THE PROPOSED RAILROAD TO KEY WEST.

One of the most interesting chains of islands off the American coast is the Florida keys, of which Key West forms a part. They constitute a chain of land links stretching out into the ocean from the mainland, and forming the passage known as the Florida Straits. A glance at the map shows that they are separated from one another by channels varying from a few hundred feet to several miles in width. In fact, between some of the keys the distance is so great that it would seem impossible to connect them with a bridge or other structure, but this is what is to be done, for engineers have recently completed plans and surveys for what is undoubtedly the most notable feat in railroad engineering which has ever been conceived —the construction of a railway to Key West by means of these islands. It will form an extension of the Florida East Coast Railway, which as its name indicates skirts the eastern coast of the State named. At present it terminates at a station twenty miles south of Miami, and on the border of the Everglades. Consequently, to lay the track to the nearest key, it will be necessary to construct a considerable mileage through this swamp; but between the coast line and Key Largo, the nearest island, no less than twenty miles of salt-water marsh intervene, which must be spanned by trestlework.

During the last two years, a corps of engineers in charge of Mr. E. Ben Carter, of the Florida East Coast system, have been making an exhaustive investigation, to determine if the extension was practicable. The territory between the southern terminus of the railway and the coast line, as well as all of the keys, and the waters separating them, have been carefully examined, with the result that the extension has been deemed possible. But before Key West can be reached, it will be necessary to build 120 miles of railway on the keys and over the sounds and other passages separating them. In all, twenty islands are available for the extension, but no less than 40 miles of elevated work must be built above the water, not counting the trestling between Key Largo and the mainland.

Fortunately, the formation of the keys lends itself to the project. Rising but a few feet above the surface of the water, it consists of coralline rock offering a level and smooth surface after the few feet of soil which has accumulated on the rock has been removed. But a minimum amount of grading will be required, and an abundance of ballast is available in the form of pieces of the rock which is found on all of the keys. The fact that the same formation lies beneath the intervening waters renders the scheme feasible in the opinion of the engineers, for it offers a sufficiently firm foundation into which the supports of the bridges and other work can be set. The depth of water, however, ranges from 3 to 18 feet, since several of the passages are navigable for vessels of this draft. The deeper channels will of course be spanned by drawbridges, and it is proposed to support them on piers of masonry at a sufficient elevation above high tide. By far the most extensive marine work will be between what is known as Bahia Honda and Knight's key. These islands, located about midway in the series, are no less than 8 miles apart, the water varying in depth from 6 to 18 feet. At this point the reef which extends along the Atlantic side of the keys for such a distance is broken, and a considerable mileage of the structures will be exposed directly to the open sea. A number of other passages vary from one to three miles in extent.

Several methods are available for supporting the elevated work, but with the exception of the bridges, it is probable that steel posts or piling will be utilized entirely. The metal below the water must be protected by incasing the pillars in wood, which has been treated to a preparation of creosote, which in turn will prevent the wood from being damaged by the teredo.

Upon the keys and adjacent waters over 100 miles of railway will be required, not counting the trestle connecting with the mainland and the portion which must be built through the Everglades to the present terminus of the line. The total length of the extension is estimated at nearly 140 miles, and when completed it will undoubtedly be one of the most expensive pieces of railway construction in the world. Nothing approaching the marine work has ever been attempted. The Third Avenue railroad on Manhattan Island is slightly longer than the section to be built between Bahia Honda and Knight's key. The Lucin cutoff, by which the Southern Pacific system crosses Great Salt Lake, comprises 26 miles of trestlework; while the New Orleans and Northeastern Railroad crosses Lake Pontchartrain on a structure which is 8 miles in length; but both of the latter are merely wooden trestles, and offer no parallel to the marine construction which must be carried out on the Key West line.

The building of this extension, however, will give the railroad in question access to one of the finest harbors on the American coast, that of Key West, which has a depth of 33 feet in the main entrance. The harbor is accessible by four different passages, and is sufficiently commodious to accommodate a considerable fleet of ocean-going vessels. It is understood that one reason for building the extension is to establish a transfer service between Key West and Havana, so that freight can be shipped from this country to Cuba by the carload without breaking bulk *en route*. Havana is about 90 miles from Key West, and a car-ferry steamer having a speed equal to the ferryboats on the North River could readily make the round trip in a day of ten hours. In connection with the Panama Canal, however, Key West possesses special advantages, as it is actually 250 miles nearer the Gulf entrance to the canal than any other city in the United States. Consequently, with railroad communication, it would offer special facilities as the port for lines of steamships to the American and Asiatic Pacific coast, as well as the islands of the Pacific.

GAS ENGINES FOR FACTORY POWER.

BY G. MEYNELL.

Until very recently the installation of gas engines for factory purposes was of a very limited scope, owing to several reasons.

First, the gas engine was unknown to the average engineer, and was therefore mistrusted in favor of the old reliable steam engine.

Secondly, gas engines were only offered to those parties utilizing a very small quantity of power, say 25 horse-power or less, owing to the fact that the cost of fuel, be it either city gas or gasoline, proved prohibitive beyond this size. The reason for this was that in sizes of 25 horse-power and less the gas engine could be trusted to operate without the supervision of an engineer, and therefore the owner was enabled by cutting the engineer's salary expense, to pay the comparatively high rate per horse-power hour called for by the gas engine, and yet save considerable money on the transaction.

This limited use of the gas engine might have continued indefinitely but for the introduction of two widely separated industries, the automobile and the gas producer industry respectively.

The first of these two was beneficial, inasmuch as it familiarized the public at large with the operation and consequent attention of the gas engine. The second industry has supplied a means whereby gas for power purposes may be generated at so low a figure on one's own premises that gas engines can be operated, even in very large units, at figures which show a vast economy in fuel over the present steam engine.

From the foregoing it will be noted that the gas engine operated on city gas is a practical paying investment for power service up to about 25 horsepower, owing to the elimination of salaries; and that in order to entertain the gas engine proposition beyond this point, it becomes necessary to look about for a cheaper form of gas.

In gas-engine rating, the power consumed, irrespective of the type of gas employed, is figured on the number of heat units required to do a certain amount of work, which has standardized itself, so that now the majority of gas engines will deliver a brake horsepower-hour for 12,500 British thermal units, or B. T. U., as they are usually termed. It is immaterial, as far as the working of the engine is concerned, whether these 12,500 B. T. U. are supplied in the form of a rich gas, such as illuminating gas, of 600 B. T. U. per cubic foot, or are supplied in the form of weak blastfurnace gas of only 80 B. T. U. per cubic foot, provided that in the latter case the engine is equipped with cylinders of sufficient capacity to handle a larger quantity of the weaker gas.

With the above points in view, there has been introduced upon the American market a type of gas generator known, for the sake of brevity, as a "producer." This apparatus is a modified and greatly simplified gas-generating plant for the purpose of generating a weak form of power gas, especially designed and adapted for the use of gas engines. It is arranged in this apparatus that coal shall be fed directly into the hopper of the apparatus, the resultant gas being drawn off at the outlet as the needs of the engine may require.

This gas, while of only 135 B. T. U. per cubic foot, forms an almost ideal fuel for gas-engine purposes, for inasmuch as it is very low in hydrogen, it admits of the engine builders allowing for very high compression in their engines without fear of pre-ignition, while the resultant efficiency, owing to the high compression, is very marked.

The introduction of the gas producer upon the American market has been very gradual and not heralded by any great amount of newspaper talk; nevertheless, this industry has already obtained a firm foothold among our manufacturers, and it would seem that the time is not far distant when the comparatively wasteful steam engine and steam boiler will be almost entirely replaced by gas and producer-gas engine plants.

In addition to supplying a means for the practical operation of the larger sized gas engines, the gas producer has added an impulse to the large gas-engine trade which is very marked, for without a fuel gas of this description the sale of large engines was entirely restricted to the natural gas fields, while now it is practical to install a high-power gas-engine plant wherever coal and water are available, with the result that although until quite recently quotations on gas engines of 1,000 horse-power or over could only be obtained from European firms, at the present time of writing no less than six American firms have submitted estimates for such high-power engines.

Visitors to the St. Louis Exposition had the opportunity to observe this type of machinery in actual operation; for a concern that is a pioneer in this line of work, had in actual service two power plants, one for the operation of the gas-engine exhibits of one of our well-known engine manufacturers, while the other plant supplied gas for the testing plant of the United States government in "The Gulch." Both these plants operated continuously and satisfactorily during the Fair, and their small coal consumption served as an object lesson to those who compared the workings of these plants with similar steam equipments.

Generally speaking, gas producers can be depended on to furnish one brake horse-power-hour from 1¼ pounds anthracite pea coal, this type of fuel being the favorite for gas-producer work, owing to the fact that the resultant gas contains no by-products to be gotten rid of by special machinery.

It can easily be estimated, with the data now obtainable on the market, what the cost of an entire equipment of gas producers and gas engines, to replace a steam plant, would be; and while the first cost of the gas plant would appear considerably higher than the cost of a steam plant of the same capacity, the resultant economy would be so very great that it would pay a very high rate of interest on the money invested, and probably pay off the entire cost of the plant in about four years in addition.

In estimating on a gas-producer power plant, the owner should first ascertain the exact maximum amount of power which he will be called upon to deliver, for gas engines, unlike steam engines, have no overload capacity whatever. Again, he should satisfy himself as to the cheapest and most readily obtainable fuel in his locality, as the builder of a gas producer can supply him with several types of gas producers designed for various grades of coal, both anthracite and bituminous, obtainable on the market; and furthermore, the cost of the plant will vary materially with the fuel to be employed. For example, a hard-coal plant will be much less expensive than one of the same capacity for soft coal, as in the latter case there are hydrocarbons in the gas which have to be removed by mechanical washers, or they would condense in the form of tar and gum up the engine.

Among the plants of this nature which have been in service sufficiently long to satisfy the most exacting demands may be mentioned that of the Camden Iron Works, Camden, N. J., and that of the Erie Railroad Company, Jersey City, N. J. This latter plant has been in continuous service twenty-four hours a day for upward of five years since its installation, and indicates the thorough reliability of this type of plant when properly installed and efficiently handled.

THE CURRENT SUPPLEMENT.

The English correspondent of the Scientific American opens the current Supplement, No. 1520, with an article on gasoline locomotives and cars for railroads. The Paris correspondent writes on a new method of treating peat. Valuable formulæ for toilet specialties are published. A full, descriptive article appears on the auxiliary power yacht "Mollihawk II." A Berlin inventor has devised a speedometer for use on automobiles. The instrument is fully described and illustrated. Prof. Berthelot reviews very exhaustively recent researches on aerolites. Capt. Winkler's interesting article on the sea charts used by the Marshall Islanders is concluded. Prof. J. W. Pernter writes on methods of forecasting the weather. The "Isophone" is a microphone designed to form a new and powerful telephone transmitter. The instrument is fully described. Schloemilch's wave detector for wireless telegraphy is fully described by our Berlin correspondent. O. M. Peterson discusses the question whether there is African blood in the white races of Europe and America. The usual Electrical, Engineering, and Science Notes and Trade Notes and Recipes are given.

A PATENT DEDICATED TO THE PUBLIC.

Dr. George T. Moore, of the Weather Bureau, last year secured a patent on a method of making cultures of nitrogen-fixing bacteria and of drying them so that they may be sent all over the world, while at the same time their activity is indefinitely preserved. Nitrogen-fixing bacteria and their importance to agriculture have been discussed in these columns.