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How a Trumpet Is Made. I. The Natural Trumpet and Horn

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successively musical critic of the *Academy* and the *Athenæum*, and also contributed many articles to the *Musical Times* and to Grove's 'Dictionary of Music.' Notwithstanding the onerous demands of this great pedagogical and critical activity, Ebenezer Prout found time for much composition, including three choral cantatas: 'Hereward,' 'Alfred' and the 'Red Cross Knight.' His editions of 'The Messiah' and 'Samson' are other instances of his activities. His edition of the former work was the fruit of much laborious investigation. Not the least of its recommendations is that it corrects numerous mistakes that crept into former editions. But perhaps he exercised a wider and more permanent influence over his generation by his luminous theoretical works than he did by his music, sound and scholarly as that is. His 'Harmony, its theory and practice,' and the series of manuals on Counterpoint, Canon and Fugue, and Form and Instrumentation, have had great vogue, and have shaped the musical thought of innumerable students. In 1894 he was appointed Professor of Music in the University of Dublin, and this post he retained until his decease. He was an active member of the Incorporated Society of Musicians. In 1904 his portrait, in his Dublin Doctor's robes, was painted by Mr. E. Bent Walker, and was presented to him by numerous friends and pupils. We are very glad to provide our subscribers with a reproduction of this picture. It is considered to be an excellent likeness of the Professor, and will form a fit companion to the portrait presented with our April, 1899, issue.

Prout had a phenomenal musical memory. He was a devout Bach worshipper, and probably knew this incomparable composer's music as well as any man in Europe. His attitude to Wagner's music was on the whole appreciative. To the extreme moderns he was less sympathetic. The present writer went with Prout to the first London performance of 'Heldenleben' (Strauss), and is not likely to forget the accompanying and subsequent expression of the Professor's opinion. Prout was a keen and brilliant controversialist, always able, in musical matters at least, to support his opinion by wise saws and modern instances. Punctuality was one of his virtues, and he planned his work with marvellous exactitude. He would tell you in March all that he meant to accomplish in the next few months, and on what day in July and by what train he would depart for his holiday, and it all came off. He was a rare linguist, a chess player, a great smoker, a raconteur of exceptional interest, somewhat of a Bohemian in dress, a genial and sympathetic friend, and his whole life was an inspiration to his great circle of friends.

The funeral took place in Abney Park Cemetery (London, N.E.) on December 9, in the presence of a large concourse of friends and representatives of the institutions with which he had been connected. The organ was played by Mr. John E. West, a relative and former pupil. There was no singing. The deceased musician's brother, the Rev. Edward Prout, delivered a simple, touching address that searched the hearts and comforted the spirits

of all present. It was stated that even during the last week of his painful illness the Professor commenced a new analysis of Bach's '48,' and that he had completed his account of the first four. On Sunday, December 5, he was in his study, about to commence the fifth Fugue, when one of his heart attacks came on. He felt that the great transition had to be made, and said, 'Lord, do not let it be long.' His prayer was mercifully granted.

It need hardly be added that the sympathy of all who knew Professor Prout or profited by his labours, will be respectfully tendered to his sorrowing widow and family.

HOW A TRUMPET IS MADE.

By D. J. BLAKLEY.

I.—THE NATURAL TRUMPET AND HORN.

In popular language the word 'trumpet' is very commonly used to denote any wind instrument that is sounded by the action of the lungs and lips of the player without the introduction of an artificial reed (the lips must be regarded as a natural double reed). It must be granted that flutes are not included in the widely-embracing term 'trumpet' as generally used, but the lip-action required for these instruments so totally differs from that required for any instrument that by the widest use of the word can be called a trumpet, that no confusion ever arises between these two classes even amongst those most ignorant of musical matters.

Before treating of the trumpet in a specific sense, the word may in the meantime be used in the popular way to signify any metal wind instrument blown by the lips, for all that can be said in this article in regard to the craftsmanship and mechanical processes concerned in the production of the trumpet, using the word in its strict and limited sense, is equally applicable to any brass instrument. The difference between one instrument and another is in the design requisite to give a desired result, just as the design of a naval architect is directed to ensure the efficiency of, and the differentiation between, say, a cargo boat, a passenger liner, and a racing yacht, while the actual methods of construction are the same in each case.

A natural horn, a conch shell, or an elephant's tusk must, at a very early period of human history, have lent itself to the purpose of forming a useful and powerful instrument for purposes of war or the chase simply by the fashioning of an orifice at its small end for the action of the lips. The 'making' of such an instrument would be a very simple matter, but it would soon be found that some were better, that is, more powerful and more easily sounded, than others. The natural tones on any such horn of conical bore approximate more or less closely to the lower notes of the harmonic series, as 1, 2, 3, 4, 5, &c., or c, c', g', c'', e'', &c., the lower two or three notes only being practicable on short horns. With a horn of about four feet in length there is, however, no difficulty in obtaining the sixth harmonic, or g'' in the harmonic scale of c, c', g', c'', e'', g'', and as by natural laws capable

of scientific explanation the horns of best tone-quality and most easily blown are also those which give this scale most accurately, the ears of man must have been to some extent trained to appreciate the intervals of the octave and the common chord ages before the investigations of Pythagoras in the 6th century B.C. concerning the relationship between the various lengths of a string and the intervals of the octave, fifth, fourth, third, &c.

If instead of a long natural horn a short horn is taken and extended in length by the addition of small cylindrical tubing, a new tone-quality is obtained, of greater brilliancy than that given by the long conical horn; and on such an instrument of the assumed four-feet length the upper notes to c'' , or the eighth harmonic, are easily obtained, but at some sacrifice of the intonation and ease of production of the first and second tones of the series. At whatever time, and in whatever way, may have arisen the distinction between the conical horn and the cylindrical tube with a comparatively short conical expansion or bell-mouth, this distinction has been known through all historic time and is the basis of all modern work in the further differentiation of tone-quality between the various families of brass instruments. In these instruments we have then two main types, viz.:

Trumpets.—With tubing cylindrical for about two-thirds of the total length, and terminating

with a conical or bell-mouth expansion. With trumpets must be included trombones, the trumpets being the treble and the trombones the tenor and bass members of the family.

Horns.—Instruments more or less conical throughout, all being less brilliant and piercing than the trumpet, but varying from the delicate quality of the orchestral or French horn to the fullness and breadth of tone of the modern saxhorns and tubas.

Thus the general object in view, in the design of any instrument included in the 'brass wind,' or trumpet and horn classes, is the production of a tube which can be blown by the lips in such manner as to give a wide range or compass of notes in agreement with the natural harmonic series. It is generally known to all students of acoustics that a cylindrical tube open at both ends has this series for its proper tones, and it is equally well known that a tube of half the length closed at one end will give only the unevenly numbered notes of the series; also that these will be of the same pitch as the corresponding notes on the open tube of double the length. As an example, the notes proper to an open tube of about eight and a-half feet in length are here given, and also the uneven notes of the harmonic series which are proper to a tube of half the length. The customary scientific pitch of 256 vibrations for middle C has been assumed:

Notes in Harmonic series	1	2	3	4	5	6	7	8	9	10	11	12
Notes from Open tube	Vibrations—64	128	192	256	320	384	448	512	576	640	704	768
Notes from Closed tube	Vibrations—64		192		320		448		576		704	

The series naturally extends indefinitely upwards, but notes relatively higher than those shown are quite exceptional, the actual pitch depending upon the fundamental note or prime tone of the instrument. A tube in the form of a cone complete to its apex has the peculiar and not easily explained property of giving resonance to all the notes of the harmonic series, and of giving them of the same pitch as those from an open tube of the same length. Such a tube, however, cannot be sounded by the lips, therefore some modification of the conical form is necessary in the production of a wind instrument, and the required modifications have been gradually evolved through experience and rule of thumb, supplemented in modern times, since the researches of Helmholtz and other investigators, by definite design in accordance with scientific observations. By modification of form must be understood the various differences of calibration, and not the bending of the instrument into parallel members as in the trumpet and trombone, or the circular form of the French horn. These general outward forms

are mainly a matter of custom and of convenience in handling, and have little or nothing to do with pitch or tone-quality. Given a certain pitch, the total or axial length of the instrument will always be the same, whether it is straight, or bent into any particular form. By 'form,' therefore, the general proportions of the tube, wide or narrow, with greater or less conical expansion and bell flanging are implied as essential conditions, and not the general outward appearance or model.

The general dimensions of the tubing suitable for yielding a certain tone-quality, compass, and volume being determined, a further accentuation of distinctiveness in tone-quality is obtained by slight variations in form of the two ends of the instrument, that is, of the mouthpiece and the bell-flange. The extreme types of mouthpieces are those of the trumpet and the French horn. The 'cup' of the trumpet mouthpiece is almost hemispherical, that of the French horn is of a deep conical or funnel shape, and between these two extremes are to be found the mouthpieces of trombones and bugles, and of the modern cornets,

saxhorns and tubas. The shallow or hemispherical cup accentuates the brilliancy already obtained by the general dimensions of the trumpet, and the more or less conical cup tends to mellowness of quality: this is heard in the fullest degree in the plaintive tones of the horn.

The extension of the bell-flange has much the same effect as the increase of conical depth in the mouthpiece, that is, the mellowness is thereby enhanced. The crispness of the army field-bugle is largely due to the very slight flanging of its bell, and on the other hand the mellowness of the orchestral or French horn is dependent to some extent on the wide, convolvulus-like expansion of its bell. If this were greatly cut down, the tone of the horn would approximate to that of the trumpet.

It may be said, 'Surely the material of which an instrument is made is of at least as much importance as exact proportions?' To this the answer is that the possible influence of the material is commonly very greatly exaggerated. The material must have a smooth surface and also be fairly rigid, so that the force of the vibrations is not absorbed; but granting these conditions are obtained, everything else is merely a matter of convenience of manufacture, cost and durability. For those who can afford silver, silver is a very good material, because it is durable and easily kept clean; but those who can only afford brass or copper may rest assured that a trumpet made of one of these humbler metals is, as a musical instrument, absolutely as good as if it were made of one of the precious metals. I have myself listened attentively to a player (unseen) giving similar passages or calls alternately on a straight bugle made of copper and on another made of brown paper, and found myself quite unable to discriminate between the two instruments. Any slight difference that there may be is more easily *felt* than described by the player, and is practically inappreciable by the listener. It should be added that in the experiment the interior of the brown-paper bugle was varnished so as to produce a smooth and non-absorbent surface.

For so long a time as short horns of indefinite tone-quality sufficed for the purposes required, the natural horns of animals and the tusks of elephants afforded sufficient and suitable material. But these must in very early days have been supplemented by instruments of metal, as evidenced by ancient frescoes and bas-reliefs. Probably the oldest written record concerning metal instruments is to be found in the words 'Make thee two trumpets of silver; of a whole piece shalt thou make them,' referring to the trumpets for the tabernacle worship, as recorded in the book of Numbers, chap. x., v. 2.

Passing by the various possible ways in which metal may have been treated in the formation of instruments in ancient and mediæval times, we may now describe the way in which a trumpet is made at the present day. The 'making' of anything necessarily begins with its design. This being completed, in the case of the trumpet according to the principles already set forth, the mechanical production is chiefly a matter of

sheet-metal work. The bell and so much of the instrument as is conical is cut from the sheet and hammered into a tubular form; the edges being thus brought together are brazed, and the exact required form is then given by burnishing down to a steel mandrel or shape and by turning in a lathe. In the best modern practice the cylindrical portions are made from solid-drawn or seamless tubes, and all the necessary bendings or curvatures are obtained by filling the tubes with lead, so that they may be bent without serious distortion or crippling; after the bending is completed the lead is melted out. The accuracy of the intonation of the finished instrument depends largely upon the skill shown by the workman in bending the various tubes without distorting their calibration. The different parts being thus formed, and smoothed and hardened by hammer-work, they are assembled together by means of ferrules and stays secured by soft or tin-solder, so that the stiffness obtained by the hammering shall not be nullified by the red heat which would be necessary if the final assembling of the parts were the result of brazing or the use of any solder requiring a red heat. The mouthpiece is always a separate part, and is usually made from a casting turned in the lathe to the exact form required. To guard against the possible risk of dirty brass coming into contact with a sore lip, the mouthpiece is generally silver-plated.

Thus far it has been possible to consider only the general lines of the actual development and construction of the trumpet. Its gradual acceptance as an orchestral instrument must be left for a future article.

(To be continued.)

WHEN HOMER NODS.

BY FREDERICK CORDER.

'Even Homer sometimes nods,' says the Greek proverb; but it is an admission that not everybody can be induced to make. The worthy souls—past and present—who write books on the Great Composers entertain the firm conviction that there are about a dozen musicians, all of a bygone age, entitled to that appellation. These are creatures of a different species altogether from the rest of mankind, and can do no possible wrong—their most blatant 'pot-boiler' is a masterpiece. *Per contra* the rest of the composing fraternity are hardly worth consideration, especially if they are alive: the length of time they have been dead is, indeed, the measure of their merit. Now, do I exaggerate? Is not this the current view put forth in histories of music and works of musical biography? I never could endure this attitude of blind worship of the few and gross neglect of the many, which is the habit of so many narrow and ignorant minds. It does not lower my opinion of Beethoven one iota that his 'Battle symphony' is quite unworthy of him, and my reverence for Wagner is not diminished when I declare that his 'Philadelphia Fest-Marsch' is an atrocious piece of work. We are all human beings, and when I try to write 'pot-boilers' they come out absolutely worthless: so did those of Mozart. But in