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Cogger et al.

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(54) **MULTI-WAVELENGTH MULTI-LAMP RADIATION SOURCES AND SYSTEMS AND APPARATUSES INCORPORATING SAME**

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(57) **ABSTRACT**

Systems for providing high-intensity and high-quality illumination and other electromagnetic radiation (EMR) to target regions. The systems each include multiple EMR sources and a radiation combiner for combining the output radiation of the multiple sources. In some examples, the EMR sources are visible light sources, such as light-emitting diodes and laser diodes. In some of those examples, the light sources are of differing colors that are combined to form output illumination having user-selected qualities, such as color and intensity. The output of the radiation combiner can be directed into an optical fiber or bundle of optical fibers for remote delivery of the output to a target, such as in endoscopy and remote-illumination microscopy. Systems disclosed can also include additional EMR beams, such as visible light beams used for pointing/targeting and non-visible beams used, for example, for heating and fluoroscopic excitation of dyes/stains, among other things.

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G02B 26/00 (2006.01)

(52) **U.S. Cl.**
USPC **359/618**; 359/298; 359/290

(58) **Field of Classification Search**
USPC 359/811–830, 290–298, 611–630
See application file for complete search history.

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13 Claims, 6 Drawing Sheets

