in essential oil, and is scarcely affected by boiling alcohol, the acids or alkalis.

The aid of analytical chemistry is needed for the proper elucidation of this most beautiful material. There can be no doubt it would prove altogether superior in the arts to purified beeswax. On extraordinary occasions, the Chinese employ it for candles and tapers. It has been supposed to be identical with the white wax of Madras; but as the Indian has been found useless in the manufacture of candles, it cannot be the same. It far excels. It far excels, also, the vegetable wax of the United States (*Myrica Conifera*).

Is this substance a secretion? There are Chinese who regard it as such—some representing it to be the saliva and others as the excrement of the insect. European writers take nearly the same view; but the best native authorities expressly say that this opinion is incorrect, and that the animal is changed into wax. I am inclined to think that the insect undergoes what may be styled auraceous degeneration, its whole body being permeated by the peculiar product, in the same manner as the *coccus cacti* is by carmine. It costs at Ningpo from 22 cents to 35 cents per pound. The annual product of this humble creature in Chinacannot be far from 400,000 pounds, worth more than $100,000.—*Dr. D. J. Macgowan.*

THE NEBULAR HYPOTHESIS.

Professor John Fiske, of Harvard University, recently delivered a very interesting lecture on the above subject at the Cooper Institute in this city, from which we derive the following:

The lecturer began by mentioning the planetary revolutions which have become so familiar to us that we commonly overlook them altogether through sheer inattentiveness, failing to realize their significance, though their harmonious relations, as Laplace has shown, prove that the various members of the solar system have had a common origin. The clue to that common origin may be sought in facts which are daily occurring before our very eyes. Every member of our planetary system is constantly parting with molecular motion in the shape of heat. Our earth is incessantly pouring out heat into surrounding space; and, although the loss is temporarily made good by solar radiation, it is not permanently made good, as is proved by the fact that during many millions of years the earth has been slowly cooling. The evidence is overwhelming which shows that the earth's surface was once hotter than the flame of an oxyhydrogen blow pipe. The moon also is cooler than formerly, as is shown by the fact that the stupendous forces which once upheaved its great volcanoes are now quiescent. The sun, too, is pouring away heat at such a rate that—according to Herschel—if a cylinder of ice 184,000 miles in length and 45 miles in diameter were darted into tho sun every second, it would be melted as fast as it came.

PLANETARY GENESIS.

There is every reason for believing that sun, moon, and Earth, as well as the other members of our system, have been from time immemorial losing more heat than they have received in exchange. As in losing heat all bodies contract, it follows that the various members of the solar system must all be much smaller than they were at the outset. Though they have increased in mass by appropriating large quantities of meteoric dust, they must at the same time have greatly decreased in volume. Obviously, therefore, if we were to go back far enough, we should find the Earth filling the moon's orbit, so that the matter now composing the moon would then have formed a part of the equatorial region of the earth. At a period still more remote, the earth itself must have formed a tiny portion of the equatorial region of the sun, which then filled the Earth's orbit. At a still earlier date the solar system must have consisted simply of the sun, which, more than filling Neptune's orbit and consisting of widely diffused vapors, merited the name of nebula rather than of star. In the slow concentration of this solar nebula, the present peculiarities of the solar system may find their explanation. The incessant loss of heat radiated into the surrounding space caused a steady contraction of the solar mass; while, on the other hand, the increasing rapidity of its rotation impressed upon those parts of it nearest the surface a tendency to fly off into space, or at least to remain behind instead of accompanying the central portion of the body in its contraction. As in every rotating spheroid, this centrifugal force is greatest where the velocity is greatest—at the equator—a time came in the history of our vaporous sun when the bulging equatorial portion, no longer able to keep pace with the rest in its contraction, was left behind as a detached ring surrounding the central mass; which ring soon broke up into many fragments of unequal dimensions. At this stage, then, we have a host of satellites surrounding the solar equator, revolving in the direction of the solar rotation, following each other in the same orbit, and gradually becoming agglomerated, by gravitative force, into a spheroidal body, having a velocity compounded of the several velocities of the fragments, and a rotation made up of their several rotations. Meanwhile the central mass of the sun, cooling and contracting, left behind a second equatorial belt, which, breaking and consolidating after the same manner, became the planet Uranus. In like manner were formed all the planets and their satellites. Such is the grand theory of nebular genesis, in which, as Mill reminds us, "is no unknown substance, introduced on supposition, nor any unknown property or law ascribed to a known substance." It involves none but established mechanical and dynamical principles.

THE PHENOMENA OF PLANETARY HEAT.

Further evidence of the correctness of the theory is found in the present physical condition of the various planets. The theory assumed that all the planets, having successively originated from the same nebulous mass of vapor, must be composed in the main of the same chemical elements; and this inference has been uniformly corroborated by the results of spectroscopic observation wherever there has been a chance to employ it. The contracting process through which the Earth has passed to its present dimensions has been or will be, under proper conditions, repeated to a certain extent upon all the other planets. Upon any planet there must eventually occur a solidification of the outer surface, and extensive evaporation and precipitation of water, an upheaval of mountains, an excavation of river beds, and a deposit of alluvium resulting in sedimentary strata. But obviously the time at which these phenomena occur must depend upon the rate at which the planet parts with its heat, as well as upon the age of the planet, and upon the stock of heat with which it started. Against the facts that the outer planets are immensely older than the inner ones, and have received during recent ages much less solar radiance, must be offset the consideration that they must have started with a much greater amount of heat than the inner ones. Manifestly when the solar mass filled the entire Neptunian orbit, it must have contained the heat of which the subsequent loss has shrunk the sun to his present dimensions. The earliest planets must therefore have possessed relatively enormous quantities of molecular motion; and the ratios of their volumes to their masses must have been very much greater than in the case of the inferior planets since formed from a cooler and denser sun. Just as the hot water in the boiler may remain warm through a winter's night, while the hot water in the tea kettle cools off in an hour, so a great planet like Jupiter may remain in a liquid molten condition long after a small planet like the Earth, though formed ages later, has acquired a thick, solid crust and a cool temperature. Hence we may expect to find the largest planets still showing signs of a heat like that which formerly kept the Earth molten, and the smallest planets in some cases showing signs of a cold more intense than any which has been known on the Earth. This series of inferences, constituting simply an elaborate corollary from the nebular theory, is fully confirmed by observation in the cases of Saturn, Jupiter, Mars, and the moon—the only planets whose surfaces have been studied with any considerable success. According to the nebular theory, Jupiter and Saturn ought to be prodigiously hot; and so they appear to be when carefully examined. The absence of any atmosphere from the surface of the moon, with the absence of any signs of liquid oceans and running water, shows a discrepancy which, however, disappears when we inquire into its past history as revealed by the present condition of its surface. That surface is almost entirely made up of huge masses of igneous rock, through which, at short intervals, there yawn enormous volcanic craters whose fires seem to be totally extinguished. This implies that the moon is a dead planet—that the tremendous forces which produced this state of things are radiated off into space. In the later ages of a planet's history, when the heat is nearly all radiated away, and the expansive force of the nucleus is consequently reduced to a minimum, the ever thickening and hardening envelope will have shrunk in upon the nucleus in such a way as to leave vast abysses capable of ingulfing all the air and water which the planet possesses. Thus it is that in the chasms of the moon, all its oceans and atmosphere have disappeared. Mars, with his oceans, his atmosphere, his clouds and polar snows, is another strong supporter of our theory.

Facts which, on a superficial view, appear as obstacles to the nebular theory, turn out, on a closer examination, to be powerful arguments in its favor. The vexed question of "irresoluble nebulæ" has been settled forever in favor of the theory, by the discovery of the bright lines, which are sure evidence of a gaseous condition. Henceforward, we add the weighty argument that masses of matter still exist in space in the very condition in which our system must be supposed to have originally existed. The distribution of nebulæ is yet another significant argument. The parallelism between the positions of the planets and nebulæ indicates a common mode of evolution of the whole starry system, and points to a gigantic process of concentration going on throughout the galaxy, analogous to the local process of concentration which has gone on in our own little planetary group.

Singular Break Down of an Engine.

A few mornings ago, the residents of the vicinity of Front street, Brooklyn, N. Y., were suddenly alarmed by a report like that of a cannon. It seems that a steam engine, which is located on the first floor of the Brooklyn Brass and Copper Foundery, was working as usual just before the accident occurred. There was no unusual strain upon it, when suddenly, and without any previous noise or signs of anything amiss, the trace at the bottom of the walking beam snapped, and although the engineer was on the spot, the whole engine was wrecked before he could shut off the steam. About one hundred and fifty hands are employed in the works. The damage cannot be fully estimated until the whole machinery has been examined, but it will amount to several thousand dollars, and the repairs will require probably three weeks time. Fortunately no person was injured.

MARVELS OF THE MICROSCOPE.—A beautiful and easily produced exhibition of crystal formation may be seen under the microscope as follows: Upon a slip of glass, place a drop of liquid chloride of gold or nitrate of silver, with a particle of zinc in the gold and copper in the silver. A growth of exquisite gold or silver ferns will vegetate under the observer's delighted eye.

Edge Tools.

Shear steel began to be made in Sheffield in 1800. The inventions of Mushet and Lucas in 1800 and 1804 further extended the manufacture. Forks and scissors were made by rolling in 1805. From this time, immense cutlery works sprang up in England, France, and Germany, and the competition between the three countries has been highly beneficial, for while England stands undoubtedly foremost, yet both France and Germany possess their own peculiar excellences. Amongst the imports connected with cutlery, there is in Sheffield an annual consumption of more than seventy tuns of ivory for the handles of knives and forks, and about 3,000 operatives are employed in forging and grinding the blades. An equal number of workpeople are engaged on pen and pocket knives, made annually to the value of $500,000. Very many are occupied in fabricating razors and scissors.

French cutlery is chiefly fabricated at St. Etienne and Thiers, where many hands are employed. Table cutlery is here produced at a rate almost incredibly cheap.

Germany, despite the superior natural advantages of England, exports knives and edged tools to a considerable amount. Solingen has received the appellation of the Sheffield of Germany, and has, since the middle ages, been celebrated forits cutlery, being especially famous for its swords, the blades of which sometimes sell for $500.

In Austria, scythes, sickles, and table knives are made annually by millions, at an exceedingly small cost of production. It is computed that 80,000 Bavarian grindstones are consumed annually in the preparation of these implements.

With the rapid development of the mechanical arts, the manufacture of tools has correspondingly grown. At one time England possessed a monopoly, and the English trade mark was a guarantee of quality throughout the world. The efforts of European States, however, have been rewarded with a share in the manufacture, while the demand for cheaper tools has extended British trade, and yet allowed a considerable portion to fall to foreign cutlers. Operatives in wood work, as carpenters, joiners, builders, turners, and cabinet makers, employ a great variety of cutlery tools; sculptors, modellers, and pattern makers require steel tools of many kinds, and all their branches of industry and art are much increased. The demand, therefore, for planes, augers, chisels, saws, and gravers is continually increasing. In some instances, the French and Germans claim to have outstripped the English. English planes, however, are as yet unequalled. Paris, on the other hand, since the period when Dubois and Dupuytren advanced practical surgery to the high scientific position it now holds, has prepared the finest surgical instruments, particularly for dentistry. The most perfect steel work has now been enlisted in the service of science, and delicate balances and other philosophical apparatus have contributed to the investigations made by our chemists and astronomers.

Luminous Electrical Tubes.

At a recent *séance* of the *Société d'Encouragement*, M. Alvergnat, maker of physical instruments, exhibited several apparatus of his invention worthy of notice. They consist of rarefied tubes which can be easily rendered luminous by electricity. The tension of the vapor in the tubes is measured by a hight of mercury varying from ·196 to ·314 of an inch. The vapor is the chloride or bromide of silicium, and by rubbing the outside of the tubes with any substance developing electricity, a bright light is produced within the tubes, formed of different colored filaments—rose colored for the chloride and yellowish green for the bromide. The tension of the vapor necessary to produce this phenomenon is greater than that for the Gessler tubes, and the electricity which illuminates these latter tubes does not pass through the new apparatus of M. Alvergnat. The ingenious arrangement which permits of the easy production of these phenomena is capable of application in the arts and sciences, and the *Comité des Arts Economiques* consider it well worthy of attention.

Antiquity of Birds.

Those most competent to give an opinion, supported by the disclosures of the rocks, which are records in the great volume of Nature more enduring than public libraries, are satisfied that the first birds on earth were waders, and not organized for flying. They were very large, too, and their legs long, fitting them for searching for food on the margins of muddy lakes and lacustrine shores. This is inferred from the foot marks of those monster bipeds found on the red sandstone in the Connecticut valley. The stride from one step to another shows they were tall, and known to geological science as *ornithichnites*. There may have been others on a smaller scale of construction. But they were extinct, probably, or disappearing with the advent of birds with wings. The ostrich, etc., are tolerable representatives of the non-flying birds of old red sandstone ages, both in their stilted legs, toes, resembling ornithichnite tracks, and their undeveloped pectoral stumps, which are merely the anatomical beginning of the wings exhibited in higher families, their successors.

When birds appeared that could soar in the air, an internal modification of structure came with expanded wings, and the weight and exterior form were essentially changed and diminished in size. The condor is probably a type of the most gigantic of flying birds whose appearance belongs to the tertiary formation of the globe.

AT a late meeting of the Polytechnic Association of the American Institute, Professor Vander Weyde exhibited artificial musk, made by treating blood in a peculiar manner. By adding little hairs, such as are found in genuine musk, the deception is so complete that it cannot be detected even by the microscope.