

THE TRIAL OF NICHOLAS BRIOT

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AN attempt had been made by Henry II to introduce machinery to the French mints in 1550, but this was not wholly successful and the Mint staff were able to persuade the authorities to retain, for general use, the old hammer method, just as they did at the Tower under Elizabeth. However, at the start of the next century, fresh initiatives, particularly those of Briot, raised again the possibility of the mechanisation of coin production. A series of tests was ordered to compare the rates of production by Briot's proposed machines and the old manual techniques. A fairly detailed report was prepared and published in 1617. This was subsequently reprinted in F. Mazerolle's magnificent volume *Les Médailleurs Françaises*, (Paris, 1902).

The report is of prime importance on two counts. First, it emphasises the ingenuity of the early artist-engineers, such as Briot, and shows us their first fumbling steps en route to the highly automated procedures characteristic of present-day mints. Secondly, it depicts for us the manner in which, over the centuries, the apparently simple method of hammer striking had evolved its own almost unbelievably complex sequence of operations.

In the following translation of the report I have not attempted to remove the considerable repetitions or syntactical and grammatical infelicities of style, because these contribute to the period flavour and indicate the ways of thought of the reporter, Henry Poullain. On the other hand, I have had to resort on occasion to a modern word or phrase, there being no obvious Jacobean equivalent. In cases of uncertainty or obscurity, the original French has been given in parentheses in the text. I record here my gratitude to my friends, Professor C. H. Cobb, for assistance in dealing with these abstruse idioms, and to Dr C. E. Challis, for editorial advice. Remaining errors are of course my responsibility. For ease of reference the paragraphs have been numbered.

Some of the statements in the text seem to be in error or to be ambiguous. It has therefore been thought appropriate to explain the implications in brief footnotes.

The general tenor of the report is understandably unfavourable to Briot's claims and in spite of support from the king, Louis XIII, Briot eventually decided to put himself under the protection of Charles I; as a result, his machinery played a significant role in Stuart numismatics, while in France the definitive adoption of modern processes was left to Jean Warin.

The narration of M. Henry Poullain, former Councillor of the Court of the Mint, concerning trials on the manufacture of coins by certain new machines, proposed by Nicholas Briot, engraver general to the Mints of France, carried out in the presence of Messieurs de Boissise and de Marillac, Councillors of State.

To My Lord the Chancellor,

§1 In the year 1617, on Monday morning, 23 January, a Mint Council was held at the house of M. de Chasteauneuf, where were the said M. de Chasteauneuf, M. de Pontcarré, M. de Thou, M. de Boissise, M. Arnault, M. de Marillac and M. the President de Chevre.

§2 At this Council I was commanded to be present; and thither (all the gentlemen being gathered) were called the workers and moneyers of the Mint of Paris, accompanied by their provost, of the one party; and Nicholas Briot, Engraver General of the Mints of France, of the other, who proposed, by means of a new

§2 As is made clear later on, the workers were responsible for the preparation of the flans, while the moneyers carried out only the striking. Adding up all the operations which had

to be repeated several times, Briot's estimate of seventeen rather understates the total.

device, operated by a single man, to turn out more blanks in one day, than twenty ordinary workers using the hammer could do; and similarly to coin more pieces in one day than ten hand moneyers could fashion or strike, reducing (by this machine) the seventeen operations which are required in the ordinary production of coins by hammer.

§3 To these statements, the workers and moneyers, accompanied by their provost, replied that they employed no more than seven or eight operations in the working and producing of coins by the hammer, of which they repeated some, to soften, compress and close up the metals. And by them it was further maintained that Briot could not (on the said machine) work or coin all types of money more swiftly than they could by the hammer, for which they offered to prove themselves, in the presence of whomever the gentlemen pleased.

§4 As a result of this quarrel, it was decreed that Briot should run a trial of his said new machine in the presence of the workers and moneyers of the Mint of Paris and, to this effect they were ordered to hand over to him nine marks of silver and three marks of gold for use on the machine. To watch this trial were commissioned M. de Boissise and de Marillac, whom I was directed to accompany.

§5 Following this decree, on Thursday morning, the twenty-sixth of the said month, the workers and moneyers, accompanied as has been said, and the said Briot, after consulting with M. de Marillac as to how, for their own surety, they should deliver to him the nine marks of silver and the three marks of gold, repaired with the said Briot to the house of a smelter, whose name he had given them, living in the street of Five Diamonds, where in their presence he smelted and cast into strips (*lames*), the nine marks of silver and three marks of gold and on this spent from four o'clock in the afternoon to seven o'clock in the evening.

§6 The next morning, the twenty-seventh of the said month, the workers and moneyers, accompanied by their provost, returned to the dwelling of the foundryman to complete the said casting of strips, where they worked from eight o'clock in the morning to after ten.

§7 These strips were cast in sand by the foundryman in the way which Briot told him and made him carry out, 1½ inches wide, 15 inches long and of the thickness of a piece of 20 sols, more or less, according to the quality of the working of each piece. These strips of gold and silver were handed over with their scissel or the remnants of their casting into the hands of the provost of the workers and moneyers, who reweighed them; and it was found that the nine marks of silver were less by one ounce of weight in the melting.

§8 On Monday morning, the thirtieth of the said month of January, the workers and moneyers, accompanied as has been said by their provost, presented themselves at the house of M. de Marillac, 6, rue Quinquempoix, where I also went, M. de Marillac having sent me notice, and soon after came M. de Boissise too.

§9 From the dwelling of the said Sieur de Marillac, having sent to know whether Briot was ready to undertake his trial, M. de Boissise and de Marillac, I accompanying them and the said workers and moneyers following us, betook ourselves at half past eight in the morning to the dwelling of the said Briot, No. 16 in the same street; at the door of which we found him waiting for us. He took us up to a small lofty room, about 2½ fathoms square or thereabouts; where, having entered, I observed four several instruments for the making of money, to wit, three for the working of the flans and one for coining them.

§10 The first of these machines, which served for the working and fabrications of flans, could be called a slicing machine (*instrument à ciseau*). It was a sort of bench grouted (*sellé en plâtre*) into the floor, 2 feet high or thereabouts and 5 or 6 feet long, at the end of which and above was a chisel (*ciseau*), sharply bevelled and thick, and beneath (from what one could guess) was an endless screw (*une viz sans fin*), to the end of which was attached a small ingot of silver cast in sand in the form of an oblong oval. By raising the said chisel, the said screw and ingot were advanced and overhung by a small amount the end of the said bench, and lowering the said chisel on to the said ingot of silver (although it was in the form of an oblong oval), cut little scales or roundels (*rouelles*) of silver, very thin, which still retained the oval shape, but which were so compressed in their height that the breadth of the oval of the said ingot became the height of the oval of the said scale or roundel of silver; several of them, nevertheless, were twisted in the cutting and others were not cut completely from the height of the said ingot; those which were twisted and not cleanly cut remaining useless for coining.

§4 At this time the mark was taken as 8 ounces and the modern equivalent is approximately 245 grammes.

§7 In line with the system current until recently in Britain, the denominations were

1 livre (or franc) = 20 sols

1 sol = 12 deniers

The thickness of 20 sol pieces at this time was somewhat variable but at least they were thicker than the 10 sol pieces which were to form part of Briot's trial striking.

§9 The fathom (*toise*) is conventionally 6 feet.

§10 Insufficient details are given to enable us to gain a very clear idea of the operation of this machine. Probably a ratchet actuated the concealed screw that moved the ingot forward after each cut. A possible reconstruction is shown in fig. 1.

The description of the action of the chisel in sometimes producing acceptable oval blanks and at others, crumpled shavings, is very convincing. The forces involved would distort the off-cut in the manner shown in fig. 2.

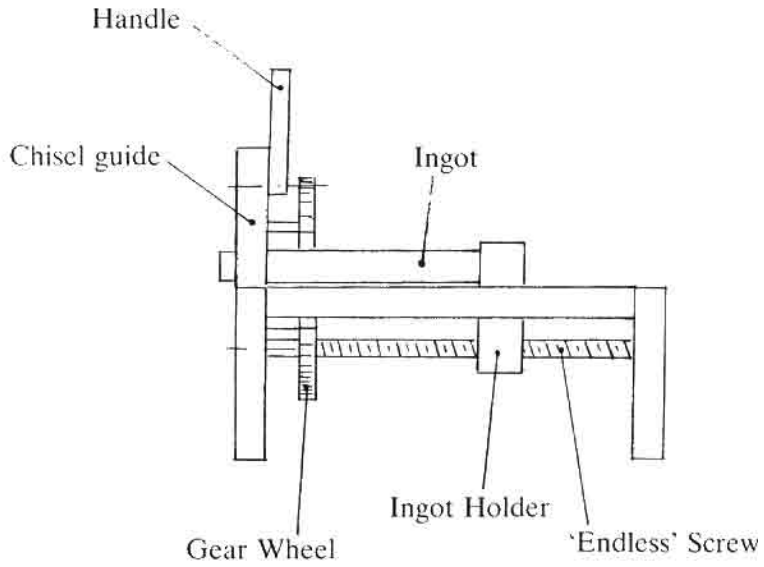


FIG. 1a. Slicing Machine

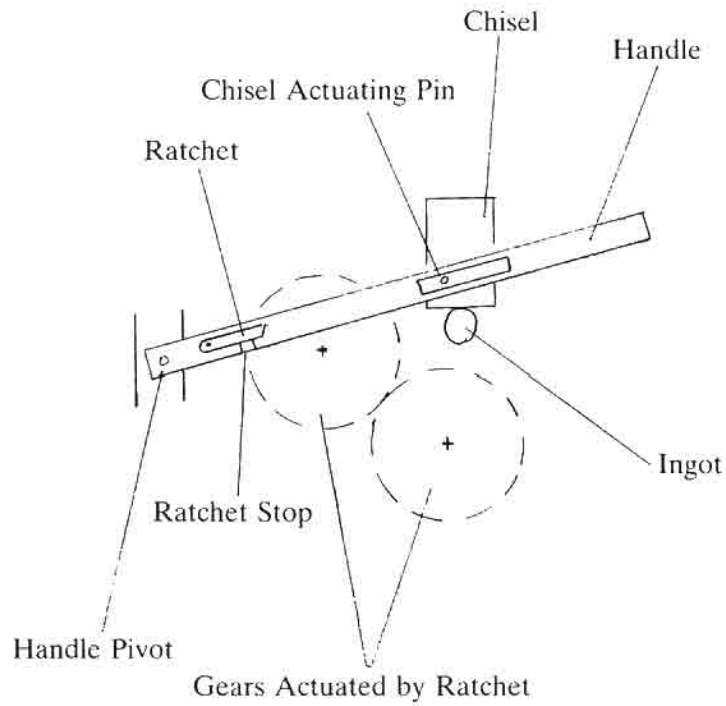


FIG. 1b. Operation of Slicing Machine

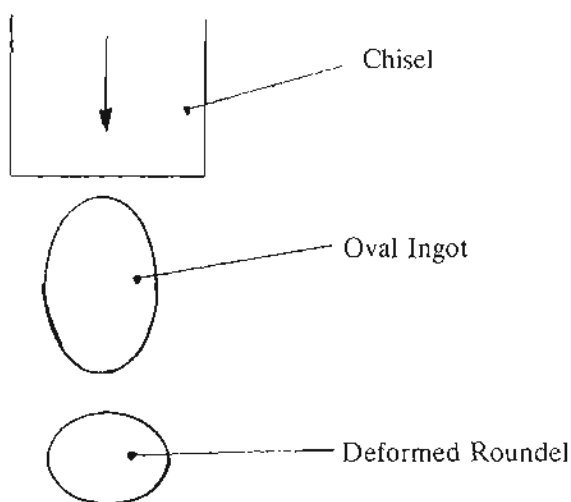


FIG. 2.

§11 On this slicing machine no test was undertaken on which a judgement could be based, because the workers and moneyers, accompanied as has been said, objected that the ingot fixed to the machine was not of their silver and they had not seen it cast; furthermore, that this slicing machine, according to Briot's own statement, could only be used for the cutting and fabrication of small pieces of money of the weight of 5 sols or less. Nevertheless, Briot made this machine to operate in the presence of M. de Boissise and de Marillac and lowering the chisel on to this ingot of silver attached to the said screw, beneath the bench, cut 60 or 80 complete little scales or roundels of silver, of which several were weighed and found to be of 12 or 13 grains weight.

§12 The second of these three machines used for the working and fabrication of flans was one which Briot called a strip roller (*laminoir*). This strip roller is like a square box or case of iron, about 1½ feet wide, 2 feet high and 1 foot long, above which were one or two little square knobs (*boutons*) of iron, used to tighten or loosen two steel rollers, said to be inside, similar to those used at the Mint of the Mill for passing and reducing the strips (*lames*) to the desired thickness; and in the middle of this box or case of iron is a flat slit where the said two steel rollers come together, which serves to admit (*passer*) the strips that it is desired to flatten and laminate. This strip roller of the said height, width and length is mounted on a strong carpenter's bench which is grouted in to the floor; on each of its sides is a large crank handle of the type used to turn the screws on wooden beds, except that the spanner or crank of this machine is very big and equipped with a wooden sleeve to hold it more easily and move it more uniformly, having a head similar to the spanners for the planks on beds, and is put on a square knob of iron, similar to those of the above-mentioned screws, and is taken off in the same way from the said square iron knobs, just as one takes away the spanners from beds after one has tightened their planks.

§13 The third and last of these three machines serving for the working of the flans of the coins and which follows the second, is a punch (*coupoir*) of the sort employed in the Mint of the Mill, except that the one from the Mill is of round shape and that of Briot is in the form of an oval. This punch is difficult to describe; there are two square blocks of steel set one above, the other below; the latter is in the form of a mortar pierced right through of the size (*volume*) required for the unstruck flan, having a hole in its upper surface smaller than that at the bottom in order more easily to cut the flan from the strip and also to make it fall more easily after the cutting. The block which is above is in the shape of a pestle of the size and bigness of the opening in the said lower block; this upper block remains poised, is attached to a screw and a little sleeve, in the manner of printing presses, except that it is pulled by one hand only. Putting between these two blocks a strip that has been passed through the strip roller, and pulling towards oneself the handle to which the upper block is attached, this block is thrust into the lower one, and in so doing cuts out a flan or blank of the size and bigness of the opening that the mortar or lower block has in its upper surface, whence falls the flan or cut blank.

§11 The grain weighs about 0.053 grammes,

§12 This machine clearly resembles an old fashioned mangle. The bearings of the upper roller could be raised or lowered by turning screws threaded through the upper

frame.

§13 A possible reconstruction of this machine is given in fig. 3.

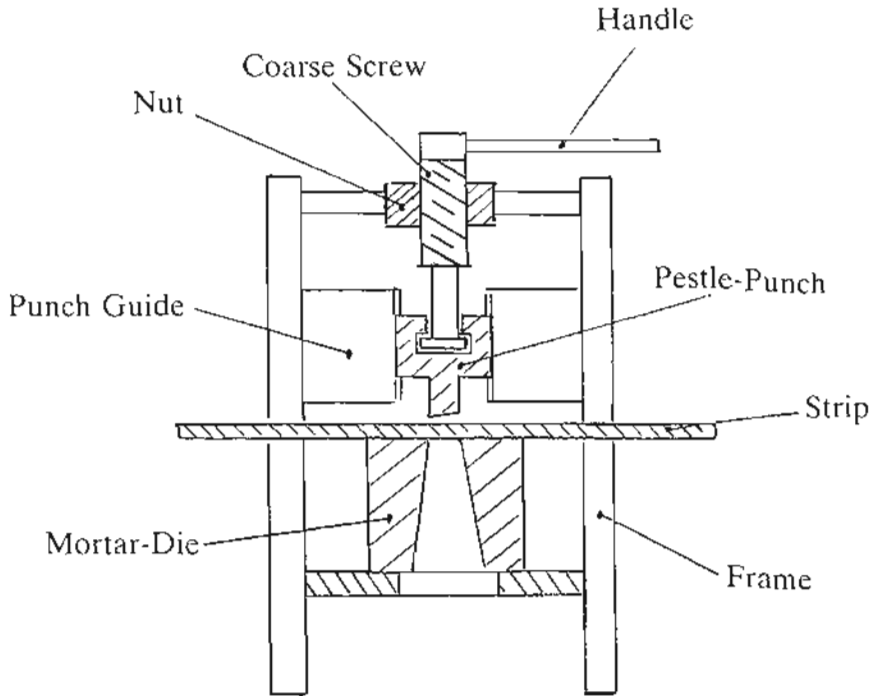


FIG. 3.

§14 This punching machine has no need of detailed explanation because it is no more new than is the strip roller. Both are no more than copies of the machinery in the Mill and the same machines that they use at present in the marking of their 'doubles' and small 'deniers' of copper, the fabrication of their jettons of silver and other metals.

§15 The fourth of these machines, especially for marking or coining the flans not marked, and fabricated as

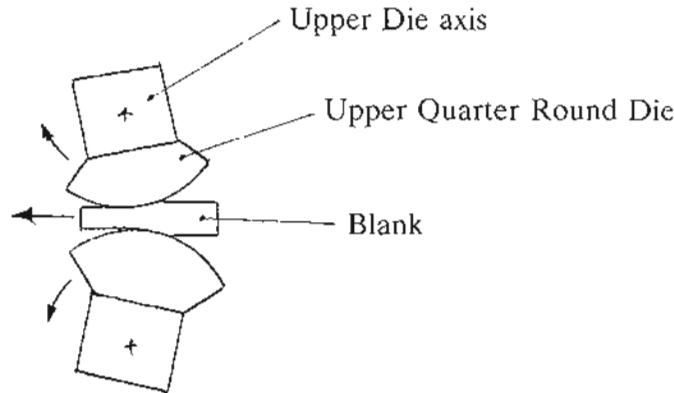


FIG. 4.

§14 The 'Monnaie du Moulin', the one set up by Henry II, was powered by water from the Seine and gave its name to Mill Coinage.

§15 Briot was effectively employing the same mechanism as on his strip roller except that instead of complete rollers, which would have to be several inches in diameter, and

therefore at least 6 inches in circumference, he saved unused space on this circumference by having quarter rollers, as shown in fig. 4. In England, Briot reverted to complete rollers, engraving six matching obverse and reverse designs around the periphery, as recently demonstrated by Edward Besly, in 'The York Mint of Charles I', *BNJ* 54 (1984), 213ff.

well on the slicing machine as on the said strip roller and punch, is one which may be called a 'coiner' (*monnoyeur*). It is also a sort of square iron box or case and is attached to the said carpenter's bench, like the strip roller, and of about the same height, but wider and longer. In this box or case can be seen in the centre two quarter rounds of steel engraved with the designs of the type of coin it is wished to mark; these two quarter rounds of steel are turned in a curve close to one another by means of two large handles on the two sides of the box, in the manner of those used in Germany to mark their jettons, except that those of Germany are furnished only with one handle, that of Briot being furnished with two, like his strip roller; this results in the fact that the flan after it has been coined and passed through the coining machine (*instrument de deux quarts de ronds d'acier*) is much less bent, flatter and more even than the German jettons which are very bent, half twisted and very inconvenient for counting through having been marked by a similar machine furnished, as has been said, with a single handle operated by only one man.

§16 Having thus pointed out all these machines, Briot, without giving any demonstration on the slicing machine, began to give one for the pieces of 10 sols on the strip roller only. First, having annealed (*recuit*) in the fire the nine marks of silver reduced to strips in order to soften the metal, he passed them through the strip roller, driven and turned by two strong men, four or five times, one after the other, just to reduce their size, aiming to get them to the thickness that he judged they should have to approach the weight of a piece of 10 sols; then from one of the strips he made a trial of the thickness that he would give to the others, in the following way.

§17 On each occasion that he passed it through the strip roller, in order to flatten it in the thickness, he cut out of it a flan (which is an unstruck piece of money) on the punching machine, and this he weighed on a balance to see whether the cut flan approached the weight it should have for the said piece of 10 sols, aiming to be on the high side; this he repeated as many times as necessary until he found that the latest flans cut from the strip and passed, as has been said, through the strip roller, reached the weight of the standard (*deneral*) for the said piece of 10 sols, one or two grains on the heavy side.

§18 This test completed, all the other strips of silver intended for the working and fabrication of the said pieces of 10 sols, that Briot had initially thinned down, after having put them in the fire to anneal them, he passed them one after the other through the said strip roller, fixed at the space and gap required and found by the said test, and then reduced the strips to flans, cutting them out on the oval punching machine; subsequently weighing the flans one after the other, separating the heavy from the light and putting aside the correct ones; those which were heavy he adjusted by a file, putting them on a small block of wood, covered with a sheet of leather, pierced in an oval of the cutter size, in which oval he placed the said heavy flans which he filed and then checked the weight on the scales, and the light ones he rejected as scissel.

§19 This little block of wood covered, as has been said, with a leather sheet, is fixed in a wooden tray, about 15 inches or so big and more than 2 deep, which serves when he reduces and adjusts the flans to receive the filings which fall from it at each stroke of the file that he passes over the flans.

§20 Briot, after having weighed, filed and checked his flans piece by piece, put them all in an iron pot in which there is water and leach (*bouture*) (which is a chemical (*drogue*) compounded of the lees of wine, dry and mixed (?) (*emyée*), and salt or alum) to blanch them; of these I weighed a mark and a half. As flans, they came to 51 pieces, 5 deniers and 4 grains in weight. This blanching and weighing completed, Briot, before marking or striking his flans on the coining machine, carried out a test with three or four of them, to find the gap or space he should leave between the two steel quarter rounds in order to strike or mark them in proportion to their thickness, so that the oval of the flans should come out round from this machine without excess or lack of metal.

§21 This coining machine has two handles and is operated by two men, as I have said. Briot was one of the two who operated it; with his right hand he grasped the handle and with his left inserted the oval of his flan at the start of the inscription or design of the coins, so that the two ends of the length of the oval were in line with (*regardoient*) the handles of the machine; then, the two of them turning the handles at the same time, the flan which was oval comes to be extended at its centre only, taking up a round shape.

§22 Then, to perform this test, Briot took a flan or unmarked piece in the form of an oval which he coined on the said coining machine; then if the flan was coined with an excess border, this showed that the two steel quarter rounds were too close for the thickness of the flan and in this case, with a little spanner which he put on the square iron knob on top of the said iron box or case, he loosened (*laschoir*) the two steel quarter rounds a small amount; then he took another flan which he tested and coined once more in this enlarged gap; if on the contrary the flan, on being coined, did not expand completely to the border or fillet at the circumference of the design, this showed that the two steel quarter rounds were too slack and, in this case, Briot tightened them up

§16 The rolling process work-hardens the metal and if it is necessary to deform it further, the stresses in it must be relieved by raising the temperature above the recrystallisation point so that the deformed and stressed crystals can

revert to their unstressed state. This is the process of annealing.

§21 The result of squeezing the oval flan between the quarter rounds is shown diagrammatically in fig. 5

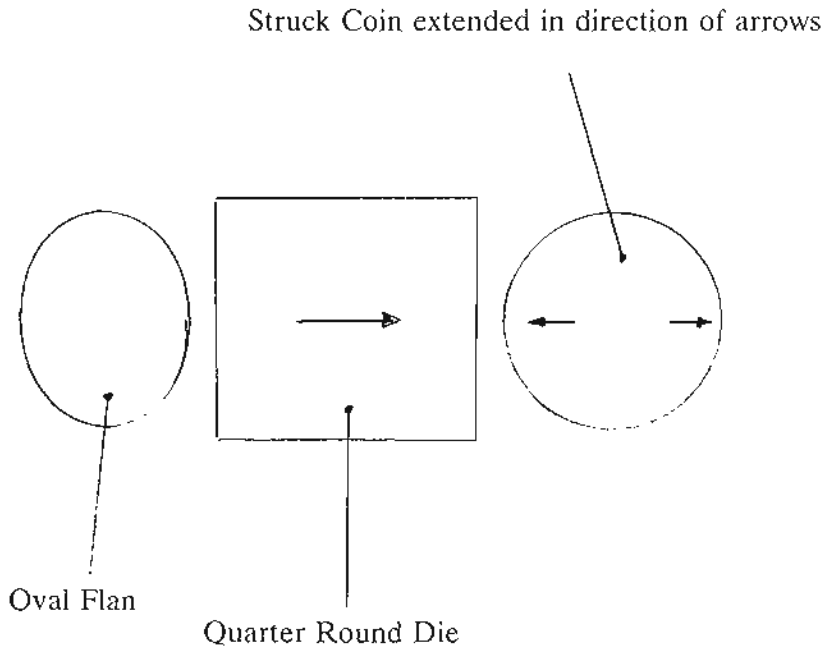


FIG. 5.

by means of the said square iron knob, repeating as many times as necessary this tightening and releasing of the two steel quarter rounds and each time coining and making a check with a flan, so that the last of them came out of the machine round and well struck with no excess or lack of metal.

§23 After this test, Briot, between the gap of the two steel quarter rounds, fixed as has been said in proportion to the thickness of the flans, began coining the 51 pieces of 10 sols that he had checked one after the other, all of which became round in shape, but somewhat bent, several with an excess of metal, others with lack, that is to say the border or fillet on the circumference was absent.

§24 The coining having been completed, I reweighed immediately the said coined pieces of 10 sols, which came to the same weight as before. To explain this deficiency it must be noted that $1\frac{1}{2}$ marks of pieces of 10 sols should weigh 51 and $\frac{3}{4}$ of a piece, the said $\frac{3}{4}$ of a piece weighing 4 deniers, 3 grains of the mark weight standard; these deducted from the 51 pieces, 5 deniers, 4 grains, which is the weight of a mark and a half of the said pieces of 10 sols, there remains 25 grains underweight on the mark and a half of the said pieces, which is $\frac{3}{8}$ of a piece under weight on 3 marks; the remedy in weight permitted to the masters and farmers of the Mint on the said pieces of 10 sols being $\frac{1}{4}$ of a piece per mark. Thus these pieces of 10 sols worked and coined by Briot are within the remedy and underweight only by $\frac{1}{8}$ of a piece in 3 marks.

§25 This trial of the manufacture of a mark and a half of pieces of 10 sols lasted from nine o'clock in the morning to past midday.

§26 Before leaving Briot's lodging, the workers and moneys, accompanied by their provost, requested M. de Boissise and de Marillac, that they would be pleased to order Briot, over and above the test on the écus that he had to carry out on the strip roller, and for which there still remained the strips of gold in the hands of their provost, to undertake a test on the slicing machine, in view of the fact that in his printed proposals he had

§24 There is a mistake here somewhere. As it stands Briot's pieces appear to be 25 grains (1 denier, 1 grain) *overweight*. In view of Briot's anxious protestations later when his products clearly were underweight, it may be

Poullains's error in calculation. On the other hand, Briot may have been relying on the fact that this group fell within the remedy.

promised to make on it all manner of pieces below the weight of 5 sols, which is heavier than the écus, or otherwise he should renounce the use of this slicing machine in the working and fabrication of coins, these workers offering to hand over to him gold at 23 carats (which is the standard for écus) to run this test.

§27 Upon which, Briot excused himself, saying he did not wish to run this test on the slicing machine, fearing lest the workers might give him gold in which there was emery that would harden and make 'bitter' the metal, which, on cutting, would spoil the edge of the chisel.

§28 And the workers persisted, offering to hand over to him pure gold which he could himself reduce to 23 carats in their presence, putting with it 1/24th part of copper; stipulating that he should cast in their presence the oval ingot of gold, necessary to cut and carry out the said trial of écus on this machine.

§29 It was further replied by the said Briot, that he could not at present carry out the test for the said écus on the slicing machine because he had not yet found the centre of the oval of the circumference for écus.

§30 To which there was no answer from the workers, nor similarly did I wish to make any rejoinder.

§31 The Lords of the Council having ordered me to accompany M. de Boissise and de Marillac to the trials that Briot and the said workers and moneyers should undertake, without upsetting anyone, nor showing greater favour to one than the others, which was the reason that on this occasion, as well as before and afterwards, all that I heard ill done or ill spoken, I kept silent about, holding myself ready to repeat it verbally or in writing if I were told to do so.

§32 Coming back to the replies by Briot, which I saw he was continuing to give to the Lords of the Council, who are the judges of the success of the trials, it seems, for this last point, where he said he had not yet found the centre of the circumference of the oval of the écus, that this answer was incorrect and beyond the sense of what he wanted to say; incorrect, since the circumference of these écus is round, and to find the centre of the oval of the écus is to reduce the circumference of the oval of the écus to the circumference of the circle or roundness of the said écus to the same centre, which is a mathematical proposition.

§33 Now this is not what Briot did; on the contrary, when cutting the ingot of gold or silver on the slicing machine, the flan which comes off the ingot, which is oval, shortens in height by more than half its dimension and then, when coined or marked on the coining machine, it extends in the opposite way by more than a third of its oval dimension. Thus to say that he had not yet found the centre of the oval of the circumference of the écus, which is to reduce the circumference of the oval of the écus to the circumference of the circle or roundness of the said écus to the same centre, is to speak incorrectly, since the flan, when cut from the oval ingot, reduces in height and, when coined, extends, on the contrary, the breadth of its oval.

§34 To have expressed himself clearly, he should have said that he had not yet found the height of the oval that he ought to give to the ingot of gold, in order, when cutting with the slicing machine, it should impart to the blanks or flans that it cut another form of oval on the width of the said ingot, which could then afterwards be marked or coined circular by the coining machine; this he will never do for all types of blanks of differing alloys and finenesses, because although he might have found the height necessary for the écus, which are of 23 carats, this same height of oval would not have suited other types of gold, which are of 18 or 20 carats only, gold at 23 being softer and extending more than does 18 or 20 carats; and thus it is with silver relative to billon.

§35 And as for the first reply, that he feared whether the workers might have put emery in the gold they handed over to him, which would make it 'bitter' and would damage in cutting the edge of his chisel, showing to confirm this statement an ingot of gold of the weight of 2 marks that he had cast in the shape of an oblong oval, which he said had become 'bitter' in the casting through air vapour (this can happen when one casts gold in a place where quicksilver has been), which was the reason he could not carry out the test for écus on the said slicing machine.

§36 Hearing this reply, which did not seem to me to be very well founded, after having handled and studied the gold ingot, which was very porous and as if scraped where cut by the blade, just like pastry when cut by a knife, I recognised on the contrary that this gold was very 'mild' and soft, touching it with the end of a needle; this softness rendered it unsuitable for cutting cleanly and evenly; which was the only reason why he did not want to run a test on this slicing machine, contrary to what he was saying and putting forward.

§37 On Friday, 3 February following, M. de Boissise and de Marillac, accompanied by myself, went to the lodging of the said Briot, where we waited for the workers and moneyers, accompanied by their provost, to see him run another trial for the quarter-écus on the strip roller, slicing and coining machines, for which Briot, on the Wednesday previous had cast in their presence and reduced to bars in his ingot moulds (*lingotières*) 4 marks of silver at 11 deniers fine, with which the provost of the said workers had supplied him, over and above the 9 marks of silver ordered by the Lords of the Council. These bars the said Briot began first of all to pass through

§34 Poullain's arguments in this and the preceding paragraphs are entirely correct. The differing hardnesses would indeed ensure that only trial and error would give Briot the correct initial ovality of his bar to finish up eventually with a

circular coin.

§36 Too soft a metal would, as Poullain says, inhibit a clean cut.

the strip roller three or four times one after the other, solely to thin them down, and then took one to make a test by weight on the thickness which he would give to the others. This bar he passed and repassed through the strip roller several times, on each occasion cutting out a flan on the punching machine and checking its weight on the assay balance, to see whether it was correct, until that bar was of such a thickness that the flan cut from it turned out to be just on the heavy side of the weight that a piece of 16 sols should have.

§38 This test completed, and after having annealed the strips of silver, he passed them one after the other through the strip roller, fixed at the required space or gap, found by the said test; on passing these strips, the strip roller went wrong in such a way, that at each turn made of the handle, there was heard the sound of irons rising up and clashing one against the other, so that the strips (at the exit from the machine) were completely split open at several places in the middle, which I pointed out to M. de Boissise, whom I was near.

§39 From the pierced and split strips, as described, Briot produced flans, cutting them out on the punching machine, without paying any attention to the place on the strip that he found under the cutter, whether it was split or not; with the result that, of the six score and three flans that he cut from the strips, he only found 19 that were just overweight, of which he adjusted 12 by filing to the standard of the pieces of 16 sols, the rest remaining as scissel. Of these 12, at the request of the workers and moneyers, present as has been said, there was carried out by me a weighing of 4 ounces; on the side of the deniers it was found (lacuna in text).

§40 After the weighing, the workers asked yet again that the light flans should be weighed piece by piece, which I did for two or three at random from the heap of the said flans. The first was light by $2\frac{1}{2}$ grains, the second by 8 grains and the third by 6 grains or so.

§41 These bars of silver for the quarter-écus having been passed through the strip roller and reduced to flans, Briot, in the same way passed through 2 marks 6 ounces of bars of gold of the fineness of écus, tested them from the roller for weight on the assay balance, then reduced them to flans on the punching machine, just as he had done with the bars for the quarter-écus.

§42 And inasmuch as it was already past midday, and that there still remained the adjusting and blanching of the flans of the écus and the coining of the quarter-écus and écus, M. de Boissise and de Marillac, at the request of the workers, accompanied as has been said, continued this test at the first opportunity, returning into the hands of the said provost the scissel, both of gold and silver, together with the light flans of three quarter-écus, and M. de Marillac took charge of the six score and three flans of écus and 19 of quarter-écus (of which 12 were adjusted) to complete them at the next working session.

§43 On Thursday, the ninth of the said month of February, M. de Chasteauneuf, de Boissise, de Marillac, Lusson and I were at Briot's lodging, where were also the workers and moneyers, accompanied by their provost. And there, continuing the above test, after the flans of the said écus had been weighed, which were found to be heavy, in the weight of 1 mark 6 ounces, there were handed over to Briot the 19 flans of quarter-écus which had been adjusted and the six score and three flans of the écus, which he first adjusted by filing; then annealed and blanched them; and afterwards coined the 61 flans of the adjusted quarter-écus and the six score and three écu flans, which he adjusted by filing and then annealed and blanched them; and afterwards coined the 61 écu flans and the 12 of quarter-écus, in the presence of M. de Chasteauneuf, de Boissise and the rest.

§44 This coining completed, at the request of the said workers and moneyers and in the said presences, I carried out two weighings, the first of a mark of the said écus. On the side of the deniers there were 61 coined écus and one flan with (lacuna in text) and another weighing of 4 ounces of quarter-écus. On the side of the deniers were 12 pieces and 6 deniers, 22 grains of weight, for this reason underweight, outside the remedy by 1 denier, 10 grains of weight for the said 4 ounces, coming in each mark nearly to $\frac{2}{3}$ of a piece outside the remedy allowed to the masters or farmers of the Mint; a deficiency in weight very far from his claims, in which he promised to cut from a mark, the quantity of blanks that each operation should weigh, such that the cutting of the mark should correspond to the piece and the piece to the mark: the masters, by decree, having only $\frac{1}{3}$ of a piece underweight in each mark of worked quarter-écus as a remedy or permitted lightness, Briot having exceeded in this test the $\frac{2}{3}$, which is more than half a piece underweight for each mark of quarter-écus.

§38 The fact that it was apparently possible to use the strip roller immediately afterwards (see §41) implies that there was not a great deal wrong with the machine. A more likely explanation of the splitting described is an insufficiency of annealing of the bars between passes. The still work-hardened metal would tend to crack and the noises referred to with such evident *schadenfreude* by Poullain are only too likely to have ensued. One can imagine Briot's desperation at this set-back and he probably carried on in an attempt to brazen things out rather than admit to a fault in his working methods (See §61).

§39 'On the side of the deniers' seems to mean 'on the scale pan for the weights'.

§43 There is considerable confusion here in the numbers of each denomination being processed, but the argument is unaffected.

§44 It is not clear what could have been the weight of the '12 pieces' put in the weight scale pan – perhaps they were accepted brass standards. In any case Briot's flans obviously were underweight, because he is found trying to explain the fault subsequently (§45).

§45 Before we left, Briot, to excuse himself from the fact that the flans for the quarter-écu had been found light in weight when coming from the punching machine, said to M. de Chasteauneuf, de Boissise and the rest, that this had happened because he had cut the strips of silver on the cutter for the pieces of 10 sols, which has a smaller surface area (*volume*) than that of the quarter-écu, his people having inadvertently taken and set up one cutter for the other.

§46 But this deficiency in weight, in my opinion, could not have arisen from this error, for even if his people had inadvertently taken and set up the cutter for 10 sols instead of that for quarter-écu, nevertheless, having previously made a trial of the thickness of the strips and weighed the flans that he cut out on the half-franc cutter, according to the standard or weight of the quarter-écu, he would have obtained, from this test, his strips thicker than if he had tested them on the quarter-écu cutter, which has a surface area larger and more extended than that of the 10 sol pieces. And this error, arising in this way, could only have been due to himself, or otherwise it would have followed that all the flans from this so-called half-franc cutter would have been found light by more than 2 deniers of weight per piece, which is the difference in weight between the weight of quarter-écu and that of the pieces of 10 sols, and it would have followed further that amongst the quarter-écu flans cut on the 10 sols piece cutter there would have been found none of the weight of 16 sols, whereas, amongst the six score and three quarter-écu flans there were nineteen that Briot adjusted by filing and weighing on the assay balance to the standard, as has been said, of the piece of 16 sols. This deficiency in weight coming from the jolts and malfunctioning of his strip roller, which had broken and crumpled the said strips of silver so that, when coming out of the said strip roller, they were completely split in the middle, as I have said; this position on the strips meeting the cutter could only result in the flans which came from it being and becoming light-weight.

§47 This test was finished on the same day at half past four in the afternoon.

§48 Thus, Briot, from three marks of silver and three marks of gold, which by order had been handed over to him by the workers and moneyers of the Mint of Paris, had made, in three sessions, only 1½ marks of pieces of 10 sols, 4 ounces of quarter-écu and 1 mark of écus, which is, in sum, 2 marks of silver and 1 mark of gold; having made into scissel, contrary to his statements and promises, 7 marks of silver and 2 marks of gold, which is more than two-thirds of his work; and having spent on it, from the outset, for casting the bars in sand by the smelter, five hours and more, and on the working and coining of them, in the three sessions described above, nearly nine hours, which is very far from the speed he promised to make.

The continuation of the narration of M. Henry Poullain, former Councillor of the Court of the Mint, of the trial of the manufacture of pieces of money, made by the usual methods of the hammer by the workers and moneyers of the Mint of Paris in the presence of M. de Boissise and de Marillac, Councillors of State.

§49 On Friday morning, the seventeenth of the said month of February following, M. de Chasteauneuf, de Boissise, and de Marillac, the president Lusson and I, were at nine o'clock at the Hotel of the Mint of this city of Paris, where there were, representing the workers and moneyers, the wardens (*gardes*), the comptrollers (*contregardes*), a cutter and assayer, two or three workers and a moneyer of the said mint; and there, in the presences as has been said, was begun, to start with, the cutting of squares. And nevertheless, since M. de Chasteauneuf, de Boissise and the others asked on the same day to see the casting in grooves (which is to prepare the ingots of gold and silver for cutting squares, which was only shown to them in the following session) and that, in Briot's trials, I started with this preparation, in order to set out more methodically the sequence of manufacture of the pieces of money that Briot had observed in his test, as against the one which the workers and moneyers carried out in theirs, I shall start with this preparation of the metals, in order not to have to speak of it on the day and session following, as was required and requested by the said Lords Commissioners.

§50 In order to prepare, therefore, the metals for the working and fabrication of coins practised from time out of mind in the Mints, the masters and farmers of them first melt in a crucible their charges of gold or silver and while these are melting, they prepare a mould of iron, shaped like a table, an inch or more thick, 15 inches long and 10 or so wide, and channelled with large furrows or grooves that they place on the furnace near the crucible in which the gold or silver is being melted, so that the mould is slightly tilted; once the gold or silver has melted, and after they have greased the mould with a little fat, to make the metal flow more easily, they grasp the crucible with tongs and then pour into the furrows or channels of the mould; and the charge poured out takes the form of little ingots or bars of gold or silver, of the length of the said furrows, which they use in the working and fabrication of coins.

§46 Poullain's demolition of Briot's excuses is quite masterly. Even if Briot were using an incorrect punch, his weight testing on sample flans would have led to a compensatory greater final thickness for the strips.

§50 Inserted here is a woodcut from the *Chronicle*, 1577, by R. Holinshed, that depicts the stages of coming by hammer (fig. 6).



FIG 6. Coining by hand. Woodcut from R. Holinshed, *Chronicle* (1577)

§51 And it should be noted, with respect to the ingots of gold only, that the said masters, after they have taken them from the said moulds, and before they hand them over to the workers, beat the said ingots of gold on an anvil with hammer blows and this is called 'beating hot' (*battre la chaude*). This is what is casting in grooves and the steps undertaken by the masters or farmers of the Mint in the preparation of the metals gold and silver, to come to the operations that the workers and moneyers carry out in the working and fabrication of coins.

§52 The first of these operations demonstrated on this day before M. de Chasteauneuf, de Boissise and de Marillac was cutting squares (*tailler quareaux*), (that some call 'chopping' (*escopeler*), which is a common word for cutting, as one would say cutting frequently, for the said workers in cutting squares, cut them quickly and overweight, without bothering about the correctness of the weight), which is with large shears to cut the ingots of gold and silver into small squared pieces, which on this account are called squares.

§53 To permit the understanding of this first operation, it should be noted that he who cuts squares stands upright, holds in his left hand his ingot of gold or silver, and has under his right arm the large shears attached to the top of a wooden column (that the workers call a peg (*cheville*) grouted into the floor, with which he cuts the ingots that he holds. Before him he has a little damped (*sourdes*) balance (which is a balance having the two ends of the beam (*feau*) lower than the nail and fork (*chapse*) which supports it) equipped with pans and suspended in air by means of a rod (*guindole*) (which the Spanish call *guindaletta* and the said workers incorrectly *guignole*), which is a little bar or flat baton in the form of a lath, pierced at the top through which passes the right branch of the beam of the balance with its pan, supported by a small block of wood attached to the said baton or lath and fixed below to a square block of wood, 5 or 6 inches in diameter, which halts and holds steady the said baton or rod. In this pan is a slightly heavy standard weight (*denerai*), of the weight of the coin of which it is desired to adjust the square (*adjuster le quareau*); the pan opposite the left hand is empty, but as soon as he has cut a square he takes it between the thumb and index finger of his left hand to the empty pan (supporting it by his other fingers beneath, for fear that the weight of the square should upset the balance) to see if it is of the weight it should be, checking only in this cutting to keep his squares heavy by two or three grains of weight, without stopping to adjust them.

§54 The second operation is beating or striking squares (*battre ou frapper quareaux*). This operation is

§52 The lumps roughly chopped off at this stage must have been very considerably deformed from the original square section of the bar, although the corners would still have been prominent enough.

§53 The description of the balance implies that the centre of gravity of the whole moving system was considerably below the suspension point, so that it was stable and 'damped' in the way that a modern balance is. 'Guindole' is

perhaps cognate with the English 'windlass' and emphasises the sense of providing a support for the balance. Such a balance can be seen at the top right of the woodcut.

§54 The operation has been misnumbered as 'third' rather than 'second'. No doubt it required great experience and skill to ensure that the initial mis-shapen rectangle did finally attain the desired circular shape.

carried out by the worker and it is considered that the first hammer blows are the master blows, that is to say that they must be given by very expert workers, the flans or blanks on which the operation is performed, never turning out well when they seat or lie badly and are badly struck.

§55 To understand more clearly this third operation, it should be noted that the workers have in their furnaces (which is the place that they work) two benches or seats, each four feet long, two feet wide and one and a half feet high or so, set up in front of the mouth of the furnaces and grouted into the wall at one end and in to the floor underneath. The first of these benches is filled with gravel and has at one of its ends a small cross plank which can be brought nearer as much or as little as is desired, on which the worker sits astride and at the other end and in front of him is a square oblong anvil, at a height more or less level with the bench or seat, which has a foot or so of area, on which the worker beats hot, strikes square and readjusts his flans; I shall speak below at the proper place of the worker's second bench or seat.

§56 Now, to beat or strike squares, the worker sits astride on the small plank of the first bench, beats and strikes each square on the anvil which he has in front of him, with three or four blows of the flattener (*flattoir*) (which is a hammer to be described later), sitting upright, which he holds in his right hand and with his left passes them one after the other and takes them off the anvil, then anneals them in the fire.

§57 The third operation is annealing (*recuire*). The worker, after having lighted his charcoal at the entrance of his furnace, puts it in a large iron frying pan (*poesle*) four or five feet long and fitted with a wooden handle, having its basin or spoon round underneath like half a sphere and about two feet in diameter. In this pan, with the lighted charcoal, the worker puts his squares or flans that he wants to anneal and with two hands holding the pan resting on one of his thighs, tosses up and down these squares just as winnowers do when they toss the corn in the winnowing shed, throwing his charcoal and flans into the air, first on one side and then on the other, until the squares of quarter-écus are white and those of half-francs are red only; then he tips them out and empties his pan.

§58 To get them out, the worker first removes the biggest lumps of charcoal which are in the pan with green twigs (*brins d'un ballet*); then throwing into the air what remains of charcoal and the flans, another worker with a bunch of feathers (*plumeau*) (which are four or six wings of partridge or other birds, sewn back to back and fitted with a little wooden handle to keep them together) fans this 'spray' of charcoal and flans so that, when falling back towards the pan, the pieces of charcoal which are lighter separate from the flans and fall to the ground, and the flans or squares, as the heavier, fall directly in to the pan.

§59 The worker and the man who holds the bunch of feathers repeat many times this tossing in the air of the charcoal and flans and this fanning with the feathers, until there remains in the pan only the flans, which the worker then tips on to the floor to let them cool. It requires for each annealing, half a bushel of charcoal for 18 or 20 marks of flans, more for more and less for less. And this annealing serves to soften the metal, which, the finer it is, the more it resists the fire and can be annealed and kept longer in the pan, so that the quarter-écus can, as has been said, be annealed until they are completely white and the half-francs until they are red only, which, because they are not of so fine a silver, melt more easily in the pan if they are kept there too long.

§60 Further, this annealing of the squares or flans is usually performed by the apprentices of the said workers, whom they call annealers (*recuiteurs*), just as the apprentices of the moneyers are called rebounders (*ricochons*); these, although they are of the family and descent and they have rights in the Mint, nevertheless, before being accepted, are obliged to serve for a year and a day the workers and moneyers without any wages nor even the upkeep of their clothing, the community supplying their food only.

§61 The worker, according to the rules, must repeat this operation for almost everything he does to the squares or flans, always performing it before he beats or strikes them on the stock or anvil, in order, as has been said, to soften their metal before beating or striking; otherwise they would split at the corners, or 'star' as they call it.

§62 The fourth operation is to adjust the squares, which the workers call 'draw in and reduce' (*approcher et rebaiser*). The one who carries out this adjustment or drawing in sits on a seat higher than a stool; in front of him is a little square table on which there is a lantern case (*lanterne*). In this case is suspended in air the beam of a small delicate balance fitted with its scale pans; in the pan opposite the right hand and supported by the arm of the beam is an exact standard weight, of the weight of the square that he wants to adjust. The pan opposite his left hand is empty, just as it was on the balance for cutting squares. With this hand he takes one of the cut

§55 The benches can be seen at the right of the woodcut.
 §57 This is perhaps the most incredible of the operations and it surely would have been perfectly possible to empty out the flans and charcoal fragments without deleterious effects on the former. However, the distinction made between the relatively pure and the more highly alloyed flans in terms of melting point is again correct. A pan of the type described can be seen in the left background of the woodcut.

§62. The final adjustment of the weight was in a sense the most important step in the whole sequence: here, too, the skill of the worker in removing the appropriate amount of metal either from the 'vulnerable' corners or from the sides was clearly crucial. In the left foreground of the woodcut this operation is being carried out, clearly by a woman, as mentioned in the next paragraph

squares (which he has in front of him in a wooden box turned on a lathe) of which, before he removes anything from it, he checks the weight of this square, lifting it with thumb and forefinger of his left hand to the empty pan, opposite the said hand, of the assay balance, to see how much should be removed; which, if it is very heavy, he removes metal from the points or angles with the shears that he has under his left arm and this is called 'drawing in' the square; but if it needs less removed, such as a grain or a half grain, he cuts off correspondingly with the said shears, and this is called 'reducing'; they repeat this 'drawing in' and 'reducing' as many times as necessary so that the square comes down exactly to its standard weight.

§63 This fashion of adjusting or 'drawing in' the squares is the special function of the daughters of the said workers and moneyers, who are called 'lady-cutters' (*tailleresses*); of their children only the males inherit, their daughters having no rights in the Mint, whereas the male children of the said workers and moneyers have a full right because of their fathers.

§64 The fifth operation is 'rounding' (*rechausser*) which is to round off and beat in the points of the squares with the 'rounder' (*rechaussoir*) which some call a small hammer (*martelet*); the rounder is a little iron hammer of about two pounds or so, which has the striking side made like a cooper's adze, that is long and tapering from its head and curved backwards, and the other side very short and small.

§65 Before the rounding, the worker sorts out the flans, separating the large from the small and arranging them on a rack (*rabotier*), which is a wooden tray, squared and oblong, 7 or 8 inches wide, 20 long and 1 thick and channelled with grooves or furrows, in which he puts his sorted squares, to wit the large in one, the middling in another and the small in yet another.

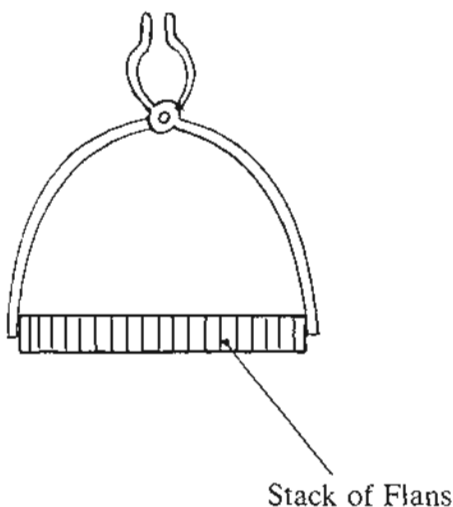


FIG. 7.

§66 This sorting completed, without annealing his squares, the worker takes about a mark of them, arranges them one against the other, grasps them by the middle of their faces with large but very light tongs (that they call 'grippers' (*estanques*)), lays them down on the anvil with his left hand, then, twisting and turning them by means of the grippers which he holds, strikes them with the rounder, which he holds in his right hand, on the points and angles of his squares, beating them in, smoothing and rounding them off in less than five or six movements of his hand; and this operation, called rounding, the worker, according to the rules, is obliged to repeat after all the other operations carried out on the squares and flans of his working.

§67 The sixth is 'flattening' (*flatir*). Flattening (to describe it correctly) is to beat, extend and true up (*dresser*) the flan or coin blank on the stock or anvil to the area (*volume*) and circumference, more or less, that it should have.

§68 Before speaking of this sixth operation, I shall describe the structure of the second bench or worker's seat, promised above, on which are undertaken and perfected the remainder of the operations carried out afterwards on the blank.

§69 Now this second bench or worker's seat is of the same length, breadth and height and is in all other

§66 The special tongs necessary to grip the stack of blanks may have had the form shown in fig. 7.

respects similar to the first one, except that it is not filled with gravel and is grouted at one end into the wall and underneath into the floor; similarly, like the first one, it has at one end a small cross plank that can be moved nearer or further away as little as one wants, on which the worker sits and at the other end in front of him is a stock (*tas*) (which is a sort of round anvil 9 or 10 inches in diameter and raised 17 or 18 inches above ground), fitted with a tang, just like the pile die for coining, and fixed in a trunk or log of timber (which the workers call '*cepeau*' and comes from the Latin '*cippus*'), which is fixed in the floor; on this stock, which is at the height of the said bench, the worker only flattens, dilates and slugs (*flait, estaize et boue*).

§70 Thus the worker, to flatten and commence to true up his squares, sits on the second bench, having before him the stock or round anvil, on which he strikes with the flattener (*flattoir*) (which is a large hammer made in the shape of an ox-horn, large towards the bottom on the side with which one strikes, and pointed at the other, weighing about 7 or 8 pounds of iron) on the face of his squares, which he trues up and enlarges to about the area and circumference, that the flan of the workpiece should have; these squares take the name of 'flans' after they have been through the sixth operation, 'flan' being the substantive of 'flatten' and one calls 'flan' the piece of money which has still not been marked or coined with the die and design of the Prince.

§71 After this operation, the worker anneals his flans, then rounds them and this way of flattening must be repeated twice on the flans according to the rules.

§72 The seventh operation is dilating (*estaizer*), which is almost the same as flattening, except that the piece is not so greatly deformed, only being trued up after rounding. This operation is performed by the worker on the same stock or round anvil and with the same flattener; when it is completed, he anneals and then rounds the flans, being obliged by the rules to repeat this operation twice.

§73 The eighth is 'slugging' (*bouer*). The worker makes a pile or stack of flans, about half a mark or so in number, on the stock or anvil; then, seated and holding with both hands a big hammer (which he calls a 'slugger' (*bouart*), weighing 16 or so pounds of iron, and shaped like the flattener, except that it is larger and shorter, strikes a blow on this stack of flans piled one on the other, which is immediately crushed and the blanks are made to join, mate up and fit plate-like together, so that they can be grasped more easily when counting and in the hand. The same worker, after having slugged his flans, anneals them, then rounds them, being required by the rules to do this twice more, and then slugs them a third time without rounding. And this eighth operation is the last carried out by the worker; his function is to true up (*dresser*) and bring to perfection the flan or blank until it is ready to blanch and coin.

§74 The ninth is 'blanching'. Blanching is to give colour to the flans according to the natural colour of their metal. The blanching is undertaken by the master or farmer of the Mint, putting his pieces of gold or silver, billon and copper in a pot to boil on the fire, with water and leach (*bouture*). With the copper flans there is another step; after they have been annealed, he puts them in pure water, which makes them shed a certain black scale, then he boils them in leach, washes them again, then dries them; and to dry them he puts them in a copper vessel which has been pierced and made like a sieve, that he warms up on a charcoal brazier, rubbing them and moving them about with a cloth until they are very dry and blanched.

§75 The tenth and last operation is 'coining', which is to mark the blanks that have been made true and fashioned by the worker and blanched by the master or farmer. This operation is carried out and completed by the moneyer, who has only this one function.

§76 After he has received from the warden of the Mint his journey (*brefve*) (which is the amount of marks in blanks given him to coin), he puts it on a rack (*rabotier*) (I have explained above what this is), which is half the size of that of the worker, and carries it to the moneyers' shop (*monnoyerie*) to mark or coin it on his bench or seat. The moneyer's seat is about the length, width and height and is grouted at one end into the wall and underneath into the floor like that of the worker; and it has at one end, instead of the small cross plank, a small wooden coffer, locked with a key, on which the moneyer sits. And similarly, instead of the stock or anvil which the worker has in front of him, the moneyer has at the middle of his seat, a trunk or log of wood fixed in the floor, at about the same height as the bench; on top and in the centre of the trunk or log of wood (that the old ordinances call '*cepeau*', as I have said above), there is a hole, in which the moneyer fixes and sets his pile, which is the lower iron or die, 6 or 7 inches long, having below a tang shaped like a big square nail, secured and thrust into the trunk up to its shoulder (*talon*), which is in the middle of the said iron; this tapers towards the top of its head, on which is engraved the face of the pile or reverse of the said piece, which is usually the arms of the Prince or State striking the said money.

§77 The trunk or log of wood they incorrectly call a '*soupeau*', because the moneyer, after having set up his pile and before starting to coin his flans, puts a big sheet of leather with a hole in the middle around the said pile, so that the log of wood lies underneath it, which gives the latter the name of 'underhide' (*soupeau*), remaining while doing this stretched on all sides of the moneyer's seat, which he uses as follows; the space from the end of his seat to his irons he employs to put his rack (*rabotier*), loaded with his journey of flans and pieces

§70 The further of the two hammermen in the woodcut seems to be carrying out this operation.

struck, and the space between his irons and himself to receive the coins that he strikes; these, with his little finger he pushes off the pile towards himself as soon as he has struck them. And when there are a number of them he picks them up and makes a stack of them that he lays on his rack, which, as has been said, is beyond his irons.

§78 With the pile fixed in position and surrounded by the leather skin, as has been said, the moneyer places between the two irons the flan he intends to mark, takes and grasps between thumb and two fingers of his left hand the trussel (which is the upper die on which is engraved the cross or Prince's portrait), and with his two other lower fingers grips the pile; then, holding the irons one against the other, he strikes two or three blows of the mallet (*maillet*) (which is a short little heavy iron hammer, flat on the faces, and weighing about three pounds) on the trussel marking and coining the flan with the figures and characters on the irons; which, when it is not well struck, to complete it, after having relocated (*regrainé*) it once more in the same irons, the moneyer, striking forthwith on his trussel and holding it against his pile, at the position where it is not properly marked, carries on until he has coined it to perfection. And this operation is the last carried out on the coin.

§79 Now, in order to refresh my memory, three workers and a moneyer went through this trial of the fabrication of coins by the hammer, with all the operations, but not repeating any of them. First, the master or farmer of the Mint, in the presences and as has been said, cast the gold and silver in grooves, which made ingots of them, which they handed over to the worker, who annealed the gold only, then beat it on the anvil. Afterwards the said worker cut squares without annealing; then he rounded them on the anvil with the rounder or little hammer, without annealing; then he beat or struck the squares; then he annealed them in the pan; then he adjusted them or drew them down to their weight, without annealing; then he flattened them on the anvil and annealed them; then he rounded them to dilate them and annealed them; then he rounded them for slugging and annealed them, which was the last operation that the worker performed, having only once flattened, dilated and slugged, although the ancient laws oblige them to flatten, dilate and slug twice, with the tools that go with these operations, and to slug a third time without annealing.

§80 M. de Boissise and de Marillac, wishing to see in this trial all the order and ceremony that the workers and moneyers were accustomed to bring to it, as much in the handing over of the journeys as in the delivery of the coined flans, and seeing that one of the workers had finished his journey of quarter-écu, which he was ready to carry to the master of the Mint for blanching (while there remained for the other worker only to dilate and slug some marks of écus and half-francs of his journey), the said gentlemen wished to go to the counting-house (*comptoir*) of the said master to see him carry and hand over this journey of quarter-écu, which the said master weighed; and it was found that there were 2 marks, 4 ounces, 7 gros of worked money of the said quarter-écu, and 5 ounces, 2 gros of scissel, which was the weight of the journey that the wardens had given him; the said worker, having done this, remained discharged.

§81 This done, the master carried all the worked quarter-écus to the foundries (*fonderies*) (that are the places where are set up in the Mint the furnaces to melt the materials and billons that come in), in order to blanch them and coin them afterwards.

§82 With this blanching done, after having handed over to the moneyer, in the form of a journey, the said batch of quarter-écus, M. de Boissise and de Marillac betook themselves to the moneyers' shop (*monnoyeries*), to observe the coining of the said journey of quarter-écu by pile and trussel; this, which was done in their presence by a moneyer, which, after it had been completed by the moneyer, he took his said journey to the office or counting-house of the wardens of the said Mint, who reweighed it; and finding that it came to the same weight that he had been given, the moneyer remained discharged.

§83 Further to demonstrate to the said lords commissioners some idea of the protocol kept in delivery of struck pieces, the said Wardens in their counting-house carried out the weighing in their presence of this whole batch of quarter-écus, one piece after the other, then by the mark, which was found to be of exact weight, without any shortfall, the number of pieces adding up exactly to a mark and the mark to the piece; of this correctness the said wardens made a record and carried out a 'small delivery', that is they handed over and delivered to the master of the said Mint these pieces of quarter-écus, thus struck and complete in all operations, being of good weight and fineness, to be used and made public as he saw fit.

§84 And since it was midday (although there only remained for the other worker to blanch and strike the flans of the said écus and pieces of 10 sols) the continuation of this trial was put off to another day, on which M. de Boissise and de Marillac gave orders that they should be shown how were prepared the metals for manufacturing coins by the hammer and what was the casting in grooves of gold and silver.

§85 Following this order, on Monday, 20 February, at 8 o'clock in the morning, M. de Boissise and de Marillac, with me accompanying them, were at the assay offices (*essayeries*) of the said Mint, where they saw

§78 The fitting back of the partially struck coin into the details of the dies must have been relatively time-consuming and not always successfully carried out, as the surviving

double-struck specimens prove. The nearer of the two hammermen in the woodcut is a moneyer, his grip on the pair of dies tallying with Poullain's description.

the casting in grooves and the preparation of the ingots of gold and silver for cutting squares. This I have described above, at the start of this narration.

§86 And from there the said lords betook themselves to the coineries, where they saw the completion of coining by pile and trussel of a mark or two of écus only. During the coining of these écus, M. de Boissise asked the moneyer; if he could mark and coin an *écu* with a single blow of the hammer? This the moneyer did; even more, reversing the said struck coin, that is putting the obverse of the said *écu* on the pile and the reverse against the trussel, the said moneyer overmarked and overstruck with two or three blows of the mallet, any trace or outline of the first striking, which seemed to satisfy the said Sire de Boissise. This trial was completed by 10 o'clock in the morning.

§87 Thus three workers and one moneyer (taking into account all the time elapsed during the handing over of journeys and the ceremony of delivery, that M. de Boissise and de Marillac wished to see during this trial and that lasted more than two hours) only took five hours to fabricate, work and coin 2½ marks of quarter-écus, 3½ marks of pieces of 10 sols and 2½ marks of écus, which is a great deal higher rate of production than Briot managed in his trial; who, in twelve or thirteen hours, including the time of melting and casting in bars of his metal, he, with two others, only made 1½ marks of pieces of 10 sols, ½ mark of quarter-écus and 1 mark of écus and made three or four times as much scissel as coined money.

§87 The comparatively small quantity of scissel is a consequence of the method of cutting off from the ingot little more in weight than the eventual coin. Time and fuel saved in this way is, of course, more than expended in the necessity

of beating the rectangular lump into a thin round flan with the accompanying annealings. Briot may have lost this battle but, in the end, the war was won by machinery.