Musiques ❧ Images ❧ Instruments

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# Musiques ❧ Images ❧ Instruments

Mélanges en l'honneur de Florence Gétreau

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BREPOLS

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# The French Trombone's Conquest of Britain

*Arnold Myers*

The French style of trombone was adopted in Britain in the 1860s[1]. This was partly a result of Henry Distin's adoption of French manufacturing practices[2] and Gustave Besson's opening a London factory in 1858 using Paris designs[3], also from the import to London of excellent instruments by Antoine Courtois from the 1850s. For the next 100 years, nearly all British tenor trombones were very similar. There were slight differences in bore and bell diameter, but apart from the maker's inscription, trombones were much the same whether made by Besson, Boosey, Gisborne, Hawkes, Higham, Keat, Rudall Carte, or other British makers. It thus makes sense to talk of a 'French model trombone' for this group of products by different makers. Today, when the very different American models such as the Conn 8H are the instruments of choice for professionals and amateurs alike, the French model trombone is often dismissed as a 'peashooter'. But it is the model that is needed for historically informed performance of a wide swathe of music, both British and French, written in the century 1850 to 1950.

The brassiness potential parameter is a tool which can be used to select appropriate instruments for historically informed performance. This, together with the bore diameter, encapsulates much of the sound quality of an instrument. The brassiness potential is a parameter derived from the geometry of an instrument which relates to its characteristic timbre.[4] Instruments with a more cylindrical bore profile, such as trombones, have a high brassiness potential; instruments with a rapidly expanding bore profile, such as ophicleides and euphoniums, have a low brassiness potential. A scatter plot with the minimum bore diameter on the x-axis shows recognised instrument types each occupying their own area of the graph. Fig. 1 shows a plot for typical B-flat tenor trombones from the period 1850 to 1950.

We see immediately that French and English trombones overlap, while German trombones are quite distinct, their position on the right reflects the fact that German trombones from the period 1850 to 1950 had a wider bore than French and English trombones. The position of the Conn 8H reflects its relatively low brassiness potential, typical of the modern trombone. The graph shows no significant trend in the design of French trombones. There is perhaps slightly more variety in the bore size of the earlier trombones and slightly more variety in the brassiness potential of the

1 The author is grateful to Andrea Fornaro, Historisches Museum, Basel; Bruno Kampmann, Paris; Gaël Bonzon, Musées d'art et d'histoire, Genève; Esther Mann, Museum of Army Music, Kneller Hall, Twickenham; Andy Lamb, Bate Collection, University of Oxford; Thierry Maniguet, Musée de la Musique, Paris.

2 Eugenia Mitroulia and Arnold Myers, 'The Distin Family as Instrument Makers and Dealers', *Scottish Music Review*, 2/1 (www.scottishmusicreview.org/index.php/SMR/article/view/20; posted 21.1.11).

3 Arnold Myers and Niles Eldredge, 'The Brasswind Production of Madame Besson's London Factory', *Galpin Society Journal*, LIX, 2006, p. 43-76.

4 Arnold Myers, Robert W. Pyle Jr, Joël Gilbert, D. Murray Campbell, Shona Logie, and John P. Chick, 'Effects of nonlinear sound propagation on the characteristic timbres of brass instruments', *Journal of the Acoustical Society of America*, 131/1, 2012, p. 678-688; Arnold Myers and D. Murray Campbell, 'Brassiness and the characterization of brass musical instrument designs', *Echoes: The Newsletter of the Acoustical Society of America*, 18/3, 2008; Murray Campbell, Joël Gilbert and Arnold Myers, *The Science of Brass Instruments*, Springer [in press].

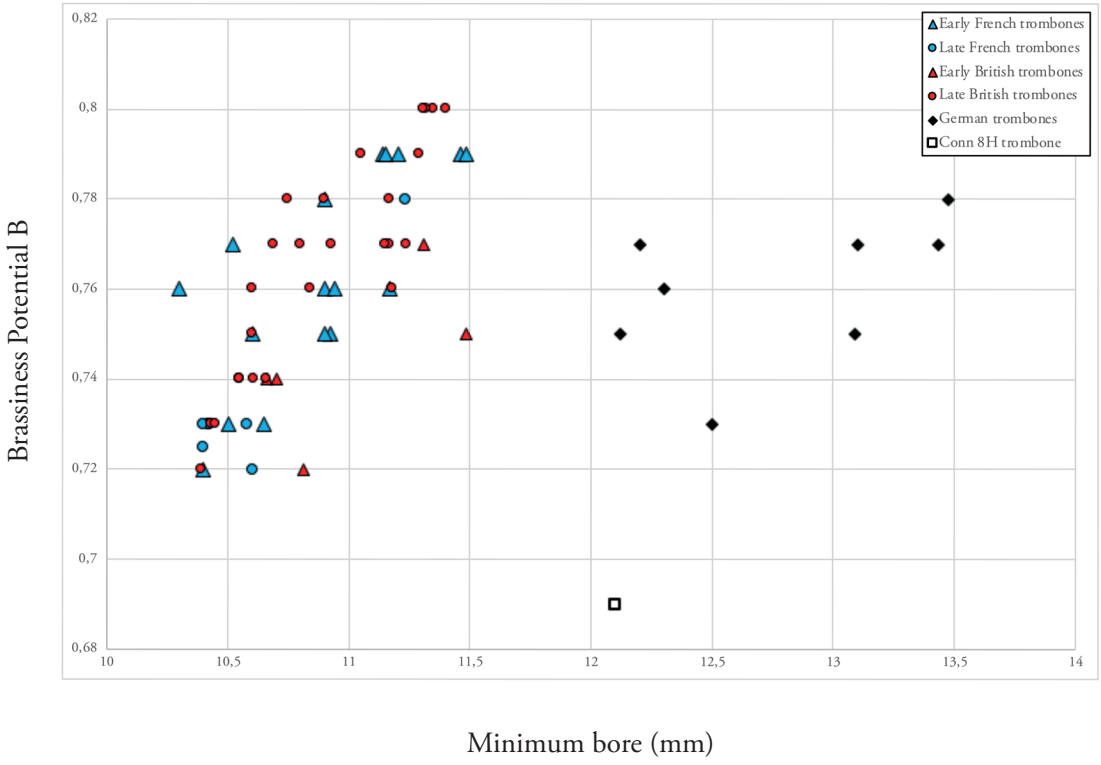


Fig. 1. Typical B-flat tenor trombones: Scatter plot of *B* against *Dmin* for British, French, and German trombones from the period 1850 to 1950.

The blue triangles show the position of French trombones made in the period from 1850 to 1900; the blue dots show the position of French trombones made in the period from 1900 to 1950. The red triangles show the position of British trombones made in the period from 1850 to 1900; the red dots show the position of British trombones made in the period from 1900 to 1950. The black diamonds show the position of German trombones made in the whole period from 1850 to 1950. The black square is the Conn 8H.

later trombones. The graph shows a small trend to narrower minimum bore and higher brassiness potential in the design of English trombones. Nevertheless the clusters overlap to such a large extent that it is valid to speak of a 'French model trombone' which was also made in Britain.

The French model trombone had a long period of manufacture and thus use. The French trombone (see fig. 2) evolved seamlessly from the early 19th century instruments. Surviving early nineteenth-century instruments by Riedlocker, Courtois frères and Halary can have a somewhat narrower bore (as little as 10.45 in the case of the Riedlocker in Geneva) as well as archaic features such as a lack of slide stockings or bell over-the-shoulder wrap. On the other hand, early 19th century British instruments have a German influence, usually with a wider bore than later British and French trombones. This contrast is more noticeable in the popular G bass trombone, more of which survive from the early period than tenors.

## Design development

In order to identify trends in the designs of narrow bore trombones in the period of their use at a professional and high-end amateur level, a sample of 32 French and 77 British narrow-bore instruments were examined and measured specifically for this article (see Appendix 1). The bore

Fig. 2. A. Courtois, Tenor trombone in B-flat, Paris, 1865. Edinburgh, University Collection of Historic Musical Instruments, inv. 3747 © Antonia Reeve

measurements presented have been rounded to the nearest 20th of a millimetre. Because it happens from time to time that the slide sections and the bell sections of trombones are interchanged, and only in a few cases do makers stamp both sections with a serial number, such a large sample was necessary to achieve statistically significant conclusions. The features discussed here are the most important for the acoustical response and output of the instruments.

The comparison of French with British instruments is slightly confused by the fact that Antoine Courtois and successors made instruments for the British market. These have a lever water-key rather than the 'siphon' normal for instruments made for the French market in the period under consideration, and are inscribed with the name of the London agent. The dating of Courtois trombones, which had two consecutive sequences of serial numbers, had to be determined by deduction and interpolation (see Appendix 2).

## The bore profile

Although it is usual to describe trombones as 'narrow bore', 'wide bore' etc., it is not always obvious at which point to measure the internal diameter of the tubing. There is necessarily a point at which the bore has a minimum diameter: this is normally some 20-30 mm from the mouthpiece receiver, at the end of the receiver taper. This minimum bore diameter is the one of the measurements used in calculating the brassiness potential of the instrument. With some trombones this minimum bore continues for the whole length of the descending inner slide, but in a majority of cases there is an expansion, either gradual or with a step at some point, to a somewhat wider bore at the slide stocking. The bore over the length of the stocking can be assumed to be cylindrical in the design and manufacture of the instrument, though in many case the very end of the descending slide is constricted as a result of handling over the period of use of the instrument. The most reliable guide to the design bore is therefore a measurement at or near the top of the stocking, and it is this measurement which is given as the bore of the trombone in this article. The same procedure needs to be exercised in measuring the bore at the stocking of the ascending inner slide; the ascending slide is usually close to cylindrical over much of its length and the mid-length of the whole instrument (the bore diameter here is sometimes used as a taxonomic parameter) lies in the ascending slide. The short length of tubing between the top of the ascending slide and the end of the tapered tenon at the friction-fit joint is often uneven and can be a little wider or narrower than the ascending inner slide.

In the bell section there is also a point a short distance from the joint at which the bore has a local minimum diameter. In the instruments under consideration, there is a step up in diameter at the joint and all the bell section tubing is distinctly wider than all the slide section tubing. Apart from some cheap nineteenth-century instruments, all French model trombones have a tuning-slide in the bell bow, and the tuning-slides are sufficiently consistently placed in the overall bore profile

for the inner slide bores to be a comparative indicator of the expansion in the bell section. In most cases the tuning-slide inners have a cylindrical bore, though some high-quality Boosey & Co instruments had a bore expansion through these inner tuning-slides (while necessarily keeping sliding surfaces cylindrical). The bore profile in the bell section is important for the acoustical response of the instrument. In Renaissance period instruments there is little or no expansion until the start of the bell flare but in modern trombones there is considerable expansion between the joint and the start of the bell flare; French model trombones fall between these extremes.

The mouthpiece is of course an acoustically important feature of the complete instrument. The particular mouthpiece used with an instrument in a performance is a matter of player preference and too variable to be considered systematically here. Nevertheless there were fairly consistent differences between the conical mouthpiece cup favoured in France and the more funnel-shaped cup favoured in Britain. A variety of typical French and British tenor trombone mouthpieces are described in the Catalogue of the Edinburgh University Collection.[5]

## Slide bore

The bores of the French trombones as measured at the descending slide stocking vary from 10.8 mm (Lafleur, c. 1910) to 11.75 mm (Besson, Paris, 1900-04) with a median of 11.45 mm. This Besson and the Adolphe Sax trombone of 1873 (in the John Webb Collection at the Royal Conservatoire of Scotland and considered a very fine instrument by players) at 11.6 are outliers: they may have been intended for the 3rd trombone player in a section, but there is no evidence to support this. There is a slight trend over the period to larger bores, with most but not all twentieth-century French trombones having a bore of 11.45 mm or 11.5 mm.

The bores of the British trombones as measured at the descending slide stocking vary from 10.75 mm (Salvationist Publishing & Supplies, c. 1927) to 11.55 mm (F. Besson, London, 1893) with an median of 11.35 mm. The 1893 Besson (in the Edinburgh University Collection of Historic Musical Instruments) was made for display at the World's Columbian Exposition (Chicago, 1893) and may represent a step towards meeting American preferences. There is no consistent trend over the period.

## Dual bore instruments

Trombones in which the descending inner slide is of a narrower bore than the subsequent ascending inner slide have been made throughout the period, and originated before the nineteenth century. Some French model trombones were dual bore, about one third of the total samples both for French and for British instruments. Of the French, those surviving are from earlier in the period. A typical example is the Antoine Courtois (author's collection) dating from c. 1900 with descending slide bore 11.4 mm and the ascending slide 11.5 mm. Of the British, however, most of the dual bore trombones are from later in the period. The biggest differential is in the Besson 'Class A' (author's collection) dating from c. 1911 with descending slide bore 11.0 mm and the ascending slide 11.5 mm. Interestingly, instruments with a model name (such as the Hawkes & Son 'Excelsior Class', the Salvationist Publishing & Supplies 'Triumphonic Class A', or the Boosey & Hawkes 'Artist's Perfected') are not consistent in being dual bore, or indeed in bore size, suggesting that designs were not maintained for periods as long as the use of model names.

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5 Arnold Myers and Raymond Parks, *Large Mouthpieces for Brasswind: Catalogue of the Collection. Volume 2, Part H, Fascicle v, 2nd edition*, Edinburgh, Edinburgh University Collection of Historic Musical Instruments, 2004.

## Stepped bore

An important feature of the modern trombone is method of construction whereby the mouthpiece receiver tube is elongated to form a lining to the inner slide, terminating in a distinct step up in bore diameter at a point between 150 mm and 250 mm from the mouthpiece receiver. The effect is to narrow the proximal portion of the bore profile, and the resultant constriction is often mistakenly termed a 'venturi' by players. This method of construction and the consequent step in the bore diameter in the descending slide is found in around half the French instruments measured and around one third of the British. The earliest instances are the Antoine Courtois dating from c. 1873 (in the musée de la Musique) with a step from 10.7 mm to 11.45 mm at 165 mm, and the Joseph Higham dating from c. 1887 (formerly author's collection) with a (step from 10.7 mm to 11.45 mm at 155 mm). There is no consistent trend over the period.

## Neck-pipe expansion

In all the trombones under consideration, there is an increase in bore from the ascending inner slide to the proximal leg of the tuning-slide. This portion of the bore profile includes the joint between the slide and bell sections and the 'neck-pipe' from the joint to the tuning-slide. The expansion ranges from the trivial (from 11.7 mm to 11.8 mm in the Sax trombone mentioned above and from 11.4 mm to 11.55 mm in an R.J. Ward, Liverpool, c. 1925 trombone in the author's collection) to the substantial (11.05 to 12.85 in the Salvation Army, London, c. 1907 in the Edinburgh University Collection of Historic Musical Instruments). There is no significant trend by date. The median values are 3.9% expansion for French instruments and 6.4% in the British, showing a possibly significant difference between French and British trombone designs.

## Tuning slide

In all trombones with a tuning-slide in the bell bow there is an increase in bore from the proximal to the distal leg of the tuning-slide. The expansion ranges from the small (from 12.35 mm to 13.15 mm in the Boosey & Co 'Perfecta' model of 1927 at the Royal Conservatoire of Scotland) to the large (from 13.25 mm to 16.2 mm in the Hawkes & Son 'Artist's Perfected Excelsior Sonorous Class A' model of c. 1928 in the Edinburgh University Collection of Historic Musical Instruments). There is no significant trend by date. The median values are 11.8% expansion for French instruments and 13% for the British.

## Bell

The bell diameters range from 136 mm in the early (c 1865) Michaud (in the Conservatoire National des Arts et Métiers) to 176 mm in the Keat & Sons (London, 1866-1917, in the author's collection). There is no significant trend by date. The acoustical significance of the bell size is often over-estimated, but there is evidence that large bells radiate sound, especially low-frequency components, more effectively[6]. The median values are 149 mm for French instruments and 150 mm for the British: the difference is insignificant.

6 Murray Campbell, John Chick and Arnold Myers, 'Acoustical Comparisons of Sackbuts and Trombones', *Historic Brass Society Journal*, 26, 2014, p. 63-78.

Fig. 3. Boosey & Hawkes, Tenor trombone in B-flat, London, 1950. Edinburgh, University Collection of Historic Musical Instruments, inv. 4249 © Dominic Ibbotson

## Sound of the French model trombone

The sound of the French model trombone can be heard in numerous orchestral, band and solo recordings from the first half of the twentieth century, both French and British. The traditional French orchestral trombone section was three B-flat instruments whereas in British orchestras and brass bands it was two tenors in B-flat with a bass trombone in G.[7] Together with slightly different mouthpiece patterns and playing styles, this resulted in a different trombone section sound. Numerous examples of the French model trombone survive in public collections and private ownership. Many of the British examples have suffered through being converted from Old Philharmonic pitch (A4 = 452.4 Hz used in brass bands until the mid 1960s) by extensions to the main tuning-slide. In historical performance of the French and British repertoire of the period 1850-1950 good original instruments are regularly employed. For the purposes of historically informed performance, it would be best to use an instrument with measurements close to the average, but it matters little if it is French or British, or if it is early or late in the period. A pioneering solo recording from the current revival period is Sue Addison's CD 'Elgar's trombone' (Cala CACD77016) in which she plays Sir Edward Elgar's own trombone (a Boosey & Co small bore tenor made in 1892, now in the Royal College of Music Museum of Instruments).

## The demise of the French model trombone

In Britain, major makers produced 'small bore' and 'large bore' models, sometimes also 'medium bore.' These were all what would be considered small bore by present-day standards and are subsumed in the above discussions. The 'small bore' models were intended for use by orchestral players and soloists while the 'large bore' were for brass and military bands. However in the 1920s the American influence of the dance band craze led to a demand from British jazz (and later swing) band players for American-style instruments. Hawkes & Son produced their 'Cabaret' model aimed at the UK market, while Boosey & Co produced a 'Large Bore' model which, according to the workshop order books, was internally termed the 'Olds Model' and appears to have been aimed at the US market. They had bore diameters of 11.95 and 12.35 respectively, so are not large bore by present-day standards. They also sported modern features such as bell and slide locks. The earliest extant examples of both date from 1925. These models were produced alongside the French model trombones which retained the traditional bore profile (although bell and slide locks were added).

7 Gavin Dixon, 'Farewell to the Kidshifter: The Decline of the G Bass Trombone in the UK 1950-1980', *Historic Brass Society Journal*, 22, 2010, p. 75-89.

The French model trombone finally and rapidly went out of fashion in post-war Britain. Boosey & Hawkes can produced their first batch of twenty-five B4040 'Imperial' model trombones with 12.3 mm bore in November 1946, followed by intermediate and student versions of the same basic design. The last extant French model trombone to be produced by Boosey & Hawkes was the B4039 'Imperial' with bore 11.3 mm ordered from the factory in January 1950 (fig. 3, now in the Edinburgh University Collection of Historic Musical Instruments). The narrow bore trombone continued to be played in the more conservative brass bands in living memory, and some of the older generation of professional players remember their first lessons on a 'peashooter' trombone.

# Appendix 1

## List of instruments measured

For each instrument the minimum bore diameter in the mouthpipe, the descending and ascending inner slide bores at the stockings, the bores of the main tuning-slide inner slides and the bell diameter at the distal end of the instrument are given, all in millimetres.

| Coll. | Inventory | Maker and serial number | date | Dmin | step | Desc slide | Asc slide | Prox mts | Dist mts | Bell |
|---|---|---|---|---|---|---|---|---|---|---|
| **French makers** | | | | | | | | | | |
| AM | 1209 | Association des Ouvriers | p. 1880 | 11.45 | no | 11.50 | 11.50 | 11.65 | 13.45 | 149 |
| AM | 1722 | Augu, Louis {4479} | e. 20 | 9.90 | 1.50 | 11.40 | 11.40 | 11.95 | 13.00 | 170 |
| AM | 1727 | Besson, F. | 1900-04 | 10.3 | 1.05 | 11.75 | 11.75 | 12.30 | 13.15 | 148 |
| GAH | 498 | Carcassonne, Georges | 1911-20 | 10.65 | 0.85 | 11.50 | 11.50 | 11.90 | 13.15 | 148 |
| GAH | 497 | Couesnon | 1911 | 11.00 | no | 11.05 | 11.10 | 11.90 | 13.15 | 154 |
| PC | E1818 | Courtois, Antoine | 1851 | 10.60 | | 11.40 | 11.50 | 11.60 | 12.80 | 139 |
| EU | 3747 | Courtois, Antoine | 1865 | 11.45 | no | 11.50 | 11.50 | 12.25 | 13.45 | 148 |
| AM | 1622 | Courtois, Antoine | 1927 | 10.40 | 1.00 | 11.40 | 11.40 | 11.85 | 13.25 | 147 |
| EU | 606 | Courtois, Antoine | c. 1872 | 11.15 | no | 11.25 | 11.55 | 12.10 | 13.10 | 149 |
| EU | 3849 | Courtois, Antoine | 1878-80 | 10.90 | no | 10.95 | 10.95 | 13.70 | 15.70 | 165 |
| PC | E973.5.3 | Courtois, Antoine {1134} | c. 1873 | 10.50 | 0.75 | 11.45 | 11.45 | 12.05 | 13.35 | 147 |
| AM | 846 | Courtois, Antoine {3550} | c. 1887 | 10.45 | 0.80 | 11.40 | 11.40 | | | |
| EU | 6456 | Courtois, Antoine {3617} | c. 1889 | 10.50 | 0.90 | 11.50 | 11.50 | 11.70 | 13.10 | 148 |
| AM | 1602 | Courtois, Antoine {5474} | c. 1900 | 11.25 | no | 11.45 | 11.50 | 11.90 | 13.30 | 149 |
| AM | 1601 | Courtois, Antoine {5546} | c. 1900 | 10.40 | 0.95 | 11.40 | 11.50 | 12.00 | 13.35 | 148 |
| BB | 2624 | Courtois, Antoine {5894} | c. 1902 | 10.65 | 0.85 | 11.50 | 11.50 | 11.95 | 13.35 | 149 |
| EU | 3665 | Courtois, Antoine {6951} | c. 1904 | 10.60 | 0.85 | 11.45 | 11.45 | 11.95 | 13.35 | 150 |
| B | R0032 | Courtois, Antoine {1045} | c. 1922 | 10.45 | 0.90 | 11.45 | 11.45 | 11.80 | 12.95 | 147 |
| PC | E974.1.3 | Courtois, Antoine {1835} | c. 1925 | 10.40 | 0.80 | 11.50 | 11.50 | 11.85 | 13.25 | 158 |
| AM | 1622 | Courtois, Antoine {2234} | c. 1927 | 10.40 | 1.0 | 11.40 | 11.40 | 11.85 | 13.25 | 147 |
| BK | 586 | Courtois, Antoine {3125} | c. 1931 | 10.65 | 0.80 | 11.45 | 11.45 | 11.85 | 13.30 | 147 |
| EU | 6379 | Courtois, Antoine {4761} | c. 1939 | 10.40 | 0.80 | 11.45 | 11.45 | 11.90 | 13.30 | 148 |
| AM | 1684 | Courtois, Antoine {6392} | c. 1947 | 10.50 | 0.95 | 11.45 | 11.45 | 11.85 | 13.25 | 159 |

| Coll. | Inventory | Maker and serial number | date | Dmin | step | Desc slide | Asc slide | Prox mts | Dist mts | Bell |
|---|---|---|---|---|---|---|---|---|---|---|
| PC | E974.1.4 | Courtois, Antoine {6802} | c. 1949 | 10.50 | 0.95 | 11.50 | 11.50 | 11.85 | 13.35 | 158 |
| AM | 1755 | Evette & Schaeffer {181} | c. 1910 | 10.40 | 0.90 | 11.45 | 11.45 | 12.00 | 13.25 | 160 |
| AM | 1753 | Lafleur | c. 1910 | 9.70 | 1.00 | 10.80 | 10.80 | 12.05 | 13.90 | 165 |
| MK | 145 | Michaud (conical bore) | 1850-55 | 10.65 | no | | | 13.25 | 14.15 | 141 |
| CNAM | 11015 | Michaud (conical bore) | 1862-67 | 10.4 | no | | | 12.35 | 14.45 | 136 |
| BK | 676 | Sax, Adolphe | 1860 | 11.05 | no | 11.10 | 11.60 | 11.75 | 13.40 | 143 |
| B | 2008.027 | Sax, Adolphe | 1869 | 11.15 | no | 11.20 | 11.45 | 11.65 | 13.30 | 149 |
| GR | 516 | Sax, Adolphe | 1873 | 11.50 | no | 11.60 | 11.70 | 11.80 | 13.20 | 150 |
| GR | 525 | probably France | e. 20 | 10.50 | no | 11.25 | 11.25 | 11.70 | 13.35 | 179 |
| **British makers** | | | | | | | | | | |
| GR | 517 | Besson, F {??00} | 1879-85 | 11.00 | no | 11.05 | 11.05 | 12.50 | 14.15 | 154 |
| EU | 6240 | Besson, F {3894} | 1893 | 11.30 | no | 11.55 | 11.75 | 12.60 | 14.55 | 153 |
| AM | 471 | Besson & Co {4542} | c. 1895 | 10.10 | 1.00 | 11.45 | 11.50 | 12.55 | 14.50 | 153 |
| AM | 1677 | Besson & Co {5242} bell and {4913} slide | 1897 + 1896 | 11.30 | no | 11.40 | 11.40 | 12.70 | 14.53 | 153 |
| EU | 6201 | Besson & Co {6726} | c. 1905 | 11.15 | no | 11.50 | 11.75 | 12.60 | 14.50 | 154 |
| EU | 2991 | Besson & Co {7345} | c. 1907 | 11.20 | no | 11.45 | 11.65 | 12.40 | 13.90 | 149 |
| EU | 212 | Besson & Co {8799} | c. 1910 | 11.15 | no | 11.55 | 11.55 | 12.55 | 14.50 | 149 |
| AM | 1228 | Besson & Co {10372, 10374} | c. 1911 | 10.45 | no | 11.00 | 11.50 | 12.50 | 14.55 | 155 |
| AM | 512 | Besson & Co {12110} | c. 1920 | 10.25 | 0.90 | 11.45 | 11.45 | 12.55 | 14.50 | 154 |
| GR | 518 | Besson & Co {12771} bell and {12768} slide | c. 1925 | 10.40 | 0.80 | 11.45 | 11.45 | 12.50 | 14.25 | 153 |
| EU | 3751 | Besson & Co {14658} | c. 1946 | 10.25 | 1.25 | 11.50 | 11.50 | 12.00 | 13.65 | 155 |
| EU | 2727 | Boosey & Co {67544} | 1904 | 11.25 | no | 11.30 | 11.30 | 12.30 | 14.65 | 174 |
| OB | 734 | Boosey & Co {108183} | 1920 | 11.10 | no | 11.35 | 11.25 | | | 151 |
| EU | 3093 | Boosey & Co {121004} | 1924 | 11.20 | no | 11.35 | 11.35 | | | 149 |
| EU | 4401 | Boosey & Co {121843} | 1924-25 | 11.35 | no | 11.30 | 11.35 | 12.35 | | 149 |
| AM | 1248 | Boosey & Co {128826} bell and {121889} slide | 1927 + 1925 | 11.35 | no | 11.40 | 11.40 | | | 147 |
| EU | 4663 | Boosey & Co {129482} | 1927 | 11.30 | no | 11.40 | 11.35 | 12.30 | 14.60 | 148 |

| Coll. | Inventory | Maker and serial number | date | Dmin | step | Desc slide | Asc slide | Prox mts | Dist mts | Bell |
|---|---|---|---|---|---|---|---|---|---|---|
| AM | 1542 | Boosey & Co {130613} | 1927-8 | 11.15 | no | 11.30 | 11.30 | 12.35 | | 150 |
| GR | 521 | Boosey & Co {130958} | 1927 | 10.95 | no | 11.05 | 11.05 | 12.35 | 13.15 | 149 |
| AM | 1668 | Boosey & Co {137210} | 1930 | 11.30 | no | 11.35 | 11.35 | 12.35 | | 149 |
| AM | 1271 | Boosey & Co {137675} | 1930 | 11.10 | no | 11.30 | 11.30 | 12.35 | | 150 |
| EU | 2496 | Boosey & Hawkes {141428} | 1932-33 | 11.30 | no | 11.40 | 11.40 | 12.00 | 13.55 | 152 |
| AM | 468 | Boosey & Hawkes {141764} | 1932-33 | 10.40 | 0.95 | 11.45 | 11.45 | | | |
| AM | 610 | Boosey & Hawkes {147520} | 1936 | 11.15 | no | 11.15 | 11.40 | 12.00 | 13.55 | 155 |
| AM | 611 | Boosey & Hawkes {147521} | 1936 | 11.05 | no | 11.05 | 11.35 | 11.95 | 13.50 | 154 |
| AM | 726 | Boosey & Hawkes {150545} | 1937-38 | 11.40 | no | 11.00 | 11.20 | 11.95 | 13.50 | 156 |
| AM | 1628 | Boosey & Hawkes {150549} | 1937-38 | 10.60 | 0.80 | 11.40 | 11.40 | 11.95 | 13.55 | 154 |
| EU | 4247 | Boosey & Hawkes {163108} | 1946 | 11.15 | no | 11.45 | 11.40 | 12.35 | 14.55 | 150 |
| EU | 4249 | Boosey & Hawkes {174981} | 1950 | 10.55 | 0.70 | 11.35 | 11.35 | 12.35 | | 156 |
| GR | 523 | Brown & Sons | a. 1911 | 10.70 | 0.45 | 11.25 | 11.25 | 12.00 | 13.45 | 145 |
| EU | 5761 | Gisborne | mid 19th | 10.80 | no | 10.80 | 10.80 | | | 160 |
| AM | 1575 | Hawkes & Son {7945} | c. 1895 | 11.45 | no | 11.45 | 11.45 | | | |
| AM | 1698 | Hawkes & Son {8119} | a. 1895 | 10.60 | 0.80 | 11.55 | 11.55 | 12.05 | 13.55 | 141 |
| AM | 1462 | Hawkes & Son | c. 1900 | 11.15 | no | 11.35 | 11.50 | 12.05 | 13.50 | |
| BB | 2596 | Hawkes & Son {12829} | c. 1900 | 11.20 | 0.85 | 11.50 | 11.50 | 11.90 | 13.55 | 153 |
| EU | 1130 | Hawkes & Son {13484} | c. 1900 | 10.65 | 0.80 | 11.50 | 11.50 | 12.00 | 13.55 | 148 |
| AM | 513 | Hawkes & Son {19053} | c. 1905 | 10.30 | 0.95 | 11.40 | 11.50 | 12.05 | 13.55 | 150 |
| AM | 1719 | Hawkes & Son {22894} | c. 1906 | 10.45 | 0.95 | 11.45 | 11.45 | 12.00 | 13.60 | 154 |
| AM | 727 | Hawkes & Son {30195} | c. 1912 | 10.57 | 0.85 | 11.45 | 11.45 | 11.95 | 13.50 | 153 |
| AM | 612 | Hawkes & Son {38007} | c. 1915 | 10.95 | no | 11.45 | 11.45 | 12.40 | 13.20 | 152 |
| AM | 607 | Hawkes & Son {39020} | c. 1920 | 10.95 | no | 11.40 | 11.40 | 12.35 | 13.50 | 152 |
| LKH | 182 | Hawkes & Son {42073} | c. 1910 | 10.45 | 0.80 | 11.35 | 11.45 | 12.10 | 13.45 | 150 |
| EU | 2730 | Hawkes & Son {46535} | 1923-24 | 10.60 | 0.80 | 11.40 | 11.40 | 11.95 | 13.50 | 153 |
| GR | 522 | Hawkes & Son {49066} | 1925 | 11.20 | no | 11.45 | 11.45 | 12.35 | 13.55 | 153 |

| Coll. | Inventory | Maker and serial number | date | Dmin | step | Desc slide | Asc slide | Prox mts | Dist mts | Bell |
|---|---|---|---|---|---|---|---|---|---|---|
| EU | 1801 | Hawkes & Son {47579} | 1924 | 10.45 | 0.85 | 11.35 | 11.25 | 12.00 | 13.55 | 152 |
| EU | 5717 | Hawkes & Son {49788} | c. 1928 | 10.60 | 0.80 | 11.40 | 11.40 | 13.25 | 16.20 | 163 |
| EU | 2947 | Hawkes & Son {57492} | 1928 | 10.55 | 0.85 | 11.40 | 11.40 | 11.95 | 13.55 | 150 |
| AM | 508 | Hawkes & Son {59976} | 1929 | 10.50 | 0.85 | 11.45 | 11.45 | 11.95 | 13.50 | 150 |
| AM | 1576 | Higham, Joseph {1349} | c. 1865 | 11.45 | no | 11.55 | 11.55 | 12.30 | 14.00 | 150 |
| GR | 519 | Higham, Joseph (13217} | c. 1874 | 10.65 | 0.70 | 11.40 | 11.40 | 11.95 | 13.65 | 149 |
| AM | 17 | Higham, Joseph (38660} | c. 1887 | 10.60 | 0.75 | 11.45 | 11.45 | 12.00 | 13.80 | 150 |
| OB | x701 | Higham, Joseph (45754} | 1892 | 10.80 | 0.60 | 11.45 | 11.45 | 11.95 | 13.75 | 150 |
| AM | 1312 | Higham, J., Ltd {71432} | c. 1923 | 10.55 | 0.90 | 11.45 | 11.45 | 11.80 | 13.35 | 149 |
| AM | 1652 | Keat & Sons | 1866-1917 | 11.50 | no | 11.55 | 11.55 | 13.20 | 14.10 | 176 |
| EU | 1770 | Pace, G.H. | c. 1895 | 9.70 | 1.00 | 11.45 | 11.50 | 11.95 | 13.30 | 145 |
| EU | 3254 | Rudall Carte {6939} | 1927 | 11.05 | no | 11.10 | 11.15 | 11.85 | 13.15 | 155 |
| AM | 470 | Rushworth & Dreaper | c. 1925 | 11.10 | no | 11.35 | 11.35 | 11.55 | 12.70 | 147 |
| AM | 514 | Salvation Army | c. 1890 | 10.80 | no | 10.90 | 10.90 | 11.75 | 13.55 | 150 |
| AM | 616 | Salvation Army, Fortess Road {6326} | c. 1904 | | | | | 12.85 | 15.10 | 160 |
| EU | 3666 | Salvation Army, Fortess Road {8329} | 1897-1911 | 10.90 | no | 11.00 | 11.05 | 12.85 | 15.15 | 162 |
| AM | 509 | Salvation Army, Fortess Road {10707} | c. 1910 | 11.00 | no | 11.05 | 11.05 | 12.80 | 15.15 | 162 |
| EU | 2948 | Salvation Army, Judd Street {14005} | c. 1915 | 10.95 | no | 11.05 | 11.05 | 12.65 | 15.20 | 161 |
| AM | 467 | Salvationist Publishing & Supplies {17340} | c. 1923 | 10.90 | no | 11.05 | 11.05 | 11.60 | 13.15 | 149 |
| AM | 606 | Salvationist Publishing & Supplies {19958} | 1927 | 10.30 | no | 11.00 | 11.00 | 11.65 | 13.15 | 162 |
| AM | 845 | Salvationist Publishing & Supplies {19961} | 1927 | 10.30 | no | 11.00 | 11.00 | 11.65 | 13.15 | 162 |
| AM | 510 | Salvationist Publishing & Supplies {20330} | 1927 | 10.45 | no | 10.75 | 11.00 | 11.70 | 13.15 | 150 |

| Coll. | Inventory | Maker and serial number | date | Dmin | step | Desc slide | Asc slide | Prox mts | Dist mts | Bell |
|---|---|---|---|---|---|---|---|---|---|---|
| AM | 939 | Salvationist Publishing & Supplies {22259, 22260} | 1931 | 11.05 | no | 11.05 | 11.05 | 11.70 | 13.15 | 150 |
| AM | 604 | Salvationist Publishing & Supplies {22456} | 1932 | 10.95 | no | 11.00 | 11.05 | 11.75 | 13.15 | 151 |
| AM | 599 | Salvationist Publishing & Supplies {22542} | 1932 | 10.85 | no | 11.00 | 11.00 | 11.75 | 13.15 | 148 |
| EU | 2728 | Salvationist Publishing & Supplies {22602} | 1932 | 10.80 | no | 10.95 | 11.00 | 11.70 | 13.10 | 149 |
| AM | 502 | Salvationist Publishing & Supplies {23926} | 1937 | 10.80 | no | 10.95 | 10.95 | 11.65 | 13.05 | 149 |
| GR | 520 | Salvationist Publishing & Supplies {23930} | 1937 | 10.80 | no | 11.00 | 11.00 | 11.65 | 13.05 | 149 |
| AM | 613 | Salvationist Publishing & Supplies {24739} | 1940 | 10.75 | no | 10.95 | 10.95 | 11.65 | 13.10 | 150 |
| AM | 469 | Savana | a 1918 | 10.81 | no | 10.80 | 10.90 | 11.70 | 13.45 | 148 |
| AM | 911 | Ward, R.J. | c. 1930 | 11.30 | no | 11.35 | 11.40 | 11.55 | 12.65 | 147 |
| EU | 2840 | Woods {12292} | c. 1895 | 10.80 | no | 11.35 | 11.35 | 13.05 | 13.90 | 147 |
| AM | 841 | by Chas. E. Foote {1235} | p. 1923 | 10.50 | no | 10.75 | 10.85 | 11.85 | 13.40 | 146 |

Source Collections of instruments investigated

| | |
|---|---|
| AM | Author's collection, Edinburgh |
| BB | Basel: Historisches Museum: Bernoulli Collection |
| BK | Bruno Kampmann (private collection), Paris |
| EU | Edinburgh University Collection of Historic Musical Instruments |
| GAH | Geneva: Museum of Art and History |
| GR | Glasgow: Royal Conservatoire of Scotland |
| LKH | London: Kneller Hall, Royal Military School of Music, Twickenham |
| OB | Bate Collection, University of Oxford |
| PC | Paris: Musée de la Musique |

# Appendix 2

## Serial numbers of Courtois trombones

Estimated dates have been proposed for slide trombones made by Antoine Courtois and successors based on the maker's name as inscribed, the address as inscribed, status of the Conservatoire as inscribed, the highest medal awarded, the name of the importer, and the serial number.

| Collection | Inventory | Maker's name as inscribed | Serial | Proposed date |
|---|---|---|---|---|
| | | **Proposed start of numbering** | **1** | **1856** |
| EU | 4215 | Antoine Courtois | 539 | 1864 |
| PC | E873.5.3 | Antoine Courtois & Mille | 1134 | 1872 |
| GR | 542 | Antoine Courtois | 1937 | 1875 |
| | | Antoine Courtois & Mille, Mille Sr. | 3288 | 1882 |
| AM | 846 | Antoine Courtois & Mille, Mille Sr. | 3550 | 1884 |
| GR | 508 | Antoine Courtois & Mille, Mille Sr. | 3554 | 1884 |
| EU | 4215 | Antoine Courtois | | |
| AM | 1602 | Antoine Courtois & Mille, Mille Sr. | 5474 | 1900 |
| AM | 1601 | Antoine Courtois & Mille, Mille Sr. | 5546 | 1901 |
| BB | 2624 | Antoine Courtois | 5894 | 1903 |
| PC | E974.1.2 | Antoine Courtois | 6392 | 1905 |
| EU | 3665 | Antoine Courtois | 6951 | 1907 |
| EU | 1865 | Antoine Courtois | 10030 | 1910 |
| | | **Proposed new start of numbering** | **1** | **1918** |
| PC | E974.1.3 | Antoine Courtois | 1835 | 1925 |
| AM | 1622 | Antoine Courtois | 2234 | 1927 |
| BK | 586 | Antoine Courtois | 3125 | 1932 |
| EU | 6379 | Antoine Courtois | 4761 | 1941 |
| AM | 1684 | Antoine Courtois | 6392 | 1947 |
| EU | 3692 | Antoine Courtois | 6536 | 1948 |
| PC | E974.1.4 | Antoine Courtois | 6802 | 1949 |
| PC | E973.5.4 | Antoine Courtois | 7878 | 1953 |

Source Collections of instruments investigated

| | |
|---|---|
| AM | Author's collection, Edinburgh |
| BB | Basel: Historisches Museum: Bernoulli Collection |
| BK | Bruno Kampmann (private collection), Paris |
| EU | Edinburgh University Collection of Historic Musical Instruments |
| GR | Glasgow: Royal Conservatoire of Scotland |
| PC | Paris: Musée de la Musique |