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Current Induction

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evolution, it ceases to be that terrible ogre that he first thought it was.

Just what is the status of organic evolution today? Since this is a question of science, we should turn to the scientists for an authoritative answer. In 1925, the Council of the American Association for the Advancement of Science passed resolutions concerning this question. This organization is the greatest organization of scientists in America consisting of some 20,000 members. The following are extracts quoted from these resolutions.

"The Council affirms that so far as the scientific evidences of evolution of plants and animals and man are concerned, there is no ground whatever for the assertion that these evidences constitute a "mere guess." No scientific generalization is more strongly supported by thoroughly tested evidences than that of organic evolution."

"The Council affirms that evidences in favor of the evolution of man are sufficient to convince every scientist of note in the world and that these evidences are increasing in number and importance every year."

High school teachers are often confronted with the problem of whether to teach organic evolution in their biology classes. There certainly is need for education along this line, but in some communities the subject must be handled with much tact. The important thing to do is to teach the facts of the living world with this dynamic viewpoint. If this conception is put across, you are teaching evolution. A pupil cannot study the variation in white oak leaves without getting a lesson in evolution. He cannot observe the breeds of dogs or the varieties of corn without learning of evolution. If possible, the subject should be presented as evolution and I think it can be done bv a tactful teacher in most communities. The teacher should teach it simply as a part of biology and not set himself up as a reformer to change his community.

There is need in the Middle West for educating people as to the true meaning of organic evolution and this will have to come largely from our biology instruction. But it must be done with tact and common sense.

C. W. Lantz

CURRENT INDUCTION

In the last number of the Science Bulletin we discussed Faraday's two experiments in current induction. It is interesting to recall at this time that September 21 of this year a centennial celebration of Faraday's discovery was held in Queen's Hall, London. Sir William Bragg, a renowned English physicist, gave the address on this occasion. This address was broadcast generally in America, being transmitted across the ocean by radio.

An exhibition was also opened on September 23 in Albert Hall, London, at which reproductions and illustrations of Faraday's history making experiments were displayed. There were also many exhibits of commercial electrical appliances founded on Faraday's discoveries and manufactured by the great industries of today. General Smuts of South Africa delivered the address on the occasion of the opening of these exhibits.

President Frank B. Jewett of the Bell Telephone Laboratories and Vice President of the American Telephone and Telegraph Company extended felicitations via trans-Atlantic radio telephone and loud speakers to those gathered in Albert Hall, London. We are pleased to quote the following from President Jewett's address:

"Although I have formal authorization to speak only for my confreres in the United States, I feel quite safe in assuming in a degree to be the spokesman for men of science of whatever nationality. As such, I say to you of Britain that, although Faraday was of your blood, we of other lands yield you nothing on the measure of the respect and admiration in which we hold him. Go where you will in our institutions of learning, in the stately edifices we raise as homes for our scientific societies, or in the more prosaic housing of our scientific industrial establishments and you will find always the evidence of our regard. For us he is ever a great simple man who enriched the world as few others have been privileged to enrich it."

"In a way there is something peculiarly fitting in this tribute which I bring you and in the manner of its delivery. Involved in it is probably more of the fruit of all Faraday's works than can be encompassed in any other single happening in our modern world."

In view of this centennial celebration of Faraday's great achievement, it would be singularly fitting for every high school science society to spend one session on a Faraday program. Nothing could be more inspiring to the beginning student of science.

Continuing our discussion of current induction, we would like to call attention to a simple interesting experiment rigged up by one of our students, Robert Huntoon, in our laboratory several weeks past. The experiment might be labeled an induction pendulum. Two coils of No. 26 insulated copper wire were compactly wound. These coils were then suspended, Fig. 1, from the ends of a wooden frame carrying a rectangular wooden bar about one square inch in cross section and about sixteen inches long. The ends of the two coils were connected together by two fine wires running along the under surface of the wooden bar to form a closed circuit. The two coils were also suspended so as to encompass the pole ends of the two permanent magnets placed as shown in the figure.

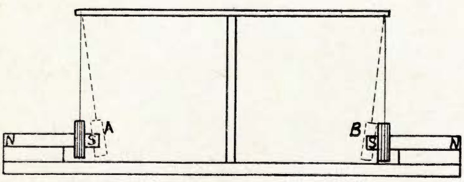

Figure 1

As soon as coil A is set in vibration, coil B begins to vibrate also, gradually increasing its amplitude to a maximum. As A dies down B also gradually comes to rest.

The explanation of this experiment is found in the fact that the number of lines of magnetic force emanating from the pole of the magnet which pass through the area of the coil alternately increase and decrease. As the lines alternately increase and decrease through the area of one of the coils, an alternating current of electricity is induced in the closed circuit formed by the two coils. Coil B, by virtue of this alternating current, gives out a varying magnetic field, which interacting with the lines of magnetic force of the bar magnet causes it to vibrate. Since the current in the circuit is alternating, the magnetic field of B is also alternating, causing successive attractions and repulsions of the coil by the pole of the bar magnet. In a crude way this experiment illustrates the basic principle that underlies the action of the common telephone transmitter and receiver.

After the principle of current induction is well grounded in the mind of the student, it becomes most important for the instructor to take up the two outstanding commercial devices which make use of Faraday's two historic experiments in a practical manner. These two commercial devices are the dynamo and the transformer. As the steam engine is the greatest invention of the eighteenth century, so the dynamo is the greatest invention of the nineteenth century.

The usual presentation of the dynamo principle which is also the principle of one of Faraday's experiments, is illustrated in Figure 2.

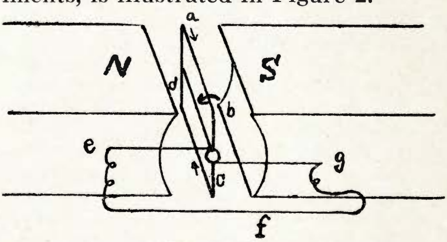

Figure 2

Current induction in a dynamo is caused by the motion of one or more closed conductors in a magnetic field. This is accomplished by rotating the conductors so that the magnetic lines of force threading their areas of cross section are rapidly and successively increased and decreased. This is virtually what Faraday did when he pulled his coil of wire to and from the poles of a horseshoe magnet.

In figure 2 we have a closed circuit, a b c d revolving in the field of a permanent magnet whose lines of magnetic force stretch from the pole marked N to that marked S. As the coil rotates to a horizontal position, the number of lines of magnetic force threading its area is reduced to zero. A current is then induced in the coil by virtue of Faraday's principle. When the coil continues to rotate from its horizontal position to a perpendicular position, the number of lines of magnetic force threading its area is rapidly increased from zero to maximum. Thus there is a continuous change in the number of lines of magnetic force threading the area of the coil during the half turn, causing the induction of a continuous, but varying current during that time. As the coil rotates through the other half turn a further current is induced but in this case the direction of the current will be the opposite of that induced during the first half. By means of a device called a commutator, shown in the figure between the ends of the brushes e and g, these two currents for each complete rotation are made to flow in the same direction in the external circuit f, giving rise to a direct current. If these opposite currents for each rotation were not made to flow in the same direction, the simple device represented in figure 2 would be called an alternating dynamo. The dynamo rule for determining the direction of a current in the revolving coils of a dynamo is given in every high school text. The revolving coil in our illustration is called the armature and the magnets are called the field-magnets. They constitute the two principal and essential parts of every dynamo or electric motor.

In figure 3 we have an illustration of a small commercial dynamo. Its

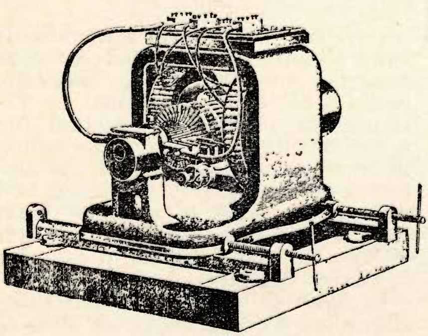

Figure 3

field magnet is a bi-polar electro magnet. The field-magnets of large commercial dynamos are usually multi-polar electro magnets. It is evident that in operating a dynamo the armature must be rotated by some source of mechanical power such as a steam engine or a turbine water wheeel.

It is interesting to note briefly that a dynamo is also an electric motor. When a current from some outside source is run through the field-magnet wires and the armature of a dynamo, the armature rotates and delivers mechanical power to any machine geared or belted to its armature shaft. The writer will continue the discussion of current induction in the next issue of the Bulletin by taking up first the invention which illustrates Faraday's other historic experiment. L. Begeman

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SNAKES THAT DO NOT EXIST

As a boy I was always on the lookout for two kinds of snakes which I never found. These were the so-called hoop snake, and joint snake. According to popular tradition—and the tradition is still with us—the hoop snake was supposed to take his tail into his mouth and go rolling about the country much to the amazement and horror of his human observers. The joint snake's pet trick was to break instantly into a variable number of pieces when hit with a club, and then to reassamble the pieces into the original snake when the danger had passed. One man told me that he once caused a joint snake no end of trouble by throwing one of the pieces into a bonfire.

How the hoop snake idea originated, I cannot say, but it is possible that the joint snake may mean only the glass snake, which does have the habit of voluntarily breaking off its tail when disturbed. This practice of autotomy or self-surgery, so to speak, occurs in a number of different animals, and is probably only a device for saving their lives. The glass snake when seized by an enemy, the king snake, for example, may simply leave his tail in the king snake's mouth and so escape, later growing a new tail.

But alas for this explanation: the glass snake is not really a snake at all, but a limbless lizard, as can easily be seen from his eyelids and external ear openings, things which no self-respecting snake ever posesses. Neither does he ever break into any parts other than tail and body. Hence the explanation is futile, which is as it should be, since the joint snake does not exist,—and neither does the hoop snake.

Roy L. Abbott