The Story of Cane Sugar

American Sugar Refining Company
This is the story of cane sugar—the sparkling white sugar you stirred in your coffee and sprinkled on your cereal at breakfast; as well as the sugar that plays such an important part in creating the satisfying flavor of your favorite dessert at dinner. Sugar is an essential ingredient in every meal and it would be almost impossible to satisfy the food requirements of our modern civilization without it.

Refined cane sugar is a pure, wholesome, naturally occurring, carbohydrate technically known as sucrose. There is a whole series of related carbohydrates known to chemists as sugars, but in everyday language the word “sugar” refers solely to sucrose.

About two-thirds of the world’s sugar supply is derived from the sweet juice of sugar cane. It is a tropical plant, thriving only in a warm, moist climate. The principal growing areas are
Cuba, Puerto Rico, India, Java, the Philippine Islands, the Hawaiian Islands, South America, Egypt, South Africa, Formosa and Australia. In the United States, sugar cane is grown principally in the State of Louisiana and, to a lesser extent, in the State of Florida.

There are definite indications that sugar cane was known and its juice highly valued hundreds of years before the birth of Christ. The earliest written mention of sugar cane appears in records of the expedition of Alexander the Great down the Indus River in 325 B.C. Writing of their explorations, Nearchus, one of the emperor’s admirals, said they found “honey-bearing reeds.”

Linked together in the Bible as articles of great value are Incense from Sheba and Sweet Cane from a far country. Another reference is by Dioscorides, a Greek physician who lived during the time of the Roman Emperor Nero. “There is a sort of hard honey,” he wrote, “which is called saccharum (sugar) found upon canes in India. It is grainy like salt and brittle between the teeth, but of sweet taste withal.”

By 600 A.D. sugar had become known throughout the Orient. Tai-tsung, Emperor of China (627-650 A.D.), sent envoys to India to learn the art of extracting a syrup from sugar cane. The syrup in turn was boiled until it became a thick, dark mixture of sugar and syrup. It is believed this was somewhat similar in color to the darkest brown sugar we have today.

A Basis of Commerce

In the 8th century, a crude kind of refining process was devised by the Egyptians. Sugar cane was introduced on the Island of Sicily by Arab traders from the Nile Valley. Growing successfully in Sicily, sugar cane spread to Spain and to the other Mediterranean border countries. Records showing the income of the Sultan of Turkey in the 11th century include 50,000 pounds of sugar as part of his revenue.
From the Moslems, the Crusaders learned the art of preserving meat with spices. From the Moslems, too, they acquired a taste for sugar. Returning home, the armies of the Crusades spread word of these new food wonders. This created a demand resulting in brisk trade between Europe and the countries of the Far East. This trade prospered until 1453, when the Turks captured Constantinople and began to levy high tribute on passing caravans. Prior to this conquest, the Italian Republics of Venice and Genoa were the principal European seaports on the Mediterranean. They had become rich and powerful because through their ports passed most of the trade between the Far East and the Northern European countries. Restriction of that commerce by the invading Turks was the principal reason why Columbus sought a new route to India and discovered America.

In the 15th century an inventor, living in Venice, received 100,000 crowns for devising a method of molding sugar. The molded sugar became known as "pains de Venise" or Venetian loaves. The process of molding sugar into cones was the last step in refining practiced for over 400 years and to a limited extent is employed to the present day. Granulated sugar as we know it today is a relatively modern innovation.
**Sugar in the New World**

Columbus carried cuttings of sugar cane to the new world on his second voyage. His letters told how he planted the cuttings in fertile soil and described the luxuriant growth of the sugar cane. Columbus quickly observed that articles of food were always gratefully received by the Indians. According to Washington Irving’s biography, to win the friendship of the wary natives whom Columbus prevailed upon to visit aboard his ship, he “gave them beads, hawks’ bells and sugar and sent them highly gratified on shore.”

Although sugar had been known to Europeans since the return of the Crusaders in the Middle Ages, ancient modes of transportation, crude refining methods and lack of an efficient distribution system prior to the 19th century combined to make sugar an expensive luxury for only the wealthy to enjoy. In fact, from an old print which features a price list of food products, we learn that sugar sold at $2.75 a pound in London in 1742.

Modern methods of refining, packing and distribution have resulted in a greatly improved product, offered in a variety of forms at prices within the reach of all. The people of the United States are among the largest consumers of sugar and our principal sources of supply are Cuba, Puerto Rico, Hawaii and the Philippine Islands, with the largest percentage coming from Cuba. It is interesting to note that the most progressive countries of the world have the highest per capita consumption of sugar, while that of the more backward nations is the lowest.

**Planting and Harvesting Sugar Cane**

Commercial production of sugar cane is begun by planting cuttings about a foot long, each containing two or three seed buds. A plant soon grows with several shoots forming a clump of cane. One such planting on virgin soil in Cuba is sufficient to produce crops annually for ten to fifteen years. New plants, termed
“ratoons,” spring up from the stubble after each harvesting. The first crop, known as plant cane, is ordinarily harvested about 18 months after planting. After the first crop, sugar cane is normally harvested every 12 months, although in some areas, notably Hawaii, at longer intervals.

The sugar cane stalks are quite similar in appearance to growing corn, but often attain heights of from fifteen to eighteen feet. They are thick and unbranched with broad, flat leaves, about three feet in length.

When the cane is ready for harvest, the stalks are cut near the surface of the ground. In most areas these operations are performed by hand; in others mechanical harvesters are used. An expert workman, using a heavy machete, can cut and load about six tons of cane a day. After cutting, the leaves are stripped from the stalks which are then loaded into ox carts. While the ox cart is still common in Cuba and much of Asia, the harvested cane is carried to the mills in every type of conveyance ranging from the most primitive to the most modern. The trend in harvesting and transportation of the sugar cane is steadily toward mechanized handling, for greater efficiency and economy.
From Field to Mill

Within easy hauling distance of each cane field there is usually a railroad siding and loading station. These loading stations are equipped with cranes which lift the load and deposit it into waiting railroad cars.

Locomotives haul the loaded cars to the raw sugar mill or "central" and are switched onto tilting tables. The cars have hinged sides so that, when these tables are tilted to a sufficient angle, the sugar cane slides from the car to conveyors which carry the cane stalks to the crushing rolls. These consist of pairs of corrugated cylinders placed one above the other, which shred the cane by twisting as it passes through. This operation separates the fibers and prepares them for the grinding mills but does not press out the juice.

The shredded cane now passes through a series of heavy horizontal steel rollers, revolving with tremendous pressure against each other, bursting the sugar cane cells and pressing out the juice. Toward the end of this operation sprays of water facilitate the extraction of any remaining juice. The fibrous residue,
known as “bagasse,” generally provides the fuel for generating the power to operate the mill and the steam for evaporation and crystallization of the juice. Bagasse also forms the basic material for the manufacture of fiber insulation board used in building construction. The sugar cane juice, which constitutes about 80% of the entire weight of the cane, is now ready for further processing to produce raw sugar.

**Raw Sugar**

The juice is first heated, after which lime is added to neutralize acidity and precipitate certain impurities which are then removed by settling and filtration.

Concentration of the juice into syrup starts in huge evaporators. The syrup is then boiled in vacuum pans which are large dome-shaped tanks, where crystallization takes place. It is essential to avoid caramelization or burning of the syrup that would result from boiling at elevated temperatures. Since liquids boil at lower temperature under a partial vacuum than in open air, a vacuum pump in connection with a condenser is employed to create a partial vacuum within the pan. The resulting mixture of sugar crystals and molasses then goes to centrifugal machines.

![Crushing Machines for Extracting Cane Juice](image)
A centrifugal machine consists of a round basket-like container with screen sides, suspended on a vertical shaft within a circular metal shell. The shaft spins the basket at a speed of 1000 to 1200 revolutions per minute. The centrifugal force thus developed throws the molasses off through the screen sides, and the sugar crystals are retained inside the basket. The resulting product is rather sticky, ranging from grayish to reddish brown in color, and is known as centrifugal raw sugar. Raw sugar is not suitable for food or as a component of foods unless further processed.

**The Refining Process Begins**

The raw sugar is packed in large burlap bags and is ready for shipment to the nearest seaport, where it is loaded into vessels and begins its water journey to the docks of cane sugar refineries in the United States. In recent years new methods have been developed for loading the raw sugar in bulk directly into ships, which are then unloaded by huge conveyors at the refinery wharves.

Sampling and weighing take place upon arrival, the samples later being subjected to laboratory analysis to establish in conjunction with the weights, a basis for settlement of customs duty, if any, and the purchase value.

From the wharves the bags of raw sugar are carried to
stations, where the bags are opened and the raw sugar emptied into a hopper that feeds a mechanical crusher, breaking up any large lumps that may have formed.

From the crusher a bucket-type chain elevator carries the raw sugar to the top of the refinery where it is emptied into mixers, known as “minglers.” The addition of syrup at this point forms a thick paste called “magma.” From the mingler the magma flows by gravity into centrifugal machines where it is washed to remove the thin film of dark molasses that still surrounds each crystal of the raw sugar. The removal of this film might be termed the first step in the refining process. From the centrifugals the washed sugar crystals are conveyed to melting tanks where they are dissolved in warm water.

**Filtering Processes**

To this sugar solution is added diatomaceous earth, an exceedingly porous, finely divided material which assists in the removal of impurities. It is then passed through pressure filters which contain circular screen discs covered with cloth. The cloth holds back all suspended impurities together with the added diatomaceous earth.

The liquid, which has a high sugar content after leaving these pressure filters, is clear but amber in color. To assure a high quality refined sugar, the removal of this color is essential, and this is accomplished by flowing the liquid through char filters. The char filters are huge, cylindrical tanks about 20 feet high, containing granular bone char. The liquid runs brilliant and colorless from the char filters, and then passes to what is called the liquor gallery to be graded. Such small quantities of the sugar liquor as retain traces of color are returned to the filters, while the fully decolorized liquor passes to the “pan-house.” When the char is used for some time it becomes inefficient. Its decolorizing properties are then restored by washing and burning processes permitting the use of the char over and over again.
Chalmette Refinery—on historic site of the Battle of New Orleans. One of the five large, modern cane sugar refineries operated by The American Sugar Refining Company.
**How Sugar Crystals Form**

After filtration, the clear sugar solution is conveyed to large, dome-shaped vacuum pans where steam, passing through copper tubes or coils, furnishes the necessary heat for evaporation of the water and subsequent formation of crystals. Vacuum pans are necessary, as explained before, to enable the sugar solution to boil at a low temperature, without burning. Boiling the sugar to form crystals of the proper grain size is one of the important steps in the refining of sugar. Through experience and with the assistance of instrument controls, the operator is able to produce the maximum quantity of crystals of the required size.

When the desired grain size has been obtained through the boiling process and the greatest number of crystals have formed, the contents of the vacuum pan are emptied into a mixer resembling a huge trough, located on the floor below. Revolving paddles maintain a uniform mixture of the warm sugar crystals and syrup, known as the "magma," to prevent the mixture from hardening. Now the sugar crystals must be separated from the syrup which still surrounds them. This is done in more centrifugal machines, similar to those used at the start of the process.
Pure White Granulated Sugar

After the syrup is thrown off, the sugar crystals deposited on the screen sides of the centrifugal machine are sprayed with clear water while the machine is still spinning, to remove the last traces of adhering syrup from each grain. When the machine is stopped, the crystalline sugar remains in the basket, sparkling white and pure. The sugar is discharged from the bottom of the centrifugal onto conveyors to be carried to huge revolving drying drums where a strong current of heated air absorbs the remaining moisture from the sugar. The dried granulated sugar now passes across inclined vibrating screens which grade the crystals according to size.

After screening, the refined sugar moves to large bins or directly to the weighing and packing machines. Under the guidance of skilled operators, these modern packaging machines automatically fill, weigh and pack the many varieties of pure cane sugar in the sanitary, convenient and accurately weighed packages so familiar to American housewives and manufacturers.
Wrapping and Packing Tablet Sugar

Packaging Sugar in Cartons
Other Varieties of Sugar

Brown or so-called “Soft” Sugars are prepared by crystalizing and centrifuging the sugar remaining in the syrup spun off by the centrifugal machines during the processing of the white granulated sugar. Brown sugars contain a nominal amount of mineral salts and possess a delectable cane or cane-molasses flavor.

Confectioners XXXX or “Icing” sugar is made by grinding pure granulated sugar to a very fine powder.

Cube and tablet sugars are formed by pressing pure moist granulated sugar in individual molds on a rotating cylinder. The individual cubes or tablets are ejected onto metal plates which are transferred to ovens for drying and hardening to retain their form.

There is also another interesting process by which tablets are manufactured. This is the so-called Adant Process, used in the United States exclusively by The American Sugar Refining Company. In this process the highest purity sugar syrup of exceptional clarity and brilliance is obtained by char filtering the sugar solution twice. The syrup is evaporated in vacuum pans and is then discharged into iron molds with dividers closely spaced where, after cooling, crystallization is completed. The crystallized mass still in the molds is sprayed with crystal-clear syrup to remove all traces of color. This syrup is then spun off in centrifugal machines. The slabs of sugar are removed from the molds, slowly dried in ovens, then sawed and clipped into tablets of superlative whiteness and brilliancy—Crystal Domino Tablets.

Sugar Syrups

Sugar refiners manufacture sugar syrups also known as “liquid” sugars— which are becoming increasingly important among various types of food manufacturers. The development of these products has been accelerated by significant savings in handling costs since they can be readily transported from the refinery.
in stainless steel tank trucks and in railroad tank cars to the manufacturer’s plant, easily stored there and subsequently pumped to any part of the plant for instant use in processing. These sugar syrups are usually made from refinery sugar solutions that have not undergone the final crystallization process but which have been decolorized and otherwise purified. They are essentially saturated solutions of sugar and/or invert sugar and are available at densities ranging from 66% to 80% solids content, depending upon the relative proportions of sugar and invert sugar present.
Sugar — An Important Nutrient

Sugar today plays an important part in our daily lives. It has long been in such general use that few have ever considered how changed our mode of living would be without it. The common use of sugar in scores of prepared foods and beverages and as a staple in home cooking, canning and table use not only affords fuel for our body’s energy needs but contributes highly to the palatability of our foods.

Everyone knows that carbohydrates are necessary in our diets for their energy value, but it is also important to know that carbohydrates serve other important functions. For example, they assist in the utilization of fat and spare protein for body-building and tissue repair. Fortunately, the human body is well equipped to use carbohydrates. Since carbohydrates are the main source of our body’s fuel supplies, sugar, being a pure wholesome carbohydrate, has a very definite place in the normal diet. Moreover, sugar is an economical source of the energy and body fuel needed for balanced, healthful diets.

Because the true value of sugar in the normal diet is becoming better understood, we now know that we can use it frequently and liberally without endangering good nutrition—contrary to the expressed opinions of many food faddists. We all recognize the value of the basic food groups as a guide to better nutrition and fortunately, we have a much greater choice of foods today which afford well balanced, wholesome, nutritious diets. Therefore, a liberal allowance of sugar need not displace nor interfere in any manner with adequate daily requirements of vitamins, minerals, fats and proteins.

Refined cane sugars, both white and brown, are wholesome, easily utilized sweeteners, rich in energy. They contain no waste, are freely soluble, require no further processing and keep indefinitely.
The American Sugar Refining Company

Organized in 1891, the Company manufactures and distributes three well known brands of sugar—Domino, Franklin and Sunny Cane. The Company owns and operates five large refineries, located at Boston, Brooklyn, Philadelphia, Baltimore and New Orleans. These modern, efficient refineries are capable of turning out about 17 million pounds of Pure Cane Sugar each working day.

To be assured that all sugars are of uniform highest quality and reach consumers in perfect condition, the individual refinery laboratories and a Central Quality Control Laboratory constantly keep close watch on the raw materials, manufacturing operations and packaging of these products. The Company’s Research and Development Laboratory is located in Philadelphia. In addition to conducting its important basic and applied researches on new sugar products and products derived from sugar, it is engaged in the development of improved refining processes, and new uses for sugar products. These activities are aimed at the
objective of providing the consumer with cane sugar products of the highest quality.

The Company also conducts extensive raw sugar operations in Cuba through its Cuban subsidiary, Central Cunagua, S.A. Its Cunagua and Jaronu mills serve a cane producing area of about 700 square miles, with a working population of 20,000 persons. The property contains some 200 miles of company operated, modern railroad facilities—and during the grinding season, these two mills crush more than forty million pounds of sugar cane every twenty-four hours — representing the harvest of approximately 1,000 acres each working day.

Notwithstanding the magnitude of these operations, the raw sugar produced by Cunagua and Jaronu represents only a small part of the total raw sugar requirements of the Company’s five domestic refineries.

Another subsidiary, Brooklyn Cooperage Company, owns and operates two plants, located at Versailles, Connecticut and at Philadelphia, engaged respectively in the manufacture of paper cartons and paper bags used for packing sugar at the Company’s refineries.

Sugars for Home Use

There are Domino, Franklin and Sunny Cane pure cane sugars for every baking, cooking and serving need. These varieties of sugar are refinery packed in small, convenient cartons and bags for all household purposes:

<table>
<thead>
<tr>
<th>EXTRA FINE GRANULATED</th>
<th>For general table use and in cooking, baking, candy making, preserving and canning.</th>
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<tbody>
<tr>
<td>CONFECTIONERS XXXX</td>
<td>A powdered sugar of extremely smooth texture. For making frostings, fondants and uncooked cake icings.</td>
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<tr>
<td>SUPERFINE</td>
<td>Dissolves instantly. Ideal for fruits, cereals, iced drinks and other beverages and for sprinkling over pies, cookies and doughnuts.</td>
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<tr>
<td>OLD FASHIONED BROWN (Dark)</td>
<td>Gives a rich cane-molasses flavor to gingerbread, baked beans, baked apples, candied sweet potatoes and fruit cake.</td>
</tr>
<tr>
<td>LIGHT BROWN (Golden Yellow)</td>
<td>Adds a delicate cane flavor to waffles, cookies, coffee cake, bread puddings, cereals, sauces and candies.</td>
</tr>
<tr>
<td>CRYSTAL DOMINO TABLETS</td>
<td>&quot;The Tablet Sugar That Sparkles.&quot; They accent the full flavor of tea and coffee. Preferred for the best in table service.</td>
</tr>
<tr>
<td>DOTS - CUBES</td>
<td>These small cubes are thrifty and dainty ...adding charm to all social occasions.</td>
</tr>
<tr>
<td>HOSTESS TABLETS</td>
<td>&quot;For everyday use in all hot beverages.&quot; These glistening sugar tablets are both economical and convenient.</td>
</tr>
<tr>
<td>SUGAR AND CINNAMON</td>
<td>In a handy glass jar designed for table use. Perfect for cinnamon toast — gives added zest to baked apples, waffles, puddings, pies, custards, cookies and cereals.</td>
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For additional copies of this booklet write to:  

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