

DESCRIPTION OF APPARATUS

The apparatus is shown in plate 1, and schematically in figure 1. A Blackhawk 20-ton ram pushes the pistons together in a homemade press. The ram is activated by a hand pump through a manifold valve which allows operation of five presses simultaneously. Each ram is fitted with a U. S. Gauge Company 10,000 lbs/in² gauge. A 700 bar Heise gauge is connected to the manifold valve and is used to check these gauges. Rudimentary measures are taken to provide coaxial alignment of the pistons. Alignment has not been found to be critical, fortunately, since thermal distortions make exact alignment very difficult.

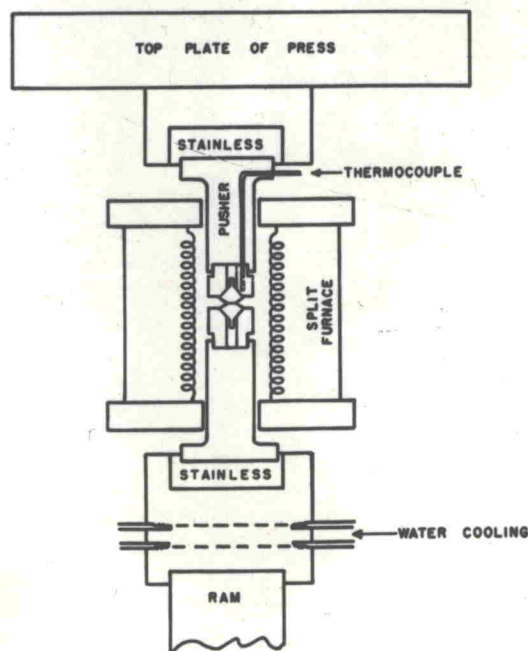


Fig. 1. Schematic drawing of apparatus.

The pistons, holders, and pushers are heated by a Hevi duty Electric Company split furnace type 123-1 of 400 watts capacity. This furnace is run over-voltage for temperatures above 700°C by means of a variable transformer. Temperature is controlled by a Brown Pyrovane controller, operated by a thermocouple inserted in the furnace winding, to respond to heater element temperature.

Materials with the highest compressive strength are most desirable for the pistons. Such materials are brittle and must be subjected to confining pressure to prevent brittle fracture. This confining pressure is provided by making the pistons conical as shown in figure 2. Two cone angles have been used: 20°, and 45° half-angle. Neglecting friction, the normal stress on the cone surface is given by the force divided by the area of the cone surface