

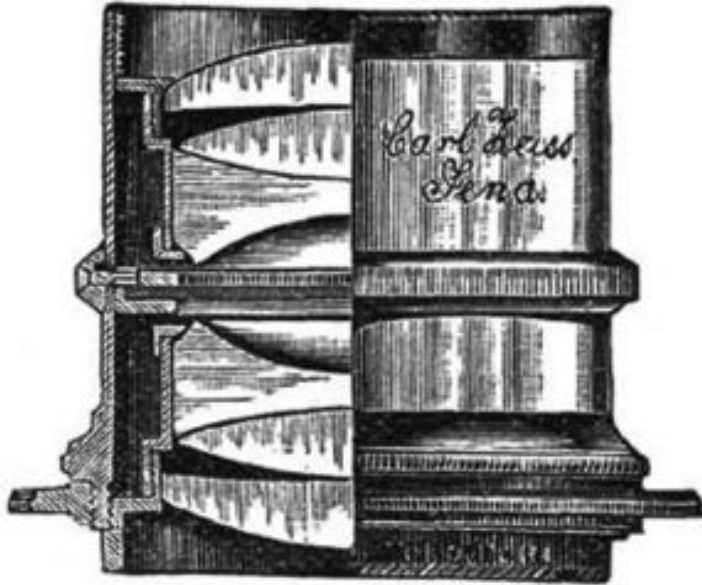
“Double Gauss”

Lens Design OPTI 517

Prof. Jose Sasian

Zeiss Planar lens

“Double Gauss”



Historical aspects

1888 Double Gauss, Alvan Clark
1890 Protar
1892 Dagor
1893 Cooke Triplet
1897 Zeiss Planar
1902 Tessar

Paul Rudolph Germany
Dennis Taylor England

A very important lens design with many variations and expansions

(No Model)

P. RUDOLPH.
OBJECT GLASS.

No. 583,336.

Patented May 25, 1897.

Fig. 1.

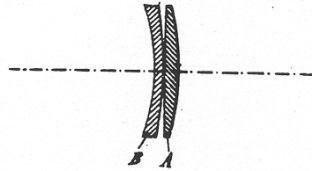


Fig. 2.

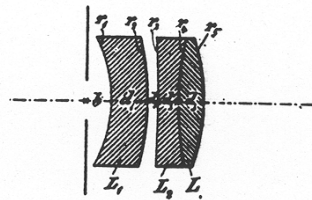
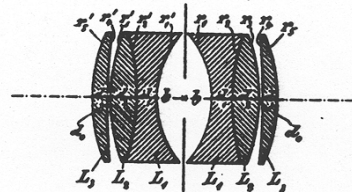


Fig. 3.

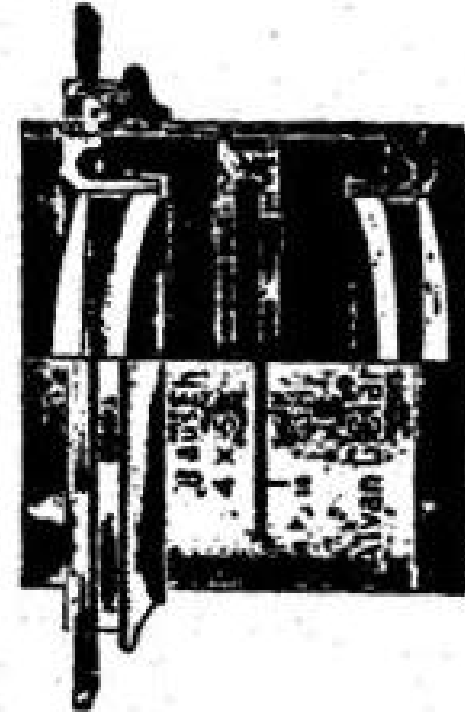


Flint Crown

Witnesses:
W. H. ...
E. P. ...

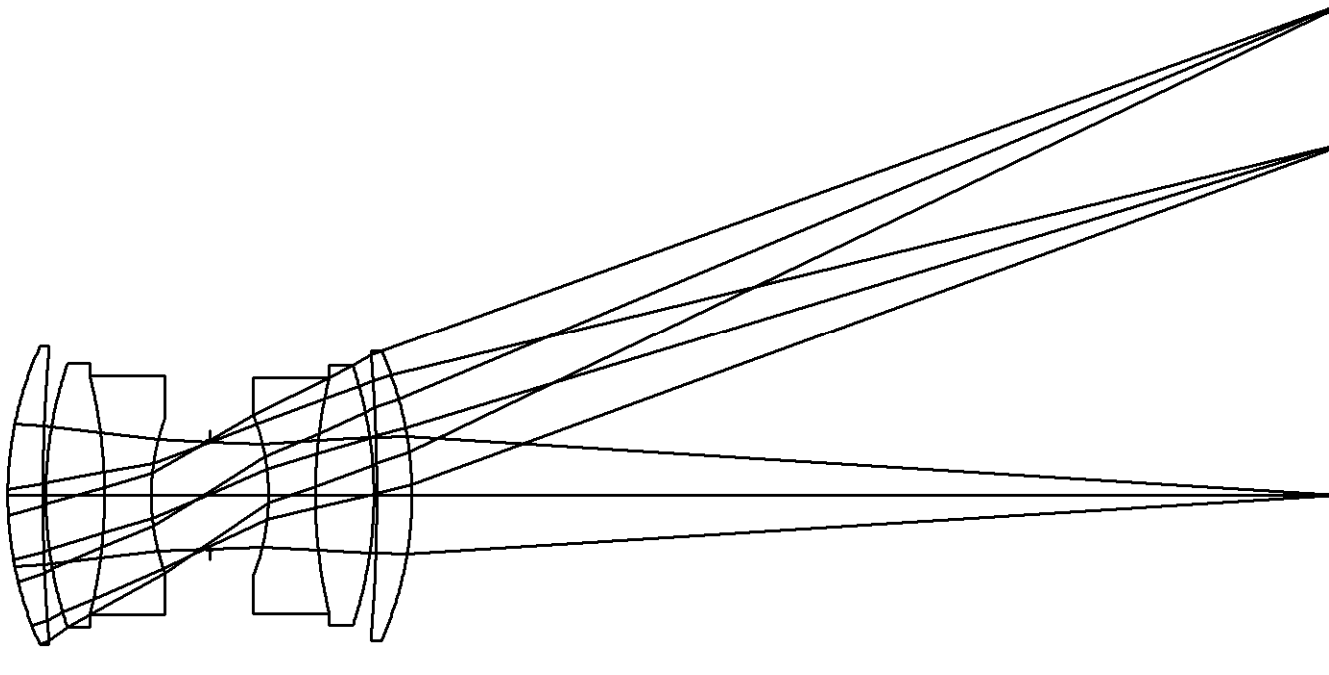
Inventor:
Paul Rudolph
by *W. H. ...*
his atty

THE HORNE PATENT CO. PHOTO-LITHO. WASHINGTON, D. C.



Alvan Clark
"Doubling the Gauss lens"

Rudolph's second aspect/embodiment of his invention



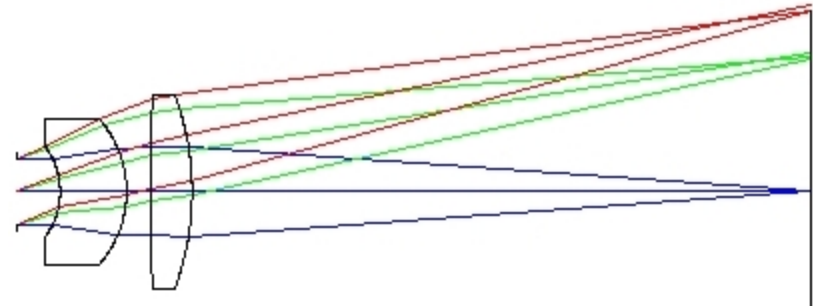
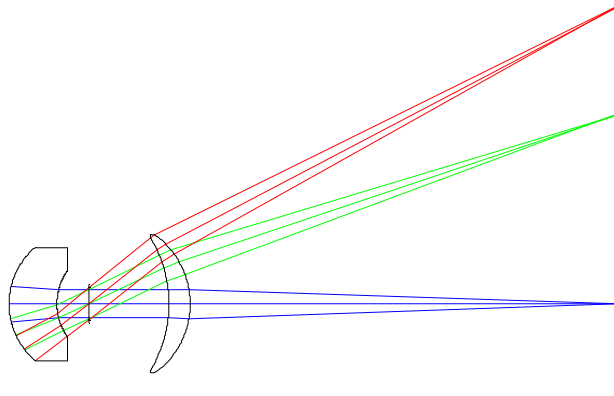
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Rudolph's design process

- Gauss
- Double Gauss
- Flattening the field by thick use of a thick meniscus lens
- Recall the Protar alternate solution
- Using the technique of doubling a lens

- Astigmatism by stop location
- Spherical aberration by meniscus bending, thickness
- Use of the symmetry principle
- First use of buried surfaces
- Aberrations are not quite interdependent as in Cooke triplet
- Referred as a “Double Gauss lens”
- Need to properly label inventions (!?)

Thick and thin meniscus



No SA, ASTI, or PETZ

- Thick meniscus lens corrects field curvature of the thin meniscus
- Thick meniscus is afocal
- Concept of an afocal corrector

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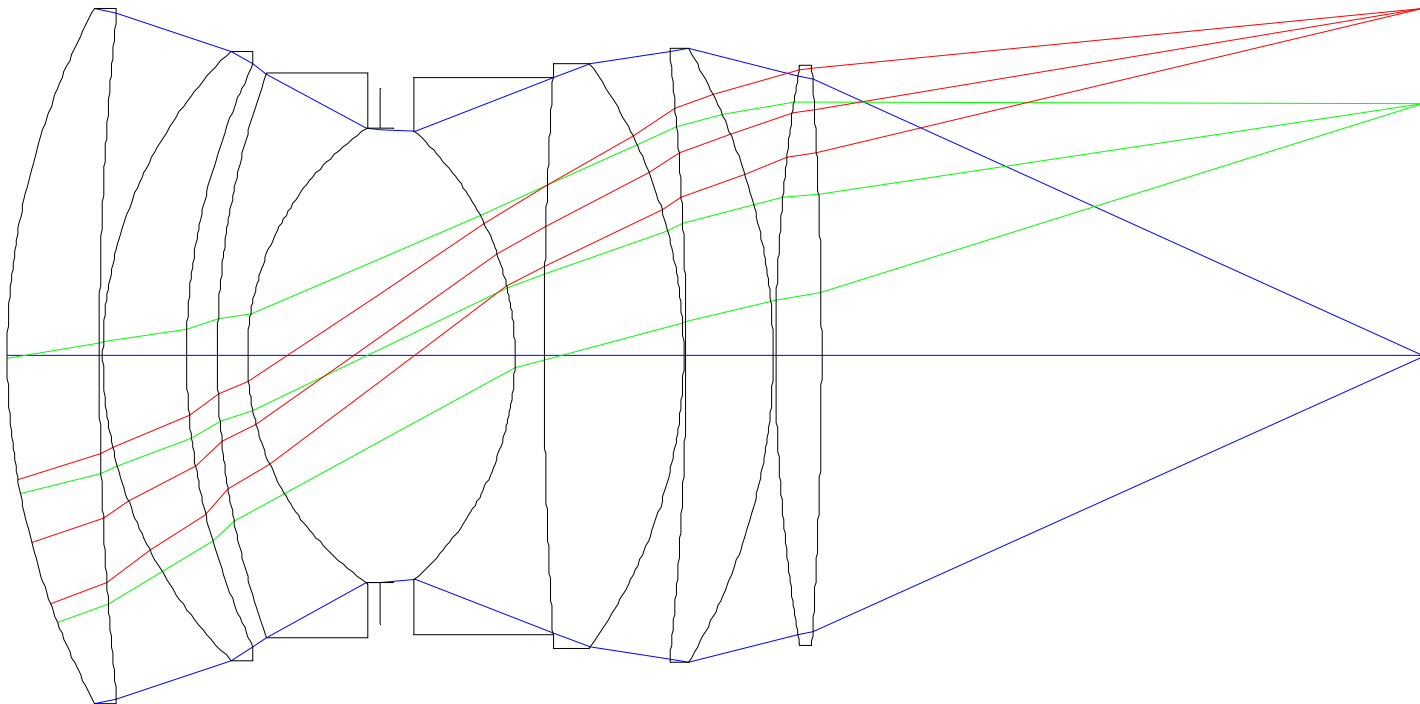
Papers

- Synthesis of the Double Gauss, Jan Hoogland, SPIE Proc.
- Design of basic double Gauss lenses, Walter Mandler SPIE Proc. V. 237, 1980.
- The design of Double Gauss Systems using digital computers, M. Kidger and C. G. Wynne, V. 6 (3), Applied Optics 1967.

Other issues

- Number of lenses and air to glass interfaces
- Manufacturing of meniscus
- Splitting positive lens to make it faster
- High-low index relationship
- Used in many cameras
- Lens volume in contrast to Tessar
- Back focal distance

A modern modified design

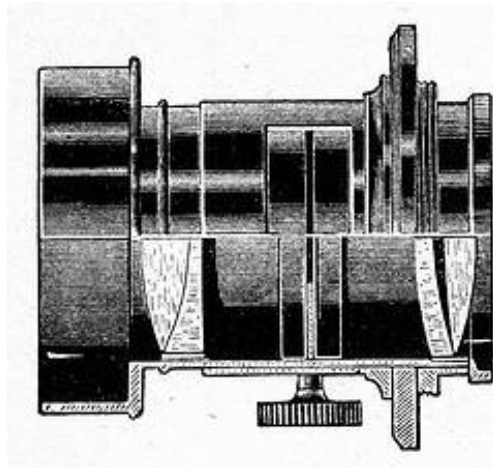


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From the landscape lens to the Planar lens summary (Variations in the landscape lens theme)

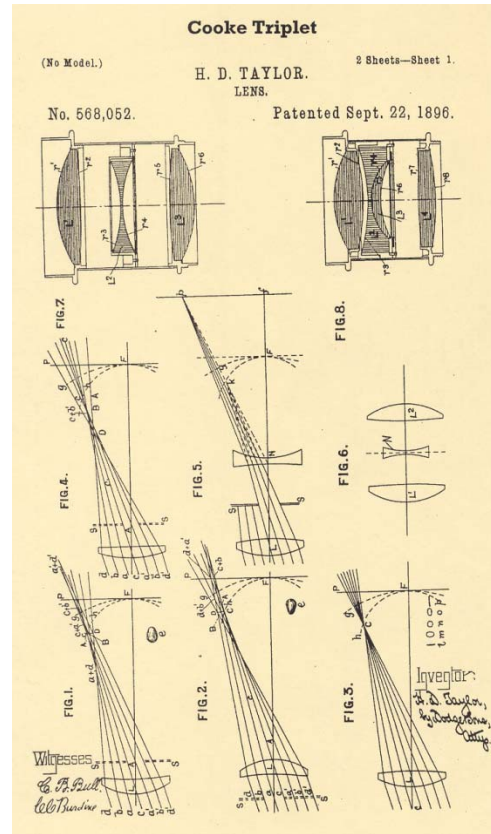
- Wollanston meniscus
- Petzval portrait lens
- Chevalier
- Doubling: odd aberrations and spherical
- Periscopic lens
- Chevalier and new achromat
- Rapid rectilinear
- Limiting astigmatism and field curvature
- New glasses
- Ross concentric (Schroeder) lens
- Protar
- Cooke (D. Taylor) triplet (as a corrector of the landscape lens)
- Planar (double Gauss)
- Tessar
- Dagor

Important basic lens forms

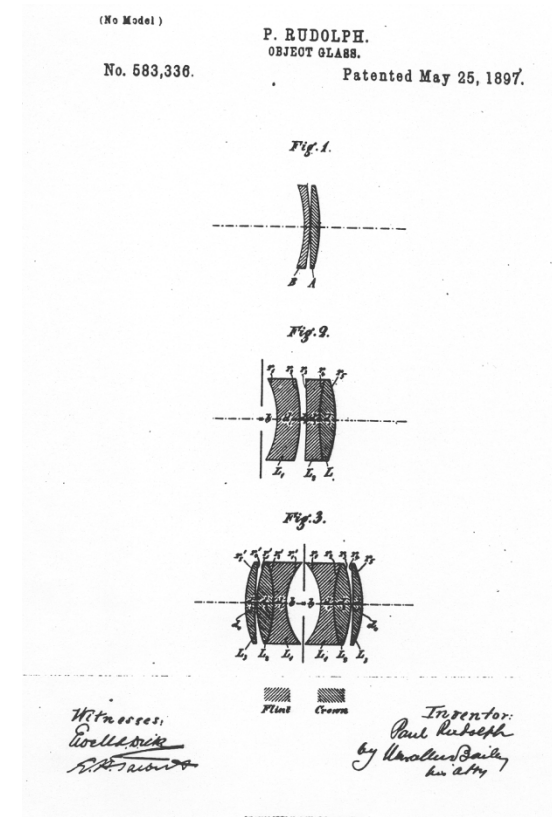


Petzval
little stress

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Cooke Triplet
Stressed with
high high-order
aberrations



DB Gauss
Stressed with
Low high order
aberrations