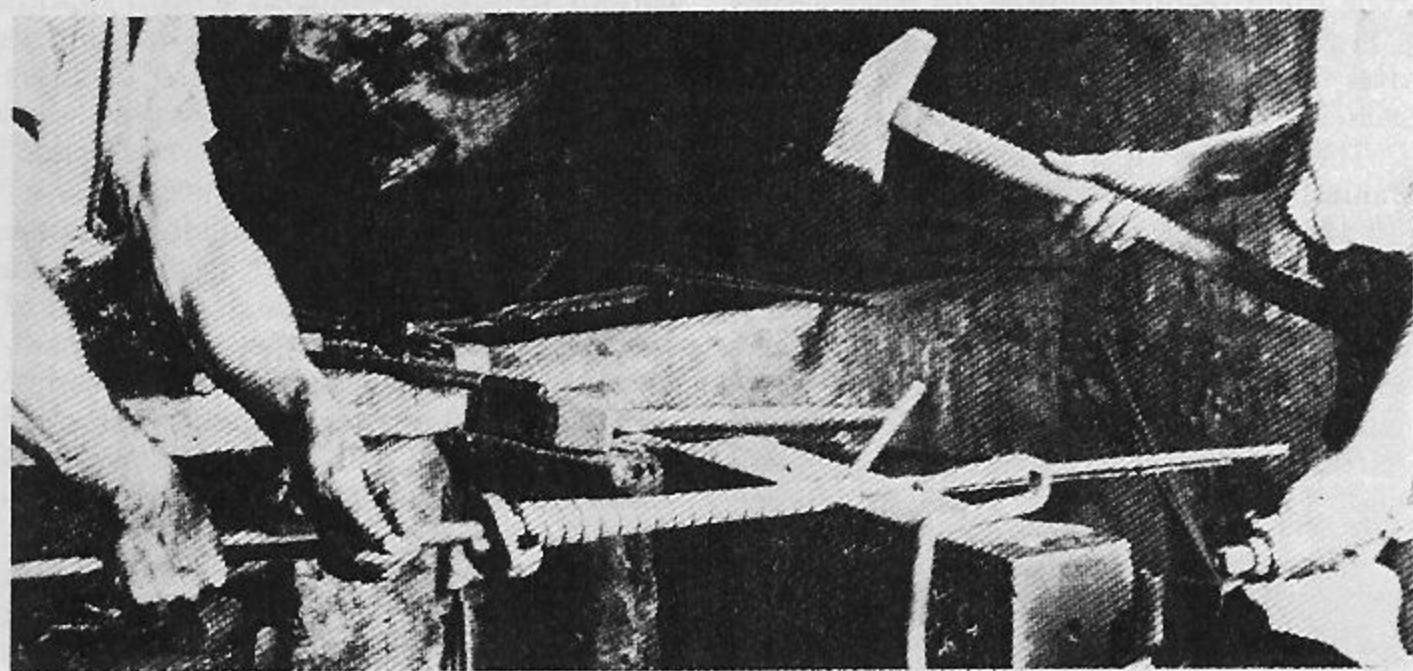


MAKING DAMASCUS BARRELS



Stage in the making of a damascus barrel. Workmen wind a heated metal ribbon around a mandrel. (Plate 2)

By JEAN PURAYE

PART I

"DAMASCUS" is a general term for a mixture of iron and steel, more or less alloyed, worked into decorative patterns utilizing the different colorings assumed by the two metals. There are two *damascus*. There is no end to the list of these, for the variations of damascus pattern are infinite in number.

These patterns are the result of placing iron and steel strips in alternate layers in exactly the same way as cards can be stacked with white and black alternating, for each layer of iron with its superposed layer of steel produces a dark sheet with a light sheet superposed, since the iron and steel have the property of readily assuming these two shades when the completed gun-barrel is subjected to the operation called scouring, which consists of applying certain acids to the surface.

Bernard damascus, named after its inventor Leopold Bernard the famous Paris barrel-maker, was composed of strips and bars of iron and steel arranged in a check-board pattern.

The iron and steel for damascus barrels had to possess special characteristics.

The iron most favored by barrel-makers was charcoal-smelted iron. "Unfortunately", writes M. Heuse-Lemoine in 1884, "coke-smelted iron has almost ousted the charcoal-smelted variety which is becoming increasingly scarce. In Belgium, only MM. Mineur et fils, of Couvin, are able to supply us with this special type of iron which, we are bound to point out, is markedly superior to any other and is essential for the manufacture of high quality damascus. Other types of iron have been tried without success, including Swedish iron, which is very strong but, because of its steely nature, does not produce a good

damascus: its own colour merges into that of the steel.

"Coke-smelted iron, because of its very low cost, can be used in the manufacture of gun-barrels, but it cannot be used for high quality damascus because of its impurities and other natural defects, and it is suitable only for cheap barrels."

Not only the iron, but also the steel used for damascus had to be of a special quality. The Kotte firm, of Lüttringhausen in Westphalia, had at this period a great reputation for steel and supplied many Liège barrel manufacturers.

We must now describe the various stages in the making of a damascus gun-barrel.

The first operation was to make the billet. This was built up with strips and bars. The strips were 4 mm. thick, 120 mm. wide and about 50 cm. long. They

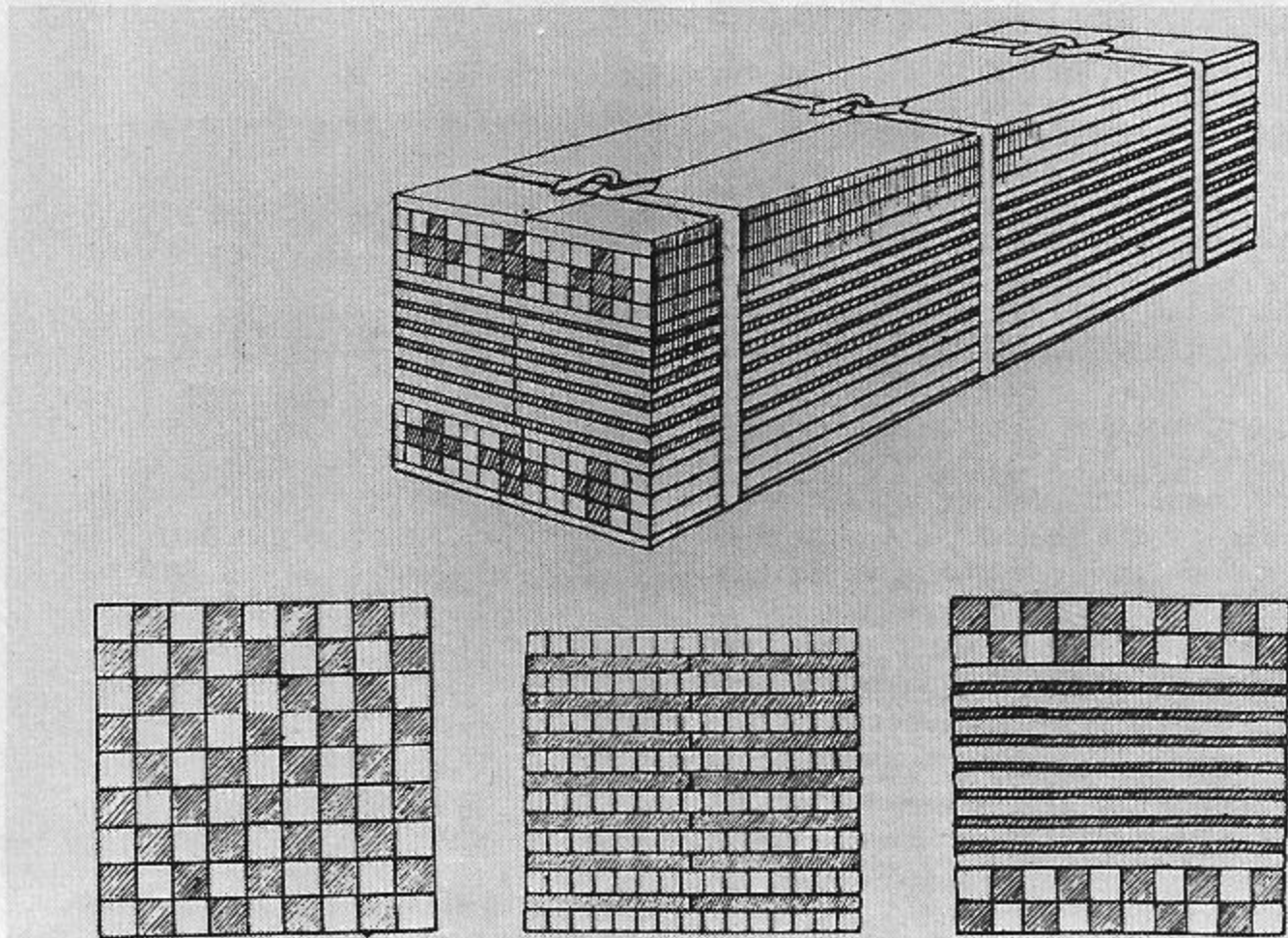
were arranged with the bars of puddled iron and steel in varying proportions, usually 60% iron to 40% steel. The two metals could be arranged in a variety of combinations, a few of which were traditional. The arrangement of the steel and iron governed the pattern that would eventually appear on the finished barrel. (Plate 1). The illustration shows a billet and some cross-sections; the unshaded portions represent the iron and the shaded ones the steel.

There were many types of damascus: the "starred", made from nine layers of iron and six of steel, plus 48 bars of iron and 30 of steel; the *Double 81 Bernard*, 41 iron bars and 40 steel bars; the *Extra-fine "Crolé"*, eight layers of iron and seven of steel; the *Washington*, eight layers of iron and seven of steel plus 20 bars of iron and 20 of steel.

The billet was placed in a furnace to weld the component metals. Too high a temperature had to be avoided, since it would cause deterioration of the metal and produce a "burned damascus". The whole billet might indeed be affected and, after the machining stage, the intended pattern would not appear; the tensile strength of the metal might even be diminished.

The welded billet was next put through the rolling-mill and reduced to square rods about 4 m. 50 cm. in length, and 5 to 9 mm. on a side according to caliber of the barrel to be made.

The *S.A. des Laminoirs de Grivegnée* had acquired a high reputation for this work and countless billets passed through its rolling mills. The *Laminoirs de la Rochette* at Chaudfontaine were equally famous and had for many years been producing strips for non-twisted gun-barrels. In 1883 special rollers were set up solely for laminating billets.



Metal billets prepared for different types of damascus. Top, starred damascus; (l.) Double 81 Bernard; (center) Extra-fin Crolé; (r.) Washington. (Plate 1)

This is an authorized version, shortened by about one-third, of an English translation published at Liège.

The rods were transferred to the barrel-makers' forges for the next stage of preparation, i.e. the twisting.

The rod was brought to white heat, one end was fixed to the bench by the smith and twisted about its own axis by his assistant. The smith supervised the operation to ensure the accuracy of the twist. Rods could be given as many as 500 twists per running meter. The twisting had to be of mathematical precision, for on it depended the regularity of the pattern.

From two to six of the twisted rods, according to the fineness of the damascus required, each about 1 m. 50 cm. long, were bunched together, heated and welded by hammering to form a ribbon, uniform in width but diminishing gradually in thickness to allow for the difference in thickness between the breech and the muzzle.

The ribbon was heated again, then wound spirally about a mandrel encased in a thin sheet-metal sheath called a "sleeve". Several ribbons were needed to make one barrel (Plate 2). The roughed-out barrel now went to another workshop for forging.

This operation consisted of bringing the barrel to white heat and then hammering it at a carefully controlled speed and intensity. It was placed on an anvil whose surface was cut with semi-circular grooves. The barrel was now a tube of which the sleeve was an integral part. The sleeve facilitated the introduction of the mandrel, called a "broche", which the smith thrust in and withdrew at each heating and hammering. At the start of the operation the hammer-blows were heavy and rapid, then the speed and intensity were gradually reduced as the metal cooled. The joints of the spirals were welded together over lengths of 4 to 5 cm. at a time.

The smith now plunged the barrel into a tub of water, plugged one end with a lump of clay, then heated the barrel once more before proceeding to the final hammering. (Plate 3).

The barrel, hammered and welded, was now ready for machining.

In the machine shop the barrel was held in a vise facing the boring bench. A square boring-bar removed the sheet-metal sleeve and bored the barrel to the correct caliber. Throughout this operation a continual stream of water was played on the barrel. The bore was now checked with a *molai* or gauge.

Next came the delicate operation of straightening the barrel. The workman examined the light reflected down the barrel; the slightest deviation from true would be revealed by the presence of a shadow, and the faulty portion would be straightened in a press or with a hammer.

The barrel now went to the grinding shop. Here any irregularities due to the forging were smoothed out on large grindstones and the barrel was brought to its final outside caliber.

A kind of "brush" of pieces of woolen cloth held in pincers was dipped into a sulphuric acid solution and wiped along the barrel. Under the action of the acid

the damascus pattern soon appeared. The pure iron showed up white; the steel, whose higher carbon content made it corrode more readily, showed up black. After a few minutes, boiling water was sprinkled over the barrel, and the acid's action ceased.

The quality of the barrel and of the damascus pattern would now be checked by an inspector who, as often as not, was the works master himself.

The "bland" barrels, as they were called, were next delivered to the gunmakers who usually did the finishing. For some guns, two barrels had to be fitted, but all barrels had to be given their final browning. There were four types of finish:



Two steps in the damascus barrel making process. Alternating strips of iron and steel are twisted, then hammer-welded to form a single bar. This is then wrapped around a mandrel and the edges are welded.

"black," "colored", "veiled" and "etched".

For the first type, the barrel was polished by hand or machine to give it a brilliant surface that brought out the light and dark shades of the metals. For the second, the barrel was bronzed, and this produced "colored damascus," the shades

ranging from olive through light brown to dark brown. For the third type, the barrel was given a black finish and the damascus pattern took on a fainter, "veiled" appearance. For the fourth type, the barrel was dipped in a hydrochloric acid solution which produced a slight groove between the scrolls of the metals: this was "etched" damascus.

The damascus-gun-barrel industry of the Liège region was located in the Vesdre Valley and for many years the roar of the forge bellows and the clang of hammers were familiar sounds to the people of Olne, Nessonvaux, Fraipont, Trooz, La Brouck, Forêt, Chaudfontaine and Vaux-sous-Chèvremont. Today, ruined smoke-blackened cottages along the Mosbeux, Havegnèe and Vaux rivulets bear silent witness to the thriving activity of the past.

We have tried to outline the main stages in the making of a damascus barrel; it is worth remembering that every single one was heated 150 times in the process of its forging and that one error could ruin the pattern or the welding and put the barrel on the scrap-heap.

In the Liège region there were many damascus manufacturers, among whom we may mention Moray, whose signature is on the barrels of the pair of pistols with mountings by "L. Folville à Liège," 1835; Désiré Mineur, of Prayon, who in 1904 claims the exclusive rights to *chain-pattern* damascus; Jean-Baptiste Delcour-Dupont, of Nessonvaux, who died in 1931 and was the last exponent of the superb damascus technique.

The *Syndicat des Fabricants de canons de fusils de la Vesdre*, a cooperative founded at Nessonvaux on 1st May, 1907, grouped its members into two categories: owners or lessees of factories, and gunmakers who bought their barrels ready-made. In the first category we find the following names: Walthère Baltus-Wilmotte, Jean Delcour-Dupont, Arthur Delvaux-Heuse, Henri Heuse-Riga, Henri Heuse-Saive, Joseph Heuse of the Heuse-Lemoine company, Gaspard Lejeune, Edmond Mairlot, Louis-Joseph Meurice, Jacques and Joseph Moray, Francois-Emile Noirfalise of A. and L. Noirfalise Bros, Etienne-Joseph Richelle, Jules Delheid of Scholberg and Delheid, Albert Taxhet-Lejeune, Emile Tomsin, Mathieu Waaue. In the second category we find: Joseph and Francois Baiwir, Catherine Noirfalise, widow of Toussaint Baiwir, Gilles Delcour-Herquet, Joseph and Dieudonné Delcour, Bauduin Doyen, Auguste Higny, Francois general types, crucible damascus and twisted damascus.

Crucible damascus is the term applied to the alloy steel that was used in the East, particularly in Damascus, for making side-arms; it is known also as damascus steel and as wootz or Indian steel. It was obtained by melting together iron, steel and several other metals. The outstanding feature of this process was the fine watered design it produced in the alloy; application of an acid solution to the surface revealed the rich light and dark pattern formed by the component metals.

Crucible damascus, after being used for centuries to make side-arms, was found equally suitable for gun barrels when fire-arms began to be made in the East. The fine miquelet-lock weapons from the workshops of North Africa and the Middle East frequently had damascus barrels richly damascened, i.e. inlaid with gold and silver and, almost invariably, engraved with arabesque designs.

It was during the closing years of the 18th century that Western gunmakers began to use a mixture of iron and steel for making barrels. All their barrels were of twist damascus, the second general damascus type.

An Englishman, William Dupein, experimented with the process in 1798. In 1806 another Englishman, J. Jones, patented a new method of making gun barrels by turning a bevel-edged band of metal in a spiral about a mandrel, each turn overlapping and welded to the preceding one.

In France, Jean-Francois Clouet (1751-1801) was probably the first to introduce damascus.

Clouet was familiar with industry in and around Liège and had been in touch with iron foundries in the region of Franchimont (in Eastern Belgium). On 8 Thermidor of Year II (26 July 1794), he urged

the armaments section of the Committee of Public Safety to employ workmen from Liège at Daigny and train them in the manufacture of arms and munitions. The link thus forged between Clouet and a few Liègeois workmen may have initiated the latter into the technique of damascus work.

How were twist damascus gun-barrels first made? The metal was charcoal-smelted soft iron together with all kinds of scrap such as old scythe blades, razors, horse-shoes, nails. The mixture was heated and hammered—a slow and costly process—into a long narrow band which was wound spirally about a mandrel and welded by heating and hammering. The “ribbon-barrel” thus obtained was passed through baths of various kinds. The surface of the finished barrels then bore a water pattern that attracted immediate admiration among devotees of luxury weapons.

On the occasion of the First Consul's (Napoleon) visit to Liège on 15 Thermidor, Year XI (3 August 1803), the arms manufacturers of the town presented him with a wall-trophy of guns and pistols and also a magnificent sporting gun.

The following description of the gun appeared in the *Gazette de Liège*: “It is a double-barreled gun and the fine grooved damascus barrel is a faultless piece of

craftsmanship by citizen Dombret.” There is no doubt whatever that at this date Liègeois barrel-makers were familiar with the damascus technique and used it for luxury weapons. The period, however, was not a propitious one for this type of work.

In 1808 there were twenty-two gun-barrel factories in the Liège region, all concentrated in the Vesdre Valley and using hydraulic power to drive the trip-hammers.

Their barrels were made by folding about a mandrel a broad iron band and welding the two edges together. The operation was simple, rapid and cheap, but these plate barrels were liable to split along their whole length if there were the slightest error in the welding or if the metal had not the characteristics required for this type of welding.

The opening years of the 18th Century saw this longitudinal welding replaced, in the manufacture of luxury weapons, by helical welding.

We find damascus barrels mentioned in an agreement made at Fraipont on 12 May, 1812, between factory owners and gun-barrel makers. The scale of charges agreed lays down that: “Damascus octagonal twin barrels (“quarré-outré”) bored after welding” should be sold at 17 Brabant florins. Ordinary twin barrels were sold at 5 florins 10. “A pair of barrels for duelling pistols in non-twisted damascus: 4 florins 10; the same in twisted damascus: 5 florins 5.”

In 1814, on the collapse of the First Empire, the state monopoly of arms manufacture was abolished and private manufacture resumed. With restrictions removed, manufacturers were able to turn out armaments, plain weapons for export, and also luxury weapons.

There is indeed justification for the contention that it was between 1815 and 1830, and not in 1835 as some historians would have it, that the gun barrel makers of Liège, already versed in the technique of damascus work, brought it to perfection.

Tradition has it that the first barrels were made from billets composed of obsolete bayonets and horse-shoe nails of charcoal-smelted Swedish iron, placed in layers between the steel hoops used to pack bales of wool exported to Verviers from England.

Whilst the first barrel-makers to use this type of billet had to weld it by heating and hammering, those of Liège were quick to make use of the rolling-mills recently set up in the region.

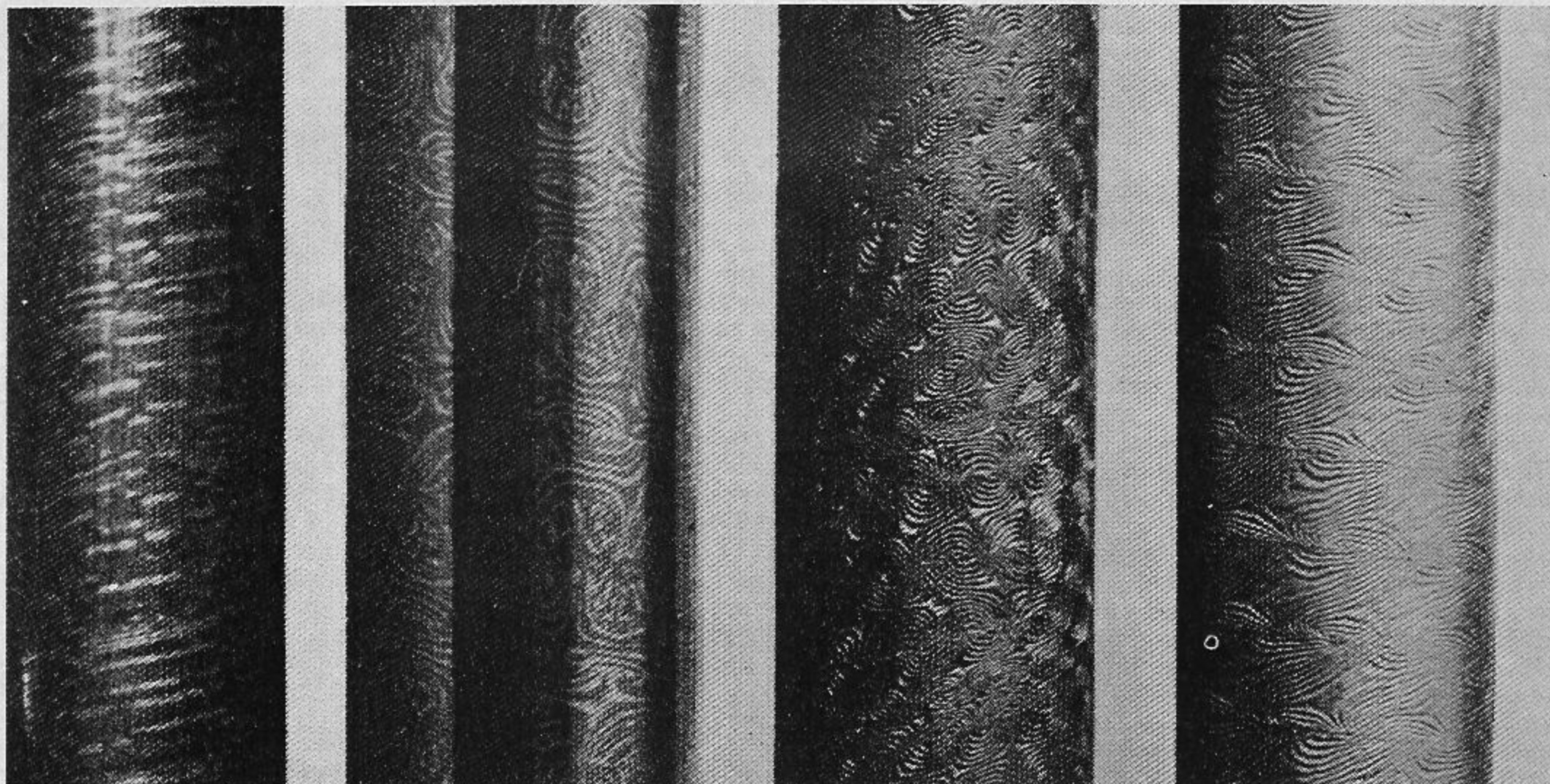
The quality of their workmanship is revealed in the two cases signed “J. Devil-lers á Liège”, made in about 1829 for H.R.H. Prince William of Orange. One case contains two pairs of pistols and the other a sporting gun; the barrels and all accessories are of the finest damascus.

Liège of course claimed no monopoly of the process: excellent damascus barrels were being produced in Birmingham, Saint Etienne and Paris.

During the 19th Century Paris had the Bernards and Leclercs, masters of their craft, and it was in Paris that the first



Barrelmakers outside their forge. Man at left is holding a roughed-out barrel; the one at right is checking the outside diameter of a hammered barrel using a gauge called a hanchon. (Plate 3)



Barrels (l. to r.) are: non-twisted brown damascus; Prince Albert brown damascus; Turkish etched damascus, four-band; and Boston etched damascus, single band (Plate 4).

experiments were made to determine the combinations of steel and iron necessary to produce the various designs known as *Turkish*, *Bernard*, *Leclerc* and *Paris da-Heuse-Méan*, Henri Heuse-Saive, Oscar Lahaye, Jean Lahaye-Marbaise, Henri Lochet, Lambert Maquinay, Servais Montulet, Nicolas Nicolet-Delcour, Jules Pirard-Ancion, Noel Remacle-Hardy, Henri Regnier, Joseph Vandalem.

What the average price of a pair of damascus barrels used to be is impossible to say. Nor is this strange when we think of the countless varieties of damascus and remember that in any one type there were varying qualities of design. The price of a *Boston Superfine* damascus that had necessitated the use of four or six "bands" was a very different matter from that of a *Boston* barrel made with only two bands.

Nevertheless we may quote a few different types and prices.

From 1880 to 1914 a pair of barrels in non-twisted (also called *tor* or *tordu*) damascus would fetch 5 F 50 to 7 F 50. These were the cheaper variety. They were of course made up from rods of iron and steel, but the rods had not undergone the twisting operation, so that the ribbon after being spirally wound, forged, machined and scoured with acid solution gave only one continuous spiral of damascus pattern.

(Until 1914 the value of the Belgian franc had remained at 19.3 U. S. cents for many years. The great decline in the value of all money since that time should be borne in mind in any attempt to relate these prices to current equivalents.—Ed.)

In his *Album publicitaire* n° 434 for 1897-1898 Ferdinand Drissen, a *Liège* gunsmith, sets out a list of his models and the types of damascus available. The

following list shows the prices for smooth-bore barrels of caliber 12, 14, 16 and 20, browned, and fitted to a type of action with locking lever between the hammers, single bolt and rear lockplates. These prices cover cost of the damascus barrel, labor and the gunsmith's profit:

Steel with imitation damascus	28 francs
Ribbon-barrel	38 francs
Birmingham damascus	42 francs
London damascus	47 francs
"Chiné" damascus	49 francs
Bernard ribbon-barrel	50 francs
Boston damascus, four bands, 2nd grade	54 francs
Boston damascus, six bands, 1st grade	59 francs
Washington damascus, 2nd grade	60 francs
Boston damascus, superior grade	63 francs
Washington damascus, 1st grade	64 francs
Chain-pattern damascus	65 francs
Bernard damascus, 3rd grade	66 francs
Bernard damascus, 2nd grade	72 francs
Horse-shoe nail damascus, 2nd grade	76 francs
"Crollé" damascus, 3-band	80 francs
Horse-shoe nail damascus, 1st grade	82 francs
Bernard damascus, 1st grade	84 francs
"Crollé" damascus, 4-band	92 francs
Turkish damascus, 4-band	93 francs
Imitation Léopold Bernard damascus	100 francs
Turkish damascus, 6-band	102 francs
"Crollé" damascus, 6-band	105 francs
"Crollé" damascus, superior grade	115 francs
Bernard damascus II, made by Heuse-Lemoine	130 francs
Bernard damascus I, ditto	140 francs
Turkish damascus, 6-band, ditto	145 francs

"Crollé" damascus, 4-band, 2nd grade, ditto	150 francs
"Crollé" damascus, 4-band, 1st grade, ditto	165 francs
"Crollé" damascus, 6-band, superior grade, ditto	180 francs

In 1900 Jean Lejeune, of Nessonvaux, supplied *Oxford Superfine* at 16 F 50, *Boston* at 10 francs and *Birmingham* at 8 francs. (Plate 4).

M. le chevalier de Hontheim, head of the group comprising the S.A. Armaf, the *Manufacture liègeoise d'armes à feu* and the *Manufacture d'Armes J. B. Rongé fils*, has kindly given us figures from his records. The group's Nessonvaux works produced thousands of damascus barrels of every type, and a ledger for 1903-1904 gives the following cost prices:

One pair of non-twisted damascus barrels	14 francs
One pair of "Crollé" damascus barrels, 3-band	14 frs 50
One pair of "Crollé" damascus barrels, 4-band	22 frs 20
One pair of Boston damascus barrels, 2-band	12 frs 50
One pair of Boston damascus barrels, 3-band	16 francs
One pair of Bernard damascus barrels	16 frs 50
One pair of Oxford damascus barrels, 4-band	23 francs

On 17 July 1914, Arthur Delvaux-Heuse, of Nessonvaux quotes the following prices: *Boston* and *Starred*, 3-band: 12 F 50; the same in single-band: 9 F 75; *Birmingham*: 7 F 65. ■



The damascus barrel of this early 19th Century flintlock pistol (note area between wood and silver inlays) may actually have been made in Damascus. The barrel bears an oriental proofmark on one side and a maker's name in Arabic on the top flat although the form and style of the pistol (r.) is 18th Century English.



DAMASCUS BARRELS: THEY FAKED THOSE, TOO.

Damascus barrels became so popular that some makers attempted to imitate them by cheaper methods and to fake their appearance outright. Part II. of the Damascus barrel story.

By JEAN PURAYE

MANY Liège barrel-makers, realizing that damascus prices were considered too high, particularly for the export trade, turned to production of "imitation damascus."

Its appearance is so obviously different from that of genuine damascus that only a novice could be deceived by it. An imitation damascus effect was produced on iron or steel barrels by outlining on them, in a greasy compound applied with a brush or rag, designs resembling the damascus patterns. The barrels were then dipped in acid which attacked only the area not marked by the grease, then washed and cleaned—this is the process of ordinary etching; the barrels then bore an etched pattern resembling the delicate tracery of genuine damascus. This was imitation "etched damascus". For imitation "color damascus", a transfer paper coated with a brownish varnish bearing patterns similar to damascus was applied to the barrel.

Many gunsmiths even marked these barrels with the names of varieties of damascus as famous as *Bernard*, *Turkish* or *Crollé*.

The production of imitation damascus roused contention between the barrel-makers of the Vesdre Valley and the gunsmiths of the Liège region; it became a government issue and was debated in Parliament.

In their periodical *L'Armurerie liègeoise* the gunsmiths answered accusations of

fraudulent imitation and unfair competition made against them. The arguments in other articles and pamphlets published on the subject centered on the rival merits of damascus and steel barrels, manufacturing costs, the requirements of customers and the export trade. Some waxed ironical on the subject. "Would any actress today", one asked, "buy imitation diamonds if the law compelled jewellers to label them 'imitation'? Obviously not!"

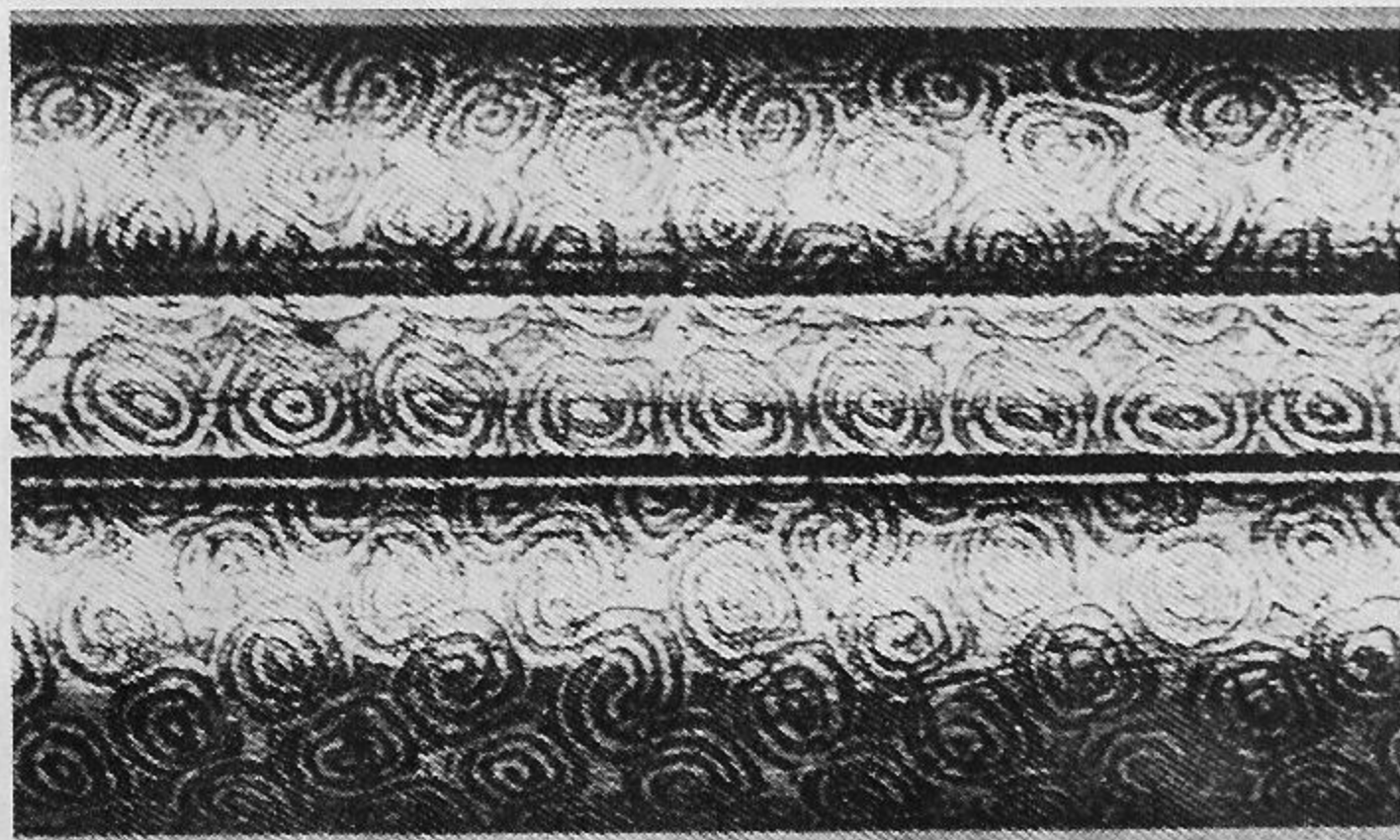
M. Nyssens, Minister of Industry and Labor, sent a Special Commission to France and England to gather information on the possible existence and extent of imitation damascus. The Commission submitted its report on September 19, 1895. It was recommended that no imitation ar-

ticle should be allowed to use the name of any genuine article. A royal decree to this effect was signed on October 31, 1895.

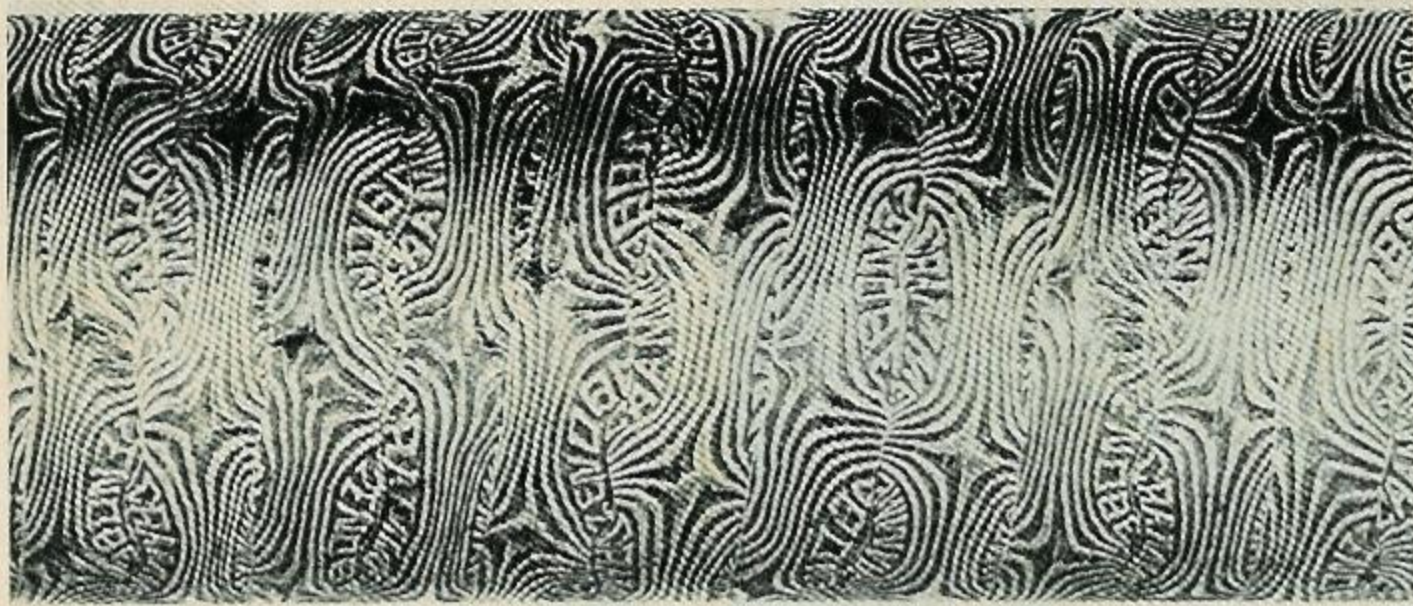
On the ground that it was in the best interests of the trade that gunbarrels should be stamped with a mark showing the nature of the metal used in their manufacture, the decree laid down that the *Banc d'Eprouves de Liège* should be responsible for stamping barrels as either "damascus barrels" or "steel barrels". This satisfied neither the barrelmakers nor the gunsmiths.

Questions were put in the *Chambre des Représentants* by M. Ancion, M. Helleputte and M. Smeets. On May 5, 1898, the Minister, M. Nyssens, addressed the Chamber, reviewed the inquiries and negotiations he had conducted on the matter, and admitted that the question of imitation damascus was one of the most "thorny problems" in his department.

Léon Troclet took up the defence of



The appearance of imitation damascus produced by etching is obviously different from genuine damascus and is easily distinguished.



Enlargement of a "Zenobe Gramme" damascus barrel with the name worked into it.

the Liègeois barrel-makers and published four articles in the newspaper *Le Peuple* in 1898.

Finally, at a sitting held on March 19, 1898, the *Commission des brevets du Conseil supérieur de l'Industrie et du Commerce* decided against the demand of the *Union des canonniers de la Vesdre* that imitation damascus barrels should be stamped "imitation damascus".

The Commission did however adopt unanimously the following recommendations:

- That it be forbidden to mark any iron or steel gun-barrel of imitation damascus with an unauthorized description, particularly with the descriptions "Turkish damascus", "Crollé damascus", "Bernard damascus", or with any description using the word "damascus".
- That the Banc d'Épreuves de Liège should conduct optional tests for damascus barrels. Barrels satisfying the conditions of the test should, on request, be marked by personnel of the Banc d'Épreuves with the word "Damascus"; the stamp should be: "L. G. Damas".
- That iron or steel barrels intended for browning in an imitation damascus pattern should bear in a prominent place the description "Imitation", this description to be stamped on the barrel at the Banc d'Épreuves de Liège.

The Commission further recommended repeal of the royal decree of October 31, 1895, and control of the imitation damascus industry.

Imitation damascus was, of course, a rival to the genuine article, but not a dangerous one. The real enemy was the steel barrel.

By 1867 the Liège region had entered the steel age. In 1865 the John Cockerill works in Seraing, near Liège, produced 1,525 tons of steel; in 1881 they produced 100,000 tons.

The Liège barrel-makers tried the new steel and adopted it. Their manufacturing process, known as the Berger system, in which bars of high-strength steel were bored with perfected modern drills, surpassed all others. Good steel barrels were

produced at very competitive prices by this quick and economical process.

Even for luxury weapons, gunsmiths abandoned damascus barrels for steel ones.

Nevertheless there were still skilled craftsmen who went on making damascus. This is evident from the following report on the gun-barrel section of the Paris International Exhibition of 1900: "There is once again a display both of damascus barrels, i.e. barrels made from a combination of iron and steel worked by various processes into a hollow tube, and of steel barrels bored from a single bar. Each type has its devotees and particular advantages, but steel is becoming increasingly popular and is gradually ousting damascus for all types of fire-arms, more particularly perhaps for high-quality guns."

At the end of the Exhibition the following comment was made in the adjudicators' reports on the "Grand Prix" awards: "In spite of the current popularity of steel gun-barrels, the damascus barrels produced by



A grinder standing beside his grindstone, holding a gun barrel.

M. Heuse-Lemoine at Nessonvaux are so perfect and still so highly esteemed in Liège and abroad, that the 1900 Jury, like that of 1899, had no hesitation in awarding him a special prize."

During the royal visit to the Liège International Exhibition of 1905, King Leopold II showed a keen interest in the fire-arms stand. A contemporary press report reads: "The damascus gun-barrels displayed by the firm of E. Heuse-Lemoine attracted the King's attention and His Majesty showed gracious interest in the explanations given by M. Emile Heuse.

"It is well known that the firm specializes in damascus barrels; they have on display a wide range of barrels with an infinite variety of beautiful patterns.

"M. Heuse-Lemoine showed His Majesty a sporting-gun barrel incorporating within the damascus pattern the title *Léopold II Roi des Belges*."

The collection at the Musée d'Armes de Liège includes four damascus barrels incorporating in their pattern the inscriptions *Léopold II 1897 Bruxelles*, *Prince Albert*, *Zénobe Gramme*, and *Liège 1905*.

This is an amazing achievement, for the craftsmen have succeeded in so arranging the different metals in the billet before the rolling, twisting and forging as to produce these inscriptions at regular intervals within the damascus pattern of the finished barrel. To modern technicians this achievement is almost incredible.

During a talk I was privileged to give to the engineers of the *Fabrique Nationale d'Armes de Guerre* at Herstal, I made reference to the damascus process and the achievements of the Liègeois barrel-makers.

During the conversation after my talk one gentleman present, after complimenting me very kindly, drew me aside and declared that such a process seemed to him impossible and that he could not accept the accuracy of my account of it.

This was a challenge! We agreed on the choice of weapons and on the rendezvous, i.e. the metallographic microscope and the laboratory.

We handed to the Central Laboratory of the *Fabrique Nationale d'Armes de Guerre* the damascus barrel incorporating in its pattern the title "Prince Albert".

A 2-cm. length of barrel near the muzzle was examined under the metallographic microscope. The results of the tests completely vindicated the honor of the old barrel-makers. We read in the report: "The wall of the barrel is formed by a quite efficiently performed autogenous welding of bands wound in double overlapping spirals. As they are now, i.e. wound into a barrel, they are about 7 mm. wide and their thickness is that of the whole wall ($\pm 2\frac{1}{4}$ mm.). The hollow cylinder thus formed assumes, on polishing, a normal metallic appearance and brightness.

"However, after suitable though very simple chemical treatment, letters and patterns appear on the surface; they are the result of an organized metallurgic heterogeneity present throughout the whole wall of the barrel.

"Whichever section of the specimen is taken—cross-section, longitudinal section or oblique section—there appear, after chemical treatment, fragments of words or even whole words."

In 1906, Sir Cecil Herstlet, His Britannic Majesty's Consul General in Belgium, published a report on the firearms industry in the region of Liège. In it we read: "The barrels, which at one time were usually made of damascus, are to-day almost all made of special steel." He estimates the annual production of damascus at 850 tons, of which 100 tons are exported to such countries as England, Italy, and Spain. "About 156,000 double-barrelled damascus guns per year", he reports, "are produced in the region."

An output of 156,000 double-barrelled damascus guns certainly seems high until we learn that in that same year, 1906, more than 1,500,000 guns were tested at the Banc d'Épreuves de Liège.

Year after year, until 1914, thousands of damascus barrels were made in the Vesdre Valley and supplied to gunsmiths in Liège and throughout the whole world. Considerable consignments of "blank" barrels were also exported, mainly to England and the United States.

In the Liège region, the 1914-1918 war did irreparable damage to the luxury weapons industry and to damascus production in particular.

Apprentices and smiths paid the heavy tribute of war with their life's blood. The production of gun-barrels ceased; machine tools were destroyed and raw material sources wrecked.

Immediately after the armistice the barrel-makers courageously set to work once more. They encountered serious difficulties. A completely new labor force had to be recruited, factories rebuilt and raw materials obtained. Some gave up the work; others had to resign themselves to utilizing such scarce and ill-assorted metals as had escaped the occupying power's systematic destruction. In addition to all this, factories which before the war had supplied the special equipment needed for damascus

had themselves been destroyed; some were rebuilt but damascus was dropped from their production programs.

The same fate befell the rolling-mills that had laminated the damascus billets. M. Delcour, of Nessonvaux, was obliged to send his billets to be welded and rolled at Monceau-sur-Sambre in the province of Hainaut.

Yet it was felt that this famous industry must be set on its feet again.

In the *Armurerie liégeoise* of August 1924 we read:

"The countless admirers of fine damascus guns need not despair. Production of damascus barrels has now been resumed at Nessonvaux.

"The famous Nessonvaux firm of J. Delcour-Dupont has begun production in a number of workshops and is achieving practically the same output of damascus barrels as before the war.

"With his customary determination, his deep technical knowledge and his unshakable faith in the success of the undertaking M. Delcour-Dupont has re-established a fine local industry that was the glory of the barrel-makers of the Vesdre Valley."

The Administrators of the *Musée de la Vie Wallonne*, anxious to enrich their documentation on local crafts, decided to make a film on damascus work. On August 29, 1924, their cinematographic section filmed the manufacture of gun-barrels at Nessonvaux.

An article entitled *La fabrication des canons damas* was published by George Laport in the *Enquêtes du Musée de la Vie Wallonne* t. I. (1925). The article gives an account of the process and a description of the tools, has a glossary and is abundantly illustrated. We have drawn freely on this source.

In 1930 George Laport wrote these words: "Despite so many difficulties M. Delcour, out of love of the craft, has resumed the task to which his forefathers devoted their lives. Yet the craft seems doomed to die and M. Delcour, despite the tenacious efforts he has made to keep



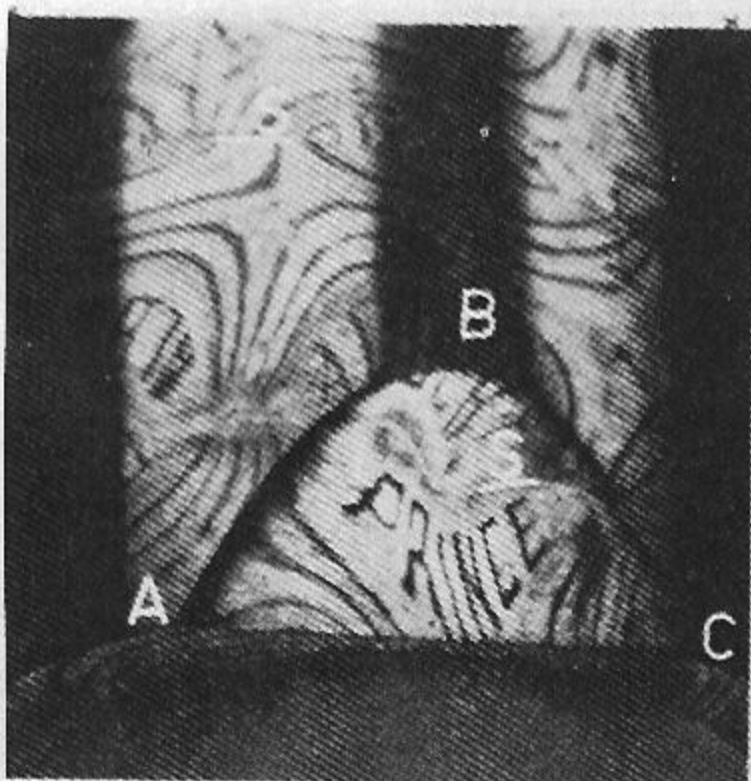
M. Jean-Baptiste Delcour (1862-1931) and his son Oscar (1888-1965) outside their works at Nessonvaux.

it alive, now unhappily wonders whether, within a few years, we shall not be forced to abandon a technique which once won world-wide admiration for the extraordinary skill of our craftsmen."

His fears were only too well-founded. The last damascus gun-barrel was made at M. Delcour's works about 1930. ■

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ABC: Oblique section showing the letters and pattern continued in depth beneath the surface of the barrel.

S: Welding lines.

↑ ↓
Cross-section.

The whole words were formed within the pattern of this Prince Albert damascus barrel.