Correspondence.

The Lunar Rainbow.

To the Editor of the SCIENTIFIC AMERICAN:

The article in your issue of July 8, 1905, "A Lunar Rainbow," calls to my mind a similar phenomenon witnessed by the writer several years ago, only this was on a perfectly cloudless night. It occurred about 9 o'clock P. M. I was coming over a hill, to the west of which was a deep valley. A thick bank of fog lay over the valley, and as I descended into the valley I saw the bow perfectly defined. The colors were very faint, but the whole arch was perfect. How long it was visible I could not say. W. W. RANDALL.

Sea View, Mass., July 12, 1905.

The Reasoning Powers of Animals.

To the Editor of the SCIENTIFIC AMERICAN:

I have with much interest noted the discussions in your columns as to whether animals can reason. Two letters to this effect, published June 3 and July 1, apparently attempt to establish an affirmative theory that animals actually do reason, giving as they do the story of the cat which has learned to open a door by its latch and even knob. Let me say in the name of psychology that these cats did in no way show reasoning power, but on the contrary it was an act of dumb imitation, prompted by dire necessity on the part of the animals to get inside or outside, and indeed they had ample opportunity to learn under the circumstances.

While I do not discredit the reasoning power of elephants or beavers, however limited it may be, it does not demand expert observation to decide positively that at least animals of the feline genus and some other carnivorous ones, as for instance the bear, are wholly destitute of reason. Why? In Central Park the reason is engraved in not only hard cement, but also in the nose of a cinnamon bear. This animal is fenced in, but he can easily see freedom outside, and he has long ago made up his mind to secure his freedom by walking outside of this cruel inclosure. Seeing that the broad side of the fence would bar him, the bear made for the front corner; but seeing this corner impregnable, he naturally turned toward the other unexplored corner quite undaunted. Of course, he is again disappointed, but since the first disappointment was forgotten by the shock of the second, he hopefully again returns to the said first corner, and so on, hour after hour, days, weeks, and year after year. Lions, tigers, leopards, etc., do exactly as does this bear; but I will say of this particular bear, that although he has worn deep holes in the cement floor in both corners of alternate hope and despair, his nose has become worn by his systematic swing of the head in spurning these really hopeless corners of escape. There is as yet no clear impression on the mind of this bear that his long search for freedom is really hopeless. But this undaunted bear can be convinced, as by cutting off his view of freedom without, and it would also teach us a lesson—that the difference between simple intuition and reasoning is enormously great.

What little reason exists in animals is so feeble, that the slightest intuitive activity on their part will easily hypnotize their reasoning powers. Imitation, as proved by the monkey or the parrot, and still more so by small children—just because they have a larger brain area—may become so extensive that almost all the product of reasoning minds may be faithfully memorized and imitated, although the minds engaged never themselves ever reason except to a negligible degree. ALBERT F. SHORE,

Member Am. Assoc. for Advancement of Science.

Brooklyn, July 7, 1905.

The Current Supplement.

Carl Lautenschlaeger's article on Theatrical Engineering, Past and Present, is concluded in the current SUPPLEMENT, No. 1542. Dr. A. P. Coleman writes on "Theories of World Building." Lord Blythswood's liquid-air plant for experiments at low temperatures is very fully discussed by the English correspondent of the SCIENTIFIC AMERICAN. The Berlin correspondent of the SCIENTIFIC AMERICAN writes on an electrical long-distance water-level indicator which has been used with success in Austria. A very excellent *résumé* of agricultural electro-chemistry is presented. The action of metals in the colloidal state on the evolution of infectious diseases is made the subject of a well-written article. An interesting lecture was recently delivered before the Cleveland Institution of Engineering (England) by Mr. Robert Whipple, in which various forms of thermometers and pyrometers, with some of their industrial applications, were described. Mr. Whipple's paper is published in full. Saghalien, the island which has just been captured by the Japanese, is fully described. Clive Holland writes on pictures with romantic histories. An abstract of the communication made by J. Butler Burke on his *radiobes*, apparently living bodies produced from day to day by radium, is published. The Rev. Reginald A. Gatty writes on "The Home of the Pigmies."

ARTIFICIAL FOUNTAIN AND GEYSER SPRINGS.*

BY MYRON L. FULLER.

Where springs issue in cool, transparent pools, or as streams of clear water from the rock, little can be added to their attractiveness by artificial means. In many places, however, the water of the springs seeps out slowly through the soil, the point of emergence being marked simply by a wet, grassy, or boggy place. In such cases the springs may often be transformed

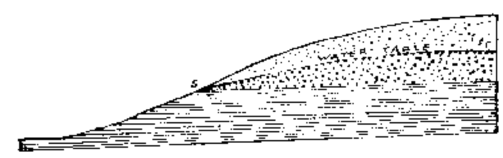

Fig. 1.—HILLSIDE SPRING WITH WATERS UNCONFINED AND WITHOUT HEAD.

into attractive spots by the construction of artistic basins, rocky arbors, rustic spring houses, and other similar means. One of the most useful methods of treatment is the construction of a so-called "fountain spring," while the most interesting, in many ways, and the most puzzling to many, is the "geyser spring." Both are of simple construction and inexpensive. Under the hands of a competent landscape gardener they can be made to form an attractive addition to parks and

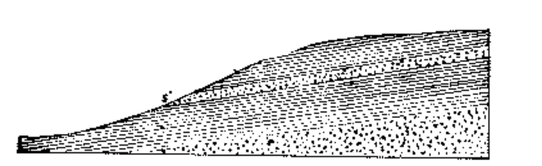

Fig. 2.—HILLSIDE SPRING WITH WATER BETWEEN IMPERVIOUS BEDS AND UNDER PRESSURE.

estates where the conditions are favorable, and where no water works system exists.

The common surface springs may be grouped according to their occurrence in two classes: Hillside springs and springs on flat or level land, both of which may or may not be under pressure or head. Where there is no pressure, the water cannot be made to rise naturally above its point of emergence, but when under head it will, if confined, rise more or less above the point at which it issues. Fig. 1 represents a hillside spring unconfined and without head, while Fig. 2 shows a similar spring, the water of which is confined between two impervious layers and under more or less pressure.

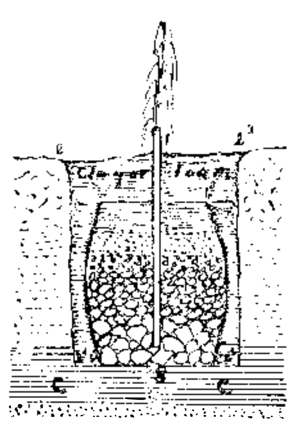

Fig. 3.—METHOD OF CONSTRUCTION OF "FOUNTAIN SPRINGS."

The latter only will rise if confined, but a fountain or a geyser spring can be constructed from either if sufficient fall can be had near the spring. Like the hillside springs, those occurring on level land can also be classed according to the amount of head, which will vary from just enough to bring the water to the surface to enough to make it boil strongly from the ground. To test the amount of head, it is necessary to confine the flow, which can be done in the manner outlined below for the construction of fountain springs.

Construction of Fountain Springs.—The term fountain spring is used to designate a spring which is made

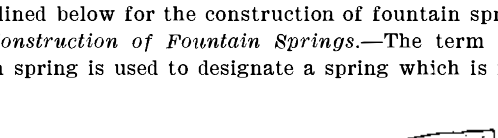

Fig. 4.—METHOD OF CONSTRUCTION OF "GEYSER SPRINGS.

to rise through a pipe to a point above the surface. It may flow gently into a trough by the roadside or in the barnyard, into the sink in the kitchen, or it may, if the head is considerable, be made to throw a jet into the air, as in an ordinary fountain.

The aim in the construction of such a spring is to confine the water, and force it to rise instead of flowing out uselessly upon the ground, as in natural springs. To do this, a circular excavation should be made about the spring, the earth being removed to a depth of three to five feet, preferably until a clay or clayey sand is encountered. The excavation when completed should have the outline indicated by e e^1 e^2 e^3 in Fig. 3.

A bottomless barrel, b b^1 b^2 b^3, may then be inserted, and a pipe placed in the center with its bottom nearly level with the lower edge. Around the pipe inside the barrel are packed stones, three or four inches in diameter at the start, and gradually decreasing in size until a thickness of two feet is reached. About six inches of sand should then be inserted, to be followed by the same thickness of clay, or as clayey sand or loam as can be found. This should fill the remainder of the barrel, and should be worked in around the edges on the outside until all avenue of escape of the water, except through the projecting pipe, is cut off. The ground should then be leveled over and thoroughly tamped down.

The result of this treatment is that the water of the spring, deprived of its ordinary outlet, is forced to rise through the pipe. The height to which it will rise and the force with which it will flow depends upon its head, which is in turn dependent upon the elevation of its source. There are many instances where the water is raised into roadside troughs, and its possibilities in connection with farm and household supplies are considerable. A few owners of important springs, as at the No-che-mo Springs, Reed City, Mich., have by this or similar processes succeeded in obtaining streams which throw jets several feet in the air, making fountains of considerable beauty.

Construction of Geyser Springs.—By a geyser spring is meant one so piped that it will at certain intervals throw a jet to a greater or less height into the air, after which the water subsides and ceases flowing until the lapse of another interval, after which it again flows. To successfully construct a geyser spring, it is necessary to find a spring at some elevation above the point at which the flow is desired and but a short distance away. A spring on a steep hillside, not more than 50 feet away from the desired point of flow, and 15 to 20 feet higher, presents the most favorable conditions. It does not matter in this instance whether or not the water is under pressure at the spring.

The spring will nearly always emerge just above an impervious layer, as at *A* in Fig. 4. A little back from this point dig a small pit about four or five feet deep, and insert a barrel with the upper edge about six inches above the top of the impervious layer. Holes should be bored in the sides to admit the water just above the clay, this part of the barrel being surrounded by fine gravel, to keep the holes from clogging and to prevent clay and sand from entering the barrel. A pipe should be connected with the bottom of the barrel by a tight joint, and should lead upward sharply until about six inches below the top of the clay, or a foot below the top of the barrel, when it should be bent gradually and carried downward, at a depth sufficiently below the surface to prevent freezing, to the desired site of the fountain, when it should be bent again into a vertical position and brought to the surface. The pipe is in fact a simple siphon.

Starting with an empty barrel, the water gradually accumulates until a height equal to that of the upper bend of the siphon is reached, at which moment a flow is inaugurated, issuing at the fountain at *F*. The flow will continue until the water is exhausted from the barrel, when it will stop, only to commence again when the level of the top of the siphon is again reached. One precaution, however, is to be observed in regard to the making of the siphon; namely, the capacity of the pipe should be greater than the capacity of the spring, otherwise the flow once inaugurated will be continuous.

The height to which the water will be thrown depends primarily upon the altitude of the spring above the fountain; the higher the spring is, the higher will be the jet. A decrease in the size of the jet will also within certain limits increase the height to which it will rise.

* Published by permission of the Directors of the United States Geological Survey.

The Maiorana Telephone.

Prof. Quirino Maiorana has been engaged for some time in perfecting his hydraulic telephone, and according to a notice appearing in Industria, has succeeded in transmitting speech distinctly from Rome to London. The successful results of this experiment have been confirmed recently, when the London General Post Office was able to understand clearly whatever conversation was transmitted from Rome. The success of this experiment is the more remarkable as the telephone line Rome-Paris-London, apart from its length, includes submarine cables in the channel, so that this achievement can be said to be the most important telephone transmission ever obtained up to now.