Lenses —their whys— and wherefores!

Conducted by Charles H. Shipman

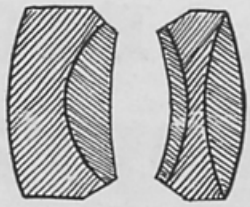
IN the last decade of the last century, The Bausch & Lomb Optical Co., by arrangement with Carl Zeiss, was able to put upon the market lenses made after the Zeiss formulae. One of these lenses was the Planar, patented in 1896 by Zeiss. This was a very fast lens for that time having speeds of F/3.6 to F/5 even in the long foci. There was also an F/6.3 for three color work. These lenses were used for photomicrography, motion pictures, and other work requiring great speed. Focal lengths were from 4½" to 24" covering plates 2¼x3¼ to 12x16 and a size larger at medium stops. Note that each element consists of a single separated glass and a cemented pair, the single glass being positive and the pair negative.

The Anastigmat Series II, F/6.3, was made in foci 3⅜" to 23¼", covering plates 2¼x3¼ to 12x15 and the next larger size at a small stop. This was a rather heavy lens of the Protar type of thick glasses, especially the front element, consisting of two glasses cemented. The rear element is made up of three glasses. This unsymmetrical construction makes for good correction but, of course, the lens is not convertible. This lens covered about 45° on the plates listed but the field covered about 85° and it could be used at small stops. They are good studio and group lenses and are suitable for cameras not too compact and having strongly built front standards. This same construction was also made in a slower series at F/8.

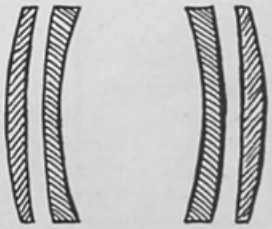
There was also a Series III and IIIA, F/7.2 and F/9 of the same type of construction except that the rear element was a cemented pair. These were general purpose lenses and could be used as medium wide angle lenses with small stops, with good definition over the whole field.

The Alvan G. Clark lens was of the

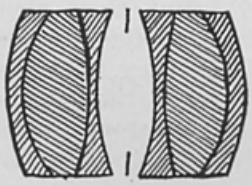
Planar Ser Ia.
F3.6 to F5.



Anastigmat Ser II
F6.3

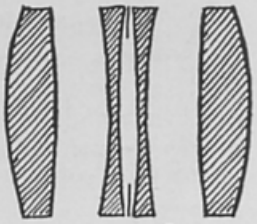


Alvan G. Clark Lens
F8



Watson's Holostigmat
F4.6 and F6.1

Steinheil Orthostigmat
Ser B F6.8 + Ser F, F9



Steinheil Unofocal
F4.5 and F6.

DIAGRAMS ILLUSTRATING MR. SHIPMAN'S ACCOMPANYING ARTICLE.

Gauss type, being made of two thin separated glasses in each element. They were light and covered about 100° over the light circle. This lens was not an anastigmat, but was well corrected especially as to spherical and chromatic errors. The Planar, mentioned above, was a Gauss type, the inner meniscus being replaced by a cemented pair of glasses having the same refractive power but different dispersion. Thus the curvature of the cemented surface could be changed without changing the refraction but the different dispersive power of the two glasses could thus be made to correct the dispersion of the single glass and still allow good spherical and anastigmat correction. Lenses of later types have replaced these older lenses, being faster and better corrected, but the old lenses are still worth having if in good shape and at a low cost.

One of the interesting older lenses was Watsons Holostigmat, one of the early fast convertible lenses. This lens was put up in sets as are the Protar Series VIIA and others. The F/4.6 had elements from 7⅛″ to 17″ focus, the combination being from 4⅜″ to 10⅜″. The F/6.1 had elements of 6″ to 34½″ giving combinations of 4″ to 20″. They were well corrected and were much used in color photography, for general work and commercial and portrait photography. While fairly thick the small number of glass to air surfaces make for clean negatives.

The Steinheil Orthostigmat was a symmetrical lens of F/6.8 and of F/9 speeds. Each element was made of two positives and one negative glass cemented. By the fact that lenses with three cemented glasses could be made to give good corrections and that the number of arrangements possible is unlimited, there were a great number of such lenses put on the market. The Orthostigmat is arranged like the Collinear, two positive and one negative glass. The Dagor type has a positive, a negative and another positive. The Holostigmat is negative, positive, negative.

The Unofocal F/4.5 and F/6 is a very interesting lens. It is constructed of four single glasses, two positives and two negatives, but all of the same focal length and dispersive power. If they were in contact there would be no focus as the two positive glasses would just balance the two negative lenses. The two air lenses between each pair of a positive and negative glass cause each element to be positive thus producing a real image. To secure a flat field free from astigmatism the focal length of the two glasses must be directly as the dispersive powers of the two glasses, and to secure chromatic correction the foci must be inversely as the dispersing power. Having all foci and dispersions the same satisfies both these conditions leaving the lens maker a better chance to correct the other errors. The eight glass to air surfaces cause more loss of light by reflection than in the case of the lenses of four surfaces, but the thin glasses cause little absorption, so that there is little choice as to light transmitting power if the glasses are of equal quality.