

# 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, serotron (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

called electrons. The apparent mass of an electron is about one-eighteenth the weight 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 as 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 electric current is 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 it to flow through it depends upon the number of free electrons available as carriers of charges.

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

A vacuum tube such as we are familiar with at the present time, the piece of metal used to furnish the electrons is heated and the electrons are usually accelerated and sometimes in some cases to increase the current. For convenience a vacuum tube is heated

ed 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 increase 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.

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 183,000 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.

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### THREE-PIECE SUIT OF BROWN



One of the newest and smartest spring forecasts is this three-piece suit of brown; duvety skirt, brocaded crepe blouse, and coat of auto-embroidered in red and yellow wool. Combined with it is a fascinating hat of tan felt with brown and tan ribbon trim.

### LONG SLEEVES ARE FAVORED

Spring Gowns Show Elongated Style in the Lead in the More Formal Apparel.

The question whether sleeves for spring shall be long or short is being answered in some of the new lines now showing. The short sleeve seems to be the preferred type for the dress of sports' prettiness, and it is favored for the combined with crepe, and the jacket that completes the suit is frequently a "little thing with sleeves merely suggested, so that one is not sure whether it is cape or jacket.

In regard to red, there is quite a little of it being shown in just these effects. Whether or not it will be as big an influence as it was last season remains to be seen. There seems to be no question that soft raspberry and strawberry shades will open the season. White is expected to be better than ever. Black and white combinations look promising.

Accordian plaiting is much used on the new models, especially for the skirts of jaunty little silk suits. Velvet ribbon is box plaited and employed as a banding, and moire is treated in the same way. The cut ostrich banding is very rich looking and has the depth and softness of fur, which it resembles at a little distance.—Dry Goods Economist.

### FASHION HINTS

Young girls' dance frocks are developed in chiffon and lace. A design of grape leaves done to mother-of-pearl sequins covers a frock of heavy white crepe.

Tan, coral, coffee color and beige are colors for which a vogue is predicted in the fashion of spring.

In place of a fur collar an evening cape of toast-color velvet has collar, made of large choux closely shirred in the centers.

An exceedingly good looking outing hat of taffeta has gray angora embroidery outlined with silver stitching. The color is a fluttering shade of porcelain blue.

A small cap effect, which molds right to the head without frame, comes from France. The hat is made from heavy moire or metallic ribbon and is without any other trimming.

To bring your gloves absolutely up to date, line the faring wrists with beautiful brocaded or brilliant colored ribbons. Gloves have never been more elaborate than they are this season, and the lining of the faring wrist is quite as important as the stripe on the back of the hand or the color of the glove.

The dress with jacket to match has come to be one of the mainstays of fashion. It is the smartest costume that one can have for general daytime wear, and with the dress consisting of the cloth skirt attached to a blouse of chiffon, which may be plaited or embroidered, it becomes a dressy as well as practical garment.

For Sports Wear. Smart sports blouses are made of striped or figured shantung with mannish turnover collars and tumbuck cuffs. The patterns are usually dark on a white background, giving a clear contrast.

### HOW

#### YELLOWED PIANO KEYS MAY BE MADE SIGHTLY.

There is nothing more unsightly than to have the white ivory keys on a piano turn yellow in spots, which is due to perspiration of the fingers in the summer time and to a slight oiliness of them in winter. An experimenter claims that he has found that the original whiteness can be restored by using a weak solution of nitric acid and water, says the New York World. Put one ounce of nitric acid and 12 ounces of soft or distilled water in a bottle having a rubber cork. If the latter is not handy, an ordinary cork dipped into melted paraffin wax will do.

Be sure to pour the acid very slowly into the water and stir it with a stick. Do not reverse this proceeding or the acid will fly up into your eyes. In using this solution, pour a little of it into a glass dish; then dip a brush into the liquid, wiping off the surplus on the edge of the dish.

If no brush is handy, tie a piece of cheesecloth on a stick and use that; in fact, cloth on a stick makes a very good brush for this work. Apply the solution sparingly to the stained keys, taking care that no acid get on the black keys or wood-work. Then rub the surface lightly with a piece of chestnut cloth to remove the stain. Next wash off all acid with a piece of flannel dipped in clear water and wipe with a dry cloth.

### CLING TO PRIMITIVE CUSTOM

How the Modern Arab Takes His Coffee, as Told by American Consul Official.

Coffee houses in Aden are crowded day and night, says Consul Raymond Davis in response to an inquiry from the Department of Commerce on the market for percolators, but they have shown no improvement in the methods of preparing cups that cheer but do not inebriate.

The Arabian method of coffee making, as described by the consul, requires the use of small clay mugs, made locally, which cost 6 to 12 annas each. In one corner of the shop a charcoal fire is kept burning, and on it are placed the mugs containing water, powdered coffee and sometimes a little ginger and sugar to be brought to a boil. As soon as it comes to a boil the coffee is consumed, with or without sugar and spices without milk. The coffee-house price is one-half anna a mug. Patrons seem to be satisfied with this primitive method, and cafe proprietors say it would cause too much trouble and take too much time to familiarize the servants with the modern coffee machine.

### How Temperature Affects Fish.

Fish are very quick to feel a change of temperature in their native element, and sudden cooling or heating of the water is very injurious to them.

A hot summer has been known to drive herring to find cooler waters at a distance. Some years ago a fearful storm raged along the eastern coast of North America. After it had subsided the sea was strewn with millions of fish like a coal, but attaining a weight of 50 pounds or more. A vessel was sent to discover the cause of the strange phenomenon. It plowed straight ahead for 150 miles and estimated that an area of 5,000 square miles was covered with dead fish. It was discovered that the storm had brought icebergs in its train, and the consequent great cold had proved too much for the fish, accustomed as they were to warmer waters. The cod has an objection to sudden changes of climate, and if put in colder water than that to which he is accustomed will be numbed. Experiments have been tried to acclimatize English salmon in Tasmania, but the difference in temperature has caused these experiments to fail.

### How Fuel Supply May Be Increased.

Researches have been made in France with respect to the use of grape pomace as fuel. Moreover, attention has been invited to various kinds of material that might be used in this way to a good advantage, and the calorific power of which possesses considerable value. It has been found that grape pomace, when well dried, is an excellent fuel and has a good heating quality. In the researches mentioned, it was demonstrated that the substance dried at 115 degrees centigrade shows 4,400 calories.

It is also shown that as this substance has much resemblance to dried peat, it can be used in suitable producer gases, and it has an advantage over peat in that it can be dried rapidly. Combustion allows of recovering most of the phosphorus compounds and potash contained in the ash, and only the nitrogen is lost. A ton of well dried pomace has the same heat value as 0.4 ton of coal. By this estimate the annual wine production in France of 1,250,000,000 gallons represents at least 175,000 tons of coal, so that the interest of this application is considerable. Pomace of other fruits could no doubt be employed.

### Why They Sympathized.

"The American boy is all right, after all," remarked the man who Sunday tried his skates for the first time after a long illness. He had been a good skater, but now was slow and awkward. A half dozen boys tore down the pond and stopped in front of him. "Just learning, mister?" asked one at the top of his voice. "Been sick," he replied. The boys held a consultation and offered to contribute their combined experience to help him learn to skate again. When the boys found out that his illness was caused by injuries suffered in France, in the World war, they held up instruction until they heard the story.—Detroit Free Press.

### Files Ninety Miles Without Pilot.

The pilotless airplane, with which the army air service has been experimenting for some months, recently made a number of successful flights of more than 90 miles. The automatic control, consisting of a gyroscope and an arrangement of bellows similar to those used in piano players, is said to be more accurate and dependable than a human pilot. The tests proved it was possible to drop bombs from this plane, on targets on or off the ground, with great accuracy.—Popular Mechanics Magazine.

### How to Sidestep Depression.

"Acquire an enthusiasm," advises some old writer. "You cannot be enthusiastic and unhappy at the same time."—Boston Evening Transcript.

### Study of Insect Life Is Important.

How far can flies travel, and what determines the direction of their flight? They have occasionally been reported many miles offshore; but in such instances it may have been the winds rather than their wings that were responsible for the long-distance transport. In the course of a series of investigations of insects affecting the health of man and animals, the bureau of entomology of the United States Department of Agriculture has sought definite knowledge regarding the question just raised. Thousands upon thousands of marked flies, notably the common house fly, screwworm fly and the black blow fly, have been liberated, so as to ascertain the direction and speed of their travel. The maximum distance or speed from the point of release as recorded for the common house fly was 13.7 miles. The dispersion was in all directions from the point of liberation.

Modern progress in medicine has shown again and again how important a knowledge of the habits of insects is for human welfare in general and many public health problems in particular. It is obviously futile to plan anti-fly or anti-mosquito campaigns with reference to small localities if the insects concerned can readily be disseminated from far beyond the boundaries of the places under control. Efforts to eliminate insect breeding places in order to relieve a particular region may be entirely nullified if neighboring breeding grounds are near enough to keep up the supply of the offending insect.

### GUIDE SEARCHERS FOR HONEY

Why Some Flowers Have Far Greater Attractions for Bees Than Others of Like Species.

Do flowers use rays not visible to the human eye to attract insects to them? Certain insects can spot ultra-violet light that cannot be seen by man, and some blossoms, in addition to their ordinary brilliant hues, vary in the kind of short light rays that they emit.

Prof. F. K. Richtmeyer of Cornell University told the Optical Society of America, meeting at the bureau of standards in Washington recently, that these invisible rays may guide pollen-bearing insects to the flowers in their search for honey. Giving signals in rays shorter than the deepest violet that we can see brings the flowers the pollen that is necessary to it in producing seed. Experiments made by Professor Richtmeyer on Colorado flowers show that flowers apparently differ in their reflection of ultra violet as much as in their visible colors.—Ireland News Leader.

### How Game Is Being Exterminated.

A Leuchoux Indian, trapping east of Macpherson, on the Arctic coast, caught 120 white foxes last winter, besides other game, which he shot or found in his fox traps. The foxes alone netted him \$4200, while a white rafter, C. Norberg, trapping at Baillie Island in the Arctic, came out with a catch of white foxes valued at \$15,000. Charles Klinkenberg, a Dane, who has lived in the Arctic for 40 years, takes in 1,000 white fox pelts at this trading post yearly, and as white foxes are fashionable, and have increased in value from \$10 to \$50 within three years, the Arctic fox will soon be as scarce as the sable and sea otter.

### Why He Missed the Train.

A certain absent-minded Stanford professor lived in the country and each day he commuted to the university, riding to and from the railroad station on his bicycle. One afternoon, when his classes were finished, he started home, but being engrossed in deep thought, he forgot to mount his bicycle and walked to the station, a mile away, pushing it along at his side. Arriving at the station he saw his train just pulling away from the platform. "How exasperating," he exclaimed. "Had I not been bothered with this confounded bicycle I could have caught that train!"—Judge.

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