

Sugar, Its History, Manufacture and Modelling Benefits

by Stan Parsons

This material was adapted from Stan's 'A Sweet Industry for your Pike' presentation to the 2003 NMRA Convention in Canada.

Both the *American Sugar Cane League* and *US Sugar* have video materials available which illustrate the process of sugar production. Stan used the *League* video in his presentation. A diagram has been inserted on the next page as a replacement [Source: R Wiles collection, originally from Lowndes, A G (1956), South Pacific Enterprise: The Colonial Sugar Refining Company Limited, Sydney: Angus and Robertson, p 139].

History

The origin of sugar has been lost in the annals of mythology; however, sugar has been held in such high regard by man that it found a place in his earliest written records. Sugar cane or 'honey bearing reeds' are mentioned in many parts of the Old Testament of the Bible. The Prophet Jeremiah mentions an article of great value as 'sweet cane from a far country'.

Nearchus, an Admiral in Alexander the Great's Indian expedition mentions 'honey bearing reeds' and Dioscorides, who lived during the time of Nero, wrote: 'There is a sort of hard honey which is called saccharum (sugar) found upon the canes in India. It is grainy like salt and brittle between the teeth, but of sweet taste withal'.

In 630A D or so the Emperor Tai-tsung of China sent ambassadors to India to learn the art of extracting syrup from sugar cane and boiling down the liquid that resulted into a soft paste similar to the darkest grades of modern brown sugar. Sugar refining, even of the cruder kind was a much later development of the Egyptians in the eighth century.

The Arabs brought sugar cane to Sicily from the Nile Valley and from there it spread to Spain, France, Holland and Italy. The King of Portugal sent Cuttings to the Canary

Islands where cultivation was successful in the fifteenth century, and from there it spread to Brazil, San Domingo and later to Mexico.

The Jesuit Missionary Fathers of San Domingo carried it to Louisiana where in 1791 it was successfully cultivated.

Sugar generated much wealth for those who produced it but until the time of Napoleon it was not affordable to the masses. Sugar sold for the equivalent of \$2.75 a pound in 1742 in the markets of London.

The average person had to settle for crude molasses as their sweetener that sold for about US\$0.30 a pint. During the Napoleonic wars sugar was extracted from the sugar beet in Europe as the Royal Navy intercepted shipments of sugar from the Americas and the Orient.



Stan Parsons Collection

Bullocks hauling cane trucks; from Stan Parsons collection.

The cultivation of cane and sugar beets expanded over the next hundred years and as the technology of sugar refining advanced the price of sugar dropped along with an increase in its consumption.

After the First World War experimentation was done on the manufacture of invert sugars derived from Cornstarch. By the 1950's corn sweeteners were starting to become a reliable source of alternate sweeteners for the food and beverage industry and today make up a sizable amount of the overall sugar production in North America.

Processing Sugar

Sugar Cane: The raw material is sugar cane and the end products in order of importance are sugar, bagasse, molasses and mud (see diagram last page).

Sugar Beets: The process is almost identical for sugar beets except for the initial stage. The beets are sliced into thin noodle shaped pieces called cossettes. These are sent to an extraction tower where the sugar juice is extracted by diffusion with water. The cossets are then sent to a pulp press to squeeze out any remaining juice.

The pulp is then dried and pelletized as high nutrition livestock feed and the juice is sent to the clarifiers as is done in the cane processing. Note:- Coal, oil or natural gas is used for fuel for the boilers.

The raw material is sugar beets and the end products in order of importance is sugar, beet pellets, molasses and mud.

Corn Sweeteners: This process involves processing corn meal into other products by way of chemical reaction. It's a very complex affair and, while part of Stan's original presentation, has not been included here.

Modelling the Sugar Industry

It should be obvious that large volumes of raw material and varied types of end product are created by the sugar industry. Railroads were built to transport high volume material and had created specialized rolling stock to carry many types of product. The uses for sugar and it's by-products are quite varied indeed

Sugar is used not only to sweeten your coffee or make candy. It is used in a wide variety of industrial applications. It is used to control the drying time of adhesives and concrete; it is used in pharmaceuticals and as stiffening and sizing agents in the processing of rope and fibers.

It is also used as a preservative in many foods and when heated gives off carbon dioxide, which helps breads, rise during baking.

It doesn't really matter whether your railroad is a mainline affair or a short line or a private industrial line of a sugar company this industry provides a wide variety of loads.

Raw materials such as sugar cane, sugar beets, corn, lime, ammonia, fuels as well as machinery make up inbound loads. These require gondolas, hoppers, tank cars, flatcars and more.

Outbound materials such as sugar, syrups, molasses, alcohol, CO₂, agricultural feeds, land fill, bagasse, cinders and equipment for repair provide loads to many other industries down the line. These require boxcars, tank cars, hoppers, gondolas, flat cars and more.

This one industry can quite easily be the focal point for most of the operations on some railroads.



Lula Plantation, Louisiana; from Stan Parsons collection.

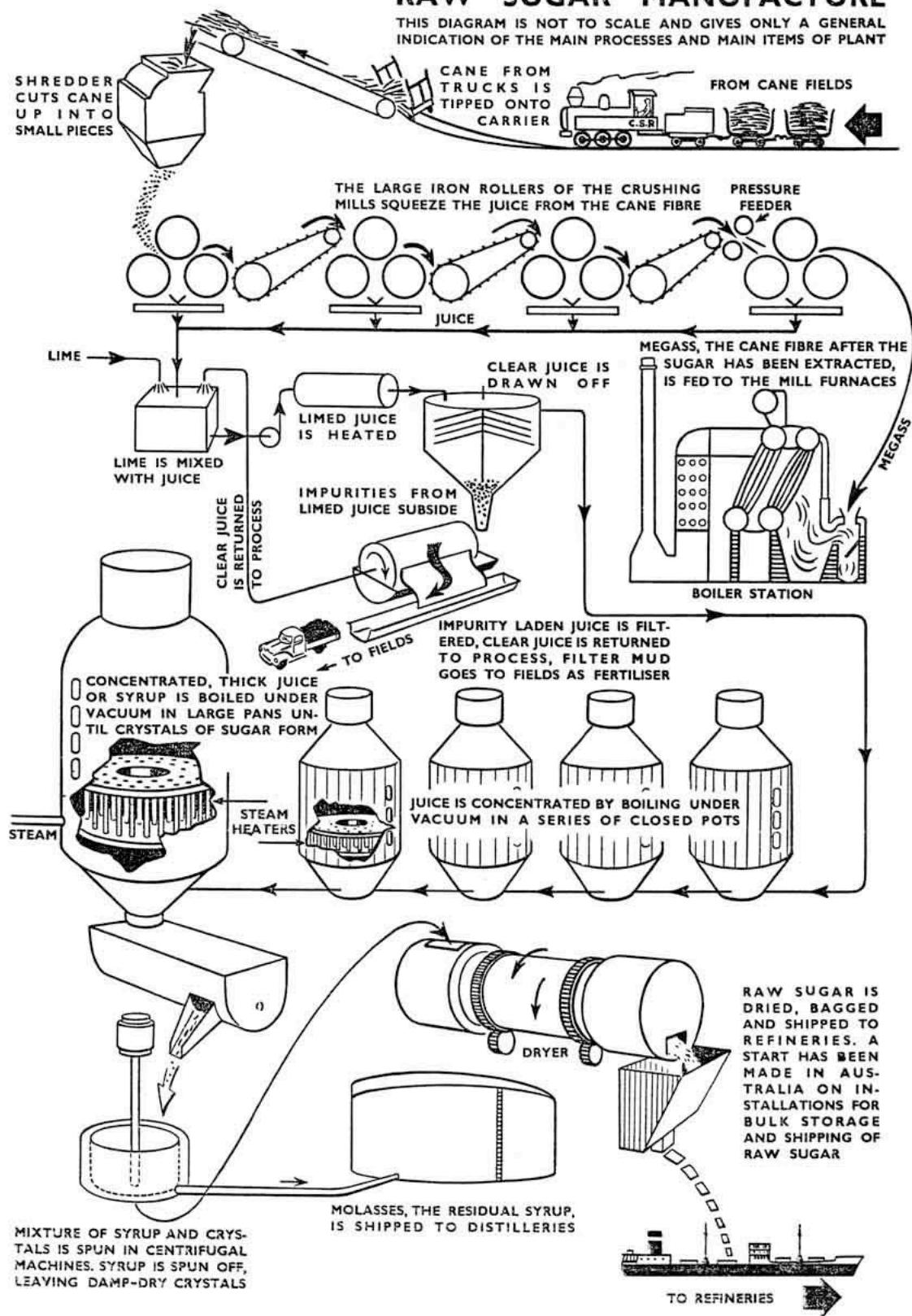


Southern Pacific cane car. Image: Tom Bassett, 1985 from Stan Parsons collection.



RAW SUGAR MANUFACTURE

THIS DIAGRAM IS NOT TO SCALE AND GIVES ONLY A GENERAL INDICATION OF THE MAIN PROCESSES AND MAIN ITEMS OF PLANT



Source: R Wiles collection, originally from Lowndes, A G (1956), *South Pacific Enterprise: The Colonial Sugar Refining Company Limited, Sydney: Angus and Robertson*, p 139.