THE COTTON PLANT AND ITS FIBER.

Linnæus recognized five primary species of the cotton plant. Other botanists have made the number seven, eight,

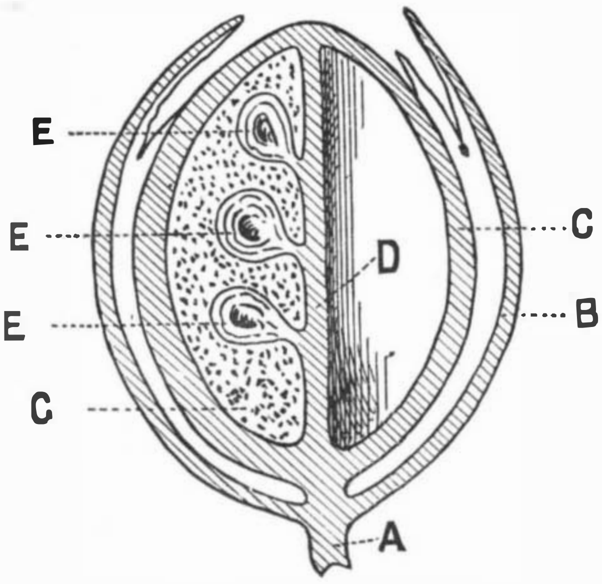


FIG. 1.

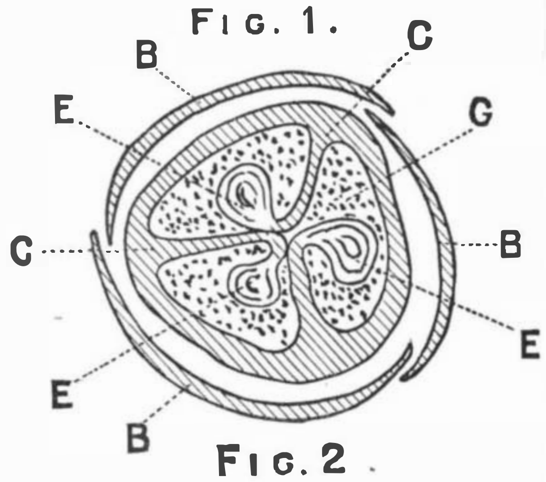


FIG. 2.

A. Stem.—B. Section of calyx.—C. Section of carpel.—D. Midweb with seeds attached.—E. Section of seeds.—G. Plexus of young cotton fibers.

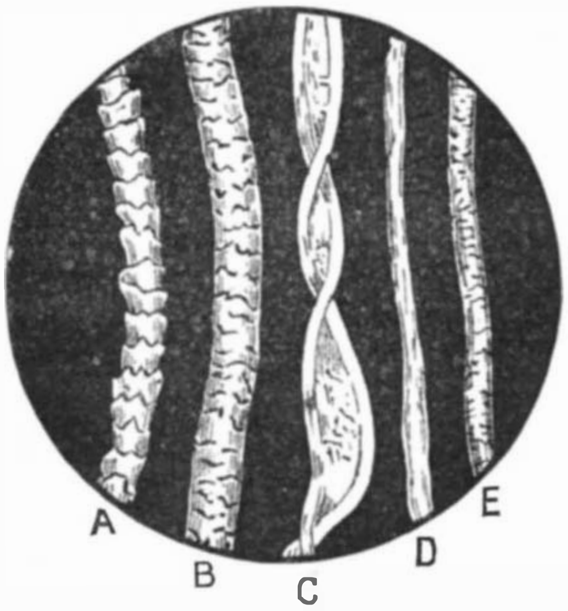
LONGITUDINAL AND TRANSVERSE SECTIONS OF EGYPTIAN COTTON POD.

and even ten. One of the later authorities, Professor Parlatore, finds seven species:

1. *Gossypium arboreum*, which occurs in Ceylon, the Moluccas, Arabia, Senegal, etc.
2. *G. herbaceum*, growing in Siam, China, India, Italy, etc.
3. *G. sandwichense*, from the Sandwich and other Pacific islands.
4. *G. hirsutum*, which furnishes our American upland cottons.
5. *G. barbadense*, including the Sea Island and Barbadoes cottons.
6. *G tahitense*, from Tahiti, the Society Islands, etc.
7. *G. religiosum* or *peruvianum*, which comprises Peruvian and other cottons with seeds in adherent files.

In his new and valuable work on the "Structure of the Cotton Fiber in its Relations to Technical Applications," Mr. F. H. Bowman holds that the best practical division is that of herbaceous, shrub, and tree cotton. The herbaceous cotton is the most valuable, and is that from which the large American crop is obtained.

Fig. 3.—(325 Diameters.)



A. Fiber of Chinese wool.—B. Fiber of Leicestershire wool.—C. Fiber of cotton.—D. Fiber of silk.—E. Fiber of mohair.

The cottons grown in different parts of the world differ in the length and fineness of the staple, the range being between the short native cotton of India, with a fiber scarcely exceeding three-fourths of an inch, and the long stapled Sea Island cotton grown on the shores of Georgia and Florida, with a fiber over two inches long.

Mr. Bowman gives (pp. 99, 100) a table of the various classes of cottons quoted in the Liverpool market, giving the name, place of growth, species, average length of staple, and the spinning "counts" for which each is generally used.

The "Sea Islands" cottons (*G. barbadense*) are used for all the finest counts, which are spun up to 2,000s. The cotton from the coast of Georgia and Florida stands at the head, with an average length of staple of 2·20 inches.

Next comes the cotton of the same species, grown on Florida uplands, with a staple 1·95 inches long. The same grown in Australia and the Pacific islands measures from 1·65 to 1·88 inches. The so-called Sea Islands cotton from Venezuela (La Guayran, *G. hirsutum*) measures 1·75 inches; while that from the coast of Peru (*G. peruvianum*) measures 1·50.

Next in length of staple comes "Egyptian cotton," the best of which (from *G. barbadense*), with a staple of 1·50 inches, is spun up to 200s. The brown Egyptian (from *G. herbaceum*) has a staple of 1·40 inches, and is spun up to 140s. The white Egyptian (from *G. hirsutum* and *G. peruvianum*) has a staple of 1·25 inches, and is spun up to 80s. The Smyrna cotton, from the Levant and Greek islands, is classed with, and is almost equal in quality to, the last named.

Next in order come the "Brazilian" cottons, which include all the South American and West Indian products, except the long-staple cottons already named. The staple ranges between 1·15 inches and 1·35 inches. Alone and mixed with American and Egyptian cottons the Brazilian cottons are spun up to 60s.

"American" cottons comprise those known as *Upland*, from Georgia and South Carolina; *Mobile*, from Alabama and adjacent States; *Orleans*, from Mississippi, Arkansas, and Louisiana; and *Texas*, from that State. The species is *G. hirsutum*, and the average lengths of staple are, in the order named: 1 inch, 1·05 inches, 1·10 inches, and 0·95 inch. Alone these cottons are spun up to 50s; mixed with Egyptian and Brazilian, up to 60s.

The "Indian" or Surat cottons, and the "Madras" cottons, under eight or ten special names, include the products of the several divisions of Hindostan and British Burmah. The staple varies between 0·90 inch and 1·20 inches, the shortest being "Rangoon," from Burmah, the longest, "Hingunghat," from the Central Provinces. Alone these cottons are spun up to 32s; mixed with American, up to 40s.

The "African" cottons are of like grade with the Indian. These, of course, do not include the Egyptian.

By "counts" in the foregoing descriptions is meant the number of hanks of 840 yards spun from one pound of cot-

Fig. 4.—(325 Diameters.)

A. Glassy, structureless fiber.—B. Thin, pellucid, unripe fiber.—C. Half ripe fiber, with thin cell wall.—D and E. Fully mature and ripe fiber, with full twist and thick, well-defined cell wall.

ton; a count of 200 means 200 × 840 yards, or 168,000 yards to the pound. American Sea Island cotton has been spun into counts as high as 2,150 hanks to the pound, so that one pound of this yarn would have a length exceeding 1,000 miles. The short American staple will average about 30 miles of yarn to the pound, as it is ordinarily spun.

A ready conception of the relative proportions of the cotton fiber may be obtained by supposing the fiber magnified until it should be one inch in diameter. In this case the ordinary American cotton fiber would measure 100 feet in length, while an average fiber of Sea Island cotton would reach over 130 feet.

The fineness of the fiber may be judged from the fact that it takes from 14,000 to 20,000 filaments to weigh a grain. If the separate fibers of a pound of ordinary cotton could be placed end to end in a straight line they would reach about 2,200 miles. The fibers are far from uniform in length, the longest, as a rule, being those which grow on the crown of the seed; the shortest grow at the base of the seed. The manner in which the fiber is distributed about the seeds in the boll is shown in Figs. 1 and 2.

The relative strengths of the different sorts of cotton fibers have been partially investigated by Mr. C. O'Neill. The results as quoted by Mr. Bowman are arranged as follows, the weights indicating the mean breaking strain: Sea Island (Edisto), 83·9 grains; Queensland, 147·6 grains; Egyptian, 127·2 grains; Maranham, 107·1 grains; Benguela, 100·6 grains; Pernambuco, 140·2 grains; New Orleans, 147·7 grains; Upland, 104·5 grains; Surat (Dhollerah), 141·9 grains; Surat (Comptah), 163·7 grains. In proportion to the sectional area of the fiber the Egyptian cotton appears to be relatively strongest. In the other cases the breaking strains are roughly proportional to the coarseness of the fiber. These measurements are set down as approximate only.

When examined under the microscope the cotton fiber is usually seen to be an irregular, flattened, somewhat twisted tube; frequently the tubular form is lost by collapse, the fiber appearing ribbon-like, with the edges thickened.

In Fig. 3, copied from the work of Mr. Bowman, the appearance of the fiber is contrasted with that of fibers of wool, silk, etc.

Mr. Bowman finds that, speaking generally, cotton fibers may be divided into three classes:

1. Those in which no internal structure is apparent.
2. Those in which the structure seems to be simply tubular, with a well-defined transparent cell-wall.
3. Those in which the structure is tubular and the interior of the cell is filled with secondary deposits, almost entirely

Fig. 5.—(450 Diameters.)

A. Unripe unmatured fibers.—B. Half ripe fibers.—C. Fully matured and ripe cotton.—D. Section of fiber showing laminated cell walls.

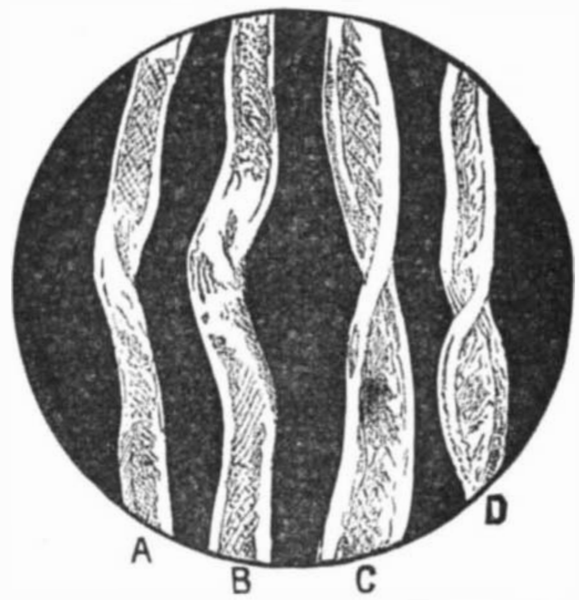
SECTIONS OF COTTON FIBER.

filling up the cavity and giving the fiber a dense, almost opaque appearance.

The first of these classes occurs most frequently in early and unripe cotton, and apparently also in cotton which is overripe from having been left too long ungathered. In both cases the outer sheath of the fiber seems to be of extreme thinness.

The structureless appearance of unripe cotton is attributed to the fact that the fiber has been detached from the seed before the period when the filling up of the interior of the elongated cellular sac which forms the fiber has commenced; in the overripe cotton the thickness of the outer wall seems to have been reduced by the process of absorption which sets in when an organic structure has reached maturity. In certain other fibers the lack of internal structure is partial, portions of their length appearing solid and incapable of absorbing dyes, a condition analogous to "kemps" in wool. This kempy structure seems to be more frequent in short than in long fibers, and probably varies with the climatic and other conditions of the growth of the plant.

Fig. 6.—(300 Diameters.)



A and B. Fibers of wild African cotton.—C and D. Fibers of coarse Peruvian cotton.

COTTON FIBERS SHOWING SPIRAL STRUCTURE.

The third class of fibers are the most valuable, since they absorb dyeing materials best, and in some cases retain the dye in the inner tube in crystalline masses. When acted upon by many chemical reagents the rigidity and solidity of the tube walls of these fibers appear to be increased, and in some cases the thickness of the wall also. Mr. Bowman says of these: "It seems as if in this fully matured fiber the central cells, up which the sap passed during the period of growth, had been fully absorbed into the tube wall when the full length of the hair was reached and the vital action which kept the cell contents in activity [was] arrested; and while the interior cells are fully matured they are shrunk in toward the denser walls which form the outer sheath, but without losing their structure, so that they are ready to be expanded again when their interior is filled with fluid or solid contents, as the case may be. In this class of fibers the central tube is always well defined. Of course, as in the case of the second class, the irregularities and twists in the fibers are quite visible, and they shade into the first and second varieties; but they form by far the largest portion of every cotton sample, and hence may be taken as the typical fiber.

In Fig. 4 are represented these three classes of fibers. Fig. 5 exhibits a number of sections of cotton fiber, as found in the different stages of growth. Fig. 6 shows the spiral structure of different cotton fibers.

Unfortunately Mr. Bowman's examinations were made at a distance from the cotton field, so that he was unable to study the mutual relations of the different parts of the fiber and of the different kinds of fiber in the green or growing state. His specimens were all selected after the cotton had been not only dried, but ginned and pressed. A corresponding study of the varying appearance of the fiber in its natural course of development could not fail to be valuable

Technical Teaching in England.

The increasing interest in technical instruction in England is shown by the fact that more than 2,500 students were taught in the classes of the London City and Guilds Institute last session. The third examination of the Institute was held lately at 115 centers. Out of 1,563 candidates 895 passed in one, and 65 in two subjects. The number of papers examined this year by the Institute was 1,776, of which 484 were for outside students.

RECENT INVENTIONS.

An improved coin holder has been patented by Mr. John Chantrell, of Bridgeport, Conn. The object of this invention is to hold rolls of coin in such a manner that the coins can be readily seen and counted and conveniently handled.

Mr. Jacob G. Titus, of Silver Cliff, Col., has patented an improvement in that class of journal bearings in which friction is relieved by use of balls or rollers interposed between the journal and its box or casing. The improvement consists in the construction of an axle journal box which adapts it to receive anti-friction balls, and also in the provision of elastic and anti-friction end bearings for receiving the end movement or thrust of the axle journal.

An improved cornstalk shocker and binder has been patented by Mr. John B. Whitbeck, of Coxsackie, N. Y. The invention consists in a roller supported by standards and carrying a transverse bar and a cord for drawing the stalks together to be bound. After binding the shock the roller and transverse bar may be removed.

Mr. Adrian C. Selby, of Covington, Ky., has patented an improved soap composed of tallow, olive oil, sal-soda, unslaked lime, rosin, borax, alum, white wax, spermaceti, and benzine.

An improved game has been patented by Mr. Stephen W. Roe, of Albany, N. Y. The object of this invention is to provide a new and simple game which is played in the same manner as billiards.

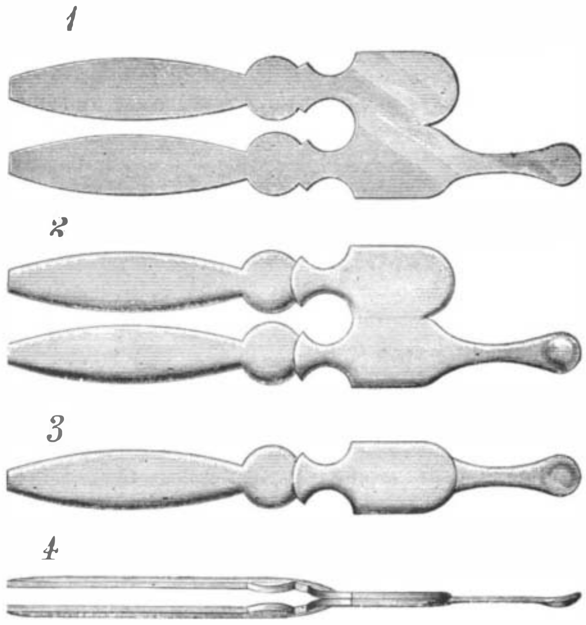
Anna M. Knoop, of New York city, has patented an improvement in crochet goods, which can be used as hat frames, book satchels, sewing baskets, etc. The invention consists in an article of crochet work which is stiffened by means of glue, gelatine, or similar substance, is then dried on a mould, which gives it the desired form, and is then protected with a suitable varnish.

Mr. John L. Symonds, of Detroit, Mich., has patented an improved trap formed of two trough or tray shaped wire netting sections hinged to each other and pressed toward each other by spiral springs on one of the sections. The trap is provided with a bait hook having a catch at the upper end, which catches on a bail of the other section and holds the sections separated; but as soon as an animal bites on the bait the bail is released and the springs force the two wire netting sections together, thus entrapping the animal.

IMPROVED INVALID BED.

The engraving shows an improved invalid bed recently patented by Mr. George B. Davis, of Richmond, Va. It is constructed so that the head, back, and legs of the patient can be raised or lowered with very little effort on the part of the attendant, and without any exertion whatever on the part of the patient.

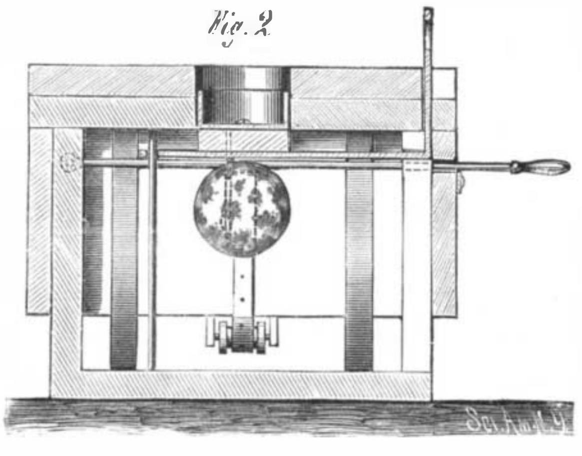
The bed is provided with a pivoted leg and foot support, which may be raised or lowered at pleasure, by means of a rope or strap attached to the support and extending upward over the foot of the bed frame. The head support is hinged, and its free end is sustained by a powerful curved spring having sufficient strength to support the headpiece and the portion of the patient's body reclining thereon. A strap



IMPROVED TWEEZERS.

attached to the free end of the headpiece extends downward, and passing under a roller is finally drawn through a buckle secured to the head of the bed. The patient's head, shoulders, and the upper portion of the body are drawn down by means of the strap, against the pressure of the spring, and the head support may be fastened at any desired inclination by securing the strap in the buckle.

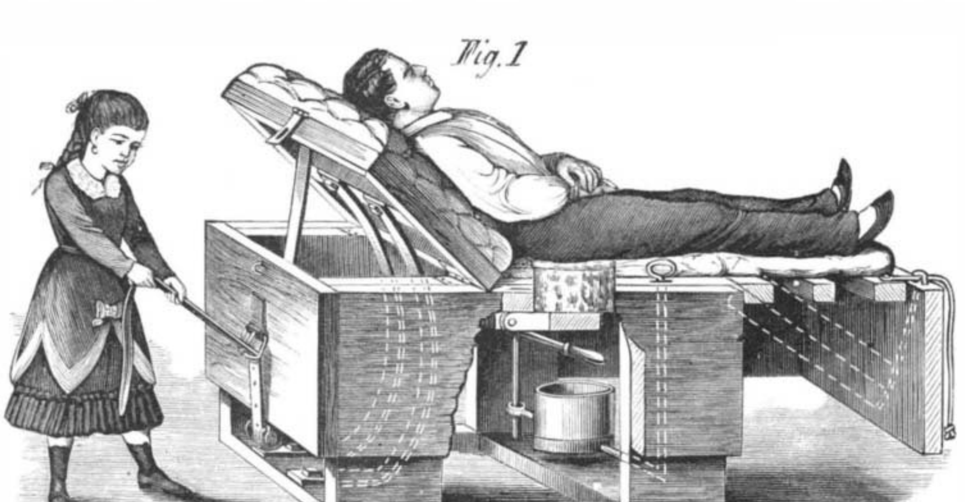
Fig. 2.



SECTIONAL VIEW OF INVALID BED.

Both bed frame and mattress are apertured to receive a vessel contained in a movable case attached to a lever arm, by means of which it may be moved up or down or swung around, as circumstances may require.

Fig. 1



DAVIS' INVALID BED.

The aperture in the mattress is stopped by a cushion when the vessel is not in use. The cushion is secured to an arm hinged to the under side of the bed frame, so that it is always ready for use.

This invention will afford comfort and relief to invalids, and will greatly lessen the labor of nurses and attendants.

Apples for Cows.

Apples, like other succulent food, are good for cows and increase their milk, provided the feeding is begun cautiously in the first place, and gradually and regularly increased. But when cows break into orchards and over-gorge themselves, fever and bloating may follow, accompanied with loss or diminution of milk.

IMPROVEMENT IN THE MANUFACTURE OF TWEEZERS.

The engraving shows an improvement in the manufacture of spring tweezers, in which the two blades and body consist of a single piece of sheet metal having the two parts of the body and blades connected by a longitudinal bend in the body. This novel method of making tweezers, or tweezers and ear spoon, from a single piece of sheet metal, has been patented by Messrs. F. L. & J. M. Ellis, of Milldale, Conn. The finished article and the several stages of its manufacture are illustrated in the engravings.

Fig. 1 is a plan view of the first stage of the blank; Fig. 2 is a plan view of the second stage of the blank; Fig. 3 is a transverse section of the third blank, the plane section extending through the body which unites the tweezer blades; and Figs. 4 and 5 are side and edge views respectively of the finished tweezers and ear spoon.

The first operation is to cut out from sheet metal—preferably steel—the twin blank, Fig. 1, it being of a proper shape for forming the two blades, the body, and the ear spoon, all formed in one and the same piece of flat sheet metal, and united at the body portion of the blank, while the blades are otherwise separate from each other, as shown. The next operation is to strike the first blank in a swaging die, to round up and hollow the blades and the spoon, as shown in Fig. 2. Then the body portion of the blank is bent, so that the two parts come toward each other. The blanks are then struck in dies, which bring the two parts of the body together and set them firmly in place, and slightly offsets the shank of the spoon at its junction with the body of the tweezers, to bring it nearer the middle of the thickness of the double body, as shown in Fig. 5. These dies may also round off and remove the sharp edges from the corners of the body and spoon. The corners of the blades may be rounded off in the second set of dies. When thus treated the article is finished, ready for polishing by tumbling and otherwise.

The Vandenbergh "Sea Messenger."

During a recent cruise of the British reserve squadron a trial was made of the new sea messenger invented by Mr. Julius Vandenbergh, of Portsmouth, England. The "messenger" consists of a vessel pointed at each end, three feet six inches in length, made of copper, and lined with cork and composition to resist external pressure. The inner case will carry a weight of sixty pounds, and is designed for the conveyance of letters and other papers from wrecked or disabled vessels. The messenger was thrown over from the Hercules flagship in latitude 56.49 W., longitude 41 E., on the 24th of July. It was picked up on the 18th of August by a fisherman off Hanstholmen, Jutland, and, although it had been twenty-five days in the water, and had traveled about 1,420 miles, it was quite uninjured.

Improvement in Teaching Deaf Mutes.

The Pennsylvania Institution for the Deaf and Dumb has established a school for the tuition of deaf mutes in facial articulation, so as to enable the children, by expression of the face, to understand what is said, and they in turn may, by imitation, pronounce words in answer. This will enable them to communicate with the world at large, although they are not able to hear, and is an advance upon the sign language now in use.

The principal selected is Miss Garrett, an experienced teacher, who has hitherto been engaged in that branch of teaching in New England. This is the first effort of the kind made in Pennsylvania. There are two such schools in Massachusetts and one in New York.—*Philadelphia Bulletin.*

Large Sugar Refinery.

The greatest sugar refinery in the world is now under construction on tidewater, San Francisco. The brick building facing deep water in South San Francisco will be 400 x 150 feet, and thirteen stories high (140 feet). A salt water supply of 3,000 gallons a minute is drawn from the bay, by a tunnel, for the monster condenser. By March next it will be finished at a cost of $1,250,000. Its yearly capacity will be 60,000 tons of refined sugar. Claus Spreckles is the master spirit. It is a result of the reciprocity treaty, by which Sandwich Islands raw sugars are admitted free of duty. He has now thirty vessels employed (all built there) plying between the islands and San Francisco. He has planted sugar cane on a large scale on islands hitherto wild and uncultivated. He has tapped the mountains, and every acre is irrigated. He buys all the native production.