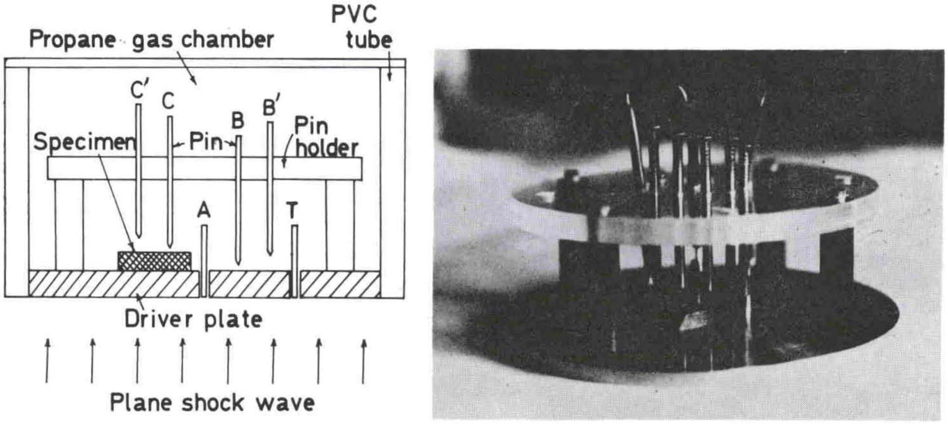

Fig. 5(a) Fig. 5(b)

Fig. 5. Experimental set of the pin-contactor technique for measuring the shock and free surface velocities
(a) Schematic cross-sectional view (b) Photograph (Specimen: TiO_x)

Pin setting is performed by inserting standard block gages as a spacer between the pin and the free surface. A photograph of the experimental set is shown in Fig. 5(b). The precision of pin distances is estimated to be ± 0.01 mm. The precision of time interval measurements is limited mainly by the planarity of the shock wave front. It is important to avoid premature shorting of pins by shock ionization of air. Propane gas is flowed into a gas chamber to prevent it. A pulse forming circuit composed of fast switching diodes is used to obtain sharp pulse signals from the pin-contactors. Since the whole event is completed within a few μs, the sweeping speed of the synchroscope is chosen to be 0.5 μs/div or 0.2 μs/div, so that the time is detected with a precision of 10 ns.

Shock compression curves of TiO_x ($x=0.84$, 1.06 and 1.28) determined at pressures up to 600 kbar were described in ref. 8, together with an example of the synchroscope record of pin signals. It is to be mentioned here that TiO_x containing plenty of vacancy sites is rather incompressible even in this ultrahigh pressure region; no evidence is found for significant filling of vacancies.

2. *Streak-photographic method*

A streak-photographic method provides more reliable and informative data on the shock wave than the pin-contactor method. A rotating-mirror streak camera with a high frequency synchronous motor, was manufactured by the workshop in our institute. Details of this camera was described in a previous paper[17]. In this camera, an object is viewed through a slit, whose image is swept in an orthogonal direction by a rectangular flat rotating mirror. Thus the film records a one-dimensional space vs. time plot. The writing speed is 3–10 mm/

(17) J. Nakai, T. Goto, Y. Syono and Y. Nakagawa, Sci. Rep. RITU, A**25** (1975), 173.

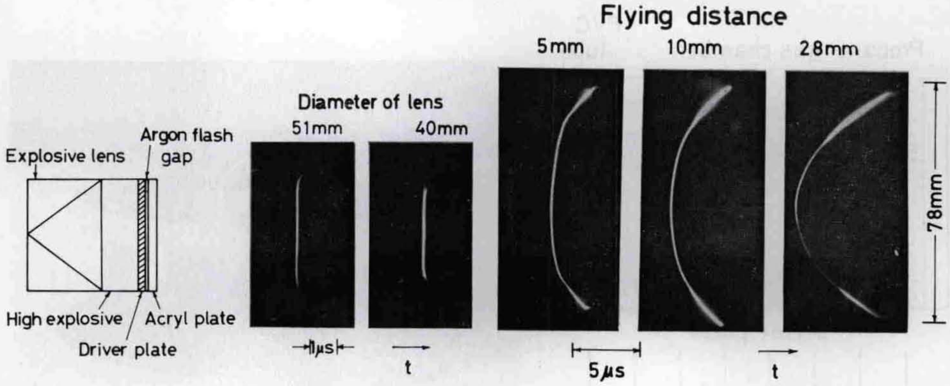

Fig. 6(a) Fig. 6(b)

Fig. 6. Planarity of the plane shock wave generators
(a) In-contact method (b) Flyer method
The flyer plate 78 mm in diameter and 3 mm thick is propelled by 30 mm thick Pentolite pad

μs, depending on the revolution of the rotating mirror. The time resolution is approximately 10 ns at best. A combination of two photographic camera lenses (an objective lens of f=300 mm, F4.5 and a relay lens of f=50 mm, F2) gives almost an equal size image of an object on the film at a distance of about 5 m. Using this streak camera, the following two techniques have been tried for the shock compression study.

1) *Argon flash gap technique*

One of the simplest optical method to detect the shock arrival is to utilize a brilliant light flash generated by shock-heated argon gas confined in a small gap. The argon flash gap technique is quite useful for the test of planarity of the plane wave generators shown in Fig. 2. Instead of the specimen, an acrylite plate is placed on the driver plate. A gap of about 0.1 mm between the acrylite plate and the driver plate is filled with argon of atmospheric pressure. The shock arrival gives rise to the motion of the driver plate which closes the gap, resulting in an emission of brilliant light. The light is viewed with the streak camera through a narrow slit; film records are shown in Fig. 6. Lines on the photographs exhibit the planarity of the plane wave generators: the in-contact method gives excellent results, while the flyer method is rather unsatisfactory, especially, in the case where the flying distance is large, as already mentioned in Section III.

An experimental set for the Hugoniot measurement using the argon flash gap technique[(12),(15)] is illustrated in Fig. 7. Specimens and acrylite blocks are assembled in a direction across the diameter of the driver plate and viewed through the slit of the streak camera. Each acrylite block is covered with an iron shim of 0.1 mm in thickness made of a piece of thin razor blade, as shown in Fig. 8. The gap filled with argon gas between the acrylite block and the iron shim is separated