signs which are drawn in scratched lines, form a second class. These seem to indicate huts or dwellings made of branches of trees. More than 20 of these are seen in the first chamber. Near them are some silhouettes of the human figure of a primitive design and rather vaguely sketched, but they are remarkable for certain details which will form an interesting study for comparative ethnography. The gesture of the arms seems to indicate that of a suppliant.

As concerns the drawings, there is evidently a connection between those which are observed in the Altamira cave and those of the six caves which have been already discovered in France. The technical processes are about the same, and the same idea predominates in all, but the Altamira drawings are far superior in all respects. The fauna which is represented here does not show, like those of the Gironde, Dordogne, and Gard caves, different extinct species such as the mammoth, nor is the reindeer to be seen. But the same is to be noted in the case of the intermediate cave of Marsoulas. The species peculiar to the cold period of the quaternary, while proceeding in a southerly direction, do not descend as far south as the latitude of Altamira.

M. Salomon Reinach makes the interesting observation that the animals which are represented in these cave drawings are all herbivoræ, and there are no carnivoræ among them. These animals are, therefore, of the class sought for by the cave dwellers, who were hunters and fishers. The fact that these were the only ones to be drawn seems to show that the object of the primitive artists was to exercise a magic attraction upon these animals. The natives of central Australia also have the habit of drawing figures of animals on the rock or the ground, with the idea of increasing the breeding of such animals, and the carnivoræ are excluded from these drawings, as this would bring bad luck. The drawings observed in the caves of the Reindeer epoch seem to have an analogous character. They were not drawn in the leisure hours of the hunter simply for his amusement, but were talismans by drawing which he expected to have an increased game supply. During this very ancient phase of human evolution, religion (in the modern sense) did not as yet exist, but magic played an important part and was associated with all forms of human activity. M. Reinach adds that according to a letter from Prof. Frazer, of Cambridge, certain facts which were brought from Australia by Messrs. Spencer and Gillen, and which are as yet unpublished, serve to confirm this opinion.

THE GANZ SYSTEM OF ELECTRIC CANAL HAULAGE.

With the Ganz system of electric haulage, a monorail track is used, and this largely accounts for the low first cost of construction, while the lightness of the locomotive used in proportion to its output, occasioned by peculiar construction, undoubtedly has much to do with the excellent showing as to working cost per ton-kilometer. The Ganz tow locomotive was designed by Engineer Fabre, and two inclined pairs of axles are provided, instead of the ordinary horizontal axles usually employed with two vertical wheels.

In the construction of this locomotive there is an inclined wheel on every axle, and each pair of wheels embraces the rail head. Since there is only a single rail, another lateral wheel is provided to brace and steady the locomotive, this wheel operating upon the ground or towpath. By the inclined wheel arrangement, the rope pull is utilized to increase the adhesion, and it is also claimed by the engineers favoring this system, that the adhesion is still more increased by the wedging action upon the inclined axles, due to the weight of the tow locomotive.

The locomotive was designed for a three-phase current, the motor operating with current of a frequency of 50 periods per second; and on account of the high speed of the motor and the low speed of the locomotive, spur reduction gearing was employed. It is stated that at 15 periods per second, this reduction gearing would not be necessary, and the motor shaft could be direct connected to the worm gear driving shaft. Mr. Szasz gives the following as the fundamental qualities of this locomotive:

1. With the use of one rail, a very high coefficient of adhesion, and consequently a very light-weight locomotive. 2. The utilization of the tow rope for the increase of adhesion of the locomotive. 3. Proportional increase of the stability of the locomotive according to the effort put forth. Continuing, he gives the following data in reference to this locomotive:

"It rests upon one rail only, which differs little in shape from the ordinary Vignoles rail. The two oblique pairs of wheels embrace the lateral and top parts of the rail head, a little room being left on the top. The weight of the locomotive rests upon the four oblique axles, being carried on one side by a spring. The motor shaft is disposed horizontally, the motor being built into the locomotive frame. Each of the four axles is driven by the worm gearing by means of two endless screw shafts, which are operated from the motor by a spur gear. The lateral broad supporting wheel serves the purpose of bracing the locomotive and thereby insuring equilibrium. This wheel is fixed on the side facing the canal, as the inclined towrope tends to tip the locomotive in this direction. If the locomotive represented a rigid system, the force of reaction on the rails causing the adhesion could only be as great as the weight of the locomotive itself, apart from that small part of the weight taken up by the wheel. As the adhesion is to be increased by the wedging action of the weight, it has been necessary to provide for a certain mobility in those parts by which the weight of the locomotive is taken up and transmitted to the rails. For this purpose the locomotive weight can be shifted on the axles. The bearings of only two axles are rigidly built together with the motor, these two axles being on the same locomotive side. The axles on the other side are able to turn round the endless screw shaft, and the locomotive weight rests on this side, by means of springs on the axle. In this way the relative position of the axles and the motor can be shifted in axial direction, and besides the axles of the one side can move around the shaft. This mobility of the axles enables the weight to develop the wedging action."

The Ganz locomotive for towing in the electric system of canal haulage has a controller, a rheostat, main switch, and plug contact for manipulating the three-phase motor. The current is directed to the motor through a flexible cable and trolley contacts, the rail being used as the third conductor. The overhead line consists of two copper wires .314 inch diameter, and the pressure used is 500 volts. The two contact wires are located 11.8 inches apart, and are placed 19.6 feet from the ground. The two conductors are supported on wooden poles placed about 100 feet apart.

"HOME MECHANICS FOR AMATEURS."

Doubtless many readers of the SCIENTIFIC AMERICAN, and all readers of "Experimental Science," will be gratified to learn that the late George M. Hopkins left a posthumous work, to which special interest always attaches. It is not always, however, that a work of this character possesses equal merit with one entirely completed before the death of the author. As a rule, such work has not had the advantage of the final perusal and correction by the author. Such has not, however, been the case in the present instance, for "Home Mechanics for Amateurs" was completed before the author's death. The present volume contains much matter which has never before appeared in print, and some articles which have already been published in the SCIENTIFIC AMERICAN. The work will furnish abundant food for thought for the amateur, and will give him suggestions whereby he may pass many pleasant hours in his workshop. Mr. Hopkins was an expert mechanic, and one of his chief pleasures was to make experiments at his home in his well-equipped workshop and laboratory. The work described in the present volume is nearly all the result of experiments made by him during such idle hours. It was the intent of the author to make the present work as suggestive as possible. No complicated aparatus is required in carrying out the experiments described. Anyone with ordinary mechanical ingenuity, having a lathe and a few tools, can make most of the articles and try the experiments illustrated and described in the 370 pages of the book. It deals with Woodworking, How to Make Household Ornaments, Metal Work, Model Engines and Boilers, Home-made Meteorological Instruments, How to Make Telescopes and Microscopes, Batteries, Electric Lights, a New Electrical Cabinet, Electric Motors and Dynamos of Various Kinds, an Electric Furnace, a Recording Telegraph for Amateurs, and How to Make a Telephone. The book is profusely illustrated with 326 illustrations. It is hoped that "Home Mechanics for Amateurs" will prove helpful to as many thousands as has "Experimental Science."

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1452, contains the usual variety of instructive articles. Mr. Frank C. Perkins presents an illustrated account of the use of electricity on Alpine railways. The use of the Parsons steam turbine in steamships is a probability that is discussed at length. A simple method of finding the capacity and horse power of pumps is outlined. The Eisemann and Bosch systems of electric ignition are described and clearly illustrated. Mr. Alfred Hands, in an excellent paper, enumerates some safeguards against lightning. Prof. Robert H. Thurston concludes his thoughtful paper on the "Functions of Technical Science in Education for Business and the Professions." J. M. Macfarlane has much to the point to say on the relation of science to common life. The Demeny contour indicator is described and illustrated. An article on the self-electrification of radium will doubtless be received with interest. How a lecture-room thermometer can be made is told in a very instructive article. The usual trade, electrical, and engineering notes are also published.

SCIENCE NOTES.

It has been stated by an eminent authority that the cyanide process "has done more than all other recent processes combined for cheapening the production of various metals, increasing the gold supply of the world, and advancing the standard of our progress and civilization."

The first recorded attempts to apply cyanide to ore treatment were by an inventor named Simpson, of Newark, N. J., who patented a process in 1885, followed by a process patented by Jules Rae, of Syracuse, N. Y., in 1887. The first really successful cyanide process applied on a large scale was that introduced by the McArthur-Forrest patent of the same year.

Curator Lucas of the National Museum, who went to Newfoundland a couple of months ago to obtain a plaster cast of a whale, has succeeded in his task. The cast is said to be the largest in the world, and when completed will be shipped to the museum. Later it will be duplicated and a replica sent to the St. Louis Exposition. It is seventy-nine feet long.

Definite words are necessary, says Engineering Record, for the expression of definite ideas. Hence scientific terms have to be employed. A term has one definite meaning which does not change with time. The rush of affairs drifts words from their original meanings, as ships drag their anchors in a gale, but terms sheltered from common use hold to their moorings forever. The word *let*, for example, has drifted in two hundred years from meaning *hinder* until now it means *permit;* but the term *bisect* has remained unaltered in significance for centuries.

Since the American occupation of Cuba, yellow fever is gradually being eradicated. This remarkable sanitary change is due partly to the explosion of the old superstitious beliefs by the army surgeons and partly to a systematic extermination of the mosquito. Dissipating the common notion that yellow fever is a deadly filth disease, highly contagious, our army experts showed that yellow fever could be spread, and was actually spread, by the mosquito. Attempts at the extermination of the mosquito in Cuba have borne such fruitful results that it can hardly be questioned that in time the leading Cuban cities will be as free from yellow fever as our Southern ports.

The recent announcement of a mosquito destroyer is commented upon in Popular Science Monthly in no very uncertain terms. It is pointed out that the original paper published in Bulletin 13 of the Public Health and Marine Hospital Service hardly justifies the newspaper claims which were made for it. Dr. Stiles, the author of the investigation, simply discovered a new parasite of the mosquito, several of which were already known, and pointed out that these organisms might be of value in holding in check the mosquito plague. There are many technical difficulties in the way of a practical utilization of these "destroyers," and there was in the original article no intimation that the Public Health Service is breeding the germs in order to infect mosquitoes.

Charles E. Bessey of the University of Nebraska writes to Science of a cedar which he claims to be over one thousand years old, as follows: "In the Garden of the Gods, near Pike's Peak, Colorado, there are many large specimens of the brown cedar, *Juniperus monosperma* (Engelm.), Sargent, and in a recent visit to that place it occurred to the writer that these trees must be very old. On the 13th of August he was fortunate enough to find the stump of a recently-cut tree, on which it was easy to distinguish the annual growth-rings. These were counted for a section of the trunk, care being taken to select a portion in which the rings were of average thickness, and on this basis the number for the whole stump was calculated. In this way it was found that this particular tree was between eight hundred and one thousand years old. In other words, this tree was a seedling some time between the years 900 and 1100 A. D."

W. S. Hendrixson has studied the behavior of finely divided silver toward substances that readily give up oxygen such as chromic, chloric, bromic, iodic, and permanganic acids. In all the experiments silver was precipitated from an alkaline solution of silver oxide by formalin and afterward carefully purified. Both chloric and iodic acids are capable alone of oxidizing large quantities of finely-divided silver. Both acids react quantitatively upon silver, with the result that a molecule of the acid is completely reduced, and six atoms of silver are oxidized, one of which forms a halide, and five form silver chlorate or iodate. Bromic acid reacts in a similar manner. Dilute sulphuric acid alone is incapable of dissolving finely-divided silver, and the seeming solvent action is due to the oxygen of the air, oxygen dissolved in the acid, or to that derived from some external source. In the near future an attempt will be made by the author to ascertain whether by excluding extraneous oxygen, the actual oxidizing power of a bichromate solution may not be very accurately determined with silver.