

## Nobel Prize in Physics Awarded to Transistor Inventors

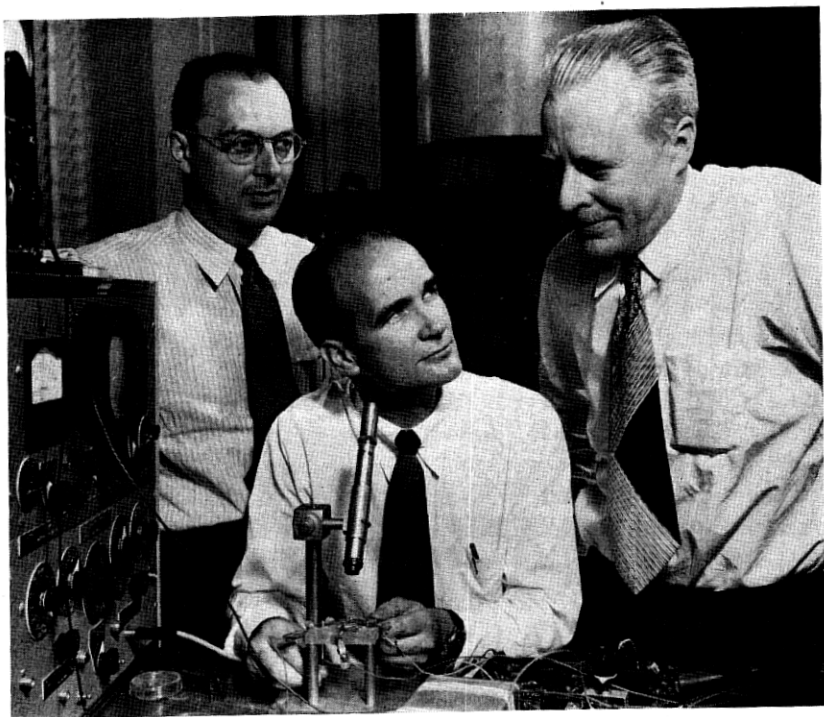
The Swedish Royal Academy of Sciences announced on November 1 that a Nobel Prize in Physics, most highly coveted award in the world of physics, had been awarded jointly to Dr. Walter H. Brattain of the Laboratories Physical Research Department, with Dr. John Bardeen and Dr. William Shockley, both former members of the Laboratories. The prize was awarded for "investigations on semiconductors and the discovery of the transistor effect."

This marks the second time that work done at the Laboratories has been recognized by a Nobel Prize. The previous recipient was Dr. C. J. Davisson who shared in the 1937 prize for his discovery of electron diffraction as a result of experiments carried out with Dr. L. H. Germer, also of the Laboratories.

Each of the three winners of this year's prize will receive a gold medal, a diploma and a share of the \$38,633 prize money. When he was notified that he was one of these winners, Dr. Brattain said, "I certainly appreciate the honor. It is a great satisfaction to have done something in life and to have been recognized for it in this way. However, much of my good fortune comes from being in the right place, at the right time, and having the right sort of people to work with."

The principle of transistor action was discovered as a result of fundamental research directed toward gaining a better understanding of the surface properties of semiconductors. Following World War II, intensive programs on the properties of germanium and silicon were undertaken at the Laboratories under the direction of William Shockley and S. O. Morgan. One group in this program engaged in a study of the body properties of semi-conductors, and another on the surface properties. Dr. John Bardeen served as theoretical physicist and R. B. Gibney as chemist for both groups. These investigations, which resulted in the invention of the transistor, made extensive use of knowledge and techniques developed by scientists here and elsewhere, particularly by members of the Laboratories—R. S. Ohl, J. H. Scaff and H. C. Theuerer.

Since the transistor was announced, little more than eight years ago, it has become increasingly important in what has been called the "new



*The Nobel Prize winners in an historic photograph taken in 1948 when the announcement of the invention of the transistor was made. Left to right, John Bardeen, William Shockley and Walter H. Brattain.*

electronics age." As new transistors and related semiconductor devices are developed and improved, the possible fields of application for these devices increase to such an extent that they may truly be said to have "revolutionized the electronics art."

The invention of the transistor, basis for the Nobel Prize award, represents an outstanding example of the combination of research teamwork and individual achievement in the Bell System that has meant so much to the rapid development of modern communications systems.

Dr. Brattain received a B.S. degree from Whitman College in 1924, an M.A. degree from the University of Oregon in 1926, and a Ph.D. degree from the University of Minnesota in 1928. He joined Bell Telephone Laboratories in 1929, and his early work was in the field of thermionics, particularly the study of electron emission from hot surfaces. He also studied frequency standards, magnetometers and infra-red phenomena.

Subsequently, Mr. Brattain engaged in the study of electrical conductivity and rectification phenomena in semiconductors. During World War II, he was associated with the National Defense Research Committee at Columbia University where he worked on magnetic detection of submarines.

Mr. Brattain has received honorary Doctor of Science degrees from Whitman College, Union College and Portland University. His many awards include the John Scott Medal and the Stuart Ballantine Medal, both of which he received jointly with John Bardeen. Mr. Brattain is a Fellow of the American Academy of Arts and Sciences.

Dr. Bardeen received the B.S. in E.E. and M.S. in E.E. degrees from the University of Wisconsin in 1928 and 1929 respectively, and his Ph.D. degree in Mathematics and Physics from Princeton University in 1936. After serving as an Assistant Professor of Physics at the University of Minnesota from 1938 to 1941, he worked with the Naval Ordnance Laboratory as a physicist during World War II. In 1945 he joined the Laboratories as a research physicist, and was primarily concerned

*Clinton J. Davisson Previous Laboratories Nobel Laureate*

In December, 1937, Dr. Clinton J. Davisson of the Laboratories was awarded the Nobel Prize in Physics for his discovery of electron diffraction and the wave properties of electrons.

He shared the prize with Professor G. P. Thompson of London, who worked in the same field, though there was little in common between their techniques. Dr. Davisson's work on electron diffraction started as an attempt to understand the characteristics of secondary emission in multi-grid electron tubes. In this work he discovered patterns of emission from the surface of single crystals of nickel. By studying these patterns, Dr. Davisson, with Dr. L. H. Germer and their associates, proved that reflected electrons have the properties of trains of waves.

Dr. Davisson was awarded the B.S. degree in physics from the University of Chicago in 1908 and the Ph.D. degree from Princeton in 1911. From September, 1911, until June, 1917, he was an instructor in physics at the Carnegie Institute of Technology, coming to the Laboratories on a wartime leave of absence. He found the climate of the Laboratories conducive to basic research, however, and remained until his retirement in 1946. Besides his work on electron diffraction, Dr. Davisson did much significant work in a variety of fields, particularly electron optics, magnetrons, and crystal physics.

with theoretical problems in solid state physics, including studies of semiconductor materials.

Mr. Bardeen, whose honors include an honorary Doctor of Science degree from Union College, the Stuart Ballantine Medal, the John Scott Medal, and the Buckley Prize, is a member of the National Academy of Sciences. He joined the University of Illinois in 1951.

Dr. Shockley received a B.Sc. degree from the California Institute of Technology in 1932, and a Ph.D. degree from the Massachusetts Institute of Technology in 1936. He joined the staff of Bell Telephone Laboratories in 1936. In addition to his many contributions to solid state physics and semiconductors, Mr. Shockley has worked on electron tube and electron multiplier design, studies of various physical phenomena in alloys, radar development and magnetism.

His many awards include an honorary degree from the University of Pennsylvania, the Morris Liebmann Memorial Prize, the Buckley Prize, the Comstock Prize and membership in the National Academy of Sciences. Dr. Shockley left the Laboratories to form the Shockley Semiconductor Laboratory at Beckman Instruments, Inc., in 1955.