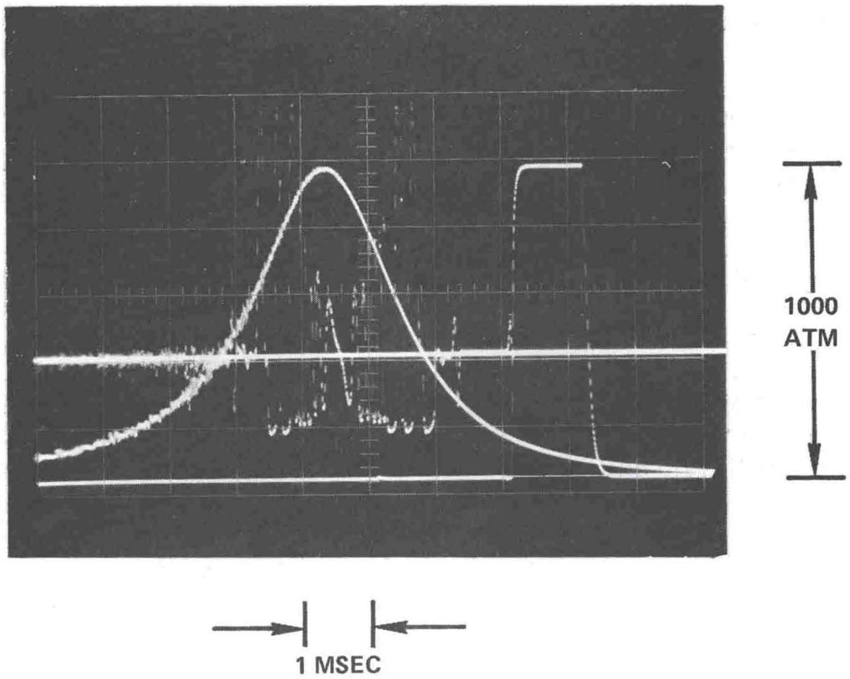

FIG. 2 PRESSURE-TIME RECORD, WITH CALIBRATION PULSE AND MPU OUTPUT.

The piston moves slowly near the end of its stroke when the gas pressure is high. During this high pressure interval, the piston motion is monitored by a magnetic pick-up (MPU) transducer mounted in the side-wall of the high pressure section of the compressor. The MPU senses the passage of steel rings mounted along the circumference of the piston body. The steel rings are separated by nonmagnetic rings and are arranged in a pattern that yields a characteristic "signature" signal from the transducer. This signature can be interpreted to yield piston position, velocity and test gas volume as functions of time.

The compressor is free to recoil on ball bushing mounts in response to forces created by piston motion. To ensure that compressor side-window alignment is correct during the moments of maximum compression, the compressor motion relative to its mounting tables is monitored with a linear motion potentiometer. Compressor recoil motion is highly reproducible for a given piston mass, and the motion potentiometer system permits recoil motion measurements that are more accurate than is required to ensure adequate optical alignment.

For spectroscopic observations during the roughly 100 μs interval corresponding to maximum gas pressure and temperature, a high-speed, electromechanical shutter (reference 3) is installed at the spectrograph entrance slit. To synchronize the shutter opening with the moment of maximum gas pressure, a triggering pulse is derived from the pressure analog signal. Since there is a delay time inherent in the shutter mechanism equal to the interval between trigger pulse arrival and the fully open shutter condition, the triggering point can be obtained by measurement of a pressure record from a previous compressor shot that yielded the desired maximum pressure and temperature. The high voltage firing circuit for this shutter is described in reference 3.

Absorption spectroscopy experiments have been performed with the compressor in a search for new opacity mechanisms in the ultraviolet spectrum of hydrogen (reference 4). For this work, a high intensity flashlamp was used that emitted an intense, short duration light pulse that was directed through the hot, compressed gas via two diametrically opposed side windows in the compressor high pressure test section. The electronic circuitry developed for this flashlamp (reference 5) requires a trigger pulse to synchronize the flash with the peak gas pressure. This trigger pulse is also derived from the pressure analog signal, and a delay time is adjusted to yield good synchronization.

The electronic system discussed in detail in the following sections brings together into one compact package the circuitry required to perform all of the functions described above.