

### 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, serlotron (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

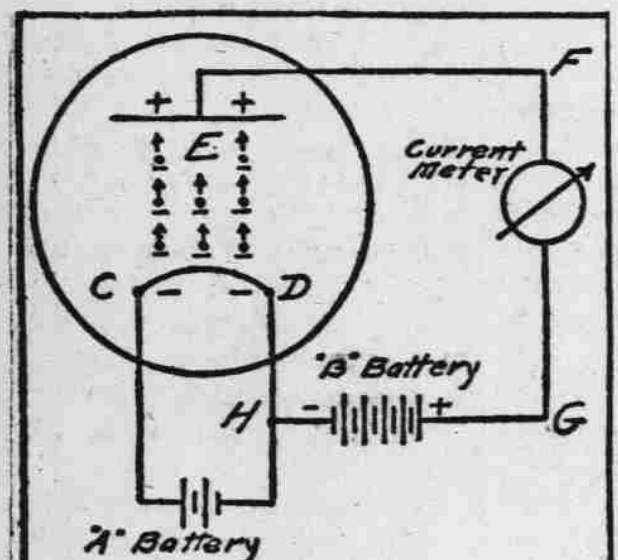


Figure III

called electrons. The apparent mass of an electron is about one-eighteenth 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 possesses 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 heat-

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 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.

# BOY SCOUTS

(Conducted by National Council of the Boy Scouts of America.)

### A MODEL RURAL TROOP

The following letter from H. H. Kurtz, scoutmaster of Locustdale, Troop No. 1, Honeybrook, Pennsylvania, shows that the scout program is equal to any situation in the hands of a devoted scoutmaster:

"This is strictly a rural troop. The borough of Honeybrook, of less than 700 inhabitants gives us only 10 scouts. The remaining 28 come from little hamlets or distant farms; 18 are farm boys—boys who live, perform work on farms. Nearly all are, in a greater or less degree, active tillers of the soil.

"The country is admirably adapted to scouting with wide and fertile valleys, long ranges of wooded hills, clear streams. We claim as our territory a section of about 200 square miles. Boys live from five to ten miles from scout headquarters. This fact makes certain arrangements necessary which will be explained.

"We set up a high ideal. We determined however we might fail in other things, to place the chief emphasis on the oath and law. Scoutcraft was distinctly secondary. After four years we still keep the ideal in view. No boy may enter the troop unless we are satisfactorily assured that he will do his best to do his duty to God, his country, and obey the scout law.

"Every boy is in a patrol and knows his number. Each patrol is properly officered, the officers being chosen on the ground of worth and merit. There are no elections. The two senior patrol leaders, the six patrol leaders and their six assistants form an "officers' council," which administers discipline, outlines the policy of the troop and advises with the scoutmaster. Nothing of importance is decided (except in emergency) without the council.

"Every scout is uniformed, and every scout procures his own uniform. A poor boy will receive aid from the troop treasury, which he may make good as he is able. Insignia is provided by the troop. Each scout is given his proper badges, shoulder knots, service stripes, etc., and it is required that these matters be in place, and that they be correct. The troop is governed by a point system. This is rigidly adhered to, and each boy reports his 'points' on honor, at the business meeting. The system governs the 'good turn' and all the matters of the oath and law, and attendance and inspection. In uniform, or out, and at any time and place the scout salutes his superiors, once in the day. Strict and unquestioning obedience is required as well as regular attendance at all of the business meetings.

"The scattered condition of the troop forbids a weekly meeting; so the business meeting, held once a month, is to be attended. No boy may go elsewhere on that evening.

"In addition to this business meeting, each patrol holds a monthly meeting. Here the indoor scoutcraft work is done, and boys are examined as to tests, or prepared for the court of honor.

"Several features peculiar to this troop have proved valuable. Each boy, entering the troop, undergoes a partial physical examination. His record is kept, and he is examined periodically, and his development noted. The records show a splendid physical standard in the troop.

"Every boy who reports, on honor, a perfect score of points for three consecutive months receives the '100 per cent duty shield.' Four such periods entitle him to the Maltese Cross award. We have a boy, of unimpeachable rectitude, who has won the award for perfect score for two unbroken years.

"The patrol that gains the greatest number of points in a month is entitled to the custody of the flags—the Troop Flag and the National Ensign. The patrol whose efficiency is adjudged the highest for the year, receives a medal.

"Official hikes are conducted at frequent intervals. No winter hikes are held. The country boy has his fill of winter experiences in his long journeys to and from school. But when spring comes we hike. The patrol most fully represented in the year's hikes receives a medal. So also does the individual scout who is present at the greatest number of hikes. Each hike is conducted by a leader, usually a troop officer, who is responsible for the welfare and behavior of all scouts who are present. No Sunday hikes, no tests passed on that day, and attendance at Divine service required of all."

### SCOUT SAVES KIDDIES

Two small children were playing in a Manhattan street when a delivery wagon horse suddenly frightened starting down the street at a gallop—all the ingredients of a possible tragedy! But, a scout was at hand, Emil Kozelonek, by name. Instantly taking in the whole situation, mentally awake, as scouts are trained to be, Emil darted into the street, snatched the children to safety from almost under the feet of the runaway. Prepared again!

### Daddy's Evening Fairy Tale

BY MARY GRAHAM BONNER  
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### LEADER SHEEP

"These are the ways of Sheep," said Leader Sheep.

All the Sheep listened to Leader Sheep.

"It is true," he said, "that Sheep are timid. They are somewhat like the members of the Deer family in that way.

"They are often very much afraid of a dog. A sheep has been known to die from having been frightened by a dog.

"But that does not happen often, and be as brave as possible, Sheep!"

"Baa, baa, baa," bleated the Sheep. "We will be as brave as possible, baa, baa, baa."

"Good," said Leader Sheep. "That is what I want to hear. Baa, baa, baa, that is what I want to hear."

"And you heard it, didn't you?" the Sheep said. "Baa, baa, baa, you heard it."

"Yes," said Leader Sheep, "I did, and it made me happy."

"Baa, baa, baa," the Sheep bleated. "He heard it, and it made him happy."

"All Sheep must be good to their little ones just as they have always been. The Daddy Sheep and Mother Sheep have always been kind and sweet and loving to the darling little lambs and so they must always be."

"They will always be loving to the darling lambs," said the Sheep. "Baa, baa, baa. A Daddy Sheep or a Mother Sheep cannot help but be good to the young."

"That is right," said Leader Sheep. "That is the way it has always been."



"There We Can See."

and that is the way it should always be."

"And it is the way it will always be, baa, baa," bleated the rest of the Sheep.

"That rejoices my heart," said Leader Sheep. "Ah yes, that rejoices my heart."

"Baa, baa, baa," said the other Sheep. "It rejoices his heart."

"There is always only one leader among a flock of Sheep," said Leader Sheep. "and as you have chosen me to be your leader, or have consented to let me be your leader, I hope you will always follow me."

"We will always follow you, Leader Sheep," they said. "Baa, baa, baa, we will always follow you."

"That, too, rejoices my heart," said Leader Sheep.

"Baa, baa, baa," said the other Sheep. "Leader Sheep is having a good time, for his heart is being rejoiced every few moments."

"That is true," said Leader Sheep. "That most certainly is true."

"And now, Sheep, I wish to tell you that if I go through a fence you must all go through the fence too. I do not mean of course that you are to go through the wood part, or wire part of a fence.

"But if I go through the hole of a fence you must go through the hole of a fence too, following me."

"Baa, baa, baa," bleated the Sheep. "We will follow you, Leader Sheep."

"That rejoices my heart," said Leader Sheep.

"Baa, baa, baa," said the other Sheep. "Once more his heart is rejoicing."

"True, true," said Leader Sheep. "and more is my heart rejoicing."

"If we see a stone being thrown, we will keep away from that part of the countryside. Oh yes, we will be careful."

"I will lead you to the top of a high hill and there we can see about us."

"We will follow you, Leader Sheep. We will follow you, baa, baa, baa."

"So the Sheep all followed Leader Sheep. And wherever he went, they went too.

The little lambs played and had a very good time, jumping up and down and copying each other. What one would do the rest would do, showing that even though they were young they too would follow a leader.

And Leader Sheep led the others safely and well.

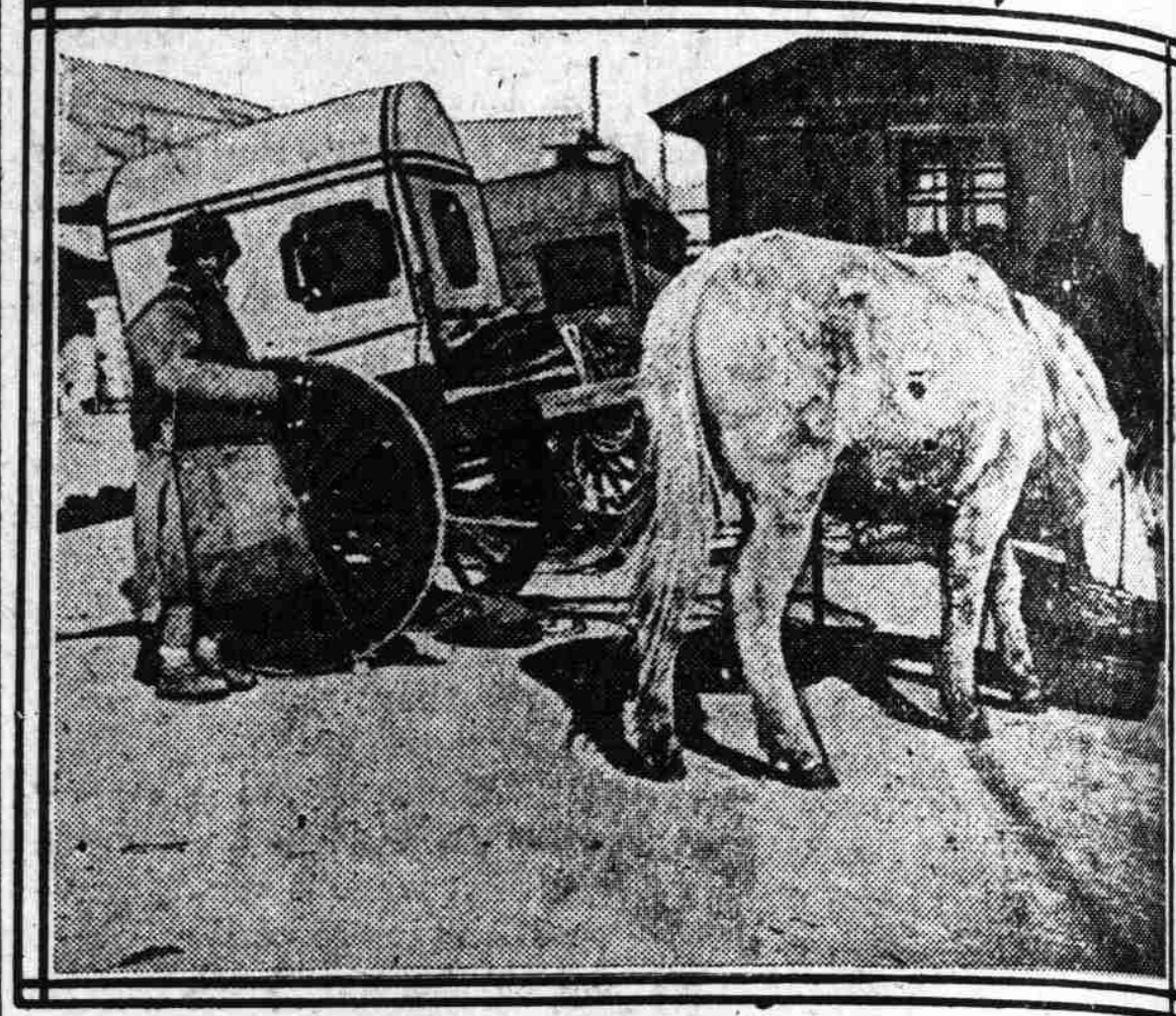
### RIDDLES

What is it that has three feet, but no legs?  
A yard measure.

What kin is that child to its own father, who is not its own father's son?  
His daughter.

What wind does a hungry sailor like?  
One that blows foul (fool) and chops about.

# SURPRISES in PEKING



The Carts of Peking.

(Prepared by the National Geographic Society, Washington, D. C.)

Peking, China's capital, which after many months of a leisurely civil war seems the definite goal of the southern Chinese rebels, is a Tatar rather than a Chinese city. To this fact is traceable its marked difference in appearance when compared to other cities in China.

As one passes within the walls of Peking he expects to find, as in other Chinese cities, the banners signs of shopkeepers throwing gay canopies across narrow, tortuous, huddled streets; but behold; broad avenues three miles long, crossed by other broad avenues three miles long, making squares as regular as those of a checkerboard.

The visitor wonders whether the builders of this city saw in prophetic vision the streets of Chicago, Denver and Philadelphia. Then he begins to realize that Peking is the one spacious Chinese city because it was built by the adventurous barbarians of the north, men who lived in the saddle, upon steppes and plains, whose feet were set in a large room.

Wonder does not stop with the length, breadth and regularity of the streets. The traffic upon them is equally unexpected. In the cities of southern China, sedan chairs edge their way with difficulty through the crowds of pedestrians and carrying coolies, who jostle each other in the narrow lanes. In Peking every street is alive with beasts and vehicles.

Dawn the smooth, tree-lined, macadam center roads autos, cabs, rickshaws and bicycles speed past slow-moving catafalques and crimson wedding processions. On each side, between sidewalk and trees, along a highway of turf, go mule-mounted equestrians, soldiers on sturdy Manchurian ponies, triplets of donkeys hauling lumber, brick, coal and crockery, portly old gentlemen straddling diminutive asses, blue-canopied Peking cabs, and caravans of camels out of the north.

### Queer Carts and Animals.

Almost as fascinating as the camels are the carts of Peking, or rather the little beasts which pull them—ponies, donkeys, mules and nondescript, elusive creatures that are neither horse, mule, nor ass, but subtle, indistinguishable mixtures. On first sight one is sure they are horses, on the second he is sure they are mules, on the third he is equally sure they are zebras, with the stripes worn off. One historian of China speaks of the ancient Tatars, as possessing horses, asses, mules, and "other peculiar breeds of the equine family." These ancient other breeds still trot about the Tatar city.

If streets and traffic, carts and camels are unexpected, no less so are the buildings. The traveler who has seen pictures of the majestic temples and palaces of Peking enters, the imposing South Gate, prepared for architectural raptures. But he finds the broad, straight highways of the city lined with insignificant one-story shops or with equally insignificant gray, windowless, one-story house walls, or long, unslovely, stretches of dull-red plastered fence walls.

As soon, however, as the traveler enters a gateway, through one of the gray or dingy brick-red walls, he comes suddenly and unexpectedly upon a palace, silent in the sun, yet shouting aloud in the barbaric brilliance of its color—crimson columns, friezes of flashing gold on green, wide-flaring roofs of resplendent yellow, all above a triple-terraced platform of marble, white like snow. Or it may be a hundred hams drone chants before an inscrutable Buddha; or a wooded park, where emperors once took their pleasure, where century-old cedars shade pathways and pleasant lakes. Shrines nestle in mulberry groves and hillocks are crowned by Buddhist topeas, from whose marble bases one looks out over the roofs of the city—miles and miles, in the center of all a great splotch of imperial yellow, the once "forbidden city," where dwelt the emperor, his sons and his daughters, his wives and his concubines.

### Unexpected in Architecture.

Indeed, the unexpected is the essence of Chinese architecture. One can never get a complete view of a temple or a yamen unless there be some adjacent hill or tower or city wall from which to view it.

On level ground only the outer wall and the entrance are seen, and when these are passed one sees only the first court, with its more elaborate entrance to the second; and so on through three, four, five, six. It may be seven courtyards, each complete in itself, each with a central building, through which one passes to the court beyond, each building larger, higher, or more decorative than the last, each breaking upon the beholder with a fresh surprise.

This is especially true of the imperial palace, which is perhaps the most effectively arranged group of buildings in all China. Gateway after gateway, each gate a palace in itself, pillared, roofed and buttressed, leads into a wide-lying courtyard, whose placid expanse dwarfs ancient trees around its edges into seeming shrubs.

Each court is a unit of grandeur and magnificence in itself, and at the same time an integral member of a series, leading up to the marble-raced courtyard of the great throne hall.

Although the imperial palace is the finest architectural ensemble in the capital, it is in the Temple of Heaven, or, as the Chinese call it, "The Happy Year Hall," where the emperor used to offer annual supplications to Heaven for a prosperous year, that we find a single building in which the simple dignity of Chinese architecture lies at its best.

### The Happy Year Hall.

This is perhaps the most frequently pictured of all Chinese buildings. Every Chinese photographer displays it in his window; every vendor of post-cards features it; every book on China reproduces it; it is probably the one view of things Chinese which every westerner who knows anything at all about China has seen. Yet there are few buildings which most pictures fall so pitifully to postcard.

In the usual print or photograph its squat, plump and heavy, like a German wedding cake. In reality it is strong and graceful and mighty, and when the visitor comes into its presence he comes into the presence of a great peace.

There it stands on a vast platform, its base above the tree-tops. Above the platform is a threefold marble terrace, white and circular; then red columns, green-gold friezes, and the fine, flaring circular roofs, with shadows and mystery under the eaves, and the roof tiles not unlike yellow like those of the imperial palace, but deep, deep blue.

But it is just in this, its chief masterpiece, that Chinese architecture, in its insistence on the unexpected, has gone farthest afield. The temple is in the midst of a huge park; acres of lawns and dense groves of ancient evergreen surround it; there is no condition conducive to the most effective use of distance and vista; the temple approaches are so crowded and cluttered with cheap, tawdry, and cadent gateways that nothing of the temple is seen until one actually stumbles upon it through the last gate.

Another of the unexpected surprises of Peking is the dragon. It is barely mentioned in some of the guidebooks, and not mentioned at all in others. It is hidden behind a hillock in the winter palace grounds and nine-tenths of the visitors to Peking walk within a hundred yards of it and never dream of its existence. It is a wall perhaps 20 feet high and a hundred long, faced completely with tile cast to represent life-size dragons in bas-relief, in various colors—yellow, purple, orange—dancing gayly above emerald billows, against a pale-blue sky.

Doubtless, one should not speak of "life-size" dragons; but the creatures of the screen are the dragons one may ever hope to see. They give rise to the feeling that a dragon lived he would be like one of these.