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, seriotron (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

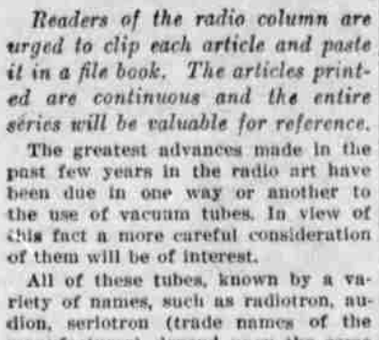


Figure III

called electrons. The apparent mass of an electron is about one-eighteen-hundreth 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 possess 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 measured, 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 represents 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 it, 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 150-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.

The Kitchen Cabinet

A man who cannot mind his own business is not fit to be trusted with the business of others.

"Woman is a miracle of divine contradiction."

GOOD THINGS FOR THE FAMILY TABLE.

There are so many good things to be prepared from stale bread that never a crumb should be wasted or even fed to the chickens unless one is too busy to provide a dish of pudding. The following dishes will suggest others:

Steamed Fig Bread Pudding.—Cream one-half cupful of shortening and mix with one-half pound of figs, put through the meat grinder. Add one-half cupful of sugar. Pour over two cupfuls of bread crumbs enough warm milk to be completely absorbed by the crumbs. Add the beaten yolks of two eggs and one-half teaspoonful of salt, mix the chopped figs, butter and crumbs; when well blended add the beaten whites, and a little grated lemon rind. Steam, closely covered in a well greased mold, for two hours.

Crumb Cakes.—Add one-half of a teaspoonful of salt to one cupful of fine bread crumbs and one cupful of chopped nuts, one-fourth of a teaspoonful each of white pepper, celery seed and one teaspoonful of poultry seasoning, one tablespoonful of butter, or bacon fat, and two well beaten eggs. Form into small balls or cakes; bake in a quick oven until brown, and serve as an entree with a slice of lemon and a spoonful of rich meat sauce.

Bread Crumb Ice Cream.—Allow pieces of stale bread to stand in the oven until thoroughly browned all the way through. Roll, sift and measure two cupfuls, add enough thick rich juice from preserved fruit to moisten the crumbs thoroughly—a cupful will be sufficient. Add two cupfuls of heavy cream, or a soft custard made from a pint of milk, two eggs and one-fourth of a cupful of sugar. Freeze as usual and serve with a spoonful of preserved fruit as a garnish for each portion.

Veal Fricassee.—Brown a veal steak and cut in pieces, let stew in water to cover, seasoned with onion. When the meat is tender thicken the gravy to the consistency of thin sauce, using two tablespoonfuls of flour to one of the liquid. Serve with young string beans seasoned with butter.

Bread Crumb Griddle Cakes.—To a cupful of buttermilk add one cupful of stale bread softened in water, an egg, one-half teaspoonful of soda and sufficient flour to make a drop batter. Cook on a hot griddle and serve with maple sirup.

"In quiet eyes the stars will bring
Their ancient sense of peace to earth;
On hedges where the roses cling,
The dew will come to crystal birth."

THE PIQUANT MINT

Mint as a flavoring occupies a very inconspicuous place in the cuisine of many households. As mint sauce to serve with lamb and as a pungent garnish to an iced drink the limit is exhausted.

Where one may pick it in the garden the temptation is to use it in too large quantities. A drop or two in a dish will suffice to make a dish especially tempting.

In selecting mint, it is well to remember that peppermint has a purplish stem, while the spearmint has a green one.

Mint Sauce.—Take twelve stalks of spearmint; wash and chop the leaves very fine. Add one tablespoonful of sugar and one-half cupful of vinegar. Allow the mixture to stand an hour before serving.

Mint Sherbet.—Take the juice of three lemons, two cupfuls of sugar and one quart of rich milk. Peel the yellow rind, or grate the rind from two lemons, add 20 stalks of bruised peppermint and cover with boiling water; cover tightly and let stand ten minutes. Strain and cool and add to the lemon, sugar and milk; freeze as usual; serve in sherbet glasses, garnished with a small sprig of mint.

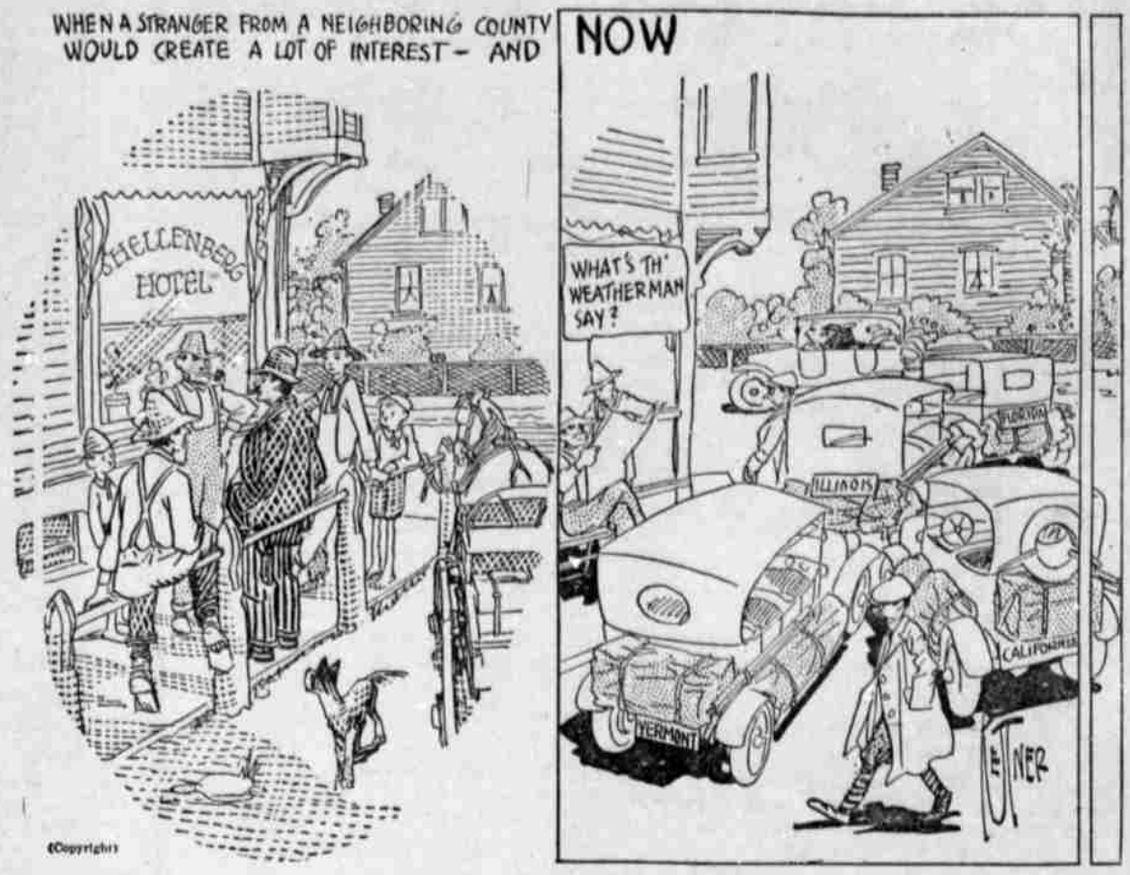
Mint Blanc Mange.—Soak six tablespoonfuls of gelatin in one-half cupful of cold water for five minutes. Bring to a boil one quart of milk, then add five tablespoonfuls of cocoa; add this to the softened gelatin, stirring constantly. When partly cooled add three or four drops of peppermint. Mold and serve with sweetened whipped cream.

Peppermint Patties.—Take two cupfuls of sugar, one-half cupful of water and two tablespoonfuls of corn sirup; boil to the soft-ball stage; set away to cool in the pan. When still warm add a few drops of peppermint, a bit of green for coloring, and beat with a wooden spoon until creamy. Drop by spoonfuls on a waxed paper. The fondant may be poured out carefully on a buttered platter and allowed to cool, then stir until creamy. Care should be taken that no grains which may have formed on the sides of the pan are scraped off into the mixture, as that is apt to grain the whole.

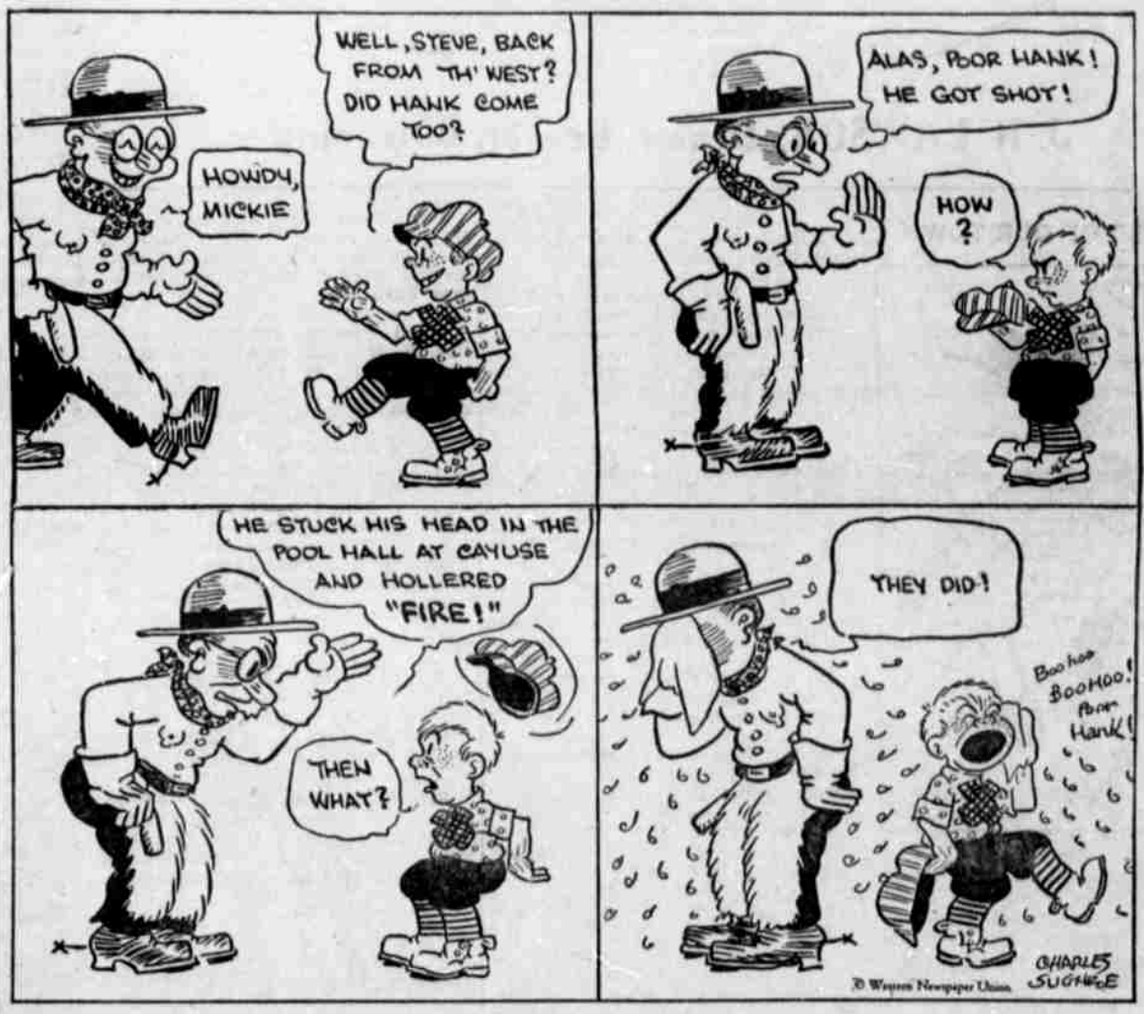
Nellie Maxwell

OUR COMIC SECTION

R'member



Alas, Poor Hank!



A Willing Helper