

Tutankhamon's Trumpets and the Hatsots'rot

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Tutankhamon's trumpets were found when Howard Carter opened his tomb in 1922. There were two of them, the first of bronze or copper and the second, found slightly later, of silver, and these are the only two ancient Egyptian trumpets that have ever been discovered. Since, so far as I know, none of the metal has been analysed, and therefore while the normal description of the first one has been of bronze or copper, and it did not look like pure copper, it is safer to use the term copper-alloy. Tutankhamon was born around 1340 BC, the son of Akhenaten (who reigned from 1351 to 1334 and who introduced the worship of one God (Aten, the sun-god) and was regarded by later generations as the arch-heretic), became Pharaoh at the age of seven shortly after the death of his father, reigned for only eleven years (1332-1323), and died aged around eighteen. This is the period known as the New Empire; Akhenaten, one of whose wives was Nefertiti, and his son belonged to the 18th Dynasty, which ran from 1549 to 1292. The 19th dynasty of Ramses I and II followed, a period which is commonly thought to have included the biblical Exodus.

The two trumpets were not found together; the copper-alloy one was in a large box full of other objects, many of them of military use, in the antechamber, and the silver one was found in a corner of the burial chamber. Since they differ in many respects (material, size, and location in the tomb) they are not, and never have been, regarded as a pair.

The initial find cards say that the first, of copper ornamented with gold, had a bell 9cm wide, a tube diameter of 1.8-2.8cm, outside diameter of the ring round the mouthpiece 2cm, a body length of 40.1cm and a bell length 8.7, so that the total length would be 48.7cm. Hans Hickmann (1946) remeasured them and claims to give a 'precise length' of 49.4cm along with other slight differences of a millimetre or two, save for the bell width, which Hickmann gives as 8.4cm, but

this may represent the difference between inner and outer diameters. He gives two pitches, a lower note of a 15-cent sharp middle C (and a poor A below), and a 41-cent flat E \flat a tenth above. Percival Kirby (1977) examined them in February 1933, and was also allowed to blow them, producing the pitches of B flat below middle C and a very strong D that rang through the Museum. He said that he took measurements to make copies, but he does not include them in this book.

The second trumpet, which the original card says was of beaten silver with gold decorations, gives a length of 58cm, a maximum width (ie the bell) of 8.8cm and tube diameter of 1.6-2.6cm. Hickmann's measurements are, again within a few millimetres, the same. His pitches are of a copy, presumably because the original was unplayable (we shall see why below), the lower the A below middle C, and a 28-cent sharp B \sharp above. For both trumpets these are taken from his Hertz figures because when naming pitches he seems to have used the high-pitch A of 256 Hz. Kirby produced the C above middle 'with true trumpet quality' and the A \flat below middle C.

I first saw the trumpets while I was in the Army and on leave in Cairo in 1947 or '48, and was permitted by Hans Hickmann, who was then living in Cairo, to blow his copies of them. Subsequently, in the mid-1960s Peter Holmes kindly made copies of them for me, based on Hickmann's published dimensions, but made of more common materials, the first of copper with brass bell and sleeves instead of gold, the second of brass, instead of silver. Those copies are shown here as Figure 1, the copper-alloy trumpet the smaller on the left in the figure. Their measurements can be found in my *Horns & Trumpets* book, p. 73.

I saw the copper or bronze trumpet at the Tutankhamon Exhibition at the British Museum in 1972, but I have never seen the silver trumpet again, and I have only the information that has been published on that one, and that, as we shall see, is almost certainly as unreliable as some of the previously published information on the copper or bronze one. Also the silver one is said to have shattered when, as we shall see below, it was blown in 1939, and therefore any constructional details are likely be from after that date, and therefore irrelevant to this paper; this of course is why Hickmann blew a copy in the mid-1940s, whereas Kirby, in 1933, could blow the original. It should be stressed, therefore, that what follows applies almost only to the copper-alloy trumpet.



Figure 1

As I wrote back in 1976 (in the *Galpin Society Journal* 29, 1976, 115-7, which was reprinted in the *Journal of Egyptian Archaeology* 64, 1978, 133-4, and now appears briefly in the Wikipedia entry on the trumpets), after the conclusion of the Tutankhamon Exhibition at the British Museum in 1972, I was permitted to examine the trumpet which was included among the exhibits. The trumpet I saw was the smaller of the two instruments found in the Pharaoh's tomb, the copper-alloy trumpet, Catalogue no. 69851 (Hickmann 1949, pp. 144 and 145, who there firmly describes it as bronze) and the reason for submitting that brief note was that my examination then revealed a number of details of its construction that had never been published by anyone, despite the number of people who had examined it. I regarded that 1976 paper as supplementary, and in places contradictory, to Dr. Hans Hickmann's major study (Hickmann 1946). I described then simply

what I saw then without any of the wider considerations which are the subject of this present paper. While I repeat here, for ease of reference, what I wrote then, I have also expanded it considerably as we go along.

Coincidentally on that occasion, while waiting to see the trumpet, I also saw in the offices of the Egyptian Department an incense stand, the top of which was clearly the origin of the so-called third Egyptian trumpet in the Louvre. This differs in all respects from the Tutankhamon trumpet described below: the longitudinal seam is a straight one, not a meander one (and leaks, Kirby says); it is said to be soldered, rather than brazed (Ziegler, 1979); it has a widely flared bell, not the straight conical bell of both the Tutankhamon trumpets; the bell is integral with the body, not riveted to it as here; there is no mouthpiece support ring; even the Louvre now regards it as unlikely to have been a trumpet; and finally it is quite clearly what it is, the top of an incense stand, and not a trumpet at all. Kirby (1977) and Ziegler give a photograph of it.

Now for what I wrote about the Tutankhamon trumpet in 1976, somewhat revised and expanded in places. I had not been allowed to touch the trumpet myself; one of the Museum staff held it (gloved of course) and turned it to every angle that I asked for. I was, though, allowed to put a plastic slide calliper on it, which gave the smaller measurements noted below.

The copper-alloy trumpet was made in two parts, the body being a slightly expanding tube of metal, rolled up from sheet between 0.2 and 0.25 mm. in thickness. It is evenly expanding, not as Hickmann said ‘cylindrical with a slight expansion towards the bell’. There is a normal, very skilfully brazed, meander joint down the whole length of the tube with, from memory, the ‘teeth’ or steps of the joint being about an eighth of an inch wide (I did not measure them at the time, so this is from memory and was judged by eye). This joint had been smoothed to a perfect finish on the outside of the tube but had been left slightly rough on the inside; the indentations of the square-toothed joint are clearly visible on the inside and easily perceptible on the outside. It is thus apparent that, as one would expect with a ceremonial instrument capable of producing only one or two notes, appearance was more important than acoustical perfection, for the internal roughness could lead to some turbulence in the air column.

The other part is the bell, which appears to have been made of electrum or of a similar alloy of gold; it is clearly of a quite different material from the body

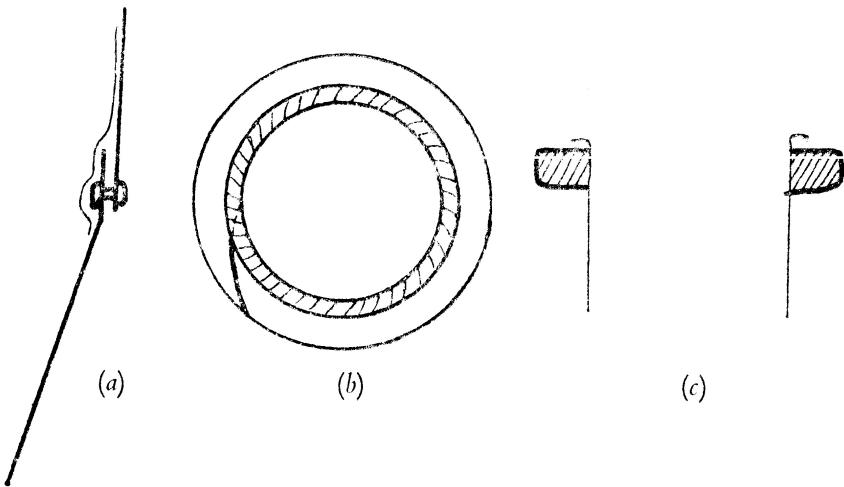


Figure 2

tube and it is so thin, between 0.1 and 0.13 mm in thickness, that surely it cannot be of pure gold, for that would be far too soft to hold its shape if it were as thin as this. The bell is a straight cone and it has no perceptible seam; neither internally nor externally is there any trace of a joint. The only conclusion that seems likely is that the joint was made without the use of a flux and that it was burnished until the edges of the metal simply flowed together.

The body tube is inserted into the top of the bell and the two are riveted together at the four cardinal points, as it were north, east, south, and west. The lower part of the body, including the joint with the top of the bell, is covered with a very thin sleeve, presumably of gold foil, for it looks like gold, which preserves the integrity of the joint against the leakage of air (see Fig. 2(a) which is not to scale; the elements are separated laterally for clarity).

The outer head of one of the rivets can be seen as a highlight below the gold foil in the detail photograph of the bell in the plate opposite p. 45 of the *Catalogue of the Exhibition* (Edwards, 1972). Why this has never been remarked previously is a mystery – each of the four rivets is clearly visible when one looks into the interior of the trumpet. Lisa Manniche (1976) states that “The bell and the conical

tube of the trumpet were soldered together” and this is quite simply untrue, and she writes it despite the fact that she shows an oblique photo of the interior of the bell, into which she only had to look. She also says that “The edges of the tube were not crenellated, but left straight, and may have been slightly overlapping when folded and joined”, and this also is untrue because, as noted above, the edges were indeed ‘crenellated’ in a clearly visible meander joint. Hickmann (1946) does not describe the construction at all; he gives measurements, but otherwise concentrates entirely on the history, use, and musical and acoustical results.

The embouchure, that most controversial of all parts of these instruments, is simply a solid ring of metal, bearing no resemblance whatsoever to any of the types illustrated by Hickmann (1946, p. 27, fig. 25). Edwards (p. 45) gives the material of the ring as silver (as do previous authors); it looked like brass to me, and my guess is that it may also be electrum. It is brazed on a diagonal joint (a scarfe joint; see Fig. 2(b)) and it is 3.25 mm thick. The proximal end of the body tube is bent out over this ring, the width of the covered portion of the ring being 1.2 mm. (the hatched area in the figure). The top of the body tube is covered by, again, a very thin sheet of gold foil. Here Peter Holmes’s copy (Fig. 1, left) is misleading; the upper sleeve is much longer on the original than in the copy. There is, in some portions of the circumference, a slight gap between the everted top of the body tube and the embouchure ring, as though the ring has slightly moved down the tube (Fig. 2(c), in which this gap is exaggerated) and, in this gap, traces of the gold foil can be seen. If these traces are a part of the sheet round the top of the tube, as we can assume those traces to be, how is the embouchure ring held in position? It is certainly not riveted; it seems unlikely that it could have been brazed through the gold. It seems most probable that it is an exact fit to the top of the tube, possibly shrunk into position, and that the slight conicity of the tube suffices to hold it in place or almost so. Certainly it can be stated categorically that the ring is not on a sleeve (Hickmann, 1946, fig. 25c) and I am as certain as one can be without probing or radiography that the above surmise is correct. If it is correct, it is evidence as to the notes obtained on the instrument.

Hickmann (1946 pp. 34 ff) and Kirby (1947 and 1952) produced three pitches from the instrument and from their copies of it, as I can on my copy, which was made for me long before the Exhibition. Kirby says that he doubts whether the highest note was ever used, since it requires considerable effort; I am certain that

it was never used because the pressure required is more than this embouchure construction would tolerate. It is probable that only the middle note was used (both Hickman and Kirby point out that the lowest note is poor in quality and carrying power and it is so poorly centred that they each elicited quite different pitches for it) and that the Egyptian military trumpet signal code was a rhythmic one on a single pitch. I suspect that this middle pitch could also have been inflected slightly in pitch (certainly I can on my copy), allowing a considerable range of signals, both inflected and rhythmic. Hickmann (1946) makes the military role of these trumpets clear beyond any doubt, showing many drawings of wall reliefs and paintings.

Back in April 1939, the BBC broadcast an army bandsman, James Tappern, blowing both these trumpets (Rex Keating, the original organiser of the broadcast, said in a later broadcast, that the silver one had shattered under this treatment). Tappern simply inserted his normal trumpet mouthpiece into the end, wrapping it with cotton wool to fit. In this way he was able to blow fanfares, part of the *Posthorn Gallop*, and so on, as can still be heard today on YouTube. Kirby (1977), having transcribed them from a recording of the broadcast, gives all the calls that Tappern had played in staff notation.

Now how does all this relate to the *hatsots'rot* of the Bible, the silver trumpets that God commanded Moses to make in the desert, shortly after leaving Egypt? These instructions we can read in chapter 10, verses 1-10, of the book of Numbers (B'midbar), verse 2: “Make thee two trumpets (*hatsots'rot*) of silver (*kesef*); of beaten work (*miqshah*) shalt thou make them; and they shall be unto thee for the calling of the congregation, and for causing the camps to move forward...” Then in verse 8: “And the sons of Aaron, the priests (*hakohanim*) shall blow (*yitq'u*) with the trumpets and they shall be to you a statute (*huqat*) for ever throughout your generations. [v. 9]: And when ye go to war in your land against the adversary that oppresses you, then ye shall sound an alarm (*hare'otem*) with the trumpets; and ye shall be remembered before the Lord your God...[v. 10]: Also in the days of your gladness, and in your appointed seasons, and in your new moons, you shall blow (*ut'qa'tem*) with the trumpets over your burnt-offerings, and over the sacrifices of your peace-offerings...”. We shall return to the relevance of each of these verses in due course.

To start with, both the *hatsots'rot* and the Tutankhamon trumpets are of the same size. Tutankhamon's trumpets are said to be (as we have seen, there is some variation in different sources) around 50cm long for the copper-alloy one and 58cm for the silver one. Numbers 10 gives no dimensions, but Josephus, some 1500 years later, describes the *hatsots'rot* as being about a cubit long. The cubit, traditionally, is the length from the elbow to the fingertip, but it varies with time, often according to the ruler's arm-length. Whiston, Josephus's translator, gives 53.3cm as that cubit. My own cubit is 50 cm and I am about six-foot tall. The *hatsots'rot* were specified in Numbers 10 v.8 to be for 'the sons of Aaron, the priests (*hakohanim*)' and Josephus was a Kohen, so he would obviously have known, and would probably have blown the *hatsots'rot* in the Temple 'over your burnt-offerings and your peace-offerings' (v. 10) before the days when he became a renegade and Titus's toady.

Can we assume that the *hatsots'rot* of his time were the same as in Numbers 10? I think that we can: 'and they shall be to you a statute (*huqat*) for ever throughout your generations' (v.8). Whether those original trumpets could have survived the number of times that Jerusalem was looted by various adversaries is improbable but not impossible. Even if they had then been lost, they would have been remembered and reproduced. Things like 'a statute (*huqat*) for ever throughout your generations' (v.8) were taken seriously, the Talmud is full of such things, for the rituals described in the Bible never ceased until the Temple was destroyed by the Romans in AD 90, and there are people even trying to revive them today. So I do think that the length Josephus gives of a cubit is likely to be correct, far shorter than those carved on the inside of Titus's Arch in Rome, which are simply the standard Roman trumpets of that period.

The construction of the originals is clearly given in Numbers 10, as quoted above. They were to be of silver and of beaten work, in other words they were not to be cast but were to be raised from sheet metal by hammering the sheet so that it curved upwards like a narrow trough, and then beaten round a wooden rod as a mandrel, exactly as was Tutankhamon's copper-alloy trumpet; they might have simply had an overlapped and soldered seam, but equally they could have had a brazed meander joint, and we should remember that Betsalel, who made all the regalia for the Tabernacle in the desert, was a craftsman of the highest level

and he was unlikely to have skimped the job of making such trumpets, so a good quality meander seam is much the most probable.

Then again, remember where we are chronologically; immediately following the specifications for the *hatsots'rot*, in our same chapter in Numbers, and in verse 11, we read “And it came to pass in the second year, in the second month...”. So this was only just over a year after the Israelites left Egypt.

What was a *hatsots'rah*? We have assumed all along that it was a trumpet and translated the word as such, though in the plural, and indeed it is clear from the specified uses in Numbers 10 that it can only have been a trumpet – ‘and they shall be unto thee for the calling of the congregation, and for causing the camps to move forward’, so it was used for giving signals loud enough to be heard over the whole encampment; and ‘And when ye go to war in your land against the adversary that oppresses you, then ye shall sound an alarm (*hare'otem*)’, so it was for use by the priests, loud enough, again, to give alarm calls, and in battle; and ‘Make thee two trumpets (*hatsots'rot*) of silver (*kesef*)’, so it was made of metal – it cannot have ever been anything except a trumpet.

The Israelites must have known what Egyptian trumpets were like – we see them in many Egyptian reliefs blown by soldiers, those same soldiers that had bullied them into making “store cities for Pharaoh, Pithom and Raamses” (Exodus 1:11) and who had chased after them as they crossed the Reed Sea. So if Betsalel was going to make a pair of *hatsots'rot*, he would have known how to make them because he had seen them in Egypt and knew what size they were and what they looked like. And yes, if you scale the trumpets to the bodies of the trumpeters in all the wall carvings and paintings, they too were about a cubit long – Tutankhamon’s ones may have been glossier than the standard army issue (they are of silver and gold and are decorated with cartouches and so on), but they were basically the same, even to the wooden cores that supported them when not in use, for in these same carvings and paintings we often see those same wooden support cores tucked under one arm of the soldiers when they are blowing or held in the other hand. Some people suggest that these soldiers are holding two trumpets, but why on earth should someone carry two trumpets in the field? In case he dropped one and trod on it? No, since we know from Tutankhamon’s tomb that trumpets had these support cores (which might have also been the mandrels on which they had been rolled up), then surely that is also what we see these soldiers carrying.

So finally we come to the point of what did the *hatsots'rot* sound like? Well, we can only assume that they must have been exactly like Tutankhamon's, with three notes, low, middle, and high – poor, good, and probably unobtainable. So they were not likely to have been able to produce anything more than that middle note, unless with practice they could manage to stabilise that bottom note, as I sometimes can on my own copy. What they could also do, is to inflect the pitch somewhat, a semitone or so above or below the main note.

By 'inflection' I mean slackening the lip slightly, dropping the jaw a little, and flattening the tongue a bit. The result is that the pitch drops slightly but not by so much as to reach the lower 'proper' note; roughly the sound resembles ah-aw, and -ah if one comes up again. Similarly one can raise the pitch slightly, though dropping it is easier. So by combining this with a variety of rhythmic patterns a very wide code of signals becomes available for military use and for moving the camps in the desert.

We have very little evidence from the Talmud of how such things may have been done in the Temple, practically only in Sukkah (51b) while discussing the water-drawing ceremony, when two priests were on the fifteen steps leading up to the southern entrance to the Temple and blew a *t'qi'ah*, a *t'ru'ah*, and a *t'qi'ah* on the *hatsots'rot*. Those steps are still there, in the excavation area below the southern wall of the Mount (almost directly below the back wall of the al-'Aqṣā Mosque), and one can stand on them today and can read there the fifteen Psalms of Ascents, psalms 120-134 (*shirei hama'alot* – *shirei* is 'songs of', and *ma'alot* means 'steps') that were traditionally recited there. These calls, *t'qi'ah* and *t'ru'ah*, are two of the same calls that are blown on the shofar and that are mentioned many times in Talmud in relation to the shofar, but only this once for the *hatsots'rot*. *T'qi'ah* relates to the basic word for blowing a trumpet, *yitq'u* back in verse 8 of Numbers 10 (there in the future – strictly the continuing tense – of the verb: the priests 'shall blow'), and it is normally defined just as a 'trumpet blast'. *T'ru'ah* also harks back to Numbers 10, to verse 9 with *hare'otem* (again future tense: 'shall sound an alarm'). So *t'qi'ah* is simply a trumpet blast and can just be a single note, but *t'ru'ah* as an alarm is more complex. Today, as a shofar call, it consists of either a series of repeated notes on a single pitch, or in some traditions as a wavering note produced by repeated inflections (or by moving the shofar from side to side against the lip, which produces the same result), and in other traditions by

what modern orchestral players call flutter-tonguing, produced either by rolling an R as one blows or by gargling in the throat. Each of these techniques is perfectly practicable on the central pitch of the *hatsots'rot* and would certainly have been nothing like what one hears from some of the ‘Reconstruction of the Holy Temple’ people. They are blowing modern posthorn copies more than cubit long, with flared bells, with modern mouthpieces, nothing like the *hatsots'rot* at all.

The only other useful references in the Talmud are one to the use on Rosh haShanah, the New Year, when the shofar blew a long note and the *hatsots'rah* a short one, because it was the shofar that had the duty of the day. The other relates to the book of Chronicles where 120 *hatsots'rot* or more were blown, with one rabbi complaining that they drowned the sweet melody of the singers! But Chronicles is a very late recension of history and tends to exaggerate the numbers of people taking part in any ceremony.

Thus we can equate the Tutankhamon trumpets, of which we have two surviving examples, with the *hatsots'rot*, of which we have no extant example, because all the evidence of descriptions overlap. We know that both were used in the same ways. It is almost certain that both produced the same sounds. And, even though we do not know how *t'qi'ah* and *t'ru'ah* sounded in Temple times, we do know what sort of calls were blown on them.

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