

The Hirsch and Büchner Filtration Funnels

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Question

What are the origins of the Hirsch and Büchner vacuum filtration funnels?

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Answer

Vacuum filtration appears to have been introduced into laboratory practice about the middle of the 19th century, probably as an adaptation of its application to industrial filtration. Writing in 1865, the Swiss chemist, Jules Piccard, recommended the apparatus shown in figure 1, consisting of a two-necked Woulfe bottle, a funnel, and a water aspirator or Geissler pump (1), and in 1868 Bunsen described an even more elaborate setup employing a thick-walled flask, a modified Sprengel pump, a pressure gauge, and a safety trap (2). The water aspirator, as Piccard noted, was a great improvement over earlier attempts to produce a vacuum using a hand-operated air pump because it generated a continuous and uniform pressure difference, whereas the intermittent pressures produced by the air pumps tended to tear the bottom out the filter paper during the vacuum stroke.

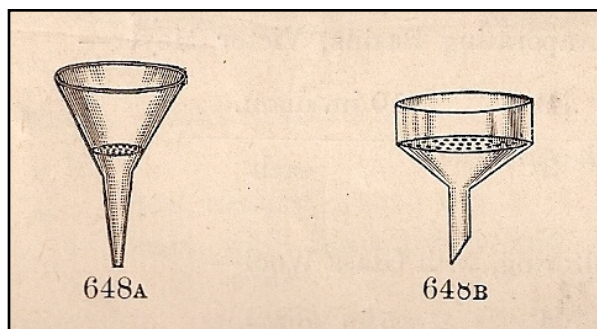


Figure 2. Early depictions of the Hirsch (left) and Büchner funnels (7).

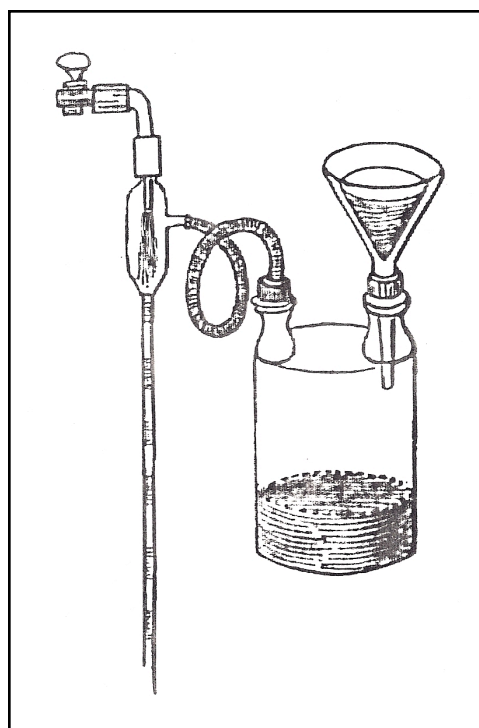


Figure 1. Piccard's original apparatus for vacuum filtration, c. 1865 (1).

Despite this improvement, use of a cone of filter paper placed in a conventional 60-degree funnel meant that the pressure differential was concentrated only at the tip of the filter cone and that, consequently, only a small portion of the available filter area was being effectively used. In 1886 Otto Witt introduced the use of a glass or porcelain plate containing perforated holes which could be wedged into a conventional funnel (3). Large enough to accommodate an unfolded disk of filter paper, it allowed one to apply the pressure differential to the entire surface rather than to just the tip. However, this device had the disadvantage that the plate did not always produce an airtight seal with the funnel and had to be reset after each usage. Hence, in 1888 the industrial chemist, R. Hirsch, patented a funnel (figure 2, left) in which the plate was permanently attached (4), and the same year, the industrial chemist,

Ernst Büchner (not to be confused with the famous German biochemist, Eduard Buchner), described a variation of Hirsch's funnel (figure 2, right) in which the section above the perforated plate was expanded and distorted to give vertical rather than slanted sides, which meant that it could accommodate much larger filter disks (5, 6). Both the Hirsch funnel and the Büchner funnel were immediately manufactured by the German firm of Max Kaehler and Martini of Berlin, though early models were often made of enameled iron rather than of porcelain.

Literature Cited

1. J. Piccard, "Eine wesentliche Beschleunigung des Filtrationsgeschäftes," *Z. anal. Chem.*, **1865**, 4, 45-48.
2. R. Bunsen, "Ueber das Auswaschen der Niederschläge," *Ann. Chem. Pharm.*, **1868**, 148, 269-293.
3. O. N. Witt, "Ueber eine Filtrirvorrichtung," *Chem. Repertorium*, **1886**, 10, 122.

4. R. Hirsch, "Ueber eine Vorrichtung zum Filtriren," *Chem. Ztg.*, **1888**, 12, 340.

5. E. Büchner, "Filtration vermittelt des Dr. R. Hirsch'schen Patent-Trichters," *Chem. Ztg.*, **1888**, 12, 1277.

6. H. L. Fisher, "Buchner Funnel or Büchner Funnel?," *Ind. Eng. Chem.*, **1939**, 17, 308.

7. *Townson & Mercer's Catalogue of Chemical & Physical Apparatus*, London, 1894, p. 94. Interestingly both forms of the funnel are identified as Hirsch funnels in this source, with no mention of Büchner.

Do you have a question about the historical origins of a symbol, name, concept or experimental procedure used in your teaching? Address them to Dr. William B. Jensen, Oesper Collections in the History of Chemistry, Department of Chemistry, University of Cincinnati, Cincinnati, OH 45221-0172 or e-mail them to jensenwb@ucmail.uc.edu