

place of the old stone needles, and were commonly used before the time of Ch'in Shih-huang—that is, more than twenty-one centuries ago. Whenever a needle happened to be made of magnetic iron, it might reveal its quality by falling into a cup of water, when it happened to be attached to a splinter of wood, for example. It came in some such way to be known commonly that certain needles had this quality. The great producing centre for magnetic iron is T'szhou, in southern Chihli. This city was very early called the City of Mercy, and the magnetic stone produced there came to be known as the stone of T'szhou, and so *t'szshih* became the ordinary name for a magnet. Later, the Chinese began to speak of the city as the "City of the Magnet," instead of calling it the "City of Mercy." The polarity of the magnetic needle would become known to the Chinese of that city and its neighborhood first. The first who noticed the polarity would be some intelligent person who communicated the fact as an unaccountable peculiarity in an age when omens and portents were diligently sought for in every natural object and phenomenon.

The earliest author who mentions the "south-pointing needle" lived in the fourth century B.C. There can be no reasonable doubt that the polarity of the needle was known at that time. The discovery of the fact must have preceded the invention of any myth embracing it. As to the discovery, there is no reason to suppose it was in any way foreign, because the Chinese use an enormous number of needles, and have an inexhaustible supply of ironstone. But though the polarity was known, it was not turned to a practical use till the Tsin dynasty, when landscapes began to be studied by the professors of *fengshui*, or geomancy. There was at that time a general belief in the magical powers of natural objects. This was a Buddhist doctrine, and it took firm hold on the Chinese mind of that age. The Chinese philosophers of those times taught that indications of good and ill luck are to be seen all through nature. The polarity of the needle would take its place in this category of thought. Though it is not distinctly mentioned by writers of the fourth century, yet to their disciples it became an essential part of the landscape compass which the professors of *fengshui* all use. Kwo Pu, the founder of this system, died A.D. 324, and it was not till four centuries later that the *fengshui* compass began to assume its present form.

The compass used by the professors of geomancy for marking landscape indication was first made about the eighth century. It was of hard wood about a foot wide, and it had in the centre a small well in which a magnetized needle floated on water. On the compass were inscribed several concentric circles, as on the wooden horizon of our globes. They embrace the twelve double hours, the ten denary symbols, eight diagrams, and other marks. This compass was used in preparing a geomantic report of any spot where a house or tomb was to be constructed, so that the construction might not be upon an unlucky site or planned in an unlucky manner. At the same time there was living a Chinese who had studied Hindoo astronomy, and was the imperial astronomer, and also a Buddhist priest. He noticed that the needle did not point exactly north, and that there was a variation of $2^{\circ} 95'$. This variation went on increasing till a century later, that is, till the ninth century. A professor of geomancy then added a new circle to the compass. On this improved compass the first of the twelve hours begins on the new circle at $7\frac{1}{4}^{\circ}$ east of north.

The compass, it will be observed, grew out of the old astrological report or nativity paper, calculated from the position of the stars, and prepared in the Han dynasty by astrologers as a regular part of social life, especially when marriages were about to be solemnized. Some of the old astronomical circles are preserved in the new geomantic chart. This was the compass used when Shen-kwa wrote on the south-pointing needle in the eleventh century. This author mentions that any iron needle acquires polarity by rubbing it on a piece of loadstone. He alludes to the variation as a fact which he himself had observed, and speaks of the south-pointing needle as an implement used by the professors of geomancy. By them it was employed in the form of a float upon water. After this, in 1122, an ambassador to Corea describes the use of the floating needle on board ship while he made the voyage. This is the first instance, the earliest by more than a century, of the use of the mariner's compass on board ship,

found as yet in any book, native or foreign. The existence of the book in which this is recorded settles the question of the first use of the mariner's compass at sea in favor of the Chinese. At that time the needle floated on water supported on a piece of wood, but in the Ming dynasty some Japanese junks engaged in piracy were captured by the Chinese, and the compass in use on board was found to have the needle dry and raised on a pivot, while still pointing southward. The Japanese had learned from the Portuguese navigators to make a compass of this kind, and probably the needles they used were brought from Europe. From this time, the Chinese adopted the principle of a pivot, and made their compasses without a well of water in the middle to float the needle in. Charts were probably used of a very rough kind, but how far is not known. What is known is that the junk-master was aware of the direction in which the needle must point to reach the port to which he was going. In the Sung dynasty, embracing part of the tenth, as well as the eleventh, twelfth, and part of the thirteenth centuries, Chinese junks went to Persia and India. The Arabs trading to China directly would learn at that time the use of the compass, and would apply it on board their dhows. From them the Europeans learned this useful invention.

The credit of the discovery, both of the polarity of a magnetized needle and its suitability for use by mariners at sea, must, therefore, according to the writer, be given to the Chinese, says *Nature*, in commenting on the article. It is China also that has the credit of having first noticed that any iron needle may be polarized by rubbing it with a magnet. In the thirteenth century the Arabs used a floating compass on their dhows. The needle was made to float on the water by attaching it crosswise to a cornstick or splinter of wood. A magnet applied to it drew it into a north and south direction. They would use Western notation to mark the quarters and intermediate points on the horizon. When, therefore, the mariner's compass was adopted from them, the Chinese 24 points were not communicated. In the European compass the notation of 32 points is Western, and rests on the winds and the sun. In the Chinese primitive mariner's compass the notation is that of the professors of geomancy, and rests on the old astrological division of the horizon into twelve double hours. From the Arab account we learn, what the Chinese accounts do not tell us, that the Chinese floated the needle by inserting it in a splinter of wood.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Crime among Washington Negroes.

A CONTRIBUTOR to the Washington *Evening Star* of the 5th instant, signing himself "A Friend of the Negro," has recently been making some comparative studies of the records of the Washington police courts, and greatly deplores the showing for crime they exhibit against the rising generation of Washington negroes. He states, and there is every reason to believe that his statement is true, that "the police report for the year ending June 25, 1890, shows as follows: assaults on policemen, 162, by whites 75, by colored 87; assaults on special officers, 25, by whites 9, by colored 16. Last year three policemen were killed by negroes, two when attempting to arrest them; and there is scarcely a year that this does not occur. In the *Star* of Dec. 24, 1888, it was stated that there were then in jail, awaiting trial or sentence for murder, 16 persons, 3 white and 14 colored. In the *Post* of March 26, 1890, it was stated that there were then on the calendar 18 murder trials, and in the *Star* of Dec. 29, 1888, it was stated that there had been in the District during the year 26 murders, the greater portion of which was by negroes. Now, when it is borne in mind that they constitute but one-third of the population, it will be seen that this is a terrible record."

Investigating this matter still further, the *Star* correspondent is enlightened in other directions, for he soon finds out that it is the present generation of negroes that is responsible for the majority

of these misdemeanors. He finds that it is not only the pseudo-civilized, coal-black Ethiopian, but more frequently the species to which I alluded in *Science* (No. 416) as "the hybrid," that is developing a marvellous fondness for whiskey, who almost invariably goes armed either with a razor or a "bull-dog" revolver, who are the law-breakers, who are rapidly becoming the skilled burglars, and who are far more dangerous than a savage for a lady to meet alone anywhere after dark.

This "Friend of the Negro," mark you, ascertained still more, much of which is quite in tune with the present writer's remarks in the *Washington Annotan Magazine* of last February, and several other quarters. He adds, "What makes it more disheartening is that here they are in every respect in the full enjoyment of all their legal rights, and in all particulars are on a perfect equality as citizens with the whites. They have the same privileges in the schools, are taught the same branches, have the same school buildings, and there is the same amount per capita spent for them as for the whites. They are abundantly provided with churches and Sunday-schools [*sic*], and, in addition, have the example [*sic*] of some of the ablest and most cultured of their race residing here in our midst." (!)

Now to this particular "Friend of the Negro" I would briefly suggest a study of a few of the higher and a few of the more lowly races of man since the dawn of history. Make those studies comparative. Next, master some of the more practical laws — and there are few or none that are not so — of biologic evolution. Get a good realizing sense of how long it has taken the white race to arrive at its present stage of civilization, and especially the fact that races of men are often quite as far separated mentally, intellectually, and psychologically, as are other races of vertebrates. Induce, if possible, some friend who is informed in such matters to impart a few wholesome facts in the premises. If I am not radically mistaken in the grade of good sense of our "Friend of the Negro," at the end of six months' time he will awaken to the fact that he has before him for study one of the most advanced races in civilization on the face of the globe, the "so-called white," which race is now the victim of another and a *parasitic* race, the "so-called negro," — vicious, low, and barbarous, with a race history, so far as it can be traced, (!) that will not bear investigation. It is not so very long ago since some of them were human flesh-eaters. As an evolutionist, as a zoologist, and as perhaps other things, I can inform the *Star's* contributor that it is quite a useless experiment to place a turkey-vulture in a cage of sky-larks and expect him to sing next morning. Moreover, it is just possible that the experiment may prove a dangerous one for the larks.

DR. R. W. SHUFELDT.

Takoma, D.C., Aug. 10.

BOOK-REVIEWS.

Achievements in Engineering during the Last Half-Century. By L. F. VERNON-HARCOURT. New York, Scribner. 311 p. 8°. \$1.75.

THE author of this work has already made himself known as a writer on engineering topics by his previous books on "Rivers and Canals" and "Harbours and Docks." In this book he describes briefly some of the principal engineering works carried out within the last fifty years, avoiding technical phraseology as far as possible. This will, of course, add to the attractions of the book for the general reader, for whom it is mainly intended; but the attention given to details, and the comparisons made between similar works carried out under different circumstances, give the book a special value for engineers.

There has been no lack of material for the book. In fact, one of the chief difficulties in the preparation of a work of this kind, when undertaken with due regard to "perspective," is the judicious selection of subjects. In this respect, we think, the author has made no mistake. Beginning with railways, he treats first of the London underground and the New York elevated roads; then of those crossing the Alps, the Andes, and the Rocky Mountains; after which a chapter is devoted to narrow-gauge, Fell, Abt, and the Rigi and Pilatus railways.

Two chapters are given to tunnels, one being devoted mainly to

those piercing the Alps, the other treating of river tunnels, such as the Detroit, Hudson, Mersey, Severn, and Sarnia, and the Thames subways. After a chapter on the progress and principles of modern bridge construction, he gives some details concerning the Hawkesbury, St. Louis, Garabit, Hooghly, Brooklyn, Forth, and Tower bridges, with some remarks on the possibility of a bridge across the English Channel. A brief chapter on submarine mining and blasting relates principally to the operations at Hell Gate in the East River.

The engineering works involved in the improvement of the chief sea-ports of the world and of some of the great river channels are very fully described; and ship-canal are by no means neglected, two chapters being given to the Amsterdam, Manchester, and Suez canals, as well as to the work thus far done on the Panama, Corinth, and Nicaragua canals. The latter, by the way, he locates on the Isthmus of Panama, under which name he seems to include all the territory extending from the mainland of South America as far north as the United States.

In the last two chapters of the book the author writes of the Manchester water-works, the Vyrnwy dam and lake, the Eddystone lighthouse, and the Eiffel tower. The book is handsomely illustrated, full-page views being given of many of the subjects treated of, and an excellent portrait of Robert Stephenson making an appropriate frontispiece.

As a whole, the book is one to be commended, though there are points in which it might be improved, as viewed from an American standpoint; and there are occasional evidences of hurried work, as, for instance, the following sentence, which, though conveying much information in small space, would hardly pass muster as a sample of good style: "The elevated railways are owned by two separate companies, and worked by a third company, to whom the lines are leased for 199 years, by means of locomotives, with coupled driving-wheels $3\frac{1}{2}$ feet in diameter, and bogie wheels 2 feet in diameter" (p. 20).

AMONG THE PUBLISHERS.

THE Humboldt Publishing Company have just ready "Mental Suggestion," by Dr. J. Ochorowicz, sometime professor extraordinary of psychology and nature-philosophy in the University of Lemberg. The preface is the work of Charles Richet.

— Longmans, Green, & Co. have just ready "Cookery for the Diabetic," by W. H. and Mrs. Poole, with a preface by Dr. Pavy; and "With Sack and Stock in Alaska," by George Broke, which will interest all who enjoy records of travel in out-of-the-way lands.

— Charles Collins has just published a fourth revised edition, by Professor Sheldon, of Olmsted's "Natural Philosophy;" also Sheldon's "Electricity," being chapters on electricity prepared for and included in the preceding book, but published separately for the use of students in college.

— Macmillan & Co. call attention to the new work of Louis Dyer, late assistant professor in Harvard University, entitled "Studies of the Gods in Greece." Professor Dyer explains the development of the cults of Demeter, of Dionysius, of Æsculapius, of Aphrodite, and of Apollo. The gods are treated with the reverence that is due to them, and the fact is emphasized that there is much in Christianity that is of Greek rather than Jewish quality.

— D. C. Heath & Co., Boston, have just published a "Manual of Plane Geometry," on the Heuristic plan, with numerous extra exercises, both theorems and problems, for advanced work, by G. Irving Hopkins, instructor of mathematics and physics, Manchester High School, N.H., with an introduction by Professor Safford of Williams College. The book is designed primarily for the author's pupils, and secondarily for the constantly increasing number of teachers who are getting more and more dissatisfied with the old methods of teaching geometry.

— G. P. Putnam's Sons have just ready the third part of the "Talleyrand Memoirs." This instalment continues the report of the Congress of Vienna in 1815, the Second Restoration, and the Revolution of 1830. It contains three portraits of Talleyrand, one