3.24 A brief investigation of reamers used by R. L. O'Mealy.

Bill Haneman

When R. L. O'Mealy died in 1947, most of his tools were acquired by Jim McIntosh, who passed them on to Seán Reid, from whence they went to Wilbert Garvin.[1] Three of the reamers remain in the possession of Wilbert Garvin, and a number of the tools, including a contrabass regulator reamer, were donated, along with O'Mealy's lathe, to *Na Píobairí Uilleann* by Wilbert and Ken McLeod.

Eventually, more of Seán Reid's own reamer collection made its way to NPU. In the process of preparing this article, two additional reamers from the Seán Reid collection have been confidently identified as O'Mealy's, to bring the total number of known O'Mealy reamers to five (the contrabass reamer has not yet been positively identified, as it has apparently found its way back into NPU's Seán Reid collection among other large reamers). It is hoped that as more of the O'Mealy pipemaking corpus, and indeed the NPU reamer collection itself, is measured and catalogued, more O'Mealy reamers may be identified.

Figure 1: O'Mealy Reamers (Garvin Collection)

The reamers – examination and measurement

The five reamers are of three quite distinct types: flat section, D section, and a remarkable five-sided prism-shaped reamer. One of the flat section reamers has been fitted with a handle by means of brazing the shaft of a commercial tool onto the flat steel – the handle is stamped "W. Marples & Sons".[2] All of the flat (i.e. rectangular-section) reamers feature "prick punch" marks near, but not precisely on, centreline, spaced at 5 to 10 centimetre intervals. The D section reamer is no longer fitted with a handle, but its form suggests that it once was. It too, sports the prick punch marks on its flat face, but bears no other identifying marks. The pentagonal reamer has a tapered square-section end such as could be fitted into a 2-jaw "shell" or "jaw and sleeve" chuck (such a chuck is most commonly seen nowadays on an old brace and bit set). It is stamped "T. Hewlis & Co.".

1 Ken McLeod, personal correspondence. See also Wilbert Garvin, "The O'Mealy Box", article 3.13 of this Journal (*Seán Reid Society Journal Volume III,* 2009).

2 William Marples & Sons. The William Marples who founded this company was born in 1809, and his brother founded Joseph Marples Ltd. See http://www.marples.co.uk/page2.html (retrieved Dec.14 2009)

Figure 2: O'Mealy reamers from the Seán Reid/NPU collection

Figure 3: Close-up of NPU reamers showing characteristic prick punch marks and rivet holes

After contemplating the difficulties of measuring all three types of reamer, I fabricated a diameter or “ring” gauge from brass plate. This sort of gauge enables the measurement of the widest extent of the reamer at a particular distance, which is of course the operative dimension of a reamer's cross section, as it determines the diameter which the reamer will cut at that point. That said, other factors may influence the actual diameter, such as relative sharpness, straightness of the reamer's axis, presence of a previously bored hole or “pilot”, flexure or harmonic chatter of the reamer, etc.

For this initial investigation a limited number of gauge holes were prepared, determined somewhat by the available drilling tools on hand. The increment between successive gauge diameters ranged from about 0.1 mm for small diameters and approximately 0.5 millimetres at the largest diameters. While probably insufficient for purposes of reproducing a tool, this range of sizes seems sufficient to make some meaningful observations. Actual size of the gauge plate holes was determined with a small hole gauge and a micrometer.

Figure 4: Ring gauge plate, small hole gauge, and micrometer

Four of the five reamers are of dimensions associated with chanters and the upper section of regulator bores – on the order of 10mm at their widest point. One of the reamers is much wider and appears to have been made for reaming bass regulators. One immediate observation about the four narrower reamers is that they are very narrow indeed at their small end – smaller, in fact, than any O'Mealy bore dimension currently known to us. It is unclear why this should be so; in the case of the flat reamers one could argue that repeated sharpening reduced their size, but the D section reamer has a very narrow tip as well, and it would not have suffered this fate upon repeated sharpening. The 5-sided reamer clearly has not been reground to an extent that would appreciably change its size. A narrower tip may facilitate the use of a quite narrow 'pilot' or minimum step-bore size, but it is unclear why O'Mealy would have chosen a more narrow, thus more difficult, minimum step-bore size than necessary. The other interesting observation about these reamers is that they are "full length" - that is, their cutting edges are as long as the complete bores which O'Mealy intended to form. It does not necessarily follow, however, that the bores were formed on a single-reamer (that is, one reamer per bore) basis. We will return to this point later...

Flat reamers have the apparent advantages of simplicity and ease of manufacture without metal turning. On consideration however, constructing a flat reamer that accurately cuts a desired bore profile presents several challenges. Firstly, the fact is that a flat reamer cuts on its diagonal; this complicates matters not only because the diagonal is difficult to dimension directly, but more so because the ratio of the diagonal to the reamer's width changes along the length of the tool. Nonetheless these are problems which can be solved either by the use of careful geometry or patient filing coupled with the use of something like the gauge plate described above.

Another fabrication difficulty which the flat form presents arises when one wishes to make a reamer narrower at its smallest end than the thickness of the steel plate. The handled O'Mealy reamer (aka "O'Mealy Reamer #1", for convenience in naming) shows evidence of having been thinned at the narrow end, in order to accommodate a narrow tip while retaining sufficient rigidity at the wide end.

The angle which the flat reamers' edges present to the flat face is very uniform and square; the edges appear to have been formed and finished by draw-filing with a very fine file. It is possible that the flat faces were lightly honed.

Figure 5: O'Mealy Reamer #1 (flat reamer with handle)

While the final dimensions of a working flat reamer may theoretically be the result of trial and error, a close examination of the other two O'Mealy reamer types (as we will do below) argues against this interpretation. Instead, they provide strong evidence that R. L. O'Mealy designed his reamers with a clear plan in mind, and possessed means of measuring them.

Allowing that flat reamers can be planned and fabricated with precision, provided care is taken and one bears in mind the geometry of their diagonal cutting profile, they present additional challenges in use. Among other problems, they are prone to harmonic chatter, which can produce a lobed pattern in the bore, and their diagonal – thus their effective cutting dimension - changes with each sharpening. Today, most makers of our pipes opt for an alternative reamer type – for instance the D-section reamer, as R. L. himself appears to have done at least once. Other writers have described the salient issues in detail elsewhere.[3] [4] The presence of a T-handle on the flat reamer reminds us, however, that in O'Mealy's day boring rates were very slow indeed, and given the difficulties in operating a treadle lathe while inserting a reamer into a billet, it seems likely that R. L. reamed by hand rather than under lathe (treadle) power. This would greatly mitigate the harmonic chatter and flexure problems. Unless the T handle was added subsequent to O'Mealy's death, we can conclude that the reamer was not chucked in a spinning lathe. Of the surviving reamers, the only one that could be chucked in this way is the 5-sided "polishing" reamer, and indeed one can imagine that it might have been desirable to do so.

Figure 6: Composite photo – two views of O'Mealy Reamer #2 (D section) showing prick punch marks and edge relief

The D-section reamer (which we arbitrarily number "#2") has a flat side – it does not appear to have been hollow ground. It appears to have been turned "in the round" on the lathe, though the sides show some grinding and/or file marks which may indicate either that the edge was "relieved" somewhat or that an attempt was made to adjust its profile slightly after it was ground to a D section. Prick punch marks, similar to those on the flat reamers, are present. Their spacing is not equidistant, nor are they perfectly axial. My current conjecture is that they were used for some sort of work-holding while the reamers were sharpened.

The 5-sided prism is markedly different from the other reamers in numerous respects. It appears to be of a different steel alloy, or at least to have been differently heat-treated. It has features consistent with having been machined commercially – that is, it sports a symmetrical tang, a perfectly cylindrical section near the 'foot', and of course it bears what appears to be a commercial stamp. The 5 sides are remarkably bright, smooth, and symmetrical – though not perfectly so, as one face displays some "wind" relative to the others. The sides are honed or lapped to a bright finish, and the edges where the sides meet are still fine enough to easily shave dust from the back of a fingernail. Such an "edge", however, presents a fairly obtuse angle – 108 degrees – and thus would make what is characterised as a "scraping" cut. The tool does not appear to have been honed or sharpened in such a way as to present a burr on the edge, thus it would be relatively inefficient for stock removal. The extremely small amount of fine material which it can effectively remove amounts to dust, and the action might well be called "polishing" or "burnishing" rather than reaming. I will refer to it as "O'Mealy Reamer #3".

The only reference I have found to "Hewlis" in a relevant context is "T. Hewlis & Co.", Warrington, Lancashire, at the crossing point of the river Mersey in the U.K. Warrington was famous well into the last century as a centre for steel making and tool manufacture. If this T. Hewlis & Co. made the reamer, Richard may have travelled far to obtain it, and it must have come at considerable expense.

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3 John Hughes, "A Method of Making Reamers", 2.07. *Seán Reid Society Journal Volume II, 2002.*

4 David M. Quinn, "On Reamers – Confessions of a self-taught pipemaker", Parts 1 – 4, *Iris na bPíobaire Vols XXVII Nos. 2, 3, 4 and XXVIII No. 2, 2008-2009.*

Figure 7: O'Mealy Reamer #3 (5-sided prism, stamped "T. Hewlis & Co.")

After discussion with several toolmakers, and examination of the reamer, I suggest one way in which the tool may have been made: by forming the desired diametrical profile "in the round", on a lathe, then mounting the piece in a dividing head and gradually filing, grinding, and lapping each side, probably with the aide of a guide or jig to keep the tools horizontal, until the five sides just met. As the 108 degree angle was formed, the bright line between them would vanish, thus indicating when the honing was complete. This would have required immense patience, but it could indeed have produced an object to challenge even the most sophisticated CNC grinder of today.

I have heard reports of one other polygonal pipemaking reamer of this type – in the collection of Taylor Brothers' tools in the Mercer Museum in Pennsylvania, USA. If this is so, it is possible that R. L. O'Mealy had heard reports of this very tool, and since the strong influence of the Taylors is evident in his work, he may have decided to try it for himself.

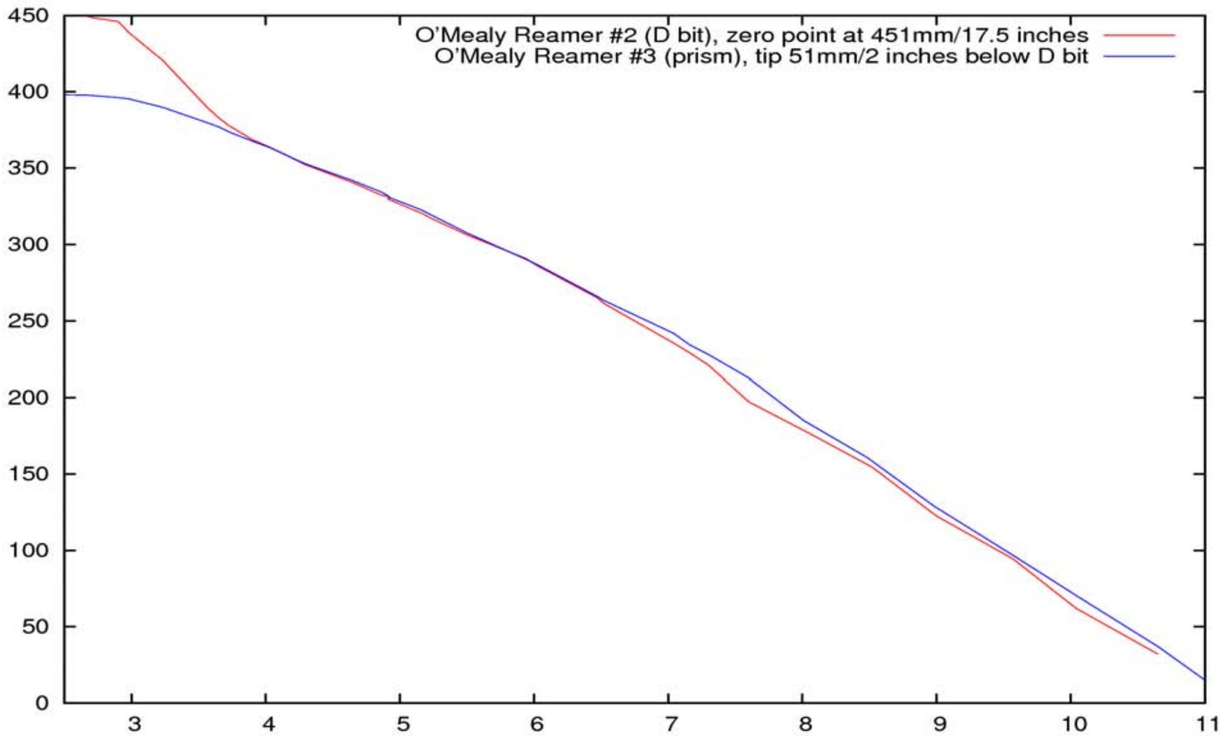

Figure 8: ring gauge diameters for O'Mealy reamers, plotted as a distance from specified points along the reamer length (451 and 425 millimetres, respectively)

Gauge measurements for the D section reamer and the 5-sided reamer are plotted in figure 8.[5] The strong similarities between the profiles of these two reamers are readily apparent, and I would propose that the 5-sided reamer was intended to polish, burnish, or otherwise refine the bore initially created with the D reamer; that is to say that these two reamers form a matched pair. It is apparent that the

5 In this and all the following plots, the bore data is represented as though the chanter or reamer were held upright, with the 'reed seat' section topmost and the bell, or reamer handle, bottom-most. Diametrical measurements are given on the horizontal axis, in millimetres, and insertion depths/heights are represented vertically in millimetres. In the case of reamers, vertical measurements are take from the notional 'bell' of an instrument into which the reamer is inserted a specified depth.

profile is not at all a straight form, but rather a subtle convex one. Another conclusion that one may draw is that the 5-sided reamer was executed with considerable precision to a specific plan. True, there are discrepancies between the two bores, but they are localised and their presence cannot obscure the close correspondence over most of their lengths. The discrepancies may represent deviations of the D reamer from an initial plan, or perhaps more likely they are the result of over-zealous edge relief, or post-manufacture “adjustment”. In any case the 5-sided reamer has sufficient cutting power to correct these small deviations, when subsequently applied.

Cecil Colville recently recounted to me some recollections of R. L. O'Mealy's chanter boring method. It is unclear whether Cecil actually observed these steps, or heard O'Mealy describe them during one of his visits to the O'Mealy household in R. L's last years. His recollections include the successive use of multiple boring tools, inserted to specific depths, apparently in order from large to small – a description consistent with what we today call “step boring” or “step drilling” in preparation for reaming. We do not know whether R. L. O'Mealy used pilot bits, or other means, to ensure concentricity of such steps. In one instance (the McCullough chanter described below) slight ridges or “steps” are discernible in the finished bore (see figures 14 and 15 later in this article) – but this was presumably a “student-grade” chanter and does not bear the O'Mealy stamp.

Perhaps the presence of three different reamer types indicates some sort of experimentation on O'Mealy's part; and perhaps, in the end having tried various reamer forms, he concluded that the improvements were insufficient to justify the expense or labor. It is also possible that the flat reamers whose kinship to existing O'Mealy bores we observe, were superseded by other D section reamers or pyramidal reamers, made to the same diametrical specifications, which have since become lost to us. It is probably unsafe to draw any conclusions on this matter.

Testing the measurement methodology and trialling the reamers

Whatever the exterior measurements of a set of reamers, the proof of their function lies in the shape of the bore which a reamer actually cuts. A number of variables may account for differences between the planned profile and the actually produced bore – for instance wood elasticity, reamer flex and/or chatter, localised differences in sharpness of the reamer or hardness of the timber, and post-reaming shrinkage. Also quite important are the straightness of the reamer and/or straightness and concentricity of the step-drilled “pilot” bore – bent reamers or warped pilot bores tend to result in bores that are locally oversized. It is also true that no handmade reamer is ever absolutely symmetrical, and as is the case with warping, asymmetrical regions of a reamer tend to cut oversize.

As a test of the gauge-plate measurement methodology, and as an additional means of characterising the O'Mealy reamers, three of the reamers were carefully applied to step-drilled bores and the results measured with the probes which I routinely use to measure instrument bores. This experimental work was carried out at the suggestion of, and in consultation with, the current custodian of the reamers. This was deemed feasible since the reamers were observed to still have a reasonable cutting edge, so that no sharpening of the tools was required – nonetheless, in using tools of historic significance there is always some degree of risk involved and some deliberation preceded the decision to proceed. In order to minimise the wear on the tools, billets were prepared from a relatively non-abrasive timber and step-bored as nearly to the final bore sizes as practicable. Castella Boxwood was chosen as the timber, since although it is relatively kind to tools and is not prone to warping, it is fine-grained and similar to one of the varieties of “boxwood” which O'Mealy actually used (in addition to several cultivars of true boxwood, *buxus semperviris* – the fact is that we don't know with confidence what species O'Mealy used in every instance).

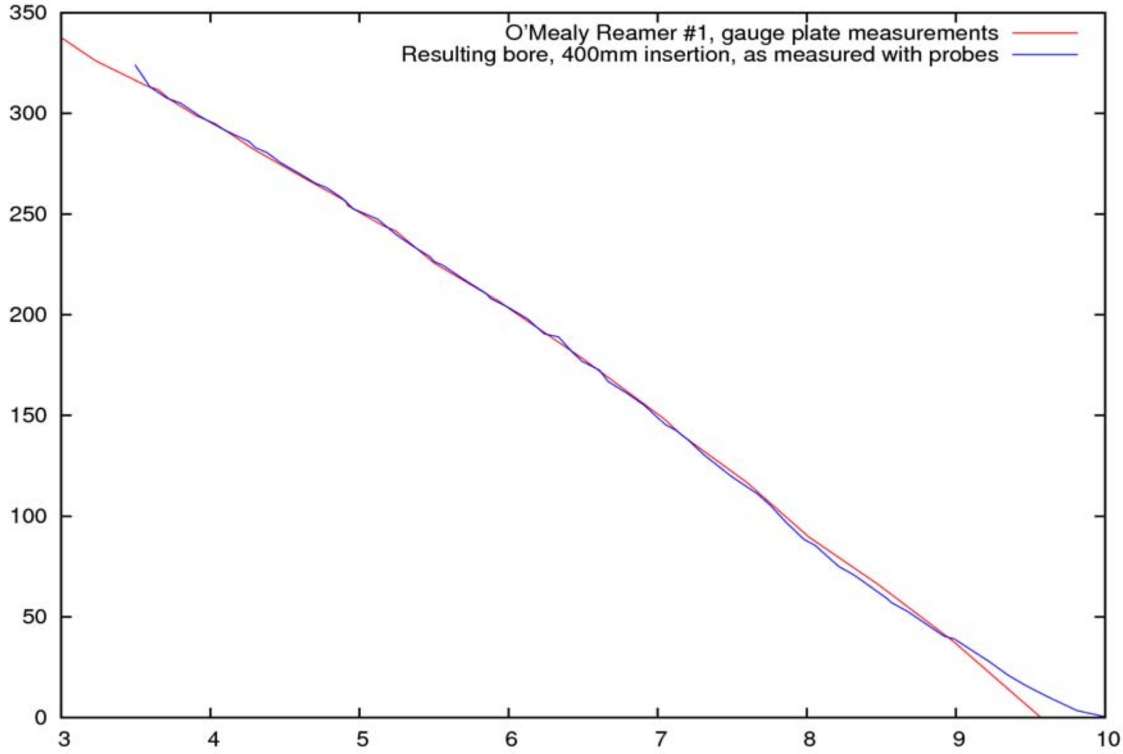

Figure 9: Reamer test #1

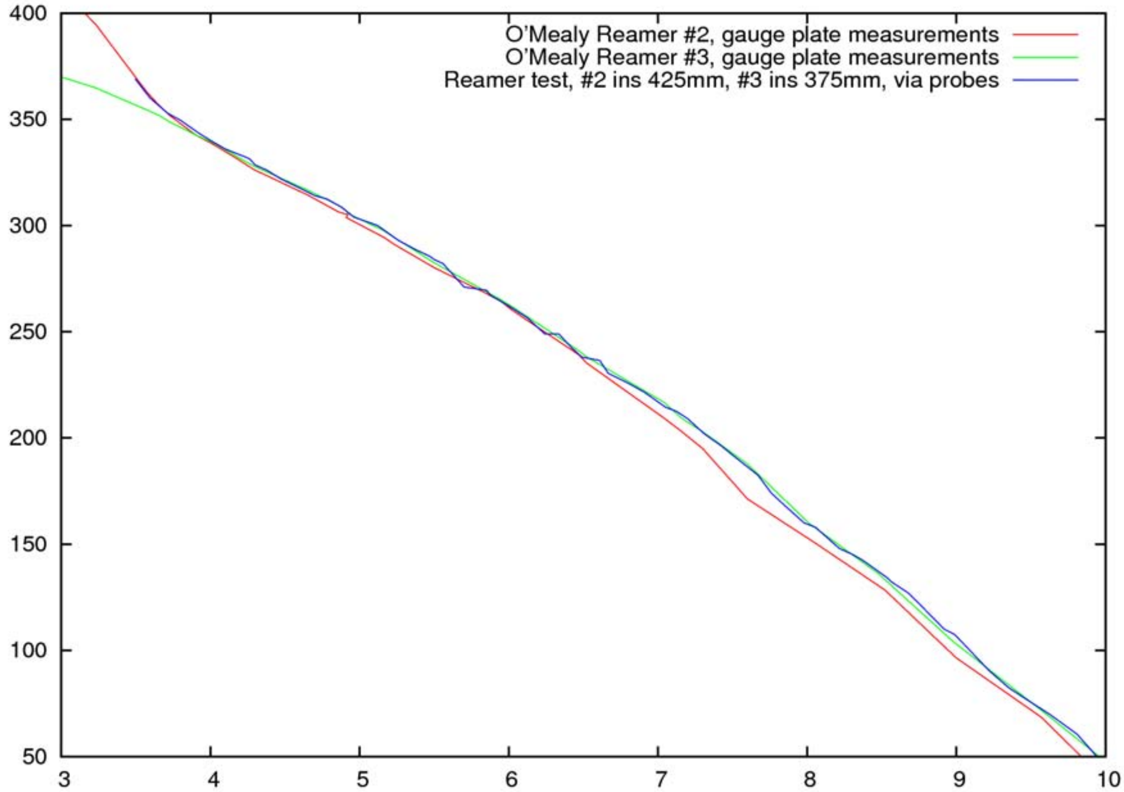

Figure 10: Reamer test #2 (using reamers #2 and #3)

Our results demonstrate excellent agreement with the results of the gauge plate measurements, while giving some indication of the inherent level of uncertainty in our methodology. Note that the measured bores appear slightly undersized in the largest diameters in both tests. For reasons of conservation, I did not continue with our reamer tests once the validity of the gauge plate measurements had been established, since the gauge plate measurements are arguably less disruptive to the reamers.

Comparison with measured O'Mealy bores: McIntosh/Stewart instrument

Having characterised the O'Mealy reamers, we compared their profiles with selected O'Mealy bores whose measurements are in our possession. Since three of the four reamers described herein are relatively narrow, we begin by looking at chanter and baritone regulator bores.

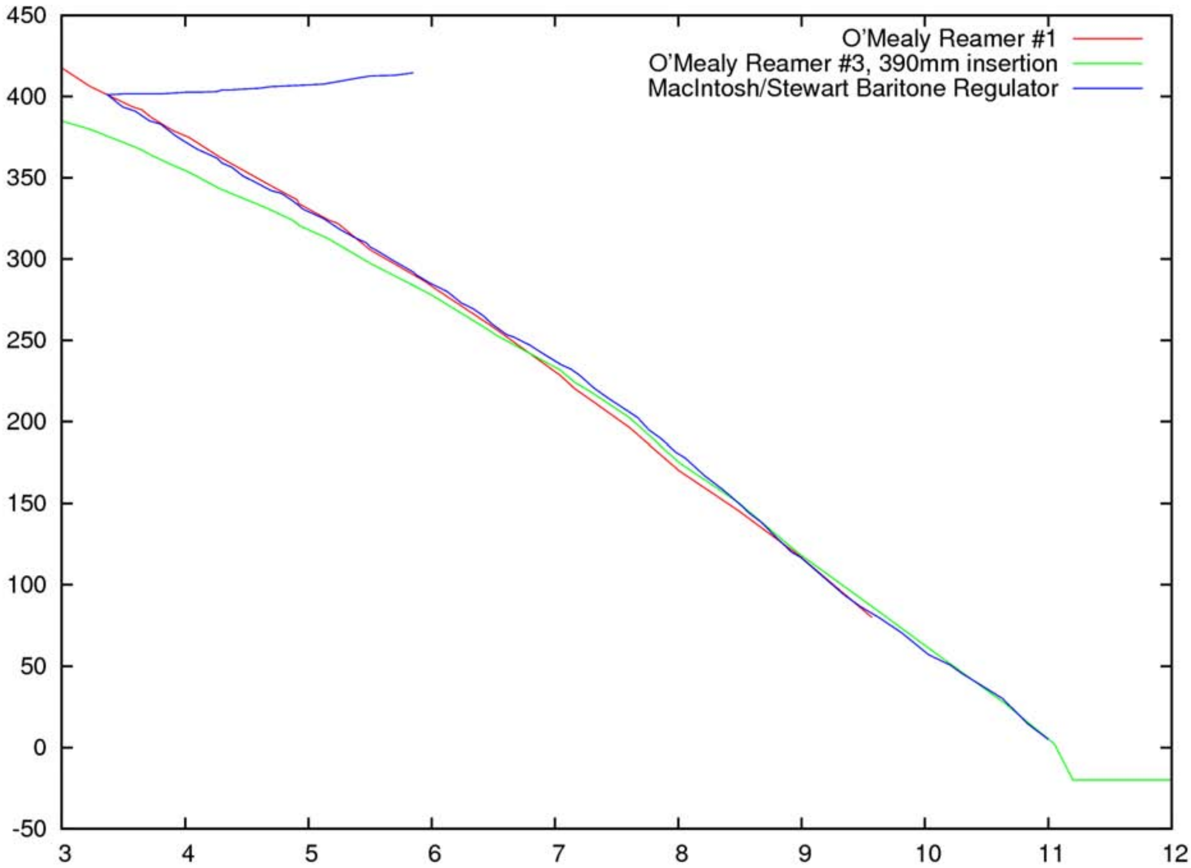

Figure 11: McIntosh baritone regulator bore with O'Mealy reamers

A comparison with the McIntosh/Stewart baritone regulator shows that the lower bore is an excellent match for the D reamer/polishing reamer set (it matches the polishing reamer most closely, as one might expect). However it is clear that the polishing reamer alone could not have formed the baritone regulator bore. The flat reamer with affixed 'T' handle, detailed above, provides the missing piece; it is an excellent match for the upper bore of this regulator and it seems quite plausible, even likely, that this regulator was reamed using these three tools.

The McIntosh/Stewart chanter's bore, though broadly similar to the baritone regulator, displays several significant differences of a type that are unlikely to have been made with the same tool. In fact, the lower bores are consistent with one another, if one allows for the possibility that an additional “foot” reamer was used to form the very bottom of the chanter's bore. The upper bore is, however not consistent with the T handled reamer's cutting profile.

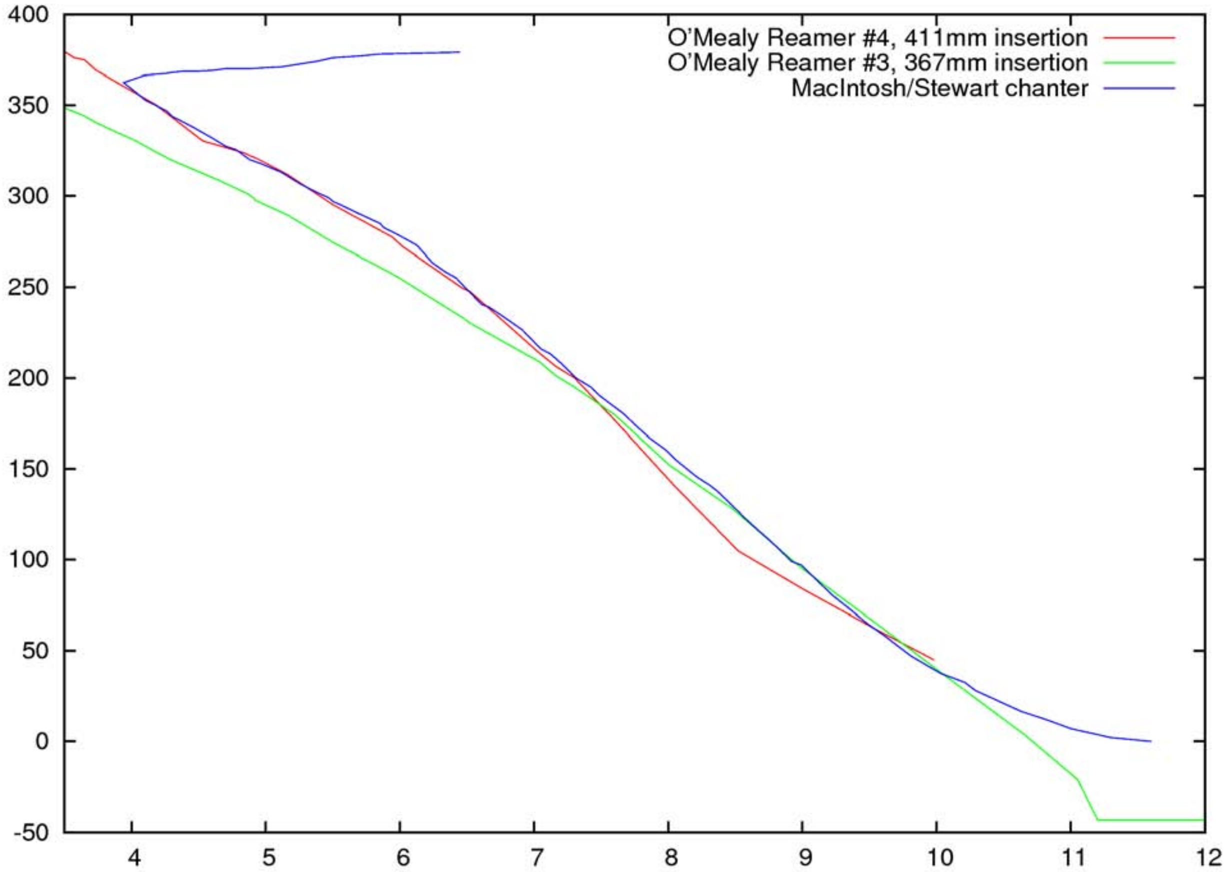

Figure 12: McIntosh/Stewart chanter bore with O'Mealy reamers

Gratifyingly, comparison with the smaller of the NPU collection reamers which bears the O'Mealy hallmarks solves the mystery; the upper bore of the McIntosh/Stewart chanter matches “O'Mealy Reamer #4” quite plausibly. With the inclusion of a supposed foot reamer, we can reasonably reconstruct the entire reamer plans for these two bores[6].

The McCullough chanter

One unusual item among R. L. O'Mealy's output is a chanter stamped “McCullough, Belfast”, which tradition has it was made by O'Mealy for the McCullough Music Shop. The O'Mealy “Box” kept by Seán Reid and passed to Wilbert Garvin, and *Na Píobairí Uilleann* in turn, contains correspondence between R, L and McCullough, the shop's proprietor, requesting that Mr. O'Mealy make practice sets for sale in the shop.

While it was reasonable to believe that the chanter stamped “McCullough” was made by O'Mealy, until it was measured recently there was no solid proof of the attribution – after all, McCullough could have sold instruments by other makers at some point in the shop's history, under a similar arrangement.

The McCullough chanter is a short, presumably “concert pitch”, chanter, turned with modest mounts but with keyblocks. Its toneholes are unusually small, and the throat measures approximately 4 mm (i.e. 5/32”).

6 The actual gauge plate measurements for the reamers, as well as the detailed results of the reamer trials, are supplied with this article as accompanying files, in directory http://seanreidsociety.org/SRSJ3/3.24/

Figure 13: McCullough chanter

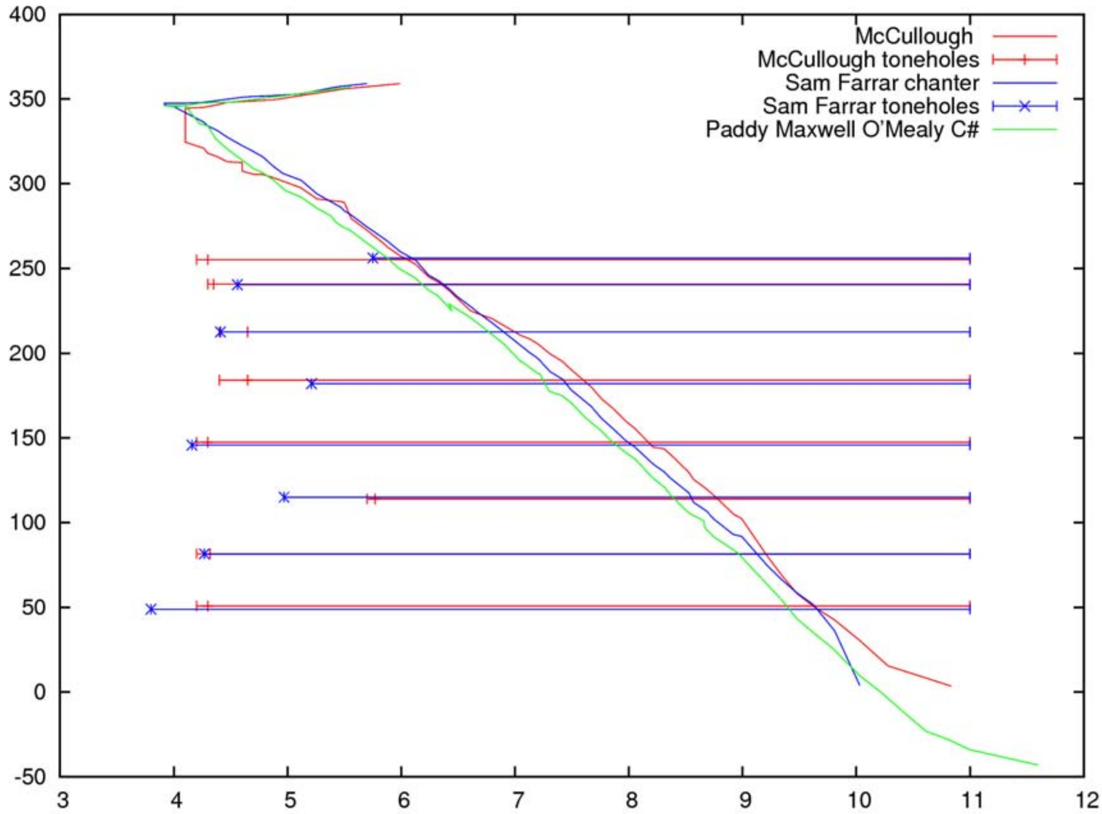

Figure 14: McCullough chanter compared with Farrar D and typical O'Mealy C# bore

The similarities between this chanter and one of the two Farrar chanters is remarkable, particularly with respect to the placement of the toneholes (see figure 14). This alone suggests that either the two chanters were made by the same hand, or that one is a copy of the other – both of which hypotheses point to O'Mealy as the maker of the "McCullough" chanter. The bore of the Paddy Maxwell O'Mealy chanter is also shown here, aligned as are the two other chanters, at the reed seat. Comparison between these bores – allowing for differences in reaming depth - strongly suggests that this Farrar chanter (the one currently being played with the Farrar Kenna set) was in fact made by O'Mealy,

A comparison between the McCullough bore and two O'Mealy reamer profiles is shown in figure 15 below. From this plot one may conclude that it is a good candidate for having been formed by the application of the D reamer (#2) followed by the "polishing" reamer (#3), or possibly with the D reamer (#2) alone. The long, parallel throat section presumably was part of the initial step-boring, as it does not exhibit any measurable taper. There appear to be ridges or shoulders in the upper bore which may be artefacts of the step-boring process. There are also some discrepancies between the observed bore and the measured reamer profiles. One possible explanation, other than errors or inaccuracies in the measurements themselves, is that the D reamer was once larger than it is now, and its dimensions altered either by intention or accident when the edges were "relieved" with a file. The D reamer does show evidence of such treatment after being ground or milled from its initially round cross-section. It is also possible that the timber was reamed under pressure, and that it thus reacted unevenly to the paring action of the tool edges – it is possible to ream undersize in spots if the wood is thin enough for its elasticity to come into play. An obvious possibility is uneven timber shrinkage, which further analysis of our collected data may help detect.

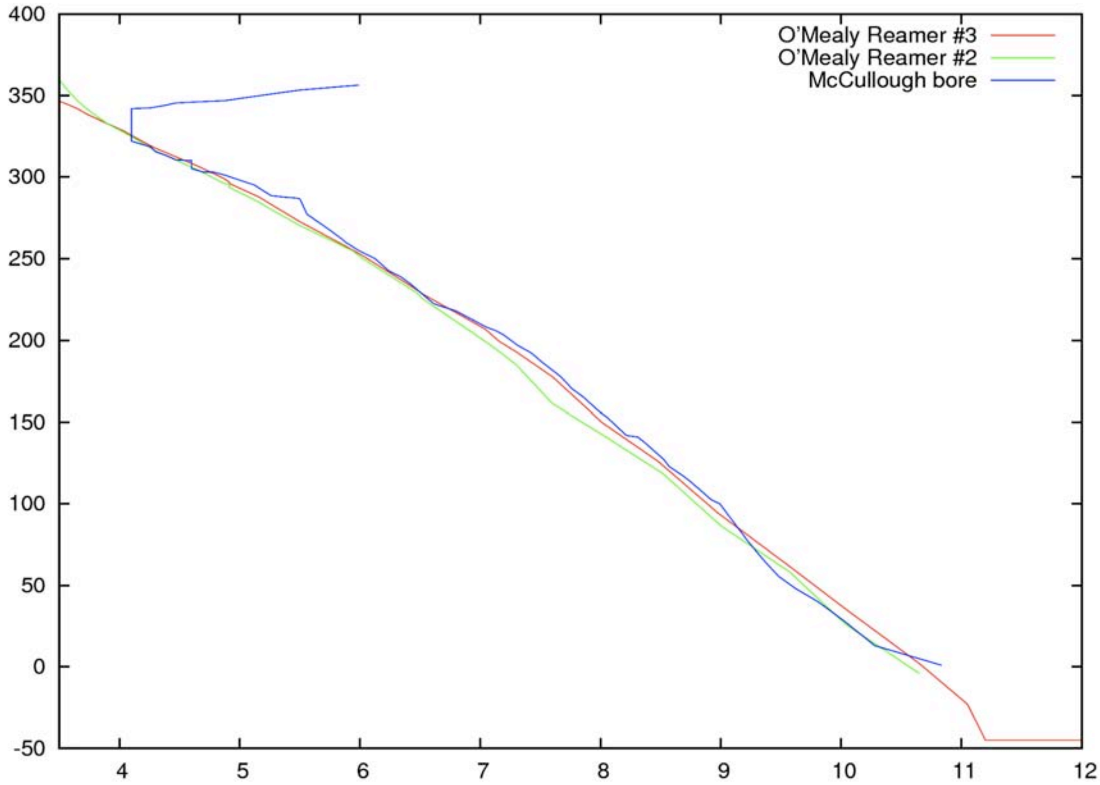

Figure 15: McCullough reamer comparison

While this chanter is reportedly quite difficult to reed (the author has not tried it himself), comparison with the Farrar "Kenna" suggests that it may merit further investigation – one certainly would not expect this chanter to respond to a normal concert pitch approach to reeding, but it may be more tractable with a reed such as would suit to a James Kenna instrument.

Chanters associated with the Farrar Kenna

Finally, having presented one of the Farrar chanters, it is very interesting to compare the two chanters associated with the Farrar Kenna, with one another. It is plausible and in the past has been assumed that one of the two chanters is the original Kenna. In comparing the two, one may see that while the upper bores are similar in form, the rest of the bores bores differ substantially; the mid-bore and lower-bore slopes differ greatly. However, the two chanters are the same length to within our measuring precision (0.5 mm) and the tonehole positions are remarkably similar. The relatively larger upper bore in the O'Mealy instrument may explains the relatively smaller tonehole sizes in the bottom hand; however the second chanter ('Farrar #2') also shows a great deal of wear as well as scalloping, and it cannot be assumed that its toneholes are unaltered – the lower toneholes may have been similar in size to the upper hand, as one would expect from James Kenna.

It is tempting to imagine that R. L. O'Mealy made one of these chanters ('Farrar #1') as an early attempt to copy a Kenna original ('Farrar #2') on which he learned to play. If this is indeed so, the comparison of reamers #2 and #3 strongly suggests that later in his career he was able to measure bores and fabricate reamers to higher precision. Figure 16 shows the two Farrar chanters and their toneholes. The James Kenna chanter data as published in Volume I of this Journal[7] is also plotted for comparison, and is broadly similar to "Farrar #2" in bore, tonehole size (with exceptions), and tonehole position.

We are indebted to Robbie Hughes for permission to examine and measure the "McCullough" chanter, and to Jonathan Farrar for permission to measure the Farrar set.

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7 Ken McLeod, "An early set of Irish pipes, c. 1780", 1.01 *Seán Reid Society Journal Volume I, 1999.*

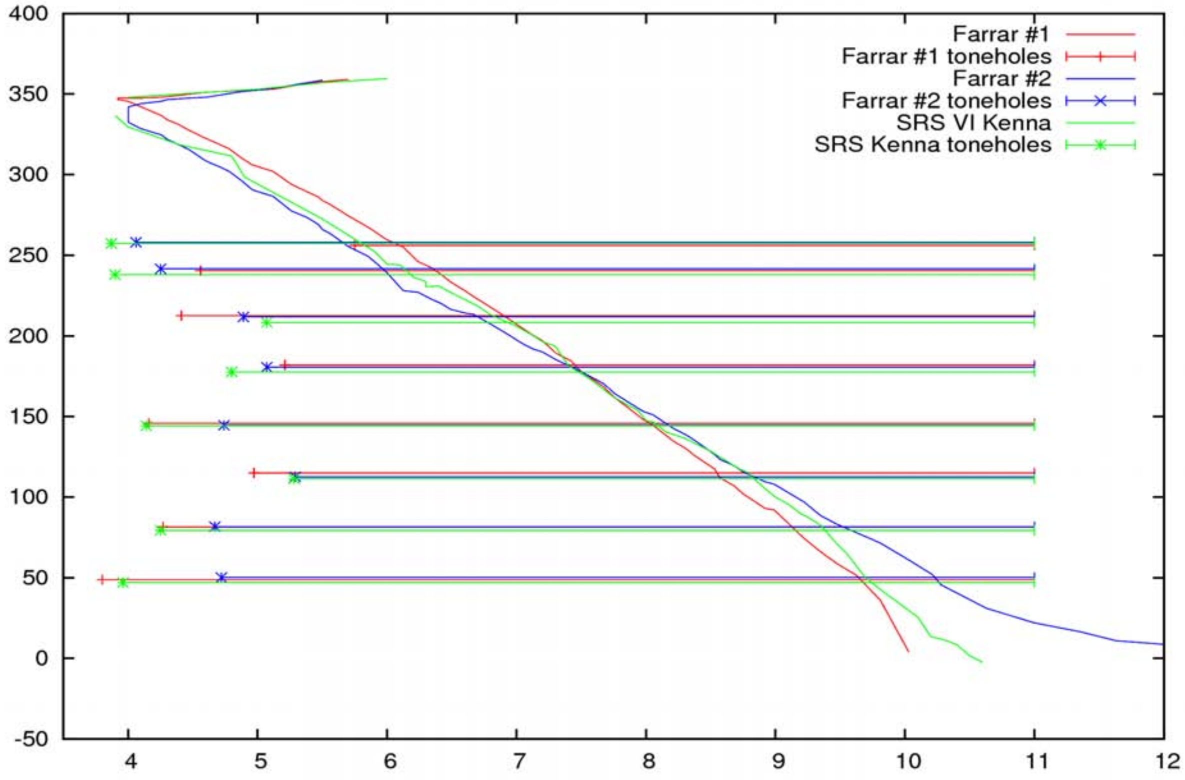

Figure 16: Farrar chanter comparison

The Paddy Maxwell chanter

The Paddy Maxwell chanter bore exhibits differences from the McIntosh/Stewart chanter such that it apparently was not made with the same reamer formula. However, its bore is curiously similar to the profile of the T-handled flat reamer ("O'Mealy reamer #1"), and it is plausible that the bore profile was formed entirely with that reamer. The Paddy Maxwell bore is plotted along with Reamer #1 in Figure 17. Note that the reamer corresponds quite well with the bore, although one must postulate the existence of a foot reamer as with the McIntosh/Stewart chanter bore.

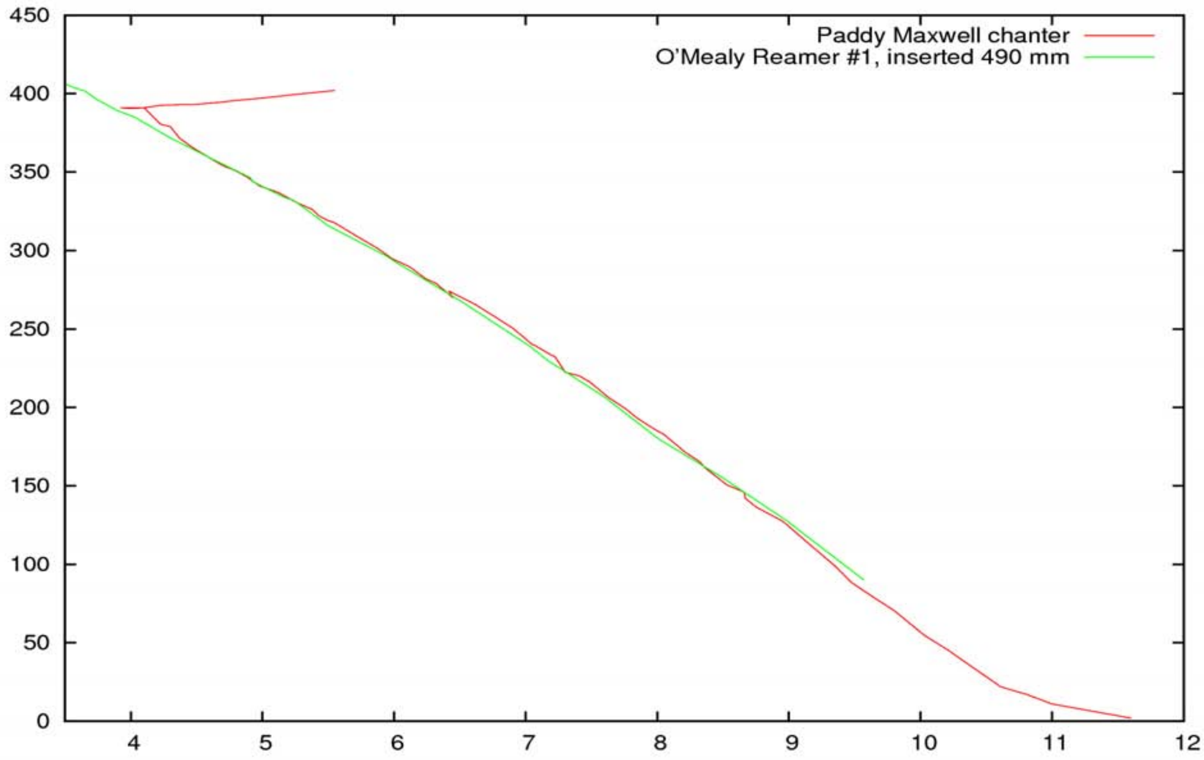

Figure 17: Paddy Maxwell bore compared with O'Mealy reamer #1

Summary and Conclusions

Three reamers firmly attributed to R. L. O'Mealy were measured, and on the basis of visual examination two more reamers were identified which bear features consistent with the first three. These newly re-identified O'Mealy reamers were also measured. Three distinct types of reamers were noted; two reamers of distinct type (D section and pentagonal-prism) appear to have formed a matched set which were intended to be used in sequence.

The first three reamers, having retained useful cutting edges, were judiciously used to finish-ream two bores, and the results confirm that the measured diameters of the reamers are an excellent approximation of the bore which they create.

The reamer profiles were then compared with known O'Mealy bores, and an additional bore attributed to O'Mealy (but not so stamped). It is shown that selected bores of O'Mealy instruments can plausibly have been formed, wholly or in part, using the reamers under investigation. Thus it is reasonable to conclude that we have identified, perhaps for the first time, specific pipemaking tools, and to some extent their method of application, used in the creation of specific historic Union pipes.

It has long been believed that classic pipe-makers of the past used multiple reamers to form the bores of instruments[8], even in cases where it would be practical to fabricate full-length tools. We now have clear evidence that R. L. O'Mealy practiced this technique, in specific instances at least.

Acknowledgements

Special thanks are due to Wilbert Garvin for making the reamers available and to Wilbert and Ken McLeod for suggesting the experiments; thanks also go to Terry Moylan and NPU for facilitating the measurement of the reamers from the Seán Reid collection.

I am especially grateful to Trevor Stewart, Jonathan Farrar, Robbie Hughes, and the other custodians of O'Mealy instruments which were measured for this study, and for permission to publish those measurements.

Thanks also go to Conor Roche Lancaster who helped measure and tabulate the reamer test results.

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8 For instance see Geoff Wooff, “Chanter design and construction of the classic makers”, 2.04, *Seán Reid Society Journal Volume II, 2002.*