in lighting and in operating the steering-gear and various auxiliary machines. On warships it will find a more extensive application. Although it will not supersede steam as a means of propulsion, it will be more widely used than at present in the manipulation of turrets, guns and ammunition hoists, and the operation of deck winches and boat cranes.

Electric communication on land, in spite of its phenomenal development, may still be vastly improved in economy. Our present system of rapid telegraphy is expensive; the sending of a message by wire is even yet far too costly for the ordinary affairs of mankind. If the twentieth century inventor will concern himself with increasing the efficiency and reducing the cost and expense of existing means of electric communication, he will confer more solid benefit than by solving the problem of electrical vision or elaborating a system of wireless telegraphy.

A NATIONAL NEED.

There has been submitted to Congress a bill which proposes to merge the Office of Standard Weights and Measures in a new bureau, to be known as the National Standardization Bureau, whose function shall consist in the custody of the national standards; the comparisons of standards used in scientific investigations, engineering, manufacturing, commerce and educational institutions with the standards adopted or recognized by the government; the construction, when necessary, of standards, their multiples and subdivisions; the testing and calibrations of standard measuring apparatus; the solution of problems which arise in connection with standards; the determination of physical constants and the properties of materials, when such data are of great importance to scientific and manufacturing interests and are not to be obtained with sufficient accuracy elsewhere. The bureau is to exercise its functions for the government, for any State or municipal government within the United States, or for any scientific society, educational institution, firm, corporation or individual engaged in manufacturing or other pursuits requiring the use of a standard measuring instrument.

The importance of this bill is evident from a brief review of the conditions which call for the establishment of a bureau of this kind. It has always been acknowledged that the selection and care of the original standards of length, mass, capacity and temperature, to which subjects attention, until recent years, has been almost exclusively confined, is one of the most important branches of scientific work that comes under the control of the government. The remarkable developments which have taken place of late years in pure and applied science have enlarged the field of such duties, until it now includes so many branches of physical and chemical research as to call for a complete laboratory, furnished with means for making the most refined measurements known to modern science, if the proposed Standardization Bureau is successfully to cope with its duties.

Germany, England, Austria and France have established bureaus and departments, more or less of the kind contemplated in this bill, and it only requires a study of the duties of these institutions, and the generous appropriations granted for their maintenance, to be satisfied of the importance, in foreign eyes, at least, of problems pertaining to standards and standard measuring apparatus. The necessity for a United States Bureau is proved by the extraordinary rapidity with which institutions of learning, laboratories and scientific societies are being established throughout the country, the rate of their growth never having been equaled in the history of any other nation. The work done in these institutions requires reliable standards for which, at present, they are obliged to go abroad. The introduction of accurate scientific methods into our various industries moreover, calls for a multitude of standards of far greater accuracy than was formerly required. Thus to secure the most economical results it is often necessary to have an accurate knowledge of the high temperature of a furnace, or the low temperature of a refrigerating process; while important commercial transactions are based upon the reading of electrical apparatus, inaccuracies in which would result in great injustice and financial loss. There is a call, moreover, for many standards and instruments of precision in the different scientific departments of the government. Further proof of the necessity for this bureau is found in the recent acquisition of territory by the United States, which will involve readjustment of the system of weights and measures in the countries affected.

Hitherto the manufacturing of scientific apparatus and instruments of precision has been confined almost exclusively to foreign countries, although it is satisfactory to note that this country promises before long not only to be able to supply its own needs, but to produce instruments fully equal to the best of foreign makers. It is absolutely essential, however, if American manufacturers are to secure the requisite degree of uniformity and accuracy, that they have access to a standardizing bureau such as is provided for the manufacturers in other countries. It is sincerely to be hoped that Congress will look favorably upon this bill and not only enlarge the function of the present office of Standard Weights and Measures, but provide it with an adequate laboratory, equipment, and working force.

THE METHODS EMPLOYED BY THE ASSAY COMMISSION.

BY MARCUS BENJAMIN, PH.D.

Each year the President of the United States appoints through the Director of the Mint, a Commission consisting usually of fifteen persons, with the Judge of the District Court for the Eastern District of Pennsylvania, Controller of the Currency, and the Assayer of the assay office in New York, ex-officio, which is required to meet in Philadelphia on the second Tuesday in February for the purpose of examining the fineness and weights of the coins reserved by the mints in Philadelphia, San Francisco, New Orleans, and Carson City. An appointment to serve on this Commission is an honor highly appreciated by the scientific men of the country, and on the list of those who have served since its creation in 1874 may be found the names of many of our best known chemists and physicists.

The present writer has had the good fortune to meet with the Commission on two occasions, and believing that the readers of the SCIENTIFIC AMERICAN would be interested in learning something of the methods by which the government certifies to the public that the high standard of its coinage is preserved, the following has been written:

The Commission meets at the time appointed in the long room of the mint in Philadelphia where the coin collection is kept, and after organizing under the chairmanship of the Judge of the Eastern District of Pennsylvania, three committees are named, as follows: One on counting, one on weighing, and one on assaying, and then the Commission adjourns until such time as it shall be convenient for the committees to make their reports. Almost immediately after adjournment of the Commission, the counting committee assembles, which consists of the members of both the assaying and weighing committees, and to them are given the sealed packages containing samples from the several mints.

Each mint is by law obliged to take assay pieces from each coinage in each month in the proportion of one for each one thousand pieces, or any fractional part of one thousand pieces, in the case of gold coins; and of one for each two thousand pieces, or any fractional part of two thousand pieces in the case of silver coins. These are sealed in an envelop and shipped quarterly by express to the mint in Philadelphia, where they are carefully preserved in a pyx, under the joint care of the superintendent and the assayer to await examination by the Commission.

The committee on counting proceeds at once to open these envelops and verify the count which is indicated on the outside of the envelop. This operation generally requires two days, and in the case of the Mint Commission that met in February this year, it was said that 41,271 pieces of money, both gold and silver, representing a value of $125,103, were submitted before the Commission.

While this money is being counted samples are selected for the use of the weighing committee, and also for the assaying committee. Those taken by the weighing committee are removed to the balance room where, under the direction of the chairman, they are carefully weighed on a large delicate balance, precaution being taken in the first instance to carefully test the weights by a set of standard weights, the accuracy of which has been previously testified to by a certificate from the Bureau of Weights and Measures of the United States Coast and Geodetic Survey.

The following deviations are allowed: In the double-eagle and the eagle, one half of a grain; in the half-eagle, the three-dollar piece, the quarter eagle, and the one-dollar piece, one-fourth of a grain. In the silver coins the deviations are as follows: In the dollar, the half, and the quarter dollar, and in the dime, one and one-half grains.

The work of the assay committee is more complex, and it requires several days for its completion. Samples having been taken of the different coinages, beginning with the gold, these are then removed to the assaying department, where a piece of each coin is selected. Pieces representing about a quarter of the coin are struck off with a cold chisel. These pieces are then rolled out and numbers stamped on them, after which they pass to a special weighing room, where one-half of a gramme of gold is weighed from each sample. Sets of fourteen are generally taken, and of these two are of pure standard gold. The weighings are wrapped in a lead sheet with a certain proportion of silver, and the little cornets, as they are called, are then taken to the assay furnaces, where they are cupeled; that is to say, placed in small bone ash cup which absorbs all of the lead and other impurities. The silver button is taken from the cupel when cold, and after all adhering dirt is removed, is rolled into a convenient shape and then twisted into a little coil which is put into a small metallic basket. These baskets contain a number of apartments, and when the proper number has been obtained, the entire basket with its contents is deposited in a bath of nitric acid. This dissolves out all of the silver, leaving the gold in its purity. The gold thus obtained is then weighed, and the result represents the actual amount of gold contained in the sample. By this means the commission, knowing the original weight of the sample, and having extracted all the impurities are able to tell exactly the proportion of gold contained in the coin, or as it is commonly called, the "fineness." The two samples of pure gold serve as a check on the process, and are also used as a means of correcting the slight differences due to the conditions of the furnace, i, e., too great heat, or not enough. By reference to the Report of the Proceedings of the Assay Commission for 1899, the first four specimens of eagles from Philadelphia showed a fineness of 899·6, 899·8, 899·7 and 899·8.

When the samples of the gold coinage have all been assayed the committee then takes up the silver, the assay of which is accomplished in the following manner: As was the case with the gold coinage, samples of each denomination are selected and pieces from each coin are cut with a chisel. These samples are then rolled out and numbered by means of a punch, after which they are sampled by means of a punch which strikes out a number of small pieces a little larger than the head of a pin. Eleven and one-half grammes are then weighed and put into stoppered eight-ounce bottles into which 10 cubic centimeters of nitric acid are dropped. The bottles are then heated so as to dissolve the silver, after which, when they are cooled, 100 cubic centimeters of standard salt solution is added for the purpose of precipitating the silver. The bottles, in sets of twelve, are placed on a shaker which is operated by power and thoroughly shaken for four minutes in order that all of the silver may be separated in the form of chloride from the solution. The small remaining fraction of silver is then precipitated with a decinormal solution of salt, by means of which the exact proportion of silver is determined. The expert who finishes the operation possesses a very accurate eye, and, by adding a drop more or less of the standard solution, is able to tell to within a tenth of the exact amount of solution required to entirely precipitate the silver. In this case, as with the gold, two specimens of standard pure silver are carried through the operation in order to check the result.

On the completion of the work of the weighing and assaying committee, the Commission is again convened, and the reports of the different committees submitted, after which every member of the Commission is required to sign the report. A pleasing feature of the experience is that at the close of the meeting the superintendent of the mint presents each member of the Commission with a handsome medal that has been prepared for the occasion, containing the head of the president on one side and an appropriate symbolical design on the other, in recognition of his services.

A SPEEDY BUSINESS TRANSACTION WITH CHINA.

It is a trite saying that we have annihilated space by the submarine cable. The remarkable ease with which business can be transacted with the Antipodes was shown a short time ago in the case of a Chinese client of the SCIENTIFIC AMERICAN Patent Agency, residing in the interior of China. He had given instructions that he was to be cabled to when his patent was allowed. He was cabled on the third of May, the rate being $1.60 per word: on May 7, a firm of New York bankers paid the funds necessary for the filing of several foreign patents, the instructions having come from Hong Kong by cable. In the four days that had elapsed between the sending of the cablegram and the paying of the money, messages were transmitted over a distance almost as great as the circumference of the earth at the equator, and had the business been transacted by mail the shortest time by the postal routes would have been fifty days provided that close connections were made.

EXCAVATIONS have been instituted on the site of ancient Knossos near Candia and the remains found are important. Mr. Hogarth has discovered a Mycenæan building on the hillside opposite the famous "Palace" site at Kephala, it seems to consist, as far as it has been cleared, of three halls, in two of which stand square pillars, a feature not hitherto apparent in structures of this period, except in a rude form at Phylakopi, in Melos. The walls were faced with thin slabs of white gypsum, many of which remain in their place, and the floors are paved with similar slabs. In what was apparently the tank of the house were found about forty vases, mostly capable of restoration and all in pre-Mycenæan. In the building itself have been found several gems and beads, obsidian tools and miscellaneous objects, besides hundreds of fragments of Mycenæn vases, which are more varied and elaborate in in design than any yet discovered even at Mycenæ. The building contains no trace of anything Roman or Greek. Preliminary excavations at Kephala were begun on March 27.