

one lock will be required to get around each of the upper three dams. From the fourth dam to Greytown in the Caribbean Sea an independent canal will be required 41.9 miles in length with seven locks, which apparently presents no difficulty. The total length of the proposed canal is 61.7 miles, and no tunnel is required. The harbour of Greytown has been partially destroyed by a silt which comes from the San Carlos, and others of the lower tributaries of the San Juan, and the branch of the river leading to Greytown has become so much filled up that it is now, at the lowest stage of the water, only 324 feet wide and 6 inches deep at the fork. It is proposed to shut off this branch entirely and send all the silt-bearing water through the Colorado mouth, which empties into the sea 18 miles from

Greytown, and to admit to the harbour only the water of the canal, which, being drawn from the main river above the mouth of the San Carlos, will be perfectly clean. The harbour then cleared out, will leave nothing to deteriorate it again.

Short breakwaters will be required to protect the entrances from the surf, both of which are included in the estimate for the work.

Careful gauging at the lowest stage shows that Lake Nicaragua, which has a surface area of 2700 square miles, and a drainage area of 8000 square miles, will supply thirty-eight times the maximum possible demand of water.

The depth of water is to be 26 feet, the width at bottom 72 feet, and at surface 150 feet. The locks, twenty-one in



FIG. 12.—Lines of proposed Darien and Nicaragua Canals.

number, with a lift of from 8 to 10 feet, are to be 400 feet long and 72 feet wide. The estimate is stated at £15,900,000.

M. Lesseps, in a lecture on the Suez Canal, delivered before the Société des Gens de Lettres at Paris, has given it as his opinion that unless the Atlantic and Pacific can be united by simply piercing the Isthmus from sea to sea without locks, as at the Suez Canal, the proposed scheme cannot possibly succeed as a commercial enterprise, because of the inadequacy of a canal with locks to pass the traffic that will frequent it, and also of the uncertainty of sufficient water to supply the lockage and evaporation. This latter objection, however, seems to be disproved by the researches of the American engineers who have investigated the subject. A further difficulty arises in maintaining a sufficient sea-water depth to the canal even after it has been formed. On this point the writer of this article, judging from documents prepared under the sanction of the Government of the United States and submitted to him by an authorized official of the Government, arrived at the conclusion that there are very formidable obstacles to the establishment and future maintenance of a deep-water entrance to the proposed Nicaraguan Canal at Greytown in the Caribbean sea. These obstacles involve the engineering problem of main-

taining permanent deep water through an extensive shallow foreshore composed of soft materials and exposed to heavy seas. The reports state "that at Greytown there are now islands where twenty years ago there was water enough to float a frigate." It remains to be seen whether the same difficulties apply to the entrance to the proposed Darien scheme; and, to show that such fears may not be unfounded, we may remind the reader that the difficulties exist, as we have stated, at the Mediterranean entrance to the Suez Canal.

The question as to the best route for transit between the Atlantic and Pacific is, it will be seen, still far from being solved, but the necessity for free access from sea to sea remains an acknowledged fact. Its importance, especially to the United States, but in some degree to all the world, is such that, great as are the engineering difficulties, this long-cherished bold idea may yet become a stupendous reality.

(D. S.)
Reference is made to the following works:—Chapman, *On Canal Navigation*; Frisi, *On Canals*; Fulton, *On Canal Navigation*; Tatham's *Economy of Inland Navigation*; Vallancy's *Treatise on Inland Navigation*; *Principles and Practice of Canal and River Engineering*, by David Stevenson, 2d edition, A. and C. Black, Edinburgh; *Report of the Secretary of the United States Navy* for 1873.

CANAL, or CANALETTO, ANTONIO (1697-1768), a Venetian painter, born 18th October 1697, was bred with his father, a scene-painter at Venice, and for some time followed his father's line of art. In 1719 he went to Rome, where he employed himself chiefly in delineating ancient ruins, and particularly studied effects of light and shade, in which he became an adept. He was the first painter who made practical use of the camera lucida. On returning home he devoted his powers to views in his native city, which he painted with a clear and firm touch and the most facile mastery of colour in a deep tone, introducing groups of figures with much effect. In his latter days he resided some time in England. His pictures, in their particular range, still remain unrivalled. He died on 20th August 1768. Belotto (commonly named Bernardo) Canaletto, 1724-1780, was his nephew and pupil, and painted with deceptive resemblance to the style of the more celebrated master.

CANANDAIGUA, a town in the United States, capital of the county of Ontario in New York, is situated at the northern end of a lake of the same name, 29 miles S.E. of Rochester by rail, in 42° 54' N. lat. and 77° 27' W. long. It is a railway junction of some importance, and has a court-house, an academy, and two printing-offices. Its incorporation dates from 1815. The lake is a beautiful sheet of water about 15 miles long, with a breadth varying from less than a mile to more than a mile and a half. It is about 437 feet above Lake Ontario. The population of the town is 4862, and of the township 7274.

CANANORE. See KANANORE.

CANARA. See KANARA.

CANARY (*Fringilla canaria*), a well-known species of Conirostral Bird, belonging to the family *Fringillidae* or Finches. It is a native of the Canary Islands and Madeira, where it occurs abundantly in the wild state, and is of a greyish-brown colour, slightly varied with brighter hues, although never attaining the beautiful plumage of the domestic bird. It was first domesticated in Italy during the 16th century, and soon spread over Europe, where it is now the most common of cage-birds. During the 350 years of its domestication, the canary has been the subject of careful artificial selection and of crossing with allied species, the result being the production of a bird differing widely in the colour of its plumage, and in a few of its varieties even in size and form, from the original wild species. The prevailing colour of the most admired varieties of the canary is yellow, approaching in some cases to orange, and in others to white; while the most robust birds are those which, in the dusky green of the upper surface of their plumage, show a distinct approach to the wild forms. The least prized are those in which the plumage is irregularly spotted and speckled. In one of the most esteemed varieties, the wing and tail feathers are at first black—a peculiarity, however, which disappears after the first moulting. Size and form have also been modified by domestication, the wild canary being not more than 5½ inches in length, while a well-known Belgian variety usually measures 8 inches. There are also hooped or bowed canaries, feather-footed forms, and top-knots, the latter having a distinct crest on the head; but the offspring of two such top-knotted canaries, instead of showing an increased development of crest, as might be expected, are invariably bald on the crown. Most of the varieties, however, of which no fewer than twenty-seven were recognized by French breeders so early as the beginning of last century, differ merely in the colour and the markings of the plumage. Hybrids are also common, the canary breeding freely with the siskin, goldfinch, citril, greenfinch, and linnæus. Some of the hybrids thus produced are, according to Darwin, almost completely fertile,

but they do not seem to have given rise to any distinct breed. It is the female canary which is almost invariably employed in crossing, as it is difficult, if not impossible, to get the females of the allied species to sit on the artificial nests used by breeders. In a state of nature canaries pair, but under domestication the male bird has been rendered polygamous, being often put with four or five females; still he is said to show a distinct preference for the female with which he was first mated. It is from the others, however, that the best birds are usually obtained. The canary is very prolific, producing eggs, not exceeding six in number, three or four times a year; and in a state of nature it is said to breed still oftener. The work of building the nest, and of incubation, falls chiefly on the female, while the duty of feeding the young rests mainly with the cock bird. The natural song of the canary is loud and clear; and in their native groves the males, especially during the pairing season, pour forth their song with such ardour as sometimes to burst the delicate vessels of the throat. The males appear to compete with each other in the brilliancy of their melody, in order to attract the females, which, according to Bechstein, always select the best singers for their mates. The canary readily imitates the notes of other birds, and in Germany and especially Tyrol, where the breeding of canaries gives employment to a large number of people, they are usually placed for this purpose beside the nightingale. In England they are taught in a similar way to imitate the woodlark. They are also taught to whistle one or two airs, and even to articulate a few words. The female possesses considerable vocal powers, but her notes are weaker than the male's, and her song usually less consecutive.

CANARY ISLANDS, THE, lie in the North Atlantic Ocean, between the parallels of 27° 4' and 29° 3' N. lat., and the meridians of 13° 3' and 18° 2' W. long. The seven principal islands, with their area in English square miles, and their population in 1860, are as follows:—

	Teneriffe.	Grand Canary.	Palma.	Lanzarote.	Fuerteventura.	Gomera.	Hierro.
Area.....	877.7	758.3	718.5	323.5	326.1	169.7	82.2
Population, 1860	93,709	68,970	31,138	15,837	10,996	11,360	5028

Fuerteventura lies nearest to the African coast, the interval being between 50 and 60 miles. Besides these there are many islets, most of which are uninhabited.

History.—There is ground for supposing that the Phœnicians were not ignorant of the Canaries. The Romans, in the time of Augustus, received intelligence of them through Juba, king of Mauritania, whose account has been transmitted to us by the elder Pliny. He mentions "Canaria, so called from the multitude of dogs of great size," and "Nivaria, taking its name from perpetual snow, and covered with clouds," doubtless Teneriffe. Canaria was said to abound in palms and pine trees. Both Plutarch and Ptolemy speak of the Fortunate Islands, but their description is so imperfect that it is not clear whether the Madeiras or the Canaries are referred to. There is no farther mention of them until we read of their rediscovery about 1334, by a French vessel driven amongst them by a storm. A Spanish nobleman thereupon obtained a grant of them, with the title of king, from Clement VI., but want of means prevented him from carrying out his project of conquest. Two expeditions subsequently set out from Spanish ports, and returned without having taken possession. At length three vessels, equipped by Jean de Bethencourt, a gentleman of Normandy, sailed from Rochelle in 1400, and bent their course to the Canaries. He landed at Lanzarote and Fuerteventura, but being opposed by the natives, and finding himself deficient in means to effect his purpose, he repaired to the court of Castile, and obtaining from Henry III. a grant of the islands, with the title of

king, he sailed in 1404 with a strong force, which mastered Lanzarote, Fuerteventura, Gomera, and Hierro, without bloodshed. Being repulsed in his attempts on Palma and Canary, he returned to Europe in 1408 to obtain further assistance. He was well received at the Castilian court, where he was promised aid; but he died shortly afterwards in France. Bethencourt's nephew had been left governor of the islands, and claimed to succeed to his uncle's rights. Being charged with many acts of misgovernment, he went to Spain to clear himself, and whilst there sold his rights to Don Enrique de Guzman, who, after expending large sums in fruitless endeavours to reduce the unconquered islands, sold them to another Spaniard named Paraza. His successors, about 1461, took nominal possession of Canary and Tenerife, but the natives effectually resisted their occupation of them. Meantime it appeared that Jean de Bethencourt's nephew had fraudulently made a second sale of the islands to Portugal, and the difference thus arising between the crowns of Spain and Portugal was ended by the cession of the islands to the former. Grand Canary, Tenerife, and Palma, remaining unsubdued in 1476, Ferdinand and Isabella of Spain compelled Paraza's successors to sell those islands to the crown; and the following year 1000 men were despatched to reduce them. After much bloodshed, and with reinforcements from the mother country, the Spaniards, under Pedro de Vera, became masters of Grand Canary in 1483. Palma was conquered in 1491, and Tenerife in 1495, by Alonzo de Lugo. All the islands still continue in the possession of Spain.

Inhabitants.—As to the derivation of their original inhabitants, the Guanches, nothing certain is known. The most probable supposition is that they came from the adjoining coast of Africa. Pliny states that the islands were uninhabited at the time of which he wrote. If this were so, we might infer, from the absence of any trace of Mahometanism amongst the people found there by the Spaniards, that the migration took place between the time to which his account refers and the time of the conquest of Barbary by the Arabs. Many of the Guanches fell in opposing the Spanish invasion, many were sold by the conquerors as slaves, and many conformed to the Roman Catholic faith and intermarried with the Spaniards,—so that all trace of them as a distinct race is lost. They were said to be of tall stature, and Humboldt styles them the Patagonians of the Old World; but the skeletons of Guanches when measured have been found to be less than average skeletons of Europeans. The Guanches embalmed the bodies of their dead, and placed them in caves; and many mummies have been found at different times in a state of extreme desiccation, each weighing not more than 6 or 7 lb. Two inaccessible caves in a vertical rock by the shore, three miles from Santa Cruz (Teneriffe), are said still to contain bones. A few words of the languages spoken by the ancient inhabitants have been preserved, and a resemblance of some of them to words of North African dialects has been noticed. On the other hand, the Guanches had customs, such as that of preserving their dead, in which they differed from the Berbers. Councillor Von Löher, one of the most recent investigators of the question, finds that the names of places in the interior of the island are generally either of Berber or of Teutonic origin, and maintains that the Guanches were in all probability the descendants of Vandal and Gothic immigrants.

The present inhabitants are slightly darker than the people of Spain, but in other respects are scarcely distinguishable. The men are of middle height, well-made, and strong; the women are not striking, in respect of beauty, but they have good eyes and hair. Spanish is the only language in use. The people have most of the traits of the people of the peninsula; they are sober, but given to

gambling; they are quick, but lazy, faithless, and superstitious. The lower orders are quite illiterate, and the better classes not very enlightened. A few booksellers' shops of a minor description exist at Santa Cruz and Las Palmas. The sustenance of the lower classes is chiefly composed of fish, potatoes, and *gofio*, which is merely Indian corn or wheat roasted and then, when ground, kneaded with water or milk.

Government, &c.—The Archipelago is politically considered part of the province of Andalusia. The governor-general, who resides at Santa Cruz, has chief command both in civil and military affairs. The actual administration of affairs is in the hands of two lieutenant-governors, who reside at Santa Cruz and Las Palmas. On the other islands are deputy-governors, acting under the lieutenant-governor to whose district they belong. The military force is composed of a battalion of soldiers of the line, numbering about 1000 men; six regiments of militia, amounting to about 8000 men, distributed amongst the islands; and a few companies of artillery. There is a military commander on each island. The great court of appeal sits at Las Palmas. Courts of first instance sit at Santa Cruz, Orotava, and Las Palmas. The land in great part is strictly entailed. The islands form two bishoprics, Tenerife and Grand Canary. The whole ecclesiastical revenue is estimated at upwards of £36,000. The monkish establishments have been suppressed, and such of the monasteries and convents as are not kept up for secular purposes are falling to ruin. No form of religion except the Roman Catholic is tolerated.

Climate and Meteorology.—From April to October a north or north-east wind of more or less strength blows upon the islands, commencing at 10 A.M. and continuing until 5 or 6 P.M. In summer this wind produces a dense stratum of sea cloud (cumuloni), 1000 feet thick, whose lower surface is about 3500 feet above the sea at Tenerife. This does not reach up to the mountains, which have on every side a stratum of their own, about 500 feet thick, the lower surface being about 2500 feet above the level of the sea. Between these two distinct strata there is a gap through which persons on a vessel approaching or leaving the island may obtain a glimpse of the peak. Travellers who ascend the mountains look down on these stationary layers of cloud. The sea cloud conceals from view the other islands, except those whose mountains pierce through it. On the south-west coasts there is no regular sea or land breeze. In winter they are occasionally visited by a hot south-east wind, called Levante, from the African continent, producing various disagreeable consequences on the exposed parts of the person, besides injuring the vegetation, especially on the higher grounds. Locusts have sometimes been brought by this wind. In 1812 it is said that locusts covered some fields in Fuerteventura to the depth of 4 feet. Hurricanes, accompanied by waterspouts, sometimes cause much devastation; but, on the whole, these islands are singularly free from such visitations. The climate generally is mild, dry, and salubrious. On the lower grounds the temperature is equable, the daily range seldom exceeding 6° Fahr. The rainy season occurs at the same period as in southern Europe. The dry season is at the time of the trade-winds, which extend a few degrees farther north than this latitude. "In no part of the world is the barometer more susceptible of atmospheric changes than amongst the Canary Islands. A rapid rise is the sure precursor of an easterly wind, whilst the contrary as certainly indicates a change to west or south-west" (Lieut. Arlett).

Agriculture, Manufactures, and Commerce.—In ordinary years sufficient grain and potatoes are produced to supply the wants of the islands. The soil on the lower part of the islands, where water is plentiful, is productive; in some places two crops of Indian corn and one of potatoes

can be obtained from the same piece of ground in a twelve-month. Except at Fuerteventura, the vine is much cultivated, but chiefly at Tenerife, the best wines being produced on the north-west coast. None, however, is considered so good as the wine of Madeira. The most esteemed kind is sent to England under the name of Vidonia. The grape disease made its appearance at the Canaries in 1853, and destroyed nearly the whole crop. Previously the total annual produce was estimated at about 40,000 pipes, of which 25,000 pipes were produced in Tenerife. Between 8000 and 9000 pipes were exported. The price per pipe on board ranged from £8 to £20. Some of the wine is distilled into good brandy. Sumach, canary-seed, and a little flax are grown. Sweet potatoes, maize, gourds, pumpkins, tara (*Colocasia antiquorum*), lentils, *Cicer arietinum*, beans, kidney beans, and lupines are extensively cultivated for food. From bad management the fruits are generally inferior. They include oranges, figs, bananas, dates, pine-apples, pomegranates, papaws, guavas, custard apples, and prickly pears. There are no cocoa-nut trees or bread-fruit trees. A little oil is obtained from the olive in Grand Canary. The agave is abundant, and supplies a material for ropes, girths, &c. The leaves of the date palm are made into hats and baskets. A good deal of orchil-lichen is gathered for exportation; and the ice-plant is grown in small quantity for barilla. The sugar manufacture, once largely carried on, has fallen before the American and West Indian trade; the only two existing mills are on Palma. Wine having been for some time so little remunerative, other products have received attention, the chief being cochineal. This insect, which feeds on a species of cactus, was introduced in 1825, and is now largely produced on all the islands,—land formerly occupied by grain and vines being devoted to its cultivation. In 1873 upwards of 5,728,000 lb. of the total value of 13,894,225 pesetas, or about £555,849, were exported, principally to France and E. gland. The silkworm is reared to a small extent, chiefly on Palma. Raw silk is exported, and some is manufactured on the spot into stockings, ribands, &c. Some linen and woollen stuffs of a coarse kind are made for home consumption, but the great bulk of the clothing in use is of British manufacture. The island goats (a peculiar and esteemed breed) furnish milk, from which butter and cheese are made. Pigs and sheep of a small coarse-wooled breed are numerous. Horses and cattle are scarce; domestic fowls and rabbits are plentiful. Asses and mules are much used. A fishery on the African coast, which gives employment to many persons, has existed from an early period. The fish, principally bream, is salted and largely consumed at the Canaries.

There is a good deal of intercourse by means of boats and small sailing vessels amongst the different islands. In this way wine, raw silk, cochineal, barilla, and dried fruits are taken to the places of export; and grain is conveyed from those islands where it is abundant to those where the supply is deficient. The principal foreign trade is with England, the chief articles of export being wine, cochineal, barilla, and orchil. The imports consist of iron, metal goods, glass, crockery, leather, and silk, cotton, and woollen manufactures. There is also a considerable trade with the United States and the countries bordering the Mediterranean. With Hamburg and France an exchange of commodities takes place. The ships employed in this commerce are foreign, chiefly British; but the islanders send a few vessels of their own with brandy, coarse earthenware, and silk goods to the Spanish West Indies, bringing back cigars, sugar, coffee, rum, cocoa (the material of chocolate), and a few other articles. Santa Cruz, Orotava, and Las Palmas are the only ports engaged in foreign trade: nearly 300 vessels enter these ports in the course of

a year. In 1852 the ports were practically made free—the small duty of 2s. per cent. only being now levied upon imported goods, with the exception of tobacco, which pays 5d. per lb., and cigars which pay 10d. per lb. Spanish steamers ply between Cadiz and Santa Cruz. The Spanish Government packet on its outward voyage to Havana touches at Santa Cruz once a month; and the same port is visited by the English mail steamers in their voyages to and from the African coast.

Zoology.—The indigenous mammals and reptiles of the Canary Islands are very few in number. Of the former, only species of dog, of swine, of goat, and of sheep were found upon the island by the Spanish conquerors. The race of large dogs which is supposed to have given a name to Canary has been long extinct. A single skeleton has been found, which is deposited in one of the museums at Paris. The ferret, rabbit, cat, rat, mouse, and two kinds of bat have become naturalized. The ornithology is more interesting, on account at once of the birds native to the islands and the stragglers from the African coast. The latter are chiefly brought over in winter when the wind has blown for some time from the east. Among the former are some birds of prey, as the African vulture, the falcon, the buzzard, the sparrow-hawk, and the kite. There are also two species of owl, three species of sea-mew, the stockdove, quail, raven, magpie, chaffinch, goldfinch, blackcap, canary bird, titmouse, blackbird, house-swallow, &c. The bird with the sweetest song is a variety of the blackcap or *Sylvia atricapilla*. As to the insects, mention may be made of a species of gnat or mosquito which is sometimes troublesome, especially to strangers, and the cockroach. The list of reptiles is limited to three lizards and a frog. The only fresh-water fish is the eel. The marine fishes are not numerous, the reason perhaps being that the steepness of the coast does not allow seaweed to grow in sufficient quantity to support the lower forms of marine animal life. Whales and seals are occasionally seen. The cuttle-fish is abundant, and is sought for as an article of food.

Botany.—The position of mountainous islands like the Canaries, in the sub-tropical division of the temperate zone, is highly favourable to the development, within a small space, of plants characteristic of both warm and cold climates. Von Buch refers to five regions of vegetation in Tenerife:—1. From the sea to the height of 1300 feet. This he styles the African region. The climate in the hottest parts is similar to that of Egypt and southern Barbary. Here grow, among the introduced plants, the coffee-tree, the date-palm, the sugar-cane, the banana, the orange tree, the American agave, and two species of cactus; and among indigenous plants, the dragon tree on the north-west of Tenerife. A leafless and fantastic euphorbia, *E. canariensis*, and a shrubby composite plant, *Cacalia Kleinia*, give a character to the landscape about Santa Cruz. 2. Between 1300 feet and 2800 feet. This is the region of South European vegetation, the climate answering to that of southern France and central Italy. Here flourish the vine and the cereals. 3. The region of indigenous trees, including various species of laurel, an *Ardisia*, *Ilex*, *Rhamnus*, *Olea*, *Myrica*, and other trees found wild also at Madeira. The clouds rest on this region during the day, and by their humidity support a vegetation amongst the trees, partly of shrubs, and partly of ferns. It extends to the height of 4000 feet. 4. The region of the beautiful *Pinus canariensis*, extending to the height of 6400 feet; here the broad-leaved trees have ceased to grow, but arborecent heaths are found throughout its whole extent, and specimens of *Juniperus oxycedrus* may be met with. 5. The region of Retama (*Cytisus nubigenus*), a species of white-flowering and sweet-scented broom, which is found as high as 11,000 feet. At the upper edge of this region a lilac-coloured