

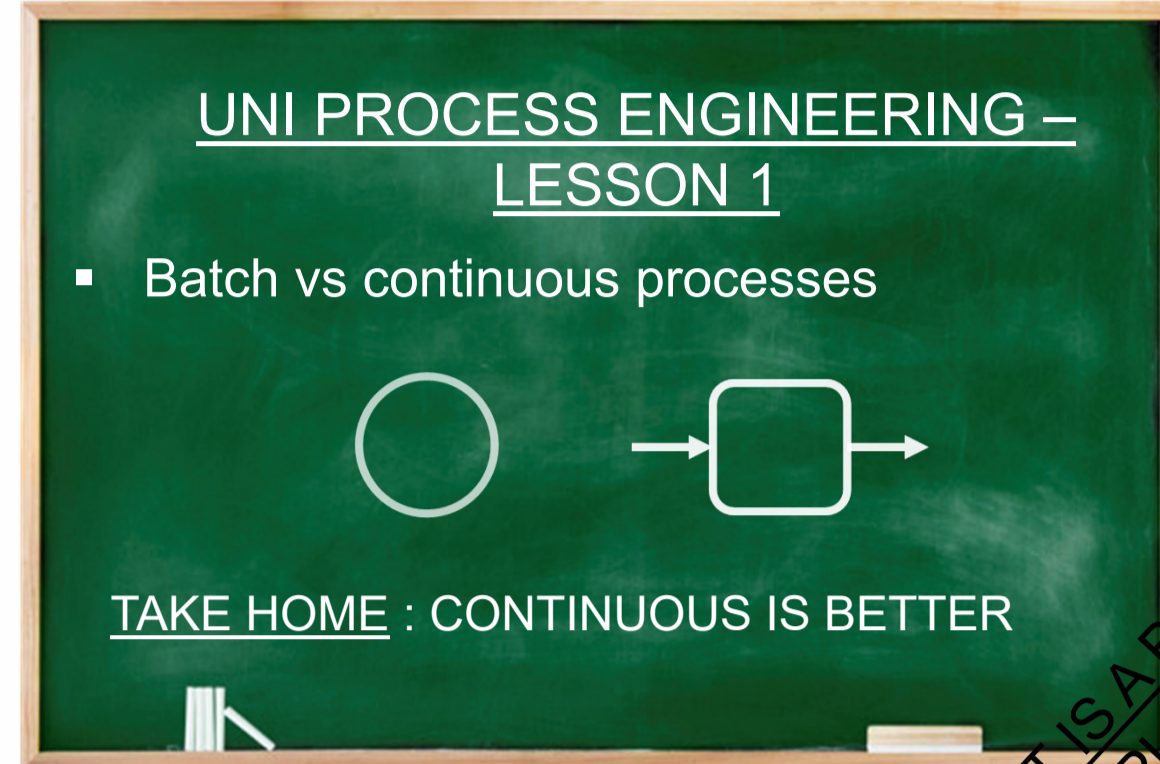
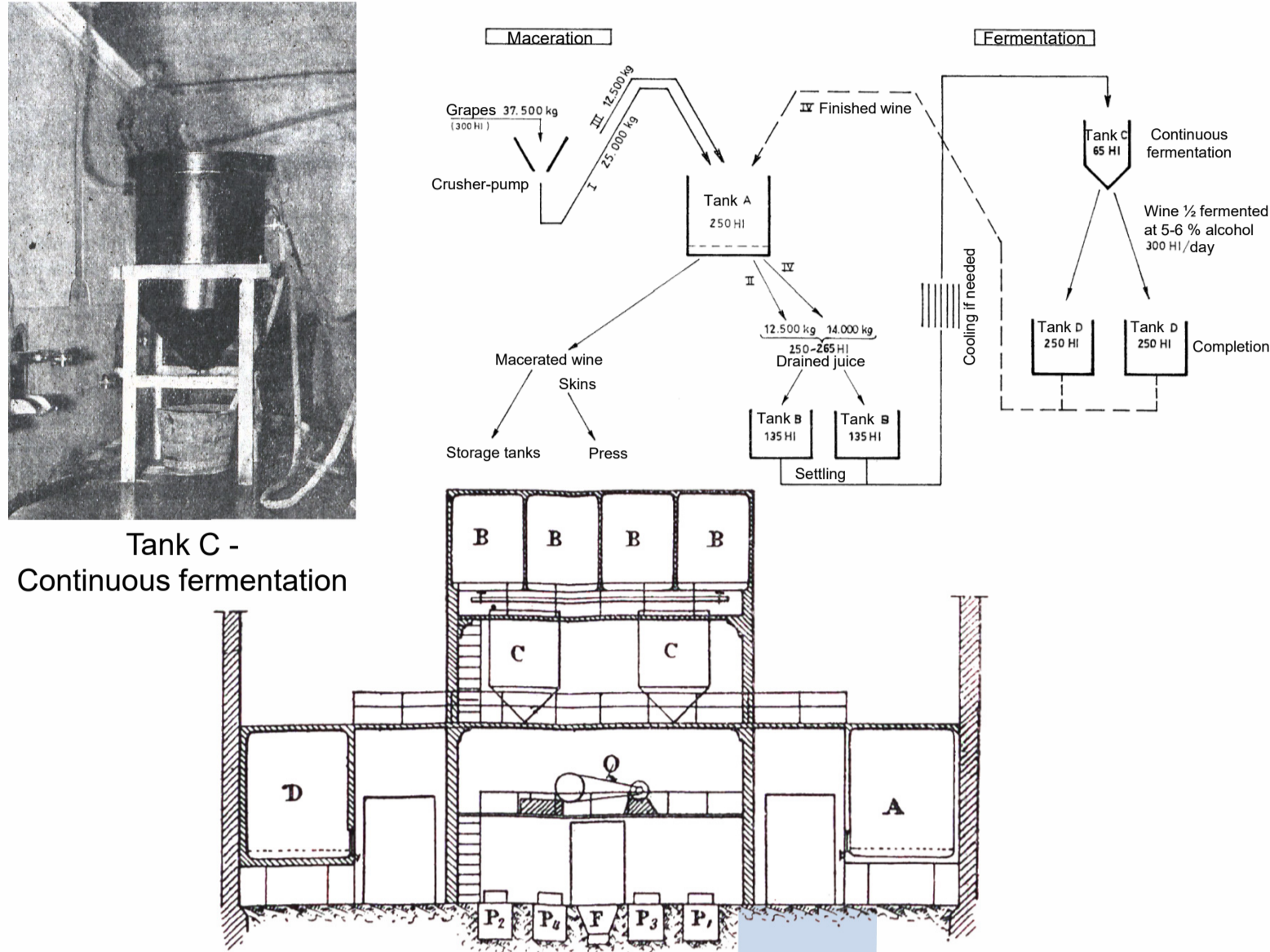
Continuous processes and fermentation: past and present



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Continuous processes are generally better:

- Smaller footprint
- Lower costs

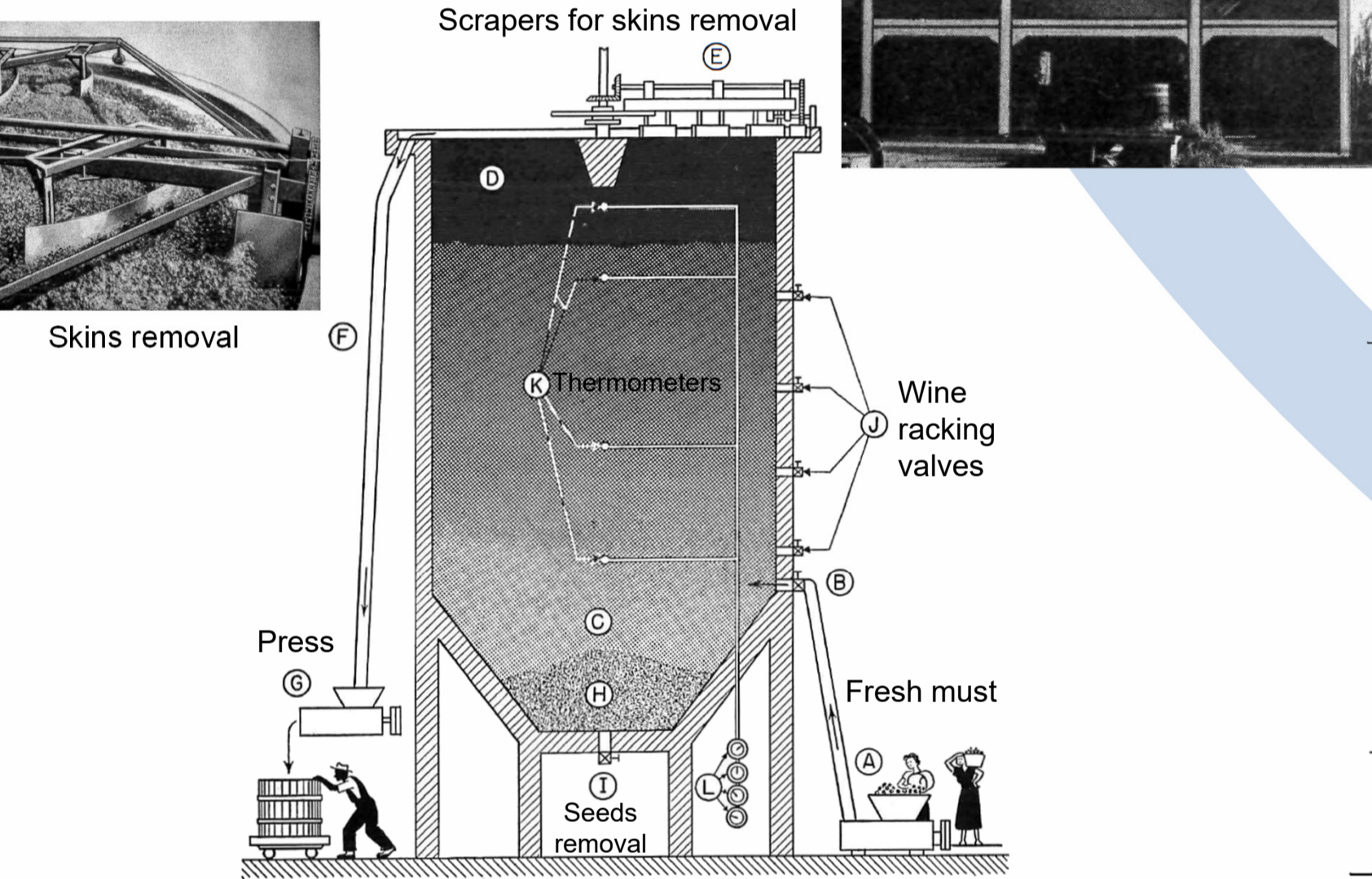
But some things to consider:

- What is the hold-up volume of the continuous process?
- How long does it take to start-up and reach steady-state?
- If it is an operation that can currently be performed in many tanks simultaneously, would adopting a continuous process using a single piece of equipment be creating a process bottleneck?
- What is the impact on wine quality?
- Does it involve purchase of an additional piece of equipment that otherwise wouldn't be needed?
- Is it appropriate across the range of different products that you make?

The answers to some of these questions can make continuous processes not as easily applicable in wineries as they are in chemical and minerals processing plants

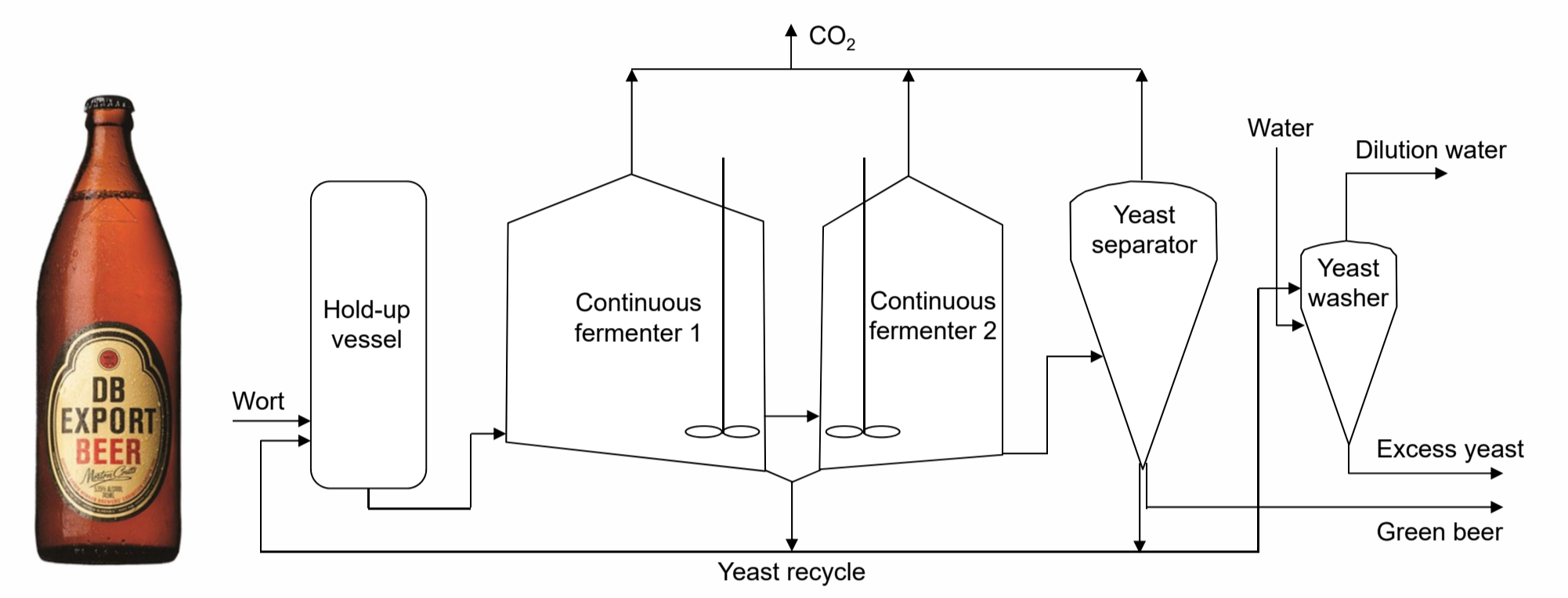
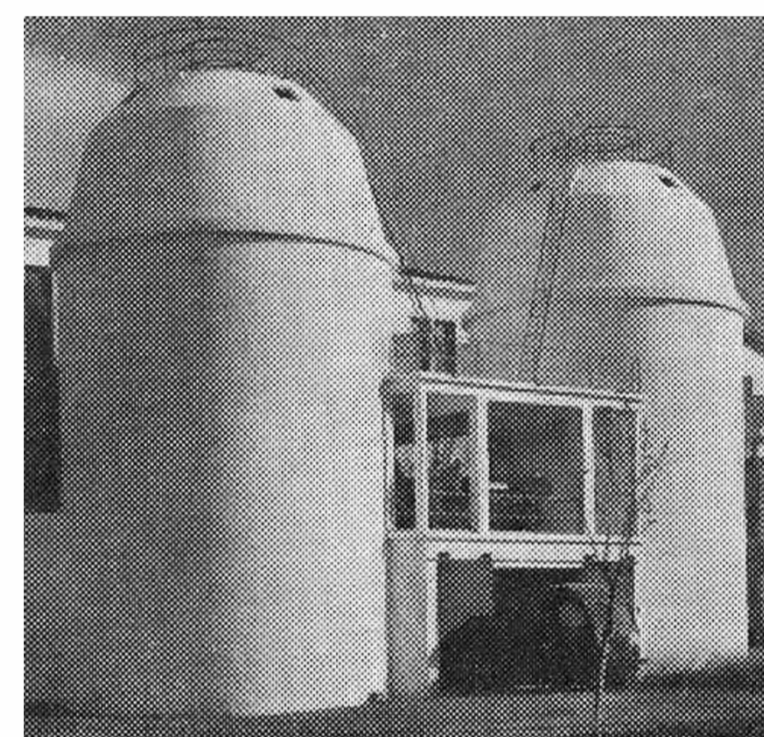
Semichon's 'Super 4'

By introducing the juice into a medium with at least 4% alcohol, *Saccharomyces* yeast are selected over other species. This particular process was advocated in the 1920s, but the concept of adding wine to juice has been used since ancient times. The fresh juice also serves to cool the fermentation. Old yeast can be removed from the conical tank bottom. For red wines the maceration and fermentation are separated, with the drained juice being fermented and then added back to the skins.



Batch versus continuous processes

Most chemical/process engineers would leave university with the general message that continuous processes are good (the teaching was probably a little more nuanced than that).

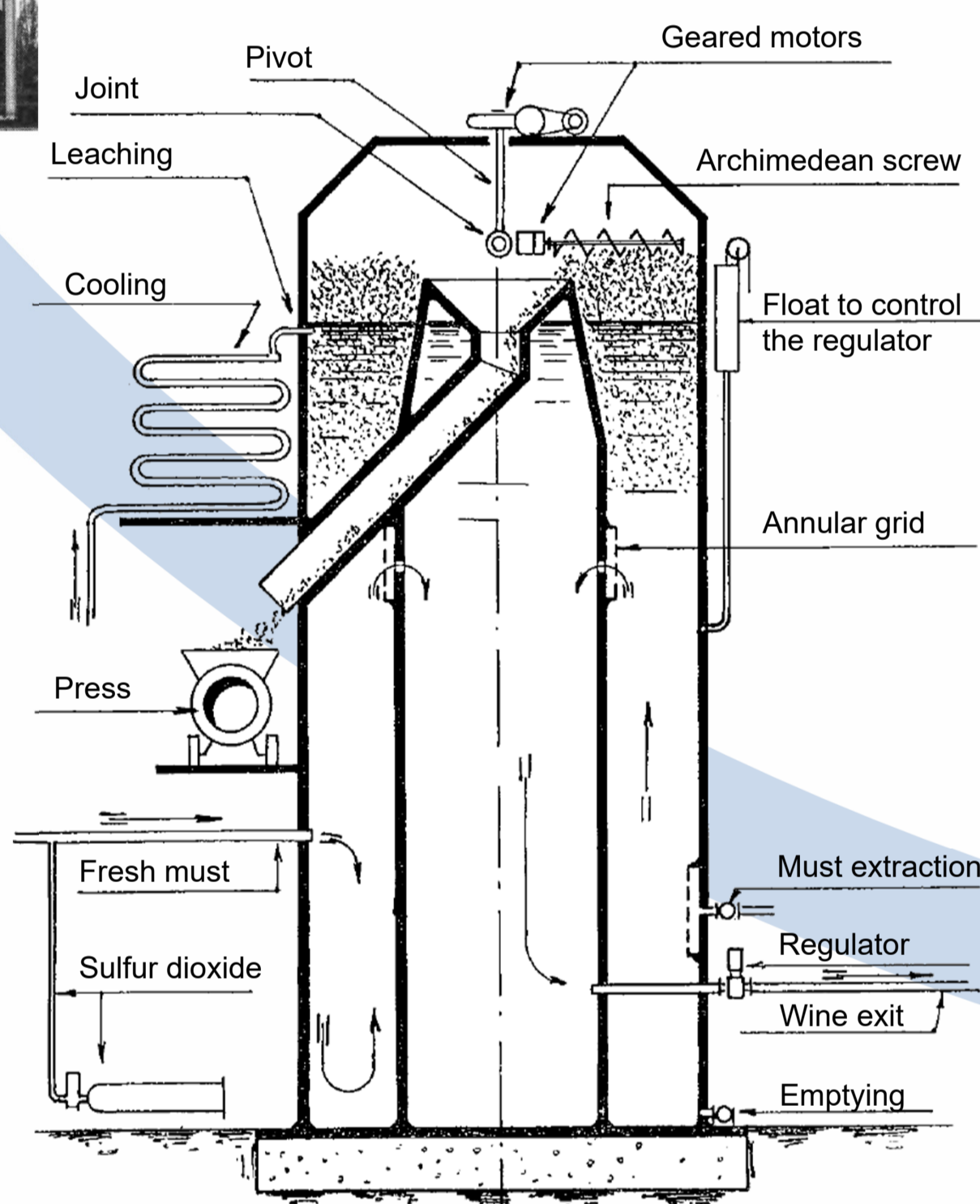


Continuous beer fermentation

Beer production is much better suited to continuous fermentation than wine production because it is less seasonal. Continuous beer fermentation was pioneered in New Zealand in the 1950s by Morton Coutts and for a long time it was successfully used to produce most of the beer in New Zealand - and it is still used by at least one major brewery. It has been trialed/used for periods by other major breweries around the world but then abandoned. At the time this technique was introduced in New Zealand there were some restrictive building regulations and taxation arrangements that made it desirable to minimise plant footprint and beer volume on-site, which further contributed to the merit of this technology.

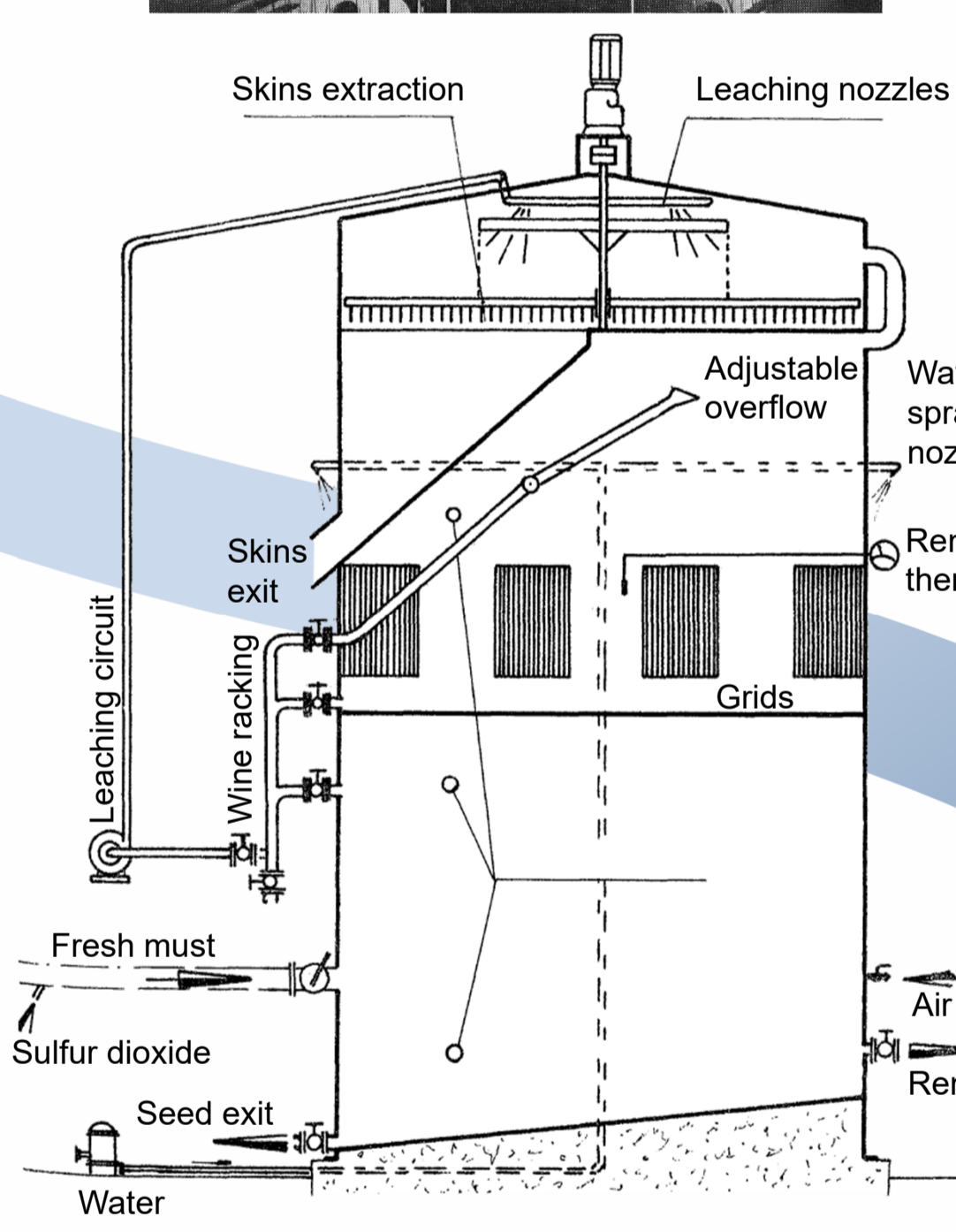
Cremaschi's continuous fermenter

In Argentina in the 1940s, Cremaschi pioneered a continuous fermentation process that automated removal of skins from a fermenter while also using the Super 4 principle of introducing juice into a partly alcoholic solution. Skin extraction was also accelerated because of the higher initial alcohol level. One of the arguments made for this and other continuous fermenter designs was that they reduce the overall winery tank capacity needed. This is definitely true, but the savings are sometimes overstated because the wine (not always completely fermented) still needs to go into another tank afterwards. Before finalising this design, Cremaschi had also experimented with simple raised batch fermenters with conical bottoms to automate skins removal, but he experienced problems with bridging.



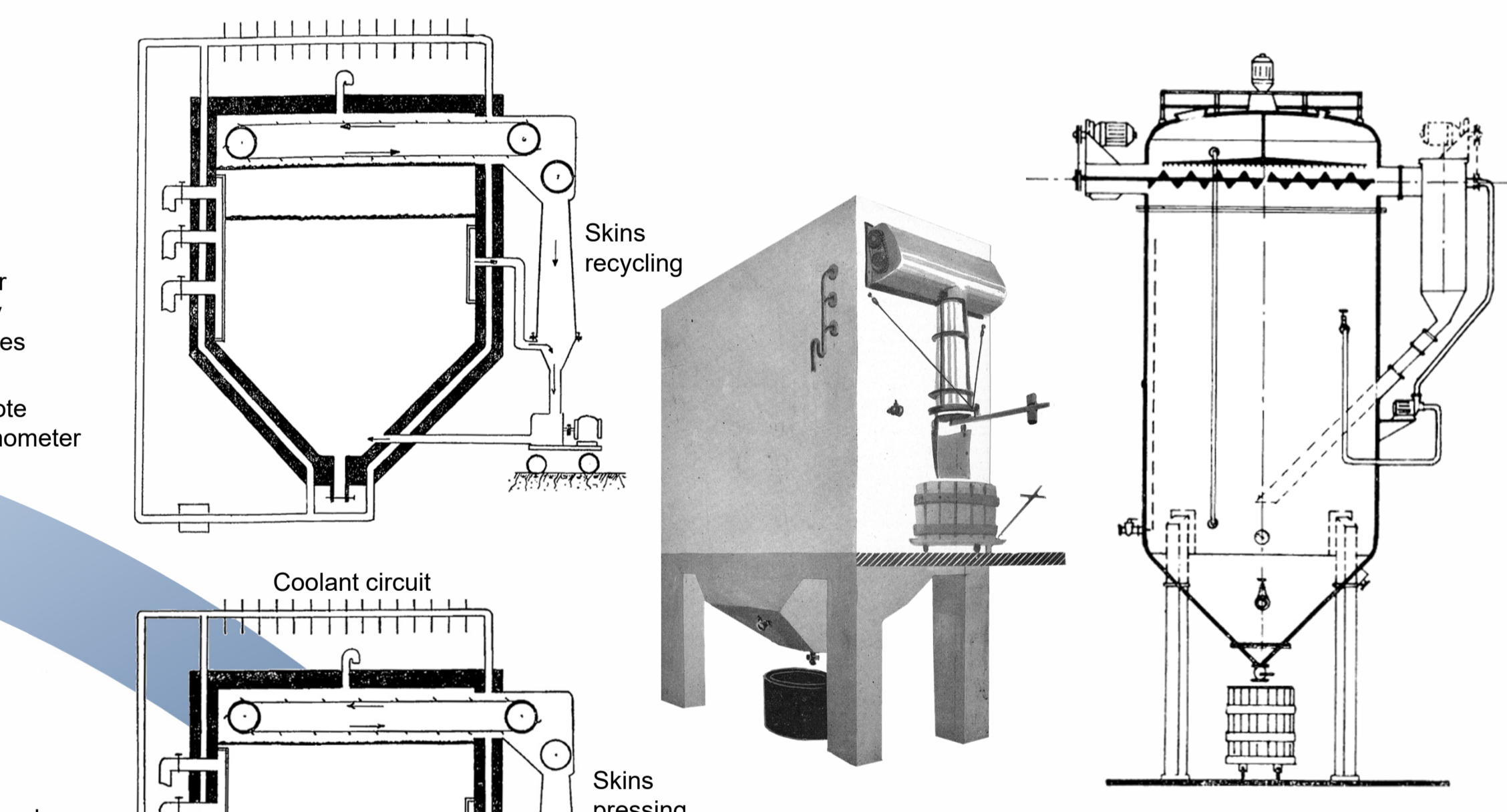
Ladousse's continuous fermenter

In France, the winery designer Ladousse developed his own system. It had an inner and outer compartment. He proposed that malolactic fermentation would be encouraged to occur in the inner compartment after the skins had already been removed. Some people were critical of the design because the extra wall hinders the escape of heat and because only the outer annulus is being used for skin contact. Build-up of seeds was another problem, but modifications were later made to facilitate seed removal. While this and the other systems are described as continuous, most do operate in a slightly semi-continuous manner - for example, in the morning an amount of wine will be removed that corresponds with the amount of fresh grapes that will be added later that day.



Vico's continuous fermenter

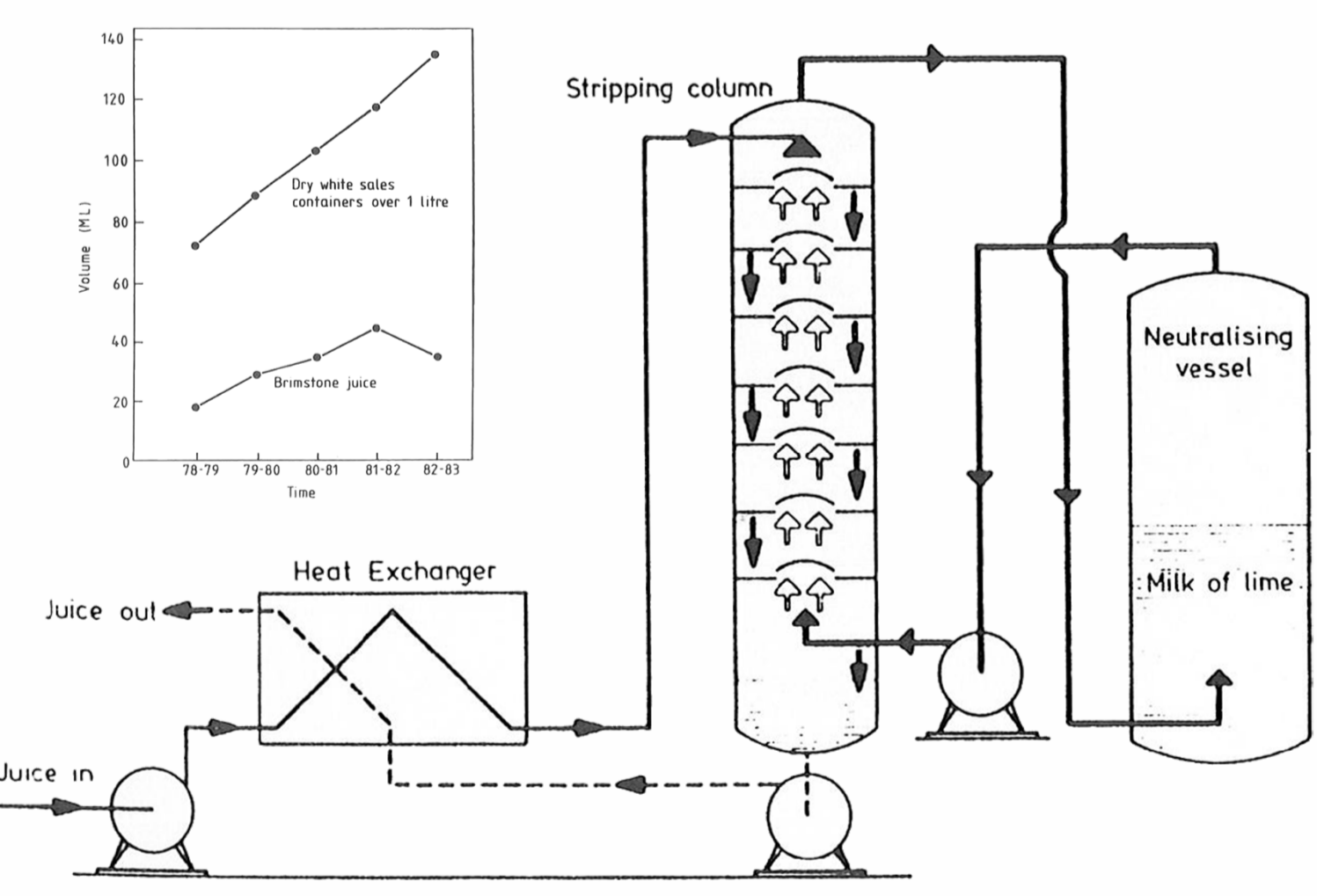
Other continuous French fermenter designs generally adopted a single tower. They were manufactured from metal to allow better heat dissipation. This design by Vico had water sprays on the exterior for cooling as well as a pump-over system to modulate extraction.



Defranceschi and Padovan semi-continuous fermenters

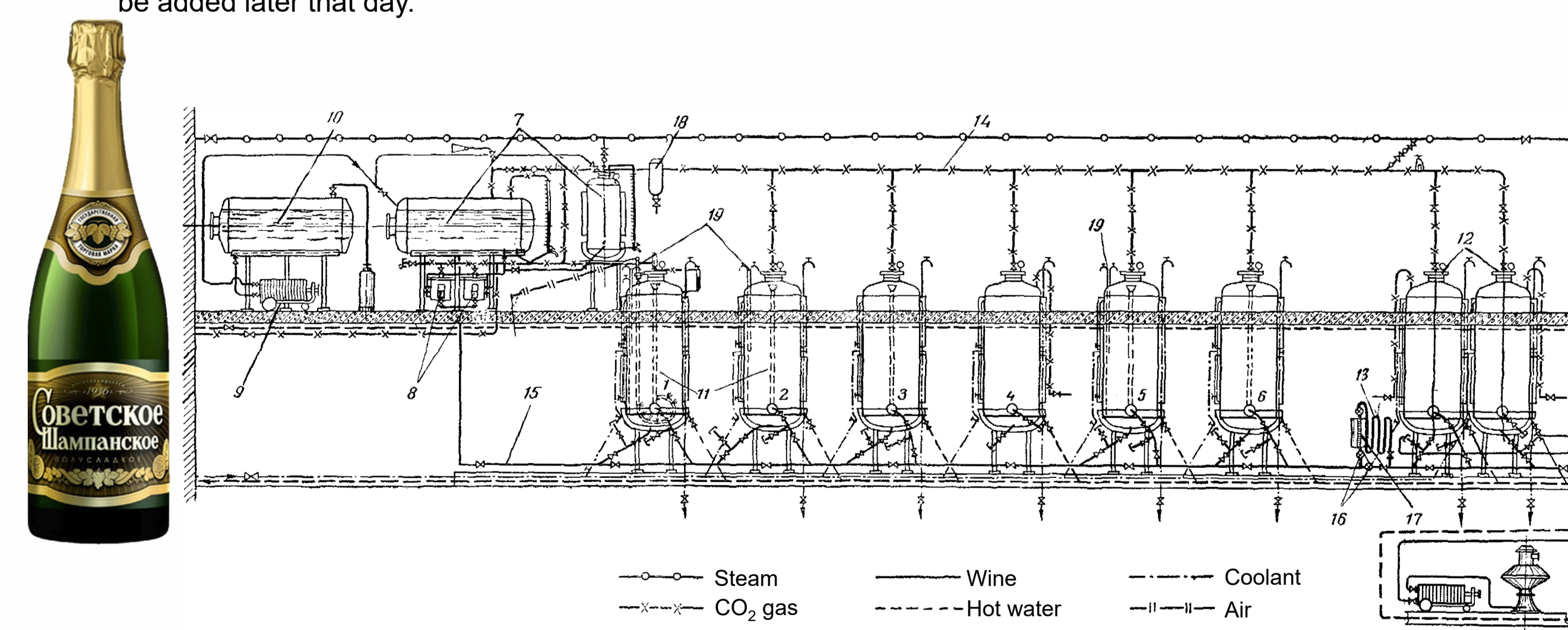
These Italian fermenter designs allowed for recycling of grape skins to increase the speed of extraction. This was not seen favourably by French authors who say it contributed to herbaceous, bitter and astringent characters. These fermenters were often operated in a fairly batch manner, but like with any device that allows skins removal, they could potentially be run continuously.

THE BRIMSTONE PROCESS - PAST, PRESENT AND FUTURE
R.A. POTTER
"It had been expected that the expanding unfermented grape juice market and the adoption of continuous fermentation systems would significantly increase the usage of Brimstone juice. To date these expectations have not been realized."



De-vintaged wine production

The seasonal nature of wine production is one of its greatest challenges. Starting in the late 1970s in Australia, clarified and protein-stabilised juice with high sulfite levels at low pH levels started to be stored for year-round fermentation and bag-in-box wine production. A & G sold 'Brimstone' desulfiting equipment in Australia to facilitate the process. This involves stripping the SO₂ from the juice at high temperature with cleaning of the strip gas by a lime milk solution (at high pH the sulfur dioxide is converted to soluble sulfites). Continuous fermentation would have coupled well with this process, but it didn't happen and the Brimstone process, always controversial, fell out of favour in the 1980s. Storage of juice with high sulfite levels is a very old practice and desulfiting with similar techniques to the Brimstone process had been used in Europe earlier and are still used today, apparently mainly for juice for sweetening wines rather than for direct wine production.



Continuous sparkling wine production - Champagnsky

The Soviet Union pioneered continuous fermentation for sparkling wine production. In the process shown, the base wine is fermented as it passes in series through six tanks and then into two finishing tanks that are used alternately.

Batch systems with automated skin removal

Continuous fermentations gradually fell out of favour, with the industry direction instead moving towards batch fermentations in stainless steel tanks that automated skin removal after fermentation and draining. These included elevated steep-sloped tanks, rotary tanks and then tanks with sweeping arms. Like the continuous fermenters they automated the skins removal process, but there was more flexibility to make different products and less risk of bacterial contamination.