Post-Graduate Report

Geoff Wilson

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1. Titanium

This armring is the first project undertaken in my year of post-graduate study. It is constructed of 4mm titanium rod, coloured blue, various silver fittings and two carved pieces of ivory.

Firstly, the titanium, as it is effectively the most interesting, as well as the most difficult material I have chosen to work with. It is an extremely hard metal, yet at the same time, it is very light. Its principle uses are based in the aerospace and aviation industries. Its advantages over materials of a lightweight nature, such as aluminium, are its strength, which I find to be at least comparable to stainless steel, its very high melting point, non-corrosiveness, and its weight are comparable to that of aluminium.

In its as-purchased condition, it is reasonably malleable. With the application of heat, albeit reasonably high temperatures, it becomes increasingly more difficult to achieve desired results, so much so, that by the time $900^{\circ} - 950^{\circ}$ Celsius is reached, normal steel tools, files, saws, sandpaper or polish have no effect on the surface. However, in its initial form, it may be bent into fairly constricted curves, mostly with the aid of a vice, to hold the work securely, a large hammer and a block of wood to hold against the work to avoid leaving hammer marks.

For larger curves, such as those of arm or neck diameters, 6 and I2 cms respectively, the choice of a mandrel close to $\frac{1}{3}$ smaller than the req uired dimension is usually advisable, to allow for the retained "memory" of the metal, which causes it to spring open.

Whilst working on this first piece, I found it possible to bend very easily by heating with an oxy-acetylene torch to red hot, then with only light- handed pressure, bend it to the required form. This however, turned out to be nowhere near the success I had at first envisaged.

The initial stage of preparation for colouring, filing and then sanding with emery paper revealed no damage to the metal, even though there was a noticeable difference in hardness. However, upon polishing, there appeared on the surface small uneven blotches of a slightly darker grey, which proved impossible to remove. Consequently, when the piece was subjected to the coloring process, the areas in question remained an uneven purplish colour, while the rest went on to a dark blue. The piece was remade without the aid of heat and was coloured successfully.

Drilling of holes through titanium can also be a haphazard affair. With only normal high speed steel drills available, of 2.3 mm diameter or less, care must be exercised to allow the drill to cut without excessive manual pressure being borne upon it. The result of too much pressure will take one of two courses. Either the drill will shatter to pieces in the hole, leaving the rather difficult task of extracting the remains of the drill, or it will blunten itself and gain heat to the point where it loses its tempering and is no longer useful for drilling holes in anything.

Having said that, I have found it most successfull to operate on a one- drill to one- hole basis. There have been instances where it has been possible to drill up to four holes with one bit, but this, I think, is a combination of good luck as well as the absence of excessive pressure.

With regard to polishing, in the first instance I found it necessary to remove the satin- finished marks left by manufacturing with fine emery paper. This stage of the process was later found to be not needed if a hard felt buff used with tripoli was employed. A number of other compounds were tried with varying success. Firstly, a gritty, very abrasive compound normally used to polish steel was tried to no avail, and then a much finer compound destined for polishing stainless steel was tried, again without success. It became apparent that the heat treatment was the source of the problem.

Since that first piece was remade, I have been able to forgo the laborious task of emerying the entire surface. It is now only required where filing has been done. The rest of the surface can be tackled straight away with the aforementioned hard felt buff. Thorough inspection of the piece is necessary to reveal any remaining flaws. Going over the piece with a calico mop removes marks left by the felt. Washing with ammonia and water is done to remove any remaining traces of tripoli from the work and then all that is required is a comparatively light going over with rouge on a cotton mop to obtain a final high polish.

After rouging is completed, a thorough wash is again essential to remove any traces of polish, grease and grime that may have been picked up during the final procedure. It should, I feel, be as close to being sterile as is feasibly possible, because even a fingerprint would be enough to act as masking agent and inhibit the even colouring overall.

It is in this area that problems have been frequently encountered. The kilns that have been used seem to be a crucial part in whether or not a uniform overall finish is obtained. Because of the convection current circulating the heat around in the kiln, small particles of dust land on the piece and effectively block off tiny spots of the metal from colouring. The result is rather irritating little spots of silver in an otherwise reasonably uniform blue. The piece is suspended in the kiln by means of fine spring- hardened stainless steel wires embedded in asbestos sheet. Drill- holes are used, to avoid having to place the wire on a part of the surface that is easily seen, as there is a difference in the speed of the different metals reaching any given temperature.

Two measures were taken to try to prevent dust accumulating on the piece. Firstly, the entire inside surface of the kiln was brushed down, and then a jet of compressed air was trained into it in an attempt to clear it of all dust and debris, while an overhead exhaust fan attempted to clear the area of airborne particles. The effect appeared negligible, as the piece came from the kiln with two dust spots on it. The temperature needed to attain a blue colour such as on this piece is approximately 460° Celsius. This can only be approximated, as the kiln is hotter towards the top than the bottom. When suspending the piece from the wires, measures are taken to ensure the piece is located as close as possible to dead centre of the interior space.

The other preventative measure taken amounted to the installation of two asbestos mats, one on either side of the kiln, to cover the heating coils in an attempt to stop the dust being blown about. Unfortunately, the success of this could only be regarded as moderate, if that.

The colouring is in fact an oxidised layer built up on the surface of the metal, and should prove to be quite durable, although not immune to scratches. Scratches of this nature, sanding or polishing will reveal the layers of oxide which have built up. Removal of the blue layer will reveal a purple layer, underneath which is a golden layer, and then bare metal.

ARMRING I-82

As with practically all the other work I have done, i.e. 80/8I, the work of I982 consists of a variety of mechanisms, fabricated from stirling silver to serve as opening devices. What these can be best described as are controlled hinges, of one form or another.

The mechanism of the first armring is a hinged lever-clamp. The pressure which holds the two ivory parts together is carried by a hinge, which has an integral part; a swivelling lever which hooks itself around the titanium ring to fasten the device. The smaller piece of ivory is fastened to the titanium ring by two circular clamps.

As for the carving, apart from restrictions placed on me by size, and the necessity to have a secure tight fitting joint of the two pieces, I am virtually free to do as I please, bearing in mind the comparative strength of the material. The result is of an organic nature, which basically means that it reminds most people of bones or shells. Of course, there are elements of a similar nature or effect, observable in my work, such as some of the joints, and my recurring use of the helix form, which is ever present in shells, but I don't consciously try to copy.

Ivory, either elephant or whaletooth, is the material I have chosen, because of a number of qualities it possesses. Firstly, its strength is greater than that of cowhorn or similar materials such as ebony, and it is able to be treated in quite a number of different ways, the same as metal is tackled. Polishing is carried out the same way for both metal and ivory, for example. Secondly, I am pleased with the combination of ivory's whiteness with the titanium's dark blue. It is carved by using a variety of dental burrs, sanded with emery paper or escapement files and polished firstly with tripoli, then finally with rouge to obtain a high polish. Rouge can cause problems, however, owing to the porous nature of ivory. Usually on the outer enamel of the tusk, rouge will work its way into the surface, staining it red, which requires resanding and polishing.

ARMRING 2-82

The second armring takes on a purely mechanical theme; there is only one carved piece, that being of titanium and serving as an opening lever. It is spring- operated. By pulling down on the lever, the spring is stretched. Connected to the other part of the lever are two rods, which connect to an opening arm.

By making the spring a little shorter than the actual distance, so that it is constantly under pressure, the piece is kept closed. The spring is made from stainless steel, hardened to spring requirements for dental purposes. The fabrication of a spring is done on a lathe. By placing the end of the wire and a rod of suitable diameter in the jaws of the lathe-chuck, and taking the other end of the wire firmly with a pair of pliers, then slowly turning the chuck by hand, wind on the required amount of coils.

The connections at either end are done by softening the metal with heat to allow bending.

The handle at the end of the lever is the first attempt I have made at carving titanium. Because of its hardness, normal burrs are ineffective, hence tungsten carbide burrs are the only thing suitable for long- term work.

The colouring of the rest of the titanium occurred at approximately 400° C. The unevenness of the colour is due to the placement of objects in the kiln. The brown- gold ends were those at the bottom of the kiln, therefore heating at a slower rate.

ARMRING 3-82

No. 3 is in effect a refinement of the first armring. It is slightly smaller in diameter, the carving is much finer and the fittings are more delicate. Again the titanium is carved. The ends where the fittings are have been tapered to considerably less than the original 3mm.

The larger piece of ivory is actually two pieces screwed together. This is the first time I have left the thread exposed. I have known for quite some time of the ability of ivory, in this case, whaletooth, to have a thread tapped into it, by using exactly the same method as used for metal.

By turning the lever clock-wise the mechanism lifts the ivory arm up off its two supports far enough to facilitate arm entry.

NECKRING 4-82

Not really much needs to be said about this piece except that it is meant to go with the previous armring. The carving is in places even finer than anything that I have previously attempted. It consists of three pieces of ivory screwed together. Also, the whole surface of the titanium has been carved, in an attempt to unify the overall piece Again, by turning the lever clockwise the ivory arm opens to allow it to be placed around the neck.

It is also the first time the titanium has coloured evenly at the first attempt. There also are surprisingly few spots on the surface meaning that I probably managed to get the kiln a lot cleaner than previously, although no new methods were employed to clean it.

BROOCH 5/82

This piece is the first completed after the mid-year report was presented. It represents the third part in a series of five. The element all these have in common is the threaded lever used to raise and lower the hinged ivory carvings, employed as opening devices in the two armrings and the neckring.

However, with the brooch, and the following pieces, the earrings, the application of the device is of a more ornamental nature. It serves no other purpose than to change the angle at which the piece of ivory is held. It provides approximately 45 of travel, which the wearer can adjust to suit their own taste.

The pivot point of the winder also provides the connection of the pin pivot, on the back of the piece. It took a couple of attempts to not allow the pin to disconnect itself. The hook, into which the pin fits, is also fastened to the titanium by means of a screw.

The titanium is again carved over the whole surface, and once again the colouring procedure was acceptably successful at the first attempt. However, there are small traces of the small silver spots around the bottom of the curve. Owing to a slightly longer time being spent in the kiln, the blue colour is a good deal paler than most other overall colours. The other piece it occurs on is the last armring, upon which small areas of the surface are paler than the surrounding blue.

The ivory, again whaletooth, is carved in such a way as to incorporate characteristics that have been employed on the previous two pieces. Firstly, it is a two-piece construction, which is fastened together by making a nut and bolt of ivory, and when securely tightened, shaping the two pieces together, it forms a raised line travelling in a helix form from piece to piece. This piece also presents the smallest diameter threading of ivory I have attempted as yet.

No real problems were encountered, but it must be remembered that, with the diameter decreasing in size, the need for an accurate bolt blank, prior to threading, is essential. Owing to the decreased depth of thread cut, there is also a proportionately smaller margin for error. Should there be too much material to be cut away whilst threading, the ivory may well chip or shatter. Having too little obviously means no thread at all.

The overall shape of the two pieces combined is generally similar in its use of lines and shapes, to that of the two previous pieces, and that of the following piece.

EARRINGS 6/82

Two highlights, one of metal and one in ivory, occurred during the construction of the earrings, part four of the series. Firstly, and possibly the most rewarding, was the experience gained from working with gold. The metal employed was gathered over a long period of time, chiefly consisting of a variety of rings, engagement and friendship, chains, medallions and assorted other small pieces of jewellery, no longer of much commercial value. That is to say, that predominately 9ct and perhaps 15% 18ct golds were used in the first piece.

The first part of the procedure involved taking all the pieces and annealing and pickling them. Annealing is the heating of the pieces to red-hot, to relieve them of the tension created by working the metal, and which forms a black to red oxide on the surface of the metal, which is then removed by the pickling solution.

Ordinary pickling solution, which is comprised of 1 part sulphuric acid, diluted with 10 parts of water, was used with satisfactory results, to remove the surface oxide. The standard gold pickle consists of half the amount of sulphuric acid, combined with nitric acid to form the one part, to which ten parts of water are added. This speeds the cleaning process up considerably, however, the silver solution provided a satisfactory alternative.

When the pieces were removed, they were wiped dry, which also removed the last traces of oxide, and then cut into small pieces, approximately no bigger than 1 cm.

These were then placed in a suitably sized depression which had been hollowed out of a large rectangular carbon block. The hole was situated quite near a corner to facilitate a pouring spout on one of the edges. At the same time, an ingot mold was prepared. The mold is a two-part assembly, held together by a purpose-built G clamp, hence it is adjustable to the width of the desired ingot. In my case, as the sides of the mold are 4.5mm apart, as near as possible to a square rod was used. The inside of the mold had first been covered with a layer of candle smoke, (subsequent use involved covering the inside with a thick, black layer of soot obtained from the oxy-acetylene torch without turning on the oxygen supply) to act as a release agent for the newly cast metal. This is also heated to a low temperature before the metal is poured in, to evaporate any moisture that may be present in it, and to alleviate the shock it undergoes when molten metal is poured into it.

Heating of the ingot mold should be concurrent with the metal approaching a molten state.

The metal, when placed in the carbon block, is at first heated gently with the oxy-acetylene torch, especially if it contains small particles, for example filings or shavings, as they are very easily blown away. This wastes metal, and could be quite dangerous.

As soon as the material seems stable enough, a more fierce heat is applied, until melting takes place. During the melting process, a small quantity of powdered borax is sprinkled over the metal to prevent an oxide from forming on the surface. When a molten state is achieved, this being determined by the liquid state of the metal, the block is carefully lifted into position above the ingot mold, with heat still being applied, so as not to allow it to cool appreciably, then it is quickly poured into the pre-heated mold. Accuracy is also important with pouring, as any spillage is potentially dangerous, and at best requires repeating the whole process.

Upon cooling, the mold is taken apart to reveal the result. In this case, what appeared was a length of square rod about 3.5cm long. The surface of the metal, although clean, was fairly uneven, along with several quite deep pits. The whole surface was then set upon with a course file. This resulted in a smooth surface, but for the deepest pits, which were then removed by a suitably sized dental burr. It is crucial that these are removed early in the process, for if they are still present after the rolling-down, they will undoubtedly break at the next stage, drawing the metal into wire.

Drawing metal down into wire entails stretching the metal through progressively smaller diameter holes in a carbon-steel plate. Many profiles are available, but in my case, circular wire of 2.5mm and 0.6mm diameter were required. A tapered section must be made on one end to enable the wire to be pulled through. The tapered end is held tightly in the jaws of the tongs, which is then wound along the length of the bench via a chain connected to a suitably geared winder. Annealing must be carried out after every four or five pulls.

Being predominately a 9ct alloy, that is only about 35% gold, it becomes surprisingly hard very quickly. Also, even though 15% of the alloy was 18ct, the resultant alloy could not legally be classified as anything but 9ct, owing to the fact that each time the metal is taken to a molten state, a small proportion of the carat content is boiled away. With later casting, the metal consisted primarily of 18ct gold with a small addition of 9 carat.

With the metal thus prepared, normal procedures were carried out to fabricate and assemble the assorted parts to form two earrings. Perhaps just a little more care was taken with most steps, as the fear of ruining something of gold is a different feeling to that of destroying something made from brass. However, it did not take long to find out just what a pleasing material it is to work with, especially applying the final polish.

With fabrication of the metal complete, the ivory carving was then tackled. Prior to this, I have only attempted comparatively simple carvings of a duplicate form. With these, however, characteristics pertaining to the previous pieces had to be incorporated, therefore these had to be considerably more complex. This first attempt, which was done by carving each piece separately, did not reach completion primarily because I felt it was, to put it mildly, aesthetically displeasing. Although that was the reason for abandoning efforts of completion, the task of copying what had already been done on the first piece would have proven virtually impossible to duplicate with the second.

The only avenue open to overcome this problem, was, following hole-drilling for securing the ivory to the gold, to make several passes over it with the burr, then make cuts as near to identical on the second piece as was possible. This made for a somewhat slower pace than average, but it proved quite successful, which can be attested to by the fact that I can no longer remember which one came first. They are, of course, not exactly identical, but they are accurate enough to stand close scrutiny.

ARMRING 7/82

This armring, though presenting perhaps the most refined design solution I have achieved so far, offers only one area of experimentation and development as yet untried, that being the possibilities offered by tortoiseshell.

Tortoiseshell,in this case, the shell of the hawksbill turtle, is usually no more than 4 to 5 mm thick, therefore having limited possibilities in a jewellery format. Nearly all its uses are confined to be of a flat nature, for example hair combs which are slightly curved, and letter openers, which are usually flat. However, I felt it would be possible to create considerably more three dimensional carvings by employing the technique of steam-bending.

A test was first made on a quickly drawn and cut out sample piece. It took the form of three near-parallel sections, joined at each end, with considerable distances between each section.

The workshop's coffee urn was deemed the most efficient means of achieving the desired results. It provided adequate facilities for fastening each particular piece to the inside, and there was more than adequate room inside the urn for suspending the pieces without immersing them in the water, as well as it being the closest and easiest means of providing constant steam for up to 30 minutes at a time.

Only one student in the workshop reacted negatively to my use of the urn for such purposes, but a subsequently produced coffee percolator appeased her during the few days I was using the urn.

The test piece was suspended inside the urn by way of a small hole being drilled in the end of it, to allow a length of small diameter stainless steel wire to pass through it and fasten it to the side of the kiln in such a way that it was not touching the sides and not hanging in the water.

With the lid replaced in position, the temperature was placed on high and allowed to boil for approximately 20 minutes. This proved to be a sufficient period of time for the material, which in this case was only 2mm thick, to become suitably malleable.

Immediately upon withdrawal, while being held firmly with a pair of pliers, a small diameter drill (2.3mm) was woven through the three pieces, forcing the center section to curve upwards and the two outer sections to curve downwards. It was then left for twenty to thirty minutes to cool and harden.

Once cool, it was found to have returned to its pre-heated condition, retaining all its working qualities. Immersion in boiling water, however, was found to give the lighter areas of its colouring an opaque appearance, which took a much longer period of time to return to normal.

Tortoiseshell shares many characteristics with materials such as buffalo and cow-horn. For instance, all are very porous while polishing. If the first polish (tripoli) is not used all over the surface, the untouched areas will soak up the final polish (rouge) to such a degree, that even after two scrubbings with soap, ammonia, water and a stiff brush, traces of rouge will still remain. I assume that, in thin enough sections, both horns could be successfully bent, and perhaps, with experimentation, ivory could be made to react similarly.

After the test piece was subjected to finishing procedures, e.g., filing, emerying and two applications of polish, and seen to be a success, a pattern was drawn out on the sheet on the part it was thickest. Allowances were made for drills to be forced through the cut-out sections. Thirty minutes in the urn proved only just sufficient for the material to be workable.

Considerable pressure had to be applied to fit the drills through and it was found necessary to tighten the whole piece in a vice to obtain an overall curve and a large pin-vice was used as a counterweight to achieve a 90 twist in one end. After it cooled, it was removed from the vice and had the drills taken out, then a subsequent re-steaming was attempted to increase the curvature of a particular section. Re-application of steam caused the shell to assume its original flat state. 30 minutes later, the process of threading drills through it was repeated, this time a larger diameter scribe was chosen to enlarge the offending curve. Owing to, most probably, too short a time spent in the urn, the section in question broke away from the main part at one end. Further attempts to rectify this problem proved fruitless.

A second piece was then drawn up and cut out, this time comprising a four part construction, which consisted of two small steam-bent parts, linked together by two round rods, threaded at each end and fastened by four small nuts. As with horn, tortoiseshell has the ability to be threaded, following the same procedures as used for ivory. Unfortunately, this was also unsuccessful, caused, not by exceeding the bending limit, but by carving a particular section far too thin. A light bump was all that was needed to break it, rendering it useless.

As these two attempts had used up nearly all the sheet in the vicinity of 4mm thick, the whole idea of incorporating tortoiseshell was abandoned in favour of using whaletooth and two connecting gold wires to achieve a satisfactorily resolved solution.

The resultant two-piece ivory carving is the finest, most delicate piece of carving I have yet achieved. This, unfortunately, also deems it to be probably the most fragile. Only the most minimal amount of pressure could be applied with all of the hand tools necessary to clean it up to a polishable state. Polishing was carried out with conical felt wheels, to avert the possibility of catching a protruding part with a larger cotton mop, and undoubdtedly breaking it.

The gold used for fabrication of the opening device can be regarded as being 12 - 14 carat, due to a high percentage of 18 carat (approximately 60 - 70 %) being used, with the remainder being various items of 9ct gold. The mechanism can be looked upon as almost the same as those employed in the last four pieces. Only the addition of the drilled flat sheet which converts the winding movement to a lifting motion can be called a modification. The pierced titanium band is probably the greatest deviation in regard to the overall appearance of the piece. On this point alone, the difference between it and preceding pieces is perhaps enough for it to be regarded as a piece in itself, and not a part of a series.

Returning once more to the inherent fragility of carved ivory, I feel it important to relate that I consider this piece, the neckring and the preceding armring, as unwearable, due to the fact that I don't think they would survive their first outing. The slightest bump, or perhaps an ill-informed attempt at opening or closing any of these pieces would result in cracking or breaking of the ivory.

I don't consider this to be detrimental, because when an overall view is taken, in my present course, it has allowed me to push carving of ivory to its sensible limits. A large number of failed attempts and broken partially complete pieces attest to this. I envisage the destiny of non-wearable pieces to be that of collectors' items.

HATPINS 8/82, 9/82, 10/82.

The series of three titanium hatpins stem from forms used in the winders of the preceding armrings, etc. Titanium was an obvious choice, based primarily on the premise that it is the strongest material available, with the added bonus of it being carvable and offering colouring possibilities.

Five millimetre rod was selected as it allowed greater opportunities for a convincingly three-dimensional shape to occur at the end of the pin. Firstly, the end to be carved was bent into curves approximately as the finished pieces appear. This was done as before, with the piece in the vice being hit into shape with a hand-held block of wood, held between the hammer and the piece being struck, to prevent marking the metal with the hammer.

The tapering of the pin was undertaken next, by rolling the rod through progressively smaller square section channels in the rolling mill. By working slowly, an acceptably evenly tapered pin section was arrived at. A course file was then employed to achieve a suitably even circular pin. Rolling the rod also work-hardened the piece, hence providing added strength. A very high mortality rate amongst drill-bits might serve as the best observation concerning the next step, hole-drilling to separate the chosen sections from one another. An inability to properly clamp the pice to the workstand, sometimes over-zealous application of pressure on the drill and the sheer volume of holes required to successfully complete the operation is where the blame can be laid.

On several occasions, drills broke off while still in the hole, necessitating more holes to be drilled close by, and usually for the offending portions to be cut away entirely. Then all the holes were done, a saw cut, (and in some areas a small diameter burr was used), was made to complete the separation.

When separated, the nose of a pair of pliers was forced into the gap, then when far enough apart, a second pair was inserted to enable the bends to be made just as required. The next task was for the piece to be carved into its final shape. Due to the reasonably restrictive diameter of 5mm with the original rod, very complex forms were not possible. Provision had been made for the pin section to be integrated with the carved area, by allowing at least a centimeter from where the the taper ended to where the drill-holes started. Drill holes also ended at least 15mm from the top end to allow the last part to remain as a solid carved section.

In regard to the final preparation, no new methods were attempted, and the whole process was conducted as it is set out in the preceding text. The pieces were deliberately suspended near the top of the kiln to increase the likelihood of the pieces emerging with a graduated colouring, the effectiveness of which can be judged to be moderately successful. The second and third pieces were also offset from the center of the kiln to hopefully achieve variations of colour from side to side. A larger amount of gold tone at the end of the pin section, I feel would have looked better, but nonetheless a quite noticeable transition from gold through purple to blue occurs. On only one piece, albeit in very small amounts, do the tiny silver spots appear, so it becomes obvious that the problems connected with cleanliness of the kiln, or whatever it may be, are still not resolved.

BROOCH 11/82

This piece, the final undertaken as part of the post-graduate programme, can be seen as displaying quite a few common characteristics with previous pieces. For instance, the threaded winder fulfills two roes, one enabling carved forms to be inter-changed, the other serves as the means of opening and closing the pin for it to be fastened to clothing.

In the case of its major role, that of allowing pieces to be interchanged from one another, the winding device is responsible for the opening and closing of a pair of jaws with circular, domed ends. These jaws, as well as the rest of the brooch's framework, is of sterling silver. The jaw mechanism and the pin mechanism are made primarily from the same gold that was used in the previous armring. By turning the winder anti-clockwise, the jaws loosen their grip on the carving, allowing it to be replaced by another piece.

More than the current two pieces of carving were envisaged, but these were settled on after many unsuccessful attempts. The first material tried was something I had never worked with before, that being boar's tusk. It consists of a very hard, armour-like outer layer, less than a millimetre thick, which when removed, revealed a dense, finely grained yellow ivory. Its downfall, however, was brought about by a comparatively large central core of a softer, translucent material. Upon carving away as much of it as possible, there still remained a large section present in a part of the form, that, had it been removed entirely, the overall piece would have been considerably weakened and would definitely not have gained anything in attractiveness. It was scrapped.

The next four attempts were carried out in elephant ivory. I wanted to find out if it was possible to link two pieces together by way of a ball and socket joint. The first part was made with ball ends at each end, one to be secured to the brooch, the other to be inserted in the socket joint of the second part. The socket was made by carving a ball end on a short stem, a saw cut being made right through the ball and terminating near the base of the stem. The inside of the ball was then carved away to allow the ball to be forced into it, with the assistance of a screwdriver being pushed into the slot left by the saw. By applying pressure on the screwdriver, the two parts of the socket were pried apart far enough to allow the ball to be squeezed through the gap. The first three broke whilst attempting to get them together, due to the stem of the socket being too fragile, and perhaps the saw cut not being deep enough to give adequate flexibility.

The fourth survived the process, having had the abovementioned problems rectified. This, though, led the forms to be overly clumsy and awkward in appearance, so much so that the piece was deemed unusable, and duly abandoned.

The resultant pieces, one of elephant ivory, the other of buffalo horn, are the fruits of nearly three weeks of searching for alternative means of solving the problem. The ivory, which was done first, held no surprises, as it was deliberately kept simple, and of relatively thick section, to enable it to retain enough strength to be serviceable.

The buffalo horn, chosen for its near-black colouring, provided a contrast to the ivory. In this application, ebony was ruled out as being too brittle in small slender sections to guarantee any success. Buffalo horn, as previously mentioned, is of the same nature as cow horn, hence no problems were encountered with its initial carving. It is far more flexible in thin sections than ivory, so the likelihood of it breaking upon being dropped is not so much a problem. It was when the polishing stage was reached that problems arose. It totally resisted any attempts to polish it via normal methods. The tripoli did not create insurmountable problems, but when rouge was applied, the whole surface, especially areas where tripoli had not thoroughly covered, took on a pale red appearance.

Removal of the rouge by scrubbing with ammonia, soap and water followed, and upon re-application of the two polishes, the same result occurred. This led to the trying of polyester resin polish and stainless steel polish in an effort to negate the effect that rouge had had on the surface, and in some areas, to complete removal of traces of rouge that the cleaning process had failed to remove. As a last resort, powdered pumice was mixed with water to form a mild abrasive, and was then applied to the whole surface via a paintbrush, to return the whole piece to a uniformly matt finish. A coat of Scandinavian oil, a timber finish, was applied and allowed to soak in for a short period of time, then rubbed back with a clean cloth to remove excess and give the surface a dull sheen. Further time for drying was allowed, and another going over with the cloth brought the finish up to what it is now. Subsequent coats of oil may serve to further enhance the quality of the finish, and possibly serve as protection against splitting, brought about by aging and extreme variations in temperature.

CONCLUSION

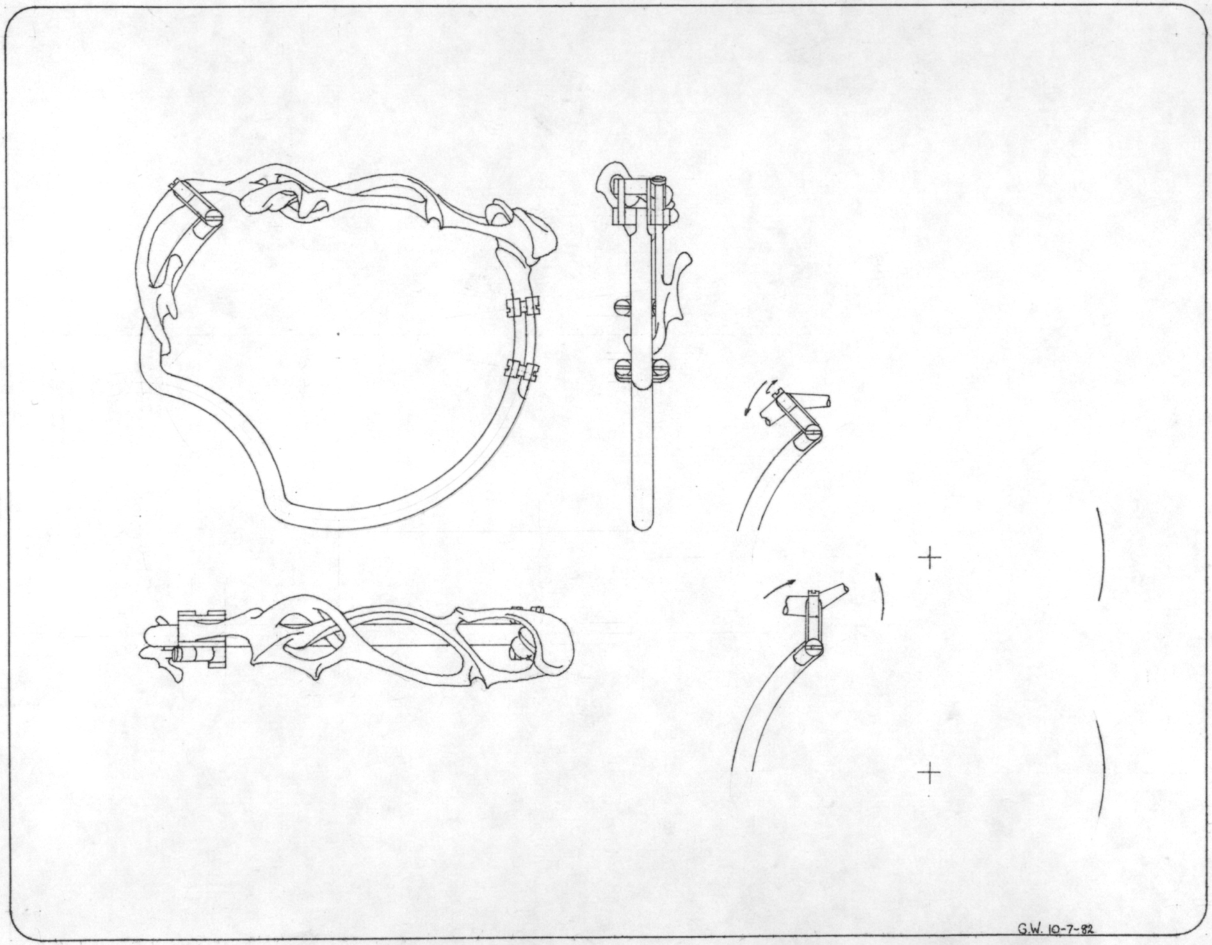
To conclude this report only a few more things need to be said. Firstly, it has allowed me to pursue and attain a level of refinement, of both design and technique, far beyond that which I achieved upon completion of my Diploma course. Work dating from that time, and earlier, takes on a clumsy appearance when displayed alongside the work of 1982.

Perhaps one of the most important facets of the year's work was that of the freedom it allowed. In most instances, decisions regarding design problems, materials to be used, sizes, etc., were made by me. Naturally the senior lecturer was consulted if something arose that I was not sure of, and advice was freely given when alternative methods or means were sought. The development of the work has been directed into three areas; titanium, mechanical devices and carving. In time to come, titanium willprobably present the greatest problems. Purpose-built equipment, such as anodizing facilities, and a large range of tungsten-carbide burrs, and drills, would allow for a substantially larger amount to be achieved, given that titanium is such a hard, difficult to work with,metal.

As for the other two elements, I think in the case of mechanical devices, much more can be achieved in this area in time. For example, the introduction of the use of low-carat gold has yielded results superior to those achieved with silver. On the same note, in the future, alternative materials such as aluminium and steel may prove to be worth close investigation.

On the topic of carving, I feel ivory, particularly whaletooth, to be the most suitable, and exquisite, material yet encountered. I intend to continue using it for as long as supply allows. There There are, of course, still many types of material as yet untried. Black coral presents a medium I would very much like to try. Plastics, whatever form they may take, are definitely not becoming to me on the horizon of future development, though. I feel no compulsion whatsoever to work with it. Though not evident in the range of finished work carried out in 1982, quite a few varieties of organic material, which I have previously not worked with, were tried. In most cases, it was simply a matter of the material being incapable of carrying out its desired application, which in all fairness was probably due to asking too much of it.

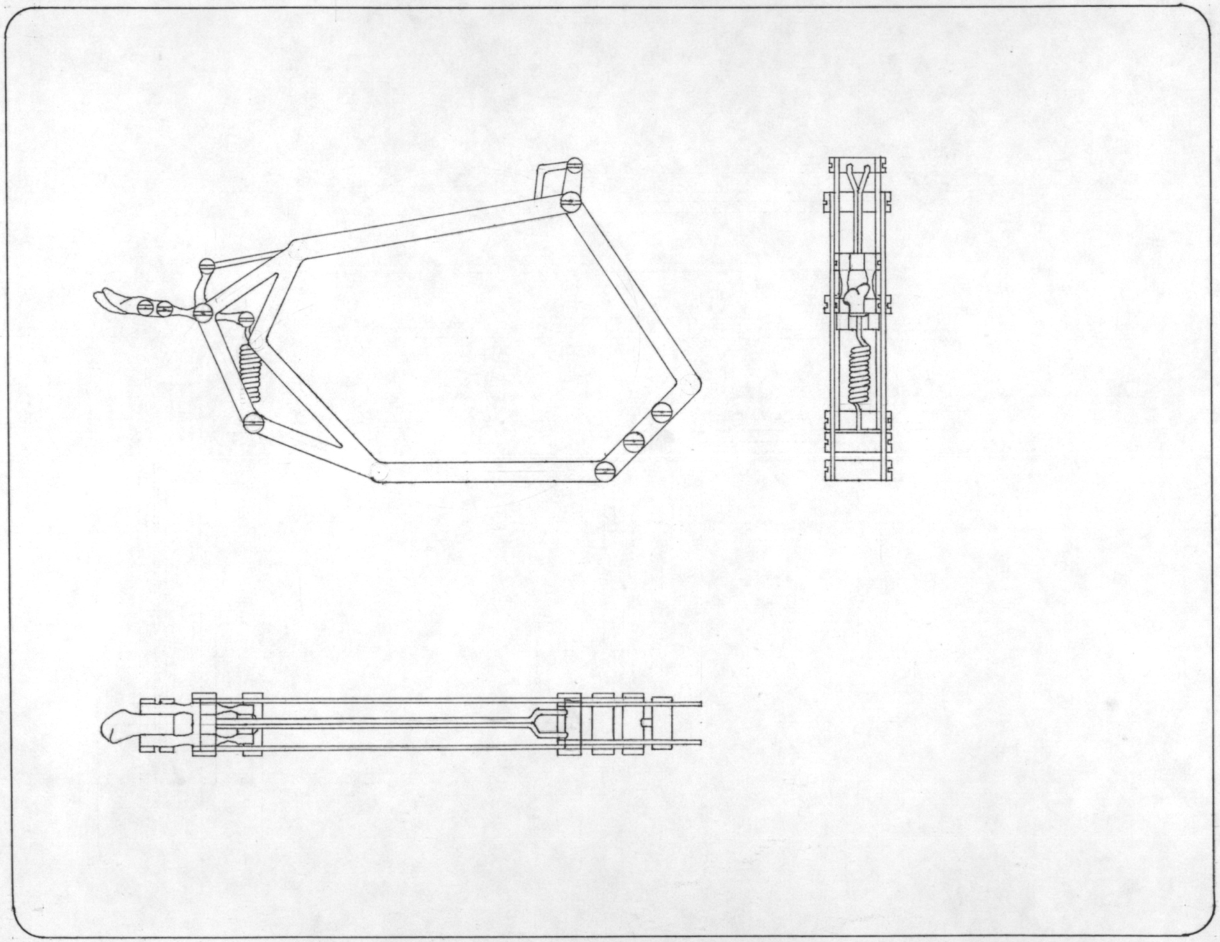
In conclusion, I feel that the year spent in the post-graduate programme has been very beneficial, in that it has allowed me to continue working in the format I have set for myself, for providing a far better and stronger stepping off point, and finally, for providing much needed impetus for future development.



armring

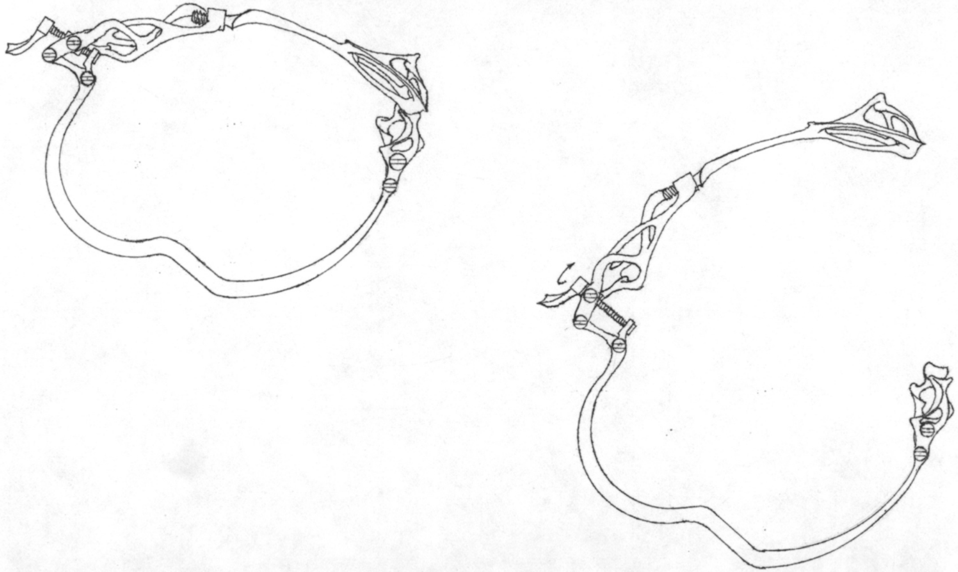
1-82

Titanium,
Sterling Silver,
Ivory.



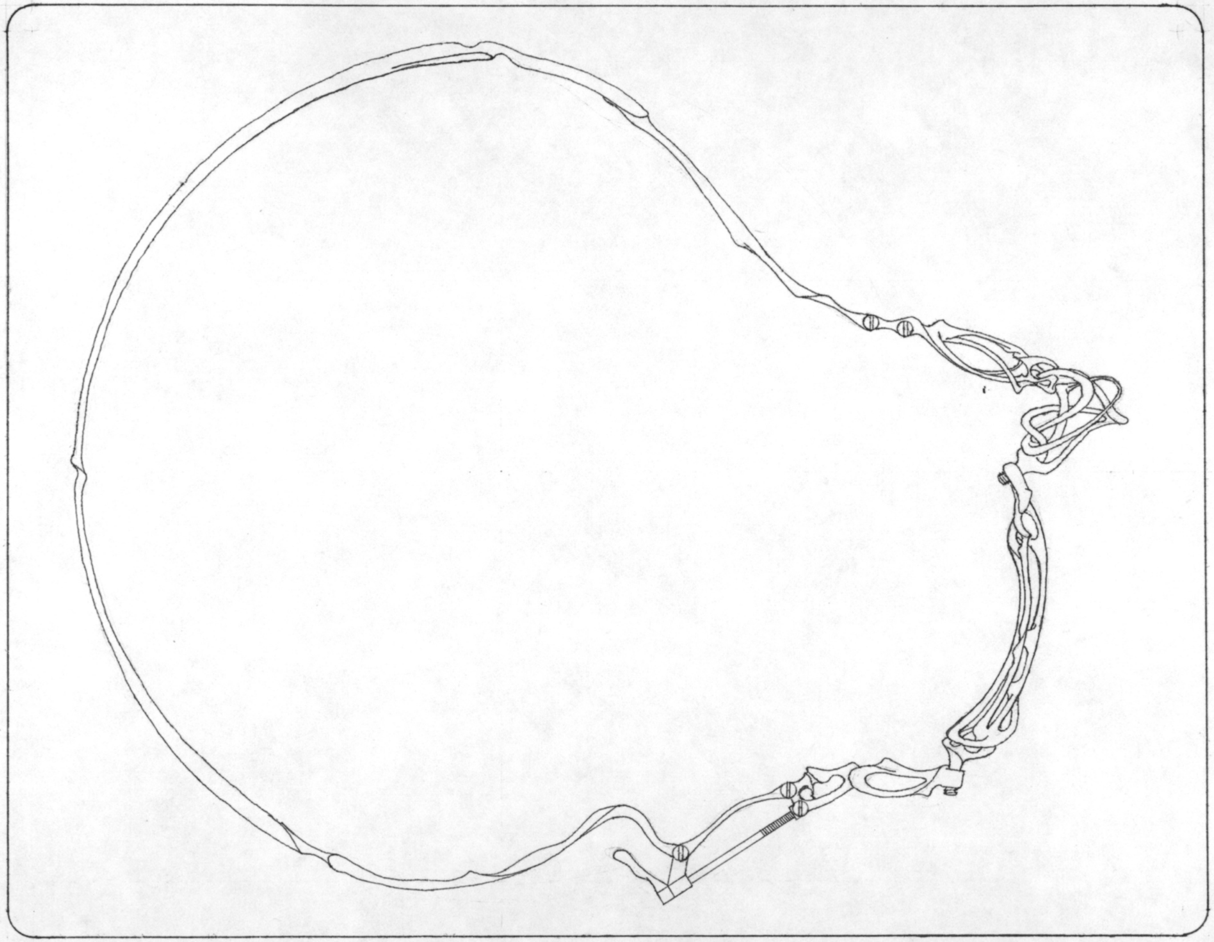
armring

2 - 82
Titanium,
Sterling Silver,
Stainless Steel.



armring

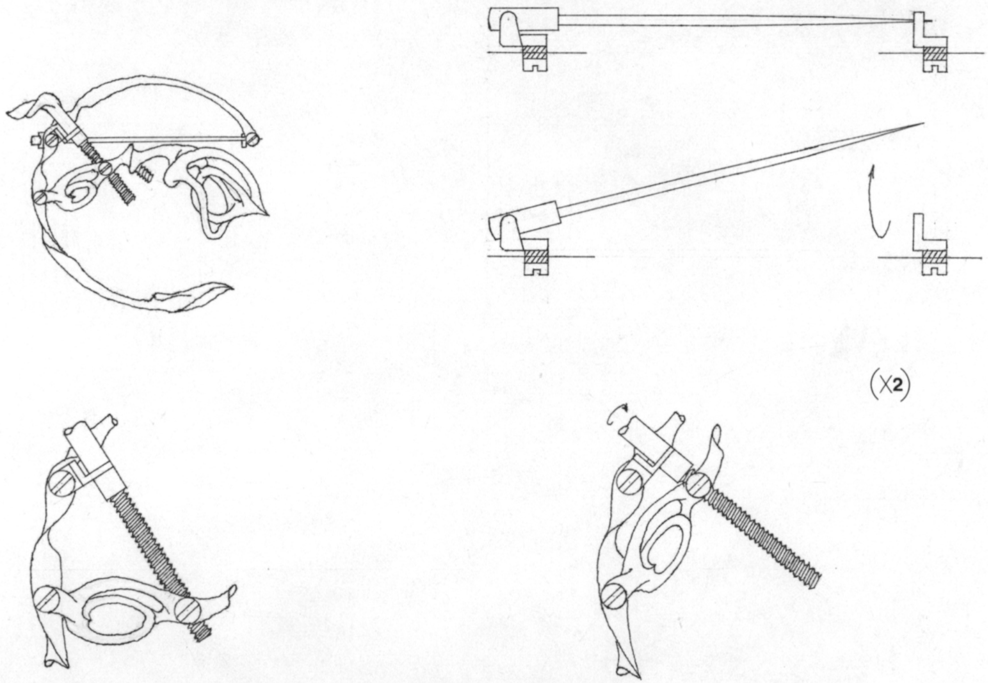
3-82
Titanium,
Sterling Silver,
Ivory.



neckring

4-82

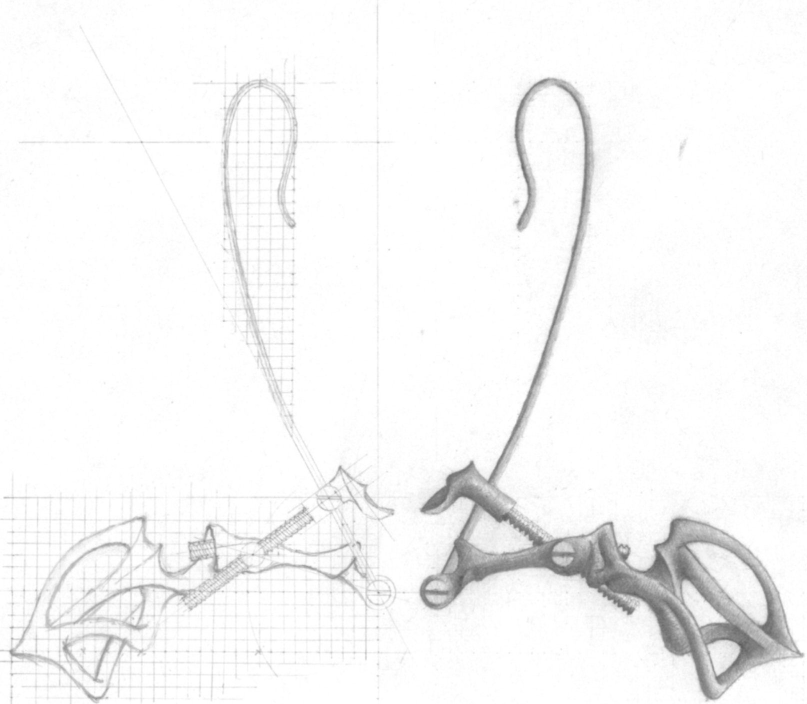
Titanium,
Sterling Silver,
Ivory.



brooch

5-82

Titanium,
Sterling Silver,
Ivory.

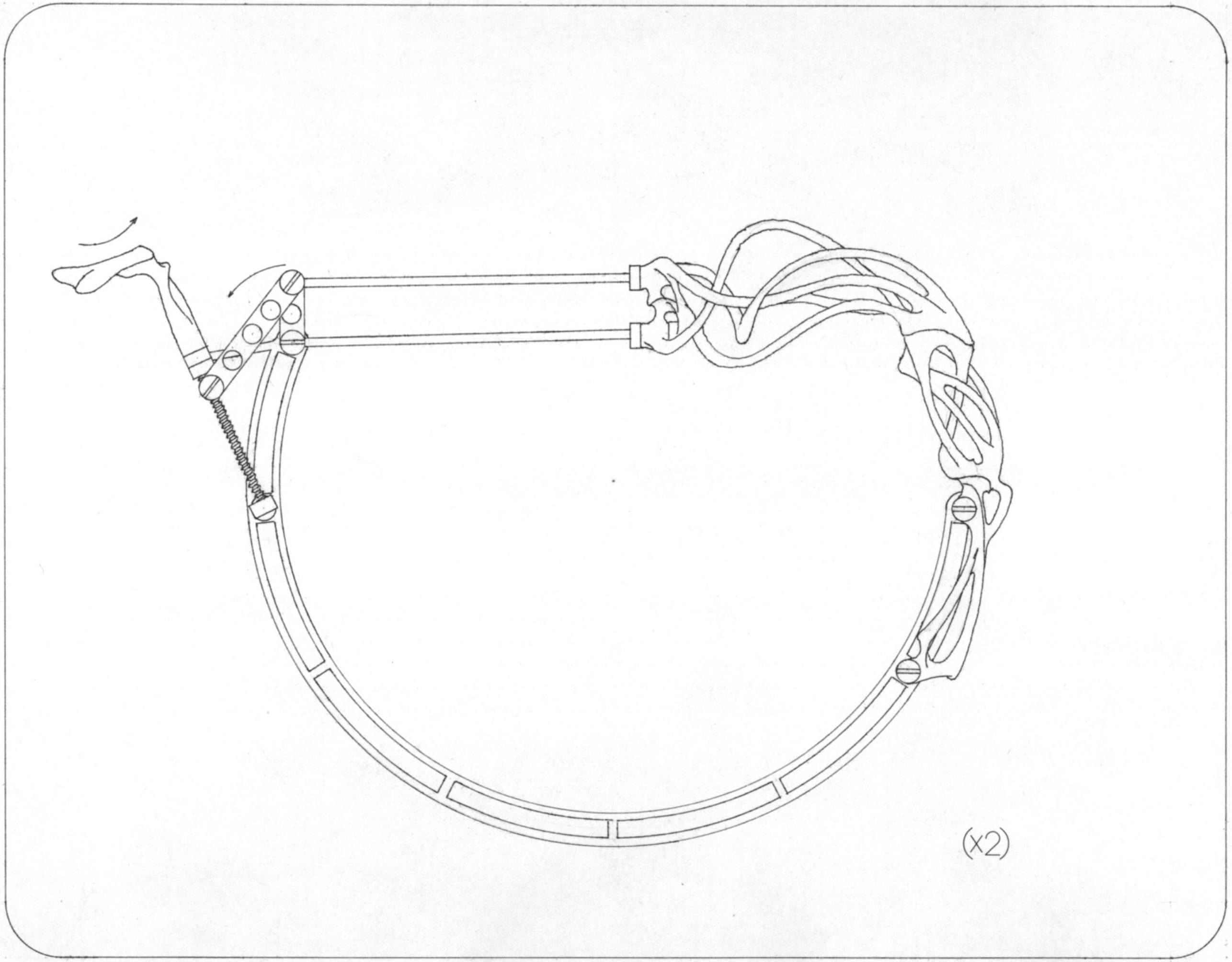


(x2)

earrings

6-82

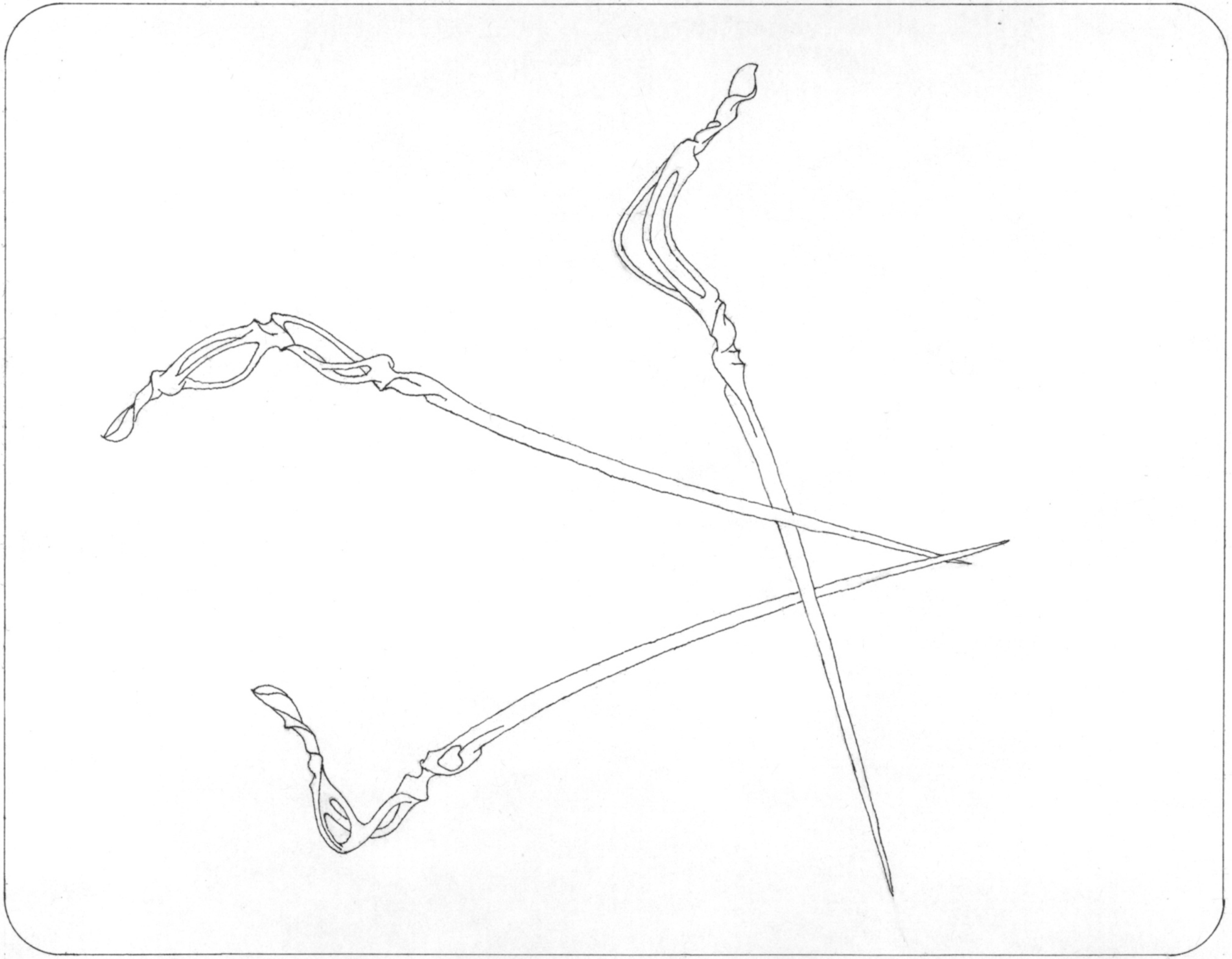
9ct Gold,
Ivory.



ARMRING

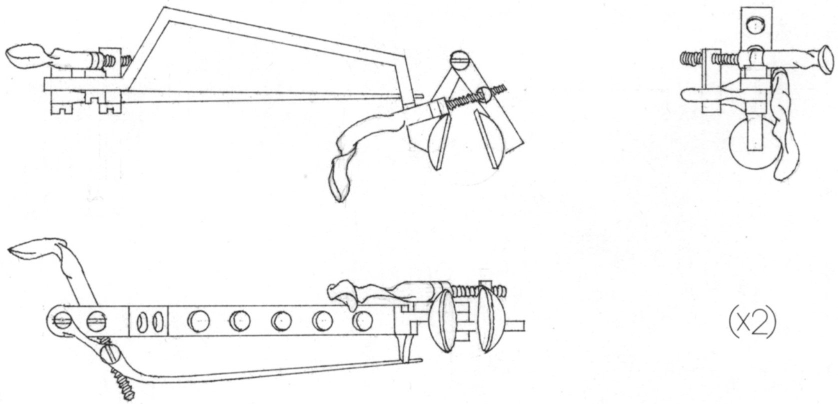
7-82

Titanium,
14ct Gold,
Ivory.



hatpins
8,9,10-82

Titanium.



(x2)

BROOCH

11-82

14ct Gold,
Sterling Silver,
Ivory,
Buffalo Horn.