

The “Grandina” LF lenses from Carl Zeiss Jena – a tale of technical excellence and economic absurdity

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Two other articles [1,2] summarized the development of the large format (LF) lens lines of the VEB Carl Zeiss Jena in the German Democratic Republic (GDR) and its short-lived successor Docter Optic in reunified Germany. In the tables of the first article [1] a few lenses were mentioned as prototypes, such as the 65mm Lamegon or the 210mm Biometar. A visit to the Zeiss archives in Jena uncovered some new information about a specific LF lens line which accounts for most of those prototypes, but never made it into production. After having read the internal Zeiss documents [3,4] on these lenses I think this was definitely a loss for the large format world. The story of these lenses is interesting enough to warrant an addendum to the previous articles; interesting not only from the historical point of view, but also as an example of the problems of a high-tech company behind the iron curtain.

The “Grandina” history

In 1961, VEB Carl Zeiss Jena (CZJ) was approached by the Czechoslovakian company Meopta in Prešov to develop a line of 5 lenses for a large format camera. Meopta was well known for their enlargers, but also made cameras, from 35mm to large format. The Meopta camera in question was a mono-rail model in the 4x5” (or 9x12cm) format [5], named “Grandina”. Meopta asked for five different focal lengths, which should all cover 4x5” with movements. The focal lengths were 65mm, 90mm, 135mm (as the “normal” focal length to be sold with the camera), 210mm, and 270mm. In addition, all lenses had to fit into a modified size 1 “Prestor” shutter to be built by VEB Pentacon in Dresden. Initially, Meopta contacted Pentacon and CZJ independently, but later wanted to interact only with one partner, CZJ, so Pentacon was appointed to be the shutter supplier for CZJ. Note that at this time VEB Pentacon was *not* part of CZJ – this merger happened much later, in 1985.

Meopta was not only a camera and enlarger manufacturer, but also an optics house. They had developed their own LF lenses in the early 1950’s, for their 5x7” (13x18cm) “Magnola” technical camera. These were the 210mm f/4.5 Belar (a Tessar type) and the 135mm f/6.8 “Largor” (a double Gauss wide angle). They also made a wide variety of enlarging lenses based on the Tessar and Heliar designs. Why they chose to approach CZJ instead of doing the development themselves is not known. Possible explanations are:

- Better expected sales in Western countries having optics with the Zeiss name
- A lack of expertise or manpower to tackle the complex development and manufacturing tasks needed to achieve the design goals
- An agreement in the Eastern Bloc countries to concentrate specific tasks at only one location.

Lens development at Carl Zeiss Jena

The people at CZJ went to work, and by 1963 five new lenses had been developed that fulfilled or surpassed all of Meopta's specifications. These lenses were the f/4.5 65mm Lamegon, the f/4.5 90mm Lamegon, the f/4 135mm Biometar, the f/5.4 210mm Biometar, and the f/8 270mm Tessar – of these, the 90, 210, and 270mm lenses also covered 13x18cm/5x7". Fig. 1 shows sketches of the optical designs based on the CZJ drawings, and table 1 lists the known specs. Samples of each lens were made for tests. Judging from the internal CZJ test reports (compare tables 2-6), and my own experience with some of the examples, these lenses were often better than their international competition at the time.

*Table 1: Technical data of the VEB Carl Zeiss Jena LF lenses for the Meopta "Grandina" 4x5 camera. Judging from CZJ's internal tests, the image circle numbers are based on a resolution criterion of 100µm or less (10 lp/mm or more). *The Copal versions of the 90mm Lamegon and the 135mm Biometar close down to f/45, and the Copal version of the 210mm closes down to f/64.*

Lens name	Focal length [mm]	Max/Min. Aperture	Elements/groups	Coverage [°] @f/22	Image circle [mm]	Filter size	Weight [g] with Prestor 1 shutter	Remarks
Lamegon	65	4.5/32*	8/4	105	156@f/4.5 170@f/22	M95x1	683	
	90				200@f/4.5 224@f/11	M118x1	1020	Copal Electric 1 version: 1180g
Biometar	135	4/32*	5/4	67	156@f/4 180@f/11	M67x0.75	395	Copal 1 version: 395g
	210	5.4/45*		66	240@f/5.4 270@f/16	M86x1	684	
Tessar	270	8/64	4/3	53	250@f/8 270@f/16	M49x0.75	278	

Originally the lenses were slated to go into production in 1964. Meopta planned to sell 750 units of the 135mm standard lens and 750 units of all the other lenses combined. CZJ planned to produce another 200-300 units for use in the GDR and for export. However, the unexpected bottleneck turned out to be the shutter production. Because of the low production numbers, the shutters were planned to be part of the existing "Prestor" shutter line (sizes 1, 3, and 5) from Pentacon in Dresden, which appeared on the (East-German) market in 1964 (note that the GDR-made "Mentor" and "Globica" LF cameras all used behind the lens shutters, so there was not a big home market for leaf shutters). Meopta asked for some changes of the Prestor 1, including a preview lever that was never realized. Due to production problems at Pentacon, the delivery of the prototype series of the lenses had to be postponed for more than a year to 1965/1966, and then with a reduced number of 5 units per lens, instead of 25. Then, in the 2nd quarter of 1966, VEB Pentacon suddenly decided to stop the production of leaf shutters completely – "surprising" for CZJ, as it was stated in the internal Zeiss report [4]. The

same report said that any future production depended on the possibility of obtaining Western-made shutters. One would think that this was not too difficult, since CZJ had done this before, fitting Tessars into West-German Compurs and Compounds in the 1950's [1]. The use of Western shutters would have needed a little bit of mechanical redesign, as the Prestor shutter sizes are not compatible with the standardized Western ones. The Prestor 1 uses the same front thread as a current Copal 1 (M40x0.75), but instead of the standard M36x0.75 back cell thread of a size 1 shutter it used M40x0.75, the same thread as on the front. In addition, the cell spacing of the Prestor 1 is 23.5mm, 3.5mm more than the standard 20mm. Still, it is not a major difference and a redesign of the mount would have been easy. I am convinced that they would have been able to sell the lenses on the Western markets at a premium price, and would have regained any initial investment in Western-made shutters. But apparently it was not possible to obtain enough hard currency within the GDR system to buy a substantial number of Compur or Prontor shutters at the time. The fact that this was at the height of the cold war, a few years after the Berlin wall was built, probably didn't help. This lack of shutters lead to the premature end of the "Grandina" lenses in 1966, with several years of design and prototyping efforts wasted.

Coincidentally, in the same year CZJ's West-German counterpart, Carl Zeiss in Oberkochen, announced a series of new LF lenses for 13x18cm/5x7", at the 1966 photokina [6]. These lenses (a

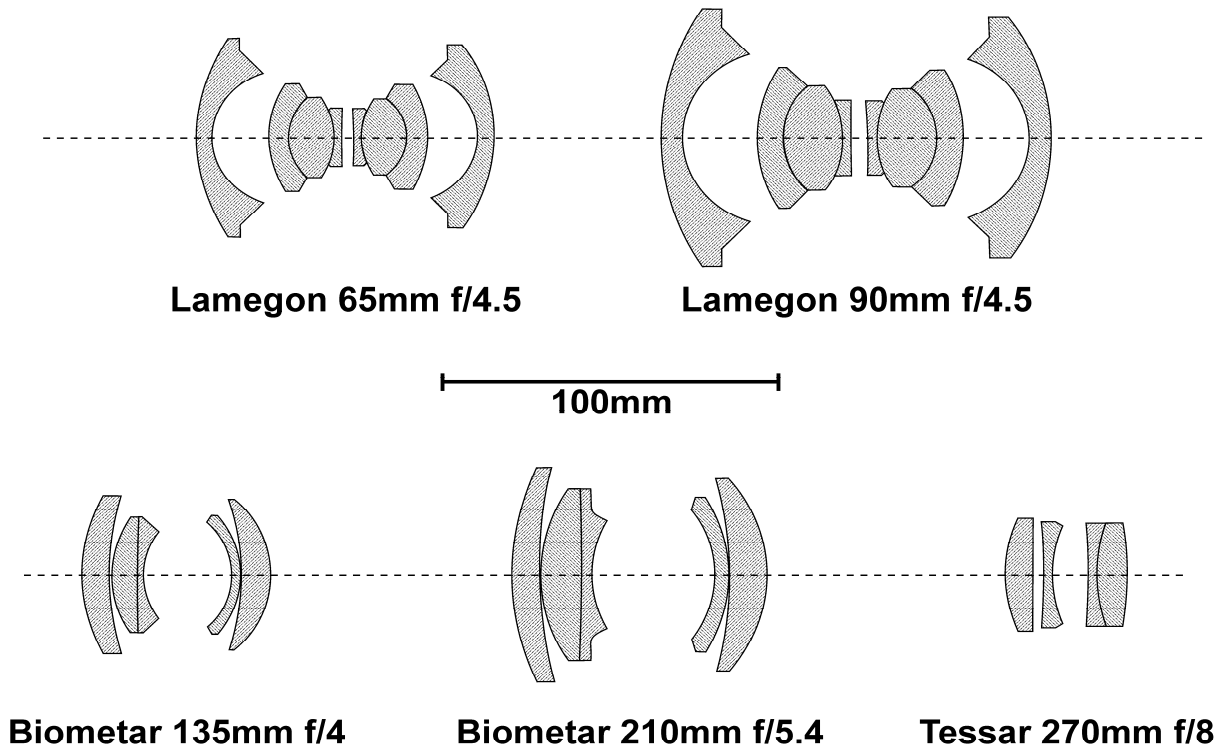


Fig. 1: Lens section drawings (to scale) of the 5 lenses for the "Grandina" camera, based on the original CZJ drawings [3,4].

110mm f/8 Hologon with 90° coverage, a 210mm f/5.6 Planar, and a 500mm f/8 Tele-Tessar) also never made it into production, in this case due to economic reasons. The crisis of Zeiss-Ikon already loomed on the horizon, and 6 years later Carl Zeiss Oberkochen and Zeiss Ikon completely stopped the Zeiss and Voigtländer LF lens lines. It is interesting to note that the 210mm Planar was pretty much the exact counterpart of the 210mm Biometar from the Grandina line.

A last interesting episode is mentioned in the CZJ files: In 1966, they exhibited the prototype lenses at the international spring fair in Leipzig, and even had some advertising data sheets printed [7], hoping to attract other customers. As a consequence, they were approached by a US company about the possibility of a license production. Obviously this never happened, but one can wonder which company that was. Kodak just left the lens production field at that time, so they are unlikely. Calumet and/or Ilex are quite likely, but Wollensak or Goerz are also possibilities.

LENSES 91

STILL CAMERA LENSES (Normal) Continued

Manufacturers Name, Model Catalog Number	Focal Length in Inches	Focal Length in Millimeters	Largest & Smallest Apertures	Film Size Covered, Maximum Aperture at Infinity	Diameter of Lensboard Mounting Hole	Outside Diameter of Front of Lens in Millimeters	Type of Mounting	Price
aus JENA (ERCONA)								
Biometar	5¼	135	4.0-	—	—	—	Copal 1	\$325.00
Biometar	5¼	135	4.0-	—	—	—	Copal 1 Electric	375.00
Biometar	8¼	210	5.4-	—	—	—	Copal 1	475.00
Biometar	8¼	210	5.4-	—	—	—	Copal 1 Electric	525.00
Lamegon	2½	65	4.5-	—	—	—	Copal 1	795.00
Lamegon	2½	65	4.5-	—	—	—	Copal 1 Electric	845.00
Lamegon	3½	90	4.5-	—	—	—	Copal 1	975.00
Lamegon	3½	90	4.5-	—	—	—	Copal 1 Electric	1,025.00
Tessar	2	50	4.5-	1¼x1½"	—	—	Barrel	80.00
Tessar	3	75	4.5-	2¾x2¾"	—	—	Barrel	85.00
Tessar	4¼	105	4.5-	2½x3½"	—	—	Barrel	100.00
Tessar	5¼	135	4.5-	3½x4½"	—	—	Barrel	125.00
Tessar	7	180	4.5-	4¾x6½"	—	—	Barrel	170.00
Tessar	8¼	210	4.5-	5x7"	—	—	Barrel	215.00
Tessar	10	250	4.5-	6x8"	—	—	Barrel	350.00
Tessar	10½	270	8.0-	—	—	—	Copal 1	295.00
Tessar	10½	270	8.0-	—	—	—	Copal 1 Electric	345.00
Tessar	12	300	4.5-	6½x8½"	—	—	Barrel	425.00
Tessar	14	360	4.5-	7x9"	—	—	Barrel	700.00

Fig. 2: 1971 catalog page listing the 65 and 90mm Lamegons, the 135 and 210mm Biometars, and the 270mm Tessar, together with other CZJ-made Tessars in barrel. For comparison, a 210mm f/5.6 Rodenstock Sironar was listed at a price of \$595 in the same catalog.

Until recently, it seemed that CZJ had never produced any lenses of this series for a Western shutter, but then one model of the 90mm f/4.5 Lamegon surfaced on the US ebay web site in 2003, mounted in a Copal Electric size 1 (fig. 4), followed by a 135mm Biometar in an old-style Copal 1 in 2011 (fig. 8). The serial nos. of these two lenses are only 3 units apart and point to a production date in the 1970's, about ten years after the development of the lenses and the production of the prototypes for Meopta. The labeling on the mount does not use the Carl Zeiss name but says instead "Aus Jena" (from Jena), so they were intended to be sold in one of the Western countries where Zeiss Oberkochen held the right to the name Zeiss (i.e. the USA and most Western European states). The back lens mount was changed compared to the original designs, not just the thread to fit the Copal shutter. It turned out that all 5 lenses were imported into the USA by the "Ercona" Company [15], a subsidiary of the Steelmasters company [16], and offered in 1971 through a catalog by Alpha Photo Products in Oakland, CA, in both Copal and Copal electric shutters as shown in fig. 2. Similar to the prototypes, these lenses are not listed in the published CZJ production number list [8], and fit into a gap of 55 numbers. Apparently, 10 years after the development ended, CZJ was able to produce a belated mini-series of this lens with Western-made shutters. Given the fact that close to none show up on the used market, I would assume that they had a very low production number, at maximum 55 units for all lenses combined.

In the following, I'll comment on the individual lens types, based on the internal CZJ reports and personal experiences with some of them. The CZJ reports contain optical bench tests and sometimes comparisons with Western competitors, summarized in tables 2-6. Note that the resolution numbers are only useful for comparing lenses tested by Zeiss Jena to the same standards – other test setups will certainly result in different numbers.

Lamegon 65mm f/4.5 and 90mm f/4.5

Other than for these two "Grandina" lenses, the Lamegon name was used for CZJ's wide angle aerial lenses, like the 100mm f/8, the 150mm f/4, or the 55mm f/5.6 Lamegon. They also had an ultra-wide angle (120°) "Superlamegon" aerial lens. "Lamegon" designates CZJ's designs based on the wide angle developments pioneered first by Rusinov in Russia (the "Russar" lenses), and developed further by Bertele (Wild Aviogon, Zeiss Oberkochen Biogon) [9]. The Biogon f/4.5 (90° coverage) and the Super-Angulon f/8 series from Schneider-Kreuznach (100° coverage) were the prime examples of this type at the time. CZJ went beyond those examples by combining an angle of 105° with a maximum opening of f/4.5, a combination not available before. As can be seen in figure 1, they used 8 lenses in 4 groups. A GDR patent was applied for in 1964 and issued on August 20, 1966 [10]. At the Photokina 1966, Schneider introduced a line of similar 8/4 construction and also for 105° coverage, but still with a lower maximum aperture, the well-known f/5.6 Super-Angulon series [11]. It took Western companies another ten years to reach the same nominal design values with the Rodenstock f/4.5 Grandagon series in the mid 1970's [12].

Fig. 3 shows the 65mm Lamegon together with a much later successor, the Doctar WA 65mm, introduced as a new design by Docter Optic in 1992 [2], and with the later Rodenstock Grandagon-N. The Doctar WA is likely based on the 65mm Lamegon, as the lens drawings are very similar, sharing the characteristic feature of rather thick and large outer menisci (compared to Schneider, Rodenstock,

Nikon, or Fuji wide angle lenses). It is not an exact copy though, as the lens radii of at least the accessible outer lens elements differ slightly between the two lenses. Note the much larger front lenses and mounts of the Lamegon and Doctar compared to the 65mm Rodenstock Grandagon-N, also an 8/4 design with a maximum opening of $f/4.5$.

Table 2: Resolving power in lp/mm for the Lamegon 65mm $f/4$, calculated from CZJ's resolution number test values (in μm)

Lens	aperture	Image height [mm]					
		0	22	42	65	78	89
Lamegon 65mm $f/4.5$	4.5	50	40	31	21	14	-
	5.6	53	45	31	26	18	-
	8	53	50	36	28	20	-
	11	56	50	36	28	21	13
	16	56	50	36	29	22	16



Fig. 3: Back left: Lamegon 65mm $f/4.5$ in original Prestor 1 shutter. Back right: The short-lived modern successor of the 65mm Lamegon, the Doctar WA 65mm $f/4.5$ in Copal 1 [2]. Front: a Rodenstock Grandagon-N MC 65mm $f/4.5$ for comparison. Scale is in cm.



Fig. 4: Original prototype Lamagon 90mm f/4.5 in Prestor 1 shutter (left) from 1966 and later Lamagon 90mm f/4.5 in Copal electric 1 shutter (right) produced for export (“aus Jena” designation) in the early 1970’s. Scale is in cm.



Fig. 5: Side view of the original prototype Lamagon 90mm f/4.5 in Prestor 1 shutter (left) from 1966 and later Lamagon 90mm f/4.5 in Copal electric 1 shutter (right). Note the different design of the back cell for the Copal shutter. Scale is in cm.

Table 3: Resolving power in lp/mm for the Lamegon 90mm f/4.5 and the Schneider-Kreuznach Super-Angulon 90mm f/8, calculated from CZJ's resolution number test values (in μm)

Lens	aperture	Image height [mm]					
		0	20	47	74	92	112
Lamegon	4.5	45	40	31	20	18	-
Super-Angulon		-	-	-	-	-	-
Lamegon	8	63	40	33	22	20	11
Super-Angulon		45	31	23	15	10	-
Lamegon	11	63	50	37	22	22	11
Super-Angulon		50	31	29	16	10	-
Lamegon	16	50	40	33	25	22	13
Super-Angulon		50	33	25	17	14	-



Fig. 6: Lamegon 90mm f/4.5 in Copal 1 electric (left) compared to the Schneider Super-Angulon XL 90mm f/5.6 in Copal 0 (right). Scale is in cm.

Figs. 4-7 show the 90mm version of the Lamegon. In figs. 4 and 5 the original prototype in Prestor shutter is shown on the left and the later version made for export in a Copal 1 electric on the right. Note the differently designed back cell for each version. One can see that the lens is quite large; with a

filter size of 118mm, it dwarfs even a Super-Angulon XL 90mm f/5.6 (fig. 6). CZJ evaluated the 90mm f/4.5 Lamegon in comparison with the contemporary Schneider Super-Angulon f/8 (a 6/4 construction) and found a much better performance for their lens, especially in the corners (table 3). The test report of the 65mm (table 2) did not include comparison numbers, but the general text stated that compared to Zeiss Oberkochen's 53mm f/4.5 Biogon (which only covers the 6x9cm format), taking into account the different formats and focal lengths, the Lamegon had the same performance in the center and was slightly better in the corners.



Fig. 7: Lamegon 90mm f/4.5 with the ring on the back lens cell removed. This ring, which protects the back lens element from mechanical damage, limits the coverage to about 92° by mechanical vignetting, instead of the 105° the lens is capable of. Scale is in cm.

Note that full coverage can only be realized with the 90mm Lamegon (both the Prestor and the Copal version), when the metal ring that protects the outer lens in the back cell is unscrewed, otherwise the image circle is limited to 187mm or 92° by mechanical vignetting (fig. 7). In addition, the back cell, with a maximum diameter of 85mm, does not fit through the mount hole of the Linhof Technika and cameras with similarly designed front standards.

Biomatar 135mm f/4 and 210mm f/5.4

The Biomatar, with 5 lenses in 4 groups (fig. 1) is derived from the common Planar design. Its design is very similar to the Schneider Xenotar 135mm f/3.5 and also closely related to the 135mm f/3.5 Planar that Zeiss Oberkochen made for 4x5 (the Planar reversed the Biomatar and Xenotar setup, with the cemented lens group facing the film). The Biomatar line, originally designed by Harry Zöllner [13], the head of CZJ's photographic optics department from 1946-1963 (from 1963 to 1977 he was the head of research for all of CZJ), has a good reputation and has been manufactured extensively in the 80mm and 120mm focal lengths for medium format. The design has a little less coverage compared to a Plasmatic-type like the contemporary Schneider Symmar, but is known to perform better at wide apertures. The 135mm f/4 version is shown in fig. 8. Carl Zeiss Jena compared their 135mm Biomatar to the similar Schneider 135mm f/3.5 Xenotar in an internal test (table 4) and found a significantly better performance of the Biomatar especially in the corners. Interestingly, the report never mentions the 135mm f/3.5 Planar from Zeiss Oberkochen, which was certainly available at the time (fig. 9). The image circle of 180mm (stopped down to f/11) is 10mm larger than the image circles of both the Xenotar and Planar rivals at 170mm. Only the 1969 redesign of the Zeiss Oberkochen Planar reached 180mm.



Fig. 8: Three versions of the Biomatar 135mm f/4. Back left: Original prototype version in Prestor 1 shutter. Back right: Original prototype version adapted in the GDR to a Western Synchro-Compur shutter. Front: Export version ("aus Jena") in older style Copal 1 shutter from the 1970's. Scale is in cm.

The popular 210mm focal length also used the Biometar design, with a maximum opening of $f/5.4$ (fig. 9). It could already be used with very good results wide open, and stopped down to $f/11$ covered $5\times 7''$ with movements (table 5). CZJ did some comparison testing with a Schneider Xenar 210mm $f/4.5$, which was of course inferior, but they stated themselves that the test was not too meaningful given the different designs and design goals. Personally I found the 210mm Biometar to be very close to a 210mm Rodenstock Apo-Sironar S, except for a little reduction in contrast, attributable to the single coating of the Biometar vs. the multicoating of the Apo-Sironar S. Both lenses show quite good resolution wide open.

Table 4: Resolving power in lp/mm for the Biometar 135mm $f/4$ and the Schneider-Kreuznach Xenotar 135mm $f/3.5$, calculated from CZJ's resolution number test values (in μm)

Lens	aperture	Image height [mm]					
		0	22	42	65	78	88
Biometar	4	46	39	29	31	20	-
Xenotar		38	29	16	25	13	-
Biometar	5.6	50	38	31	34	20	-
Xenotar		50	31	16	27	13	-
Biometar	8	50	38	28	43	22	-
Xenotar		50	31	17	31	13	13
Biometar	11	50	50	34	43	29	-
Xenotar		50	38	22	31	13	16



Fig. 9: The CZJ 135mm $f/4$ Biometar (top right) together with the Zeiss Oberkochen 135mm $f/3.5$ Planar from 1956 (top left) and the 1969 Planar redesign (top center), the Schneider 135mm $f/3.5$ Xenotar (front left,) and a 135mm $f/5.6$ Schneider Apo-Symmar (front right). Scale is in cm.



Fig. 10: Top left: Biometar 210mm f/5.4 in original Prestor 1 shutter. Top right: Biometar 210mm f/5.4 adapted to a modern Copal 1 shutter. Front: Rodenstock Apo-Sironar S 210mm f/5.6 for comparison. Scale is in cm.

Table 5: Resolving power in lp/mm for the Biometar 210mm f/5.4, calculated from CZJ's resolution number test values (in μm)

Lens	aperture	Image height [mm]					
		0	18	36	75	119	134
Biometar 210mm f/5.4	5.4	45	42	33	21	13	-
	8	71	56	36	25	14	-
	11	67	56	36	33	16	-
	16	71	56	38	36	22	11

Tessar 270mm f/8

This Tessar was the longest lens of the line. The comparatively small maximum opening resulted from the requirement to use the Prestor 1 shutter, limiting the free diameter. The development report mentions that an existing Tessar model could not be used, and that the new development tried to take advantage of the small maximum opening by pushing the aberration correction even further than before. CZJ claimed it was the best regular Tessar ever built (compare table 6 for the test results). About 20 years later, Nikon used the same approach of reducing the maximum aperture in exchange for an exceptional performance with their M series, which are also Tessar constructions (compare Kerry Thal-

mann’s excellent article on Tessar types [14] for more information). The 270mm f/8 Tessar and the 300mm f/9 Nikkor-M actually resemble each other quite closely (fig.11), except for the multicoating of the Nikkor. In my experience the performance of the 270mm Tessar is on par with the Nikkor-M.

Table 6: Resolving power in lp/mm for the Tessar 270mm f/8, calculated from CZJ’s resolution number test values (in μm)

Lens	aperture	Image height [mm]					
		0	24	48	75	126	137
Tessar 270mm f/8	8	53	43	37	29	14	-
	11	62	50	48	32	19	11
	16	62	62	59	43	23	15
	22	62	62	62	50	29	21



Fig. 11: Tessar 270mm f/8 in Prestor 1 shutter (left) together with Nikon M 300 f/9 in Copal 1 (right) for comparison. Scale is in cm.

Summary

In conclusion, it is quite unfortunate that the “Grandina” lenses never made it to the market for real – especially taking into account that the reason was simply a lack of shutters. Some of the prototype models (called “Nullserie - series zero” by CZJ) surface on the used market occasionally and are worthwhile to get. The Prestor 1 shutter they often come in may be a bit of a drawback, as it is a little quirky to use (no preview lever, T and B are next to the high speeds) and parts for it are impossible to get, except by “cannibalizing” another one (more Prestors were sold with Tessar and Apo-Tessar

lenses). Remounting in a modern shutter is possible, but requires machining of adapter rings as well as of the new shutter itself, rendering it useless for other lenses (this does not apply for the few later versions that already come in modern shutters). I had a remounting done for one lens and personally think it was well worth it, but the additional cost of several hundred \$ for the new shutter and the machining should be considered. The few models in standard shutter sizes sold in the 1970's in the US are apparently even scarcer, but quite worthwhile to get.

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Arne Cröll has been involved in large format photography since 1991. His primary photographic interests are landscape and still life, mostly in black and white. Being a materials scientist by profession, he enjoys the combination of the creative and technical aspects of large format photography. His interest in Carl Zeiss Jena and Docter Optic goes back to 1994, when he visited the Docter Optic booth at Photokina. Presently, he lives part time in Freiburg in Germany and part time in Huntsville, AL. He can be reached at acroell@knology.net, his web site is: <http://www.arnecroell.com>.