

PHYSICS

THEN and NOW

By Paul D. Foote

An after-dinner address presented before the American Physical Society, March 16, 1956, Pittsburgh, Pa. A former president of the Society, Dr. Foote is now serving as Chairman of the Engineering Section of the National Academy of Sciences and as head of the National Research Council's advisory committee to the Army's Office of Ordnance Research in Washington, D. C.



I HAVE been a member of the American Physical Society for forty-six years and accordingly must be classed as an "old timer". Chronologically speaking, I am next to the oldest surviving past president. Dr. Swann was president in 1932, and I followed him in 1933. All the preceding presidents have passed to their final reward.

When we organized the Optical Society in 1916 as an offshoot of the Physical Society, the first thirty applicants to mail a check for five dollars to Dr. Nutting were to be considered the charter members. My check was delayed in the mail, so that I became number 33. Since then, I have moved to number six, with only five members chronologically senior to me. These are sobering facts which, added to retirement from active duty, justly entitle a little reminiscing.

The first meeting of the society that I attended was in Minneapolis in 1910. At that time, the total membership was about 500 as contrasted with approximately 12 000 today. The attendance at the meetings was small, usually around 50, but everybody knew one another, and special attention was given to encouraging the younger members of the group. I recall that the officials of the society at this meeting (Crew, Magie, Peirce, Merriitt, Ames, and a few others) invited the two youngsters H. E. Ives and me to attend an informal affair at a Rathskeller where we discussed until midnight what was then modern physics. At many a breakfast or luncheon in the early days, I was a guest of Michelson, Millikan, Gale, and other prominent physicists interested in youth. I fear that with the gigantic meetings of today such inspiring personal contacts have been lost, at least to the young people just starting their careers. Perhaps, however, the youngsters today do not need the stimulus of personal contact with the leading physicists; they receive plenty of stimulus from the personnel officers of the various institutions and corporations. Those of you who attended the Feb-

ruary meeting in New York may have visited the fifth and sixth floors of the Hotel New Yorker where all the bedrooms on these two floors had been converted to offices staffed with engineering and employment personnel engaged in interviewing and pirating prospective candidates for lucrative positions in industrial, government, and academic laboratories. Out of curiosity, Dr. Swann and I fought our way through the mobs in these halls and barely avoided signing contracts with half a dozen agencies. It was reported that at least three bell-boys were registered as nuclear physicists before they realized the seriousness of their commitments.

Interest in physics over the decades has been something like an ascending series of logistic curves, and, while we may be approaching criticality at the present moment, we have had our asymptotic periods and many critical situations, some of which have been the opposite of explosive—in fact, the chain reaction was in danger of stopping altogether. The older physicists will recall the period of the fourth decimal place in the early 1900's. Then came the relativity theory, the quantum theory, and the age of atomic spectra. All of these basic developments produced an impetus to the logistic curve, but by the middle Thirties, following a decade of radio, we were having meetings to discuss the saturation point as far as electronics were concerned. Many prominent physicists argued that there was no future for the electronic engineer. Then came the tremendous expansion of industrial research in every phase of American business enterprise, television, gadgetry galore for improving the standard of living, followed by nuclear energy and military research. Now we have the development of nuclear energy for peaceful purposes, rockets, satellites, automation, and electronic computing to relieve the physicist of routine work in order that he may devise still more complicated machinery to satisfy our as-yet-unknown desires and requirements. Certainly we are enjoying today the most prosperous and thrilling experiences in the entire history

of physics. We are far up on the new logistic wave but with no indication of an asymptote or even a decreasing tangent.

Circumstances were quite different at the beginning of the Thirties. Over the years, the council had viewed with distrust any encroachment upon purely academic physics by those who were concerned with industrial activity. This resulted in the separation from the society of groups of physicists who were promoting engineering and industrial research. The first group to leave our fold was what finally became the wealthy and powerful Society of Electrical Engineers. This was followed by the Optical and Acoustical Societies, and still later by several other groups. As soon as a branch of physics developed to the point where it was able to draw upon industry for a portion of its financing, there was a trend toward segregation. This trend was gradually depleting the Physical Society of all sources of revenue except dues, and weakening the broad position of physics. In union there is strength, and with large numbers all unit costs and general overhead are reduced. Presidents Gale and Swann saw the threatening financial clouds during their administrations from 1929 to 1932. Finance and unification of physics were the chief topics at our council meetings. As a member of the council, the later vice-president, I was appointed chairman of a committee consisting of L. A. Jones, A. W. Hull, H. E. Ives, L. O. Grondahl, K. T. Compton, G. B. Pegram, and Henry Gale, to see what should be the remedy. It appeared impossible to effect an organization like the Chemical Society or some of the large engineering societies, but we finally arrived at a solution which has proved very satisfactory, with none of the physical societies relinquishing their autonomy. This was the American Institute of Physics, which has just celebrated its 25th anniversary. With a sound business organization in prospect, it was not difficult to secure financial assistance from industry and especially at the start from the Chemical Foundation. Our society owes its profound gratitude to W. W. Buffum of the Chemical Foundation for its support during the first few years of this crisis, and to the substantial contributions of a large group of physicists and industries. Under the able management of Dr. H. A. Barton, the Institute has operated on a much more economical basis than would have been possible with independent groups. To appreciate the financial problem confronting the Physical Society when I became president in January, 1933, the dues for that year, collected the preceding fall, had all been spent on past debts, leaving nothing for the current administration. All this was remedied by philanthropic agencies when they were convinced that our new organization was under capable business management. It is hoped that the new groups of physicists forming in specialized subjects will profit by the lessons we learned during the early Thirties, and continue to be affiliated with the Institute or the Physical Society.

During my long connection with petroleum industrial research, I have been impressed by the unique correla-

tion between the membership of the American Physical Society and the domestic demand for petroleum, which is running around nine to ten million barrels per day. The long-time trend over the past 40 years has averaged a yearly increase of 6% for both commodities. Whether the physicists are responsible for the increase in petroleum demand, or petroleum is responsible for the increase in physicists, is still a moot question. For a short time, beginning in 1946, the percentage increase in physicists exceeded the demand for oil, but now the rising curves on a semi-log plot have become parallel, and both conform to the long-time trend. The domestic supply of both commodities has been insufficient to meet demand and an appreciable import has become necessary, the percentage of imports to domestic production being comparable for physicists and for oil. Since demand for both commodities exceeds domestic production, we may assume that the costs for each will increase over the coming years.

Our nation is the largest consumer of energy in the world, and the rate at which energy demand is increasing can be appreciated by the following facts relating to the three fossil fuels, coal, petroleum, and gas. Starting with the Declaration of Independence, half of all the coal we have ever used has been mined since 1925. Half of our total demand for oil has taken place since 1943. Half of the retail sales of gas has been made since 1946. These are astonishing figures, especially when extrapolated to 1975. A similar calculation may be made for the membership years of the Physical Society. Half of the physicist-years since the organization of the Society in 1899 has been enjoyed by the public since 1946, precisely the same as for the gas industry. Certainly we are experiencing a remarkable epoch in the consumption of power, fossil fuel, and physicists.

When the Physical Society meets in Pittsburgh in the year 2006, fifty years hence, probably no one present tonight will be able to digest the excellent dinner at the evening gathering. However, there will be a new crop of old timers, and plenty of young physicists—provided a sufficiently large banquet hall has been constructed in the meantime. One of the old timers will be called upon for a brief period of reminiscence. He will recount the amateurish experiments of the 1950 decade with particle accelerators, bevatrons, and the like, and the maze of so-called fundamental particles, none of which had been properly correlated. He will discuss the attempts at understanding gravitation, and the conversion of merely one-tenth percent of mass into useful work as the beginning of the peaceful applications of nuclear energy. He will conclude with the statement that he has lived during the most productive and thrilling period in the entire history of physics, and that the future promises untold rewards for the newly-inducted members of the American Physical Society. He will lament in 2006 that his only regret is that he cannot be present at the Pittsburgh banquet of the American Physical Society in the year 2056.