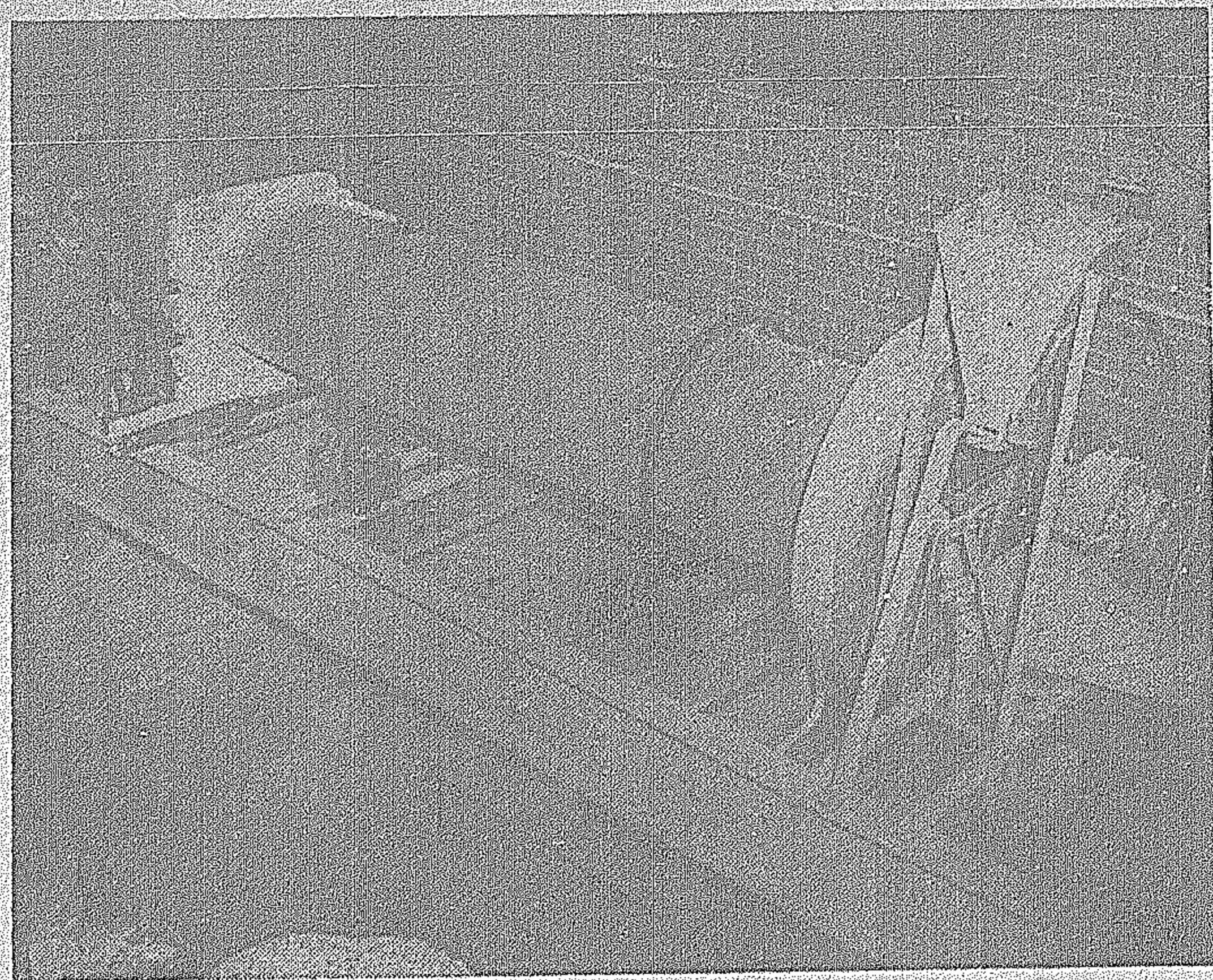


The Rotary Kiln in Operation



EISENHOUR MAKES TEST RUNS—Charles W. Eisenhower is shown making test runs on rotary kiln located in the ceramics Lab.

Color Separation and Corrosion Fatigue Are Two of Many Physics Projects

Calculating Machines

During the past four years the Foundation staff members associated with the program on the noise reduction of the Comptometer Calculating Machines for Felt & Tarrant Manufacturing Company have developed special techniques in adapting electronic equipment to the measurement and analysis of sound or vibrations. The availability of these skills and equipment made it possible for the Foundation to embark quickly on a critical N. D. R. C. war research project without any loss of time for preliminary organization.

Color Separation

The extensive program of color reproduction for the Graphic Arts carried on at the Foundation for several years has made possible the acquisition of knowledge, experience and skills in handling color reproduction techniques. The background thus provided has proved indispensable during the past year in connection with the Army and Navy Diesel Lubricant Testing Program, as in a part of this testing program it is necessary to make photographs of the pistons and bearings in full color so that proper evaluation of the performance of the oil can be made by the appropriate army and navy approving committee.

Corrosion Fatigue

A comprehensive study has been conducted to determine why certain high pressure gas cylinders fail in service shortly after having passed the standard hydrostatic test. This study has revealed that failures of this type are due to corrosion fatigue of the interior surfaces.

Diesel Combustion

The development of equipment and methods for making optical studies of diesel combustion, which has been carried on for the last three years, has been successfully completed. Some of the optical methods are now being adopted as standard engineering tools in the research and development laboratories of the Caterpillar Tractor Company which sponsored this work.

Electro-mechanical Devices

During the past year the electrical staff of the physics section has co-operated with the electrical section of the U.S. Army Engineer Board of Fort Belvoir, Virginia, in a program of research and experimental model construction on electro-mechanical devices for military operational use.

Filters

The Cuno Engineering Corporation has under way a study of both aircraft lubricating oil filters and gasoline filters for naval use.

Several time-saving methods for manufacturing gasoline filters were studied during the year. Numerous filtering media were examined in order to develop a small and effective lubricating oil filter of the full-flow type. A study of hydraulic fluid fil-

ters has been started to develop a filter for use by the armed forces.

Fluid Flow

The study of the cavitation effects produced by the rapid flow of water through valves and orifices has been continued for another year. A method of applying high speed photography to this study has been worked out, and is being used to obtain more exact information on the nature of the cavitation process.

Mica

Prior to the beginning of the present war, this country depended very largely upon India for its supply of strategic mica. The danger that imports from this source might be curtailed or stopped entirely made it imperative that the War Production Board take immediate steps to increase the production of mines in this country and, at the same time, launch an extensive research program to find methods of more rapid inspection and fabrication of the block mica. The Armour Research Foundation is one of three laboratories in the United States selected to cooperate in these research investigations.

National Defense Research Committee

Extensive projects have been conducted for the N. D. R. C. by the Foundation. As these projects are in the restricted classification it is not possible to report any information on them other than the fact that the broad facilities of the Foundation have made it possible to carry several programs through all stages from developmental work to actual production of equipment for field tests, and that some of these developments have already been used effectively on various battle fronts.

Spray Equipment

Operations in the Spray Equipment Project during the year have been restricted to testing work on the performance of several small compressors to be used for special purposes by the air corps.

Watch Technology

During 1943 the Watch Technology Project has been devoted entirely to problems arising in connection with the manufacture of timing mechanisms for military uses.

Special Studies

In addition to its long term research programs the physics section has served in many other ways. Special techniques in light transmission, colorimetry, microscopy, spectrophotometry spectrography and X-ray have been applied to the solution of problems not only in physics but also in chemistry, metallurgy and mechanics. Even greater has been this laboratory's contribution in these other fields through specialized photographic methods such as photomicrography, macro-, macrostereos- and microflash-photography, and high speed motion pictures.

Airport Paving Is Mechanics Study Sponsered by CAA

Airport Paving

Studies on airport paving are being made for the Civil Aeronautics Administration. This work involves determinations of static and dynamic loads imposed by military aircraft on runway surfaces.

Brake Press

During the year both photo-elastic and electrical strain gage analysis were made on a Verson Allsteel Press Company brake press. The photo-elastic analysis was used to indicate points of stress concentration by the use of bakelite models, and actual measurements were carried out dynamically on the prototype.

Core Boring

The Civil Aeronautics Administration is sponsoring a project for obtaining undisturbed test cores from soil stabilized materials.

Electric Motors

Studies have been made to develop a fractional horsepower single-phase motor with a high starting torque. The new motor was required to offer better starting characteristics than are now normally available. The investigation included the possibility of production at lower cost.

Gear Wear

Progress continues on the Whiting Corporation project to determine the factors which contribute to gear wear, in order to obtain a practical formula for the design of gears.

Impact Studies

The fundamental impact studies sponsored by the Whiting Corporation are continuing, with the overall object of obtaining design criteria for material subject to dynamic loading. Of special interest is the intensity of load or the magnitude of the stress that can be carried safely over extremely short periods of time.

An X-ray diffraction technique has been developed for the quantitative measurement of plastic deformation in structural steel, and has been employed in the determination of both the magnitude and depth of penetration of plastic flow in the neighborhood of the points of collision of pairs of pendulum bars.

Pressure Vessels

Large scale tests are in progress, dealing with the fatiguing of an industrial pressure vessel requiring raising and lowering the internal pressure from 200 lbs. per sq. in. to 1200 lbs. per sq. in. through 100,000 cycles. The vessel is quite large and requires heavy pumping facilities.

Volute Springs

Under the auspices of American Steel Foundries, an investigation on the characteristics of volute springs has been carried out. The results of this work appear in the first Proceedings of the Society for Experimental Stress Analysis.

Welded Tanks

The investigation initiated by Chicago Bridge & Iron Company, on the effect of the hammer test on welded pressure vessels, has been carried to a conclusion. The results of this work have been presented to the American Welding Society.

Wire Rope

A large fatigue testing machine has been built to determine the effect of various factors on the life of wire rope. Studies are now being conducted on 1/2" extra-flexible crane ropes using several different sheave diameters.

Wood Technology

During the past year a laboratory for investigation of wood products has been added. Rilco Laminated Products, Inc., one of the Weyerhaeuser companies, is sponsoring a project for the development of laminated structural members from lumber. This study includes the investigation of wood, adhesive preparations, jointing methods, and plant control.

Need of U. S. Forms Nucleus For Foundation's Own Research

In addition to the services rendered through the medium of industries, associations and governmental agencies, and in other ways, the Foundation regularly carries on research under its own sponsorship on problems of general public benefit and on development of devices and principles of significant scientific application. In common with the other phases of the work, during the past year this part of the Foundation's program has been concentrated upon subjects of immediate or potential value to the war effort both at home and abroad.

Electrical Weighing

Work is in progress for the application of various types of electrical gages to the problems of static and dynamic weighing.

Electron Optics

During the year a program of theoretical studies in electron optics has been under way. Through a mathematical application of the "stream function," a formula has been developed for the refractive index in electrostatic and magnetic fields. The formula takes into account the relativistic change of electron mass which is of practical importance in the case of high speed electrons.

Electronics Research

Purely as a Foundation contribution to war needs, a general electronics development program has been in progress. Equipment utilizing multiple differential timing circuits promises to be of particular significance in meteorological and seismic applications. Other investigations pertaining to the use of modulated infra red radiation have led to the development of equipment that will find application in protective alarm systems, traffic control, railway signaling, etc.

Elevator Controls

During the past year the new automatic leveling system for elevators, developed and patented by the Armour Research Foundation as a result of Foundation-sponsored research, was first applied with satisfactory performance in a hospital passenger elevator. The new system gives a constant slowdown speed independent of the weight of the car load, together with better leveling and accuracy of stop, and permits the use of standard A.C. elevator equipment without conversion to D.C.

Ozone

Studies of the use of ozone in various industrial operations have been continued throughout the year under the sponsorship of the Foundation.

Sound Recorder

In addition to the continuous research program on the Foundation's newly developed Magnetic Wire Sound Recorder, the organization has found it necessary to undertake the actual production of a considerable number of these instruments. This production, by hand-methods, was requested of the Foundation as

an emergency measure in order to meet urgent military needs during the period in which the General Electric Company was tooling up for licensed commercial-scale production of the units for a wide range of military applications.

Vegetable Oils

As a Foundation sponsored project a study of oil bearing seeds growing within the continental United States has been initiated, to alleviate the shortage of certain oils heretofore imported from sources no longer available. Preliminary surveys made over a period of months indicate that certain oil-bearing seeds not now utilized may assume a position of major importance not only in making the United States independent of foreign supplies, but also as a pay crop for acreages unable to support conventional farm products.

National Registry of Rare Chemicals Extends Service Throughout Entire World

Apart from the general operation of advancing the useful knowledge of science and of providing a scientific research and engineering service to industry on a not-for-profit basis, the Foundation has continued to engage in various other specialized services in the public interest. Certain ones of these may merit particular mention.

National Registry of Rare Chemicals

Now well into its second year of operation since its establishment by the Foundation in the middle of 1942, the National Registry of Rare Chemicals provides without charge a central world clearing house for information on the location and availability of uncommon chemical materials needed for special purposes.

The Registry has been able to fill 75% of the requests received, and at the end of its first year 2100 such requests had been received from laboratories and plants in the United States, South America, England, Australia and the Union of South Africa. The Registry files contain immediate sources for more than 6,000 rare chemicals.

City Noise Reduction

In connection with the campaign to reduce city noises in Chicago, the Foundation and its staff members have participated actively without remuneration, supplying equipment, making noise measurements, and publishing the monthly News Letter for the Greater Chicago Noise Reduction Council.

The annual Achievement Award for the most active work in reducing city noise in a city of 500,000 or greater population has been given to Chicago for the year 1942-43 by the National Noise Abatement Council, as a result of the program carried out by the local organization.

Civilian Defense

During the past year the Foundation's contribution to the work of the Office of Civilian Defense, Department of Techniques, has included skilled photographic service and consultation in the evaluation of smoke obscuration as a means of air raid protection.

During the preceding year the Foundation provided its facilities to aid in determining the type and locations of air raid warning signals for proper coverage of Chicago's industrial, business and residential areas.

Ceramic Arts and Crafts

By the use of the ceramic milling equipment and kilns the ceramic laboratories have been able to aid the war program through direct service to Foundation research projects and by making, from ceramic materials, critical parts to replace rare or costly metals in certain apparatus and factory production equipment.

Photomicrographs



TAKE FUSION MOVIES—Paul Moreau is shown making photomicrographic motion pictures of metallic fusion.