

Industrial Outlook.

The Industrial Manufacture of Absolute Alcohol—I.

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It is well known that absolute alcohol cannot be obtained by mere distillation even from its very strong aqueous solution although the most efficient still-heads are employed, the reason for this being that alcohol and water form an azeotropic mixture which behaves like a pure liquid and is more volatile than pure alcohol. The constant-boiling

on a large scale owing to poor yields and high cost of the drying agent. The most successful industrial methods are based on the valuable observations of Sydney Young¹ and his collaborators, the data obtained by whom are given in Table I.

Sydney Young discovered that when a mixture of equal weights of benzene and

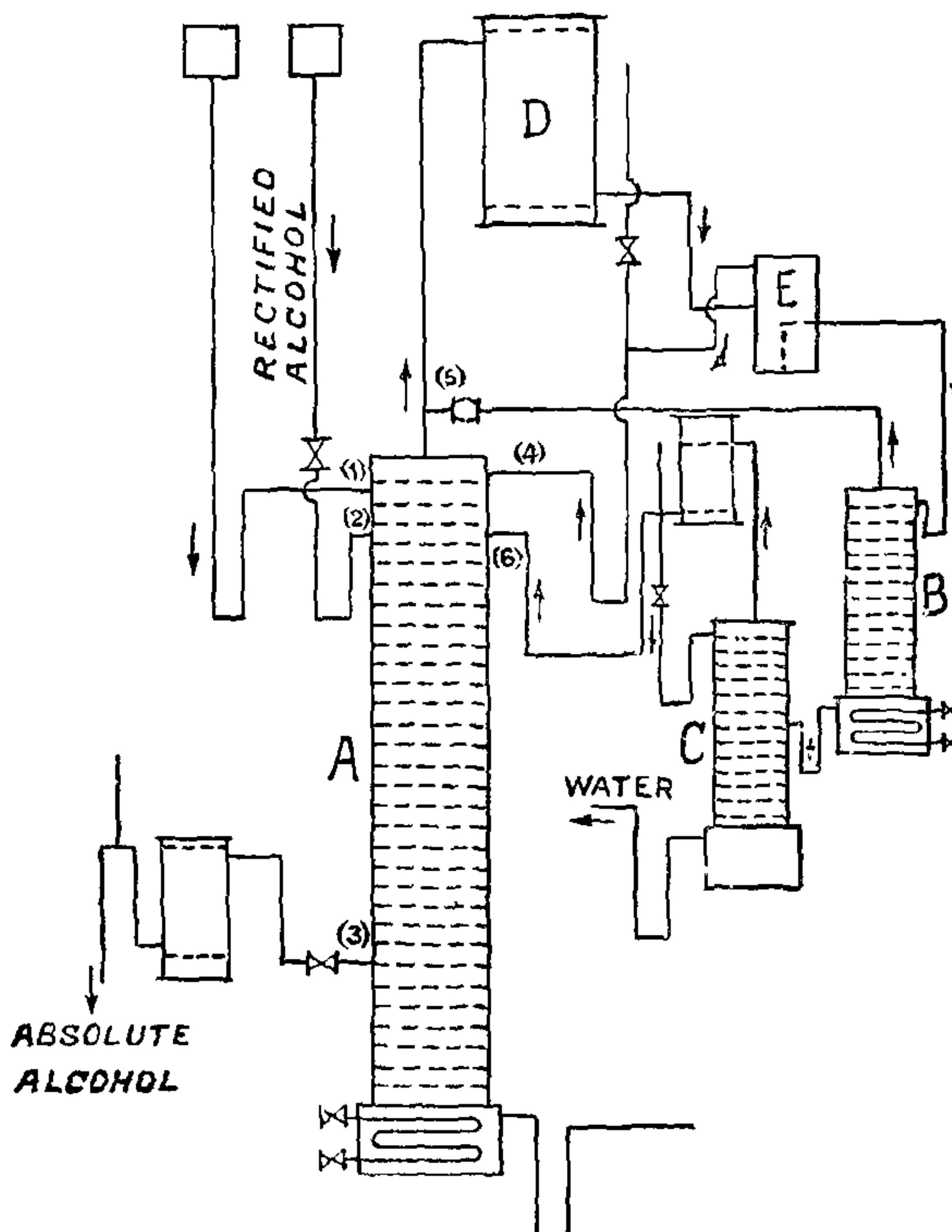


Fig. 1.

mixture contains about 4.5 per cent. of water (Table I). The usual laboratory methods of preparing small quantities of absolute alcohol by treatment of dilute alcohol with solid drying agents like lime, calcium chloride, calcium carbide, calcium metal or potassium carbonate are uneconomic when practised

95 per cent. alcohol are distilled, a ternary azeotropic mixture containing alcohol, benzene and water is formed, this mixture being more volatile and also richer in water

¹ *Distillation Principles and Processes*, 1922, p. 179.

TABLE I.

Boiling Points and Percentage Composition of Alcohol, Benzene and Water Mixtures.
(A=Alcohol. B=Benzene. W=Water.)

Liquid	Boiling pt.	Percentage Composition		
		A.	B.	W.
W ..	100			
B ..	80.2			
A ..	78.3			
<i>Mixtures:</i>				
A-W ..	78.15	95.57	..	4.43
B-W ..	69.25	..	91.17	8.83
A-B ..	68.24	32.36	67.64	..
A-B-W..	64.86	18.5	74.1	7.4

than the alcohol-water mixture. It is therefore possible to expel all the water from 95 per cent. alcohol by adding to it a suitable quantity of benzene and carrying out a fractional distillation. During the distillation, there is a tendency towards formation of three fractions, all the water and benzene and some alcohol going over in the first two fractions, while the third fraction or residue consists of anhydrous alcohol. The distillate separates into two layers, the upper layer forming roughly 85 per cent. of the total volume. The composition of the two layers is as given below in Table II.

TABLE II.²

	Water	Benzene	Alcohol
Upper Layer ..	0.5	84.5	15.0
Lower Layer ..	32.0	11.6	56.4

With the help of the above introduction it will be easy to visualise the large-scale plant shown in Fig. 1, and its operation. Rectified alcohol is conveyed by the pipe (2) to the top of the distilling column A which is heated by a steam coil at the base. The binary azeotropic mixture which is formed fills the top of the column and flows back into it from the condenser. Benzene is now introduced gradually (pipe 1) in order to form the ternary mixture until the temperature in the middle of the column falls by 2-3° in the process. The column being thus prepared for dehydration the rectified alcohol is now fed continuously into

it. Part of the liquid condensed in cooler D is sent to the separator E where it separates into two layers having the composition shown in Table II. The upper layer which is rich in benzene is sent back to the main column A in order to form more of the ternary mixture, while the lower layer flows into the subsidiary column B where the benzene in it is removed as the ternary mixture and transferred to column A. The dilute alcohol flowing from the base of column B is introduced into the rectifying column C, where it is resolved into 95.5 per cent. alcohol which is conveyed to the main column A. The water separated at the base of the column is thrown out of the system. In the main column A itself, the dilute alcohol descends from plate to plate and parts with its water to benzene which carries it away to the top of the column. Anhydrous alcohol completely free from benzene accumulates in the base of the column and is drawn off by a syphon device.

Some technical details regarding the process will not be out of place in this article, in view of the fact that the Mysore Sugar Co., Ltd., Mandya, are erecting a plant supplied by the French firm who have arrangements with the owners of the patent rights, the "Usines de Melle", for manufacture of the required plant. The said firm, viz., "Ateliers Pingris and Mollet-Fontaine à Lille, France" have erected several plants in various parts of Europe including Germany. More than a hundred millions of gallons of absolute alcohol are being prepared every year by this process, one particular factory having a capacity of 40,000 gallons of absolute alcohol per day.

Several modifications of the plant are available to operate it to produce (1) liquors like arrack and rum for human consumption, (2) rectified spirits, or (3) absolute alcohol.

The question of the production of industrial alcohol for purposes of power-raising has received considerable attention in recent years owing to the enormous quantities of molasses available in sugar factories, which, unless utilised, threaten to paralyse the sugar industry. Considering the low price of the molasses and the efficient processes available for manufacture of absolute alcohol, one can expect to see a Power-Alcohol industry firmly established in India in the near future.

The author will be pleased to furnish additional information on any points of obscurity either in the technical or industrial aspects presented in this paper.

² Guinot, *Chime and Industrie*, 1926, 15, 325.