BODY AND UNDERFRAME REPAIR MANUAL

THE TRIUMPH MOTOR COMPANY (1945) LTD., — A SUBSIDIARY OF
THE STANDARD MOTOR COMPANY LTD., COVENTRY

TRIUMPH MAYFLOWER

BODY and UNDERFRAME REPAIRS and ADJUSTMENTS

PRICE 10/-

THE TRIUMPH MOTOR COMPANY (1945) LIMITED
A Subsidiary of THE STANDARD MOTOR COMPANY LIMITED, COVENTRY

FOREWARD

In preparing this Manual, repair instructions which can be carried out without expensive tools and equipment have been outlined. The equipment indicated in this book, will certainly be available in the premises of any Body Repair Specialist and, is unlikely to present difficulty to any normally equipped Motor Vehicle Repairer.

The integrated construction of the body and chassis used in the manufacture of the Mayflower will be new to some garages. It is hoped that a study of this Manual will enable such repairers to appreciate the slightly different repair procedure to be used with this type of construction, as compared with that employing a separate body and chassis.

Familiarity with the slightly different construction of the Mayflower and a little experience in the modified technique of dealing with body and frame damage on this car, as compared with the better known arrangement, should remove any misgivings with regard to this type of work.

The section on "Welding" has been very kindly contributed by Messrs. The British Oxygen Co. Ltd., and it is wished to gratefully acknowledge this assistance.

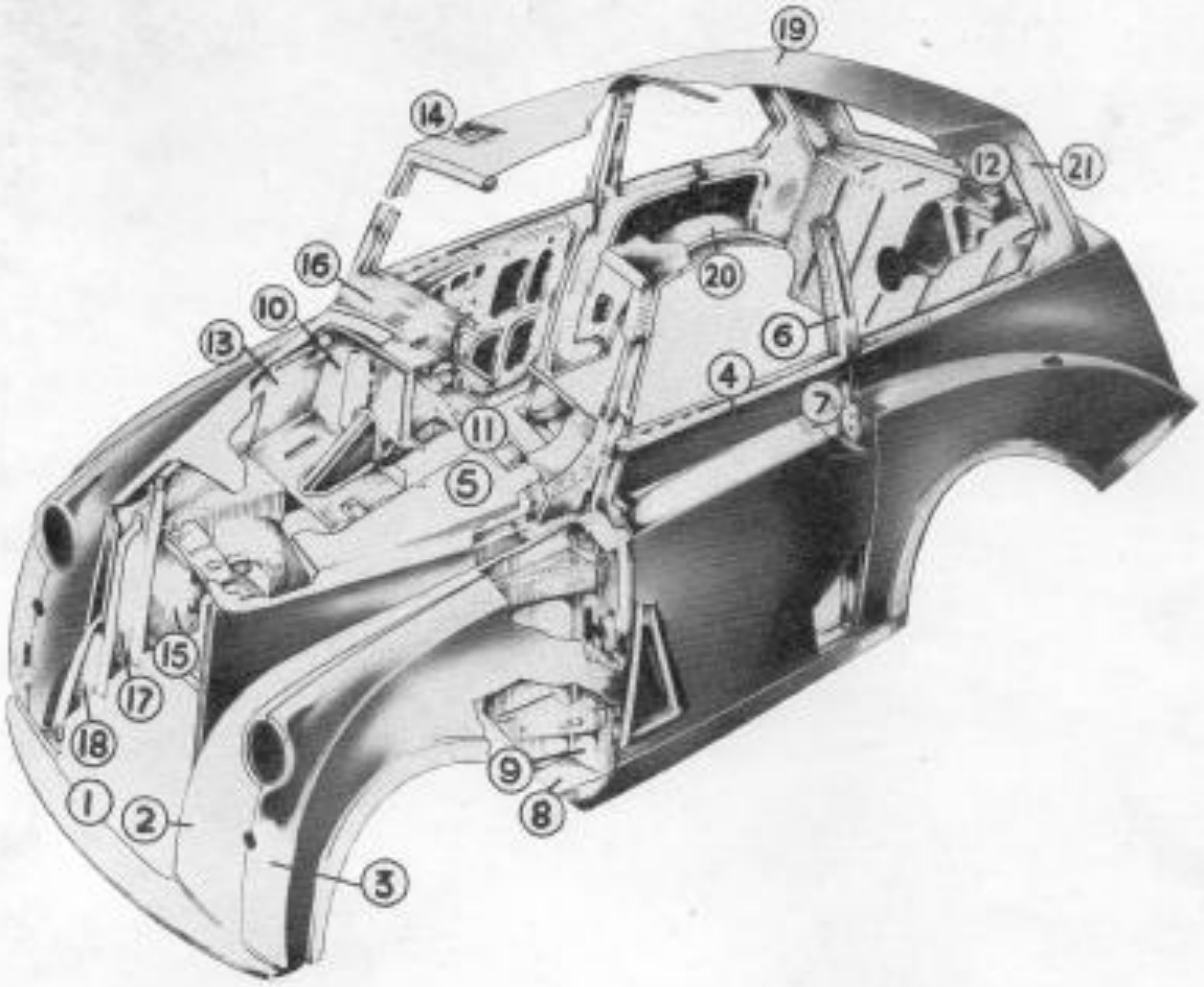


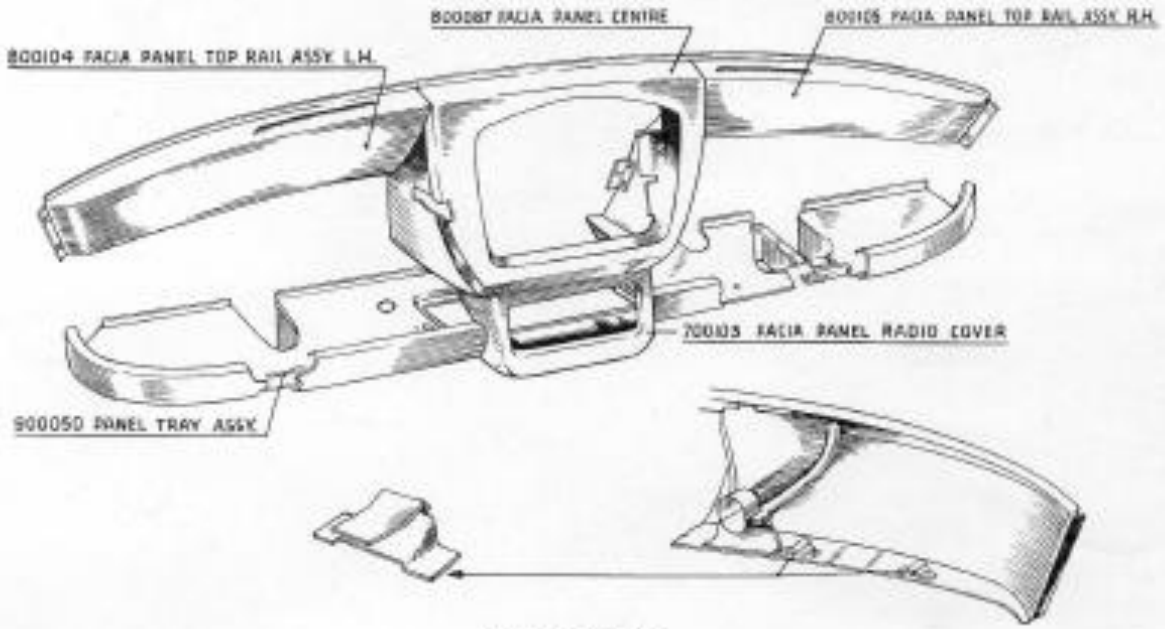
Fig. 1.

NOTE.

Where " handed " components are mentioned in this Notation, the Detail Numbers for L.H. and R.H. are both given.

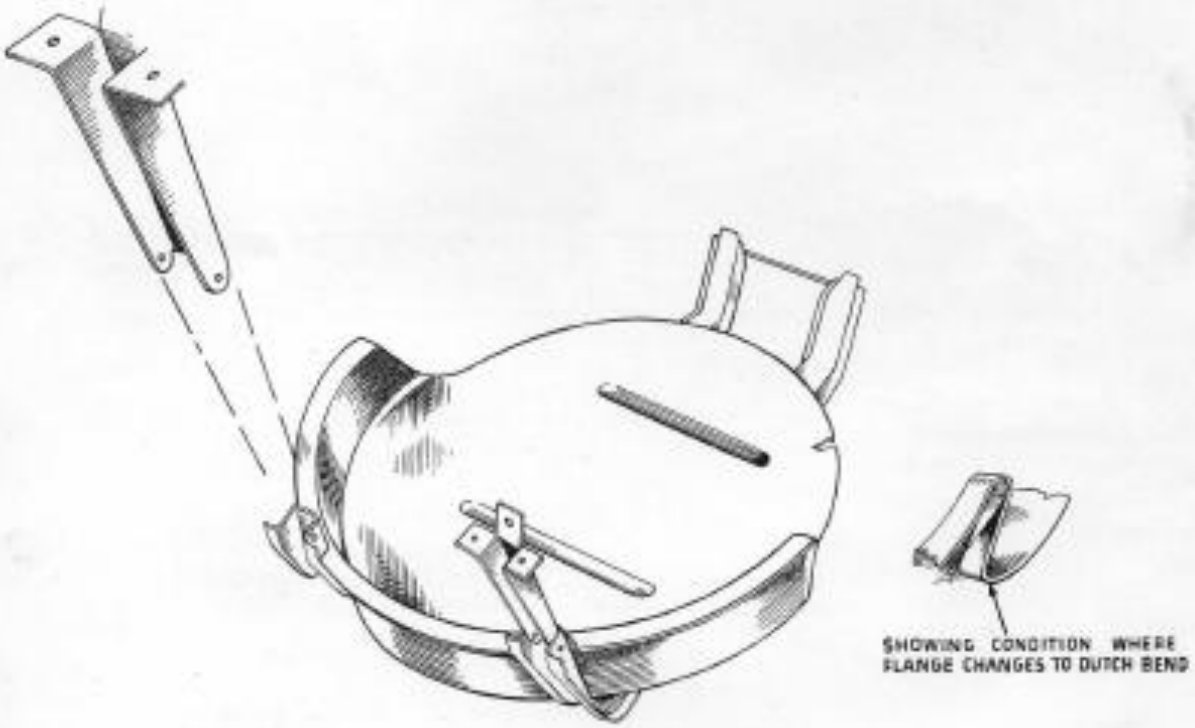
NOTATION FOR FIG. 1

Notation No.	Detail No.	Description
1	100097	Front Bumper Valance Assembly.
2	900017/8	Front Wing Inner Panel (L.H. & R.H.)
3	900019/20	Front Wing Outer Panel (L.H. & R.H.)
4	800151/2	Door Assembly (L.H. & R.H.)
5	900147	Bonnet Assembly.
6	800174/5	Post "B" Upper (L.H. & R.H.)
7	900095/6	Quarter and Post " B " Assembly (L.H. & R.H.)
8	800172/3	Sill Assembly (L.H. & R.H.)
9	700224/5	Post " A " Assembly (L.H. & R.H.)
10	800169	Dash Front Assembly.
11	900071	Facia Assembly.
12	900077	Trunk Lid Assembly complete.
13	800167/8	Dash Side Assembly (L.H. & R.H.)
14	800170/1	Cantrail (L.H. & R.H.)
15	800261/800182	Assembly Valance Panel Rear (L.H. & R.H.)
16	700209	Scuttle Top Panel Assembly.
17	80016/7	Radiator Support (L.H. & R.H.)
18	800211/2	Valance Panel Front (L.H. & R.H.)
19	800253	Roof Panel Assembly.
20	900023/4	Wheel Arch Panel Outer (L.H. & R.H.)
21	700359/60	Roof Side Panel Assembly (L.H. & R.H.)



FACIA ASSEMBLY

Fig. 2.



800223 SPARE WHEEL SUPPORT ASSY.

Fig. 3.

Section One

BODY AND FRAME COMPONENTS

The Mayflower body and underframe are an integrated assembly, the combined body and chassis being built from units welded together.

The illustrations shown in this Section are intended to assist repairers when ordering components to deal with a body or chassis repair. The details given in this should be studied in conjunction with a Spare Parts List.

The components detailed in this Section are limited to those required to enable a practicable repair to be made, as more extensive repairs would necessitate the employment of special jigs and fixtures, which are unlikely to be available outside this factory.

The details given below do not include the special front end frame assembly mentioned on page 5 of Section Two. As this component assembly is not normally listed as a separate item and can, therefore, only be obtained as a special order.

The only underframe components, which are likely to be of practical assistance when dealing with a repair, apart from the front end frame assembly are the following :

PART	**DETAIL NO.**
Side member assembly, L .H.	400143
Side member assembly, R.H.	400144
Front cross member assembly with starting handle bracket	200223

Section Two

Body Frame Repair

Accidental damage to a body frame of a major character is shown in Fig. 1.

The repair of this type of damage necessitates the complete " turnover " of the vehicle. It should be appreciated that before such a " turnover " is made, a complete mechanical strip should be carried out and the body seats and quarter lights removed.

Fig. 1. *Showing accidental damage to a body frame of a major character.*

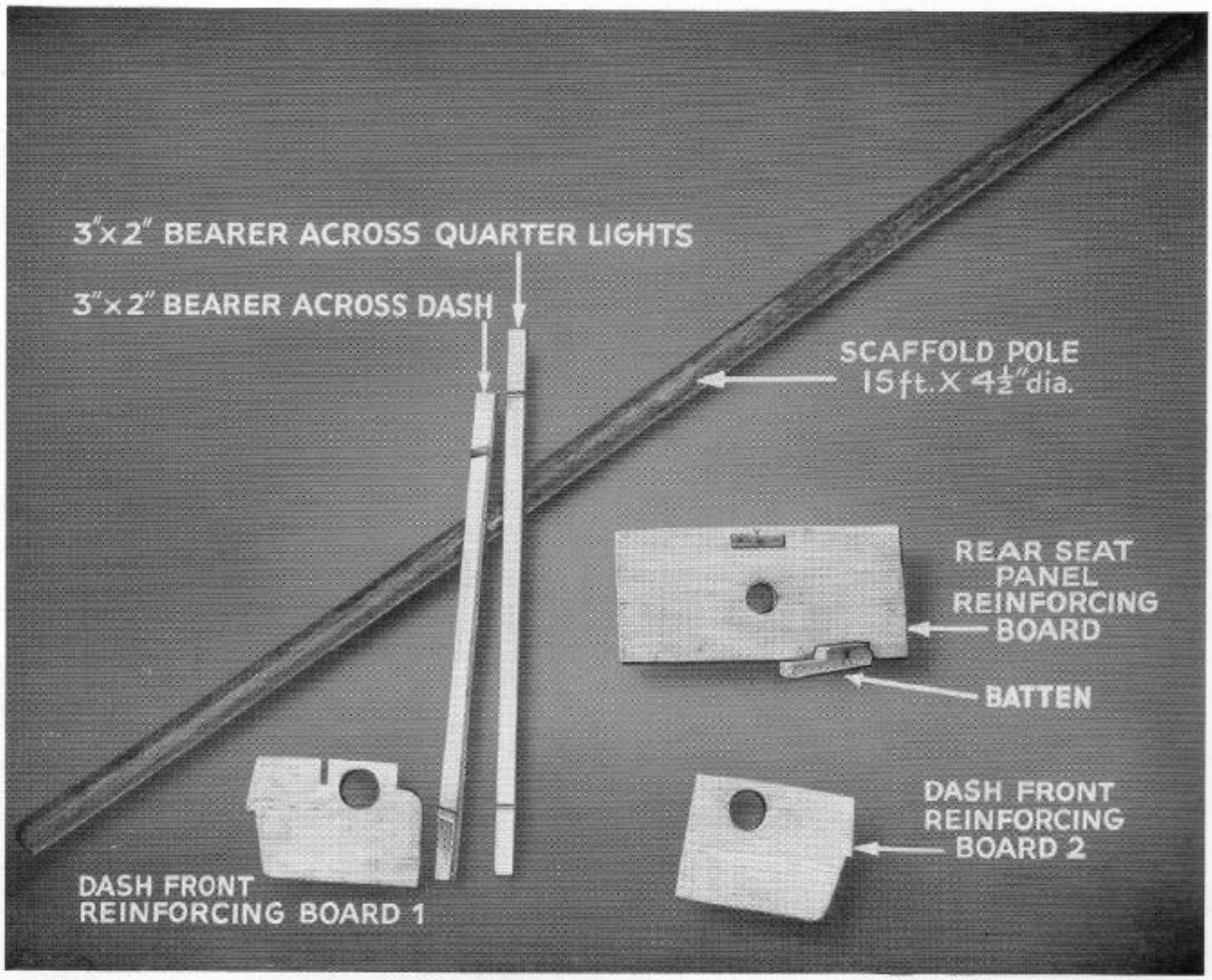


Fig. 2. *Repair equipment required for dealing with accidental damage.*

Fig. 2 illustrates suitable equipment, for carrying out a repair of this nature, which can be easily made or cheaply obtained from local sources. The two reinforcements shown in Fig. 2 are of ½ in. plywood, the one for the dash front being made in two parts, right-hand and left-hand, overlapping at the centre, and assembled together in position as shown in Fig. 3. The reinforcement fitted in the luggage boot, which is shown in Fig. 4 is in one piece and made so as to fit tightly between the wheel arches and luggage floor and top panel, being further secured in position by a batten (hidden by the pole in the illustration) between a flange at the top of the boot interior and the piece of wood screwed on to the face of the reinforcement. This reinforcement of the body is necessary to enable the load to be carried on the pole shown. Prior to fitting the reinforcement ply boards in position, the 5 in. metal discs, fitted respectively at the front and rear, to the lower dash panel and rear squab support panel, must be removed.

Take a builder's scaffold pole, 15 ft. long, and 4 ½ ins. in diameter, and insert through apertures in the two reinforcement boards as shown in the illustration, leaving an equal length protruding at the front and rear of the body. Two engine

lifting cranes, one at each end, will make the body "turnover" easy. If only one such crane is available, lift front end sufficiently to enable a trestle 3 ft. 6 ins. in height to be placed under that end. Disengage crane and lift the other end of the pole a sufficient height to clear the floor level and complete the body "turnover."

Having completed the " turnover " as described above, take a 3 ins. by 2 ins. Bearer member and place with even projection at each side of the body, through quarter-light apertures, placing a small trestle on each side, and lower rear end of body to rest on cross member and trestles. The crane may now be used for the removal of the high trestle from under the pole and to lower the front end to rest on dash as shown in Fig. 5.

Proceed to check, as described below, the amount of distortion and the direction this takes.

Take a steel bar 3 ft. 3 ins. long by in. in diameter, accurately making centre-punch marks, one at the centre of the bar and one on each side, 18 ins. from this central marking. Next pass the bar through the right-hand front end

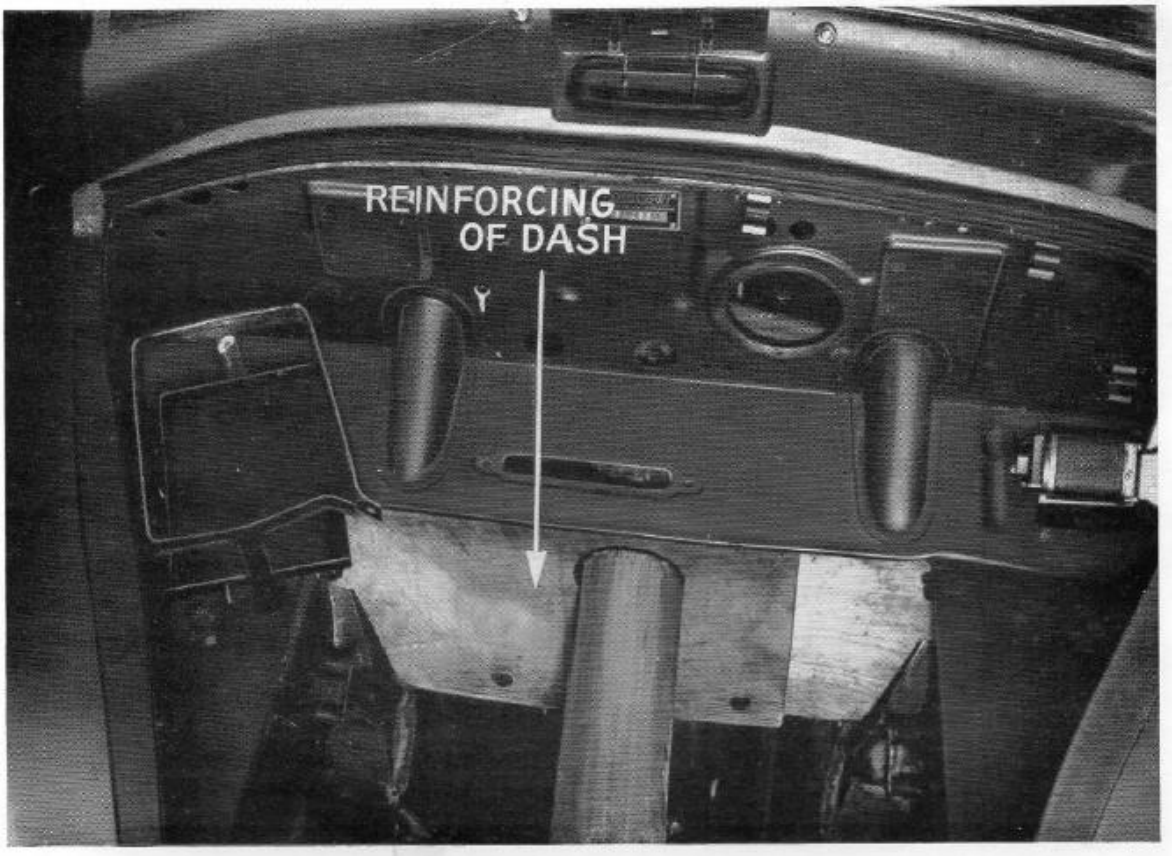


Fig. 3. *Shows reinforcement of dash to accommodate lifting pole.*

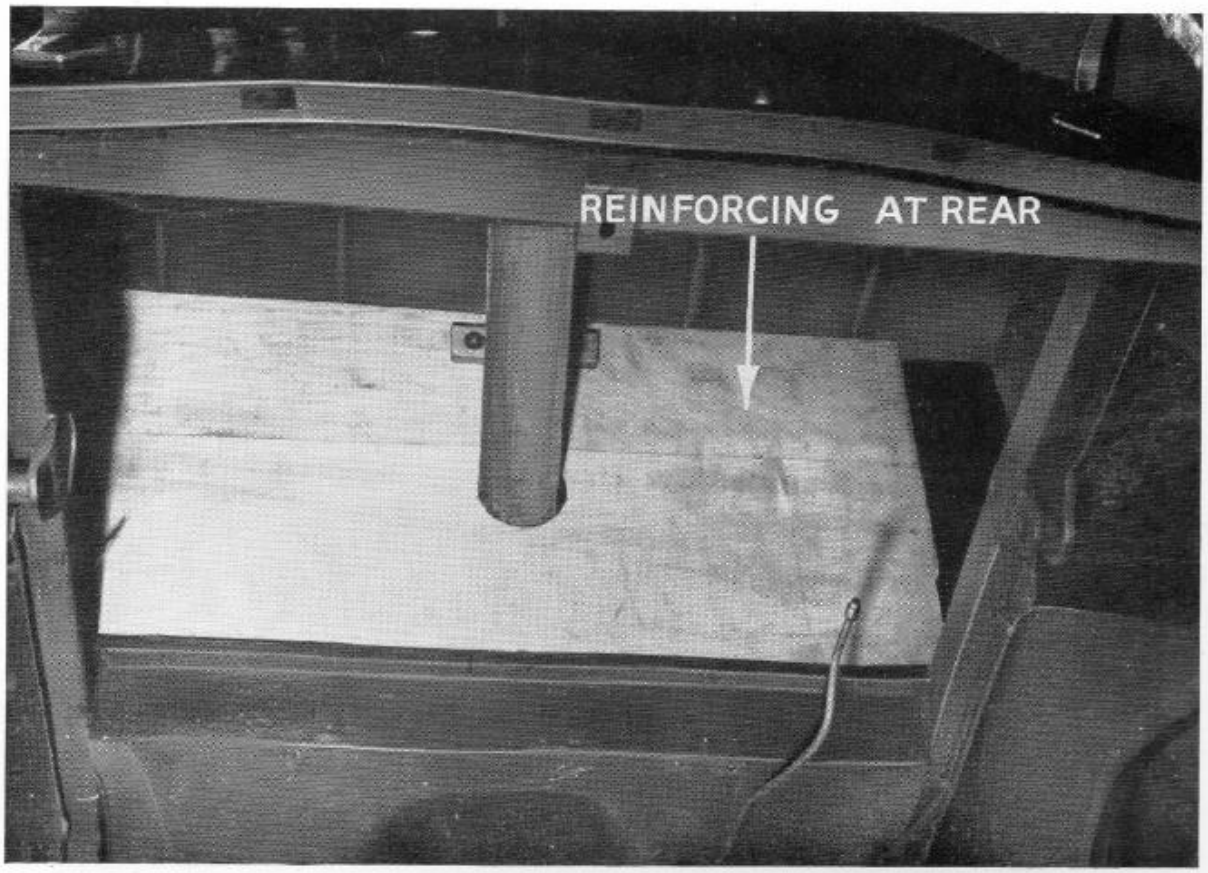


Fig. 4. *Showing reinforcement at rear of car to accommodate lifting pole.*

rear spring shackle bracket, approximately 2 ins., then draw bar back through left-hand bracket until the central centre-punch mark coincides with the centre line of the frame, the outer centre-punch marks will then represent the centre line of each rear spring eye. With the centre-punch marks uppermost on the bar use a trammel bar with points from right-hand and left-hand spring centres to mark off centre on front frame cross member as shown in Fig. 6. By checking from the centre mark made on the frame cross member to the right- and left-hand tooling holes shown in illustration, the amount of error, if any, at this point can be seen.

A hydraulic jack is used to push the frame to its original position, care being taken to prevent crushing of frame members. Suitable blocks of wood, closely following contours or angles and fitted to member or members, as shown in Figs. 7 and 8 are recommended to prevent damage by crushing.
If side member is badly crushed, it may become necessary to open sufficiently locally to enable the insertion of the appropriate tool for re-shaping, closing up and welding after completion, when the necessary repair has been effected and true alignment obtained, reinforcement of the repaired section with 18 gauge plates is recommended, fully welding these in position as shown in Fig. 9.

Frame Repair Checks

1. Strain a light gauge piano wire along centre line of frame, Fig. 10, and check front suspension pick-up points and front axle centre line, Figs. 6 and 10.

2. Place across frame, 20 ins. to the rear of front axle centre line, a suitable member of 1.60 ins. thickness, as shown in Fig. 11. A straight edge should now be placed on the bar which passes through each spring shackle, to extend forward over each of the four right- and left-hand front suspension abutment brackets (situated 6.10 ins. and 3.40 ins. fore and after of the front axle centre line) and 8 ½ ins. to the right and left of the frame centre line. The face of each set of four brackets should be parallel to, and 2.6 ins. from, the straight edge. Each front suspension bracket face measured laterally from a horizontal plane through the frame centre is inclined outwards at 10 degrees.

3. Place a straight-edge laterally across the frame and resting on the forward pair of front suspension abutment brackets (there being four pairs of such brackets) and take a slight reading, as shown in Fig. 12, with the 7/16 in. bar through each rear spring bracket. The bar and top of straight-edge, when viewed from the front in a horizontal plane, should be parallel to one another.

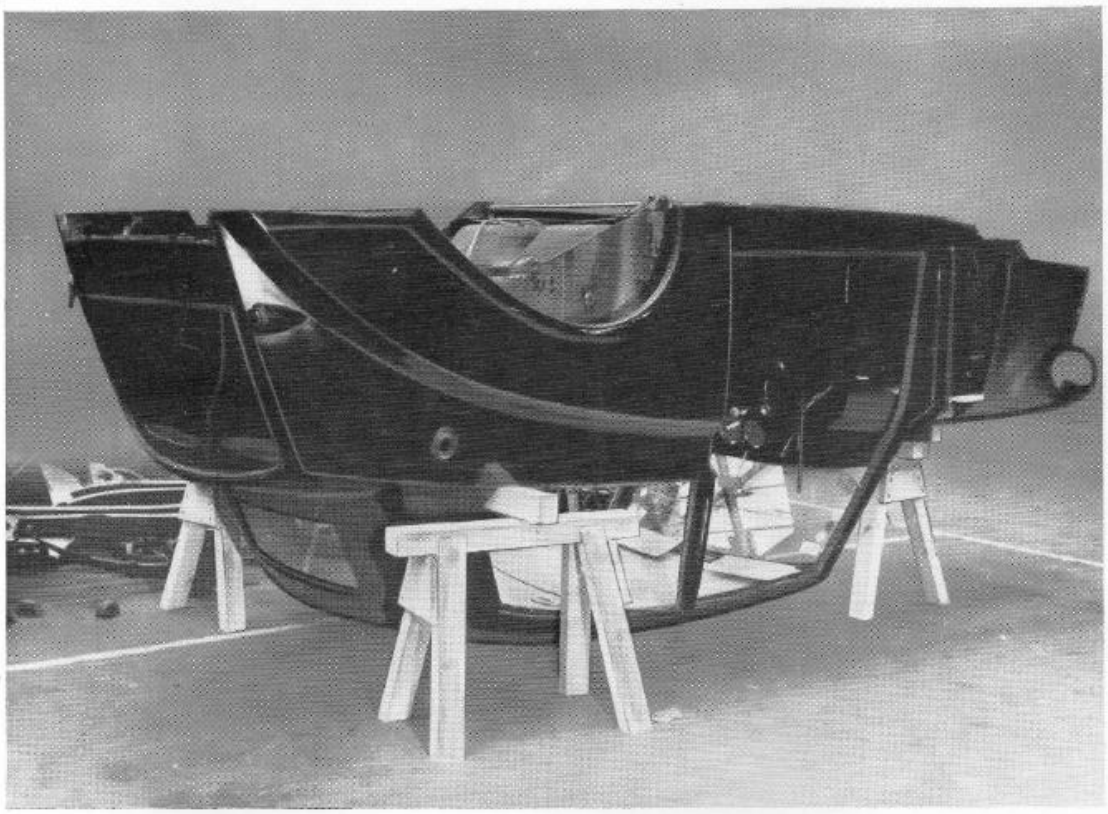


Fig. 5. *Showing method of supporting the inverted body on four trestles.*

Extensive Front Frame Damage

If frontal body frame damage is too excessive to repair in the manner described above, a new front end frame may be purchased from the Spares Department.

Having cut away the damaged frontal portion of the body frame to enable a diagonal junction to be made with the new front end frame, the abutting ends of the new frame will be suitably cut to enable diagonal jointing and a reinforced over joint of 18 gauge plate added, as recommended above for local frame repair. An example of a reinforced diagonal joint is shown in Fig. 9.

Replacement of Front Wings

Body panel sections and wing panels are obtainable from our Spares Department, details of these being given in Section 1 of this Repair Manual. If only an outer panel has to be replaced, the following procedure is recommended: Burn off, with acetylene torch, to within approximately ½ in. from centre beading, as shown in Fig. 13, the total length of the panel

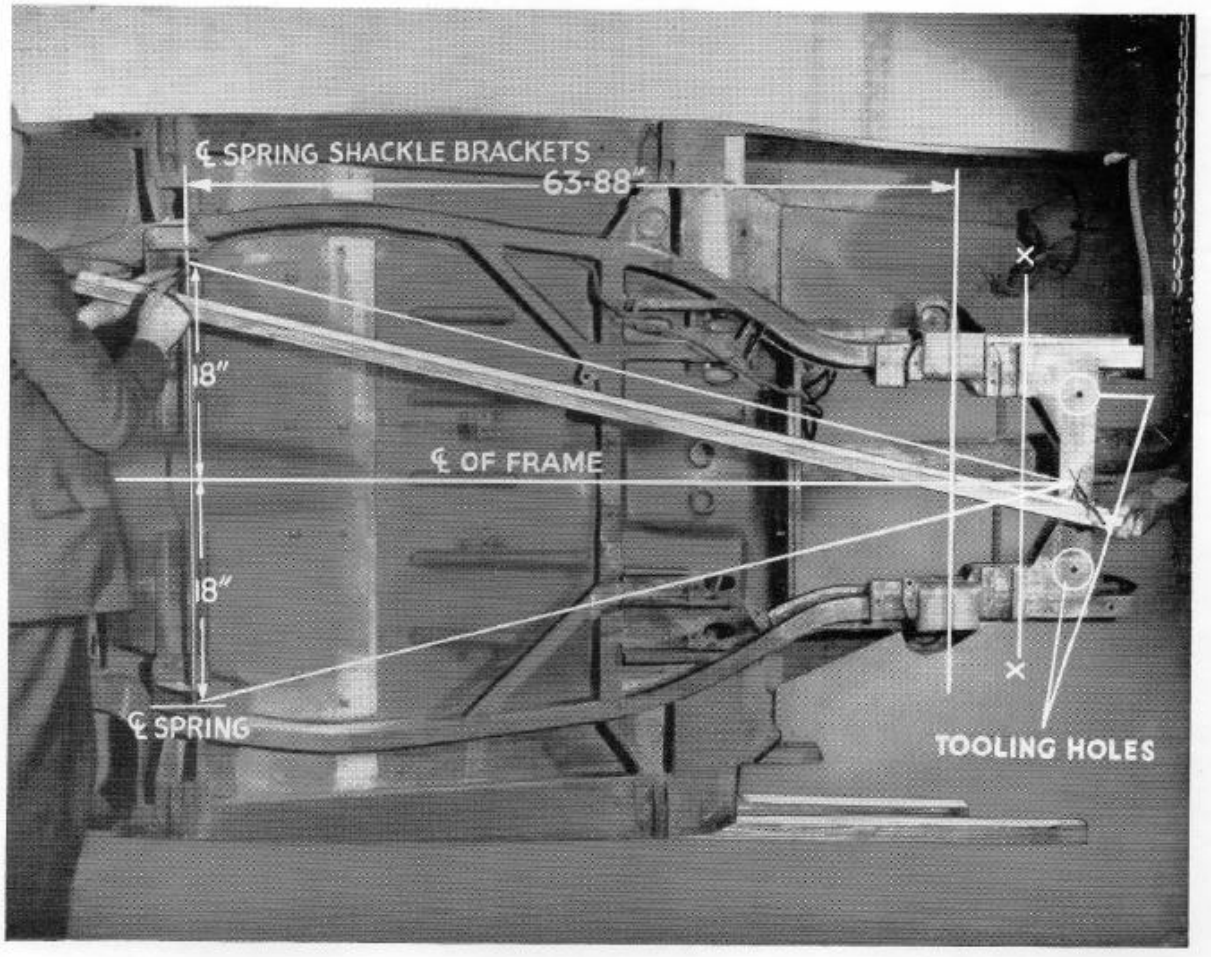


Fig. 6. *Showing method of trammelling the underframe.*

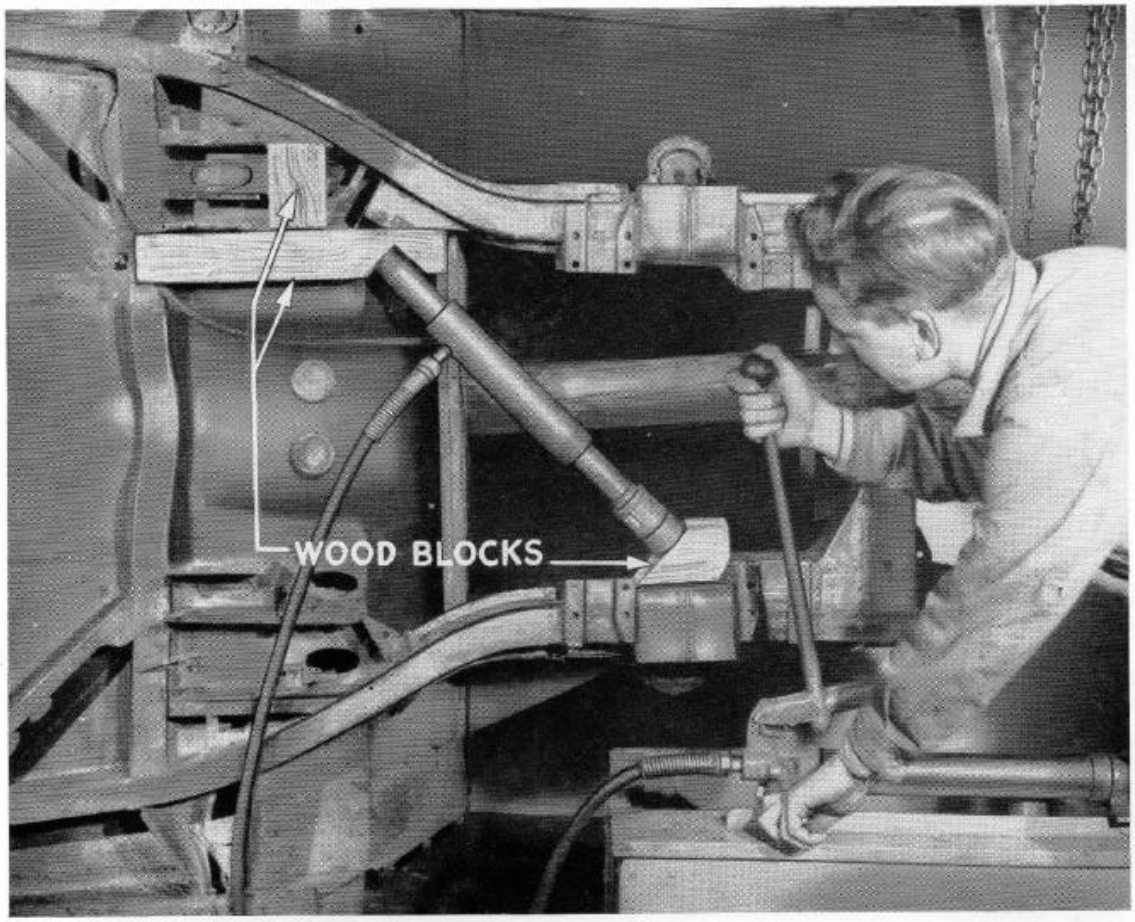


Fig. 7. *Showing use of jacking tool to rectify frame damage.*

portion to be replaced and file through the edge which is flanged over post *A,* withdraw headlamp and remove damaged wing panel. Clean off paint at centre joint on fragment of panel to be removed, exposing original weld spots and drill each spot in this fragment only, thus freeing it for removal.

As inaccessibility makes the re-welding difficult, either by spots or gas, the two flanges to be joined may be bolted together. To ensure correct assembly, make a full-length drill template and use on the new and original panels. Approximately twenty 1/2 in. by 3/16 in. bolts, equally spaced, will be required. The front joint may be welded as edge on post *A* after making a flange.

REPAIRS AND ADJUSTMENTS OF BODY FITTINGS

Replacement of Windscreen

1. EXTERIOR. Remove four chrome plated corner finisher pieces from the front, lift out the chromium plated beading and then raise outer edges of glazing rubber from retainer channel.

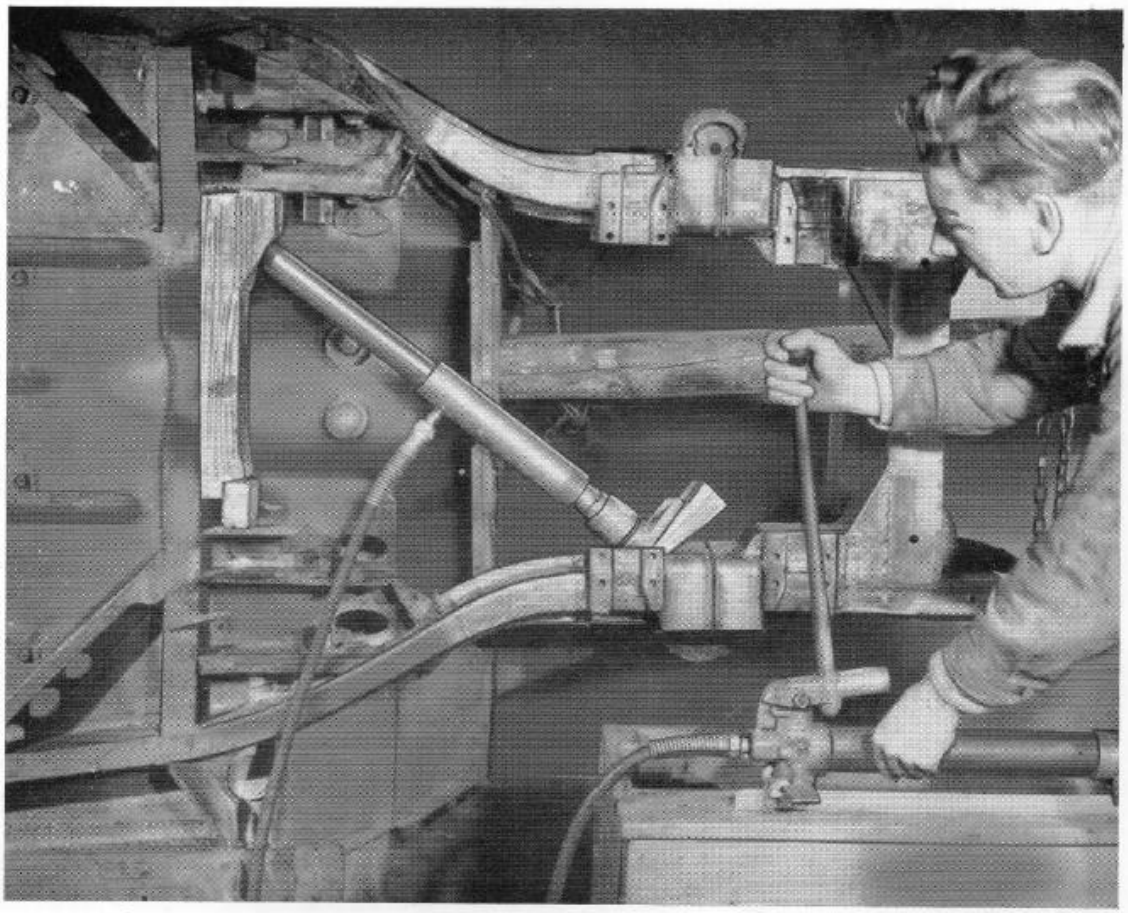


Fig. 8. *Showing use of jacking tool to rectify frame damage. Note wooden blocks to prevent crushing of frame members.*

2. INTERIOR. Take a suitable instrument to break the seal between rubber surround and screen aperture metal flange. The screen may now be forced out forwards through the aperture. Considerable force may be required to perform this operation and an assistant will be required outside the car at the front.

To Refit

Use petrol to clean any fragments of original sealer from inside sealing rubber and metal screen aperture.

Apply a fresh coat of Bostik solution to rubber channel, glass edge and metal aperture, afterwards allowing time for this to become tacky. When solution is tacky, fit rubber around glass and offer up to metal aperture from the front, holding firmly in position, whilst an assistant lifts the specially moulded Up on rubber over receiving aperture (a piece of cord can be conveniently used for this purpose as shown in Fig. 14) from inside the car, subsequently fitting the outer rubber flange into retainer channel from outside the car.

The outer finisher headings are now fitted, care being taken that they are so placed to pick up with corner pieces. An application of soft soap to the beading will considerably assist this operation.

Removal and Refitting of Quarter-lights (See Fig. 15)

The chromium plated frame, complete with ventilator, is secured from within by Parker Kalon drive screws, which fit into nut plates clipped on to frame. The screws, fourteen in all, are obscured by a specially moulded lip on sealing rubber, four screws are equally spaced between ventilator hinge post and end of frame and four directly opposed at frame top, three at *A* in rear vertical member and three at *B*.

Having removed the holding screws, the quarter-light and rubber surround are forced out of the body aperture.

When refitting, care must be taken to lift the covering rubber lip through aperture and over metal flange without damage. A new seal at each screw plate should be made, using Sealastic, Bostik or Dum-Dum.

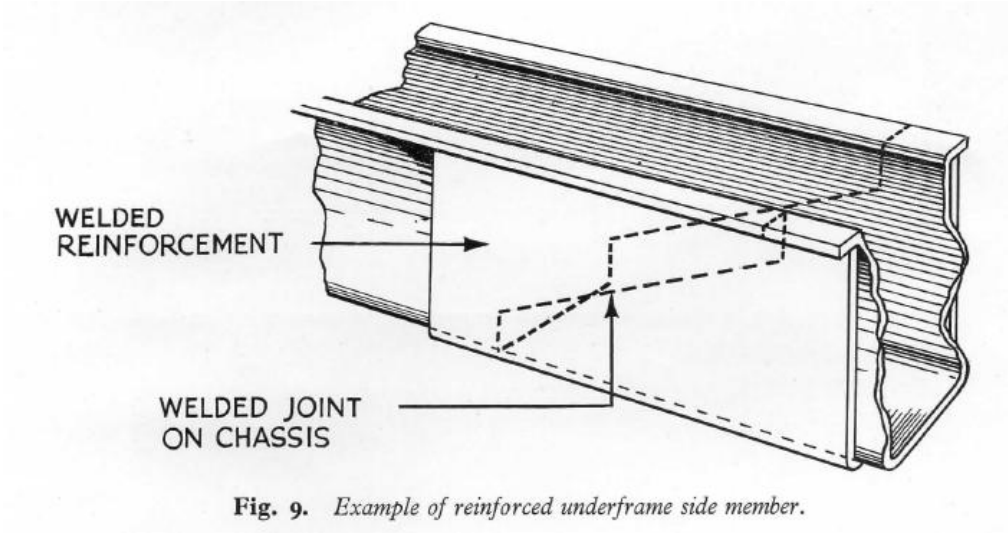


Fig. 9. *Example of reinforced underframe side member.*

Fitting and Removal of Roof Trim Panels (See Fig. 16)

The roof trim panels are in three sections and fitted in the following order:

1. Front panel.
2. Joined together to form one unit are left-hand and right-hand back light quarter-panels and short roof section.
3. Intermediate roof panel and one centre joint lapping strip.

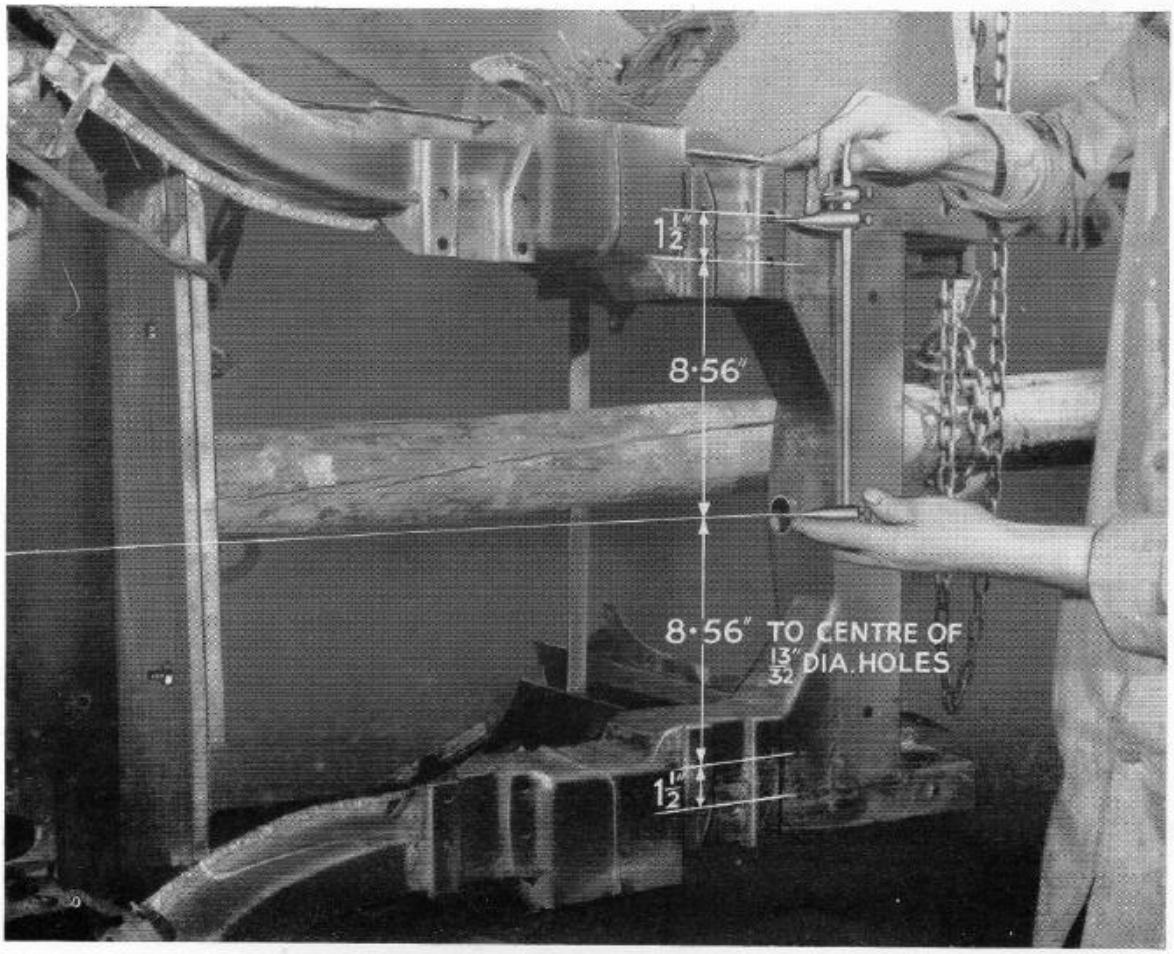


Fig. 10. *Checking front suspension pick-up points.*

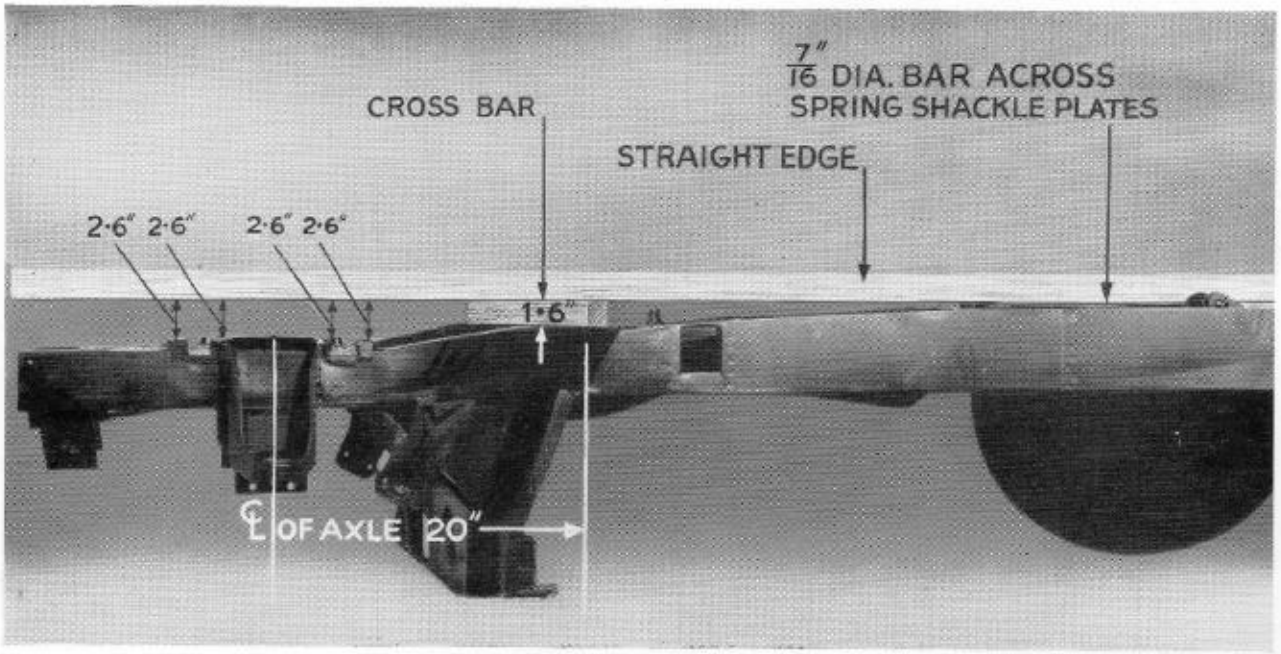


Fig. 11. *Checking horizontal alignment of underframe.*

Method of Fitting

Place outer edges of No. 1 panel over left-hand and right-hand cantrail mouldings in the inverted position and spring panel upwards, taking care not to break millboard panel and push forward top screen moulding into correct position. Fit centre joint strip and secure with eight drive screws to roof across rail.

Next place No. 2 assembly into position and pull inner flange of back light glazing rubber through panel aperture and secure at joint under back light and both quarters with drive screws.

Now assemble No. 3 panel as with No. 1 (front panel) and finally push it forward over centre joint strip.

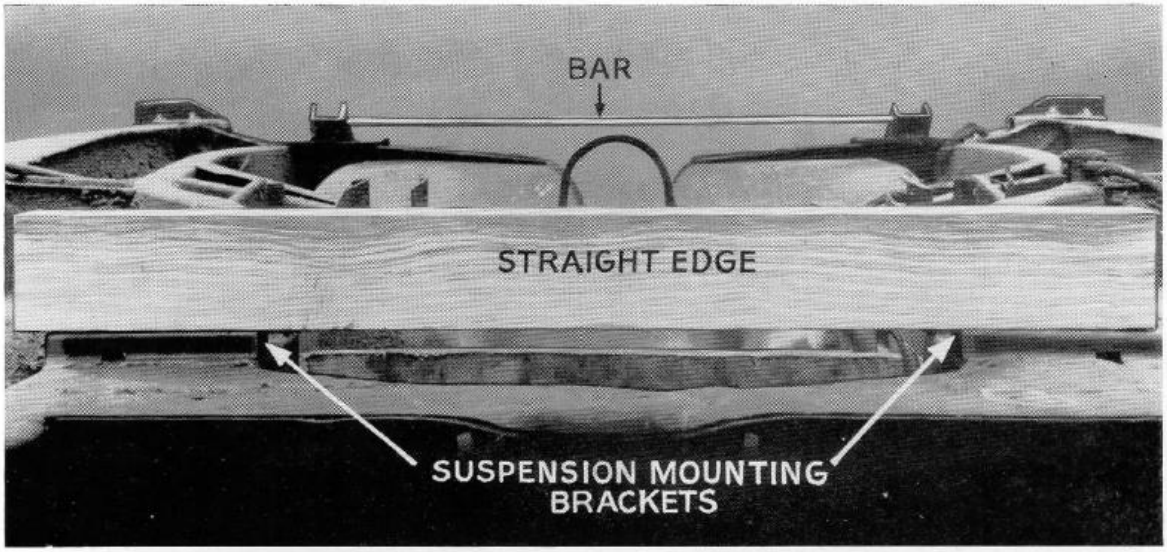


Fig. 12. *Bar and top of straight edge when viewed from the front in a horizontal plane, should be parallel with one another.*

Method for Removal

To remove, the method for assembly is reversed. First remove roof light and use aperture, thereby provided to grip panel and pull back off lip of centre joint strip. Now insert fingers between Nos. 2 and 3 and pull down panel to inverted position and withdraw. (See Fig. 16).

An additional strip of felt, placed as near to the edge of panel as to completely fill gap between trim panel and roof panel, will cure rattles or vibrations which may develop.

DOORS

To Strip and Rebuild (See Fig. 17)

Remove window handle and inside lock handle by depressing rosettes and extracting cotter pins.

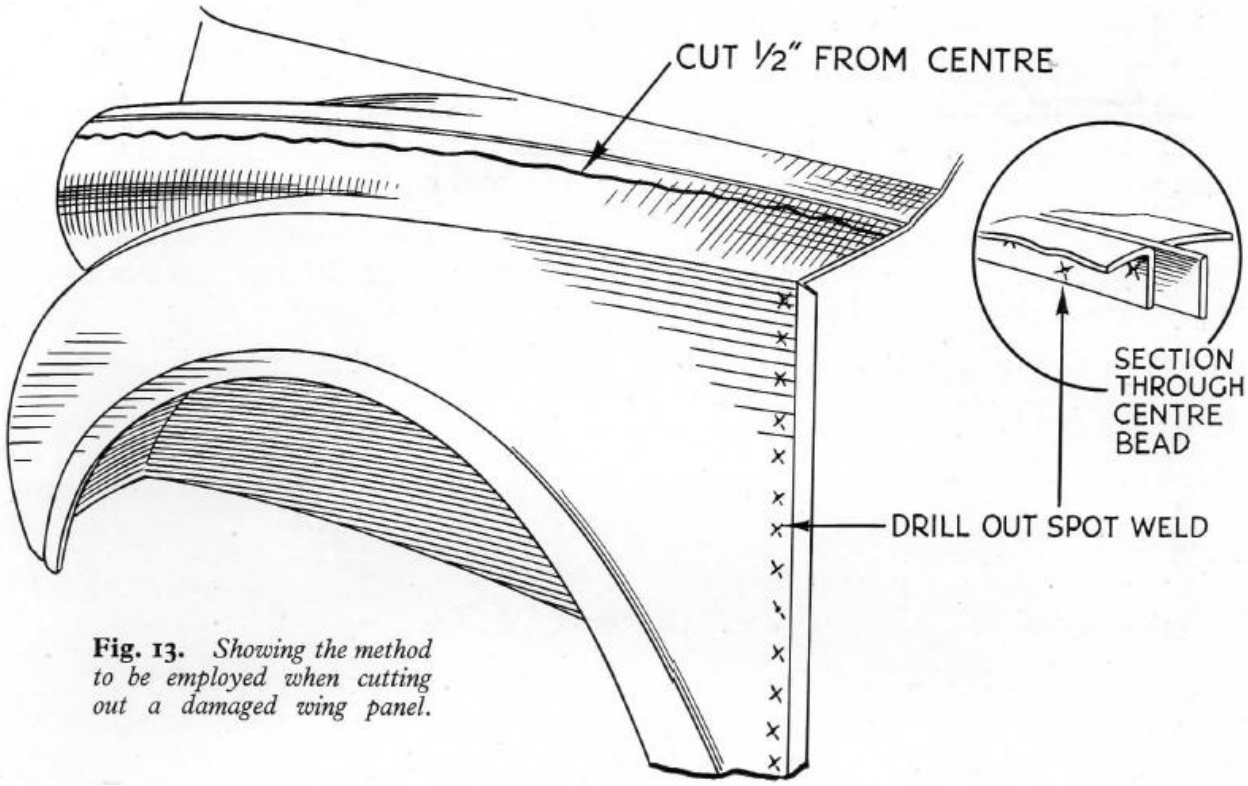


Fig. 13. *Showing the method to be employed when cutting out a damaged wing panel.*

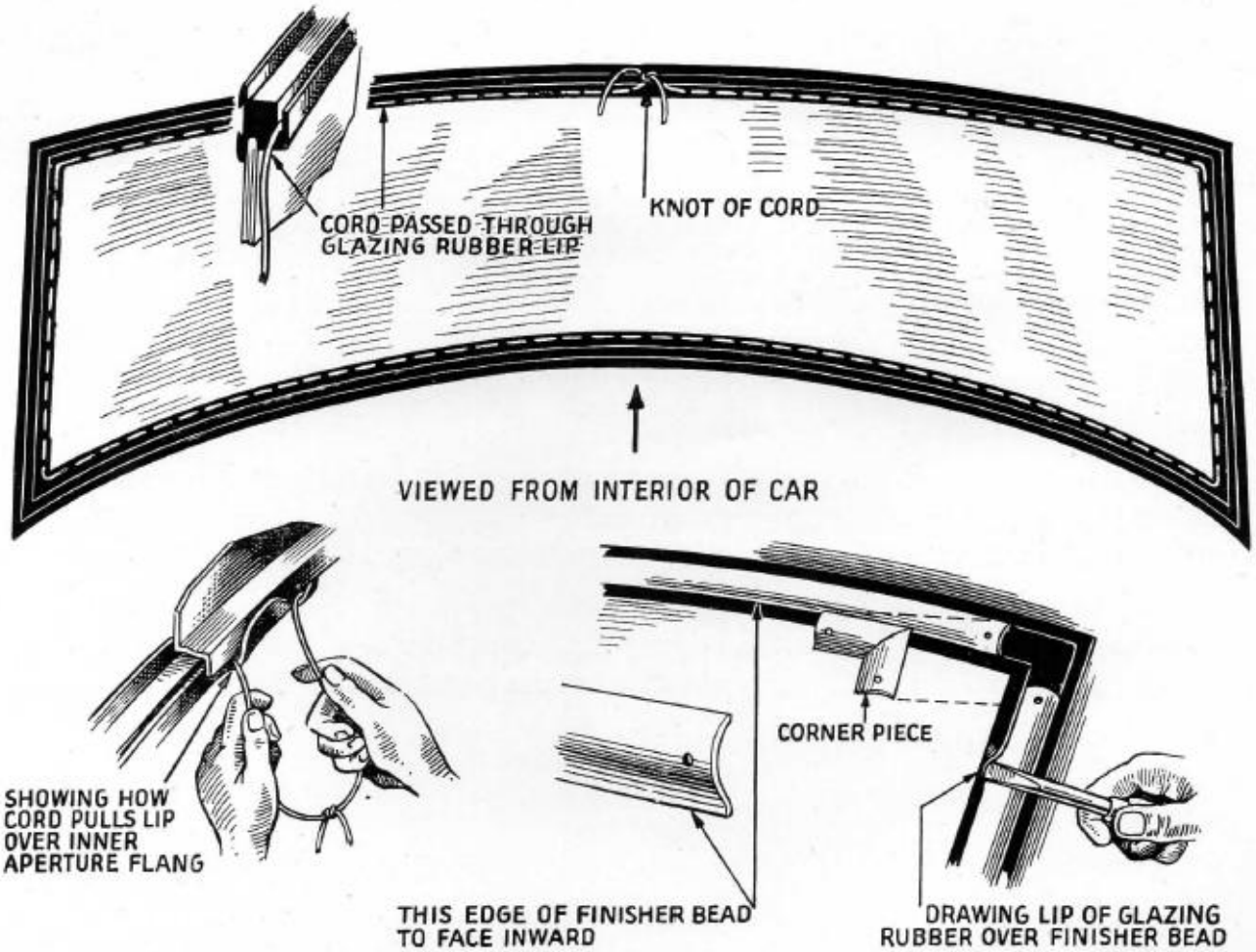


Fig. 14. *Refitting a reglazed windscreen to car. A similar procedure for seating the rubber beading may be employed when fitting a new rear quarter light to body.*

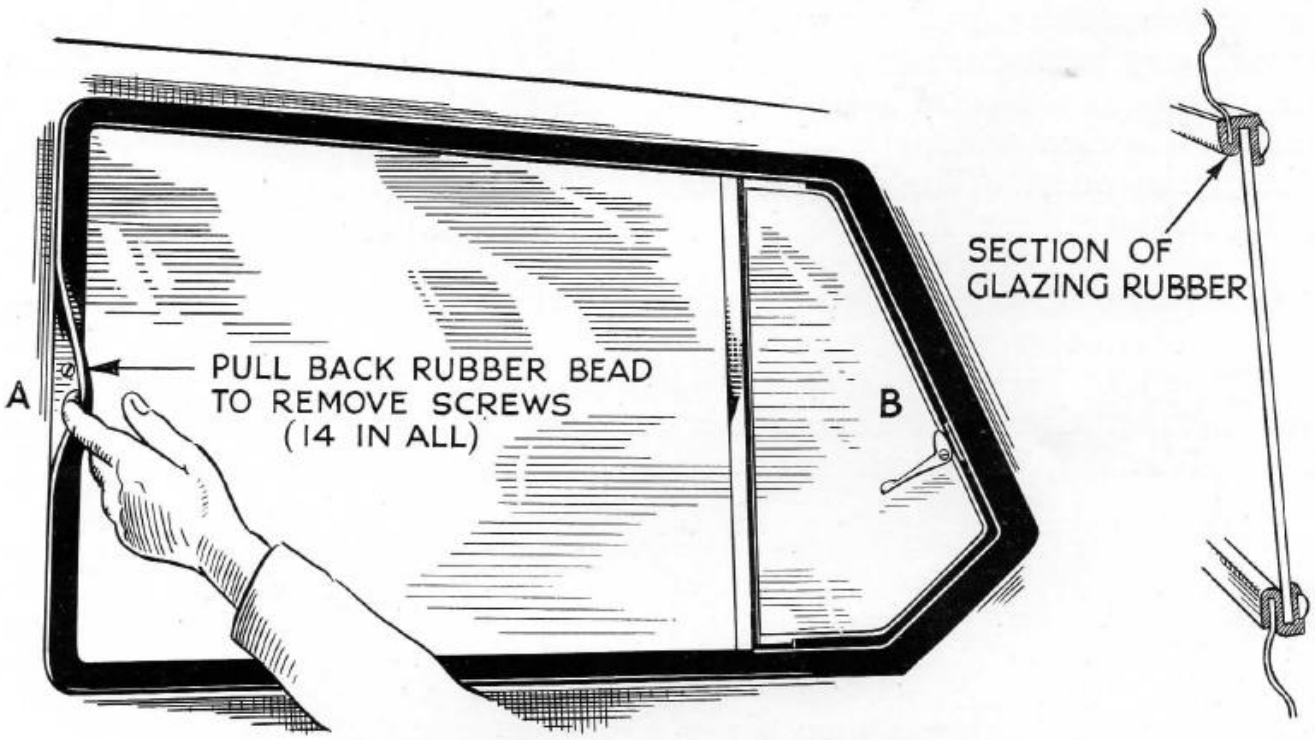


Fig. 15. *Showing the rear quarter light rubber beading turned back to expose one of the fourteen Barker Kalon drive screws.*

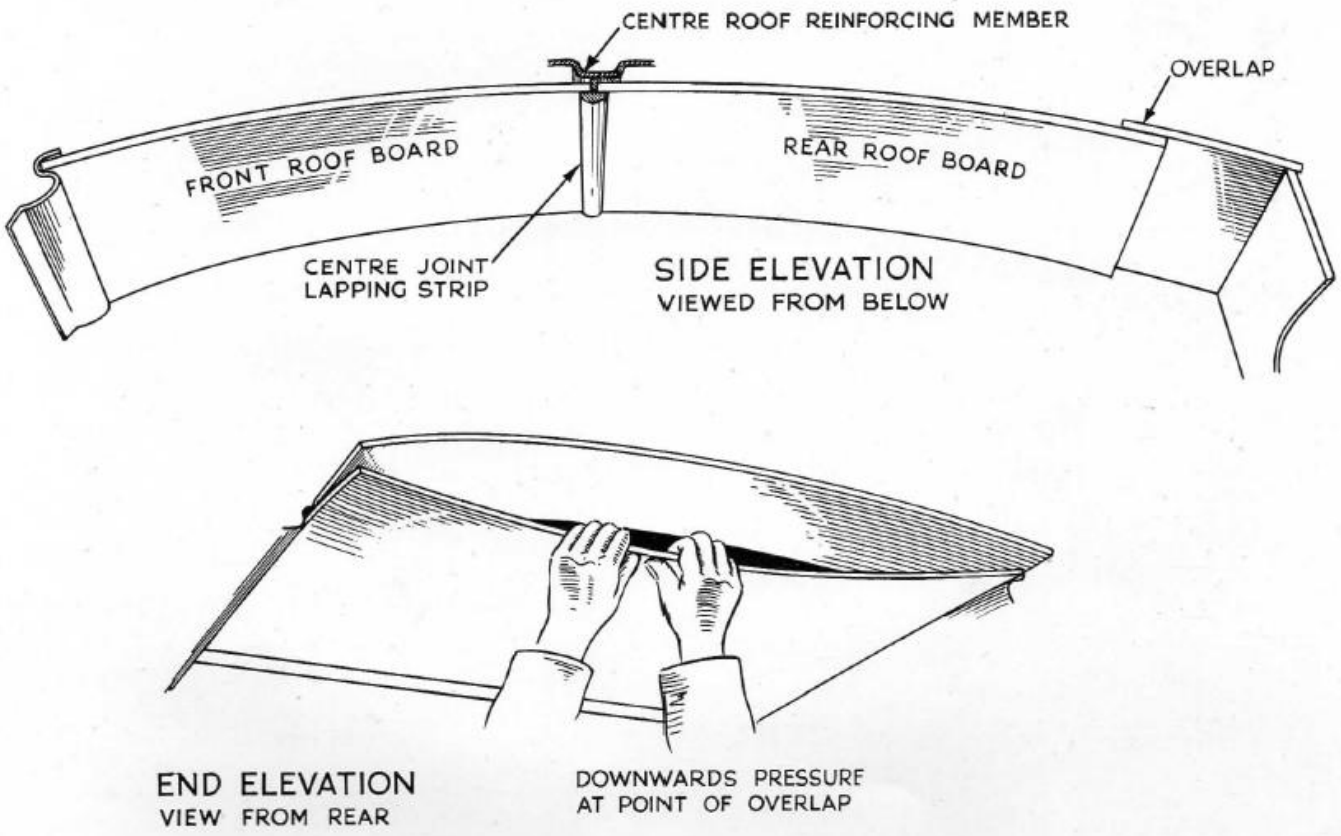


Fig. 16. *Illustrating the construction of and method of removing roof trim panels.*

The trimmed casing board is held in position by twenty-two spring clips attached to the casing board and engaging holes in the metal door frame. Insert screwdriver between door inner panel and casing and prise off, taking care not to break clips.

Remove the door window bottom stop (four drive screws) and lower window, disengaging window lifting arm and dropping light to clear door waist and garnish rails. Remove fringed finisher strips after freeing seven retaining spring clips. The vertical window frame members are secured by screws, as shown in Fig. 18. Remove the rubber grommets in lock pillar panel and withdraw the three cheese-headed screws. Finally, remove the two hexagonal screws at the bottom of the centre post, withdraw door and the two nuts at the base of the vent. The light frame can now be lifted out, following its removal, by the withdrawal of the glass.

Remove the four cheese-headed screws securing the quadrant type winder, and carefully force this winder into the inside of the door and withdraw. Withdraw cotter pin attaching lock remote control link afterwards removing remote control and lock.

To re-assemble, the reverse procedure to the foregoing should be employed.

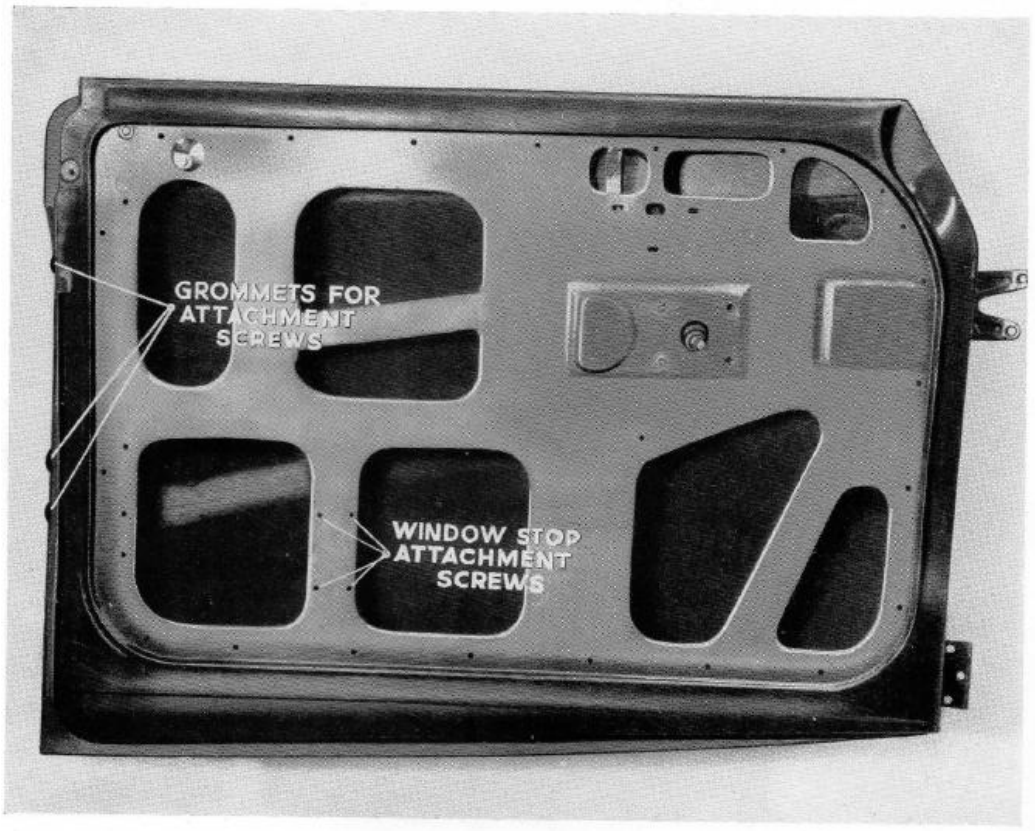


Fig. 17. *Showing dismantled door assembly.*

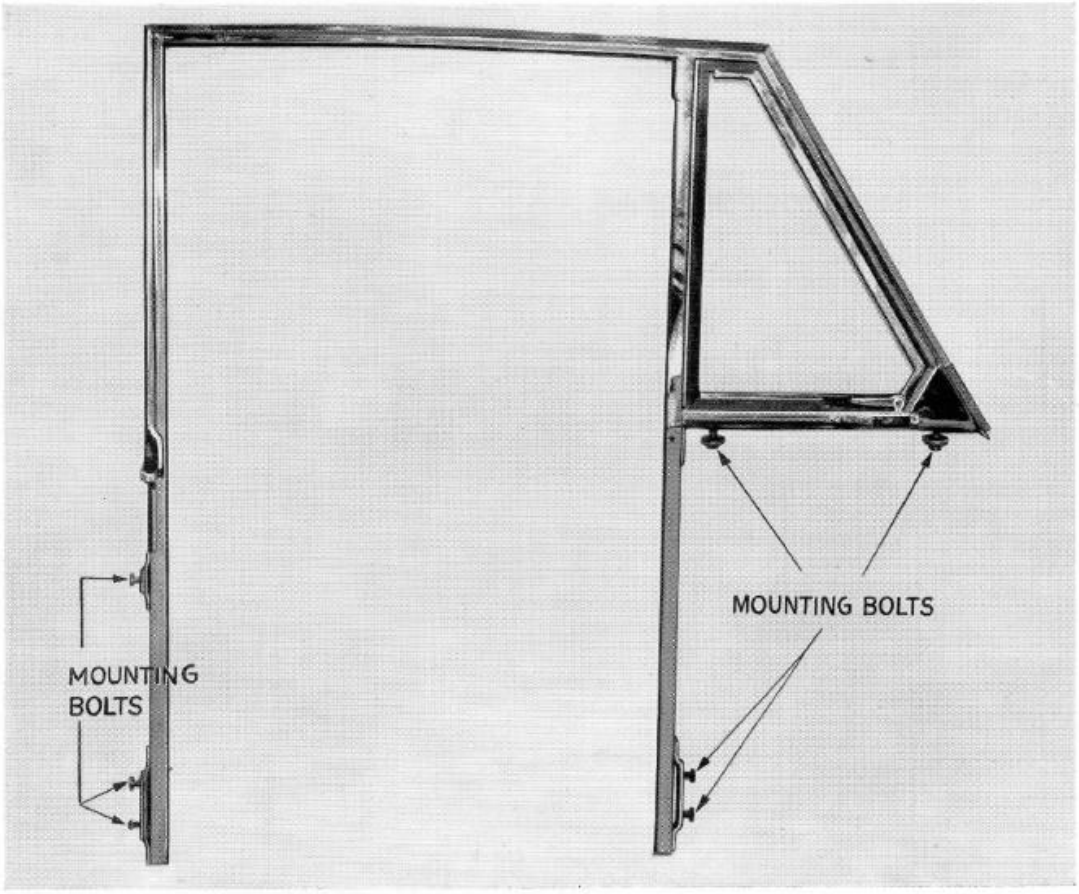


Fig. 18. *Vertical window frame members.*

Under Frame Dimensions

Fig. 19 gives dimensioned view of the under frame assembly to enable repairers to carry out checks for accidental damage.

Tools and other Equipment Required

Whilst most repairers will be in possession of the necessary equipment to deal with the repairs outlined in this Manual, there may be others who are not so equipped.

As a guide to repairers who may not be equipped to deal with body and under frame repairs, lists of suggested tools are given. In addition to the items suggested, oxyacetylene equipment will be required, details of this appearing in Section III under "Welding Hints."

The body panel tools and body jacking equipment shown in Figs. 20 and 21 may be obtained direct from Messrs, Timson Bros., Moor Street, Birmingham, 4.

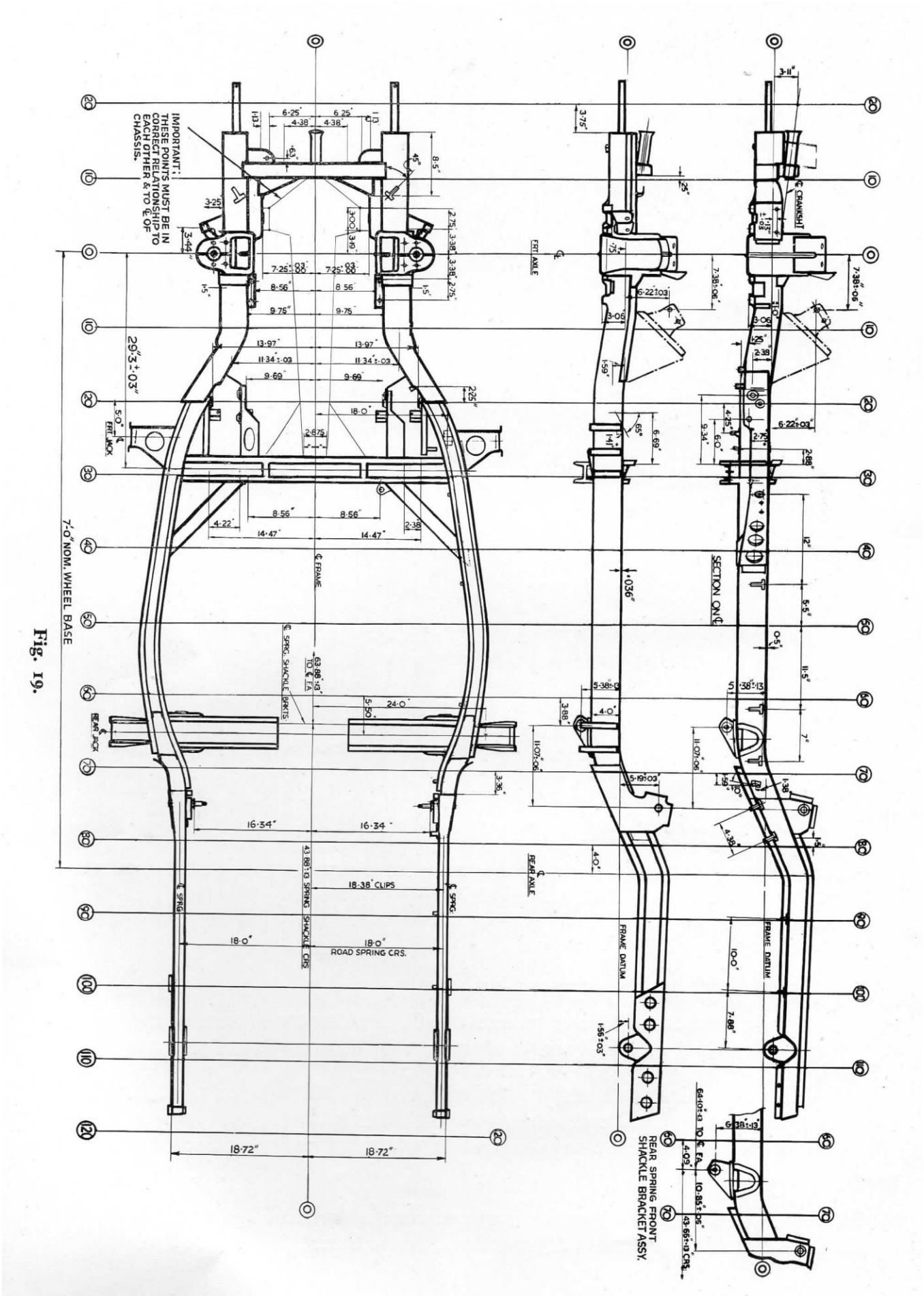

IMPORTANT:
THESE POINTS MUST BE IN CORRECT RELATIONSHIP TO EACH OTHER & TO ℄ OF CHASSIS.
7'-0" NOM. WHEEL BASE
29"±·03"
18·72"
18·72"
16·34"
16·34"
18·0"
18·0" ROAD SPRING CRS.
18·38" CLIPS
24·0"
℄ FRAME
℄ SPRG.
℄ SPRG.
℄ FRT AXLE
℄ REAR AXLE
FRAME DATUM
FRAME DATUM
SECTION ON ℄
REAR SPRING FRONT SHACKLE BRACKET ASSY.

Fig. 19.

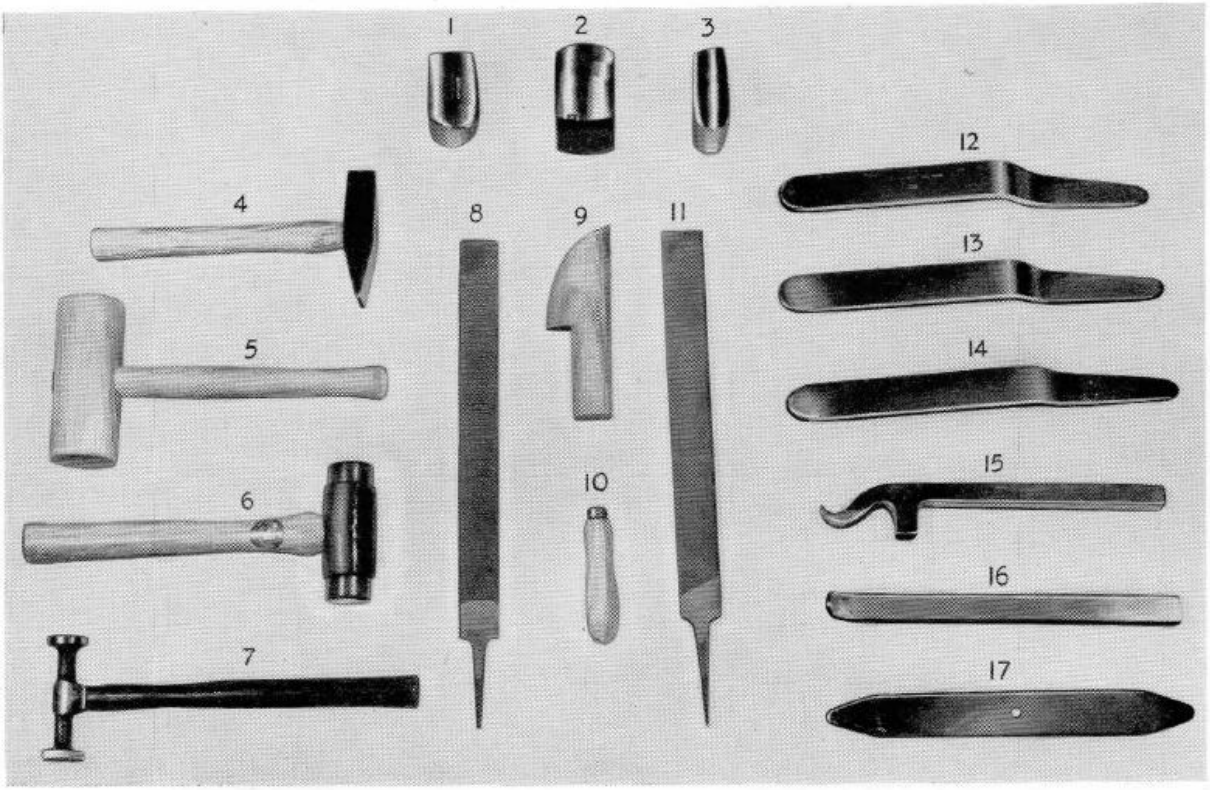


Fig. 20. *Body panel tools.*

NOTATION FOR FIG. 20

Notation No.	Description
1	Dolly Block, General Purpose (No. 325).
2	Dolly Block, High Crown. (No. 327).
3	Dolly Block, Shallow Crown. (No. 326).
4	Pin Hammer. (No. 341).
5	Lignum Mallet. (No. 329).
6	Hide Faced Hammer. (No. 328).
7	Bumping Hammer. (No. 342).
8	File, Milling 14 ins. (No. 338).
9	Solder Paddle. (No. 330).
10	File Handle.
11	File, Hand Smooth. (No. 339).
12	Spoon, Heavy Round End. (No. 331).
13	Spoon, Heavy Cranked. (No. 332).
14	Spoon, Medium Cranked. (No. 333).
15	Spot Weld Tool. (No. 336).
16	Dolly Spoon. (No. 337).
17	Spoon, Light, Taper Ends. (No. 334).

NOTE. The numbers quoted in brackets are Messrs. Timson Bros. reference numbers.

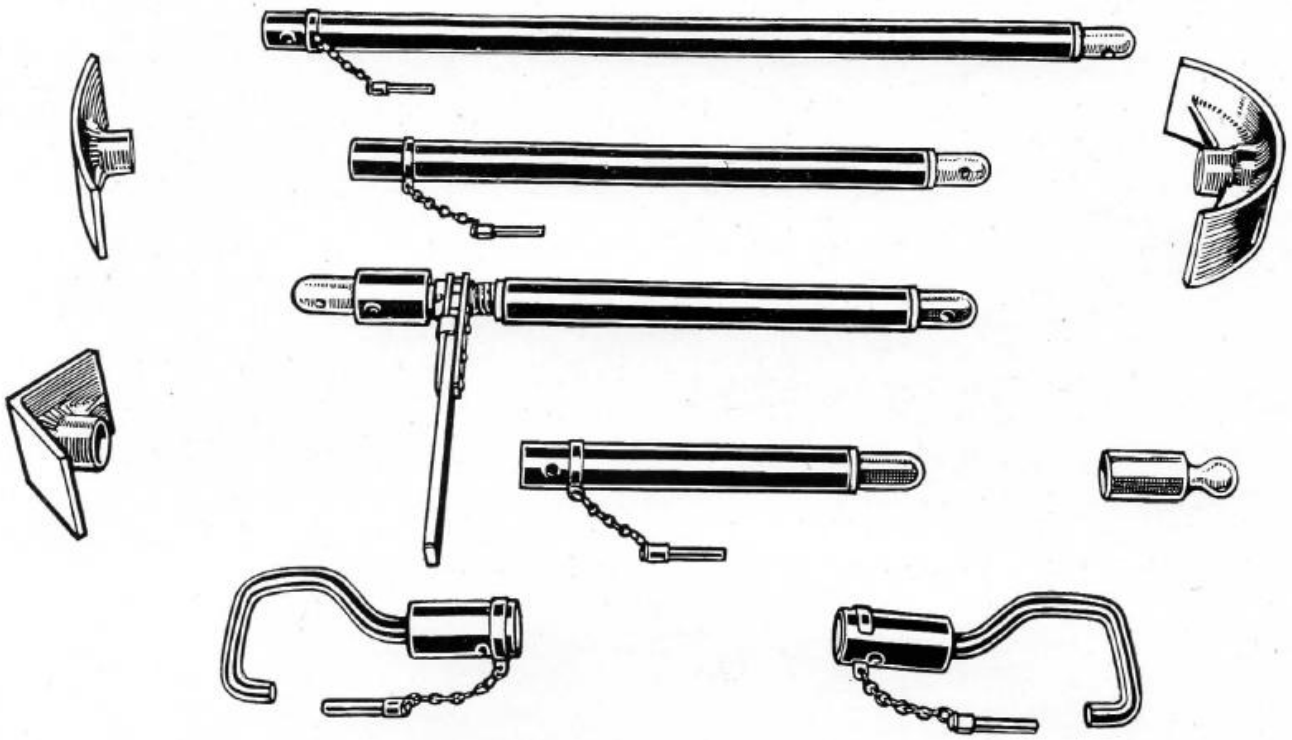


Fig. 21. *Body jack equipment.*

Section Three

HINTS ON WELDING

The following notes apply to equipment supplied by THE BRITISH OXYGEN COMPANY LIMITED, but they will also be of use when dealing with other similar equipment. It should be observed that whilst these notes are fairly comprehensive and will give guidance to operators with the minimum of experience, at the same time it is not recommended that those entirely unused to the operation of welding equipment should attempt to make repairs or carry out serious work without the assistance or instruction of a trained welder.

Equipment

The most convenient type of oxy-acetelene equipment for sheet metal repair work consists of high pressure outfit utilising both oxygen and acetylene in cylinders. This equipment is completely portable if mounted on either an indoor or outdoor trolley and can be moved readily to the job.

The complete equipment is as follows:

High Pressure (H.P.) Equipment, using dissolved acetylene

1. Supply of acetylene in cylinders.
2. Supply of oxygen in cylinders.
3. Blowpipe, with necessary nozzles.
4. Acetylene pressure regulator.
5. Oxygen pressure regulator.
6. Two lengths of rubber canvas hose,
7. Set of keys and spanners.
8. Welding goggles and spark lighter.
9. Welding rods.
10. Welding fluxes.
11. Trolley for accommodating complete equipment and cylinders.

Assembly:

1. Stand both cylinders vertically—if not on a trolley, the oxygen cylinder will need a proper stand or support. Oxygen cylinders are painted BLACK. Acetylene cylinders are painted MAROON.
2. Open valve on oxygen cylinder momentarily, in order to dislodge dirt or obstruction in the cylinder valve, then close.
3. Open valve on acetylene cylinder momentarily and then close.
4. See that jointing surfaces in cylinder valves are free from oil or grease.
5. Screw oxygen regulator (painted Black) into oxygen cylinder valve. Oxygen cylinder valve outlets and oxygen regulator connections have RIGHT-HAND screw threads.

6. Screw acetylene regulator (painted Maroon) into acetylene cylinder valve. Acetylene cylinder valve outlets and acetylene regulator connections have LEFT-HAND screw threads.
7. Tighten the regulator in the cylinder valve. Do not use excessive force, but make certain that the joint is gas-tight.
8. Connect hose (acetylene red, oxygen black) to screwed outlets of regulators by means of screwed connections secured in ends of hose. Blow the hose through with gas from cylinder before attaching to blowpipe, in order to remove dust or dirt and to remove chalk when hose is new.
9. Connect the other end of the hose to the blowpipe, the acetylene hose to the connection marked *A* the oxygen to the connection marked *O.* Keep the blowpipe control valves closed. A high pressure blowpipe (Fig.2) should be used with H.P. equipment.
10. Fix the appropriate size nozzle to the blowpipe. (Table 1.)
11. Open the cylinder valves very slowly by means of the cylinder key. Do not open suddenly, or there may be serious damage to the regulator and the possibility of an accident. Open two or three full turns of the cylinder valve spindle, but not more.

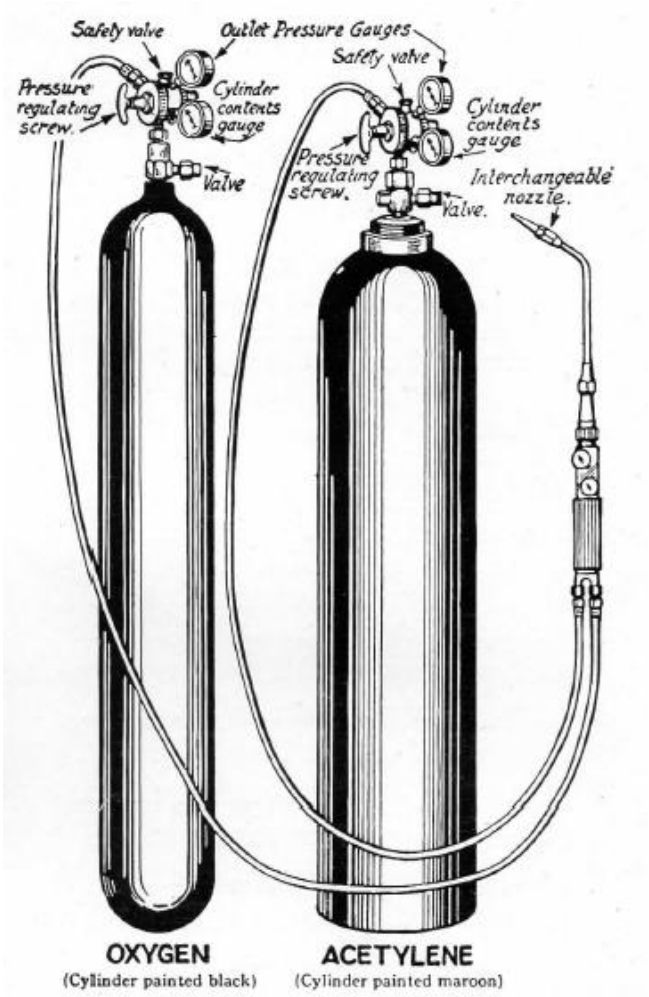


Fig. 1. *High pressure oxy-acetelene welding outfit.*

12. Set the regulators at the correct working pressures (Table 1.)
13. Open the acetylene control valve on the blowpipe, wait a few seconds until air is blown out and pure acetylene is coming from the blowpipe nozzle, then light, preferably by means of a spark lighter.
14. Reduce or increase the acetylene supply by the blowpipe valve until the flame just ceases to smoke.
15. Turn on the oxygen by the blowpipe control valve until the white inner cone in the flame is sharply defined, with the merest trace of an acetylene haze. (See page 4 - Flame Adjustment).

The blowpipe is now adjusted for welding steel and work may be commenced. Do not light the blowpipe until everything else has been prepared for welding.

The outfit is now ready for operation but before starting, study the following notes and diagrams which describe the oxy-acetylene flame, its characteristics and the adjustment that is possible.

TABLE 1

High Pressure Blowpipes

NOZZLE SIZES, WORKING PRESSURES AND GAS CONSUMPTIONS FOR VARIOUS METAL THICKNESSES.

Plate Thickness Inches	Nozzle Size	Regulator Pressures lbs./sq. in. Oxygen and Acetylene		Approximate Consumption
		CH	DH	Cu. ft./Hr.
$\frac{1}{32}$	1	2	2	1
$\frac{3}{64}$	2	2	2	2
$\frac{1}{16}$	3	2	2	3
$\frac{3}{32}$	5	2	2	5
$\frac{1}{8}$	7	2	2	7
$\frac{5}{32}$	10	3	3	10
$\frac{3}{16}$	13	3	4	13
$\frac{1}{4}$	18	3	7	18
$\frac{5}{16}$	25	4	9	25
$\frac{3}{8}$	35	4	—	35
$\frac{1}{2}$	45	6	—	45
$\frac{3}{4}$	55	8	—	55
1	70	10	—	70
Over 1	90	14	—	90

The size of nozzle given for a particular thickness of steel is for general guidance only, and will vary according to the skill of the welder, mass of metal, etc. The capacity of each nozzle overlaps the capacities of those next in size to it. The values given are for down hand butt welds in mild steel. For other techniques, nozzle size and pressure may have to be varied slightly, *e.g.,* for copper select a larger nozzle; for aluminium a smaller nozzle.

CH and DH nozzle sizes indicate the approximate consumption of each gas in cubic feet per hour, using a neutral flame at the pressures indicated.

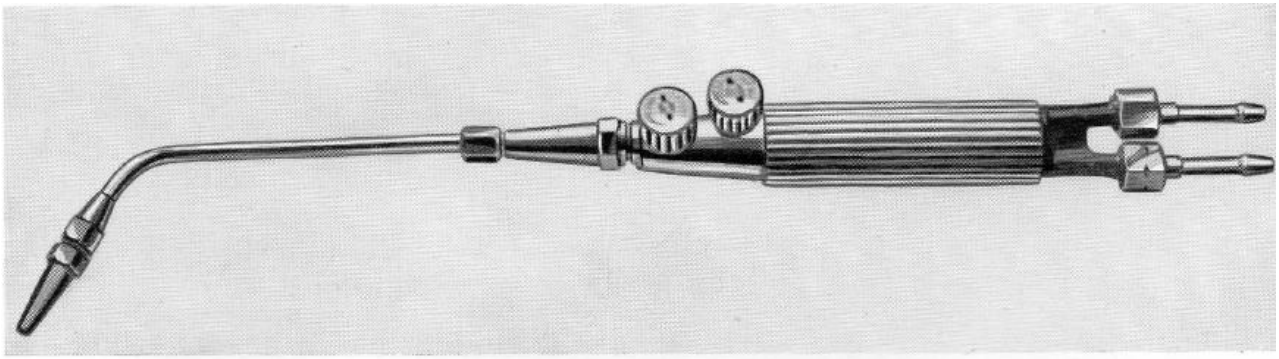


Fig. 2. *Type DH. H.P. blowpipe for welding metals from $\frac{1}{64}$ in. to $\frac{5}{16}$ in. Use $\frac{3}{16}$ in. bore rubber canvas hose Ref. H.P.*1.

The notes which are given in this Section are not meant to be comprehensive; they are intended as a guide to the most important points to be observed by a welder, and should be extended by perusal of more detailed welding literature* by practical experience and, particularly, by expert instruction. Where details are given in connection with welding methods, it is understood that the instructions are to apply to right-handed welders. Nozzle sizes, etc., quoted in the table are for general guidance only; experienced welders will know that it may be necessary to depart from the values shown according to the job in hand. For example, to weld mild steel rod or bar use a nozzle two sizes smaller than for plate of the same thickness.

General

Endeavour to work methodically in all welding operations. Prepare the work carefully beforehand. Clean the metal free from scale, rust, paint, grease, etc., and pay particular attention to the adjustment of pressures, correct size of nozzle and diameter of welding rods. (See Table 1.)

Flame Adjustment

To light the high pressure blowpipe, the acetylene blowpipe control valve is turned on first, and, when acetylene is issuing from the nozzle, the gas is ignited. It will burn with a yellow smoky flame. The acetylene blowpipe control valve should now be gently adjusted until the flame just ceases to smoke.

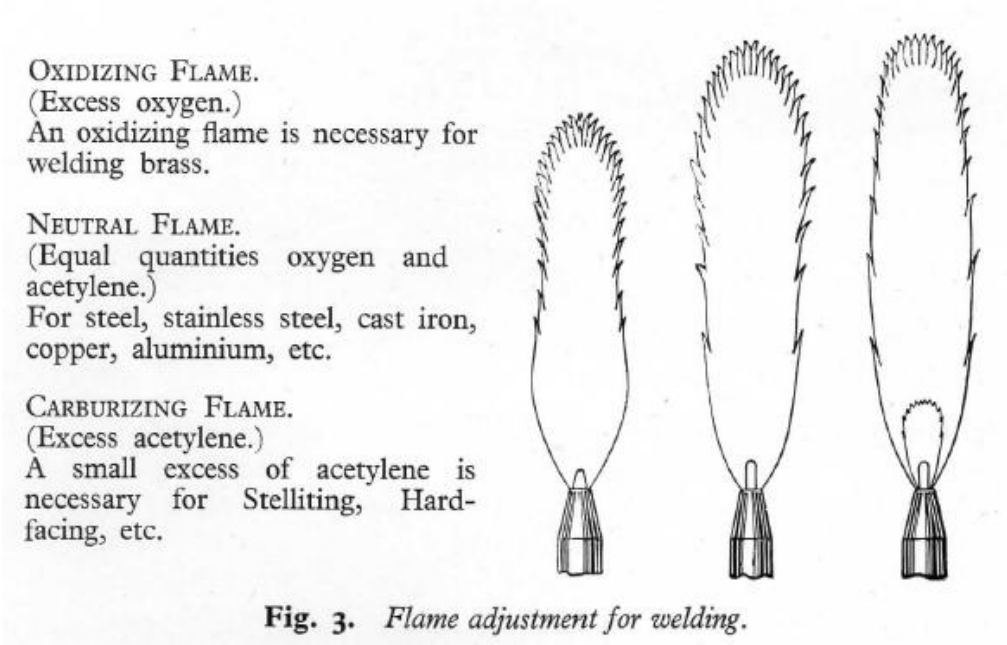


Fig. 3. *Flame adjustment for welding.*

The oxygen blowpipe control valve should now be turned on and the oxygen supply increased until a sharply defined centre cone is obtained. Now slightly close the oxygen valve until there is a very faint haze around the outline of the centre cone. The flame thus obtained is what is known as a neutral flame (Fig.3). In this condition the blowpipe is burning equal quantities of oxygen and acetylene. It is generally advisable to have the slightest possible haze of acetylene around this centre cone, because in practice it is found there is a tendency for the flame to become slightly oxidizing as welding proceeds, and in the majority of cases it is very harmful to have an excess of oxygen. If an oxidizing flame is required, the acetylene control valve on the

** The B.O.C. Handbook for Oxy-Acetylene Welders'*

blowpipe must be closed until the requisite oxidizing flame is shown. If a carburizing flame is necessary, the acetylene control valve must be opened and a feather of acetylene should be produced at the end of the central white cone.

When the flame contains an excess of acetylene it is a carburizing flame and it gives up carbon when applied to heated steel.

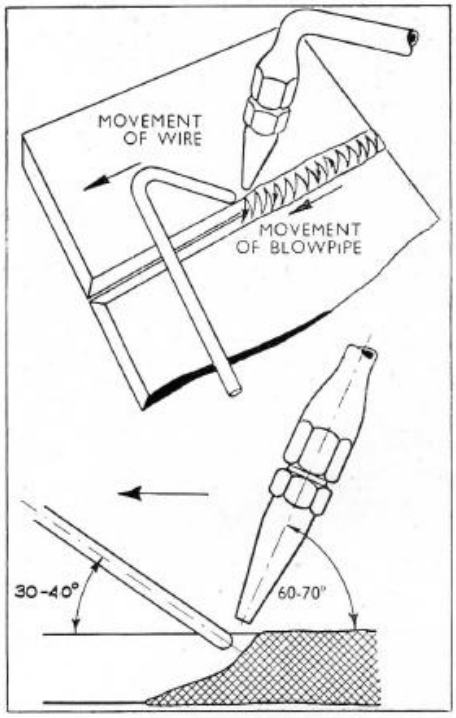


Fig. 4. *The leftward method of welding.*

Leftward Welding

Leftward welding is used on steel for flanged edge welds, for unbevelled steel plates up to 1/8 in. and for bevelled plates up to 3/16 in. It is also the method usually adopted for cast iron and non-ferrous metals. When the job has been suitably arranged, the weld is commenced on the right-hand end of the joint, and welding proceeds towards the left. The blowpipe is given a forward motion, with a slight sideways movement just sufficient to maintain both edges melting at the desired rate, and the welding wire is moved progressively along the weld seam. These movements are illustrated in the sketch (Fig. 4). The sideways motion of the blowpipe should be restricted to a minimum.

Making the Weld

The following notes apply to the welding of steel, for although as has already been indicated, other commercially used metals can be satisfactorily oxy-acetyiene welded, a description of the various techniques employed is not within the scope of this Manual. Those seeking further information are recommended to text books relevant to this subject, namely, the B.O.C. Handbook for Oxy-Acetylenc Welders and the Oxy-Acetylene Welding Repair Manual.

Assuming that the correct nozzle size has been chosen and the regulators set to the correct working pressures as the details given earlier in these notes, the welding flame should be lighted and set to a neutral condition.

When welding, the tip of the flame cone should be held just clear of the surface of the metal, and rust, scale or paint should have been previously removed from the edges to be joined.

The welding rod should be what is known as Copper Coated Low Carbon Steel. The rod is copper coated to prevent rusting during storage and the copper has no effect upon the weld.

No flux is required for steel, since the oxides which, due to their high melting points, prevent satisfactory welding without flux on some metals have, in the case of steel, a lower melting point than that of the parent metal.

The blowpipe should be held in the right hand and the welding rod in the left, the leftward welding technique being employed; that is, welding progresses in the direction in which the flame is pointing, the welding rod being held in front of the flame. The blowpipe should be held at an angle of between 60 and 70 degrees with the surface of the metal and the rod at an angle of 30 to 40 degrees, as shown in Fig. 4.

The blowpipe should be held as steadily as possible over the seam. It is not necessary to impart to it any side-to-side movement except on thick sections. Such movement spreads an unnecessary amount of heat over the surface of the metal adjacent to the joint and increases the tendency to buckle and distort. The blowpipe should also be held at a constant distance from the metal surface, and the operator should avoid the tendency to lift the blowpipe as this also spreads heat over the metal at the sides of the weld.

The filler rod should be added to the joint at regular intervals as required.

For this type of welding the surface of the work should be approximately horizontal. Welds can also be made in the vertical plane, using this technique, but in that case a slight sideways motion of the blowpipe may be desirable in order to retain adequate control over the weld metal (See Fig. 4).

Joints should be tacked before commencing to weld. Tacks should be at regular intervals, 1 in. to 2 ins. apart, according to the length of the joint and the type of job. When welding, the operator should practice until he is able to produce a weld which has fused the full thickness of the metal being welded, with a smooth top surface having a regular ripple effect and without any sign of undercutting or other undesirable irregularities. The underside of the weld should also be regular in appearance.

Welds may be hammered either hot or cold in order to apply any correction that may be necessary either to preserve the alignment of the edges during welding or to remove buckling after the weld has been completed. When removing buckles, remember that hammer blows should be as light as possible, as heavy hammer blows tend to spread the metal and may increase the buckle. Provided the joint has been thoroughly fused for the full thickness of the metal, any reinforcement that remains on the surface of the weld after welding may be removed by grinding or filing without seriously affecting the strength of the joint.

Whenever possible, patches should be circular or oval in shape ; cracks should always be welded outwards towards the open end. Enclosed cracks should be welded in two or more stages from the commencement of each end of the crack to the middle. During their practising period beginners should make a habit of testing and critically examining the welds they make for signs of welding defects or irregularities.

The best practical way of testing a weld is to place the welded sample in the vice with the welded joint parallel to and just clear of the jaws. Then, either with the hand or with a mallet, bend the upper portion of the sample in an endeavour to break the piece on the weld line. The direction of the bend should be such that the top side of the weld is on the inside of the bend. A good specimen should not break, and it should be possible to bend it fiat again without any sign of cracking or breaking. If the piece breaks readily, either a brittle weld or lack of full fusion of the joint is indicated. Brittleness may be caused by the use of an oxidising or a carburising flame, or by holding the cone of the flame in contact with the surface of the molten metal. Lack of complete fusion may be caused by one or a combination of the following errors:

1. The welding speed being too fast.
2. The flame being held too far away from the surface of the work.
3. The use of a nozzle too small for the thickness being welded.
4. Holding the blowpipe at the incorrect angle.
5. The use of too small a size filler rod, or by the addition of too much filler rod, and applying it before making sure that the base metal is melting.

Pieces of metal used for practice work should not be less than 4 ins. wide by 6 ins. long, the welded joint being made on the 6 ins. side. The pieces should be supported so that they are clear of anything on the underside of the joint, otherwise the operator will find it difficult to achieve penetration for the full thickness of the metal. During practice, beginners should try the effect of welding with both correct and incorrect flame adjustments and examine the effect on the welded sample as above described. They should also practise welding both free and tacked edges so as to examine the effects of expansion and contraction, and the degree of control that is possible by manipulation of the blowpipe flame.

GENERAL SAFETY PRECALTIONS

It is recommended that users of oxy-acetylene should obtain detailed information on safety precautions to be adopted when operating such equipment and in this connection should refer to the following publications :

a) Home Office Memorandum, "Safety Measures for the Use of Oxy-Acetylene, Equipment in Factories." (Form 1704).
b) The free B.O.C. Booklet " Safety in the Use of Compressed Gas Cylinders," copies of which can be obtained from the nearest B.O.C. District Sales Office.

Acetylene Cylinders (Dissolved Acetylene)

Remember that acetylene is a highly inflammable gas and if allowed to mix with air is likely to explode if ignited by flame, heat or spark in the vicinity. See, therefore, that all joints, especially those at the cylinder valve which are under high pressure, are gas-tight, hose is in good condition and gases turned off at the cylinders when work is finished. Do not test for leakage with a flame but with soapy water.

If an acetylene cylinder leaks at the gland round the valve spindle, the leakage can usually be corrected by tightening the gland nut. If the cylinder leaks at the valve or at the base plug, and the leak cannot be remedied by firmly closing the valve, the cylinder should be moved into the open, away from fires, furnaces, electric motors and such sources of spark or heat. The suppliers should be immediately advised. Forbid smoking and naked lights near the leaky cylinder.

If acetylene from the cylinder catches fire at the valve or regulator due to leakage at connection SHUT the valve and make the joint properly tight before further use.

If a cylinder becomes hot or fires internally due to excessive back-firing or use of faulty equipment, close the valve, disconnect the regulator, immediately remove the cylinder into the open, then OPEN THE VALVE FULLY to allow the gas to escape freely. Meantime apply water to the body and top of cylinder from a hose or immerse the whole cylinder in a tank of water. In the event of such an occurrence advise the suppliers immediately.

Always store and use acetylene cylinders in an upright position.

Special attention is drawn to the label attached to the neck of each cylinder, on the back of which precautions are printed.

Oxygen Cylinders

NEVER, UNDER ANY CIRCUMSTANCES, ALLOW OIL OR GREASE TO COME INTO CONTACT WITH OXYGEN FITTINGS. OXYGEN SHOULD NOT BE USED INSTEAD OF COMPRESSED AIR AS A SOURCE OF PRESSURE OR BLAST. OXYGEN ESCAPING FROM LEAKING HOSE WILL FORM AN INFLAMMABLE MIXTURE WITH OIL OR GREASE AND MAY CAUSE CLOTHING AND OTHER ARTICLES TO TAKE FIRE VIGOROUSLY FROM A SPARK. OBSERVE EXACTLY THE SAME PRECAUTIONS AGAINST LEAKS AS FOR ACETYLENE. OXYGEN SHOULD NEVER BE INHALED FROM CYLINDERS OR USED FOR VENTILATION.

General

Store oxygen and acetylene cylinders apart. Stacks of oxygen cylinders should be carefully chocked to prevent rolling and should never be more than four deep. Full cylinders should be kept apart from empties and used up in rotation as received. Cylinders must be kept cool, and protected from sunlight, frost, rain and corrosive conditions.

Never handle cylinders roughly. They should not be banged or allowed to fall from a height. When lifting by crane a protective mat or cradle should be used, and never a magnet. Whether full or empty, cylinders must not be used as rollers or supports.

In use, do not allow cylinders to come into contact with electrical apparatus or cables, and keep them away from slag and sparks as from electric arc welding or oxygen cutting. Do not allow the blowpipe flame to impinge upon the cylinder walls.

It is dangerous to alter valves or to use adaptors, and if this is done the suppliers cannot be responsible for the consequences.

Always take gas from cylinders through properly designed regulators with proper gauges. Blow out the cylinder valve before connecting the regulator, and see that the socket is clean. Protect the regulator from knocks. Remove it before transporting the cylinder.

Always close the cylinder valve before moving the cylinder, after work is finished and when the cylinder is empty. NEVER LOOSEN OR REMOVE CYLINDER VALVE.

If a cylinder is damaged, please notify suppliers when returning.