A "cold" filamentless radio tube

Already built in many experimental forms. Operates as amplifier, modulator, detector, oscillator

By CLINTON W. HOUGH
*President, Wired Radio, Inc.**
60 Broadway, New York City

Editors' foreword

Widespread interest was created by the announcement in "Electronics" for September of the development of an entirely new type of cold radio tube that operates without filament or A-battery supply. Editors of "Electronics" visited the laboratory at Ampere, N. J., and witnessed the operation of the new tube, both as an amplifier, and as a modulator. Later visitors report having listened to a three-tube radio broadcast receiver which used these filamentless tubes exclusively.

Since the appearance of "Electronics" item, inquiries have poured in from all parts of the country, and a number of prominent radio men have already visited the laboratory and inspected the tube in operation.

Dr. Hund has had in preparation for "Electronics" an exclusive article giving the characteristics of the new tube, but since some of the patent applications for latest forms of the tube were not finished as this issue goes to press, he has preferred to delay publication of his complete article to a later number. In his place, President Hough has contributed the following statement.

IN *Electronics* for September, 1931, page 89, appeared the first announcement of a new type of tube which is being developed at our research laboratories at Ampere, N. J., by Dr. August Hund. In that article it was stated:

"A new filamentless radio tube now being developed by large independent interests, will apparently do everything the three-electrode vacuum tube can do—as amplifier, rectifier and oscillator.

"Such tubes have a high amplification factor, are simple and easy to make, and can be manufactured for a few cents each. Already they have been applied exclusively in a three-tube radio set with satisfactory results. They have also been employed in test transmitters. Having negligible internal capacity, they can be worked directly on short waves even below one meter. Fortunately this invention is in strong independent hands, where it can be administered for the benefit of all concerned."

In response to the request made to us by the editors of *Electronics* for additional information regarding these new tubes being developed in our laboratory by Dr. Hund, at the moment there is not much more to be said. The editors and other visitors have seen the tubes operating as oscillators, modulators, detectors and amplifiers. There are several types of these new tubes, and they perform all of the functions of the various types of vacuum tubes.

An interesting feature of the new tubes is the complete elimination of all filaments and heaters. The tubes function on the usual B-battery or plate-voltage supply only, controlled by signal impulses. The tubes also function

DR. AUGUST HUND

Dr. August Hund and his "cold tube" photographed in his laboratory at Ampere, N. J. Dr. Hund is widely known among radio men for his work while with the U. S. Bureau of Standards

*Subsidiary North American Company.

HOW WIRED RADIO, INC., CAME TO DEVELOP FILAMENTLESS TUBE

Wired Radio, Inc., a subsidiary of the North American Company, one of the largest owners of electrical utility companies in the United States, is developing a system for broadcasting music, speech and general entertainment over the electric light wires by means of multiple carrier-current channels superimposed on the regular lighting frequency. It has some 1,600 patents on radio, audio and carrier-current inventions. At Ampere, N. J., it employs a staff of 200 engineers, physicists and mechanics. Wired Radio, Inc., also controls many important musical copyrights which return it a seven-figure income from royalties.

The parent North American Company controls the electric lighting companies in Cleveland, Detroit, Washington, St. Louis, Milwaukee and a number of other cities, with properties making up a total valuation of nearly a billion dollars. Into these cities it is eventually planned to introduce "wired radio" programs over the electric light wires on a monthly rental basis without advertising in the programs.

instantaneously. There is no waiting for a filament or heater to reach operating temperature.

Some types of the new tube amplify at very high frequencies, their amplifying factor increasing with the frequency. This is useful in the construction of highly efficient amplifiers for very short wavelengths.

The new tubes have been made in a wide variety of sizes,—for example, from the dimensions of a peanut kernel, up to 30 watts output capacity. They have also been used in various types of receiving sets.

Radio transmitters are now in use with the new tubes operating as oscillators, modulators and amplifiers.

One interesting development is a single oscillating tube which is simultaneously generating three frequencies carrying three wired radio programs.

This new development in radio tubes, for which full credit should go to Dr. Hund, has so many new features that radio engineers now have a new device with which to accomplish additional wonders.

The new tubes seem to have an indefinite life, with uniform action throughout. They operate cold, they work without a vacuum, and they are inexpensive to manufacture.

Dr. Hund has had under way for *Electronics* a paper describing fully his new tube and it is our wish that he disclose its details and operating characteristics so that engineers who are interested may have first-hand and reliable information. In the meantime, I hope the above general information will be of interest to *Electronics* and its readers.

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COLD TUBES IN GERMANY—DR. SEIBT'S PATENTS

CONSIDERABLE work has been done in Germany by Dr. Georg Seibt of Berlin. Patents recently issued to him in England (Nos. 341,061-2-3-4 and others) give some idea of his experiments. In general the idea of a gaseous discharge furnishing the plate current through ionization is disclosed in his patents.

For example a glow discharge taking place between cathode and anode is used in place of a heated filament. The electrons starting from the glow discharge pass to a second anode and en route are acted upon by a controlling electrode.

If, as an example, the glow discharge takes place between two electrodes which are negative with respect to a surrounding, grid-like, element, electrons leaving the glow discharge area will be attracted toward this grid-like element which acts as cathode for the remainder of the elements, which are, as in a triode, a control grid and an anode.

It has been said that such tubes would be noisy in operation, due to the gaseous discharge, but such noise would not modulate a signal being amplified unless some non-linear part of the characteristic were used. It has also been suggested that little power can be secured from such tubes. The statement above which explicitly indicates that as much as 30 watts can be secured, from Dr. Hund's tube, shows that the low power limitation has been overcome.

Dr. Seibt uses neon, among other gases, at a pressure of about 6 mm, and the gas should be as pure as is possible to obtain it, he states.

Hopes for cold-cathode tubes have been voiced many times by radio, vacuum tube, and telephone engineers. In the telephone plant there are probably 100,000 repeaters (amplifiers operating at audio and carrier frequencies). These repeaters have an average of three tubes, each consuming approximately one-half ampere of current at about 4 volts, or about 2 watts. Here, then, is a power consumption of 600,000 watts. This is expensive power because it now comes from storage batteries which must be kept charged and in condition.