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Through, Lapped or Blind: The Dovetail Joint in Furniture History

Furniture joints can tell historians, conservators and curators much about the history of a piece. Although there are many varieties of wood working joints, it is often the dovetail that is seen as the quintessential cabinet-makers' joint. Indeed, even to the nonprofessional, the dovetail is one of the most recognisable joints in furniture.

Considered one of the strongest of cabinet joints, whether hidden or exposed, it so often reflects quality and artisanship. Ranging from the elementary to the complex, the dovetail joint has a number of variations from the simply functional to the clearly decorative.

This paper considers the origins of the dovetail from ancient Egyptian cabinetwork, through its development as a builders' and joiners' joint, to becoming the symbol of refined cabinet making. It will consider the applications of the joint in both hand and machine-cut versions. Of particular interest are the attempts to mechanise the method of dovetail joint cutting. The nineteenth century in particular has left a legacy of patented processes and developments that show us how creating dovetails changed from a skilfully crafted hand operation to a simple and speedy machine process using the modern-day router and jig combinations.

The development of this simple, though sophisticated joint and its many variations, is a fascinating story.

The Dovetail Joint

From simple carpentry to sophisticated decorative joints, from basic building techniques to the highest standards of cabinet making, it could be argued that the dovetail joint can represent the history of furniture and timber building construction and production in microcosm. Contemporary furniture makers and conservationists continue the tradition. Although the joint is commonly associated with woodworking, it has been used in metalwork for projects as various as bridge building (e.g. Ironbridge at Coalbrookdale, UK)[1] to metal bedstead frames.

Basics

The dovetail is a joint devised for woodworking that uses a fan-shaped or 'dovetail' shaped projection on a board or member, which is designed to fit an equal-sized shape or pin in another board or member. It is a version of a finger joint and offers excellent long grain to long grain surface connections that resist warping but allow some movement. According to Elyot's dictionary of 1565 they were 'A swallowe tayle or doove tayle in carpenters workes, which is a fastning of two peeces of timber or bourdes togither that they can not away'.[2]

Initially they were crude, often very wide and coarse, and sometimes held with a nails for extra grip. However, the use of the dovetail joint meant that sections of timber for drawer sides and carcases did not need to be so thick. This allowed for a slimming of the proportions over time that created drawers that were more elegant. Known as the common or through dovetail, the original dovetail joint had exposed end grain on both the pin and the slot. Cabinet-makers found this to be unsatisfactory for the adhesion of veneer, so they devised the stopped, lapped or half-blind dovetail. They had the advantage of providing a side grain surface. The most sophisticated dovetail was the full blind or mitred version. Used for carcase work, this secret dovetail gives a strength and quality to a cabinet, although its value is actually limited. The extra-strong wedged dovetail was also developed, and appears to be particularly

associated with German work.[3] Although most well-known for drawer construction, dovetails have also been widely used for carcase structure, and other forms of framing and sliding shelves.

A defining characteristic of the practical and visual effect of the dovetail joint is the angle of the cut of the tails and pins. The ratios and the subsequent angles can tell us something of the maker as well as the degree of sophistication of construction. The very earliest dovetails were often 1:1 (45º angle) ratio. Early seventeenth and eighteenth century dovetails were often 1:2 or 1:3 ratios demonstrating quite a crude application of technique, but nevertheless practical. It is generally accepted that 1:5 (11 º) or 1:6 (9.5º) is the strongest version and this is widely used. Anything over that, i.e. 1:7 or 1:8 (7º), is found in furniture from the later eighteenth century and represents flamboyance in both design and execution. These types of dovetail often appear in contemporary craft work as they often reflect hand-making skills. A ratio of 1:4 (14º) was common for the later, machine-cut dovetails.

All dovetails were originally hand cut, either by chisel or saw. Evidence of saw use, in which small horizontal cuts may be seen on the inside front corner of a drawer, will show where the maker has overshot the cutting line. Very often a scribing mark, to guide the artisan in his measuring and cutting is found, and often there is slight irregularity in the size and spacing of the cuts. In poor quality work, there may be evidence of filling and/or packing.

Origins

The dovetail appears to have originated by at least the Egyptian first dynasty (3000 B.C.) as it was found in furniture boxes and coffins, as well as in ivory work.[4] It is clear that the dovetail was also used as a building joint. Evidence from Roman buildings has shown that its wide use in both furniture and construction. The Roman architect Vitruvius, in his discussion on construction methods for roof beams, includes the use of the *securicla* (little axes) or dovetail joint.[5] The joint is also found on a much smaller scale in Roman furniture examples.[6]

Although any tracing of the transition from the Roman to the medieval period is fraught with difficulties, it is clear that versions of the dovetail joint continued to appear in medieval work.[7] For example, a record from 1104, of a chest containing the body of St. Cuthbert showed it was 'joined and united by the toothed tenons of the boards which come from this side and from that to meet one another'.[8] Further developed in the fourteenth century for caskets and small box work, the dovetail was common by the fifteenth century in Italy, although often hidden by exterior decoration.[9]

Early examples in England

Penelope Eames has published details of a chest in the Chapel of the Pyx in Westminster Abbey of circa 1480 with a 'highly individual form of frame construction, with a series of rails and stiles with dovetailed joints'.[10] (**Fig 1)**
There is a superb surviving example of a barber-surgeon's chest in walnut, which clearly features dovetail construction. It is from the Tudor *Mary Rose* ship that sank on 19th July 1545 and is a good surviving representation of the furniture type. [11] (**Figs 2, 3**) Although often defined as the distinguishing form of a cabinet-maker, the dovetail was in fact widely use in carpenters' work for house building, as well as by joiners making furniture. The definition of 1565 already mentioned, speaks of the dovetail as 'a swallow talye or doovetayle in carpenters' work.[12]

Indeed, the London joiners and carpenters companies [guild] published a set of demarcations on 6th September 1632, which mentioned in passing the following items as being the province of the joiner:

> 5. Item all sorts of Chests being framed duftalled pynned or Glued.
> 6. Item all sorts of Cabinetts or Boxes duftalled pynned glued or Joyned.
> 7. Item all sorts of Cupboards framed duftalled pynned or glued.
> 8. Item all Sorts of presses for wearing apparell Mercers Silkmen Haberdashers Goldsmiths Milleners or Napkin presses being pannelled duftalled pynned or Glued.[13]

Interestingly, the express use of glue also distinguished the work of the joiner from the carpenter. This clearly shows that the apparent distinction between joiners and the later defined cabinet-makers that suggests that the dovetail was an invention of the seventeenth century and a hallmark of the cabinet maker is clearly incorrect. However, it is true to say that cabinet-makers did develop the dovetail joint to a high degree of sophistication.

Other developments

Contemporary European paintings often supply visual representations of the use of the through dovetail. For example, images such as Durer's painting of a stool and chest with dovetail from 1506 and the image of Mary's deathbed [Danube school 1522] demonstrate an apparently commonplace method of joinery.[14]

Furniture historian, Robert Trent, has successfully argued that the period 1560-1640, was a very influential one in English furniture making, not least concerning dovetail developments.[15] Since the 1540s chests with board and dovetail construction were imported from Western Europe into England. An example of a chest, this time fitted with a drawer, and with a date of 1587, shows the English adaptation of the dovetail method.[16] Although the tails are quite large and crude, Trent says that this example 'provides a precedent for both dovetail construction and the use of drawers by Englishmen in an advanced furniture form of probable urban origin'.[17]

How the transition of techniques occurred is extremely difficult to unravel. Was dovetail making actually a continuation of the medieval carpentry practices or did it go into abeyance until the sixteenth century? The imported /European chests were of board construction, joined by dovetails, so did these provide examples? Was the development of dovetail working in England through the products of immigrant *schreiners* or *skrynemakers* from Germany and Holland? Did this drawer construction derive from northern Germany and subsequently influence the Dutch to adopt the dovetail in the mid-seventeenth century? These questions will have to be left open for the time being.

In any event, the development of the dovetail was a process of refining and nowhere is it more evident than in drawer construction. Abandoning the mortise and tenon that required timbers to be at least 25 mm thick or more, was a great step forward. Carcase furniture could be built for instance, with sides of 18 mm thickness and drawers could fit within a fraction of the object's sides. Indeed, drawer construction and the associated dovetails can give an indication of the date of production. By the 1680s, the dovetail was a common feature of drawers. Beadings or mouldings often hid the end grain of the through dovetail, but soon the use of veneers overtook the moulding idea. The lapped dovetail featured from circa 1690-1700, giving a better surface for veneer adhesion and the original broad dovetails gradually

narrowed so that by the mid-century many fine dovetails ended in a point. As the eighteenth century progressed, the dovetail construction allowed drawer linings to narrow considerably so that they reduced from 13mm to as small as 3 mm.

American developments

Whatever the case in Europe, settlers arriving in America took their particular craft practices with them and these can be quite revealing. For example, the Boston chest of drawers of c.1670 (**Fig 4)** demonstrates the single lapped dovetail used for drawers from the 1640s. A court cupboard example from New Haven dated 1675-1700 (**Fig 5**) shows large half-blind dovetails with some evidence of later nail repair. However, the William and Mary high chest from circa 1700-25 (**Fig 6**) shows a more sophisticated and refined approach to drawer construction.

Despite this, the through dovetail with a veneer front is still used. The example of the Rhode Island fall front desk c. 1690-1735 displays these characteristics. (**Fig**. **7**) Drawers were not the only use for the dovetail of course. They were widely used in carcase furniture. The two examples in (**Fig 8**) show the bases of American fall front desks. The c. 1720 Delaware Valley desk on the right has half-blind carcase dovetails with a ratio of between 1:4 and 1:5. The desk on the left has evenly spaced 1:6 half-blind dovetails with both the pins and tails of equal proportion. The decorative qualities of dovetails were also exploited to a degree. A walnut dressing table from Pennsylvania c.1720 and 1740 demonstrates this in its carcase construction with its use of 1:5 half-blind dovetails. (**Fig 9**)

The German influence on American furniture construction and on the dovetail in particular, is found in examples with the wedge dovetail detail. Schranks from New York, from the first half of the eighteenth century show a particular wedged dovetail detail.[18] A 1750 Philadelphia desk on frame has a particularly neat wedge dovetail joint (**Fig 10**) Although other dovetails were used on crude work, such as the 1750 Germantown bench with a blind through dovetail to fix supports to the seat, (**Fig 11**) the wedge style continued to be used in high style furniture.

Eighteenth century Europe.

The dovetail in a variety of forms continued in all sorts of furniture made in the eighteenth century. English examples from c.1700 still show drawers made with simple through dovetails with end grain directly in contact with the veneer. Constructional dovetails were also widely used. Examples of its use in table frames, wardrobes and chests all attest to its common application. However, it was still the drawer that took pride of place in dovetail work. The spectacular drawers built by illustrious makers remain a perfect demonstration of skill and geometry in drawer making. The examples of Chippendale and Riesener demonstrate the skill and quality not surprisingly associated with these makers. Even in this quality work there was some acknowledgement of economics. The dovetails at the front of the drawers, where they were likely to be seen, were half-blind whilst at the rear of the drawers they were cut through. (**Figs 12, 13, 14, 15)** The distinction between the fine English dovetails and the slightly less so French example is of interest.

In one particular eighteenth-century case the dovetail was visually ‘hidden’. In Georg Haupt’s 1770 desk the eye-level drawer in the **(Fig. ?)** cartonnier has a decorative tulipwood veneer covering it, whilst the standard desk drawer joint is left exposed.[19] **(Fig.?)**

Nineteenth century

With changes in demand and the increasing need for furniture, especially items with drawers, mechanised methods of construction or preparation were developed to meet this challenge. Although Jeremy Bentham had attempted to make a comprehensive patent for joint cutting in 1791 and 1793,[20] it was not until 1851 that 'fancy-cabinet-maker' H. J. Betjeman patented an English dovetail machine.[21] However, it was in the USA that machine-dovetailing meet with the most interest from inventors. Between 1833 and 1900, inventors applied for an astonishing one hundred and six patents for dovetailing machinery in the USA alone.

In 1858, George Molesworth presented a paper to the Institute of Civil Engineers on the use of machinery in woodworking. Specifically he noted that: (**Fig 18**)

> Hitherto, dove-tails have not been much made by machinery. Sir Samuel Bentham patented the plan of cutting dove-tail grooves, with a circular saw bevelled upon the edge, in wood set to the proper angle. Mr. Wimshurst lately took out a patent for dovetailing with a series of cutters, one of which, Fig. 43, cuts the dove-tail out of the wood, which is moved up to it from below, while the dove-tail socket is cut out by a series of cutters, Fig. 44.
> The objection to this mode is, that it is difficult to keep the sharp points of the dovetails, and the corresponding points of the socket-cutter, perfect. The machine patented by Burley answers well for small work. The dovetails are cut out by reciprocating chisels, Fig. 45, acting upon the work placed on an inclined bed. When half the cut is made, the work is placed on a bed, inclined in the reverse direction, for the cut to be finished. The dove-tail sockets are cut out by a series of saws on the same axis, Fig. 46. The work is placed on a sliding tray, at an angle to the edge of the saws, so that when the tray is moved up to them, an oblique cut is made. The work is then placed upon the other side of the tray, and the second oblique cut completes the socket, whose depth is regulated by stops, with which the tray comes in contact. A new species of dove-tail, lately introduced in America, seems likely to come into general use ; this dove-tail is formed on the mitre of the joint, and extends along the whole length of the work. [22]

Three years later the publicity for the American Burley dovetailing machine (mentioned above by Molesworth) alleged that it was able to produce seventy-five to one hundred dovetail joints per hour. (**Fig. 19)**

> We call attention to the advertisement under this head in another column, and which is well worth the attention of those to whom it is addressed. Performing in one hour the work of twenty men for one day, and this with mathematical accuracy, it is pronounced by competent judges to be one of the most useful of modern inventions.'[23]

Further developments came quickly. Another American inventor, F.A. Gleason, devised a machine for cutting dovetailing joints in 1855. An article in the *Scientific American* described this machine, for creating mitred dovetail joints with a pair of small circular saws is controlled by a treadle, the whole machine 'occupying but little more space than a man's hat, and does the labour of eight to ten persons'. [24] Gleason subsequently patented improvements in his machine in 1863, 1864 and 1879. There is

little evidence so far as to its success. Nevertheless, the idea of a circular saw attachment either human-powered or machine powered continued as a theme. (**Fig. 20**) One particular development though was a clear success. In 1870, Charles Knapp received a patent for a dovetailing machine that cut joints in a fashion based on a dowel in the side of the drawer front and hole with a semi-circular outline to the drawer side.[25] (**Fig 21**) This machine was equipped with various cutters and drills that formed a pin within a semi-circular hole. This became the pin. The side panel was drilled to the same semi-circular shape and with a hole for the pin.

During the mid-late nineteenth and early twentieth century, the Arts and Crafts movement's considerations of revealed construction particularly encouraged the use of exposed dovetail joints amongst others. This was not only a reaction to the machine-made joints but an opportunity to celebrate skilled artisanship (but at a price). Sometimes these ideas were publicised. For example, Gustave Stickley's *The Craftsman Magazine* of 1905 showed a design and cutting list for a screen complete with decorative dovetails that were intended to project from the surface of the panels a little. This is probably more correctly termed a dovetail key.[26] (**Fig 22**) Other makers included the early twentieth century Californian designers Greene and Greene who devised their own take on the through dovetail with a decorative effect, achieved by using inlays in the tails.[27]

Although modern artisans still employ hand-cutting techniques, in the twentieth century the spindle router became an important machine for cutting joints including dovetails, which could be profiled to demand. (**Figs 23, 24)** Modern workshops continue to use versions of routers and associated jigs.

Into the twenty-first century, whether for fine cabinet making or commercial use, the dovetail remains the joint of choice for both its structural and decorative potential.

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[1]See http://www.sedgleymanor.com/people/abraham_darby.html

[2] Cooper, *Thesaurus Linguæ Romanæ et Britannicæ* 1565, (OED) W. Salmon, *Palladio Londinenis* (1767) also says: *Bond*, a Term used among Workmen •, for when they say, *Make good Bond*, they mean, fasten the two or more Pieces of Timber well together, either with Tenanting and Mortising, or Dove-tailing.

[3] See E. Klatt, *Dies Konstruction alter Mobel*, J. Hoffman, 1961. Also see B. Forman, 'German Influences in Pennsylvania Furniture' in *Art of the Pennsylvania Germans* New York, Norton, 1983.

[4] A. Lucas and J. R. Harris *Ancient Egyptian Materials and Industries*, Histories and Mysteries of Man Ltd., London, 1989, p.453.

[5] *Ten Books of Architecture* (c. 25BCE), Book 4, 7,4.

[6] See Roger Ulrich, *Roman Woodworking*, Yale, 2007.

[7] R.W. Symonds mentions a cabinet with small drawers in the Vatican that is mentioned in an eight century inventory in Singer, Holmyard and Hall, *History of Technology*, 1956, p. 241.

[8] P. Eames, 'Furniture in England France and the Netherlands from the Twelfth to the Fifteenth century, *Furniture History Society*, 1977, p.228.

[9] See for example, Young, Peter; Darrah, Jo; Pilc, Jennifer; Yorke, James. .A Sienese *cassone* at the Victoria and Albert Museum', *The Conservator* 15.1 (1991). 13 Oct. 2010.

[10] P. Eames. p.149 also Plate 38.

[11] D. Knell, 'Tudor Furniture from the Mary Rose', *Regional Furniture* 1997, pp. 62-79.

[12] T. Elyot *Thesaurus linguæ Romanæ et Britannicæ*, 1565, (OED).

[13] Edward Jupp *Historical Account of the Company of Carpenters of the City of London*, London: William Pickering, 1848.

[14] The Institut für Realienkunde des Mittelalters und der frühen Neuzeit has a number of images of medieval furniture See http://tarvos.imareal.oeaw.ac.at/seiten/datenbanken.html.

[15] Robert F. Trent, 'The Chest of drawers in America, 1635-1730', Winterthur Portfolio, Vol. XX, Spring, pp.31-48.

[16] See V. Chinnery, *The Oak Tradition*, ACC, 1999.
[17] R. Trent, 'The Chest of Drawers in America, 1635-1730: A Postscript', *Winterthur Portfolio*, Vol. 20, No. 1 (Spring, 1985), p. 33.
[18] See Peter Kenny, 'Two early eighteenth-century schranke: rare survivals of the German joiner's art in the Hudson River Valley', *American Furniture*, 2001, p220-242.
[19] See further L. Ljungstrom, *George Haupt Gustav IIIs hovschatullmakare*, Stockholm, 2006
[20] Pat. nos. 1791/1938 and 1793/1951.
[21] Pat. no. 1851/13588.
[22] G.L. Molesworth, "On the Conversion of wood by Machinery", *Minutes of the Proceedings of the Institute of Civil Engineer*s, 1858, Vol. 17, pp. 17-39.
[23] *New York Times*, Oct 9th 1861.
[24] *Scientific American*, Vol. 811, No. 8, November 1855, p. 62.
[25] See US Patent No. 63532 April 1867 and improved version Patent No. 122,390, January 1872.
[26] See also G. Stickley, *Craftsman Homes*, New York, 1909, p. 181.
[27] See E. S. Cooke, Scandinavian /modern Furniture in the Arts and Crafts Period: The Collaboration of the Greenes and the Halls, *American Furniture*, 1993, p. 62.

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1 Penelope Eames, *Furniture History*, 1977, p. 149.
2. Courtesy of Mary Rose Trust.
3. Courtesy of Mary Rose Trust.
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16.
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18. Minutes of Proceedings, Institute of Civil Engineers, Vol XVII, 1857-8.
19. Hagley Museum and Library, trade catalogue collection.
20. D. Denning *The Art and Craft of Cabinet Making*, 1891, p.142.
21. Private collection.
22. *The Craftsman* May 1905.
23. Gordon Logie, *Furniture from Machines*, 1947.
24. Gordon Logie, *Furniture from Machines*, 1947.