covering the high pressure end of this cone with a metal, the sapphire itself can be made to resonate owing to the impedance mismatch on the low pressure side.

Figure 1 shows a bomb assembly good for pressures up to 5 kbar with the sample in place. All parts of the bomb are constructed from BeCu. Nonmagnetic stainless steel capillary tubing (3-mm-diam) is used to transmit the pressure fluid into the bomb. A standard tubing connection is used to press the tubing into the half-hard BeCu packing ring. This packing is followed by a neoprene O-ring to make the initial seal. A small nonmagnetic spring is used to hold the sample in place.

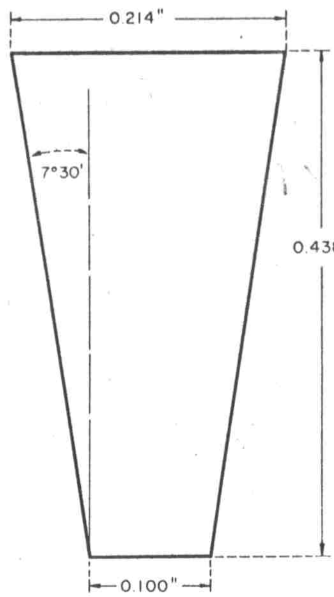

FIG. 2. Dimensions of the sapphire cavity. The length and taper determine the resonant frequency.

The resonant frequency of the sapphire cone is dependent upon both its length and the angle of taper. We have used the dimensions shown in Fig. 2 in order to obtain a resonant frequency of 22.5 kMc. Care must be taken in grinding the sapphire cone to avoid chipping the edges. A small chip in the cone will lift the degeneracy of the resonant TE_{11} mode and cause multiple resonances in the cavity. We have also found by carefully lapping the sapphire into the bomb with a fine diamond lapping compound, no auxiliary binder is needed to seal the cone against leaks. The single crystal cone must be oriented such that the *c* axis of the Al_2O_3 is parallel to the length of the cone. This not only increases the mechanical strength but prevents the anisotropy of the dielectric from elliptically polarizing the microwave fields. In this configuration, the circular TE_{11} mode, with the same polarization as in the external rectangular waveguide, can be excited in the cone.

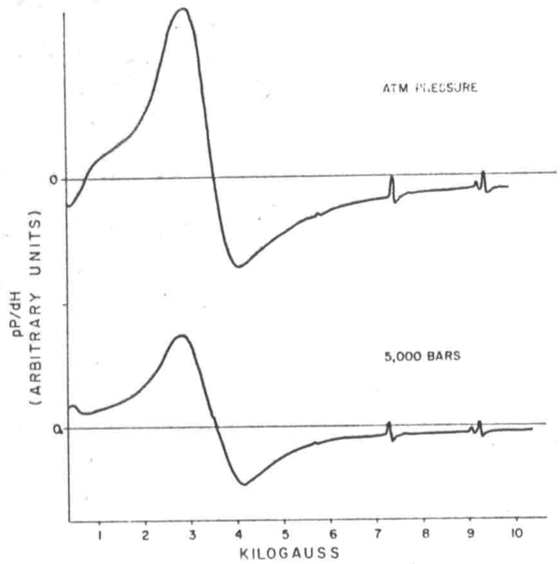

FIG. 3. Derivative of power absorbed by the iron sample vs field at two pressures. The small amplitude, narrow lines at higher fields are due to the Al_2O_3.

The Q of the cavity is dependent upon the parallelism of the cone ends. We have achieved loaded Q's of about 500 which are pressure independent. The Q of the cavity is dependent only on the properties of the Al_2O_3 and sample, permitting the use of a variety of pressure fluids. The resonant frequency is practically independent of pressure, changing less then 2 Mc/kbar.

As an indication of the use of this device, Fig. 3 shows the ferromagnetic resonance absorption in polycrystalline iron at atmospheric pressure and 5000 bars. The sample was a thin disk with the static field applied parallel to the sample surface. A brass mask was placed between the sample and the sapphire in order to expose only $\frac{1}{16}$ of the area of the sample to the microwave power. The derivative curves were taken using a standard K-band spectrometer. At high pressures the field of minimum absorption is shifted below the minimum field available to us in the gap of the iron core electromagnet (less than 100 G).

We are happy to acknowledge the skilled assistance of Steve Greer who constructed the apparatus.