ENGINEERING SECTION
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Mr. K. S. Arnold, Chairman

The Chairman delivered the following opening address.

In this opening address I need only refer briefly and in general terms to the developments which have taken place recently in Sugar Engineering, as many of the aspects are dealt with in the papers presented to the Section, and in the Symposium, and will therefore be the subject of detailed discussion among delegates at the Sectional Meetings. While there have naturally been general improvements in all classes of cane sugar machinery since the Eighth Congress of the Society was held in the British West Indies in 1953, the most notable advances have undoubtedly taken place on cane crushing mills. For this reason it is appropriate that the subject chosen for the Symposium of the Engineering Section should be "Recent Developments in Sugar Cane Mills". The following is a brief review of the trend of recent developments in cane sugar machinery.

Cane Crushing Mills. In the recent operation of mills the tendency has been further to increase crushing rates, and to this end there has been an appreciable increase in roller surface speeds. Whereas some years ago 30 ft. per min. was to be considered reasonably fast, in some cases almost double this figure is now being achieved, and on certain new milling plants speeds as high as 75 ft. per min. are envisaged.

Cane Feeding and Juice Drainage. The increase in roller surface speed, coupled with the associated increases in crushing rate, have brought about prominence of various types has been greatly extended, and the fitting of feeder rollers is becoming standard on new installations. The problem of dealing with the much larger volumes of juice arising from higher crushing rates has also received attention, and certain features are discussed in one of the papers presented to the Section.

Automatic operation of Cane Carrier. Concurrently with attention to the mill itself for achieving higher crushing rates, thought has been given to improving the regulation of the cane feed to the plant. Whereas formerly the speed of the cane carrier depended entirely on manual regulation of the cane carrier engine or electric driving motor, efforts are now being directed towards developing automatic control. The functioning of the cane knives has in some instances also been incorporated in the control system to ensure that the feed on the carrier is adjusted in relation to the power demand on the knives, thereby preventing overloading and consequent stalling of the driving motors. By providing a more uniform cane feed to the mills, and a reduction in stoppages due to chokes on carrier and knives, such control makes an important contribution towards higher crushing rates. Two papers presented to the Section describe systems which have recently been developed for the automatic control of cane carriers and cane knives.
Steam Turbine Drive. The application of the steam turbine to the driving of cane mills represents a revolutionary change on this plant, and noteworthy progress has been made over the past three years. At the time of the Eighth Congress only a few installations existed, and delegates were able to see only one unit operating on a mill during their visits to numerous factories. Turbine drive is gaining in popularity and all recent large cane milling plant installations have been provided with this form of drive, which now gives indication of superseding the single cylinder steam engine. One of the papers presented to the Section deals with the application of turbine drive.

Hydraulic Pressure System. The use of gas/oil bottle type accumulators on the hydraulic pressure systems of cane mills is rapidly extending. Many conversions continue to be made from the conventional weight-loaded accumulator to this more convenient and compact type. It is also now being fitted to the majority of new milling plants, and gives promise of becoming the accepted standard type. Some radical developments have also been made in the design of the hydraulic cylinder which applies pressure to the top roller bearings of mills. Certain of these designs have successfully undergone trials, and are now being applied on some new milling plants.

Roller Bearings on Mill Rollers. Over the past few years some manufacturers of mills have changed from journal bearings to roller bearings on the cane crushing rollers, and some plants now being installed in India are fitted with the roller type. It is noteworthy, however, that this is by no means a new development in so far as India is concerned, as two milling plants manufactured by a Calcutta engineering company 25 years ago and installed in Indian factories were fitted throughout with roller bearings. Although obvious advantages exist in the use of roller bearings on mill rollers, their higher initial cost and certain attendant problems have so far held back their general application. The subject of roller bearings is dealt with under one of the items in the Symposium.

Steam Plant. There has been a tendency over recent years to raise the steam pressure employed in cane sugar factories. Where single cylinder steam engines are employed for driving the mills, the steam pressure is restricted to about 150 p.s.i.g. due to cylinder strength considerations. If steam is generated in the boilers at a higher pressure than this, it is necessary to lower the pressure for the mill engines by passing the supply through a reducing valve. This means that upwards of 40% of the total steam generated at the boilers has immediately thereafter to be reduced in pressure, which is not an entirely satisfactory arrangement. As steam turbines are suitable for the highest of steam pressures, the limitation does not apply when turbines are installed for driving the mills, and factories can therefore now quite economically install boiler plants for pressures of 350 lbs. p.s.i.g. or over, and take a direct supply for driving the mills.

By assuring a proper steam balance in a cane sugar factory the bagasse from the mills can provide ample fuel for the total steam requirements without having recourse to high efficiency boiler plant operating at high pressure and,
where this condition exists, there is no justification for installing expensive high-pressure boiler plant. It is now, however, often customary to locate subsidiary industries adjacent to a sugar factory with the object of obtaining from the latter a cheap supply of steam and electric power, as will be seen by delegates on some of the factory visits. In this circumstance a higher thermal efficiency must be achieved in the sugar factory if the surplus steam and power required for outside consumption is still to be obtained from the bagasse supply alone.

The higher thermal efficiency required can often only be obtained by generating steam at high pressure, coupled with the employment of bagasse furnaces of high combustion efficiency. For the higher pressures and increased efficiency, boilers equipped with various ancillary equipment such as air preheaters, economisers, forced draft fans and water walls, are now being introduced into cane sugar factories. New types of bagasse furnace have also been developed which are tending to supersede the simpler step-grate and flat-grate types. New methods of feeding bagasse into the furnace have also been devised, included among which is the sprayer type which sprays the bagasse into the combustion chamber. Two papers have been presented to the Section on these subjects, one describing a new type of furnace, and the other illustrating designs of boilers and furnaces from the simple low-pressure type up to the more complicated modern high-pressure installations with ancillary equipment.

Vacuum Pans. Developments continue to be made in vacuum pan design for promoting faster boiling by a more rapid circulation of the massecuite. To improve this in the coil pan, the coil cross-section has in certain cases been altered from the circular form to the flattened oval shape, the long axis being placed vertically so that less resistance is offered to the massecuite flow.

Other developments have continued in the direction of ensuring a low-head of massecuite above the heating element of the vacuum pan, such that circulation and heat transfer increased by the lower hydrostatic head. Vacuum pans having circular ribbon-type heating elements are becoming increasingly popular in sugar refineries, and some have been employed in beet factories. So far, however, this type has not been introduced into the cane sugar factory.

Centrifugals. Further advances continue to be made in sugar centrifugals, mainly in the direction of high-speed and automatic operation. The former simple type of machine 42" dia. running at 960/1150 r.p.m. is now seldomly seen in new installations, and has given way to the modern heavy high-speed machine, running at 1450/1750 r.p.m., equipped with numerous electric or hydraulic devices for the control and automatic timing of the operations in the cycle, and with electric braking. Although the electric-driven centrifugal is extremely popular, certain factories prefer the water-driven machine which is being manufactured for high-speed running and with all the facilities of the electric-driven type.

Although the above advances enable centrifugals to operate on a shorter cycle, to function under a rigid timed control, and effect considerable labour
saving, the system is still intermittent, as the basket has to stop for discharging and after recharging has to be accelerated up to full speed again. The advantages of continuous centrifugal operation are thus obvious, and development work is being vigorously pursued towards the production of successful continuous machines. Some forms are now beyond the experimental stage, and one continuous type has been installed in an Indian sugar factory for dealing with particular types of sugar, and the supply of similar units to other factories is contemplated.

The above resume mentions only some of the advances made in cane sugar machinery since the last Congress was held nearly three years ago. There will be other improvements which have been initiated in the various cane sugar countries represented by delegates at this Congress, and the opportunity will be afforded during travels, on visits to factories, and at meetings in Delhi to interchange information on the development work which has been carried out, and on the results achieved.

In the Engineering Section the Congress will bring together delegates from many countries representing various aspects of sugar engineering. There will be members from universities and technical institutions with their contributions from the research side, engineers engaged in the direct operation of sugar machinery in the factories with their experience of practical operation of the plant and the problems involved, and representatives of sugar machinery manufacturers with their knowledge of plant design and construction. The Congress presents a valuable opportunity for the expression of opinions from the various viewpoints, the ventilation of problems and obtaining of assistance towards their solution, and provides in India a pleasant and hospitable meeting ground for the co-ordination of ideas towards the advancement of the science and practice of sugar engineering throughout the world.