sumption of gas was 20.45 cubic feet per horse-power hour. Gas costs $1 a thousand feet or less. It is proposed in this city to install in each pumping station three 1,500-horse-power units, or 4,500 horse-power, and to erect three or more stations in Manhattan and two perhaps in Brooklyn. Gas, on a basis of 20 cubic feet per horse-power hour and $1 per thousand, would cost 2 cents a horse-power hour, or $90 an hour for each station. Ten hours a month would make the fuel cost $900 per station.

The lowest price at which electric current is sold in this city is 5 cents a kilowatt. At this rate, and allowing nothing for loss in converting the current into power at the motor, the supply would cost $1,687.50 for 10 hours' use per month per station, or nearly double the cost of gas. With five stations of the size mentioned, the difference in cost would amount in a year to $46,050.

Gas engines of 1,500 horse-power are already built and in successful use, and their adaptability to fire service has been demonstrated. Electric motors of that size would be an experiment, although they could undoubtedly be successfully built and operated.

One other matter deserves consideration. This is the source of supply. No one questions the ability of the gas companies to furnish all the fuel that might be required, even if the whole power of every pumping station were required for many hours at a time. Gas can be had and is stored in vast quantities.

Electrical conditions are different. It is a grave question whether any producer of electric current would be willing to have the fire pumping stations as customers at any price as a commercial proposition. Some of them might be willing to supply the current from motives of civic patriotism.

The proposed pumping stations would be the worst kind of customers from the commercial point of view. They would ordinarily take no current, and, when they did demand power, would require it in enormous quantities. The demand would be as likely to occur during the hours when the ordinary drafts upon the power houses were at the peak as at any other times.

The report of the State Railroad Commission, made recently upon the condition of the street and elevated railroads in this city, showed clearly that there exists a great lack of electric power for ordinary purposes, especially in Brooklyn, and that no surplus of power is likely to exist for a long time to come. A sudden demand for 4,500 horse-power—just enough to operate one of the proposed stations—occurring in a busy hour would be a serious thing, and a demand for power to operate two or three such stations would at times tax the abilities of a combination of several of our largest stations.

THE BRITISH NAVAL PROGRAMME FOR 1904.

BY OUR LONDON CORRESPONDENT.

The British naval programme for 1904 is an expensive and elaborate one, the estimates for the ensuing year aggregating $184,445,000. This sum represents an increase of $12,160,000 upon the estimates for 1903, and is the largest sum ever voted by the British government for naval purposes for one year.

The sum to be expended upon the construction of new vessels is $58,370,880, which is also an increase of $7,588,730 upon that for 1903. Of this sum, however, $5,000,000 will be devoted to the completion of the purchase for $9,375,000 of the two vessels "Constitucion" and "Libertad" which were built for the Chilian government and which were recently secured by the British Admiralty.

One result of their purchase has been the modification of the shipbuilding programme so far as concerns the construction of battleships. Only two battleships, instead of three, are authorized for the ensuing year. The composition of the new programme is as follows: First-class battleships, 2; armored cruisers, 4; destroyers, 14; submarines, 10; making a total of 30 vessels to be added to the fleet.

During the past twelve months, from April 1, 1903, to March 31 of this year, the British navy has been augmented by 40 ships composed as follows: Battleships, 6; armored cruisers, 9; second-class cruisers, 1; sloops, 2; submarines, 3; destroyers, 11; torpedo boats, 8.

By April 1 of this year the following ships will be in course of construction: Battleships, 8; armored cruisers, 13; second-class cruisers, 1; third-class cruisers, 4; scouts, 8; destroyers, 23; submarines, 11; river gunboats, 6. Total, 69 vessels.

During the twelve months from April 1, 1904, to March 31, 1905, which is the official year of the British government, 32 of these vessels will have been completed and passed into the navy. This addition will be composed of: Battleships, 3; armored cruisers, 5; second-class cruisers, 1; third-class cruisers, 4; destroyers, 8; submarines, 10; river gunboats, 1.

In the two battleships authorized in the current programme, the Admiralty propose to introduce a new class of vessel to be known as the "Lord Nelson" class. The heaviest battleships at present in the British navy are those known as the "King Edward VII." class, of 16,350 tons, and approximate the "Connecticut" class at present being built for our own navy. Mr. Philip Watts, the British naval designer and director, however, has a firm confidence in the heavy battleships, and these new ships will surpass the "King Edward VII." class. Although the tonnage, and in fact any particulars concerning this new type of battleship are being withheld from publication, I am in a position to state that they will approach the 18,000-ton vessels which were described some little while ago in the Scientific American. Their armament will be particularly formidable, especially so far as concerns the secondary class. They will each carry eight 9.2-inch guns in addition to the four 12-inch weapons, with ten 6-inch quick-firers in the central battery. The protective armor will resemble that of the "King Edward VII." class, only it will be commensurate with the larger dimensions of the new ships. Each vessel will cost $8,000,000.

During the past year the construction of the eight vessels constituting the authorized number for the "King Edward VII." class has been hurried forward. This course has been decided upon so that the Admiralty may have a homogeneous squadron composed of boats of the same design, speed, etc., since experience has shown that four sister ships form a unit possessed of great tactical and administrative convenience. The vessels in this squadron will be divided into two divisions of four vessels each. One very prominent feature of the British naval department is the celerity with which the work of construction is undertaken in both the government and private dockyards. During the past twelve months the government dockyards have carried out their work so efficiently and expeditiously that the construction programme of last year had to be accelerated in order to keep the yards sufficiently provided with work. The armored cruisers which are to be laid down this year will be of the "Duke of Edinburgh" type, armed with six 9.2-inch guns, and ten 6-inch guns, with a speed of 22¼ knots.

Special attention is being devoted to the construction and equipment of the fleet with efficient submarines. The naval department is convinced that this type of vessel has a useful sphere of action. Prolonged experiments have taken place during the past twelve months with the submarines already in commission. The ten submarines projected in the current programme are to be built upon the designs formulated as the result of the experiments upon the designs prepared by Messrs. Vickers, Sons & Maxim, Limited, the constructors of the present submarines.

The construction of the destroyers is being delayed somewhat, as the Admiralty desire to prove the efficiency of the steam-turbine-propelled ship more completely, before they commit themselves definitely to any system of propulsion for these craft. The various tests with the "Velox" and "Eden," both of which are fitted with Parsons turbines, have not yet been carried out. Furthermore, there are two vessels in process of construction at Messrs. Palmer's Yarrow-on-Tyne shipyards, which are equipped with inclosed engines. Both of these systems of propulsion promise well, so that the Admiralty have decided to await events before deciding the question.

During the coming year the personnel of the navy will have to be augmented by 4,000 men to man the new ships, bringing the actual fighting strength up to 131,100 men. The naval reserve is being considerably strengthened by the establishment of numerous centers at various points round the coast, obsolete third-class cruisers being depositioned to serve as drill ships.

The present vessels in the fleet are also being extensively overhauled and modernized in accordance with present requirements as rapidly as possible. These ships are being practically reconstructed and provided with as formidable a modern armament as their capacities warrant.

During the past year experiments have been conducted incessantly with oil fuel. Progress has been somewhat slowly, but has been exceedingly sure. There are innumerable difficulties at present to be overcome if oil fuel is to prove possible, but these problems are being gradually surmounted. The British naval department is sanguine that oil fuel is destined to play a very important part in naval affairs. Simultaneously with these experiments the question of the storage of this fuel is being closely studied and developed. The experience gained in this direction with the battleships "Mars" and "Hannibal" with their cylindrical boilers has been utilized in connection with the Belleville boilers of the "Bedford."

At the same time the policy of composing the various squadrons into homogeneous divisions of battleships is being zealously pursued. This is particularly the case concerning the Channel, Mediterranean, and China fleets. It is recognized as imperative, if a squadron is to prove efficient, that all the ships should be standardized as regards their speed, etc.

SCIENCE NOTES.

Comparing the values found for the heat of combustion of compounds of the fatty series with the figures for the heat of combustion of the cyclic compounds of the same molecular weight as the former, P. Zuboff, in a paper recently read before the Russian Physico-Chemical Society, arrives at the conclusion that the heats of combustion of the bodies of the fatty series, though being little different from those of the corresponding cyclic compounds, are nevertheless apparently somewhat higher than the latter. Thence it is inferred that the compounds with open chains possess a somewhat higher store of energy than the corresponding body consisting of a closed group of atoms.

Prof. Lugeon of the University of Lausanne has been studying the population of the valley of the Rhone between Martigny and the Rhone glacier. The statistics show that the right bank of the river between these points has a population of 34,000, while only 20,000 persons live along the left bank. He has found that along a part of the river banks which present exactly the same topographic conditions, the side which is most exposed to the sun has from four to five times as many inhabitants as the other bank, which is in the shadow of the mountains that ward off most of the direct rays of the sun. With one or two exceptions, all the villages have been built on the bank which is most fully exposed to the sun's rays.

At a recent meeting of the German Physical Society, Berlin, Herr Fr. Hensler read an interesting paper on the magnetical properties of manganese alloys. Whereas both pure manganese and manganese copper are known to be quite non-magnetic, the author has found that certain other manganese alloys are highly magnetizable even if copper or any other non-magnetical metals be added. The following list of metals and metalloids thus yielding more or less strongly magnetizable manganese alloys, free from iron, is given: Tin, aluminium, arsenic, antimonium, bismuth, boron. The most interesting results are derived from an investigation of manganese-aluminium-copper alloys, it being shown that keeping the latter for some time at a temperature of 110 deg. will reduce them to a state of stable equilibrium, corresponding with the maximum susceptibility. It may further be inferred that for equal percentages of manganese, the susceptibility will increase, as the percentage of aluminium is increased, until a maximum is reached, corresponding with equal atomic percentages of both metals. It is an interesting fact that, according to Wiedemann, Quincke and Du Bois' researches, aqueous solutions of manganese salts should exhibit magnetical susceptibilities somewhat higher than those of the corresponding ferric salts. As both the salts and certain alloys of manganese, which itself is not at all ferro-magnetic, thus show strongly ferro-magnetic properties, the author compares these alloys with a salt solution where copper would play the part of solvent, the above combination of atomically equal quantities of manganese and aluminium that of the solved salt. The transition points beyond which the alloys become non-magnetical are relatively low; for increasing percentages of manganese and aluminium they are found to rise. A. G.

M. E. Weinland has been making a series of researches to show why the digestive secretions do not attack the body of different living organisms. The organs which carry on digestion are charged with ferments which are powerful in attacking and dissolving the aliments which are introduced, but nevertheless they have no action upon the surface of these organs or upon the parasites which often lodge there. The reason for this has not been clear. In 1891, J. Frenzel gave the opinion that the parasites were protected by an anti-ferment which they secreted, and this could account for the fact that tape-worms, for instance, could take up their lodging in such organs. M. Weinland made some experiments which are of interest in this line of ideas. He took a certain quantity of fibrin and placed it in a pepsin solution in order to dissolve it, at the same time adding a small quantity of liquid obtained from the tape-worm (tænia). He found that in this case no digestion of the fibrin occurred, even though it was left in contact for an indefinite period, but otherwise it would be dissolved in a few hours. He thus considers that it is not the living tissues themselves which resist the action of the digestive liquids, but the secretions with which they are impregnated. The anti-ferment which he succeeds in extracting is very powerful in its action, and it keeps its properties for many months; it loses them by boiling, however. A temperature of 60 deg. C. for 10 minutes has but little effect, but at 80 deg. the activity is lessened. The active principle can be precipitated from the juice of the tænia by alcohol. Although it opposes the action of pepsin, a ferment and anti-ferment can be put in presence without destroying each other. The latter seems to exert only an opposing, and not a destructive action on the ferments, and when removed, the ferments commence to act as usual.