

gether, and the work is carried out from the cantilevers as a base. The strains during erection, it will be clear, resolve themselves into one of tension for the upper chords and of compression for the lower chords of both truss and cantilevers. These are provided for by making the lower chord of heavy lattice and plate work adapted to resist a thrust until the central panels of the hanging truss are reached. The lower chord for these panels is composed of eye bars. The reason for this will be evident. So far the whole strain has been one of tension for the upper chord and of compression for the lower. The tension has come against wedges situated near the end of each cantilever. As soon as the members of the truss are in place, the wedge is backed out and the upper chord of the connecting truss is relieved from tension, and at once becomes a compression member, while at the same instant the lower chord of the truss ceases to be compressed and enters into tension. The only reason the lower chord is made of rigid character for the greater part of its length, enabling it to resist compression, is to make it capable of sustaining the strain of erecting. Its last chord members are put in as simple eye bars, because for the last panels the erecting strain is very light. As far as the actual bridge or truss functions are concerned, the whole chord might be of tie rods. The stiffness of the bottom chord takes the place of false work.

The wedge we have alluded to is in the upper chord. A second one is in the lower chord. The two are shown in the cut. Both are removed when the structure is joined. They are used during the last connecting to bring the parts together. By working them in or out, the projecting and meeting portions of the truss can be swung up or down and to right or left, so as to come into accurate alignment. When the last tie rods are in place and the wedges removed, the cantilever span can be distinguished as of three parts. By removal of the upper wedge the upper chord is "cut," by removal of the other the lower chord is "cut." Hence the through connection of both chords being destroyed, the truss exists as an independent structure. It is suspended at each end by a tie rod which is attached to the upper and outer corners of the cantilevers and to the lower corners of the truss. As the truss and cantilever expand or contract with change of temperature, the suspending rod swings back and forth, but no effect is produced upon the cantilever, as no thrust or pull in the absence of the wedges can be exerted upon it.

To carry on the work of construction, engine houses are mounted on wheels and travel out on rails as fast as the panels of the trusses and cantilevers are constructed. These contain hoisting machinery. The iron work is brought on scows, or on the shore underneath them, and the pieces are hoisted by steam power. As each piece comes into its place, the pins are driven in place. Where rivets are required temporary bolts are used, to be replaced by rivets in due time. Each foreman has a book giving explicit directions how to put the work together. The men, by practice, become apparently quite reckless in working at so great a height, but this is only apparent. They all wear arctics or rubber overshoes of some kind in winter, and rubber-soled shoes in summer, to be secure from danger of slipping. So far the casualties have been few.

The bridge is made of steel, of about 63,000 pounds breaking strain. The members of largest section are the lower chords of the anchorage trusses. These represent a species of box girder in exterior dimensions, 30 inches deep and 40 inches wide. The largest member weighs less than 20 tons. The largest eye bars are 8 by 2 inches in section and 49 feet long. Others are 8 by 2½ inches in section and 37 feet long. The largest eye bolts or pins are those receiving the thrust of the lower chord of the cantilevers. These are 9 inches in diameter. These dimensions may be contrasted with those of the Forth bridge, whose lower cantilever chord is a plate iron hollow cylinder 9 feet in diame-

ter, and one of whose pieces is a cylindrical member 12 feet in diameter.

On each of the two piers nearest the shore, four sets of steel rollers, 3 inches by 3 feet 6 inches, and twenty-four in a set, carry the ends of the anchorage trusses and of the cantilevers of the east and west spans. These allow for expansion and contraction under changes of temperature.

Madder.

This coloring matter is more extensively used by cotton dyer and calico printer than by the wool dyer. It has been the subject of much research, and the composition and nature of its coloring principles are now well understood. It has long been used as a dyestuff. The ancient Egyptians, the Greeks, and the Romans are said to have used it. Though not a wood, it will be best to discuss it here in connection with the redwoods, as it holds, as a wool dye, a position intermediate between that of the redwoods and the yellowwoods. It is the root of a plant called *Rubia tinctorum*. Dr. Schunk states that the coloring matter exists in the plant as a glucoside, that is, in combination with a sugar. He calls the glucoside *rubian*.

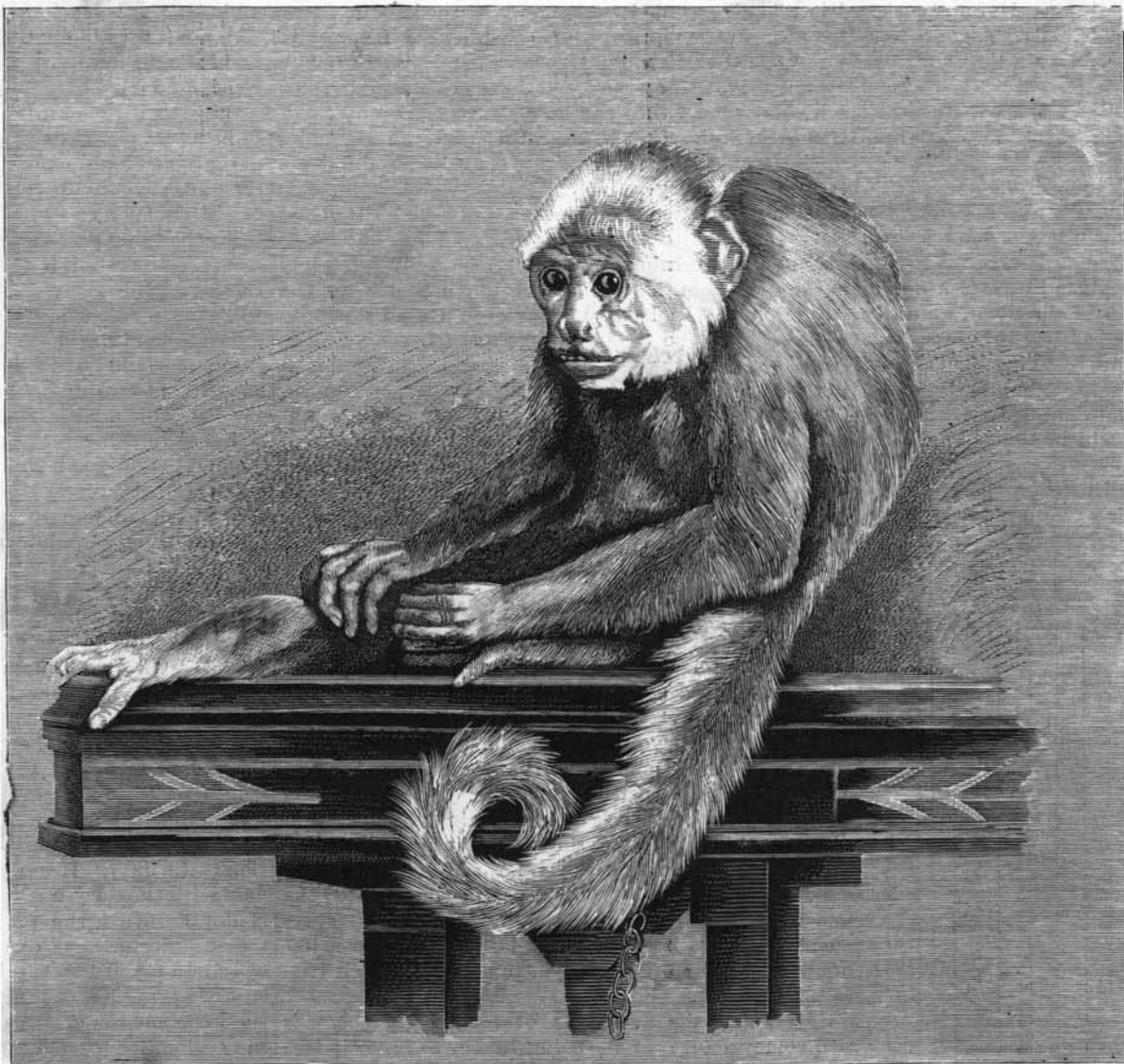
The principal coloring matters yielded by madder are

been brought against the sinful nose. Headache, cough, dyspnea, earache, neuralgia, hay fever, acne, convulsions, and syncope are only a few of the many evils which this troublesome organ is accused of having inflicted upon long suffering man, and it bids fair to outstrip even the ovaries as a center for morbid reflexes. As regards apnoea, however, it is said not to be a reflex, and the mechanism of its production is assumed to be a purely physical one. The lymphatic spaces beneath the dura mater have been found to be in direct communication with the mucous membrane of the nasal fossæ, and inflammation of the latter is supposed to interfere with the elimination of the waste products resulting from cerebral activity, thus leading to mental sluggishness. But whatever may be its methods, the nasal organ is evidently responsible for many, if not most, of our ills. Clearly, the nose must go.—*Medical Record*.

MATHEW, THE CUBAN MONKEY.

We give an engraving, from *La Ilustracion Cubana*, of an educated monkey, brought up by Messrs. Lopez & Inelan, of Havana, where the animal enjoys a great reputation for intelligence. He will stand erect and salute all present, wrestle and fight with any dog of

his size, compel a cat to be his most patient servant, capture a pigeon and make it open and shut its bill like a parrot, strike an attitude of the fiercest attack on signal from its master, or on a contrary signal relapse into the most submissive and inoffensive of creatures. The above is only the merest outline of a few of the many things which this remarkable animal has been taught to do. His fame having reached Madrid, he has been sent over there, where he now attracts great attention at the Retiro.



MATHEW, THE CUBAN MONKEY.

Kerosene Oil as an Anti-Incrustator for Steam Boilers.

Mr. Lewis F. Lyne read a paper before the last meeting of the American Society of Mechanical Engineers upon the use of kerosene oil for preventing incrustation in steam boilers. The experience upon which the paper was based was gained in connection with the working of the Jersey City Electric Light Company's station, where there are in operation two 100 horse power Root's boilers and one boiler of the same type developing 155 horse power. The water used in these boilers made a great deal of scale—so much, indeed,

as to half fill with hard deposit the 4 inch tubes of which the boilers are principally constructed. Finding that no other expedient would rectify this evil, Mr. Lyne commenced to experiment with kerosene oil; allowing some of this kind of oil to flow into the boilers by means of an arrangement like a large steam cylinder tallow cup fixed upon the water feed pipe. When the experiment was started, there was about one-fourth inch of scale in the boiler tubes. Two quarts of kerosene were put into the boiler every alternate day for a month, when it was found that the scale was so far dissolved and loosened that a scraper would clear off most of it. Continuance of the treatment eventually cleared the boiler from scale in every part. Finally the rule was adopted of putting in one quart of kerosene oil per day for each 100 horse power boiler, and three pints per day for the 155 horse power boiler. The water is blown down two gauges every week, and the entire contents once a month. Water is never used to wash the boilers out, nor is a scraper necessary, for the mud all goes away with the water. Another thing worthy of notice is that, whereas it was impossible to keep gauge glass tubes in use more than a month or two, because they became badly corroded and grooved, and consequently broke, since kerosene has been regularly employed this corrosive action has ceased.

To keep frost, etc., off plate glass windows, keep the inside air dry, or inner sash tight, so that the air in window inclosure will be cold, and ventilated from the outside. A partial remedy is to have ventilating openings in the top of the window casing.

alizarine, purpurine, and pseudo-purpurine, of which the first is by far the most important, being the only madder color which may be considered fast and permanent. The artificial production of alizarine from anthracene, one of the products of the distillation of coal tar, is one of the most important and interesting applications of chemistry to the arts that has been made of late years. In 1868, Graebe and Liebermann found that when alizarine and zinc dust were distilled, the hydrocarbon anthracene was obtained, and by reversing the process they succeeded in obtaining alizarine from anthracene. The artificial coloring matter seems to possess all the properties of the alizarine of madder. In wool dyeing the chief uses of madder, besides acting as a ferment in the indigo vat, are for the production of drabs, browns, and olives, for which its coloring matters are well adapted. The colors obtained with madder on wool are very fast and permanent.—*Indus. Record*.

The Nose the Source of all our Woes.

At the last congress of German naturalists and physicians, held in Wiesbaden, Dr. Gacy reported several cases of mental disturbance characterized by an impossibility of fixing the attention on any subject, except for a very brief period, or of prolonged mental effort of any kind whatever. This condition, to which the author gave the name of apnoea, was always associated with certain lesions of the nasal mucous membrane and obstruction to the passage of air through the nasal fossæ.

This is, we believe, the latest accusation which has

Thermometer Scales.

Much annoyance is caused by the great difference of thermometer scales in use in the different civilized countries. The scale of Reaumur prevails in Germany. As is well known, he divides the space between the freezing and boiling points into 80°. France uses that of Celsius, who graduated his scale on the decimal system. The most peculiar scale of all, however, is that of Fahrenheit, a renowned German physicist, who, in 1714 or 1715, composed his scale, having ascertained that water can be cooled under the freezing point, without congealing. He therefore did not take the congealing point of water, which is uncertain, but composed a mixture of equal parts of snow and sal ammonia—about—14° R. This scale is preferable to both those of Reaumur and Celsius, or, as it is also called, Centigrade, because: 1. The regular temperatures of the moderate zone move within its two zeros, and can therefore be written without + or —. 2. The scale is divided so finely that it is not necessary to use fractions whenever careful observations are to be made. These advantages, although drawn into question by some, have been considered sufficiently weighty that both Great Britain and America have retained the scales, while the nations of the Continent, France, Spain, etc., use the other two.

The conversion of any one of these scales into another is very simple, and easily made. To change a temperature as given by Fahrenheit's scale into the same as given by the Centigrade scale, subtract 32° from Fahrenheit's degrees, and multiply the remainder by $\frac{5}{9}$. The product will be the temperature in Centigrade degrees.

To change from Fahrenheit's to Reaumur's scale, subtract 32° from Fahrenheit's degrees, and multiply the remainder by $\frac{4}{5}$. The product will be the temperature in Reaumur's degrees.

To change a temperature as given by the Centigrade scale into the same as given by Fahrenheit, multiply the Centigrade degrees by $\frac{9}{5}$ and add 32° to the product. The sum will be the temperature by Fahrenheit's scale.

To change from Reaumur's to Fahrenheit's scale, multiply the degrees on Reaumur's scale by $\frac{9}{4}$, and add 32° to the product. The sum will be the temperature by Fahrenheit's scale.

For those who wish to save themselves the trouble we have calculated the following comparative table:

C.	R.	F.	C.	R.	F.	C.	R.	F.
-30	-24.0	-22.0	14	11.2	57.2	58	46.4	136.4
-29	-23.2	-21.2	15	12.0	59.0	59	47.2	138.2
-28	-22.4	-20.4	16	12.8	60.8	60	48.0	140.0
-27	-21.6	-19.6	17	13.6	62.6	61	48.8	141.8
-26	-20.8	-18.8	18	14.4	64.4	62	49.6	143.6
-25	-20.0	-18.0	19	15.2	66.2	63	50.4	145.4
-24	-19.2	-17.2	20	16.0	68.0	64	51.2	147.2
-23	-18.4	-16.4	21	16.8	69.8	65	52.0	149.0
-22	-17.6	-15.6	22	17.6	71.6	66	52.8	150.8
-21	-16.8	-14.8	23	18.4	73.4	67	53.6	152.6
-20	-16.0	-14.0	24	19.2	75.2	68	54.4	154.4
-19	-15.2	-13.2	25	20.0	77.0	69	55.2	156.2
-18	-14.4	-12.4	26	20.8	78.8	70	56.0	158.0
-17	-13.6	-11.6	27	21.6	80.6	71	56.8	159.8
-16	-12.8	-10.8	28	22.4	82.4	72	57.6	161.6
-15	-12.0	-10.0	29	23.2	84.2	73	58.4	163.4
-14	-11.2	-9.2	30	24.0	86.0	74	59.2	165.2
-13	-10.4	-8.4	31	24.8	87.8	75	60.0	167.0
-12	-9.6	-7.6	32	25.6	89.6	76	60.8	168.8
-11	-8.8	-6.8	33	26.4	91.4	77	61.6	170.6
-10	-8.0	-6.0	34	27.2	93.2	78	62.4	172.4
-9	-7.2	-5.2	35	28.0	95.0	79	63.2	174.2
-8	-6.4	-4.4	36	28.8	96.8	80	64.0	176.0
-7	-5.6	-3.6	37	29.6	98.6	81	64.8	177.8
-6	-4.8	-2.8	38	30.4	100.4	82	65.6	179.6
-5	-4.0	-2.0	39	31.2	102.2	83	66.4	181.4
-4	-3.2	-1.2	40	32.0	104.0	84	67.2	183.2
-3	-2.4	-0.4	41	32.8	105.8	85	68.0	185.0
-2	-1.6	0.4	42	33.6	107.6	86	68.8	186.8
-1	-0.8	1.2	43	34.4	109.4	87	69.6	188.6
0	0.0	2.0	44	35.2	111.2	88	70.4	190.4
1	0.8	2.8	45	36.0	113.0	89	71.2	192.2
2	1.6	3.6	46	36.8	114.8	90	72.0	194.0
3	2.4	4.4	47	37.6	116.6	91	72.8	195.8
4	3.2	5.2	48	38.4	118.4	92	73.6	197.6
5	4.0	6.0	49	39.2	120.2	93	74.4	199.4
6	4.8	6.8	50	40.0	122.0	94	75.2	201.2
7	5.6	7.6	51	40.8	123.8	95	76.0	203.0
8	6.4	8.4	52	41.6	125.6	96	76.8	204.8
9	7.2	9.2	53	42.4	127.4	97	77.6	206.6
10	8.0	10.0	54	43.2	129.2	98	78.4	208.4
11	8.8	10.8	55	44.0	131.0	99	79.2	210.2
12	9.6	11.6	56	44.8	132.8	100	80.0	212.0
13	10.4	12.4	57	45.6	134.6			

Industrial Record.

Prehistoric Researches in Southeastern Spain.

Two Belgian engineers, Messrs. Siret, are about to publish the important results of their extensive archaeological researches in Spain, which extend over the coast from Carthage to Almeria. The oldest remains belong to the neolithic period. There is not a trace of metal to be found in these ancient habitations. The implements consist of polished axes, perforated shells, pottery, grinding stones, chipped flints, and primitive walls of stone. In another class of sites which belong to a more recent period, remains of copper and a few bronze implements were found. The inhabitants lived in stone houses, the stones being cemented by earth. Flint implements, particularly arrow heads and knives, ornamented pots, bone points, and numerous copper celts, were found in the houses. Cremation was practiced to a considerable extent by the people of that period. Copper ores and scoræ proved that they practiced the art of smelting.

In a later period fortified villages, with walls made of stone and mud, were built on the tops of the hills. In the space surrounded by the walls, the ruins of

burnt houses, implements, remains of grain which was kept in clay pots, cloth made of broom, and handmills were found. Flint was used only for making saws. The dead were buried in natural caves, or in stone boxes under the houses or near them.

At the end of the copper period the inhabitants still lived on the tops of steep hills, in fortresses. The implements consisted of the same material, but, besides, moulds for casting copper, ivory, gold, and silver were found. Over twelve hundred graves belonging to this period were opened. All of them were situated in the houses, and consisted either of small chambers of stone, of stone boxes, or of huge clay pots with rounded bottom and wide mouth. The largest of these are over three feet long and two feet wide. The skeletons are doubled up, hands and knees being pressed against the chin. Sometimes husband and wife are found in the same urn. The study of this vast amount of material will be highly interesting. Virchow points out that part of this ancient culture is probably due to Phœnician influence.—*Zeitschr. für Ethnologie*, 1887, No. v; *Science*.

Our Lost Species.

BY E. M. HASEBROUCK.

Those species of North American birds termed "lost," and excluded from many of the lists in consequence, are at present of considerable interest to many ornithologists, both from the fact that a thorough search may, at any time, reveal the existence of some one, and that within the last few years two at least, the great auk (*Plautis impennis*) and the Labrador duck (*Camptolaimus labradorius*), are believed to have become absolutely extinct.

The first of these, *P. impennis*, has been written and rewritten upon so much of late, that I do not wish to say much concerning it here. "It formerly inhabited our coast from Massachusetts north nearly to the Arctic circle. In Iceland it has been traced down to 1844, while in the *American Naturalist*, vol. vi., page 368, is recorded the finding of a single dead specimen in the vicinity of St. Augustine, Labrador, in November, 1870." Unfortunately, the "character, date, and disposition of this alleged individual are questionable, and it seems improbable that the species lived down to so late a period." At present it is accounted extinct, but, with all due respect to the opinions of others, there seems to me to be still a chance for its being rediscovered, and, strange as it may appear, this chance I would place solely with the Arctic explorer. In the reports of different expeditions, we learn that after a certain latitude has been reached, the tide of migration changes its course, and that birds as well as mammals move in a northerly direction. This is pretty sure evidence that somewhere at the far north, beyond the region of snow and ice, there is a milder climate to be found, and one undoubtedly teeming with animal life. If, in the years to come, some one succeeds in reaching the pole, and discovers this land (if existing), does it not seem reasonable to suppose that the great auk will be found among its inhabitants? which, having experienced the persecutions of man, has sought safety and retirement within its borders. This last borders somewhat upon the Utopian. I know, yet time may prove it true in part at least.

Concerning the Labrador or pied duck, there is still some chance of its being taken, as recently two instances have come under notice in which the birds in question were picked and eaten by the shooter, and afterward, when too late, thought to have been specimens of this bird. In both cases the description tallies very closely with that of a cabinet skin. In a recent number of *Forest and Stream*, Dr. Shufeldt gives an able article on this subject, and strongly holds forth that the bird may still be found.

Leaving these so-called extinct birds, we come to the lost species proper, or those which, through scarcity or diminutiveness, have eluded the efforts of collectors since the original specimens were taken. Four of these have not been seen since the time of Audubon and Wilson, and are known only from their works.

These are: The carbonated warbler (*Dendroica carbonata*), blue mountain warbler (*Dendroica montana*), small headed warbler (*Sylvania* (?) (*microcephala*), and Cuvier's kinglet (*Regulus cuvieri*). The others are scarcely of more recent date, and are: Townsend's bunting (*Spiza townsendii*), Brewster's linnet (*Acanthis brewsterii*), Bachman's warbler (*Helminthophila bachmani*), and the Cincinnati warbler (*Helminthophila cincinnatiensis*).

Eight species once known to science now lost!

Let us take them systematically, and try to discover the reason, and if possible the remedy, for such a state of affairs. In the first place, we must admit that all are small, and therefore less likely to be noticed than otherwise; and, secondly, that a number were taken in territory that has never been carefully worked, and in one or two localities little if any work has ever been done. *Carbonata montana* and *microcephala* were all taken in such region, namely, the mountains of Virginia and Kentucky, whose vast expanse certainly offers splendid fields for discovery in this line;

and when there in 1885, on the "Black Ridge" of the Cumberland in Kentucky, I saw, among others, five of what I now and then firmly believed to have been *montana*, but owing to circumstances was unable to secure the birds. Concerning *R. cuvieri*, I can only say that the species is a supposed hybrid between *R. satrapa* and *R. calendula*, and unless exceedingly close could not be distinguished from one of these. Therefore, among the thousands upon thousands of kinglets that yearly pass the student, it is not improbable that specimens of this bird exist, and by collecting a large series one or more might be obtained and a long disputed point settled.

H. bachmani is a well tried and thoroughly established species, and up to within a few years was frequently taken. Several ornithologists have made trips through the localities in which it was formerly known to exist—South Carolina, Georgia, and Cuba—but nothing concerning it has of late been heard. It seems improbable that the species could have become extinct, and future explorations, perhaps in comparatively new country, may serve to bring it again to light.

Of *H. cincinnatiensis*, but one specimen has ever been taken, and that near Cincinnati, Ohio. It is presumably a hybrid between *H. pinus* (pine warbler) and *Geothlypis formosa* (Kentucky warbler). If such is the case it is unlikely that it will ever be taken again, and it ought hardly to have a place in this list, as it is considered more of an oddity than a species.

Brewster's linnet (*A. brewsterii*) and Townsend's bunting (*S. townsendii*) are each represented by a single specimen, and remain unique. No one knows to a certainty whether they are hybrids or representatives of distinct species. The one has not been taken since 1881; the other dates from as far back as 1833, when it was taken by Mr. J. K. Townsend, on May 11, in Chester County, Pennsylvania. It is doubtful whether either will ever be taken again, and if perchance it should, unless taken in sufficient numbers to guarantee its position, it would but confirm the opinion of its being the offspring of two distinct species. This, then, sums up the list, which, with the exception of three, still stand a chance of being rediscovered and placed on the permanent list of North American birds. There is always something peculiarly fascinating about searching for that which is liable to turn up at any moment, and until all disputed points in our ornithology are settled, students will continue to search for the desired information.

The Decadence of the China Tea Trade.

The Chamber of Commerce of Foochow, one of the three principal centers of the export tea trade of China, has responded to the appeal of the Chinese government, through Sir Robert Hart, to suggest remedies for the serious decline in the China tea trade. The substance of the letter in which this appeal was made was published in the *Times* of November 14. The Foochow Chamber points out that the vital consideration is the duty. Heavily taxed China tea cannot compete with the duty-free tea of India, and if the taxation is not remitted, the tea trade of China is within a measurable distance of extinction. The entire crop of Indian tea in 1890 will be laid down in London at a cost of 6d. per lb., or under, while the average cost of the Foochow Congou this year was 9d. per lb. laid down in London, for teas inferior to those of Indian growth. "It is too late, to recover the ground lost, but timely and vigorous measures may possibly enable China to retain a good share in this important trade."

Other causes have contributed to the decadence of the China tea trade. Among these, the Foochow Chamber mentions negligent cultivation, imperfect firing, excessive admixture of dust and stalks, and fraudulent practices on the part of the native tea guilds. Formerly it was the practice among tea growers to trench the ground in the plantations, manure the plants, and prune them at least once a year, while every year some were replaced by new shrubs. Now, however, no trenching, manuring, or pruning is done, no new stock is planted, and the worn-out trees are so stripped that four and even five crops are taken instead of three, and the last crops are torn off with shears or bill hooks. "No wonder the teas show deterioration. No wonder the Indian leaf is preferred to such a product." Owing to want of sap in the leaf, the teas are so lightly fired that they commence to deteriorate within three or four months of packing. The dust and stalks have lost the Continental markets and those of Australia and Canada to the Foochow teas, and caused the latter to be replaced by tea from Ceylon.—*London Times*.

ONE of the best and simplest remedies for torpid liver or biliousness is a glass of hot water with the juice of half a lemon squeezed in it, but no sugar, night and morning. A person to whom this was recommended tried it, and found himself better almost immediately. His daily headaches, which medicine had failed to cure, left him; his appetite improved, and he gained several pounds within a few weeks. This is so simple a remedy that any person thus afflicted will do well to give it a trial, as it cannot possibly do any harm.