apparatus was calibrated in terms of the hydrostatic pressures needed to induce known phase transitions in different materials.[7] From the calibration curve, the hydrostatic component of the applied pressure could be determined as a function of applied force, measured using a strain gauge load cell.

A 35 megahertz, quartz, x-cut transducer was bonded on the back of one piston and a 30 megahertz, quartz, y-cut transducer was bonded on the back of the other piston; Dow 276-V9 resin was used as a bonding agent. The transducers were maintained free from external stresses by drilling holes in the steel blocks used to apply pressure, see Figure 1. Electrical contact was made with the transducers through these holes. No bonding agent was used between the piston and specimen faces since the applied pressure forces the pistons and specimen together firmly enough to produce good acoustic contact.

It is difficult to resolve ultrasonic pulses from small specimens, and inaccurate time measurements result from transit time techniques. Therefore, an interference technique was used to determine the ultrasonic velocities. This technique was first developed by McSkimin[8] and was adapted to this pressure apparatus by Ahrens and Katz[9] and Gilmore,[7] Figure 2. The transducers were excited, one at a time, by a pulsed oscillator at frequencies in the region of 1/2 the resonant frequency so that the transducer output was approximately independent of small frequency changes. The resulting ultrasonic pulses were reflected internally from the piston-specimen faces, and when the pulse duration was made longer than twice the transit time within the specimen, interference occurred between reflections. The carrier frequency was varied until reflections from the two interfaces were π radians out of phase with each other, and destructive interference between the overlapped reflections was observed on the oscilloscope, Figure 3. At this frequency the internal reflections within the sample were all in phase but were π radians out of phase with the internal anvil