Equipment evolution: Pressing (batch)

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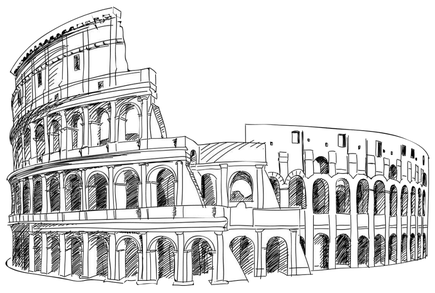
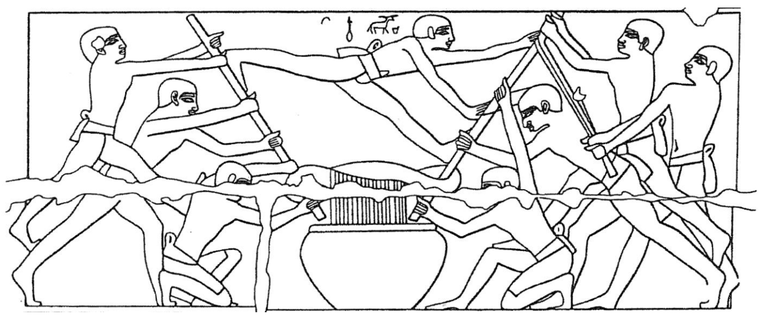


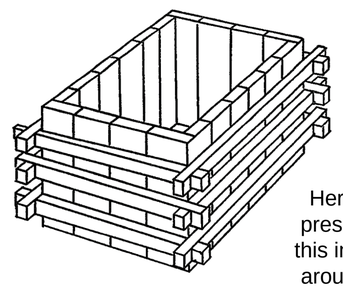
There were few advances in press design between Ancient Rome and pre-industrial Europe

Most of the beam presses and the direct external screw press below were described by Roman era authors (Cato c. 160 BC, Hero c. AD 60, Pliny c. AD 80) but were still being used in the 1700s.



Torsion bag press in Ancient Egypt

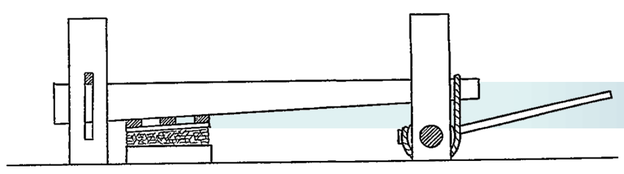
Pomace is placed inside a porous bag and twisted with poles. Tracing from Niankhkhnum and Khnumhotep's tomb at Saqqara c. 2400 BC.



Wooden basket

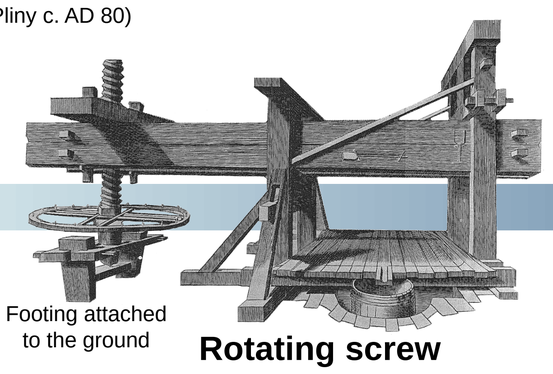
Hero (c. AD 60) described the wooden press basket as a new invention. Before this invention, a rope was typically wound around the marc to hold it in place when using beam or central screw presses.

Beam



Compound machine

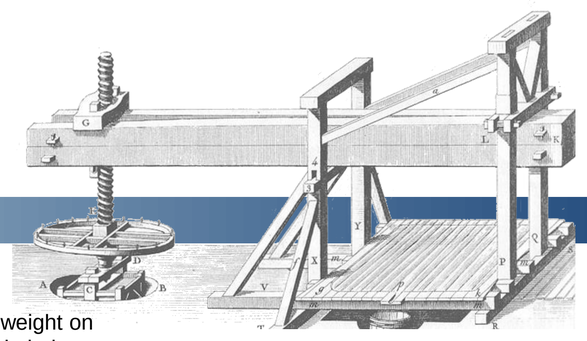
This design described by Cato c. 160 BC combined the mechanical advantage of the beam with that of a windlass.



Footing attached to the ground

Rotating screw

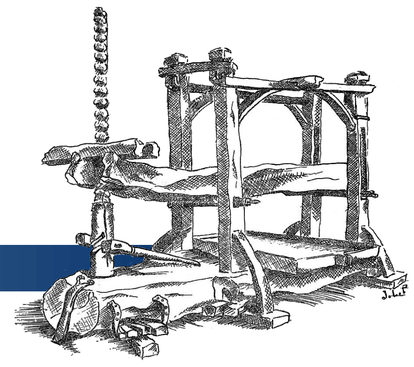
The rotating screw was a better way of raising and lowering the beam than a windlass. The screw has a greater mechanical advantage and is self-locking. First century BC.



Counter-weight on screw in hole

Counterweight

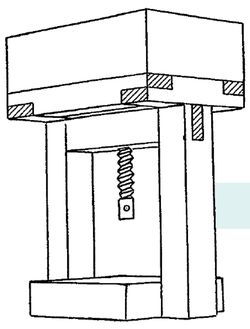
Placing a counterweight on the screw limited the application of pressure. It also eliminated the need for footings for the screw, which were prone to rot and be pulled out.



Connection to the frame

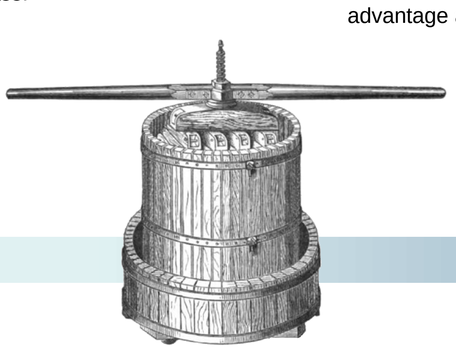
The connection of the screw section to the frame eliminated the need for frame footings. The press was no longer connected to the ground.

Central screw



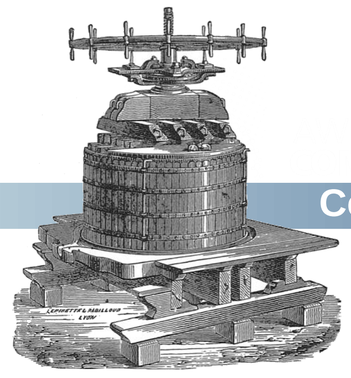
Direct external screw

The elimination of the beam and use of a direct screw made presses smaller. Advances in thread-cutting described by Hero, likely made this design possible. First century AD.



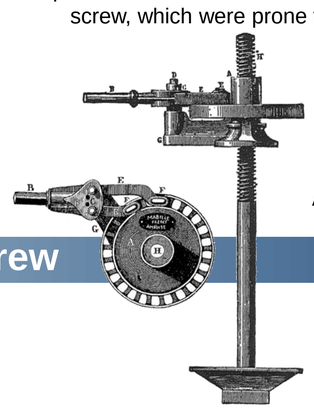
Fixed metal internal screw

Metal replaced wooden screws. The screw became the fixed element of the press with the nut now being turned to tighten. This allowed even smaller presses c. 1830.



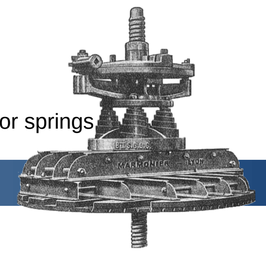
Percussion press nut

A top wheel is spun and a collar on this wheel hits a collar on the nut to tighten/loosen it. This allowed greater compression than possible with a simple nut and handle.



Ratcheting press nut

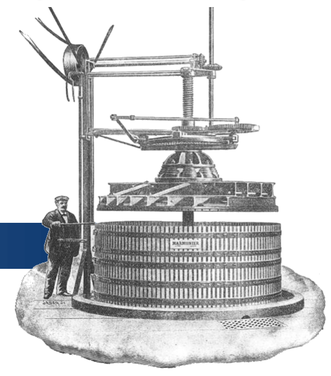
This revolutionary device provided such mechanical advantage that 1 or 2 people could now press quite large quantities of grapes. The nut also conveniently progressed as the handle was both pushed and pulled. Mabille c. 1869.



Accumulator springs

Accumulators

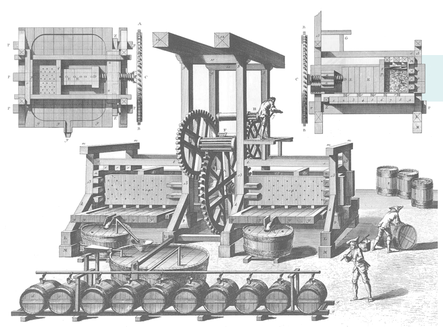
Traditionally a pile of wooden blocks was stacked between the press nut and pressing plate. The elasticity of the wood meant that when tightening stopped, the juice would continue to flow for a period. The assembly and disassembly of the blocks was labour intensive. Spring pressure accumulators removed the need for the wooden blocks.



Power

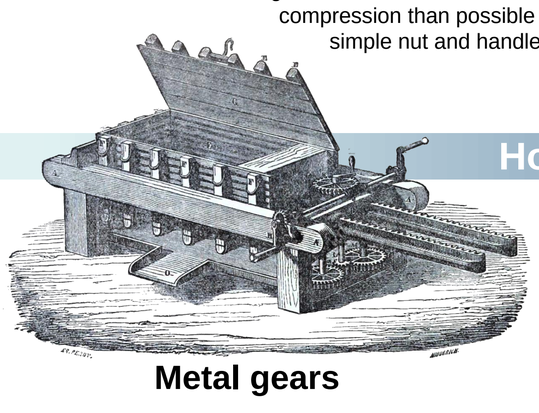
From the late 1800s there was an increasing use of power for pressing instead of manual labour. Hydraulics were also used together with multiple mobile press baskets such that one basket could be filled while another was being pressed.

Horizontal plate



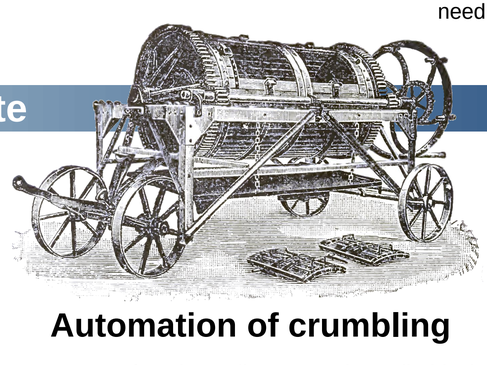
Elaborate dual horizontal press with wooden gears

In 1762 the Encyclopedié of Diderot and d'Alembert provided this elaborate illustration of a dual chamber horizontal press. Later reports suggest this design was too slow, did not provide sufficient pressure and would need expensive metal gears to be effective.



Metal gears

Benoît's Trojan press of 1839 was the first horizontal press with metal gears.



Automatic programs

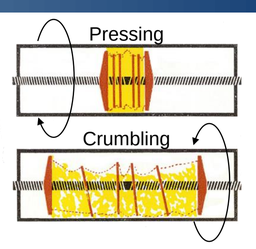
In the 1960s, programming discs that set pressures and times were introduced on horizontal plate presses automating the pressing process. Electronics followed in the 1970s.

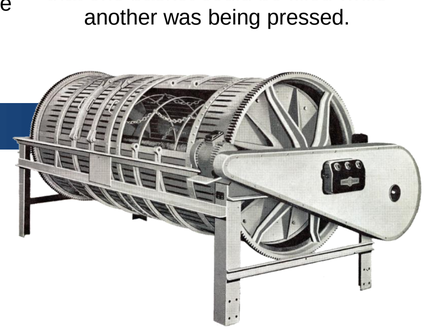
Self-optimising programs

Presses that use measurements of juice flow rate (direct or indirect) to optimise the pressing program were introduced in the 1980s and became increasingly sophisticated in the 1990s.

Automation of crumbling

In 1904, Ménard-Naudin patented a cylindrical horizontal press that automated the cake crumbling process. Two plates running on a fixed screw and guide rails on the basket, press as the basket is rotated in one direction and crumble as it is rotated in the other (aided by a system of internal rings and chains).

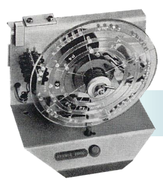




Mass production

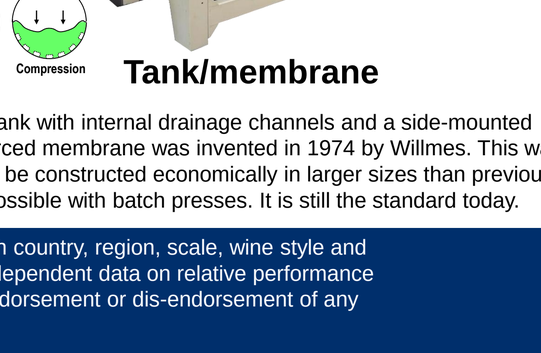
Horizontal plate presses were perfected and mass produced after 1945 by CMMC-Vaslin. They became very common.

Programming



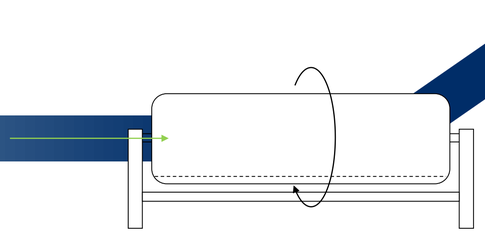
Bladder

The rubber bladder press was introduced in 1951 by Willmes. A key design principle was that the centrally mounted bladder would quickly press a thin circumferential layer of cake.



Tank/membrane

A tank with internal drainage channels and a side-mounted reinforced membrane was invented in 1974 by Willmes. This was able to be constructed economically in larger sizes than previously possible with batch presses. It is still the standard today.



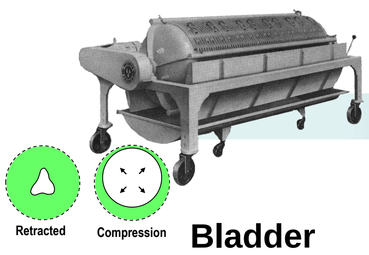
Axial filling

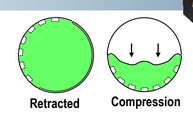
Axial filling allowed rotation during filling and therefore increased drainage. This enhanced press capacity and made tank/membrane presses feasible for larger operations. Late 1970s.

Protection from oxygen

During crumbling inert gas is injected into the press chamber (and recycled in some designs) or SO_2 solution is sprayed.

Pneumatic





Sources include: Bonnet (1984), Diderot and d'Alembert (1762), Drachmann (1932), Frankel (1999), Guyot (1864), Humbel (1976), Laborde (1907), Pacottet (1915), Thudichum & Dupré (1872), Troost (1961), and many equipment suppliers.