day long, but he prolongs his day far into the night. By day his song is not very musical, but at night it seems softened and subdued almost to sweetness. The country boys call him the "sheep-sheep shear-shear-shear" bird, as an imitation of his song. The first two notes are uttered sharply with a considerable pause between them then, the last very rapidly — nearly run together.

Two other birds are not uncommon night singers — the grasshopper and henslow's sparrows (*Ammodramus s. passerinus* and *A. henslowi*), especially the latter. His modest little song is so drowned out during the day by the larger birds that he must sing at night it he be heard at all. I have often heard his note well into the night.

There is one winter night singer, the chestnut-colored longspin (*Calcarius ornatus*). As one wanders over the snow-clad hills on some frosty night, he may near the clear *chee-ho* of this bird starting from the snow where he lies hidden.

LYNDS JONES.

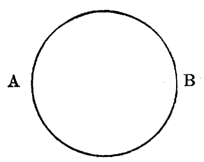
Oberlin, Ohio.

The Earth as a Conductor.

In reference to the communication on the use of the ground in an electric circuit, June 16, you may allow me to say: The earth is not a conductor of electricity in any sense, only as a convention. All Du Moncel's measurements, and they were many, gave the resistance of the earth as about 100 ohms. This resistance is negligible in long circuits, telegraphic or telephonic, but not in short circuits.

On the principle of contact electricity (see Ayrton and Perry, Jenkins or Gorden) it was wrong to place a copper plate at one end and a tin plate at the other, as their contact or connection by wire would produce a current along the wire. Nor was it proper to put charcoal or carbon or iron around either plate on the same principle. Both plates, preferably, should be of copper surrounded by sulphate of copper. There is considerable resistance offered in the passage of a current from one kind of material to another (see Jenkin passim).

The earth may, for convenience, be called a reservoir of electricity, but its quantity is always constant and no electricity can be taken from it at one point without putting an equal quantity into it at another point. The action or roll of the earth in the circuit is like this. Consider a lake of large dimensions with a



lift and force pump at A connected with a pipe which crosses the lake to B; the water lifted at A and forced over to B falls into the lake, but not a drop of it ever gets back to A.

If you will consider a ground wire in a large telegraph or telephone office with a number of circuits of variable resistances and different polarities attached to it you will see that it is absurd to say that a positive current from one battery goes down that ground wire and off to a distant point while at the same instant a positive current from a distant battery comes up the same wire. That is the common sense view of it, and it is supported by Kirchoff's law, $\Sigma C = 0$, or the sum of all the E M F's or currents meeting in a point equals nothing. In fact, the ground wire in a large office may be cut (as I have often seen it done for experimental proof) without stopping communication. When three or more wires are joined to the same ground either one of the wires acts as a return wire for the others when the ground wire is cut. But when all are open at once, then the ground comes into play to form the circuit for the first one that closes. It is also useful as a regulator of current, but the manner of doing this is not properly introduceable here.

If nothing had been said of the use of tin at one end and copper at the other the resistance of 102 ohms as found would indicate a good ground. But as some current probably arose from their use, doubt is cast upon the measurements. Still, on the whole, the ground was as good as is usually made.

One hundred ohms' resistance in the earth circuit under all circumstances should be reckoned on and may be regarded as a constant.

D. FLANERY.

Memphis, Tenn., June 30.

On the Evolution of the Habit of Incubation.

IT may be stated as a general rule that harmless snakes produce their young by means of eggs, while poisonous serpents are viviparous, to which fact they probably owe their generic appellation of "vipers." The oviparous snakes, like most other reptiles, deposit their eggs in a sunny spot, and never trouble themselves about the incubation, but leave the eggs to hatch out as best they may under the influence of the sun's heat. There is, however, a very curious though authentic instance on record of a caged python, in the *Jardin des Plantes*, at Paris, which hatched out her own eggs. She laid fifteen in all, and then coiled herself around them, and so incubated them in much the same manner as a setting hen, her temperature being observed to increase perceptibly during the period.

This strange fact, whether an anomaly or whether a natural habit of the pythons, seems to throw considerable light on the evolution of the habit of incubation, so universal among birds, for it must be remembered that the bird is closely allied to the reptile, and is in fact but a higher form of the type. This relationship is clearly shown by the study of the morphology of the bird's organs, for every part of a bird's body is but a modification of the corresponding part of the reptile; it is also shown by the fact that birds are found in geological strata immediately after the reptiles, and hence must have appeared upon the face of the earth at a later period. Were any further proof necessary, it is furnished in an irrefutable manner by the science of embryology, for the bird passes in the egg through all the reptilian stages of development before it is finally hatched out in its perfect form.

This being the case, we may rest assured that the habit of incubation has been evolved at some time during the evolution of reptiles into birds, and hence this case of the python hatching its own eggs acquires exceptional interest.

We may premise that the habit could never have been evolved unless it were of some value to the species, but we must at the same time admit that the incubated egg would in all cases hatch out far in advance of that heated only by the sun, hence those individuals which thus appeared earlier than their brothers ran a better chance of surviving in the struggle for existence. So far, so good, but how did the habit originate ? What first led snakes or other reptiles to think of hatching out their eggs? That it was not intelligence we can safely assert, for all who have had any experience in keeping snakes, agree in stating that their intelligence is of the lowest order. I am therefore inclined to believe that what first led animals to incubate their eggs was the heat developed in the egg during the process of hatching. Snakes are exceedingly fond of heat, in fact I have known them to injure each other in cages in the attempt to retain the warmest places. Hence we can infer that if, when basking in the sun, a snake chances to lie near its eggs, especially if these have already begun to hatch, it will soon feel their heat and so be led to coil more closely about them, and while thus warming itself it will at the same time hasten the process of incubation.

The next question that arises is, how this habit of incubating her eggs, even when thus acquired, will be transmitted to the offspring, for if not transmitted, the habit could never become general.

So little is known of the principles of inheritance that we cannot hope to solve this problem at present. Even Darwin, who made a life-long study of the subject, and to whom we are indebted for the ingenious theory of *pangenesis*, was forced to admit our abject ignorance of the laws of transmission of characters from parents to children. We can, however, infer that those serpents most susceptible to the cold would be most likely to remain by their eggs, and this susceptibility to cold would tend to be inherited by the young