Some Aspects of the Indian Sugar Industry*

By C. J. H. Penning, M.Am.Soc.Mech.E.
(*General Manager, Mysore Sugar Co., Ltd.*)

THE development of the modern Indian Sugar Industry has been spectacular. It has been my privilege to be closely connected with similar rapid development and modernisation of an indigenous sugar industry in the Philippines and in South China, but the development in India has been unique in many respects.

To begin with, many laymen have contributed to this progress and in spite of this, the industry in India has reached a very creditable grade of efficiency in a comparatively short time.

A young industry like the Indian sugar enterprise will naturally be compared with similar and older industries elsewhere. Indeed, severe criticism has been launched against the Indian industry, especially by sugar interests in Java. A leading article in a Dutch newspaper was headed "Protection produced deception". The writer bitterly ruminates on the loss of the Java sugar export trade to India, which at its optimum exceeded 10,00,000 tons annually. This has now been reduced to about a tenth of this, and the decline is continuing. The article alleged, amongst other things, that the Indian industry, through protection, had grown far too quickly; that a large amount of capital had been invested without adequate returns and that investors blamed the Government and demanded more and yet more protection. However, the facts and expectations of the first Tariff-Board, embodied in their report were as follows:—

(1) That the price of imported Java sugar would drop to Rs. 4 per maund and, perhaps, to Rs. 3–4 per maund.

(2) That in case the price of Java sugar should drop below Rs. 4 per maund, the duty should be increased by 8 annas.

(3) That the reasonable sales price of Indian sugar during the period of protection, should be Rs. 8–13–0 per maund.

(4) That the average recovery of Indian factories at the end of the period of protection would be 9·4%.

The protection given to the sugar industry in India, was principally aimed at betterment of the cultivators' conditions. This is very obvious, because as soon as the new mill-owners were reaping large profits under cover of the protective tariff and low cane prices, the Government of India nearly killed the industry, first by levying an exorbitant excise duty and later by regulating the cane prices. The excise duty was, in my opinion, indefensible, but it was the easiest way for the Government to collect some of the large sums of money which remained in the country as a result of the development of this modern industry. Many profited; cane growers, jute and cotton mill-owners, railways, machinery and other suppliers, fuel merchants, wholesalers and retailers in the sugar trade, but for the Government the easiest way to collect was at the source. This was undoubtedly unjust to the many people who had invested money in this industry on the promise of good returns for several years from a protected industry. Even before any reserves could have been set aside or plant properly depreciated, the excise duty absorbed all of the profits of the smaller factories. And, the average size of the Indian factories *was* small, very much smaller than the factories erected in the Philippines where the industry turned in a few years from small muscovido plants (gur plants) to the manufacture of cargo sugar (96 Pol.) by large central factories. The question of the minimum size of an economic plant thus became important and after considerable discussion a 400-ton unit was decided for Mysore. And, when I came to Mysore to build this 400-ton plant, I saw the possibilities of rapid expansion necessary for ultimate financial success. The yard and mill site were therefore planned from the start for 1,200 tons and the first extension to 800 tons was ordered as soon as the 400-ton plant was in operation. Had this not been done, with the consequent annual increase in yield from about 5,000 tons of sugar to over 8,000 tons in the second year, the Company would not have made any profit at all for the second year, because the excise duty paid during the second year was exactly the amount of nett profits made during the first year. Other owners also soon realised that the 400-tons unit was no longer economical, if a Rs. 40 excise duty had to be paid, with the result that factories with the necessary finance rapidly increased their daily crushing capacity.

Various critics have pointed out that both cane production and sugar content of the cane are much higher in Java, the Hawaian Islands and Mauritius, than in India. Such comparisons are not fair because of climatic variations, soil differences, irrigation facilities and also because of the methods of cultivation which are much better, being closely controlled by the factories who cultivate their own cane. Canes in these countries are cut as near as possible to maturity and are milled inside 24 hours after being cut and properly topped. With such raw material, it is easy to get 2% more sugar of higher purity than under the conditions prevailing in India, where cane is purchased from ryots who have neither the knowledge nor facilities or desire for intensive cultivation. Canes are cut days ahead, then transported to the mills over long distances; after arrival at the weighbridges, there is, sometimes, still further delay.

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Cane is a perishable product and no time should be lost in milling the cane as soon as possible, after it has been cut.

Now, with the cheap and very reliable motor lorries available, transport by motor lorries is quite a paying proposition.

In Mysore, the Sugar Company, assisted by the Government, embarked on a programme of building feeder roads from villages to existing main roads and improving main roads. Weighbridges located at strategic points, have reduced the maximum ox-cart haulage to seven miles.

From these yards, motor lorries and lorries with trailers move the cane in the shortest possible time to the Factory.

The ryot in India is paid by weight for his cane and, therefore, collects everything growing in his field including secondary and tertiary growths, badly grown cane, damaged stalks, diseased canes, and as much top as he thinks he can get away with. It is a battle of wits, the buyer making deductions for poor cane, the ryot trying to deliver the last scrap of cane from his field.

In Mysore State, conditions are very much better, because the ryots get instructions in the cultivation and husbandry of cane, have irrigation, are advanced fertilisers and agricultural implements, whilst the crop is controlled by Inspectors in the field who give only permission to cut down when the cane is as near as possible at its best.

Cane production in India varies from 10 tons to 62 tons per acre and whilst well-cultivated canes have a sugar content of 18% or even higher, we are glad if the average percentage of the cane milled reaches 14% whilst it is sometimes below 10%.

Furthermore, cane is bought in India as early as possible and as late as possible, as long as the recovery still allows a margin of profit.

In Java, the capacity of a factory is adjusted to the area on which the factory grows its cane and if at all it is possible, all the cane is milled inside 100 days and as near to maturity as possible. Bad canes, if there be any such, are left in the fields, canes are topped way down (tops are used for seed) and the cane milled as soon as possible after cutting. With similar raw material, the factory results in India would be as good, if not better, than in Java. Specially because the Indian factories being newer, are modern, which cannot be said of all Java factories, where fixed mills, old fashioned heaters and evaporators, double subsiding and primitive handling of mud, can still be found in several factories.

Conditions in the Philippines are also strictly not comparable with those in India. The erection of the large central factories in the Philippines was mostly undertaken by concerns already owning large sugar properties elsewhere. The size of the factories was large and they were built and operated by experts. Also the Filipino planter is a man of substance, cultivating hundreds of acres instead of one, with modern cultivation implements and as much fertiliser as he can economically use. Moreover, he is not paid in cash, but receives his share of the sugar actually obtained from his cane, so that he is very much interested in supplying the best cane he can.

A planter who brings bad cane to the mill would soon be unpopular with the other planters.

In the Hawaian Islands, the care given in order to obtain good canes is perhaps even more than in Java and one could say that here the recovery of sugar starts in the fields, whilst in India, in many factories, the recovery starts at the weighbridge, by making deductions in weight or price. Improvement is only possible by educating the ryots to produce more cane per acre and better cane, but it will be a slow process.

Criticism has also been launched against the type of machinery installed, but we must not lose sight of the fact that cheapness was one of the principal conditions laid down by the new factory owners. As competition was so keen, and everybody copied specifications, there was soon a similarity between the equipment offered by British manufacturers.

Generally speaking, the equipment of the Indian sugar factories is as good as that of similar factories in the world, but it cannot be denied that the operation of the installations was, in the beginning, not very good and still leaves much to be desired. It is easier to build factories than to find experienced operators and the training of staff and labour requires time and patience.

My experience has been that the blame put on defective equipment is in most cases due to lack of operating experience.

In the Mandya Factory, the gradual increase in capacity has in no small measure been due to the experience gradually gained by staff and labourers. India produces many young men who have received an excellent college education and who after several years training have proved to be efficient operators. It has been my experience that it takes 5–6 years to train an unexperienced staff and the labourers to operate the complicated process of white sugar manufacture.

There is another reason why conditions in India are so different from those in the P.I. All factories here make plantation white sugar which requires considerably more skill than the making of cargo sugar of 96 polarisation. Not only is the machinery more complicated, but it needs more frequent cleaning and heavier operating charges through the larger amount of chemicals, some of corrosive nature, employed in the white sugar process.

We have in India sulphitation and carbonatation factories. Equally good sugar can be made by both processes, but as the crux of making good plantation white sugar lies in a perfect clarification of the mill juices, it is easier to obtain good sugars with the carbonatation process where all juice is filtered, than by subsiding, as is usual in sulphitation plants.

Sulphitation of the syrup, from which white sugar is boiled, to a pH of 5 or below, is necessary in both processes to obtain good plantation white sugar with reasonable keeping quality. If the pH rises above 5, good sugar cannot be made. The essential thing to obtain good clarification in a double sulphitation factory is the use of good lime.

The extraction obtained by the mill is of course important when the raw material is purchased for cash. Several factories have obtained an extraction of 93 per cent. In my opinion, this should not be higher in a factory making white sugar, as otherwise, too many impurities are introduced in the mill juice. In order to maintain good extraction, care should be given to the condition of the rollers, returner bars and scrapers and rollers which have worn smooth should be immediately regrooved. This means that spare rollers and a roller lathe must be part of the factory equipment, as well as an adequate supply of returner bars, scraper toes, etc. In many small mills this is lacking, with the result that the extraction suffers, as a result of poor operation, and not as a result of low quality of the original equipment.

Boiling house recoveries in good factories fluctuate in India between 83 and 87, which, considering the large quantity of molasses produced by Indian canes, cannot be considered unsatisfactory. As I said before, recovery should be started in the field; with mature sound canes, higher boiling house recoveries will follow.

The cost of manufacture, that is the amount spent per ton of sugar manufactured, for payrolls, chemicals, maintenance of machinery, general machinery supplies, filter cloth, lubricants, fuel or outside electric power, water rate, bags and twine and camp maintenance, is closely connected with the daily output. By making double the amount of sugar, costs will be nearly halved. For this reason anything which interferes with the output, stoppages for lack of cane, breakages, or lack of operating experience are exceedingly costly. The larger the output, the smaller will be the fixed charges per ton of sugar for off-season expenses, interest and Head Office expenses. This again brings us to realise that in order to be successful, a factory must have ample funds, so that the operation will not be interrupted for lack of spare parts.

A sugar factory cannot be run successfully on shoestring finance, and in well-managed concerns, the largest part of the profits is usually reserved for depreciation, purchase of equipment and cash reserves for emergencies. A financially strong concern will also be able to buy better quality cheaper and obtain the largest possible discounts.

The major part of the cost of sugar is the amount paid for the raw material, *i.e.*, the cane. The price paid in India by the factories for the cane is in many cases too high.

The cost of cane should not be more than 50% of what the factory obtains from its sugar sales. Therefore, if sugar prices are Rs. 240 per ton, the factory will obtain about Rs. 200 and the ryot should be paid not more than Rs. 100 per ton of sugar or, with a 10% recovery, Rs. 10 per ton of sugarcane.

If prices go up, the factory can afford to pay a higher price for the cane, but during the last five years, many factories have paid 60% and more of their sugar revenue for their cane. Improvement can, as I said before, only be expected from improved cane cultivation, as below a certain minimum price, the planter would not be able to exist. Improvements in the recovery is having, in most factories, the most careful attention of the management. With better canes, the cost of manufacture could be further reduced. The education of the ryot is a task which Government should undertake by spending some of the excise money for this purpose.

To illustrate what can be done, we have the instance of the Mysore Sugar Company, which held a crop competition, awarding prizes for the best cultivated cane on one-acre plots, five-acre plots and larger holdings. Prizes of Rs. 100 and Rs. 500 were awarded. The result showed what could be done by an intelligent ryot. None of the competitors produced less than 42 tons per acre, one just over 62 on a one-acre plot, one averaged over 43 tons per acre on an 18-acre plot. The sugar contents were over 17, the purities of the juice over 88, in some cases, considerably over these figures. Apart from the prizes, the ryots were rewarded by the very much larger cash returns from the tonnage harvested. The Mysore Sugar Company also operates several farms, mainly with the object to show the ryots, what results can be obtained when proper attention is given to the selection of cane and its cultivation. Manurial experiments are being made every year, not only with artificial manure, but with molasses, molasses lime powder and compost made from all refuse collected at the weighbridges.

Before closing, I should like to say a few words on the use of the by-products of the sugar factory, which has been given quite a bit of attention in India. The one and only profitable way to use the waste molasses is by converting it into alcohol. The best way to do this is by having a distillery attached to the factory so that any surplus bagasse can be used to operate the distillery. In Mysore, the distillery was erected in the second year of the factory's operation and has proved to be a very good investment. Rectified spirit (96°) is mainly manufactured, besides a small quantity of potable spirits for local consumption. All tractors, locomotives, service automobiles and lorries of the Company are operated on denatured rectified spirit or on a mixture of 2 parts spirit and 1 part petrol.

The Indian chemical industries can absorb large quantities of alcohol. Alcohol is the base of many modern explosives and the manufacture of acetone is being considered in Southern India. Rectified spirit of 96°, although making a good motor fuel in high percentage alcohol mixtures, cannot be used in petrol motors without making slight changes. The fuel is, therefore, not interchangeable with petrol. Moreover, the amount of petrol consumed in

India is so large that there would never be enough alcohol to permit the admixture of a large alcohol percentage.

In order to make the mixing of alcohol with petrol commercially possible, the rectified spirit must be dehydrated. Committees have been appointed to study the possibilities of the manufacture of dehydrated rectified spirit or absolute alcohol and the required legislation for the exclusive use of petrol alcohol motor fuel. Mysore State has taken the lead and has now an absolute alcohol plant in operation, and legislation is expected to be passed early next year making the mixing of all petrol sold in the State with a certain percentage of absolute alcohol obligatory.

The maximum percentage is 25%, but when all molasses manufactured in Mysore State is distilled into Absolute Alcohol, not more than 10% of the petrol consumption will be available. Even a 20% mixture will not require any adjustments to pertol motors. In fact the alcohol-petrol mixture will be a fuel of higher octane, slower burning, therefore less liable to "pinking", give less carbon deposit and less carbon monoxide in the exhaust gases. Even when using 96° pure alcohol, there is no difficulty in India in starting from cold, so that the petrol-alcohol mixture will provide a better fuel than the low grade petrol now sold in South India. If all waste molasses produced in India could be made into absolute alcohol, it would mean a large revenue to the sugar industry and an invaluable asset in case of war.

Other by-products of the factory are the surplus bagasse, but this is seldom available when "noble" canes are being cultivated. The best use of surplus bagasse is as fuel to run a distillery. Paper and Celotex manufactures are major industries requiring a huge capital outlay. Then we have the filter press mud, from which a kind of inferior wax can be obtained, but the best use is, in my opinion, to spread it on the fields, in order to correct bad soil conditions. We have also, ashes, which are useful for soil correction or can be used to fill insanitary holes. The fine ash dust we give to the Malaria Control Board, to mix with Paris green. The mixture is blown over stagnant water pools in order to kill the mosquito larvæ.

In closing, I would like to state that the Indian Sugar Industry has grown from a very promising infant to a well-grown youth, whose behaviour might be criticised, but who gives promise to grow into a mature and useful member of the Indian industry and who fully deserves the support and encouragement of its father, the Government of India.

Indian Central Jute Committee
Technological Research Laboratories

THE laboratories were officially opened on January 3rd, 1939 by His Excellency the Viceroy, in presence of His Excellency Lord Brabourne. The foundations were dug in early February 1938 and the building and equipment were ready for the staff to go into occupation in early September.

The laboratories are situated in Regent Park, just outside the Tollygunge municipal area, about five miles south of Calcutta. The central block contains on the ground floor the Manager's office, jute godown and machine store, and on the first floor, the Director's office, general office and sample-room. The tower portion contains the main staircase and, on the second floor, the main water-tank. In the east wing there are three large, air-conditioned rooms which contain the spinning machinery, comprising a jute softener, teaser card, warp and weft breaker cards, warp and weft finisher cards, drawing frames, roving frame and spinning frames, all being of the most modern type. The machines are provided with individual electric motors, the drives being by V-ropes except in the case of the softener. A vary-pitch V-rope drive is fitted to one of the spinning frames. The drawing frames and the roving frames are each divided into two sections, one for the finer yarns and one for the coarser yarns. Each spinning frame has twenty spindles, one being for the finer yarns and one for the coarser yarns.

The spinning machinery has been provided with the object of enabling spinning trials to be made on small samples of fibre under controlled conditions.

The immediate objects of the investigations which are in progress are, firstly, to make reports on samples of fibre resulting from breeding trials, manurial experiments and the like and on any other samples which are sent for appraisement such as samples taken from the various jute-growing areas in connection with the Committee's marketing investigations. Minor modifications are being made in the spinning machinery in order that reliable information may be obtained from quite small samples (say 20 to 160 lb.) and special precautions are taken to ensure that the yarn produced accurately represents the sample of fibre under test.

The second main object of the early work in the laboratories is to find out what connections there may be between the various measurable characters, whether physical or chemical, of the raw fibre, its behaviour in spinning and the quality of the yarn produced. When this object is achieved it will be possible, by examining a representative sample of fibre, to predict its spinning quality and so to assess accurately its value. It may ultimately be possible to devise simple tests suitable for use in markets and baling houses.