gained in the course pursued at some colleges. The pupil may object to menial duties, but it is necessary to do such things when told by the foreman, if only to gain their confidence. Providing he does his work accurately and moderately quickly, he will soon be asked to undertake more difficult work. The discipline exercised in the works, the thorough, systematic, and accurate way in which things are done, the strict attention to all small matters of detail, and the habit of punctuality acquired, will do much to form the character and fit the pupil for further pursuing his studies, conducting himself, and controlling assistants in after life.

On the termination of this mechanical apprenticeship he may at once become a student with a civil engineer, or he should go to some good scientific college. Care must be taken not to overtax the mind, and to keep the body in good physical training. The student may now be considered to have completed his preliminary training, but his education as an engineer will only be terminated by death.

NEW YORK ACADEMY OF SCIENCES.

A meeting of the Chemical Section of the New York Academy of Sciences was held Monday, December 10, at the Stevens Institute of Technology, Professor Newberry presiding.

DISCOVERY OF NEW ELEMENTS.

An important letter from Professor G. A. Koenig of the University of Pennsylvania was read, in which he makes the following communication: "I am engaged and have been for a considerable time past in a study of titanium. The investigation is one absorbing much time and the progress is very slow. My results hitherto obtained convince me that all natural Ti O_2 is capable of being separated into compounds yielding different reactions, and hence that titanium must be considered as composed of two metals at least, but I think three. The trimorphism of Ti O_2 led me into this investigation and will find finally its explanation in the above sense. I am unwilling however to publish partial results."

Professor Henry Wurtz of Hoboken exhibited some curious specimens of flint, whose density he had carefully determined and which he had thus found to contain the "opal molecule" instead of that of ordinary silica. He also exhibited a number of shells.

The first paper read was entitled Contributions from the Laboratory of the University of Minnesota, by Professor S. F. Peckham.

ANALYSES OF THE ASHES OF WHEAT BRAN.

A substance having the appearance of a vesicular limestone and stated to be the ash of wheat bran that had been placed under a boiler was analyzed by Miss Cora I. Brown in the University laboratory. It was of a uniform gray color, appeared to be completely fused and had a density of 2·34 and a hardness of 3½–4. Its composition was found to be

Potassium Chloride.....	K Cl	1·2887 per cent
" Silicate	$K_4 Si O_4$	2·5936 "
" Phosphate	$K_3 PO_4$	5·8337 "
Sodium "	$Na_3 PO_4$	11·7370 "
Hydrogen " ...	$H_3 PO_4$	9·3721 "
Calcium "	$Ca_3 P_2 O_8$	18·2342 "
Magnesium "	$Mg_3 P_2 O_8$	41·4600 "
Ferric "	$Fe_2 P_2 O_8$	3·8058 "
Calcium Sulphate.....	$Ca SO_4$	1·9567 "
Water (hygroscopic).....	$H_2 O$	·4379 "
Sand and insoluble residue.		3·1700 "
		99·8897

The professor bestowed the highest praise upon the above determination by Miss Brown, as having been performed by the most accurate and skillful manipulator he ever had under his instruction.

ANALYSES OF GLAUCONITE.

An analysis was made of a species of glauconite imbedded in what is called the St. Laurence limestone, found at several points in the valley of the Minnesota river and quarried for a building stone. This is a hard silicious limestone containing sufficient iron to give it an ocherous shade of color with yellowish streaks. The glauconite is distributed through this rock in the form of small green grains which are obtained by dissolving the stone in hydrochloric acid and separating them from the undissolved quartz. Their composition was found to be: Si O_2, 48·20 per cent; Fe O, 27·09 per cent; $Al_2 O_3$, 6·94 per cent; $K_2 O$, 7·54 per cent; $Na_2 O$, 1·02 per cent; $H_2 O$, 8·72 per cent; total 99·51.

THE RUSSELL MINERAL SPRING.

The analysis of a clear and sparkling water of a slight greenish color and hydrosulphuric acid taste, taken from the cellar of a house in Minneapolis, proved it to contains Ca CO_3 Mg CO_3, NCl, Ca SO_4, Si O_2, Mn CO_3, Fe CO_3, Ca Cl, KCl, $Ca_3 (PO_4)_2$, with traces of other substances, amounting in all to 19·065 grains in a gallon of 231 cubic inches. It has a temperature of 45·5° F., at which it contains 15·386261 cubic inches of free CO_2 in solution. The amount of $H_2 S$ varies from a trace to a few cubic inches per gallon. The reputation which this water has attained as a remedial agent may be in part due to the presence of the relatively large amount of calcium phosphate, or it may be due to the peculiar combination presented by the simultaneous presence of phosphate of lime, protocarbonate of iron and sulphide of hydrogen. It may be said, however, that the causes producing certain physiological effects are very obscure; and when these effects are observed to follow the use of complex mixtures dissolved in large quantities of water, but little satisfaction can be gained from theoretical speculations of one or the other ingredient of the mixture. But little more can be said than that the water contains small quantities of substances, that give, when found in large proportions, the specific characters to seltzer, chalybeate and white sulphur springs, and that its use in many instances has been attended with beneficial results.

The reading of the above paper was followed by illustrations of

SOME RECENT DEVELOPMENTS OF THE SINGING TELEPHONE,

by President Henry Morton. He described briefly a series of experiments made under his direction at the Stevens Institute by Messrs. Geyer, Beckmeyer and Ayres. Taking the mouthpiece of Reiss as a starting point, they tried a great variety of materials to receive the impulse of the voice, and finally concluded that the best results are produced with common note paper. To increase the volume of the sound received, sounding boards of musical instruments were tried and a guitar was found to be best adapted. The professor exhibited several telephones made on this principle. A strip of iron is cemented to the guitar and the poles of the magnet are placed opposite this strip and as near it as possible without actually touching. By the aid of a current from a very weak battery a tune sung in another room of the Institute was transmitted through half a mile of wire to the guitar receiver and became distinctly audible, filling the large hall without difficulty. The same effect is produced with an intermittent current from a coil and break circuit.

Professor Albert R. Leeds followed with a series of communications on the examination of drinking water.

RELATIONS BETWEEN FISH AND PLANT LIFE AND THE POTABILITY OF DRINKING WATER.

The subject of the wholesomeness of drinking waters was brought prominently before the public of this section by the excessive mortality of the fish in the Passaic river during last June. This appeared of such importance to the professor that he made two visits to Paterson to collect information. No naturalist appears to have examined into the nature of the disease. Its external indication was the formation of a soft spot on the side of the fish, and death speedily followed the rapid growth of this spot. That the refuse of factories was not the cause was plain from the fact that fish had died in great numbers above the Falls even in the tributaries of the Passaic, and also in isolated bodies of water like Rockland Lake. Mr. John Roe, one of the fish wardens, stated that the water was unusually low during the epidemic and the weather had been excessively hot. Where the disease was most prevalent, the depth of the water varied from 3 to 8 feet. It appeared also that at this time unusual amount of aquatic plants of a low order had invaded the stream. The following inferences may be drawn: 1. That the rapid development of vegetable growth may be attended with the production of spores or gemmicles forming a specific poison to fish life. 3. That the organic impurities arising from the action of the sun upon shallow water and the gases evolved may originate disease. 3. The supply of oxygen might fall below the point requisite to the support of life by being consumed in the oxidation of vegetable matter; by the partial exclusion of the air from the water by the crust of floating algæ; and by a diminution in the supply of highly aerated water from higher levels by reasons of the draught. A very heavy rain put an end to the epidemic. The third hypothesis seems the strongest. During the prevalence of the epidemic no complaint was made at Paterson, Newark, Jersey city, or Hoboken, in reference to the appearance, taste or smell of the water.

Disagreeable smells in water may be due to several lyngbyæ and oscillatoriæ which produce an indescribably suffocating odor; to some species of beggiatoa which emit a sulphurous exhalation; or to certain species of decaying nostocs, whose odor resembles that of the pig pen. These are oscillatoriæ which appear as bluish green masses on mud or shallow water. A thorough study of the fresh water algæ will be found of the utmost importance in the solution of the problem of water purification.

The "combustion process" is the best method of chemically determining the true nature of organic impurities in water, and an organic analysis of the residue the true ground of comparison between waters, whether impure from natural or artificial sources. The determination of the dissolved oxygen may also be of much sanitary importance.

The paper concluded with

NEW METHODS OF DETERMINING AMMONIA, CHLORINE, NITRIC AND NITROUS ACIDS IN DRINKING WATER.

Having shown that Bunsen's method of determining ammonia by the use of iron and platinum leads to erroneous results from the presence of nitrogen in iron which is not perfectly pure, Professor Leeds described the following ingenious method of detecting minute quantities of ammonia. The distillates from different samples of waters are placed in test tubes and diluted to the same volume. A small quantity of a standard solution of iodide of mercury in water containing iodide of potassium is then added, and the faint yellowish coloration so produced is compared with that obtained in a series of solutions containing known quantities of ammonia. Instead of using the latter, a much more rapid comparison is effected by means of a wedge-shaped prism filled with a liquid of the same tint. The test tubes are placed in a rack provided with mirrors, so that the light transmitted through the solutions may be compared with that transmitted through the prism. The latter is then moved to and fro until depth of the tints produced is the same. The amount of ammonia corresponding to the thickness of the prism is then read off on a carefully prepared scale. By means of this apparatus the writer just determined the presence of ·000035 of a gramme of ammonia.

SILVERING GLASS.

In reply to various correspondents who are desirous of ascertaining the best methods of coating glass with silver, we would say that we give in our SUPPLEMENT of this week (No. 105) a collection of the best methods, all of which we think will be found practical and useful. The method described by Chapman will be found especially convenient. By its use almost any experimenter, old or young, may make excellent mirrors, either of plane, concave, or convex glass, and produce a great variety of silver ornamentation for home objects, that will well repay the trouble, and in some cases result in substantial profit.

Professor Huxley on Technical Education.

Professor Huxley has recently delivered a lecture on technical Education before an English working men's association, in the course of which he gives his views as to what working men should know. He defines technical education as the teaching of handicrafts, and the requirements thereof he sums up to be reading, writing, and ciphering, a taste for one's calling, an acquaintance with the elements of physical science, a knowledge of a foreign language, and the scrupulous avoidance of the practice known as "cramming."

As to the means for carrying out this ideal education, Professor Huxley strongly advocates the more extended teaching of natural science in the public schools, and he thinks that the mode of instruction should be especially practical and experimental. He also recommends some special means for utilizing in the public interest unusual talent or genius found in schools.

It was Edward Everett, we believe, who regarded anyone who could read, write, and cipher as well educated, and if to that a knowledge of a foreign language was added, the education, he considered fine. Professor Huxley goes a step beyond this, it would seem; and besides his recommendations while excellent, appear rather too general to be susceptible of ready practical application.

The New Museum of Natural History in New York City.

The new American Museum of Natural History, the corner stone of which was laid by Ex-President Grant in 1874, was formally opened recently by President Hayes. The ceremonies consisted in addresses by the President of the Board of Trustees, the President of the Association for the Advancement of Science, and others.

It is not generally known that the fine structure now open, and which is located at 77th street and Eighth avenue in this city is but a small portion—one eighteenth—of the colossal edifice ultimately to be erected. Four entire city blocks have been purchased and set apart for the building, which will be 850 feet wide and 650 feet long, surmounted by a dome 120 feet in diameter. The structure now finished contains the various collections of objects of natural history hitherto kept in the Arsenal in Central Park, besides a large number of new and rare specimens lately added. It is of brick trimmed with granite, and is 70 feet wide and 200 feet long. There are four exhibition stories, and the entire structure is built of iron, concrete and other fireproof material.

A Remarkable Little Steamer.

The small steam yacht Estelle was lately tried at Bristol, R. I., under the direction of Mr. C. E. Emery, C.E. The test lasted eight hours through the waters of the bay as far at times as Beaver Tail, where they met quite a heavy sea.

The thermometer stood at 35° Fah. when the torch was applied to the furnace fires. In four minutes afterward the engines worked water out of her cylinders, with a steam pressure of 25 lbs. to the square inch. One minute later the large cylinder moved. At the expiration of ten minutes from the time the fires were lighted, the Estelle had been backed out of the wharf, turned, and was on her course. During the trip of eight hours she made 103 statute miles, including five sharp turns. Her average pressure of steam was 65 lbs. only, at a temperature of 345°. Her average revolutions of propeller per minute were 130. The expenditure of fuel was considerably under two tons.

On the return trip, after the course to be run was finished, the blower was put on the fire, running steam up to over a hundred pounds, and the little craft showed her heels on a spurt at the rate of sixteen miles an hour.

AMERICAN LOCOMOTIVES FOR RUSSIA.—We understand that the Baldwin Locomotive Works, Philadelphia, Pa., are now proceeding with the construction of fifty large-sized, first-class locomotives, lately ordered for Russia. They are to be completed during March next. In all, nearly 2,000 men will be required on the job, for which about $500,000 are to be paid.

NEW STEAM FOG WHISTLE.—A new fog whistle was lately tried at Bristol, R. I., and in just four minutes after the fire was lighted, it gave a blast which was heard ten miles distant.

SUCCESS OF THE PHONOGRAPH.—Mr. Thomas A. Edison, the inventor of the talking phonograph which we recently described, informs us that he has constructed a new and larger machine which not merely speaks with all the clearness which we predicted would be obtained, but loud enough to be audible at a distance of 175 feet.