ing with moving trains with the same facility as between fixed points. The bridge is provided with a trolley wire for electrically lighting the trains. This wire, which was used in the telephone experiment, was connected with the train dispatcher's office and with the bridge offices, and upon the cars were placed arms provided with compound brushes which touched the trolley wire. The circuit was completed through the car truck and track rail, the connection between the circuit wires and truck being completed by a brush resting on one of the car wheels.

The compound brush consisted of a number of brushes of brush copper fastened together with intermediate pieces of soft rubber. The brushes being electrically connected with each other and with the telephone wire, arranged in this way, unbroken conversations could be carried on while the trains moved along. The electrical contact of the compound brush with the trolley wire was so perfect that the sliding of the brush on the wire produced no noticeable effect.

It is proposed to permanently equip the cars with telephones and to provide a suitable electric conductor on the bridge in convenient position for contact with the brushes carried by the cars.

THE THERMOPHONE.

The thermophone is an instrument for measuring temperature, particularly the temperature of a distant or inaccessible place. It was devised by Henry E. Warren and George C. Whipple, in 1894, for the purpose of obtaining the temperature of the water at the bottom of a pond. The first experiments were so successful, says the Progressive Age, that they were encouraged to study further into the capabilities of the instrument, with a view to adapting it to various scientific and commercial uses. These studies led them to believe that the thermophone is an instrument of great value, not only for obtaining deep sea temperatures, but for many meteorological and scientific purposes.

The apparatus which is here presented for inspection resembles Siemens' resistance thermometer more than any other. It takes advantage of the fact that different metals have different electrical temperature coefficients. The accompanying diagram illustrates the general arrangement.

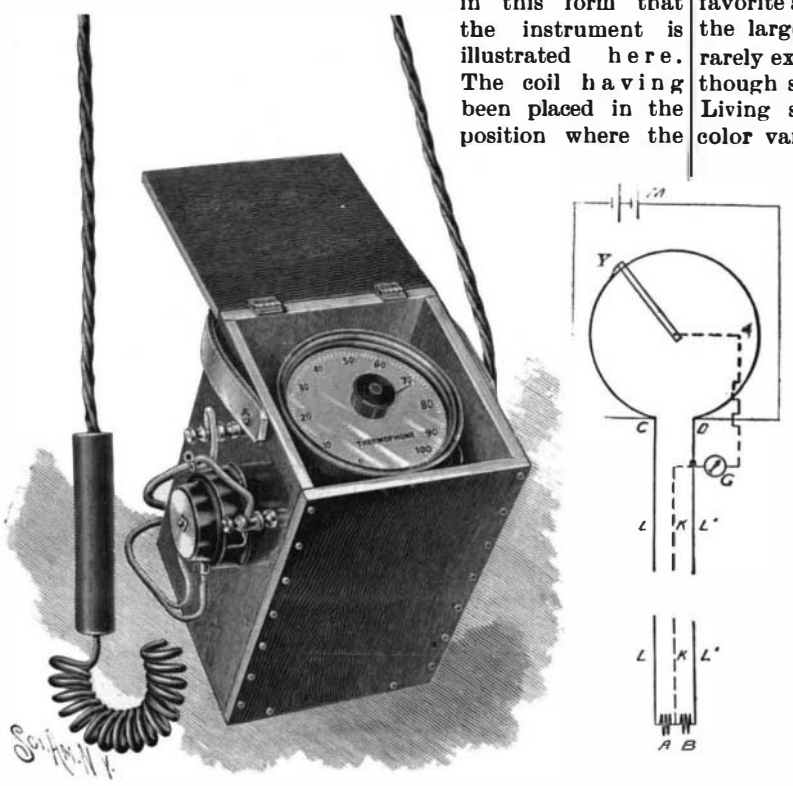
A and B are coils of different metals placed in proximity and joined together as shown in the figure. These coils are connected with a slide wire, CD, by means of the leading wires, L and L'. The two ends of CD are connected in circuit with a battery, M. A galvanometer, G, is put into a leading wire connecting the junction of A and B with a movable contact, Y, on the slide wire. The galvanometer will indicate zero current when $\frac{A}{B} = \frac{CY}{DY}$ But A and B, having different temperature coefficients, will vary in resistance at different rates with changes in temperature; consequently there will be a different value of $\frac{A}{B}$ for every temperature. The value of $\frac{A}{B} = \frac{CY}{DY}$ may be directly read from a scale placed under the sliding contact, Y, or the temperature corresponding to the given ratios of $\frac{A}{B}$ may be marked upon the scale.

The slide wire is wound around the edge of a disk above which there is a dial graduated in degrees of temperature. The hand on the dial is directly over the movable contact on the slide wire, and both are moved by turning a knob in the center of the dial.

It is easily seen that the temperature of the slide wire, CD, has absolutely no effect upon the reading of the instrument, for being made of one piece of metal, which has the same temperature throughout its length, each portion of it will rise or fall in resistance at the same rate with changes in temperature; consequently the ratio of its parts will not vary. The effect of temperature changes on the leading wires, L and L', will not sensibly affect the reading for the same reason.

In place of the galvanometer it has often been found advisable to use a telephone, in connection with a circuit breaker, to show the presence of a current. It is in this form that the instrument is illustrated here. The coil having been placed in the position where the temperature is desired, the transmitter is taken from its hook on the left hand side of the box and held to the ear while the right hand of the operator turns the knob over the dial until a point is reached where no sound is heard. The dial hand then indicates the true temperature. If desired, a number of coils can be located permanently at a number of distant points and thrown into connection with central dial box, at will, by means of a little switch board; a scheme which might be valuable for practical application in a large gas works, as it would enable the superintendent to ascertain the temperature at any given set of points in the works at any time without his leaving his office or desk. This instrument, as we are informed, is more sensitive than a mercurial thermometer. It can be made with any desired range, and its readings are independent of pressure, an important feature in a deep sea instrument.

E. S. Ritchie & Sons, Brookline, Mass., are manufacturers for the United States and Canada.



THE THERMOPHONE.

THE FRILLED LIZARD—CHLAMYDOSAURUS KINGI.

The above named lizard inhabits the northern or tropical territories of the Australian continent, and is tolerably abundant in both North Queensland and the Kimberley district of Western Australia.

The habitat of the frilled lizard is essentially sylvan, its resort being the thickly wooded scrublands, and its favorite abiding place the trunks and lower limbs of the larger trees. The length of the finest examples rarely exceeds three feet, and of this the long, rough, though slender tail monopolizes the greater moiety. Living specimens exhibit a considerable individual color variation. The predominant hue of the body is pale brown with reticulated markings, while the frill, in the males more especially, is usually decorated with interblending tints of yellow, scarlet and steel blue.

No living example of this singular lizard had, up to the present year, been brought alive to Europe, a circumstance which will account, to a large measure, for the fact of certain abnormal phenomena connected with its life habits having hitherto attracted little or no scientific attention. Through the possession of living specimens of Chlamydosaurus in both Queensland and Western Australia, several interesting data concerning the species have fallen within my notice.

Having, furthermore, succeeded in bringing one out of several examples embarked safely to England, my presentation of the animal to the Zoological Society's Gardens, where it was on view for some weeks, has afforded many fellow naturalists the opportunity of verifying the phenomena here recorded. The most conspicuous structural feature of Chlamydosaurus kingi is the extraordinary development of the cuticle of the neck, that gives to it its popular title. This takes the form of a voluminous frill or collar, which, while the animal is at rest or undisturbed, is neatly folded in symmetrical pleats around the creature's neck and shoulders. No sooner, however, is the lizard excited to hostility by the approach of a threatening assailant, than, coincident with the opening of the mouth, the frill is suddenly erected, much after the manner of the unfurling of an umbrella, and stands out at right angles to the longer axis of the body, measuring under such conditions some seven or eight inches in diameter.

The mechanism by which the erection and depression of the frill of Chlamydosaurus is accomplished is intimately connected with a slender process of the hyoid bone, which traverses the substance of the frill on each side, and is so adjusted that the opening of the creature's mouth and the erection of the frill are synchronous operations. A characteristic photograph from life of this lizard in a condition of excitement, and standing at bay, with mouth open and frill erect, is afforded by Fig. 1, representing one of many I was fortunate in securing from the specimen I brought to England.

The function of the frill in Chlamydosaurus is, as apparently indicated by the circumstances and conditions under which alone it is displayed to view, purely that of a "scare organ," wherewith by its sudden expansion many of its would-be assailants are frightened and deterred from attacking it. Instances have, in fact, been recorded to me of dogs, which will readily rush upon and kill other and larger lizards, such as Varani, refusing to come to close quarters with so formidable looking an object as Chlamydosaurus, when it turns upon them with gaping mouth and suddenly erected frill.

Chlamydosaurus displays, however, additional defensive tactics. When approached these lizards will often spring aggressively at the intruder, and in addition to using their not very formidable teeth, will lash sideways with their long, rough tails with such vigor as to smartly sting the hand which may fall within range of the unexpected impact.

The natural food of the frilled lizard consists almost exclusively of Coleoptera and other bark-frequenting insects, a fact which emphasizes the difficulty of keeping them long in a state of captivity. The several specimens in my possession became fairly accus-

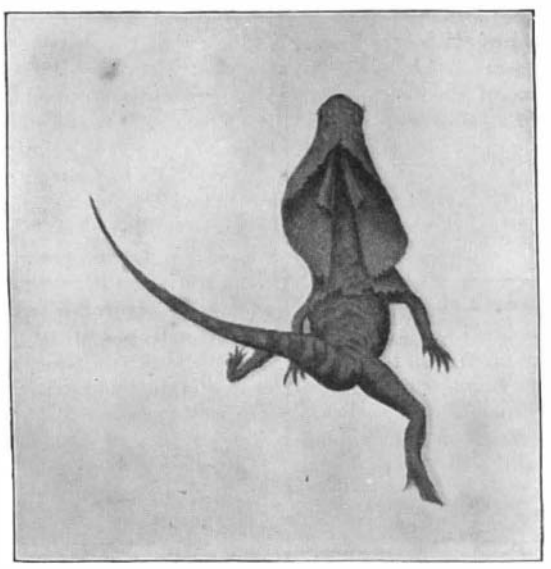


Fig. 2.—CHLAMYDOSAURUS RUNNING ERECT.
Posterior View, taken with Anschutz hand camera.

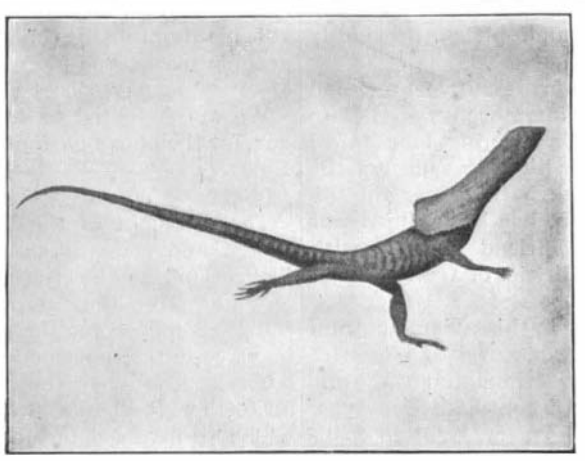


Fig. 3.—CHLAMYDOSAURUS RUNNING ERECT.
Profile View.

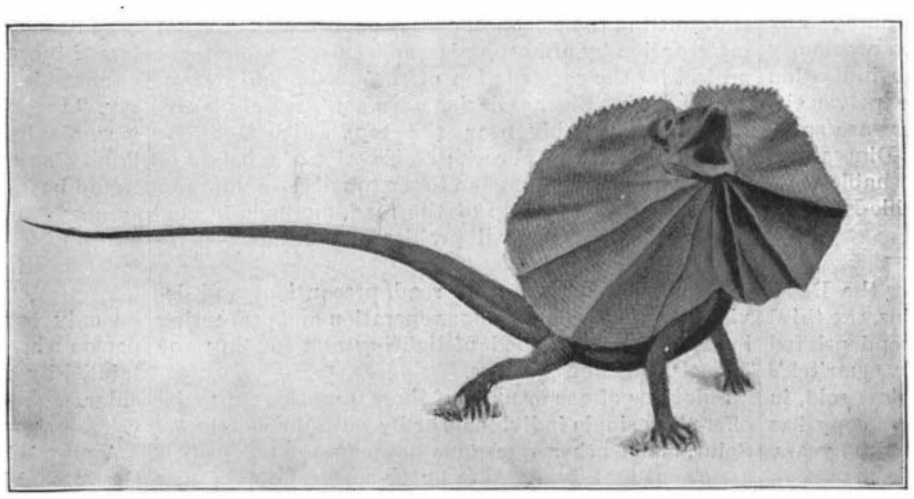


Fig. 1.—CHLAMYDOSAURUS KINGI STANDING AT BAY WITH ERECTED FRILL.

tomed to dieting on raw meat, though they would not take to this artificially substituted pabulum voluntarily. On the slightest excitement, however, they would open their mouths and erect their frills, and on which occasions it was a simple matter to administer pieces of meat, which were then readily assimilated.

The most remarkable feature placed en evidence by the specimens I kept in captivity was their peculiar method of perambulation. The statement that the frilled lizard was in the habit of running erect on its hind legs only was made to me in Queensland some years ago. I failed, however, to verify this assertion through the single living specimen I there had in captivity for a short interval; and neither was a friend in the northern district of the colony more fortunate, who, at my request, made experiments with several specimens. I was, on these grounds, inclined to suspect that the rumor that had previously reached me was the outcome of an optical illusion, many lizards, such as Grammitophoræ, running so erect on their haunches that it might be imagined their fore limbs were raised from the ground.

It was, consequently, to my no small gratification and delight, on becoming the owner of several specimens, including the one brought to England, obtained for me, with the assistance of the aborigines of Roebuck Bay, Western Australia, that I found myself in a position to fully establish the truth of the report concerning the erect gait of Chlamydosaurus that had been communicated to me in Queensland. Possibly the specimens previously experimented with had been slightly injured during capture and lacked the stamina to walk upright. At all events the Roebuck Bay examples, brought in straight from the bush, were in vigorous health, and at the first trial when left at liberty, save for a light retaining cord, ran along the ground almost perfectly erect, with both their forelimbs and long tails elevated clear of the ground.

The attempt was made on the spot to permanently register, with the aid of the Kodak camera, the absurdly grotesque appearances these lizards presented when progressing in this bipedal fashion. Such, however, was the speed at which the animals ran, that the shutter of that instrument did not work fast enough to secure anything better than a blur at close quarters, and it was only by bringing an Anschutz camera with its most rapid roller blind shutter to bear on this specimen, after its arrival in London, that the Figs. 2 and 3, here reproduced, were secured. While even these partake much of the nature of silhouettes, they will serve to indicate the more characteristic running attitudes which this lizard may assume.

Fig. 2 in this series carries with it so essentially human an aspect that one is sorely tempted, at the risk even of incurring scientific contumely, to place a cricket bat in its right hand. The distance Chlamydosaurus will traverse in this remarkable erect position may average as much as thirty or forty feet at a stretch, and then, after resting momentarily on its haunches, it will resume its running course. When, however, a short space of a few yards only has to be covered, the animal runs on all fours, sitting somewhat high on its haunches after the manner of many ordinary lizards, such as the Grammitophoræ, previously referred to.

The profile outline of Chlamydosaurus, presented by Fig. 3, is peculiarly interesting, since it possesses so much in common with that of a running long tailed bird, such as a pheasant. This bird like aspect of the frilled lizard, as exhibited when it crosses the observer's path in bipedal fashion, has been the recent subject of remark to me by a friend familiar with the species in the Kimberley district of Western Australia.

Special interest is attachable to this avian like ambulatory deportment of Chlamydosaurus by reason of the generally accepted interpretation that the birds are modified descendants of a reptilian archetype. The temptation is naturally also very great to institute comparisons between, and to suggest possible affinities with, this peculiar lizard and the extinct group of the Dinosauria, and among whose representatives a bipedal locomotive formula was apparently a characteristic feature. A reference, however, to the skeleton of Chlamydosaurus does not encourage any sanguine anticipations that may have been previously entertained in this direction. It yields no indication of that peculiar avian modification of the pelvic elements, adapted for bipedal locomotion, that are so essentially diagnostic of the more typical Dinosauria, while in all general points it is indistinguishable from that of the ordinary Agamidæ.—W. Saville-Kent, in Nature.

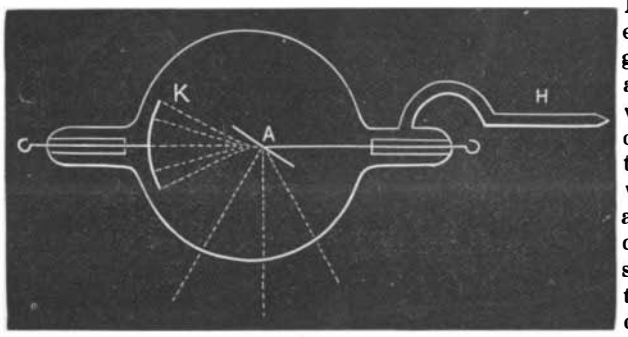
A PSALTER printed on vellum in 1459, for the Benedictine monastery of Sankt Jakob, at Mainz, the third book from the Mainz press and the second printed book with a date, is offered for sale in Mr. Quaritch's Liturgical catalogue for $26,250. When last sold, in 1884, this copy brought $24,750. No other copy has appeared in the market for almost a hundred years. It is far rarer than the Mazarine Bible, the first book ever printed.

THE NEW X RAY "FOCUS" TUBE.

A new tube for producing the X rays has recently been designed by one of the professors at King's College, London, which is so great an improvement on anything in this line that has been previously produced that it will undoubtedly give a great impulse to the practical applications, especially to surgery, of the new photography.

The sharpness of the image obtained in these photographs is due to the fact that the cathode rays are focused to a point where they impinge on a plate of platinum fixed on the anode. The X rays which produce the photograph radiate from this point, and, of course, produce a much sharper shadow of the object being photographed than when radiating from the extended luminous patch on the glass of the tube which has hitherto generally been used. The cut shows a section of the "focus" tube. The cathode plate, K, is a concave disk of aluminum which focuses the cathode rays at a point near the center of the bulb. The anode plate, A, is a small piece of platinum foil placed at an angle a short distance beyond the focus of the cathode rays. Curiously enough, the cathode rays do not cross like rays of light at the focal point, but behave rather like a number of fluid jets coalescing at the focal point, and proceeding thence onward as a solid parallel jet. The point where the rays impinge on the platinum still retains its small dimensions, though the plate is placed some distance beyond the focal point.

Platinum is known to be one of the most opaque substances for the cathode rays, and thus very little of the radiation passes through the platinum foil. The greater part of the radiation is absorbed by the platinum, and given out as X rays from the luminous point, by a kind of diffuse reflection. The anode plate, A, being set at angle, the best part of the radiation is directed downward through the sides of the bulb, where it can be conveniently utilized to produce the photograph in the usual way. The tube, H, through which the bulb is exhausted, is shaped so as to permit the tube to be fixed in a stand at the required height. The anode and cathode plates are connected to the terminals



of the induction coil by platinum wires fused through the glass.

The great reduction in the length of exposure obtained by this tube will undoubtedly soon enable the X rays to be utilized for the examination of the thicker parts of the body, as, for example, in abdominal surgery. It is highly probable that, by the use of special photographic plates, and phosphorescent screens, the time of exposure may soon be still further reduced.

We are indebted to the Electrical Review, of London, for the above particulars.

International Electric Railway Prize Problem.

The president of the commission in charge of the design and construction of the mountain railway in Switzerland to the top of the snow-clad Jungfrau Mountain gives the following information concerning the prizes offered for the solution of certain problems involved in the construction of this road.

The total sum of the prize offered is 30,000 francs ($6,000) for the best solution of a number of questions which are involved in the construction and operation of this road. The chief points involved are the following:

1. In the laying out of the road; the profile of the tunnel; the roadbed and elevated structures; the rails, rack, switches and crossings. The best system for transmitting the electrical energy; protecting against interruption by atmospheric conditions; rolling stock; project for the construction of the station and restaurant at the Eiger Glacier station; design of the station (presumably near the top), which is to be bored out of the solid rock; an elevator of a height of 100 m. and 8 m. in diameter, to the top of the mountain.

2. In the construction of the road, methods of boring the tunnel, and all problems connected therewith.

3. In the operation of the road, precautions and devices for assuring continuous operation and preventing interruptions. Method of lighting and heating the tunnels, cars and stations.

Solutions of one or more of these questions may be offered by single individuals or by several collectively. Solutions of other questions not enumerated, which are deemed of importance in the construction of this road, will also be accepted. The scientific commission will decide on the value of the answers, and their results will be published. By offering the prizes the company reserves the right to adopt the solutions for which prizes are offered, without further cost, on this road only. Solutions which do not receive prizes will be returned.

The following information is added: The maximum grade is 25 per cent, the gage 1 meter, the smallest radius 100 meters, the smallest "ausrundungsradius" 500 meters, the greatest width of rolling stock 2·50 meters, and the greatest height 3 meters, the allowable speed 7 to 10 kilometers per hour. The water power for generating the current amounts to about 5,000 horse power, and will be taken from the two Luetchinen; from the turbine to the beginning of the road the distance is about 8 kilometers, and from there to the beginning of the tunnel, 2·5 kilometers; the tunnel has a length of 10 kilometers.

Applicants for prizes should send drawings or models, if necessary, as also estimates of cost. Prizes will be received up to August 1, 1896. Further information may be obtained from the Bureau der Jungfraubahn, Bahnhofstrasse 10, Zurich, Switzerland.

Progress of Scientific Work.

A year or two ago attention was called to the prediction of an eminent authority that we were entering upon a period of scientific activity that would far transcend any previous experience. The most indifferent observer cannot fail to be amazed at the manner in which this prophecy is being fulfilled. Chemists are astonished to find that the long familiar atmosphere contains a large proportion of a substance hitherto unknown—the strange and inert argon; and helium, so long known in the spectrum of the sun, is discovered as a terrestrial element. With the liquefaction of air and hydrogen we are introduced to a new chemistry of cold. The development of the electric furnace brings great possibilities in the reduction of certain metals, and among its remarkable products yields calcium carbide, the source of acetylene, which is the first hydrocarbon to be produced artificially on a large scale, and a revolutionary achievement in chemical synthesis. Most surprising of all is the new form of radiant energy. Eager students everywhere have quickly begun experimenting with the mysterious X rays, and in a few days we are given the new art of "shadowgraphy," which promises, among other marvels, that the sick can have their diseased organs brought to view, while the curious can have their skeletons photographed while they wait. The details of this new photography are being improved daily. Other epoch-making discoveries are almost grasped, and it is clear that, with so many roads opened to peaceful conquest, our end-of-the-century days leave no time for demoralizing wars over political boundaries.—Mining.

The Deepest Shaft in the World.

At the greatest depth ever attained by miners in the history of the world, the mines in the vertical Red Jacket shaft of the Calumet & Hecla copper mine have recently stopped sinking at a depth of 4,900 feet, as this is the required depth necessary for this company to reach the limit of its underground territory. Bored wells have been carried down to a greater depth, but the Red Jacket shaft is the largest and best constructed mining shaft in the world. Its inside dimensions are 14×22½ feet, divided into six compartments and timbered throughout with pine. The shaft was started in the fall of 1880. The new shaft rock house, which will be built of iron and will be made fireproof throughout, is the only part of the work necessary to put this deep shaft in commission, as the hoisting machinery, which consists of two pair of triple expansion engines of 3,000 horse power per pair, and will hoist a load of ten tons 60 feet per second, was planned and put in place while the sinking of the shaft was going on.

The Untruthfulness of Morphinomaniacs.

The mental and moral destruction which occurs in a victim to the morphia habit is a fact which unfortunately has been only too frequently demonstrated. This point has led to some discussion respecting the expediency of rejecting the testimony in a court of law of those who are known to be addicted to the use of morphia. One authority has even gone so far as to say, "I would not believe a man who is a victim of the morphia habit on oath." No doubt the moral obliquity as to truthfulness present in such a person would be perfectly uncontrollable, under any circumstances, and unrestrained, even although he had sworn to tell the truth. But before coming to any definite decision upon the question of receiving or rejecting the evidence of such a witness, it would first of all be only expedient to determine what constitutes a person whose mental and moral capacities have been tainted by the use of morphia.—Med. Press and Circular.

A BILL is before the Ohio legislature claiming bicycles as vehicles to bring them within the vehicle taxation laws.