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High Pressure Microwave Cavity for Use in Magnetic Resonance*

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A sapphire cone terminated at the large end with a metallic sample serves simultaneously as a pressure seal and the resonant structure for a 1-cm magnetic resonance spectrometer.

TWO devices have been described which are useful for the study of paramagnetic resonance under hydrostatic pressure. The design of Walsh and Bloembergen[1] uses a 50-Ω coaxial coupling to a coaxial cavity. With this method resonance experiments at frequencies up to 10 kMc can be performed. Lawson and Smith[2] used a 1-cm circular waveguide coupled into a cavity inside a pressure vessel via a conical sapphire window. Neither of these methods are particularly suited for magnetic resonance in metals. The coaxial method will not operate at sufficiently high frequencies to be useful for some of the broad, low field lines in ferromagnetic metals. In both of the above devices the resonant frequency is greatly affected by the pressure dependence of the dielectric constant of the pressure fluid used. The fluid used with these systems is limited to one with a low loss tangent in order to maintain a high Q in the resonant cavity.

The purpose of this paper is to describe a simple device which can be used for magnetic resonance in metals at frequencies of 24 kMc and higher under hydrostatic pressures up to 10 000 bars. In the method of Lawson and Smith[2] a sapphire cone, acting as a pressure seal, is used to match the microwave power into the pressure chamber containing a resonant cavity. We have found that by

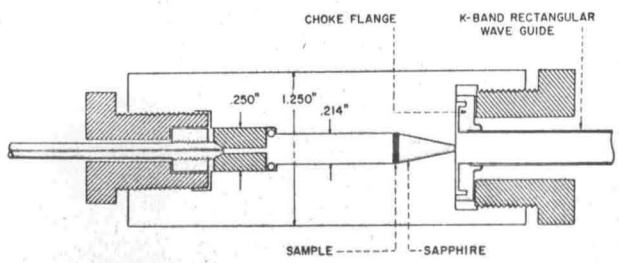

FIG. 1. Microwave bomb showing the sample terminating the sapphire cavity. Not shown is the spring holding the sample in place.

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[1] W. M. Walsh, Jr., and N. Bloembergen, Phys. Rev. 107, 904 (1957).

[2] A. W. Lawson and George E. Smith, Rev. Sci. Instr. 30, 989 (1959).