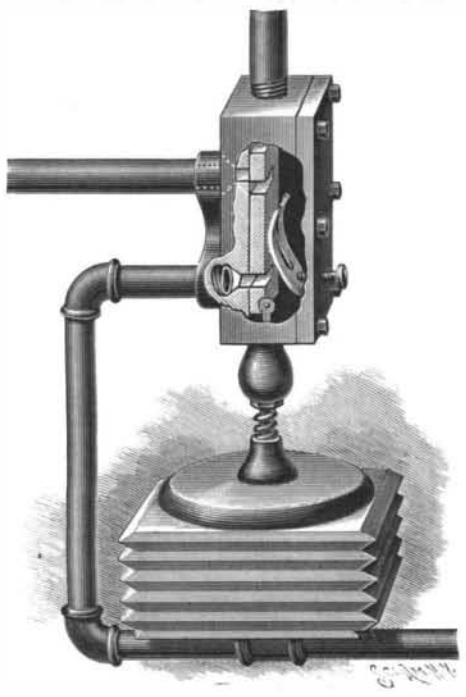
A NOVEL FLUID PRESSURE REGULATOR.

The improved fluid pressure regulator represented by our engraving and recently patented by Jenkin Williams and Joseph R. Rees, of Pueblo, Col., is provided with a chest connected at its top by a pipe with a main for leading gas, steam or other fluid into the chest. In the chest is formed a valve seat from which two ports lead to a service pipe and an escape pipe respectively. On the valve seat a slidable valve is mounted,



WILLIAMS' AND REES' FLUID PRESSURE REGULATOR.

pressed tightly against the seat by a spring, the tension of which may be regulated by a screw. The valve is provided with two ports so arranged that when the lower port is in register with the service pipe, the upper port is disconnected with the escape pipe, and vice versa. The service pipe has an upwardly extending branch, opening into a bellows, which in turn press against a rod surrounded by an expansive spring and extending through a stuffing box into the chest, there to connect with the sliding valve. When the fluid enters the chest, it passes through the service pipe, thence to be distributed to the devices on which it is to be used. The fluid also passes through the branch pipe into the bellows, expanding them so as to hold the valve in the open position shown in our cut. When the pressure in the main increases abnormally, then the pressure in the service pipe causes the bellows to expand still further, thus moving the valve upward, cutting off the fluid from the service pipe and bringing the port of the escape pipe into register with its valve port. A sufficient quantity of gas having by this means escaped, the bellows collapse correspondingly, the valve slides down, thereby closing the escape pipe port and opening the service pipe again. Should the service pipe break, the bellows collapse completely, the valve descends and the fluid is cut off from the service pipe, thus preventing its waste. An effective arrangement is therefore provided for automatically shutting off the supply of gas or water to a building in case of fire.

AN AUTOMATIC ACETYLENE GAS GENERATOR.

Artificial illumination produced by means of acetylene gas is found to possess more of the qualities of daylight than other artificial lights, not excepting even arc light. The recent invention of the electric method of making calcium carbide permits of the production of acetylene gas by a very simple process at a cost which allows of its general application.

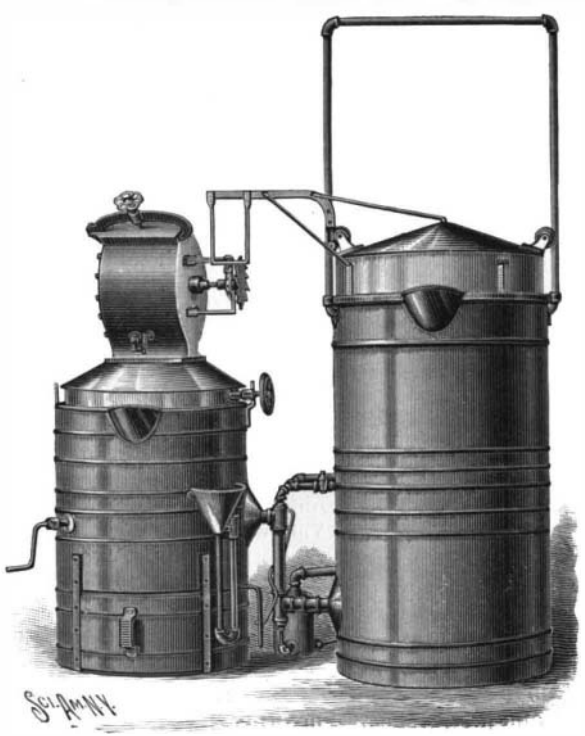
The important feature in the use of acetylene is to secure a simple generator for making the gas continuously with safety and economy.

Our engravings represent an acetylene gas generator of this description. It is known as the "Ordway," and is manufactured by the National Acetylene Gas Generator Company, of Corning, N. Y., and St. Paul, Minnesota.

The apparatus consists primarily of an automatic feed generator and a gasometer. The automatic feed device, which is placed above the water tank, has a casing containing a magazine, which is cylindrical in form and divided into ten or more radiating compartments. The compartments are filled with calcium carbide from the top of the inclosing case, each compartment being then closed by a hinged and latched cover. A trip placed on the side of the inclosing case engages each latch as it passes by, and causes the cover of the compartment to open. The calcium carbide drops into the water below, where it is decomposed without heating the apparatus, the heat being absorbed by the water. This gas bubbles through the water, rises to the top of the generator and passes through pipes to the adjacent receiver, where it is again discharged into water, removing the impurities. The gas fills the gasometer, causing it to rise, and is then conducted from the gasometer by a distributing pipe. By this method a fixed quantity of gas is generated each time, and the gasometer is designed with ample capacity to hold this; there is consequently no over-production or waste. The escape or safety pipe is arranged within the gasometer by means of telescoping tubes, forming a water seal.

As the gasometer discharges its gas it slowly descends, and when near the end of its downward course, a pawl carried by an outwardly extending arm engages a ratchet wheel on the shaft of the magazine. The weight of the gasometer acting upon this wheel causes the magazine to rotate, thus closing the empty compartment and bringing the latch of the next compartment cover into contact with the trip, thereby opening the cover and causing the contents of the compartment to fall into the water below. A locking device prevents the feed cylinder from rotating through more than one space at a time, and a detent prevents the backward rotation of the cylinder. The action of this feed mechanism is consequently automatic.

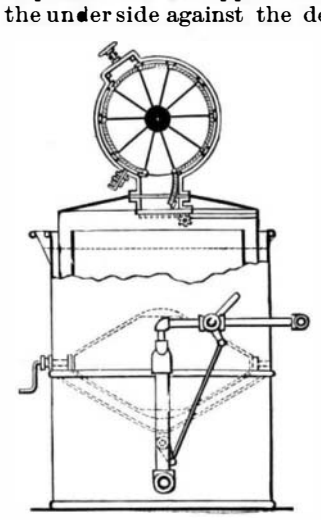
In the lower portion of the generator an agitator mounted upon a shaft is turned by a crank outside the tank. By it the residuum may be loosened from the bottom of the tank and drawn off by a cock connected by rods with the valve of the distributing pipe of the gasometer. By turning a lever the cock and the valve of the distributing pipe are opened simultaneously, thereby equalizing the gas pressure and preventing siphoning. The large gate valve shown at the base of the cylinder is closed when the machine is recharged, thereby cutting off the gas and preventing any escape into the room. A dial register is provided, by which it may be seen at a glance how much carbide there is in the generator at any time.



AN AUTOMATIC ACETYLENE GAS GENERATOR.

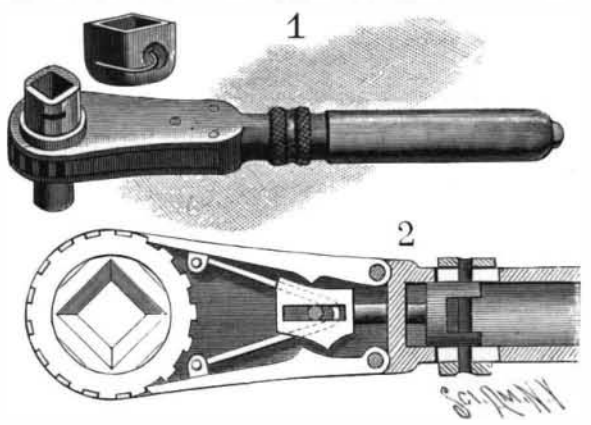
Sleep of Plants.

In a large number of plants examined, Herr E. Stahl finds that the nocturnal position of the leaf or leaflets acts as a protection against the deposition of dew, and thus promotes transpiration and increases the amount of nutriment conveyed to the assimilating organs by the ascent of water in the stem. He regards this as its main function rather than, as has been alleged, the prevention of excessive radiation. The nocturnal position of the leaf or leaflets may be classed under two heads: (1) They are directed downward, so that the under side is better protected than the upper side against the deposition of dew (Biophytum sensitivum, Oxalis acetosella, Robinia pseudacacia, Hedysarum gyrans, Impatiens noli-me-tangere, etc.) (2) They are so placed that the upper side is better protected than the under side against the deposition of dew (Colutea arborescens, Trifolium repens, Impatiens glandulifera, etc.) This difference is usually correlated with a difference in the disposition of the stomates on the two surfaces, as is well seen in the two species of Impatiens named; but there are exceptions to this rule. Geotropism probably also plays some part in producing the vertical nocturnal (nyctitropic) position of leaves and leaflets.—Bot. Zeitung, 1897, 1te. Abtheil., p. 71.



A REVERSIBLE RATCHET WRENCH.

In the improved reversible ratchet wrench shown in our cut, the wrench-socket on which the ratchet wheel is formed or secured is mounted to turn in a casing provided with two plates formed at their rear ends with semi-cylindrical extensions on which a handle screws for holding the parts of the casing securely in position. Referring to the sectional view, it will be seen that fulcrumed, spring-pressed pawls pivoted in the casing



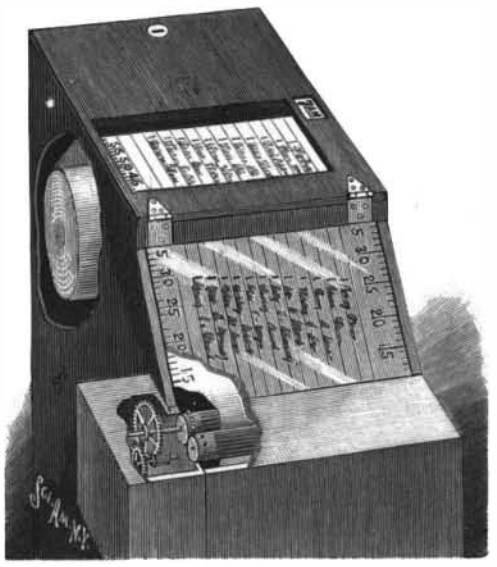
TYLER'S REVERSIBLE RATCHET WRENCH.

engage the ratchet wheel at opposite sides, the pawls being provided with inclines which may be engaged by the cam faces of a longitudinally moving cam block. By this arrangement either pawl may be thrown in mesh or out of mesh with the ratchet wheel. The cam-block is provided with a stem extending rearwardly through a clamp provided with lugs projecting over part of the semi cylindrical extensions, the stem being formed with a head fitted to slide into the same extensions. This head is engaged by a cross-pin passing through slots in the handle casing, to connect with a ring or collar fitted to slide on the semi-cylindrical extensions.

In using the wrench, the ring is pushed forward or rearward, bringing either pawl into operative position as desired and according to the direction in which the workman wishes to use the wrench. An auxiliary socket carrying a spring for engagement with a recess on the wrench-socket enables the wrench to be used for large objects. The invention has been patented by Elias M. Tyler, of Emigrant Gap, Cal.

AN IMPROVED TIME RECORDER.

The time recorder illustrated in our engraving, and recently patented by Frederick W. Cook, of San Antonio, Texas, embodies features which are a de-



COOK'S TIME RECORDER.

parture from previous devices of this character. The operative mechanism in Mr. Cook's contrivance consists of clock-driven rollers which act directly upon a roll of paper mounted in the casing. The paper is lined longitudinally and is graduated along its edges to represent hours and minutes. The clock-rollers draw the paper over a table at a wide opening in the casing, so as to enable employes to write their names upon the longitudinal lines. A slot in the lid on the left hand side of the opening partially exposes the graduated edge of the paper and enables the employe to see at what time he writes his name. A transfer strip is secured to the under side of the lid and extends transversely into the opening and in a line with the slot. When an employé writes his name, he makes a mark upon the strip which transfers the impression in different colored indelible substance to the paper beneath and indicates the exact time when the name was written. Instead of exposing a single space to accommodate one name written transversely, as in the ordinary time recorders, the apparatus, it will be seen, provides for a number of lines upon which several names may be written longitudinally at approximately the same time. The clock mechanism, by acting di-

rectly on the rollers, dispenses with all auxiliary devices. The apparatus is designed for use in large stores, offices, factories and the like, and is also adapted to record the rounds of a night watchman.

PORTO RICO AND THE REDUCTION OF SAN JUAN.

Last week it was our pleasing duty to chronicle the decisive victory of Manila Bay, we are now able to announce that the reduction of San Juan, the fortified capital of Porto Rico, by Admiral Sampson was attended by few casualties and no injury to the fleet. The squadron, consisting of the flagship "Iowa," the "Indiana," "New York," "Terror," "Amphitrite," "Detroit," "Montgomery" and the "Porter," in search of the Spanish fleet, arrived at San Juan, Porto Rico, at five o'clock in the morning, May 12. The "Detroit" led the squadron to the harbor, and the "Iowa" fired on Morro fort and the "Detroit" followed at short range, and the others in the order named, with the exception of the "Montgomery," steamed in an ellipse before the forts. The first round of the firing was aimed too low, but in the second round the ships got the elevation and silenced the guns of Morro. They also fired upon the town and repeatedly drove the Spaniards from their guns. The forts mounted seven good guns, but their markmanship was wretched. They fired hundreds of shots, but they only hit the "New York" and the "Iowa" once each, doing no damage except to kill one seaman and wound six others. The bombardment lasted three hours and the fortifications were completely reduced, and havoc was wrought in the city by the shells of the fleet. Admiral Sampson retired to Mayaguez after the bombardment, as he had no intention of capturing the town, his intention now being to engage the Spanish fleet.

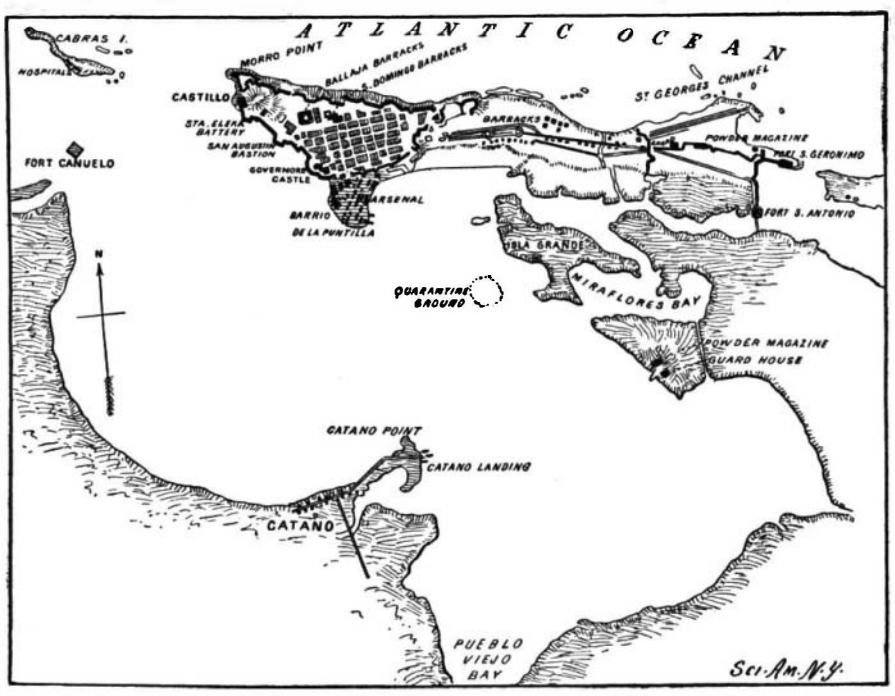
We will now consider the island of Porto Rico and will glance briefly at its history. Our engravings are made from photographs recently taken in the island and show some of the scenes in this tropical land.

Porto Rico, the fourth in size of the Greater Antilles, lies 70 miles west of Hayti and it is about a thousand miles, as the crow flies, from Havana to the harbor of San Juan du Puerto Rico. It forms an irregular parallelogram, 108 miles long and 37 miles broad; its area is 3,550 miles, which is less than that of the island of Jamaica, or about seven-tenths that of the State of Connecticut. The northern coast is rugged, and at the eastern end of the island it is very high and the cliffs extend in almost an unbroken line from Cape San Juan to the port of the same name. Porto Rico is traversed from east to west by a range of hills which are so situated that the streams flowing north are much longer than those flowing to the south. The highest part is near the northeast corner, and the highest peak, Yunque ("Anvil"), is 3,600 feet high and can be seen for a great distance out at sea. The mountain ranges serve to divide the island into two parts as regards climate. As the hills and mountains intercept the northeast trade winds with their rain clouds, there is sometimes almost a superabundance of moisture in the lowlands of the north, while in the south severe drouths occur and the land demands artificial irrigation, which is, as yet, carried out with very little system. The island is, on the whole, well watered. Over 1,300 streams have been counted, of which 47 are considerable rivers. The island is rather beautiful in appearance, forests still covering all the highest part of the hills, but the interior seems to be one vast system of mountains, and from the deck of the steamer there seems to be a limitless sea of hills with rounded summits and with such gentle slopes as to be susceptible of cultivation to their very summits. In reality, however, it is level compared with the other West Indian islands. It is strange that few of the rivers are navigable even at their mouths, and vessels of small burden can ascend them only for a few miles.

The climate is such that foreigners are easily acclimated, and fevers there have the reputation of not being as contagious or as dangerous as in Cuba and San Domingo.

The residents are acclimated to fever and do not suffer much, but the casual visitor in the summer is in danger. The climate is divided generally into two seasons, the wet and the dry, or there may be two brief rainy seasons, when the sun passes over the earth in the vernal and autumnal equinoxes; and in the latter the hurricanes occur. The dry months are usually from November to April inclusive, and the wet are from May to November. The longest day scarcely exceeds thirteen hours, and the difference between the maximum and minimum of heat is much less than with us; in summer the annual mean being about 75° to 80°, with the daily range of not much more than 10° and an average winter temperature of 70°. Then there is the daily alternation of sea and land breezes, the former setting in about nine in the morning and continuing through the day, the latter beginning soon after sunset and holding until an hour after sunrise, the hottest times being in the intervals between the two. The worst natural characteristic of the island is the tremendous hurricanes that sweep across it between the months of July and October.

Porto Rico was discovered by Columbus, in November, 1493, and in 1510 Ponce de Leon founded the town of Caparra, which was soon after abandoned, and with more success in 1511 the city of San Juan Bautista. The native inhabitants were subdued according to the usual methods of colonization which were adopted by the Spaniards, by sweeping them entirely away, and from that time on, the island was left to fill up with Spanish and slaves. It has therefore been very nearly a detached section of Spain itself, and has kept in closer sympathy with the Spanish government than has any of her other colonies in the western hemisphere. In 1595 the capital was sacked by Drake, and in 1598 by the Duke of Cumberland, and it had other sieges, for in 1615 Baldwin Heinrich, a Dutchman, lost his life in an attack on Castillo del Morro. The attempt of the English in 1678 was equally unsuccessful, and Abercromby in 1797 had to retire after a three days' siege, though in the same campaign he captured Grenada, Demerara and Trinidad. In 1820 a movement was made toward a declaration of independence on the part of Porto Rico, but Spanish supremacy was completely re-established in 1823, and the last traces of slavery were abolished in 1873 by the abrogation of the system of forced labor. In 1870 Porto Rico was made a province of Spain instead of a colony. Recently, when the so-called system of autonomy was offered to Cuba, Porto Rico received the same. It now has a premier and a house of representatives and all the other forms and shapes of a representative government, but they are all in the hands of the Spanish oligarchy that controlled the island while it was still a colony. Like Cuba and the Philippines revolutionary parties existed in Porto Rico; its leaders are exiles living in Europe and the United States. The discontented elements of the population, which are by no means small, have not dared to fight, lest Spain import a greater army and sweep them off the face of the island, the military roads making concentration of troops easy. The insurgents are in no shape to battle with the 40,000 troops Spain keeps on the island, but they are hoping for some good to come to them as a result of the war over Cuba. The inhabitants of Porto Rico numbered, in 1877, 813,937, the negroes being over 300,000.



MAP OF THE HARBOR OF SAN JUAN.

In Porto Rico the entire land has the appearance of a picturesque and continual chain of habitations, the land being under good cultivation, with fields of sugar, plantains, coffee, patches of rice, etc. There are some sixty towns and villages on the island, but it is really a land of fertile farms between the innumerable hills and mountains and rich valleys. The soil everywhere is very fertile and cultivable, even to the mountain crests, the pastures of Porto Rico being famous for the succulent qualities of their grasses, upon which feed cattle and horses. These are shipped in great numbers, and constitute the chief wealth of a great many people engaged in the business. Among the hills also are thousands of coffee plantations, for here the soil is good and the climate is adapted for its perfect development. In the valleys also grow the sugar cane, cocoa, bananas, plantains, in fact, all sorts of tropical fruits. The banana industry has been vastly increased in the island of Jamaica during the past five years and it has rescued many a planter from ruin. This will also be the case in Porto Rico, which has everything for its profitable cultivation, provided proper attention is given to growing them. With its wonderful range of vegetable products and consequent facilities for subsistence with the minimum of labor, Porto Rico may well be termed an earthly paradise; but while nature has done everything for this island, the race whom the accident of discovery placed in power have done worse than nothing toward its development. Poverty exists everywhere, since the taxes are so oppressive, administered as the government is by alien office holders assisted by foreign soldiers. The island has 470 miles of telegraph and 137 miles of railway, besides 170 miles which is under construction.

San Juan is the capital of Porto Rico and has about 28,000 inhabitants. It is on the northeast shore of the island. The harbor, as will be seen by our map, is one of the finest in the West Indies, being large, sheltered and capable of accommodating any number of the largest ships, having anchorage in it from three to seven fathoms. It bears a striking resemblance to Havana Harbor, to which it is but little inferior. Its entrance toward the north is invitingly open to the vessels of our great republic. Its entrance is over 2,000 feet wide and is defended on the west side by forts erected on two small islands. On the east side of the harbor is an extensive sand bank, but the entrance to the harbor has no sand bank. The harbor is big and deep, but the coral formation makes it impossible for ships of any great draught to get close up to the wharves. The city occupies all of what is generally supposed to be an island, but it is not really built on an island at all, but on a coral reef at some distance from the shore for a great part of its length and joined to the main island at the eastern end by a short bridge. The town is completely inclosed within massive walls of stone and mortar, which rise to a height in some places of from fifty to one hundred feet. Like Havana, which has its "Morro" or citadel (literally a round Moorish tower), it has, or rather had, fortifications on an extensive scale, with bastions and drawbridges, with sentry boxes hanging over the sea and grim, gray walls towering threateningly. One may find a very counterpart on a small scale in the old fort at St. Augustine and every way similar to those at Havana before her walls were torn down.

The peninsula upon which Morro and the lighthouse stands is thrust out into the sea, one side breasting the thundering surges of the Caribbean Sea and the other guarding the placid waters of a beautiful and almost landlocked harbor. The old forts suffered terribly from the shells of Admiral Sampson's fleet and offered but little effective resistance to the fire of the modern rifles. They had an advantage over a fleet in being at a considerable elevation, thus enabling them to deliver a plunging fire. Until early in last year the only battery of any consequence was placed toward the east coast, designed specially to protect the city from an anticipated attack on the land side. The battery has several Krupp guns of medium caliber. It is believed several more of these were mounted in Morro Castle at the other end of the town. The remainder of the ordnance in San Juan along the walls was, until very recently, of an obsolete pattern and unserviceable against the armor of modern ships. A large number of rifled guns were sent to San Juan from Spain about three months ago, and recent reports indicate that they have been mounted. There are forts and batteries all along the outer edge of the reef.

Though the main portion of San Juan is inclosed within the walls, through which entrance is obtained only by well guarded gateways, yet there is a small town by itself in the Marina between the fortifications and the wharves. Here is a fine public garden and pleasure space for booths and restaurants as well as the public cockpit where battles royal are frequently waged. The buildings of the inner city are of stone, massive and substantial like those of Havana and the city of Mexico, and are of the old world type, which would not furnish much food for a conflagration in case of a bombardment. Here the captain-general and chief officials reside. Many of the wealthy inhabitants have summer residences at Bayamon, and the very poor live in the huts shown in one of our engravings. The "Morro" is an interesting place with its deep dungeons and covered ways.

San Juan is not a very attractive city under its present conditions, owing to its filthy streets and lack of attention to sanitation. The only thing that saves the city is its being built on a declivity and it is therefore fairly well drained. Yellow fever is quite prevalent. That the city is not a healthy one is shown by the frequent funeral processions that pass through the streets to the cemetery, whichlies between the sea wall of the fort and the shore, the interments being in columbarie. San Juan is only one port of the islands, and there are some harbors that are as fine, if not as large and land-locked. The other most notable city is Ponce, having a population of about 35,000.

The total revenue for 1894-95 was $5,454,958, while