There are discovered from time to time what are known as freak wells. One in particular is located in Mexico. It was drilled with every indication of producing a big supply of oil. After the nitro had been set off there gushed forth a volume of hot water, mud, stones, and very little oil. The gases in the oil and the force of the explosion caused the opening, which was sixteen inches at the start, to widen out so much that this time it spread over an area of more than forty acres. At the time it spouted, the woods around it caught fire, and many thousands of dollars were

spent in putting it out. At this time very little oil is taken from the well, and its spoutings are intermittent.

There are many erroneous ideas as to the handling of kerosene and gasoline. It is not generally known that oil, that is, kerosene, is not explosive. A simple experiment can be tried to demonstrate this fact. Place a small saucer of kerosene on a table, and throw a lighted match into it. In every case the oil will put out the light from the match. Gasoline also is not explosive. It is the vapor thrown off from the gasoline

that causes the explosion. In the case of kerosene the flame is put out because the oil is cold and there is no vapor. But hold a match to a wick which feeds on oil and you can light the wick. That is because there are but few drops of oil on the wick, which draws more oil when that is exhausted.

The petroleum market has advanced to such an extent that much modern locomotion is now by gasoline or oil. The auto and aero also use gasoline, and where formerly the auto used steam, now the only article is gasoline.

The Evolution of the Art of Writing

Some Forerunners of Our Modern System

By Dr. Alfred Gradenwitz

Battak Book Written with Soot Paste on Bark.

Edition de Luxe of the Koran.

THE art of writing, like language itself, doubtless allows the degree of civilization of a people to be gaged, a more elaborate or simplified script being characteristic of a high mental development, while a rudimentary system of writing invariably belongs to a low stage of civilization. Moreover, there is an obvious interaction between language and writing, the latter fixing the former and contributing to its propagation.

In all parts of the earth the most rudimentary means of recording language is a picture-writing which eventually develops to more elaborate systems. This evolution has taken a diametrically opposite course in Europe and the Near East on one hand, and in the Far East on the

other. The ancient picture-writing of the Chinese in fact developed to the most admirable ideological script, where each sign stands for a given idea. The many thousands of signs which compose Chinese writing in their turn consist of a limited number of component ele-

ments by the combination of which all abstract ideas can be expressed in a most ingenious fashion. Writing thus becomes practically independent of the language it is meant to represent, and as it were constitutes a universal language of its own. In fact, the monuments of Chinese literature on which the civilization of the Far East is based, are equally well understood by the inhabitants of any part of the Celestial Empire, irrespective of its native dialect. Nay, they are read with the same facility by the Japanese, Siamese, Koreans, Annamites and any other nation of Southeastern Asia, each of which reads the same sign with the sounds of its own language.

Malacca Bible. Hindoo Script on Bamboo Shavings.

Siamese Book on Slate Paper.

Arabic Pen and Ink Case.

Tablet with Script from Lagos (Africa).

As this elaborate script offers the undoubted drawback of preventing a universal knowledge of the art of writing and reading in all classes of society, the Japanese about (800 p. D) adopted beside the higher literary writing, a simplified syllabic script called Hiragana, which is mainly intended for the use of the illiterate, though a combination of the two systems is frequently found.

Writing Set of Mohammedan Negroes.

Characters Used by the Pangree Negroes (on Bark).

Our own system of writing can be traced back to the ancient Egyptian hieroglyphs which at first were merely a system of picture-writing. As, however, some hieroglyphs were eventually singled out to designate sounds, the Phenicians, having been taught the art of writing by the Egyptians, gave up the picture-signs proper, adopting only the phonetical characters. These were taken over on one hand by the Hebrews from whose writing Arabic script has sprung forth, and on the other, by the Greeks and from these by the Romans, thus giving rise to the development of occidental writing.

The oldest writing material was stone or burnt clay, in both of which the most important moments in the life of a nation or the individuals were engraved with a view to preserving them to a remote posterity. In Northern Europe the ancient Teutons long used an alphabet of runes, viz., 24 and eventually 16 characters, which originally served for religious purposes, as magic signs on amulets, etc. The signs of Egyptian picture-writing have been preserved in the inscriptions of many stone monuments and especially the obelisks and pyramids where all the more important events of the time have been cherished. The ancient Babylonians, Persians, Medes and Assyrians engraved their wedge-shaped or cuneiform

signs in clay, made resistant by burning in a furnace.

Arabic script forms an important group with many varieties in use in all Mohammedan countries in Turkey, on the Nile, in Soudan, East Africa, Persia, Afghanistan, etc. The adherents of the Great Prophet generally write with cane pens called *kalam* (from Latin *calamus*), resembling our old goose-quills, which are kept in a pen-case made of wicker-work or metal with the ink pot attached to it. For the first school instruction primitive wooden tablets strewn with ashes are frequently used, on which the children write with small wooden rods. The wood is frequently replaced by some more resistant material, such as the collar bones of camels, of all things. In India, they also write with a cane style, which is there called *Rulum*; the point of this style however, is adjusted somewhat differently from the arabic *kalam*, as the Hindus write from the left to the right, whereas Arabic is written inversely from the right to the left.

The Brahmins of India first introduced colored writing (from China) at about 500 B. C. The Hindus originally wrote on the bark of trees, and later on cotton fabrics or Chinese paper, while any especially important documents were fixed on gold or copper sheets. Some rare tribes of Eastern India, e. g., those of Laos, still use a strange kind of engraved script, the characters being carved by means of a metal style into palm leaves or bamboo rods. These letters are sent by special messen-

Camel's Shoulderblade Covered with Arabic Script.

Magic Formulae of the Battaks, Scratched Into Bamboo.

Assyrian Cuneiform Writing on Brick.

Diary of Tehukthes Eskimo (on Bone).

gers, who have frequently to travel over great distances, the addressee rubbing the letter in with some dye stuff, so as to bring out the script clearly.

Some strange systems of writing are found among the highly developed Malay tribes in the interior of Sumatra, the Bedjang, Tagals, Bugi and Battaks, that of the last being especially interesting. The Battaks, it appears, had in a remote past received some civilization from the Hindus, and their art of writing, therefore, represents a stage of at least two thousand years ago. This writing is

partly a primitive smearing and partly a carving script. In the former case the interior bark of trees or some sort of parchment made from bamboo supplies the writing material, on which a thin soot paste is smeared by means of a palm-tree rod. The carving script is written by means of an iron style engraving the characters into palm leaves, bamboo cane or similar resistant materials.

This primitive writing of the Chinese also was a scratching script, the first attempt to chisel characters into stone after the manner of hieroglyphs, or to engrave

them in metal being made between 2,000 and 1,500 B. C. Bamboo tablets were later used to engrave the characters, while in the last centuries before our era, the Chinese began writing with ink and brush, which method they have kept to this very day. In fact, Chinese ink has achieved fame as a product never equalled by any imitation. The Japanese, also write with brush and ink.

Nicely decorated tubes of bamboo or metal, which are frequently artistic master pieces, are used by the Chinese and Japanese as reservoirs for their writing utensils.

The Theories of World Making*

A Review of the Earlier and the Most Recent Hypotheses

By A. T. DeLury

ON the subject of cosmic theories there appeared within the year lately closed an important work by Poincaré, "Les Hypothèses Cosmogoniques." In this work—a course of lectures to advanced students of the Faculty of Sciences at Paris—the distinguished scientist examines in detail the arguments for, and the objections to, the more outstanding hypotheses that have been formulated. The great value of the book will, I think, be found in the fact that in a matter where scientific judgment and acumen is quite as large a part as positive demonstration, we have presented to us the opinions, the doubts, and the hesitations of one competent in almost unequalled degree to approach the problem. The reading of this work has led me to consider with you this evening certain of the cosmic hypotheses that have most claimed attention.

As the theories will be examined principally in relation to the solar system it may be well to bring together the more essential facts pertaining to that system:

(1) The Solar System consists of a central body, the Sun, and a number of planets, Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, Neptune.

(2) The planets revolve about the sun in orbits that are ellipses, the sun being at a focus of each elliptical orbit. The ellipses approximate very closely to circles, i. e., their eccentricities are small.

(3) The planes of the orbits lie close to one another, being inclined at angles not greater than 7 degrees 15 minutes to what will be called the plane of the solar equator. As a phenomenon, the sun and the planets are seen from the earth ever within a narrow belt of the heavens.

(4) The sun rotates on an axis which determines the solar equatorial plane. The planets also rotate and several of them have one or more satellites or moons which revolve about the parent planets much as the planets themselves revolve about the sun. One planet is surrounded by a ring, or rather a set of rings, which revolves about the planet.

(5) The planes of the orbits of these moons are for the most part but slightly inclined to the equatorial planes of the parent planets and to the solar equatorial plane.

(6) The sense of all these movements—with certain exceptions to be noted later—whether of rotations of the sun and the planets, or of revolutions of planets or satellites, is the same, that of west to east in the heavens, as we say.

To these, with a view to definiteness in the image called up, though the facts cited are not without moment to any theory, let us add.

(7) The mean distances of the planets from the sun range from 36,000,000 miles, that of Mercury, to 2,792,000,000 miles, that of Neptune. The volume of the sun is large compared with any or all of the planets; if we call the volume of the earth 1, that of Jupiter is 1,309, the aggregate volume of all the planets is 2,221, while the volume of the sun is 1,310,000. If we call the mass of the earth 1, that of Jupiter is 318, the aggregate mass of the planets is 446, while the mass of the sun is 332,000.

To account for the unity or solidarity suggested by the small eccentricities of orbits, the approach to co-

incidence of the orbital planes, the uniformity in the sense of motion, many early speculative views were entertained, but we shall pass them by to consider the hypothesis stated first by Laplace in 1796, usually referred to as the Nebular Hypothesis.

It would be interesting and illuminating to quote from Laplace the considerations that led him to entertain the theory that bears his name, as well as his statement of the formal hypothesis, for, very generally, the outlines of his views have failed to present or insist upon certain essential features. Time, however, will not permit this, and I shall have to ask you to be content with a condensed account which will, at least, emphasize the features to which I have referred.

In seeking the veritable cause or source of the phenomena cited, Laplace points out that it must have embraced all the planets, and, distances considered, it must have been a fluid of vast extent. To have imposed an almost circular movement in the same sense about the sun, this fluid must have surrounded the sun, as an atmosphere that must have extended beyond all the planets. Through loss of heat the atmosphere would progressively retire under the action of gravity, and if we suppose it endowed with a motion of rotation, necessarily slow, but as of one mass with the sun, we have a brief statement of the undeveloped hypothesis. The march of the process would be condensation through loss of heat with the necessary increase in rate of rotation, and the reaching of a stage when at the equator the velocity of the particles of matter would be such that the so-called centrifugal force would balance the force of gravity, when zones of vapor would be abandoned. While these zones might be expected to condense into rings, the uniformity which this would demand both in the material of the ring and in the process of cooling would have been rare, the only instance being the rings of Saturn. The disruption of rings would lead to the formation, under attraction, of spheroidal masses with a movement of rotation in the sense of their revolution since the inner molecules had a slower velocity than the outer ones. If one of these masses were sufficiently large, it would attract the others to it to form one such spheroidal mass with the motion of rotation as described. In the smaller planets—the asteroids with orbits intermediate to those of Mars and Jupiter—we have, perhaps, a disrupted ring not aggregated into a single planet. The formation of satellites would be analogous. Inequalities in temperature and density—for there could scarcely have been uniformity in these qualities—would produce the deviations from regularity that appear in the slight eccentricities of orbits and in the slight inclinations of orbital planes. Laplace thought that our system at one time might have presented some such appearance as do the nebulae which, under the telescopes of the time, suggested, in general, a strong central condensation. Thus to his speculations came to be associated the name Nebular Hypothesis.

This bold and genial theory, commended by the authority of Laplace as well as by what we may call its reasonableness, held almost undisputed sway over the minds of men throughout the greater part of a century. But, very early, difficulties appeared. In the first place, it was not clear that certain phases of development could be justified on dynamical grounds. Again, in time, the telescope revealed striking though not numerous variations from that uniformity in the

movements of the planets and satellites which had suggested the hypothesis. Last of all, the advances in the sciences that touch the problem of evolution called for modifications in the presentation of the theory so fundamental that to many it seemed that the hypothesis was ceasing to be itself. The more striking of these difficulties will now be considered.

About the middle of the century, E. Roche, Professor at the University of Montpellier, set himself the problem of giving to the theory of Laplace the precision that comes from a specific mathematical or dynamical treatment and of following it out to its logical consequences. The papers of Roche were published in the proceedings of the Academy of Montpellier; they were given a wider publicity in the great work of Tisserand and now find a clear exposition in the already cited work of Poincaré. It is shown that under the supposition of a strong central condensation and of a movement of rotation by which each particle of the atmosphere is carried, not independently, but as part of a rotating whole made up of sun and atmosphere, the results claimed by Laplace are, in the main, either normal or possible. Gaseous matter would not escape in a continuous stream at the equator, but would be left behind in rings of vapor at epochs and in this regard the supposition of strong central condensation and of uniform motion of rotation as of one body is necessary. The rings abandoned would normally in time become unstable, and under rupture could aggregate into planets, though the time implied in this would be very great. When it came to the abandonment of zones of vapors by the condensing planet, and the advance to the sub-planetary or satellite condition, a new element or influence in the development of a system from the planetary center appears in the attraction of the sun. The action of the sun through tidal distortion and friction would tend to equalize the periods of rotation and of revolution of the planet; later, the planet condensing, the tidal effects would be less and the rate of rotation of the planet would increase. In like manner the satellite would have its two periods tend to equality, and having progressed further in the march of condensation, would be less likely than the planet to experience a later acceleration of rotation. Indeed, the inner planets themselves would seem to have their two periods nearly equal. Thus, in the satellite the conditions would be unfavorable to the formation of an additional series of satellites, and no case of such is known. Roche showed also that, in the rotating mass as postulated by Laplace, there would be a flow of matter, along the surface, from the neighborhood of the poles to the equator, and that this matter, with lower actual velocity than the surface matter near the equator, would tend to become immersed in the atmosphere and form interior rings which would lead to the formation of a planet within the atmosphere. This planet moving within the atmosphere would experience a contraction of its orbit and an increase in the rate of revolution. Another important feature of Roche's work was the establishing of the fact that at a distance from a planet less than two and one-half times its radius a small satellite of approximately the same density would be disrupted.

It is in place now to refer to the work of Sir George Darwin on tidal friction. Laplace and Roche had pointed out certain general results of such action. The importance of tidal friction as an inevitable and power-

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