vantage of this system, claiming that they practically obtained one horse power per pound of coal per hour, whereas about two and a half pounds of coal per horse power per hour is required in some of the best patterns of marine engines and boilers. The radical change which such success as this would cause in all steam engineering must at once be perceived, and the preliminary trials made in England, as well as the practical demonstration of the system afforded by the voyage across the Atlantic, seemed to bear out the conclusion that something at least approximating to what was claimed for this machinery had been obtained, under circumstances which made the tests substantially complete.

In view of the importance of the matter, therefore, the Secretary of the Navy, in August last, ordered a trial to be made, by a Board of United States Naval Engineers, of the machinery of the Anthracite, and their report has just been submitted to the Department at Washington. The Examining Board consisted of three Chief Engineers of the Navy—Messrs. C. H. Loring, S. P. L. Ayres, and George W. Magee—assisted by three assistant-engineers, for making and recording observations, and taking indicator diagrams, and the trial continued through twenty-four consecutive hours. The water evaporated by the boiler was carefully measured, and the coal used was accurately weighed. The vessel was made fast to the wharf at the Navy Yard, Brooklyn, N. Y., and the test was particularly directed to ascertaining the horse power obtained from the known consumption of fuel and evaporation of water. The following were the results, as given in the *Evening Telegram:*

	Pounds.
Total quantity of coal consumed	4,400
Total quantity of feed water pumped into boiler	35,114
Average steam pressure in boiler	31½
Average vacuum in the condenser, in inches	26¼
Average pounds of coal consumed per hour	183½
Average pounds of coal consumed per hour per square foot of grate	11·98
Average indicated horse power	67·7081
Pounds of coal consumed per hour per indicated horse power	2·7115
Pounds of feed water consumed per hour per indicated horse power	21.63875

It will be seen that, in this trial, so far from obtaining one horse power per pound of coal per hour, it required nearly 2¾ lb. of coal per horse power per hour. This result is attributed principally to the fact that the steam pressure was comparatively low. In the former trials, and on her voyage, about 450 lb. pressure was maintained, and the machinery is especially adapted to work constantly at a pressure as high as 500 lb. without any undue strain or wear. A further explanation is found in the fact that the Cumberland bituminous coal was used in the Navy Yard trial, while Nixon's steam navigation coal was used in the English tests. One object of the voyage of the Anthracite over here was to test the capacity of her machinery with the employment of different kinds of coal. The furnaces had been theretofore worked principally without any artificial blast, although she is fitted up with a fan blower to be used for obtaining high pressure, or should it be desirable from the nature of the fuel. It was especially intended to experiment with anthracite coal, but it will be readily understood that, in experiments with these different kinds of fuel, extending over only a brief period, the economic results obtained are not to be fairly compared with what might be achieved under a longer experience. In every other respect the trial was a decided success for the Anthracite's machinery, and it is to be regretted that the experiments were not continued long enough to practically demonstrate whether the Perkins system would or would not do all that is claimed for it.

PROGRESS IN AMERICAN TELEGRAPHY.

The annual report of the president of the Western Union Telegraph Company for the year ending June 30, 1880, furnishes many figures of interest to others than the stockholders of the company. The latter, however, appear to have no reason to complain, the net profits of the company for the year footing up over $5,000,000, the capital stock of the company being about $41,000,000. The net profits for the fourteen years from 1866 to 1880 exceed $45,000,000. The telegraph business of the year is represented by 29,215,509 messages, $12,782,894.53 receipts, $6,948,956.74 expenses, and $5,833,937.79 profits. The company has in operation 85,645 miles of line, 233,534 miles of wire, and occupies 9,077 offices. The new offices established and equipped during the year number 543. The number of messages sent was over 4,000,000 more than the year before. The increase in mileage of wire was 22,000 miles; the increase in miles of pole lines was 2,658. The ratio of expenses was 54 3-10 per cent of the receipts, against expenses of 56 2-10 per cent the previous year, and of 63 9-10 per cent the year preceding that, and the cost per message reduced to the average of 22 3-10 cents, against 23 1-10 cents the previous year, 25 cents the year preceding that, and 29 8-10 cents the year ending in 1877.

THE NATIONAL ACADEMY OF SCIENCE.

The regular November meeting of the National Academy of Science began in this city Nov. 16. This meeting is always devoted to purely scientific subjects. Among the papers read were:

"Report on the Dredging Cruise of the United States Steamer Blake, Commander Bartlett, during the Summer of 1880," by Prof. Alexander Agassiz; "On the Origin of the Coral Reefs of the Yucatan and Florida Banks," by Prof. Alexander Agassiz; "On Some Recent Experiments in Determining the Electromotive Force of the Brush Dynamo-electric Generator," by Prof. Henry Morton; "Measurement of New Forms of Electric Lamps Operating by Incandescence," by Prof. Henry Morton; "On the Intimate Structure of Certain Mineral Veins," by Prof. Benjamin Silliman; "Mineralogical Notes," by Prof. Benjamin Silliman; "On the Relationship of the Carboniforus Euphoberia to Living and Extinct Myriapods," by Prof. S. H. Scudder; "The Basin of the Gulf of Mexico," by Prof. J. E. Hilgard; "Observations on Ice and Icebergs, and on the Duration of the Arctic Winter," by Lieutenant Schwatka; and "The Turquoises of New Mexico," by Prof. Silliman.

The papers by Professors Agassiz and Hilgard add materially to the knowledge of our South Atlantic Coast, the Gulf of Mexico, and the Caribbean Sea.

Speaking of the work begun last June, south of Cape Hatteras, on a line parallel with the coast and about 120 miles distant, Professor Agassiz said that instead of finding a gently sloping sea bed, as has heretofore been supposed to exist in these latitudes, the dredgers discovered what proved to be a continuation of the plateau the northern portion of which is known to extend as far as Cape St. George, its southeasterly limit resting, it is supposed, on the Bahama Banks. The western ledge on this plateau was examined during last summer's cruise, and proved very interesting from a geological point of view. The eastern slope has not been traced. Its exact limits are a matter of conjecture, but are to be determined in next year's cruise. The sides of this plateau are steep. Three ship's lengths from a point where a depth of 100 fathoms had been reached, the sounding apparatus did not strike bottom until 450 fathoms of the line had been paid out. The most animal life is found on the edge of the plateau. The character of the animals is, on the whole, the same as that of the species found in the Gulf of Mexico and the Caribbean Sea. The edges are composed of rich deposits of alluvia and mud, washed from the top of the plateau by the action of the Gulf Stream, the course of which extends over the entire length of this Atlantic plateau. The expedition found at the outfall of the Gulf Stream a wealth of marine life larger than at any point in the tropics. The deposits of numerous rivers flowing into the Atlantic Ocean serve to enrich the western slope. The plummet would sometimes sink from 18 to 20 feet into the slimy deposit. The fauna of this region was remarkable rather for its immense quantity than for the number of species. Under the strong current of the Gulf Stream the plateau was almost entirely bare of animal life. In summing up the results of the cruise Professor Agassiz spoke of the great success of the expedition, and said that their facility in dredging had become something extraordinary by long practice, and the work they had been able to accomplish in six weeks was wonderful. When the Blake made her first cruise one haul a day was considered pretty active employment; the last day they were out this summer they made eight hauls.

In his second paper Professor Agassiz directly combated the theory of Darwin's, ascribing the production of atolls to continuous subsidence. The reefs and atolls of Florida and Yucatan furnish abundance of evidence of such formations where there has been no subsidence.

The first note of dissent from Darwin's theory was sounded in 1851, when Prof. Louis Agassiz, accompanying the Gulf Exploring Expedition, examined the structure of the Florida reefs. The only strict atoll observed was one forming on the Florida coast, which had been fully investigated by the expedition. After giving a brief history of opinion on this subject, and explaining in connection with it the structure of the Alacran reef now forming off Yucatan at a point about equidistant between the one hundred fathom line and the northwest shore of the peninsula, Prof. Agassiz instanced the latter as an illustration of what is going on upon a gigantic scale on the Florida coast, along the Windward Islands, on the coast of Cuba, and off the peninsula of Yucatan. The formation of the peninsula of Florida south of 87° north latitude, and that of a portion of the Island of Cuba, as well as the structure of the Florida and Yucatan banks, were embraced within the scope of the paper. Prof. Agassiz conceived that the foundation of the Florida and Yucatan peninsulas was laid either by volcanic action or by an original folding of the crust of the earth, and the inquiry must consequently start with the time when this substratum was laid. In order that the coral reefs might grow upon these submarine plateaus there must be a certain depth of water—about 90 feet—and there must be a sufficient drift and deposit of food at the points where they were found. From about latitude 37° the whole southern portion of Florida was built up by coral action. It was easy to understand from what sources the food supply was derived for these submarine island builders. The prevailing winds of this region come from the northwest, carrying a current along with them that floated upon its surface vast amounts of the sediment of life from very distant coasts, and here the sediment sank, some of it having traveled from as distant points as the shores of Africa. The current having passed over the Florida projection struck the Yucatan bank, and was thence reflected, leaving a large deposit along the margin of the reefs to feed the busy builders engaged beneath.

The manner in which the limestone deposit was laid upon the submarine plateaus formed by original upheaval of the earth's crust, or by volcanic agency, was next taken up and discussed. Upon the tops of the plateaus thus formed, said Prof. Agassiz, lived innumerable colonies of star-fishes and sea-urchins, which left behind, from age to age, their limestone skeletons. Mr. Murray had calculated from data obtained during the voyages of the Challenger that every square mile of the sea contains from two and a half to three tons of limestone. Thus these plateaus were raised little by little until their altitude was such that coral settlements could be established, and these little creatures could grow and build.

Professor Hilgard began by reviewing the history of the exploration of the basin of the Gulf of Mexico and its approaches since 1846. The systematic prosecution of the work did not begin until 1872. A relief model of the basin was exhibited together with a map.

The area of the entire Gulf, cutting it off by a line from Cape Florida to Havana, is 595,000 square miles. Supposing the depth of the Gulf to be reduced by 100 fathoms a surface would be laid bare amounting to 208,000 square miles, or rather more than one-third of the whole area. The distance of the 100 fathom line from the coast is about 6 miles near Cape Florida; 120 miles along the west coast of Florida; at the South Pass of the Mississippi it is only 10 miles; opposite the Louisiana and Texas boundary it increases to 130 miles; at Vera Cruz it is 15 miles, and the Yucatan banks have about the same width as the Florida banks.

The following table shows the areas covered by the trough of the Gulf to the depths stated:

Depth.	Area.	Differences.
2,000 fathoms.	55,000 square miles.	
1,500 "	187,000 "	132,000
1,000 "	260,000 "	73,000
500 "	326,000 "	66,000
100 "	387,000 "	61,000
Coast line.	595,000 "	208,000

The maximum depth reached is at the foot of the Yucatan banks—2,119 fathoms. From the 1,500 fathom line on the northern side of the Gulf to the deepest water close to the Yucatan banks, say to the depth of 2,000 fathoms, is a distance of 200 miles, which gives a slope of five-ninths to 200, and may be considered practically as a plane surface.

The Yucatan channel, which is the feeder of the Gulf, has a depth of 1,164 fathoms and a cross section of 110·36 square miles; the Strait of Florida in its shallowest part, opposite Jupiter Inlet, with a depth of 344 fathoms, has a cross section of only 10·9159 square miles. As a consequence of this disparity the waters of the Florida Strait must show a greater velocity than those of the Yucatan channel.

Referring to the model, Prof. Hilgard called attention to the important fact that the depth of water off the mouth of the Mississippi was such as to warrant the conclusion that the jetties would always prove sufficient for their purpose.

Professor Morton's electrical papers, particularly the one on the Maxim incandescent lamp, awakened unusual interest. Mr. Maxim's method of building up and equalizing the resistance of the carbon filament of the lamp was described at length. The globe of the lamp having been filled with the vapor of gasoline, the electric current is turned on. Any unequal resistance in any part of the carbon causes that part to become incandescent before the rest. The result of this local heat is that the gasoline vapor is decomposed in the vicinity of this point, and its carbon deposited upon the very spot where it is wanted. This building up of any defective points until the whole filament is of the same temperature, forms the value of the invention. Professor Morton then gave the results of his experiments with a lamp arranged to run at a high candle power, say 1,500 candles. Run under such conditions as to give a light of 40 candles, the calculation showed a development equal to 240 candles per horse power. At 52 candles the rate was found to be 336 candles per horse power; at 12 candles, 136 per horse power; at 49 candles, 426 per horse power; at 98 candles, 607 per horse power. This was far inside of what the lamp would stand; he had himself run it up to 250 candles, and it was stated by the inventor that it was capable of 1,500 candles.

Perhaps the most important information presented to the Academy, during its earlier sessions at least, was Professor Wolcott Gibbs' new method of analyzing metals by electrolysis. His plan is to place the metal in solution in a beaker, add pure mercury, and connect the mercury with an electric battery. By the electric action the metal was thrown down upon the mercury and the beaker beforehand, and then after the process to determine the metal by again weighing the vessel and the mercury. This method, he said, was applicable to mercury, tin, cobalt, and other metals. It did not apply in arsenic and antimony. He did not despair of separating potassium and sodium by the process, although his experiments with these metals had not been completely successful.

Professor Hunt said this process came with the beauty and force of a revelation; its simplicity recommended it. Every chemist would await further developments with great interest. He also asked what battery power was used. Professor Gibbs said the power of the battery was immaterial, except in point of time. The stronger the power the shorter the time required for the process. With a power equal to a Bunsen battery of 40 or 50 cells he had precipitated 15 grammes of zinc from a solution in from 20 to 25 minutes. A battery power of two or three cells would probably precipitate 3 or 4 grammes of zinc in an hour.

A Cheap Book.

We were shown the other day a copy of an edition of the New Testament, published in London, and sold at retail for one penny (two cents). Mr. Elliot Stock is the publisher, and has sold already 400,000 copies. He expects within a year the sale will number 1,000,000 copies.