A DOG BICYCLIST.

We reproduce herewith a photograph representing a Scotch Gordon dog of pure breed accompanying his master upon a tandem bicycle. The dog is here simply a tourist that rides on the bicycle only on a level and during descents. In going up hill, he trots alongside of the machine. Our bicycle readers who have dogs might turn their attention to such training of their animals, for whose convenience a small and well balanced seat might be attached to the machine.—La Nature.

DOG TRAINED TO RIDE ON A BICYCLE.

The Lowest Temperature of Luminescent Visibility.

A new determination of the lowest temperature at which a hot body becomes visible is published by Signor Pettinelli, in the Nuovo Cimento. He heated a cast iron cylinder 30 cm. long and 14 cm. broad in a wrought iron jacket, over a Bunsen burner, to a temperature of 460° C., as indicated by an air thermometer, and then observed its flat end in a dark room from a point 60 cm. above it. When it had cooled to about 115° the red heat vanished and gave way to an indefinite hazy glow. This glow completely disappeared at 404°, and repeated observations gave an error of only 3°. High emissive substances, such as the mantles made by Auer and others for incandescent gas lighting, became visible at the same temperature, but reflectiug surfaces had to be heated 20° higher before they appeared to the eye, and glass still more. These low temperature rays were found to traverse glass and water like ordinary light rays, but they suffer a comparatively greater absorption. Different eyes differ slightly in their capacity for seeing them, the maximum divergence being about 6°. But the extent of surface must be the same. Signor Pettinelli found that if he screened off all but one-fortieth of the surface, the body had to be heated 6° higher than before to become visible.

A NEW MOTOR CYCLE.

Inventors have for a long time been working on the problem of the propulsion of bicycles without the aid of muscular power. Unlike the motor carriage the advantage of the motor cycle cannot be so easily demonstrated, for bicycle riders use their wheels very largely for exercise and for the pleasure in riding, and anything in the way of power propulsion would not be received with favor by them.

There is, however, a class of people who would welcome the advent of a practical motor cycle, as it would enable them to prolong their excursions and would eliminate the element of fatigue.

We present an engraving of an experimental motor cycle. built by Nelson S. Hopkins, of Williamsville, New York. The motor is heavier (it weighs 12 pounds 4 ounces) than would be ordinarily required for use on a bicycle. Mr. Hopkins has succeeded in building a motor which will propel a wheel and rider over moderate grades, and weighs only 8½ pounds.

HOPKINS' GASOLINE MOTOR CYCLE.

The motive power is derived from gasoline which is contained in an aluminum reservoir which is strapped to the upper part of the diamond frame. From the reservoir the gasoline is conveyed to the carburetor by means of a small pipe. A valve limits the quantity of the gasoline which is admitted to the carburetor. This valve may be operated from the saddle by means of a rod. The valve stops and starts the motor and regulates the speed. From the carburetor, where the vapor of the gasoline has been mixed with air, the mixture is drawn into the compressor and is then forced into one of the two explosion cylinders, where the charge is ignited by an electric spark, contact being controlled by the movement of the piston. The use of two cylinders makes it possible to obtain an impulse at every turn of the shaft and by means of gears the wheel is propelled with great freedom from jerkiness and vibration. The battery is placed under the saddle in a tool bag, and the spark coil is fastened to the diamond frame, but in later experiments both the battery and coil have been carried in the tool bag.

At the back of the shaft is a small steel gear wheel, which runs with a larger one of phosphor bronze secured to the hub of the wheel. This large gear wheel is movable, and it is arranged so that the motor can be entirely disconnected from the running gear, thus allowing the wheel to be propelled in the ordinary manner. The feet are rested on coasters or on the pedals. Usually the chain is thrown out of gear by the aid of the clutch, but in hill climbing both the motor and pedals are used to propel the bicycle.

It is, of course, impossible for the wheel to run without a rider upon it to keep it balanced, and should he fall, the wheel would stop of its own accord. The weight of the motor being on one side, of course, tends to throw the wheel out of balance, but this is remedied by throwing the center of the saddle over a trifle. All the working parts, except the gears, are inclosed.

Human Endurance of High Air Pressures.

A series of interesting experiments as to human endurance of higher pressures than are usually employed in compressed air work has recently been made by Mr. Hersent, the engineer in charge of the new harbor works at Bordeaux, France, where the quay foundations are being constructed by the compressed air system, and we take the following particulars of these tests from Engineering, of London. As the sponge divers descend from 160 to 200 ft. without injury, it was considered that workmen should be able to endure corresponding pressures under the better conditions of an air chamber, and Mr. Hersent therefore formed a commission of doctors to work with him in ascertaining if men could safely sustain a pressure of 70 lb. per sq. in. The test chamber was fitted with windows, a telephone, electric light and a steam coil, by which any desired temperature could be maintained.

Three men volunteered for the tests; one being a regular compressed air workman, the second an occasional workman, and the third a man who had only entered the working chamber on a few occasions. These men were subjected to pressures for a length of time, usually about one hour. The tests were commenced with a pressure of about 28·4 lb. per sq. in., and the pressure increased very gradually, by about 4·27 lb. per day, to 76·8 lb. per sq. in., while the time for the pressure reduction was increased about ten minutes for each 1·42 lb. increase in pressure. The period of compression was also increased, but to a smaller degree, this being of less importance. All three men sustained without difficulty a pressure of 46·9 lb. with a reduction period of 56 minutes. One of the men, being indisposed from an independent cause, was then withdrawn. At 58·3 lb. pressure the man who was used to working in the chamber felt some temporary inconvenience, and at 65·4 lb. his companion, who was not accustomed to compressed air work, had to be withdrawn, as he suffered from pains in the side. There was no trace of paralysis, but it was not considered safe for him to continue the test, which was finished by the first man alone, who sustained a pressure of 71·1 lb. for one hour, the pressure being then reduced in 2h. 25m. When released from the chamber this man took some sulphurous baths, which had cured the pains of his companion, and then underwent the final test, in which the pressure was raised to 76·8 lb. in 45 minutes, continued for an hour, and then reduced to normal pressure in 3h. 3m. The temperature was increased from 56° F. to 68° F. during the compression, maintained at 68° during the test, and then gradually increased to 86° F. during the reduction of the pressure. The man suffered no inconvenience, with the exception of a tingling sensation, which passed away after a short time. It is considered that, if certain precautions are taken, men in good health can sustain a pressure of 76·8 lb. per sq. in., that means should be provided for heating the chamber at will, and that good ventilation should be maintained during the reduction of the pressure.

As it has been proved that the workmen should rest after leaving the air lock, especially after working under high pressures, elevators should be provided to bring the men to the surface. These experiments go to show the practicability of men working under compressed air at greater depths than have yet been attempted.

The greatest pressure thus far used in compressed air work was 52 lb., corresponding to a head of 120 ft., in the East River Gas Company's tunnel. This was the extreme reached on this work. The ordinary pressure was about 45 lb., corresponding to a head of 104 ft. At the Limfjord Bridge, in Denmark, men worked for some time at a depth of 113 ft.

Our Coal Supply.

In the March number of the New York Bond Record is an article on anthracite coal by William Griffith, which seeks to answer the questions: "How much anthracite is there, and how long will the supply last?" and "What proportion of the future supply do the various interests control and how much can they ship to market?" Mr. Griffith begins by quoting liberally from an article by President Harris, of the Reading Railroad, on this question, in which Mr. Harris estimated that the original contents of the anthracite fields amounted to about 14,453,400,000 tons, of which 82½ per cent, or about 11,921,400,000 tons, remained to be worked. With a production of 45,000,000 tons a year, this supply would last for 265 years, although Mr. Harris estimated that of the actual coal unmined only 5,960,700,000 tons would probably be actually available, which would shorten the period of use one-half. Mr. Harris said we could have coal for 100 years at the rate of 60,000,000 tons a year. Mr. Griffith, in his article, which is an elaborate one, accompanied by long tables and detailed maps, works out estimates on a basis of his own. He gives a tabulated estimate of the approximate future supply of the railroads entering the Wyoming region. He claims that Delaware & Hudson's supply, at the rate of 1895 shipments, will last 26 years; Ontario & Western's, 9 years; Erie Railroad's, 21 years; Susquehanna & Western's, 18 years; Pennsylvania Coal Company's, 54 years; Lackawanna's, 51 years; Lehigh Valley's, 57 years; Central New Jersey's, 124 years; Pennsylvania Railroad's, 52 years. The grand total of unmined coal in the Wyoming region he estimates at 1,278,130,750 tons, with a duration of 52 years. The table gives no figures as to other coal fields.

The Annual Reception of the New York Academy of Sciences, March 26.

BY E. O. HOVEY.

The third annual reception of the New York Academy of Sciences, which consists mainly of an exhibition intended to illustrate recent progress in all branches of science, was held Thursday afternoon and evening, the 26th of March, in the American Museum of Natural History. The afternoon session was intended especially for the teachers and advanced pupils in the schools and was informal in its character. In spite of the unpleasant weather, the evening session was very largely attended, and the whole affair was pronounced a decided success. The exhibition was very comprehensive in its scope, fourteen departments of science being represented. So much material was displayed that it was impossible for a person to get even a general idea of what was to be seen and studied, and our report can deal with only a few of the most striking features of the exhibition. It seemed to many that it would be well if the academy could arrange to hold the reception two days instead of one, or could have the lecture on a different evening from the main exhibition.

Popular interest evidently centered around the exposition of the Roentgen X rays and their application. Prof. M. I. Pupin, of Columbia University, delivered an interesting and instructive lecture on the subject, illustrated by apparatus, experiments and photographs. One piece of apparatus that he had was Edison's latest invention, the "fluoroscope," which had been received from the celebrated electrician only three days before. This instrument consists of a hopper shaped box, the small end of which is fitted into a hood which is placed over the eyes like the eyepiece of an oldfashioned stereoscope. The large end of the hopper is closed by a flat screen coated with tungstate of calcium, which has been found to be especially susceptible to the fluorescent influence of the X rays. The screen is about ten inches distant from the eyes, and the whole apparatus is thus very compact and convenient. After the lecture many persons in the audience availed themselves of Prof. Pupin's invitation to examine the shadow of the bones of their own hands through the new fluoroscope, a novel experience for every one. This instrument will enable surgeons to examine broken bones, gunshot wounds, etc., by means of the X rays, without the tedious delay and inconvenience incident to developing photographic plates.

In the sections of physics and electricity in the exhibition hall were numerous Roentgen photographs of a great variety of objects, the most striking of which was a life size representation of the hand and forearm of an adult, with every peculiarity in the outline of the bones clearly brought out. The term used by Prof. Pupin for these pictures is "radiographs." Another interesting exhibit in the section of physics was the apparatus recently devised for photographing the human vocal chords while in action and photographs made by it. These photographs show that the cartilages rotate, and thus vary the length of the vibrating portion of the chords.

In the photographic section there was a very interesting series of photographs of lightning. These showed that lightning is wavy, not zigzag in its course. Forked and branched discharges, both natural and artificial, were represented, as well as "thunderbolts." One picture showed how trees are of service during a thunder storm in dissipating, neutralizing or conducting a discharge. Another was of ribbon lightning, which was caught by the camera from the rear platform of an express train at midnight while crossing the prairies of North Dakota. In this section also was a beautiful series of reproductions by the new three-color process of studies from nature and paintings from negatives and plates untouched by hand.

The astronomic exhibit consisted of several pieces of apparatus and of a large number of photographs illustrating the work done at the observatories of Harvard and Columbia Universities and at Allegheny, Pa. At the last place much work is being done toward the solution of the problems of planetary atmospheres and rotation by spectroscopic methods.

Experimental psychology is a science which has taken great strides of recent years, and some most ingenious machines have been devised for use in its investigations. One of these was on exhibition at the reception and excited much popular interest, to judge from the crowd around it watching its operation. The machine is adapted for use with several different mental stimuli, but the color wheel was the only one used on this occasion. The observer looks at the rotating wheel, and, as soon as he sees the given color, he pushes an electric button. The machine registers the instant when the color comes in sight and the instant when the observer responds to the stimulus. It has been found that, as a rule, educated people are more quick to respond than uneducated.

Ethnology and archæology had a large exhibit, mostly from the recently made collections of the American Museum of Natural History. Here were representations of animal forms in pottery, painting, weaving, gold, stone, and wood, in the art of ancient Peru, and portrait heads in pottery of the same time and place. A series of pathological specimens from a prehistoric burial ground in Kentucky showed that both sexes were equally subject to inflammation and suppuration of the bones, the skeletons of nineteen out of fifty-five adults being affected with it. Skeletons exhumed last summer at an Indian burial place at Tottenville, Staten Island, showed a very close relationship between the prehistoric people of that locality and the Indians now living in Nova Scotia. Dr. G. M. West exhibited diagrams which he had prepared which show that children develop differently in different parts of the country and at different times in the same locality. In Worcester, Mass., children grow very tall, especially the boys. In Boston and Toronto both boys and girls are shorter than the average, while in Milwaukee they are a little taller. The diagram of Oakland, Cal., presented a curious phenomenon. At one time the children were all very short, then they began to get taller, and the girls have kept the upward tendency, while the boys fell back again and then took a new start upward. Another interesting exhibit in this section was that of arrow games in Asia and America. By means of many specimens Mr. Stewart Culin showed how playing cards and chess had originated in the arrow. He also illustrated the hypothetical development of the seal cylinder, the Chinese coin and the folding fan.

Next to this section came that of palæontology, and the strange skulls and pictures in it attracted much attention. The pictures formed a series of attempts to put flesh and blood on to the wonderful skeletons which have been found in the extensive Tertiary lake deposits of western North America, and gave one a vivid idea of what the condition of affairs must have been when the uintatherium, titanotherium and hyrachyus (or rhinoceros) dominated the land.

Geology, mineralogy and physiography occupied the north end of the space given up to the academy for the evening. The first contained much matter of great interest to the specialists present, though most people would have passed the whole by as being so many "stones." A suite of specimens and photographs illustrated the mode of occurrence of the ores and rocks in the now famous Cripple Creek, Colorado, gold fields. The ores are fresh or decomposed telluride of gold and are oftenest associated with dikes of igneous rock (phonolite or nepheline basalt), which penetrate the red granite of the Pike's Peak region, or a decomposed breccia of andesite, though they also lie in veins which fill more or less irregular veins in the andesite breccia away from dikes. A series of variegated marbles from Swanton, Vt., showed a beautiful and remarkable variety of colors and markings. Madrid, New Mexico, furnished a suite of specimens of coal showing the change from pure bituminous to pure anthracite, caused by the proximity of volcanic rocks. The display of minerals was very large and contained many unique specimens, as well as samples of rare and new species. The monster tourmaline crystal from One Hundred and Seventy-first Street and Fort Washington Avenue was exhibited, as well as a much larger but coarser crystal of the same mineral from Bethel, Conn.

Specimens of the new minerals, lorandite, northupite and lawsonite, were shown, as well as large quantities of the very strange and heretofore rare mineral thaumasite, which has very recently been found in abundance at West Paterson, N. J. The display of minerals from this new locality was rendered especially noteworthy by the exhibit of A. H. Ehrman, who has the choicest of the material thus far obtained there. In one corner of the mineralogical section Geo. F. Kunz had a booth erected in which, by means of electric light passed through violet glass, he showed that some diamonds are strongly phosphorescent, while most diamonds do not have this property. One of the stones he exhibited emits phosphorescent light for several hours after the original source of light has been shut off. One of the anomalies shown in this section were pseudomorphs of pyrite and turquoise after orthoclase from Cerro de Potosi, Bolivia. The section of physiography was of especial interest to teachers, on account of the newly issued text books, relief maps and models and wall maps on exhibition.

In the botanical department one could see numbers of beautifully mounted preparations illustrating new species of plants and microscopical and other features illustrating recently elaborated life histories and relations of plants and groups of plants. The economic as well as the scientific side of the science was shown in three series of specimens, preparations and drawings used in making a comparative study under varying circumstances of as many plants which are used extensively as drugs, with the object of furnishing means of determining whether the plants had been collected at the proper time or not and whether they were retaining their valuable properties or not.

Persons interested in chemistry were much pleased at the opportunity given in the chemical section of seeing the spectra of the newly discovered elements—argon and helium—as well as the apparatus used in extracting helium from the mineral monazite.

Living things always arouse interest, and the aquaria shown in the department of zoology were always surrounded by crowds of people who seemed perfectly willing to expose their ignorance by the curious questions they asked. One aquarium contained living tube worms and a ship worm, corals, barnacles, a soft clam and some sea anemones. Others had in them paradise fish, the nest building sticklebacks and black dace, fish bred for great eyes, for particular colors and for fantails. The largest single item exhibited in any of the sections was in this of zoology; it was the great Asiatic elephant Tip, of unsavory fame at the Central Park menagerie and elsewhere.

We are apt to think of bacilli or microbes as being harmful things, but that they are not always such was shown in the department of bacteriology by the exhibit of Prof. H. W. Conn. In milk received some time ago from Uruguay he found a bacillus which proves to have a marked power of ripening cream for butter making, improving the flavor and keeping qualities of the butter made by its use.

The section of anatomy had an exhibit which consisted for the most part of series of casts showing variations in the pectoral muscles of man, and comparing them with similar muscles in nine other animals, and showing the development of the sternalis muscle, which is now usually very small and useless, but which in some former stage of life apparently extended all over the chest, and was very important.

The president of the academy this year is Prof. J. J. Stevenson, of the University of the City of New York, and just before Prof. Pupin's lecture on the Roentgen X rays he gave a general survey of recent scientific work, especially that accomplished in the past year. Prof. H. F. Osborn was the chairman of the reception and exhibition committee, while Dr. J. L. Wortman was chairman of the special committee of arrangements. The departments of the exhibition with the men in charge of each were:

Physics, William Hallock and Herbert T. Wade; electricity, M. I. Pupin; photography, Cornelius Van Brunt; chemistry, Morris Loeb and C. E. Pellew; astronomy, Harold Jacoby; geology, J. J. Stevenson; mineralogy, E. O. Hovey; physiography, R. E. Dodge; zoology, William Stratford: bacteriology, T. M. Cheesman; palæontology, J. L. Wortman; anatomy, George S. Huntington; ethnology and archæology, Franz Boas and M. H. Saville; experimental psychology, J. McK. Cattell.

The Hospitals of Florence.

Many institutions now engaged in active charitable work in Florence date their origin from the twelfth and thirteenth centuries, and successive generations of Florentines have carried it on, in many cases without intermission, down to the present day. Hence we find, says the British Medical Journal, bacteriological research and modern methods of treatment, antisepsis and hygiene, carried on side by side with traditional usages in buildings which carry the mind back to early mediæval times. There is not a single modern hospital in Florence; the new hospital for children is without the walls. Among the records of early charitable institutions of Florence are those founded by the Knights Templar and the Knights of the Order of St. John of Jerusalem in the twelfth century. The principal hospital of the present day, Santa Maria Nuova, was founded in 1288, and about the same time the captains of the Bigallo determined to preside over the hospitals in order that the sick should be tended with brotherly love; the captains of Or San Micheli took into their charge orphans, the destitute and widows, and the brotherhood of the Misericordia undertook to transport invalids to the various hospitals, and the dead to their last resting places. This brotherhood is still performing the same work of mercy, and may be daily seen robed in long white gowns which completely cover the head, and are only pierced with eyelet holes, traversing the streets of Florence with their living or dead burdens. In 1340 Villani's history records that there were more than 1,000 beds for the sick poor in Florence. At the end of the fifteenth century there were thirty-five hospitals, some special, some general, and some to give shelter to the destitute. All these institutions were established by the various guilds or privately endowed, and if all the wealth left to Florence had been preserved to its original destination, it is said that half Tuscany would belong to institutions for the relief of the poor. In early days the moneys left to the poor generally reached their destination—a contrast, says Pastarini, with present times, when much of that which was intended for the poor finds its way into the pockets of the employes of charitable institutions. Many of these charities were suppressed by the Council of Regency, in 1750, and many more by Peter Leopold, who wished to centralize public institutions in the state. At the present day most of the hospitals are directly or indirectly under government control.

AN early sign of incipient pulmonary tuberculosis is prolonged expiratory murmur. The respiration is apt to be short and "catchy."

Johannesburg Gold Fields Described.*

It is now a matter of history how Col. Ferreira and party made the discovery of the Johannesburg gold fields by the accidental uprooting of a tuft of grass. Such an unusual occurrence resulting in the discovery of continuous and permanent mineralized lodes or "ledges" will be explained in the following description of the character of the country, etc.:

Journeying westward over an open, treeless, undulating, prairie-like country at the foot of a slightly rising and crested hill to the right and some 5,000 feet above sea level, one travels along the divide of watersheds of that part of South Africa between the parallels 22 and 27 of south latitude, over grassy plains and slopes known as the "high velt" with numerous springs ("fonteins") bursting through the surface every few hundred yards, some to flow northward to the Limpopo and others southward to Vaal River, and suggesting the district name of Witwatersrand (White-waters-range), at this time—a little less than ten years ago—a veritable paradise for game, the habitat of roving bands of springboc, blesboc, koodoos and other species of antelopes, a country better calculated to excite the ambition of the shepherd or stockman than the prospector, there being no distinguishing feature to disturb the general contour of the undulating "high velt," not even the shade of grass or species of wild flowers varied to mark the narrow line, stretching some forty miles from east to west, forming the "main reef series of auriferous lodes" lying hidden a few feet below the surface or any defined outcrop to guide the prospector to the hidden wealth, or to create the least suspicion in his mind that he had been traveling for miles upon his "bonanza." But the accidental revealing of "colors" at the water fontein soon brought into action the prospector's pick and pan, when the source of wealth was discovered to be in the gravelly soil, and at greater depth in compact conglomerate lodes in a quartzose sandstone formation.

In constitution and structure the "main reef series" are conglomerated bodies of waterworn or rounded quartz pebbles, varying in thickness (or depth), separate and parallel, and evidently of aqueous origin, deposited in solution, probably an ancient lake or river bed, moraine or of geyser action, either theory being equally tenable until more positive proof shall have been discovered by future workings. Twelve lodes, or locally called reefs, constitute the series, seven of which are "dead lodes" and five "pay lodes," which vary from one to a few inches in thickness, to one from sixteen to twenty-four feet thick. The order of bedding of the series compasses about 130 feet, measured at right angles, both to the trend and dip of formation. Lithologically the conglomerates (locally called "banket") are composed of quartz pebbles, the fracture having a glassy luster and color subtransparent to a blue opaque, and varying in size from three-fourths inch to two and a half inches in diameter, the matrix, or cement, being composed of granular brecciated quartz, apparently of the same origin as the pebble, but alone forming the mineralized body. I believe the past nine years' operations have failed to discover any gold in the pebble itself. The supposition is therefore advanced that the gold is also of aqueous deposition and subsequent to that of the pebble and matrix. The value of the lodes also varies with the thickness, the thinnest being the richest, averaging $48, and the widest $7 per ton. The milling average for the past year yielded $11.50 per ton.

The character of the ore below a depth of fifty feet from the surface is a solid conglomerate sulphide, becoming more friable and disintegrates under the weathering and oxidizing influences at the surface. The ores are, therefore, free milling and amalgamating for a limited depth, after which concentration and cyaniding is the process most commonly adopted.

The country rock, also a quartzose sandstone and evidently also of sedimentary origin, is considerably disturbed by faultings and intrusive bars and dikes. Running parallel to the main reef series some two miles distant to the south is a low mountain chain of diorite, the major factor of disturbance of formation and dips, from which the various bars or loess at varied angles traverse the formation, which, together with the unequal shrinkage, causes the true continuity of the lodes to be broken and practically dividing the main reef series into sectional parts. Such faultings occur laterally to the lodes and are from a few feet in some instances to some hundreds of feet in others, notably in a property named the Gladstone. The lodes continuing two-thirds the length of this property were lost by faulting, and ultimately discovered nearly 600 feet to the north, and so completely segregating the property into two separate and distinct mines. The dip of the lodes also is very variable at different parts of the series, ranging from fifteen degrees to the vertical, but the general dip may be said to average forty-five degrees, synclinally to the south.

The operations of the diamond drills have been very extensive and have demonstrated the fact that the lodes are continuous to the lowest depth attained, about 4,000 feet vertically, while the "prospects" at this depth are very considerably richer than at the apex of the lodes. The subject of deep levels, therefore, is of critical importance to the mining industry of the "Rand" and forms one of the grievances of the Uitlanders, which they recently attempted to redress by force of arms.

The size of a Transvaal mining claim being 150 feet in direction of lode by 400 feet wide and the right to mine confined to the verticals of either end or side lines, the right of ownership is held upon a "diggers' license," renewable every month at a cost of $5 for this area, and the number of claims held by the mining companies vary from a block of six to one of 186 claims. It is therefore obviously necessary for the mining companies to secure as much lateral area as the dip and practical working depth justifies. This area (locally called bewaarplaatsen) must necessarily extend, where the angle of dip is flat, over many lateral claims of 400 feet each and aggregating in an almost prohibitory annual tax, and an injustice to so important an industry when compared to the mining laws of the United States or Canada. Take for comparison the mines in British Columbia, in which so many citizens of Spokane are interested, and we find that upon the Boers' terms and conditions each British Columbia claim would cost the owners, in diggers' licenses only, no less than $2,246.50 per annum, as against $12.75 per annum charged for the privilege in British Columbia. Also in comparison with the mining laws of this State—Washington; the mining claim is equal in area to fifteen Transvaal claims, with no fixed annual charge following the small fee upon recording. Moreover, the Boers' prohibitory taxation does not stop here, as the government reserves the right to rent, lease or sell the surface area as is seen fit; therefore the mining companies must pay another tax for surface rights covered by the necessary buildings, mining and recovery works, etc., incidental to the industry. The Boer government thereby inflicts a severe penalty upon the Uitlander for encroaching upon his beloved heritage in search of gold, and also takes every possible opportunity to impress his hatred and contempt for a people of this progressive age and civilization.

The developments of diamond drilling operations previously referred to will convey some idea concerning the "life" of the "Main Reef Gold Lode Series" (of which Johannesburg is the center) now being mined for a distance of over forty miles, but for more definite information we will take the annual tonnage of ore now being extracted, viz.: Three and one-fourth million tons, the proved depth (measured with the angle) of lode as 6,000 feet, the average collective thickness of the five pay lodes as twenty feet, the weight of ore at twelve cubic feet per ton, and duducting 15 per cent for faultings, etc., and ten million tons extracted to date, we have for the forty miles "ore in sight" equal to the next 550 years' operations at the present rate.

*By F. G. Jordan, M. and C. E. in Mining, a Journal of the Northwest Mining Association.

Temperatures at Great Depths.

AT WHAT DEPTH AND TEMPERATURE CAN OUR MINERS WORK?

Mr. Agassiz says, for several years past he has, with the assistance of the engineer of the company, Mr. Preston C. F. West, been making rock temperature observations as they increased the depth at which the mining operations of the Calumet and Hecla Mining Company were carried on. They had now attained at their deepest point a vertical depth of 4,712 feet, and had taken temperatures of the rock at 105 feet; at the depth of the level of Lake Superior, 655 feet; at that of the level of the sea, 1,257 feet; at that of the deepest part of Lake Superior, 1,633 feet; and at four additional stations, each respectively 550, 550, 561, and 1,256 feet below the preceding one, the deepest point at which temperatures have been taken being 4,580 feet. They proposed, when they had reached their final depth, 4,900 feet, to take an additional rock temperature, and to then publish in full the details of their observations.

In the meantime they thought it might be interesting to give the results as they stood. The highest rock temperature obtained at the depth of 4,580 feet was only 79° F., the rock temperature at the depth of 105 feet was 59° F. Taking that as the depth unaffected by local temperature variations, they had a column of 4,475 feet of rock with a difference of temperature of 20° F., or an average increase of 1° F. for 223·7 feet. "This," says Mr. Agassiz, "is very different from any recorded observations, Lord Kelvin, if I am not mistaken, giving as the increase for 1° F. 51 feet, while the observations based on the temperature observations of the St. Gothard tunnel gave for an increase of 1° F. 60 feet. The calculations based upon the latter observations gave an approximate thickness of the crust of the earth, in one case of about 20 miles, in the other of 26. Taking our observations, the crust would be over 80 miles, and the thickness of the crust at the critical temperature of water would be over 31 miles, instead of about 7 and 8·5 miles as by the other and older ratios. With the ratio observed here, the temperature at a depth of 19 miles would only be about 470° F., a very different temperature from that obtained by the older ratios of over 2,000° F.

"The holes in which we placed slow-registering Negretti and Zambra thermometers were drilled, slightly inclined upward to a depth of 10 feet from the face of the rock and plugged with wood and clay. In these holes the thermometers were left from one to three months. The average annual temperature of the air is 48° F., the temperature of the air in the bottom of the shaft was 72° F."

Mr. Edward Hull, in his work on "The Coal Fields of Great Britain," made an inquiry into the physical limit to deep coal mining, and he states that in Paris, at an artesian well sunk to 550 yards, the general result in chalk was found to be 1° F. increase for every 60 feet beyond the normal. In Westphalia a similar boring was carried to a depth of 768 yards, and the result was an increase of 1° F. for every 54 feet. Near Geneva an artesian boring gave 1° F. for every 55 feet. At Mondorf, says Mr. Hull, an artesian boring gave 1° F. for every 57 feet, and he gives details as follows:

	Yards.	
Lias	59·15	about.
Keuper	226·02	"
Muschelkalk	156·17	"
New red sandstone	342·60	"
Old schistose rocks	17·32	"
	801·26	"

In the Tresavean mines in Cornwall, Mr. Hull goes on to say, the depth is about 2,112 feet and the temperature was between 90° and 100°; this result would give an increase of 1° for every 56½ feet. At the Monkwearmouth Colliery experiments showed an increase of about 1° for every 60 feet. At the Dukinfield Colliery, during the course of sinkings, the thermometer was inserted in a dry bore hole and removed as far as possible from the influence of the air in the shaft, and left in its bed for a length of time varying from half an hour to two hours. The sinkings went down at that time to 2,055 feet. There were also observations made in the open workings at 120 yards from the shaft and at a depth of 2,151 feet. The first of these observations gave 51° as the invariable temperature throughout the year at a depth of 17 feet. Between 231 yards and 270 yards it was nearly uniform at 58·0°; and the increase from the surface, says Mr. Hull, would be at the rate of 1° F. for 88 feet. Between 270 and 309 yards the increase was at the rate of 1° for 62·4 feet; between 309 and 419 yards the increase was at the rate of 1° for 60 feet; between 419 and 613 yards the increase was at the rate of 1° for 86·91 feet; between 613 and 685 yards the increase was at the rate of 1° for 65·6 feet. The result of the whole series of observations gives an increase of 1° for every 83·2 feet.

Mr. Hull adopts 50·5° F. as the standard of departure—or, in other words, as the temperature of no variation at a depth of 50 feet underground—and then adding 1° for every 70 feet beyond the first fifty, and taking into account the increased density of the air, he considers the theoretical increase of temperature at several depths would be found as follows:

Depth in feet.	Increase of temperature due to depth.	Increase of temperature due to density of air.	Resulting temperature.
1,500	21·42	5·0	76·92
2,000	27·85	6·5	84·85
2,500	35·5	8·5	94·00
3,000	42·14	9·83	102·47
3,500	49·28	11·66	111·44
4,000	56 42	13·16	120·08

Mr. Hull did not consider our miners could work at a higher temperature than that of 94°—almost that of the tropics. But he thought it would be possible to reduce the heat even of a mine 4,000 feet in depth to a degree not only tolerable, but admitting of healthy labor, and it was for that reason he fixed the limit of possible coal mining operations at 4,000 feet.—Science and Art of Mining.

NOVELTY in advertising is the thing now. The latest and one of the most humorous schemes has been amusing the patrons of theaters for three or four nights, says a city contemporary, and has succeeded in escaping the notice of managers. A bald headed man is the instrument. On his shining pate is painted in indigo blue the name of a patent medicine. He sits in the front row, and conducts himself with propriety, while people behind him are convulsed with laughter, each observer supposing that here is a practical joke some one has played on an unsuspecting friend.

WHEN dogs, cats, and other animals, carried long distances on cars and steamers, sometimes confined in bags and baskets, can, without asking any questions, find their way home, and birds traveling thousands of miles come back year after year to the same nests, and carrier pigeons to their dovecotes, Our Dumb Animals thinks it is pretty sure that they know some things to a knowledge of which no human being has yet attained. There is a vast field of animal intelligence to be studied, and the more we study, the more we shall be filled with wonder and admiration.