How Birds Sing and How They Fly.

This was the subject for consideration at a recent meeting of the Boston Scientific Society. The Boston Commonwealth says: The speaker was Mr. C. J. Maynard, the well-known naturalist. This gentleman has been interested in birds from an early age, and more than twenty-five years ago he began making anatomical studies of them, with particular attention to the larynx. He has himself examined the throats of the majority of the birds of the east coast of this country and the Greater Antilles.

A general division may be made into birds which sing and birds which do not. The anatomy shows clearly this division, and from the position and kind of muscles or membranes the bird may be referred to one or the other of the classes independent of auricular evidence. The larynx which birds use in singing is not the upper larynx, but an inferior one, placed just at the top of the bronchial tubes. There has always been a difficulty in bringing the matter to the attention of students in the lecture room, but recently Mr. Maynard has succeeded in making casts of the vocal apparatus of certain birds, which are soon to be introduced into certain schools. He exhibited these casts and made clear by them the muscular arrangement of the larynx of the crow, which he had selected because it can really sing and can modulate its voice to a considerable extent. This fact is not generally known, but at certain seasons the male crow has a very pretty song. The vocal apparatus of the crow is very perfect, some crows being able to talk, as can the raven.

Aided by the models, of which a dozen or more were distributed among his auditors, Mr. Maynard named and described the different muscles of the larynx and stated their purpose, these muscles being not the mechanism producing the sound, but serving to control the tension of the larynx or of the vocal membranes which lie at the top of the bronchial tubes. Of the vocal membranes, there are normally two, but in some variations there may be but one, and in some cases even this is wanting. The different tension of these vocal membranes in conjunction with air expelled through the throat produces the sounds which we hear from the birds.

While the vocal chords are usually present, there are, as might be supposed, some very wide variations in the exceptions. The humming bird, the note of which resembles very closely the squeak of a mouse, has a sphincter muscle governing the tension of its larynx. The turkey buzzard has no chords at all, and the only sound which it can make is a hiss, such as would result from the expulsion of air through an open tube. The owls hoot by the vibration of air within their great larynx. The swan has a very long larynx, which is bent about much like the convolutions of a trumpet, and the note is resounding and trumpet-like. In the wild goose, the vocal mechanism is of exceeding delicacy and beauty: the bronchial tubes are themselves the vocal chords or membranes, being delicate and transparent throughout their entire length. By means of this, the clear and musical note of the wild goose is produced. The most singular of all the vocal mechanisms of birds is that of the American bittern.

The note of this bird resembles "pon-ka-pog, pon-ka-pog," or, as described by some, the bubbling of a note up through water. Mr. Maynard thinks that our pond may readily have taken its name from the note of the bittern. How the bird has been able to produce such a note has always been a puzzle to naturalists. A short time ago, Mr. Bradford Torrey, the writer of so many charming bird sketches, and Prof. Faxon, seeing a bittern in Concord, watched him, and came to the apparently ridiculous conclusion that the bird sucked the air. In proof or disproof of this supposition, Mr. Maynard sought out the bittern and, on making an examination, found that these gentlemen were right. The bird was fitted with a peculiar muscular arrangement of the throat which serves exactly this end, the sucking in of air and the production of a note by its expulsion. The throat is flexible and may be greatly distended, being, when filled with air, some six inches in diameter. A muscular compressor prevents the air from entering the stomach of the bird, and two muscles in the lower mandible of the bird, together with the tongue, form an airtight valve at the mouth, which, being slightly relaxed, allows the air to bubble forth, making in its course two impacts against different parts of the bird's bill. This explains very satisfactorily the curious note.

A few words about methods of communication in birds followed. Mr. Maynard is satisfied that they can communicate by sound. He had at one time a tame crow, which had never learned crow language, and, when liberated among the birds that ought to have been his friends, was always attacked and obliged to seek the protection of his master.

Following this came some considerations of the flight of birds. The most interesting feature of this was the comparison of the breast bones of different birds. Those birds which attain very high rates of speed and which from necessity must suddenly swerve in their course have a re-enforcing mechanism, permitting them to withstand that sudden pressure of the air which is of necessity resultant from their changes of direction. Some interesting facts were stated in the course of the discussion. The frigate bird, which is an exceedingly powerful flier, can ride out the fiercest West Indian hurricanes. The duck hawk is the swiftest bird known to naturalists. Ducks themselves have been known to make speed at the rate of one hundred and fifty miles per hour, but the duck hawk can overtake ducks at maximum speed with such superior velocity as to make a great shock when striking its prey, while its flight at such times is so rapid as to elude the eye.

A CYCLE CAB.

Lately there has appeared in London a new vehicle in the shape of a cycle cab, of which we give a sketch. The driver in front works pedals and steers, while a footman, mounted behind, also assists the propulsion, as shown. Horses are at a discount wherever this vehicle prevails.

A CYCLE CAB.

Coating Aluminum with Other Metals.

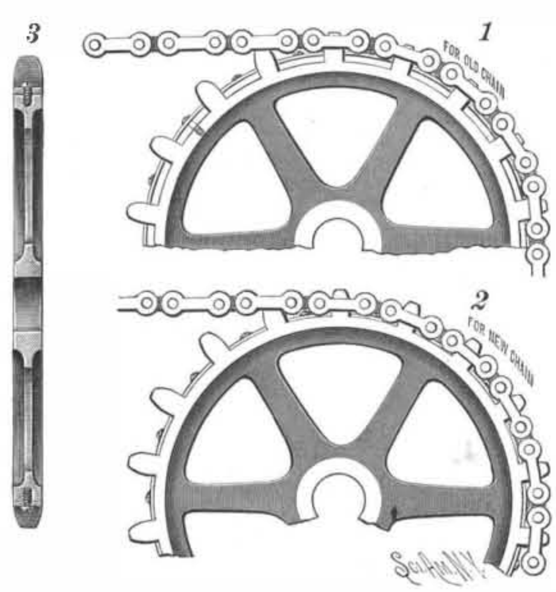
The processes ordinarily used for covering metals with zinc, tin, and lead have not, up to the present, appeared to be applicable to aluminum. When a plate of aluminum, mechanically or chemically cleaned, is immersed in melted tin, zinc, or lead, these metals slide over the surface of the aluminum without alloying therewith.

Mr. Oliven has found that, in order to fix the above-named metals, it suffices to submit the surface of the aluminum to a vigorous brushing in the metallic bath. For this purpose a steel brush or any other analogous instrument may be used. Under such circumstances, the aluminum becomes covered with a regular layer of the molten metal.

The want of success of the operation was due, it appears, not to the want of affinity of the aluminum for the metals in question, but to the immediate formation, in contact with the air, of a thin stratum of oxide of aluminum, which friction removes.—Le Genie Civil.

A SPROCKET WHEEL IMPROVEMENT.

This illustration represents a simple means of causing the sprocket chains of bicycles to fit the wheel at all times, no matter how much the chain may be stretched. A patent has been allowed upon this improvement to Messrs. P. D. Murphy and Edward Kolb, of No. 75 Main St., Lockport, N. Y. When a chain does not fit, on account of its stretch and the wear of the teeth, one has only to place under each of the plates which separate the teeth, the required thickness of paper, soft metal, or any other material. Fig. 1 represents such placing of packing on an old wheel, which is not needed on a new wheel, as shown in Fig. 2. The filling also deadens the rattle of a wheel and does not add appreciably to its weight. With this improvement the life of sprocket chains may be greatly increased, and the chains caused to fit the wheel until entirely worn out.



MURPHY & KOLB'S IMPROVEMENT IN SPROCKET WHEELS FOR BICYCLES.

The Torpedo.

A naval officer writes as follows in a recent number of Engineering:

The torpedo is essentially an immoral weapon, depending mainly for success upon secrecy, subterfuge, and deception. It was offered to our grandfathers in its first crude form as a fixed submarine explosive, but it was declined with thanks, or rather with scorn, as being unworthy of honorable combatants. Our morals are more elastic; and although it may be doubted whether the locomotive torpedo will have a governing influence in any fair stand-up fight of the future, it must be regretfully acknowledged that its moral—or rather immoral—effect will be considerable; and when accompanied by its proper handmaidens—secrecy, subterfuge, and deception—it may prove very troublesome.

Vessels will endeavor to approach under false colors, fire their deadly missile and run. The use of false colors has always been recognized as perfectly fair for reconnoitering purposes, and so long as ships did not fight under them. But now the true colors and the torpedo will be exhibited at the same moment, with awkward results. Hence it will behoove men-of-war at sea to be extremely shy of allowing any ship to approach within torpedo range, and they will do well to fire at everything that attempts to do so, until they are quite satisfied as to her identity and intentions.

The records of the Chile-Peruvian war afford us numerous instances of the diabolical use of various sorts of torpedoes during that conflict; and although European nations may not descend to such cruel and useless methods of destruction as were then employed, yet it seems very probable that torpedo warfare will lead to the terrible cry of "No quarter." It is difficult to see how it will be possible to give quarter to an enemy's torpedo boat caught at sea. Her success depends upon the tactics of the stealthy midnight murderer; and if caught in the daylight, she and all on board of her must be destroyed like vermin, surrender or no surrender.

As an illustration of this point, let us imagine that a group of six torpedo boats (they will probably act in groups) comes out from a hostile port, and attacks the ships at anchor in one of our harbors in the middle of the night, with the deliberate intention of sending as many ships as possible to the bottom, with all hands. The attack may or may not be successful, but in any case the boats will endeavor to get clear of the land, and if possible to regain their own port before daylight. Supposing, however, that they are so unfortunate as to fall in with one of our cruisers, and that in consequence of the weather being rough the cruiser is able to overhaul them. The last of the flying group will come first within effective gun range, and will doubtless surrender. Is the cruiser to stop and capture her, and allow the other five to escape and attack again to-morrow night? Such a course would be ridiculous, and she would have no option but to sink as many as possible of them without stopping to pick up the crews. This, no doubt, would lead to reprisals and counter-reprisals; and the end thereof is not apparent, save that the advent of the torpedo is not likely to help in humanizing naval warfare.

The Panama Canal.

The new Panama Canal Company was legally constituted at the meeting of shareholders held on October 20. MM. Baillet, Brolemann, Carraby, Chanove, Jonquieres, Lebegue, Ramet, St. Puentin, and Souchin were appointed administrators for six years, while MM. Barbier, Lemoine, and Fougen were named commissaries. Before closing the sitting, M. Lemarquis, the legal representative of the old bondholders, who presided, announced that a cablegram would be at once sent to M. Mancini, at Bogota, who would on its reception announce the constitution of the new company to the Colombian foreign minister, and that on October 21, 800 workmen would resume the so long abandoned work of the Culebra cutting. Though the list of administrators proposed by M. Lemarquis was adopted unaltered by an overwhelming majority of the shareholders, the meeting was very tumultuous. M. Thiebaud protested against the constitution of the new company, and declared that the proposed new administrators were the representatives of the men who had ruined the old Panama Company. The proposed new administrators represented MM. Eiffel, who subscribed ten million francs; Hugo Oberndoerffer, who subscribed three million five hundred thousand francs; Buno Varilla, who subscribed two million two hundred thousand francs; the administrators of the old company, who subscribed eight million francs; and the credit establishment, which subscribed ten million francs. In all nearly thirty-four million francs or not quite $7,000,000. With such persons at the head of the enterprise, it would be useless to hope the public would subscribe the remaining five hundred million francs required to complete the canal. M. Thiebaud's remarks were received rather coldly, and did not prevent the list of administrators prepared by M. Lemarquis from being adopted almost unanimously.

Progress of the Phonograph.

A new sort of phonograph, invented by M. Koitzow, is described in the Revue Industrielle. Like all phonographs, the new machine is extremely simple. As in the Edison phonograph, a cylinder is used mounted in journals, and actuated by clockwork, but, instead of the wax covering of the Edison phonograph, M. Koitzow uses a hard kind of soap, cast in brass moulds. The soap has the advantage of retaining the impression longer than wax, and of not being subject to softening in hot weather. The sound to be impressed on the cylinder is recorded by a sort of ear trumpet, of hard rubber, and the impression is reconverted into sound by means of a lever with arms of unequal length, the short arm of which carries a point, in contact with the cylinder, while the other is attached to the membrane, the vibrations of which reproduce the sound. The soap cylinders last a long time. When the surface is covered with impressions, it may be washed off, and a fresh surface exposed. The impression need not be more than a thousandth of an inch in depth, so that one cylinder can be used to receive and transmit two hundred and fifty thousand words.

For many reasons, says the American Architect, it is to be desired that the phonograph should be developed into an instrument of practical utility, and any improvement is to be welcomed that will make it so. To say nothing of the moral effect that would be produced on people by having their own hasty words preserved and repeated to them, by the unerring cylinder, such a machine would be of great use in business. Some very rich men keep a stenographer concealed behind a screen in their offices, within hearing of what may be said to them, or what they may say in reply; and their conversations with strangers are reported and the notes preserved, for use in case of attempts to pervert such conversations for blackmailing purposes. Where it is inconvenient to employ a special stenographer, a good and silently-acting phonograph would make an excellent substitute, and its testimony might, in many cases, effectively frustrate the schemes of knaves. In fact, so dramatic might be the effect of the unexpected reproduction, in court, of a dialogue which one of the parties thought had taken place without witnesses, in the trial, perhaps, of a probate case, or of an action for breach of promise of marriage, or for some great and well-concealed fraud, that we have often wondered why some playwright did not introduce a phonograph in the most exciting scene of a realistic drama. It would not be easy to imagine an effect more novel and absorbing than that which might be secured by bringing the wily villain of the piece triumphantly to the last act, showing him there victorious and exultant in the middle of his fellow rascals, while unfortunate Virtue sobbed in the background, and, just as wo had nearly overwhelmed the audience, having the junior counsel for the defendant (in love with the oppressed heroine) arrive with a little box under his arm, and elicit from it, by turning the crank, a series of buzzings and squawks, on hearing which the villain should turn pale, pull from his pocket bundles of stocks, bonds, "title deeds" and so on, fling them at the heroine's feet, and seek safety in flight with his companions, only to be caught and dragged cursing back by the police, while the good people joined hands all around, uttering, as the curtain fell, the inarticulate murmurs expressive of virtuous joy.

Carborundum Electric Light Carbons.

Many efforts have been made, says the Electrical Engineer, to improve the quality of illuminating carbons, for the purpose of lengthening the life of the filaments, rods, or points, and also to produce a combination of carbon with other substances that would give more light for the electrical energy consumed. Many combinations of materials have been made, both in the mass of the filament, rod, or point, and in the coating of the mass. The main object of inventors has always been to produce a carbon containing a material having an excessively high fusing point and equally difficult of oxidation, and at the same time having a high luminescent value.

Mr. E. G. Acheson, well known as the inventor of carborundum, has recently produced a carbon in which he claims to have covered these points. He takes pure carbon and carbide of silicon (carborundum), reduces both to fine powder and mixes them in the proportions of nine parts of the former to one of the latter, together with tar or any other good binding material. The mixture is then baked and moulded into the proper form for use.

In order to get the full and complete effect of the illuminating qualities of the carbide of silicon more distinctly separated from that of the carbon, the ordinary cored carbon rod or point is used and the core is filled with the carbide of silicon, either alone or with a binding agent.

For the filaments of incandescent lamps, the carbide of silicon in a very fine powder is mixed with and suspended in the oil used in the oil bath, for the treatment and building up of the carbons; and in the process of depositing the carbon from the oil bath on to the filament, the fine particles of carbide of silicon become fixed to the filament simultaneously with the deposit of carbon.

As carborundum is formed at a temperature approximately that of the electric arc, it is necessarily free from all volatile matters and eminently fitted (as the result of having already existed at these high temperatures) for the light-giving body. It has also been demonstrated that it resists oxidation to a greater extent than any other known material, having resisted such chemical action when highly heated and exposed to a stream of oxygen gas. Associated with these two essential qualifications of infusibility and non-oxidizability, is a third equally valuable one, that of luminescence, as it is claimed to produce a greater amount of light for the electrical energy consumed than any illuminating body heretofore used.

Gas for Fuel.

At the recent meeting of the Ohio Gas Light Association, Dr. Donald McDonald read a paper with the above title, giving an interesting comparison of the relative value of gas and coal for heating purposes, and of the proper manner of using gas for house heating. The following are extracts:

For cooking or for occasional fires gas can be used with economy at $1 per 1,000 feet. With a good gas at 50 cents per 1,000 feet, all sorts of cooking can be done with it, and the heating of parlors and dining rooms, and those bedrooms which are not used as sitting rooms during the day, can be done at a cost so little greater than the cost of coal that people will put up with it on account of the greater convenience of gas. At 35 cents per 1,000 feet for a good gas containing (say) 700 heat units, gas can be used as a heating agent all over a residence, and the cost will not exceed that of anthracite coal at $8 a ton or soft coal at $3.50 a ton, after allowance is made for kindling and labor.

If gas at 50 cents per 1,000 feet is burned in a good gas stove, in a tolerably close room, without any chimney draught, the products of combustion escaping into the room, the amount of gas required to heat the room will be so small that coal will not compete with it in the price. The room, however, if it is small and close, will become unfit for habitation, owing to the consumption of the oxygen of the air, and the formation of carbonic acid and watery vapor.

One hundred cubic feet of natural gas weighs 4,287 pounds. It is composed of 1,072 pounds of hydrogen and 3,215 pounds of carbon; it requires for its perfect combustion 969·3 cubic feet of air, weighing 74,561 pounds. It makes in burning 9,648 pounds of steam and 11,788 pounds of carbonic acid, equal to 100. It produces 94,593 heat units when the steam is not condensed. The total products of combustion are, therefore: Steam, 9,648; carbonic acid, 11,788; nitrogen, 57,412; total, 78,848 pounds. If these products of combustion escape at a temperature of 600°, they carry off with them 12,712 heat units, or about 14 per cent of all the heat produced by the fire. If they escape at 300°, they carry off less than 7 per cent. Suppose, however, that for any reason twice as much air as is necessary to combustion passes through the fire, and escapes up the chimney, along with these products of combustion: at a temperature of 600°, we would then have a loss of heat units equal to 23,332 heat units, or about 26 per cent of all the heat produced by the fire. If three times as much air as is necessary for combustion is admitted and allowed to escape at 600°, then the loss is 40 per cent.

It must be remembered, however, that with a wide open chimney and a strong draught, not only is the volume of air which escapes up the chimney increased, but also the temperature is apt to be high. We find, therefore, that if a fire takes in five times as much air as is necessary, and that it escapes at a temperature of 800°, then the loss will amount to 92 per cent of all the heat produced by the fire.

A room 16 × 16 × 12 feet contains about 3,000 cubic feet and will require 2,177 heat units in order to bring its temperature up from 30° to 70°. If the combustion were perfect, and there were no other loss than that due to the actual products of combustion escaping at 300° F., such a room should be heated from 30° up to 70° with the consumption of 3 feet of gas per hour; or, assuming that the air is changed three times per hour, and that there is no loss through the walls or windows, 9 feet of gas per hour would keep such a room warm.

The next question, and one equally important, is, At how low a price can gas companies afford to sell a first rate gas? There is no doubt but that a natural gas company can afford to manufacture artificial gas to supply the deficiencies during cold weather, and sell the mixture for 35 cents per 1,000 feet, and even much cheaper. The question as to what illuminating gas companies can do in this line is not one so easily settled. Assuming, however, that none of the expenses of the illuminating gas company would be charged to the cost of furnishing the fuel gas, except the interest and repairs on the additional apparatus, and the cost of the additional fuel and labor necessary to make the extra amount of gas, then I believe that a very fair profit would be found in selling 18 candle power gas, to be used as fuel, at 40 cents per 1,000 feet. If this were done, and the attention of the public properly called to the advantages of this fuel, I believe that I am not a false prophet when I say that the time would come when the receipts from gas sold for fuel would greatly exceed the receipts from gas sold for light.

With regard to the question of how this gas is to be made, I can only say that my experience in the line of making artificial gas is not long enough to entitle my opinion to any great weight on the subject. It is evident, however, that what is wanted is not cubic feet, but heat units, and that in order to get these heat units at a reasonable cost, we must get them from substances in which the heat exists at a reasonable cost. For instance, if gas containing 700 heat units per foot is to be sold at 40 cents per 1,000 feet, then the cost of 1,000,000 heat units is 57·14 cents. Now then, if this gas is made entirely from naphtha distillate at 2½ cents per gallon, then each 1,000,000 heat units in the gas would cost the company, exclusive of labor and all other items, about 18 cents, provided all the heat in the naphtha could be got into the gas. As a matter of fact, however, only a percentage of the heat existing in the naphtha can be recovered in the gas, and I shall assume that this percentage is 60. On this basis the heat units in the naphtha gas would cost the company for gas making material alone 30 cents per 1,000,000 heat units. With coke at $3.50 a ton, rating it at 14,000 heat units per pound, and assuming that the same percentage will be recovered, the gas would cost the company 19 cents per 1,000,000 heat units. With soft coal at $1.50 a ton, 14,000 heat units per pound, and the same assumption as to the percentage of heat to be recovered in the gas, we would have a cost to the company of 8·9 cents per 1,000,000 heat units. These figures seem to force the conclusion that when gas is made at a price low enough to be sold as a general heating agent, it will be made with soft coal, and may or may not be enriched with crude oil or naphtha.

The author then proceeds to describe the plant in use at Louisville, in which a water gas plant is combined with the retorts of a coal gas plant. This apparatus was erected by the National Heat and Power Company, of Philadelphia, and experience with it shows a consumption of material per 1,000 feet of gas about as follows: Gas coal, 35 pounds; boiler coal, 13 pounds; coke, 10 pounds; oil, 2½ gallons. The gas made is a good quality of illuminating gas, and rich enough in heat units to allow it to be mixed with natural gas in almost any proportion.

Cylindrical Cotton Bales.

The shipment of cotton, compressed by a new method, made from Waco, Texas, arrived in Boston recently. It was the largest single car load of baled cotton that has ever come into Boston, and consisted of one hundred and twelve bales. They weighed 53,000 pounds, and it is stated that fifteen bales more could have been squeezed into the car. The average capacity of a box car is 50,000 pounds, so that this load of cotton overran the standard by 3,000 pounds, and is estimated to be 30 per cent more than is put in the same space when the bales are packed in the old-fashioned way. According to the Boston Journal of Commerce, the increased capacity is produced by what is termed the Bessonnette compress, a new method of baling cotton recently patented. By this method the bales are made round. They are about four feet two inches in length and two feet in diameter, with an average weight of about 500 pounds, and are intended to take the place of the old-time box bales. By this method the cotton is taken from the condenser and is rolled into a cylindrical bale, being compressed as it rolled up. The air is thus forced out of the thin layer or mat, as it comes out of the condenser, and is kept out by being rolled between two ponderous rollers of several tons each. The inventor claims many advantages in cost and protection of the fiber, and cotton men think this system of round baling will, in a great measure, revolutionize the exporting business. While seventy-five or eighty of the old box bales will completely fill a car, it is claimed that one hundred and fifteen or more of the round can be stuffed into a car. The car came in over the New York and New England Railroad, and there were a number of cotton and shipping men to inspect the novelty, as it was the first car load of the kind ever shipped North. Of course the increased capacity must be gained from the round bale permitting a denser compression, so as to give a much greater weight, foot for foot, to compensate for the loss in storage capacity possessed by the square bale.

Maxim's Flying Machine.

Mr. Hiram S. Maxim gives in the National—an English magazine—a description of his experiments on flying by means of an aeroplane. His flying machine, when finished and loaded with water, fuel, and three men, weighed nearly 8,000 pounds. The actual horse power developed on the screws was 363 horse power, with a screw thrust of about 2,000 pounds. The total width of the machine was over 200 feet. On running the machine at 30 miles an hour, very little load remained on the track, and at 36 miles an hour the whole machine was completely lifted.