

TRADE OF VEHICLE BODY REPAIR

PHASE 2

Module 2

UNIT: 1

Tools



Produced by

SOLAS

An tSeirbhís Oideachais Leanúnaigh agus Scileanna
Further Education and Training Authority

In cooperation with subject matter expert:

Maurice Stack

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Introduction

Hand Tools used in Body Repair Work

Mass production methods have made the present day motor car such that it requires special techniques, skills and tools for the rectification of body damage. Specialist tools have been designed to suit the varying contours and shapes of the present all-steel bodies and panels. These tools are made of high-carbon tool steel, which is forged and then heat treated to give long service in the hands of a skilled body repair worker. In a body repair toolkit the basic tools are the hammer and the dolly. All other tools have been developed around these, giving us the specialist tools which are now currently available. A repair job cannot be successfully carried out before one has completely mastered the skill of using the planishing hammer and dolly in coordination with each other, as this skill is the basis of all body repair work involving the use of hand tools.

Unit Objective:

Tools

By the end of this unit each apprentice will be able to:

- Name vehicle body repair tools and indicate their purpose.
- Display the method of holding vehicle body repair tools to maximize control and reduce fatigue.
- Maintain tools correctly
- Define terms used in body repair work.
- Identify the dangers involved in the use of vehicle body repair equipment.

Key Learning Points:

- Safe work practices
- Names and functions of tools
- Methods of holding tools
- Maintenance of tools
- Storage of tools
- Terms used in body repair work (tools)

1.0 Panel Strength and Distortion

The construction of body panels are ‘stamped’ out of flat sheets of light gauge metal by mechanical presses, each using a set of dies. The two dies are shaped to the part they stamp; the lower die is stationary while the upper die moves up and down, operated by the pitman. As the press operates the steel sheet is squeezed between the dies to form a finished part. Presses are used for forming, piercing, bending and punching. Some dies being designed to perform two or more operations at any one time. The quality of panels produced at one run in the press shop contributing to low cost production of body shells. One of the most common methods used to strengthen a flat sheet of metal is to curve it. The amount of increased strength being proportional to the height of the curve or crown.

Before the sheet is formed in the press it can be assumed that the grain structure is constant and the thickness uniform throughout. When the metal is formed it is bent beyond its elastic limit because its shape is permanently changed or set. The outer surface stretches (or lengthens) while the inner surface shrinks (or shortens). The pressure exerted on the metal by the press also changes the grain structure to harden the surface layers.

Bending of metal is used to give strength to components: consider a flat sheet metal strip, it has very little strength and bends easily. Now bend up the edges at right angles on both sides into a ‘U’ shape and the resulting channel section is very strong. Attachment of a ‘U’ channel is difficult: so that a top-hat section (that is the channel with the edges bent again through 90°) forms an ideal section for underbody and other frame structures.

Outer body panels unsupported over large areas, are given strength and stiffness by right angle bending or flanging at the edges, a similar effect can be obtained by building into the design curves or ridges passing across the panel.

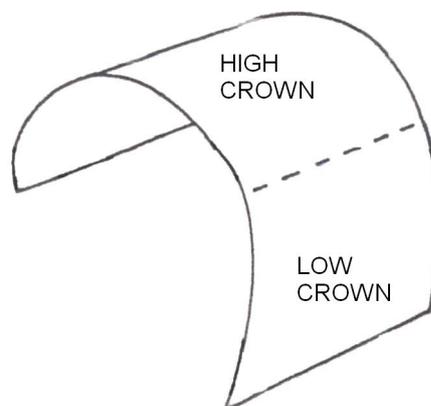


Figure 1: Panel Strength

When a sheet metal panel is bent by accidental force, or impact the force passes through the panel to give an area of direct damage at the point of contact and a wider area of indirect damage. This action leaves a series of valleys, V channels or buckles across the surface, the ridges that appear being hard, rigid areas.

In accident repair work it is important to know or determine the direction of the force causing the damage, so that exactly the opposite sequence is applied to correct it. This means that in general the indirect damage is corrected first and direct damage last.

2.0 Methods of Holding Beaters and Beating

The amount of corrective force required will depend on the gauge of metal to be straightened and the extent of the damage. The repairer can control the intensity of the blows to be delivered. Body and arm movement can be varied from light blows, controlled by finger movement or wrist movement. Blows that can be developed from the elbow or shoulder, even two-handed blows involving movement of the body from the waist. The actual force delivered to the metal surface will also depend on the weight of the beater used. The weight and size of the dolly or spoon and indeed the area of actual contact with the panel will be factors to take into account. Too great a force between beater and dolly can stretch the metal locally (fig 2) moving it outwards or inwards, as the metal cannot move sideways to be absorbed within the panel. This action will involve further correction by shrinking.

The operation of beating metal is the highest skill in the whole business of vehicle body repairing. The ability to control the intensity of the blows delivered, together with the knowledge of how and where to direct the blows, anticipating the result to be expected is the mark of the expert. Expertise can only be achieved by continued practice, once the basic requirements are understood.

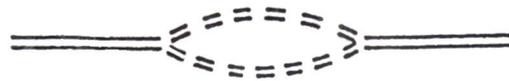


Figure 2: Stretching of Metal

To develop striking power using the fingers only, hold the beater as in figure 3. Note that the forearm is held at an angle of about 20° to the horizontal and remains in that position throughout.

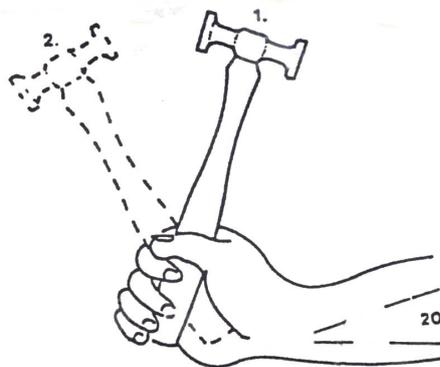


Figure 3: Holding of a Beater

When trying this method of beating for the first time only very light blows may be possible. Strength in the fingers can only be developed by practice. Throw the head of the beater at the palm of the hand, without movement of the wrist or elbow. Alternatively, use a block of soft wood to show up if the blows are being received squarely.

Striking with the combined action of the fingers and wrist can be developed by following through from the above description by added wrist action. The movement from 1 to 2 in figure 4 is achieved in exactly the same manner as described above. A follow through action of the wrist will cause the beater to make contact with the panel at position 3.

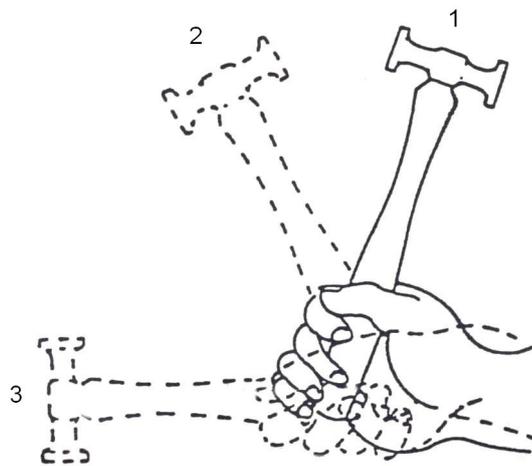


Figure 4: Holding of Tools

Some difficulty may be experienced at the initial attempt to strike with this co-ordination of movement so that practice is again essential. Heavier blows for roughing-out purposes become more in line with the natural movement of the elbow and shoulder, as in the use of ordinary hammer so that no description is deemed to be necessary here.

In the early attempts at panel beating, some difficulty may be experienced in aiming the beater at the panel to strike squarely on to a dolly below. Place a small dolly below the panel and tap the top surface lightly with the beater. Find the high surface of the dolly by checking for maximum rebound. Once this can be achieved, move the dolly about, following the movement with the beater to develop co-ordination until fairly rapid action is possible.

3.0 Metalworking Techniques

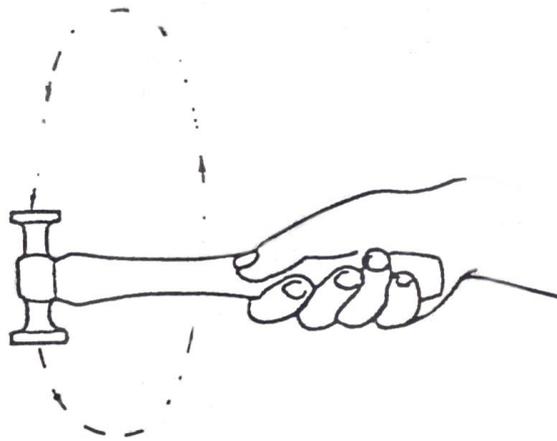
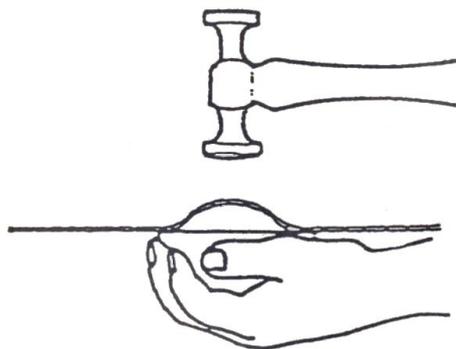


Figure 5: Beating Techniques

Beaters should be well-balanced i.e. the length of the shaft should give a feel of balance, when the tool is held in the hand at a point about three quarters of the shaft length from the head. The handle should not be gripped

tightly, as it can cause fatigue in the arm muscles when beating over extended periods. When beating on metal the blows should land squarely on the surface. In all dinging operations the beater should travel in a circular path (fig.5) with rhythmic action of some 100 to 120 blows per minute. In this manner the metal receives a sort of sliding, or glancing blow resulting in but a small area of contact with the surface. To level out a panel the beater should be moved about in regular rows striking the metal at intervals of about 1cm, with light blows until leveling is completed. Beaters of sufficient size and weight, such as roughing-out and bumping are often used alone, or in conjunction with a piece of hardwood to raise the elastic areas of the metal. The non-elastic outer ridges are then re-shaped by 'spring-beating' or 'on and off' the dolly techniques. On the dolly or direct beating is shown in figure 6 the dolly is selected, so that its contour to be held under the ridge is near to the original shape of



the panel at this spot. Beating is then directed at the peak of the ridge, commencing with light blows, increasing in intensity to a level, sufficient to push the ridge back. Work along the ridge from end to end in a progressive manner.

Figure 6

In the case of a ridge with an associated depression on one side 'of the dolly' or 'indirect' beating is applied. Again the dolly is selected to be close to the original panel shape and held under the depression (fig.7).

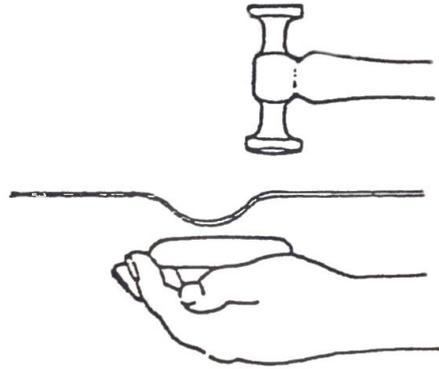


Figure 7

Beating on the ridge away from the dolly will cause a reaction to produce an alternating impact on the panel. First the impact with the beater and then the impact from the dolly alternatively until the depression is removed. 'On the dolly' beating can then be resorted to

bringing the panel up to the final stages of leveling. In panel finishing (fig.8) small low areas should be raised by using the side of the round face of the beater, initially. The surface is now checked with the body file, to highlight any remaining low spots. Each spot should be raised individually with a blow, or a series of tiny blows with the pick. Care must be taken not to strike the low spots too hard, otherwise they will become rough and pimply the metal is stretched and subsequent shrinking may be necessary. Use of the body file on the metal in a pimply condition can cut out holes in the panel if the low spots have been picked up smoothly. This finishing operation requires a considerable amount of patience, a great deal of skill and a good 'eye' if it is to be carried out efficiently.

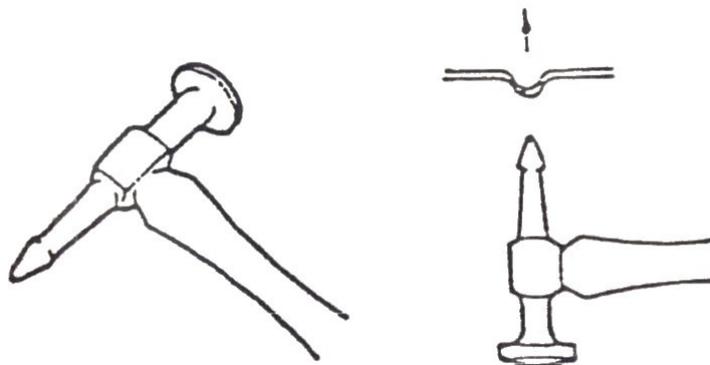


Figure 8

4.0 Vehicle Body Repair Tools and Their Purpose

4.1 Hammers

Planishing Hammer

The planishing hammer or panel hammer is used more than any other tool in the body repair trade and for this reason the best hammer available should be obtained. The principal purpose of the panel hammer is the smoothing and finalising of a panel surface after it has been roughed out to the required shape. The planishing hammer should have a true and unmarked face, and it must be kept polished and free from road tar, underseal and paint, which readily adhere to its working faces during use. This tool is designed solely to be used in conjunction with a dolly block, it must never be used for chiselling or any other work which might mark or impair the faces of the hammer, for if the face of the hammer became marked the marks would be transferred to the surface of the panel. These particular hammers are generally made with one face square. This face is usually flat, while the other, round end is slightly domed or crowned. However, hammers are available with the square end domed and the round end flat or alternatively with both faces flat or both faces crowned. In practise the square end which is usually flat, is used for planishing on a curved surface of a panel, or in corners or against swaged recessed sections and the crowned end for reasonably flat panels. The difference in the faces stops the panel surface being marked with the edge of the hammer when used in conjunction with dolly block. The weight of the planishing hammer for general and new work ranges from 12oz (340g) to 16oz (450g) and the handles which are usually very thin at the neck of the shaft for balance purposes, are made of hickory or ash to give the hammer a good rebound action when used with a dolly block.

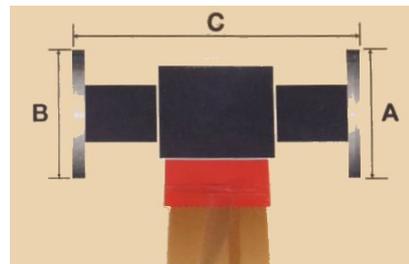
Features:

- High quality investment casting alloy steel head with hardened striking surface.
- Fine quality octagonal wooden shafts fitted as standard.
- Wood and steel wedged handles ensure maximum head retention with improved safety.
- The heads have a tapered centre allowing the shaft to expand into the head and is secured with a double wedge.

- Blue band on handle – Flat Face
- Red band on handle – Crowned Face
- Forged alloy steel to British Standards

BS4114 forging

EN9 alloy steel



Standard Bumping Hammer

This hammer is used for initial roughing out of work on damaged panels. It is also used for finalizing and finishing. The round face is $1\frac{3}{8}$ (35mm) in diameter and the square face is $1\frac{1}{2}$ in (38mm) square and the total weight is 14oz (395g). The hammer is made with either flat or crowned faces.

Panel Beater – Standard Bumping 056100oo			
Medium-weight, crowned face panel beater suitable for straightening thicker gauge metals where significant corrective force is required.			
Technical: 056100oo			
ØA (mm)	B (mm)	C (mm)	Weight (g)
41	38	97	425



Panel Beater – Standard Bumping 056000oo			
Medium-weight, flat face panel beater suitable for straightening thicker gauge metals where significant corrective force is required.			
Technical: 056000oo			
ØA (mm)	B (mm)	C (mm)	Weight (g)
41	36	97	425



Panel Beater – Standard Bumping 056200oo/056800oo			
Light weight flat or crowned face beater suitable for applying measured force in areas of light damage or on thinner gauge metal are also available.			
Technical: 056200oo			
ØA (mm)	B (mm)	C (mm)	Weight (g)
32	25	89	368
Technical: 056800oo			
32	25	89	368

Light Bumping Hammer

This tool is ideal for work on light gauge materials. It is used in the same manner as the standard bumping hammer.

(a) Bumping Hammer
(crowned faces)

(b) Bumping Hammer
(flat faces)

(c) Light Bumping hammer
(crowned faces)

(d) Light Bumping
Hammer (flat faces)

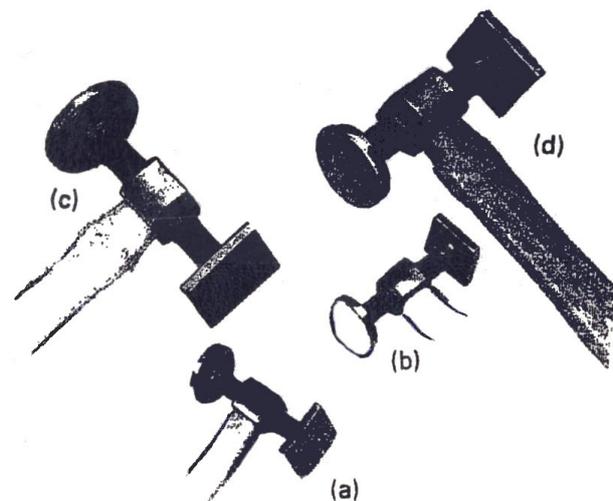


Figure 9: Bumping Hammer

Dinging Hammer

This hammer (a and b fig 10) is a long-reach planishing hammer and is designed for careful, controlled finishing work. It is extremely well balanced and gives a very good finish when used correctly. Hammers can be obtained for light or heavy work with weights from 12oz (340g) to 18oz (510g).

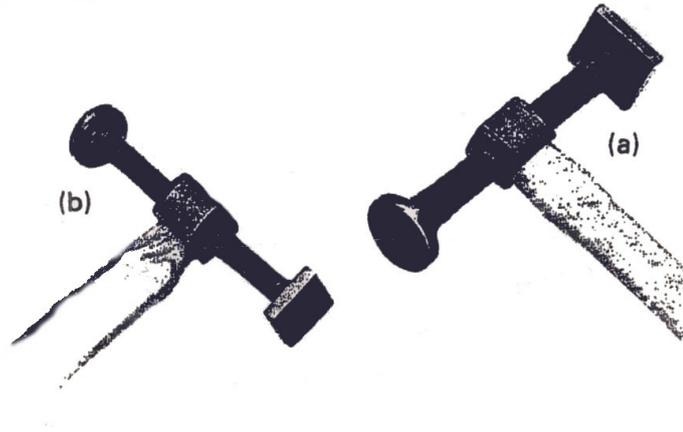


Figure 10: Dinging Hammer

Dinging Hammer 056300oo			
Technical: 056300oo			
ØA (mm)	B (mm)	C (mm)	Weight (g)
30	27	146	425

Shrinking Hammer

Shrinking hammers are similar in design to a normal planishing hammer but have faces which, instead of being smooth, are serrated giving a cross-milled effect like a file. The purpose of the serrations is to achieve a shrinking affect when the hammer is used in conjunction with a dolly block. This is caused by the fact that the contact area between hammer and metal is greatly reduced by the serrations on the face. This tool is used largely when beating the surface on over-stretched panel areas which have to be hot-shrunk in order to return them to their normal contours. Hammers are available for light or heavy shrinking, according to the depth of the serrations.

Shrinking Hammer 053900oo

Heavy duty flat face shrinking hammer, specifically designed for panel beating. To be used in areas where the deformation requires more marked shrinking.

Technical: 053900oo

ØA (mm)	B (mm)	C (mm)	Weight (g)
48	41	97	539

**Pick and Finishing Hammer**

This tool is used in place of, or in conjunction with, the planishing hammer. Its main use is to pick up small, low areas on the surface of a panel which is in the process of being repaired by planishing. On panels that are reasonably flat, such as door panels, parts of roof panels and bonnets, this method of raising low areas is quick and if carried out correctly, does not unduly stretch the metal.

To lift a low area with a pick hammer, one or two taps with the pick end of the hammer are directed from underneath the panel under repair to the centre of the low area. The blows stretch the metal sufficiently to raise the surface surrounding the point of the low spots where the blows were struck. This slightly raised area is next tapped down lightly with a planishing hammer or the finishing end of the pick hammer on to a suitably shaped dolly block and the panel is finished off by filing with a panel file. When one becomes proficient in using this tool it is possible to raise the surface with light blows and finish off by filing only. However, without sufficient experience there is danger of overstretching the metal owing to the inability to direct the blow accurately on to the low area under repair. The pick and finishing hammer has a pointed end which is suitable for removing low spots and is also a useful finishing hammer, having a crowned surface on a round face of 1½ in (38mm) diameter.



Pick and Finishing Hammer 053000oo			
Technical: 053000oo			
ØA (mm)	B (mm)	C (mm)	Weight (g)
38		135	430

Straight Pein and Finishing Hammers

These hammers are used in a similar manner to the pick and finishing hammer, but are designed with either a straight or a curved peined end which acts like a chisel.



Straight Pein and Finishing Hammer 056500oo			
Technical: 056500oo			
ØA (mm)	B (mm)	C (mm)	Weight (g)
41		130	425

Curved Pein and Finishing Hammer

This tool is identical in use to the straight pein and finishing hammer except that its curved pein end allows for greater flexibility in dressing out sections which are difficult to work on owing to their awkward shape or position.

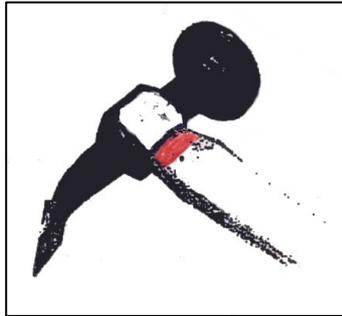


Figure 11: Curved Pein and Finishing Hammer

Curved Pein and Finishing Hammer 053700oo			
Technical: 053700oo			
ØA (mm)	B (mm)	C (mm)	Weight (g)
41		142	425

Fender Bumping Hammer

This tool has a long curved head with one face which is circular to reduce the effect of stretching the metal when in use this hammer is used for roughing out and dressing out damaged sections on panels to restore them to their correct shape and curvature before planishing begins. The heavy weight of this hammer, together with the curve, makes it very effective for hammering out difficult and inaccessible sections.

Figure 12: Fender Bumping Hammer



Fender Bumping Hammer 057000oo			
Technical: 057000oo			
ØA (mm)	B (mm)	C (mm)	Weight (g)
28		209	980

Engineers Ball Pein

Used for striking chisels, punches, rivets etc. and for general engineering use.



Mallets

Mallets can be of the round or pear-shaped type made from boxwood or lignum vitae, or can be rubber, aluminium, plastic or hardwood fitted to ash handles, to form a complete mallet. Standard round mallets have cylindrical heads. Bossing mallets combine the hemisphere and cone; sometimes referred to as a ‘pear shaped’ mallet. Both patterns are now available in other materials, such as rubber, rawhide and the softer metals, as in copper-faced mallets.

Rubber mallets with interchangeable screw-on heads are ideal for use on aluminium and may be used in the manufacture of panels in sheet steel. Hollowing (figure 13) is a process of thinning metal from the centre of a given blank, to produce a double-curvature panel. This can be accomplished by the use of a bossing mallet and a sand-bag. Beating of the metal commences in the centre of the plate, working outwards in increasing circles, until the required curvature is obtained. Uniformity in the intensity of the blows is important to produce a regular shape. Raising is an opposite effect in which the metal is thickened up at the edges. The method is to produce a series of ‘puckers’ in the edge of the panel by malleting or ‘blocking’. The puckers are then worked out to the edge of the panel with a bossing mallet and a suitable dolly. Care must be taken to hold the metal in the pucker and use the mallet to disperse the excess metal into the adjacent plate as the pucker is worked out.

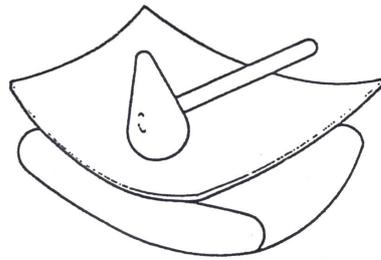


Figure 13: Hollowing

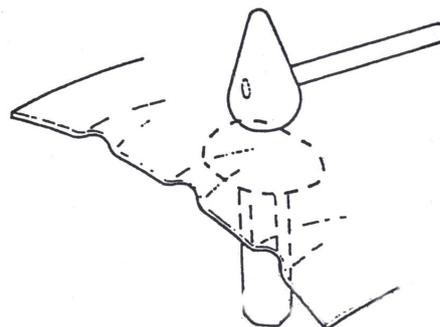


Figure 14: Raising

Rubber mallets, with interchangeable heads, are ideal for use on aluminium and may be used in the manufacture of panels in sheet steel.

No. 053100 Rubber Faced Mallet

The aluminium head of this mallet is fitted with screw-in rubber faces which are easily replaceable, supplied with one flat and one coned face.

Replacement Heads for Rubber Mallet

No. 053112 Flat Face.

No.053111 Coned Face.



Copper/Rawhide Hammer 053200oo

A useful addition to any body shop toolkit, handy when refitting rubber boot and door opening seals.



Bossing Mallet 056700

Combination round and coned faces. Lignum vitae or Canadian rock maple head and ash handle.

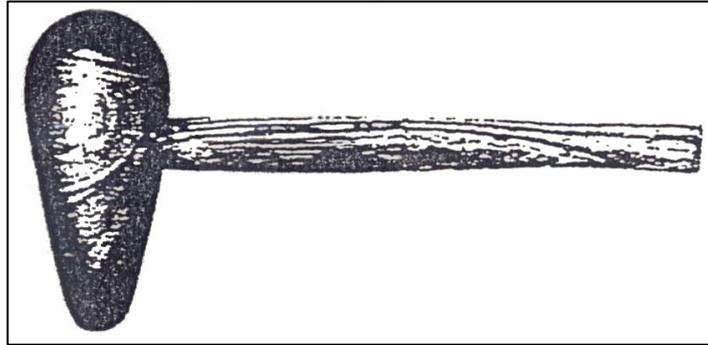


Figure 15: Bossing Mallet

4.2 Hand Dollies

These are cast or drop forged steel blocks, heat treated to provide the correct degree of hardness. The shapes of the dolly blocks have been designed to provide a working surface that is highly polished and suitable for use on many contours found on motor vehicle bodies. They are used in conjunction with the planishing hammer or beating file and act as a support or anvil to smooth out the surface area of panels that have been damaged. These dollies, together with the planishing hammers are the most essential tools for the panel beating trade. Obviously one dolly block will not be suitable for all shapes requiring planishing; therefore it is advisable to have a set of these dollies which would be suitable for a wide range of the shapes and contours encountered on the ever-changing body styles of the modern motor vehicle.

When selecting a dolly block for a particular job, it should always be remembered that as flat a dolly block should be used as possible for the job in hand, then the dolly will not only cover the panel area quicker because of its bigger face area, but smooth out the metal without excessive stretching. When working on panel contours it must be borne in mind that a dolly block having a high-crowned surface, hence the choice of block depends on whether the particular section under repair needs to be stretched quickly or just smoothed and planished without stretching.

It is very common for the faces of the dolly blocks to become coated with paint, road tar or anti-drum compounds which it picks up from the underside of panels under repair. This coating must be removed from the surface of the dolly block so that when it is used with the hammer there is a metallic contact (metal to metal) between the dolly block, work and hammer. This contact should be heard as a ringing noise if successful planishing is to be achieved. Various dollies are shown in figure 16.

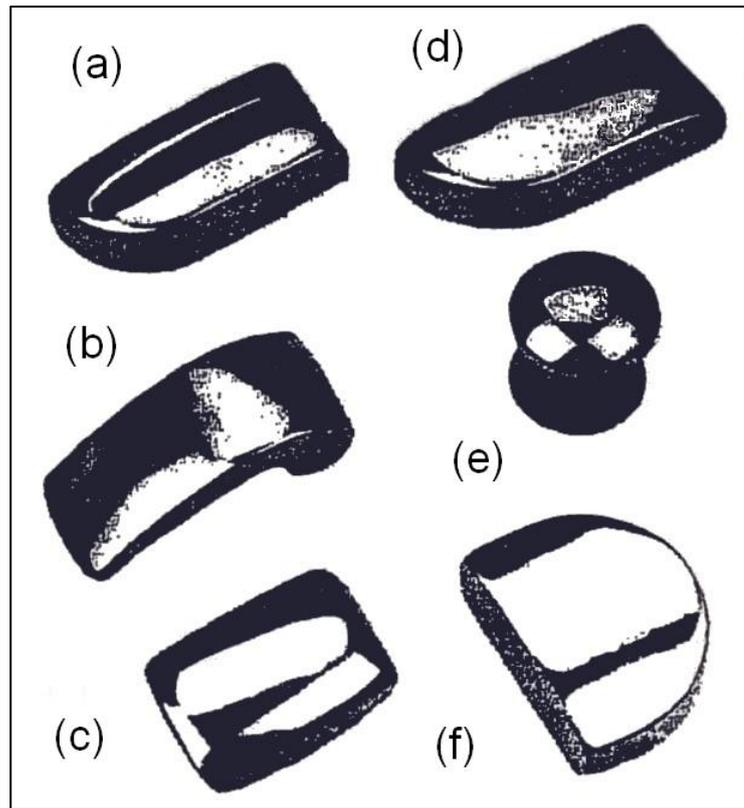


Figure 16: Various Dollies

- (a) Shrinking Dolly
- (b) Lightweight Curved Dolly or Comma Block
- (c) Regular Dolly
- (d) Toe Dolly
- (e) Round Dolly
- (f) Heel Dolly

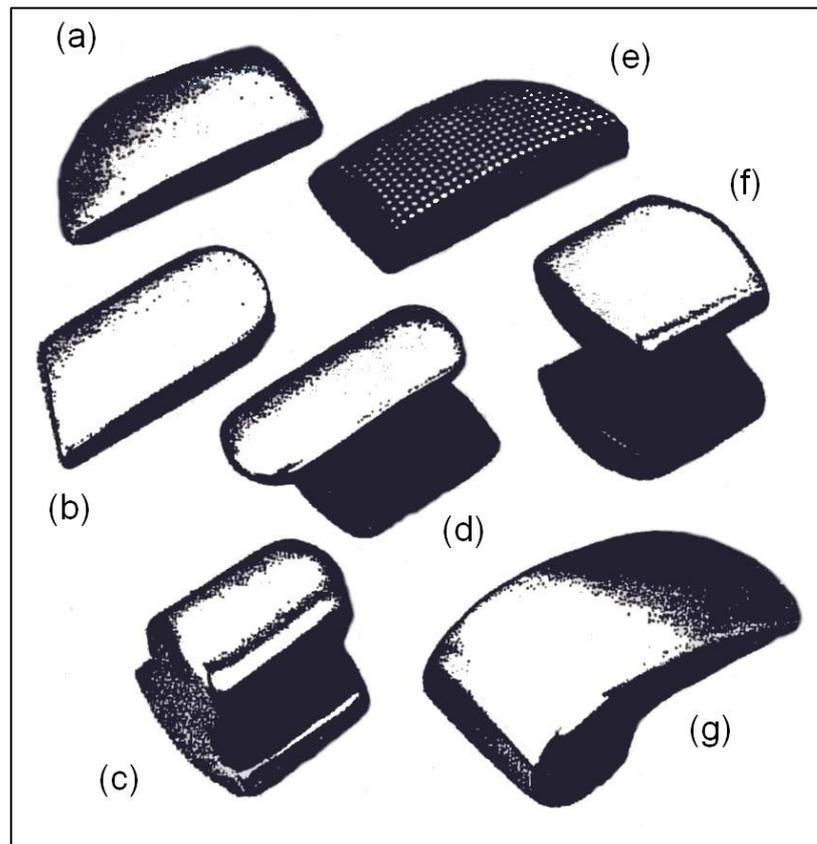


Figure 17: Various Dollies

- (a) Thin Toe Dolly
- (b) Angle Dolly
- (c) Utility Dolly
- (d) General Purpose Dolly
- (e) Grid Dolly
- (f) Double-ended Dolly
- (g) Curved Dolly or Comma Block

Double-ended Hand Dolly

Is conveniently designed for a good grip with two useful surfaces, one high crowned and one low crowned. It is ideal for general planishing and roughing out. Its weight is 3lb 4oz (1473g).

Utility Dolly

The utility dolly forms the basis of every body kit. It offers a variety of useful faces and is found ideal for working in confined spaces.

Utility Dolly 055200oo			
Technical: 055200oo			
L(mm)	W (mm)	D (mm)	Weight (kg)
72	65	55	1.28



General-purpose Dolly

Is very well shaped and easy to hold and offers wide, low-crowned faces which are essential when working on the new body styles. Its weight is 2lb 12oz (1247g).

Heel Dolly

Has a low flat face with radiused corners. It is suitable for corner and angle work and is easy to handle because of its fairly small weight of 2lb 14oz (1020g)

Thin Toe Dolly

Has similar surfaces to the toe dolly but is thinner and is ideal for working in awkward places where other dollies cannot be used its weight is 2lb 4oz (1020g).

Toe Dolly

Combines a large flat face with a low crown on other faces and is long and thin for easy handling in narrow sections. The bottom face is ground flat which adds to the versatility of this block. Its weight is 3lb (1360g).

Toe Dolly 055800oo			
Technical: 055800oo			
L(mm)	W (mm)	D (mm)	Weight (kg)
120	60	28	1.3



Shrinking Dolly Block

Is designed for shrinking welded seams and reducing stretched areas prior to filling. It has a groove down the centre of the block into which the stretched or welded seams can be dressed. Its weight is 3lb (1360g).

Grid Dolly

Is similar in shape to the toe dolly but has a larger crowned grid face on the upper surface. The base has a plain flat face for normal finishing work. It has been designed to act as a shrinking dolly when used in combination with a shrinking hammer and the application of heat. The weight is 2lb 4oz (1130g).

Round Dolly

Is light, small and very easy to hold. It offers high and low crowned faces for work on small areas of damage. The weight is 1lb 10oz (736g).

Curved Dolly or Comma Block

Has a long curved face, combined with the high and low crowned areas and the tapering face, it is extremely well suited to the modern body design, and is comfortable to hold in difficult areas and narrow corners. The weight is 3lb 6oz (1530g).

Curved Dolly 055300oo			
Technical: 055300oo			
L(mm)	W (mm)	D (mm)	Weight (kg)
135	62	45	1.4



Angle Dolly

Provides both flat and low crowned polished surfaces on a dolly only ¾ inch thick. The curved end has a regular radius whilst the straight end offers an obtuse and an acute angle. Ideal for use on narrow section double-skinned door panels and sharp corners. The weight is 1lb 6oz.

Anvil Dolly

Provides a wide surface for low crown work. The narrow end is useful for backing up mouldings and the larger end as a raising block. Also useful as bench anvil or with heat where the hand has good clearance. The weight is 4lb.

4.3 Applications of Beater and Dolly

Reshaping a Flange

The utility dolly 055200 is placed in the damaged flange (figure 18) Using the edge most suitable to the shape and size of the original flange. An upward and outward pressure is applied to the dolly. The flange is now reformed by 'on-the-dolly' beating, starting at the inner edge of the flange, gradually working to the outer edge as indicated, until it is back to its original form.

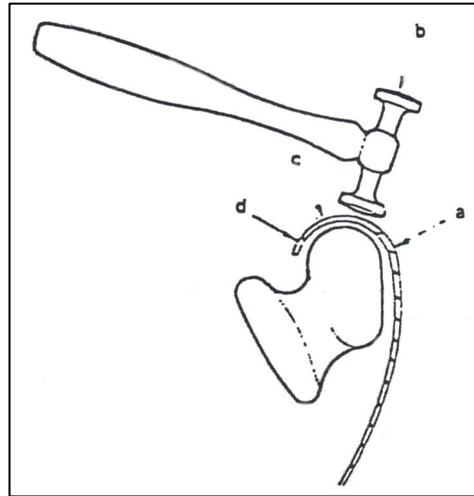
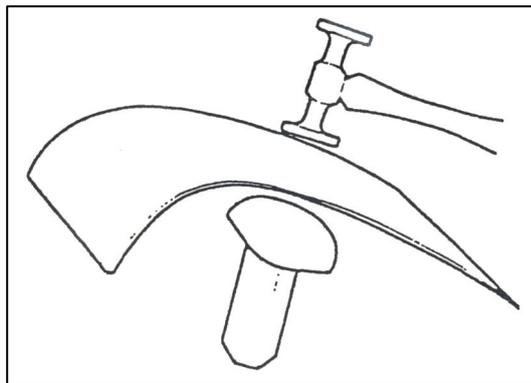


Figure 18: Reshaping a Flange

Figure 19: Shaping Crowned Panels



The panel is first 'roughed out' by hydraulic or other means of releasing the metal in the ridges. The panel is now smoothed and levelled by on and off the dolly beating. The dolly must be held tight up against the metal, as it is moved backwards and forwards across the crown

as the beating continues. The choice of the dolly will depend to some extent on the shape of the original crown. The dome dolly 055600 is illustrated in this situation (figure 19).

Using a Low-Crown Dolly in Reshaping

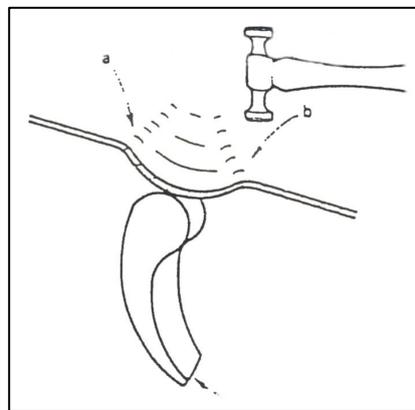
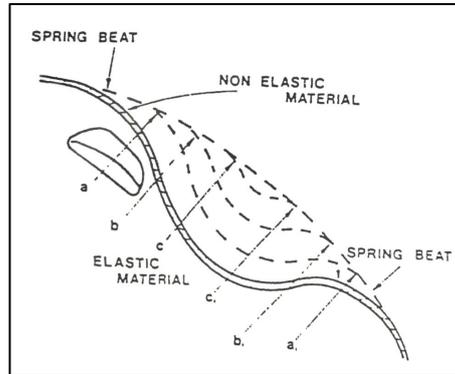
A toe dolly 055800 possesses a low crown and is most suitable for this purpose. The dolly can be used in the hand to deliver a series of blows to the underside of the panel in the area of elastic metal, starting at the edges and working towards the centre as shown (figure 20). After the two blows (a and a1) have raised the metal back to contour locally, the outer ridges can be eliminated by spring or off-the-dolly beating. This action releases any stresses locked in

this area of the metal. Alternating between dolly block and beater (b to b1), (c to c1) the metal will be raised to its original shape.

Figure 20: Low-Crown Dolly in Reshaping

Raising a Low Spot with a Curved Dolly

Holding the dolly 055300 lightly against the metal (figure 21) use the off the dolly technique beating at (a) and (b) to lower the ridges and at the same time raise



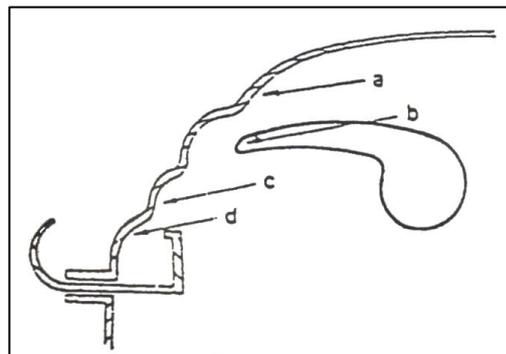
the metal, because of the light support given by the dolly. If the low spot is still lower than the surrounding sheet metal, strike the underside of the panel, one, two or a series of blows, until the panel is raised to its proper level. The dolly can now be turned onto its face so that on or off the dolly beating can continue until straightening is completed.

Figure 21: Raising a Low Spot with a Curved Dolly

Reshaping a Roof Panel with a Curved Dolly

The edge of the curved dolly can be used just above the roof rail (figure 22) to restore the shape of the roof. Repeated blows with the wide edge over the damaged area will raise the metal as a roughing out process. The low crown face or suitable area of the dolly beating to make the restoration complete.

Figure 22: Reshaping a Roof Panel with a Curved Dolly



To Reform or Manufacture a Bead or Moulding

The shape of the final bead will determine the best dolly to use. In figure 23 the angle dolly 054700 is used. If the bead is to be manufactured on a replacement panel or patch plate, its size and shape must be clearly marked along the panel or patch plate with three lines to show the crown and outer edges of the bead. The dolly is held lightly under the centre line of the marked out metal and it is beaten until it is slightly stretched. The outer edges and the ends of the bead are then formed by off the dolly beating, until the metal is stretched sufficiently to hold the head in position.

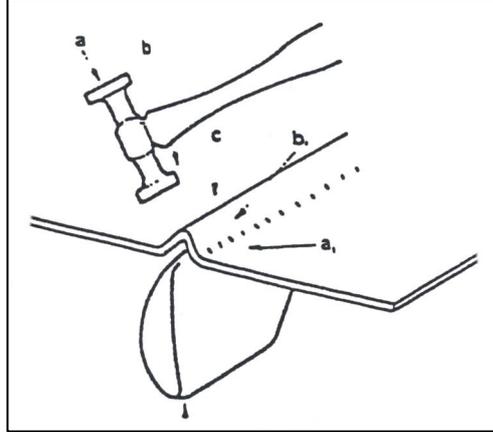


Figure 23: Reform or Manufacture a Bead or Moulding

To Restore the Shape of a Bead

As in figure 23 the dolly 054700 is placed in the damaged bead and pressed firmly against the inner surface. The panel is now beaten on each side of the bead as indicated by the arrows, shaping the metal around the face of the dolly. This action continues along the entire length of the bead until it is of proper shape.

Raising Low Sections of a Welded Joint

To raise the low sections of a weld (figure 24) the corner of a dolly is held directly beneath the low area and a blow or series of blows are struck from above. This action raises the low metal, supported by the point of the dolly, while the surrounding high and unsupported weld area is driven down. This style of beating can also be employed during roughing out and finishing operations, if the need arises.

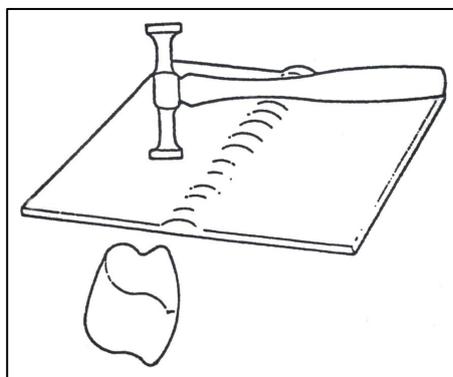


Figure 24: Raising Low Sections of a Welded Joint

5.0 The Right Tool for the Job

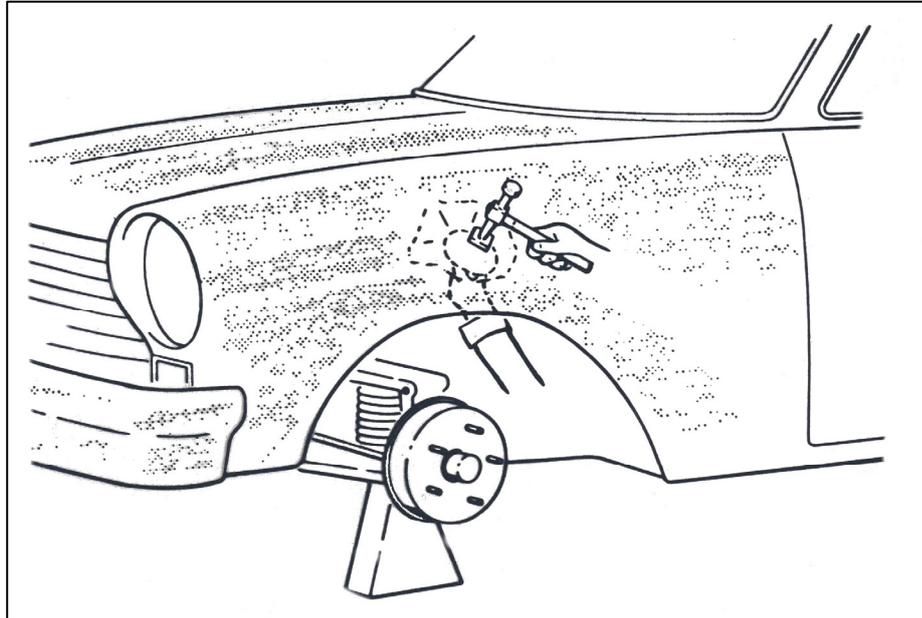


Figure 25: Bumping Hammer straightening fender crown

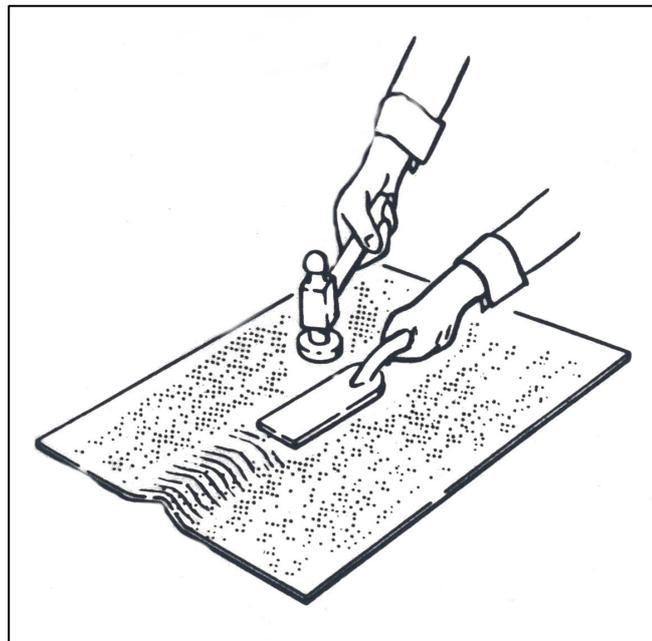


Figure 26: Spring Beating Spoon and Hammer driving down a ridge

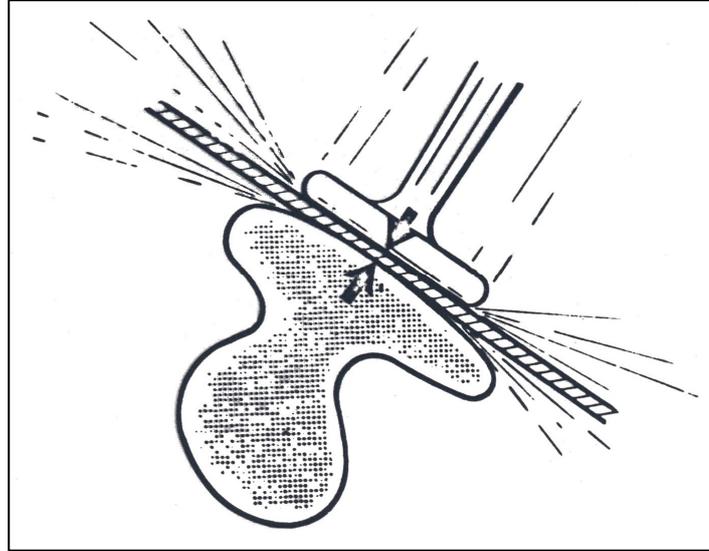


Figure 27: Hammer on-Dolly

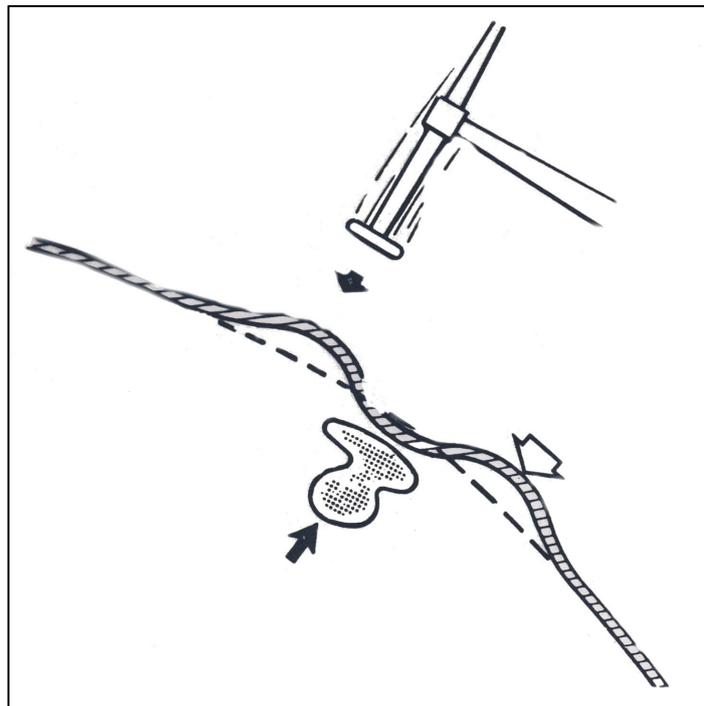


Figure 28: Hammer off-Dolly

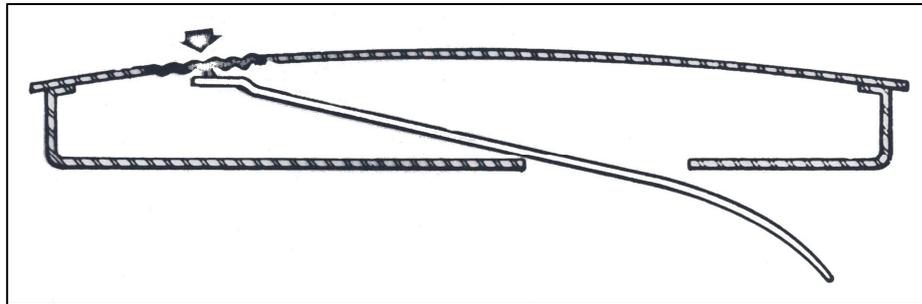


Figure 29: Long Pick on Door Damage

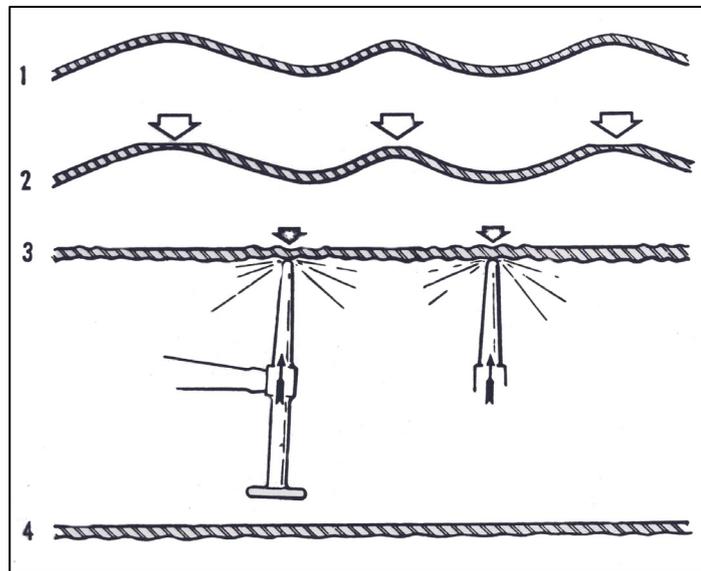


Figure 30: Filing and Picking Process-Exaggerated

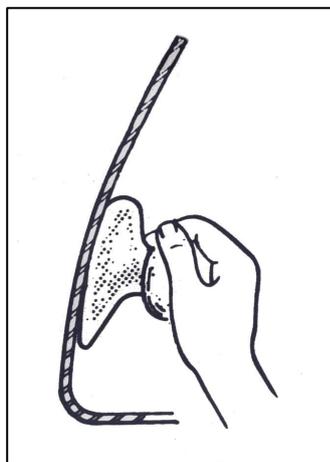
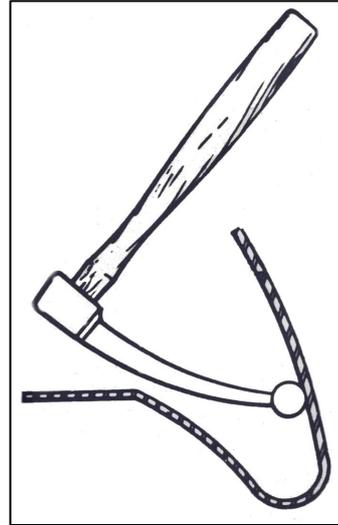


Figure 31: Utility Dolly

Figure 32: Bumping Hammer

5.1 Body Spoons

These tools are made from a high grade steel which has been drop forged and heat treated. They are sometimes called prying spoons because the spoon end is used in the same manner as a dolly in conjunction with a hammer. The body spoon really does the same job as a dolly block but is designed for use in confined spaces where a normal dolly block cannot be held in the hand, e.g. between door frames and outer door panels the spoon end, which acts as the dolly, must be kept in good condition and free from anti-drum compound so that it gives a metal-to-metal contact when used in conjunction with a hammer. The spoon can also be used for roughing or easing out by wedging the spoon in between panels.

No. 051200 Heavy Duty Pry Spoon

Body spoons are used for really rough work and the No. 051200 has been produced in a very high grade material to stand such usage. Apart from normal bumping work it will withstand heavy prying work. The blade reduces to a very thin section without loss of strength.



No. 057400 General Purpose Spoon

This double curve utility spoon is the basic item in any panel beating tool kit. The applications for a spoon offering such different curves are innumerable. After many years it remains the best selling item in the range.

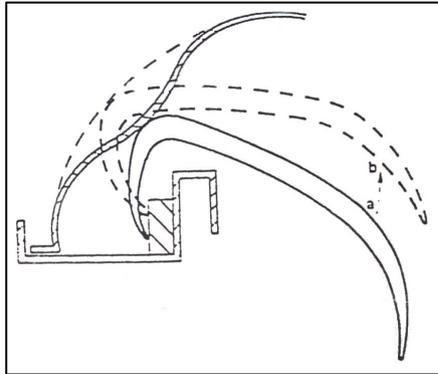


Figure 33: General Purpose Spoon in use

No. 057300 Inside Pry and Surfacing Spoon

This short handled spoon is exceptionally useful in limited spaces efficient as a light prying spoon behind braces and panel edges.

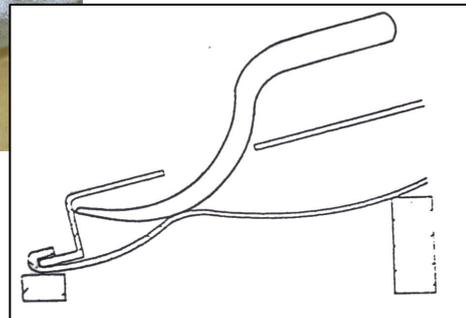


Figure 34: Pry Spoon in use

No. 051000 Thin Spoon

Styling changes particularly on the very smallest of cars produce the need for a slim spoon to enter restricted spaces. The blade has a slow taper and is ground with a medium crown along its length.

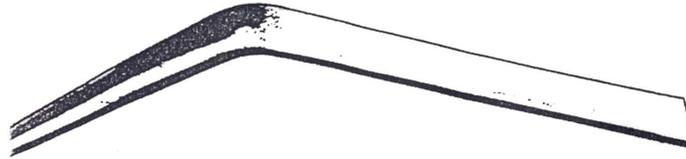


Figure 35: Thin Spoon

No. 051300 Long Reach Dolly/Spoon

General purpose long reach dolly/spoon with wide, tapered head and long handle suitable for reaching where access is restricted. A compromise between dolly and spoon has been reached by the long reach dolly where the head is separated from the shaft to gain access not possible with dolly or spoon, an application of the long reach dolly to an outer door panel. By a hole drilled in the inner panel to accommodate the shaft while the head of the dolly is passed through a normal access hole, to be fitted to the shaft within the door structure.



No. 057500 High Crown Spoon

Equally useful as a dolly or a spoon, they have been designed to offer a broad working area with a high crown to positions where other dollies and spoons cannot be used.

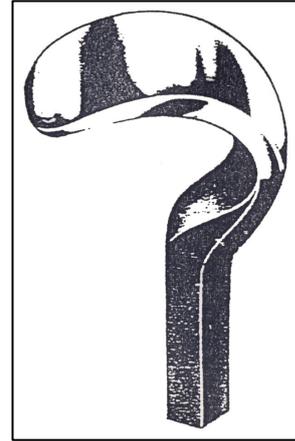


Figure 36: High Crown Spoon

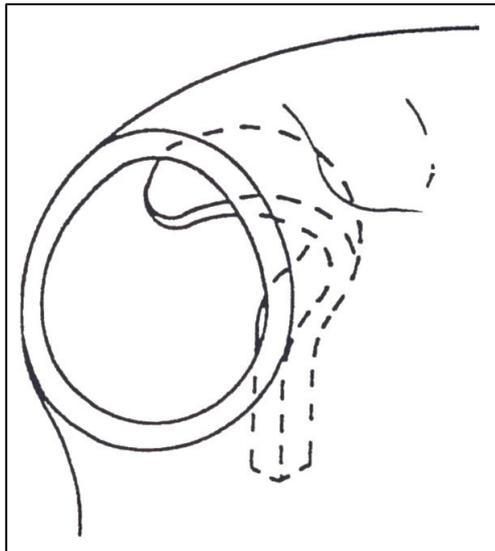


Figure 37: High Crown Spoon in use

No. 057800 Surface Spoon



The feature of this spoon is the really large working face with a very slight crown. The long reach enables it to be used around struts and braces without time consuming dismantling work.

No. 051100 Spring Hammering Spoon

A light pressed steel spoon designed for spring hammering on panels which show minor blemishes during the finishing stage. The broad blade spreads the blows over a large area.



Figure 38: Spring Hammering Spoon

The damage and sharp blows with a beater are delivered to the back of the spoon, spreading the force over a large area. In this manner marking of the panel is prevented and the damage corrected in many cases without injury to the paint work. The intensity of the blows should be closely controlled so that the area is not forced down below its normal position. This spoon is not made for prying or levering, its surface should be kept clean and highly polished. Any irregularities on the surface will be reproduced on the panel, in the reverse order.

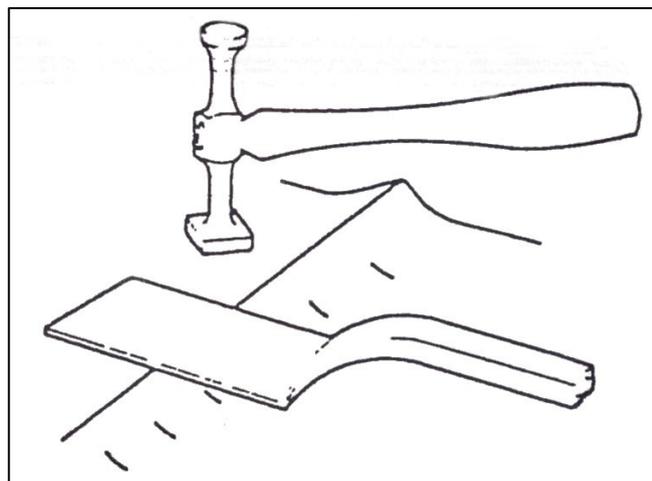


Figure 39: Spring Beating Spoon in use

No. 057900 Drip Moulding Spoon

The special lip on this spoon can be hooked under drip mouldings without slipping. This makes a simple job of a difficult operation. The curved surface is fully finished to enable the tool to do finish work.

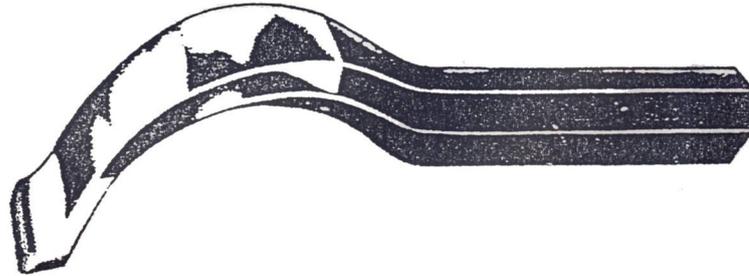


Figure 40: Drip Moulding Spoon

5.2 File Hammer or Beating File

This tool is designed to be used like a hammer in conjunction with a dolly block although it is actually a file with a serrated face and is suitably shaped for holding in the hand. The milling on the file blade tends to shrink the panel as well as leaving a regular rough patterned surface ideal for locating low spots on the panel under repair and for finishing with a body file. The tool is used in conjunction with a hand dolly and with a glancing blow. It is most effective on large flat sections, where it will be found ideal for smoothing and leveling out wavy panels. Two types of beating files are available, one is flat for use on low-and high-crowned surfaces, while the other is half-round in shape and is used on convex or reverse-curved panel sections.

Bumping Blades

- Suitable for removing bumps, dents and flattening wavy surfaces
- Ideal for semi-finishing work on body panels
- Milled serrations help prevent metal stretch

Bumping Tool – Half Round 059500oo



Figure 41: Bumping Blade

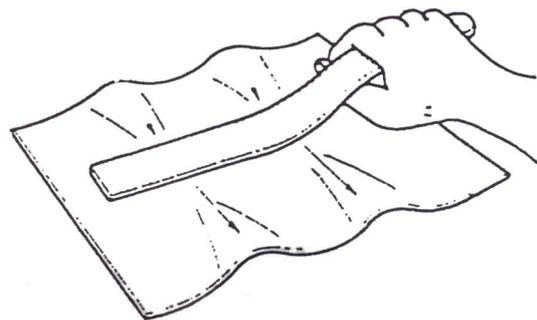


Figure 42: Bumping Blade

Bumping Tool – Flat 059400oo

5.3 Body Files Holder

Flexible Panel File

This tool is designed with a two position handle and has a 14in (30cm) spring steel backing plate to give adequate support over the whole blade. Positioned between the two hand grips is a turnscrew threaded left and right hand for adjusting the blade to concave or convex positions to suit the user's requirements. The main use of this tool is to assist in the final planishing of the work. First and most important, it locates areas which are low on the surface of the panel under repair, second, it files out small marks or defects on the

panel surface. It can be adapted to file the surface of almost any shaped panel by setting the blade either straight, concave or convex. The file blades are specially designed so that they do not remove too much metal, and the milled serrations are wide apart and curved to prevent clogging when filing metal which has been painted, soldered or plastic filled. It is important to release the tension on the file blade after use.

Body Blades Holder



5.4 Body File Blades

These flexible, double-sided blades are produced from a special alloy steel and heat treated. The milled teeth allow a smooth filing operation and are specially shaped to reduce clogging. The blades are either flat or radiused according to the surface to be filed.

Supercut blades are 8tpi (teeth per inch) general-purpose standard blades.

Standard cut blades are 9tpi and used for soft metals such as lead and solder fillers.

Fine cut blades No.057122 are 13 tpi with good flexibility a good general purpose blade for use on all but the hardest of materials, used for aluminium, copper and brass. Recommended holders – No.057100 adjustable. No.059800 rigid and No.059900 rigid.



Figure 43: Fine Cut Blade

Extra fine cut blades are 17 tpi and suitable for cast iron, steel or narrow section of metal.

Plasticut Blades are 6.5 tpi and used for plastic body fillers only.

Half-round plasticut type No.059325 the companion blade to the plasticut flat blade No. 057125 specially for use on plastic fillers but similar in section to No.059321. Recommended holder No.059300.



Figure 44: Half-Round Plasticut Type

5.5 Hand Snips

The offset combination of universal snips is preferred by the panel beater when cutting thin gauge metal. Universal snips are suitable for cutting straight lines, outside and inside curves. A right and left hand pair of combination snips will be suitable for most of the sheet metal cutting that will be encountered by the panel beater and there is no need for any curved-blade snips. When the more popular right-hand snips are used, the waste metal forms a coil to the left of the cutting blades, thus causing little distortion to the surface of the sheet or panel being cut, similarly, with the left-hand pair of snips the waste metal passes to the right of the cutting blades, leaving the undistorted sheet or panel on the left. Snips can be obtained in varying sizes with either straight or crank handles. A straight pair of snips is often necessary for long straight cuts.



A. Standard Pattern

B. Universal combination snips

C. Panel Separator

Vice Grips

Vice grips are generally used for holding objects together. It acts as a clamp when spot welding, riveting, welding etc. available in various sizes.



Vicegrip 9R



Vicegrip 10R



Vicegrip 5WR

5.6 Welding Clamps

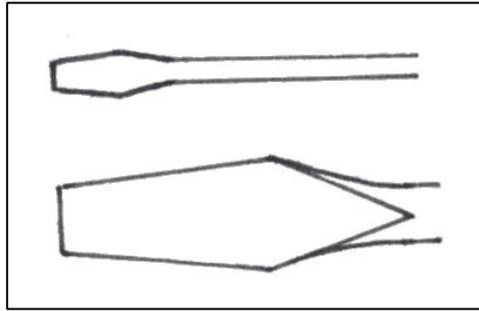
The welding clamp has a powerful grip which holds parts in alignment while leaving both hands free for the welding operation. The deep throated jaws and centre opening provide the operator with maximum visibility and full access to the welding area.



5.7 Screwdrivers



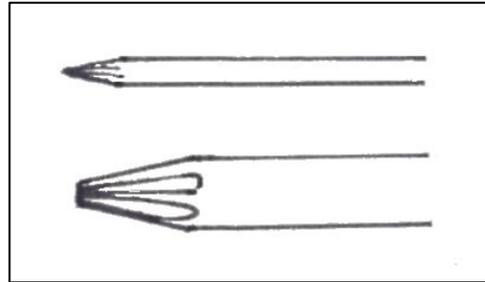
Plain Screwdriver



It is used primarily for tightening or loosening slotted screws. Screwdrivers are available in various lengths and with different types of handles e.g. wood, metal or plastic materials.

Philips Screwdrivers

This screwdriver has a cross-shaped tip. This fits into the head of a screw which has a recess of the same shape. This type of screwdriver will not slip and burr the end of the screw if the proper size is selected.



5.8 Spanners sizes 6mm – 22mm



5.9 Tape Rule

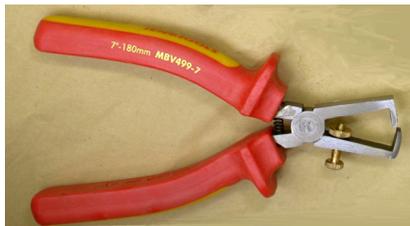
The length varies from 6ft to 12ft or from 2m to 3.5m. It is very popular for measuring and laying out large jobs.



5.10 Pliers



Insulated Side Cutters



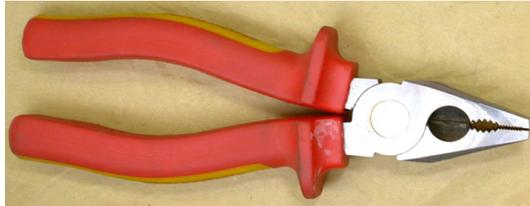
Insulated Wire Stripping Pliers



Insulated Adjustable Pliers



Insulated Long Pliers



Insulated Combination Pliers

5.11 Socket Set



5.12 Panel Separators



Slim/Wide Chisel with Hand Guard

This chisel is used widely by the VBR metal worker; it is used mainly for cutting sheetmetal.

5.13 Tork Sets Allen Keys



One of the characteristics of the skilled worker is the way in which he selects and uses his tools. For this reason, it is essential that you know how to select and use both hand and machine tools correctly. If you do this you will save time and the work will be much easier. When you have selected the correct tool for the correct operation you have taken the first step in becoming a successful craftsman.

5.14 Recognition, Selection and Maintenance of Hand Tools

Sheetmetal hand tools are used to scribe or measure lines, perform layout operations and shape or cut metals. Some of the hand tools in the following notes actually perform these operations while others such as stakes and punches serve as aids in performing them.

It is important to keep tools in good shape avoid tools going rusty by giving steel tools an occasional oiling. Tools with a sharp point should be stored carefully.

5.15 Scriber

It is used to mark lines on metal. It can be used in conjunction with a straight edge and square.



5.16 Steel Square

The flat steel square is used to layout right angles (90°) and can also be used as a scale. It is an invaluable tool for accurate layout work in pattern drafting. The long arm is known as the body or blade, the short arm is known as the heel or tongue. These squares come in various sizes.

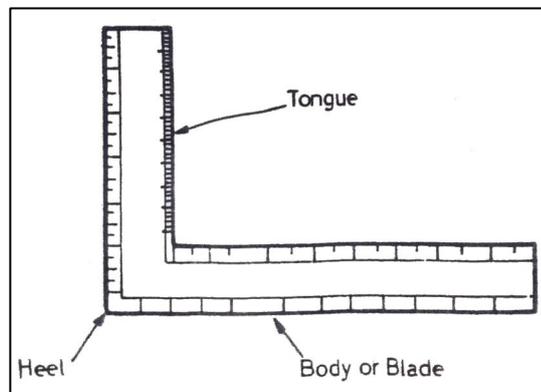
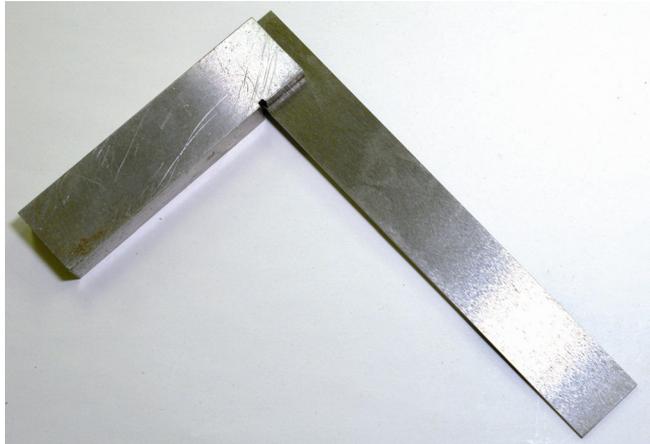


Figure 45: Steel Square

5.17 Hacksaw

The hack saw is used for cutting materials by hand. It consists of a renewable hardened steel saw blade fitted into an adjustable frame, which is usually provided with a screw adjustment for controlling the tension of the blade. It is necessary to have both junior and senior hacksaws in your tool kit.



Senior Hack Saw



Junior Hack Saw

5.18 Dividers

Made with each straight leg tapered to a needle point, dividers are manufactured in various sizes and types and are used to space off equal distances, to divide lines into equal parts and to scribe arcs and circles. Spring loaded screw types are a more accurate type.

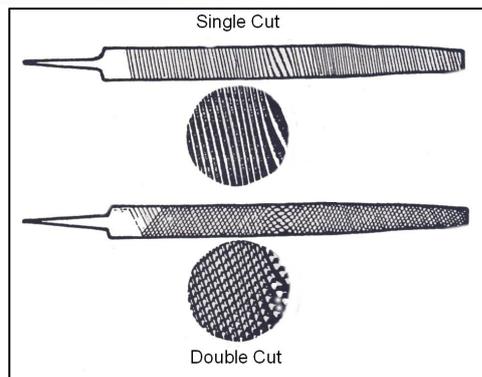


Rules are manufactured in a variety of types and lengths each of which is designed for measuring or laying out different work.



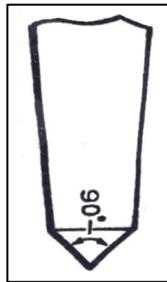
5.19 Files

There are many shapes and sizes of files available with various grades of cut. Files are used to remove burrs from sheets of metal, to straighten uneven edges and for various other operations that require a small amount of metal to be removed. They should always be used with a handle. Common types used by the sheet metal worker are flat, square, round, half-round.



5.20 Centre Punch

Similar in design to the prick punch except that the tapered point is ground to an angle of 90° included. They are available in various shapes and sizes and are used for locating the centre for drilling etc.



5.21 Vernier Calipers



- 4 Functions.
- Frosted chrome plated scale and vernier.
- Stainless and hardened steel.
- Lapped measurement surfaces.
- Reading vernier scale 0.05mm.

5.22 Hand ‘Pop’ Gun

Riveting in confined spaces requires the use of a hand ‘pop’ gun. These are unsuitable for larger dimensions of rivets, due to the reduced amount of leverage available.



6.0 Specialised Tools

6.1 Punches

Hole punches have interchangeable heads to punch holes of either 5mm or 6mm diameter and enable joining panels to be accurately aligned for welding. The 5mm diameter hole is for gas welding or brazing and the 6mm hole is for MIG welding.

Wing Punch is a hole punch with a specially designed head which allows it to be used on wing panels and channel sections and also fit over roof gutters and wheel arches.



Edge setter is a portable hand-operated tool designed to provide a 'joggled' joint or stepped edge on a repaired or new panel, thus creating a flush-fitting lap joint.

6.2 The Rolastep Edge Setter

Is a portable tool used on the vehicle or a panel assembly. Its rollers produce a smooth, uniform stepped panel edge to create a flush-fitting lap joint, allowing a panel replacement to be inserted.



6.3 Door Skinner

This is a special tool for crimping flanges tightly on replacement door skins. It is used by first bending the flange to an acute angle and then tightening or crimping the flange to the door frame. During this operation, interchangeable tough nylon pads prevent damage to the surface of the door skin.



6.4 Portable Flange Rolling Tool

Preparation

The edge to be flanged should first be thoroughly de-burred and any rust or uneven deposits cleared away.



Set Gauge

Grip and close the handles but keep the clamping lever in the raised and un-locked position. Then turn the adjuster screw until the first step of the rollers will just slide easily over the edge of the job. A clearance fit is essential, otherwise distortion and thinning might occur. This is particularly important when flanging soft metals such as aluminium.

Operation

The handles and clamping lever should now be closed and the rollers pressed against the edge of the job. Then with a socket spanner or air ratchet wrench connected to the hexagon drive, the tool is carefully wound along the edge. If difficulty is experienced in starting off, then the handles should be released and locked a little way in from the front edge. The tool can then be reversed over the front edge before resuming normally. If an air ratchet wrench is

used for any curves it will be necessary to use a series of short bursts.

To Reverse the Flange

If it is required that the flange be formed upwards instead of down, then the two rollers may be reversed on their shafts. However, to do this it must be remembered to withdraw the rollers as a pair.

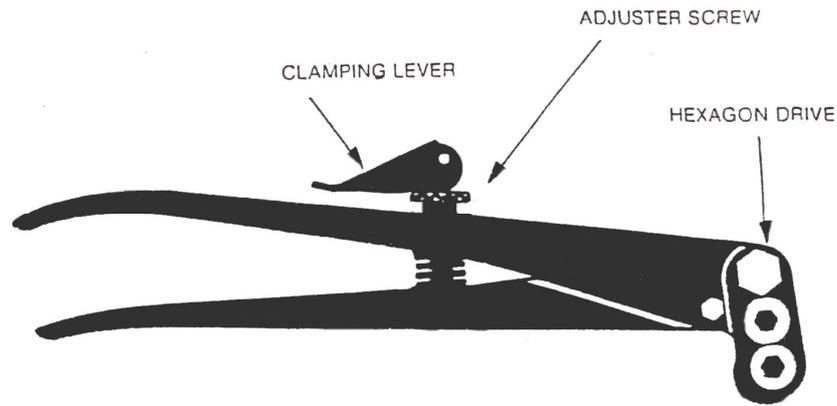


Figure 46: Portable Flange Rolling Tool

6.5 Door Hinge Pin Remover and Replacer

This is designed for the removal and replacement of hollow hinge pins used on vehicle door hinges.





a. Body Trim Tool

This is a universal spring steel tool for removing body trims and clips and also weather strips, door trims, headlamp fittings, windscreen clips plastic mouldings, motifs and badges.

b. Door Handle Spring Clip Removers

These are specially designed pliers for fitting or removing the spring clips used on many modern door handles. One jaw sets in the neck of the spring whilst the other grips the other end and whole spring is then levered out.

c. Trim Panel Remover

This tool is designed to remove vehicle trim panels, upholstery and roof liners without damage. It also fits a wide variety of button-type fasteners used on vehicle trim.

d. Trim Clip Removers and Unhooking Pliers

e. Window Handle Clip Remover

6.6 Zip Cut Spot Weld Remover

The zipcut spot-weld remover is used with an electric or air drill and is ideal for removing spot welds on all areas of bodywork and subframes. The cutter blade (A) is reversible with two cutting edges. Adjustments (B) provides for varying depth of cut so that only the upper panel is released (C), leaving the original spot weld behind on the lower panel.

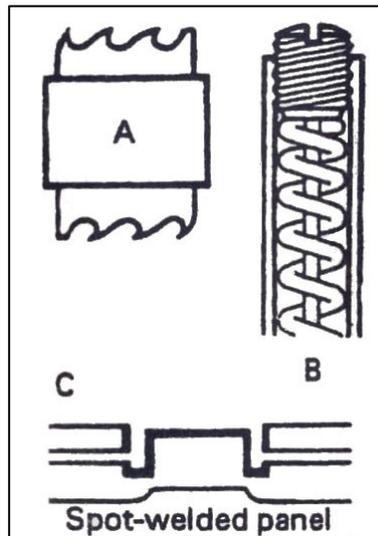


Figure 47: Zip Cutting Blades

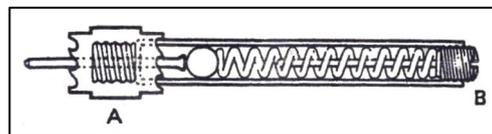


Figure 48: Zipcut Spot-weld Remover



Cone drill or variable hole cutter.



Cobalt drills or spot drills



Spot weld removing tool

6.7 Drilling Machines



Drill battery powered

Drill bit holding tool





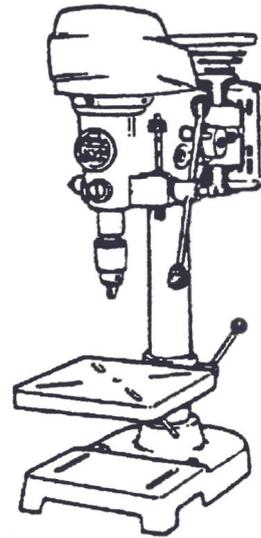
Drill bits

6.8 Radial Drill



Figure 49: Radial Drill

- Exercise caution as hands and hair can become entangled in the drill.
- Ensure metal is gripped securely as metal may pull when drill penetrates workpiece.
- Ensure correct speed is used.
- Drill pilot hole first if large hole is required.
- Always remove chuck key before switching on.
- There are floor mounted and bench-mounted types. Each type should be securely bolted down.
- Wear safety glasses.



6.9 Air Saw



6.10 Belt Sander



6.11 Sealers and Trim Glue Removing Tool



6.12 Grinding Machines

Grinding machines are made in a variety of types and sizes depending upon the kind of work to be ground. The motor driven bench or floor grinder is the type most commonly used in the VBR shop.

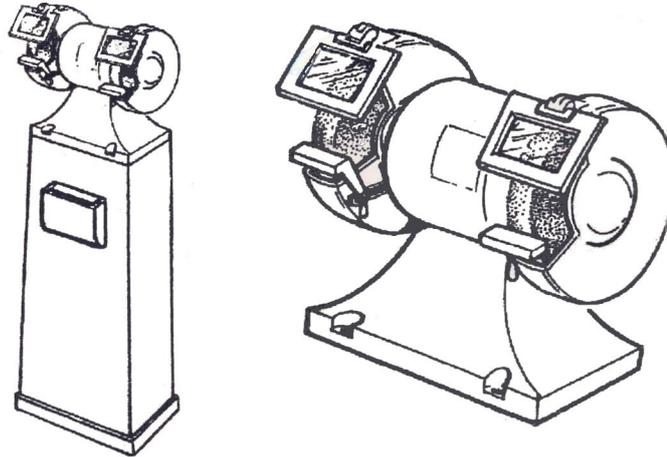


Figure 50: Floor and Bench Grinder

These grinders are used for all kinds of general off-hand grinding and for the sharpening of centre punches, chisels, drills and other small tools.

6.13 Electric Angle Grinder

The main use of the angle grinder in the VBR shop is for removing excess weld metal on welded joints. Several general rules govern the use of the disc grinder. If these are observed they will enable the operator to



become proficient very quickly in the use of the grinder. The rules are considered good shop practice and are directed towards the safety of the operator. In the first instance, if the device is electrically operated see that it is properly connected and earthed. Shop floors are usually of cement, they are generally moist and therefore relatively good conductors of electricity. If the grinder is not properly earthed it is possible to receive a fatal electric shock when the machine is used.

6.14 Treadle Guillotine

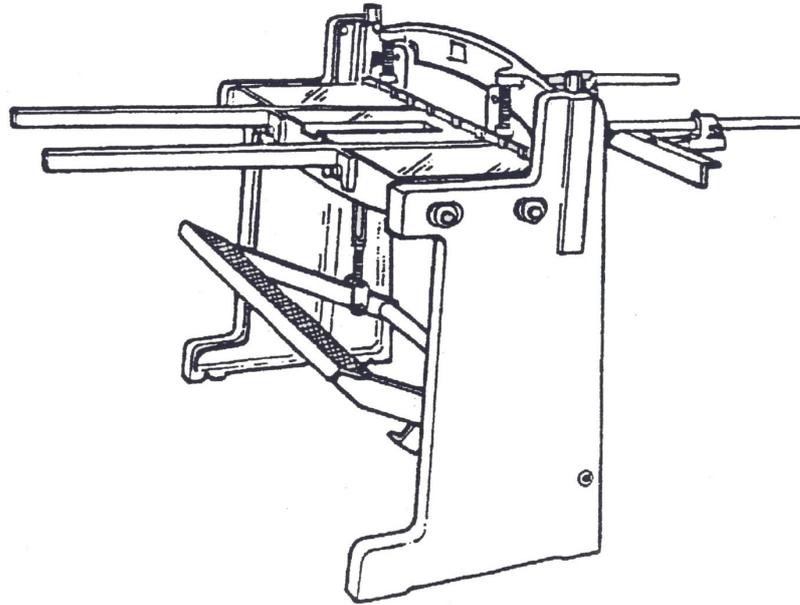


Figure 51: Treadle Guillotine



- Ensure nearby people are clear of foot pedals.
- Do not over-exert in trying to cut metal.
- Do not exceed capacity of machine.
- Ensure your own feet and legs are clear of the foot pedals.
- Take care in handling the sheet itself.
- Only one sheet should be cut at a given time.
- Never cut wires, rods or seams.

6.15 Box and Pan Bending Machine

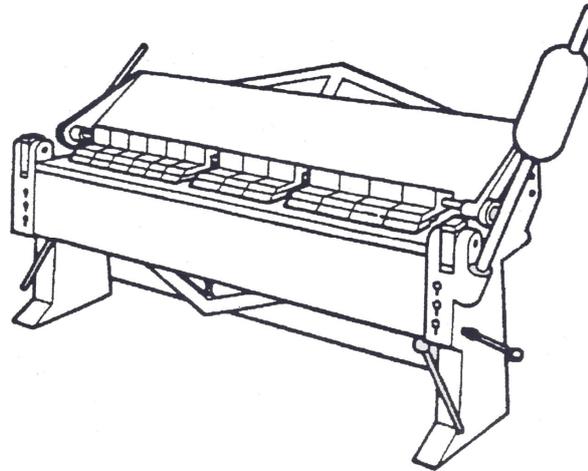


Figure 52: Box and Pan Bending Machine



- Beware of swinging counter-balance weights and bottom leaf (bed) of machine.
- Do not use improper manual handling techniques when using machine or moving metal in or out of benders. This machine can put great strain on your back.
- Beware of blade crush when using machine or especially changing blade.

This type of machine, while suitable for all types of bending operations, has special provision for folding pans, trays or boxes. No rods, wires or metal beyond the capacity of the machine should be bent on this machine. Always adjust metal thickness.

6.16 Polishing Machine

This is a machine which can be either electrically or air driven. It has a hard rubber flexible pad onto which the actual pad is fastened by means of a centre nut. It is used in the body shop for polishing on panel after painting.

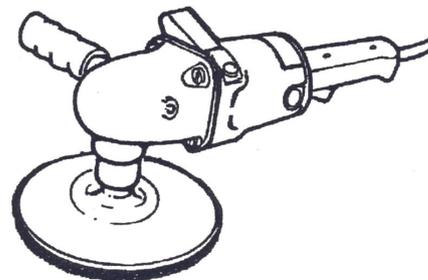


Figure 53: Polishing Machine

Abrasive Holder

An essential tool for use on plastic body fillers. The necessary rubbing down with abrasive after filing on elastic fillers is speedily affected with this tool. It is light, well balanced and easy to use. Quick change clips ensure rapid fitting of replacement abrasive strip.



6.17 Abrasive Orbital Sander



Available in air or electric

6.18 Eccentric Sanders

- Optimum surface quality for intermediate and light sanding thanks to the 5mm sanding stroke.
- The sanding pad brake, stepless control electronics and a sanding pad that runs completely flat on the working surface help you to achieve high quality results.
- Weighing only 1.8 kg means you can work in comfort. 7mm sanding stroke for sanding filling compounds and thick lacquer coatings.

- Neat sanding pattern through flat, even tool running regulated by control electronics.
- Non-tiring work due to ergonomic tool design, vibration stop and smooth-running motor.
- Robust construction comprising low-wear plastic elements and high-quality gear unit.



6.19 Setting Tool

A light bending iron with a host of applications. Specially suitable for re-setting external door hinges, brackets etc. produced from a single drop forging with sturdy forks carefully heat treated.

6.20 Impact Driver

The impact driver will loosen or tighten the most stubborn screws, nuts and bolts. The tool is supplied with a complete range of interchangeable bits.

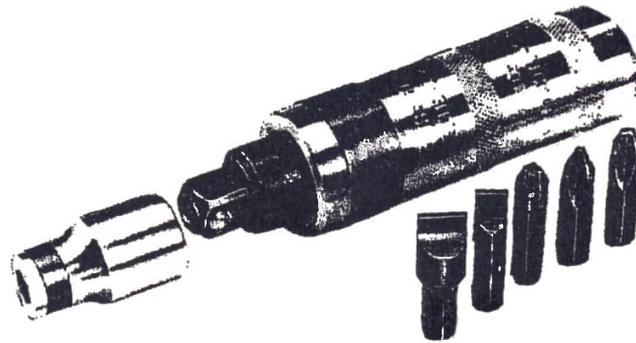


Figure 54: Impact Driver

6.21 Tool Box

The apprentice will each collect his or her own basic toolkit.



6.22 Pad Lock

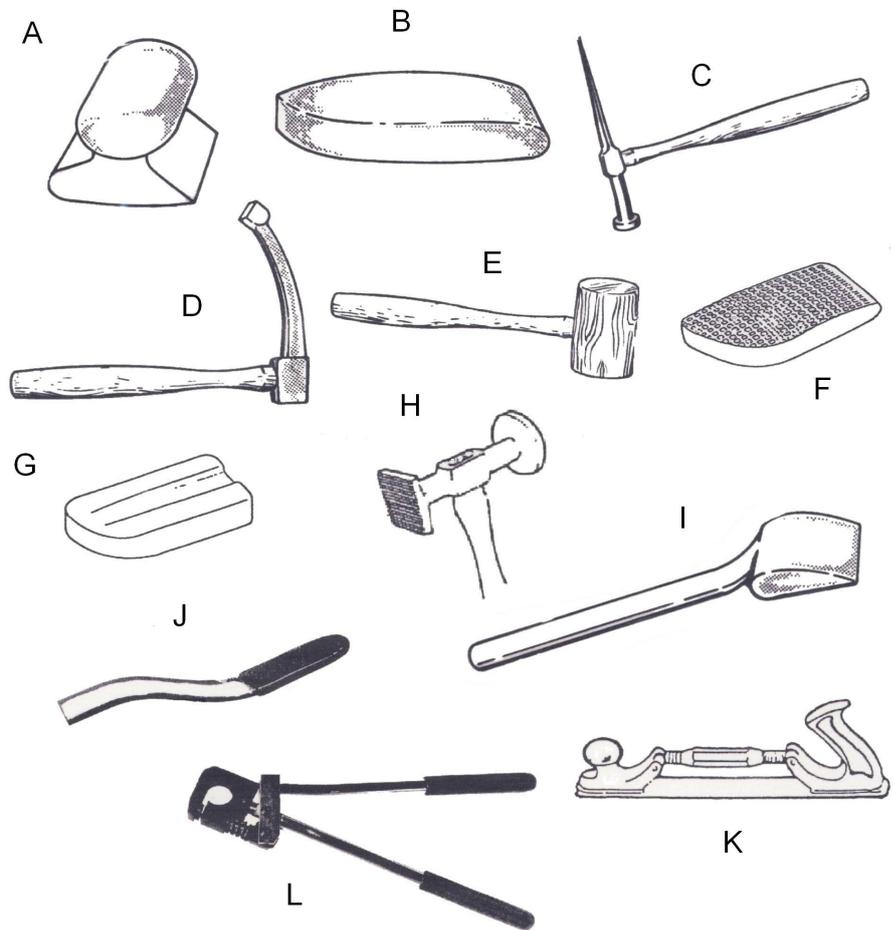


Summary

The pride of the craftsman, is the set of tools he possesses. Care of tools throughout their working life is important, all bright surfaces should be kept clean and free from scourers and blemishes that could be transferred to the body panels. Storage of tools when not in use is also important, but this will depend on the working conditions in the body shop. Wall boards with the necessary clips and tool silhouettes can be purchased with a specified set of tools. This is ideal for general usage from a central store, as missing tools can be quickly identified. The same sets of tools are available in metal tool boxes, most useful when each worker maintains his own tool kit.

Self Assessment

1. Name the following Tools



Answers to Question. Module 2. unit 1.

1.

- A. Utility dolly
- B. Toe dolly
- C. Pick and finishing hammer
- D. Fender bumping hammer
- E. Wooden mallet
- F. Grid dolly
- G. Shrinking dolly
- H. Shrinking hammer
- I. Long reach dolly/spoon
- J. Bumping blade (flipper)
- K. Body file holder

Suggested Exercise

Name and state the function of various body repair tools
Carry out minor maintenance and store in a safe and practical manner

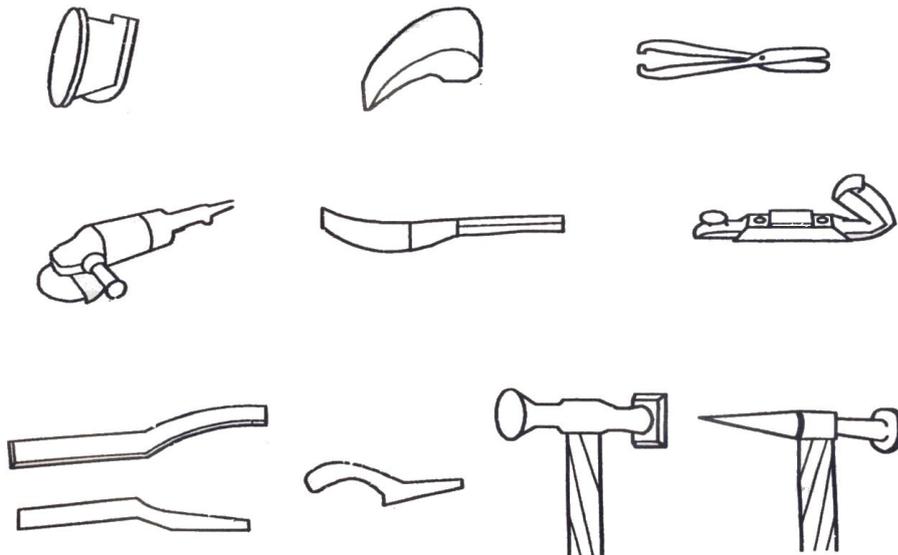
Exercise – Identifying Tools

Instructions:

- State the name and use of the tools shown

Tools and Materials:

- Selection of Dollies
- Spoons
- Bumping files
- Snips
- Body file
- Panel hammers
- Sander



Dimensions	Gen. tol.	Scale	Material
mm		nts	
TOOLS			
SOLAS	Phase 2. Mod 2. Practice		

Standards: Work carried out in a manner that is unlikely to cause injury to apprentice or others.

Training Resources

- Classroom
- Flipchart
- Overhead projector
- Common tools
- Tool catalogue
- Slides
- Copies
- Pens
- Text book ‘The Repair of Vehicle Bodies’

SOLAS

An tSeirbhís Oideachais Leanúnaigh agus Scileanna
Further Education and Training Authority

*27-33 Upper Baggot Street
Dublin 4*