Reactor on the Ready; Dragon Fur for Bearings

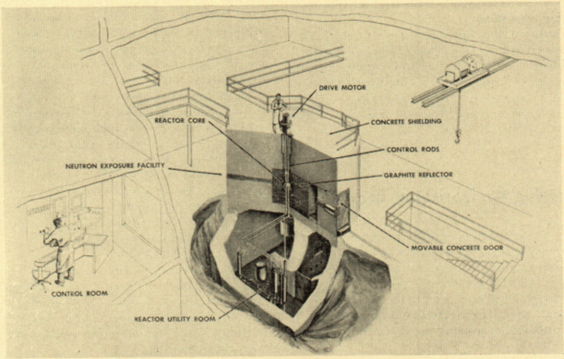
Armour Research Foundation starts up first private reactor aimed solely for industrial research

Fluorocarbon fibers—a new material for nonlubricated bearings operating under severe conditions

SOMEDAY not too far off nuclear reactors may be no rarity in the process industries. A milestone in that direction was passed just about a month ago with the announcement from Armour Research Foundation that its new research reactor had gone critical. For the first time, points out Richard F. Humphreys, director of Armour's reactor program, industry can conduct reactor studies without security restrictions and military competition.

The Armour reactor marks another first, too. Not since the original installation at the University of Chicago has a reactor been constructed in such a highly populated area as the Illinois Institute of Technology campus on Chicago's near south side.

The reactor, built for ARF by North American Aviation's Atomics International Division, is intended for use as a neutron and gamma ray source, not for generating electricity or for research on reactors themselves. Its primary job probably will be the production of radioactive



samples. Since over half of all neutron-induced radioisotopes have half lives of less than a day, ARF sees some obvious advantages to having a source of such radioactivity close at hand to supply tracers for its other research facilities. Such short-lived tracers do not leave significant radioactivity behind in a material over an appreciable length of time.

The reactor has other research applications which should appeal to the process industries. It makes possible:

- Study of the influence of radiation on chemical reactions, plastics, organic systems, and metallic alloys, as well as cold sterilization of foods.
- Chemical analysis by neutron activation—one of the most sensitive methods for determining trace impurities by tagging materials.
- Structure analysis by neutron diffraction; since diffraction of neutrons is almost independent of atomic weight, the method does not have the limitations of standard x-ray diffraction techniques and may prove valuable for structure analysis of light elements in the presence of heavy elements, as well as for studying organic compounds or hydrogen and oxygen in solids.

The ARF installation is a homogeneous solution or "water boiler" type of reactor capable of operating at a power level of 50 kilowatts. Fuel consists of enriched uranium (in the form of uranyl sulfate) dissolved in about four gallons of water. Fission, which takes place in a spherical steel core measuring about one foot in diameter, is controlled by four boron rods. The core is surrounded by a stack of graphite bars which act as a reflector and by five feet of dense concrete for a shield.

A feature of the unit is its "self-contained" design which confines all the radioactivity within the shield. No gaseous or liquid materials are exhausted or discharged. The hydrogen and oxygen produced by radiolysis of the solution water are recombined and the resulting water returned to the core tank.

Fibers for Nonlubricated Bearings

Fabrics woven from tetrafluoroethylene fibers are the key to a development which may eliminate conventional lubrication in many types of bearings. This is the word in a recent announcement from Du Pont, which has worked with American Metal Products Co. in producing a new automobile suspension joint using Teflon fiber.

Although automotive applications may be the door opener, many other frictional uses of tetrafluoroethylene fiber which could eliminate the need for lubrication are also under development. Among them:

- Spherical parts such as rod ends and ball-socket joints for special controls and self-aligning bearings.
- Cylindrical parts such as seals, bushings, pistons, and sleeve bearings for all types of machinery.
- Flat or sliding parts.

The development, says Du Pont, represents a new tool for solving many mechanical problems encountered in the lubrication of hard-to-reach parts or in operation of frictional parts in extreme temperatures or corrosive chemical environments. One promising use is in bearings and other frictional parts on food and textile processing machinery where contamination of the product from lubricants poses a difficulty.

Teflon fibers, however, are expected to be used primarily in bearings and joints subject to intermittent motion. Conventional lubrication appears to be better in bearings subject to continuous motion at high speed under high load.

The fiber counterpart to tetrafluoroethylene resin was introduced experimentally by Du Pont three years ago and is now available commercially as staple fiber, tow, and continuous filament. It is so indestructible that Du Pont chemists have nicknamed it "dragon fur." It can be boiled in sulfuric or nitric acid or in alkalies without harm and will withstand temperatures up to 500° F. In addition, it has a very low coefficient of friction and can be used under heavy loads—the major reason it seems promising for high-load bearings where other plastics are unsatisfactory.

At temperatures above 400° F., however, precautions should be observed. Toxic vapors are given off when Teflon is exposed to high temperatures, although adequate ventilation provides ample safety. Care should be exercised, too, not to contaminate smoking tobacco with the material; cigarettes should not be carried into areas where they might become contaminated. Other than at elevated temperatures, though, Teflon is unusually inert, nontoxic, and nonirritating, Du Pont points out.

Largest single application of Teflon fiber to date is as packing material for chemical-resistant valves and pumps. Other uses include filters for corrosive liquids and gases, electrical and thermal insulation, and diaphragms and gaskets for chemical processing.