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(54) **CATADIOPTRIC OPTICAL SYSTEM WITH TOTAL INTERNAL REFLECTION FOR HIGH NUMERICAL APERTURE IMAGING**

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

(75) **Inventors: Masatsugu Nakano, Tucson, AZ (US); Jose Manuel Sasian-Alvarado, Tucson, AZ (US)**

(57) **ABSTRACT**

(73) **Assignees: The Arizona Board of Regents on behalf of the University of Arizona, Tucson, AZ (US); CANON KABUSHIKI KAISHA, Tokyo (JP)**

A catadioptric optical system includes, in order from an object side to an image side and arranged along an optical axis, a first catadioptric unit, a second catadioptric unit disposed in axial alignment with the first catadioptric unit and with a space therebetween; and a lens group disposed in axial alignment with the first and second catadioptric optical units. Light rays arriving from an object plane undergo a first reflection at the image-side surface of the first catadioptric optical unit, a second reflection at the object-side surface of the first catadioptric optical unit, a third reflection at the image-side surface of the second catadioptric optical unit, and a fourth reflection at the object-side surface of the second catadioptric optical unit. Advantageously, the sum the outward Petzval curvatures is cancelled out by the sum of inward Petzval curvatures.

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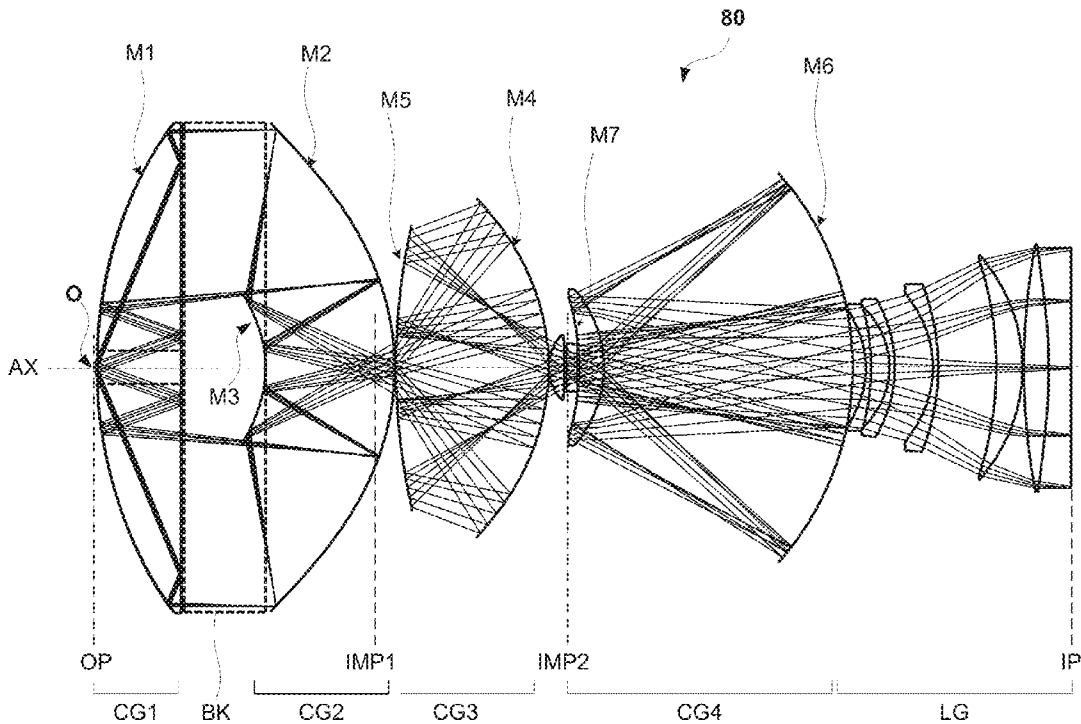
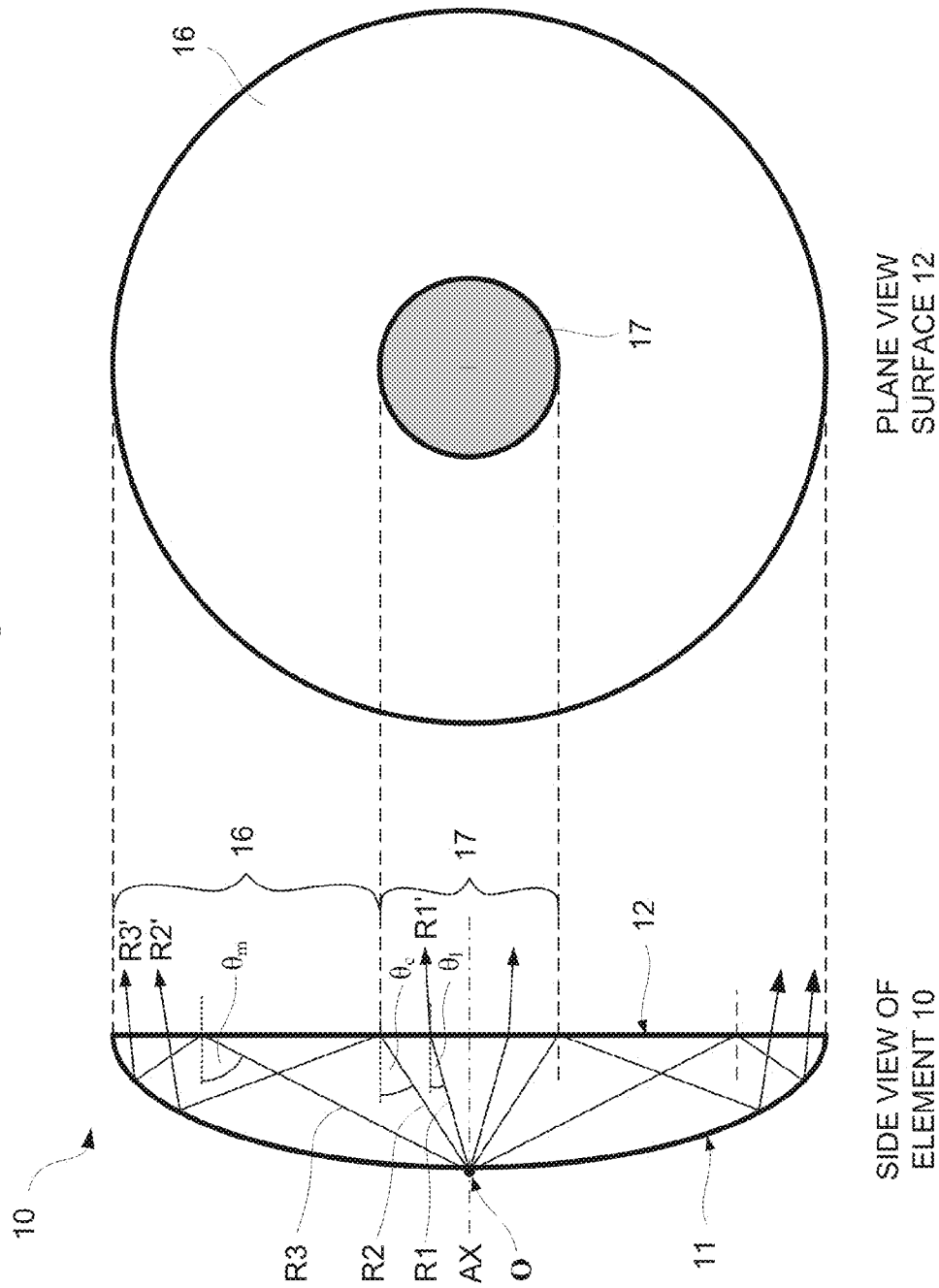


FIG. 1



PLANE VIEW
SURFACE 12

SIDE VIEW OF
ELEMENT 10

FIG. 2

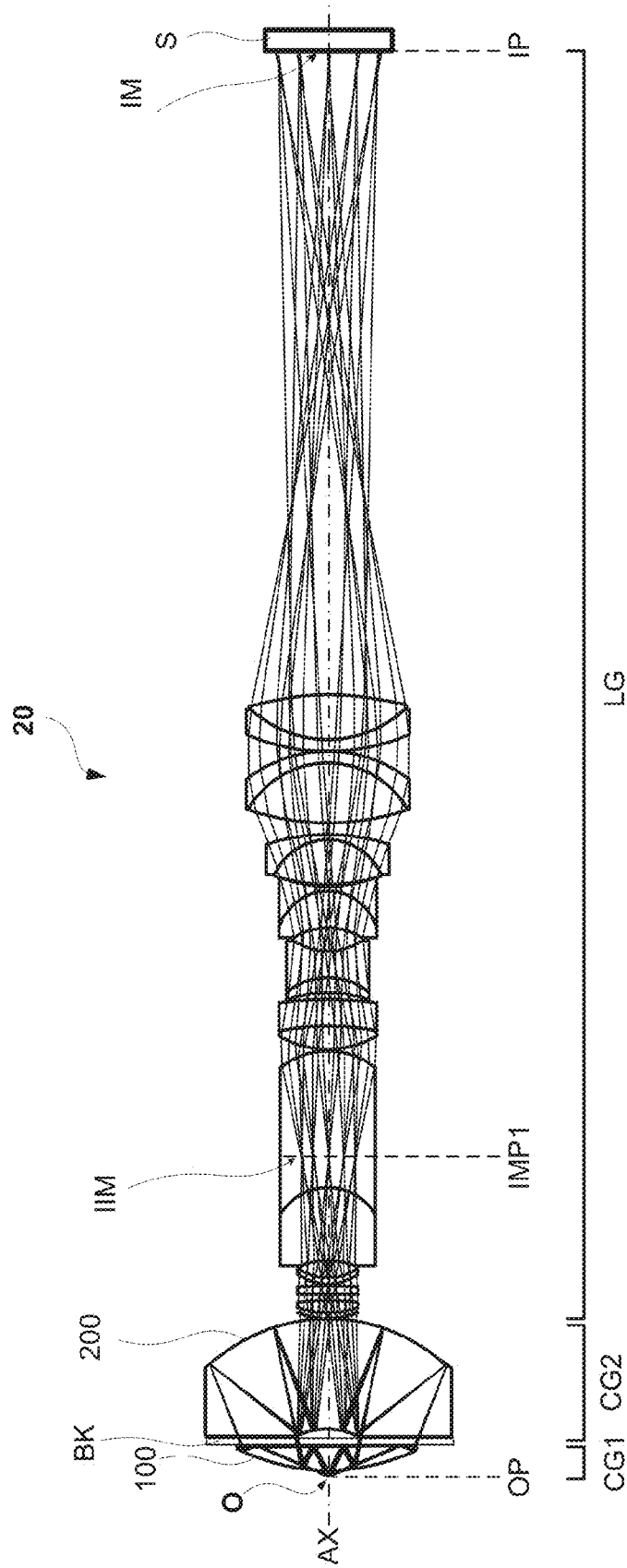


FIG. 3

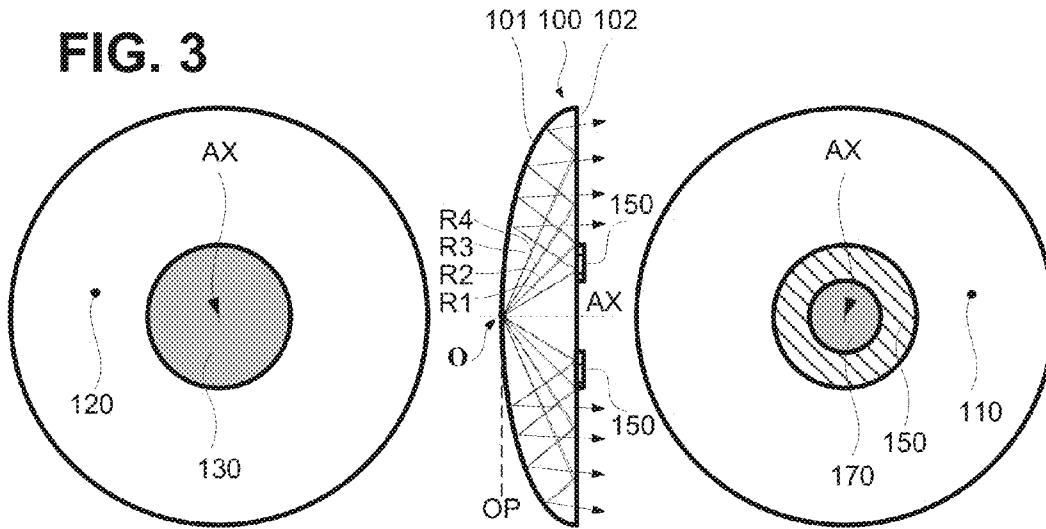


FIG. 4

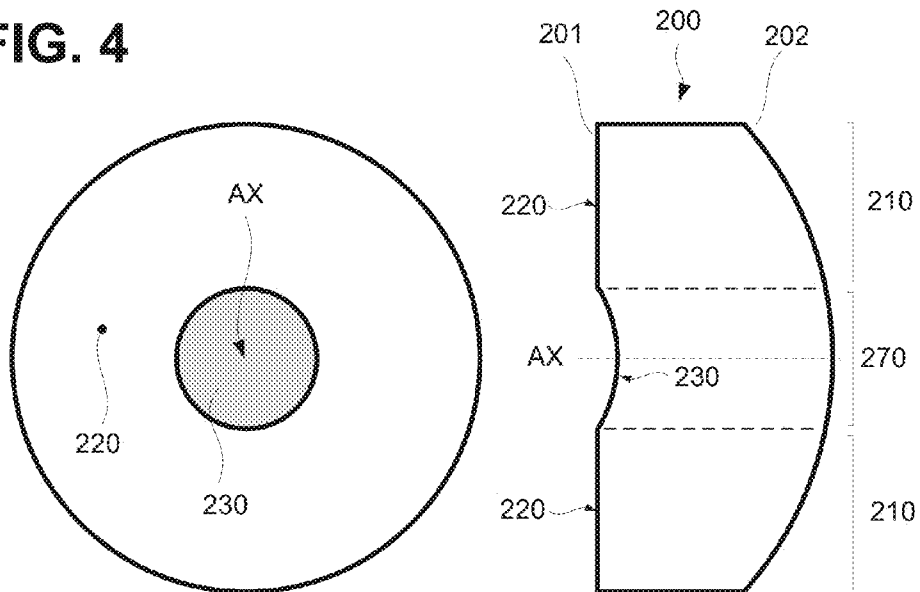
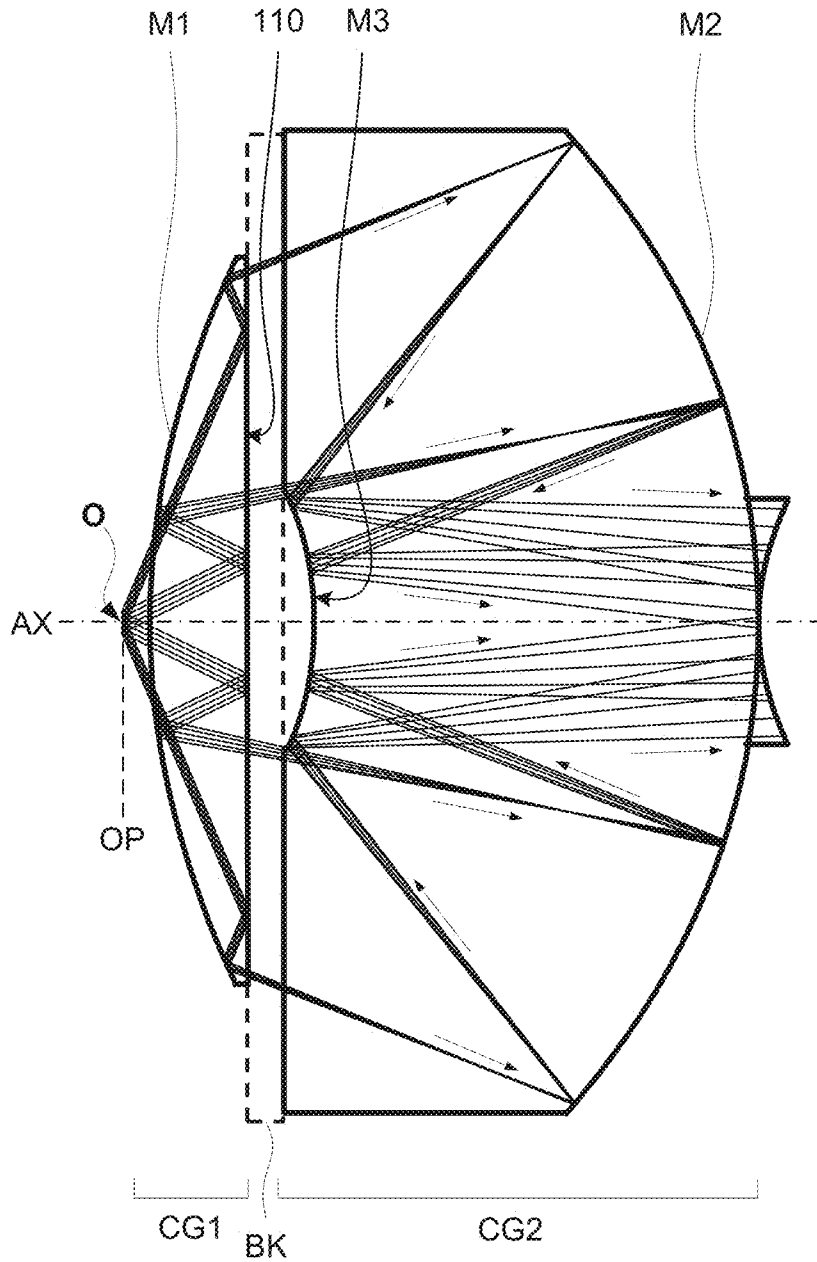


FIG. 5



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