SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845)	$3.00	a year
Scientific American Supplement (Established 1876)	5.00	"
Scientific American Building Monthly (Established 1885)	2.50	"
Scientific American Export Edition (Established 1878)	3.00	"

The combined subscription rates and rates to foreign countries will be furnished upon application.

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, JANUARY 11, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE ALCOHOL MOTOR AND ITS POSSIBILITIES.

France imports all her petroleum. She also produces more alcohol than her citizens can use. Undoubtedly this state of affairs led patriotic French engineers to begin a series of experiments some two years ago for the praiseworthy purpose of using alcohol as a motive agent instead of foreign petroleum, and of filling the pockets of the impoverished peasant.

These experiments bore little fruit, largely because nothing was known of the behavior of alcohol when used in a motor. Two years ago in the Paris-Chantilly contest only one alcohol carriage succeeded in finishing. Perhaps the bad weather then prevailing had much to do with the failure of the other alcohol-driven vehicles. Nevertheless, the performance of the one successful carriage was so discouraging and the consumption of alcohol so inordinate that it was feared gasoline would never be supplanted. With the Paris-Rouen test the prospects brightened somewhat. Finally the Paris-Roubaix contest won for the alcohol motor a certain prestige which it will probably continue to hold.

Encouraged by these results and prompted by the desire to furnish chauffeurs with much-needed information on the efficiency of alcohol as a motive agent, the French Minister of Agriculture recently instituted a series of tests, the tabulated results of which will be found elsewhere in this issue. For the first time engineers are now supplied with accurate data which give them what they never had before—a trustworthy means of comparing alcohol with petroleum and other motive agents. For this reason alone the Minister of Agriculture's researches should receive their full meed of praise.

Compared with the gasoline motors, it cannot be denied that the alcohol engine seems at first distinctly inferior. When the price of alcohol and the greater consumption of fuel are considered, an automobilist is inclined to cling to his gasoline motor. Moreover, the *alcool dénaturé* has a calculated thermic value of only 5,297 calories per kilogramme; while the calorific value of gasoline in 11,400. In order, therefore, to cheapen the alcohol and to increase its thermic value, rectified benzine is used as an enriching agent. Exactly what the proportions of the mixture of alcohol and benzine should be was no very easy matter to determine. It has now been definitely ascertained that a 50 per cent mixture (called "electrine"), the heat value of which is 7,479 calories per kilogramme, is most serviceable. In the tests referred to the effective utilization of the alcohol was divided by the product of the amount of alcohol consumed per horse power, and multiplied by the percentage of carbonizing liquids contained in the mixture. Consequently, the more alcohol and the less carbonizing liquid a motor consumed, the higher would it stand in the final lists. Many tests have shown that the consumption of 50 per cent carbureted alcohol is about equal to that of gasoline for the same power, despite the pronounced difference between the theoretical calorific values of the two.

A critical examination of the tables which we publish on another page will show that in consumption the alcohol motor is more economical for higher than for smaller powers. To be sure, economy increases with the power in all motors. Nevertheless, it is certainly remarkable that a 14 horse power Gobron-Brillié two-cylinder motor, mounted on a 1,224-kilogramme carriage, should consume only 125.07 cubic centimeters of 50 per cent alcohol per ton-kilometer; while a voiturette weighing 490 kilogrammes and driven by a single-cylinder 6 horse power motor should consume, under the same conditions, 155.4 cubic centimeters per ton-kilometer. Perhaps the most satisfactory figures are those tabulated for cars of 650 to 1,000 kilos and over. In this class the efficiencies seem to have been exceptionally high. In compiling the tables effective normal operation, regularity and smoothness of running under variable loads, trustworthiness of ignition, ease of starting, general excellence of construction and simplicity were all considered. For that reason motors which, from the tables, would seem to have consumed a very small amount of alcohol, are nevertheless rated very low; the road tests evidently revealed some defect.

The relative high efficiency of alcohol is attributed to the expansion of the water-vapor contained or produced in the alcohol at the moment of explosion. The expansion imparts elasticity to the motive agent and reduces the shock of the explosion. In order to utilize this excellent property still further, a German manufacturer recommends a mixture containing 20 per cent water, and claims that by its use he has reduced the consumption to 0.375 kilogrammes per horse power hour. In France still better results have been obtained. There the consumption has even been cut down to 0.272 kilogrammes per horse power hour.

As a result of the tests instituted by the Minister of Agriculture inventors will probably seek to improve the alcohol motor. For improvement there is certainly much room. The longer expansion of carbureted alcohol will require a motor longer in stroke and heavier than the gasoline engine. But for automobile use motors cannot be much increased either in volume or in weight. To devise a motor which will permit the most efficient utilization of alcohol without inordinately increasing the weight will be a rather nice problem to solve.

LARGE STATIONARY AND MARINE ENGINE UNITS.

On another page will be found a description of the powerful stationary engines for driving the alternators of the new Manhattan Elevated power house. These engines are the most powerful of their type extant, and greatly exceed the units built for the power house of the Metropolitan Street Railway Company, each of which has a rated horse power of 4,500 and a maximum of 6,000 horse power. The engines of the latter plant are of the vertical, cross-compound type, with cylinders 46 and 86 inches diameter by 60 inches stroke. There are eleven units, and the maximum horse power of the station is therefore 66,000. In the new Kingsbridge station of the Third Avenue Railway Company the engines will have a maximum rated horse power of 6,250, and as there will be sixteen of these the total horse power of the station will be 100,000. The Metropolitan and Kingsbridge engines are practically alike in type, although the former were built by the Allis-Chalmers Company and the latter by the Westinghouse Machine Company.

The magnificent engines of the Manhattan station at 74th Street are of a new type. Each unit is made up of two compound condensing engines, one at each end of a 34-inch shaft, at the center of which is carried a huge 42-foot alternator, of which the 32-foot revolving field weighs 185 tons, the whole alternator weighing 445½ tons. The engine consists of two high-pressure cylinders of 44 inches diameter and two 88-inch low-pressure cylinders, the common stroke being 60 inches. With 150 pounds' boiler pressure and a speed of 75 revolutions per minute the engine will develop a maximum indicated horse power of 12,500.

These figures afford an interesting comparison with the largest marine engines extant, which are installed on the Hamburg-American steamer "Deutschland." Here the total horse power of 37,500 is developed by twin engines, 18,750 horse power being developed on each shaft. Each engine is therefore 50 per cent more powerful than the engines of the Manhattan plant. There are six cylinders working on four cranks, the two high-pressure cylinders being arranged in tandem above the two low-pressure cylinders. Steam at 225 pounds pressure is led from the boilers to two 36⅝-inch cylinders, from which it passes to a 73⅝-inch first intermediate, then to a 104-inch second intermediate, and finally to two 108-inch low-pressure cylinders. Forced, hot draft is used at the furnaces, and the consumption of coal for all engines is 1.45 pounds per horse power per hour, or excluding the auxiliaries 1.3 pounds. It should be added that the stroke is 72 inches, and the speed of revolution at 37,500 horse power about 80 per minute.

It will be noticed that there is a wide difference between the marine and stationary engine practice as exemplified in these, the two largest units ever built for their respective classes of work. The marine engine is characterized by high steam pressure, high piston speed, multiple expansion and great compactness, while the stationary engine uses what would be called in these days a low steam pressure, while the piston speed is relatively low, and multiple expansion is only carried to the point of compounding instead of the point of quadruple expansion as in the marine engine. Each type is well fitted for its particular duty, and the difference in practice is explained by the conditions imposed. In the case of the marine engine, space is limited, and it is therefore necessary to get the largest rate of horse power per unit of weight of engine. On the other hand, in the case of the stationary engine there are no strict limitations of space imposed. Economy of weight is not a prime consideration, and hence, compared with the engines of the "Deutschland," it will be found that the Manhattan units are much more liberal in apportionment of weights, and that in valves, condensers and other details there is an apparent clinging to old practice which would be conservatism in marine work, but is not so under the conditions which govern the operation of large stationary power plants. The marine engine is run at high pressure for five or six days consecutively, and is then turned over to a repair gang who have four or five days of uninterrupted work in which to give the engine a thorough overhaul ready for her next five days of running. No such thing is possible at a stationary plant, which must be run steadily day and night under variations of load such as never occur in marine practice.

AUTOMATIC CLOSING OF WATERTIGHT BULKHEADS

Although theoretically there is a large degree of safety secured by the complete subdivision of the interior of modern steamships by means of watertight bulkheads, the too frequent failure of this system to keep vessels afloat after collision would seem to suggest that the advantages are more theoretical than real. As a matter of fact, it will be found on investigation that where a well-divided ship has foundered the fault has been not in the system of subdivision so much as in the many perforations of the watertight bulkhead by doorways and passageways below the water-line. Although such openings are supposed to be guarded by watertight doors, it is evident that the value of the subdivision is finally and absolutely dependent upon the efficient oversight of these doors and the care that is taken to close them in the event of collision. Many naval architects have endeavored to overcome the difficulty by absolutely prohibiting the construction of watertight doors below the water-line; but this arrangement involves great inconvenience, especially in passenger ships, as all communication from compartment to compartment necessitates climbing to the upper deck and descending into the desired section of the ship. The compromise which seems best to meet all the conditions is that which permits of a certain number of watertight doors below the water-line, and the installation of a system by which they can all be automatically and simultaneously closed from a central station in case of collision. One of the most successful systems of this kind is that which has been installed on the "Kronprinz Wilhelm," which is known as the Dörr hydraulic watertight system. The central station is located on the bridge, and in the event of collision the officer first moves over a lever, which sets an electric bell ringing for twenty seconds at every bulkhead door. At the end of that period the lever releases the throttle wheel for starting the hydraulic closing cylinders, on turning which the doors are released and closed. When the door reaches the bottom of its seating it closes an electric circuit, and a corresponding glow-lamp in a plan of the bulkheads in the pilot-house is illuminated. The system appears to be thoroughly satisfactory, and is being applied to every vessel in the company's fleet.

THE FIRST IRON VESSEL IN GREAT BRITAIN.

BY ANSLEY IRVINE.

It is interesting to note that it was as early as the year 1809 that Robert Dickenson, the eminent inventor, first suggested to the Admiralty a scheme by which the old wooden ships of the Royal Navy were to be gradually replaced by vessels built of iron, and thus make the English fleet incomparably stronger than any combination that could be brought together by foreign nations.

The proposed innovation was promised due consideration, and, in 1830, twenty-one years afterward, the conclusion arrived at by the Admiralty was that iron vessels would be practically useless in the line of action and totally unmanageable in a storm! Absurd as the assertion now appears, it was, nevertheless, ardently supported by Dr. Lardner, a scientific authority, who said the idea was perfectly chimerical and that there was about as much chance of an iron boat reaching New York as there was of its voyage to the moon.

A fierce storm of invective and derision was waged against all who had the temerity to hold an opinion contrary to that of the Admiralty and its "scientific" supporters. But Thomas Wilson, a young Scotch boatbuilder, ignored the bigoted opposition, and, in 1816, commenced to build a boat of iron at Fasken, Scotland. She was named the "Vulcan." Her dimensions were 60 feet in length, 12 feet in breadth, and 5 feet in depth. All the plates, rivets, and angle-irons were made over the anvil by Wilson and his blacksmith. The plates were fixed perpendicularly or boiler-fashion, not horizontally as in modern iron ships. The boat was specially constructed for the passenger service on the Monkland Canal, and plied between Port Dundas and Loch No. 16.