

(12) **United States Patent**
Shafer et al.

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(54) **MICROLITHOGRAPHIC REDUCTION
PROJECTION CATADIOPTIC OBJECTIVE**

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G02B 23/00

(52) **U.S. Cl.** **359/366**; 359/731; 359/733

(58) **Field of Search** 359/364, 365,
359/366, 726, 727, 728, 729, 730, 731,
857, 858, 859, 732, 733, 734

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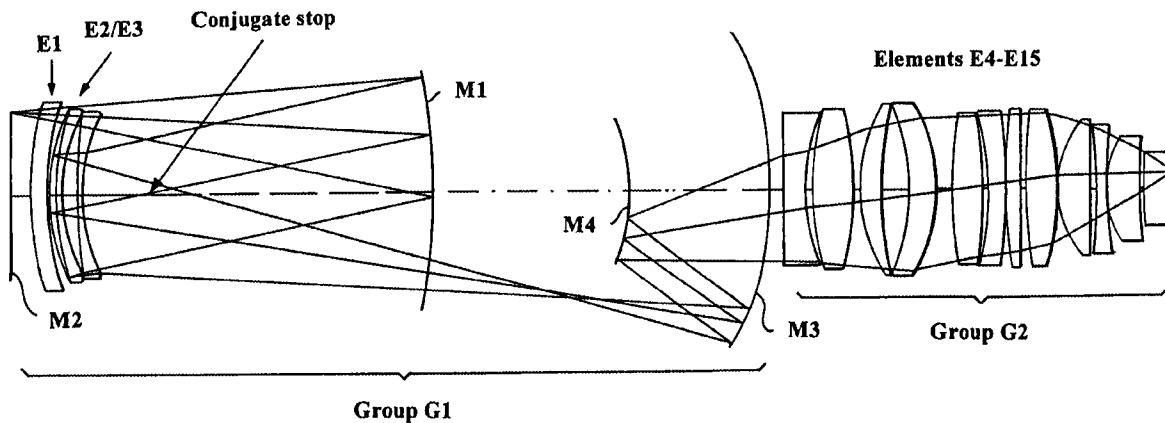
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(57) **ABSTRACT**

A photolithographic reduction projection catadioptric objective includes a first optical group having an even number of at least four mirrors and having a positive overall magnifying power, and a second substantially refractive optical group more image forward than the first optical group having a number of lenses. The second optical group has a negative overall magnifying power for providing image reduction. The first optical group provides compensative aberrative correction for the second optical group. The objective forms an image with a numerical aperture of at least substantially 0.65, and preferably greater than 0.70 or still more preferably greater than 0.75.

26 Claims, 4 Drawing Sheets



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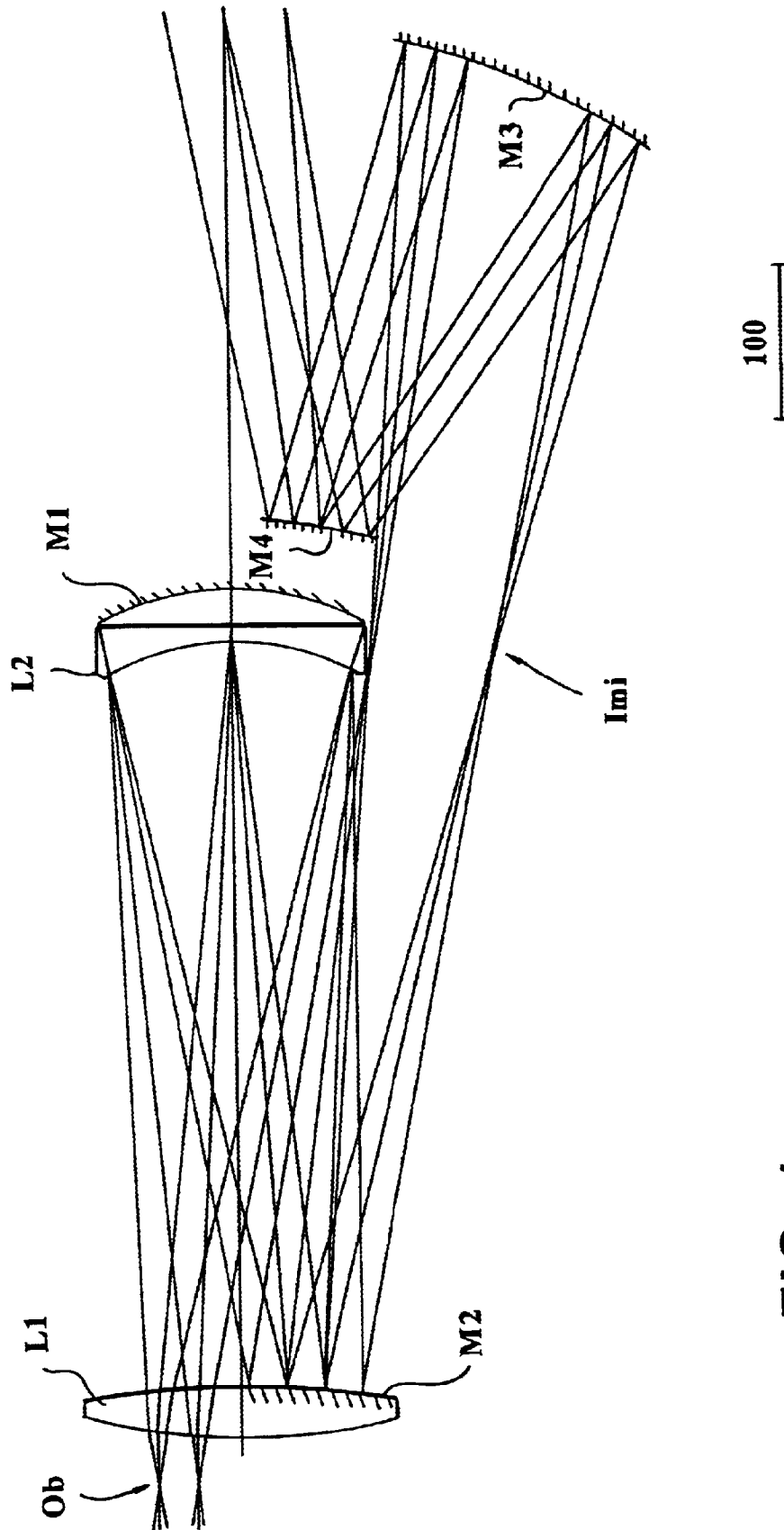


FIG. 1

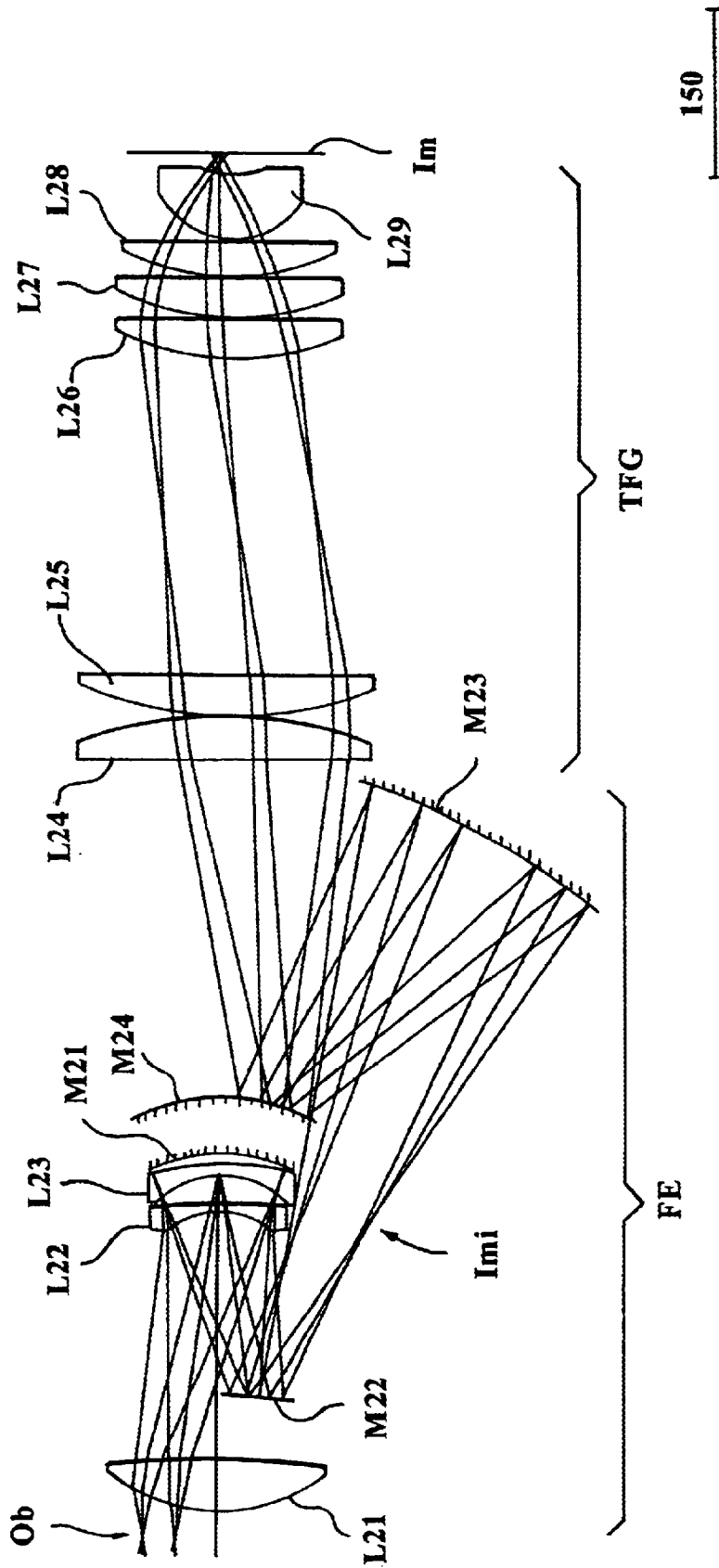


FIG. 2

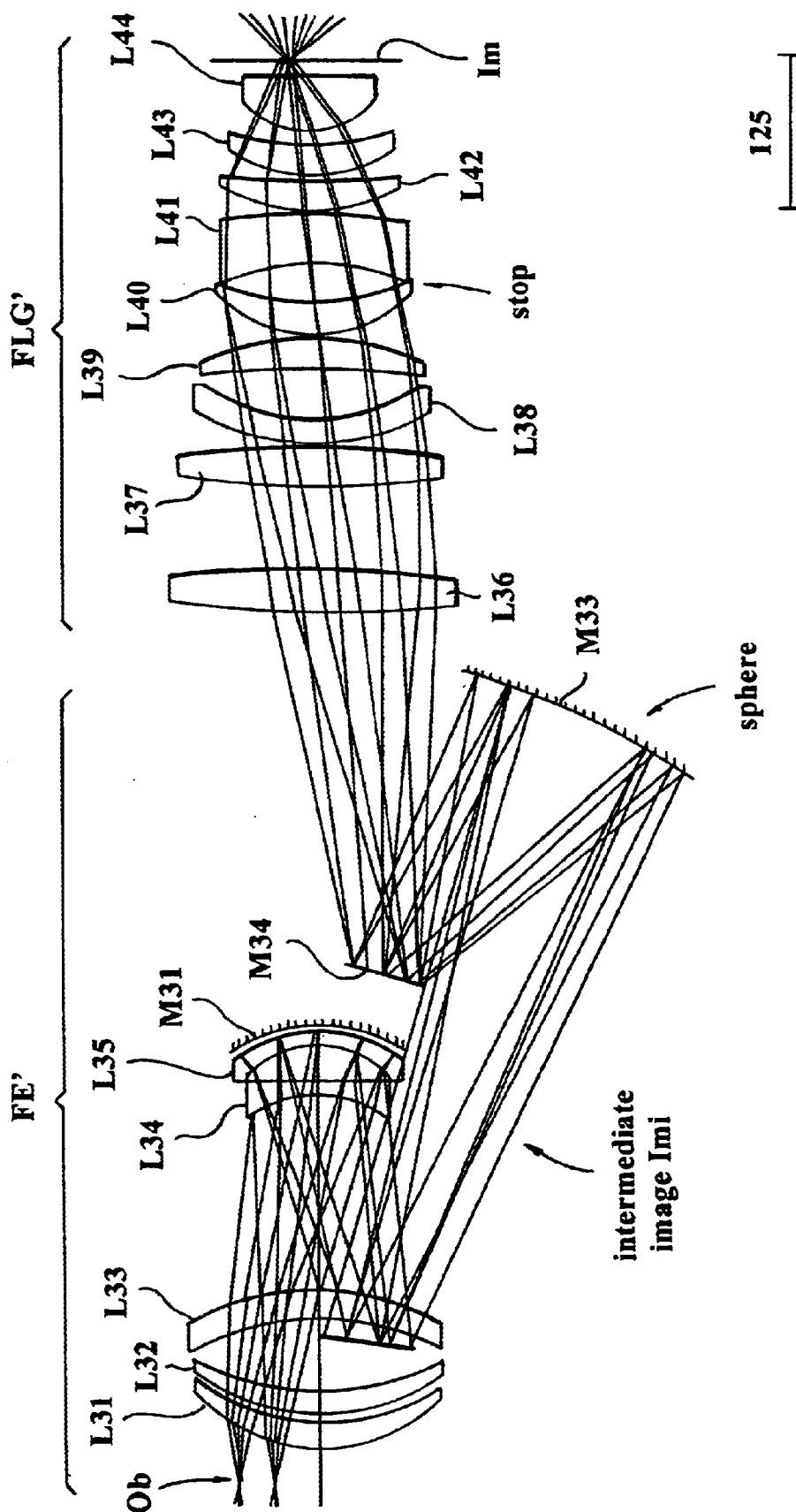


FIG. 3

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