THE STRIKING OF PROOF AND PATTERN COINS IN THE EIGHTEENTH CENTURY

G. P. DYER AND P. P. GASPAR

This paper records the results of a study of proof, pattern, and currency pieces of the early milled period and of an examination of the surviving tools and dies from that period held by the Royal Mint. These two lines of inquiry began separately, but as the work progressed their inter-relationship became clear and the two finally merged, enabling us not only to formulate objective criteria for the identification of proof strikings but also to postulate a method of production for proof and pattern pieces different from that employed for ordinary coins.

In this period proof and pattern coins are, of course, very often readily distinguishable from their currency counterparts. Patterns by definition present few problems of identification, while on proofs the details of the design are normally more sharply defined and the field is generally superior as a result of the more careful polishing of the surface of the dies. Moreover, in the case of proofs of gold and silver coins, the edge is likely to be plain instead of grained or lettered. Closer examination, however, shows that these visible differences on patterns and proofs can be supplemented by others, less obvious perhaps but arguably more significant for the light they throw on the method of production.

The most important of these additional differences relates to the lettering. Attention has often been drawn to the fact that on currency pieces letters with uprights have bases that are frequently fishtailed or bifurcated, and indeed this type of lettering is regarded as one of the most characteristic features of the eighteenth-century coinage. By contrast, on proofs and patterns the letter bases are usually square and unindented and seldom show the exaggerated serifs associated with currency pieces. This same firmness of outline is present also in the beading around the rim, for on proofs and patterns the beads are normally well defined and complete, whereas on currency pieces they are elongated and tend to disappear off the edge of the coin. The differences are well illustrated by a pair of George II crowns of 1746 in the Royal Mint collection (Pl. V, 1). This example has been carefully selected to illustrate the distinction, and it would be as well to emphasize that there is not a hard and fast rule, for fishtailed letters can sometimes be seen on proofs and square letters on currency pieces. The tendency, however, is undeniable.

Another consistent feature of these early patterns and proofs is the evidence they bear of having received more than one blow from the dies. This normally shows itself in a partial doubling of the letters, but on occasion the displacement is much greater, as on a proof guinea of 1729 (Pl. V, 2). Doubling of busts and shields can also occur and, somewhat strangely, the doubling may be present on only one side of the coin. It is

1 W. J. Hocking, JVC, 4th ser. ix (1908), 97.
easiest to see where a coin has been allowed to tone naturally, since the squashed letters from the previous blows have a tendency to tone less quickly and therefore show up as bright areas.

To the square letter bases and the doubling can be added a cross-section that may frequently be wedge-shaped, a feature that is often accentuated by vertical burrs thrown up in striking. A very sharp burr may be seen, for example, on a Una and the Lion five-pound piece in the British Museum, and the authors have recently examined an 1831 twopence on which the burr on the obverse is so sharp and prominent that it can only be described as grotesque. These are nineteenth-century examples, and it should perhaps be stressed that the reference in the title of the paper to the eighteenth century is merely a convenient shorthand. The period to which these comments relate begins with the milled coinage and some of the features which have been observed are still apparent as late as the middle of the nineteenth century.

The edges of proof and pattern coins often appear roughly filed, and in addition occasionally show a single step or raised witness line at some point around the circumference. The step is clearly shown on a pattern farthing of Queen Anne (Pl. V, 3), where it forms a distinct and irregular ledge. By the late eighteenth century the step is no longer seen but has been replaced by a regular raised witness line, as on a proof Irish halfpenny of 1775 (Pl. V, 4). Finally, late eighteenth-century proofs usually have an upright die-axis and show a disregard for standard weight and fineness; they are generally made of fine gold or silver and their weights may vary substantially from standard and, for coins of the same denomination and date, from each other.

It seemed that many of these differences could not be explained merely by more careful treatment or by heavier pressure in striking. On the contrary, the differences appeared to be related to each other and to reflect a fundamental difference in the method of striking. For this reason attention was increasingly focused on the surviving dies and the surviving mint records.

The Royal Mint has a collection of over 10,000 obsolete master tools and dies, and although nineteenth- and twentieth-century material makes up the greater part of the collection there are some 600 or so items from the early milled period. Of these items more than half are punches, the remainder being matrices and dies. They were catalogued by an unknown hand about 1840\(^2\) and were recatalogued and published by W. J. Hocking in 1910 as part of Volume II of his *Royal Mint Museum Catalogue*.\(^3\)

In checking the tools against Hocking's catalogue, an immediate difficulty was encountered. This concerned a group of about twenty items with lettering and designs complete which Hocking had described as matrices,\(^4\) that is to say, the tools used to raise punches which in turn were used to sink dies. These tools do indeed resemble modern matrices by having gently tapering sides instead of a neck. Hocking assumed that they could not be dies, which by his time always had a neck in order to permit the use of a collar, and he was probably encouraged in this view by the presence in the collection of about seventy contemporary dies which do have necks. Thus he might

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\(^2\) Anonymous manuscript catalogue of the die collection of the Royal Mint (c.1840) in the Royal Mint Library, 1,328 entries, 100 pp.


well have believed that dies with necks were normal while the much smaller number of items without necks served the more exotic purpose of raising punches.

The identification of these items as matrices, however, raises impossible difficulties, because without exception all are beaded and lettered and no details of the designs are omitted. Hocking would have us believe, for example, that the quarter-guinea reverse tool of 1718 (Pl. VI, 5), complete in all its details, is a matrix from which punches were made. If Hocking were right, this would mean that on all dies the position of the inscription in relation to the design would be consistent, but study of early milled coins indicates that there is no such consistency, that it is in fact the variation in the positioning of the inscription that is far and away the easiest means of distinguishing individual dies. Moreover, among the large number of punches that survive from this period none exists with beading and lettering, and on most of the reverse tools certain details of the design in addition to the inscription have been omitted and left for the engraver to add by hand to each individual die. Thus the quarter-guinea reverse punch (Pl. VI, 6) is incomplete in all these ways and it is not easy to see how it could have been made from the complete and finished tool shown in Pl. VI, 5. If anything, the opposite is true, for the other tool must surely be a die sunk from such a punch and then completed by hand.

To be more specific, two of Hocking’s so-called matrices are for the obverse and reverse of the Cromwell Crown of 1658.5 The obverse carries across the base of the effigy the same crack that is so evident on the coins and it is well known that the surviving coins show the development of this crack across the effigy. Now if this tool were a matrix, one would have to suppose either that a series of punches was raised from a progressively cracking matrix or that there was a series of matrices which all cracked in the same place but to varying extents. Either supposition is frankly absurd, and it is evident that the tool is the actual die that struck the coins. This conclusion persuaded us that all twenty or so items in this category were probably dies but caution dictated that independent means should be sought for confirmation.

Fortunately, die records survive and indeed for the eighteenth century they are surprisingly complete.6 Under the terms of the Mint Indentures the engravers were expected at intervals to produce for inspection all the coinage tools in their possession. The numbers were then checked and worn-out or defective tools were defaced, while those fit for further use were left good and returned to the engravers. There is an isolated account of 1685 and then very nearly a complete set of returns for the whole of the eighteenth century and until 1812. The returns were made at irregular intervals, with sometimes a gap of only a few months between returns and sometimes as long as six or seven years. By comparing each return with its predecessor it becomes possible to work out for each denomination how many matrices, punches, and dies were sunk in the interval between the two returns. Even better, for the thirty years between 1743 and 1773 the accounts record the actual dates on which the new matrices, punches, and dies were sunk.

These returns, which Hocking appears to have neglected, provide indirect but convincing evidence that the disputed items are dies. They show that on six occasions during the eighteenth century punches and dies, instead of being destroyed, were

5 Hocking, 1910, nos. 18 and 19. 6 PRO MINT 14/8-14/13.
withdrawn from the engravers' stock and issued to the Warden of the Mint or to the Mint Office:

in 1702 46 punches were issued to the Warden
in 1717 48 punches were issued to the Warden
in 1724 28 punches were issued to the Warden
in 1744 34 punches were issued to the Warden
in 1746 1 punch was issued to the Warden, and
in 1768 33 dies were issued to the Mint Office.

It soon became clear that the 1717 withdrawal of forty-eight punches corresponds with the present holding of Queen Anne tools, the 1724 withdrawal with the holding of George I tools, and the 1744 withdrawal with the Young Head tools of George II. If the disputed items are assumed to be dies, and if obsolete items remaining in the engravers' stock in 1812 are included, then all but a handful of tools now surviving in the mint collection for the period from 1702 to 1800 can be accounted for.

The two-guinea and half-crown tools illustrate this particularly well:

### TWO GUINEAS

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<th>Dies</th>
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<td>Obverse</td>
<td>Reverse</td>
<td>Obverse</td>
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<tr>
<td>Issued to Warden, 1717</td>
<td>—</td>
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<tr>
<td>Issued to Warden, 1724</td>
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<td>Issued to Warden, 1744</td>
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<td>—</td>
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<tr>
<td>Issued to Mint Office, 1768</td>
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<td>1</td>
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<tr>
<td>Total</td>
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Current holding of 1702-1800 tools 1 1 5 5 3 1

### HALF-CROWN

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<tbody>
<tr>
<td>Obverse</td>
<td>Reverse</td>
<td>Obverse</td>
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<tr>
<td>Issued to Warden, 1717</td>
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<td>Issued to Warden, 1724</td>
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<tr>
<td>Issued to Warden, 1744</td>
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<td>—</td>
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<tr>
<td>Issued to Mint Office, 1768</td>
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<tr>
<td>Left good, 1812</td>
<td>—</td>
<td>2</td>
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<tr>
<td>Total</td>
<td>—</td>
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Current holding of 1702-1800 tools — 2 4 5 2 1

This convincing reconciliation can be repeated for the other denominations, although it must be stated that adjustments to Hocking's descriptions were necessary since some of the reverse tools had understandably been assigned to the wrong reign while certain others had been incorrectly identified.

The correlation between the entries in the die records and the present holdings of the mint collection is undoubtedly of great significance. It throws light on the structure of the collection, on its purpose and its development, and enables the surviving tools to be
seen for the first time in their proper context. Much of this will be discussed on other occasions, and for the moment we are concerned only with the relevance of the correlation to the twenty fully lettered items which Hocking had described in 1910 as matrices. Its importance here is that it provides a contemporary description of many of the disputed items since it can be demonstrated that they must have come into the collection as part of the group of thirty-three dies issued to the Mint Office in 1768. They are therefore dies and further reassurance came with the discovery that the catalogue of the collection prepared about 1840 also describes them as dies.

The reattribution of these tools raises a fresh question. If both groups are dies, it needs to be explained why in the same period some dies have necks while other, contemporary, dies do not. That an explanation should exist seems almost inevitable from the evidence of the die records, which suggest very clearly that the die-makers were hard-headed men whose approach was essentially practical. They were hardly likely to indulge in an extra process, the turning of the neck, without good reason and the more so since they would no doubt have realized that the junction of the neck with the body of the die becomes a point of weakness.

In answering this question the mint records again proved helpful. In an account for the year ending 5 January 1764, Reuben Fletcher, the Mint Smith, charged ten shillings for a 'pair of shouldered half guinea dies for pattern pieces' and the following year the same amount for 'a new pair [of] shouldered dies for shilling proof pieces' and 24s. for 'four pairs [of] shoulder dies for proof pieces for small money'. The term 'shouldered die' appears to describe well enough a die with a neck, and the implication is obvious that dies with necks were specially prepared for the striking of proof and pattern coins. This was quickly confirmed, for it was soon possible to locate proof and pattern pieces which had been struck from about twenty of the surviving shouldered dies. For example, the cracks in the shield on the reverse die for the quarter-guinea proof of 1764 appear on a coin in the mint collection (Pl. VI, 7, 8). As proof pieces are listed in the catalogues for the date and denomination of nearly all the shouldered dies, there seems little doubt that, when a greater number of proof and pattern pieces have been examined, many more of the surviving shouldered dies will be matched with coins struck from them.

The realization that shouldered dies were used for proof and pattern pieces and tapered dies for currency pieces suggested the need to consider seriously whether important differences in production techniques were implied by the presence of a neck.

Attention has already been drawn to the observation that letters on proof and pattern pieces tend to have uprights with square bases, while the same letters on currency pieces tend to be fishtailed. On the dies themselves, whether shouldered or tapered, the letters always have square bases so that the presence of fishtails pointed to some difference in the way in which the two types of dies were used. The presence of a neck suggests the use of a collar to hold the blank in place at the moment of striking by the dies, while the gently tapering sides of the currency dies make it just as certain that a collar could not be used. And when a collar is not present there is nothing to restrict the outward flow of metal when the blank is squashed between the dies with the result that metal flows away from the bases of the letters. Those with vertical uprights

7 PRO MINT 1/2.
are distorted most as the upright tends to act as a channel and therefore encourages the flow of metal, leaving a hollow which gives the letter a fishtailed appearance. Even curves are affected as metal is pulled away and the beads, too, are dragged outwards and lose their shape. A collar not only restricts this outward flow but also produces a flow back towards the centre, allowing the metal to take up the exact shape of the design details on the die and minimizing the distortions produced by uncontrolled metal flow.

This observation that the fishtailed lettering and fugitive beading so typical of early milled coins might be no more than an accidental consequence of the striking process arising from the absence of a collar is not new, but it seemed right to subject it to practical confirmation. An experiment was accordingly arranged by the Royal Mint involving the use of a pair of modern dies on which the letters had uprights with square bases. When coins were struck from these dies in a collar the bases remained square, but when the dies were used without a collar the lettering at once developed fishtails and other distortions. The detailed results of these experiments will, it is hoped, be published in due course, but briefly stated they appear to show that fishtailing occurs regardless of the metal used, the thickness of the blank, or the force of the blow.

Further confirmation of the restraining influence of the collar may be seen on misstruck pieces. It sometimes happens, for instance, that at the moment of striking a blank may rest on top of the collar rather than within it, and the result is the presence of fishtails and fugitive beading on the struck piece (Pl. VII, 9). Alternatively, if a blank is undersize the collar will not fulfil its normal restraining function and fishtailed lettering will again result. This can happen when a blank intended for another coin is unintentionally mixed with larger blanks (Pl. VII, 10) but will also occur where a small segment is missing from the circumference of the blank (Pl. VII, 11). In other words, the blank has to make full contact with the collar if fishtails are to be prevented.

That a collar of some kind was present when eighteenth-century proof and pattern pieces were struck therefore seems virtually certain. This would rule out use of an ordinary coining press in which the upper die was attached to the descending screw since it is doubtful if the movement of the screw could have been controlled accurately enough to allow descent of the upper die into a collar without frequent smashing of the die against the collar. Rather, it points to the use of a different technique and, again, the accounts of Reuben Fletcher, the Mint Smith, provide the vital clue. His accounts for 1763, in addition to recording the manufacture of shouldered dies, include the following entry for work carried out in the die-press room of Tanner, the Chief Engraver: 'To a man eight days assisting at the press in striking patterns, sinking dies, etc.'

Fletcher's account refers to the die-press room and therefore points clearly to the use of a die-sinking press to strike proof and pattern pieces. Until recently the Royal Mint in fact used such a press to strike medals, and it was a consideration of recent medal-making techniques which suggested that in the seventeenth and eighteenth centuries proof and pattern coins might have been struck on a screw press in much the same way as modern medals. This technique involves a loose assembly of dies and collar (Fig. 1). The lower die is placed on a block on the press table, a collar is fitted around its neck,
an early proof and pattern coin to be removed, annealed or softened if necessary, and then carefully repositioned between the dies to receive another blow from the ram. Even though the use of loose dies permits the locking by hand of the dies and the partially struck coin, perfect registration of blows may not always be achieved and it is this that explains the doubling of letters and design elements that is often observed on early proofs and patterns. Also explained is the seemingly curious feature of doubling sometimes being observed on one side only of a proof piece since in these cases just one of the dies would have been out of register when a subsequent blow was received from the ram.

If this reconstruction of the striking techniques is correct, another feature of proof and pattern coins which reference was made at the beginning of this paper can be explained, namely their wedge-shaped cross-section. This would occur if the descending ram, either because it failed to descend accurately or because the dies had not been centrally located, or because the bottoms of the dies were not level, caught the assembly of dies, collar, and blank a glancing or uneven blow. That this could have happened on eighteenth-century presses seems unquestionable since even now precautions have to
be taken with modern dies and presses to prevent the production of wedge-shaped medals. Thus it is still occasionally the practice of the Royal Mint to ensure a uniform thickness by turning the assembly $180^\circ$ and repeating the blow.

It will be noticed that this method of production requires the presence of a collar. Some kind of collar, which may fit only loosely as in modern medal-making practice, must be employed to prevent extreme sideways motion of the dies upon impact of the screw. The necks of the shouldered dies would therefore appear to have been necessary so that a collar could be used to hold the loose upper die over the blank and the lower die. This collar, as we have seen, would have the effect of producing square letter bases and well-defined beads, but it must be emphasized that however desirable these features might be in themselves they do not supply the reason for the presence of the collar. On the contrary, the collar was employed solely to hold the dies and the blank together, so that square letter bases on proof pieces like fishtailed bases on their currency counterparts are merely an accidental consequence of the striking process.

The loose collar explains also the presence on proof and pattern pieces of fins and burrs. A perfect fit of collar and dies would be difficult to achieve (some early shouldered dies are nearly oval in shape), and fins and burrs would be formed by the metal forcing itself into gaps between the collar and the dies. But what the loose collar does not seem to explain is the single step or witness line found on the edge of many plain-edged proofs and patterns. As has been illustrated (Pl. V, 3, 4), both step and line can be prominent features, and if on occasion they appear not to be present it may be that they have simply been obscured by filing. Both step and line appear to stem from a common cause, but what has produced them is by no means obvious. That there is only a single step or line rules out the use of a modern-style split collar consisting of three separate segments, since there would then have to be three lines instead of one. Also ruled out is a parallel-bar edge-marking machine of the type available at that time for giving blanks lettered or grained edges since there would then have to be a second step or line at $180^\circ$ from the first.

The device that was most probably employed is a steel band of the type described by Ansell.\(^\text{10}\) In his discussion of the Petition Crown Ansell takes up the suggestion of a colleague that the edge inscription was engraved on a band of steel something like a watch spring (Pl. VIII, 12). This band was then coiled round the inside of a plain collar. After striking, the band and the coin were knocked out from the collar, whereupon the band sprang free from the coin. This would leave a single witness line, produced where the ends of the band either meet or overlap.

This may make sense for a special coin like the Petition Crown but it does seem somewhat complicated for plain-edged proofs, especially at a time when roughly scored edges were apparently acceptable. The use of such a band is quite unknown to the modern generation of mint officers, but in its favour from a practical point of view is its usefulness as an aid in the ejection of the coin from the collar. Arguably, indeed, it would have been essential in the case of the 1787 proofs, for some have a noticeably channelled edge, and without a band the horizontal burrs would have trapped the coin in the collar. The horizontal burrs themselves can be explained if the band were not quite as wide as the thickness of the blank, while the slight fluctuation in the position

of the line on die duplicates can be explained by the need to reset the band for each new coin.

There is, too, something else which has helped to overcome initial scepticism about the use of a band. At first sight two pattern farthings\(^{11}\) of Queen Anne in the mint collection seemed to be a mass of irregular file marks but a comparison of the two pieces showed that the marks match each other perfectly all the way round the edge (Pl. VIII, 13). This test has since been successfully repeated on proof two-guinea pieces of 1733, on silver proofs of George II, and on three pattern halfpennies of Queen Anne,\(^{12}\) struck from the same obverse die but from three different reverse dies. It is clear that there is no such thing as a plain edge on proof and pattern coins, that beneath their plainness they are likely to bear distinctive arrangements of scratches and marks that may be common to pieces that are die duplicates. These marks, which in any case are in relief and cannot therefore have been produced directly by a file, could well have been produced by contact with a band.\(^{13}\)

The Royal Mint has again been kind enough to conduct a practical experiment to support this conclusion. The results have still to be carefully considered and analysed but it has been possible by using a band with chamfered ends to produce a witness line of the type seen on late-eighteenth-century proofs. The deep marks, however, remain a problem. Although the thin bands used for the first experiments did tend to crease and score in use, the overlap was marked by two lines instead of one. A rather thicker band succeeded in producing a single line, but on this band the irregular ‘file’ marks had to be induced by hand (Pl. VIII, 14). Nevertheless, the successful reproduction of a single witness line at least shows that the steel-band idea is not as improbable as it seems. The ‘file’ marks may indeed have served, and been intended to serve, a practical purpose by gripping the blank and thus maintaining the position of the band between successive blows of the press.

The idea of the band may even tell us something about the few proofs of this period which have lettered or grained edges. These pieces appear different from their currency counterparts, the lettering for the most part being less coarse and the graining less pronounced. The lettered edges, as on currency pieces, have overlaps or joins at 180°, but the difference in the appearance of the letters and the signs of damage and vertical displacement perhaps point to the use of a different process. Whether this involves a two-piece band, a split collar, or some other means remains to be determined. The grained-edge proofs may be rather easier to explain if only because of an interesting irregularity which appears on the proof shillings and sixpences of 1746. Pl. VIII, 15 shows a proof sixpence of 1746 with a distinct discontinuity in the graining. The same discontinuity appears on other specimens and it occurs in much the same place on them all, that is to say, on die duplicates its position varies as little as does that of the step or line on plain-edged coins. It is therefore tempting to argue that the graining is the result of contact with a grained band wrapped round the inside of a plain collar.

The question of a steel band, though not without interest, is hardly central to the argument and we ought perhaps to return to general principles. The basic idea of a

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\(^{11}\) W. J. Hocking, op. cit. vol. i, Coins and Tokens (1906), nos. 1558 and 1565.

\(^{12}\) Peck, 1964, nos. 723, 725, and 730.

\(^{13}\) A caution must be sounded that the edges of some 'plain-edged' proof and pattern coins, and medals, were filed, and these pieces will show unique patterns of incuse scratches that sometimes obliterate or at least obscure the raised marks.
loose assembly of dies and collar was, as previously stated, suggested by knowledge of modern medal-making processes and therefore a closer look at eighteenth-century medals seemed likely to be instructive. What was found on these medals were all those features which have already been described for proofs and patterns: the square letter bases, the doubling, the wedge-shaped cross-section, the steps, and the witness lines. In addition the dies used to strike the medals were nearly always of the shouldered type associated with proof and pattern coins. The conclusion is therefore inescapable that there is a far closer relationship between proof coins and medals than there is between proofs and the corresponding currency pieces.

On reflection this need not cause surprise. Permission to strike medals was one of the perquisites of the mint engravers until the middle of the nineteenth century. The wish to concentrate this work within their own department would be natural, and use of a diesinking press had the advantage of enabling the medals to be struck without recourse to the moneyers and their coining presses. It is not suggested that the moneyers never struck pattern and proof pieces, but it is reasonable to suppose that patterns and proofs might well generally fall into the same category as medals and be regarded as very much the private preserve of the engravers. Indeed, it is known from the nineteenth-century records that the supply of proof pieces, subject to certain official constraints, was usually handled by the engravers, and in 1787 that the Master of the Mint’s instruction to strike 168 proof sets of the new guineas, half-guineas, shillings, and sixpences was sent direct to Lewis Pingo, the Chief Engraver, and not to the moneyers. If, indeed, the engravers were able to strike proof pieces on their own account there might well be a financial incentive to preserve and use proof dies for as long as possible. This may explain both why more proof dies have survived than normal dies and why the former are often badly cracked and chipped.

This administratively tidy arrangement leads us to associate pieces with indented letter bases with the moneyers and those with square letter bases with the engravers. Stated as baldly as this, it may seem unimportant to the numismatist but the successful separation of moneyers’ and engravers’ pieces, so fully supported as it is by objective criteria, may perhaps throw light on several numismatic problems. It could well be helpful, for instance, in the case of the rare Dorrien and Magens shillings of 1798: strays from the production run halted by the Privy Council would have indented letter bases while square letter bases would indicate a proof made by the engravers, possibly before or after the event. Another example is the Queen Anne farthing of 1714, where we would need to see indented letter bases or fugitive beading before we could be convinced that there are currency pieces. As for official medals, those with fishtailed letters now require explanation: there is, for example, in the British Museum a Coronation Medal of Queen Anne with indented letter bases and it was therefore interesting to find documentary evidence that some of these medals were struck by the moneyers.

There are still a number of grey areas in this account of how proof and pattern coins were struck during the eighteenth century and much work remains to be done. Nevertheless, it is hoped that sufficient progress has been made to indicate the fresh insights that may be gained from an exercise that combines a study of the coins with, on the one hand, an examination of the surviving dies and, on the other, an equally careful

\[14\] PRO MINT 1/14, p. 12.  \[15\] PRO MINT 6/2.
examination of the mint records. It is this three-pronged approach, involving coins, dies, and mint records, which we believe to be the way forward in the study of the early milled coinage.

Acknowledgements

We should like to acknowledge the assistance which we have received from various members of the staff of the Royal Mint. In particular we wish to thank Mr E. M. Phillips, who supervised the two experiments to which we refer, and Mr R. C. Meaden, who provided the illustrations.

The American National Endowment for the Humanities has generously supported research into the die collection of the Royal Mint and its organization. The studies reported in this paper have developed from this research, which is continuing.
Fig. 10.—Fillet and Collar.

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DYER & GASPAR: PROOFS AND PATTERNS