rear cell was yellow when the lens arrived, probably because of radiation damage, but the front cell was clear. Since I bought mine another, s/n 501965, that seems much yellower has appeared on eBay. A month of soaking up UV from a 20w BLB bulb cleared mine. Very sharp and contrasty at distance at f/9 and f/16. Its aperture scale has no marking for f/11. A very usable little lens, best at f/16.

6 1/4" / 6.3 B&L Tessar Ser. IIb. Stops to marked f/32, true f/45. Uncoated. Bought from an Internet vendor just because. A 1920 B&L catalog reports that this lens covers 4x5 wide open, 5x7 "at the smaller stops." Price new was \$47.50. Although the barrel's aperture control ring is marked 4.5, 5.6, ... , not 6.3, 8, ... , as expected the lens' focal length and maximum aperture (with the ring set to 4.5) seem to be correct. Images it put on film at 10 m and ~ 300 m, f/11 and f/16, are passable, not the best but certainly not the worst.

And another, with focal length in mm, not inches. 158 mm. In the correct barrel, stops to f/45. Post-WWII, coated, and with a purple and a yellow dot on the trim ring. The dots' significance is unknown. Seems to be the same design as my older one. A comparison of the two lenses makes



Figure 42: Taylor Hobson tessar type process lenses: different mechanical designs, apparently the same prescription. All are superb.

me think that the older one is in the wrong barrel and that its cell spacing is wrong. The newer one shoots better than the older, but isn't as good as the 160/5.6 Pro Raptar. Still a very usable lens.

160/5.6 Pro Raptar in a blue-faced Rapax, a slightly long normal lens for 4x5. Wollensak's answer to Schneider's Symmar. It is a great lens for out-and-about shooting that I bought only after making sure its rear cell would clear the 2¼ x ¾ Pacemaker front standard. It is as sharp as my 101/4.5 Ektar and takes lovely pictures. Not dirt-cheap, but as new old stock from a used equipment dealer much less costly than the equivalent used Schneider and Rodenstock lenses. Now a cult lens, has brought absurd prices on eBay. Andrew Glover, known as Dagor77 on eBay, has sold a number of these lenses; he believes that the 160/5.6 and 210/5.6 Pro Raptars are the best f/5.6 plasmat [10] type lenses of their focal lengths.

170/6.3 Kodak Anastigmat in Ilex Universal. Dialyte type, uncoated, probably from a Kodak folder. Camera show find, bought to try out.

7"/4.5 Cooke Aviar Series II [sold]. Another Taylor Hobson lens, bought to fill a gap in focal lengths and because, as usual, it wasn't too expensive. The Vade Mecum quotes a 1955 advertisement as saying "The crisp overall definition of Aviar lenses makes them prized amongst professional and amateur photographers as the finest anastigmats ever produced in any country, and they are eminently suitable either for monochrome or for the production of colour transparencies." And remarks "Well that was true in 1955, and they are still very good today." SKGrimes made an adapter for front-mounting it on a #1. This one, unlike my small disaster of a 5"/4.5 Aviar, really is in very good condition and shoots well; contrasty but not quite as sharp as the 6"/9 at f/11 and f/16. I wouldn't call its definition crisp.

Zeiss Kodak Anastigmat No. 4, F6.3. Uncoated. A B&L lens bought just because, and because the price was right. I estimate its focal length as around 7". It is larger than the 6¼" B & L mentioned above. Interestingly, both lenses are mounted in the same barrel. 21 mm end-to-end, maximum diameter of diaphragm 22 mm. At wide open, it seems to be f/6.3, at marked f/6.3 it

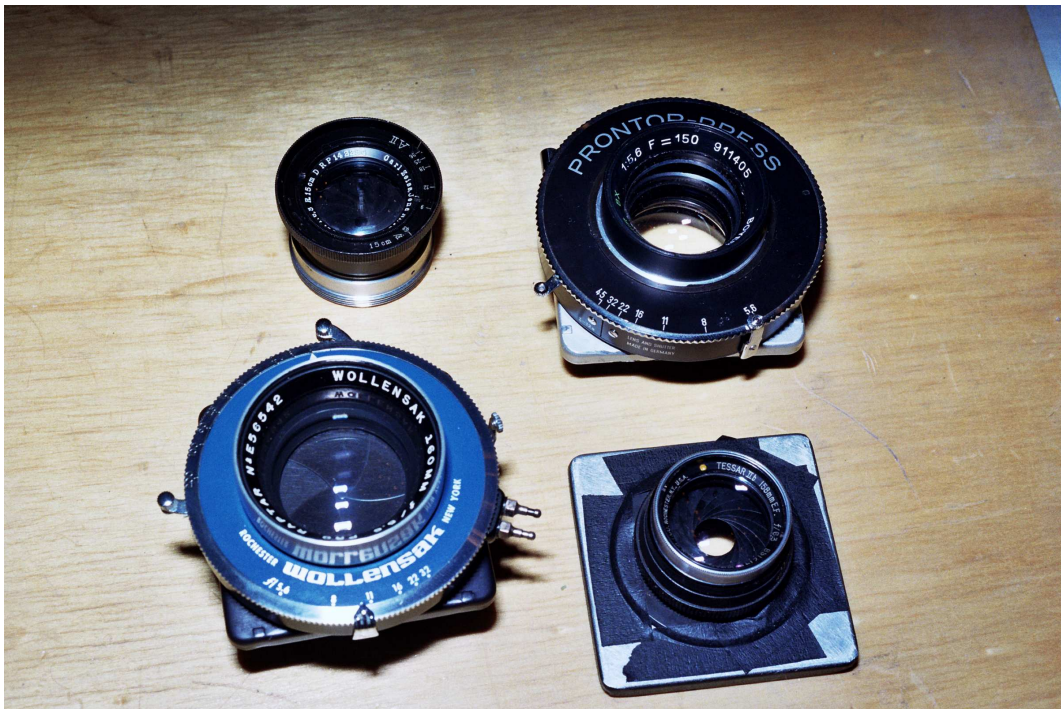


Figure 43: Six inches or so: these are all usable lenses, I would not feel deprived if made to use only one of them. But these good plasmats [10] are a little better than the Tessars; the Wolly Pro Raptar is the best of the lot.

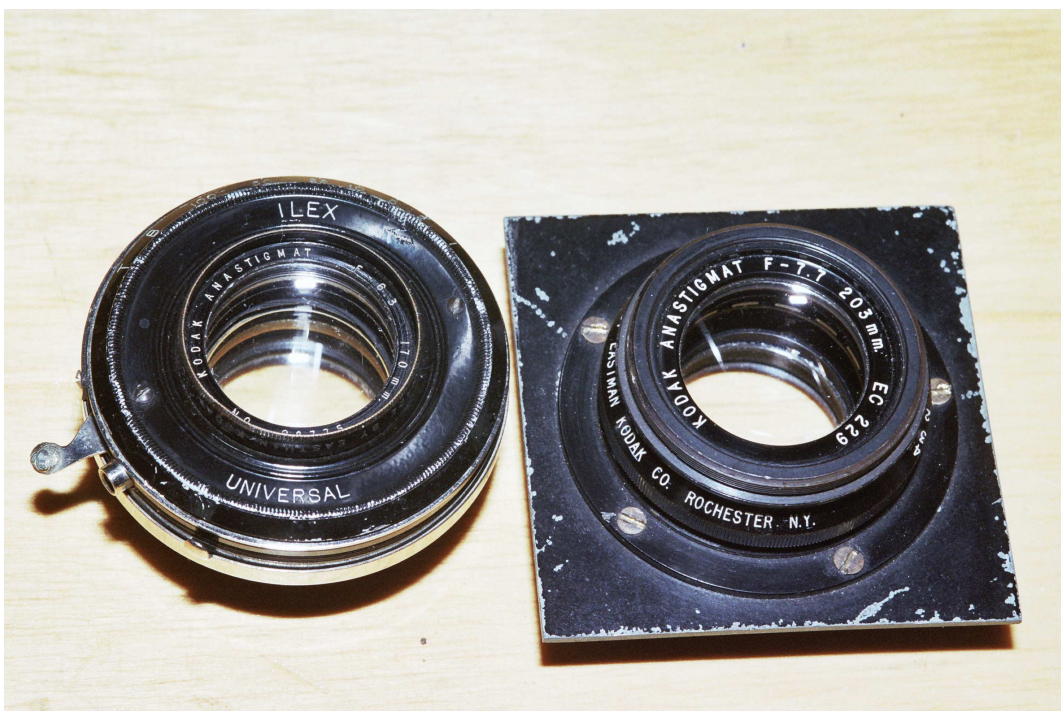


Figure 44: 2 Kodak Dialytes: the 170/6.3 in Ilex is probably from a Folding Pocket Kodak. The 203/7.7 is set up to be used in a process camera, is threaded externally at the front to attach to a prism. Younger versions of this lens are coated and badged "Kodak Ektar." As can be seen from the 170, not all Kodak dialytes are f/7.7.

seems to be f/8. It passes light, forms an image, and wide open puts a passable but somewhat dim image on the ground glass. It doesn't shoot badly at all.

180/5.6 Tominon in barrel, stops to f/45. Bought to find out what it was. Now I know, it is a triplet. Threaded at the rear to screw into a #1 shutter, like Tominon macro lenses for the Polaroid MP-4 system. This lens is, however, not mentioned in any of the MP-4 documentation I've been able to find. Unlike the MP-4 Tominons I've seen, it has a serial number. It was correctly advertised as having a bad scratch on the rear element. Even so, the view through it is not bad. As a taking lens at distance, though, it does very poorly.

180/6.3 Boyer Saphir in Synchro Compur #1. Bought, with the help of a Dutch friend, from a seller on <http://www.fotoapparatuur.nl>, a Dutch sales site. Its shutter arrived broken, has been fixed. Good lens, but much larger and heavier than the 180/10 Apo Saphir. Temporarily, perhaps permanently retired; it developed fungus on the front surface, is somewhat cruddy inside, and I can't get the front cell apart for cleaning.



Figure 45: Seven inches: The Apo-Saphir is best, the Fotokopist the worst – I regard it as unusable for general photography – but the Beryl is the best compromise for 2x3.

180/6.8 Fotokopist Spezial Reproduktions Optik, stops to f/45. Uncoated. Slightly asymmetrical 4/4 double Gauss. Threaded M39x0.75. Found at a camera show. There was a Fotokopist GmbH in Berlin in 1941, also one in Frankfurt am Main in 1940. Fotokopist seems to be a job description as well as the name of a firm. When I tried it out, it shot poorly at distance.

180/6.8 Boyer Beryl. In M39, stops to f/32. Bought from a seller on marktplaats.nl with the idea of putting the cells in shutter and using it if it isn't too much worse than the 180/10 Apo Saphir. Its cells go into a #1, I have several empty #1s in the drawer, and as everyone knows a shutter without a lens cries out for one. This Beryl can also be front-mounted using the same adapters as the 180 Apo Saphir; this frees a shutter for another use and vignetting shouldn't be a problem. The #1s in the drawer continue to beg for lenses. Convertible lens, the rear cell alone is 320/13.

Before WW-II Boyer offered Beryl sets, cells of different focal lengths that fit the same barrel

and could be combined to make lenses with a variety of focal lengths. I'm not sure swapping cells between my 180 and 210 (see below) Beryls makes good sense because the two focal lengths are so close but will try the experiment sooner or later.

Shoots well, is a good usable lens. The Apo-Saphir is a little better but I wouldn't feel deprived if I had to use the Beryl instead of the Apo Saphir. And the Beryl has more coverage, so would be more useful than the Apo Saphir on 4x5 and, especially, 5x7.

180/10 Boyer Apo Saphir. In M39, stops to f/90. Bought from the nice guy in Aix-en-Provence who had sold me a 40/4.5 Luminar bundled with three Boyer enlarging lenses via eBay.fr. The price was right and it is an interesting object. Has a slot for waterhouse stops. My 360 Apo Saphir shoots very well and so does the 180. In fact, the 180 shoots sufficiently better than the 7"/4.5 Aviar that it has replaced the Aviar in my out-and-about kit.

6.2.4 8" to 11" (200 mm to 270 mm)

203/7.7 Kodak Anastigmat in barrel, stops to f/64. Uncoated, made in 1941. Camera show find. The front end of the front cell is threaded externally to fit a prism. This is, then, the process lens version. In its present condition, very hard to mount but I've managed to hang it in front of a Nikon for a few trial shots. Competitive with my 210/7.7 Beryl-S.

210/4.5 Industar-51 [sold]. Made by the Kazan Optical-Mechanical Factory (KOMZ). This tessar-type Soviet lens came mounted on a bellows, probably for an M39 mount Zenit SLR, via an adapter with an LTM male end. I put it on the Speed using an SKGrimes female M39-to-male #1 adapter. It covers 2x3 as mounted. The crudely-made Soviet adapter's interior needed to be blackened. I had the impression that the I-51 was much smaller and lighter than the 210/9 GRII (see below), but when I put them side-by-side I found I'd been mistaken. The I-51 in its adapter to M39x1 is longer and heavier than the GRII in its adapter to #1; the GRII gives the impression of being enormous mainly because of its very wide diaphragm control ring. At normal distances at f/11 and f/16, the I-51 turned out to be much less sharp than the GRII. Cheap, no thrills. Bought at a camera show.

210/5.6 Boyer Zircon. In barrel, stops to f/64. I've bought two of these via eBay, the first from a vendor in the UK, the second from a vendor in Spain. The UK lens vanished in transit. The Spanish one arrived and is a disappointment, not in as good condition as the vendor claimed; the front cell has the classic "cleaned with steel wool" look. But now I have a much better idea of what a Zircon is. The cells go straight into a #1 and the spacing is correct. 6/4 plasmat [10] type. Central sharpness and contrast competitive with 210/7.7 Beryl S even with the damaged front. Convertible lens, the rear cell alone is 350/12.

This lens can be used on a 2x3 Graphic only if hung in front of a shutter. The rear cell will not pass through the front standard or through the film gate.

210/5.6 Rodenstock Rodagon [sold]. In barrel. Bought as a speculation from a seller on TouTyPasse.com, one of several French equivalents of craigslist. It arrived in good order, except for separations around the periphery of the front group. Rodenstock lenses of its era (s/n 6 302 503, probably made in 1967) are unfortunately prone to separation. Sold.

210/5.6 Fujinon-W. Bought as loose cells through the US large format forum because the price was very right. The cells go into a #1. The front is scratched, but not as badly as the 210 Zircon's. The rear cell will not pass through a 2x3 Graphic's front standard, must be removed and reattached through the film gate. Not usable on a Century or 2x3 Crown, the cameras are too short, but OK on a 2x3 Speed. Worse than 210/6.8 Beryl and 210/7.7 Beryl shot in the same session. Note that Perez and Thalmann (see <http://www.hevanet.com/cperez/testing.html>) found the 210/5.6 Fujinon-W (same version as mine) they tested quite acceptable at f/16 and f/22; no data at f/11.

210/6.3 Prinz. A tessar type lens that arrived in a Copal #1 cock and shoot shutter. I didn't want the lens, bought it for the shutter. Very inexpensive; it doesn't happen often, but off-brand lenses in shutter sometimes sell for much less than the used shutter's normal price. Yamasaki Optical tells me that they manufactured it for Prinz "more than twenty years ago." Yamasaki still sells a 210/6.3 Commercial Congo, and my lens' measurements match the ones given for it on their web site. I've looked through the lens and shot with it. Although the front cell's first element has extremely visible cleaning marks and invisible fine scratches, the view through the lens is good and it shoots well at f/11 and f/16.

210/6.3 Boyer Saphir. In barrel, threaded M45x1. Stops to f/32. A tessar type, Diaphragm locked at f/8. While trying to unlock it, I broke the diaphragm. The cells won't go into a #1, as reported in CEDIS-Boyer's fiches techniques; even so I should look into having the diaphragm repaired. Bought via eBay.fr.

210/6.8 Boyer Beryl in barrel, threaded M39x1. Stops to f/45. A 6/2 Dagor type. Cells go into a #1. Convertible lens, the rear cell alone is 360/13. Bought on eBay.co.uk. This lens spent its life embedded in a Gestetner copy camera. Usable, but my first trial found it not quite as good as my 210/7.7 Beryl S. On retest, up to the 210/7.7. Convertible lens, the rear cell alone is 360/13. Bought via eBay.fr.



Figure 46: Eight inches: Upper left is a 210/5.6 Apo Gerogon, upper center is a 210/9 Konica Hexanon GR II, and upper right is a 210/6.8 Beryl. If I had to pick one, I'd use the Beryl. But in fact I use a 210/7.7 Beryl S, not shown here.

210/6.8 Boyer Émeraude [returned with thanks to its owner]. In barrel, threaded M53x0.75. Borrowed from Phillippe Cas to see what it was and how well it shoots at distance. It is a 6/2 Dagor type. According to Rolyn Optics, a reprographic lens not recommended as a taking lens at distance. Shot better than the I-51 at ~ 200 m, but worse than my Beryl S. According to Eric Beltrando, the Émeraude is just a rebadged Beryl in a barrel with a slot for Waterhouse stops. But then, Emerald is a kind of Beryl.

210/7.7 Boyer << S >> 1/1. Rolyn Optics' 8/82 price list includes a six elements in two groups

210/7.7 Boyer Beryl S. In M39, stops to f/32, a large minimum aperture for a process/copy lens, if that's what it is. A mystery lens when bought, bought because the price was very right. It can be screwed into a #1 shutter using my SKGrimes female M39-to-male #1 adapter and a short LTM extension tube. The extension tube is needed because the lens' rear cell is too wide to pass through the adapter. A Dagor clone, but without focus shift on stopping down [18]. It makes infinity on a short tube in front of a #1 on my Century Graphic. On my 2x3 Speed, which is longer, it goes nearly to 1:1 with more tubes before vignetting is a problem. At ~ 35 and ~ 1,000 feet at f/11 it is slightly, not much, softer than the GRII; at f/16 it is just perceptibly softer. Nicely contrasty, i.e., gives well-saturated color. It sometimes replaces the 210/9 GRII in my out-and-about kit because it is so much smaller, nearly as sharp, and has higher contrast. Eric Beltrando says it is simply a Beryl with restricted maximum aperture. The cells will *not* go into a #1. Convertible lens, the rear cell alone is 360/13.

210/9 Konica Hexanon GRII. One more copy camera lens in M72x1, stops to f/45. Steve Grimes made a cup-shaped adapter that holds it in front of a Copal #1. As mounted it covers 2¼ x 3¼ with room to spare. The combination will focus inside six feet on my Century, closer on my Speed. Most of the shutter's depth is in front of the lens board and the adapter holds the lens out in front of the shutter. This gives about three inches more extension than if the lens were mounted in shutter with the rear cell behind the board. If the lens were in shutter, though, it couldn't be used on a 2x3 Graphic since its rear cell is wider than the front standard. The camera's front standard just won't accept some modern lenses. If mounted on board it would work nicely on a 4x5 Speed, but as set up now probably won't cover 4x5.

The 210/9 GRII is a very sharp lens that I also use close-up on a Nikon with the same old female #1-to-T-to LTM adapters, a couple of feet of ELNY extension tubes, and a female LTM-to-male Nikon adapter. Pretty good wide open, slightly better at f/11 and f/16; better from f/9 to f/16 than my 200/4 AIS MicroNikkor. Until I shot it against the 210/7.7 Boyer I hadn't noticed that it is a little flary. It needs a lens hood, perhaps a good cleaning too.

I've had two. The first one, bought at a camera show, had a little internal schmutz that Mr. Grimes advised me wasn't bad enough to justify the expense of cleaning. When another appeared on eBay bundled with a 210/9 Apo-Gerogon (see below), I bought the bundle. The bundle's GRII was cleaner than the first so I sold the first.

210/9 Eskofot Ultragon [sold]. The 150's big brother, never used, bought because the price was very low and as an alternative to the 210/9 GRII if it didn't work out. Sold to recover my investment. Bought from an internet vendor.

210/9 Rodenstock Apo-Gerogon [sold]. Stops to f/64. This process lens came bundled with my second 210/9 GRII. Sold as quickly as possible. The cells absolutely positively won't go into a shutter.

And another still on hand, gift from Vivek Iyer.

210/9 Schneider G-Claron. Stops to f/90. Dagor type. Bought as a speculation from a seller on eBay.fr, almost too pretty to give up. Shoots very well on 2x3, so it will be hard to give up.

240/9 Schneider G-Claron [sold]. Stops to f/90. I found two at my local flea market, bought them as a speculation, not as lenses I seriously intended to use. Each was in a Schneider 837 barrel that mimics a #1 shutter. On board, as they should be mounted, they won't quite make infinity on my Speed. They will if mounted in front of the board, but mounting them that way doesn't look practical. Usable or not, I've shot them on a Nikon and they are very good indeed from f/11 to f/22.

Schneider's archive site

(<http://www.schneiderkreuznach.com/archiv/archiv.htm>) has documentation on G-Clarons of two types. The older document, dated 7/76, reports on a 6/2 lens, i.e., a Dagor type. The newer one, dated 5/82, reports on a 6/4 wide angle Plasmat [10]. My pair were made between 10/67 and

11/68 and are both Dagor types. This is a considerable surprise. Common wisdom, as reflected on Usenet and photography bulletin boards, consistently reports that G-Clarons are Plasmats. A web search found only one mention of the older version.

Some time after I'd sold my first two 240 G-Clarons, I found another 6/2 240/9 Dagor type G-Claron in barrel at a good price on eBay.co.uk, bought it as another speculation. The seller said it was "as new," and it was. Lovely lens, like the others, too hard to use on my cameras. Buy low, sell high enables me to purchase lenses I really want and can use.

240/10 Boyer Apo Saphir in barrel threaded M53x0.75 (same as 300/10 and 360/10 Apo Saphirs), stops to f/128. Bought from an internet vendor because I wanted it, no other good reason for having it. As expected, it shoots very well, best at f/16.

250/5.6 TeleOptar in Graphex [sold]. Bought from an advertisement in Shutterbug magazine. This is the longest standard issue lens for 2x3 Graphics. I never liked this lens, sold it.

250/6.8 Boyer Beryl in barrel, threaded M61x1. Bought somewhat as a speculation from a seller on TouTyPasse.com, one of several French equivalents of craigslist. Now that I have it I'm tempted to leave 240/10 Apo Saphir and 10.16"/9 TH Copying Lens at home and use it when I need a lens around 10". Convertible, the rear cell alone is 450/13. SKGrimes modified (bored and threaded the outer ring) the 150/9 Apo Ronar's mount adapter inexpensively to make an M61x1-to-M72x1 adapter. First shots taken with it quite poor, not clear whether the problem was the lens or me. A second try made it clear that the lens is fine; I'm the problem even though my ophthalmologist reports that my eyes are in good condition.

10.16"/9 Taylor Hobson Copying Lens. A tessar type in M39x1, stops to f/128. Bought in the hope it would be useful out-and-about. Much smaller and lighter than the 260/10 Nikkor-Q, much less expensive than a mount adapter for it. Engraved "Supplied by Eastman Kodak Limited." It seems that the 10.16"/9 was originally made for the Haloid Model D type VR, later sold as the Xerox 1385, an electrographic plate-maker with a reproduction camera on top that allowed variable ratio enlargements and reductions. Makes infinity on a short tube in front of a #1 on the Speed, can be used with more tubes to get close focusing. Covers 2x3 at infinity. On the Century it requires several inches of extension tube to get a reasonable focusing range. It shoots well but my first shots with it had a yellowish cast; this, I think, because of radiation damage to glass in the rear cell. UV light (see comments on 6"/9 Cooke Copying) cleared it. After clearing, very sharp and contrasty at distance at f/11 and f/16. A good replacement for my 250/5.6 TeleOptar.

260/10 Nikkor-Q. I believe this lens is identical to the better-known 260/10 Process Nikkor. Like it, 4/4 double Gauss. Bought because: the price was right; to replace my unloved 250/5.6 TeleOptar; and it is a lovely artifact. Stops to f/32, a relatively large minimum aperture for a process lens. In the interest of science, I spent more money than I should have chez SKGrimes to have an adapter to #1 made for it. A huge lens that looks absurd on a 2x3 Graphic. According to the QC sheet that came with it, its focal length is actually 266.6 mm. I might not have bought it if I'd had the 10.16"/9 TH when I came across it. I think that the TTH shoots somewhat better.

270/9 G-Claron in barrel [sold]. Bought as a speculation from a seller on TouTyPasse.com, one of several French equivalents of craigslist. Pretty lens. Plasmal [10] type, and the cells go into a #1. Sold.

6.2.5 12" (300 mm) and above

30 cm f/9 Cooke Apotal. A tessar-type process lens from Taylor Hobson, stops to f/128. The price was right. It has mounting threads at each end and a screw-on trim ring for the end that faces the subject. With a slot for Waterhouse stops. Pretty lens with, however, nearly invisible scuffing on the outer side of the front element. The Vade Mecum says "the 12 and 14in versions were mounted (2.25inx24TPI threads) in a No 4 Acme shutter . . . they covered very well both for



Figure 47: Ten inches: My 260/10 Nikkor-Q's focal length is, according to the quality control sheet, 266 mm. It is identical to the lens later sold as Process Nikkor. For more information on it, see <http://homepage2.nifty.com/akiyanroom/redbook-e/> [19], where it is characterized as "Supernatural Grand Lens."

illumination and sharpness ... The central image is especially impressive: sharp and contrasty." My lens' rear cell was slightly yellow when received, perhaps because of radiation damage. UV light (see comments re 6"/9 Cooke Copying) cleared it. It can't be used as is on a 2x3 Graphic, but after it was cleared I hung it in front of a Nikon on a string of adapters; the central image is indeed sharp and contrasty; good at f/11, better at f/16, not quite as good at f/22 as at f/16. Strong competitor for 300/10 Apo Saphir and 305/9 Apo Nikkor, not strong enough to justify having an adapter for front-mounting made.

300/10 Boyer Apo Saphir. In barrel, threaded M53x0.75. Stops to f/128. Bought because the price was right. It is a little more comfortable fit on my 2x3 Speed than the 305 ApoNikkor and, unlike the 305, will make infinity on my tandem rig in short configuration. Not quite as sharp at apertures larger than f/16 as the 305 ApoNikkor.

12"/4 Taylor Hobson Telephoto, stops to f/16. Perhaps the longest lens that can be used comfortably on a 2x3 Speed Graphic. Unfortunately it vignettes at infinity; ~ 2-3 mm is lost at each end of the frame. This is not due to the lens, which has ample coverage, but to the bellows' front frame. Bought from the surplus dealer who'd earlier sold me several AGI F135 cameras each with a pair of 38/4.5 Biogons, plus two loose Biogons. He sold 12"/4s as F139 lenses, has no more left.

The Vade Mecum reports that the 12"/4 tele was used on F95s and Agiflites and says: "a very desirable lens, but the rear clearance is rather limited for mounting to civilian 6x6cm or large format cameras ... of extremely high quality for 6x6cm and nearly covers 5x4in." Elsewhere it says that the lens "is known to cover 5x4in." Mine are ex-RAF from an AGI F139 camera. The F139 is an electric motor-driven version of the clockwork powered Williamson F134. The Agiflite is an improved F139. I've seen Agiflite mounts, they are identical to the F139 mount.

As promised, the lens has very short back focus; at infinity the rear element-to-film distance is around 85 mm, so it can be used on all sizes of Speed Graphic but not on a Graflex. I don't believe it can be put in shutter. Extracting the first one I bought from its F139 mount so it could be put on board was surprisingly difficult. I later bought a second as a spare -- one never knows when a surplus dealer will sell out -- that came out of its F139 mount very easily. The spare's glass is in better condition, so I use it. I eventually sold the first one at a considerable loss.

This is a fat, heavy lens -- 94 mm diameter at the front, three pounds -- that puts a considerable strain on the camera's inner bed rails and front standard. Fred Lustig recommends putting a "crutch" on the outer rails' front crossbar to support it. I've made one from 1/2" polycarbonate sheet with an acrylic lip glued on; luckily, 1/2" is exactly the thickness needed. Like its 4"/2.0 little brother, the 12"/4 makes infinity with the front standard on the inner bed rails and needs a fixture to square up the front standard. The chinaman Fred Lustig made for the 4" also works for the 12".

305/9 Apo-Nikkor. Dialyte type process lens, stops to f/128. In M72x1, fits the 210/9 GRII's mount adapter. With slot for Waterhouse stops. Bought from a seller on Astromart. The price was right. I bought it to use on my tandem rig. Mounted in the 210/9 GRII's adapter to #1, it will not focus to infinity on the tandem rig. But mounted on about 40 mm of adapters (#1-to-T, T-to-M39, M39-#1) it focuses usefully close on the Speed. Adam Dau of SKGrimes tells me that the 305/9's cells, once extracted, will go directly into a #1 shutter; I haven't dared to try taking mine apart.



Figure 48: Foot long hot dogs: 305/9 Apo Nikkor, 12"/4 Taylor Hobson Telephoto from an AGI F-139. The 12" tele is much more comfortable fit on a 2x3 Speed Graphic than the Apo Nikkor.

And another, bought at a camera show in the hope of reselling it profitably. This lens isn't quite as sharp at ~ 200m as the first. Eventually resold at a slight loss.

14"/5.6 Cooke Aviar [sold]. Uncoated, stops to f/16. From the same internet-based junk dealer as the 6"/1.9 Super Six. S/n TT 286842, bears the MoD "Broad Arrow." Made under the same contract as the 14"/5.6 Aviar s/n TT 285405 figured in the Vade Mecum. After it arrived I realized it was a blunder, too big and heavy to use on a 2x3 Speed. The view through it is better



Figure 49: Foot longs: Frontal aspects. The 12"/4 tele is a large lens. Large.

than expected; when shot on a Nikon it was flary at all stops, sharpest wide open. On the whole, not as usable as I'd hoped.

14"/10 Wray Apo Process Lustrar Series II. Stops to f/90. Ought to be coated, doesn't look it. Bought in the expectation that it could be used on my Speed. Like the 300/9 Apotal, it is double-ended and has a slot for Waterhouse stops. The Vade Mecum says "This type was seen in 4.0in, 12in, 18in and 25in. These are still a dialyte type but offer a higher performance and the coating is harder, and are much to be preferred for use. The dialyte can be used from infinity to close up where it was intended to be used. They are seldom in shutters, but are marked Series 11. ... The B.J.A. 1953 p212 noted a 25in example as entirely freshly computed and 'superlatively good' and well up to the 18 and 36in examples of the series. It was really good even for 3 color work at f16- much wider open than usually used in this work". The view through it wide open is surprisingly bad. When shot on a Nikon, soft and flary at f/11; better at f/16; quite sharp, still somewhat flary, at f/22. A disappointment.

360/10 Boyer Apo Saphir. Stops to f/128. In M53x0.75. Bought from a photo.net member who'd posted a question about Apo Saphirs; I replied, he offered to sell me the lens. Bought because the price was right and it is smaller than the 14"/10 Wray. A Heliar type, with a slot for Waterhouse stops.

On www.galerie-photo.info, Henri Gaud wrote of another, longer, Apo Saphir: 600 mm F/10 "*celui est très bon, je l'utilise encore, a part le cercle de couverture, même niveau qu'un Fuji C, rendu un peu plus chaud*" (this one is very good, I still use it today, compared to the Fuji-C, the image circle is smaller and color rendition warmer, but both play in the same league). On that site, Simon Clément quoted the 7/65 Boyer catalog on the Apo Saphir: "*spécialement étudié pour les reproductions en noir et blanc et couleur, symétrique, correction chromatique très poussée, optique composée de cinq verres, angle de 45°*" (specially designed for B&W and color copying work, symmetric design, extremely well color-corrected, 5 elements, field angle 45°).

Sharp and contrasty at f/11, sharper at f/16, not quite as good at f/22 as at f/16. By far the best

of my 14" lenses, and it works on the tandem rig.

420/9 Apo Nikkor. Stops to f/128. In M90x1, fits the 480's adapter to #1. The back of the rear element has a monstrous cleaning mark, a 25 mm circle. Otherwise very clean, and it shoots as well as my other Apo-Nikkors. The price was very, very right.



Figure 50: Beautiful long lenses: 420/9 and 480/9 Apo Nikkors. I don't use the 420 because its focal length is too close to 360 mm. On 2x3, both lenses are fully usable wide open.

450/10 Lomo RF-5. Stops to f/90. In M72x1, just barely fits the 210/9 GRII's mount adapter because its rear section is longer.

Process lens with slot for Waterhouse stops. Bought at a camera show in the hope that it would be good enough to use on my tandem camera rig. A narrow angle 6/4 double Gauss type. It shot well on a Nikon. If I had known I'd soon come across an affordable 480 Apo Nikkor I would not have bought this lens. It is, though, somewhat easier to set up and use on the tandem rig than the 480, because it is smaller.

480/9 Apo-Nikkor. Dialyte type process lens, stops to f/128. In M90x1. With slot for Waterhouse stops. Bought from a seller on Astromart. The price was right. It was one of the reasons for building my tandem rig. Much larger diameter than the RF-5, weighs about 100 g more. Focuses to 10' on the tandem rig when attached to the front shutter by an extension tube approximately 40 mm long. The tube is not absolutely necessary, but provides useful clearance between the lens' mount adapter and the front standard's latch. I've found few situations for which 480 mm is the right focal length, it is usually too long. But the lens shoots well.

600/9 Klimsch Rodenstock Apo Ronar-L [sold]. Dialyte type process lens, stops to f/260. Bought from an internet vendor with the intention of making a 2x3 "Baby Bertha" to use it. A large, heavy lens – about 3.3 kg -- that I eventually sold. An elephant, possibly pure white. The 600/9 Apo-Nikkor, which is much lighter, seems a better prospect for my "Baby Bertha". The name "Big Bertha" has been applied to long lens (up at least '60s) SLRs built around 4x5 and 5x7 Graflexes.

610/9 Apo-Nikkor. Another dialyte type process lens, stops to f/128. Catalogue weight



Figure 51: One good, one bad, neither in use: My 450/10 LOMO RF-5 is usable, my 14"/10 Apo Process Lustrar Ser. II isn't; soft below f/22 and flary. I don't use the RF-5 because its focal length is too close to 480 mm.

1.4 kg, exactly 3 pounds according to a postage scale. Bought because the price was very right and because I despaired of finding a 600/9 Apo-Nikkor at any price. The 600/9 is a tessar type, catalogue weight 775 g, and should fit my 480/9 Apo-Nikkor's mount adapter. But 600/9s are much less common than 610/9s.

Put in an adapter to #1 shutter by SKGrimes to be used on a long lens 2x3 SLR – Baby Bertha – cobbled up from a 2x3 Graflex RB Series B and a 2x3 Cambo SC. It can also be used on the Cambo without the Graflex. When I had the Graflex mated to the Cambo I had a 12" extension tube made and bought a third standard and a 30" rail for the Cambo.

36"/8 Bell & Howell Telephoto. An aerial camera lens in barrel. Gift from Charlie Barringer. No diaphragm, in horrible condition, completely unusable. Weighs > 20 pounds. It encourages me to be very cautious about adding a really long lens to my kit. Getting the extension needed will be costly and difficult, the longer lens will be heavy, and using it won't be easy. I wouldn't reject a gift 1210/12.5 Apo-Nikkor for Baby but the B&H monster tells me that I probably won't be able to use it.

900/10 Boyer Apo-Saphir in barrel. Stops to f/128. Unlike my shorter Apo-Saphirs (longest focal length, 360 mm) this lens doesn't have mounting threads at both ends. Claimed coverage at infinity, 655 mm.

I saw it on eBay.de, bid low expecting to be trampled; instead, lightning struck and I got it for half of my maximum. The price listed in Rolyn Optics 1982 catalog was \$4,899; I paid \$201 including shipping. This lens is much too long to work on my 2x3 tandem Graphic, can be used on the Baby Bertha and my 2x3 Cambo SC.

The monster mounting threads M140x1.5 – can, like my other long lenses, easily covers 2x3 when mounted in front of a #1. Unlike the others, it needs a crutch to support it; its weight is more than a shutter can bear. There are many ways to make a crutch to fit the Cambo's rail. The least



Figure 52: Longer still: Not, alas, quite possible on my tandem Graphic but the reason I built a "Baby Bertha" from a Graflex 2x3 RB Series B and a 2x3 Cambo SC.



Figure 53: 90 and 900. Or, slow and slower.

costly I think – was to mutilate a 4x5 Cambo SC standard. Part of its carrier frame had to be cut away; the lens won't pass through the frame's throat, whose diameter is only 121 mm.

The 900 covers 2x3 when mounted in front of a Copal #1. I did the experiment before sending it to SKGrimes to have an adapter to #1 made and again after it came back. There is, however, a problem with using it in front of a #1 that reflects a combination of good luck and bad analysis. I've used lenses up to a 480/9 Apo-Nikkor successfully in front of a #1 on my tandem Graphic. This is great good luck. I've never paid close attention to how the 480, in particular, worked or thought much about it. I didn't think about the exit pupil's size or the shutter's aperture when I sent the 900 to SKGrimes. No analysis is very bad analysis.

The 480's exit pupil is 30 mm at f/16. I've shot it at f/16 and f/22, so didn't notice that at apertures larger than f/16 the shutter's aperture partially occludes the exit pupil. This happens with the 900 at apertures larger than f/32. As far as I can tell, the shutter's aperture doesn't act as a stop to reduce illumination at the film, it vignettes the cone of rays projected by the lens, limiting coverage, and prevents the diaphragm from reducing illumination at the film while the exit pupil is larger than the shutter's aperture. Similarly, my 610/9 Apo Nikkor in front of a #1 impossible with my tandem Graphic, possible with Baby Bertha and my little Cambo works properly only if the lens is stopped down to at least f/22.

One solution is to mount a Compound #5 shutter in front of the 900 Apo Saphir, possibly also in front of the 610 Apo Nikkor. By an odd coincidence I've had a Compound #5 – an industrial shutter, I think, with no diaphragm for some time. It came from eBay.fr's petites annonces. The expensive parts of the 900's adapter to #1 can be salvaged. The cup can be attached directly to the board, the holes in both can be enlarged. The shutter will have to be overhauled.

6.3 Which of my lenses are in my “travel kit?”

I have more lenses than can or should be taken to the field together. They won't all fit in the tool bag I use to carry my Graphics, lenses, and accessories. Some are functionally equivalent. Some aren't that good. After the latest round of shootouts, I've reduced my travel kit to:

General use: 35/4.5 Apo Grandagon, with center filter; 47/5.6 Super Angulon; 60/5.6 Hexanon; 80/6.3 WF Ektar; 105/5.6 Saphir BX (= Zircon); 127/4.5 Tominon; 160/5.6 Pro Raptar; 210/7.7 Beryl S; 250/6.8 Beryl; 305/9 Apo-Nikkor.

I chose these focal lengths to keep the steps between focal lengths relatively even and not too large. This is why, for example, I decided to carry the 160 Pro Raptar instead of a 150 Saphir BX. Both are fine lenses, but 150 is too close to 127, too far from 210.

Tandem Graphic: 360/10 Apo Saphir, 480/9 Apo-Nikkor. The tandem lenses and brackets travel in a separate case that also holds a 610/9 Apo-Nikkor for use on my 2x3 Cambo SC with and without its 2x3 Graflex RB Series B module. After I build a support for it, I'll try it on the tandem.

Closeup/macro in the field: 4"/5.6 Enlarging Pro Raptar

To make the point that old lenses can be good: 130 CZJ and 150 CZJ f/6.3 Tessars, both made in 1912. That these two are small and light makes carrying them easier to justify. The better of my two 85/6.3 B&L Tessars will eventually join them.

Because I like them and have room for them: 135 and 180 Apo Saphir, 180 Beryl, and 10.16" Taylor Hobson. This is pure irrationality even though all are, like the f/6.3 Tessars, light and small.

I travel with more lenses than the average reasonable photographer. As long, however, as I obey Edward Weston's law (“If it is more than 500 feet from the car, it isn't photogenic.”), my kit's bulk and weight are endurable. For subjects too far from roads, I have a cart that works fairly well on rough ground.

I behave differently with my Nikons. When I bought my first real camera, a Nikkormat FTN, in 1970, it came with a booklet that recommended getting lenses whose focal lengths were, respectively, half normal, normal, twice normal, and so on. My Nikon kit has few lenses and they roughly fit that progression. 24, 55, 105, 200, 400, 700. I can approximately match that on 2x3 with 47, 105, 210, 420. There are no 25 mm lenses that cover 2x3 - the 35 Apo-Grandagon seems to be the shortest lens that will cover the format – and an 800, although possible with the Baby Bertha, isn't very practical.

7 Oscilloscope cameras as a source of shutters:

Scope cameras were used to record oscilloscope traces on Polaroid film. Most offered in the US were made by Hewlett Packard or Tektronix . A few models contain shutters that may be worth recovering if the camera can be bought at a good price.

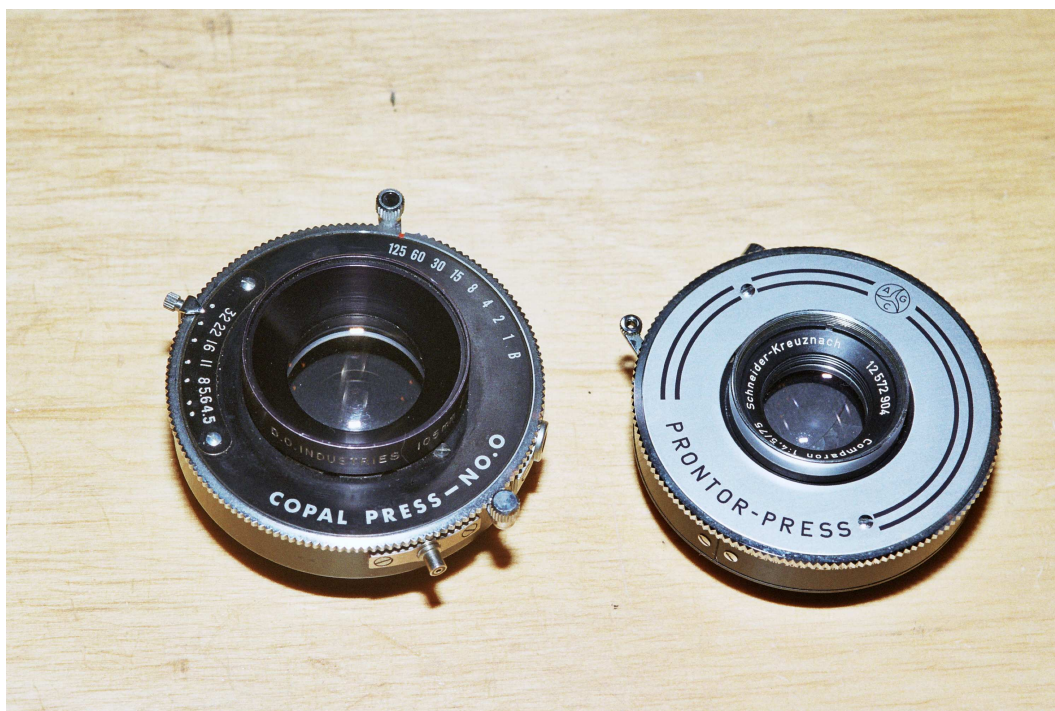


Figure 54: Some see lenses, others see shutters. The people from whom I bought the Sirchie cameras that had these lens/shutter assemblies thought they were selling cameras. Most photographers would have thought that I bought lenses. In fact I bought shutters.

Tektronix C-12, C-19, C-27, and C-58P cameras have mechanical shutters. Some have Oscillo-Paragon lenses in Ilex Universal #3 shutters. In Ilex parlance the Universal shutter is a press shutter; the Acme is the cock-and-shoot equivalent. The scope camera Ilexes I've seen are hard to use because their rear tubes are not threaded externally to accept retaining rings.

Other examples of these cameras have Oscillo-Raptar lenses in Alphax shutters. Some, perhaps not all, scope camera Alphaxes are threaded externally at the rear.

Hewlett Packard 196A and 196B also have mechanical shutters. I've seen them with Oscillo-Raptar lenses in Alphax or Pi-Alphax shutters.

A few scope cameras contain Copal Press shutters. Polaroid DS-31, -34, 39, Shackman 7000 and Tektronix C-4 for example. It isn't clear which size shutter (#0? #1?) any of these cameras has.

Copal shutters from Polaroid cameras that hold any lens but the 127/4.7 Tominson have diaphragms with limited maximum apertures.

Most scope cameras have electronically timed solenoid shutters. Electronic shutters can usually be recognized at sight most are in plastic cases without visible levers for setting speed or aperture; there are also clearly marked Ilex Electronic shutters – but sellers don't often post images that show their scope camera lenses. That a scope camera has a socket for a power cord, a fuse holder, or knobs for aperture and shutter speed is strong evidence that its shutter is electronic. Tek C30 and C-5x, e.g., C-5, C-51, , cameras (except the C-58P) have electronic shutters, as do HP 122, 123, 197A and 197B. Using these shutters is difficult, not worth the effort.

The list of scope cameras above is far from exhaustive but includes the types that are often offered on eBay. Models I haven't mentioned are potential donors but should be bought cautiously. What's been sold once can be sold again, but because these cameras are large and heavy shipping them can be quite costly and so recovering delivery costs is hard.

Oscillo-Paragons and Oscillo-Raptors, usually with focal lengths between 3 and 5, are sometimes offered in shutter without a camera. Some people suggest using these lenses for closeup work on 4x5. If the price is low enough and fuzzy images of smallish objects are wanted or the shutter can be used, why not? The three inchers won't cover 4x5 at infinity, so don't think of them as inexpensive wide angle lenses for 4x5.

Buying a used scope camera or a lens in shutter that was extracted from one in the hope of getting an inexpensive and usable Ilex or Alphax shutter is risky. Some, perhaps all, of the shutters have diaphragms that open no wider than necessary. I've bought a Tek C-27 that contained a 75/1.9 Oscillo-Paragon in #3 Ilex Universal whose diaphragm opens only 28 mm; #3 Universals for normal applications open to 34.6 mm. And I've seen a 75/1.9 Oscillo-Raptor in Alphax with a limited diaphragm. It is probably best to avoid 75/1.9 lenses. 80/1.3 and 125 mm lenses are the best bets.

8 Big Lessons Learned?

Ken Ruth was right. Inexpensive barrel lenses are made for Speed Graphics and there are many on the market. With little money and not much ingenuity or imagination the range of pictures that can be taken with 2x3 Speeds can be extended in interesting and unexpected directions.

I'm not, however, enthusiastic about close-up work illuminated by available darkness. For me, macro lenses for large format cameras ought to be in or in front of a leaf shutter so that flash can be used with them. Copal #1 Press shutters made for the Polaroid MP-4 seem ideal for this purpose. Other apparently inexpensive relatively large shutters are less useful and more expensive to use.

Ken Ruth was wrong. Long, but not too long, lenses from copy and process cameras that can be mounted in front of a leaf shutter can be used on **all** 2x3 Graphics. So can short macro lenses in barrel. One doesn't need a Speed Graphic to benefit from their low prices.

Thanks to eBay, gear that isn't earning its keep can be sold to raise funds for other equipment that might be more useful. If one buys carefully, equipment bought to try out can sometimes be resold at a small profit. And then there's the occasional unrepeatabe windfall.

Our cheap and extremely cheerful little press cameras that sit on the cusp between medium and large format will accept a broad range of lenses intended for other applications. I'd never use a Graphic the way I do a Nikon, but in situations where they can be made to work at all 2x3 Graphics produce results the smaller format can't equal.

Acknowledgements

I'm very grateful to Emmanuel Bigler for translating my text into French and for his editorial suggestions, which improved it greatly.

The last word ...



Figure 55: Stinky the Obnoxocat expressing vexation at being ignored by his person, who gives too much attention to photographic equipment and not enough to him.

9 Notes & References

- [1] See the Appendix below for a short notice about Charlie Barringer (sec. 10).
- [2] *2¼ x 3¼ or 2¼ x 2¾ camera*: The 2¼ x 2¾ format is also known as 6x7 cm. In the US, 2x3” press cameras use cut-film in size 2¼ x 3¼ inches whereas in Europe the 6,5x9 cm cut film size was in use. Actually, 6,5x9 cm sheets of film are slightly bigger, their dimension is in fact 2½ x 3½ inches i.e. 63.5 x 88.9 mm. Except for users who wish to work with those specific cut-film sizes requiring specific, non-interchangeable cut-film holders, in all this article, 2x3 (2x3”) and 6x9 (6x9 cm) will denote the same camera formats. Moreover most 2x3” / 6x9 cm cameras can accept 120 (or 220) rollfilm backs, providing 8 (or 16) exposures of size close to 56x82 mm and in 6x7 format 10 (or 20) exposures of size close to 56x70 mm.
- [3] *Back Focus or Back Focal Distance*: distance between the last lens vertex and the focal point. It is very common that the short back focal distance of view camera wide-angle lenses makes impossible to mount them on a reflex camera.
- [4] *In barrel*: of course in all lenses, individual lens elements are held together by a *barrel*. The expression *barrel lenses* means that the lens has no built-in leaf shutter. Most barrel lenses, or shutter-less lenses, however, have a built-in iris and aperture control; however there exist numerous examples of barrel lenses with a fixed aperture, for example in scanners, xerox copiers or microfilm projectors.
- [5] *T-mount*: this is a simple metric thread mount, M42x0.75 mm, widely used to attach a 35 mm SLR to a microscope or a telescope. It should not be confused with the “universal” M42x1 mm threaded mount used to attach lenses to a variety of 35 mm SLRs like older Pentax and Praktika cameras. In M42x1 lens mounts, thread pitch is 1 mm, not 0.75 like in the T-mount, but the nominal diameter is the same. “T2” can also be found for the T-mount. Some T/T2 adaptor rings can rotate in order to perfectly set the lens position with respect to the camera body. T-mount rings can be found in most bayonet styles, allowing to adapt T-mount lenses to almost every new or used 35 mm SLR available on the market, as well as step-up rings from the T-mount to the video C-mount standard and modern Four-Thirds and Micro-Four-Thirds bayonet standards.
- [6] An exception to the rule is the modern Sinar DB behind-the-lens shutter system. A single shutter of large diameter is attached to the front standard of the monorail camera just behind the rear lens cell, and can serve for a whole range of barrel lenses sold in a dedicated “Sinar DB” mount.
- [7] *threaded to screw into a #1 shutter*: specifications for #1 shutters are as follows
- iris max diameter: 30 mm
 - front cell thread: M40x0.75; rear cell thread: M36x0.75
 - lens board hole diameter: 41.6-41.8 mm; retaining ring thread: M39x0,75
 - cell spacing = overall thickness: 20±0.025 mm
- More shutter sizes here: <http://www.skgrimes.com/compur/index.htm>

- [8] lp/mm: line pairs per millimeter. or cycles/mm, a classical means of measuring the fine pitch of grid-shaped test patterns in resolution targets. The correspondence with lines pairs per inches is: $25.4 \text{ lp/inch} = 1 \text{ lp/mm}$; one lp/ inch $\simeq 0.04 \text{ lp/mm}$. Converted into dots or samples, two dots or two samples are required to pass one cycle, so 1 lp/mm needs 2 points or two samples per mm, 1 lp/mm requires $25.4 \times 2 = 50/8$ dots or samples per inch, 8 lp/mm requires about 400 samples per inch.
- [9] *Royal Microscopical Society (RMS) thread*: most lenses used on a microscopes have a standard RMS thread mount,
<http://www.micrographia.com/tutoria/micbasic/micbpt02/micb0200/ot023shi.htm>
 diameter 0.8" ; Whitworth (55° angle) ; 36 threads per pitch ; metric equivalent: 20.32 mm in diameter with a pitch of 0.706 mm.
- [10] *6/4 plasmat types* Originally, the Plasmat is a (6/4) lens design by Paul Rudolph, the father or Carl Zeiss Planar and Tessar lenses. The Plasmat was introduced in 1918 when Rudolph had left Zeiss and worked for Hugo Meyer. It is a quasi-symmetrical design like Von Hoegt's Goerz Dagor, except that instead of cemented triplets in the Dagor, the Plasmat uses cemented doublets and an air-spaced single element in each group of 3. It is one of the most fruitful (6/4) lens designs of all times, which inspired up to now modern top-class view camera lenses of standard focal length.
- [11] The *Lens Collector's Vade Mecum* can be obtained on CD from this vendor :
<http://www.antiqcameras.net/lensvademeccum.html>
- [12] LTM: Leica Thread Mount, a famous thread size used to mount lenses on Leica rangefinder cameras prior to the introduction of the Leica-M bayonet mount. LTM is a standard size for many modern enlarging lenses. Specifications are a strange mix of metric and Imperial, thread diameter is a metric 39 mm while the thread pitch is an Imperial 26 TPI ; the full metric specification would be precisely M39x0.977. Beware however that it is not uncommon to find pseudo-LTM threads of actual metric specifications M39x1. For enlarging lenses where the number of mounting threads is usually small, mechanical tolerances often allow to actually mount a true LTM M39x26TPI on a M39x1 and vice-versa.
- [13] Since the first Planar design in 1896 at Carl Zeiss Jena, this registered trade name has been used by the manufacturer to denote numerous different lenses made of 5 to 7 lens elements. The twin-lens Rolleiflex was equipped with different Planar lenses, 5- or 6-element designs, focal lengths 75 or 80 mm. Single lens 6x6 Rolleiflex cameras are equipped with a 7-element 80/2.8 Planar lens similar to the Hasselblad's. Dan Fromm's Planar lens is a 5-element design, most probably similar to the 80/2.8 5-element Planar fitting the Rolleiflex TLR.
- [14] Patrice-Hervé Pont, "Les chiffres clés, de A comme Alpa à Z comme Zeiss" - 3-rd ed., 2000, Éditions du Pécari - Atlantica-Séguier, ISBN : 2-91284-814-8 <http://www.atlantica.fr>
- [15] *Full Plate*: an old glass plate format, the Full Plate or Plate 1/1; dimensions 8½" x 6½" (165x216 mm). http://en.wikipedia.org/wiki/Film_format
- [16] *dial-set Compur*: in pre-WW-II Compur shutters, speed selection was done through a dial located above the lens. The German for this is: *Rad-Compur*.
<http://www.kamera-geschichte.de/images/v0011a.jpg>.
 Later, Compur speeds are controlled by a ring surrounding the lens, the *rim-set Compur* (*Ring-Compur* in German).
<http://www.kamera-geschichte.de/images/v0012a.jpg>

[17] <http://lyricsplayground.com/alpha/songs/t/toofatpolka.shtml>

[18] *focus shift on stopping down*: in some older lenses like the Dagor, the best focusing plane that can be found visually on the ground glass is different when the lens is wide open (for framing and focusing) or when the lens is stopped down to the actual working aperture. This is due to residual aberrations, mostly in the edges of the image; the effect is important with a lens affected by spherical aberration, for example a single un-corrected lens element. When using older lenses affected by focus shift, it is sometimes recommended to frame and focus with the lens stopped down to the final working aperture. This procedure, unfortunately, does not solve all problems since on the ground glass the image will be very dim and the apparent depth of field will increase, which does not help finding the best focus.

[19] <http://homepage2.nifty.com/akiyanroom/redbook-e/>

10 Appendix: *in memoriam*, Charlie Barringer (1943-2010)

Charlie Barringer, an appreciation

During a discussion on and off Usenet about an obscure Zeiss macro lens Willem-Jan Mark-erink introduced me to Charlie Barringer and Marc James Small, coauthors of **The Zeiss-Ikon Compendium**, (*Zeiss Compendium East & West: 1940-1972*, ISBN 1874707243, Hove Books, 2002), Charlie and I soon discovered that we lived only a few miles apart and a friendship ensued. Charlie was a friend, an inspiration, and a bad influence.

Charlie encouraged me to pursue my closely-linked hobbies of photography and accumulating photographic equipment. He was himself an active photographer, in recent years primarily with digital equipment, and an obsessive accumulator. He is best known among collectors of photographic equipment as a Zeiss specialist and in fact Zeiss was his first love.

But his tastes were catholic. All good equipment appealed to him; in addition to his many Zeiss cameras, and, naturally, Zeiss lenses to go on them, he had first rate lenses from many manufacturers. One of his great treasures was a 44/5.6 Super Aviogon. Another, that made it clear that although he was an avid collector he was not a perfectionist, was an 80 inch Zoomar mirror lens with what appears to be a bullet hole in the front element. Much of the rest of his collection was similarly less than pristine.

In lenses, he pursued the informative and the extreme. The informative, e.g., a small mountain of 50/1.5 Sonnars, primarily to understand what Zeiss had done. The extreme, i.e., short or long for the format covered, because, well, that's what he liked.

Charlie often lectured me on the importance of getting the shot and on the relative unimportance of, e.g., scratches on lenses. For him a lens that was good enough was good enough. The test of goodness was the final print, not the lens' appearance or design. He had, therefore, great respect and affection for the humble Tessar.

There were, however, times when a desire for perfection seized him. The obscure lens that brought us together was a 45/4.5 Mikrotar I'd bought at a camera show. He had one, as did Mr. Small. When I decided to sell mine I mentioned to Charlie, in passing, that I was negotiating with a prospective buyer. He took his out of its drawer, checked it, found that it was defective, and in a great panic implored me to sell him mine.

He was also at times seized by the need to possess. He had a Miniature Speed Graphic that he used occasionally for testing lenses in barrel. I once bought a 2x3 Crown Graphic with Graflok back and no focusing panel as a parts camera, then looked at closely and decided it was much too good to dismantle. When I mentioned it to Charlie he discovered that he needed a 2x3 Crown Graphic and worked very hard to convince me to sell it to him. He needed it. His life would be incomplete without it. He whined and nagged and cried and begged until I gave it to him as a gift to make him stop pestering me.

Charlie was also a bad influence. He used his Mini Speed to estimate whether an extreme lens, a 1.75/2.8 Elcan, would cover 2x3; after looking at the image it put on the Mini's ground glass, he thought it would. The sight of his large short lens stuffed into the front of his Mini Speed was the inspiration I needed to acquire one and have it put properly on board. Unfortunately it doesn't, after all, cover 2x3. But now we know.

Charlie will live in my memory, though, more as a kind and caring person than as an accumulator and student of photographic equipment. During his final illness he put much energy into caring for his aged parents and for his wife, whose breast cancer was diagnosed after he received his death sentence. He clung to life until it was clear that Thérèse was cancer-free. As he was dying, Charlie gave some of the pearls of his collection to friends. His heirs, he explained, would not miss them and the gifts would please their recipients.

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