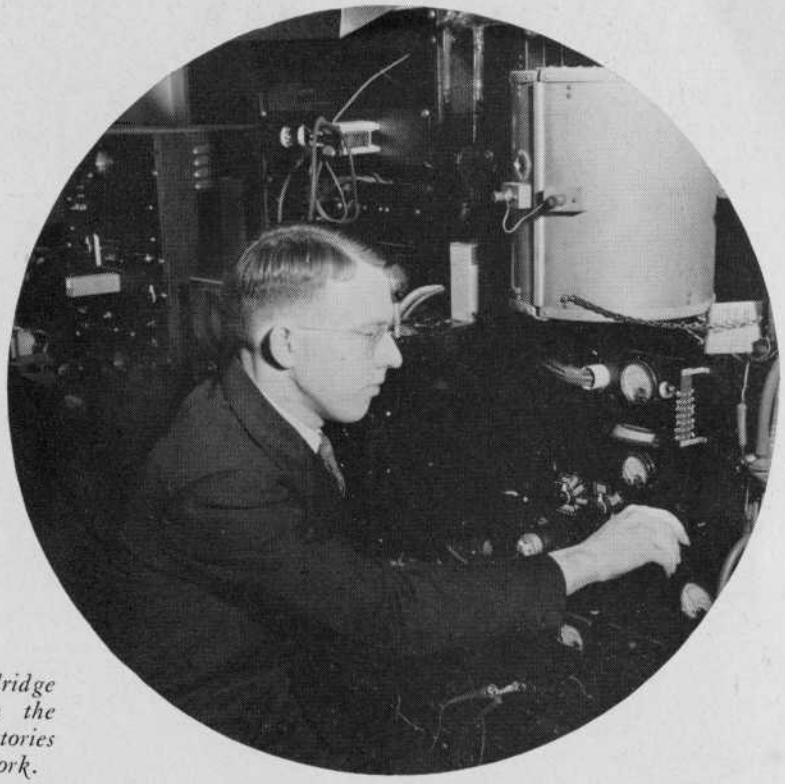
Maker of Electrons

This Sooner Physicist Delves Into Strange Scientific Fields To Hunt for Information That Might Help Telephone Service



Dean Wooldridge at work in the Bell Laboratories at New York.

DEAN E. WOOLDRIDGE, '32, has an unusual job. He is a producer of electrons.

Mr. Wooldridge entered the University of Oklahoma in 1928, and began a pre-law course. Like many pre-law students he postponed taking his science requirement until his junior year. Unlike most pre-law students, he was so fascinated by what he saw of modern science in Physics 1 that he determined to make a career of it. Exchanging government and philosophy for physics and mathematics, he was able to work off a major and minor in the latter two subjects, respectively, in time to get his B. A. degree in 1932. He stayed on another year to take some of the courses he had missed and received an M. S.

The next three years were spent on an even richer diet of physics and mathematics, at the California Institute of Technology, in Pasadena. Emerging with a Ph. D. degree in 1936, Mr. Wooldridge went right to work for the Bell Telephone Laboratories in New York, where he has been ever since. For two years now he has been concerned with the production of electrons.

An electron is a very small particle which carries a very small quantity of electricity. The current which flows through your reading lamp is made up of a stream of such particles. Quite a stream, in fact. For in one second there will flow through your lamp as many electrons as there are eyedropper-sized drops of oil under the entire surface of Oklahoma. The telephone company is interested in electrons because they constitute, literally, the life-blood of the industry. The electrical impulses which flow through your telephone receiver and cause you to hear the voice of the person at the other end of the wire consist entirely of a stream of electrons which ebbs and flows in accordance with the vibrations of the vocal cords of the speaker. So in a sense every employee of the telephone company has to do with the production and marketing of electrons.

But Mr. Wooldridge is concerned not so much with the electrons which flow through the wires of your telephone instrument as he is with electrons that jump through space in vacuum tubes. The vacuum tube is almost as important to the telephone business as the telephone handset, for without it telephone conversations could take place over only a few miles' distance.

The trouble is that, in one way or another, many of the electrons which start through the wires at the speaker's end of the line fall by the wayside before they reach the telephone held by the listener. Hence, in a long distance conversation, there must be amplifiers placed at regular intervals along the line, whose function it is to convert a pulsating electrical current involving only a small number of electrons into an exactly similarly pulsating current involving a much larger number of electrons. This amplified current of electrons then travels several miles farther, before it, in turn, has to be boosted, etc. The amplification is done in a vacuum tube, in which a strong electron current hops through space from one metal element towards another, the amount of current which reaches the second element being controlled by the much smaller currents being amplified. In this way the weak currents turn the strong ones on and off as often as they themselves flicker on and off, in synchronization with the fluctuations of the vocal chords of the speaker, who started the whole business.

Just as electrons in wires constitute the raw material with which the telephone instrument works, so does a cloud of electrons in a vacuum make up the working material of the vacuum tube. Mr. Wooldridge is specifically interested in producing that cloud. Fortunately it is not necessary to manufacture the electrons, since all matter contains them in profusion. The trick is to get them out into the surrounding space, where they can be worked with. For the electrons don't like to leave home. And there aren't very many ways of inducing them to do so.

The most common method of evoking electrons in appreciable quantities from a solid is to drive them out by heat. There is a limiting temperature that the electrons can stand; when their home gets hotter than this, they commence to leave. The glowing element in the middle of the vacuum tube in your radio set has no other function than to make things so hot for the electrons in that element that enough of them will escape into the surrounding space to carry on the business of the tube. The amplifier tubes used by the Telephone Company employ similar heated elements. But heating requires power, and power costs money. Your long distance phone rates are determined largely by things like this. Consequently scientists and engineers have worked for years trying to discover ways of getting more electrons for less power.

One of the until-lately unexploited possibilities is "secondary electron emission." This is the name given to the observed fact that, under the proper circumstances, several electrons can be knocked out of a surface by shooting against it only one bombarding electron. To those concerned with producing electrons more cheaply, this looked like several for the price of one.

The catch is that stable emitting surfaces are hard to produce and don't last

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long. The Bell Telephone Laboratories hopes to remedy this situation. Since purely empirical methods, in a field like this, never get very far unless they are based upon accurate knowledge of the fundamental physical processes underlying the phenomemon, Mr. Wooldridge has been turned loose to find out whatever he can about what happens between the time the bombarding electrons go in and the time the secondary electrons come out.

Progress has been made. Long a mystery was a peculiar dependence of the yield of the secondary emission process on the speed of the bombarding particles. The Sooner scientist has shown this to be a natural consequence of the wave-mechanical nature of the electron and the bombarded target. Mr. Wooldridge's experiments have revealed the surprising fact that a temperature change sufficient to cause the number of electrons emitted by the hot element in your vacuum tube to increase several hundredfold produces a change only about one per cent in the secondary emission from a surface.

As is true of all fundamental research, each discovery, by its implications, leads to new speculations and new experiments. No one can predict where the trail will lead. It is possible that nothing will ever come of Mr. Wooldridge's work that will directly pay back to his employers the money they have invested in it.

But the telephone company has learned that in the long run, directly or indirectly, fundamental research of the type done by Mr. Wooldridge and his co-workers does far more than pay for itself. If it were not for work of this type done in the past, your telephone rates today would be much higher and your telephone service would be incomparably less universal.

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On O. B. U. Staff

Faculty appointments for 1941-42 at Oklahoma Baptist University, Shawnee, show five Sooner alumni on the staff there. They are Dr. Orin Cornett, '37ms, associate professor of physics and mathematics; Edward Hurt, Jr., '39ma, director of athletics, instructor in physical education; Dr. Frank Keen, '30bs, '32med, universiy physician; Mrs. Kenneth Phelan, '27 ba, '30ma, instructor in English; Carol Marie Steward, '38ed.

Bellattis Buy Newspaper

C. R. Bellatti, '12law, former publisher of the *Blackwell Tribune,* and his son R. Marsden Bellatti, '33journ, have purchased the *Stillwater Daily News.* E. E. Johnson, one of the former owners, retains an interest in the paper.