

RESEARCH IN GLASS IS HORIZONTAL AT PRESTON LABORATORIES

Technological research at Butler embraces all types of glassware as well as scientific problems outside of the glass field

By **CYRIL B. DELGADO**

In the August 1938 issue of THE GLASS INDUSTRY there appeared an article describing the Preston Laboratories in Butler, Pennsylvania, outlining the activities in glass research carried on by a competent staff under the direction of Dr. Frank W. Preston. Since the publication of this original story many changes have taken place at the Laboratories; in personnel, scope of scientific research and the diversity of glass products for which research has been engaged in.

Much has been printed in this publication and elsewhere on the work of the Preston Laboratories in the glass container field not only in actual technology but in broken bottle litigation where technical evidence evolved in the Laboratories was introduced in defense of the defendant glass manufacturers. Because of the preponderance of material published in connection with the glass container activities of the Preston Laboratories we recently visited Butler with a view to learning first hand just what other work the Laboratories do in the glass field. The visit was truly illuminating since it clearly revealed that Preston Laboratories are active not only in practically all other types of glass but engage in scientific research extending quite outside the field of glass.

Space limitations and other considerations prevent a minutely detailed account of the technical research carried on by the Preston staff, but a brief resume, as it applies to varied glass products, should be recorded just in case any misconception prevails that the Preston Laboratories are devoted exclusively to glass container research. A summary of the diversity of glass products which have been subjected to scientific study at the Butler Laboratories follows:

Wire Glass Manufacture: Breakage under service conditions leading to the development of new and improved methods and apparatus for the production of stronger structural sections of rolled glass, and the study of heat and light transmission problems involved in the use of wire glass.



Original Laboratory Building: It houses most of the clerical force, a small drafting office, chemical laboratory, physics laboratory, standard testing procedure department and part of the machine shop. The upper floor is the caretaker's apartment.

Window Glass: Annealing problems with the Fourcault Process. Devitrification problems, especially with tinted and colored glasses made by the Fourcault method and an investigation of the causes of "carbon lines" and other optical heterogeneities with a view to their elimination.

Plate Glass: Grinding and polishing problems; machinery design and plant layout, breakage problems.

Table Ware: Development of static and impact testing methods of breakage; the effect of heat treatments on durability; study of the influences of manu-

facturing processes on strength; analysis of the significance of existing testing specifications and design as a factor in strength.

Glass Fibers: Development of structural elements to make use of the high tensile strength of glass fibers; the practical utilization of glass fibers and plastic combinations; mathematical theory of lightweighting for airplane structures; analysis of available natural and synthetic materials combining light weight and high strength; biological analogies in lightweighting.

Scientific Glassware: Methods of determining serviceability of glass seals in X-ray and electronic tubes.

Glass Blocks: Design of larger glass blocks with the view to improving resistance against the partial internal vacuum.

Glass Containers: Research on glass containers falls into two categories; that with which the container manufacturer is directly interested and can control and that which concerns proper use and methods of handling glass containers by the users. Research as it affects the first phase of container work includes design of bottles for maximum efficiency, "the lightweighting program" and the effect of heterogeneity upon strength (cord research). The Laboratories' activities as they pertain to users' problems include improvements in users' methods



The Pilot Plant houses development work which has progressed beyond the accommodations of the original laboratory building.

of handling and mistakes in domestic use and in bottle plants. One phase of container research which has been invaluable both to the glass manufacturer and the bottler is the serious effect of internal damage to strength, and a broad educational program has been developed for the bottler on this particular factor and other abuses to which containers are often subjected by the user. In connection with container research an important part of the over-all program is the devising of appropriate tests and provision of suitable and efficient apparatus for glasshouse laboratories and bottling plants.

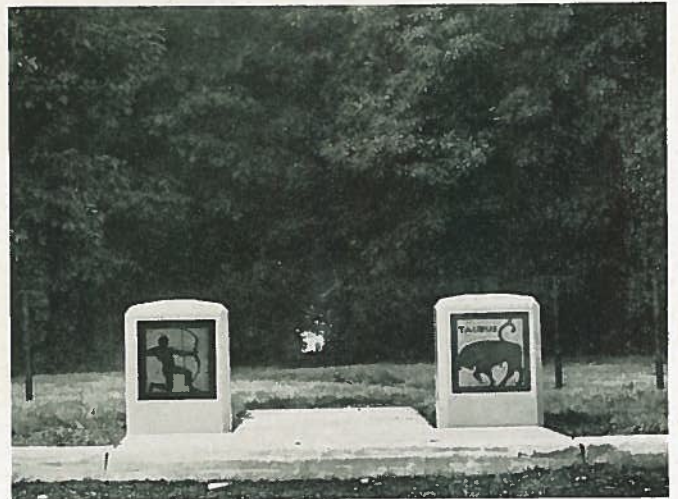
Behind all the glass technology that is done at the Laboratories is, of course, basic, scientific research which relates directly or indirectly to specific glass problems. For example, physics and geology play a basic part in glass technology as it is carried on at Butler. Hence, under the general heading of Physics and Geology we find the Preston staff engaged in studies of the ultimate nature of the breaking processes of glass and other materials; fracture technology; the effect of adsorbed moisture; temperature co-efficients and crack propagation. Diagnosis of causes of breakage of glassware; rock crushing and ore-dressing; physics of "drag-cracks" in rocks and faults and fractures in rocks generally.

While it would be erroneous to convey the idea that Preston Laboratories is an institute concerned with scientific research in general, rather than glass technology which is its primary interest, the broad scope of scientific interest entered into could not escape the notice of this reporter. This is evidenced by work now being conducted for the United States Army and Navy in connec-

"McCormick Dam" where the wild fowl stop off.



tion with the development and improvement of fire control instruments for airplanes, anti-aircraft batteries and training instruments. An outstanding example of work outside the glass industry, and yet of importance to glass, is the biological investigations through which it is hoped solutions of certain structural problems in airplanes may be obtained. A particular aim of these studies is the adoption of glass fibers as a possible solution to these problems. Further evidence of this breadth of interest in matters scientific by the Preston Laboratories is revealed in the variety and number of published papers. Between eighty to one hundred papers have appeared in publications such as the American Journal of Science; Proceedings of the Smithsonian Institute; Journal of the American Ceramic Society; Journal of the Society of Glass



"The Shambles," Sagittarius and Taurus. By Edward Howard, the architect (son of George Howard, inventor of the Howard Feeder). This Zodiacal allegory is entitled "Shooting the Bull." The signs are deeply sandblasted into opaque and colored glass.

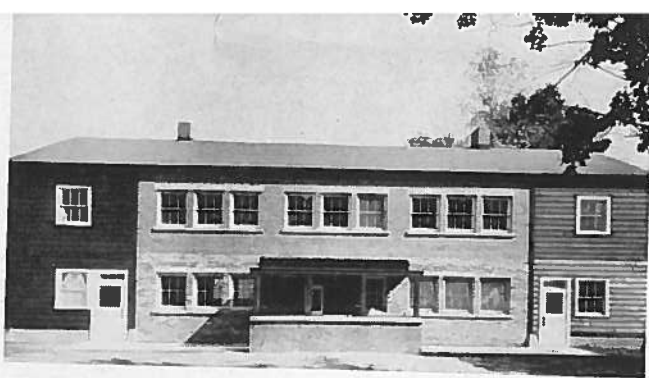
Technology of England; THE GLASS INDUSTRY and many others.

Exemplifying the purely scientific endeavors which sometimes engage the Preston staff is the report by Frank W. Preston for the Proceedings of the Smithsonian Institute of the Chicora Meteorite, a meteoric mass which flashed out of the heavens and landed without any serious consequences in Butler County in 1938.

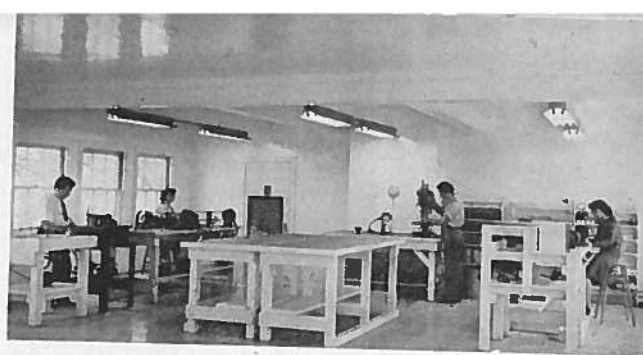
A treatise on the physics of "Upward Drilling" in refractories and volcanoes, published in the American

"Norris Dam" with African geese enjoying life in the Alleghenies.





The "Instrument" building housing certain experimental manufacture and partly employed for biological studies.



Part of upper floor of the "Instrument" building showing apparatus for working lenses, plastic prisms and for experimental optical devices. The ceiling in the further bay is Owens-Illinois "Microprite."

Journal of Science is another paper emanating from the Laboratories typifying its general scientific researches.

In connection with research on refractories, the Laboratories have been doing a great deal of work on tracer elements in refractories and their detection in glass. Here again the over-all interest in glass is indicated since these investigations are as important to window glass, for example, as they are to container ware.

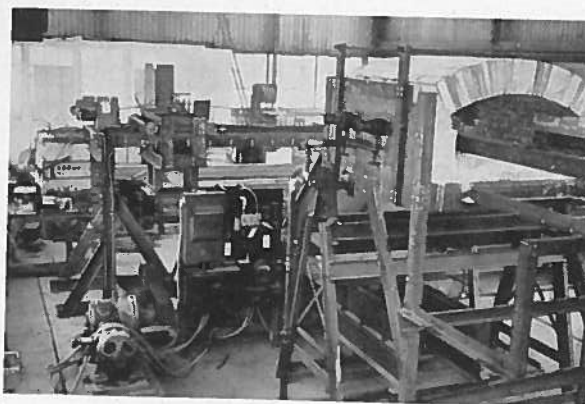
As stated earlier in this article many changes have occurred at the Preston Laboratories since the first story appeared and these changes have not been confined only to the personnel and its work but also to the "plant." The original housing facilities have been augmented since 1938 by a storage shed where inactive research materials, apparatus and equipment for maintaining the buildings and grounds can be stored. It should be noted here that the laboratory grounds now amount to some eighty acres which permits experiments on explosives and combustible and inflammable liquids. The vast size of the grounds and topography of the country also make possible tests on range finding and height finding on planes which are continually flying over head.

Another new structure is the steel frame building or Pilot Plant measuring 80' by 120' by 40' to the eaves. This was constructed to house the development for the Pennsylvania Wire Glass Company relating to a new form of structural glass. The third addition to the group of new buildings is a two-story structure of hollow wall construction, well insulated with glass wool. This building is now being used for certain experimental manufac-

ture and part of it is employed for the biological investigations previously referred to.

The sum and substance of any organization—be it a scientific laboratory, a glass plant or an Army—is people, hence the story of Preston Laboratories would be incomplete without some mention of the staff which must carry out the broad policies and undertakings of Dr. Preston.

As in all organizations the war has wrought changes in personnel and the present complement of about thirty people is practically an entirely new staff, formed within the last five years. As a result of this turnover in personnel and the highly specialized training required it was



Interior view of Pilot Plant showing apparatus for forming structural glass.

found that the distribution of functions had to be changed as the personnel changed, in other words, the law of supply and demand as it relates to human endeavor had to be reversed and the job had to be adapted to the man and not the man to the job. In spite of all difficulties, however, the research staff under Dr. Preston are carrying out many important research projects and to complete the record the names of these individuals should be recorded. They are: Dr. L. G. Gehring, chief chemist; Dr. A. M. Knight, physical chemist; Herman J. Scholtz, chief draftsman and assistant engineer; Brian B. Christman, ceramist and specialist in optical glass and plastic elements; H. Eugene Powell, chief physicist; Rus-

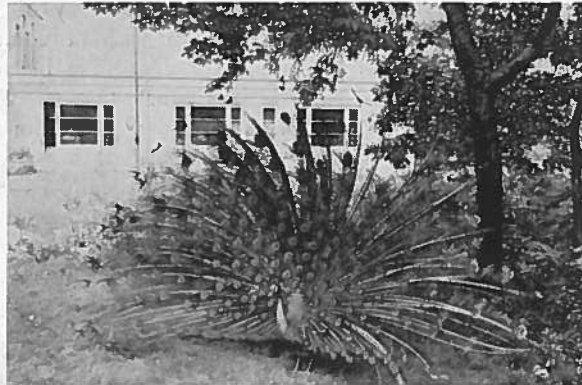
A corner of the lower floor of the "Instrument" building—the biologist office.



sell T. Norris, chief biologist, and Marcus L. Basham, chief electrician and optical glass worker. The most recent addition to the staff is Professor Eugene F. Poncelet, a graduate of the University of Liege, Belgium. Professor Poncelet will continue to devote his researches to rock cracking, ore-dressing and glass fracturing.

No story of the Preston Laboratories would really be complete without some mention of the diversions of Dr. Preston and staff. Of striking interest is the collection

of pheasants of many varieties from all parts of the world, peacocks, raccoons and other wild life. These have all been provided with proper lodgings by virtue of the spacious grounds. The "Norris Dam" (Russell T., chief biologist), the "McCormick Dam" where the wild fowl stop off on their migrations, and many other natural and man made (Preston) objects of interest, all contribute to life at this unique laboratory where so much serious work is being done high in the Allegheny Hills.



Peacock on display, one of the many beautiful specimens in the Preston "aviary."