Evaporators - BMA stays fully abreast of technological advances

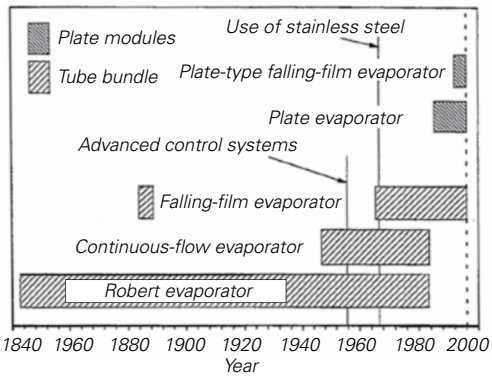


Fig. 1:

Development of different evaporator versions in the German sugar industry[1]

The requirements that sugar factory evaporators have to meet are determined by the process of sugar production and by the complex, but carefully adjusted heat distribution in the front-end and crystallisation processes. Since it has become common practice to put the steam in the evaporator plant to more than one use, the temperature differences in the different evaporation effects must be as small as possible. The evaporators must therefore have large heating surfaces and excellent heat transfer characteristics.

Short retention times and small juice volumes in the evaporator vessels are important factors in meeting the defined sugar quality and avoiding undue sugar losses. Equally important are effective separators for separating droplets from the vapour. Evaporators with a compact design, small footprint and short pipe lengths can be adequately integrated into the system even under the typically constrained conditions in sugar factories. These conditions have led to different types of evaporators for use in the sugar industry (Fig. 1) [1].

More than 150 years ago, Robert evaporators were a real technological breakthrough in terms of heat transfer and cleaning the surfaces available for heat transfer. In these evaporators, evaporation takes place in an upright tube bundle rather than on a horizontal tube bundle [2], [3]. Intensive scientific investigations into the basic principles of heat transfer brought advances in the evaporator technology: in 1950/51, continuous-flow evaporators were available that featured much improved heat transfer [4]. These evaporators were built by BMA as "high-velocity evaporators" (Fig. 2) [5].

At the end of the 19th century, the idea of improving heat transfer led to the development of falling-film evaporators, but since distribution of the solution handled proved to be problematic, they were only in use for a short period [3]. With advances in automated measuring and control systems, and with improved juice distribution, falling-film evaporators eventually became a reliable option at the end of the 1960s. BMA started delivering its customers with these falling-film evaporators in 1973, and in 1987 this evaporator line was expanded to include segmented falling-film evaporators (Fig. 3), specifically for use in the last evaporator effect of sugar factories [6].

Plate modules for heat transfer are considered to be the most recent step forward in evaporator

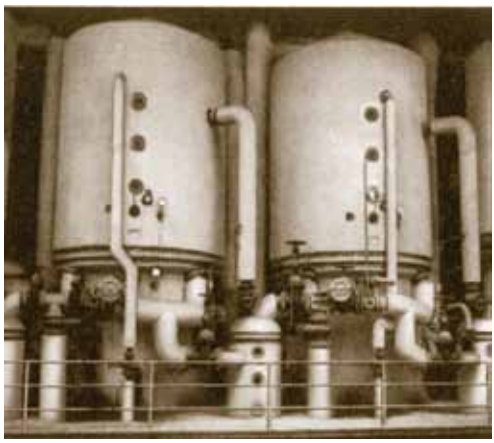


Fig. 2:

BMA high-velocity evaporator[5]

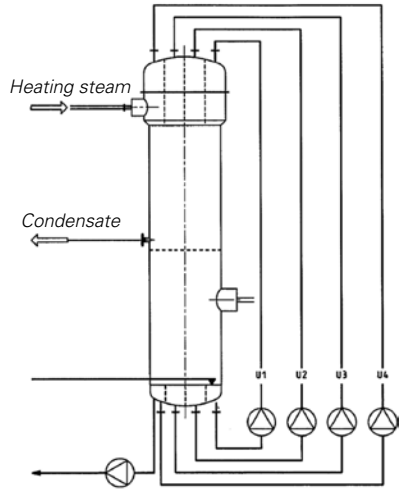


Fig. 3:

Falling-film evaporator

with 4 segments[6]

technology. In plate evaporators and plate-type falling-film evaporators, the heating surfaces are composed of individual profiled plates. These plates are connected so that chambers for condensing steam alternate with chambers for sugar solution within one plate module.

At BMA, highly efficient equipment has always been a central issue for all essential steps in the sugar production process. Since steam consumption must be reduced as much as possible, modern plants have to be equipped with evaporators with large surfaces and excellent heat transfer characteristics. Only then can BMA extraction plants, crystallisation in continuously operating VKTs, and pulp drying integrated into fluidised-bed steam dryers (CSDs) be used to their full potential.

Although BMA used to be very successful with Robert evaporators, this type of evaporator was discontinued some time ago. Because of the possibility to install larger heating surfaces, and because of improved heat transfer and shorter juice retention times, tube-bundle falling-film evaporators have prevailed over Robert evaporators in the beet sugar industry.

To be able to offer its customers ideal evaporator solutions, BMA's supply line covers the latest generation of plate-type falling-film evaporators, in addition to tube-bundle falling-film evaporators (Fig. 4). When it comes to deciding which of these two types of evaporator would best suit the given conditions, the discussion between BMA and the customer normally concentrates on the following criteria:

- Operating conditions in the sugar factory
- Possible temperature differences
- Installation conditions
- Need for cleaning
- Flexible and reliable operation
- Equipment maintenance
- Capital and operating costs
- Profitability of investment

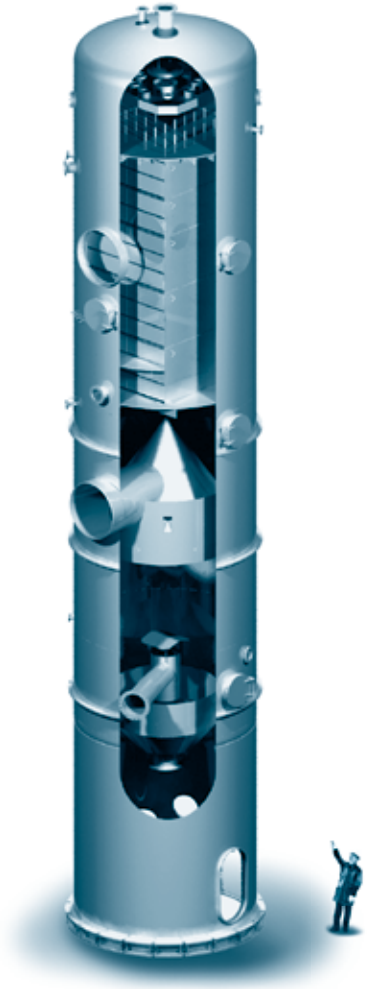
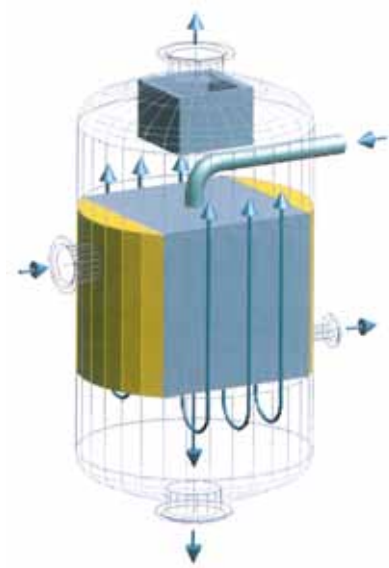


Fig. 4: Plate-type falling-film evaporator with bottom-end entrainment separator[7] and alternative construction principle[8]



Both tube-bundle and plate-type falling-film evaporators are built by BMA and can be ordered from BMA as complete units. The tubes and the plate modules for these evaporators are delivered by renowned suppliers with many years experience in the production of heating surfaces. As part of BMA's constant efforts to offer sugar factories expert assistance and perfect solutions to their evaporator needs, be it new equipment, more efficient energy use or plant extensions, BMA is staying fully abreast of developments in its evaporator supply line.

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Benefits

- Suitable type of evaporator available from BMA
- Well-founded recommendations based on BMA's extensive experience in energy management, and manufacturing and operating evaporators
- BMA engineering closes the gap between evaporators and their integration into a sugar factory concept

References

[1] Lehnberger, A.: Verdampfapparate für die Zuckerindustrie - Rohrbündel oder Plattenpakete? Zuckerind. 121 (1996) No. 10, pp. 791-798

[2] Greiner, W.: Verdampfen und Verkochen. Leipzig: 1912

[3] Eichhorn, H.: 100 Jahre Zuckertechnik - Ideen und deren Verwirklichung. Festvortrag anlässlich des 100-jährigen Bestehens des VDZ. Zuckerind. 116 (1991) No. 5, pp. 329-358

[4] Wagner: Wärmeübergangszahlen beim Durchlaufverdampfer. Z. Zuckerind. 2 (1952) No. 5, pp. 162-163

[5] BMA: New high speed evaporator for sugar factories. BMA-Informationen 5, No. 21-24, Braunschweig, 1966

[6] Farwick, E.: Eindampfen - fallend statt steigend in einem segmentierten Verdampfer. In: Handbuch Wärmetauscher, Essen: Vulkan-Verlag, 1991

[7] BMA: Plattenverdampfer: Eine wichtige Erweiterung des Lieferprogramms. BMA-Informationen 45, pp. 12-13, Braunschweig, 2007

[8] BMA: Neu im Programm: Platten-Fallstromverdampfer. BMA-Informationen 35, pp. 21-23, Braunschweig, 1997