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Efficient Continuous-Duty Bitter-Type Electromagnets for Cold Atom Experiments DYLAN SABULSKY, PALOMA OCOLA, COLIN PARKER, The University of Chicago, NATHAN GEMELKE, The Pennsylvannia State University, CHENG CHIN, The University of Chicago — We present the design, construction and characterization of Bitter-type electromagnets which can generate high magnetic fields under continuous operation with efficient heat removal for cold atom experiments. The electromagnets are constructed from a stack of alternating layers consisting of copper arcs and insulating polyester spacers. Efficient cooling of the copper is achieved via parallel rectangular water cooling channels between copper layers with low resistance to flow; a high ratio of the water-cooled surface area to the volume of copper ensures a short length scale $\sim$1 mm to extract dissipated heat. High copper fraction per layer ensures high magnetic field generated per unit energy dissipated. The ensemble is highly scalable and compressed to create a watertight seal without epoxy. From our measurements, a peak field of 770 G is generated 14 mm away from a single electromagnet with a current of 400 A and a total power dissipation of 1.6 kW. With cooling water flowing at 3.8 l/min, the coil temperature only increases by 7 degrees Celsius under continuous operation.

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