

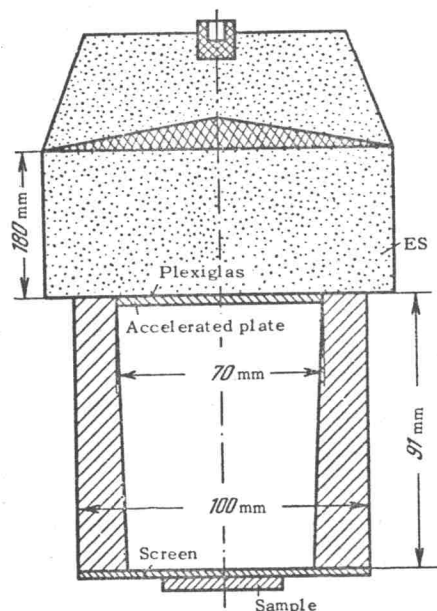


FIG. 9. Acceleration of thin steel discs by explosion products. ES — explosive charge.

One of the devices^[39] intended for investigations by the braking method is shown in Fig. 9.

A 1-1/2 mm steel disc attached to the charge is accelerated to 5600 m/sec by expanding explosion products and passes through a lead nozzle over a distance of 90 mm length.

To minimize the heating of the striker, the accelerated disc is separated from the charge by a thin layer of Plexiglas or by an air gap of 5–6 mm, to ensure a smooth buildup of the explosive-substance pressures. At the end of the path, the disc strikes a screen on which are placed the investigated samples. Analogous systems were described by McQueen and Marsh^[40].

In the investigations of the British scientists Morris and Skidmore^[41], reported in 1962, the striker was a thin steel shell of a hemispherical cumulative charge, striking synchronously the investigated sample, which in turn was made in the form of a spherical segment with outside radius 76 mm. The results of the measurements of the wave velocities were extrapolated to the external surface of the segment, where they were compared with the velocity of motion of the shell at the instant it struck the segment. In^[41] this velocity amounted to ~9 km/sec. In the work of the Soviet scientists, the striker velocities reached ~9 km/sec in^[36-39], and ~14 km/sec in^[42,43] and others.

The rates of displacement of the shock fronts, partitions, and strikers are usually determined with electric-contact pickups introduced in the body of the sample (Figs. 5b and 6b), or placed along the path of motion of the partitions and the strikers (Figs. 5a and 6a). At bases of 5 mm and velocities

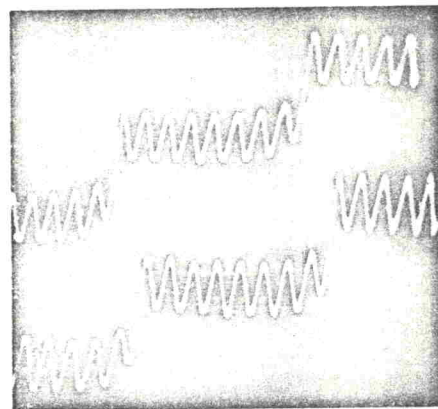


FIG. 10. Oscillogram recording the time between the closings of pickup contacts. The period of the scale sinusoid is 5×10^{-8} sec.

5–10 km/sec, the measured time intervals amount to $(0.5-1.0) \times 10^{-6}$ sec. Modern high speed oscilloscopes can record these intervals with an accuracy of ~1% (Fig. 10).

In the Soviet Union, the electric-constant procedure was developed in 1947–1948 by Tsukerman, Krupnikov, Etingof, and Lebedev, with the author of this review participating^[36]. In the USA, the procedure was developed independently somewhat earlier by Goranson^[44], Mallory^[45], and others.^[28]

Another method of registering very fast processes is based on recording light signals on rotating-mirror cameras. The rate of motion of the beam on the film in such instruments reaches 4–6 km/sec^[46].

In experimental gasdynamical practice, the use of photographic methods for the measurement of detonation speeds is traditional. They found extensive application in the Soviet Union and in the USA from the very beginning also in the study of strong shock waves—for the measurement of wave and mass velocities and the speeds of sound in compressed matter, for recording wave collisions, and for continuous observation of the trajectories of surface motion. Some examples of the use of optical recording by Soviet researchers are presented in Secs. 5 and 6. Photography with a slit photochronograph was used by Walsh and Christian^[47,28] as the principal experimental method. A schematic diagram of the experimental block and of the photochronogram (from^[28]) are shown in Fig. 11.

The moving image of the slot through which the photograph is taken records on the film the successive passage of the shock waves through the gaps on the boundary between transparent Plexiglas blocks and the screen with the samples, and also the striking of the sample against the partition. Glow is initiated when the shock wave enters the gaps and stops several nanoseconds later when the shock wave enters into the plexiglas plates, which lose their transparency upon impact.