University

The Infra-Red Spectrograph

(Comments on March Sooner Magazine Cover Picture)

A spectrograph is an instrument which splits up light into its different colors. Table salt put in a flame emits a yellow light of one color or wave length; this yellow light is emitted by the atoms of sodium. The light from a red neon sign consists of a number of different wave lengths, or colors; these are usually spoken of as "lines" and the spectrum made by a spectrograph is called a bright-line spectrum. These lines are emitted by the atoms of neon. Each kind of atom emits a spectrum which is characteristic of that atom. These spectral lines may be in the visible or in the ultra-violet, the latter being wave lengths that are too short to be seen.

A molecule also emits a spectrum which is characteristic of that molecule. When light of all wave lengths of infra-red light (light whose wave lengths are so long that they are not visible) passes through a layer of a "transparent" gas or liquid, certain wave lengths are selectively absorbed. These absorbed wave lengths are characteristic of the molecules of the substance which does the absorbing. Thus, an infra-red absorption spectrum of a substance may reveal the composition of that substance.

Infra-red light is absorbed so strongly by glass that the prism in an infra-red spectrograph must be made of some other substance. The prisms are usually cut from huge crystals of sodium chloride (ordinary table salt) or potassium bromide, a similar salt. Obviously glass lenses cannot be used in such an instrument. In the infra-red spectrograph the invisible light is focused by parabolic and elliptical mirrors.

This long wave length infra-red light does not effect a photographic film so another means of recording the spectrum is necessary. Any sort of light, when it is absorbed, produces heat (remember when you parked your car in the bright July sun last summer). In the infra-red spectrograph the light which comes through the salt prism is focused with a spherical concave mirror on a thermocouple. This heats the couple causing a tiny electric current which can be amplified and made to actuate a recording mechanism. The current generated in the thermocouple is proportional to the intensity of the light which falls on it, and the deflection of the recording mechanism is proportional to this current. Thus, bright lines cause large reflections of the recording device which draws a curve on a moving paper strip.

The wave length of the infra-red light, as well as its relative intensity, can be read from the recorded curve. And from this information the composition of the substance may be determined.

By the use of such infra-red spectra it is possible to analyse certain petroleum hydrocarbons much more rapidly and accurately than can be done in any other way.

Such analyses were vital in our prosecution of the war, particularly in the production of petroleum fuels and synthetic rubber.

The infra-red spectrograph, which was built in the instrument shop of the department of physics, was of the Wadsworth-Littrow type. It is a large three-prism instrument designed especially for research purposes. Any prism is brought automatically into the exact operating position by simply pressing a button.

Each sixty degree salt prism has a face six inches by four inches.

Even yet infra-red spectrographs of this size are not being manufactured commercially. Smaller instruments having less resolution are available.

Construction was begun in February, 1943 and completed in May, 1944.

"Prexie" Stratton D. Brooks, recently visited the O. U. Campus again while enroute to his headquarters in Kansas City. Dr. Brooks, president of the University from 1912 to 1923, is shown above visiting with a group of old time friends, many of whom were staff members during those years of O.U.-Brooks development programs on the campus in Norman. Seated and visiting with these former associates, Dr. Brooks was the guest of Emil R. Kraettli, secretary of the University, and Mrs. Kraettli in the Blue Room of the Oklahoma Memorial Union where a special reception was held for him. Reading from left to right, are Mrs. Guy Y. Williams, Professor C. F. Giard, acting chairman of department of music; Dr. Brooks; Dr. S. W. Reaves, dean of the College of Arts and Sciences; Dr. J. H. Felgar, dean emeritus of the Engineering School; Dr. Edward Everett Dale, research professor of history, and Dr. Guy Y. Williams, veterans' liaison officer.

The contract price of the spectrograph (exclusive of prisms) was $14,500.

The instrument which was built here for the Naval Research Laboratory is the best in the world at this time. It has a close rival in the spectrograph of the Texas Company, which cost much more. A very recent comparison of spectrograms shows that the O. U.-built instrument gives the highest resolution of any instrument in existence.

Early in 1943 only two other laboratories had experience in designing such instruments. These laboratories were both busy with other important contracts and could not promise to complete an instrument for the Navy in a reasonable time. Through our Oklahoma Research Institute, Dr. J. Rud Nielsen, and Dr. William Schriever undertook the design and construction of the spectrograph. Mr. Ralph Fearnow, the young Oklahoma-born instrument maker of the department of physics, was in charge of and did most of the actual shop work.

The instrument shop of the department of physics, was established in 1921 by Dr. William Schriever, then assistant professor of physics, who also served as instrument maker for the department until 1925 when the department secured a half-time instrument maker from the National Bureau of Standards. Dr. Schriever has been the regular staff member responsible for the instrument shop since it was established.

Dr. Nielsen, through the University of Oklahoma Research Institute has been co-operating in the preparation of a catalog of infra-red spectra of highly purified hydrocarbons. The spectroscopy laboratory of the University department of physics was the second laboratory to make contributions of spectra to this catalog which is sponsored by the American Petroleum Institute and the National Bureau of Standards. The Shell Development Company of Emeryville, California was the first. Last September 11 laboratories were contributing; these included the Naval Research Laboratory. For a long time our O. U. laboratory contributed more spectrograms than any of the other laboratories. Some of this work was done jointly with the research department of the Phillips Petroleum Company of Bartlesville, Oklahoma. Although these spectrograms were available only to members of the American Petroleum Institute during the war, they will soon be released to the public.

Enjoying a cup of coffee and a doughnut and "looking back over the years" are (reading left to right) Professor C. F. Giard; Walter S. Campbell, professor of English, and Dr. Stratton D. Brooks.

The Old One-Two

Some future Billy Conn or Gene Tunney might pop up in the beginning boxing class that Dewey "Snorter" Luster, former football coach at the University of Oklahoma is now teaching. Mr. Luster personally coaches the men, most of whom have had no former experience. A novice tournament will be held in March with only beginners allowed to participate.