

Mc CARTNEY

TETRAHEDRAL ANVIL PRESS

For Pressures to 2,000,000 P.S.I.

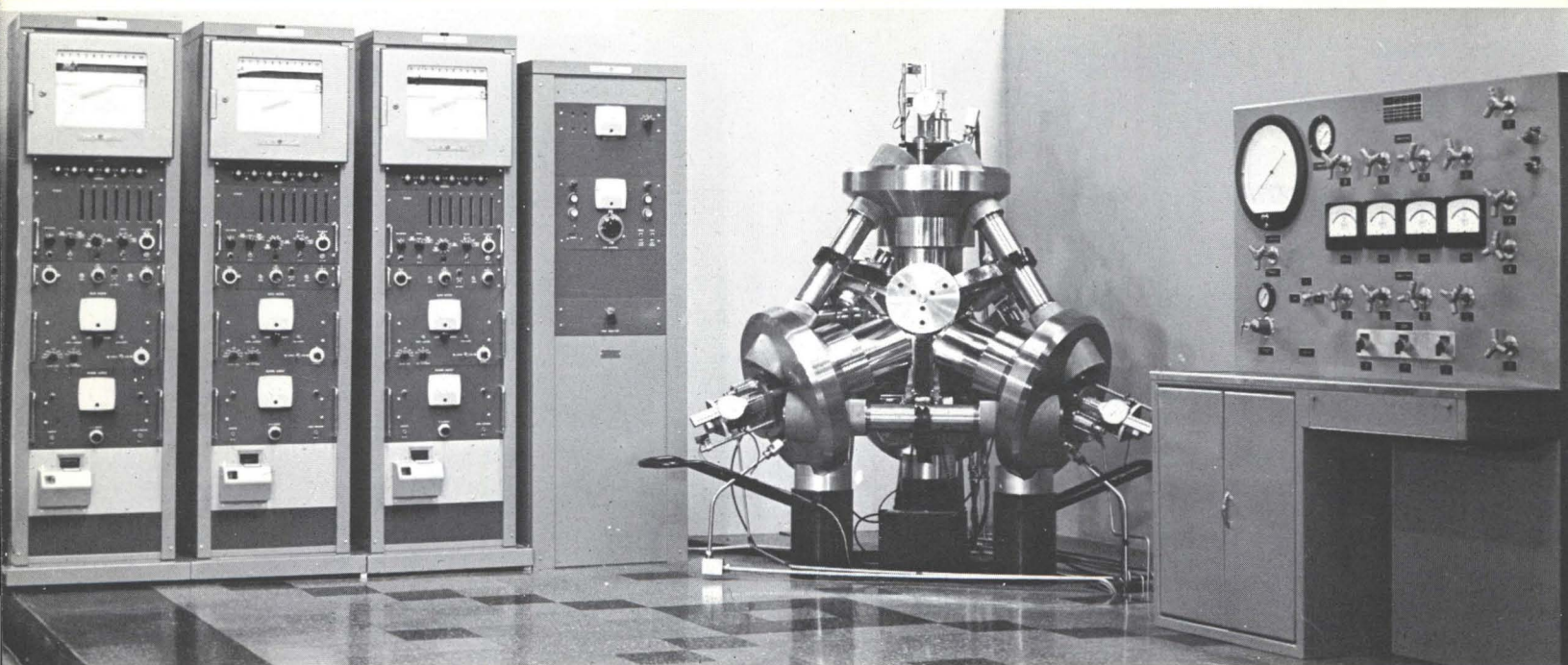
SECTION 800-1
Revised 10-64

PROCLAIMED—"The most versatile type of high pressure machine in existence" — the Tetrahedral Anvil Press and associated x-ray equipment, will permit researchers to instantaneously observe and measure phase changes which take place in the crystal structure of materials under pressures up to 2,000,000 lbs. per square inch and with temperatures up to 1000°C (for a limited period of time).

The Press can be a tremendous aid to engineers, geologists, physicists and chemists in observing the behavior and capabilities of metals and compounds.

Pressure is increased until the plastic is extruded from between the anvils to form a gasket seal.

Two x-ray tubes (one directed between two rams and the other located in a cylindrical cross-axis hole in one of them) with molybdenum targets, are mounted on the press so that x-rays from the sample can be detected from different angles. When the tube in the ram is excited, the x-ray beam passes through a collimator along the axis of the ram and emerges through a small hole in the center of the anvil. As the x-rays from either tube strike the sample, diffracted rays pass out of the

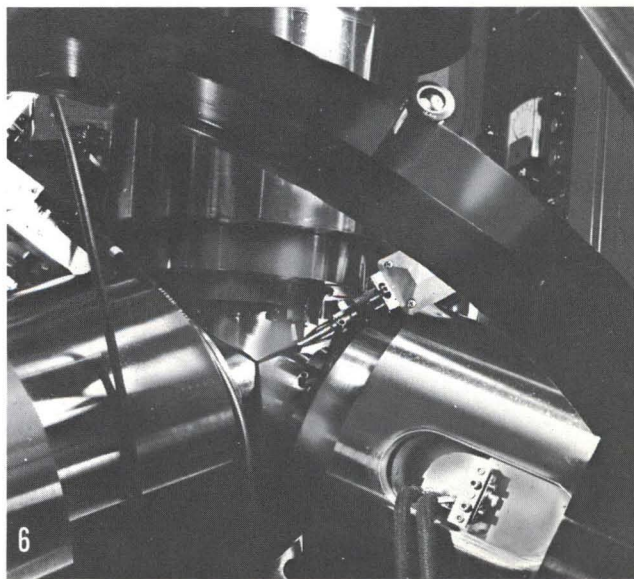
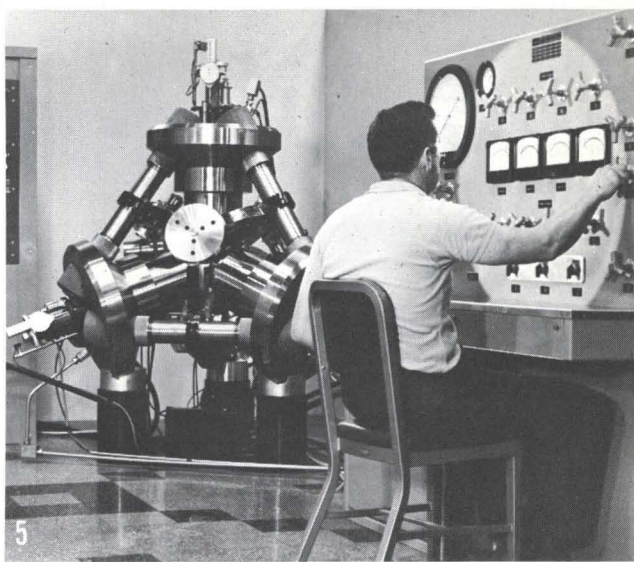
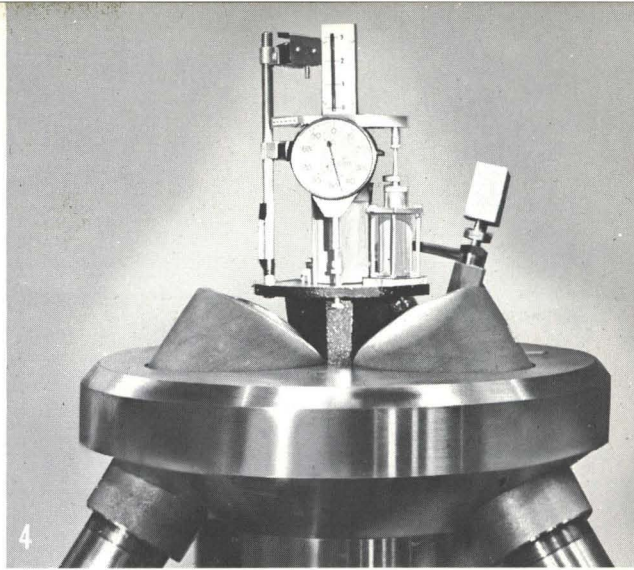
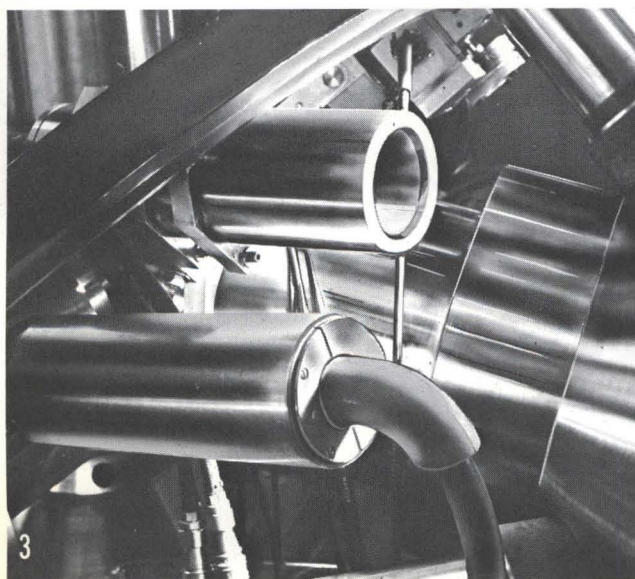
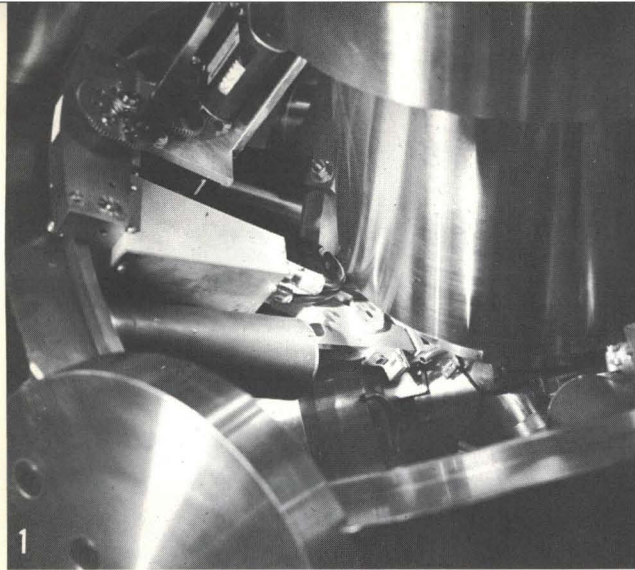


The Tetrahedral Anvil Press and equipment shown above consists of four hydraulically operated rams equipped with carbide anvils, two separate x-ray tube systems, three x-ray detection systems, a high voltage x-ray power supply and a control console.

Boron-filled plastic used to encase samples in the die has desirable frictional and pressure transmitting properties and is relatively transparent to x-rays. The hydraulic rams, each exerting 600 tons pressure, are brought together so that the anvils form a pressure chamber for the sample, which has been inserted.

pressure chamber through the thin gasket of the extruded plastic, and are detected by scintillation counters. Each counter is connected to a strip chart recorder, rate meter and scaler for visual indication or printout of detected signals.

The detectors are mounted on geared carriages . . . one for each axis . . . which move along a circular track to scan the 20 angles characteristic of x-ray diffraction. Each of the scanning tracks lies in a plane which passes through the axis of the x-ray tube ram and the axis of one of the other three rams.



- (1) Shows x-ray preamplifier unit and carriage, as well as three anvils in the center extending from the high pressure cylinders.
- (2) Shows the optical piece used by the operator to visually check the alignment of the anvils.
- (3) Shows the two x-ray tube mountings. Lower mount goes through the piston and up to the sample.

- (4) Shows the top ram base and the position indicator for locating the anvil from center reference point.
- (5) Shows remote hydraulic control at the control console for positioning the anvils in the press.
- (6) Shows x-ray tube mountings from opposite side. Upper mount has a collimator directed between the anvils to the sample. Lower mount shows x-ray tube mounted in the piston. Photo also shows optical piece for center alignment of anvils.

BRIGHAM YOUNG UNIVERSITY
PROVO, UTAH



EARL C. CROCKETT, ACTING PRESIDENT

November 27, 1964

RESEARCH DIVISION

McCartney Manufacturing Company
635 West 12th Street
Baxter Springs, Kansas

Gentlemen:

I am writing to express my appreciation for the excellent work that you have performed in building various pieces of high pressure/temperature apparatus to our design and specifications. We have had various high pressure components constructed by several manufacturing organizations and have had, by far, the most satisfactory results from components made by your firm. I am happy to see that Research Corporation has licensed you to manufacture Tetrahedral Presses. This will make it possible for many laboratories to purchase the top quality apparatus made by your firm. I might also mention that I am very pleased with the Tetrahedral X-ray Diffraction Press that you recently completed for the French Government.

Perhaps the most interesting discovery made with this type of device is the fact that ytterbium could be caused to transform from a close-packed face-centered-cubic structure to a non-close-packed body-centered-cubic structure by the application of 40,000 atmospheres of pressure. This is the first time that such a pressure-induced phenomenon has been observed. We have followed the melting point of tin as a function of pressure and have determined its phase diagram up to about 700°C and 120,000 atmospheres by means of this device. The pressure resolution of the Tetrahedral Press exceeds that of any other type of apparatus. Consequently, we have been able to discover a new phase of cesium previously overlooked by all high pressure researchers. Although this phase exists over the small pressure range of 0.5 kb, we were able to determine its structure at approximately 42.5 kb in the X-ray Diffraction Press.

Of course the X-ray Press can be used as a conventional Tetrahedral Press for the synthesis of diamond, coesite, and other materials in addition to being used to take x-ray diffraction patterns under high pressure/temperature conditions.

Again let me thank you for the quality of your workmanship.

Very truly yours,

H. Tracy Hall
H. Tracy Hall
Director of Research
Room 224 ELB

HTH/lw

McCartney Manufacturing Company builds the Tetrahedral Anvil Press under license from Research Corporation in New York and in consultation with Dr. H. Tracy Hall, Director of Research, and Dr. J. Dean Barnett, Associate Professor of Physics at Brigham Young University.

The name "McCartney" has been associated since 1946 with the manufacture of high pressure equipment to rigid specifications and close tolerances, with the assurance of quality and trouble-free performance. The company specializes also in the finishing of tungsten-carbide

for applications other than machine tools. Equipment requirements of many of the major manufacturers of high pressure polyethylene are made by "McCartney."

Prompt attention will be given to your inquiry.

McCARTNEY

"SERVING THE FUTURE TODAY
With Extreme Pressure
Equipment"

Manufacturing Company, Inc.
BAXTER SPRINGS, KANSAS