Equipment

The information reported here is obtained from manufacturers and from other sources considered to be reliable. Science *does not assume responsibility for the accuracy of the information. A coupon for use in making inquiries concerning the items listed appears on page 1098.*

■ VACUUM ARC FURNACE is rated at 3000 amp maximum and handles up to 40 lb titanium or 70 lb steel. Fixed or consumable electrodes may be used. The latter are fed automatically. A mechanical pump reduces pressure from atmospheric to 1 μ-Hg in 40 sec. The furnace is available as an integrated unit or with separate control desk. (Consolidated Electrodynamics Corp., Dept. 433)

■ DOUBLE-PULSE GENERATOR produces two separate or mixed outputs at variable repetition rates and separations and independently controllable in width, amplitude, and polarity. Repetition rates may be varied from 200 cy to 2 Mcy/sec. Pulse width and separation may be varied from 0.1 to 100 μsec. Output from each channel may be varied ± 35 v into a 93-ohm load. (Electro-Pulse Inc., Dept. 435)

■ FLOWMETER measures gas or vapor flows as low as 1 cm^3/hr and up to 10 cm^3/min or higher. Flow is sensed as pressure drop across interchangeable, precisely-formed channel. Read-out is provided by a sensitive differential-pressure gage. Electrical outputs suitable for recorder actuation are also available. Corrosive gases can be handled. (George K. Porter, Inc., Dept. 436)

■ ELECTROMECHANICAL SCANNER scans in either a horizontal or a vertical plane. A desk-height plotting table with printing stylus provides printed read-out conforming to detector position. Automatic motor-driven scanning is normally rectilinear. Motion on the x-axis is continuous; x and z motions are step-wise, with adjustable spacing. (Automation Inc., Dept. 438)

■ REMOTE MANIPULATOR includes a lateral displacement mechanism that enables the slave arm to be displaced 30 deg with respect to the master arm, thus providing increased coverage of the hot cell while permitting the operator to remain seated in front of the shielding window. A stereoscopic television camera, controlled by foot pedals, permits viewing of areas not visible through the window. (W. G. Pye Ltd., Dept. 439)

■ SQUARE-ROOT INTEGRATOR for use with flowmeters provides a continuous means of totalizing flow. The device utilizes a double disc and ball mechanism. With a given speed on the lower disc, the upper disc and counter turn at a speed pro-

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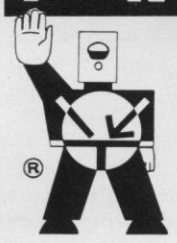

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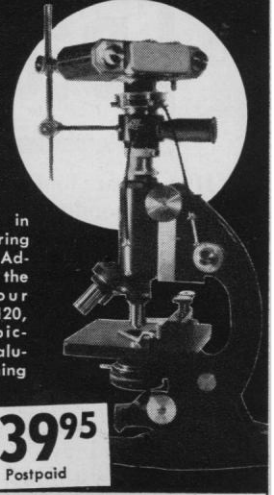

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portional to the square root of the displacement of the balls from the center of the disc. Linearity is 0.25 percent of full-scale, repeatability is ±0.5 percent. Maximum input speed is 60 rev/min. Input shaft torque is 0.35 in.-oz. (Librascope Inc., Dept. 440)

■ ALIGNMENT TELESCOPE consists of a 17-in. telescope and an 8-in. reflector. The telescope remains fixed while the reflector moves along the line of inspection. Discrepancies are measured between the optical center of the reflector and the optical axis of the telescope within the limits ±0.04 in. Flatness, alignment, and concentricity are measured to 0.00005 in. Addition of a divergent lens to the telescope permits angular measurements. Precision of ±0.25 sec is obtainable. (F. T. Griswold Mfg. Co., Dept. 441)

■ EXPERIMENTAL EARPHONES effect noise reduction by furnishing an interfering wave. A miniature microphone in the earpiece creates a signal opposite in phase and equal in amplitude to the ambient noise. Low-pitched sounds are reduced to one-tenth their original volume. Higher pitched sounds are absorbed by a foam cushion. (Radio Corporation of America, Dept. 442)

■ VERTICAL ILLUMINATOR for stereoscopic microscope provides vertical shadowless illumination of deep, small-diameter orifices when the angle is too acute for standard oblique illumination methods. The illuminator consists of a lamp housing with bracket for attachment to the manufacturer's microscope stand, a vertical reflector, and a variable transformer. (American Optical Co., Dept. 444)

■ GAS CHROMATOGRAPH achieves detection by burning gases emerging from the column and monitoring the temperature of the flame. A thermocouple of very low thermal inertia is used to measure flame temperature. A mixture of hydrogen and nitrogen is used as the carrier gas. Exit gas is ignited initially by a spark. A regulated compressed-air supply is fed into the combustion chamber to support combustion. On full sensitivity, 10^{-7} g of hydrocarbon per milliliter of carrier gas is said to be detectable. The area of the chromatogram peak, corrected for heat of combustion, is proportional to the weight of the substance present. Sensitivity and stability are independent of temperature. Substances with boiling points up to 375°C can be analyzed. (Shandon Scientific Co., Ltd., Dept. 448)

■ CARBON-14 LABELED COMPOUNDS listed in 1958 catalog include 38 new compounds. Prices and ordering information are given. Among the new compounds are guanine-2-C^{14}, guanine-8-C^{14} and thymine-2-C^{14}. (Research Specialties Co., Dept. 454)

■ CENTRIFUGE features a control panel that may be lifted out of the basic instrument housing for remote operation. Interchangeable rotors provide versatility. Among these are an anodized aluminum rotor providing forces up to 34,800 *g* with capacity of 400 ml divided among eight compartments; an eight-tube continuous flow system; and an eight-cell particle-counting rotor (Ivan Sorvall, Inc., Dept. 453)

■ PERMANENT MAGNET has field strength 1,717.5 gauss ±0.1 percent and maximum field inhomogeneity at gap center of 40 mgauss over a 2-in. region. Gap is 2-in. thick by 10-in. in diameter. Series-connected sweep coils provide a maximum sweep amplitude of 40 gauss peak-to-peak with current sensitivity of 750 mgauss/ma. Weight is 375 lb. (Schlumberger Well Surveying Corp., Dept. 447)

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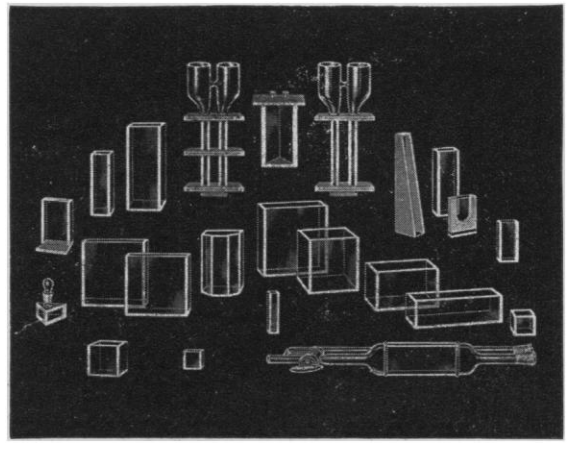

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ARE YOU OVERLOOKING SOME OF THE MOST CRITICAL CHALLENGES IN THE MATERIALS FIELD?

Listen in on this interview with Dr. A. E. Focke, Manager Materials Development at General Electric's Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio

Q. ***Dr. Focke, I have heard it said that the Aircraft Nuclear Propulsion Program adds a new dimension to materials technology. Do you agree?***

A. Strictly speaking, Mr. Walsh, reactor development for any application may be said to do this, since materials must be selected for their nuclear as well as their physical properties.

For some applications we look for high neutron absorption cross sections; for others, low capture cross sections.

For example, the material selected for the *moderator* must be capable of slowing down the neutrons produced by fission to thermal energy, about 1/40 ev from their original energy of several million ev with a minimum loss of neutrons by parasitic capture. *Control rods* on the other hand, must have high capture cross section for neutrons.

In practically all material applications for the nuclear power plant for aircraft which we are developing here, however, we have a high temperature problem of dimensions unique in materials technology.

Q. ***Why is that, Dr. Focke? Aren't these problems similar to those already solved for marine nuclear propulsion?***

A. In the ANP program weight and size are severely limiting factors. Here we are dealing with a small, high density reactor a small fraction of the size and weight of the submarine reactor. To jam high energy into small volume requires the development of high temperatures. Generally the higher the reactor exit-air temperature, the better the overall performance of the power plant.

The crux of the problem here is the fact that common materials desired for some parts of the reactor for nuclear considerations, cannot operate at the maximum temperature of the over-all system.

These charts, prepared for a recent paper will give you a better conception of the materials problem. Fig. 1 summarizes the general requirements. Figs. 2, 3 and 4 review a few of the basic physical properties of each of 11 metals selected for discussion.

Q. ***Can a materials man work effectively at ANP without previous training in nucleonics?***

A. Certainly. All the orthodox skills of the metallurgist, ceramist or chemical engineer are called into play here. The Aircraft Nuclear Propulsion Department will provide necessary training and information in nucleonics.

Q. ***What you've just told me, Dr. Focke, I certainly can discern the challenge to the materials man that you have here. I suppose you are working with alloys of some of the more exotic metals so much discussed in the latest technical literature?***

A. Security limitations forbid my naming specific materials on which we are concentrating our investigations at this time. We have, however, made considerable progress, though a great deal of work remains to be done before our first high performance nuclear power aircraft makes its maiden flight.

One of our principal problems is to be sure we have people with the required technical competence and specific abilities to function effectively.

Component	High Strength At High Temp.	Ability to Resist Oxidation	Neutron Absorption Cross Section	Density	Special Requirements
Fuel Elements	x	x	Low	--	Compatibility with fuel.
Moderator	x	x	Low	Low	Ability to slow neutrons to thermal effectively.
Control	x	x	High	--	
Shield					
a. Gamma	x	x	--	High(1)	(1)Ability to attenuate γ.
b. Neutron	x	x	High(2)	Low	(2)Ability to absorb without producing γ.

FIG. 1

Some characteristics of 11 metals in relation to possible application in Nuclear Power Plant for Aircraft — prepared by Dr. A. E. Focke, Manager, Materials Development.

Thermal Neutron Absorption Cross Section In Barns	
1. Hf	105.0
2. Re	84.0
3. Ta	21.3
4. W	19.2
5. U	7.68
6. Th	7.4
7. Ti	5.6
8. V	5.1
9. Mo	2.5
10. Cb	1.1
11. Zr	0.18

FIG. 2

Melting Point-°F	
1. W	6116
2. Re	5756
3. Ta	5426
4. Mo	4752
5. Cb	4474
6. Hf	4032
7. V	3452
8. Zr	3375
9. Th	3308
10. Ti	3020
11. U	2071

FIG. 3

Crystal Structure		Allotropic Transformation
1. Re	h.c.p.	NONE (known)
2. Hf	h.c.p.	b.c.c. 3020°F
3. Ti	h.c.p.	b.c.c. 1620°F
4. Zr	h.c.p.	b.c.c. 1584°F
5. Th	f.c.c.	b.c.c. 2426°F
6. W	b.c.c.	NONE
7. Ta	b.c.c.	NONE (known)
8. Mo	b.c.c.	NONE
9. Cb	b.c.c.	NONE
10. V	b.c.c.	NONE
11. U	ortho	tetra 1220°F; b.c.c. 1427°F

FIG. 4

Metallurgists, ceramists, physical chemists, solid state physicists with background in hi-temperature materials are invited to inquire about professional opportunities in these areas. Nuclear experience, while desirable, is not essential.

Write in confidence including salary requirements to: Mr. P. W. Christos, Professional & Technical Personnel — Division 63-WP

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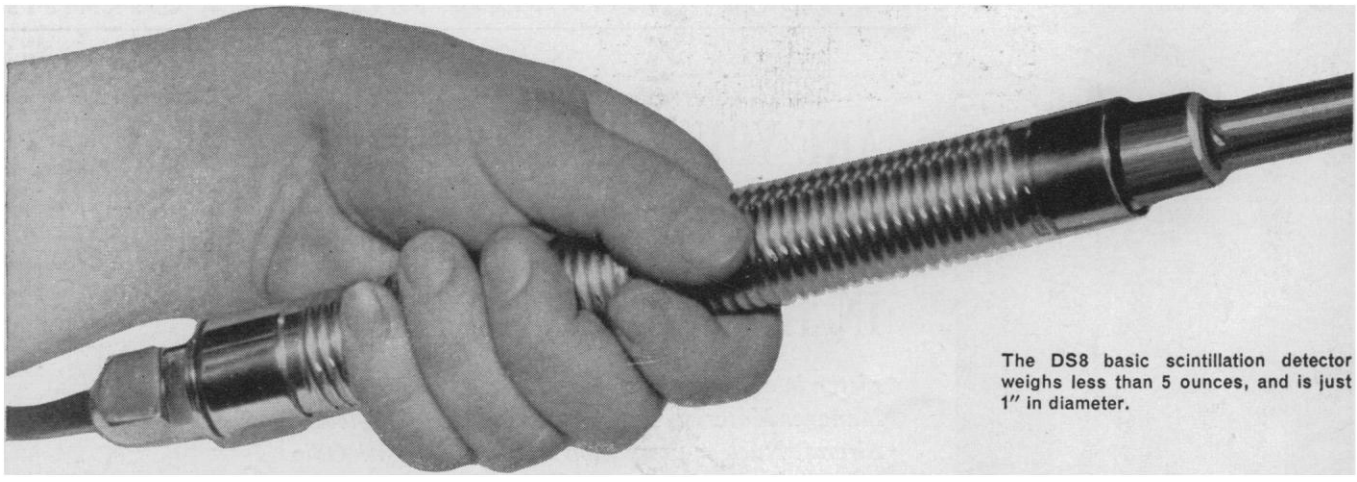

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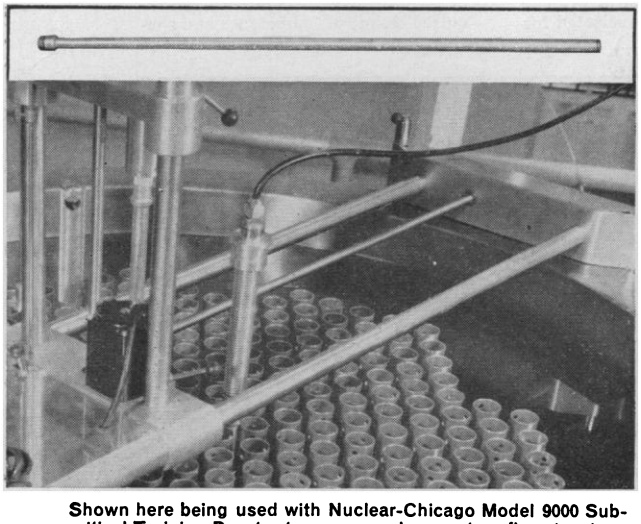
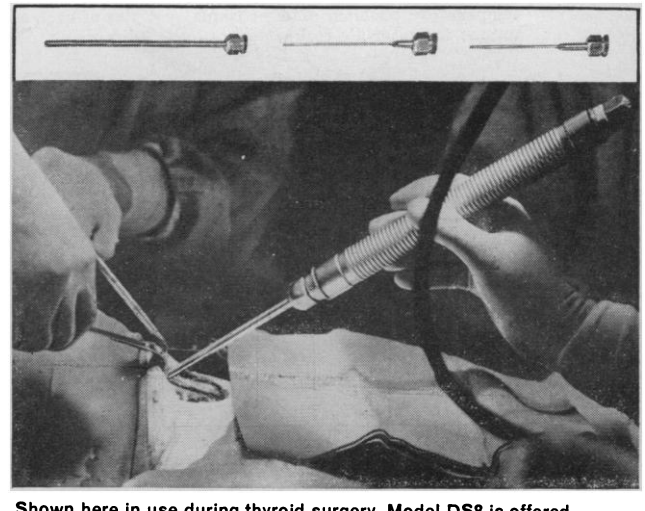


Shown here being used with Nuclear-Chicago Model 9000 Subcritical Training Reactor to measure slow neutron flux at various points in the lattice, neutron probes are 42" long and are available in two diameters, 3/4" and 11/32".



Shown here in use during thyroid surgery, Model DS8 is offered with three beta-gamma sensitive needle probes 2 mm, 3 mm and 6 mm in diameter, 10 cm to 15 cm in length. All probes are easily interchanged by loosening a simple hand nut.

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