

DECORATIVE METAL WORK.

A Practical Handbook
For The
Amateur Metal Worker In:
Iron, Brass, Zinc, & Copper.

An ebook Version Of The Original
1906 Print Version
By George Day.

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Australia. 2005.

Introduction.

This ebook has been republished from the original 1906 print edition, even though this information is now almost one hundred years old, it provides fascinating reading & learning about lost metal working techniques.

To any one new to the art of working with metal, the writings enclosed will make the understanding of metals that much clearer, and even to the well practised metal worker, there will be a number of gems learnt from the reading material in this ebook.

The working of metal takes many shapes, form, and styles. While we at the home foundry are principally involved with metal casting, we felt the retro knowledge expounded within **Decorative Metal Work** will help many people to understand the true meaning of working with metals of all kinds.

The ancient craft of wire work is fully explained within the pages, if you have ever wondered how the artisans created those wonderful works in wire, then this book will expose long lost secrets of the art of scroll wire work, and you'll be pleased to learn that this intricate wire work can be carried out with very simple hand tools, the traditional methods allowed truly creative designs to be made with out resorting to braze welding etc.

Whether you are just fascinated about the colourful history of metal, or whether you want to learn more about how the old time metal workers created their works in metal, this ebook will fill in the missing parts for you.

I hope you enjoy what this ebook has to offer you, it is old technology but at the same time, if you're interested in metals of any kind, then it will be a very interesting read for you. You may even decide to make a few of the metal projects explained within the following pages.

We have endeavoured to republish this book as closely to the original as is possible, there are several passages that refer to "Present Times" please remember they are talking of another era of almost one hundred years ago. The writing and language style is old and quaint, but at the same time it will explain basic things about metal that you may not know of.

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Much new material has been provided in the book in the form of links to various web sites with important information about many of the metals discussed, take the time to explore and learn about them.

We trust you will enjoy reading and learning about the ancient history of metals, and also learn the art of working with metal.

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Chapter One. Metal Work- Its History.

Like all other things, metal work has a history, and it dates back to the very earliest times. It is the most ancient of arts, practised in the oldest Egyptian period, particulars of which are hidden under the dust of ages. Work of this kind was common in Rome during the first century and in our own country in Anglo-Saxon times.

A kind of iron working was common in the sixth century before Christ, as it is recorded by Herodotus that one Glaucus, of Chios, practised the art. Other ancient writers also mention the work of Glaucus, who made himself famous by constructing a vase with iron plates set over each other after the fashion of tiles overlapping; and it is also recorded that 1500 years before Christ vessels of this kind were not uncommon, gold, silver, lead and brass being freely used.

Pliny, the historian, likewise refers to the art, especially that of soldering of metals, particularly lead, as he states that oil must be used to secure perfect adhesion. (What secret oil was this Ed).

In reference to the copper of scripture, it must be remembered that the translators of the scriptures, not being acquainted with the technicalities of art, did not understand the distinctions, which names bear in those arts; hence we have the word brass used synonymously with copper & bronze.

Brass is a compound of copper and zinc; bronze is a compound of copper and tin - alloys of distinct character and composition, and of artificial production, there being no such thing as a **brass ore** or **bronze ore**.

Consequently, when we read "Brass is molten out of the stone: (job xxvii, 2), or" Out of whose hills thou mayest dig brass" (Deut.viii.9), it is evident that it is not that alloy of brass which is meant, but the metal, or ore of copper. Besides, there is no evidence, either in scripture or other writings, nor any remnants of ancient art, of the metal zinc having been known to the ancients. Consequently there could be no brass; but copper was well known, and some of the mountains in Palestine produced that ore.

When the word "brass" is used in scripture in reference to ores, or being dug out of the earth, it should be translated as "copper". In most other instances the word brass should be translated "bronze," an alloy well known in earliest times; and as copper is the principal metal in this alloy, it follows that a reference to bronze necessitates a previous metallurgical operation for copper.

The first mention we have of bronze is "Tubal-Cain", an instructor of every artificer in brass and iron". From this we note that even in the antediluvian world the metallurgical arts were practices, a fact which harmonises with the account we have of the Ark of Noah, a magnificent structure for such an early period.

Although it is not mentioned, there can be no doubt that the knowledge of metallurgy and the art of working metals such as iron and copper greatly facilitated Noah's work in the construction of that gigantic vessel.

What is known to us moderns as **niello** work was practised for making records by hollowing a plate, smoking it, and then wiping the surface. Leaving smoke in the hollows, so as to impress upon any soft substance such as wax, clay, etc.

Such crude work as this foreshadowed the printing processes of later years, this using a hollowed out plate for making impressions only became generally used when the break up of the Roman empire took place and the inventors and workers became scattered all over Europe.

Adaptations of this principle of working took place in the Middle Ages in Europe generally, and it reached perfection by reason of the rudiments being so well mastered by those who devoted their very lives to perfecting their various decorations, and also making the best use of the resources. They were entire strangers to the hurry and drive of modern civilisation; their aim was not “**how much**” but “**how well**” they could do what ever they undertook, hence it is that ancient work serves as perfect patterns in these latter days.

The old Venetian workers carried the work to the greatest perfection, and at the present time their successors retain their cunning, for in Florence and Venice Art Metal decoration furnishes employment to great numbers of men, women & children in various sections of those cities. The men work out the heavier parts, leaving the lighter portions for the women and children, who, through long and careful practice, become very expert. Working rapidly and with the greatest dexterity.

But to come to later times in England, according to records, metal founders figured in the historical pageant of 1415. These workers were located in York, and their occupation was among the soft metals such as copper, tin, and lead, out of which they cast various domestic utensils. The founder, as his name implies, melted down the metal and then poured it (**fund ere**) into the mould. We moderns speak of a foundry; the term “founder” as a worker is now obsolete, but old names such as John Le Founder, Robert The Founder, clearly show that this was once common.

These various metal workers were divided into classes. The Pewterers supplied most of the domestic utensils, which were made of metal and were highly valued, for in many old wills the family pewter was bequeathed as heirlooms from father to son. Brave was the glitter that greeted the eye as one entered the “house body” and confronted the “pewter rack” with its rows of dishes and plates, all bright as silver and reflecting the flickering fire in flakes of gold. Great was the housewife’s pride in keeping them all clean & bright, as they were much prized by the household.

Another prized worker was the *latoner* or *latener*, who used **latten** composed of **lead with brass or copper**. This was the material of which the “brasses” in our old churches and graveyards were made, also some of the household utensils already referred to.

The **lead beater** was another class very common in the middle ages. His wares were mostly for the poorer classes, who could not afford pewter or latten, so were obliged to content themselves with utensils formed with the more easily worked and cheaper metal; leaden vessels were very common and were adapted for all purposes.

The *tinker* (tingler) very much resembled the individual of the same name of today. He was the man who travelled and announced his approach by striking or rattling a kettle, hence his name the – **tinkler**.

From the tinker to the goldsmith is a long stride. The variety of names held by this individual were considerable, being known as goldsmith, Red-smith (Redesmyth), orfeure or beater, and goldbeater, but most of the jewellery came from abroad; only a few real workers were to be found in this country. (England)

But after all, Iron was the metal, which employed the greatest variety of trades. The following occur in our records—Smiths, smithy-men or fevers; nail makers (naylor, Naylor) locksmiths, marshals, spur makers, cutters, blade smiths, armourers, and bit makers (Lorimers) and others.

The smith or smithy-man (Norman fievre) is a prominent character in English village life.

**“Beneath the spreading chestnut tree
The village smithy stands”**

Everybody knew the man of iron sinews and his smithy; in fact a village was not complete without the blacksmith. But formerly the different kinds of smith were called black, red or white smiths, according to the metals they worked—iron, gold, or tin plate.

Then again there were the nail maker, or Nasmyth, locksmith, cutter and blade-smith, who made sharp instruments, the former for peace and the latter for war. The bow makers, bowyers or bowers, arrow makers, arrow-smiths and fletchers were all important sections of the community in Old England.

The arrow-smiths confined themselves to the manufacture of the head. In an old act of 1405 we find: “Item”, because the arrow-smiths do make many faulty heads for arrows and quarrels, it is ordained and established that all heads for arrows and quarels after this time to be made, shall be well boiled or braised, and hardened at the points with steel,” these heads required much skill, and formed a very important feature in the metal working of the period.

Art Metal work has, however, become popular in many countries, notably our own and also in America. A recent writer on its subject declares that in the United States it has been received with marked favour. Children even have taken it up, it is being taught in the schools, and in many places it has become quite a fashionable hobby with the fair sex of all grades of society.

It was introduced into the Home Arts and Industries Association, Albert Hall, South Kensington, especially Venetian bent ironwork, where Miss M.H.C. Legh, who some time ago wrote a handbook on the subject for the benefit of class holders, regularly taught it in classes. This little brochure was very elementary, but admirably served its purpose, and did much to popularise the work in this country.

Other works have subsequently appeared dealing with the various sections of the work, so that to-day Art Metal decoration is much sought after and very extensively practised.

Such in brief is its history, and it is to further the efforts of workers that this volume is written.

Chapter Two: What Metals Really Are.

Iron, Cast and Wrought—Silver—Tin—Zinc—Copper—Bronze—Brass—Gold
Silver—Nickel—Aluminium—German silver.

The science of Mineralogy is beyond the scope of our present volume, but is necessary, nay important, that every beginner in the art of metal working should acquire some knowledge of the material used, both as to its origin and nature, and adaptability of the several kinds used in the work.

Minerals from which we obtain our metals belong to the inorganic world, and the words “organic” and “inorganic” are used in reference to living and non-living matter. Minerals are formed frequently, and they increase rapidly, but they cannot be said to be born or to grow. Many minerals are remarkable for their beauty of crystalline form, their wonderful lustre and their special adaptability for ornamental purposes, their variety, colour and brilliancy: these are gems or precious stones.

Others are obtained and used chiefly in their conditions as metals, some are valuable such as gold, and are found chiefly in a native state: These are called precious metals. Others such as **silver**, **copper**, etc, are less valuable, are also found in a native state, but in combination as ores.

Some of the most useful metals, as iron, lead, zinc and tin, are never found in a native state as metals, but are abundantly mixed with earthy or other matter - these are also ores. These ores are sometimes metallic, but more frequently earthy, and are buried in the earth, sometimes regularly deposited in beds, but more generally occupying cavities in rocks.

The most useful as well as the most common is iron, and is found in abundance throughout England, South Wales, Canada, and the United States of America.

Update Note: *Australia also has some of the largest known deposits of Iron ore, located in the Kimberly - Pilbara region of Western Australia)*

Iron is the hardest of metals, of a livid grey colour, insoluble in water, fusible by heat, and is a conductor both of heat and electricity. Iron is of two kinds, cast and wrought: The former is the metal separated from the ore by smelting and run into moulds; the latter one of the lightest, strongest, and most tenacious of metal, and generally used for all kinds of domestic and manufacturing purposes.

There are many kinds of iron ores, of which mention must be made: --

Hematite or Kidney Iron.

So called from its characteristic form, which occurs in large kidney shaped nodules. This ore is sometimes called bloodstone, and is found in abundance in Canada, Western England, Saxony, and Sweden, and vast deposits exist in Western Australia. Check the following link for more info:

<http://www.datametallogenica.com/pages/minidisc/html/mtt>

Spathic Iron Ore.

Is Found in England—in Cornwall, Devon, Durham, and in parts of Somersetshire. This ore is used as a flux in the smelting of other iron ores, and is sometimes found in connection with another ore of a similar kind, which enhances its value for the making of steel. Check the following link to learn more about spathic Iron Ore:

<http://pages.cthome.net/fwc/ROXBURY.HTM>

Magnetic Iron Ore or Magnetite.

This is the kind of ore found in Norway, Siberia and North America. It is especially remarkable for its power of attraction. It is, in fact a natural magnet, and when smelted forms one of the best and most valuable forms of iron.

<http://www.nswmin.com.au/minerals/az-minerals2.shtml>

Iron Stone.

In some districts, clay iron-stone is used as an iron ore, and from the close proximity of coal in the district where found it forms an important and valuable iron ore, and although not so rich in metal as some of the other varieties, it forms nearly two thirds of the iron produced in Great Britain at this point in time.

Iron Pyrites.

Is an ore not so much used in making iron as in the production of copperas, or iron sulphate or sulphuric acid. The various processes of iron manufacture are most interesting, but they do not come within the province of the present volume.

Of the several kinds, that known as cast iron is the cheapest and most fusible of this class of metals, and is employed for all purposes of engineering works. It is also used for small articles of domestic, such as pots and pans, pails, cans, and kettles, and is abundantly used in making ornamental iron work.

The possibility of being able to cast iron into moulds of various patterns adds to its usefulness and universality.

Bar or malleable Iron.

If cast iron deprived of its carbon. Malleable or wrought iron thus differs from the cast material, from its being almost entirely free from carbon, so that a further heating of puddled iron is necessary before the metal is converted into the best quality of bar or wrought iron, which when perfect, possesses all the qualities which render it so very valuable, viz: - Ductility, malleability, tenacity, and the property of being welded together at a red heat—that is, two pieces of bar iron can be united or welded together by hammering, as a blacksmith would do.

Wrought Iron.

<http://www.appaltree.net/aba/history.htm>

<http://www.realwroughtiron.com/wiac.htm>

This kind differ very considerably in its properties from cast iron, in that the latter can be easily broken or shattered, while wrought iron is most tenacious and tensile, especially when heated, in which state it can be rolled into sheets as thin as paper, or drawn in to fine wire.

On this account it is used largely for the manufacture of locks, hinges, bolts, nails, and screws, to say nothing of the larger uses to which it is applied, such as bridges, armour plates for fortifications, ships of war, etc.

Sheet Iron.

http://www.ihbc.org.uk/context_archive/44/Corriron.htm

Important dates are 1728, when Payne and Hanbury introduced their Rolling Mill for the production of Sheet Iron 1760.

This is wrought iron rolled to the required thickness, so that it can be used for all kinds of metal work, especially that described in our pages. It may be interesting to know that iron so rolled is often coated with zinc, to produce what is familiarly called galvanised iron, such as is used for small sheds, out houses, even churches and chapels.

This process of galvanising or coating with zinc retards the effect of damp air or water on the iron, which would otherwise rust. Sheet iron coated with tin is called tinplate, which is commonly used for many utensils for domestic purposes.

Steel.

Steel is iron combined with a small but definite portion of carbon; the following link will describe in full the making of steel with modern technology.

<http://www.australiancoal.com.au/steel.htm>

Steel is hard, brittle, and capable of being highly polished. The amount of carbon may vary from 0.4 to 1.5 percent; below this it passes into wrought iron.

The usual way of producing steel is by using refined iron, with the necessary amount of carbon. In the cementing process, bars of iron about three inches broad, and three quarters of an inch thick are placed, together with powdered oak or birch charcoal, in large troughs made with firebrick, and exposed in furnace to along-continued high temperature, which lasts from a week to twenty days, according to the quality of steel required. It is then allowed to cool gradually, the process occupying about three or four days.

The result of the operation is known as blistered steel, from the bubbles or blisters that appear on the surface. This blistered steel is then converted into shear steel by binding several layers together, re-heating these to a welding heat, and then hammering the mass so as to cause them to unite in one. It is this kind that is used for the manufacture of scissors, knives, and general cutlery.

Tin.

Tin is a hard, silvery white metal. The ore, known as tinstone contains sulphur, iron, and arsenic.

(Click on this link for early Australian Tin Mining history)

<http://www.liswa.wa.gov.au/wepon/mining/html/tin.html>

What is commonly known occurs in England only in the counties of Cornwall and Devon. Small quantities are found in Isle Of Man, France, Spain, and Russia; it is also found in Brittany, Bohemia and Saxony, In Europe and in Asia, Malacca and Borneo. *(Many other countries now also produce tin.)*

Zinc Production.

<http://www.australianminesatlas.gov.au/info/factsheets/zinc.jsp>

Zinc is an ore producing a metal which is brittle, hard, light, and of a bluish colour, and when polished presents a bright metallic appearance. It is not used in the arts so much as in general work, such as roofing of house, pipes and gutters. Iron covered with zinc is known as galvanised iron, the use of which is common. The ore is found in several parts of England, Scotland and Ireland, Belgium, France, Spain, and other parts of Europe, also in the United States Of America and Australia, the link above is an interesting read about mining for Zinc in Australia.

Copper.

<http://www.australianminesatlas.gov.au/info/factsheets/copper.jsp>

<http://www.azcu.org/minetomarket/>

Copper is an ore producing a hard elastic, and **sonorous** metal, meaning;

1: producing sound (as when struck)

2: full or loud in sound.

3: imposing or impressive in effect or style.

It is of a light salmon-red colour; it is tenacious in a high degree. When heated it can be rolled into very thin sheets, or drawn into fine wire; for this reason copper is admirably suited to all kinds of art metal work. Copper is found, both in ore and as native pure copper, chiefly in Cornwall, Devonshire, Lancaster, Anglesea, Cardiganshire, Carnarvon shire, Montgomeryshire, Isle of man, Ireland, Scotland and in Various other countries, East & West. Copper is very durable, owing to tis quality it is largely used for the making of household utensils.

Bronze.

<http://www.sinopro.com/Replicas/replicas.htm>

<http://www.artworksfoundry.com/process/casting.htm>

Bronze is a fine-grained alloy of a reddish colour, a mixture of copper and tin and sometimes zinc. The brass or bronze mentioned in the bible was a mixture of this kind, as the most ancient coins and metallic ornaments have been found made of bronze. This metal is hard brittle, and sonorous, the latter quality making it especially useful in the manufacture of all kinds of bells, gongs, parts of machinery, mathematical instruments and for art work—as it's beauty and ease in working at once makes it a deserved favourite both with amateurs and professionals alike.

Brass.

http://www.copper.org/innovations/2000/01/history_brass.

Brass is one of the most useful of all the metals for the art worker. It is a mixture of copper and zinc. It's colour is a bright yellow, much harder and more easily fused than copper; which renders it more adaptable for receiving delicate impressions from moulds, so that it is fitted for all kinds of delicate castings. It can also be highly polished. All these qualities render it especially suitable for ornamental work, and it is used extensively for house furnishing, such as finger-plates, brackets, chandeliers, door-handles, pendants, and many other adornments for drawing room and boudoir. It is easy to work, as our subsequent pages will show.

Gold.

<http://www.onlygold.com/TutorialPages/HistoryFS.htm>

http://www.gold-eagle.com/editorials_00/mbutler031900.html

Gold is an ore, and found both in dust and nuggets. This is the most precious of all the metals, and has been considered so from the very earliest times. It is the only metal of a yellow colour in its pure and natural state. It is as soft as lead, yet so tenacious that it can be beaten out to extreme fineness, even to the two hundred and fifty thousandth part of an inch.

This is almost inconceivable, but is nonetheless a fact. Gold is almost always found native and nearly pure. In the vein, gold is generally crystalline, occupying spaces in crevices or cavities of quartz rock. A few large blocks have been found, these are called nuggets, but the greatest quantity of gold is in much smaller fragments such as grains, scales and fine dust.

In ancient times gold was obtained from many countries, and it is perhaps the most widely distributed of all metals. Africa has been and is, still rich in gold. Washings have been found in England and Wales, some parts of Scotland, but not in any great extent. The properties of gold are very remarkable, especially its weight as compared with other metals. It is nearly twenty times heavier than water. Another remarkable property is its inextricability. It is unaltered in colour or condition by any exposure to any influence, and may be preserved uninjured for any length of time. It does not rust like iron or tarnish like silver. It does not combine with other metals except in a state of fusion. Its colour scarcely varies except when mixed with copper or silver as alloy.

It's tough, and is easily hammered into any shape. Again, gold is not a hard metal, so that to make it fit for general uses for jewellery and coins it has to be alloyed with silver or copper. So that its natural colour is somewhat altered.

It mixes readily with these metals when in a fluid state, but gold is never found in combination with any earthy minerals such as copper, sulphur, or carbon.

A natural mixture with silver is called Electrum; mixed with palladium it is known as Jacotinga; mixed with tellurium, Aurotellerit. Although one of the best metals for art metal work, its extreme value prevents its being generally used except for the very highest purposes, where expense is of no consideration. It is, however out of the list for general metal workers.

Silver.

Silver is remarkable for its brilliant white metallic colour. It is often found native, but more commonly met with in combination with tin and other substances, such as sulphur, antimony, and arsenic. Owing to its exquisite whiteness and resistance to ordinary atmospheric influences, its capability of being highly polished, this metal is used extensively and renders it the most interesting and useful of metals. When struck it emits a clear, ringing sound. It is harder than gold, but softer than copper. It has been known from earliest times, and besides its use for coinage, plate, and jewellery, it is also useful in medicines under the form of nitrates and oxides. These are of immense value.

<http://www.silverinstitute.org/facts/history.php>

Of the ores of silver much could be written. That known as Vitreous or Silver Glance is a crystalline, which contains 86 1/2 % of silver. Black Silver or Brittle Silver ore is similar to the former, but it has antimony present. Which makes it less heavy. Ruby Silver has 60 % of silver. Horn Silver has only 68 to 76 % of the metal. It is soft and is easily cut. There are other kinds of minor importance. A Large part of the silver in general use is not derived from the native metal or silver ore, but is artificially removed from the lead produced from lead ores, as it is unusual to find lead without silver, though silver is found without lead.

Nearly the whole of the silver used at the present time is derived from the minerals in which silver and lead are combined; very little from the pure ore in metallic state.

Nickel.

<http://www.azom.com/details.asp?ArticleID=2104>

Nickel is a metal of a hard greyish-white colour, so near to the appearance of silver as to form a good substitute. It is ductile, malleable, weldable and very tenacious. It is less fusible than iron, and does not oxidise on exposure to the atmosphere. Nickel in an ore, and is found in all meteoric stones or aerolites (Meteorites), its chief ore being the sulphuret or Kuppnick of the Germans. There are several alloys of nickel known under a variety of names, such as white copper, copper nickel, or arsenical nickel, and a new one has appeared called Garnierite, used now in the manufacture of what is known as nickel bronze. The principle use of nickel generally is as an alloy for forming German silver and other white combinations.

Aluminium.

<http://www.world-aluminium.org/history/>

http://www.aluminium-cans.com.au/Intro_history.html

This is an ore found in clay felspar and other rocky substances. It is white in colour but with a bluish hue, capable of a very high polish, its most remarkable feature being its lightness, lighter than glass and one fourth the weight of silver. It is very sonorous, and when alloyed with gold of enormous

strength. The uses of which are numerous, especially in the lighter manufactures such as watch chains, pen and pencil cases, various articles of jewellery, statuettes, and ornamental metal work of all and every kind. It is easy to work, and, associated with other metals, makes an agreeable combination.

German Silver.

<http://www.infoplease.com/ce6/sci/A0820635.html>

<http://www.barkingrock.com/catalogd.htm>

German silver is an alloy of several metals. The proportions are usually as follows: Copper five parts, zinc three parts, and nickel two parts; though of course, the various metals are not peculiar to Germany. It derived its name from the fact that it was first made in Germany in the proportions named, and found to be a success.

It has special qualities, notably hardness, toughness, and a susceptibility of a high polish, it being nearly as white as silver. The use of German silver so called is chiefly for electroplating upon and for the manufacture of forks, spoons, teapots, dish covers and such like articles; on exposure to the air, however, it becomes tarnished a yellow colour. The cost is so much less than the metal it resembles, that it is used extensively.

Hyper links to exotic metal web sites.

Titanium.

http://www.itponline.com/index_files/page0002.htm

Tungsten.

http://www.itia.org.uk/tungsten/tungsten_history.html

Magnesium.

<http://en.wikipedia.org/wiki/Magnesium>

Chapter Three. What metal work really is.

This industry originated many years ago in Italy, where it reached perfection especially in Venice, hence it is generally known as Venetian. It embraces all kinds of ornamental work, but for the better understanding of the subject it may be divided into two kinds, hot and cold. The hot includes all, which is melted and cast into moulds, or else that which is merely heated and worked until it is in such a condition that it may be hammered into shape. To give a simple illustration, take the making of a horseshoe: the iron is cut the desired length, plunged into a clear charcoal fire, and made-red hot, then hammered with sledge-hammers and bent into the proper shape: here we have a familiar example of iron work of the hot kind. Cold work is when the metal used needs no heating, but is worked up in its natural condition. This division of the work may be further divided into:

Band Strip or Ribbon work, so named from using the material in strips or ribbons. Cut Sheet Work, when shapes are cut out of flat material and formed into artistic shapes and designs in various ways.

Special Cutting. This is painting patterns or pictures over open spaces, cut in thin sheet, metal, cardboard, or wool.

Repousse, or embossed sheet metal work, is the art of embossing sheet metal or, in other words, making raised designs by beating it with proper tools and a hammer.

Nail or Knob Work is a very easy and beautiful method of ornamentation, practised very extensively in years gone by. It consists of round-headed or boss nails of iron, brass, copper, or silver, which may readily be obtained in all sizes and of various shapes. These are simply arranged in rows, or in such a fashion as to form a pattern when driven into boxes or any article it is desired to ornament.

Scale Work is another form of ornamentation made by cutting iron or brass into small round pieces or discs, and by fastening them on to a board in such a fashion as to cause them to lap over each other resembling the scales of fish, such as trout or salmon-hence the name.

Sheet Silver Work.

This is more expensive on account of the material used. Many charming silver ornaments may be made from small coins, should it not be convenient to obtain sheet silver; workers in this branch of metal work have freely used threepenny-pieces, sixpences, and shillings. Other kinds of metal work might be named; many of them would be far beyond the powers of ordinary amateurs, requiring special knowledge and, in some cases, years of apprenticeship and considerable outlay in order to achieve any measure of success.

Any one who desires to make metal work a hobby as may be described and shown in these pages can undertake such work. It is by no means difficult, but easy of accomplishment, and is really most useful and essentially ornamental. What is specially needed are brains and hands-brains to originate and develop ideas-hands and skilful fingers to work out the ideas in solid form. Application and perseverance are also essential.

One of our recent writers points out that among our early ancestors every well-educated man was a Smith. Smith, Earl, and Thrall, or the artisan, the noble, and the labouring man, were the family names of the whole human race-and there is no reason why every man should not be more or less of a smith now. All such work opens the eyes and makes deft the hands in all kinds of crafts, and the first step to it will be found in the practice of metal working."

The various kinds enumerated in this chapter will be found fully described and illustrated in subsequent chapters under their several headings.

Material Used.

It is well to lay in a small stock of light strip or ribbon iron before commencing work. This costs but little; it may be had $\frac{3}{16}$ ", $\frac{1}{4}$ " or, $\frac{1}{2}$ " inch wide, and about $\frac{1}{32}$ " of an inch in thickness. The most useful generally are strips about 12 inches long and not more than $\frac{1}{4}$ " inch wide. Even the lightest strips are very strong, and are the best for all suspended objects. For standing objects,

where rigidity is essential, the thicker kind is used, and sometimes a rod of iron is twisted up so as to support it. The metal should not be either too flexible or too stiff, it should bend easily and uniformly, and when once bent should remain in shape.

The average cost of the metal will be found as follows:

Prices of Material.

Note: The prices quote for materials almost one hundred years ago are shown in the following lines, it is interesting to note the effects of inflation with what one would expect to pay today.

Best strip or ribbon iron, all sizes 6d. Per pound. It may be purchased of various widths, such as 1/3", 3/16", 5/16", 3/8" and 1/2",

Polished copper or brass: 1s. 6d per Lb.

Fine Copper wire, 2s per Lb.

Dead Black (Mat) paint: 10d per lb.

Copper rivets, 4d. Per Oz.

Note:

4d = four pence (Pennies) (About two cents)

2S = Two Shillings. (25CentsAU)

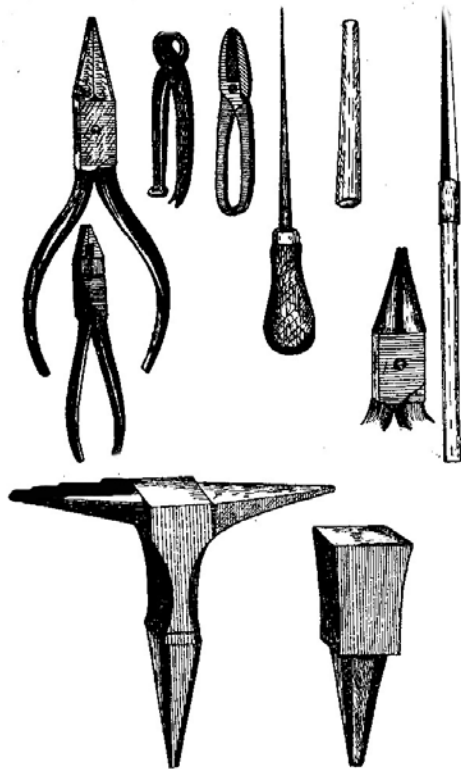
1s.6d = One Shilling & one sixpence. (15Cents Au)

Chapter Four. Tools Required for Metal Working.

It is by no means necessary for a beginner to spend a fortune on tools. Purchase what is absolutely necessary for a start, and then, as may be required, add to the stock from time to time. Of course some tools are necessary; good work cannot be produced with what are called "makeshifts." here let us offer a word of advice. In purchasing, good quality tools are never cheap, but they last for years, many of them for a lifetime, it is simply false economy to save a few pence or shillings at the outset with cheap tools, and the difference between so-called cheap and those that are really good is so small as not to be worth consideration.

For bent Iron work-which is the first step to metal working - the following are absolutely necessary: -A pair of **shears**, or what are known as **tinman's snips**; a pair of **cutting pliers**, a pair of **round-nogged** (nosed) and another longer in the nose-three pairs in all will be found indispensable; a **punch** for making holes in the iron; a **rimmer** for making the holes as large as occasion may require; an **awl** long in the point, useful for marking out designs and tracing patterns on the metal; a **small anvil**, a **template** for the purpose of bending curves (these may be made out of rods of wood or iron), and lastly a **hammer**. (Ball peen)

Metal working tools.



Note:

A very effective anvil can be fashioned from a short length of railway line, the basic shape can be achieved with gas cutting equipment, then use a large nine-inch angle grinder to clean up and finish the job.

A very handy hard scribe can be made from a small diameter chain saw file. Break off the tang and grind smooth, heat the other end to a cherry red and hammer to a taper point, finish the job using a bench grinder to grind a fine scribing point.

Shears or Snips. These are for cutting the strips of iron or metal to the proper length.

Pliers of various kinds as named; the cutters should have flat jaws and a cutting edge, not so much for the cutting of the metal as for snipping off the narrower portions and odd corners. The round-nosed pliers are for making the several curves. These should be about four to eight inches in length, and are usually made with tapered jaws.

Punches. Such as are used for ordinary work-made of steel, so that holes can be easily punched in the strips.

A Rimer is for enlarging and smoothing the holes made by the punch.

The Awl should be long pointed, though ordinary bradawls will serve equally well, but a long pointed tool with a sharp point is necessary for marking out and designing.

The Anvil. This is the most expensive of the worker's outfit. These may be had in all sizes; one about four or five inches will be sufficient. This can be driven into the bench, or placed on a heavy block of wood-that is should it not have a spike. If an anvil cannot be obtained, what is known as a bolt stake will do; or if only small work is to be done, a flat iron reversed will serve.

(See notes on previous page re railway line anvil.)

Templates are made of wood or metal. These are simple various curvatures, nodules, or pins fixed on to a board. These should stand out some little distance, and are used for the purpose of bending the metal round them so that the several curves should be accurate and agreeing in curvature with others used in conjunction, as accuracy and uniformity in most working is most important; this cannot be arrived at where pliers only are used for bending.

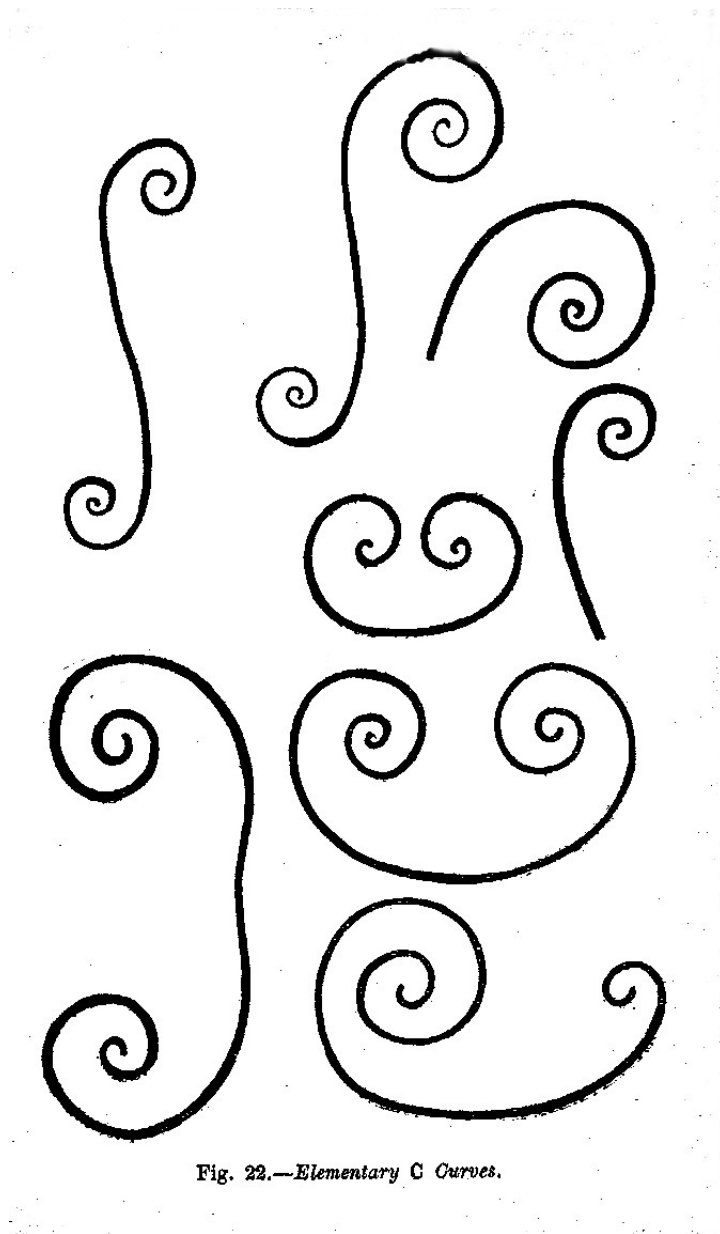
To a worker with tools the making of this template will be an easy matter. Several sizes should be made so that curves of various kinds may be produced according to the work in hand, see **Fig. 22** below.

Hammer. If possible there should be two, one large square-headed and the other somewhat smaller. A hammer is a tool almost too well known to need description, yet very few are acquainted with the names of its various parts. The bundle is known as the helve, the iron appendage the head, the round or square side of which is the face, and the opposite end the tail. The end of the handle, which enters the eye of the head, is the tongue; other parts of the hammer are known as eye, peen, or claw.

Metal workers, in fact all who handle tools, should pay some attention to the handles. To get the right shape adds to the pleasure of work of whatever kind it may be, besides lessening the fatigue and weariness, which an ill-shaped handle produces. Whether the handle belongs to a hammer or an awl, it should be made to fit the hand so that it may be grasped in comfort, and in such & way that it may accomplish the work desired.

Besides the tools named, a small table vice should if possible be obtained-this may be fixed on the edge of the bench or table; also & bottle of black varnish and & brush, a tape measure, some narrow strips of sheet iron, and a small quantity of wire for binding it. The kind of wire used by florists for bourbonnieres will admirably serve the purpose.

Although the list of absolute requirements may at first sight appear to be somewhat formidable, the cost is by no means large, and will come within the means of any ordinary would-be metal worker. As work progresses, more tools may be obtained as exigencies arise. Many others might even be named and will doubtless suggest themselves to the worker, but in all case it is best "to make haste slowly"



Note:

A large proportion of metal working shapes evolve around the curves and scrolls shown at left.

The round nosed, or pointed pliers can be used to form the scrolls.

A more advanced method is to make up some formers, which can be used to roll the wire or metal around to the desired shape.

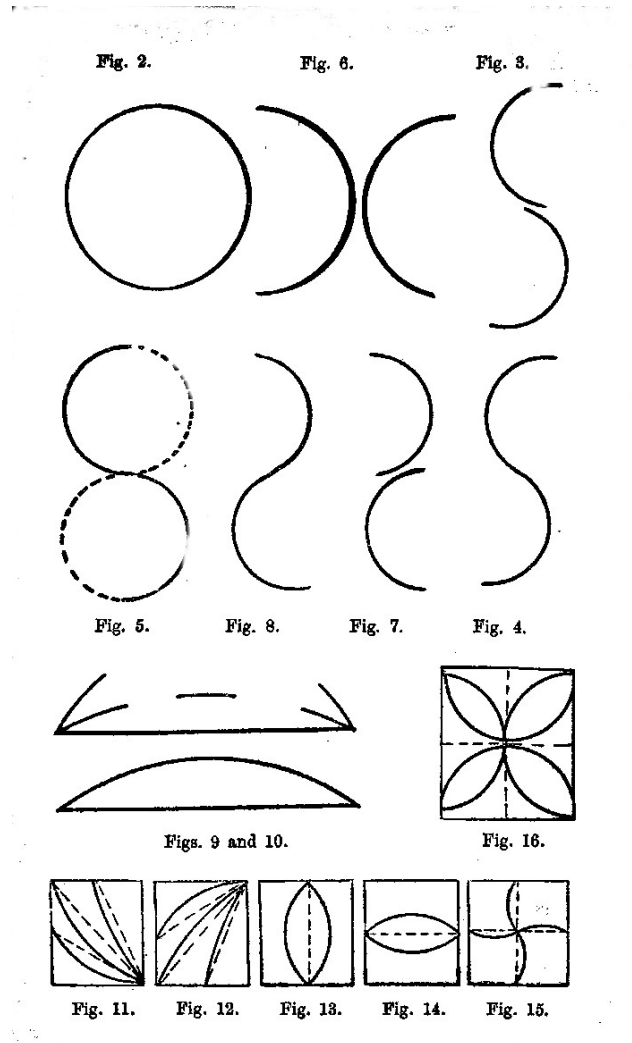
The formers will allow many pieces of the same size or shape to be made which will give a uniform finish and accuracy to any metal work design.

A small amount of trial and error will quickly allow the metal worker to fine tune any design.

Chapter Five. Methods of Drawing Transferring, and Copying the Pattern.

IT has been said that the line of beauty is the " S " curve, and it is most important; in metalwork as in all others, beauty of form should be studied. The principle of this curve is founded upon the opposition and balance of its component lines, and originates in the symmetry of a single geometrical circle. To better understand this problem the several illustrations are here given. **Fig. 2** is the circle, **Fig. 3** the halves or semi-circles, evolving towards the completed figure as shown by **Fig. 4**. **Fig. 5** shows the transition from the conventional "S" curve to its reverse; and **Fig. 6** gives the fundamental curves of this reversed "S." **Fig. 7** corresponds with **Fig. 3**, and **Fig. 8** with **Fig. 4**, showing the evolution towards the perfect figure.

For drawing a curve the best method is to draw a straight line first. Then at each end of this line draw a small part of the curve, showing the direction, which the curve takes. Next fix the highest point of the curve above the straight line and complete the curve in one stroke; Figs show these two. 9 and 10. In order to gain facility in curve drawing, which is the most difficult in all designing, it is as well to practise the several patterns and designs as shown By Figs. 11, 12, 13, 14, 15, and 16 -- no explanation of these is necessary.



Figs. 15 and 16 are double curves crossing or touching the straight lines in the middle. The direction of the ends and the highest point on each side should then be first drawn. The curve should then be drawn from end to end without a break. A little practice will render the task a comparatively easy one.

Methods of copying are as follows: First; Copying Direct.

For this purpose the carbon or wrapper paper is generally used. This is laid between the pattern and the metal, and then all the lines done over with a

transfer point or a hand pencil. For straight lines a ruler can be used, and circles with the compasses. In course of working, the progress should be

ascertained from time to time by carefully raising both the drawing and transfer paper, so that any omission may be made good at the time, completing the pattern as it is being drawn.

Another method, instead of using the transfer paper, is that of tracing the original carefully with a pen and aniline copying ink, which, when completed, is then to be laid face downwards on to the metal, the back slightly damped with a sponge, and then the paper pressed down with a dabber. The paper must be carefully lifted and the ink allowed to dry, when it will be found that the pattern is sharply reproduced on to the metal.

Another, but less simple, method is that of using templates. These must be transferred with a pencil or transfer paper, and is only advantageous when several separate pieces of any part must be cut out, or if several specimens of the same object are to be produced for which the same templates or patterns can be used.

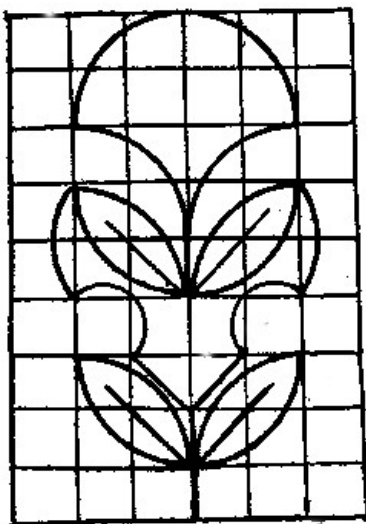


Fig. 17.

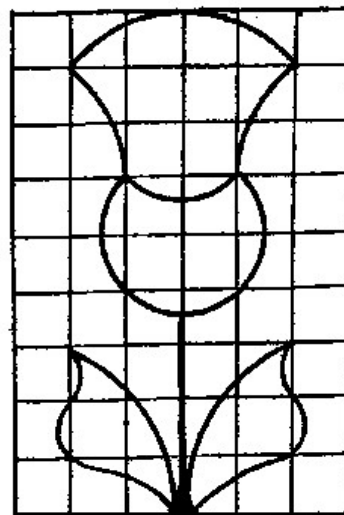


Fig. 18.

Methods of Drawing Designs.

Methods of Drawing Designs.

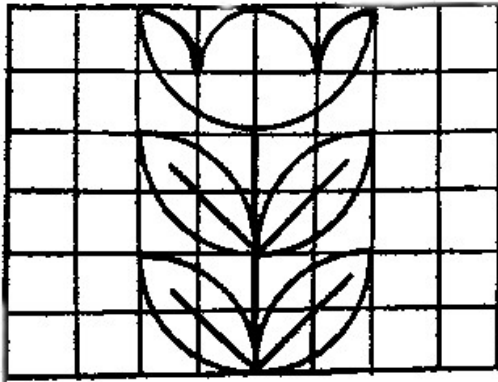


Fig. 19.

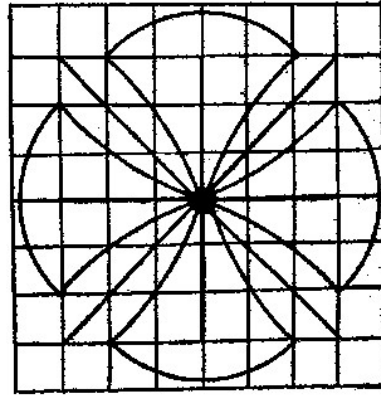


Fig. 20.

These templates are made in the same way as decorative painters prepare their patterns. The pattern is traced on stout paper in one of the above-mentioned ways; or sometimes the pattern is pasted on to the paper and coated on both sides with **polish or oil varnish** (any excess of the latter being removed by a cloth), and the pattern must then be cut out with a sharp penknife, (Or scalpel blade) on a glass plate or smooth board, straight lines are drawn with a ruler and the curved ones carefully by hand—all must be perfectly firm and clean. Slight straps must be left at any points of intersection as in flat painting, so that any contiguous pieces may not fall out of the drawing after being out. To transfer the drawing to the metal, a tool & technique known as a stencilling brush is used; any colour can be used, such as the common inks etc.—but not too thin. The brush is simply made of hog bristles, mounted in metal and about four inches in length, not running to a point.

Second Method is: Copying by the Chemical Process.

Chemical copies produced on sensitised paper, such as are common in photography, are sometimes used with very good effect. The method of procedure is as follows:

There is, however, a restriction in the use of photographic paper, as only such pictures or designs can be copied as are on tolerably thin paper and have a series of bold black lines. Procure the paper, which may be purchased in packets of various sizes at any photographic dealer's, and place the picture or drawing face downwards upon it; lay a large glass plate over it, weighted along the edges with pieces of iron or stone. Then expose the whole to the direct action of sun or bright daylight, taking care that the glass plate presses

evenly and closely on the picture, so that the copy will appear distinct; of course, if a photographic frame can be used, so much the better.

The copy will be produced more rapidly if the exposure takes place in direct sunlight. The thickness of the paper on which the original has been executed is also of great importance, as the rays of light must pass through the paper, and effect the chemical decomposition of all such parts of the sensitised paper as are not protected by the lines of the picture, while these, on the contrary, are not acted upon by the light, and consequently remain white. As soon as the projecting border of the sensitised paper not protected by the picture shows a metallic appearance, then the copy may reasonably be supposed to be taken, and the whole should be removed from the bright light to a darkened corner or room.

The copy must now be fixed; this can be done by using a photographic toning and fixing fluid, costing a small sum at any chemist's or photography supply shop; then wash the print thoroughly, allow it to dry, and it is ready for use.

The picture or design will, of course, be reversed in the copy, and white on a dark ground. This will signify little, in the matter of patterns or designs. The copy produced must now be evenly and quickly pasted over, and laid upon the metal plate so that no air-bubbles are formed, and then gently dabbed with a cloth and weighted, until it is thoroughly dry-when the work can be proceeded with, transferring the pattern either by cutting along the white lines (in the case of fretwork), or by means of a blunt point in the case of repousse. After the transferring, the remains of the paper can easily be removed by damping. This process, however, can only be recommended in the case of difficult and intricate patterns or designs.

Note:

If you do not wish to undertake and use the old time production methods, the above could well be done with the aid of a computer and relevant drawing software programs. Use your printer to print out your individual design, and then transfer the pattern as explained above.

Third Method.

Another method of copying should be mentioned, namely, that of using a pantograph, which is an instrument used for copying drawings mechanically and with little trouble. Sometimes it is required to transmit a design on an enlarged or reduced scale. The old fashioned way is to do this on paper, ruled in squares, but even then, to say nothing of the time involved, it is difficult to get all details in their proper proportions, but with the pantograph a true copy can be made, true in all its details and on any required scale. Pantographs are easily made, but they cost but little, and can be obtained at any artist colour and material shops, or, from the local second-hand dealer.

Template Designs.

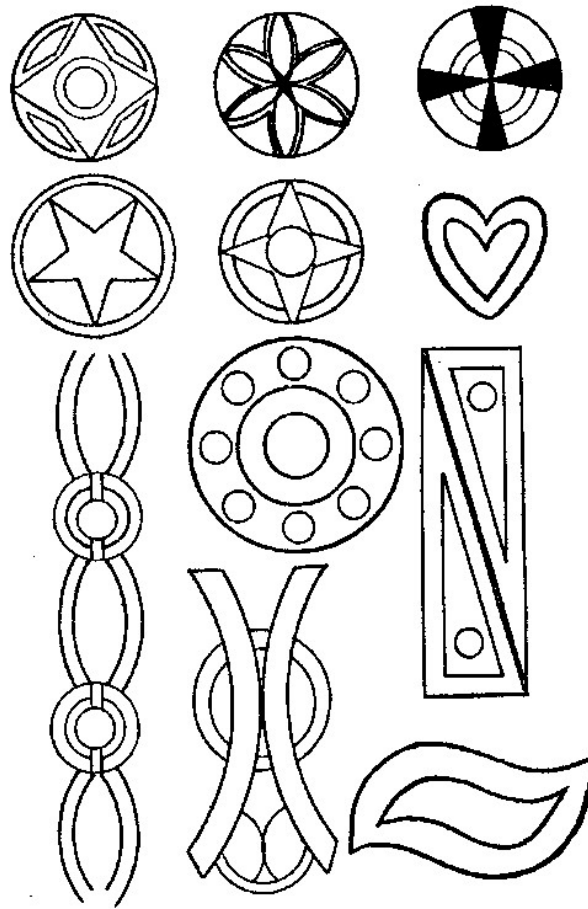


Fig. 21.—*Designs.*

Transferring the Pattern.

Although the pattern may be transmitted by means of the carbon paper on to the surface of the metal, to save the eye whilst sawing and to prevent the surface from being scratched, it is better to glue the paper pattern on to the metal; and in order to do this firmly, take a few drops of methylated spirit, drop them on to the surface in order to remove grease or any dirt, then rub the metal well with a dry cloth. To fix the paper, a little good glue, (**substitute dilute mix of PVA wood work glue**) to which an equal quantity of glycerine has been added, is the best medium to use for the purpose.

Having fixed the paper, well grease it with olive oil -this will render greasing the saw unnecessary. The straight line can, of course, be cut with the shears or scissors.

When all parts have been sawn out, the paper need not be removed until absolutely necessary. All edges to be soldered must be sloped with the flat-nosed pliers before soldering, and the edges should be as sharp as possible.

Drawing, Transferring, Copying.

C and S curves are so called from their general resemblance to the letters named. These are used in many combinations. To do perfect work, these must be symmetrical and geometrically true. It will not be a waste of time if a few hours are devoted to shaping them. The curves take many forms; they may be long, short, thin, with various endings, close or open spirals, as the work demands.

The principal difficulty with the beginner is bending the material in flowing curves without kinking, for a badly formed **O** or **S** will only mar the work, no matter how well it may be done in other particulars. Curves themselves are really strips of metal bent into graceful forms; to serve as ornaments. These are **riveted or clamped** together as the exigencies of the work demand.

Practice should commence by making a circle, then an oval, an “**O**” and “**S**” curve, & “**V**” angle, and lastly a **wavy line**. To form a circle-this may be made without the end crossing, or one end may overlap. First of all form the circle with compasses on a piece of paper; let it be the exact size required, then bend the metal to the pattern; should any irregularity occur, this can easily be remedied with the use of the pliers.

In the same way describe the oval, and work the metal with the help of the large pliers and the flat-nosed ones; after a little practice the work will not be found difficult.

The “**C**” curve is the most used in metal work; to form this, hold the metal with the flat pliers and bend the strip at one end into a roll so that it can be enlarged to the required curve, then work the other end in the same way. With the round-nosed pliers twist the free end into a small curve, then work outwards, forming the larger curve, and finally diminishing down to the small ones at the opposite end, taking care that no kinks are made in the process.

Do not bend too much at one time, but proceed slowly and carefully from start to finish. If, however, much of this work is required, **template pins** should be used, see **Fig. 23** below. This is used as a **bending appliance**, made of wood of various curvatures affixed to a stout timber baseboard.

These curvatures or pins stand up about half an inch, and the strip of metal may be bent round them. The C curves are the most common forms in metal work and are of great variety. Descriptions of actual working cannot be further given; what is wanted is **practice**-this is worth pages of print, and is the **only way to find out what will or what will not do**.

The **S** scrolls are not quite so much in demand, but they are equally necessary. A simple **S** has the same shape at both ends, though not always of the same size; this of course depends upon the nature of the ornament

Wooden Template Pins Attached to Timber Base.

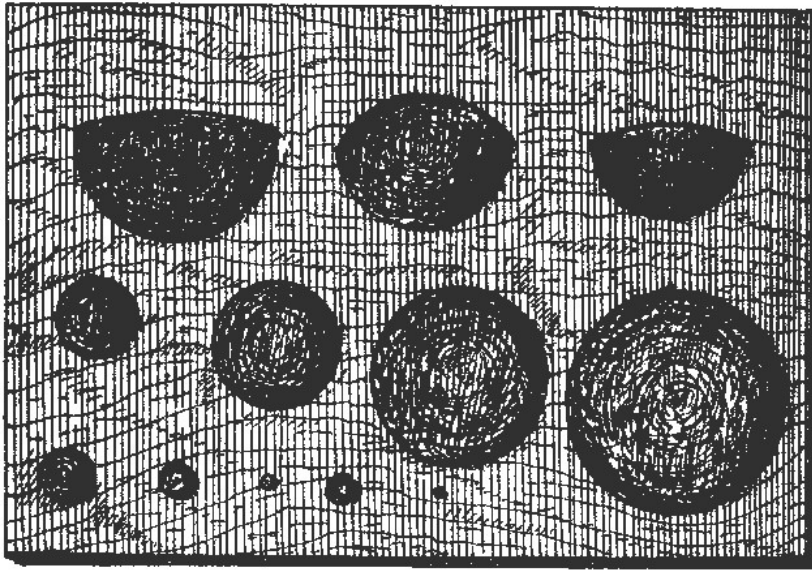


Fig. 23.—*Template Pins.*

Elementary curves. Leaves for floral designs formed out of strip iron and fastened with rivets. **Fig 24.**

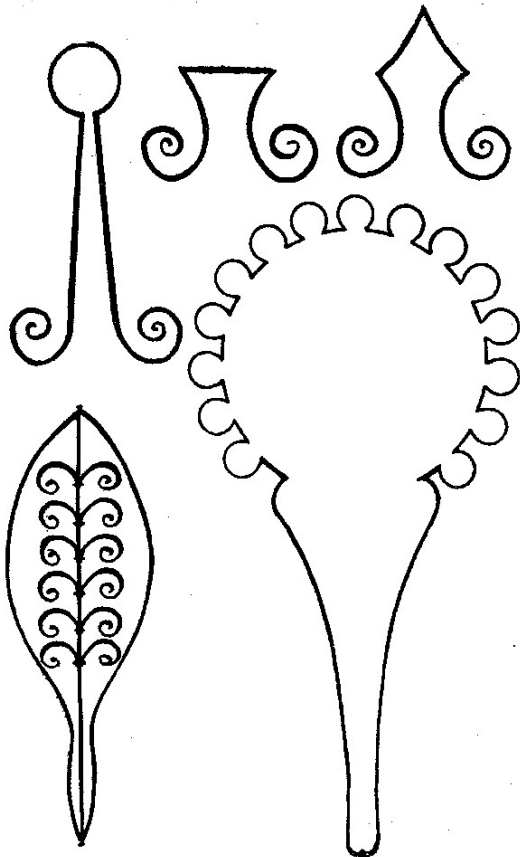


Fig. 24.—*Elementary Curves, etc. Leaves for Floral Designs formed out of Strip Iron and fastened with Rivets.*

Template pins and base-board can also be made from metal.

The pins can be turned up in various sizes on a lathe if you have one, or know of a friend with one tucked away in his /her workshop. Metal template pins will certainly last a lot longer than wooden ones.

desired. The making of them is much the same as the **C** curves, with the difference of the second scroll being turned in the opposite direction from the first one. **V** angles are comparatively easy to fashion. These, again, show varieties in the double and treble.

Wavy lines are more difficult, as they must necessarily be uniform in shape. This work should be done with the round-nosed pliers. Take hold of the metal with the pliers and bend the first curve, turn the pliers half round and bend the next, and so on until the work is completed; when finished, go over the whole, rectifying any little irregularity that may have occurred, bearing in mind that the curves should be made semi-circular and in all cases angular bends should be avoided.

Spirals are very effective if well formed, and are often useful as endings, such as often occur in mediaeval work. In these, again, an infinite variety is seen. Generally they should be made of narrow metal, so as to present a lighter appearance. It will be seen that they bear some resemblance to the wavy curves, but instead of the curves being equal in size and form, they get smaller and smaller until they finally end in a point. **See Fig 25.**

The methods of using these various forms will be shown in our subsequent workings. There are very many other shapes-in fact the number is almost infinite; the material used lends itself to any shape and in skilful hands can be fashioned at the will of the worker, and so long as the forms are graceful and symmetrical they cannot fail to be artistic.

In order to achieve success in art metalworking, it is necessary to begin at the beginning and advance by easy stages to perfection in the art. To do this, commence with the simplest designs and use the commonest material. The beauty of the work consists in the general effect it has by appealing to the

artistic sense of the individual. The article may be unpretentious and simple in itself, the workmanship not by any means perfect, yet it will possess a charm that can hardly be described.

Take, for instance, a piece of sheet iron, such as is known as tin-and very many small useful articles may be fashioned out of this very common material. Procure a sheet of this tin, cut it into a strip measuring one inch wide and eighteen inches long, and about 1/32" of an inch thick. Cut the strip, beginning at one end, nearly to the middle; then out from the opposite end, finishing to within about one inch of the end of the former cut. This cutting can be done with a strong pair of ordinary scissors, or shears if such are handy.

Having made the cuts, open out the narrow strips at one end, and with a ruler curl them so as to form two of the feet; then with the other end make the third foot by bending as the former. Procure any kind of vessel-glass, metal, or earthenware, and wind the remaining strip of metal round it, and you have at once a tasty flower stand, simple in form, yet artistic in appearance, **see Fig. 26.** This may be made ornamental, if desired, by painting, gilding, etc, using such colours as will harmonise with the surroundings. This method of working

will afford a means of utilising broken household articles which are usually consigned to the rubbish heap as being useless, such as vases, footless wine glasses, ornamental bottles, or even phials, tins, etc.

Holders can also be made with stout paper or card, to any design desired, so that real ornamental articles may be fashioned at small cost and without any special constructive ability.

Another simple but useful household article can be made in the same way, using the same material, viz., a candleholder, **see Fig. 27**. The strip of iron may be of any length, the most convenient being about 15" inches.

Fig 25. Elementary Curves.

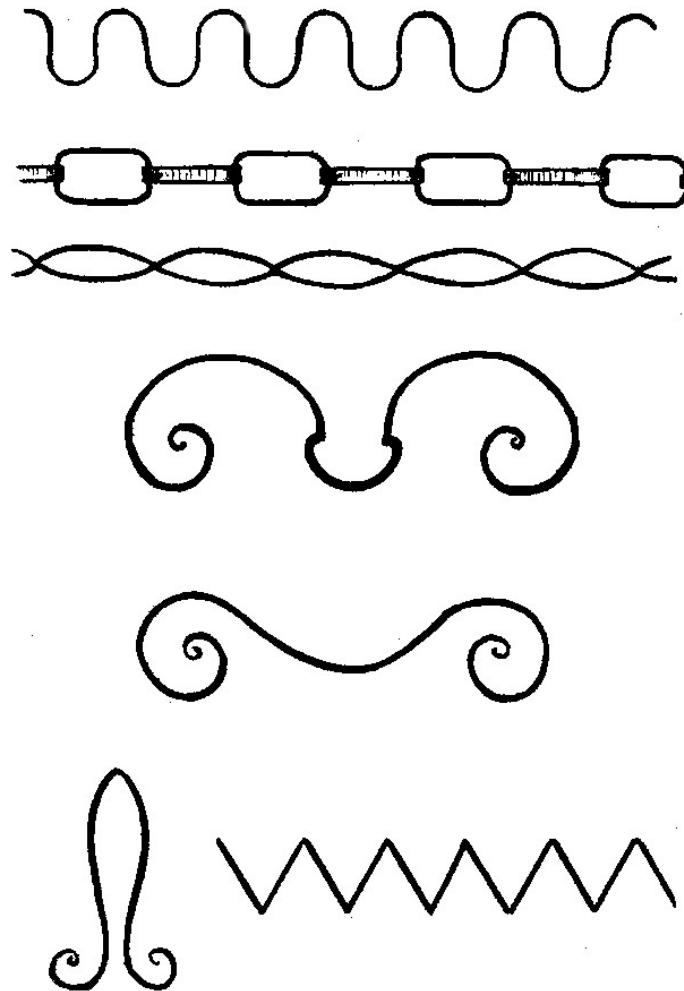


Fig. 25.—Elementary Curves.

A Wavy Line. A Chain. A Curve.
A Double Curve for Ornamentation.
A Chain Link. A Border.

Fig 26. Artistic Flower Vase Stand.

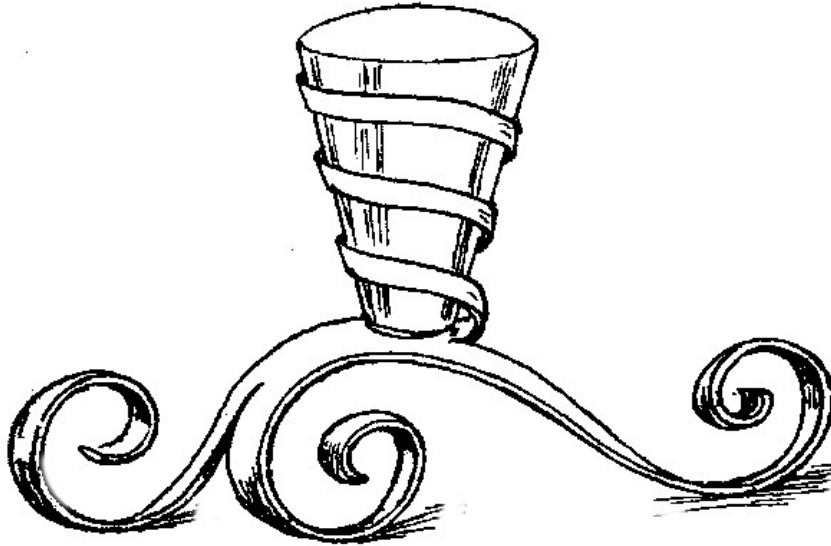


Fig. 26.—Flower Stand.

Fig 27. Candle Holder.

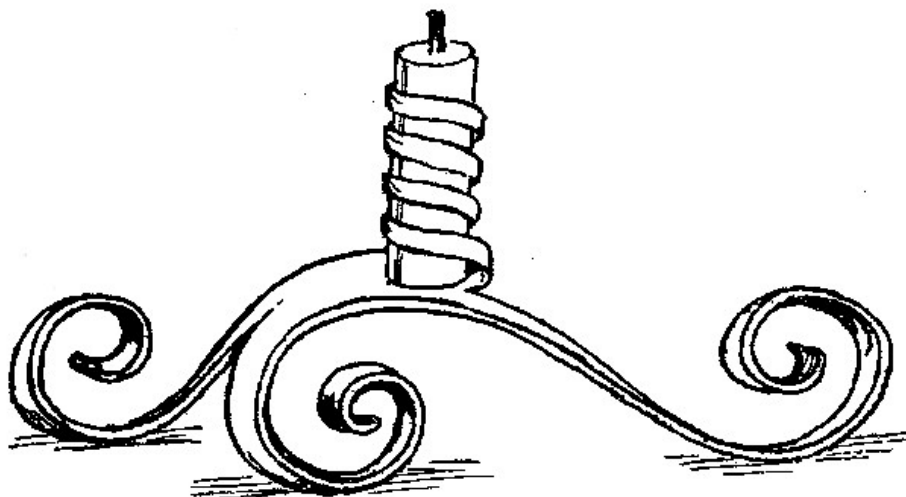


Fig. 27.—Candle Holder.

To begin making the clock stand the strip should be cut in the same way as the flower holder stand, and one end wound round a ruler and the other three bent and curled as shown by the illustration shown in: **Fig 27**. Care, however, must be taken to fashion the spiral straight, so that the candle may be held upright. In order to lift the candle as it burns down, & small piece of tin should be out in shape of a star slightly smaller than the spiral. Four small projections are bent upwards, whilst the fifth is kept straight to serve as a handle.

The lower end of the candle is hold between the four upturned projections then placed at the top of the spiral, and as the handle is turned one way the candle is lowered down the spiral, and raised when the handle is turned in the opposite direction. This useful article can he painted or gilded if desired.

Our next work is that of an ornamental clock-stand, **Fig. 28**. The size of the stand will of course depend upon the clock. These American productions usually measure about three inches from the front to back, so that the strip of iron should be slightly less in width and about eighteen inches long. From each end a wedge-shaped piece is cut, and two holes are made near the centre to receive the legs of the clock.

The metal must now be bent to the shape of the bottom of the clock and turned about half-way up each side, then bent over so that the ends of the strip, opened out and curled, may form the feet of the stand. "How it's done " will be clearly seen by a study of the illustration, so that further description is needless.

This simple piece of work really makes an art ornament for the mantelpiece, and at the same time serves a most useful purpose. The ornamentation can be according to the fancy of the worker.

Fig 28. Clock Stand.

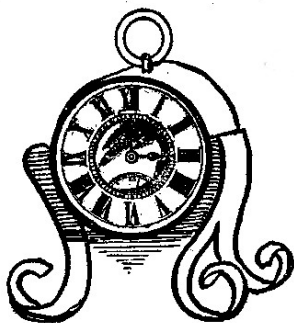


Fig. 28.—Clock Stand.

Fig 29. Kettle stand.

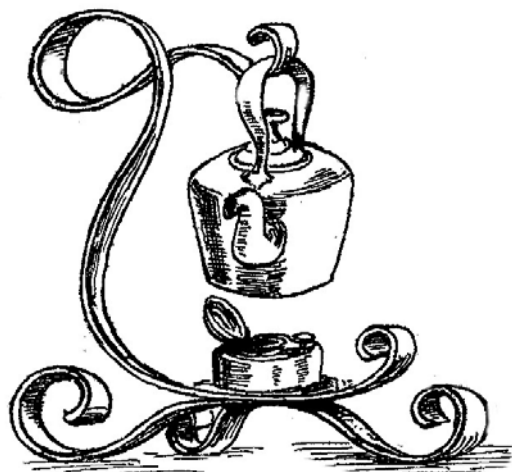


Fig. 29.—Kettle Stand.

Before finishing with simple working, there yet remains mains another article of special use in every household, viz., a small kettle-stand, **Fig. 29**. In selecting the various pieces of metal for working, judgment must be exercised. For the stand now under consideration, the sheet iron or tin must be slightly thicker than that used for the two holders previously described-in as much as the latter must be strong enough to bear the weight of the small kettle of water.

The length of the strip should be about two feet and the width three inches; the strip which supports the kettle must of course be longer than the strips that axe curled to form the feet, so that the metal must be cut accordingly -that is, two cuts must be cut along the strip instead of one as in previous workings.

At each end of the strip when out there will be one strip one inch and a half wide and two others three quarters of an inch; the wider ones are bent, one to form the arm for holding the kettle, and the other to hold a small lamp below; while the four narrow strips-two at each end - axe opened out and curled so as to form the base of the stand.

Nothing now remains to be done save the painting or ornamentation. These three articles are the easiest to make, and will serve as an **excellent introduction to the art of metalworking**.

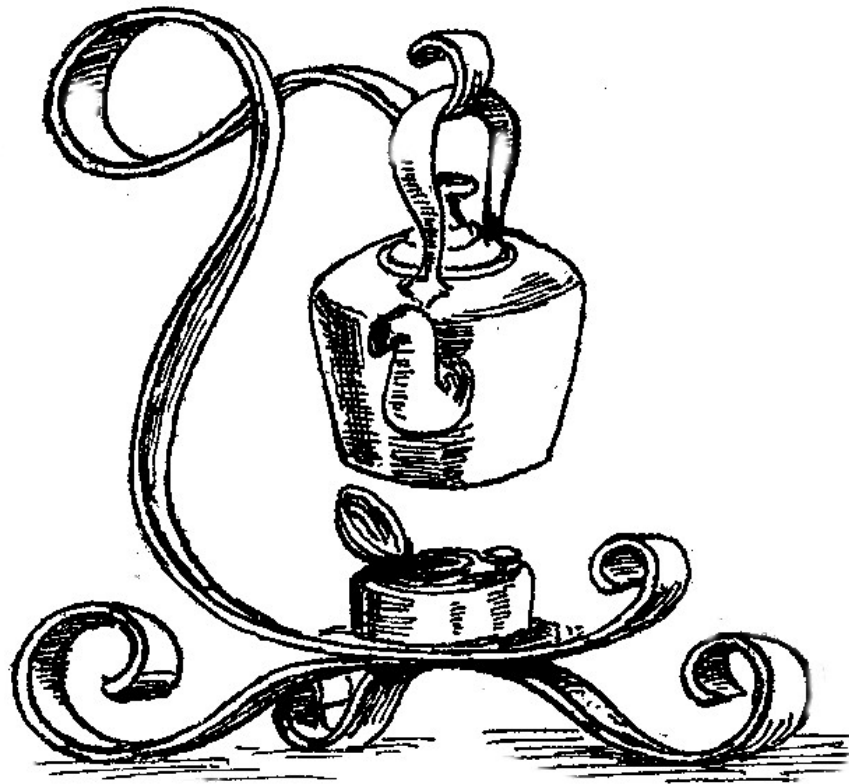


Fig. 29.—Kettle Stand.

Chapter Six. General Methods of Working.

With tools and material at hand work may be now commenced, bearing in mind that the round-nosed pliers are used for bending, the long-nosed pair for clinching the small strips which hold the curves together. The small vice fixed onto the bench or work table will be found of great service in bending the stronger strips at right angles, one end of the strip being screwed between the jaws of the vice, so that the other may be hammered into shape; it is also of the greatest use in forming spirals. Always have at hand a rule or tape measure in order to determine the lengths of symmetrical curves, as this is a most important feature in all metal work. Without grace and symmetry in design, the object can never be pleasing to the eye, and all labour expended on its production will be worse than useless.

In bending, take the strip of iron in the left hand, the round-nosed pliers in the right, and slightly bend the extreme end of the strip. It is most important to gain the true curve at the commencement of the work. The pliers should slip slowly along, bending the iron evenly at all points. If by accident an angle is made, it can be reduced by using the long nosed pliers.

When two curves are finished, they may be connected by means of a small binding piece shown in **Fig. 30 & 31**.

Binding Methods.

Illustration “**A**” (page 32) shows how to commence; “**B**”, the top when finished; “**C**”, the underneath where the small binder meets. The strips may be fastened so that one end may lap over the other, which makes the joint stronger, or end to end, which gives the neater appearance.

The curves may be temporarily fastened to a frame by wire to get them properly arranged before binding. When the articles are finished, two coats of black varnish should be applied to prevent rusting.

For practice in making curves no better piece of work, can be suggested than in **Fig. 33**, which shows a visiting card holder intended for fixing on to the outside of a door of a flat, studio, or chambers.

In making the holder the frame must be done first, the corners bent in the vice. It may be made in two pieces, which can be connected by a binding piece when finished. This will also help to aid the curved strip next to V in its position. Every curve should be applied to the drawing or tracing, which should be laid out flat upon the worktable to ensure its correctness.

This proceeding will save much time and trouble. After making the first curve of a pair by means of the tape or rule, take the measure so that the next piece may be cut the same length. In many patterns the same curve is repeated, and accuracy and method are of the first importance, for if the scrolls are not of equal size and all bent true to the drawing it will be impossible to finish the work.

For this reason the several pieces should be placed together on the work table before binding, when any inaccuracy will be at once seen and can either be corrected, or, if that is impossible, the faulty scroll or scrolls may be replaced by others properly bent. When fastened together in the manner shown and described above, the work should be laid aside to dry. When finished, a piece of stiff cardboard should be fixed to the visiting cards can be slipped in between it and the frame itself.

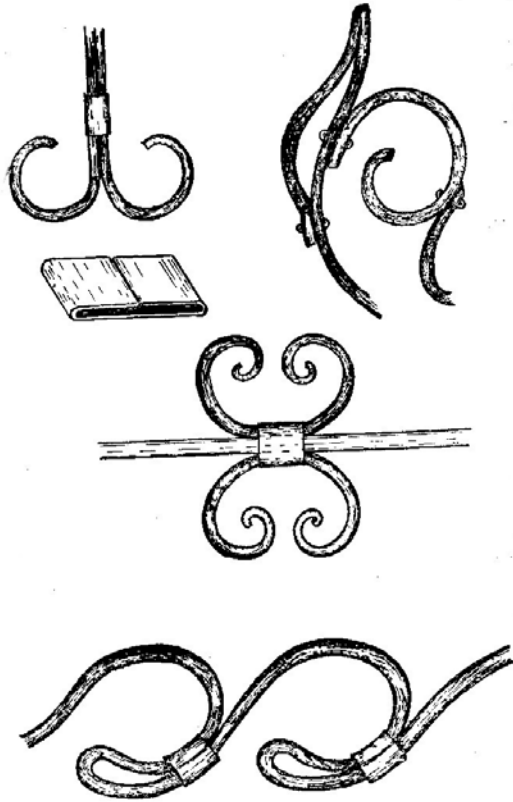


Fig 30. Methods of Fixing by Bands & Rivets.

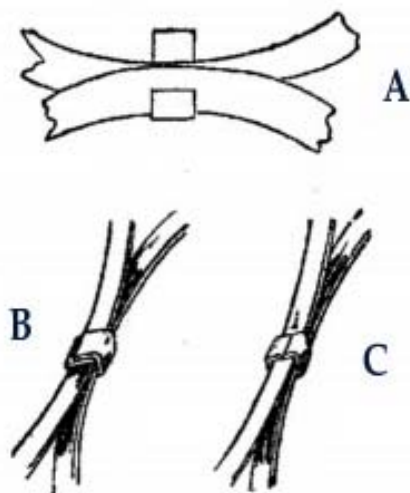


Fig. 31. Method of Binding.

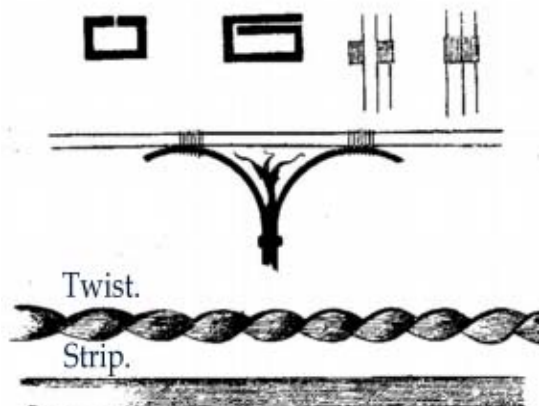


Figure. 32- Methods of Binding.

Traditional ironwork scrolls in **S** curves and **C** curves. These patterns can be used to design modern indoor and outdoor wrought iron furniture.

Note the way the very ends of the scrolls are finished, beautifully tapered. Compare the handcrafted quality here with what you currently see presented in furniture shops which is passed off for custom wrought iron work. Much of it is just rubbish.

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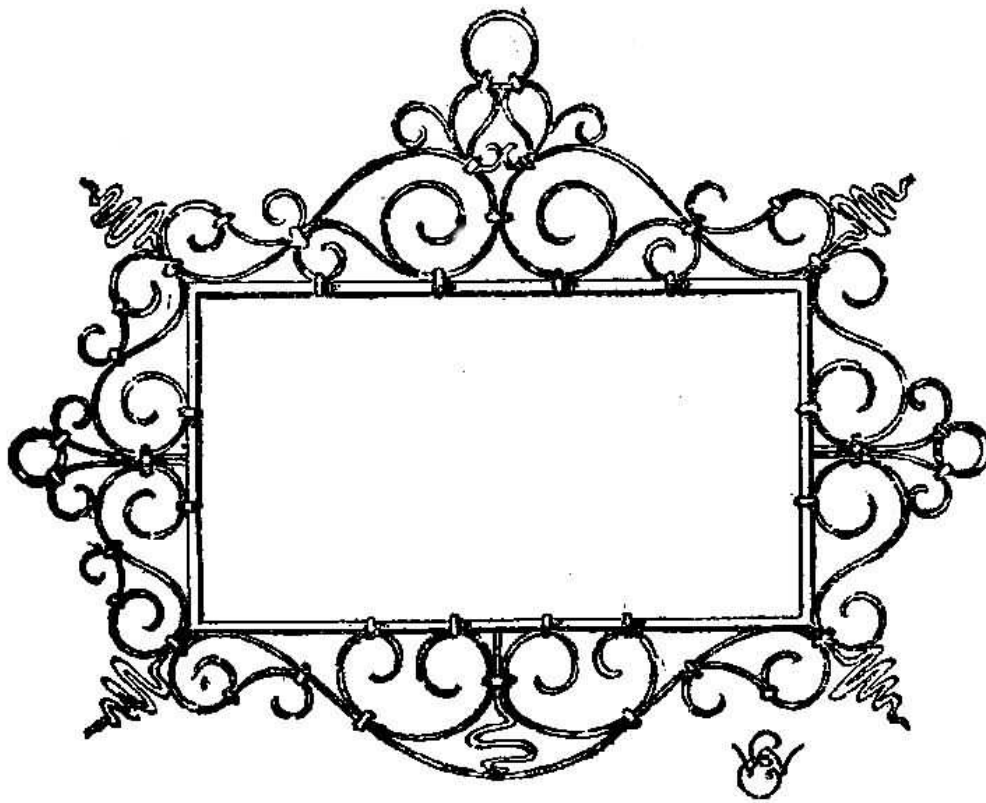


Fig. 33. Design for Card holder to Hang on Door.

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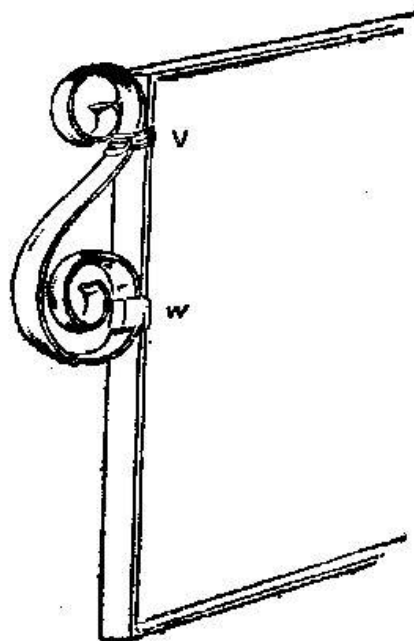


Fig. 34. Side View of Card Holder.

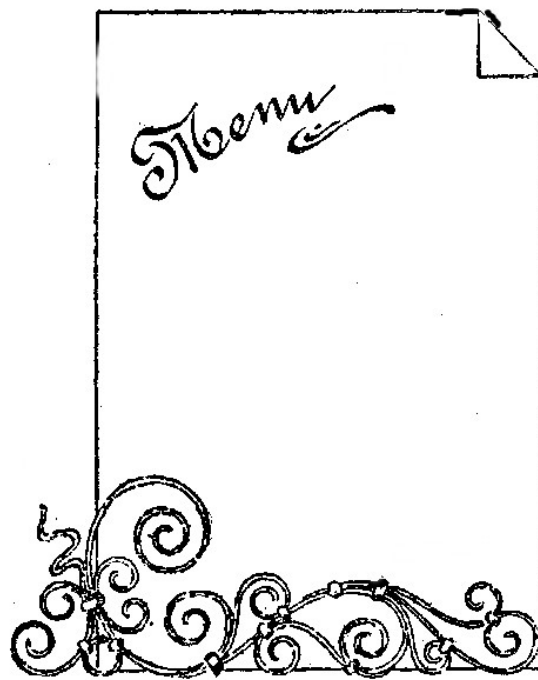


Fig 35. Menu Stand In Bent Iron.

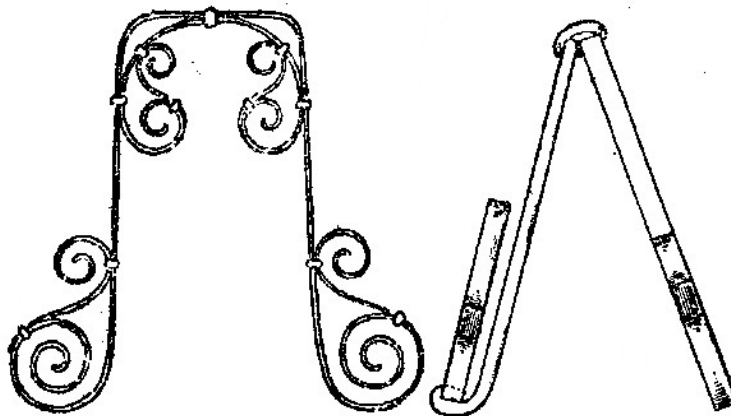


Fig 36. Easel For The Menu Stand.

(The bent wire - iron examples shown above can be made using the simple hand tools outlined at the beginning of this book. It requires practice and patience and a good eye for good form and evenness in the design. All of the scrolls and bent wire have been joined together using the binding method described above.)

Many small articles may be made with bent iron which will not only be decorative but useful, such as **Fig 35**, which represents a menu stand, or will serve equally well as a photo frame.

To make this small article will not involve much trouble. By studying the illustrations provided, the work should not prove to be difficult. Each iron strip must be bent very carefully to form the curves, and they must all be connected at the places shown with the small binding pieces as explained.

Having completed the menu stand, prepare the cani for it as in **Fig. 31**. To make a slip and rest for the card, take a round iron wire and bend it to the shape as in illustration. The ends of this wire should be bent round points “**A**” and “**B**”, and the rest should then be formed in such a way as to give enough space for a card to slip between it and the front part. The stand will be complete by connecting the easel with the top of the frame by means of wire.

Fig. 37 suggests a treatment for & candlestick. The materials required are some **sheet iron**, an **old tin candlestick holder**, and a few pieces of **iron wire one-eighth or three-sixteenths** of an inch thick.

First of all rip the bottom from your old candlestick and in its place fix a funnel-shaped form of thin sheet iron, with a piece of stout wire projecting downwards from the bottom of it to fasten the lower part of the scroll feet to. Then bend three sets of scrolls the desired size to form the legs, and bind these to the candlestick with iron wire.

Fig. 39 is an illustration of a **cuff or collar box**, which should not be difficult to make. First from six hoops of round wire of medium strength, or, if preferred, square iron strips one eighth of an inch in width. One of these hoops for the top, one for the bottom, and four for the cylinder.

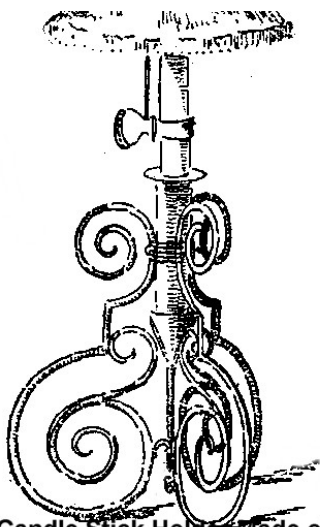


Fig 37. Candle Stick Holder Made of Sheet Iron & Wire.

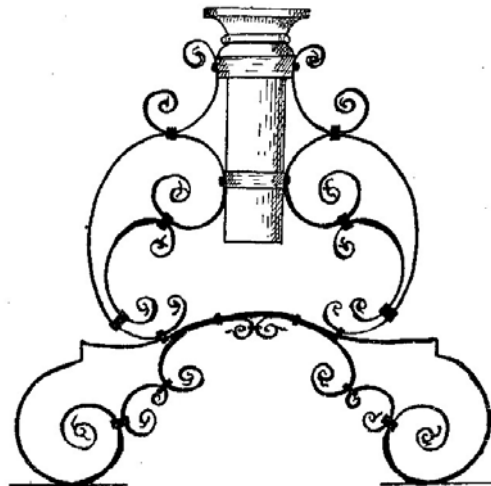


Fig 38. Another Design For A Candle Holder.

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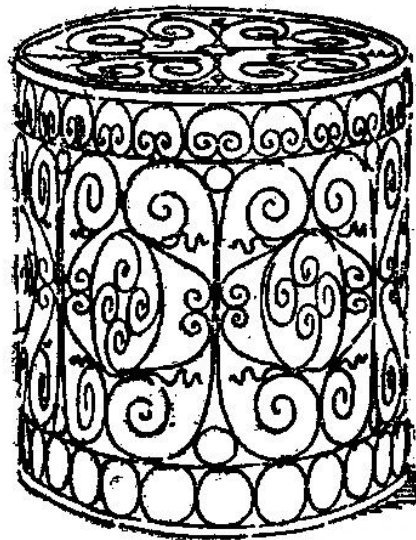


Fig 39. Cuff Box Made From Bent Iron Wire.

The bottom may be of thin wood, bound with one of the rings and made fast to the lower edge of the cylinder. The top should be fastened to the upper edge, with one piece of ribbon to act as a hinge. Opposite the hinge may be a bow to act as a handle to lift the lid by. The interior of the box should be lined with silk of a bright colour, so that the black iron scrolls may form a pleasing contrast.

The pattern of the ironwork may be left to the worker. That shown in the illustration will be found simple and easy of execution. It is as well to think it out and make a drawing the exact size of the intended box, so as to work to it at every point; this will prevent any error or malformation of the curves and scroll. The bindings had in this case better be of wire rather than bands.

Figs. 41 and 42 show designs for holding a watch. The longer horizontal strip may be made slightly concave the better to support the watch. **Fig 40** shows plainly the hook for the watch. No further explanations are needed, as a study of the illustrations will show clearly how to proceed in the working.

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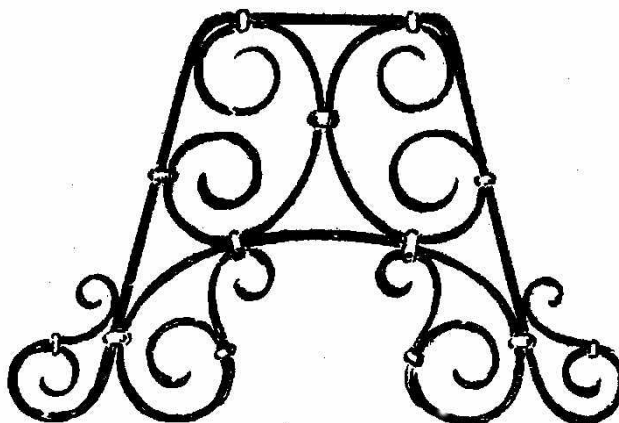


Fig 41 Watch Holder.

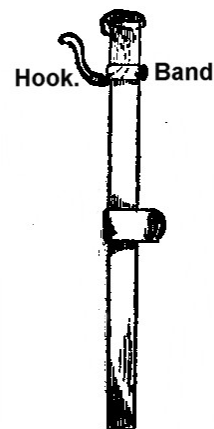


Fig 40 Hook For Watch.

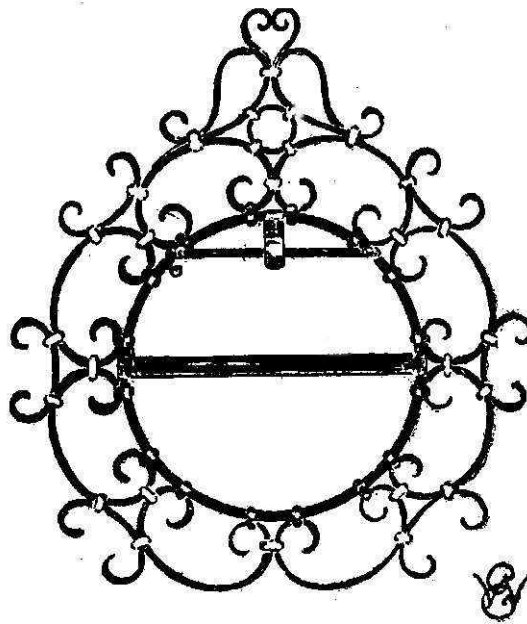


Fig 42. Watch Stand Back.

The Making Of Grilles.

Grille or screen making is by no means common, although it is a most useful as well as ornamental branch of art metal work. In ancient times it was not so. The grilles of medieval times are most interesting and serve as patterns for us moderns, as the variety of design in the scrollwork is most remarkable.

It is supposed that in late Norman times the introduction of grilles into churches, cathedrals, and abbeys took place, the oldest specimen in this country being that in Winchester Cathedral fixed against the door of the nave. This is supposed to date from **1093**. The grilles at Lincoln and Chichester, and that to the tomb of Queen Eleanor at Westminster Abbey, each belong to different kinds of working, as also those to be seen in the various ecclesiastical buildings on the Continent, tending to show that the work was a gradual one, advancing by slow steps to perfection both in design and execution. To the metal worker a study of them will be an education, showing more clearly what may be done by patience, perseverance, and skilful manipulation of the material at hand.

Grilles with us are used for filling up vacant spaces in doors or windows, and must be designed and made to fit those spaces. Not every worker is capable of designing, so it often happens that this kind of work is left undone. Patterns of most work that is conventional can be purchased, but as sizes vary considerably such patterns are not readily obtained. To overcome this difficulty we here give details, with illustrations, to enable the worker to form his own grilles with the most easily fashioned curves and scrolls, which will at once be not only useful but also especially ornamental. For decorating the upper part of a doorway **Fig. 43** will prove a success. Some doorways are so

high that to place a curtain pole close under the soffit of the frame and hang a curtain from it would give it a very long and drawn-out appearance. This undesirable effect can be remedied by placing a pretty wood or metal grille in the upper part of the doorway, and fastening the curtain pole directly under it from which the curtain may be hung.

To make a grille similar to the design shown in illustration only needs a little application and but a small outlay for materials. For this work, and in fact for any other plan out the design on a table or workbench. Draw the full-sized detail on a piece of smooth brown paper; lay this on the table so that every iron scroll may be bent so as to agree with the lines of the drawing. As the pattern is only scrolls and combinations, instructions as to forming them need not be here repeated.

Fig. 44, although a grille, is somewhat different to the preceding, as this is intended for the top part of a front door or window having a piece of clear glass. The outside frame should be of stout iron—about one sixteenth of an inch thick by one quarter of an inch wide. Bend this at the corners so that it will fit inside the style of the door or window in which it is to be placed. Allow it to be a sixteenth of an inch smaller all round than the style, so as to make room for the bits of iron that will wrap round it at intervals which are necessary to hold in place.

Make the frame, then lay it down on a smooth table over a piece of smooth brown paper free from creases or wrinkles, and mark with a pencil the size of the frame; then sketch in the full-sized design as you desire in the finished grille. On this plan you can bend and fit each scroll in place, and when the entire design has been worked out in iron the parts may then be fastened. In this pattern when fastening the rings to one another, care should be taken so as to clamp the small piece of fastening iron to hold the ends of the hoop and at the same time hide the joint, giving the whole an appearance of being a jointless band of iron.

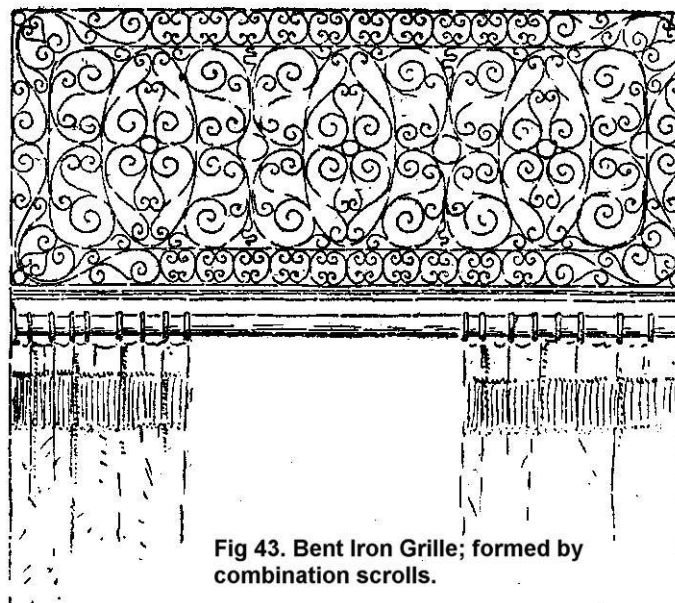


Fig 43. Bent Iron Grille; formed by combination scrolls.

A Brass Matchbox Holder.

A very simple working is that of making a matchbox holder of repousse brass work. Get a piece of sheet brass and mark it off as shown in illustration; the front, back, and two ends are the parts to be worked upon. The size of the box holder can be large or small as best suited. To attach the brass to the block, gently heat the cement, not making it sufficiently hot so as to melt the pitch, then beat the metal in the fire, and while both it and the cement are warm place it on the block, pressing it with a cloth until every part is in contact with the cement.

After it is cold the design (previously drawn) must be transferred to the metal by means of the carbon paper, and then traced out with a tracing tool. When this has been done, the metal must be removed from the block and turned face downwards to raise the repousse parts; to do which, the metal needs be refixed to the block and the parts to be raised must be gently hammered with a raising tool, beginning with the highest point and working towards the lowest edge.

The work must be finished by again turning the brass and placing it back on the block once more. The modelling must be finally corrected and the background punched evenly with a small patterned punch. When this has been done and the metal has been well polished, the matchbox is complete, and need only to be turned up at the dotted lines and joined at the corners.

To make a block about one foot by nine inches and two inches thick, procure **7 lb** of soft pitch, black resin **4 lb**, tallow **6 oz**, powdered bath brick **6 lb**. Melt these ingredients over the fire and allow to cool, then the mixture can be shaped into proper form for working. The block thus made will last indefinitely, and can be used for all kinds of repousse.

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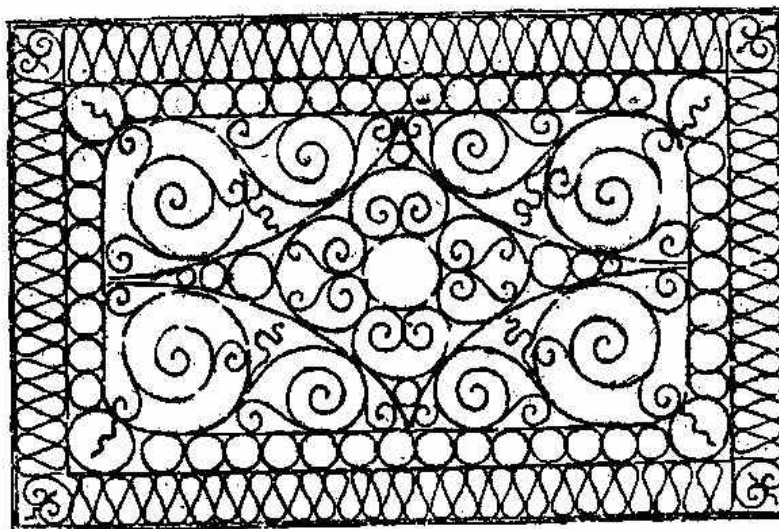


Fig 44. Grille For Front Door.

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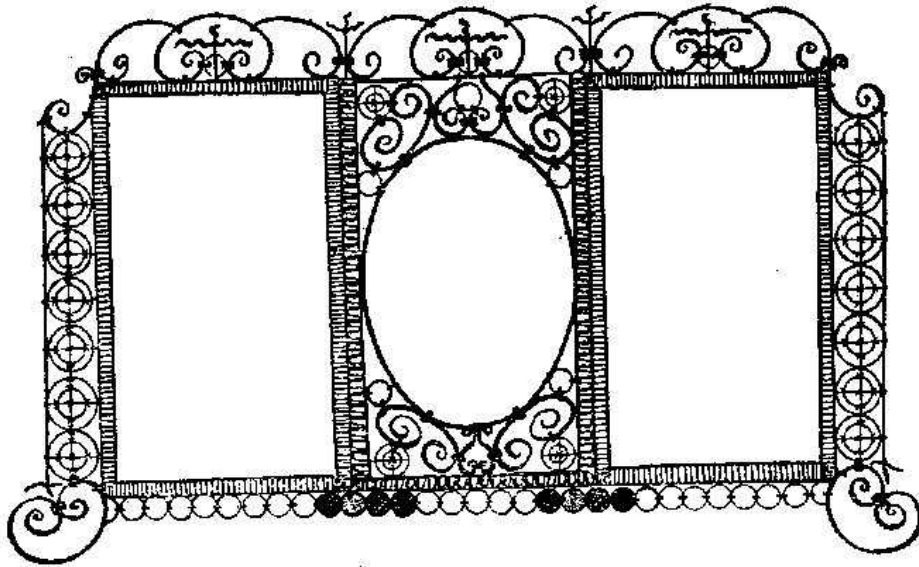


Fig 45. A Frame For Photographs.

A Hall Lantern.

There are so many devices and designs for lanterns that it is sometimes very difficult to select, but one made out of sheet iron, using coloured glass, over which a design should be worked out with narrow strips and fastened together, and to each other, is one that will recommend itself to all workers, especially beginners.

The lantern should measure twenty inches in height, not including the ring by which it is to be supported, seven inches square at the bottom, and at the widest part, which should be just under the top or roof, twelve inches square.

To make this lantern, cut twelve strips of sheet iron two inches wide, and with a pair of pincers bend each piece to form an angle. The outside surfaces of these angles can be decorated at regular intervals with small squares of heavy sheet iron fastened on with rivets, which will give the appearance of large-headed nails. Of these angle strips form a square base of seven inches, and in each corner rivet the end of an upright.

The riveting should be done by punching a hole through the iron with the punch or a sharp-pointed awl, uniting the iron with copper tacks; these will answer well for light rivets, iron tacks would either break off or be too stiff to work unless held in the vice. The copper tacks can be riveted with an ordinary hammer and an iron held between the knees.

Now form the top frame, which should be twelve inches square, and rivet the upper end of the corner ribs in each corner of it. Then make the roof by cutting four pieces of iron six or seven inches high, thirteen inches wide at the bottom

and four inches at the top. These must be fastened to each other by laying an angle plate under each corner and riveting one edge of the two sides of the roof to it, then make the top box and fasten it to the top of the roof. To the top of this box the ring must be secured, and the complete roof in turn is to be riveted to the lower framework of the lantern.

A round disc, slightly larger in diameter than the hole in the bottom of the lantern, should be made fast to the bottom of the front, and provided with two projecting ears to catch in hooks fastened to the bottom of the lantern. These hooks serve the purpose of holding the lamp in place and prevent it from falling out. The lantern can now be glazed.

Procure some glass for the four sides of the lantern, white or any other colour as may be preferred, but before fixing them make the grille panels ' of the narrow strips of brass and fix them in position. In making a grille to fill a flat surface, first of all mark out a piece of smooth brown paper the exact size of the space to be filled, and then with a pencil draw the design as you desire it to appear in iron.

Over this drawing bend and fix the small scrolls before binding them together. When this has been done, the glass may be fixed in position for the time being, and the frill then made and fastened in the angles of the roof. The scroll at each corner of the bottom can then be made and riveted on. Finally the whole work may be painted with black finish. In order to suspend the lamp in position, procure or make a chain and attach to it a strong iron hook, such as one as will support the weight of the lantern. This makes a very useful as well as ornamental article for any entrance-hall.

Chapter Seven. Brass Colouring and Lacquering.

This is a metal surface coloured by lacquer or chemical action. To obtain the various colours several methods are known and practised.

Browns of all shades may be obtained by immersing in a solution of nitrate or perchloride of iron; the strength of the solution will determine the depth of the shade. Clean the brass, leave it in damp sand, and then polish with a dry brush.

Violet. - Dip in a solution of chloride of antimony.

Chocolate: Burn on the surface of the brass moist red oxide of iron, and polish with graphite.

Olive Green: Make the surface black by means of a solution of iron and arsenic in muriatic acid, polish with a black lead brush, and coat when warm with a lacquer composed of one part lac varnish, four of turmeric, and one of gamboge.

Green and Light Coating of Verdigris. - Dilute acid followed by spontaneous drying,

Orange inclining to Gold. - Polish, and plunge -for a few seconds in a warm neutral solution of acetate of copper.

Greyish Green: Dip in a bath of copper.

Steel Grey Bronze: Dilute boiling solution of chloride of arsenic.

Blue Bronze: Strong hyposulphite of soda.

English Brass Colour: Heat to redness, dip in sulphuric acid, then in dilute nitric acid; wash, dry in sawdust.

Black Bronze: Coat with a solution of platinum or chloride of gold mixed with nitrate of tin.

Japanese Bronze: Solution of sulphate of copper, alum and verdigris.

Black: Polish with Tripoli wash with a solution of nitrate of tin one part, chloride of gold two parts; or dip in bath obtained by dissolving copper filings in nitric acid, then beat over charcoal, and repeat in order to develop colour; or mix a strong solution of nitrate of silver in one dish and nitrate of copper in another, mix the two, then plunge in the brass and heat to develop the colour.

The following is a receipt, which gives to brass a variety of shades, according to the length of the exposure or the amount of the application. First appears a light colour, then all shades successively from red, dark blue, light blue, and finally brown.

Dissolve sixty grains of bitartrate of potash in a litre of water, to which add thirty grains of protochloride of tin dissolved in a fifth part of a litre of water, heat to boiling point and allow the resulting precipitate to settle. The clear liquid must now be poured under constant stirring into a solution of 180 grams of hyposulphite of soda in one fourth of a litre of water, and again heated to boiling point, during which operation a quantity of sulphur will be liberated. The resulting clear solution is now ready for use.

NOTE:

The recipes and formulae described above use certain chemicals, which may be potentially very harmful to your health. Please obtain professional guidance and advice before handling any chemical substance. Remember these recipes are from another era where OH&S were virtually unknown.

Rubber gloves, protective clothing, eye goggles, and a respirator will provide personal safety and protection.

It is your responsibility to seek professional chemical user information.

Lacquering

Is a means of preserving brass from tarnishing without giving it artificial colours such as have been just described. Lacquering is primarily a varnish

composed of **shellac** dissolved in alcohol and coloured by means of **gamboge**, **saffron**, and various other colouring matters.

The term is also applied to compositions containing none of the above ingredients, they being replaced by **turpentine**, **resin**, etc. The proportions of the shellac and alcohol vary; two gallons of alcohol to one pound of shellac is the most common proportion. The ingredients should all be pure and of the best quality in making, whether large or small quantities.

Heat them together in an earthen vessel over a gentle fire in a water bottle until they are well mixed. A good varnish used for brass in its simple form and **small quantity is one ounce of shellac dissolved in one pint of methylated spirits of wine**; to this simple formula is added such colouring matter as may be desired. Lacquer suffers a chemical change by heat and light, and must therefore be kept in a cool place and in dark-coloured vessels, such as glass or earthenware, and the brushes used should be of camel's hair with no metal fittings.

CHAPTER EIGHT: TO ETCH ON METALS.

ETCHING is engraving executed by a pointed tool and acid upon a metallic surface previously coated with varnish.

The history of etching is interesting, the art is believed to have originated in Germany, judging by its name *Etzen*; but the earliest known etchers were Albert Durer, a German, and Agostino Veneziano and Paxmogiano, Italians.

The method of working is to well clean the metal with benzine, then with what is known as ground, which is a composition consisting of **asphaltum** four parts. **Burgundy pitch** two parts, **white wax** one part. These are all melted and compounded, then tied up in a silk rag. The metal plate is heated, rubbed with the ground, then spread evenly and allowed to cool.

The design is traced with a pointed tool known as an etching point, which lays bare the metal wherever it goes. When this is finished, a **wall of wax** (dam) is **raised round the design**, capable of holding the dilute acid, which does the work.

For a copper plate this consists of **nitrous acid** one part, **water** five parts; for steel, pyroligneous acid one, nitric acid one, and water six parts. This is poured on to the plate, which it corrodes on the lines made through the ground." This is called biting in." The etching should now be swept with a feather to remove the bubbles from the surface, or, in case of a steel plate, agitation may answer the same purpose. When a sufficient depth is attained for the lighter tints of the etching, the acid is removed; the surface washed and allowed to dry. The parts having sufficient depth are now "stopped out " by a varnish of **Brunswick black** laid on with a camel's-hair brush. When this varnish is dry, another "biting in " will deepen the lines of the parts not stopped out; and when these parts are deep enough for the second tint, the varnish is removed and the plate dried. This process is repeated as often as way be necessary.

The wall or dam of wax is finally removed, the plate cleaned with turpentine, and, if necessary, finished with a graver, to give certain parts more effectiveness.

In the course of working, should the edges of the strokes splinter off and appear ragged, it shows that the etching ground is too brittle, and it is then necessary to remelt it, adding some pure turpentine, well stirring whilst adding, and taking care that the mixture does not burn or become overheated.

Etching on soft ground is sometimes practised, in order to imitate a chalk or pencil drawing; but since the art of lithography has been in vogue it has somewhat gone out of favour; it is, however, work for an amateur. The soft ground is made by adding one part of hog's lard to three parts of etching ground, such may have been described. This is laid on the plate with the dabber in the usual way.

A piece of smooth writing paper, having the design in outline, is damped and stretched over the plate. A pencil is then used to follow the lines of the design, observing that the softer the ground the softer should be the pencil. When the paper is removed, it withdraws the adhering line of ground and the plate is then "bitten in" in the usual manner.

The principle of etching metal by acid for decorative purposes is much the same as that observed for artistic work. The difference is that in the latter, the drawing is made on the metal for the purpose of printing impressions from it; in decorative etching, the drawing or design eaten into the metal is made for its own sake, being the final and only object sought.

To prepare the plate for etching, cover the face with a thin coating of wax, which can be readily spread by heating the plate on the top of a stove or gas jet. Then pour the melted wax on it by means of an iron ladle, holding the ladle with the right hand, while the plate is held by means of a pair of pincers or nippers with the left, turning the plate in such a way as to spread the wax, allowing it to run overtly, and when well covered the surplus can be removed.

There are various kinds of etching grounds, but one of the best is made by boiling refined wax from four to six hours in order to remove the "stickiness," making it yield readily to the needle point in outlining or to the lead pencil, which is the best tool to use when portions of the background are to be cleared for the action of the acid.

When the wax is sufficiently boiled, remove all in, purities by straining it through a strainer, or sieve, of thin open muslin. Strain into a shallow tin-pan, allowing it to form a cake three-eighths of an inch in thickness. It can then be easily taken from the pan when cold, and broken into convenient pieces for use. The design to be etched must first be drawn on paper, when it may be transferred to the waxed plate by means of black or red carbon paper. The plate must, of course, be waxed on face and back. When the design has been

transferred to the plate, go over the lines with a dull point, being careful that the lines are traced clear to the metal.

When the design has to be eaten completely through, it is desirable to trace just outside of the line, so that the eating away by the acid may not encroach on the design. When the design has been traced on the plate, place it in a porcelain dish or shallow wooden trough, and pour pure nitric acid over it till it is covered about a quarter of an inch. If the etching is done in cold weather it is advisable to keep the acid near the fire, for some time before using, so that it may not chill the wax and cause it to spring from the plate, which it will do by sudden application of cooling liquid.

The etching should be done in the open air, as the fumes from the plate are not merely unpleasant, but they would, if in a close confined room, tarnish or rust every metal article exposed to them.

If the design to be etched contains light line surface decoration, five minutes of the bath will probably cut it a sufficient depth. The plate must then be taken out and tested with a point to ascertain if the lines are deep enough. If they are not, it must be returned to the bath, when the light surface decoration is sufficiently etched, wash it by pouring lukewarm water over it, then dry with soft newspaper or blotting paper. Now "stop out" all such lines as are eaten to the required depth, by passing a heater over them, which will melt the wax and cause it to fill the etched lines.

This heater can be made of iron or copper wire three-sixteenths of an inch in diameter, brought to a dull point and bent.

Place this in a handle, this heated and brought into contact with the wax already on the plate, or with a small portion held in the left hand, will cause it to melt, and it can be then deposited where required. When the waxing up is completed, taking care throughout to repair by means of the heater any portions where the wax may have sprung from the plate, return the plate to the bath.

Fig 48.

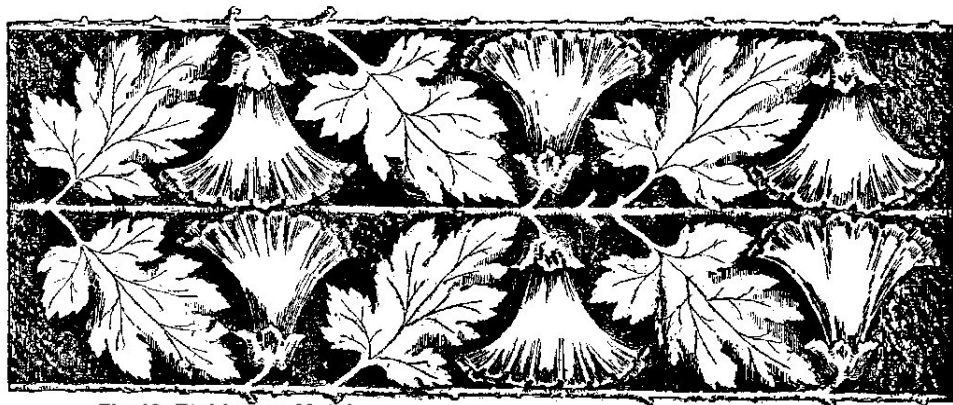


Fig 48. Etching on Metal.
A Panel hammered and Etched.

About thirty to sixty minutes will be required to eat completely through a **No 24** or **No 22 plate**.

If the design is not entirely released by the acid from the background, use a narrow steel chisel to free it. A little filing of the edges may be necessary to bring them to a desirable finish. Holes to secure the hinges, by means of round-headed brass tacks, should not be etched but drilled. When the etching consists of a surface design only, that is where no portions are to be eaten completely through, it is best to use nitric acid diluted with an equal quantity of water. **The design Fig. 48 is a panel hammered and etched.**

One of our greatest workers in metal has suggested ornamentation to add to its appearance. He says, " When the sheet of metal is tolerably thick it may be ornamentation, supposing it to be iron or zinc. Out with the graver or point grooved lines deep enough to receive gold or silver, brass, German silver or copper wire, lay the wire in the grooves and hammer it in. This will generally hold fast, but the process to be perfect requires that the metal should be heated and fluxed with borax."

Articles etched may also be gilded, either with gold leaf and size, or with gold (or bronze) powder and gum water; this latter may be protected with a coat of retouching varnish. Even a very little gilding, tastefully applied, on black ironwork greatly improves its appearance.

We can, with a file or graver, run or opt a, line along the centre of a strip of iron; this is made easy by slipping over the strip a sliding flat ring in which there is a hole to receive the cutter, the point of the cutter or graver is then inserted, and bearing on push it along; fill the groove thus made with gilding or gold powder paint.

CHAPTER NINE. SOLDERING AND BRAZING.

In many kinds of metal work something more is wanted to connect the different parts than wire clamps or rivets; it is often necessary to actually unite portions of the work or, in other words, to make the metal one & kind by welding together. This work is by no means difficult when one knows "how it's done."

What is soldering? It is derived from a Latin word signifying to make solid. Solder is a metal compound of a, very fusible nature which, when properly used with heat, unites two pieces of metal together. The kind of solder used depends upon the metals it is proposed to join. The tools used are by no means expensive, and, after a little practice, not difficult to handle.

The requirements for a soldering outfit are as follows:

A soldering iron, a scraper, a file, a small quantity of spirits of salts (may be obtained at any hardware shop), a strip of soft solder, a little powdered resin, a piece of candle, a few scraps of ordinary zinc, and a sheet of emery cloth. The total cost is not more than two shillings.

The soldering iron is altogether misnamed, for the essential part is not iron but copper. It is, in fact a small piece of copper bar, fitted into a holder made of iron fixed in a handle of wood. The point of the copper must be pyramidal, not conical-or, in other words, the section of the bolt must be square, and the four sides tapered off as a pyramid. A great deal of the success of the work depends upon this, so that special attention ought to be given to this instruction.

The scraper can be almost anything-a piece of steel sharpened at the end, the blade of an old knife, in fact anything that will scratch or scrape. Its use is to remove all patches of Bolder, and to scrape oxidised metal and dirt along the parts on which the solder is to be placed-in reality to clean it.

The file may be any ordinary file; it is for the purpose of removing roughness or inequality likely to prevent a smooth joint being made. Spirits of salts is again misnamed; for in reality it is an acid-hydrochloric acid-and what is known as "**killed spirits** " is really a solution of chloride of zinc.

Procure a small quantity of the **hydrochloric acid** and place it in a small earthen jar or pot, and put into it a few small **scraps of zinc**, which must be perfectly clean. The acid will at once act on the zinc part of it, uniting with the metal, thus forming the **chloride of zinc**.

Add more and more zinc until the acid will dissolve no more-when this has been arrived at the liquid is known as "killed spirit ", then add a small quantity of rainwater, and put it into a bottle for subsequent use. This **chloride of zinc** will be required for soldering all articles made of iron, tin, copper, and brass, while for zinc the crude acid will be sufficient. It should be borne in mind that this **chloride is poison**, and therefore must be carefully handled.

Sometimes resin alone is used instead of this liquid for soldering tin and pewter, also lead and compo, which is the material with which ordinary gas-pipes are made.

In order to solder, it is necessary to procure what is known as solder, this can be purchased at any tool shop. Its common name is soft solder, and is a mixture of lead and tin. Before commencing the work, it is necessary to " tin " the iron; this is done by first placing it in the fire and making it nearly red-hot. Whilst warm, file a bright surface, so as to clean the metal, then rub a little of the killed spirit upon the place thus cleaned, rub on the solder until it sticks, and the work of tinning is completed. Then with the iron well heated pick up a portion of the solder, until it clings to the joint, taking care that no grease be present, or the solder will not adhere and no joint will be possible.

The copper bit must always be kept tinned; if it loses its coat the process must be repeated. Care should be taken that this does not happen, which may be prevented by not heating the iron too much; a dull red heat will be found quite sufficient for all working purposes.

To solder zinc use the soft solder, and as a flux; hydrochloric acid, mixed with one third of its bulk of soft water. Neither the killed spirit nor resin will answer. To solder compo-so called by its being formed of tin, lead, and zinc-use the softest solder, and as a flux resin, with a frequent application of the candle end so as to prevent the solder clinging to the metal, as well as to clear the joint.

To solder brass, spread on it a little borax made into a paste with water, and then upon this lay a thin piece of tinfoil; the piece to be attached is then placed in position, and the whole hold over a clear coke fire, or between red-hot tongs. The tin melts and runs, so that the union is complete. Resin or borax may be used as a flux, or even a mixture of both. In any soldering work care must be taken not to use too much flux, but just enough, and no more, to accomplish the purpose.

In order to better understand the principle of soldering, a professional worker has made it clear in few words, which we quote:

" The reason that union takes place between soldered surfaces is that an amalgam is formed, or compound metal, the solder actually combining with that to which it is applied". If, however, more is added, the latter only forms a mass by itself, tending to keep apart the edges of the metal between which a union is desired, and rupture will in such case readily take place.

Hence it is also necessary to select for different metals some compound that will make a solder capable of forming such a combination, while at the same time its melting point is somewhat below that of the metals to be united, Tin and lead form just such a solder for brass, both metals being able to combine with it, and being in fact often used to render the brass softer and more easy to work. But it is not so easy to unite two pieces of iron in the same way, because the affinity between iron and tin is not so strong, and the union will be less accordingly. Iron is therefore more generally brazed or joined by means of molten brass. Although solder formed of tin and lead in various proportions is commonly used for almost all metals to which it can be made to adhere, it is necessary for some metals to have something more fusible.

"The metal bismuth has the property of rendering easily fusible metals with which it may be combined such as two parts tin, one lead, one bismuth, will be found a very soft solder, and may be used with the ordinary copper bit."

These are the words of an experienced worker, which clearly explain the why and the wherefore of all soldering.

Brazing.

The process of uniting metals just described is known as soft soldering. There yet remains another method, common to metal workers, which is & similar operation, but named hard soldering or brazing. This requires greater heat, and is accomplished either with a blowpipe flame, Bunsen burner, or in a clear fire. Special spelter is necessary, or something that will melt a trifle below the fusing point of common brass, and if it is not granulated it must be worked into fine powder with a file.

It is necessary to always choose a solder with a melting point several degrees below that of the metal to be soldered, remembering at the same time that the best joint will be secured by using that kind of solder which has some affinity for, or some constituent akin to the metal to be soldered.

A recognised list is here given of the suitable solders or combinations of metals for specified working:

For Iron or Copper	Copper 2 parts, zinc 1 part.
• “ “	Tough brass 5 parts, zinc 1 part.
• “ “	Copper 1 part, zinc 1 part.
• For Strong Brass	Copper 4 dwt., zinc 6 grains, tin 9 grains.
• For Brass	Brass pins (tinned) 2 parts, silver 1 part.
• For Brass	Copper 13 parts, fine silver 11 parts.
• For Brass	Copper 1 part, brass 1 part, fine silver 19 parts.
• For Brass	Brass 5 parts, zinc 5 parts, fine silver 5 parts.

A good tough malleable solder, suitable for copper, iron, infusible brass, or silver, is composed of equal parts of good tough brass and of fine silver. A supply of borax must now be procured, then if there is & gas jet near by, an artificial blast can be sent through a burner of the Bunsen type and a proper degree of heat directed on a bed of charcoal, where the work should be buried waiting to be brazed. The joint to be brazed is intended to be made as firm as possible by having a close fit well pressed together, so much so that it will stand some sharp blows; for when the brazing materials first melt, and are well absorbed in the joint, it is a relief to realise what a blow or sharp rap will do toward working the solder through the joint and knocking off the waste material.

The **borax** is first spread over the joint as the work approaches a low red heat, and it soon swells up and turns into a snow-like froth on account of the water of crystallisation boiling out of it, settles down and flows over the joint like glass, ready to clean off the surface and prepare the way for the soft brass that is about ready to melt under this temperature.

Then comes the green blaze that is always a sure index that the work of sweating the joint with brass is being performed. The zinc from which is due the green blaze when the brass flashes, is employed in the brazing material to reduce the melting point of brass, and when it volatilises and gives off the fumes that produce the coloured blazes, leaves the brass behind in a less fusible state.

It will be advisable for the worker, then, to prepare the work with the brass all in position, and heated so carefully that none of it will melt till the joint is well heated alike and every portion settles down at the same moment. Borax is a substance that is supposed to dissolve all the rust and every kind of earthy substance, and make a clean surface no matter how the work is brought together; but the surfaces that are found on both the outside and inside of steel pipes as well as drop forgings will need to be cleaned off by some other treatment in which a file or scraper will be found useful.

With sheet iron a joint can be brazed by using filings from soft cast iron in the same way as if it was brass, and a joint produced that will pass for welding. In all kinds of brazing the substance used for this purpose is inclined to etch the edges of the work and mar the surfaces wherever they have been exposed to the fused material, with the exception of silver.

When used for the solder this substance has such a liking for iron and steel that it will take hold without any of that biting action whatever, and when we come to see how economically it can be used for these purposes, it would appear to be the cheaper material in the end.

Such are the principles of brazing or hard soldering. For much of this scientific information the writer is indebted to a skilled American worker.

Note:

Many home workshops these days would have as part of the equipment small Oxy acetylene gas brazing outfits, this equipment makes the job of brazing fine pieces of metal much easier than the old traditional hot charcoal bed. If you intend to carry out much of this bent ironwork it will be worth your while to invest in this type of equipment.

CHAPTER TEN: STENCIL CUTTING.

The cutting of stencils is another branch of metal working, and is simply the making patterns for painting pictures on various articles, or for ornamentation and decorating halls, rooms, staircases, etc. Stencil plates are sometimes made of cardboard and wood, but oftener of metal. For this purpose a thin sheet of iron, brass, copper, or zinc will be required, usually about 1/32" of an inch in thickness; but should zinc be used, a stouter sheet must be obtained. This is easier to cut, but owing, to the increased thickness not quite such fine work can be done as with copper or brass.

As to the cutting for some of the metals, this may be done with the fret saw, but zinc cutting requires care. If it is cut with shears the edge is stretched, so

that it cannot be made to lie flat. it may be cut with a chisel by laying the zinc upon a level sheet of iron and with an ordinary firmer chisel and mallet out any given design marked on the metal. Chisels for this work are such as are used by joiners, but properly tempered, and the blows given should not be inordinately heavy, but strong and straight. Some- times stencils are chased on thin brass, but the process is not recommended. Another method is that of etching, which work has already been fully described.

Stencil cutting covers a wide area, as there are so many methods and uses to which it may be applied. The greater part of the subject is beyond our province, so far as metalworking is concerned. Two or three designs are, however, given as showing what may be done by chisel cutting.

Stencilling affords means of decorating rooms as well as many articles of every-day use, and is by no means difficult. The pattern should be cut out of thin metal, and so arranged that its various parts are held together by what are known as ties. When working a stencil, the forms are blocked out in masses and separated from each other by lines, and the parts to appear are holes.

These separating lines and ties axe of course solid and atop out the colour, so when the stencil plate is applied to the wall or article to be decorated and the colour painted through by dabbing a stiff brush on the open parts, the dividing lines and ties appears white or in the ground tint of the wall or object upon which the plate is laid. If the space to be covered is large, a bold floral design should be chosen. It may be done in several colours, but for this separate plates are necessary. A Greek key is a, very common pattern, and repeats well. A stencil alphabet is exceedingly useful, and many other designs will readily suggest themselves to the worker.

Shadow stencils wore formerly very common; these may be cut out of thin sheet iron and held between a lamp and blank wall, so as to show a shadow picture. Sometimes moving parts were introduced, to the great delight of a juvenile audience. Such work is by no means difficult; the effects produced are wonderful and pleasing. Various designs of general stencil work will be seen by our various illustrations.

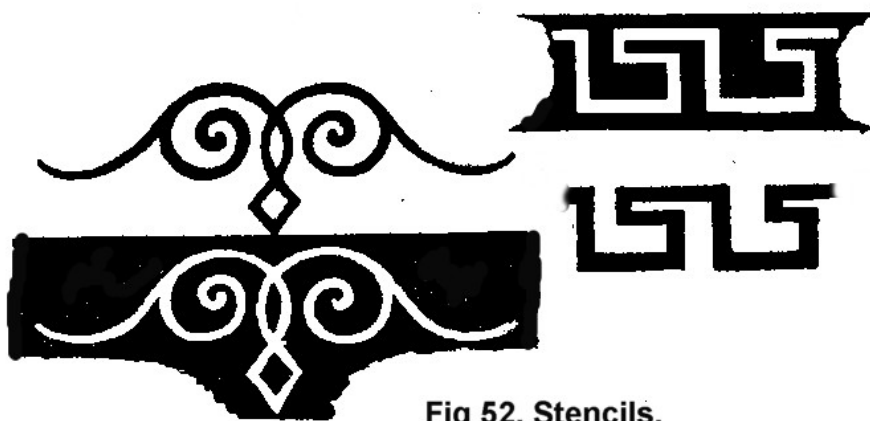


Fig 52. Stencils.

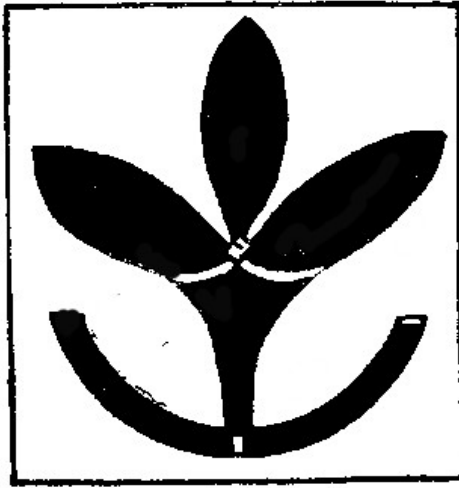


Fig 53. A Stencil.

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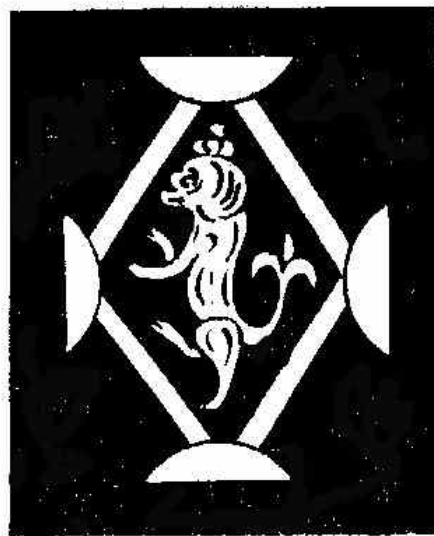


Fig 54. Stencil Designs.

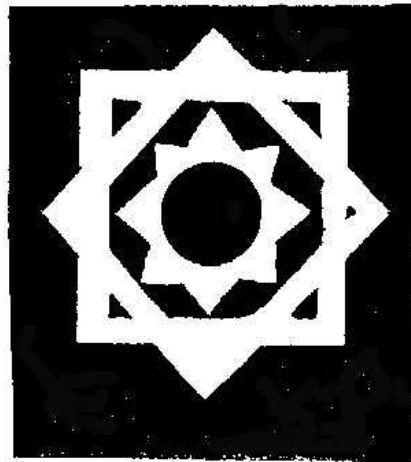
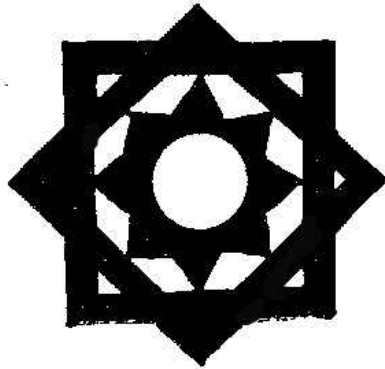


Fig 55. Stencils.

Chapter Eleven: Fretworking in Metals.

FRETWORKING or, as it is sometimes called, Saw Piercing-is similar to the same process as in wood, which is tolerably well-known and more generally practised. It must, however, be borne in mind that the worker will have greater difficulties in the cutting of metals than those met in working with woods, even those of the toughest kind. Zinc, brass, copper and other metals are closer in substance than any kind of wood, therefore harder, and also causing damage to the saw blades used.

But the difficulties are all at the outset; after a little practice and some familiarity with the material used the work will be found to be as easy as any other, with splendid results which will fully compensate for any slight difficulties and the sacrifice of a few saw blades, which may soon be replaced.

It is best for most work to use the handsaw rather than a machine; the work may be slower but more care is possible, and better results will follow. We do not mean that a treadle machine should not be used-certainly not, but let this be an after-consideration; for first workings, handsaws should be used.

A saw frame can be purchased for a small amount, and with it a dozen saws of various fineness. To those accustomed to woodworking a description is not necessary, neither are instructions required as to how to use them. The metals usually employed for this work are brass, copper, and zinc, but the latter is not much used for decorative Purposes. Copper is softer than brass, and is therefore more liable to bend; so that the best material for fretwork is brass, as it can be had of various thicknesses, and can be kept plain, ornamental and lacquered, according to the purpose for which it is used.

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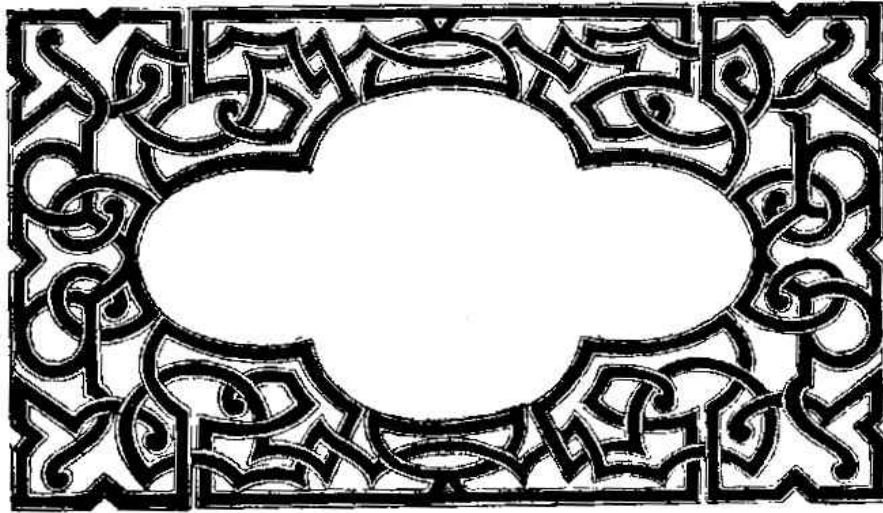


Fig 56. Fret Work Design.

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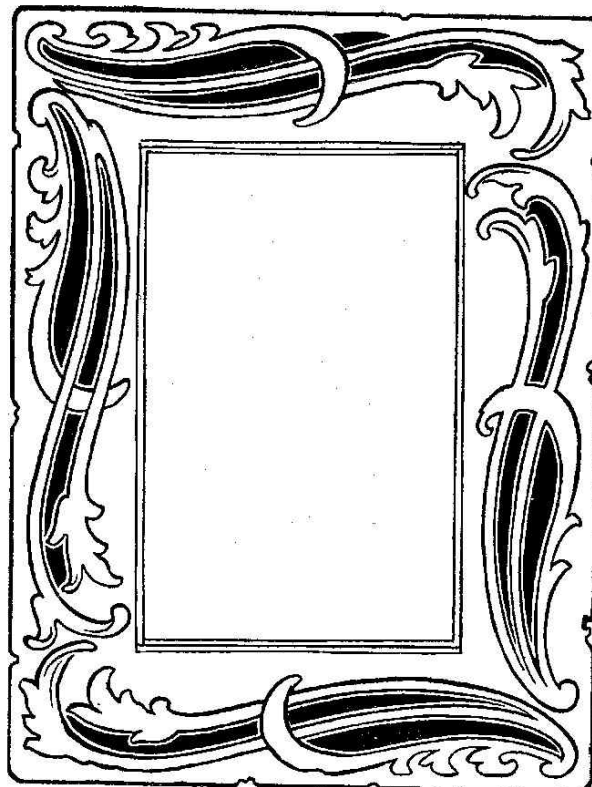


Fig 57. Fretwork Photo Frame.

Although almost any thickness of the metal may be cut, it will be at all times the best plan to use the thinnest that will answer the purpose, and for most uses that of a, of an inch will be sufficient. In purchasing, always get polished brass; the difference in price is so small between the dull and bright that it is not worth considering, and it makes all the difference in the work when finished, as polishing or lacquering is saved. Still, if unpolished metal is used it had better be brightened with emery, powdered pumice-stone, and finally with rottenstone, until the requisite brightness is obtained.

To become not only a skilled metal fret-worker, but also an artistic one, requires some little thought. Wood fretwork has become common, and not always judicious. This in a great measure is owing to ignorance, with which it has been misapplied. In no kind of decoration is the distinction between picture and ornament more needful to insist on than in this, and in none has it been more ignored.

Naturally treated, human figures, birds, beasts, and fishes, and even portraiture and landscape, have been attempted in fret cutting. But artistically considered, the only suitable designs for the purpose are geometrical, or those in which natural forms are treated as purely conventional ornament.

Designs are here given-**Figs. 56, 57**; by a study of these it will be seen what is meant by geometrical. To execute these, or any other, first make a paper or cardboard pattern of each, using tracing paper to line out the design by; then placing a piece of carbon on to the metal and on the top the marked pattern, go carefully over it with a pencil or blunt tool until the figures show on the brass.

When this has been done, cutting may be commenced, carefully following the lines, cutting in them, and from time to time halting in the work for the purpose of testing its accuracy, by laying on the tracing to see that the lines have been kept. Should any deviation be found, the error can at once be rectified. All this may seem tedious to a beginner, but it is a good maxim, make haste slowly, especially in metal fretwork.

Work of this kind is especially useful in connection with woodcarving. To be effective in this it should be confined to those features where a real or Booming added stability is introduced by the employment of metal decoration, such, for example, as strap-hinges and lock-plates on cabinet doors, decorative hinges and corners on caskets or handle and lock-plates on drawers.

Fig 58, below, is the design of a hinge forming one of a pair that was used on the doors of a small cupboard nine inches above the top of a writing desk. The doors, each 12 x 4, were too small for any effective carving, but yet occupied a position demanding effective treatment. This was secured by covering the doors with a bold and elaborate design in metal.

hinges of this description can be attached to ordinary brass butts by knocking out the pin and using half the hinge that contains the three bends to which is

attached (after bending the two projecting ends) the newly designed hinge, and which corresponds to the half that is thrown away.

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Fig 58.

In fixing brass mounts use ornamental screws or nails -these can be obtained in great variety; but where nails or screws cannot be used, strong liquid glue or cement may be used instead, but such a method can hardly be recommended.

If at any time unpolished brass is used the same can be lacquered; but before any lacquer is applied care should be taken to remove all grease spots, then polish the surface and warm it slightly, put on the liquid with a soft brush, working quickly and evenly.

Do not go over the same part twice, as the lacquer dries rapidly and ridges are apt to be formed, which ridges cannot be removed, therefore spoiling the effect of the work when finished; but if any accident occurs after this fashion, remove the varnish entirely by using spirits, then re-lacquer.

As a guide to the beginner it may be useful to know that brass suitable for fret-cutting, $\frac{1}{32}$ " of an inch in thickness, polished on both sides, is sold in plates measuring twelve inches by six at one shilling per plate. This is about the usual price for this article; unpolished material at a slightly less cost.

Polished copper or brass can also be purchased in varying widths and thicknesses at 1s. 6d. per pound at most tool shops and of machine and hardware merchants.

Chapter Twelve: Bent- Iron Decoration.

This material is most suitable for a very large number of articles in the house-candlesticks, menu-stands, holders for flowerpots, and a very practical way of utilising bent iron is to decorate a set of fire irons. The curves are of the simplest kind, and the method of working by no means difficult. If the iron is purchased in a sheet, cut it into strips about a quarter of an inch wide; this can be done with the shears or a strong pair of scissors. In bending, hold the iron in the left hand and the round-nosed pliers in the right, and then bend slightly the end of the strip.

Be very careful at the start, for unless a true curve be obtained at the outset it will be very difficult to handle it afterwards, but should a sharp bend be accidentally made instead of the desired curve, it may be rectified by using the long-nosed pliers. When all the curves are made, they can be connected by means of a small binding piece, and then should be fastened temporarily to a frame with wire, so that they may be got exact and right before binding them on to the objects for which they may be intended. This is especially necessary when the same curve has to be repeated, and helps to ensure accuracy. Or if they are laid out on the table any divergence will be at once seen, and the work can be more easily corrected than afterwards.

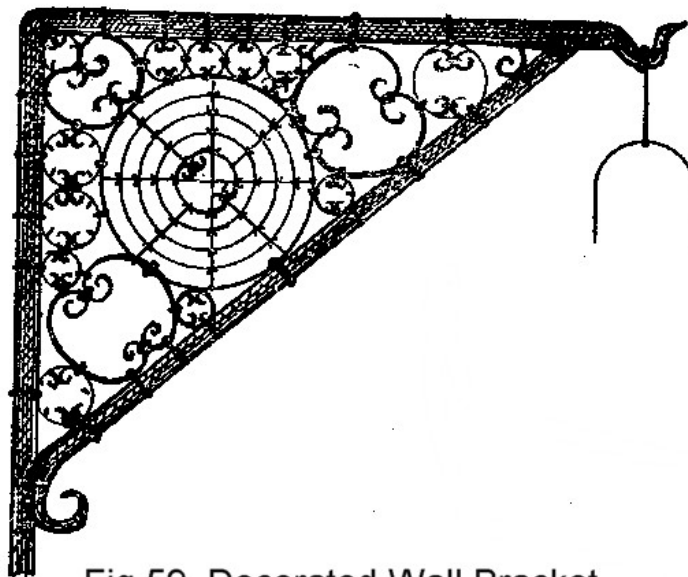


Fig 59. Decorated Wall Bracket.

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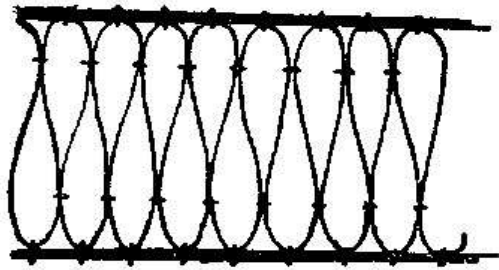


Fig 60. Curves For Decorating.



Fig 61. Letters From Bent Iron.

Repeating **C** or **S** patterns in ironwork help to create pleasing design patterns. With modern day wrought iron work a small gas-welding outfit can be used to braze together the iron instead of rivets or bands. Gas brazing will speed up the work considerably and could even create a more even and presentable finish. BUT, this is only a suggestion; if you wish to follow the traditional methods by all means please do so.

Many things that may be ornamented will suggest themselves to each individual work. The effect is most striking, and when the work is well done they become real and uncommon ornaments.

Cross Strips and Borders.

For the substance of this chapter the writer has to acknowledge his indebtedness to Mr. Charles Godfrey Leland, who has done so much in past years to extend the knowledge and practice of metal working in this country.

He says-referring to crossed strips-they have a very pretty and curious effect; they are not much used in strip or ribbon work, and not even mentioned by any writer known to me. To make the strips cross one another, take a flat very thin file or fret saw, and cut half through a strip at the point of intersection, then cut in like manner through the other; then cross the two. If they do not cling firmly, fasten them with a twist of thin wire.

This is a very important effect as regards design, since it enables the artist to develop the vine to any extent in strap work and not limit himself to masses of **C's** and **S's** or of curves stuck feebly together with no regard to growth or development.

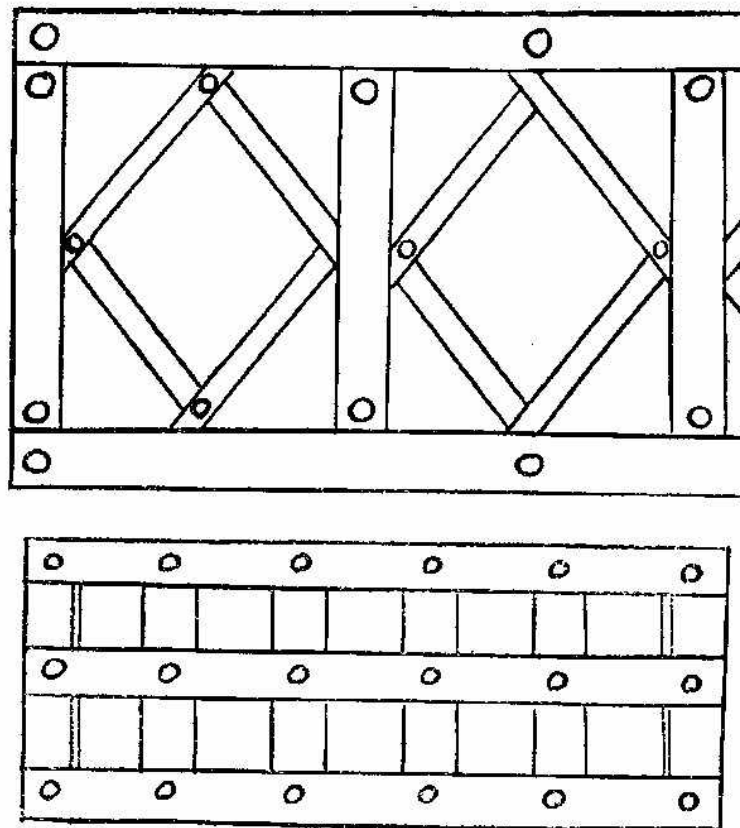
Another good effect may be produced by drilling holes at intervals in a strip $\frac{1}{3}$ of an inch apart, and passing through the holes, in and out, brass wire. Rivet or clamp the wire at the first and last holes. Small round-headed brass nails at intervals riveted on holes give a varied and brilliant appearance to simple work.

Borders are sometimes formed by the wavy lines as already shown; they also consist of ornaments regularly repeated on one or between two frame rods, as **Fig. 60**.

Wherever a rectangular space is to be filled a border adds greatly to the appearance, and for this reason is especially applicable as a frame for a picture or mirror. Borders may be filled with inscriptions in letters, as well as with ornaments, **Fig. 61**.

Borders or rather plain bands of brass may be slipped over. Cylindrical cups, or square objects of iron, tin, or copper, or copper bands on other metals. They may be riveted on with brass-headed nails. Such bands may be ornamented in various ways.

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Figs 62- 63. Cross Bands.

Chapter Thirteen: Nail and Scale Work.

To an artistic mind ordinary materials may be used for decoration producing charming effects, and there can scarcely be found commoner materials than nails-brass headed nails.

This method of decoration was much practised in the middle ages, in the days of the Stuarts, evidence of which may be seen in some of our national museums, such as South Kensington, where may be seen a coffer of William and Mary, with artistic design traced out with fancy-headed nails. Even prior to this period it was recognised that this kind of work was much in vogue, by the bosses found on ancient armour and in the many specimens of old repoussé or embossed sheet-brass work.

As to the effectiveness of this working, most of us have observed the "set-off" that is given to even modern furniture by common brass nails when used as edging to chairs, couches, and other articles of household use. This kind of ornamentation has, however, gone out of fashion during later years, but it has been somewhat revived since a recent exhibition in London, in which some fine specimens were on view of real artistic designs traced out by means of round-headed or boss nails, iron, brass, copper and silver, such as can readily be purchased of any dealer

in furnishing materials or ordinary metal work. These nails are simply arranged in rows forming patterns and driven into boxes, chests, or panels for doors or cupboards. Here opens a wide field for the artistic designer in which no special knowledge is required, merely skill in forming the pattern and a deft hand in using the hammer in order to produce, marvellous effects.

The tools required are a pricker for piercing the holes along the outline of the design to correspond with the positions in which the nails are afterwards to be placed. A hammer, not too heavy; and it is as well to use a piece of wood about one inch thick, shaped after the fashion of a paper-knife, holding it over each nail in the act of driving it in its place, so that the nail shall not be bruised or otherwise injured, as well as to ensure it being driven straight. The design, which should be kept as simple as possible and one easily indicated by outlines.

Mark the pattern out in white chalk or draw it mathematically upon paper and transfer it to the article to be ornamented by means of the carbon paper.

Whichever kind of nail is used, see to it that they exactly meet each other when hammered in. This work is known in Germany as "**Venetian nail work**," it being a combination of bent-iron rosettes when attached to wood. This is simply iron rosettes nailed at intervals on to a panel. Leland has it that 'this work is not properly nail work of the old English kind, but rather the art of making, firstly, highly ornamented heads of nails in bent iron, repoussé, etching, and casting; and, secondly, of forming ornaments such as rosettes, or bosses, which were nailed on at regular intervals. **Nail work proper ranges from dots the size of a pin's head to circles** or knobs of any size, and the simplest form of all is by driving short pins into a panel in lines with

these simple materials. Charming designs can be fashioned with very little ingenuity.

Then, again, a combination of strip iron and nail work so common in the middle ages is most effective, all in straight lines with the angles made by riveting, as shown in our illustration.

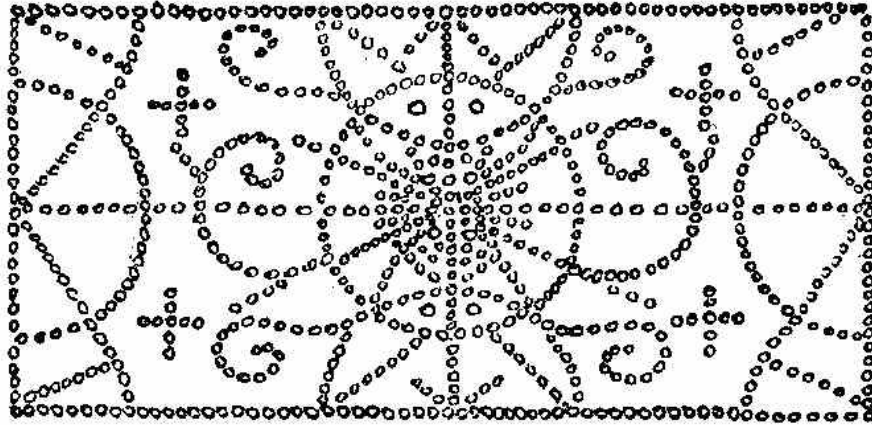


Fig 64. Design For nail Work.
Front or Lid of Box.

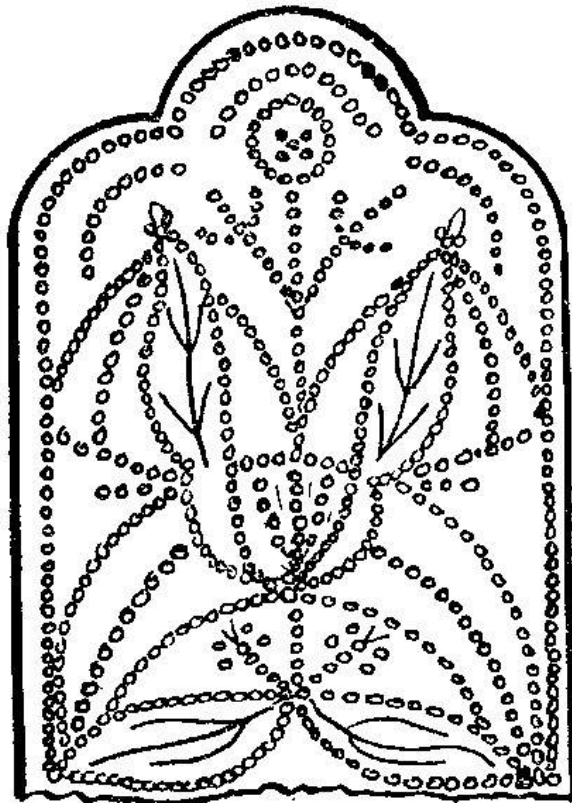


Fig 65. Design for Nail Work.

Nail Work and Scale Work.

Old boxes, whether large or small, can be tastefully decorated with nails; the boxes should be carefully cleaned, and sandpapered, and for greater artistic effect stained a suitable colour. Decide upon an approved pattern, draw this on a piece of paper, and then transfer it to the wood. This can be done in several ways; this has already been shown.

Another very simple and effective method is to rub white powdered chalk over the back of the paper upon which the pattern is drawn, then place the paper upon the box and go over the pattern with a hand point; this will leave the impression in white lines on the box. Select the nails and commence working; place each nail point exactly on the line and drive it home neatly and cleanly.

The nail beads should touch each other, no lapping over or allowing spaces to appear between; if the eye cannot judge the exact spot it will be better to measure the distance, pricking each with a sharp pointed awl, as the beauty of the work entirely consists in the scrupulous accuracy shown in placing the nails. As an instance, supposing the nail head is half an inch in width, the worker must mark off half an inch on the line, putting the first mark a quarter of an inch from the commencement of the line. This if supposing that the same kind and size nails are to be used throughout. But it often adds to the appearance by using different sizes alternating, so that the several distances must be marked off accordingly.

A very good pattern may be worked out by using a large nail as a centre, say five-eighths of an inch in diameter, and graduating through smaller ones until quarter-inch ones are used only at the ends. Then a border can be made of alternating large and small nails.

Another variation is to use nails with different shaped heads and so work out a fantastic pattern; in fact there is simply no limit to the work that may be done both as regards material used and objects that may be ornamented, both useful and ornamental.

Nail work is specially adapted for decorating chests, trunks, and small articles of furniture. Nails also look well on blue or crimson plush or any other fancy background; for such, nails of various colours are very effective and should be used. The length and thickness of these nails depend upon the size of the heads. Of course it need hardly be mentioned that, whatever article is to be decorated, care must be taken that the wooden foundation is of such a thickness as will prevent the nails from projecting on the other side.

Then, again, the wood should be well seasoned, or when it shrinks the nails are apt to fall out. Soft woods are the best, such as lime, pine or alder, but whatever may be the foundation it may be treated in various ways, such as polishing, varnishing or enamelling, covering it with cloth, satin, velvet, plush, or even chintz; but when any covering is used give the surface of the wood a coating of paste, so that the covering may adhere thoroughly and be free from wrinkles.

Leather is also suitable for backgrounds, as is Japanese leather paper; this latter is especially good as, having a pattern, the nails can be placed so as to follow it. Holes should be made for the nails, taking care that they are smaller than the nails; push them in with the fingers as far as they will go, and drive home with the hammer as already directed.

Scale Work.

This is very interesting kind of work, and is quite as easy as that first described. Instead of using nails, small discs or round pieces of any kind of metal are used. They may be of any shape-round, scalloped, leaf-shaped or semi-circles, and put on one overlapping the preceding, so when finished they may present the appearance of scales of a fish; hence the name Scale work.

Any kind of material may be used-brass, iron, copper, German silver, white metal, and these several materials if used alternately have a charming effect, forming really artistic decoration. Work of this kind can be done with waste material cuttings, odd pieces that can be obtained at small cost from any dealer, tin man, or metalworker.

Empty tins which can always be found in every household, sardine boxes, biscuit, milk and sweet tins, can all be utilised, broken up and out into desired shapes before commencing. Mark out or draw the design, such as a fish, man in armour, dragons, or any fancy sketch, and proceed to fix the scales. In so doing it is best to drive the nail or tack into the upper right- and left-hand corners. The tacks should be perfectly flat, similar to artist's drawing pins. Form one row and then another, causing the latter to lap over the former until the whole design is covered.

A study of the several illustrations here given will make all clear, and fully show how to do the work.

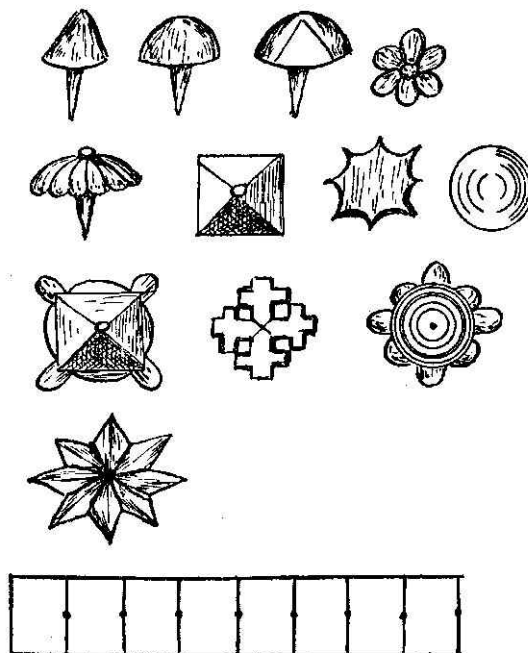


Fig 66. Nail Head Shapes, and How To Place Them.

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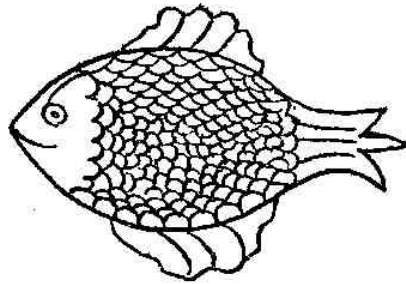


Fig 67. Design For Scale Work.

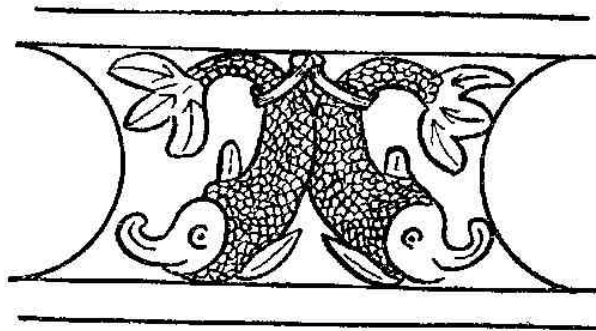


Fig 68. Design For Scale Work.

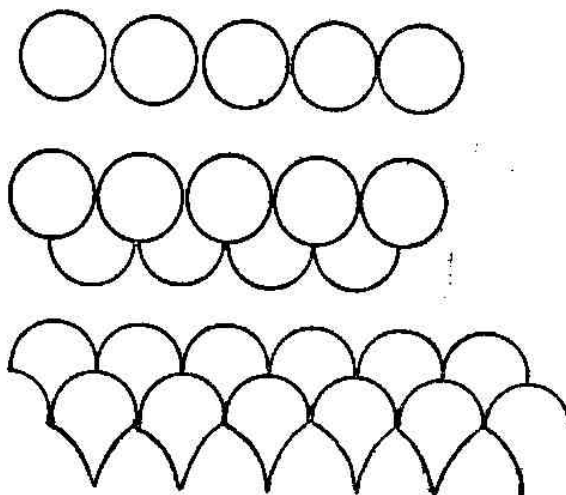


Fig 69. Method of Placing The Scales.

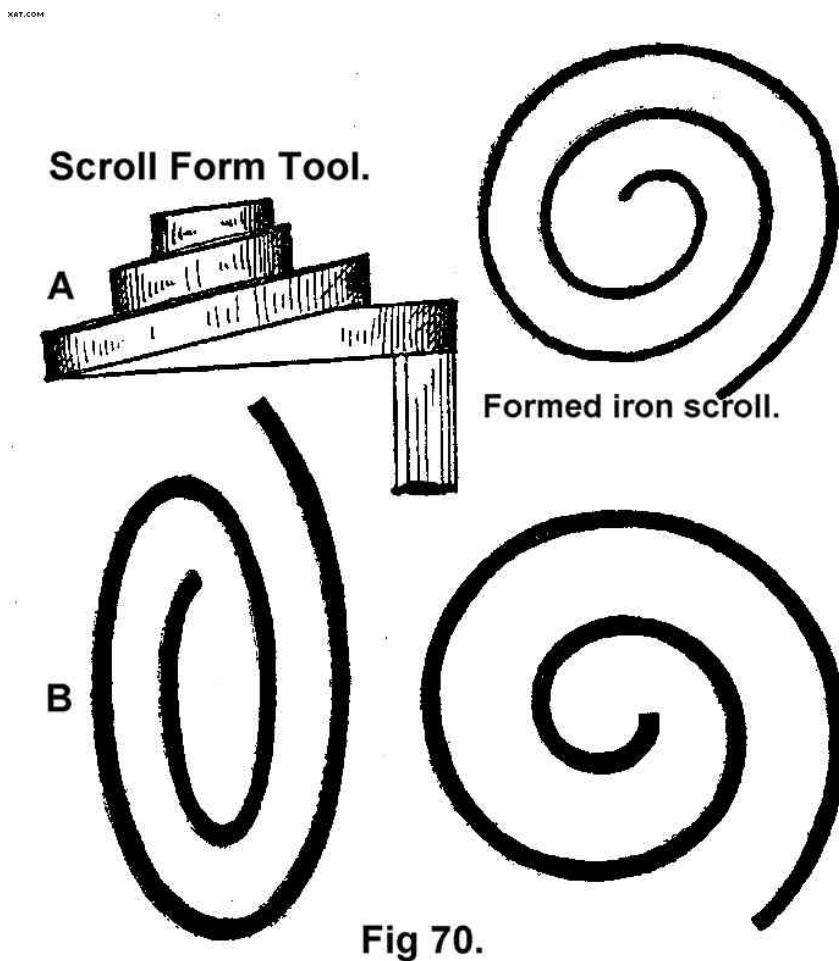
Tool For Bending Iron Scrolls.

A flat bar of iron, 1 1/2" by 1/2" inch, should be bent to the required shape of the scrolls, such as **Fig. 70**, with one end turned sharp down to fit in the hole of an anvil or in a vice. The scroll iron should be bent conical as at "**B**", so that when screwed up in the vice the iron to be bent may be turned round the scroll iron, the end being fixed to the centre by a screw clamp.

This iron can easily be bent this way, and where there are a number of scrolls required exactly the same size and shape the method described will economise time. And will be found better than forming each individual scroll by hand in the ordinary way of bent-iron working.

Note:

Special wrought iron working tools can be bought from tool suppliers, they make working with metal pretty easy, but the tools sets are not cheap, the instructions shown here will allow you to make your own scroll bending tool for almost next to nothing. Once you learn the operating skills you will start to produce work equally as good as the pieces made in the special tools.



Chapter Fourteen. Copper Modelling.

Among the many kinds of metal used and worked at the present day, that known as copper modelling has many recommendations, especially for small articles and as an occupation for ladies. The material used is the very thin rolled copper sheeting, which is so thin that a pencil will emboss it. The design is marked out, and the relief is done with a round-pointed style at the back and the finishing touches are done on the front.

But on account of the extreme thinness of the metal, it requires some kind of backing to prevent it from becoming dented or otherwise damaged; for this purpose beeswax or plaster of Paris can be used, filling the intaglio side of the design. Melt the beeswax or mix the plaster and fill up the back of the design; this, when allowed to set and get hard, will sustain the relief.

This work is specially suited for book-covers, and any ornamental fancy work requiring additional adornment. If a book-cover is the work, select the metal and cut a piece slightly longer than what will really be wanted; trace the design by any of the methods detailed in these pages, working out the pattern with the pencil or agate point; then cut to the exact size so as to fit the place intended, fill in the back, and finally fix it on to the cover of the book, using small brass or copper studs.

This method of working will be found suitable not only for book-covers but for photo frames, blotters, lids of small toilet-boxes, jewel-cases, ornamenting round boxes by working out a design flat and then bending round the box, fastening with the small pins or studs such as are used by all upholsterers—in fact the purposes to which this copper modelling may be put are almost infinite and will doubtless suggest themselves to the individual worker. It is claimed that copper modelling does what metal work does, only with half the labour and expense.

This work has recently come to the front under the name of "Albo Metal Relief," and has been practised and developed by a lady worker, Miss Eliza Turek, at her studios, 8, St. George's Square, Primrose Hill—from whom all requisites may be obtained. The tools recommended, costing but a small sum, are those shown by our illustrations, Fig 73. **A, B, C, and D.** They resemble those usually employed for leatherwork; **the tracer** is pointed at one end and rounded at the other.

The **ball modeller** is also of wood, and is useful for rounding the design. The **steel leveller** is for the purpose of smoothing out the background, whilst the **matting punch** is of metal to produce a kind of stippled background. For doing the work it is recommended that layers of cloth or a piece of felt be stretched upon a table or flat board, upon which the thin metal should be placed face upwards; upon this place the design previously drawn upon paper.

Take the double-ended tracer and go over the outline with just sufficient pressure that the design may be clearly visible on the metal, correcting any mistakes that may have been made. Now reverse the metal upon the cloth or felt, and with the tracer or modeller press the design out from the back.

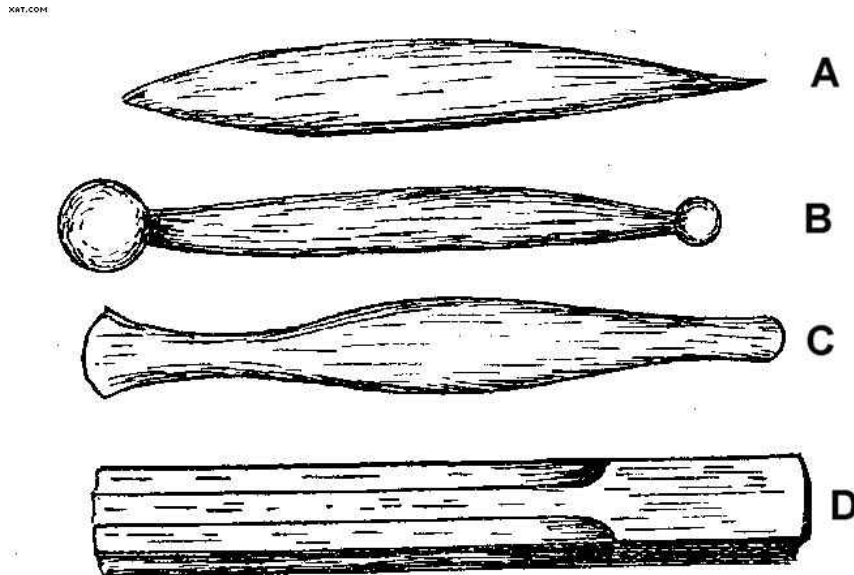


Fig 73. The Tools For Copper Modelling.

This requires care, as the pressure must be an even one so as to avoid all angles. Next turn it over face uppermost and rub down the ground with the leveller, taking special care with all angles and curves that may be in the design; if this is well done it will show up the patterns in high relief.

Now use the matting punch over this background in the same way as stippling with a brush is done. It is better whilst doing this to place the metal on a hard bed such as wood or slate, holding the punch exactly upright and using a small repousse hammer.

When this has been done, the back must be filled up with the beeswax or plaster as before mentioned, allowing it to dry thoroughly, then cover the entire back with suitable paper with strong gum or glue.

It will be seen that the copper costs less than the Albo metal, but it does not keep its colour so well, which is a very great consideration. The Albo metal presents a brilliant silvery appearance, and is practically indestructible. This can be used with great effect for panels, doorplates, and for appliqué designs on wood or leather.

Chapter Fifteen. Useful Recipes for Metal Workers.

Cementing Metals to Leather.

To unite iron or other metal to leather, dissolve by heat one part of shellac in five parts of moderately strong ammonia; both the iron and the leather should be roughened, and if the cement is too stiff it must be slightly warmed before applying. Or wash the metal in hot gelatine and steep the leather in a hot infusion of gallnuts, and unite when hot.

Cementing Brass Letters to Windows.

Use 16 parts of copal varnish.

- | | |
|----|--------------|
| 5 | Drying oil. |
| 3 | Turpentine. |
| 5 | Liquid glue. |
| 10 | Stucco. |

Fixing Metal to Marble, Stone, or Wood.

Use 9, cement made as follows:

- 4 parts of carpenter's glue.
- 1 part of Venice turpentine.

Fixing Lead to Glass.

Mix together equal parts of red lead, litharge, and white lead. These must be ground previously in linseed oil, which may be obtained from any paint shop.

Cementing Brass to Leather.

Ordinary cycle-tyre cement can be used. The brass should be made rough with a file, and then made hot, and the melted cement spread over with a stick. By again heating until the cement is pasty, and pressing on the leather, it will adhere firmly.

To Prevent Steel Rusting.

A simple way of preventing the oxidation of polished steel articles is to dust them over with quicklime. When articles are required to be preserved for many months, strips of paper freely covered with powdered lime may be wrapped round them, or they may be placed in boxes and the interstices filled up with quicklime. Or mix with fat oil varnish four-fifths of well-rectified spirits of turpentine. Apply this varnish with a sponge, and the articles will retain their metallic brilliancy and not be liable to rust; or rub over the surface a mixture formed by melting together equal parts by weight of paraffin and beeswax.

To Protect Polished Steel.

Dip the steel in a solution of common soda, one part soda to four parts water. Atmospheric influences will not change it. To renew it when corroded, brush with & paste composed of one half-ounce cyanide of potassium, half an ounce of Castile soap, one ounce whiting, with sufficient water to form a paste. The steel should be first washed with a solution of half an ounce **cyanide of potassium** in two ounces of water.

Note:

Cyanide of potassium is highly poisonous.

To Prevent Iron Rusting.

Melt fresh mutton suet, smear over the metal with it while hot, then dust it well with un-slaked lime, powdered and tied up in muslin. Wrap the articles in baize and keep them in a dry place, use no oil on them except salad oil. Or, moderately-heated benzine, dissolve half its weight of wax, and if this solution be carefully applied with a brush, the evaporation leaves a very adhesive and permanent coating of wax which will preserve the metal even from the action of acid vapours.

To Protect Polished Surfaces.

Beeswax dissolved in benzine makes an excellent varnish for the protection of all highly polished metallic surfaces; it may be applied with a brush. Or make a mixture consisting of copal varnish mixed with olive oil so that it gives a degree of greasiness, adding thereto as much spirits of turpentine as of varnish.

Brass Alloys,

These are very varied, but the following may be taken 2,9 being fairly representative:

Yellow brass consists of 60 parts copper to 40 parts zinc or spelter, and is known as Muntz metal.

Brass for wire consists of 64 parts copper to 40 zinc.

Red metal is made of copper 6 to 61 parts to 1 zinc.

Gilding metals, which are rich brasses, are made from 85 parts copper to 15 parts zinc down to 96 copper and 4 zinc.

Cartridge metal consists of 68 parts copper to 32 zinc, but the proportions vary according to quality desired.

Phosphor bronze consists of ordinary copper containing varying proportions of phosphorus, usually from 1 to 2 per cent. the former is used in tubes, and the latter for hard castings.

Gun metals consist of many mixtures, one being copper 87, tin 9, and zinc 4.

To Make Brass Brilliant.

Beat Sal Ammoniac into a fine powder, then moisten it with soft water, rubbing on the metal (which should be heated over charcoal) and rub dry with bran and whiting. Another method is to wash the brass with rock alum boiled in strong lye, to the proportion of one ounce to a pint; when dry, rub over with fine Tripoli. Either of these methods will give brass the brilliancy of gold.

Polish on Brass.

Owing to irregularities of surface, it often happens that difficulty is encountered in ~getting a good polish on brass or copper articles when finished. If, however, they are immersed in a bath composed of aqua fortis one part, spirits of salt six parts, and water two parts for a few minutes, if small, or longer if large, they will become covered with a black mud, which on removal by rinsing will display a beautiful lustrous under-surface. Should this lustre be deemed insufficient the immersion may be repeated, care being always taken to rinse thoroughly. All articles cleaned in this manner should be dried in hot, dry sawdust.

To Clean Brass.

Rub the surface of the metal with rottenstone and sweet oil, and then rub off with a soft cloth and. polish with leather. A solution of oxalic acid rubbed over tarnished brass with a, cotton rag soon removes the tarnish, rendering the metal bright. The acid must be well washed off with water and the brass rubbed with whiting in powder, using a soft chamois leather.

It should be borne in mind that in all cases where acids are employed for removing the oxide from brass the metal must be thoroughly washed afterwards, or it will tarnish in a few minutes on exposure to the air. A mixture of muriatic acid and alum dissolved in water imparts a golden hue to all brass articles, by steeping them in the liquid for a few minutes.

To Bronze Brass Objects.

Erst clean and warm the articles, then wash over with a hot solution of ammonium chloride, then place over-night in a diluted solution of two parts verdigris, and one part ammonium chloride, in six parts of vinegar. In the morning remove and wash.

To Silver Brass Objects.

Mix three parts of chloride of silver with twenty parts of powdered cream of tartar and fifteen parts of powdered common salt. Moisten a suitable quantity of the mixture with water, and with a piece of blotting paper rub it upon the object, which must be thoroughly clean. The latter must then be rubbed with a piece of cotton, upon which precipitated chalk has been dusted, then washed with water and polished with 9, dry cloth.

Another good method, is to take one ounce of aqua fortis and dissolve in it, over a moderate fire, one ounce of silver cut small or granulated; when wholly dissolved remove from the fire, and put into it as much white tartar as required, so as to absorb all the liquor. The residue will be a paste with which you may rub over any article made of brass or copper, which, if properly done, will present a beautiful silver appearance.

Please Note.

Please remember that the information provided in this book is almost one hundred years old. There are compounds and chemicals in some recipes, which are potentially extremely hazardous & dangerous to your health.

You should take the time to get professional advice & investigate the possible safety implications of using those chemicals and compounds.

There may well be other less dangerous chemicals you can use to achieve the same results with metal work.

ALWAYS use high quality protective clothing, facemasks, and breathing apparatus at all times while handling and using dangerous materials.

The End.

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