

through a producing well, the pressure near the well will drop somewhat below the original value. This decrease of pressure tends to cause dissolved gas to separate from the liquid to some extent. As production from a well proceeds, the zone of lowered pressure extends farther back into the formation surrounding the well. The gas separating from the liquid in the very small pore spaces in the rock forms small bubbles. Energy is required to force these bubbles through the minute, devious channels toward the well and flow of oil to the well is thus impeded. A certain amount of this difficulty is unavoidable, but it again points to the desirability of keeping gas in solution in the oil just as long as possible in its travel through the reservoir. Lower rates of production require less pressure differential near the well, and are therefore desirable for the sake of better long-term recoveries. Other means of keeping formation pressures high are also helpful in this regard.

Project 37 pointed out to the industry that, with suit-

able precautions, the pressure upon a saturated solution of gas in oil could be lowered by several hundred pounds per square inch without the evolution of any gas bubbles. This type of supersaturated solution could, in many cases, be maintained so long as no agitation or turbulence occurred in the liquid. The advantages of this phenomenon in keeping the oil as long as possible in its most mobile condition are sufficiently great that the project is now undertaking an extensive program of research and investigation of this particular type of behavior.

The scientific information gathered by the workers of the project over a period of twenty-five years has been made available to the public through technical publication channels. In addition to two book-length works, some 130 scientific journal articles have appeared, and the series is extending at the rate of about five each year. Considered broadly, this form of cooperation between industry and educational institutions offers interesting opportunities for benefit to all.

THE MEN BEHIND PROJECT 37

THE AMERICAN PETROLEUM INSTITUTE, at its 32nd annual meeting in Chicago in November, celebrated the 25th anniversary of Project 37. The high point of this celebration was the presentation of Certificates of Appreciation to two Caltech scientists, for their work on the project—Drs. William N. Lacey and Bruce H. Sage, Professors of Chemical Engineering.

Dr. Lacey has directed this hydrocarbon research at Caltech since it was first begun 25 years ago. Dr. Sage has co-sponsored the research since 1937. In making its awards to the two men the American Petroleum Institute noted that their work "has been of untold value to refiners and others because it enabled them to predict accurately how hydrocarbon mixtures would react under given circumstances" and "to save tens of millions of barrels of high-grade distillate which otherwise might have been lost forever."

This is not the first time Dr. Lacey and Dr. Sage have been honored for their hydrocarbon research. In 1946 Dr. Lacey received the Hanlon Award of the Natural Gasoline Association of America "for meritorious service to the natural gas industry." In 1947 he was given the Anthony F. Lucas Gold Medal of the American Institute of Metallurgical Engineers.

In 1949 Dr. Sage was named the first recipient of the Precision Scientific Company Award of the American Chemical Society for achievement in petroleum chemistry for his "contributions to the knowledge of petroleum and its products."

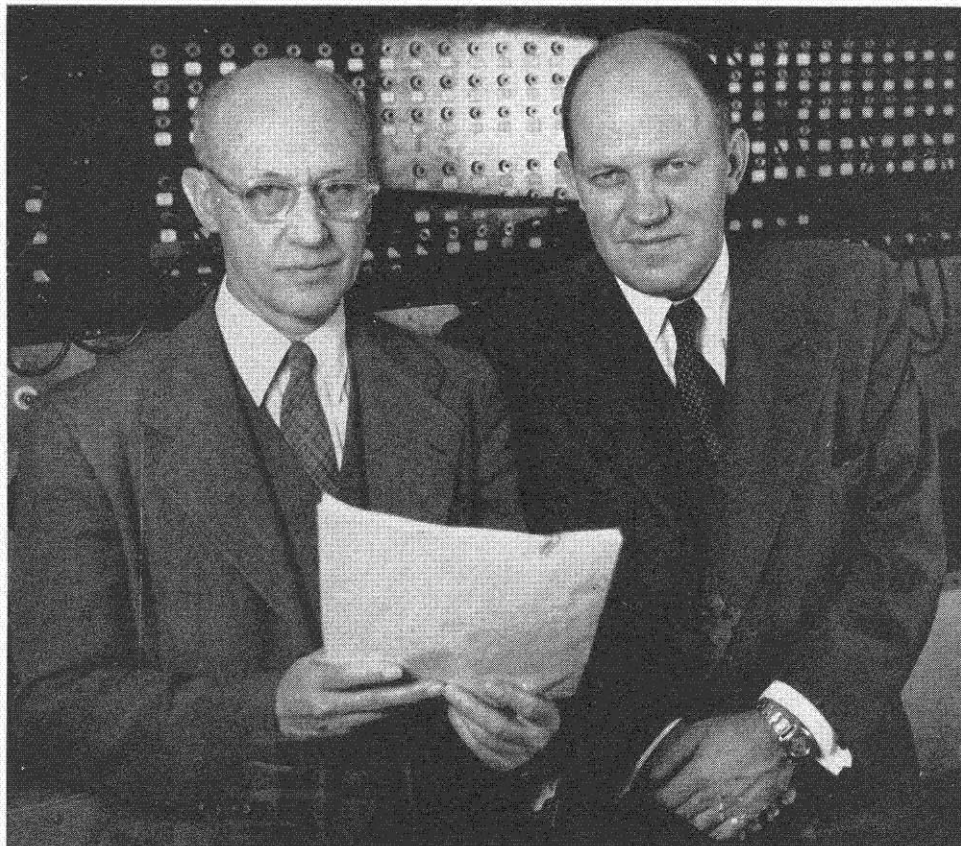
At Caltech, the Chemical Engineering department is under the joint direction of Dr. Lacey and Dr. Sage. Though the hydrocarbon work is, and always has been, their chief research project, it is certainly not the only activity they are engaged in.

Dr. Lacey, for example, successfully manages to fill out a large portion of his time by serving as Dean of Graduate Students at the Institute. Like all good deans, most of the work he does in this position is above and beyond the call of duty. He functions variously as career consultant, financial adviser, substitute father, and court of final appeal to the Institute's 600-odd graduate students.

One of his minor chores is to read every thesis presented by every candidate for Engineer and Ph.D. degrees at Caltech. There are about 90 of these theses every year running to a total of about 10,000 typed pages, and covering, of course, a rather wide range. In one sitting, for example, Dr. Lacey may run through "Complex Function Theory for Functions with Values and Arguments in Locally Convex Linear Topological Spaces," and top it off with "The Course of Vitamin B₁ Metabolism in Man as Indicated by the Use of Radioactive Sulfur, a New Synthesis of 4-methyl-5-beta-hydroxyethylthiazole, and a Demonstration of Anti-coincidence Radioactive Counting Techniques."

Dr. Lacey came to Caltech as an instructor in Chemistry in 1916. A graduate of Stanford (1911), he received the degree of Chemical Engineer there in 1912. He served as an assistant in Chemistry at the University of California from 1912 to 1915, while studying for his doctorate there. After he received his degree in 1915 he worked for a year as a research chemist for the Giant Powder Works in San Francisco, then served as a Research Associate at MIT before joining the Caltech faculty in 1916.

He became a full professor at Caltech in 1931, and was made Dean of Graduate Students in 1946, succeeding the late Richard C. Tolman. He was Chairman of



W. N. Lacey and Bruce H. Sage, Caltech Professors of Chemical Engineering, and the men behind Project 37.

the Faculty in 1944-45, and is a member or past member of the Faculty Board and Faculty Committees on the Science Course, Student Relations, Registration, Industrial Relations, Graduate Studies, Contracts and Patents.

During the first world war Dr. Lacey served as a First Lieutenant in the Ordnance Department Reserve, and saw active duty from 1917 to 1919 at the Rock Island Arsenal, in Illinois, where he was assigned to the design, construction and operation of artillery shell and fuze-loading plant.

In World War II he was a supervisor under the OEM contract covering the National Defense Research Council's research and development on artillery rocket ammunition at Caltech. In 1948 he was awarded a Presidential Certificate of Merit for this work.

Dr. Lacey is a member of the American Chemical Society, the American Institute of Chemical Engineers, Sigma Xi, Tau Beta Pi, and Phi Lambda Upsilon. He is a past-chairman of the Southern California Section of AICE, and a councilor and past-chairman of the Southern California Section of ACS.

Dr. Sage has been quoted as saying, "There is nothing like the combination of several part-time jobs to stimulate the mind and to keep busy." He should know.

Aside from his research, Dr. Sage teaches several graduate courses at the Institute. Until recently he served as Associate Director of Engineering and head of the Explosives Department at the Naval Ordnance Test Station, Inyokern. He is now Senior Consultant there.

Though he thrives on keeping as many jobs going as possible, Dr. Sage has all his life found time to indulge in his favorite hobby—which is to roam over

isolated portions of the Southwest on pack trips. And, though his work required him for a number of years to maintain homes in Altadena and Inyokern, he had—and still has—a cattle ranch in central New Mexico to round out his activities.

New Mexico is Dr. Sage's home state. He was born in State College, and was graduated in 1929 from the A & M college. He received his M.S. in 1931 and his Ph.D. from Caltech in 1934, and has been associated with the Institute ever since. He has been a full professor here since 1944.

From 1941 to 1946 Dr. Sage served as a consultant to the Division of Rocket Ordnance of the National Defense Research Committee of the Office of Scientific Research and Development, and later as investigator and supervisor of the Propellant and Interior Ballistics Division of the National Defense Research Council's rocket program at Caltech.

He played an important role in the development of rockets for military purposes, and in 1948 received the Medal for Merit, the outstanding civilian award for contributions to the war effort, for his studies on rocket ballistics and development of an extrusion process for double-base propellants.

Dr. Sage is co-author with Dr. Lacey of *Volumetric and Phase Behavior of Hydrocarbons*, *Thermodynamic Properties of Hydrocarbons*, and *Thermodynamics of One-Component Systems*. He is a member of the American Institute of Mining and Metallurgical Engineers, the American Chemical Society, the American Institute of Chemical Engineers, and the California Natural Gasoline Association, as well as Tau Beta Pi and Sigma Xi.