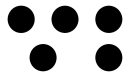
Tutti Reedi

A brief description of
different ways of sounding reeds

Jeremy Montagu



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THE REED ITSELF

For our purposes here there are two meanings to the word 'reed'. One is for a plant whose hollow stem can be used as a musical instrument, whether blown across the top as a flute or in any other way that the player chooses.

The other meaning is that of a small segment of that plant, along with artificial imitations of such segments, with which a player can blow and cause vibrations and thus generate sound within a tube of any natural or artificial material. It is this second meaning that we are dealing with here.

There are five types of reeds used for musical instruments:

1) The single reed, a single surface beating against a solid frame;

2) The double reed, two surfaces beating against each other;

3) The retreating or dilating reed, one or more slits in the side of a tube, opening and closing;

4) The free reed, a blade vibrating to and fro between the sides of a frame;

5) The ribbon reed, a strip of suitable material vibrating as air streams across it;

6) The human lips, which we will not discuss here because such instruments are normally called the Brass, i.e. Horns and Trumpets of all sorts;

X) Not a reed at all but a diaphragm substituting for a reed.

All of these function in response to a current of air, normally but by no means always, coming from a player's mouth. Some, especially the single and free reeds, are often blown mechanically, and single and double reeds are often blown by bellows or through an air-reservoir such as a bag.

Single reeds can either be a blade sliced from the side of a plant stem (I am trying to avoid using the word 'reed' in the first sense above, to avoid confusion), but still attached to the tube at one end, so that its edges and the free end beat against the edges of tube whence it was sliced. Because it is still part of the tube it is called idioglot (idio=same or self, and glot=tongue). Alternatively it can be a blade of suitable material tied against an aperture in a solid mouthpiece, such as that of a clarinet or saxophone. Because it is not integral with the mouthpiece but merely attached to it in some way, it is called heteroglot (hetero=other, and glot=tongue).

Double reeds can either be the end of a flattened tube, such as a plant stem, or they can be two blades of suitable material tied together, such as our oboe and bassoon reeds.

The retreating or dilating reeds are normally one or more slits cut vertically along a short length of a tube, usually that of a fresh plant stem. Henry Balfour in the Pitt Rivers Museum called them retreating reeds because, as they are blown, the sides of the slit seem to move away from each other when blown, but dilating seems a better and more understandable term because the slit dilates slightly when blown. Like the idioglot single reeds, the top

end of the tube must be closed so that the air is forced to pass (and thus vibrate) the reed as it goes into the tube. The only slight parallel of the dilating reed among our orchestral instruments is the human lips on a brass instrument. This is because the single- and double-reeds normally stand slightly open and are forced by the air stream to close and open rapidly, whereas the human lips and the dilating reeds normally stand closed when silent and are forced by the air stream to open and close rapidly.

The free reed was probably originally, and sometime still is, an idioglot blade cut in the side of a tube, distinct from the single reed in that the cut is vertically through the tube so that the reed can swing freely to and fro through the aperture, but today it is more commonly a metal blade, either cut idioglottally in a small sheet of metal, or in our instruments heteroglottally fixed to one end of a close-fitting frame. Examples are mouthorgans, and in our culture also reed organs, concertinas and accordions of all sorts. It is arguable that it has a larger analogue in the jews harp.

The ribbon reed is seldom, perhaps never, part of an instrument but is simply of itself, a strip of almost any material held in a frame so that air can be blown across its horizontal width, thus making it vibrate, its pitch varying with its tension and the air-speed. A blade of grass held between the sides of the thumbs is one example. In normal use it is either a simply a noise-maker or else an animal lure or imitator, rather than a musical instrument in the normal sense. Whether such things as pieces of bark or carp-scales, held in the mouth, which are musical instruments

proper, come under the same head is arguable, as is an analogue with the aeolian harp.

The diaphragm as a substitute for reeds is a very new development. It was first devised as a noise-maker for football matches and such occasions (a successor to the South African *vuvuzela*). It is a thin disc of plastic fixed to the top of a tube, that vibrates with its own pitch when air is directed against it though a nozzle. Subsequently, musicians have discovered that cutting finger-holes in the tube turned it into a musical instrument that could be played in the same way as a single- or double-reed instrument, whether mouthblown or blown through a bag – at least one imitation Northumbrian bagpipe has been seen and heard, and other instruments are developing rapidly, including those with a sliding trombone-like tube.

So much for the reeds, though we shall return to each of them in separate papers in this sequence. But what of the reed itself?

Most of the reeds, as the word suggests, are vegetable in origin, either grasses or cut in or from large grasses such as bamboos and canes. Those used in our orchestras with oboes, bassoons, clarinets, and saxophones, are made from the species *Arundo donax*, the best quality of which is grown in southern France. Others, especially the small idioglot double reeds used in the Near East and the Orient, may be made from short sections of a rhizome, a subterranean or subaqueous root.

An alternative today for many instruments is the use of plastics, partly as a cheap substitute for beginners, but also because

good quality and properly matured *Arundo donax* is becoming difficult to find. However, as yet, nobody has come up with a plastic as responsive as a good quality natural cane.

And what of the reed instruments themselves?

Most instruments with single reeds use the reed to generate vibrations in an air column within a tube with fingerholes. One such tube without fingerholes uses a slide instead, the slide saxophone. There is also a number of single-reed instruments which simply use the reed to make a sound. One obvious example is the old-fashioned bulb motor horn, modern versions of which are often fitted to bicycles. Many others are hooters of all sorts, often children's toys, and others are used in game lures by hunters. One major group is fitted into our church organs, such as trumpet stops and others such as the regal. While many of these organ stops have a pipe attached to them, looking like a post horn, it is said that these pipes are simply resonators to enhance the sound and the appearance; the pitch is controlled by the mass and length of the reed itself and the shape of the pipe controls the tone quality. Certainly this was true for the reeds of the late mediaeval and early renaissance regal, a very small organ. A large variety of resonator shapes for regals is shown in Praetorius's *De Organografia* of 1619, and in other books on the organ.

Double-reed instruments show rather less variety. Though again a few appear as game lures, the vast majority are used to transmit vibrations to an air column with fingerholes. This lack of other uses is probably explained by the relatively delicacy of

the reeds themselves. Whereas the single reed, whether idio- or heteroglot, has its quite solid mouthpiece against which to beat, the double reed is often made of two very delicate slips of cane with nothing to support them. Our oboists, for example, perpetually worry about making a good reed for their oboe, and then having made it, worry even more about how long it will last.

To digress here briefly, I have often wondered why our oboists and bassoonists very often make their own reeds, or have them made for them by a specialist to their specific requirements, whereas hardly any clarinetists make their own, but simply buy them from shops. Several professional clarinetists have told me that it is common to buy a box of reeds and toss half of them as inadequate, or pass the rather better ones on to pupils as sufficiently 'adequate' for their purposes. Why do they not take the same trouble as the oboists and bassoonists?

Dilating-reed instruments are almost invariably idioglot, simply the upper part of a tube with fingerholes, and their geographical distribution is very limited, as we shall see in due course.

Acousticians have told us that a free-reed can only produce a single pitch, but this is because they only deal with the instruments of our culture. In other areas, especially parts of South-East Asia, free-reeds can also generate vibrations in an air column with fingerholes. This is due, as Alan Thrasher has told me, to differences in the shape of the reed. They are also used for a single pitch, fitted into the side of a tube, and a set of these tubes is placed in an air-holder in oriental mouthorgans. These tubes

each have a single fingerhole, but this fingerhole does not affect the pitch; when it is closed it couples the vibration of the reed to an air column of fixed pitch, controlled by the acoustic length of the tube, and so produces a single note. Those used in our culture, in reed organs, squeeze boxes, and harmonicas, produce each the single pitch of the reed itself, usually without a tube or any other form of resonator.

The ribbon reed also produces a pitch of itself and is used mainly to produce a squawk, though with skill the pitch can be varied quite considerably to produce different pitches, again often as hunting lures. If one can consider the pieces of bark, etc, mentioned above as possibly coming under the same head, then a really skilled player can produce elaborate melodies.

What do we know of the early history of these instruments? Not in fact very much. We do know that reed pipes have been used from time immemorial as folk instruments over most of the known world, but we do not know how immemorial that time has been. This is simply because such instruments, made from lengths of cane or lighter reeds, such as the poet's 'oaten stop' simply do not survive in the earth for archaeologists to discover, though we do have examples from ancient Egypt, from ancient Rome and Greece as the tibia and aulos, and earliest of all the silver pipes from the royal tombs of Ur of the Chaldees in Mesopotamia, before the days of the biblical Abraham. The Chinese record that their mouthorgans go back to somewhere around 3,000 BC, but I do not know whether any have been found in sites

that can be dated so early. Equally early, it has been surmised that some of the Neolithic bone pipes found archaeologically may have been generated by such reeds. Most Neolithic pipes appear to have been flutes of various types, but some do look as though they might have had a reed in the end. If so, it is difficult to believe that such pipes did not exist earlier still in more ephemeral materials than bones, and so we might look even further back to the Mesolithic or even to the Upper Palaeolithic.

Keeping now to our initial order of the five varieties of reed (plus diaphragms), we shall take each in turn, in separate articles.

WHOLLY IDIOGLOT SINGLE REEDS

These differ from the Idioglot Single Reeds described in another paper in this sequence because while the reed is the same, it is cut into the top of the instrument so that all is one: the reed and the fingerholes are all on the same piece of tubing. These instruments are usually quite small, around 15 cm (6 inches) in length. Whether the instrument is wholly idioglot or whether the reed is cut in a separate mouthpiece, one thing is essential: the tube must be stopped at the upper end, usually by a natural node. This is because unless the air goes into the tube past the reed, the reed will not vibrate – if the upper end were open, the air would take the easy route and simply flow down the tube unimpeded by having to make the reed vibrate. The blade can either be up-cut, slicing the blade upwards towards the top, or down-cut, slicing the blade down towards the fingerholes. The former is the more common because, if the reed is often blown, the constant vibration may make the cut extend itself with use, and the natural node will add strength to the hinge, whereas if it is down-cut, it might extend the slicing and combine itself with the uppermost fingerhole or, if it were as a separate mouthpiece, simply fall off the end.

With the up-cut reed, the whole mouthpiece down to the end of the reed has to be inserted in the mouth, for if the lips touched the end of the reed, that would stop it from vibrating. With the down-cut reed, the lips can close on the blade toward the hinge

end, and bridle it, to control its vibrating length and thus its pitch, as we shall see with an organ reed below. There are other ways of controlling its pitch, and one that is often seen is a small blob of wax on the free end of the tongue, adding to its mass and thus its pitch; this also darkens the tone by reducing the higher frequencies.

The great advantage of the use of a separate mouthpiece is that if the reed ceases to work for any reason, one can simply make a new mouthpiece and stick it into the tube. If the reed of a wholly idioglot instrument stops working, then the only thing one can do is to throw away the instrument, wasting all the work that one has done in placing, cutting, and tuning the fingerholes.

As a result, the single-reed instruments with a separate mouthpiece are far the more commonly seen and heard around the world. Nevertheless, we do find wholly idioglot single-reeds. One example in my collection comes from Crete. The upcut reed is integral with the cane pipe, which is stopped by a node at the proximal end, so that it is truly idioglottal. The reed is on the flattened frontal surface, as are the five burned fingerholes. There is some blue and red decoration, although the red has now vanished due to exposure to light. It was said to have been a practice chanter for the local bagpipe. It came from Nicholas Shackleton in part-exchange, along with the information about its use.

Another such instrument came from Eivissa (Ibiza). It is somewhat more complex, with the reed truly idioglot but this time downcut. It has a high thumbhole (above the topmost fingerhole

on the other side), with six fingerholes burned in. The base of the reed is lashed with waxed thread as a bridle, which can be slid up along the reed for tuning, for its pitch is largely determined by its length, and this also inhibits the reed from splitting further down the tube. The lower end of the pipe has an attached bell made from the tip of a horn, perhaps that of a goat, into which the pipe is inserted diagonally. This addition does not seem to be traditional, for none of the examples in the Barcelona Museum had such a bell, though all those seen nowadays have a bell either of horn or of a whelk shell. I suspect that this is designed to make the instruments more attractive to tourists. It was bought from Ramon Pinto Comas's music shop, Casa Parramón in Barcelona.

To digress briefly, the use of a bridle for tuning a reed is also found with our organ reed-pipes, those with beating reeds such as the trumpet stops and so on, not the free reeds of the harmonium. In two examples that I have, which I think are fairly typical examples, the reed itself is a slip of thin, narrowly-tapering brass fixed into a slot of a metal body (called the shallot) above a cavity that leads to the base of the resonator pipe. A long, stiff metal iron wire, fixed fairly tightly through a hole in a projection, is bent sideways at the end to rest firmly on the reed itself. By moving this wire along the reed, to lengthen or shorten the vibrating length of the reed, the reed can be tuned. I found, by blowing it by mouth, that a very small movement of the bridle along the reed makes a very considerable difference to the pitch obtained. – it takes only a very slight movement to sharpen or flatten the

pitch. I've digressed from the idioglot reed here to discuss how the tuning bridle works, but while we're on organ pipes it is necessary to emphasise that with organ reedpipes, it is the length and the mass of the reed that determines the pitch; the pipe is a only coupled resonator whose shape etc determines the tone, and thus the name of the rank or stop to which it belongs – the resonator does not affect the pitch.

Also this description of the shallot, the slot, and the reed is also that of the idioglot instruments that we have here, even though here they are two separate pieces of brass. Because the idioglot reeds are sliced longitudinally, the separation leaves a shoulder of cane against which the reed can beat, just like the shoulder and distal end of the slot of the shallot.

A very different variety of wholly idioglot single-reed instruments is found in Nigeria, among the Hausa people. These are side-blown. Instead of putting the top of the instrument into the mouth, the player holds the side of the tube to his face and covers the reed area with his mouth. There at least three types of these: the *til'boro*, the *busan karo*, and the *damalgo*. The *til'boro* is the smallest of the three, but all are made from lengths of guinea corn stalk, a common term for sorghum. They are made only at harvest time, for this is when the corn is cut. The *til'boro* is made from a single internode, whereas the other two are usually made from two internodes, with the nodes burned through or poked more or less clear with a rod. This *til'boro*, and two of my *damalgos* are covered below the reed with a sheath of red leather resembling

morocco leather, which is stitched at the back of the instrument and is decorated with black ink. This shows that the instrument is made with some care and trouble, and suggests that the instrument is expected to endure for at least a little time. The other two *damalgos* and the *busan karos* are left uncovered, so this would seem to be a choice by the makers. They are made and played by young men for entertainment and to earn pocket money; presumably the better the instrument looks, the more likely it is that some money will be made.

The *til'boro* is open at each end, either of which may be stopped with a finger. There is one thumbhole, knife-cut through the leather cover, at the end furthest from the reed, about 20° off the line of the reed, towards the inside as the instrument is played. The long, very flexible, idioglot reed (*belu* or *beli*), is a strip of the cortex 50mm long and about 0.6mm thick, cut in the side of the tube near one end. It has a light cord bridle (*zare*) which is pulled by the player to control it. The pitches are produced by both blowing and sucking, and the pitch differs according to the direction of the airstream, in or out, and the flexibility of the reed gives it a tone quality very similar to that of a free reed..

David Ames described the instrument to me, on his return from Nigeria, and asked me whether I thought that this was a free reed instrument or not; it was impossible to be certain when listening to the sound on his tapes, nor from his description. He therefore asked the Gidan Madauchi Ibrahim Bagudu of Zaria to send me examples of each type. It is indeed a side-blown beat-

ing reed but with so long and so flexible a reed that the sound is extraordinarily close to that of a free reed such as a mouthorgan. Professor Ames's query was complicated by the fact that players use both inhalation and exhalation, something that occurs with no other single reed instrument known to me, but which is common on free reeds in Asia. I do not know of any side-blown single reeds other than the *til'boro* and its relatives, the *busan karo*, and the *damalgo*, nor have I heard of any indigenous African free reed instruments. Much of the detailed information here was either provided by David Ames in conversation or has been taken from his and Anthony King's book, A *Glossary of Hausa Instruments*.

This was my introduction to the Madauchi (an officer of the Emir's court analogous to that of a Vizier in the *Tales of the Arabian Nights*), from whom I have obtained a number of instruments of various types over the years.

The *damalgo* is similar to the *busan karo*, in that both are made of two internodes of guinea-corn, but the *damalgo* has a spherical gourd as a reed cap over the proximal end with the reed and also another gourd over the foot, whereas the *busan karo* does not have these gourds. Two of my *damalgos* are covered in red leather, similarly to the *til'boro*, from immediately below the reed to the foot, with the leather stitched at the back, with black ink decoration and with two prominent leather tassels. A fingerhole burned through the leather cover near the distal end is stopped with the left thumb. The lower gourd is fairly firmly fixed between the swelling of the lower node and the end of the leather sleeve.

The upper gourd covers the reed and has a hole in the side through which it is blown, while the lower gourd also has a round hole cut in it approximately 45° from the line of the bore so that it can be stopped by the palm of the hand when the thumb is over the fingerhole. The reed bridle is of hard string.

There are many other examples of wholly idioglot reed instruments around the world, but these should suffice as examples.

IDIOGLOT SINGLE REEDS

The reed itself in its simplest form is a piece of cane, closed at the top by a natural node of the cane, with a blade sliced in the side of the cane, still attached at the upper end, sometimes with the blade scraped down to make it more flexible and thus vibrate more easily. Such scraping is not always seen, though some scraping at the hinge end where the reed is attached to the body is also often seen. The only problem with this is that it weakens the reed precisely at the point where it is most likely to break. Also a slight bevel in the tube immediately below the free end of the reed is often helpful. The bottom end of the tube is chipped or scraped so that it can be inserted into the top of a tube with fingerholes. The simpler, wholly idioglot instruments, with the reed, mouthpiece, body with fingerholes, all in one are described in a separate paper in this series.

So these are the more common single-reed instruments that have a separate mouthpiece, still idioglottal, and inserted into the top of the body. Just a few examples will be discussed here, partly to show their similarities and their differences, and partly also to show their wide distribution around the world.

There are examples from various parts of Europe, the first made for the same purpose as the Cretan wholly idioglottal example in that paper, as a bagpipe practice chanter. It comes from Hungary where it was bought from a man at a folk fair, who was

making them while people watched. The pipe is made of elder and the mouthpiece has a downcut reed. There is a high thumbhole and six knife-cut fingerholes which are left very rough for the customer to even them out to tune them, but each fingerhole is at the base of a very neatly-cut cup so that the fingers make a good seal over the hole. The mouthpiece is lapped with thread to hold it in position.

I have examples also from Eivissa (Ibiza), all made from very light cane, not much thicker than a wheat or oat stalk.

Others, similarly light-weight, are used in Russia. They are called *Péschtschiki* or *Schaleika* and they are made of a light cane. They came from the Belgorod people of the Afanasieroka Village in the Alekscierd Region of South Russia, and they were given to me by Dr Vyacheslav Shourov during a seminar in Rotterdam in 1995. The first is made of a slightly thicker cane than the second, with five fingerholes which are rectangular but with slightly rounded ends, and it has a cow-horn bell. Its mouthpiece is wrapped with green plastic(?) tape to make it fit the body, and the distal end of the body is cut off obliquely so that the bore faces forward within the bell. The proximal end of the body is cut off in an upward-pointing V. The downcut reed looks as though it is bridled with black thread, for a tag of thread projects from underneath the tape. The bell has a triangular hole cut in its side, just at the end of the natural hollow of the horn, to accept the pipe; the end, which faces forward in use, is neatly cut in 30 points. The second is quite different: the four fingerholes are approxi-

mately round and look as though they were haggled with a rather blunt knife. The proximal end is cut off obliquely, longest at the front, and the reed is truly idioglot, and also downcut. This instrument therefore should be in the wholly idioglottal section, with the other truly idioglot reeds, but because both came together from the same source, it seems best to keep them together. The proximal ends of each mouthpiece are not plugged, and presumably the player had to plug the end with the tongue so as to force the air to vibrate the reed ratehr than passing freely down the tube.

I have, too, examples from India, but these I think are a child's toys, though that does not mean the serious ones do not also exists there – we shall see examples when we come to the geminate singe-reed pipes. It is axiomatic, too, that children's toys are often the detritus of adults' instruments from long-forgotten strata of folk music and instruments. I have examples from Turkey, with downcut reeds, the upper end of the mouthpiece stopped with wax (which might be missing from the Russian ones), some with a thumbhole and five fingerholes and another with the same number of fingerholes but no thumbhole, suggesting that they come from different parts of that country. Laurence Picken's book on the *Folk Musical Instruments of Turkey* gives so much detail on these instruments that there is no need to elaborate on them here.

Another more interesting example comes from the Berber people of Morocco. Berber is a somewhat pejorative term, though widely used, for it is cognate with Barbarian (hence the old term of Barbary Coast) or outsider even though the Berber were in

Morocco before the Arabs, and a preferred term by the people themselves is Imazighen or, in the plural Amazigh or Am'zighi. In that part of the world, from Morocco through to the Near East, the norm is for geminate pipes, whereas this is a single one. It has five burned, and also knife-cut, fingerholes and the reed on the mouthpiece is upcut; it has a spare reed held on to the body with twine, something that is customary also with the geminate pipes.

Instruments of this type also exist in Indonesia, where I have examples from both Sunda in western Java and from Padang in western Sumatra, where it is called *bansi*. The body is some sort of reed, lighter than a cane, with four fingerholes that were burned into the tube. The mouthpiece has a downcut reed and is of a cane tube, blocked by a pith plug at the upper end. The lower end of the mouthpiece is cut off obliquely at 90° to the reed and is inserted into the tube so that the oblique end fits beside the uppermost fingerhole. It was given to me by Vafa Taghasi, a child who had bought several out there.

And finally for this section, we turn to Britain, with a reconstruction of the ancient Welsh hornpipe, the *pibcorn*, made by Philip Bate. This is based on one of the few surviving examples, this one belonging to the Society of Antiquaries of London, of which Philip Bate was, like me, a Fellow, and which is now deposited on loan in the Museum of Welsh Life at St Fagan's. The pipe itself is of wood, probably originally of elder, with a high thumbhole and six fingerholes. There is a reed cap of cow-horn on the upper end and a horn bell. The reed cap has a plain end,

for the player has to put the lips against it, but the bell has the traditional jaw-shape cut-out and toothed decoration. The purpose of the reed cap is to keep the mouthpiece and reed out of the player's mouth and so prevent it from getting too wet, for it is a fragile piece of straw, stopped at the upper end with sealing wax, and a downcut reed similar to that of a Northumbrian bagpipe.

As for a number of other instruments, Henry Balfour, Curator of the Pitt Rivers Museum for more than forty-five years, wrote the basic article on the instrument in his "The Old British 'Pibcorn' or 'Hornpipe' and its Affinities" in the *Journal of the Anthropological Institute*, November 1890, pp. 142–54, but unfortunately he does not mention the material of the reed, though he does describe a number of other instruments from around the world of the same type. We shall see a number of them here, other instruments which have such reed-caps, which are also called stocks, as with the Scottish stock-and-horn, a similar instrument to the Welsh pibgorn (spellings vary between pibcorn and pibgorn, each being a combination of pipe and horn). The stocks also have another function, often that of being tied into the mouth of a bag, and we shall meet them again, both in the next section on the geminate pipes, and again when we arrive at the bagpipe section below. While the stock is also often made of wood, enough of them, like the pibgorn, have a stock of horn and a great many have horn for the bell, and so a common group name for them has often been the hornpipe – whether there is any connection with the dance of that name is unknown.

On the whole, these seem to be more common than the single instruments that we have been looking at in the other Idioglot papers in this sequence. One reason seems to be that when the two pipes are tied parallel together, so that one can finger across the pair of pipes, with each fingerhole producing the same nominal note, this generates a stronger sound than when blowing either pipe separately. This is because the two are normally very slightly out of tune with each other, just by a few vibrations per second (Hz). This sets up a vibrancy in the sound as the two pitches beat against each other by the number of Herz between them, and it enhances the loudness as well as making the sound more interesting to the ear.

One further point is that all the instruments we have met so far have been cylindrical in bore, and therefore they are lower in pitch than one might expect from their length, and also that their range was limited. Here we have to diverge briefly into acoustics.

With a reed-driven instrument with an expanding bore, like our seventeenth-century-onwards orchestral oboe for example, if one opens fingerholes in turn from the bottom, sounding from C up to B, then closes them all, squeezes the reed a little and blows harder, one can go on up the scale from that B into the next octave.

But, with a reed-driven instrument with a cylindrical bore, like our seventeenth-century and early eighteenth-century *chalumeau*,

this does not happen; going up the scale from the bottom and then closing all the holes again, squeezing the reed and blowing harder, would give you an upper G instead of the C, so there is a gap between the top open note and the upper note beyond it.

Now, this example is a bit simplified, and I used 'seventeenth-century' in order to avoid the keywork that was introduced in the eighteenth century that does allow you to fill that gap, but the instruments that we are talking about here did not have any keywork. As a result, they could only play in their basic, lower range, or, with an extended technique in the upper range, but not continuously from one range to the other. Most in fact stick to the lower range and in addition, a reed-driven instrument with cylindrical bore will always sound lower than one with expanding bore of the same length. This applies to our modern instruments, too: if you stand a clarinet and an oboe side by side, they are much the same length, but the lowest note of the clarinet is an E most of an octave below middle C, whereas the lowest note of the oboe is only a semitone below middle C. I am not going into the reasons for this here; they will be found in any book on musical acoustics. But the result is that all our instruments in this section sound rather lower in pitch than one might expect from just by looking at their length.

The simplest geminate pipes are those that have one melody pipe or chanter and one drone pipe, and are made from cane. They are often, as with my *arghūl* from Egypt, lashed together with tarred twine. The chanter, usually the right-hand pipe, nor-

mally has six fingerholes, though sometimes there may be fewer, and the holes are usually knife-cut, though sometimes they may be burnt with a hot iron. Often, as though the maker was uncertain whether he was making this type of instrument or one where each pipe has fingerholes, the drone-pipe has marks on it parallel with each hole of the chanter. There are usually extensions to the drone-pipe, some up to two or three feet long, so that different drone notes can be sounded. These extensions are attached to the ends of each drone section with the same tarred twine that joins the pipes together so that they do not get lost. I bought one of these, and the next instrument, in Egypt while I was stationed in the Canal Zone with the army in 1948, hearing Egyptian music on the loudspeakers in the streets of Port Said, and being introduced to Hans Hickmann, by the staff of the Institut Fouad Premier de Musique Arabe in Cairo, in search for further information – I can't remember whether I bought them in Cairo or in Port Said. These were the first exotic instruments I had ever heard and I was fascinated by their sound. However, what with post-army musical studies and a career as a professional musician, it was not until I spent a year as Curator of Musical Instruments at the Horniman Museum from 1960 to '61 that my interest in the instruments of the rest of the world was rekindled.

The more normal geminate pipe, such as my Egyptian *zummāra*, has two parallel chanters, two bamboo tubes held together with tarred twine, each with the same number of fingerholes. Such instruments are of quite high antiquity. Hickmann pub-

lished an example of New Kingdom period, with a wall-painting of a player of Old Kingdom date, c.2700 BCE. Each pipe on my example has six circular fingerholes, very neatly knife-cut (if they were burned, all traces of charring have been removed), and each the same diameter. The mouthpieces have upcut idioglot reeds and, as is quite common, there are two spare mouthpieces, attached with a long twine, as are the inserted mouthpieces. The construction is quite elaborate: each mouthpiece is inserted into a middle-piece, which in turn is inserted into the body with its fingerholes, forming a stepped expansion over the whole. As a result, it sounds in the octave that one would expect for its length. These two instruments must also be the first instruments in my collection. There is a two-millimetre difference in length for the bodies, which provides the normally expected vibration in the pitch of each note that is played.

One thinks of expanding-bore instruments as getting wider quite smoothly from the reed to the bell, but a series of steps, each cylindrical but a bit wider than the next, is surprisingly effective, not effective enough for our orchestral purposes but perfectly adequate for the simpler requirements of much traditional folk music. Expanding bores are often referred to as conical bores, but this is not correct terminology because they are not truly cones, so expanding bore is the preferred term.

A variant *zummāra* of mine was said to have come from Arabia, and I have seen others from other Arab countries. The two slightly expanding-bore body tubes are of bird-bone, held together

with soldered metal bands at the top and the bottom (the bands are non-responsive to a magnet, so perhaps they are of tinned brass). A strip of the same metal, lying between the bones, runs along the two tubes at the back, with a soldered-on metal ring below the top band to which the two very short cane middle pieces, held together with tarred twine, are tied. There are six drilled fingerholes in each tube. The mouthpieces have upcut idioglot reeds, and some hair remains under the left reed, a common device to make the reed more responsive by holding it very slightly open; a beard or moustache hair is usually better than one from the head because it is slightly thicker. The bones are incised with ring and dot black-filled decoration, with two parallel lines above and below each fingerhole, with four rings in two pairs between each (ie fingerhole, 2 lines, 4 rings, 2 lines, fingerhole), and eleven rings between the lowest fingerhole and the foot (5 pairs with a single central above). All is beautifully made and very light in weight.

Instruments like these are found all round the Mediterranean and beyond, in a variety of forms, many more or less identical with these. Others take the form of hornpipes, like the pibgorn we have already seen but geminate like those immediately above, and others as bagpipe chanters, with or without the bag. Others, from further afield, use a gourd as a chanter stock, and all these we shall meet here.

Starting on the west side of Europe, in the French part of Euskal Herria, the Basque area which crosses the border between France and Spain, during the International Folk Music Council

(now the International Conference for Traditional Music) meeting in Bayonne in 1973, I bought from a French-Basque nationalist an instrument that he told me was spiritually the most important of the Basque instruments, an *alboka*. Some years later, a better one was given to me by Sabin Bikandi Belandia, with an LP played by the maker, in exchange for some books. Dr. Bikandi, who lives in the Spanish part of the Basque area, played down the spiritual importance, but agreed that along with the pipe and tabor, this was an important instrument among the Basques. The *alboka* is a geminate horn pipe. The two pipes of cane are set into a half-moon shape wooden yoke, embedded in beeswax, like pipes laid in a trough. The neatly-made yoke has two heart-shaped cut-outs, with between them the initials LB, for the maker Leon Bilbao, along with scroll patterns burned into the wood. The horn bell with three holes on each side (small, larger, small), has very fine dentations cut on the edge. Both it and the mouth-horn are pinned to the yoke with two small nails on each side; the cane pipes are luted to each horn with beeswax. A horn octagonal ring is attached to the bell by a copper wire, and holds a chain which goes to the front cut-out. The two mouthpieces are embedded in wax, one in the top of each pipe, and they have idioglot down-cut reeds, which are bridled with white thread and are well and properly tuned to produce beating unisons. There are five burned fingerholes in the left-hand pipe and three in the right-hand pipe, parallel with the lowest three in the left.

A Tunisian example is more like the normal *zummāra*, save that it has a small horn bell on the end of each pipe – an identical instrument serves as the chanter of a bagpipe, and each is called a *zukra*.

Bagless bagpipes, as Anthony Baines called them, are endemic in what was Yugoslavia, and appear in various forms, all usually geminate. Some have two bores drilled parallel in the same piece of wood, others have two divergent tubes, and both use a wooden mouthcap in which the reeds are set into the tops of the pipes. The mouthcap has a groove round the top of the cap, which shows that once upon a time this cap was the stock of a bagpipe and that the use of the bag has now gone out of fashion. There is usually a different number of fingerholes in each pipe, often five and three, and the player may either finger across both pipes for the upper holes, using the lower hole or holes as a drone, or more usually have one hand on each pipe.

Instruments with a gourd body are used all over the Indian sub-continent; one well-known use is as the snake-charmer's pipe, though the *punghī* is also used as a musical instrument without a snake. Usually there are two pipes, one with fingerholes and the other without, but I have one triple example with a second drone pipe.

It is clear that this use of geminate pipes is common over a wide area of the globe, and it is not restricted to reed instruments, for double or even triple flutes, similarly arranged, are even more widely distributed.

When did someone attach a slip of cane to the top of a tube, instead of an idioglot mouthpiece? We have no idea. There does not seem to be any evidence for such an arrangement until Denner 'improved the *chalumeau*'. Indeed we have little evidence for *chalumaux*, other than written music for them.

There is a number of European folk instruments today, some of which have been mentioned in the relevant article in this series, and these presumably go back to earlier times; all are idioglot. There was one instrument from the Snoeck Collection, now lost to us, in the Royal Military Exhibition in London. C R Day described it as truly idioglot, dating it to the '16th or 17th century', and stating that it was made of cane and was covered with red leather. Snoeck's own catalogue has even less information about it. Mersenne describes, but does not illustrate, an instrument that he calls *Chalumeau*, and leaves us little the wiser. There is no evidence at all that I have ever found for a folk instrument with a heteroglot reed other than those that are known to have been back-formations from the clarinet, such as the Swedish Meråker clarinet.

So it does look as though this, the use of a heteroglot single reed, may have been one of the aspects of Denner's improvement of the chalumeau. Thereafter the chalumeau appears in a number of early eighteenth-century scores by people like Vivaldi, Graup-

ner, Telemann, and contemporaries, and then vanishes again because later, in the same first decade of the eighteenth century, Denner invented the clarinet, on which there is sufficient literature to require no more here.

DOUBLE REEDS

There seems little point in separating idio- from heteroglot double reeds, as we have with the single reeds, because the idioglot double reeds are essentially ephemeral and therefore we have no examples from any earlier times. They consist of straw and similar fresh materials which can have the upper end flattened to form the reed while they are green and still soft. There is much poetic literature referring to such instruments, 'oaten reed and pastoral stop', and so on. I have frequently used a paper straw, cut to a point, to demonstrate such instruments at lectures – plastic straws also work, but they need longer points to let them blow easily.

The heteroglot double reed is either a flattened plant stem or, for our oboes and bassoons, a slip of cane, gouged and scraped, folded over, separated at the thinnest point, and then joined together again at the thicker ends to fit over a metal staple.

The staple is necessary for all the expanding-bore double-reed instruments because the narrow end is so small in diameter that one could not squeeze a reed directly into the top, whereas a reed can be set on to the end of a narrow tube which can then fit into the top of the instrument. This is in contrast with the cylindrical-bore double reeds because with these the top of the tube is wide enough for a plant stem to fit into it.

These cylindrical-bore double reeds are comparatively few. They begin in time with the ancient Greek *aulos* which, as de-

scribed in another paper in this sequence (Divergent Geminate and Multiple Reed Pipes) used either double or single reeds. There is a widespread range of instruments that either derived from the *aulos* or may perhaps have been its surviving ancestor. These are all single pipes, thus relating to the *monaulos*, the single-pipe *aulos* rather than the double one more often used by the Greeks, and they are found from Turkey through Armenia and Central Asia right through to China, Korea, and Japan. Whether they spread over this wide area from Greece or whether the origin was Central Asian, and they then spread both east and west, we simply do not know. This has been a trade route since ancient times, known as the Silk Route, and in the nature of trade and traders, objects can go back and forth in any direction, for traders will always follow the trade.

Two characteristics of all of them, from the Turkish *mey*, through the Armenian *balaban*, the Chinese *guan* and the Japanese *hichiriki*, are the very large double reed and the low tessitura of the playing range. The diameter of the reed at its cylindrical end is half an inch or more and its length varies from just over an inch to two or three inches. It often has a bridle over the flattened end to help keep it flat. The materials used vary from the bamboo of the Orient to the softer plants used at the western end of the axis.

The low tessitura is caused by the cylindricity of the bore, for a reed-driven cylindrical bore sounds around an octave lower than one of expanding bore of the same length, an inescapable natural law of acoustics. I said 'around' because those of expanding

bore, often referred to as conical, are not true cones – the cone is truncated by the narrow end, but when they are blown the cone seems to complete itself part way down the player's gullet, thus extending the length of the air column.

The expanding-bore double reeds are often called shawms. They are widespread around the world, and it is arguable that this is due to the spread of Islam, often confirmed by etymology. The Moroccan name *ghaita* came into English as the wait pipe – the waits were principally shawm players; *alghaita* is the name of the Nigerian Hausa version of the shawm, and *ghaita gallega* is still the Spanish term for a bagpipe, the subject of another entry in this sequence. The Turkish name is *zurna*, the Macedonian *surna*, Indian *shahnai*, and the Chinese *sona*, and so on. The English term shawm is more likely to be a corruption of *chalumau* from Latin *calamus*.

The reeds on some are very small, not much over quarter of an inch long, some of them made from underwater rhyzomes, whereas others are larger and made from grasses of various species. Some areas prefer a soft material that can be squeezed to shape, and others prefer harder ones that can be scraped from canes. All the reeds are held wholly within the mouth rather than being gripped between the lips, which leads to the loud sound that rings in the ears, ideal for an outdoor instrument such as the wait-pipes. And almost all are blown with circular breathing – the longest I have heard was about twenty minutes non-stop from a Burmese

player of the *hne*, and that was an incomplete recording, so it may originally have gone for longer.

It was in our culture that the shawm needed to come indoors at the court of Louis XIV, and that led to an instrument with a narrower bore profile and a narrower and longer reed that was gripped between the lips, thus eliminating the higher partials of the shawm sound, our oboes and bassoons. There are suggestions, e.g. in Mersenne, that the bassoon may have been the leader, and certainly its predecessor, the curtal or dulcian, was more portable than the great bass shawm. At what stage in this process players were gripping the reed is unclear – it is possible that this only began with our early-music shawm players to avoid blasting the microphone out of the studio. We do know also that Indian *shahnai* players of classical and Bollywood music have fairly recently taken to lipping the reeds, again probably to benefit the microphones.

The use of a pirouette, a lip-plate or wooden block on the staple, varies from one culture to another. A Turkish player told me that it was only necessary for those with false teeth, and another said that it was to protect him while playing and dancing, in case he bumped into another dancer, so that the shawm would not be rammed down his throat. In Indonesia we see larger pirouettes, so wide that they support the cheeks, like the *phorbeia*, the cheek-strap used by the Greeks with the *aulos*.

One final point is that while the cylindrical-bore shawms can be made from plants that have a natural hollow stem, including

woods with a removable pith such as elder, the expanding-bore shawms need a lathe-turned body – we see that first in antiquity with the Faliscans, a sub-tribe of the Etruscans around 400 BCE, and then with the Romans. There is one exception to this, the Forked Shawm, the subject of another, though older paper, in this sequence.

DIVERGENT GEMINATE AND MULTIPLE REED PIPES

Here we can go back into Antiquity and to archaeological finds such as the silver pipes of Ur of the Chaldees, and to the *aulos* of the ancient Greeks, and with these divergent pipes, one can play in two parts, or play a melody on one pipe against a drone on the other. Divergent because the pipes are separate and are held, one in each hand like a large <. All these divergent reed pipes are of cylindrical bore and therefore with a lower pitch than one might expect from their length and of limited range. This is a fundamental matter of musical acoustics: cylindrical pipes played with a reed sound around an octave lower than a flute of the same length and instead of overblowing an octave (like a flute or an expanding-bore reed instrument) they overblow a twelfth (an octave plus a fifth, eg C to g), which means that unless the player has an unnatural number of fingers, or the instrument has the keywork of a clarinet, there is a gap in the compass between the top note of the fundamental range and the lowest note of the overblown range.

The silver pipes from Ur, excavated by Leonard Woolley from a 'private tomb' in the Royal Cemetery of Ur in the 1920s, are the oldest example that we have of divergent geminate reed pipes, dating from around 2450 BCE. They have clearly been deliberately broken, 'killed' in ritual terms (a not uncommon practice with tomb finds), and each pipe was both bent and broken into

short sections so that their reconstruction into playable tubes is controversial, especially as it seems probable than some sections may be missing. Dimensions vary in the literature, even the bore diameter has been variously stated to be 3mm and also 6mm, and the number of fingerholes in each 'reconstructed' pipe has varied from three to five; there does at least seem to be a general consensus that there were two pipes. We cannot know what reed types were used to sound them, whether they were played with single reeds or with double reeds, nor whether they would have been held divergently, one in each hand, or tied together as parallel pipes to be fingered across the pair, though divergent seems to have been the more probable from the probable positions and numbers of the fingerholes. The reeds are more likely to have been single reeds like those we have already met, perhaps of straw if the narrower bore diameter is correct, or cane if the wider, but we cannot eliminate the possibility of a flattened stem to make a double reed. At least we can be certain that they were musical instruments, for it is difficult to think of any other use for narrow tubes with holes along their length.

We have so few surviving *auloi*, nor that many Roman *tibiae*, and nor that many clear illustrations of either, that we cannot be certain whether always, or sometimes, each pipe had the same number of fingerholes as the other. Such few examples as survive sometimes have the same number and spacing of fingerholes, but the majority do seem to differ both between each of a pair and between different pairs. A number of illustrations on Greek pots

and in carvings etc do mostly look as though the player is fingering differently on each pipe, whereas some others do look as though the fingers on each hand are at the same level on each pipe. However, since such pot paintings and carvings are not photographs we are left with the eternal problem of iconography: did the painter or sculptor actually know how the pipes were played? And did he or she really know what they looked like? After all, one could not make a working guitar by copying a Picasso painting! Nor do we know for certain whether they used an idioglot single reed, or a double reed. Again we are dependent on the iconography, and this does seem to show quite clearly both types of reed, so it may well have been a matter of personal choice by the player, some preferring a single reed and some a double. While there are literary accounts of the *aulos* being used with the military, the overwhelming evidence of the iconography is that they were played by women, often for parties and after-dinner entertainment, and that the women may well have performed other functions later in the evening. What we can say with certainty is that the *auloi* were always held divergently, with one hand on each pipe, and that the majority of players used a *phorbeia*, a strip, probably of cloth, laced tightly across the cheeks to prevent them being too greatly distended while the player blew.

We can assume from this that the players used circular breathing, using the cheeks as an air reservoir while breathing in through the nose. We know, from watching Nigerian shawm players, that they do distend their cheeks while doing this, almost like balloons,

and we have seen that sometimes when they stop playing their cheeks fall like dewlaps, rather as one sees with a bloodhound's cheeks. This is because, with much use, the skin gradually loses its elasticity and so can fail to go back to shape. This was something that the Greeks clearly wanted to avoid, and therefore they used these support straps. Other peoples have had a similar idea, and in Java the shawm *tarompet* sometimes has great wings of coconut shell. or metal. to go across the cheeks and support them in the same way as the *phorbeia* – we shall meet an example in another paper on Double Reeds. We shall also find that this may have been the reason for the invention of the bagpipe.

The *tibia* was the Roman derivative of the *aulos*, coming perhaps through the Etruscans. Like the *aulos*, it could either be a single instrument, *monaulos*, or more often a pair, also held divergently. Some that have been found had a mechanism to change pitch so as to use a different scale or mode. Not with keywork like our orchestral instruments, but with rings that would close off one hole and open another. In this way, different modes could be played, for one must remember always that with divergently held instruments, the player had only one hand on each. Thus, with only four or five notes available, it could indeed be useful, for example, to close an E and open a D or an F instead, or to flatten or sharpen a note.

One of the things that we do not know about the *aulos* is where it originated. We have no evidence for the instrument from the Bronze-Age Myceneans; all seems to have come from the

later classical period, but whether the *aulos* was an indigenous invention, whether it was adopted from somewhere further east, or whether it travelled eastwards from Greece, we simply do not know. What we do know is that it travelled in one direction or the other, for we do see its derivatives all over Central Asia. All of these are a *monaulos*, that is to say a single pipe played with both hands, and all the examples that I know of today have a large double reed, so we shall not meet them until we reach that paper in this sequence on the Double Reeds, but there is one European divergent reed pipe that is clearly an *aulos* descendant, and it is both divergent and multiple, not just a double but a triple pipe.

This is the *launeddas* of Sardinia. There are two chanters (melody pipes) held divergently, one smaller than the other, played one with each hand, the smaller usually with the right hand, and a third drone pipe, ie without fingerholes, lashed to the larger pipe. All three pipes have each an upcut idioglot single reed. The *launeddas* appears to be a conflation of the *aulos* and the typical North African geminate single reed pipes that we meet in a separate article in this sequence.

Further European *aulos* derivatives are different. Some are bagpipes such as the Italian *zampogna*, to which we shall return in the Bagpipe article here, and others, in Sicily for example, are duct flutes and thus beyond our subject here.

THE FORKED SHAWM – AN INGENIOUS INVENTION

This was originally a paper, given at a conference on Near-Eastern music at the Maison Français in Oxford in 1996 and subsequently published in the Journal of the International Council for Traditional Music the following year.

The forked shawm is a type of instrument which is in common use around the southern and eastern shores of the Mediterranean, from Morocco (Cherki 1981:38),[1] across to Egypt (Collaer & Elsner 1983:48), in Turkey (Picken 1975:485ff), in parts of the Balkans, and certainly as far east as Azerbaijan (Vertkov *et al*. 1975:fig.415), probably Georgia (*ibid.*: fig.456), and perhaps Uzbekistan (*ibid.*:fig.582), What is important is that this particular variety of shawm, with the simple and ingenious device of the fork, is the most important development in the history of the shawm in two and half thousand years.

It is necessary, to begin with, to define some terms and to explain some characteristics of the shawm and other reed instruments. A shawm is normally understood to be an instrument of fairly wide conical bore. Its internal profile expands fairly rapidly from the player's end, the proximal end, where it is narrow, to an open bell at the distal end. It is played with a double reed, made

[1] In addition to the sources cited here and elsewhere, most of the instruments mentioned are described, and some are illustrated, in Sadie 1984 and Baines 1992. Most are represented in my own collection.

either of two pieces of cane or from a flattened plant stem. The difference seems to be a matter of cultural preference, rather than depending upon botanical distribution. North of the Mediterranean, from the Atlantic to the Adriatic, shawm reeds are made from two blades of a cane-like reed, most commonly *Arundo donax*. South and east of the Mediterranean and the Adriatic, the reed is normally a flattened plant stem. Picken (1975:358) gives full details of the Turkish variety; other varieties, from Morocco to China, have not, so far as I know, received the same scientific attention. Irrespective of its material, the reed, instead of being gripped between the lips, is normally held within the mouth cavity, where it can vibrate very freely, which gives rise to the very loud sound immediately recognisable as characteristic of the shawm. Thus the shawm is quite unlike our orchestral oboe both in bore and in playing technique, for the oboe's bore is fairly narrow, and its double reed, again of two blades of *Arundo donax*, is longer and narrower than that of the shawm, and is gripped firmly by the player's lips. Examples of the shawm on the northern shores of the Mediterranean are the Basque and Navarrese *gaita*, the Valencia *dulzaina*, the Catalan *tiple* and *tenora* and the *gralla*, the Italian *ciaremella*, and. further north, the Breton *bombarde* and the chanters of many bagpipes, from the Spanish *gaita gallega* to the Scots *piob mhór*.

We also speak of the cylindrical-bore shawm, an instrument whose bore does not expand and which is also played with a double reed. Some examples are the Japanese *hichiriki*, the Chinese

guan, the Persian *balaban*, and the Turkish *mey*. All of these, and their cognates in other countries, can be shown to be connected with the ancient Greek *aulos*, and to be a type of instrument which travelled down the Silk Route between Europe and China. In which direction they did so, and which are ancestral to others, and indeed the connexions themselves, are not our concern at this moment and in this context. Unlike the type of shawm we have already described, their bore is a straight cylinder rather than a cone, but like the reeds of the conical shawms also east of the Mediterranean, the reed is again a double reed, again of a flattened plant stem, but one very much larger and very much wider in diameter.[2]

The shape of the instrument's bore, whether it be a cylinder or a cone, is important and controls the acoustical behaviour of the instrument. A reed-driven conical bore, an instrument which is played with a reed and which has an expanding bore, such as our oboe and our saxophone, as well as the conical shawm, overblows octaves. A reed-driven cylindrical bore, on the other hand, an instrument played with a reed and whose bore does *not* expand, such as our orchestral clarinet, and the cylindrical shawms, not only overblows twelfths instead of octaves, but produces a lowest note which is considerably lower in pitch than that of a conical instrument of the same length. This is why, of the soprano saxo-

[2] Picken (1975:476) suggests from the same plant, despite the size difference, as the very much smaller reed for the *zurna*.

phone and the clarinet, both of which are built in the key of B flat, and both of which are much the same length, the conical soprano saxophone only goes down to the A below middle C as its lowest note (its sounding pitch, not its written pitch), whereas the cylindrical clarinet goes down to the D a fifth lower (again its sounding pitch), even though both are about the same length. Because the bore of the saxophone is conical, it therefore overblows to the upper octave; because the bore of the clarinet is cylindrical, it therefore overblows to a twelfth. By 'overblows' one means opening a vent, usually a thumb-covered hole, in the upper, more proximal part of the bore, covering all other fingerholes, and blowing rather harder so that the air column jumps to a higher mode of vibration.[3]

The same applies to shawms, so that those of conical bore such as the *gaita* and *dulzaina* (to cite only two examples) overblow to the octave, whereas those of cylindrical bore, such as the *hichiriki*, *mey*, and so on, overblow to the twelfth, if at all.[4]

It is easy to make a cylindrical bore, whereas it is difficult to make a conical one. For a cylindrical bore, one can use a length of bamboo, which has a natural cylindrical bore, as with the *hichiriki*, or one can simply burn a hole with a hot iron in a piece of wood, or use a drill to make the hole. To make a conical bore,

[3] Somewhat a simplification, but probably sufficient in this connexion; it can also help to jog the end of the reed with the tongue.

[4] It is often much more difficult to persuade cylindrical-bore reed instruments to overblow than those of conical bore.

one needs a tool called a reamer. This is a sharp-edged, conical, metal tool which is shaped, with files, by forging, or more easily on a metal-working lathe, to the precise profile that it is intended to produce inside the instrument. To use it, one must first drill a cylindrical pilot bore through the piece of wood, and then, with this tool, ream that out to a cone. If one has a reamer, this is fairly easily done on a lathe, though it takes time and considerable care. Without a lathe the task is considerably more difficult because of the problems of keeping everything straight and properly aligned. Without a reamer, or without the skill to make one, then one must use a tool with a straight, non-tapering blade. This must be held against the side of the bore, gradually pushing it further and further in, gently enough that the wood will not be cracked but firmly enough that the blade does not chatter in the bore, keeping the angle correct all the way, in order to turn a cylinder into a cone. The whole process is difficult, especially if one wants a fairly wide cone, and really is only easily done in shaping the flare of the bell. We can see widely flared bells on some early Turkish instruments such as those portrayed by Carpaccio in Venice around 1500,[5] and also on one from Turkey in the Laurence Picken Collection which is now in the Museum of Archaeology and Ethnography at Cambridge University.[6] The operation is particularly tricky in its final stages when one has to reach right in to the top of the tube

[5] E.g. *The Turkish Ambassadors in Venice*.

[6] CUMAE 77/55. Illustrated in Picken 1975:plate 41n.

with the blade, for it is very easy to distort the lower part of the bore as one does so. Some conical shawms, including that just referred to in the Picken Collection, and several Nigerian and Mexican shawms in my own collection, appear to have been carved by hand, rather than on a lathe, which is even more difficult to do. However, once all this trouble has been taken, and all this work has been done, one has an instrument which is far more efficient than one of cylindrical bore. With the conical bore overblowing an octave, we have an instrument which can, with only six fingerholes, cover a full range. Say, for simplicity, that we are starting on C, with all the fingerholes covered. If, for simplicity of explanation again, we take the instrument to be tuned to our diatonic scale, opening six holes in sequence would take us up D, E, F, G, A, to B; opening the thumbhole and covering all the other holes again and overblowing would produce the upper C, and then one can go on up, through the next octave. With a cylindrical bore, the six holes would take us to B again (if we started on C), but covering them all and overblowing would produce the high G a twelfth above the C, not the C an octave above. Thus there would be a gap in the compass, between the B and the high G, which could only be filled by adding more fingerholes. Another four fingerholes would be needed, for the upper C, D, E, and F. Using ten fingerholes is difficult when we only have ten fingers and thumbs to do it with and we have to hold the instrument up at the same time!

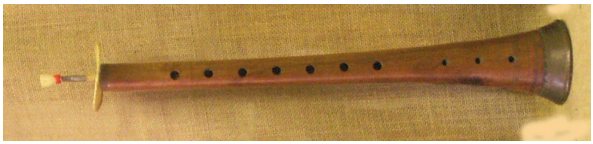

Figure 1

This is why, in antiquity, the development of the conical-bore shawm, which seems to have happened among the Faliscans,[7] somewhere around 500 BC (Becker 1966:Abb.3), was such an advance. This, too, is why we find the conical-bore shawm over so wide a geographical area today. As we have already suggested, it is used from Northern Europe, where it is often blown through a bag as the chanter of a bagpipe, through all of southern Europe, into north and west Africa, across the Middle and Near East, through India, Pakistan, and Tibet, and much of the southern parts of what was the USSR, to China, Korea, and Indonesia, and, presumably as an ex-colonial import from Spain, into Central America.

Now let us turn to the subject of this article, the forked shawm (fig. 1). This instrument appears to have a cylindrical bore, if one discounts the terminal flare of the bell (the clarinet has this flared bell, as well, without affecting its cylindricity) and thus it seems to be more primitive than the conical shawms. And yet what histor-

[7] The Faliscans were a sub-tribe of the Etruscans.

Figure 2

ical evidence we have strongly suggests that it is a fairly recent development. Laurence Picken's evidence (1975:499) is quite clear: that the forked shawm must be later in use in Turkey than the widely-flared, conical-bore, hand-carved instrument already mentioned, and which must originally date to 1800 or so, perhaps as early as 1700. Any of us who have heard shawms played from Morocco to Turkey and into the Balkans, know that it overblows octaves, not twelfths. Thus we know that it works as though its bore were conical, despite its cylindrical appearance.

How is this achieved? The answer is the fork in the head. This is a delightfully simple and yet a highly ingenious way of converting an easily made cylinder into a cone. For a cone to be effectively conical, to be acoustically conical, it does not need to be what a geometrician would call a cone. A simple stepped cone made by putting three bits of different diameter bamboo together, stepping one into the next, works perfectly well, as Nazir Jairazbhoy's recordings and report from the Dumbu or Paidi have shown us (Jairazbhoy 1988:32). Experiment with sections of aluminium

tubing of different bore diameters will confirm it and will, perhaps, demonstrate the acoustical principle more securely in that being factory made, they are quite certainly cylindrical. And this what we have with the fork. The reed goes on to a metal staple, a short tube which itself is usually, but not always a short cone; it is cylindrical in some examples. That staple is fixed into the top of the wooden fork (fig. 2) which forms the cap of the instrument and which has a short cylindrical bore drilled through it, slightly wider in bore than the staple. At the bottom of this bore through the cap, the wood is carved into a fork. The gap between the tines of the fork is slightly wider than the width of the previous bore, but the effective bore is wider still because the sides of the fork, at 90° to the tines, are open to the full bore of the instrument into which the fork is inserted, so the bore is both wider and in shape something like an oblong with rounded ends. If, when looking down the bore, one were to take the fingerholes as the north side and the thumbhole as the south, the east and west sides would be formed by the two tines of the fork. The north side opens to the full width of the bore first, to allow access to the uppermost fingerhole, thus forming the third step (staple, bore through the head, access to the north side of the bore). The fourth step is to the south side of the bore, at the thumbhole. Thereafter patterns differ: some forks have tapering tines on the east and west, leading fairly smoothly into the bore, as in fig. 2. Others remain the same thickness all the way, and step only to the full width of the bore at the end of the tines, this forming the fifth and last step,

where the bore becomes circular again. Even this can be complex in geometry because the distal ends of the tines are usually cut to a point on their north and south sides. Thus a mathematical program for this device would be of very high complexity but the practical result is that we have a short, stepped cone set into the top of our cylindrical tube.

Now where did this simple but ingenious device originate? We do not know. There is, as yet, very little work done in historical ethno-organology. All that we do know is that the instrument is used from Turkey northwards into Macedonia, but not much further, south and west from Egypt throughout North Africa to Morocco, and east into Central Asia at least as far as the Caucasus.[8] The easy assumption is that it was a Turkish invention which spread throughout the Ottoman Empire, but it could just as easily have been a Moroccan invention which trickled along the southern littoral of the Mediterranean until it met the Ottomans in Egypt, whence it travelled to Turkey and so into what used to be Yugoslavia. Or devised in Central Asia, where so many of our instruments seem to have begun, the lute, the gong, the long trumpet, the fiddle bow, and thence travelled again to the centre of the Ottoman Empire. Or, of course, anywhere in between. It has been suggested[9] that Turkey, as the heart of the Empire, was the technological centre and thus the obvious point of origin. But

[8] See note 1 and the references in the earlier part of this article.

[9] By Dr Eckhard Neubauer when a shorter version of this article was presented as a paper at the ICTM Conference on Arabic and Beduin Music at the

this is not necessarily so; the best swords, for example, were made in Syria, and other areas also had their specialities. It is, besides, an invention, and the spark of invention can strike anywhere.

As for when it was invented, all that we can say is that it must surely be later than Carpaccio's time (the early sixteenth century) and equally it must be earlier than a hundred years ago. My own guess would be fairly early in the nineteenth century, but it is only a guess.

So here we have an ingenious device which was quite easy to make. In England gypsies used to make clothes pegs in large numbers with a bodger's lathe, almost exactly like these forks, which they sold from door to door to housewives to hang up their washing. Thus it is clear that anybody with quite simple tools could make such a device. Once this device was created, it became far easier to make the body of the shawm, especially to drill its bore, for this could now be a straight cylinder with a conical bell. The bell is easily turned just with a knife, for it is easy to reach. So there is no doubt at all that the forked shawm was a progression and not a retrogression, far easier to make and equally efficient.

It is not usual, in ethnomusicology, to discuss technological developments in the ways in which we do in European[10] system-

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Maison Française in Oxford in 1996. I would here express my thanks to Professor Dieter Christensen for his encouragement to convert that paper into this article.

[10] By which I mean the pop- or symphony-orchestral-music culture in which we, in Europe, America, Japan, and much of the world, also live.

atic organology, but the development of the fork was a progression which, in its way and within its culture, was just as important to the history of instruments, and to musical life and use, as such developments within our pop and orchestral culture as the electric guitar, the Boehm system flute or the invention of the valve for brass instruments.

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BAGPIPES

Bagpipes are both a face-saving and a labour-saving device. Face-saving because the Roman Emperor Nero is said to have 'played the *aulos* with his arm'. Assuming that this meant that he was squeezing a bag under his arm with the *aulos* fixed into the bag, it would mean that he could avoid any risk of distending his cheeks too far while he was using continuous breathing, so preserving his facial vanity. And labour-saving because using a flexible bag as an air reservoir avoids the need for continuous breathing.

The *aulos* in a bag is still an *aulos*; the shawm in a bag is still a shawm; the single-reed pipe in a bag is still a single-reed pipe. It is these that have been, and still are, the basic bagpipes around the world.

An additional advantage of the bag is that extra pipes can be added to it. These are most commonly a drone pipe, or even two or three drones as with the Highland Great Pipe, or the court musette, or the Northumbrian, or the Irish uillean pipes. An extra chanter, the melody pipe, is unusual because one only has one pair of hands with which to cover the fingerholes, but double chanters, with the pipes parallel and fingered across both pipes, as with a number of geminate single-reed pipes described elsewhere in this series, are very common, especially around the Mediterranean.

The reed usually stays with the instrument, a double reed with the expanding-bore instruments and a single reed with the cylin-

drical ones. Drones are usually cylindrical, so as to get a pitch below that of the chanter, and so usually have a single reed, though the Italian *zampogna* has expanding bore drones and therefore double reeds. The French court *musette* was unusual in this respect, having cylindrical pipes and double reeds.

Most bagpipes are mouth-blown, and the more advanced ones have a non-return valve in the mouthpipe so that one can take one's mouth away, either just to breath or to sing while playing; for how long one can sing before refreshing the bag, depends on the size of the bag. Where there is no non-return valve, as on my Tunisian example, the player has to put the tongue over the end of the mouthpipe to stop the air from escaping (it tastes revolting!).

Today the Highland Great Pipe has usurped the territory of many other bagpipes, but there were and still are many indigenous pipes. We have many church carvings and other evidence that there was a considerable variety of bagpipes in other parts of Britain in mediaeval times, and some of these are being revived today; there is still a number of regional bagpipes in France, though the Breton *biniou* has mostly succumbed to the Highland, and the Spanish *gaita gallega* still thrives, though the Maltese *zaq* has become rare. Many eastern European bagpipes such as the Polish *bock*, are still going strong, as are the southern European geminate bagpipes. Even in countries where the military bands use the Highland pipes for greater swagger and show, the local folk musicians may retain their own pipes. The *biniou* and the

Italian *zampogna* retain the practice of having a shawm playing with bagpipe.

We also have still a wide variety of parlour pipes, which are quieter instruments with cylindrical bores. Outstanding among these are the Northumbrian small pipes and the Irish *uillean* pipes. These Irish pipes are unique in having extra drones called regulators, with a series of keys along them which, when opened with the arm, can provide a full harmonic accompaniment to the melody of the chanter. This is a highly skilled process and by no means all players that I have heard seem to have mastered the technique, for one sees players with pipes that have the registers but who seldom use them.

DILATING REEDS

These are almost exclusively South-East Asian instruments – 'almost' because we have one example from Lapland. They may well exist or have existed also in other places, but so far we have no evidence for them.

The reed consists of one or more short vertical (ie parallel with the length of the stalk) slits in the upper end of a stalk of a fairly soft material such as a rice stalk that is closed at the top by a node. They seem always to be wholly idioglot. Cutting fingerholes in such material is not easy but it can done with a very sharp narrow blade; an easier method is with the burning end of a cigarette or a hot iron. They are ephemeral, lasting only a short time. The only examples that I have seen in museums have been preserved in tubes full of alcohol or other preservative liquids, since otherwise they would simply dry up and disintegrate.

They are called dilating reeds, or retreating reeds, because when the slit end is held in the mouth and blown, the slit rapidly opens and closes, the sides of the slit moving away from each other and hence retreating, and the top of the instrument dilating slightly to allow the slit to open. Thus their behaviour is analogous with that of the human lips when blowing a horn or a trumpet.

The Lapp instrument, called *fadno*, was reported by Ernst Emsheimer, and was a stalk of angelica (a plant familiar to us as a green strip used on cakes) with around four fingerholes and a

dilating reed. It seems to be unique to the Sami people living in that area with no parallel known elsewhere.

FREE REEDS

The free reed is called free, because unlike the single reed which beats against the rest of its mouthpiece, or the double reed which beats against its twin, the reed is a blade of bamboo or bronze that swings freely to and fro in a closing-fitting frame without beating against anything.

It seems to have been initially an Oriental device, and one question is the possibility of its links with a larger instrument, the trump or jews harp. With both instruments there is a tongue in a close-fitting frame, and today, again in the Orient, both have the tongue cut from a thin sheet of bronze, or slip of bamboo, or other suitable material. The free reed is small enough that it can be made to vibrate by human breath; the jews harp is larger, so that it needs to be plucked by a finger, usually at the hinge end, or by jerking a cord through the hinge end of the instrument, and its vibration and sound are greatly amplified by being blown across its width. Whether one led to the other, we have no evidence. Its origin is unknown – whether in Thailand, or China proper, the Naga territory, or in the border lands between these states we simply do not know.

The free reed is most commonly used, in these same areas, in mouthorgans. A group of pipes, fitted into a common vessel of wood, gourd, metal, etc, each has a reed set in its side at a convenient point to fit into the chamber, and also has a small fin-

gerhole. By closing the fingerhole, the reed is coupled to the air column of the pipe and will then sound. On the more advanced mouthorgans such as the Thai *khaen*, the Chinese *sheng*, and the Japanese *sho*, the sounding length of each pipe is controlled by slots cut in the pipe, which allows the pipes to be arranged in pleasing figurations, where their physical length bears no relation to their acoustical length. The Chinese, for example, say that their shape resembles the phoenix's wings and the sound the phoenix's cry, and this shape was copied in Japan. The Thai *khaen* has its pipes arranged in two parallel rafts, arranged in order of physical length, with the reed-holder about one third of the way up the length, but the sounding length is controlled by slots cut in the bamboo pipes. In other simpler mouthorgans the pipes are arranged just by their physical length.

In some areas, in many parts of the Chinese periphery among the minority peoples, the free reed is cut idioglottally in thin sheet bronze and inserted into a slot cut in the bamboo of the pipe close to the stopped proximal end of a tube, usually of bamboo, with a set of fingerholes. This is against the acousticians' cant, which assures us that a free reed can sound only a single pitch, based on its length and mass. However their free-reed pipes will sound a series of pitches by opening the fingerholes just as well as any other type of reed-blown pipe. The Karen people in Burma and other minorities also blow side-blown horns, not by the vibration of their lips but via a free reed set into a slot cut in the wall of the horn or of a wooden instrument in the shape of a horn, with

a thumb hole in the tip of the horn, for, just as in Africa, theirs is a tonal language in which they can communicate by musical means. The Miao people can also 'talk' with pitches from their mouthorgans.

What makes the difference is the shape of the reed and how it lies in its slot. Alan Thrasher has shown that a rectangular reed with the free end cut off square lying flat in its slot when at rest, will produce just one note and it can be sounded by both blow and draw; this is the type used in the Chinese *sheng* and Japanese *sho*. If the end is slightly raised from the sides of the slot that same shape of reed will sound only on blow, and if it projects slightly downwards it will sound only on draw; this is the type used in many of our squeeze boxes and harmonicas. But if the reed is cut as a long triangle, coming to a point at the end, as in many such jews harps, then it will generate the air column and allow fingerholes to produce different pitches; this is the *bawu* and is the type used among the Chinese minorities. And a few Asian mouthorgans have the end of the reed cut in a slant instead of square, and just what does, so far we do not know, but in at least one type it can allow a second not to be obtained from each pipe.

In the mid-eighteenth century a *sheng*, the Chinese mouthorgan, arrived in St Petersburg, and was there studied and taken apart. Mersenne had also studied a Thai *khaen* and included it in his great book, *Harmonie Universelle* of 1636, but it seemed then to have attracted no further interest. It was otherwise in Russia

a century later. Organ builders took up the idea and fitted a free reed in some ranks of organs pipes. The idea travelled across Europe and it must soon have been realised, though whether in Russia or further west I do not know, that a free reed does not require a pipe to resonate its sound, any more than a regal had needed pipes, three or so centuries earlier.

The result was all our reed organs, originating in the early years of the nineteenth century, whether blown across the reed like a harmonium or sucked across it like an American organ. This allowed a full-size organ, down to 64-foot stops, to be built into a case no larger than an upright piano. This was followed by all the smaller bellows-blown instruments, concertinas, all the varieties of accordions and button-boxes, and eventually the harmonica, our version of the mouthorgan.

These are a very recent development and were invented, I have been told in Spain, as replacements for the *vuvuzela*, as noise makers to enthuse fans at football matches and other similar occasions, but they have since become musical instruments.

They are not reed instruments but I have heard and seen them being used to replace reeds in instruments such as bagpipes, and it may well be that before long they will be used as substitutes for other reed instruments as well.

I was sent my first example as a query for classification, and it is so different from any other instrument that we have had to introduce a whole new section for it in the MIMO version of the Hornbostel-Sachs classification system. Since then I have acquired another in a toy shop in Israel, so they seem to spreading rapidly.

The diaphragm is a sheet of flexible plastic, capping the cup-shaped top of the instrument. There is a nozzle at the side into which one blows to make the diaphragm vibrate and thus produce a sound. On one of mine the bell is separate from the tube and therefore it can be slid up and down, so altering the sounding length and the pitch, and thus proving that the diaphragm will make the air column vibrate just as a reed will. I have so far resisted the temptation to bore fingerholes in the tube, but if I can obtain another specimen I shall do so. I emphasise that one

simply blows through the nozzle – this is not a kazoo that responds to humming.

Modifications that I have seen have simply been tubes with cling film or polythene tied or stuck over the top of the tube; when blown on, either by mouth or through a bag, they work perfectly well. At least one that I saw had a bag, a chanter with fingerholes, and drones, and it sounded very much like a small-pipe such as a Northumbrian bagpipe.

So this is why, the diaphragmophone, appears within this series on Reed Instruments, because the diaphragm can be used as a substitute for a reed.

CIRCULAR BREATHING

Circular breathing is a technique that is regarded as essential for reed-instrument players pretty well worldwide. It is used on other wind instruments also: I have heard it used with Tibetan ritual instruments such as the human thigh-bone horns and also on the long trumpets, and in India, in a recording, by a conch-blower who blew two conchs simultaneously. It is also a basic element of the technique for the Australian didgeridu. It seems to be used less often with flutes but I have been told of some people who do use it.

Its purpose is to allow a continuous flow of sound of the melody, and also from a drone accompaniment wherever a drone is used. It is done by breathing in through the nose at the same time as blowing out through the mouth, and using the cheeks as an air reservoir in alternation with the lungs. It is widely taught with a straw and a glass of water, the player having to learn to keep a steady flow of bubbles rising through the water. The water, like the instrument's reed, provides an element of back-pressure, which makes it rather easier. This, I think, is why it is so rarely used on flutes, because blowing a transverse or a duct flute produces much less back-pressure than either a reed or a cup mouthpiece. It is possible that blowing a rim-flute, because the lips are more nearly closed, does provide rather more back pressure, and certainly that is where I have heard of it being used.

The main problem in learning to use circular breathing is air pressure. The use of the straw and a glass of water is fairly quickly learned, but the muscles that run across the cheeks are not as strong as the diaphragm, which means that the air pressure from the cheeks is lower than that from the lungs. It is a natural acoustical feature that lower air pressure produces a lower pitch and a higher air pressure a higher pitch. As a result, a long-held note can waver in pitch as the player changes from lungs to cheeks. Learning to equalise the two is the most difficult part of the process. Nazir Jairazbhoy produced an excellent example of this problem in one of his recordings from his journey through India. A small boy was blowing a reed instrument by the roadside and the pitch did indeed waver as he played, but his elder brother, who was more advanced in learning this technique, ran up to assure Nazir that this was not the proper way to play, and proceeded to demonstrate his greater skills in keeping the pitch steady. The difference between the sounds of the two children was very clear.

A lesser, but still serious. problem lies in the behaviour of the cheeks themselves. When used as an air reservoir they are of course distended. If distended too much and too often, the skin will stretch and may eventually fail to return to normal. To avoid this, in ancient Greece, a culture where bodily perfection was regarded as important, aulos players used a phorbeia, a strap running across the cheeks to support them. In Java and other parts of Indonesia a winged pirouette on the reed's staple is sometimes used to support the cheeks in the same way. A more permanent

solution is to replace the cheeks with an external air reservoir, and it is arguable that this was the reason for the origin of the bagpipe. The only other alternative is to learn to strengthen the cheek muscles and so avoid excessive distension.

There was an attempted solution in our orchestras, especially for oboists, cor anglais players, and maybe clarinetists and bassoonists, with the invention of the Aerophor. This was a foot pump with a tube that entered the corner of the mouth. It was invented, in 1912, by the Dutch flautist Bernard Samuels, who worked as a musician in Germany, but an unfortunate result was that users got sores and boils in their mouths, and so it was abandoned, despite some composers, especially Richard Strauss in his *Alpine Symphony*, having taken advantage of it. Instead, some of our orchestral players have followed the musicians from other cultures by learning to use circular breathing.