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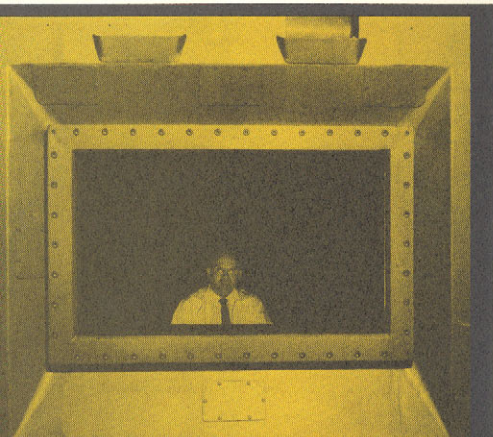
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**vision
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GROWTH THROUGH RESEARCH



PENBERTHY Instrument Company was founded in 1947 to produce and market sunglasses using a neutral gray glass which had been developed by Larry Penberthy. The new glass provided eye protection without changing color perception. This initial venture provided the basis for other development activities.

As its second project, the company developed an optical pointer which was sold throughout the United States.

In searching for other products to manufacture, calls were made on the Atomic Energy Commission's Hanford Works. A contract was obtained for building large optical periscopes to be used for observing experimental and production operations involving radioactive materials. While the periscopes simplified observation in high radiation areas, it became apparent that a better means of viewing was needed.

Radiation shielding glass windows mounted in the walls of hot cells would have provided a wider, clearer field of vision, but suitable glass for such windows did not exist.

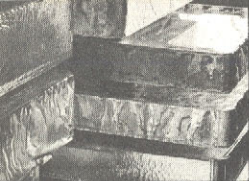
To create this new material, the company carried out an intensive 90-day research project which culminated in the production of samples of a clear glass which was two and a half times as dense as ordinary glass, and contained 75 per cent lead by weight. As a result of this successful effort to develop a new product for a specific need, the company was awarded production contracts.

For a period of three years, from 1949 through 1951, the Penberthy Instrument Company was the world's only producer of high-density glass. Applications for the new glass were found at most atomic installations, and the company's production facilities expanded rapidly.

The first high-density glass produced by the company was poured from a furnace having a melting capacity of eleven pounds. Today this scale of operation has been increased by more than a hundredfold. Twelve-hundred-pound melts are now routine.

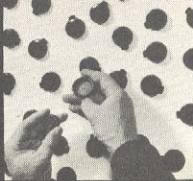
The company has continued and expanded its program of research to meet the changing needs of the growing atomic industry for new shielding glasses. The demand for Penberthy windows has followed a rising curve, which is expected to continue.

In addition, the company has broadened its total program and currently is working on glass bulbs for X-ray and electronic tubes, continuous-filament glass fibers, eye-protective glasses for welding helmets, refractory materials which withstand temperatures as high as 4,000°F, and a special glass for atomic flashlights.

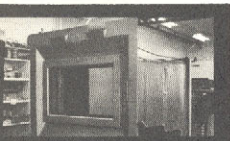


These rough slabs of glass are ready for sawing, grinding, and polishing. They weigh between 800 and 1,200 pounds, and are worth \$500 to \$1,000 in their raw state.

More than 280,000 radiation detectors have been produced by Penberthy Instrument Company for the U. S. Navy and the Canadian Department of Defense. The detectors' sensitive element is a piece of silver phosphate glass.



GLASS PRODUCTS BY PENBERTHY

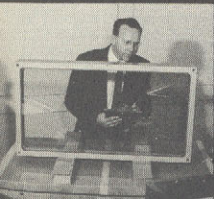


From the operator's side, this window affords undistorted, wide-angle vision. This type window sells for between \$10,000 and \$30,000 each, depending on size and shielding power required.



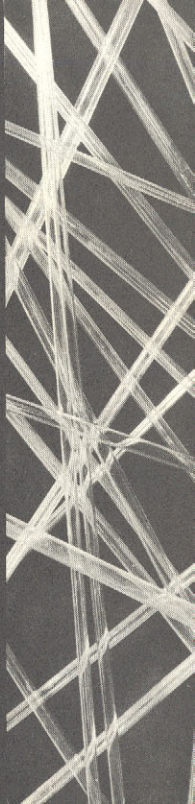
Glass tubing is made from specialized types of glass; one type is resistant to radiation darkening, another is boron-free for non-capture of neutrons, and another is suitable for sealing to metals.

When mounted in a shielding wall at the atomic facility of a leading aircraft manufacturer, this will be the "hot side" of the window. This window is 54 inches thick, yet has 43 per cent light transmission.



Many of the windows are single slabs of glass. This one is four inches thick. It will be used in a 12-inch-thick concrete wall, and will provide the same degree of protection as the wall itself.

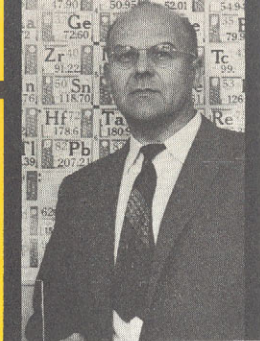
These bulbs will be used in self-luminous atomic signal lights being developed by a customer in the East. The bulbs, which do not darken when exposed to radiation, are a special glass developed by the company.



PERSONNEL

Because of Penberthy Instrument Company's emphasis on developmental work, a large proportion of the people on the staff are engineering and professional. At the present time, the ratio is approximately one engineer or scientist to every three manufacturing or administrative employees. Those engaged in production activities are chosen for their technical experience or special skills, since there is very little routine, repetitive work associated with the company's manufacturing processes.

In technical areas, the Penberthy staff provides an unusually broad diversity of knowledge and ability. The company employs specialists in electronics, mechanism and machine design, glass-forming equipment design, high-temperature technology, optics, control instrumentation and the high-temperature chemistry of glasses, refractories and metals.



Larry Penberthy, president, has a background as a physicist, mechanical engineer, optical engineer, chemist and glass technologist. His specialty in industry has been process development. A graduate of College of Puget Sound, Tacoma, Wash., he has had graduate work at the University of Washington, University of Rochester and Rochester Institute of Technology. For five years he was head of the Production Development Department of the Optical Division of Eastman Kodak Co. He also did research in glass making at Houze Glass Co. He is the originator of dense lead glass for radiation shielding windows. His achievements in the glass industry include the development of high-speed production grinding and polishing techniques and the development of a patented electrode system which boosts the output of large glass furnaces. He is consulted by glass companies throughout the world, and has visited many countries in connection with electrode installations and refractory improvements. He has been president of Penberthy Instrument Company since it was founded in 1947.

John F. Gifford, general manager and director, has had extensive experience in chemical process development, technical management and administration. He was graduated from Oklahoma A. & M. with a B.S. in chemistry, and did graduate work in chemistry and physics at the University of California at Berkeley. For ten years he was engaged in research and development work at Oak Ridge National Laboratories, the University of California Radiation Laboratory, and the Hanford Atomic Works. A pioneer in the development of remote control equipment, he holds several patents in the field. Since joining the company in 1954, his accomplishments have included the successful process control of radiation dosimeter manufacture, development of two new technical glasses and the expansion of sales of radiation shielding windows.

Robert E. Tavis, administrative advisor and director, has a background in administrative work, production control, personnel management, sales, and purchasing. He is a graduate of U.C.L.A. in business administration, and has taken graduate courses at U.S.C. He served five years in the Air Force in aircraft maintenance and production control work. He has been employed as sales engineer and branch manager for a firm handling specialized industrial equipment, and as purchasing agent and industrial engineer for a Spokane manufacturing firm. He also managed his own company in the turf irrigation field. Since joining the company, he has organized the personnel department, assisted in company financing and performed other administrative duties.

Lee F. Miller, chief engineer, is the originator of oil-front windows and the customized design approach currently employed by the company on large windows. Since joining the company in 1955, he has designed more than 90 radiation shielding windows, glass furnaces, and process equipment. A graduate in mechanical engineering from the University of Idaho, he spent three years as an engineering officer in the Navy, five years as assistant professor of mechanical engineering, Oregon State College, and three years at Hanford Atomic Works designing remote handling equipment for radioactive chemical research programs.

David D. Billings, chief chemist, was graduated in chemistry from U.C.L.A. He served as an officer in the Navy during World War II. Before joining the company, he was chief chemist for Glass Containers Corp., Los Angeles, with responsibility for chemical and physical tests on glass and glass raw materials. Since accepting his present post at Penberthy, he has participated in the development of metal oxide electrodes, color control processes for high-density glass and non-browning lens glass for atomic flashlights.





Charles T. Robinson, metallurgical engineer, is a graduate of the Colorado School of Mines. Before joining the company he was with Boeing Airplane Co. as a metallurgical development engineer, and with Phelps-Dodge, El Paso, as assistant superintendent of the casting and fire refining department. His current work with the company is in the exploration of melting systems and high-temperature metals.



William L. Hawks, ceramic engineer, is a graduate of the University of Washington. He has had ten years experience in the ceramics industry, including six years in research, service engineering, quality control and production supervision with Gladding, McBean & Co., Seattle, and four years as manager of a refractory products manufacturer in New Jersey. He is in charge of refractory products development for the company.



Ray H. Coulter, large window assembly and machine shop supervisor, is an experienced experimental and prototype machinist. Before coming to the company in 1953, he worked as experimental machinist and shop foreman at Monsanto Chemical Co., the Western Regional Research Laboratory of the U. S. Department of Agriculture, and Puget Sound Engineering Co. He has contributed to many of the company's development and manufacturing programs by establishing fabrication and assembly procedures.



Chester K. Rhett, supervisor of glass melting and furnace construction, has been associated with Penberthy since 1948. He constructed the first furnaces used to produce high-density lead glass and has supervised the construction of virtually all furnaces used by the company from that time to the present. He also has assisted in construction of glass polishing equipment and processing machinery. A journeyman optical instrument maker, he also is a qualified welder and machinist. Prior to joining the company he was employed at Spokane Air Force Depot and served four years in the Navy as an aviation machinists mate.



Frank R. Lindell, mechanical engineer, obtained his B.S. in mechanical engineering from the University of Washington. He is a member of Tau Beta Pi, engineering honorary, and Sigma Xi, science honorary. He has been employed by the Washington State Public Service Commission as an engineer; Pacific Car & Foundry Co. as factory representative for the firm's Eastern Division; Gladding, McBean & Co. as plant layout, design and safety engineer, and Boeing Airplane Co. as test and evaluation engineer for heating and ventilating components. Since joining the company he has participated in the design of electric furnaces, boiler installations and mechanical equipment.

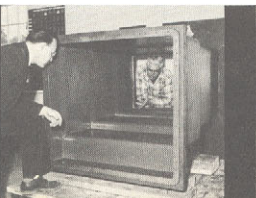
V. Neel Wilson, electrical specialist, joined the company in 1952 and has taken part in the design, development and construction of numerous items of equipment. He is responsible for the installation and maintenance of all electrical equipment and instrumentation. He has designed and constructed annealing equipment, processing machinery, electric furnaces and control systems. He also designed elements of the semi-automatic assembly equipment on which Penberthy dosimeters are produced. Previously he was employed by Kenworth Motor Truck Corp. as technician, and by Hyster Co. as a service engineer.

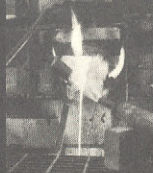
Eugene G. Bader, left, lead glass production supervisor, has worked in all departments. A trade school graduate, and journeyman sheet metal worker, he currently is completing a correspondence course in mechanical engineering. Before coming to Penberthy in 1952, he served in the Air Force, and was a shop foreman at Sand Point Naval Air Station.

Wesley L. Drain, assistant production supervisor, is responsible for glass polishing and framing. Since joining the company in 1950, he has had experience in all production processes. A graduate of Hemphill Diesel Engineering School, Seattle, he has worked as an aircraft mechanic and tool and die maker.

Pearl W. Penberthy, secretary-treasurer, has handled a variety of secretarial, financial and administrative responsibilities since the company's inception. In addition, she has participated in contract administration and the handling of patent matters. A graduate of Morningside College, Sioux City, Iowa, she holds a degree in library science from the University of Illinois.

John F. Zugish, accountant and office manager, is a graduate of Griffin-Murphy Business College, Seattle. Before he joined the company in March, 1957, he was employed ten years as accountant with Stimson Mill Co., Seattle, and served six years in the Marine Corps.





BUILDINGS • DEVELOPMENT FACILITIES

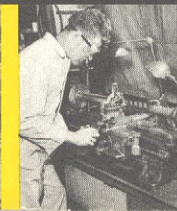
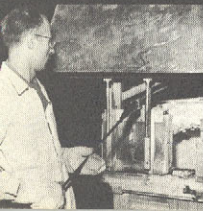
AT PRESENT the company occupies three buildings in Seattle's central industrial zone. Total floor area is about 11,000 square feet. One building houses batch mixing, melting and annealing operations, and the chemical laboratory. In the second building are sawing, grinding, polishing, window assembly, final inspection, and the radiation source room. The pilot operations building has a 27-foot clearance to roof so that some of the glass furnaces can be elevated for gravity flow of the glass to machines at floor level. Administrative and business offices are located in the pilot operations building.

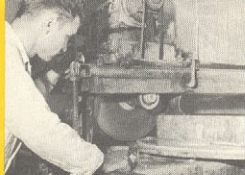
Immediate expansion plans include purchase of a tract of land in the same area, and construction of additional buildings for manufacturing.

A CONSIDERABLE proportion of the company's available space is devoted to development facilities, which include a pilot plant manufacturing area, a glass melting laboratory, an optics laboratory, an electronics shop, and a machine shop.

In the pilot-scale manufacturing, glass is produced in quantities of a few pounds to several tons. During these operations, equipment and methods are tested, quality of product is examined, and cost of production is determined. Pilot runs are made both in support of the company's manufacturing activities and as a development service to customers.

Another function of the pilot operations group is the development of special furnaces for making these new glasses. Electric melting has been found to be a superior method and is used almost exclusively.





PRODUCTION FACILITIES

THE BASIC processes of glass manufacture are batch mixing, melting, drawing or casting, annealing, grinding and polishing. The company is equipped to perform all of these functions at its Seattle plant.

The majority of the equipment items employed to produce various types of heavy lead glass and to polish large slabs for radiation shielding windows have been designed and built by the company's technical staff.

For mixing and preparing dry materials for melting, the company has batch mixers, screens, scales, and drying ovens. A 5,000-cubic-inch capacity furnace is employed for melting batches for large cast slabs. Eight other furnaces of up to two tons capacity are available for high temperature melting of special glasses. All furnaces are equipped with the necessary automatic temperature controls.

Thirteen 30-cubic-foot and three 20-cubic-foot annealing ovens are used for production requirements.

Cutting and grinding of slab glass for windows is accomplished with large diamond saws and diamond grinders of up to 1,500 pounds capacity. Seven precision polishing machines which can handle slabs up to six feet long and four feet wide weighing as much as 1,500 pounds are used to produce the optical quality surfaces on all glass installed in Penberthy radiation shielding windows.

In addition to equipment used in actual glass production, the buildings are equipped with overhead cranes, hoists, conveyor systems, lift trucks and other devices for handling heavy glass. A small machine shop equipped with modern machine tools and metal working facilities is available for fabrication of window frames, special tooling and production machinery.

A large inventory of electrical equipment, laboratory devices, instrumentation, and test fixtures has been assembled for experimental and developmental activities. The company also has a high intensity radioactive cobalt source for gamma radiation testing.

