Science & Progress.

THE SUN'S TEMPERATURE.

Its Heat Has Always Been Overestimated, it is Now Said.

It is easy to infer that the problem of the sun's temperature is a difficult one, from the fact that the estimates of various republic authorities range all the way from the millions of degrees contended for by Secchi and Ericsson, to the three, four, or five thousand of Pouillet and Vicaire, says C. A. Young in the Cosmopolitan. The very high estimates, however, are obviously wrong, being based on the hypothesis that the amount of heat radiated by a body is proportional to its absolute temperature. It really increases much more rapidly, as has been known for a long time, and the low estimates referred to are founded upon a purely empirical law deduced from this knowledge—a law of more than doubtful application to conditions differing so much from those of laboratory experiments. For the past decade the value assigned by Rosetti (about 18,000 degrees F.) has been very generally accepted as the most probable; but within the last two years new investigations by Le Chatelier, in France, and by Wilson and Gray, in Ireland, working by different methods, both apparently improvements on Rosetti's lead to reasonably accordant values, which are considerably lower—14,000 and 12,000 degrees.

Within a few months Scheiner, of Potsdam, has come upon a spectroscopic phenomenon which in a general way confirms these results, without, however, deciding between them. Among the lines in the spectrum of magnesium there are two which behave in a curiously contrasted way. One of them, having a wave-length of 435.2 microns, is conspicuous in the spectrum produced by the electric arc, where the temperature is not far from 6,000 degrees F., but is wholly absent from the spark-spectrum at a temperature much higher—probably not less than 20,000 degrees. The other line (wave-length 448.2) is brilliant in the spark-spectrum, and absent in that of the arc.

Now this latter line is very conspicuous as a dark line in the spectra of the great white stars, like Sirius and Vega, and wanting in the solar spectrum, while just the reverse is true of the other. Hence, the obvious conclusion that the white stars are much hotter than the sun, and that the temperature of the sun's absorbing atmosphere is approximately that of the electric arc—certainly not lower than that, but also certainly not so high as that of the electric spark. As for the atmosphere, or shell of incandescent cloud, which constitutes the visible surface of the sun, it must be much hotter than the absorbing atmosphere. It is a pity that observation does not fix the limit of possibility somewhat more closely, but to do so it would be necessary to determine just the temperature at which one of the magnesium lines gives place to the other, and so far as we now know, it may be anywhere between 6,000 degrees and 20,000 degrees.

SEEING BY ELECTRICITY.

Professor Bell is Conducting Some Astonishing Experiments.

Professor Alexander Graham Bell is spending these months at his place in Nova Scotia, engaged in a series of investigations which will no doubt have important and perhaps sensational results. His outdoor work is devoted to experiments in "aerial navigation," in connection with Professor Langley, of Smithsonian Institution, while in his laboratory he is endeavoring to demonstrate a problem to which he has given a great deal of thought, and in which he thoroughly believes. It is to harness electricity to light, as it has been harnessed to sound, so that the people may be able to see a great distance, just as the telautograph enables them to write and the telephone enables them to speak at a great distance. Professor Bell firmly believes that it will be possible some day to see from Washington to New York as easily as one can convey the sound of the voice that distance. He insists that the fact has already been demonstrated and that it only remains to construct the apparatus necessary to bring the possibilities of the discovery into actual and practical use. This is exceedingly difficult—much more difficult than the construction of the telegraph instrument or the telephone, for the reason that the vibrations of light are so much more rapid than the vibrations of sound. But Professor Bell is confident that he will soon be able to discover a diaphragm sufficiently sensitive to receive the vibrations of light and produce the effect necessary to convey the impressions to the human vision.—Chicago Record.

New Zealand's Experience.

The introduction of predaceous animals, to hold certain pests in check, has not proved an unqualified success in New Zealand. A local paper of that colony states that the weasels, which were imported to keep down rabbits and rats, are increasing so rapidly as to become a serious menace to poultry keepers. Their success in keeping down the rabbit pest is problematical, and so far are they from destroying rats, it appears that they fraternize with them, one farmer having found a rat living on merry terms in the same nest with four weasels.

Fishing With a Thermometer.

A French doctor has just discovered why some fishermen catch cod and others do not. He found that on the northerly side of high submarine peaks the cod would not bite, while on the southerly side they did. By attaching thermometers to fishing lines he further found that most fish was taken at a temperature between forty-five and fifty degrees, and that at forty-five degrees, with a depth of about fourteen fathoms, the catch was best.

THE ECONOMY OF GAS ENGINES.

An Interesting Resume of Their Value as a Means of Power Producing.

In a paper read before the Incorporated Institution of Gas Engineers in London, Mr. Bryan Donkin gave a number of facts as to the extent to which gas engines are used and the degree of economy they have attained. He said that, according to Mr. Dowson, gas engines for electric lighting, developing about 7,000 horsepower, had been sold in England and Otto engines for 11,000 horsepower in Germany. Messrs. Crossley informed him that the number of Otto gas engines in use in England was about 20,000, and he might assume that there were about nearly double this number for all kinds of gas engines.

At "Chateau Lay" an Otto gas engine, feeding about 650 glow lamps, consumed 1.2 pounds of fuel per indicated horsepower per hour for the manufacture of its Dowson gas. At the Chelsea flour mill a 60 nominal horsepower twin cylinder gas motor, with Dowson gas, used during a full load test about .87 pound of anthracite and coke per indicated horsepower per hour. The engine had a cylinder 17 inches in diameter by 2 feet stroke and made 156 revolutions per minute. At the Leven tweed mills there were, he said, four gas engines with Dowson gas, developing 200 horsepower. These engines used during a six days' test 1¼ pounds of anthracite per brake horsepower per hour. With coke from the gas works the consumption was 1¼ pounds per hour.

At Godalming paper mills there were gas engines giving 400 indicated horsepower, with an avarage consumption of one pound of fuel per indicated horsepower per hour. At a weaving mill in Halifax there were four gas engines of about 200 indicated horsepower using 1.2 pounds of gas coke per horsepower per hour. At the Uxbridge waterworks a water pumping test was made in February, 1892, using generator gas. The consumption was a pound of coal per indicated horsepower, or 1¼ pounds per horsepower of water lifted per hour. The approximate power was 16¾ indicated horsepower. The whole of Messrs. Crossley Bros.' large works are driven by gas engines using Dowson gas made from anthracite coal. There are eight gas motors from 12 to 30 nominal horsepower, indicating collectively about 325 horsepower.

The firm stated that the consumption was from 1 to 1½ pounds per indicated horsepower per hour. The net cost of the anthracite fuel, labor, interest on capital and repairs worked out at about 2½ pence per 1,000 cubic feet. Comparing this with average town gas and allowing for the difference in thermal value, the equivalent cost would be about 10 pence per 1,000 cubic feet. A single cylinder gas motor indicating 280 horsepower, driving a large flour mill in France, was lately seen by Mr. Donkin working with generator gas from French coal. The preliminary trials gave about three quarters of a pound per indicated horsepower per hour. The engine will give a maximum of 320 indicated horsepower.—Providence Journal.

The Fairy Ring of Helena.

The well known circle on the pasture lands about six miles east of Helena, near the old overland stage road and which has been a curiosity and a source of speculation for years, is identical with the fairy rings so common in some parts of England. There were formerly two of these rings, but one has entirely disappeared within the last few years. The remaining one is about 200 feet in diameter and forms a perfect circle. The ground forming the circle is about two yards wide and quite destitute of vegetation. Many theories have been advanced as to the cause of these rings. Some say that it is the result of lightning; others that a herd of buffalo, pursued by wolves, stopped and formed themselves into a circle as a means of defending their young, and thus tramped out the grass.

These rings have attracted the attention of scientific men, and recent investigations have shown they are the result of the centrifugal development of certain kinds of fungi, among which is the common mushroom, which shows a tendency to grow in this manner. The spot where it has grown is unfitted for its continued nourishment, and the spawn extends outward to new soil, forming the circle. These rings are common in eastern Montana along the Musselshell river, but the one near Helena is the most perfect in the state. —Helena (Mon.) Independent.

Railway Charges.

The following table showing the average railway charges for freight transportation per mile for different countries has been carefully arranged for the United States authorities:

United States	Cents 1.23
Germany	Cents 1.70
Austria	Cents 2.10
Belgium	Cents 1.54
Denmark	Cents 2.76
France	Cents 2.14
Italy	Cents 2.40
Luxembourg	Cents 1.92
Norway	Cents 3.00
Holland	Cents 1.52
Roumania	Cents 2.64
Russia	Cents 2.32
Finland	Cents 1.98
Switzerland	Cents 3.36
Average for Europe	Cents 2.02
Average in United States	Cents 1.22

Laboring in High Altitudes.

According to an American journal, some curious facts were brought to light on the capabilities of men to labor at high altitudes, during the construction of the Peruvian Central Railroad. This line starts at Lima, and, proceeding inland, reaches its highest point at the tunnel of Galeria, 15,645 feet above sea level. It is stated that men were able to do a fair "sea level" day's work as long as the altitude did not exceed 8,000 feet to 10,000 feet above sea level, but beyond this there was a sudden falling off in the work of one-fourth to one-third up to the heights of 12,000 feet, and at still higher elevations 100 men were required to do work easily done by fifty at sea level.

THE HOME GYMNASIUM.

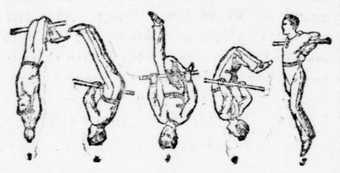
SOME EXERCISES THAT WILL PROVE ATTRACTIVE AND VALUABLE.

Work on the Horizontal Bar—Hanging by the Hands—Breasting the Bar—Hanging by the Legs—Circling the Bar—The Muscle Grind.

In this article are detailed some of the rudimental exercises in the home gymnasium. You should begin training so moderately that you will never feel a soreness from it.

With the gymnasium you can develop nearly every muscle of the body; and you can learn to do some exceedingly clever feats, but it will require time and patience. Go at it with the same system that you study mathematics or Latin.

The horizontal bar is the simplest, yet it furnishes the most varied and interest-



THE HORIZONTAL BAR.

ing forms of exercise and amusement of any other two gymnasium adjuncts. The muscles of the arms, wrists, chests, abdomen, legs and hips are chiefly benefited by bar exercise.

In the exercises herewith described, the bar should be at a sufficient height above the head to require a slight spring to grasp it.

Stand directly under the bar, jump up and grasp it firmly with both hands, the palms facing from you and the thumbs on same side with fingers. Practice this until you can sustain your weight, either at a standstill or swinging back and forth, for several minutes. Then practice hanging with one hand.

Grasp bar firmly as before, and gradually, by bending the arms at the elbow, raise the body until your chest is even with the bar. Once or twice will fatigue you at first, but continue it until you can breast it seven or eight times successively.

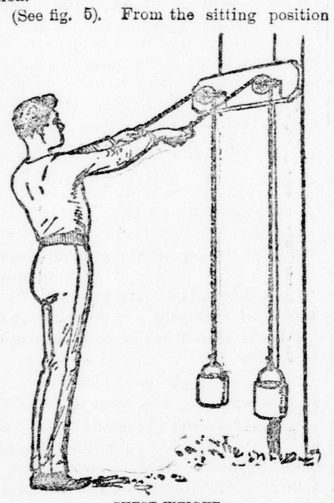
Grasp bar with both hands, bend the knees, bring them between your hands, and hook them over the bar. Let go with your hands, allowing the body to drop, head downward. To reach the ground from this position, swing back and forth vigorously until the head rises about even with the bar, and, on the forward swing unhitch the legs from the bar and spring quickly to the ground, alighting on the feet. This, on first appearance, seems difficult, but a few trials (I would suggest making them over a mattress or sawdust) will perfect you in it.

(See fig. 2). Breast the bar as before described. With the legs together and held stiff, move them forward and upward, describing a circle, and bringing the body around the bar until you lie flat upon it. From this position you circle round and round the bar as many times as practicable. Circle it both forward (that is, going around in opposite direction from the one in which you came upon it) and backward.

(See fig. 3). Hang by the legs as before described, but do not let go with the hands. Loose one leg, bring it as far back as possible and with a very vigorous kick throw it forward, carrying the body around the bar. As the body falls over the bar, repeat the kick for the second circle. After the first two or three revolutions the body will go around of its own momentum.

(See fig. 4). Grasp bar firmly with both hands. Bring the legs between them and bend them over the bar. Pull the body up with the arms until the small of the back rests on the top of the bar. Now, raise the body erect, pulling the seat back between the hands, and assume a sitting position.

(See fig. 5). From the sitting position



CHEST WEIGHT.

ease yourself forward off the bar, throwing the arms around it (one at a time). With the hands clasping your pantaloons at the sides, swing your legs back and forth, vigorously carrying the body over the bar. Repeat the motion as body falls over the bar for the next revolution. This is the celebrated muscle grind movement.

The primary exercises on the rings are so simple that detailed descriptions are unnecessary. Swinging back and forth, "chinning" and "breasting" the rings, "skinning the cat," hanging by the legs, etc., should be practiced for several weeks. You will then improvise more difficult and interesting ones.

For gymnasts who care for boxing the striking bag is an admirable apparatus. With it you can train yourself to hit a powerful blow. The bag should hang about even with the breast.

Use light chest weights at first, say from two to four pounds. Never exercise long enough to fatigue yourself. Assuming position designated in the figure, carry the rings above the head, down to sides, and out at arm's length. Then turn the back to rings and repeat same motions. All of the exercises are simple, but in the course of time wonderfully effective.

A Saying of Napoleon.

Great men are those who can control both good luck and fortune.

FAMOUS ANIMALS.

Tray, the Noble Life-Saving Dog of the London Docks.

Tray was one of those noble dogs who live about the docks and save people who fall into the water. Some of these dogs have received medals for bravery, in saving life, from the Humane Society. We do not know that Tray ever got a medal; probably not, but he certainly deserved one, and he got something much better than any medal, and that was a poem by Robert Browning, who made him celebrated.

One day a little beggar child was sitting on the edge of the quay. She was playing with her doll, and singing to herself and having a nice time, so that she forgot how near she was to the edge, and all at once she lost her balance and fell into the water.

The poor child screamed as she fell in and the people on the dock all rushed to the edge and looked over, but the water was very deep, ten or twelve feet, and the current very strong, so that the men were afraid to jump in after the poor little girl, who was drowning before their eyes. To be sure they had to think of their own wives and children before risking their lives to save her. While they were all calling on each other for help, and none willing to be the one to come forward, a dog ran up. He was not afraid, and he did not stop one minute to think about whether he would get drowned.

He saw the child struggling in the water and he leaped over at once. He dived down to the bottom, then he rose near her and in a minute he had her tight and swam with her to land.

The people took her from him and she stood on the pier dripping with water. Then they turned to Tray to praise him, but he was gone. He had jumped over again.

They were surprised. They thought another child must have fallen in without their seeing it, but they were quite willing that Tray should have all the respon-

TRAY.

sibility of saving it. This time Tray was a long time under the water. They began to wonder what had become of him, but no one thought of doing anything to help the brave dog. They did not even throw a rope out that he could have caught in his teeth, although the current ran very strong where he had gone down. However, he did come up to the surface in time and then they saw he had something in his mouth.

He came slowly to shore, for he was very tired. He had been down to the very bottom of the river and fished up the doll which the little girl had in her hand when she fell over, and now he came to her with it. It was just as good in Tray to save the doll as to save the child, but the people laughed at him, except the little girl. Tray trotted off home. He did not know what a hero he was or how much better than the people who thought themselves so much wiser than the dog, and yet would not run a risk of hurting themselves to do what he had done without thinking of himself at all.

Engraving on Eggs.

Here is an experiment pretty and simple: Write upon the eggshell with wax or varnish, or simply with tallow, and then immerse the egg in some weak acid, such, for example, as vinegar, dilute hydrochloric acid, or etching liquor. Wherever the varnish or wax has not protected the shell, the lime of the latter is decomposed and dissolved in the acid, and the writing or drawing remains in relief.

A few precautions must be taken in order to be successful at the experiment. In the first place, as the eggs that are to be engraved are usually previously blown, so that they be preserved without alteration, it is necessary before immersing them in the acid to plug up the aperture in the extremities with a bit of beeswax.

As the eggs are very light, they must be held at the bottom of the vessel full of acid by means of a thread fixed to a weight, or wound round the extremity of a glass rod. If the acid is much diluted, the operation, though it takes a little longer, gives better results. Two or three minutes usually suffice to give characters at have sufficient relief.

Beautiful Things.

Beautiful faces are those that wear—
It matters little if dark or fair—
Whole-souled honesty printed there.

Beautiful eyes are those that show,
Like crystal panes where heart fires glow,
Beautiful thoughts that burn below.

Beautiful lips are those whose words
Leap from the heart like the song of birds,
Yet whose utterance prudence girds.

Beautiful hands are those that do
Work that is earnest, brave and true,
Moment by moment the long day through.

Beautiful feet are those that go
On kindly ministries to and fro—
Down lowliest ways, if God wills so.

Beautiful shoulders are those that bear
Ceaseless burdens of homely care
With patient grace and daily prayer.

Beautiful lives are those that bless—
Silent rivers of happiness,
Whose hidden fountains but few may guess.

A Cunning Animal Villain.

The wolverine, carcajou or glutton is better known as being the trapper's evil genius than for the value or beauty of his own fur. He is the greatest thief and the most cunning villain in our whole mammalian fauna, and mountains of hard words have been heaped upon his ugly head. In fighting weight he is about the size of a setter dog, but in form he may best be described as a cross between a badger and a bear. He has the head, legs, feet and tail of a badger, and a bear-like body.