ELECTRICITY IN THE HOUSEHOLD.

In this, the electrical age, no new house is considered complete unless it be fitted with electric lighting circuits, whether the owner intends to use electricity or gas as an illuminant. And yet the incandescent lamp has been in practical use but little over a score of years. But aside from its utility for illuminating a building, and for running an electric fan, the electric circuit offers many other advantages which the public is only just beginning to appreciate. The accompanying illustrations show what a variety of uses the electric current can serve in an up-to-date home. The fatiguing treadmill operation of the sewing machine is done away with and the work is performed by a little electric motor about a foot high and six or seven inches broad, which gets its power from the ordinary lighting circuit and, changing this to mechanical movement, transmits it to the sewing machine through a friction wheel bearing on the starting wheel of the machine. The speed can be very delicately regulated by means of a small lever and the machine can be as quickly started or stopped as by foot power. As shown in our illustration the operator can assume any easy, comfortable position, as the only duty required is to steer the cloth under the needle. Even an invalid can safely operate a machine thus driven.

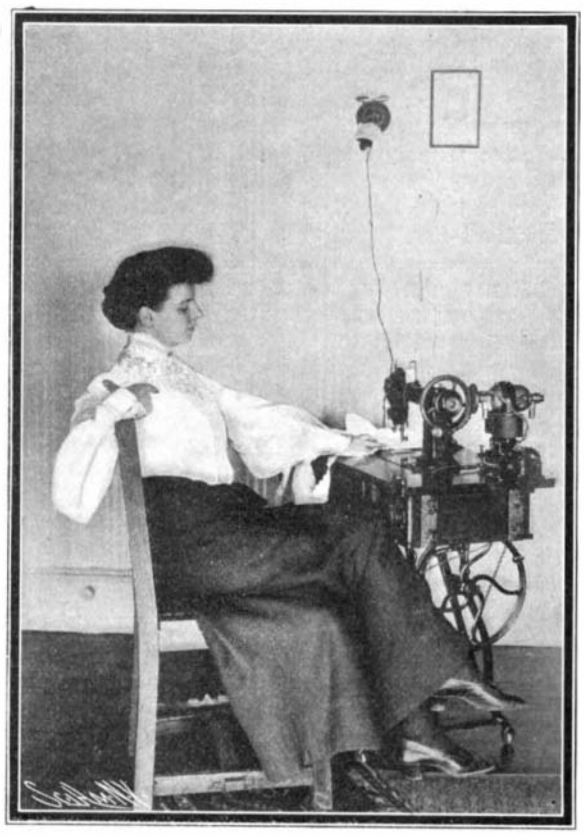
The electrically-heated flatiron shown in another illustration possesses the advantages of maintaining an even temperature which continues as long as the device is connected with the electric circuit. The iron heats up in a few minutes and is very handy especially for occupants of flats and apartments in laundering small articles. It is also particularly useful for pressing a crease in a pair of trousers and smoothing out the wrinkles in a coat and vest.

One of our illustrations shows an electric "hot-water" bag, which might better be termed "hot-wire" bag, for instead of being filled with hot water, it contains coils of fine flexible wire which are heated on passing the current through them. The bag heats up in five minutes, and as is the case of the electric flatiron it possesses the advantages of yielding a uniform degree of heat as long as it is in use. This is certainly a long step in advance of the hot-water bags now commonly used, which have to be refilled with hot water every fifteen or twenty minutes, and even then a uniform heat is not maintained.

Electric curling-iron heaters are to be found on the dressing tables of many fashionable hotel bedrooms. They are small and neat and they work automatically. The slipping of the iron into the heating chamber turns the current on and the withdrawing of the iron turns it off. They are popular because they do away with black smears of soot that the heating of a curling iron in a flame of gas occasions.

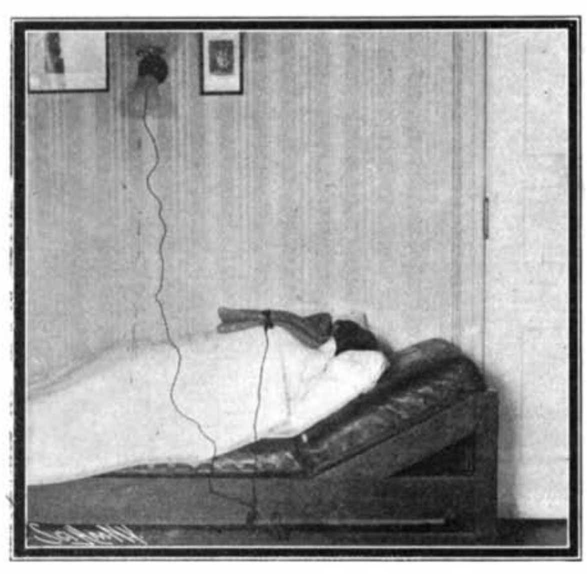
The electric chafing dish shows still another use of electricity in the home. It is really a small stove which can be regulated at will to give the desired intensity of heat. A traveler will find this stove particularly useful. It can be carried in the overcoat pocket and in a hotel room, on a train, on board steamer, or wherever electricity is available the little stove can be set up and used for preparing coffee, tea, Welsh rarebit, etc.

Aside from the electrical devices illustrated herewith, there are many others which are coming into practical use. Electric griddles, cake irons, toasters, cereal boilers, and coffee urns are but a few of the many devices which are now finding their way into homes equipped with electricity. None of these contrivances calls for more than three-quarters of a cent per hour to operate, and besides their cheapness, their cleanliness, and their handiness, they have the additional quality of absolute safety. Insurance companies recommend them and the insurance rates are lowered where they are in use.

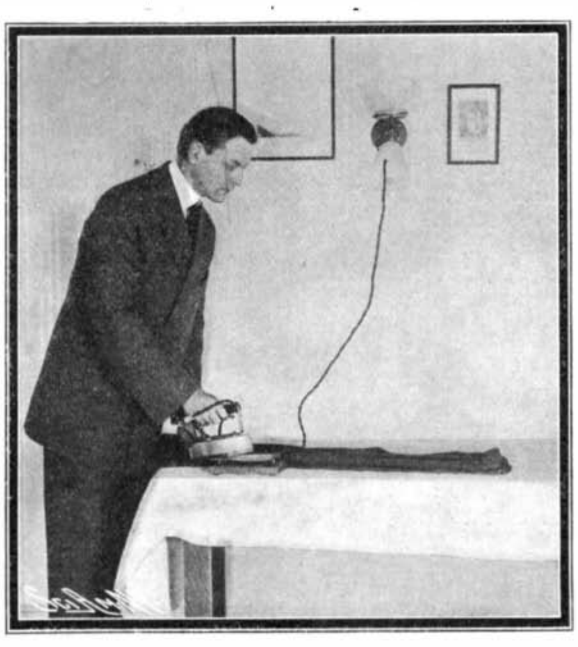


Sewing Machine Run by Electric Motor.

The Electric Chafing Dish.



The Electric "Hot-Water," Bag.



Pressing With Electrically-Heated Flatiron.

The Electric Curling-Iron Heater.

ELECTRICITY IN THE HOUSEHOLD.

New System of Measuring Criminals.

The police of London have introduced experimentally a new measuring system for recognizing criminals. As it has been successful, it will soon be adopted by a number of other police departments both in England and abroad. In this system only the impressions of the fingers are taken. Compared with the Bertillon system, it has, above all, the advantage of simplicity, as it can be applied without any contrivances, and is, therefore, much less expensive. Whether it can completely take the place of the Bertillon system remains to be seen. The Berlin police have for the present also inaugurated a card collection of impressions of the fingers for recognition purposes. The new system is called "Daktyloscopy."—Richard Guenther, Consul-General, Frankfort, Germany.

OUR KNOWLEDGE OF THE MOON.*

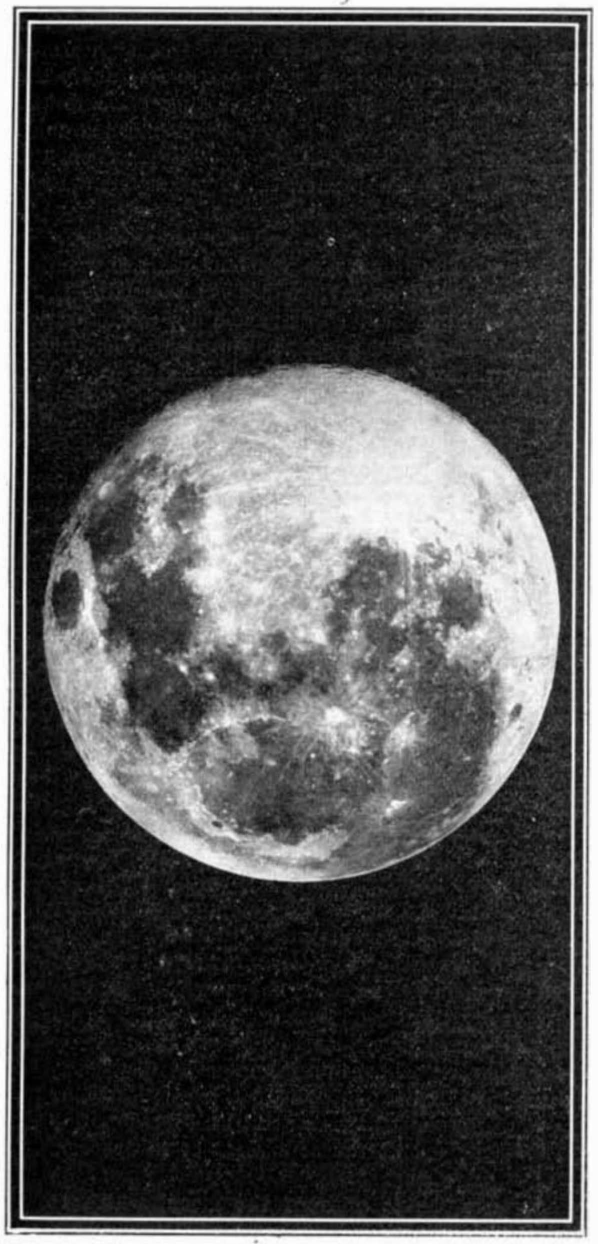
Prof. Pickering's book on the moon, although essentially a popular work, is nevertheless an important contribution to the literature of a subject which has been made the object of ceaseless study even before astronomy had developed into a science. Based as the book is on very recent observations carried out by Prof. Pickering through the aid of Harvard University's observatory, and particularly on a splendid photographic atlas of the moon's surface prepared under Prof. Pickering's direction, it cannot but meet with the reception that it deserves. Astronomers who seek more technical information can find it in the Annals of the Harvard observatory; but the man who has a leaning toward science but who has not sufficient astronomical training to warrant a perusal of the more pretentious annals, will find here just what he needs—an accurate, and withal a confessedly popular account, of what astronomers have discovered on the surface of the earth's satellite. With this brief expression of opinion, we may be permitted to pass to a general review of the contents of Prof. Pickering's work.

Just what may have been the origin of the moon has been the subject of much speculation. The most currently accepted theory, however, is that the moon is supposed to have been originally part of the earth, and that in some way it has broken off from the parent mass. We are certain that when the earth was still a plastic mass the terrestrial day was much shorter than it is at present. As the original earth cooled, and contracted from its nebulous form, its rate of rotation must have steadily increased, and with it its centrifugal force. The powerful solar tides which then existed, however, did much to reduce this increase. The final period of rotation was shortened to about three hours. Gradually, the force of gravity at the equator became less and less. The solar tides in consequence became higher and higher. One day a cataclysm occurred, the like of which this earth has never seen before or since. Five thousand million cubic miles of material were hurled from the earth's surface by centrifugal force, never again to return to it. The somewhat fanciful suggestion has been made that the great depression occupied now by the Pacific Ocean indicates the spot which was filled by the moon, and that the eastern and western continents were cleft in twain when that great division occurred, floating like two huge ice floes on the denser, partly metallic fluid of the earth's interior. These huge depressions, when the surface had sufficiently cooled, were afterward filled with water, according to this theory, thus forming other existing oceans.

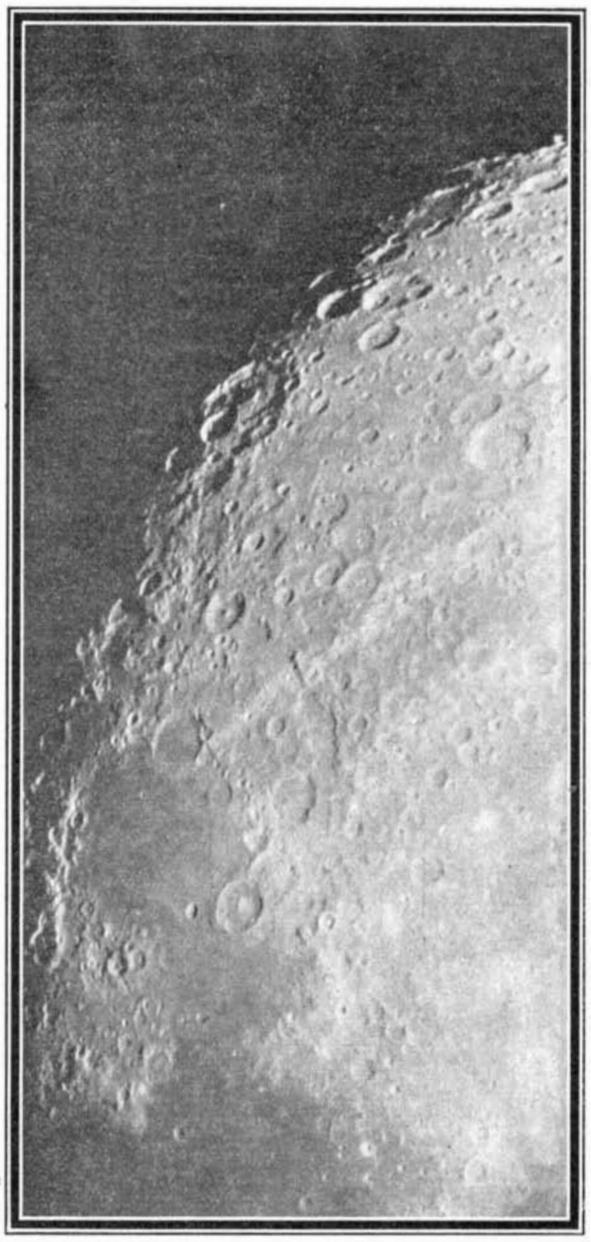
When did this separation of the moon and earth occur? It must have been rather recent in astronomical chronology. It is certain that the earth must have been already condensed from a huge gaseous mass to a comparatively solid or liquid form, very near its present size. The moon is probably one of the younger members of the solar system. Still, astronomers estimate its age at something like fifty million years.

When it first began its journey around the earth, the moon could not have been spherical; for the earth would not have permitted so large a body to retain its shape so near its own surface. The moon's present form was probably assumed after it had escaped to a distance of a few thousand miles, a distance that constantly increased and will continue to increase within certain well-defined limits. When our satellite has retreated to about 350,000 miles, the length of a lunar month will be increased to fifty of our present days; and our day will also have been increased fifty-fold. The earth and moon will constantly turn the same face toward each other as

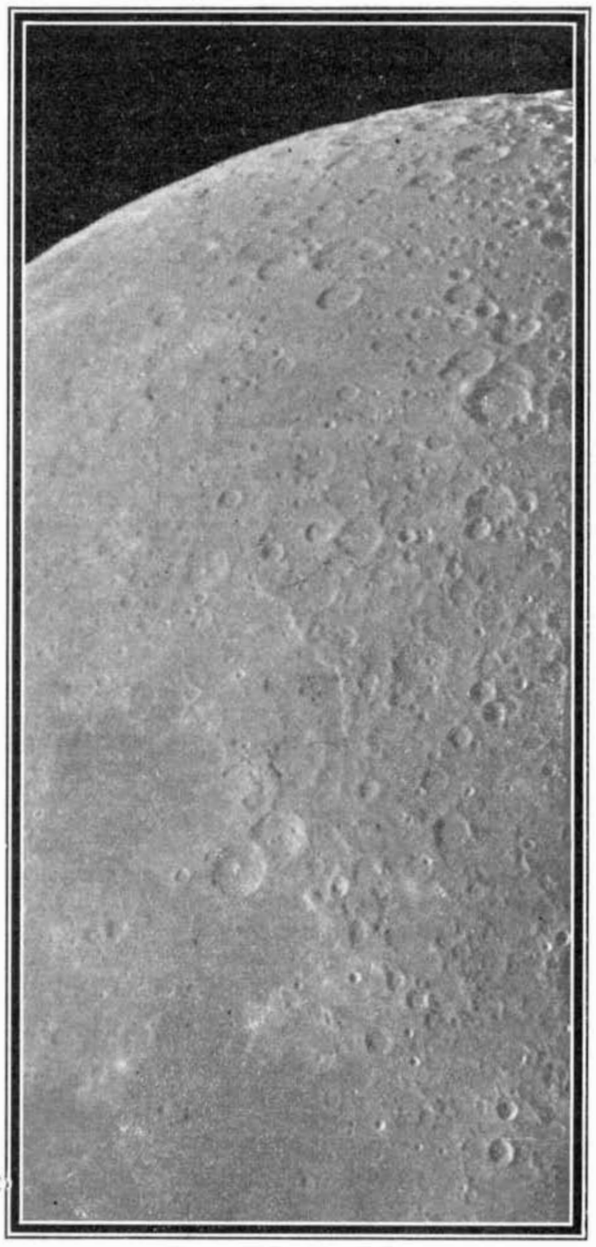
* The Moon. By Prof. William H. Pickering. New York: Doubleday, Page & Co. 1903.



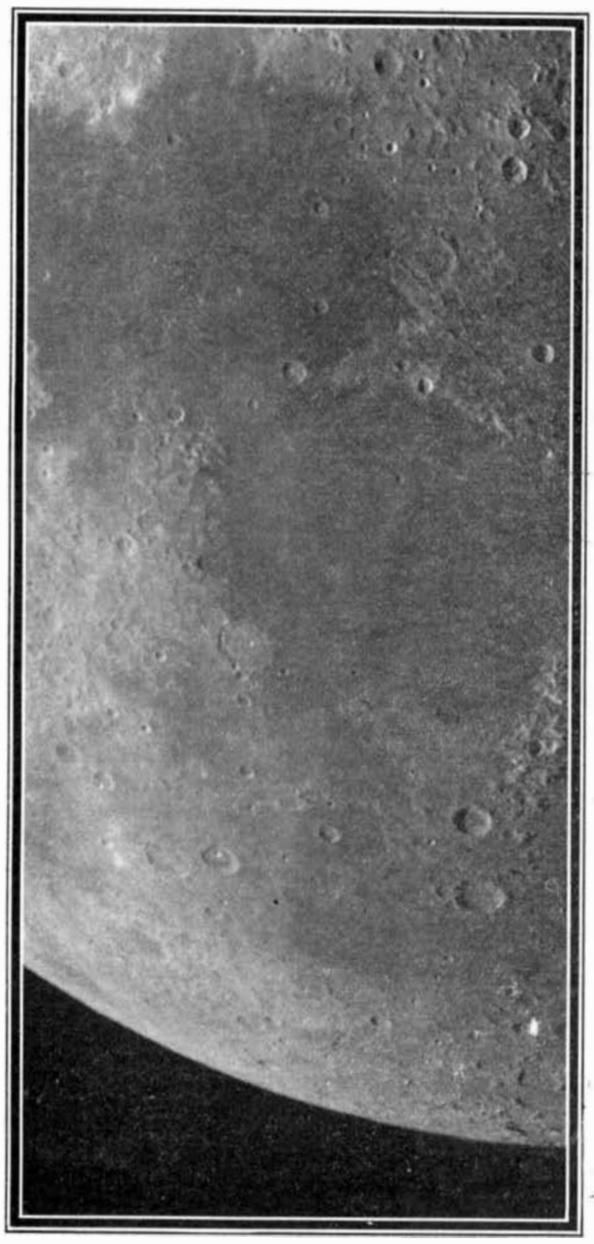
The Full Moon.



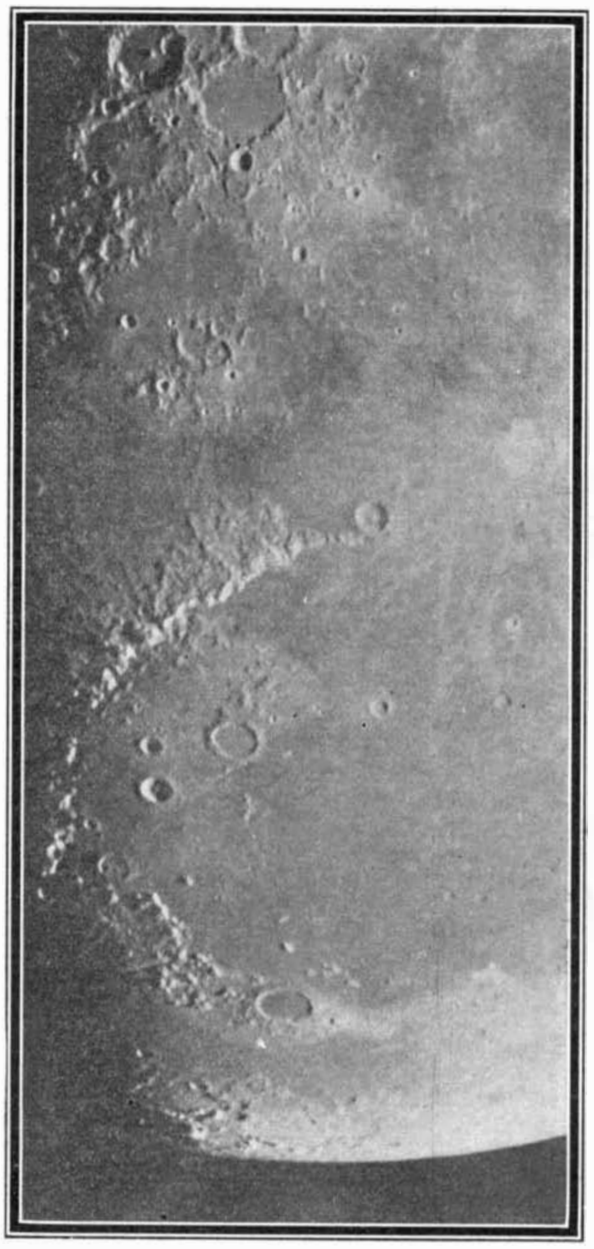
Piccolomini. Theophilus.



Piccolomini. Theophilus.



Mare Tranquillitatis. Mare Serenitatis.



Mare Imbrium. Plato.

Kepler. Aristarchus.

The entire surface of the Moon was carefully mapped out and photographed five times, under the direction of Prof. Pickering, on the Island of Jamaica.

PART OF THE HARVARD PHOTOGRAPHIC ATLAS OF THE MOON, SHOWING SOME OF THE MORE PROMINENT CRATERS.

they did from the very beginning. This conclusion is based upon the assumption that when this event occurs, we shall still have seas and tides, of which fact, however, astronomers are by no means certain.

From time immemorial, it must have struck astronomers that the moon always presented the same face toward the earth, a phenomenon which is to be explained by the fact that the moon rotates on its axis in precisely the same time it revolves around us in its orbit. The cause is to be found in the tides—not our tides raised by the moon, but the moon's tides raised by the earth. It has been concluded by astronomers that the great lunar tides of that early period were not tides of water, but of molten rock, rising not merely a few feet every twelve hours, but many miles—so fearful in the gigantic force which they developed that they quickly retarded the rotation of the moon. Soon it happened that the moon ceased to turn with regard to the tides. Thus it came about that the moon's period of rotation on its axis and its revolution about the earth were made to coincide.

These great tides must have ceased ages before the human race was born. They have probably left their permanent mark upon our satellite. Very likely its surface is not spherical, but slightly elongated in the direction of our earth. If the moon's time of revolution begins to exceed that of its rotation, the earth's attraction on this projecting surface will retard its rotation by just the proper amount to bring about a coincidence with exactly the same result that a tide would have had.

The greatest distance from us that the moon ever reaches is 253,000 miles; the nearest it ever comes to us is 222,000 miles. The time required by the moon to travel around the heavens until it arrives at the same point again is 27 1-3 days. This, the true period of revolution, is called one sidereal revolution. The time required by the moon to pass from full moon to full moon, or from any other phase to the same phase is 29½ days, which period is called its synodic revolution and is usually referred to as the lunar month. Both periods are subject to slight variation.

The phases of the moon may be explained by the fact that the moon is a dark spherical body which shines only by reflected light. Astronomically speaking a new moon occurs only when the moon is between us and the sun, and is, therefore, invisible. The new moon, popularly so called, is seen only when the sky is sufficiently dark to present a complete outline of the disk. This illumination is due to the light which comes first from the sun, is reflected to the earth and back to the moon, and thence to the earth. What we really see is the earth light shining on the moon.

Because the moon moves at different speeds in different portions of its orbit, while its axial rotation is uniform, it happens that we sometimes see a little further around one edge of the moon and sometimes around the other—a phenomenon which is called by astronomers the moon's libration, that is, its balancing in longitude. There is also a libration in latitude, which is caused by the moon's turning sometimes one pole toward the earth, and sometimes the other. These librations enable us to see just a little of the other side of the moon, about nine per cent perhaps; but the rest must remain forever invisible.

Although the moon's velocity in its orbit compared with that of some other celestial objects is comparatively low, yet its speed, compared with our terrestrial standards, is enormous. It moves with a mean velocity of 3,350 feet per second—a little faster than the highest speed yet given to a cannon ball.

The mass of the moon is about 1-80 of that of the earth. Notwithstanding its smaller size, the bodies on the moon are much lighter than they would be here. The ratio is almost exactly one-sixth. A man who weighs 180 pounds on the earth would find that he weighed only 30 pounds on the moon. He could carry two men at once on his back for 20 miles, much more easily than he could walk that distance without a load here. He could throw a stone six times as far as on the earth. He could jump over a moderate-sized house or tree, and would not consider the feat at all wonderful.

The moon is commonly considered a body without life, without an atmosphere. According to Prof. Pickering, however, it is not altogether so lifeless as we once supposed. Astronomers have never been able to detect the slightest refraction of a ray of light coming from a star and passing very near the moon's surface—a test which was at one time considered proof positive that the moon could have no atmosphere. When, however, an atmosphere becomes extremely rare, we are not sure just what will be the effect upon the refraction. It is barely possible that the moon may have a much denser atmosphere than observation might seem to indicate. Refraction in the case of the moon is extremely slight, so slight that it is quite immeasurable. It has been assumed that the moon's atmosphere, if it has one, is about 1-10,000 that of our own. The strongest evidence that we possess of a lunar atmosphere based on direct observation is found when the moon occults a bright planet, such as Jupiter. Under these conditions a dark band is always seen crossing the planet, tangent to the edge of the moon. This absorption is never seen at the dark limb of the moon, indicating that the absorbing medium, whatever it is, is condensed to a solid by the intense cold that must prevail during the lunar night.

When the moon parted company with the earth, the two bodies doubtless divided their own atmosphere in proportion to their respective masses. But since the force of gravity on the moon's surface is but one-sixth that of the earth's surface, the density of the lunar atmosphere must have been only one thirty-sixth that of the earth's. But even this is 300 times more dense than we actually find it at the present time. The lighter gases have been escaping from the moon for ages with considerable rapidity, leaving behind the denser gases, a process which is also occurring on the earth, but much more slowly. If the moon has an atmosphere, of what is it composed? Oxygen and nitrogen would escape from the moon's atmosphere as rapidly as hydrogen does from the earth. Carbon dioxide gas on account of its heaviness is more readily retained and is probably to be found on the moon is considerable quantities. It is likely, however, that any gas not constantly renewed from the moon's interior would have disappeared from its surface long ago. The moon's atmosphere consists probably of water vapor and carbon-dioxide gas. There may be an amount of carbonic acid (which is to plants what oxygen is to animals) in a cubic foot of the moon's atmosphere much larger than that contained in an equal bulk of our own.

According to Prof. Langley, the temperature of interplanetary space cannot be far from that of absolute zero or 460 degrees below zero in the Fahrenheit scale. This is probably also the temperature of the night side of the moon. What the temperature of the day side may be, under a vertical sun, has not been determined with much exactness. Sir John Herschel and Lord Ross thought that it might exceed that of boiling water. Prof. Langley considers it very uncertain, but probably not far from the freezing point. Prof. Very has shown that the moon is at least harder than the snow upon its surface.

To the selenographer, the moon's craters are perhaps the most interesting objects of study. Whether any of these craters are still active has not as yet been accurately determined. Some observers claim to have noted effects of volcanic disturbances. A careful study of some of the craters affords proof that some of the volcanoes may not be extinct. Prof. Pickering has studied dense clouds of white vapor that apparently arose from the bottom and poured over the southeast wall of what is known as Schroeter's Valley, and has obtained evidence which would seem to prove that regularly occurring lunar changes of some sort are in progress.

If there be any active volcanoes on the moon, it is evident that they must expel something. That something, if we may judge by the volcanoes on the earth, is water vapor and carbonic acid gas. We have seen that the moon's temperature has been estimated at —460 deg. F. Obviously, water in the liquid state can hardly exist at that temperature, for many craterlets on the moon are lined with a white substance which shines brightly in the sun. A white substance which lines some of the larger lunar craters is also found on a few of the higher lunar peaks. Besides these very bright patches, there are other regions less brilliant, but exhibiting the curious phenomena of being invisible for the first twenty-four hours after sunrise, and gradually appearing as the sun rises higher and higher, becoming fairly conspicuous at the end of a couple of terrestrial days and then fading and disappearing before sundown. The most striking appearance, however, consists of long bright lines radiating in all directions—in some cases for hundreds of miles—from a central crater. These white patches are thought to be snow, invisible except when illuminated by the direct rays of the sun, because the lunar sky is absolutely black on account of the rarity of its atmosphere. The fact that these white patches gather at the pole on the mountain peaks would seem to indicate that snow does fall upon the lunar surface.

If the moon has an atmosphere of which water is not the least important ingredient, there is no reason in the nature of things, why organic growth on its surface should not be possible. Moreover, the presence of carbonic acid gas on the moon as a supposed ingredient of this atmosphere would lead one to infer that vegetation of some kind might exist, since carbonic acid is the food of plants. It may be objected that the rarity of the atmosphere would preclude the existence of organic life. To this it may be replied that certain forms of vegetation on the earth often subsist for years without water. On the antarctic continent, for example, a certain lichen grows at a temperature that rarely rises to the freezing point. If there be vegetation upon the moon, it would have certain advantages over our own. In the first place, the low lunar specific gravity would enable the leaves or branches to lift themselves with one-sixth of the effort required on earth. The absence of high winds upon the moon would permit a plant to rise above the surface of the ground without clinging close to the rocks as it would have to do in our arctic regions. Whether or not there really is vegetation on the moon's surface is a matter of some dispute. Prof. Pickering believes that there is, basing his belief upon observations of what he has called "variable spots"—portions which exhibit a rapid darkening, beginning shortly after sunrise, followed by an equally rapid fading toward sunset, accompanied by a diminution in size as they darken. From the peculiar character of the variation observed, Prof. Pickering concludes that organic life resembling vegetation is the only simple explanation of the changes which he has observed. Considering the long lunar day as a miniature terrestrial year, the theory of such life becomes colorable. The vegetation, if there be any, shoots up, flourishes and dies in a lunar day just as it grows and withers on the earth in a terrestrial year.

"Canals" are usually associated with the planet Mars. Still there is some evidence that the moon too has what may be called its canals, although on the whole, the lunar canals are much smaller and perhaps broader in proportion to their length than those of Mars. Yet on account of the clearness of the moon, its canals are much more readily studied than those of Mars. These canals, according to Prof. Pickering, may be accounted for on the planet Mars by processes of vegetation. The formation of the lunar canals may likewise be explained by the presence of plant life. The study of these canals of the moon is important, chiefly for the light it may throw upon a similar phenomenon of Mars. If they are due to vegetation, and if, indeed, it can be definitely proved that vegetation does exist upon the moon, it shows with what remarkable tenacity life clings even to a body that is nearly dead. The conclusions as to the existence of vegetation and an atmosphere on the moon are largely Prof. Pickering's. It is doubtful if they will find ready acceptance by most astronomers; still the proof which he has advanced of the soundness of his theories is at least interesting.

The photographic atlas of the moon, which forms perhaps the most important part of Prof. Pickering's book on the moon, corrects many errors in prior maps, which have been made from observation. The accompanying illustrations show with what painstaking care the work of taking photographs of the moon by the Harvard College astronomers has been carried out. From the number of photographs taken, Prof. Pickering concludes that the total number of craters and craterlets possible upon the moon, under variable conditions, exceeds 200,000, but is less than one million.

Prevention of Fire in Theatres.

In a paper recently published in Dingler's Polytechnic Journal (No. 5), C. Wegener draws attention to the fact that the amphitheatre being the best possible "ventilating pipe" of the point of origin of a possible fire, a radical alteration of the ventilating conditions in theatres would be the most fundamental requirement. The dangers of locating the main ventilating tube above the amphitheatre are pointed out, the hot, and accordingly rather expansive, gases as produced in the case of a fire on the stage being instantaneously sucked through the amphitheatre. Fireproof curtains would be quite illusory in the case of a similar arrangement of the ventilation both in the case of their being of asbestos and of iron, this being the cause of the inefficiency of the asbestos curtain in the Chicago disaster. Moreover, a partial lowering of the asbestos curtain must result in the ventilating effect being increased, as the fire gases, after being momentarily stagnated, will in the next moment issue from below the curtain with elementary force, igniting all they find on their way. The ventilating pipe should therefore be located at the back end of the stage, ventilating the whole of the amphitheatre above the stage. Three or more pipes should therefore be arranged at suitable places, being provided with reliable suction devices. In order that the gases should have an issue at any height, the pipes should be fitted with suction openings at different heights, when the fire gases following the horizontal suction would instantaneously issue outside through the opening. Suitable safeguards, as for instance fireproof curtains, would in this case prove quite satisfactory.

Extinguishment of Petroleum Fires by Means of Milk.

Every day the journals bring to our notice new accidents due to the negligence or imprudence of those having petroleum lamps under their charge. Every well-kept kitchen is provided with a little stock of milk. While water only quickens the flame of petroleum or of gasoline, milk immediately extinguishes it and prevents all danger. This is a process which every mistress of a house ought to post in a prominent place in her kitchen.—Translated from Le Journal du Petrole.