METALWORK TECHNOLOGY

City of Cambridge

Committee for Education

TECHNICAL CENTRAL Boy's SCHOOL

Nature Note Book

Name R. OLESEN

Standard 4R.

Date 15 SEPT. 53

ROAD SAFETY

Never run straight out on to the road when you leave the school premises, or when you leave your home.

SYLLABUS IN HANDICRAFT.

School Certifiate (G.C.E.)

Part I: Theory 1¼ hrs.

Part II: Drawing and Design 1¼

PRACTICAL WORK: 3 hrs.

Paper I: Theory.

There will be a choice of questions, which will require an elementary knowledge of the following:—

(a) Common kinds of tools and their uses, construction and maintenance.

(b) Metals and alloys in common use in the handicraft room; their treatment suitability for for various purposes.

(c) The nature and use of solders, fluxes, lubricants etc,

(d) Construction, processes, and finishes; methods of fastening used in metalwork; simple decorative treatments and appropriate finishes.

(e) Design and construction with reference to various aspects of the craft, e.g. forging, rolling, casting, turning, sheet metal, beaten metal, welding.

Paper II :- Drawing and Design.

The paper will test :-

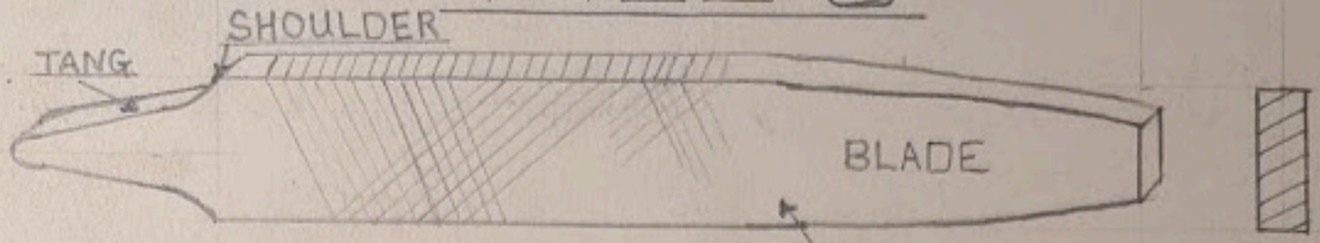
(a) Ability to make and read properly dimensioned work drawings to scale, using First Angle orthogonal projection, and drawn according to Engineering Drawing Office practice, using drawing board, Tee-square and drawing instruments. Measurements may be in either English or Metric units. The only sections required will be vertical and horizontal.

(b) Knowledge of construction and methods of showing this by means of sketches, isometric or oblique projection, or other methods of pictorial representation.

(c) Layout of drawings, dimensioning, and lettering.

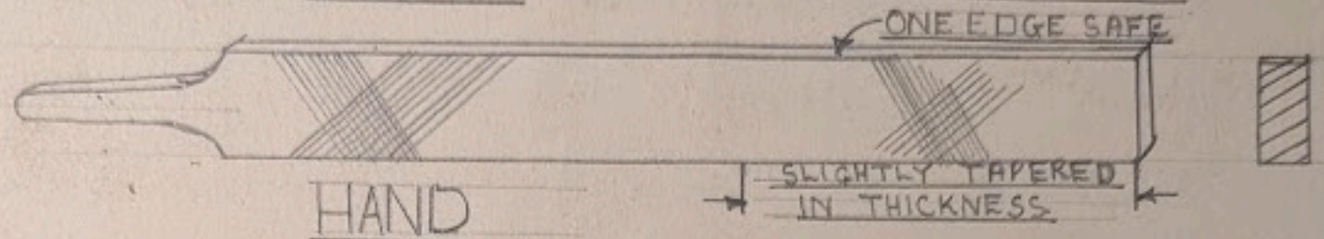
(d) Understanding of design in relation to metal work,

FILES



FLAT

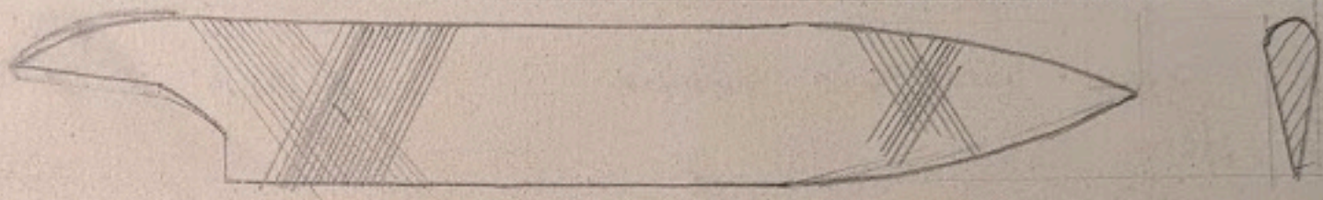
DOUBLE CUT



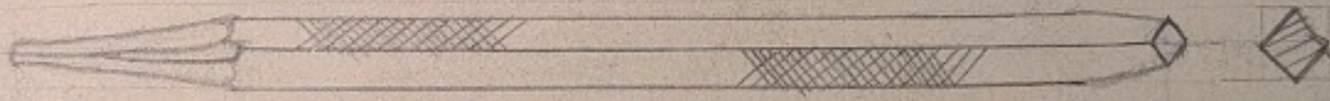
HAND

PILLAR

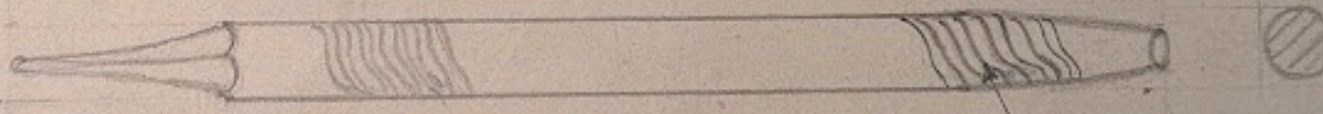
USUALLY NARROWER AND NO TAPER IN THICKNESS



KNIFE EDGE

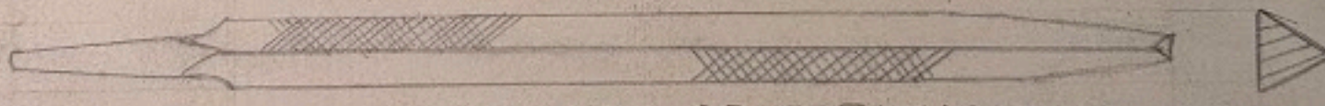


SQUARE

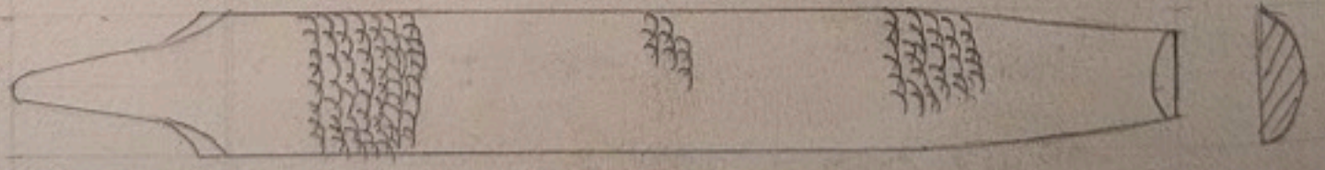


ROUND

SINGLE CUT



3 SQUARE OR TRIANGULAR



HALF ROUND

FILES AND FILING

TYPES

Types of files most widely used are :— hand, flat, ½-round, square, three-square (Triangular) & round. These are described by their shape; other files are named according to their use i.e. saw files ward or warding files and rifflers.

Swiss files are similar to small files of the above shapes. but have very small teeth, giving exceptional fine cut. Round files may be parallel or tapered; tapered type known as "rat-tail". Short round files drawn down to a fine point are known as "pin-files".

CUTS" OR GRADES

"Cut" refers to the number of teeth or cuts per inch of length, most files being obtainable in 6 different cuts i.e. :—

ROUGH CUT — 14 to 22 T.P.I

MIDDLE CUT — 16 to 26 "

BASTARD — 22 to 32 "

SECOND CUT - 28 - 42 T.P.I.

SMOOTH " - 50 - 65 " -

DEAD CUT - 70 - 110 "

LENGTHS:

Most files are made in lengths from 4" to 16" in 2" steps but Swiss files only up to 10" maximums. Warding similar files made only up to 6". Length is measured from shoulder to tip.

CARE OF FILES:

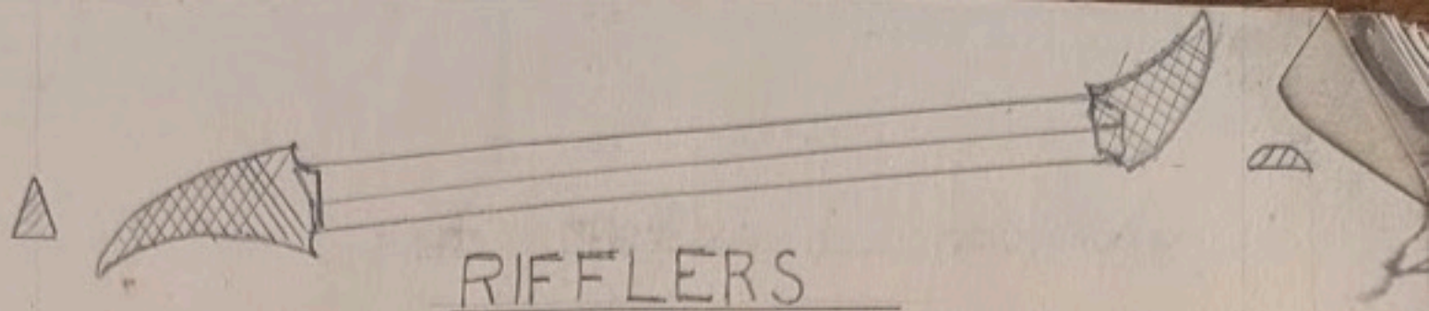
Files should never be used without a handle driven tightly onto the tang for the following two reasons:-

(a) It is not a complete tool without the handle and is therefore unbalanced.

(b) There is a danger from the tang piercing the hand.

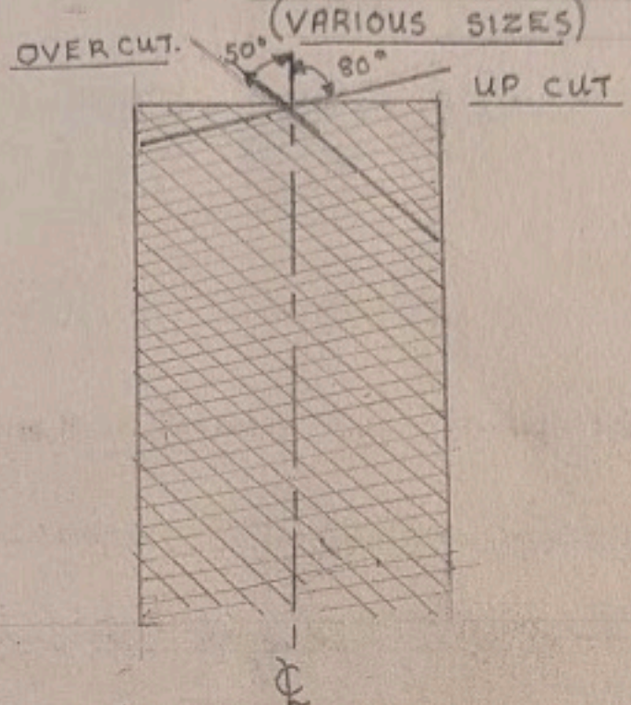
Handles must always have a metal ferrule in place, other-wise the handle will split under the wedge action of the tang.

Files should be kept separately from other tools and from one another, never allow files to rub against



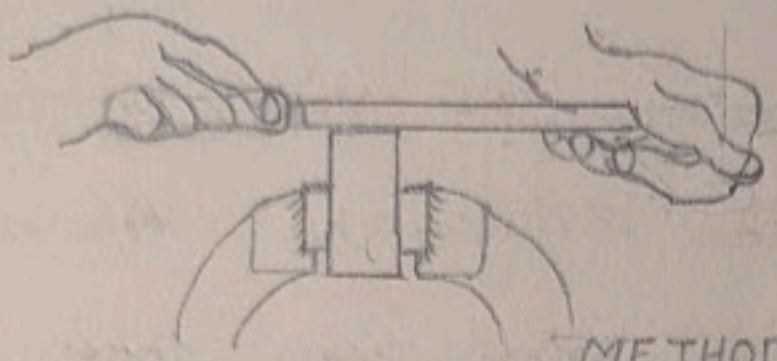
RIFFLERS

(VARIOUS SIZES)

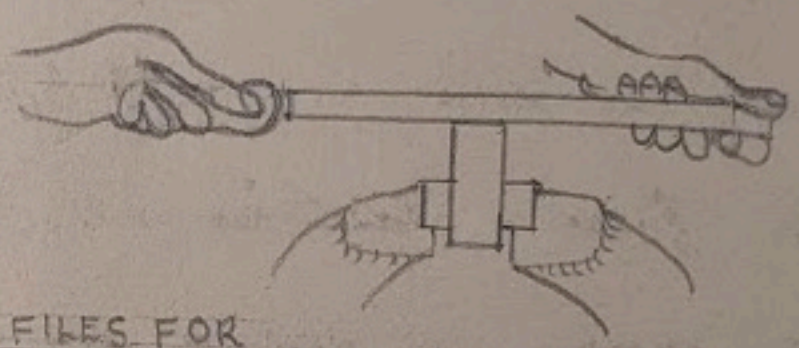


USUAL ARRANGEMENT OF THE TWO CUTS ON HAND AND FLAT FILES AS WELL AS CERTAIN OTHER TYPES.

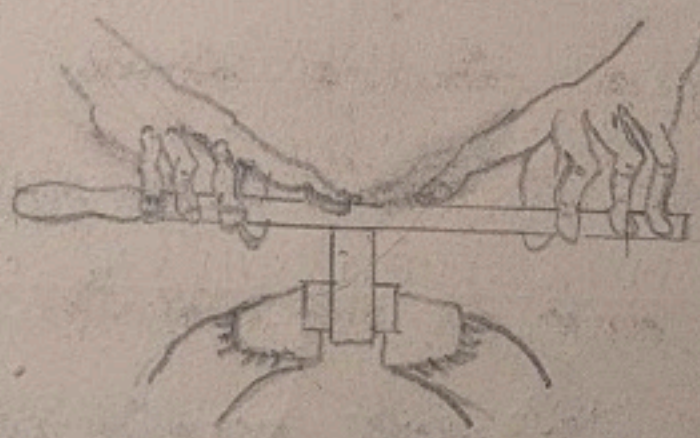
FILE CLEANING BRUSH MADE FROM A WOODEN BASE AND A STRIP OF CARDING



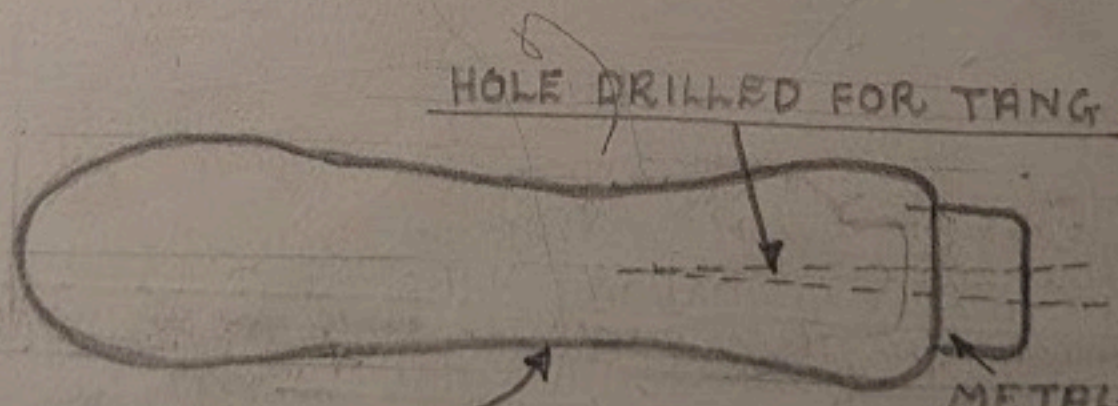
METHOD OF HOLDING FILES
FOR HEAVY CROSS CUTS.



METHOD OF HOLDING FILES FOR
LIGHT CROSS CUTS



METHOD OF HOLDING FILES
FOR DRAWFILING.



FILE HANDLE

one another. Ideally, files should be used on different metals in a certain sequence ie. when new used on zinc, then copper, aluminium, brass, Iron and steel, in that order. "Pinning" occures when chips of metal, particularly the softer metals, get fixed between the "cuts". If filing is continued with files in this state, large scratches will result. A wire brush, or "file card," should be handy in order to remove the pinning. Any filings not removed by brushing should be forced out by the toothed edge of a strip of brass. The strip of brass should be stout and the toothed edge formed by rubbing the edge square to and in the direction of the "up-cut". If any fragments still remain they should be removed very carefully by means of a scriber point.

RECONDITIONING.

rejected files can sometimes be made serviceable by boiling them for 10 minutes in a strong caustic Soda solution, afterwards cleaning well with a file brush, rinsing in

P.T.O.

paraffin and drying. Worn files can be sharpened to a limited extent by immersing in dilute hydrochloric acid for an hour or so.

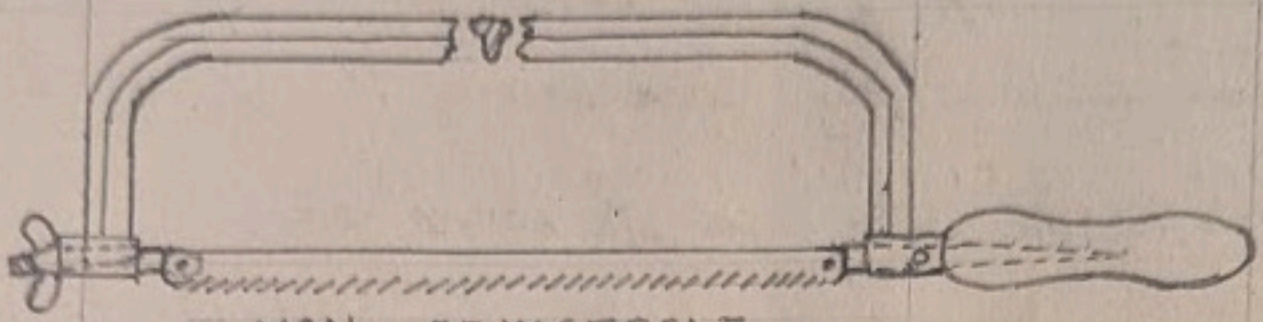
CROSS AND DRAW FILING

The two principle methods of filing are cross (ordinary filing) and draw filing. The latter produces a smoother surface i.e one with a greater number of finer, even scratches and essentially a finishing process. Cross filing is employed to remove the bulk of excess material and when shaping or fitting. An edge or surface should never be left from cross filing but should be finished by draw filing immediately the cross filing is completed.

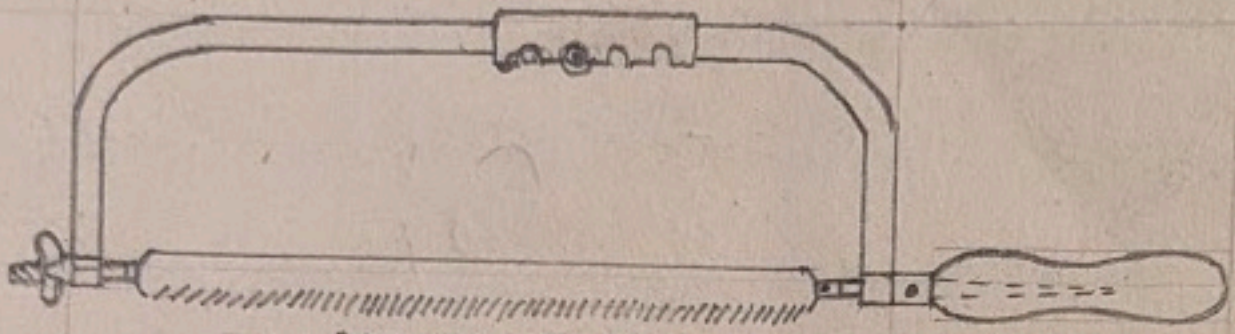
Throughout almost every filing operation the most important point is to keep the file perfectly horizontal. Edges or faces at an angle to the horizontal should be titled in vice when ever possible to enable this situation to be maintained.

Most filing is carried out with the work gripped

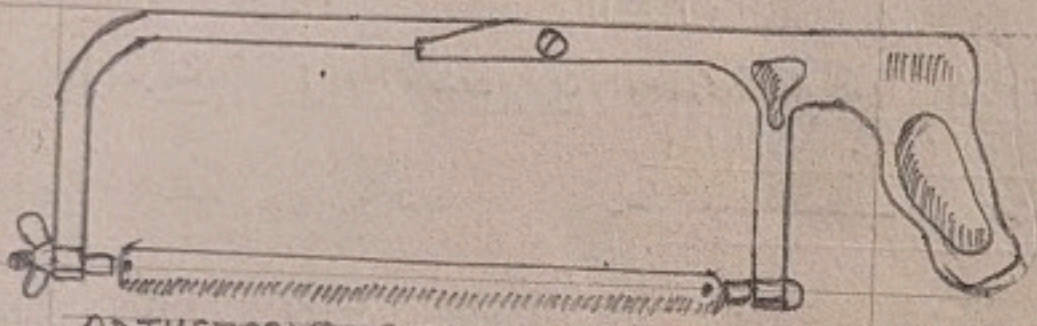
HACK SAWS



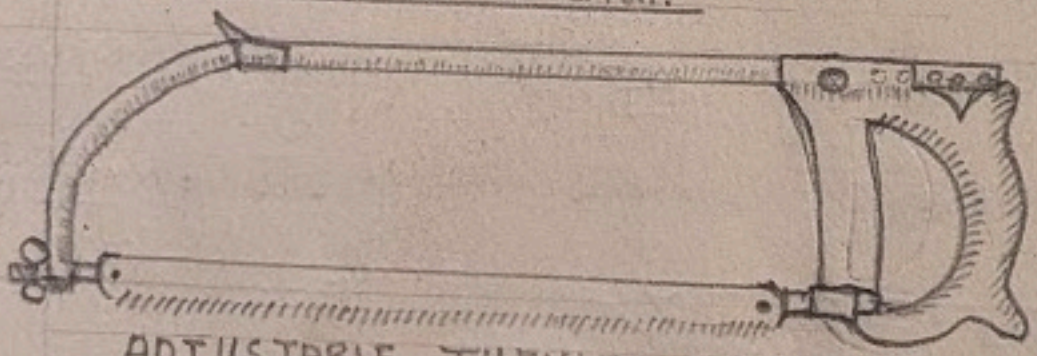
NON - ADJUSTABLE



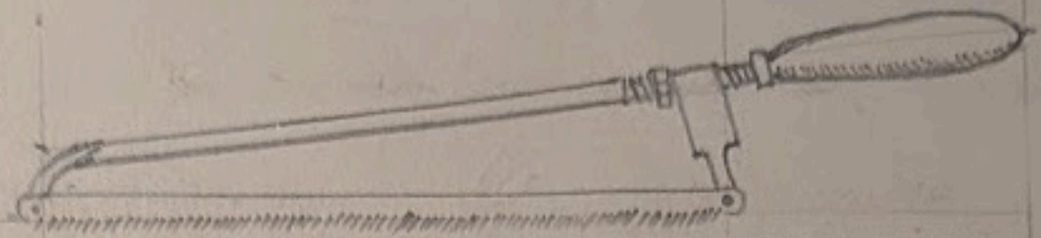
ADJUSTABLE



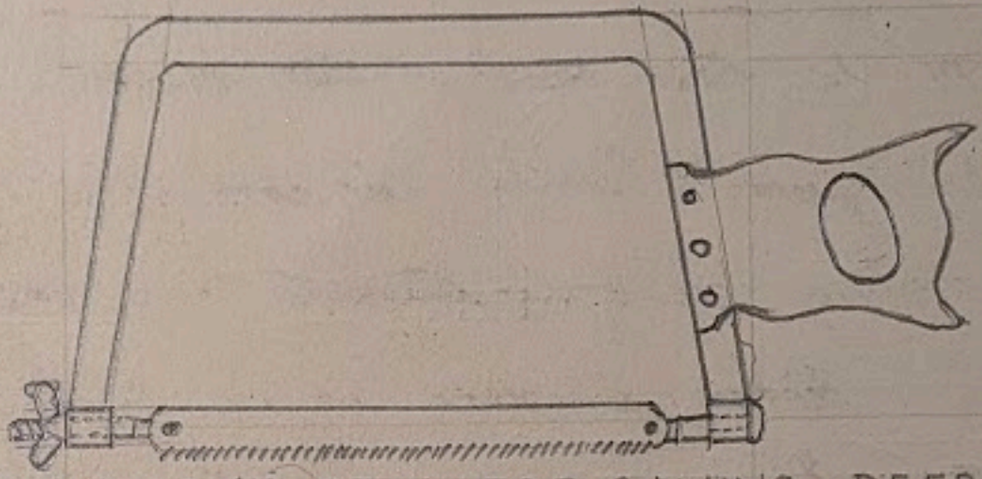
ADJUSTABLE, PISTOL-GRIP



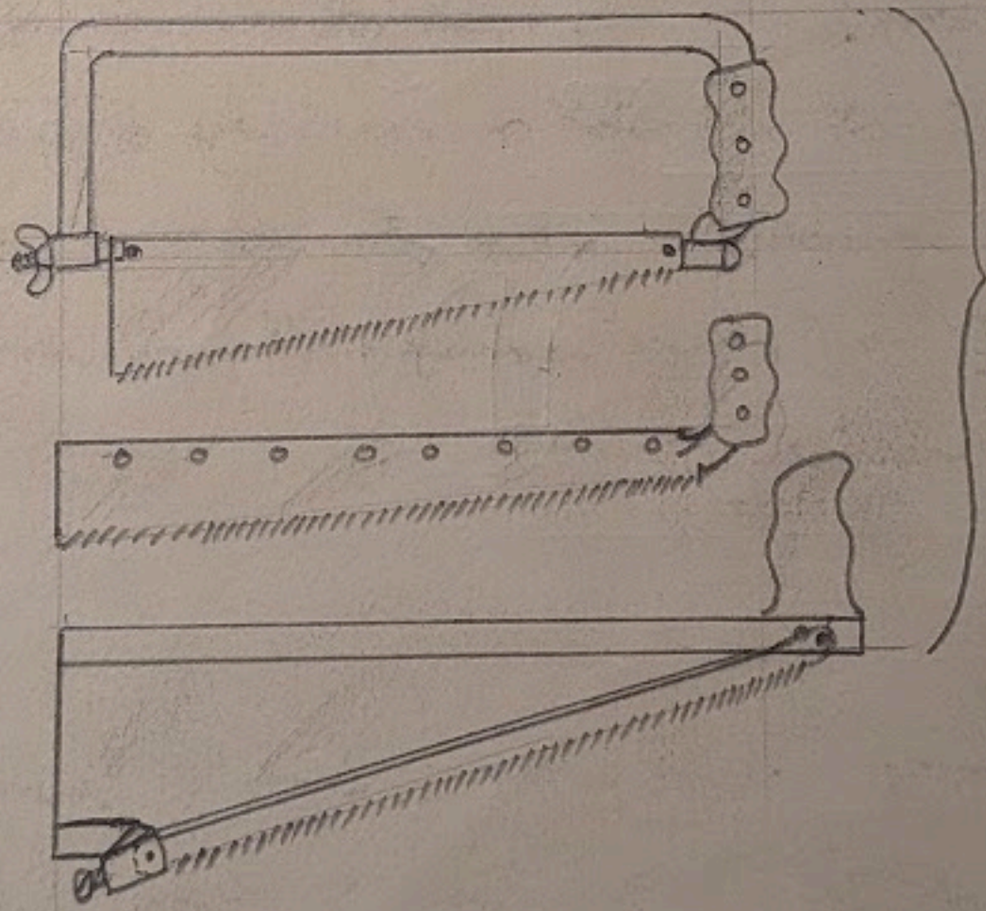
ADJUSTABLE, TUBULAR FRAME



SPECIAL TYPE OF SMALL HACKSAW, USEFUL WHEN WORKING IN A CONFINED SPACE.



A DEEP FRAME SAW, FOR SAWING DEEPLY OR MAKING INTERNAL CUTS



3 SPECIAL TYPES OF HACKSAW FOR CUTTING SHEET METAL.

in a vice, and for accurate work it is essential that the vice should be at the correct height. The height is determined by standing close to the vice, facing at right angles with the right arm straight down. If the right arm is then bent at the elbow the tip of the elbow should just touch the top of the vice without either tilting the body towards the vice or raising the shoulder. When the vice is to high the use of foot or duck boards is recommended to raise the body the required amount. With the vice too low it should be "blocked up" the required amount, by a wooden insert between vice and bench, or as a temporary measure work may be carried out more comfortably by standing with the legs well astride

AHW 21/2/54

Saws and Sawing

Hacksaws:

The hacksaw is the only type of saw generally associated with metalworking, although and decorative work the piercing saw is widely used.

Types:

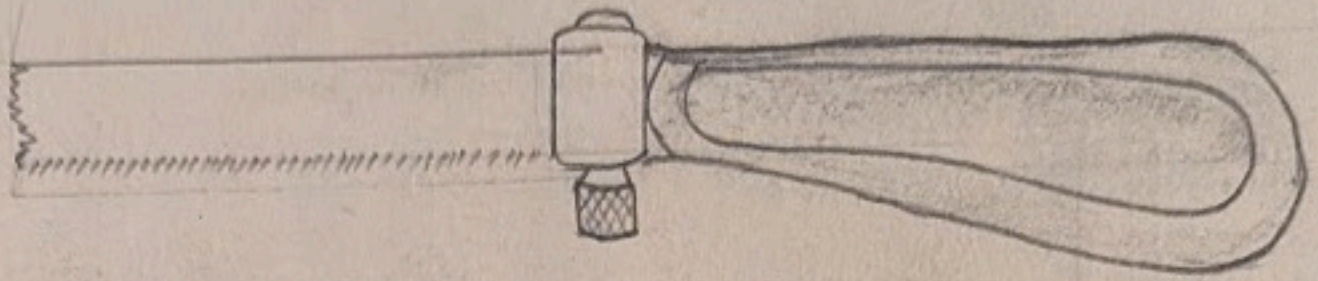
The sketches indicate the principal patterns of hacksaw, the majority of which embody a frame adjustable for the main lengths of blades i.e. 9, 10, 11, 12, inches.

The tubular frame type of a good make is generally considered to be the best.

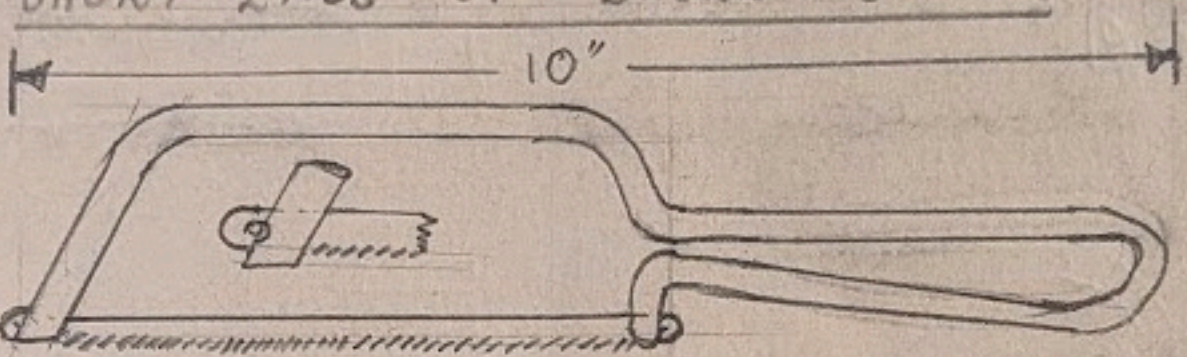
Beside the main adjustement for blade length, provision is made for the tensioning of the blade by means of a wingnut or similar device.

Special Types:

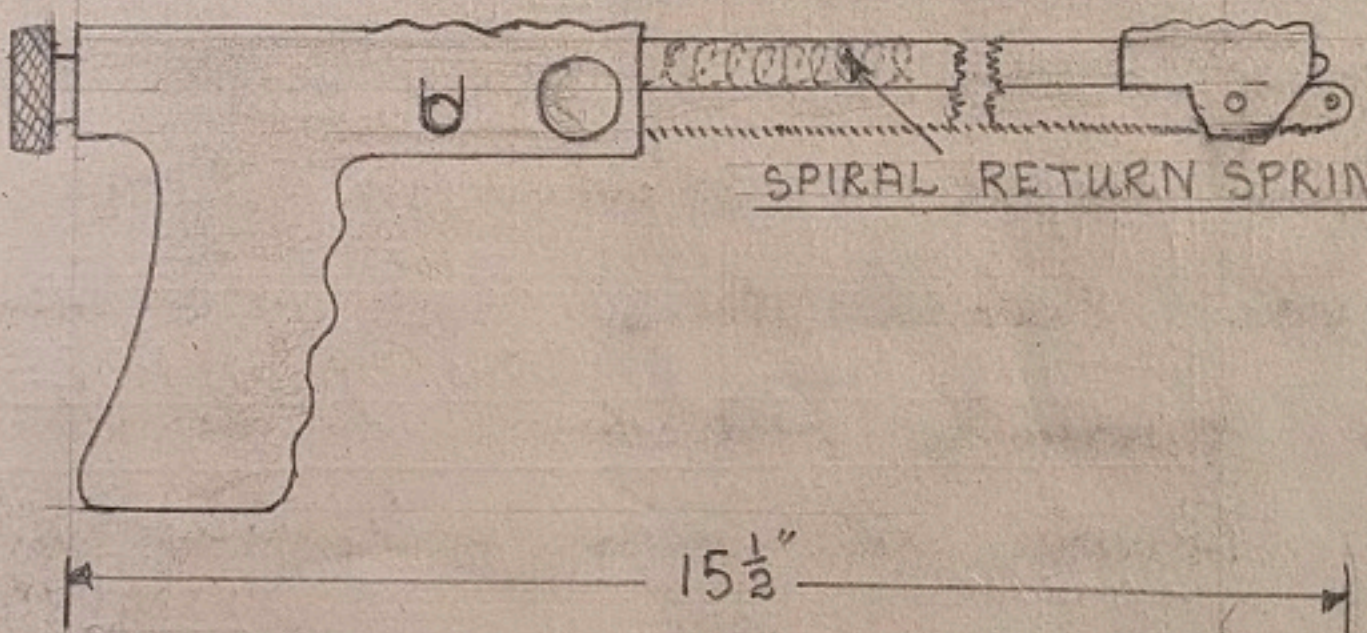
A few special forms of hacksaw are given in accompanying sketches.



A PAD HANDLE WHICH CAN BE USED WITH SHORT ENDS OF BROKEN BLADES



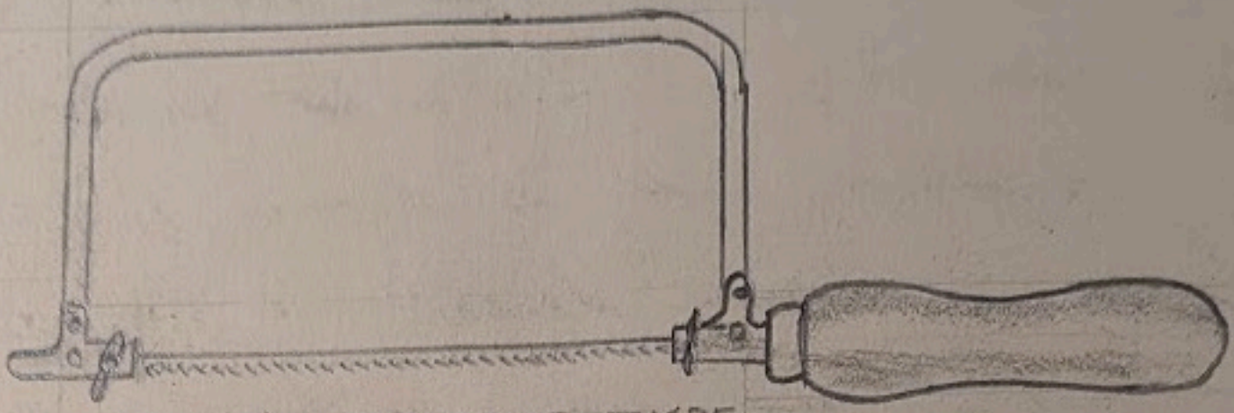
JUNIOR HACKSAW. BENT STEEL ROD FRAME. BLADES FIT INTO SLOTTED ENDS OF FRAME, RETAINED BY PINS IN END OF BLADES. TENSIONED BY SPRING OF FRAME.



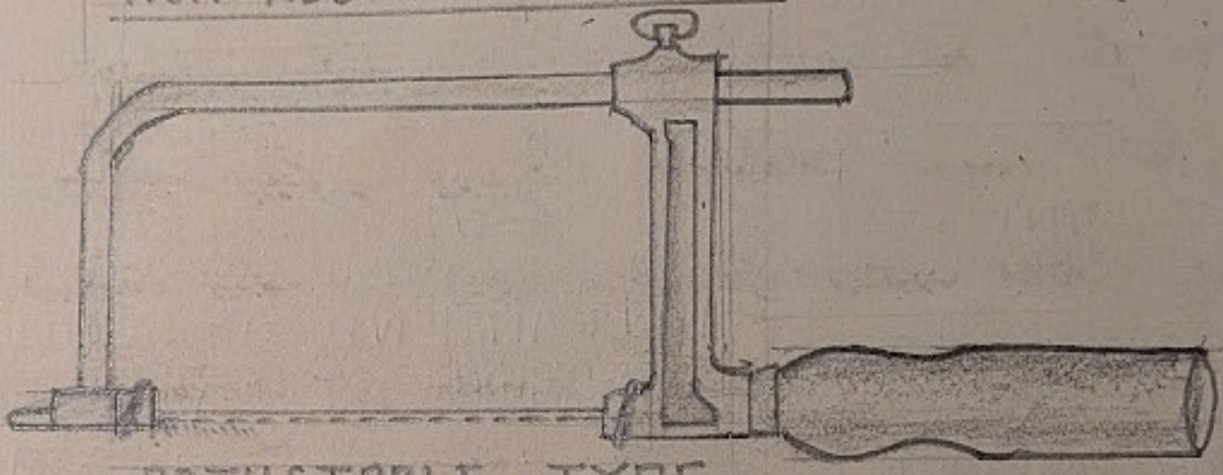
SPIRAL RETURN SPRING INSID

"LEYTOOL" ENDLESS OR SPRING RETURN HACKSAW, SUITABLE FOR SHEET METAL, INTERNAL CUTS, ETC.,

PIERCING SAWS

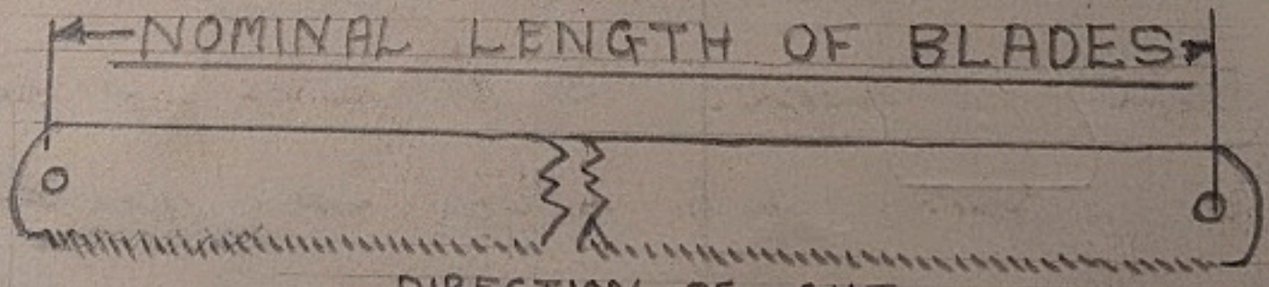


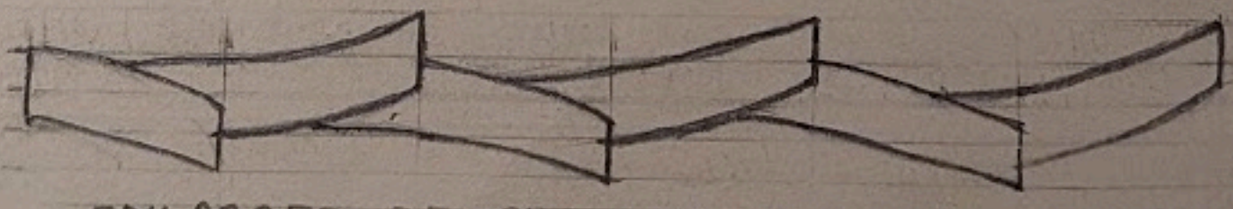
NON-ADJUSTABLE TYPE



ADJUSTABLE TYPE

HACKSAW BLADES.





ENLARGED DETAIL OF SET FOR COARSE TOOTHED BLADES (EACH TOOTH BENT SLIGHTLY OUTWARDS IN ALTERNATE DIRECTIONS

These include a type for working in confined spaces generally available for blades of 6 or 8 inches, another with a larger frame than Normal for sawing deeply or making Internal cuts, and three types specifically for cutting wides sheets of metal. The angle of the blade in these three types allowes a clean cut to be made accros wides sheets of metal, asbestos, plastic, etc, without interfeance from the supporting frame. The pad handle is particularly useful where short stroke sawing may be employed and where a normal saw could not be used. It uses up lengths of snapped blade not other-wise useable.
The endless (or spring return) hacksaw of recent development may be used in place of many of the fore-going.

Hacksaw blades:

The length of blade is the measurement from the outside of one hole to the outside of the

other. Normally made in lengths of 9-12 inches in inches.

Types:

(1) ALL HARD - hardened throughout complete width, they last longest when used by skilled workers but snap easily when used by unskilled persons.

(2) DOUBLE EDGED - having hardened teeth and soft centre, this type being wider than the single edged is used for sawing brass or copper tubing etc.

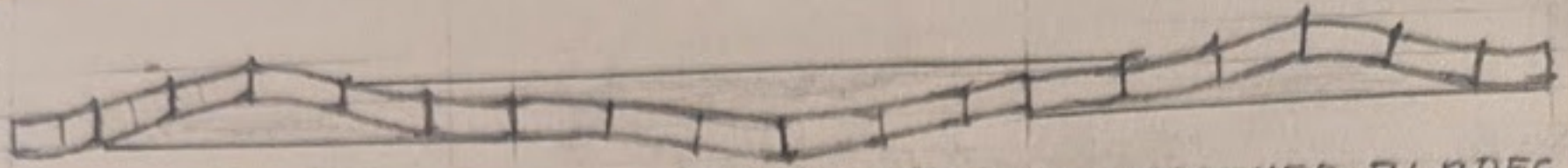
(3) FLEXIBLE.

These are particulary useful for unskilled workers or when working in awkward places where it may be difficult to keep the saw straight.

(4) High-speed alloy steel blades.

TEETH:

The teeth of all blades are given a 'set' ie. the teeth are bent slightly outwards alternately in order that the Kerf shall be wider than the thickness of the blade thus preventing



ENLARGED DETAIL OF SET FOR FINE TOOTHED BLADES (GROUPS OF TEETH BENT SLIGHTLY OUTWARDS IN ALTERNATE DIRECTIONS.

the binding of the blade in the cut or the Kerf. The finer toothed blades have the set applied in alternate groups of teeth as shown in sketches.

The grade of blade is denoted by the number of teeth per inch of blade. As a rough guide the following grades and the materials for which they are used are given

MILD STEEL — 18 T.P.I.

CAST STEEL & BRASS — 22 T.P.I.

TUBING, SHEET & OTHER LESS ROBUST MATERIALS OR SECTIONS — 32 T.P.I.

THE METALS

GROUP		METAL	REMARKS
FERROUS		IRON - WROUGHT	NEARLY PURE IRON.
		IRON - PIG or CAST	VERY IMPURE IRON
		STEEL - MILD	IRON & CARBON ALLOY
		STEEL - TOOL OR CAST	" BUT HIGHER CARBON CONTENT
		ALLOY STEELS	
NON FERROUS		COPPER	PURE METAL.
	ALLOYS	BRASS	ALLOY OF COPPER AND ZINC IN VAR. o/o's
		BRONZE & GUNMETAL	ALLOY OF COPPER AND TIN.
			ALLOY OF COPPER, TIN, AND ZINC.
		TIN	PROTECTING METAL
	ALLOYS.	PEWTER	TIN & LEAD ALLOY
		SOLDER	" " "
		WHITEMETAL	ANTI FRICTION METAL.
		FUSIABLE METAL	BISMUTH & CADMIUM. (Temperature Sensitive)
		BRITTANIA "	MODERN PEWTER
		TYPE "	

GROUP	METAL	REMARKS
	LEAD	MOST INERT METAL.
	ZINC	GALVANISING. DIE CASTING ALLOYED WITH ALUMINIUM CONSTITUEN OF THE ALLOY- BRASS.
	CADMIUM	RESISTS CORROSION.
	NICKEL	AS MAJOR AND MINOR CONSTITUENT OF ALLOYS, FOR PLATING
	COBALT	PIGMENT, AND ALLOYED WITH STEEL.
LIGHT NON FERROUS.	ALUMINIUM LARGE ALLOY GROUP, MAINLY WITH:-	SHEET, ROLLINGS, CASTINGS, AND EXTRUSIONS.
	COPPER.	
	ZINC.	
	SILICON.	
	MAGNESIUM.	
	CHROMIUM.	
	NICKEL.	
	DURALUMIN	AN ALLOY OF: AL (95%); 4% Cu, 0.5% MAGNESIUM, 5% MANGANESE - HEAT TREATS & AGE HARDENED

GROUP	METAL	REMARKS
	MAGNESIUM.	2/3 WEIGHT OF ALUMINIUM BURNS RAPIDLY.
	BERYLLIUM	STILL IN EARLY STAGES OF DEVELOPMENT. ALLOYED WITH COPPER TO MAKE NON MAGNETIC SPRINGS, NON SPARKING TOOLS Etc.
STEEL ALLOY METALS	~~STEEL~~ TUNGSTEN.	3,387 °C VERY HIGH. MELTING POINT.
	MOLYBDENAN.	2,625 °C "
	CHROMIUM.	1,830 °C "
	MANGANESE.	1,260 °C "
	TITANIAN.	1,850 °C "
	VANADIUM	1,715 °C "
THE PRECIOUS METALS.	GOLD CARAT = 1/24 OF ALLOY) B.S. 9 carat = 37.9 % " 14 Carat = 58.4 % " 18 Carat = 75 % " 22 Carat = 91.7 % " 24 Carat = 100% GOLD.	RARELY USED PURE — ALLOYED WITH SILVER, COPPER AND OCCASIONALLY ZINC or NICKEL.

GROUP	METAL	REMARK.
	SILVER	ALLOYED WITH COPPER & ZINC (BRASS) TO MAKE SILVER BRAZING ALLOY. i.e. SILVER SOLDER.
	[SILVER - 92.5% SILVER & 7.5% Copper]	
	PLATINUM GROUP.	
	PLATINUM.	
	PALLADIUM.	
	RHODIUM.	
	RUTHENIUM.	
	IRIDIUM.	
	OSMIUM	MOST DENSE METAL.
OTHER METALS (SOME VERY UNCOMMON).	POTASSIUM, SODIUM, LITHIUM, RUBIDIUM, CALCIUM, COLUMBIUM, TANTALUM.	about 70 metals in all known to metallurgists. ALL metals now known though some only in theory.
	RADIUM, MERCURY, SELENIUM, BISMUTH, ARSENIC, ANTIMONY, PRASEODYMIUM. LANTHANUM, NEODYMIUM.	

METALS AND THEIR PROPERTIES.

EXISTANCE & METHODS OF WINNING:

Metals are Elements, i.e. they cannot be resolved into simpler substances by chemical means. ($\frac{3}{4}$ of 92 chemical Elements are metals). They are rarely in a "free", uncombined state. They exist mainly as compounds with non metalic elements the most common being oxygen, Sulphur or Carbon-di-Oxide, being respectively :—

METAL + OXYGEN = OXIDE

METAL + SULPHER = SULPHIDE.

METAL + CARBON-DI-OXIDE = CARBONATE

These compounds are the metalic ores, they rarely exist in a pure state but are mixed either with the ores of other metals, sand or Clay, when mined the first requirement is to separate the ore from the unwanted material either by hand picking, flotation or mechanical sifting.

To obtain metal from the ore it is necessary to break up or "Reduce" the compounds, getting rid of the other

element and leaving the metal. This can be achieved by several means, reffered to generally as "smelting"; they are:-

(1) Heating together with charcoal, coke or coal i.e. carboraceous material having an affinity for oxygen: Thus oxygen from the ore, combines with the carbon leaving the metal either solid, molten or gaseous.

(2) Electrolysis.

(3) Alumino Thermics reaction, powdered aluminium is mixed with the ore and ignited. The strong reaction generates heat, the aluminium combines with oxygen from the ore leaving the ore.

REFINING:

Where metals are smelted by other than Electrolysis they are liable to contain impurities metals required to be pure are subjected to electrolitic refining similar to the method of smelting. Impurities are not always a disadvantage. The purer the metal is the softer it will be. Purity to a degree of 100% rarely obtained. The term "Pure" is usually

applied to metals obtained by best industrial practice. otherwise qualified by a term such as 'super purity' or 'electrolytic purity'.

Properties of metals:

Metals have many valuable qualities. They are strong and durable; can be made hard or soft and have a beauty of colour and of lustre. They the posses the following important properties :—

(1) MALLEABILITY — can be hammered to shape.
(2) DUCTILITY — can be drawn without snapping.
(3) FUSIBILITY — Can be melted and cast into shape.
(4) CONDUCTIVITY — Conducts heat and electricity.

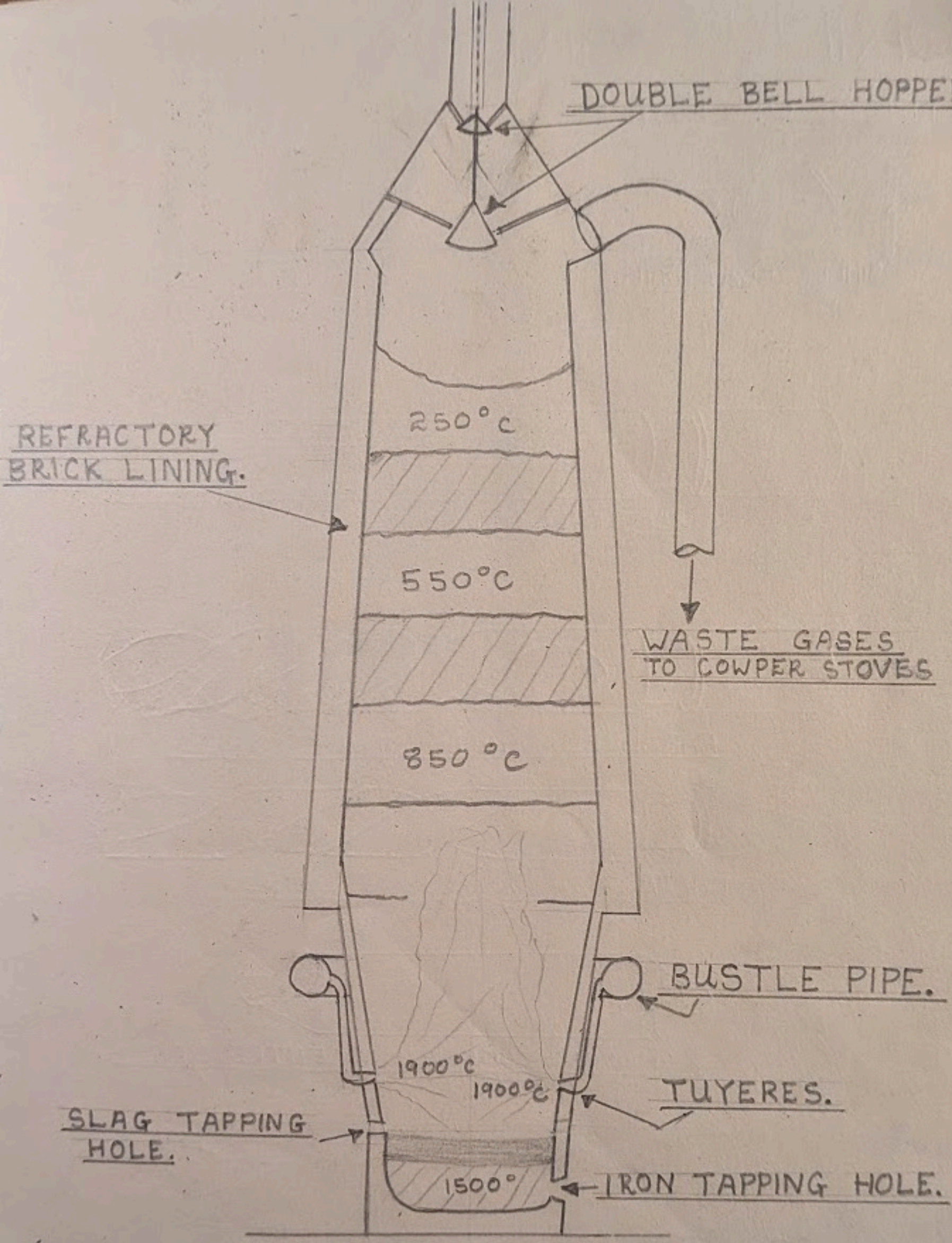
These properties exist in some metals to a greater or lesser degree than others.

ALLOYS:

In order to improve the properties of metals i.e. increased hardness, decreased liability to corrosion, etc, metals are frequently mixed together after being refined to a high degree

of purity individually, producing an "alloy". Such a product may consist of 2, 3, 4 or more metals and — or more metals depending upon the effects required.

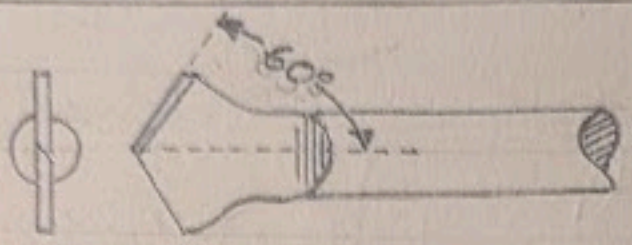
Alloys are not necessarily only mixtures, in some instances the metals dissolve completely in one another in other cases only partial dissolving take place. The result of such mixing should not be considered on a pro-rata or percentage basis, frequently the addition of a minute percentage of another metal into an alloy will have results far out of proportion to the weight for weight properties of that metal.



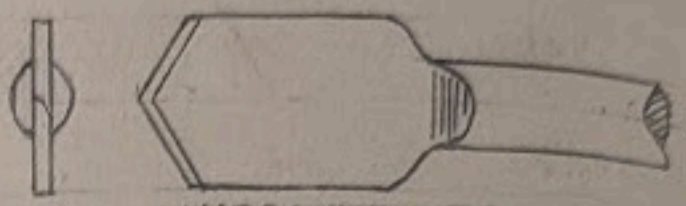
THE BLAST FURNACE.

DRILLS AND DRILLING:

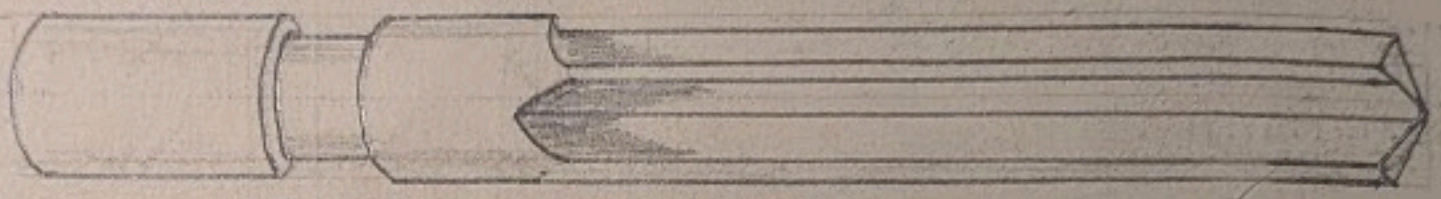
TYPES OF DRILL:



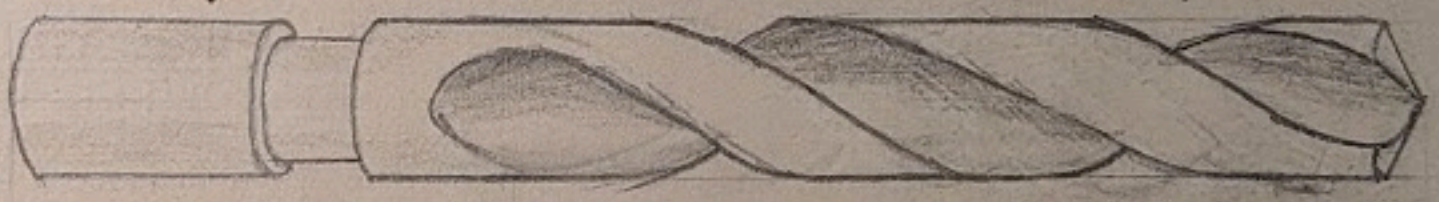
SIMPLE FLAT DRILL.



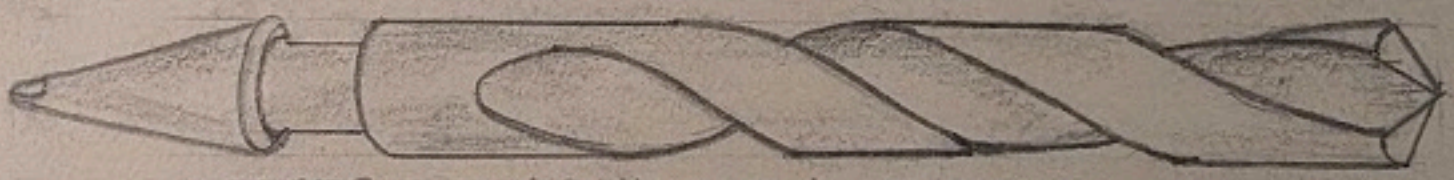
IMPROVED PATTERN.



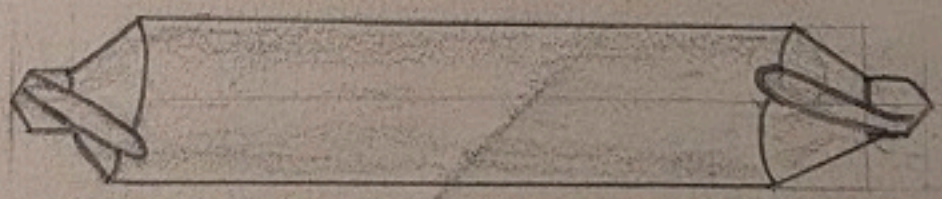
STRAIGHT FLUTED DRILL



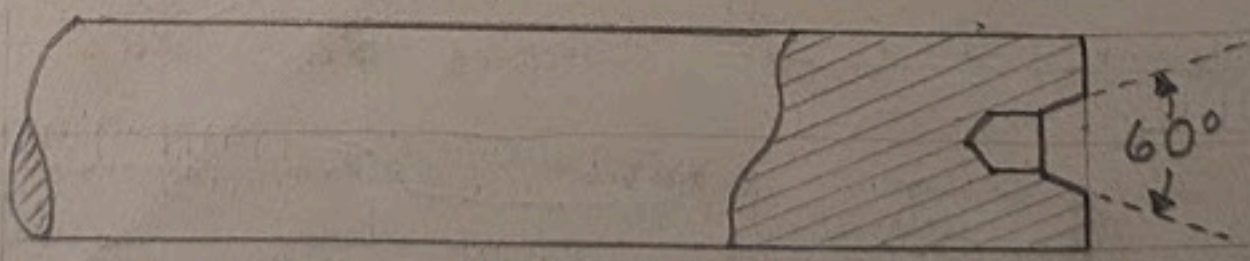
PARALLEL SHANK TWIST DRILL.



TAPER SHANK TWIST DRILL.



SLOCOMB'S COMBINATION CENTRE DRILL



END OF BAR CENTRE-DRILLED FOR TURNING BETWEEN CENTRES.

Except for hot metal and thin sheet, where a punch may be used, drills are used for producing round holes. The process is known as 'Drilling', not 'boring' which is a lathe operation. Drills may be held in a hand drill, breast drill, drilling machine (power or hand operated, portable or stationary), or the lathe.

TYPES OF DRILL:

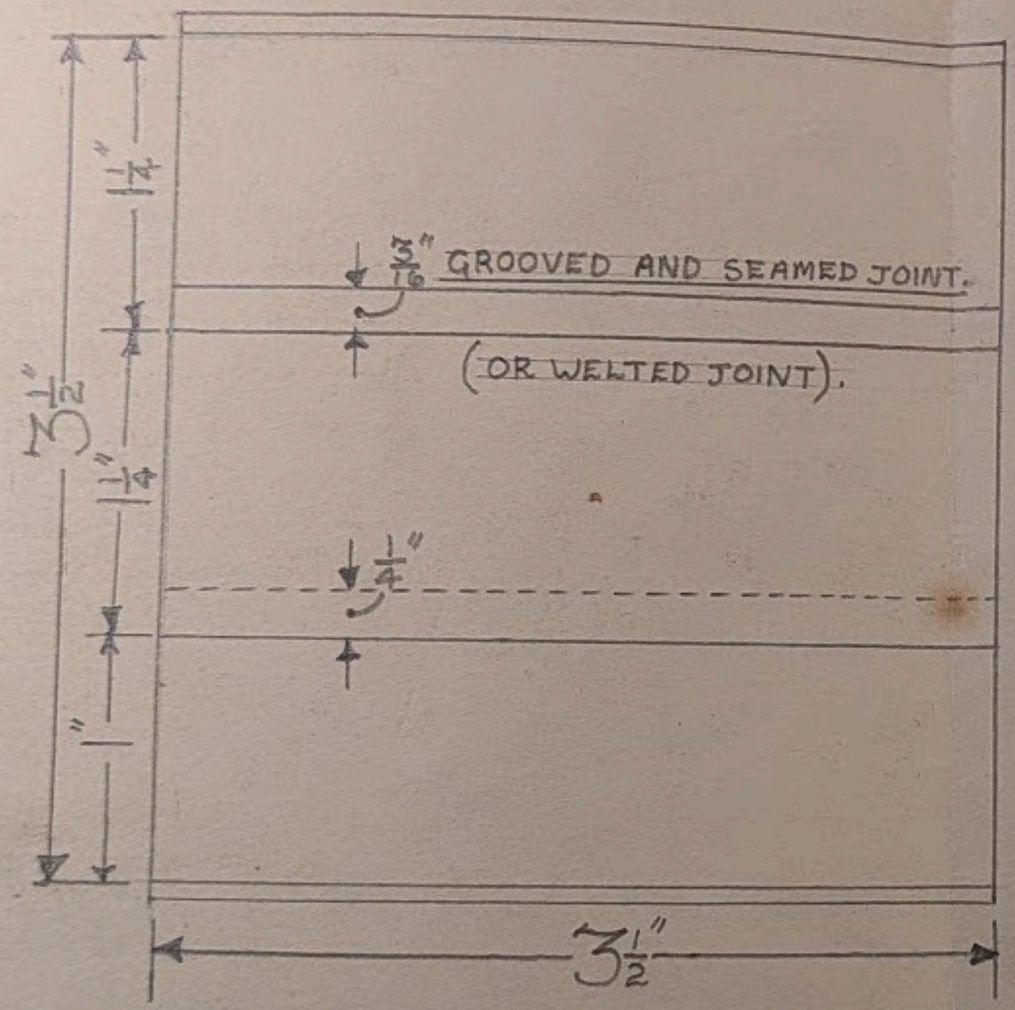
(1) Flat (or diamond pointed) drill: This type was universally used years ago, and is still occasionally used where a simple and cheap tool is required. It is easily made from flattened tool steel, rod or bar, hardened and tempered, and then ground to shape (see diagram). It is suitable for Brass but is an inefficient tool, scraping rather than cutting, producing out of round holes and tending to wander in

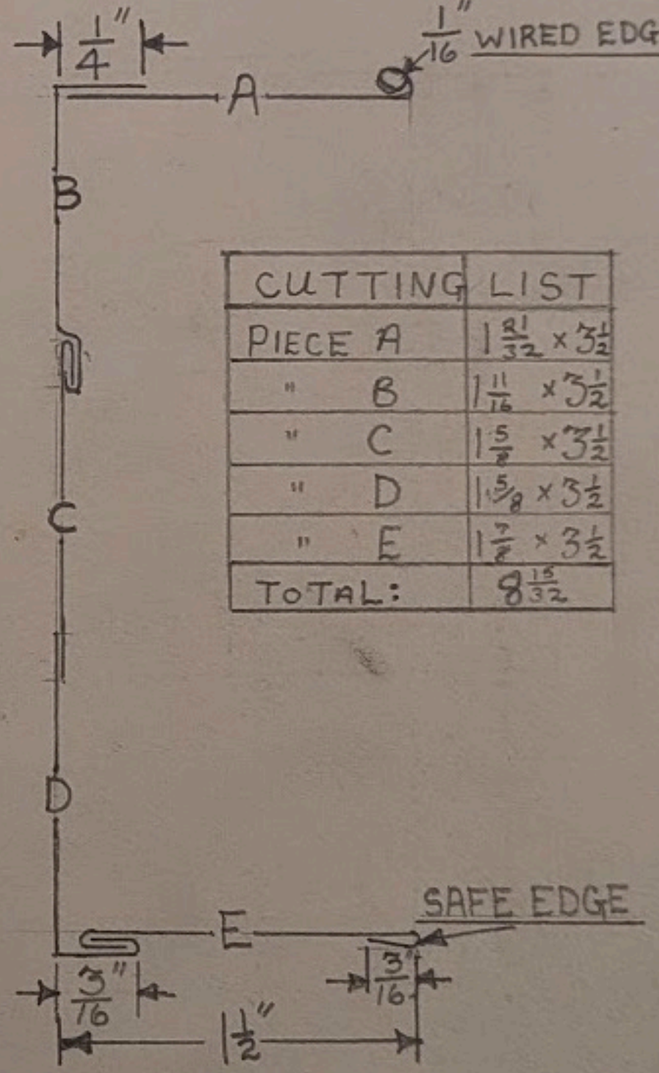
deep holes.

2). Straight fluted drill: This is an improvement upon number one but still depends upon a scraping action. It is again useful for Brass and for thin sheet where the upright flutes help to prevent the drill catching as the tool breaks through the opposite side of the metal.

3). Twist Drills:

These were developed by the American engineer Henry Morse, who "twisted" the fluted drill giving it true cutting edges. It is now universally used, being made from carbon or high speed steels, Originally fluted on a milling machine and accurately sharpened on a automatic grinder. These drills can be relied upon to give a perfect hole, accurate in size, truly circular, and straight in vertical section if the condition of the





CUTTING	LIST
PIECE A	$1\frac{21}{32} \times 3\frac{1}{2}$
" B	$1\frac{11}{16} \times 3\frac{1}{2}$
" C	$1\frac{5}{8} \times 3\frac{1}{2}$
" D	$1\frac{5}{8} \times 3\frac{1}{2}$
" E	$1\frac{7}{8} \times 3\frac{1}{2}$
TOTAL:	$8\frac{15}{32}$

R. OLESEN. | TINPLATE EXERCISE. | FORM: 5A.

drill and the requisite angles are maintained. The flutes decrease in depth from the point to the shank thus increasing the size of the web. This fact must be borne in mind when using a worn-down drill or resharpening a snapped off drill. Morse twist drills can be obtained with either parallel or taper shanks.

Twist drill sizes.

Three sets of drills are normally used in Great Britain though a fourth, metric size is obtainable. The three sets are :—

(a) Fractional sizes — Ranging from 1/32" diameter to 2" diameter in 1/64" steps. Larger than 2" diameter can be obtained on order.

(b) Number drill (Wire gauge) — Numbered from one to eighty. Number One being the largest and number eighty being exceptionally small. Numbers One to sixty comprise the normal set of number drills. Number one is equivalent to .228" Number two is equivalent to .221" Numbers three

is equalent to .213" etc until number 78 is equivalent to .016 and number 79 is .014" and 80 is .0135

(c) Letter drills (Letter gauge) - named from A to Z, Z being the largest. These drills continue increasing in size from where the number drill ends for example letter drill 'A' is equivalent in diameter .234" & B = .238 and 'C' = .242 and so on until 'X' = .397 and Y = .404" and Z = .413" dia.

Tables are available giving the equivalent sizes in decimal fractions of an inch of all three sets of drills. By using these sets of drills a range of holes from 13½ thousands of an inch up to ½" in diameter with only two or three thousands of an inch difference between each hole can be obtained.

---

(4) Slocombe combination centre drill:

This special type of drill combines both a small drill and a countersink of 30° sides. It carries out the two operations of drilling and countersinking in one operation and it is primarily used in preparing the ends of bars to fit lathe centres ready for turning. It is normally double ended

drill and the requisite angles are maintained. The flutes decrease in depth from the point to the shank thus increasing the size of the web. This fact must be borne in mind when using a worn-down drill or resharpening a snapped off drill. Morse twist drills can be obtained with either parallel or taper shanks.

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and is available in a small range of body and point sizes.

(5) Countersinking cutter:

In order that woodscrews or countersunk headed machine screws shall rest flush with the surface, a 90° chamfer around the hole into which they fit is required. This is produced by a countersinking cutter.

(6) Counter bore: (or peg drill)

This is used similarly to a countersinking cutter but allows cheese headed screws to be set in flush with the surface.

A simple form of peg drill is also shown.

(7) Flat Bottomed Drill:

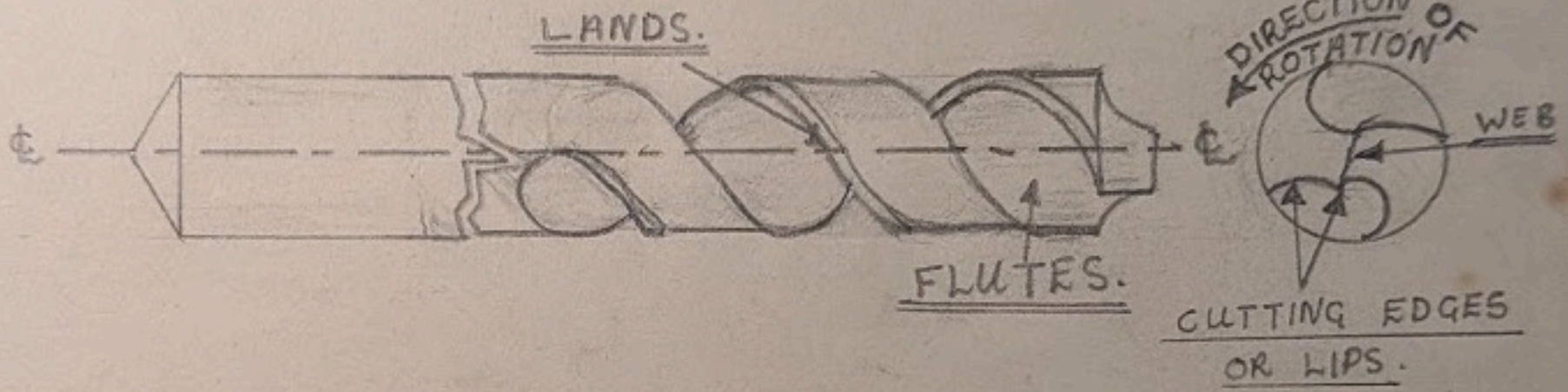
This is like a peg drill without the peg and is used for cleaning out or squaring the bottom of a blind hole where this should be required.

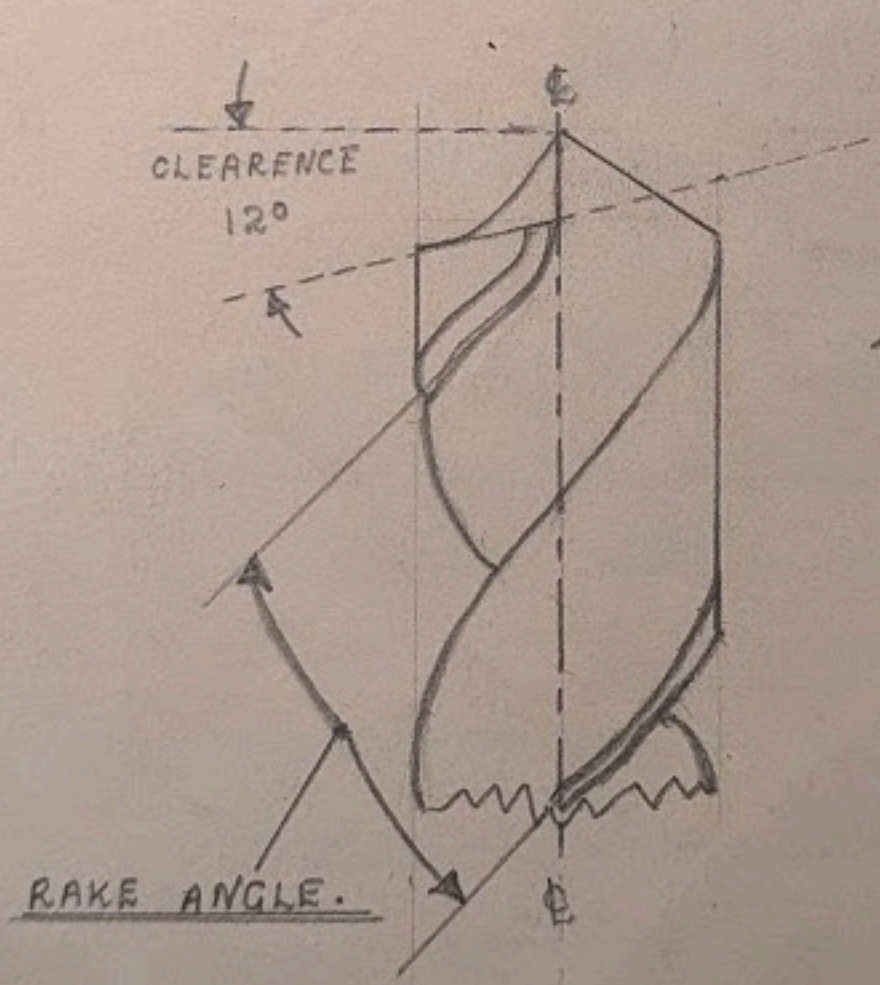
(8) Tank and washer cutter:

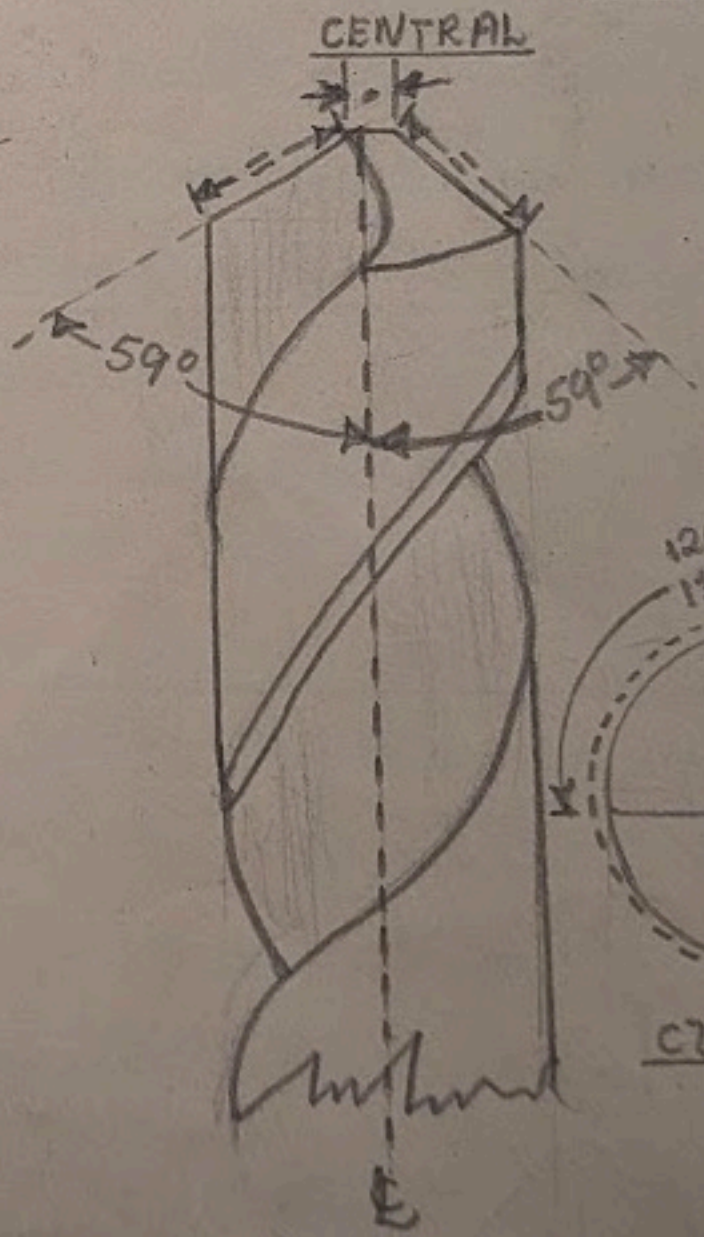
This is a form of drill designed for cutting large holes in sheet metal, consisting of a central twist drill and a cutter mounted on the central stem, adjustable in relation to the central drill. The whole is used in a

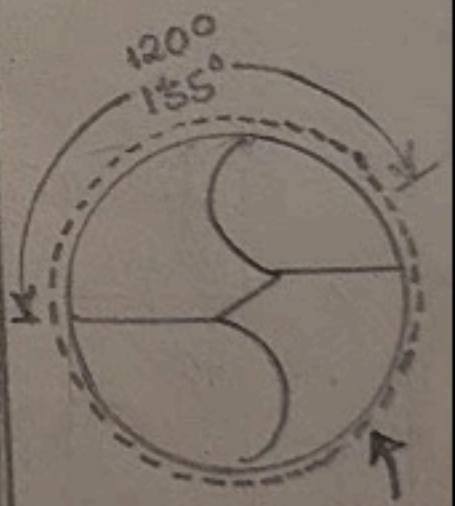
hand brace (carpenters) the cutter moving around perpendicular of the desired hole cutting out the waste in the form of a washer

DETAILS OF TWIST DRILLS:

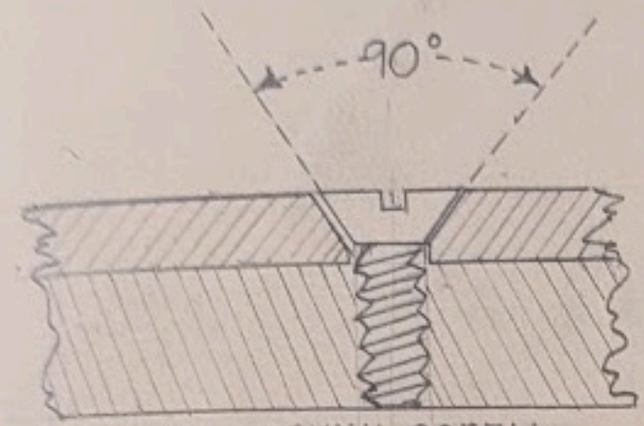




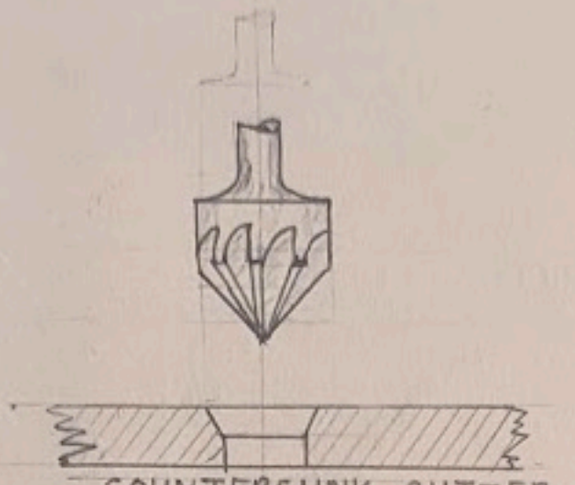




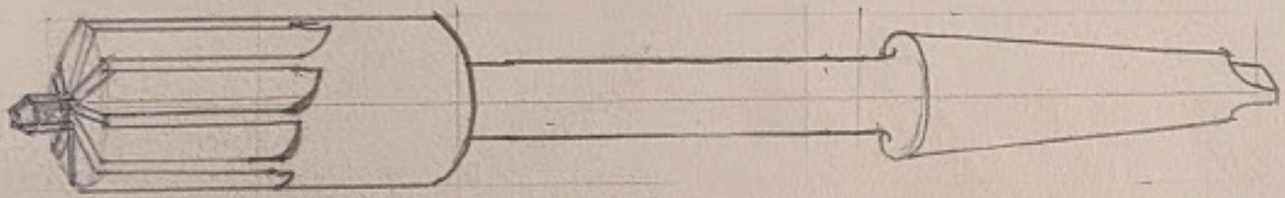
SPECIAL TYPES OF DRILL:



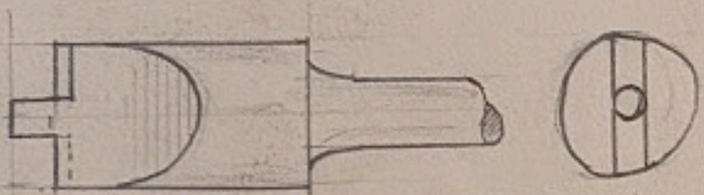
COUNTERSUNK SCREW.



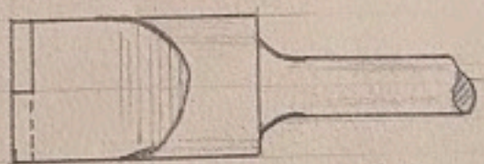
COUNTERSUNK CUTTER.



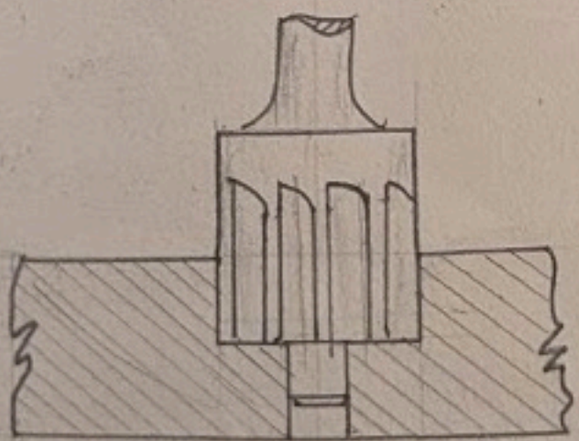
COUNTERBORING CUTTER



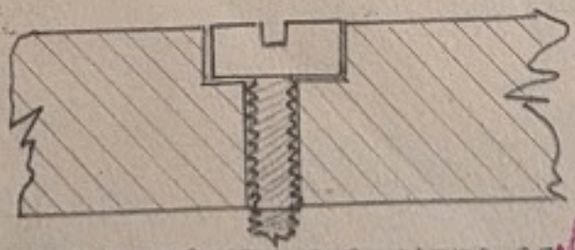
SIMPLE COUNTERBORE OR PEG DRILL.



FLAT BOTTOM DRILL.

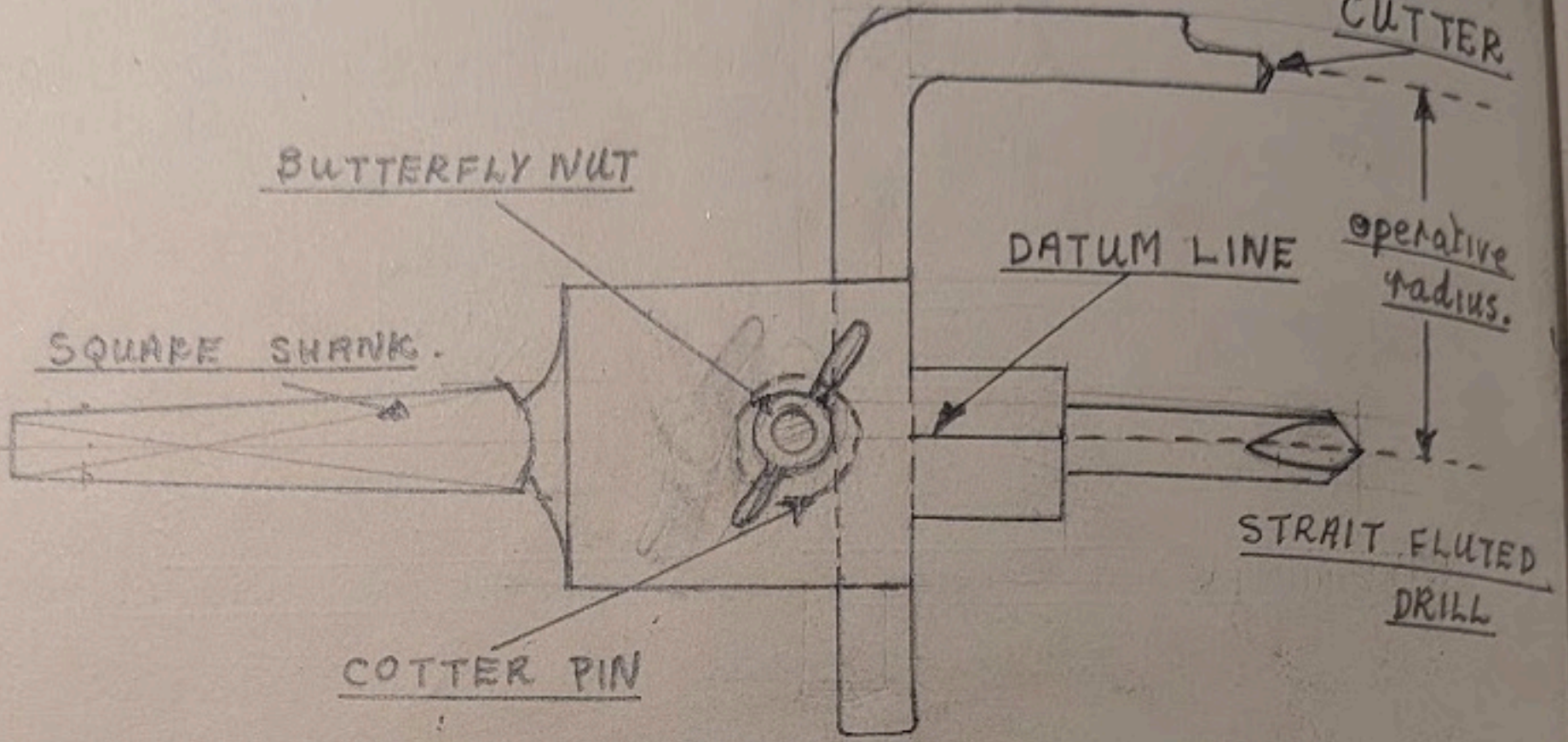


COUNTER BORING.



COUNTERBORE FOR HEAD OF CHEESE HEADED SCREW.

25-1-15


CUTTER
BUTTERFLY NUT
DATUM LINE
operative radius.
SQUARE SHANK.
STRAIT FLUTED DRILL
COTTER PIN

TANK CUTTER

RIVETS AND RIVETING

Riveting provides a permanent and rigid method of joining metals, except where a single rivet may be employed as a pivot pin. The method is used extensively in boiler-work, shipbuilding, structural work, as bridges, building structures etc, and on sheet metal work too large for soldered joints as brackets, milk churns, ventilator ducts. The most common form is the snap-head rivet but where the round head is inconvient the countersunk rivet allows a flush surface. Other types are shown in the sketches. Rivets may be made of steel, soft Iron, brass, copper, aluminium.

For forming the head of a snap head rivet, an amount 1½ times the diameter of the rivet should be left protruding from the materials to be riveted, while for a countersunk rivet an amount equal to the diameter of the rivet should be allowed.

In riveting two pieces of metal together, the required number of holes should be punched or drilled in one piece only, the second piece should have one hole drilled or punched and the two pieces of metal joined by one rivet.

SNAP HEAD

PAN HEAD

FLAT HEAD.

MUSHROOM HEAD.

COUNTERSUNK HEAD.

DEEP COUNTER-SUNK HEAD.

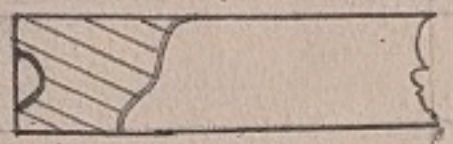
HOOK HEAD.

CONICAL HEAD.

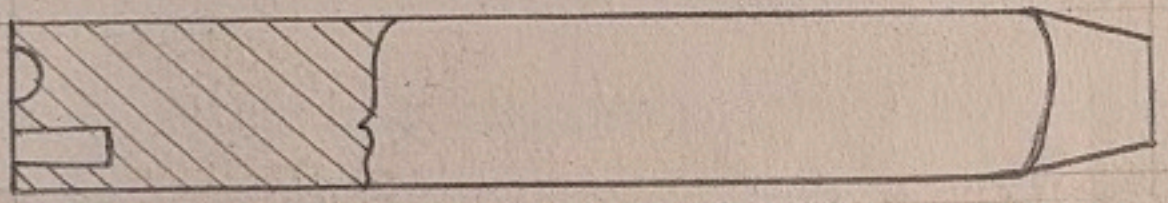
BIFURCATED RIVET.

TUBULAR RIVET.

RIVET SET.



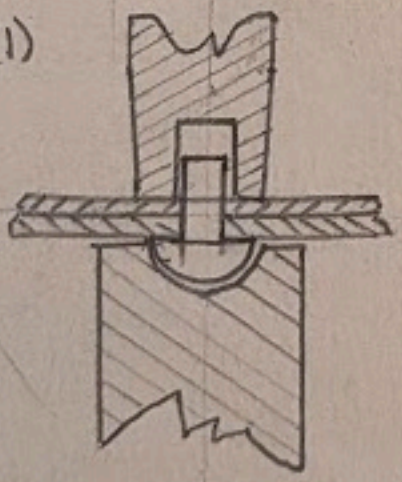
RIVET SNAP.



COMBINED RIVET DOLLY.

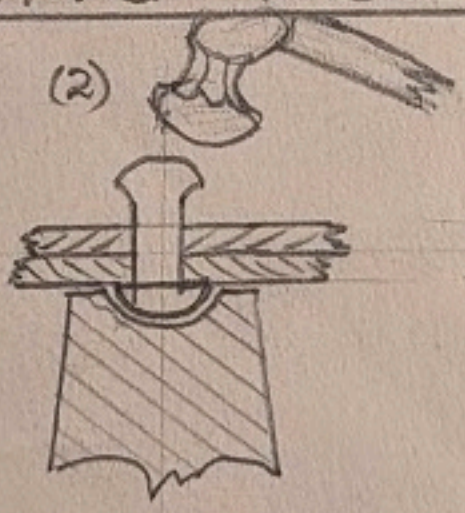
RIVETING DOLLIES.

(1)

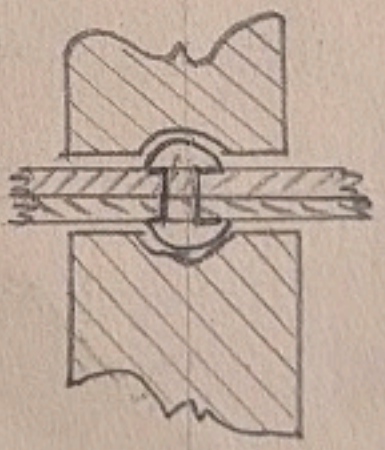


PLATES 'SET' DOWN BY RIVET SET.

(2)



HEAD FORMED BY HAMMERING.

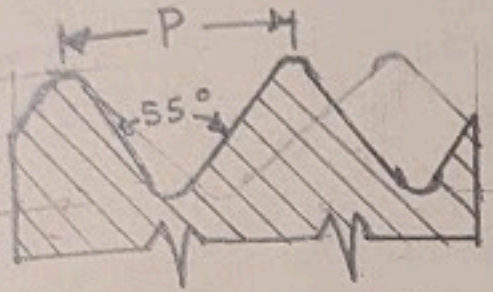


HEAD FINISHED WITH RIVET SNAP.

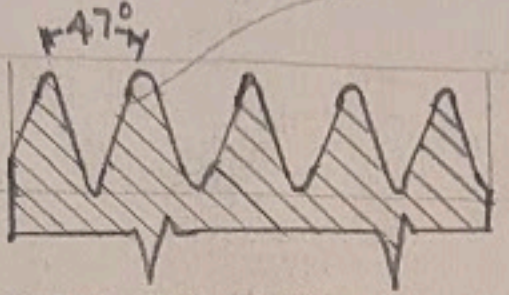
Further holes may then be drilled and riveted one-by-one along the joint. This ensures that the holes coincide throughout the length of the work. When the rivets is in place the metal should be made to bed well up to the head of the rivet by tapping a rivet set around its tail, the head is then formed by a succession of light blows with a ball-pined hammer and completed with a 'cup tool' or a 'rivet-snap'. Hot riveting which is used extensively in Industry, having the advantage of closing joints tightly by the contraction of the rivet on cooling, is seldom used in handicraft-work.

SCREW THREADS AND SCREW CUTTING:

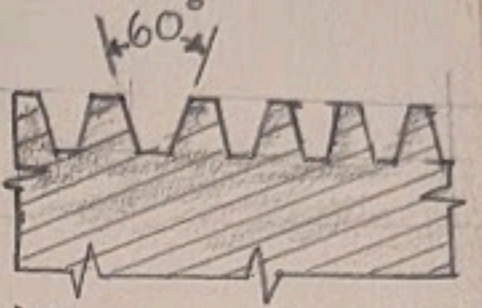
THREAD FORMS:



B.S. WHITWORTH (WHIT) BRITISH STANDARD FINE. (B.S.F)



BRITISH ASSOCIATION (B.A)



"SELLERS" THREAD (STANDARD AMERICAN)

ROAD SAFETY

1 Never run straight out on to the road when you leave the school premises, or when you leave your home.

2 Before you cross the road look to see that no traffic is coming from any direction.

3 Never cycle in to the school gate, and don't cycle out of the school premises.

4 Never run into the road behind or in front of a stationary vehicle.

5 Always cycle on the left side of the road, and keep in single file.

6 Don't play on the road.

7 Never try to get a free ride on or behind a vehicle.

8 See that your bicycle brakes and tyres are in good order.

9 Above all don't take risks.

10 When on a road without a footway, walk on the right side of the roadway, thus facing the approaching traffic.