RADIO

VACUUM TUBE USED AS RADIO DETECTOR

How This Device Depends on Emission and Control of Electrons for Its Operation.

Readers of the radio column are urged to clip each article and paste it in a file book. The articles printed are continuous and the entire series will be valuable for reference.

The greatest advances made in the past few years in the radio art have been due in one way or another to the use of vacuum tubes. In view of this fact a more careful consideration of them will be of interest.

All of these tubes, known by a variety of names, such as radiotron, audion, [illegible] (trade names of the manufacturer) depend upon the same fundamental principles for their operation. For the sake of simplicity of brevity these will be referred to in this column simply as vacuum tubes. A vacuum tube can be made to function as a detector, as an amplifier, or as an oscillator.

The vacuum tube depends on the emission and control of electrons for its operation. The electron is the smallest subdivision of matter which mankind recognizes and it carries the smallest known charge of negative electricity. For years previous to electron research it had been held by scientists that matter was built up of distinct particles or units which they called atoms and molecules. At first the molecule was assumed to be the smallest quantity of matter that could have a separate existence or take part in chemical action, but more vigorous research pointed to the fact that the molecule is made up of still smaller elements which are termed atoms; that is, a molecule may be composed of several atoms. Then for a time it was assumed that the atom was the very smallest quantity of an element that could exist, but later researches have revealed that atoms may be further subdivided into particles

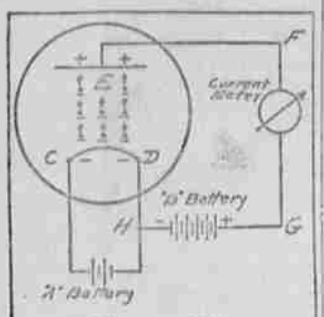

Figure III

called electrons. The apparent mass of an electron is about one-eighteen-hundredth part of that of an atom of hydrogen which is the smallest of the chemical atoms.

According to the electron theory an atom consists of a definite number of electrons grouped around a nucleus having a positive charge and so long as none of the component electrons are driven from the atom the latter presents no detectable charge. The positive charge on the nucleus is said to be exactly neutralized by the negative charges on the electrons grouped about it.

Suppose now that by some means an electron can be detached from the atom. Then the atom becomes what is known as a positive ion and it exhibits the properties of a positively charged body, or in other words since an electron which carries a negative charge has been removed from the atom which has equal positive and negative charges, the portion of the atom now remaining has a deficiency of negative charge and acts like any positively charged body.

On the other hand if some force can be brought to bear that will add an electron to a normal atom which is neutral as far as electrical charges are concerned, the result will be a negative ion, which will possess all the properties of a negatively charged body. An atom then which has a deficiency of electrons is called a positive ion and one having excess of electrons is called a negative ion.

Since each electron carries a negative charge of electricity an electron [illegible] a certain quantity of electricity. Forcing electrons to move from one point to another causes electricity to flow. The ability of any medium to conduct electricity or allow a current to flow through it depends upon the number of free electrons available as carriers of charges.

It has been known for many years that the space surrounding a piece of heated metal is a conductor of electricity. It has been demonstrated more recently that this is due to the release of electrons, and that if an incandescent metal be placed in a bulb exhausted of all gases, pure electrons will be liberated from the incandescent metal.

In a vacuum tube such as we are using at the present time, the piece of metal used to furnish the electrons is called the filament and is usually made of tungsten, and sometimes is coated with oxides to increase the electron emission. For convenience the filament of a vacuum tube is heated by a battery current and it is this heat furnished by the battery current that constitutes the force that disrupts the atoms of the filament and liberates electrons.

Fig. III is a spherical glass bulb from which all the air and gases have been exhausted and having mounted in it a filament C-D which can be heated to incandescence by the "A" battery connected to it, and the metallic plate E. When the filament C-D is heated to incandescence by the "A" battery connected across its terminals electrons are emitted. Connecting the cold plate E to the incandescent filament C-D by means of the circuit E-F-G-H which includes a current meter and a "B" battery, with its negative side connected to the filament lead at H and its positive side connected through the current meter, the plate becomes electrically positive with respect to the filament.

Since like charges repel and unlike charges attract, there will be a movement of electrons from the filament to the positively charged plate and the current meter will show a deflection which indicates that a current is flowing in the circuit E-F-G-H.

Increasing the "B" battery voltage causes an increase in the current flowing in the circuit E-F-G-H, the plate circuit, until the positive charge on the plate E is so strong that all of the electrons given off by the filament are attracted to it. Assuming that the temperature of the filament is kept constant and that the plate voltage has been increased to the point where all of the electrons given off by the filament are attracted to E, any further increases in the "B" battery voltage will not cause any increase in the current in the plate circuit.

Increasing the temperature of the filament will increase the total number of the electrons emitted.

FRISCO TALKS TO HONOLULU

New Radio Station at the Presidio Can Be Heard Half Way Around the Globe.

"Hello, Honolulu."

That may sound like fiction, but it is a reality, nevertheless.

The new radio station at the Presidio, San Francisco, with aerial conditions right, can be heard half way around the globe. Officials in charge of construction declare it to be the most powerful vacuum tube transmitter on the Pacific coast.

Located on the highest point in the Presidio, overlooking San Francisco bay, two 120-foot aerial towers to augment its efficiency, the new station will command similar stations in Salt Lake City and Cheyenne.

Radiophones on German Trains.

Wireless telephone instruments will be installed on a number of important German express trains, and receiving instruments will be placed in hotels and embassies, according to an announcement made recently. Experiments conducted in a moving freight car have shown that the wireless system works well, the men engaged in the testing of the instruments being able to hold conversations with friends in Berlin. The tests were made under the observation of engineers, military attaches and the diplomatic representatives of the United States and Sweden.

Handling Vacuum Tubes.

When you handle the vacuum tubes of your receiver great care should be exercised that they are not knocked about or that the elements are broken. These little lamps are the heart and soul of the set. A good way to operate these tubes is to keep the glow just a little below the critical point.

ADVICE FOR AMATEURS.

The voltages applied to the plate circuits of amplifying tubes are not extremely critical and one voltage control will suffice. The detector tube, however, is often very critical and an efficient potentiometer will work wonders in controlling it.

Apparatus used for the reception of broadcasting is exactly the same as that used for the reception of code signals. The transmitting equipment, however, is different.

The use of a single wire for reception is advantageous because it lessens the amount of objectional interference in the way of static. It is equally as good as a multiple wire system for reception.

Defective "B" batteries will often cause roaring in the telephone receivers.

The electron often talked about is the smallest known quantity of negative electrical energy. In motion it makes up the electric current.

A "soft" vacuum tube is used as a detector tube and a "hard" vacuum tube as an amplifier. The terms "hard" and "soft" refer to degree of evacuation.

Radio waves travel at the same speed as light, namely 186,000 miles per second.

A wavemeter is an instrument used for checking up the wave lengths of sending and receiving stations.

Gas pipe or water pipe systems may be used for grounds, the latter being more advisable.

Lightning protection secured by grounding the antenna when not in use is essential and is required by the underwriters.

Art.

Art, like the universe, exists for its own sake, and as the universe remains constant though our conceptions of the universe are subject to incessant change, so must art remain independent of the ephemeral conceptions of art.—Heine.

Persia Now Educates Women.

In Persia, where parents at one time were glad to be rid of little girls and willingly sold them for a few dollars, there is now a strong desire for educated womanhood as evidenced by the establishment of industrial and other schools for girls.

Churches

All church notices must be in the hands of the [illegible]

LATTER DAY SAINTS—Regular services at the Tabernacle. Sunday school commences at 10:30 a. m. Sacramental services at 12:15 o'clock p. m. Mutual Improvement Association, Sunday at 7:30 p. m. Priesthood and Relief Society meeting at 7:30 p. m. Primary association at the tabernacle Tuesday, for children, 4 p. m. Primary association [illegible] chapel, for children, Thursday at 4 p. m. [illegible] class at the tabernacle Thursday at 2:30 and 7 p. m. [illegible] Regular choir practice at the Tabernacle Thursday at 7 p. m. The public is cordially invited to attend any or all of our services.—Rudd I. Stoddard, bishop.

First Church of Christ, Scientist—Corner of First and Washington. Sunday morning service at 11 o'clock. Subject: "God the Preserver of Man."

Sunday school at 9:45 a. m. Wednesday evening meeting at 8 o'clock. Reading room open to the public every Monday, Wednesday and Saturday from two to four. All are welcome to attend our services.

St. Peter's Episcopal Church—Corner Fourth and O avenue. June 11th will be Trinity Sunday. Services, Holy Communion 8 a. m.; Church school 9:45; Morning Prayer and sermon 11:00; Evening Prayer 7:30 p. m. Our sermon topic will be [illegible] "The Te Deum." Sunday, "The Holy Ghost, the Comforter." The Girls' Friendly Society wound up a very successful year's work at its regular meeting held in Hoban hall Wednesday evening. They are now adjourned for the summer, but they will have an admission service for candidates in two or three weeks and, we hope, a summer camp in July. The Brotherhood of St. Andrews has also adjourned for the summer except as special meetings may be called by the director. Our regular church services will be kept as usual that we will join in the union evening services in July and August.—Joe W. Gunn, rector.

M. E. Church South — Sunday morning Sunday school at 9:45 and preaching at 11 a. m. Epworth League 7 p. m. Preaching 8 p. m. All are invited. Our services will all be in the basement until such time as the church is completed. Our revival meeting will begin July 18, Rev. Jeter doing the preaching. We are going to put up a tabernacle that will seat 1000 people. Brother Jeter is one of the best evangelists in the country today. Let all pray for a great revival.—A. J. [illegible], pastor.

First Baptist Church — G. B. Hagan, superintendent. Sunday school 10 a. m. Sermon 11 a. m. by the pastor. Young People's Meeting 7 p. m. A good program is prepared. Evangelistic song and sermon at the evening hour. The association was very satisfactory. The parsonage is going up. Let every member be present to swell our crowds. We welcome the public.—A. B. Fitton, minister.

Presbyterian Church — Tomorrow will be observed as Children's Day in our morning hours, with the regular session of the Sunday school opening at the usual time of 10:45, with the study period following. Then will come the special exercises of the children during which time an opportunity will be presented for the presentation of children for the rite of baptism. The conclusion of the exercises will be a few remarks by the minister to the children and parents as well. The fairest flowers of civilization are the children of Christian parents and in the growth of those flowers the church school takes a leading part. Help us to help them. The young peoples' meeting in the evening at 7:15 and the worship hour of the day will be at 8 in the evening when the minister will present a timely and interesting subject. We invite all to attend these services.—W. C. Ross, minister.

Undenominational service will be held in the pavilion at the park on Sunday at 3 p. m.—W. D. Fullerton speaker. All invited.

The First Methodist Episcopal Church — Children's Day Service Sunday forenoon under the auspices of the Sunday school. It will open at 10:30, when the school will assemble in the main auditorium of the church and will engage in a beautiful service of songs and recitations suitable to the day. A brief address by the pastor will constitute part of the program. Parents are urged to attend with their children and so help to make the occasion a joyous one. Please note the change in the hour. Epworth League at the accustomed hour. Plans are being perfected for the attendance of a large delegation at the Wallowa Lake Institute which will open in about two weeks. Be on hand to boost. Harvey Carter, president. "Good News" will be the subject of the evening sermon. It will be a message of good cheer to all. Where can you spend an hour more profitably and pleasantly?—G. H. Quigley, minister.