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THE "PACKAGE DEAL" MOTOR INDUSTRY CONCEPT 1/

by

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1. Introduction

During the earlier formative years of the RELIANT MOTOR COMPANY it was necessary to produce automobiles which would sell in a market dominated by mass produced vehicles. The production of these vehicles had to be achieved with limited capital outlay.

To meet these requirements special Design and Production Techniques were evolved.

From these techniques, the "Package Deal Industry" scheme was devised.

All major items of a motor vehicle are covered, these include the Body, Chassis Frame, Engine, Gearbox, Rear Axle, Front Suspension, Upholstery etc.

2. Object

To create, in newly industrialising countries, a viable National Industry which, after several years would stand in its own right and not be just an assembler of other manufacturers products.

As production and the skill of workers and management increases, the range of vehicles being constructed would expand, the vehicles in this range being tailored to suit the specific requirements of the local market.

By virtue of the high local content attainable, even at the commencement of operations, large savings in Foreign currencies are possible.

Further, the establishment of a motor vehicle industry will in itself encourage the setting up or expansion of supporting industries leading to further savings in Foreign exchange and ultimately to the country being self-sufficient as regards motor vehicles of all types.

3. Range of Vehicles

The range of vehicles within the "package deal" can be made, like the design of the vehicles themselves, to suit the requirements of each particular country.

As the country develops the requirements will possibly change as the market becomes more sophisticated. With the "Package Deal", modifications to the vehicles can be easily incorporated to meet these changing market requirements.

A typical range of vehicles could be as follows:-

3.1 Model FW5 - 4 to 5 Seater Saloon Passenger Vehicles

Vehicle specification - Appendix 1.1
photograph - Appendix 2.1

Using 1200 c.c. to 2000 c.c. engine, the choice of engine being dictated by the local requirements.

Variations of this vehicle which could be produced on the one basic chassis would be

2 or 4 door Saloon

Estate Wagon

500 KG Pick Up Truck

500 KG Van

3.2 Model TW9 800 KG 3 Wheeler Pick Up

Vehicle specification - Appendix 1.2
photograph - Appendix 2.3

With a choice of 700 c.c. or 1200 c.c. engines.

As the economic conditions of the country improve, this vehicle would take the place of the horse and cart for local transportation of goods and farm produce.

The vehicle would be low priced compared with similar capacity vehicles and would be economical to run and maintain.

In many countries it is possible to drive a 3 wheel vehicle on a motor-cycle driving licence, this adds further to reducing operational costs.

3.3 <u>Model C4VX - 1100 KG Van</u>

Vehicle specification - Appendix 1.3

For this vehicle the range of engine would be from 1600 c.c. to 2000 c.c.

It would provide high speed intertown transportation for medium weight cargo.

Variations of this model would, for example, be 1300 KG Pick Up Truck and 12 seater Bus.

3.4 <u>Model HD C4RX - 8500 KG Capacity Truck</u>

Vehicle specification - Appendix 1.4

Total Gross Vehicle Weight of - 13000 KG.

Here again a choice of Power Units would be available to suit the requirements of the local conditions.

This vehicle would form the basic transport for industry and farming.

Variation on a common chassis includes large Box Van

Inter-Town Busses

Tanker

also with slight variations articulated vehicles could be produced.

Thus as can be seen from the above typical range the majority of all motor transport requirements can be met.

4. Advantages of the "Package Deal"

It is proposed to study the various aspects of the economics etc. of one of the above range of vehicles namely the 4/5 seater Saloon.

4.1 Low Capital Investment

The low capital requirement of the Package Deal vehicle is obtained by virtue of the following:-

4.1.1 The design of chassis frame, where the majority of the individual pressing are very simple and require little tooling.

4.1.2 The body is made of Glass Fibre and expensive press tools and heavy presses are not required. The moulds required for producing the body panels are made from Glass Fibre and eventually with experience, can be made locally.

4.2 Capital Requirement

The comparison of the "Pack Deal" Saloon vehicle to an "all steel" mass produced vehicle is rather difficult, however typical Capital Requirements are shown on table 1.

Table 1 Comparison of Capital Requirements

(a) All Steel Vehicle

The following estimates are based on the requirements for producing 25,000 vehicles per year on a single shift.

(i) Land Requirements — 500,000 square metres.

(ii) Estimate of the Cost of Building and Plant

Press Shop - covering all major body pressings and body assembly operations	£7,600,000
Paint Trim and Assembly Shop	£2,900,000
Utilities - Quality Control, maintenance etc.	£ 800,000
Suppliers Tooling - for suppliers exclusive tooling.	£1,900,000
Total -	£14,000,000

Plus Cost of Land

Note: Type of Buildings Required.

The buildings must be specially designed with suitable extensive foundations necessary for the heavy body presses.

(b) Package Deal FW5 Vehicle

Production Rate per year on single shift.	1000	3000	5000
(i) Land Requirement	20,000 sq. mtrs.	35,000 sq.mtrs.	45,000 sq.mtrs.
(ii) Estimate of the Cost of Building and Plant.			
Buildings and utilities.	£112,000	£192,000	£260,000
Plant and Equipment for glass fibre moulding, paint and assembly operations.	£20,000	£32,000	£40,000
Plant and Equipment for Welding and Trimming	£5,000	£8,000	£10,000
Tooling - moulds, drill & router jigs, bonding and assembly fixture.	£15,000	£25,000	£35,000
Total -	£152,000	£257,000	£345,000

Plus Cost of Land

Note: Type of Buildings Required

In this case only standard Industrial light buildings are required and no special foundations etc. are necessary.

It should be noted that for the All Steel Vehicle, an annual production of 25,000 units is stated. Lowering the annual production, below this figure, only slightly reduces the overall capital requirements and the vehicle obviously becomes even less economic.

This shows the big advantage for the "Package Deal" vehicle where even 1000 units per year can be made a profitable undertaking.

With the "Package Deal" scheme, as the market grows so can the production by simply adding additional moulds, etc. and labour. Therefore the growing market can be met by small incremential increases in capital expenditure. This increase in capital can be partly paid for by the profits from the vehicles already produced and the need for large credit facilities does not arise.

4.3 Capital Return

By virtue of the low capital outlay the capital return is much quicker than with the conventional all steel vehicles.

As a new factory can be built and be producing vehicles within 9 to 12 months of the commencement of the programme (as compared with 3 years or so with an all steel vehicle) it means less capital risk and earlier returns.

Also model changes can be quickly introduced by simply modifying the existing moulds and the cost of replacing expensive tooling as with a conventional vehicle is avoided.

5. PROFITABILITY with the "Package Deal"

It is possible to make a profit even at production of 1,000 vehicles or more per annum.

6. LOCAL CONTENT

As previously stated, a high level of local content can be achieved from the inception of the product.

6.1 Frame

All the Frame pressings are of simple design and little or no tooling is necessary. The majority of frame pressings can be made with guillotines, hand folders, Brake presses and small presses.

6.2 Body

As the body is Glass Fibre, only the raw materials need be imported, (i.e. glass mat, resin, etc.) the bulk of the body cost being the local labour content.

6.3 Upholstry and Trim

The seats trim panels are of fairly simple design and can be produced with the minimum of equipment.

7. K.D. UNIT

As the industry and local support industries increase, the content of the K.D. Unit can be progressively reduced until the whole vehicle is produced locally.

The K.D. Unit is available in various stages to suit capital and facilities available.

7.1 Typical K.D. Unit Stages

7.1.1 Manufacture Stage I (Complete Vehicle Kit less Body)

The K.D. Unit would comprise a complete set of components and sub-assemblies, less all glass fibre body panels, paint and lubrication, (frame welded together.)

7.1.2 Manufacture Stage II

K.D. Unit as Stage I but less the following parts which would be made locally.

Tyres, flat glasses, seats, batteries, carpets.

7.1.3 Manufacture Stage III

As Stage II but the following would be produced locally:-

Radiator hoses, springs, footbrake and handbrake assemblies, accelerator assemblies, petrol tank, door hinges, wiring harness, frame welding (the loose pressing would still be part of the K.D. Unit).

7.1.4 Manufacture Stage IV

As Stage III, but with the Frame Pressings, Radiator, Exhaust Assembly, glazing rubbers, Sunvisor, Rear Spring Shackle Assemblies made locally.

These stages can be varied, or some stages can be missed out altogether depending on the market facilities available.

As the local industries increase so the content of the K.D. Unit can be reduced.

Even at Stage I it is possible to obtain a relatively high local content. The cost of the K.D. Unit (Stage I) being approximately 75% of the cost of the imported complete vehicle.

8. Labour Content

One of the problems usually facing newly developing countries is how to provide useful employment for its people.

With the "Package Deal" Vehicle with its FRP body, the labour content is much higher than with an all steel body and, therefore, the "Package Deal" vehicle provides employment for more people.

The "Package Deal", by virtue of providing more employment, in itself, helps to raise the standard of living which in turn creates more demand for goods and services.

8.1 Type of Labour

For the production of the "Package Deal" vehicle a high percentage of the workers need not be skilled. The local workers can be trained within a few weeks to produce vehicles of a high standard even where no previous experience of industry exists.

Selected personnel suitable for chargehands and foremen are usually given intensive courses in the U.K., then these selected personnel, with the help of technicians from the U.K. train the local workers.

The labour content requirements, that is man hours per vehicle required is shown in table 2 below.

Table 2 - F.W.5.A. - 2 Door - Labour Content

Operation	General Details	Man hrs/vehicle
WELDING	Chassis Frame	10,80
ASSEMBLY	Chassis Line mounting:- Front suspension, steering engine/gearbox, rear axle & suspension, exhaust system & wheels.	2.22
MOULDING	Body (all FRP part), including mould preparation, moulding, trimming & bonding comprising:- Main body shell, front & rear bulk heads, boot & bonnet lids, doors and small details.	62.48
PAINTING	Body - including door hanging, boot & bonnet lid mounting, and all preparation work.	23.50
ASSEMBLY	Final Trim Line - includes mounting painted body, fitting:- steering column & wheel, facia, instruments, electrics, foot pedals, radiator, heater, glazing, seats, trim & headlining, carpet, door hardware, petrol tank, road test, final checks, service (cleaning & polishing).	32.60

PRODUCTION MAN HOURS PER VEHICLE	131.60
Linefeeders, chargehands & inspectors	26.2
Stores and general labourers	13.2
Total (works) man hours per vehicle	171.0

9. Details of Construction & Manufacture

The two main items to be considered, are the Chassis Frame and the Body. These two items providing the bulk of the savings in capital expenditure etc. when compared with an "all steel" vehicle.

9.1. Frame

The complete Frame is illustrated in Figure 1 and Figure 2 illustrates an exploded view showing the majority of the individual pressing which together comprise the the frame assembly.

9.1.1. Material

The majority of the pressings are made from 2 mm. thick steel sheet, British steel specification BS1449 - EN 2A which is a good quality Mild Steel (28.3Kg/mm^2 minimum alternate tensile strength) suitable for electric arc and shot welding.

9.1.2. Construction

The main side members comprises items (RH member) 5, 19, 20 and 22

(LH member) 2, 36, 37 & 34A, these are parts of simple channel sections spot welded together to form a rigid box section.

All the other pressings (with exception of items 29, 30, 31 & 45 centre section) are angle channel or top hat in section.

9.1.3. Tooling

As previously stated all the pressings (with a few exceptions) can be made using only the simplest of equipment and tooling.

The tooling required is as follows:-

Guillotine
Brake Press
Folders
Fly press or small power press
Standard set of knotching and punching tools for use on the Fly press.

9.1.4. Welding

The main frame sidemembers are first located as shown on Figure 3 and then spotwelded together.

Other sub-assemblies such as the Rear Damper Brackets (Figure 4) and the Front Suspension Pillar (Figure 5) are then welded together.

The main sidemembers, sub-assemblies etc. are then welded together as shown on Figures 6 & 7.

A strict welding procedure giving the correct sequence of welding is rigidly adhered to, to overcome welding distortion problems.

9.2 BODY

The Body is constructed of GlassReinforced Plastic and before discussing the details of construction it is proposed to briefly describe the materials and the moulding process used.

9.2.1 Materials

Glass Fibre reinforced plastic is produced from four basic materials, that is:- polyester resin, accelerator, catalyst and glass fibre mat.

When pre-determined proportions of accelerator and catalyst are added to the resin a chemical reaction takes place and the resin solidifies. The time taken for this reaction is controlled by the proportion of each material used and the temperature.

By itself the cured resin has little mechanical strength and glass mat is introduced into the resin before it has cured the resulting laminate has considerable strength and rigidity.

9.2.3 Moulds

The forming of the laminate is achieved by means of a mould which is an inverse replica of the required finish component.

A high degree of accuracy and quality is essential in the manufacture of the moulds, any imperfections being reproduced on the finished laminate.

The moulds are produced by impregnating several layers of mat with resin over a master pattern. When the resulting glass fibre mould is removed from the master pattern, the mould is highly polished and waxed. The mould is then ready for the production of moulded components.

9.2.3 Production Process

The simplest and most suitable method for low scale production is by the "Hand Lay Up" method as follows:-

The production mould is first thoroughly cleaned and polished. A release agent (wax or a film of polyvinyl alcohol) is applied to ensure that the laminate will not adhere to the mould.

To obtain a hard smooth surface on the component, the mould is sprayed or brushed with a gelcoat resin which is then cured. This gelcoat must be of even thickness to prevent shrinkage leading to cracks etc.

Glass mat is cut to the required shape and applied to the mould, resin (containing suitable quantities of accelerator and catalyst) is then brushed firmly into the mat, until the mat is completely saturated.

Before the resins begin to harden, the mat must be rolled to make sure that no air has been trapped in the laminate. One or more layers of mat may be laid up in this way, depending upon the thickness and strength required.

Curing time is governed by resin "min" in relation to the temperature, and low temperature ovens may be used to accelerate curing if the ambient temperature is not consistently high.

9.3.1. **Main Glass Fibre Components**

One of the advantages of Glass Fibre construction is that the number of parts required to make a body can be reduced to a minimum as compared with a steel body, thereby reducing body assembly costs. The main items comprising the vehicle body is as follows:-

9.3.1. Main Body comprising: outer shell, front and rear bulkheads.

9.3.2 Bonnet lid (Hood) comprising: outer and inner skins.

9.3.3. Boot lid comprising: outer and inner skin.

9.3.4. Doors comprising: outer and inner skin.

9.4 The OUTER SHELL (see figure 8) comprises the whole of the "outside" of the car body and incorporates the engine compartment, front and rear wheel arches, floor near foot well, propellor shaft and gearbox tunnel, rear seat well, boot floor, petrol tank well, spare wheel well and tool kit well.

9.4.1 Mould - The outer shell mould is a split mould mounted on a "trunnion" type rotating fixture.

The mould is split into 6 parts as follows:-

9.4.2 Base - incorporate floor, boot floor and wheel arches.

9.4.3. Top - incorporate top face of nose, windscreen pillars, roof, rear screen, and top face of boot.

9.4.4 RH and LH sides - incorporating side door aperture and rear quarter window

9.4.5 Front - incorporate: the mounting faces for the headlamps and front flasher lamps and grille aperture

9.4.6 Rear - incorporate: the mounting faces for the rear lamps and rear flasher lamp faces, and rear number plate recess

The trunnion bearings are mounted on the (frame work attached to the) "top" section of the mould on the longitudinal centre line of the vehicle, so that the complete mould can be rotated 360°. This enables the mould to be rotated to the most convenient position for the workers laying up the glass fibre laminate.

9.4.7 Moulding Procedure - Outer Shell

9.4.8 Each section of the mould is cleaned, polished and the release agent is applied (including joint faces).

9.4.9 After the release agent has dried, all the sections except the "base" are bolted together.

The mould is then in two main parts, that is, the upper section and the base section.

9.4.10 These two parts are then gelcoated leaving a strip around the final base/upper joint face clear of gelcoat

9.4.11 After curing the glass fibre mat is then laid up into the upper section and base again leaving a strip around the base/upper joint face clear of mat

9.4.12 The upper section and base are then bolted together and the strip left clear of gelcoat and mat is now gelcoated. After the gelcoat has cured the upper section and base laminates are joined together by a 15 c.m. strip of Glass Fibre.

This jointing strip is applied by working through the various apertures in the body that is the headlamp; front grille; engine compartment; doors and boot lid apertures.

9.4.13 After curing all sections of the mould are unbolted and removed. This leaves the Outer Shell moulding resting on the top mould.

The outer shell is then lifted off the top mould partly trimmed and placed in the assembly fixture ready for the front and rear bulk heads (shown shaded on Fig. 8) to be bonded in.

9.5 <u>FRONT BULK HEAD</u> (see figure 9)

This moulding incorporates the top of the foot well, fascia mounting face, inner windscreen pillars, sides of the foot well, and the header rail.

9.5.1 <u>Mould</u> - The mould for the front bulk head is a simple one piece mould.

The mould is layed up in the normal way, cured and trimmed.

9.6 REAR BULK HEAD (see Fig. 10)

This moulding incorporates the inner rear quarters, rear screen header rail, parcel shelf and inner side panels up to the door apertures.

9.6.1 Mould - as with the front Bulk Head the mould is a one piece mould and the Rear Bulk Head Panel is layed up, cured and trimmed in the normal way.

9.7 ASSEMBLY - MAIN BODY

For the fitting of the Front and Rear Bulk Heads into the Outer Shell an assembly fixture similar to the Outer Shell mould is used.

9.7.1 First the "Outer Shell" is placed in the fixture, then the "Front Bulk Head" is fed through one of the door aperatures in the outer shell.

9.7.2 The bonding adhesive is applied to the joint faces and the front bulk head is pressed into position and clamped using simple clamps as shown on Figure 11.

9.7.3 Similarly the Rear Bulk Head is fed through the door apertures and bonded in position using large moulded pressure pads to clamp the various joint faces together, this is shown on Figure 12.

9.7.4 The Main Body (outershell complete with front and rear bulk heads) is then cured, trimmed and is now ready for preparation for painting door hanging etc.

9.8 BONNET & BOOT LIDS (See Fig. 13)

Both these double skinned components are similar in construction, and comprise of an outer and inner skin bonded together. The inner skins incorporates stiffening ribs and when bonded to the outer skins, they form very rigid panels.

9.9 SIDE DOORS

The general assembly of the complete door is shown on Figure (14.)

The steel door frame surround item 2 is bolted to the Glass Fibre moulding item 1. The rear leg of the frame surround forms the rear channel for the drop glass item 19. The front channel for the drop glass is incorporated in the leg of the ventilator item 97.

The glass fibre door moulding comprises an outer skin and inner skin bonded together, this is shown on figure (15.)

After laying up the two skins, the two moulds are pressed together and the two skins are bonded together. After curing and removal from the moulds, the door moulding is trimmed. The underside of the top face is locally reinforced by a glass fibre strip which is bonded in position through a service aperture cut in the inner skin.

9.10 Miscellaneous GRP Parts

The remaining GRP items such as the Facia panel, petrol tank cover etc. are straight forward single skin mouldings and are of no particular interest.

10. Local Manufacture of Other Major Items

10.1 As the number of vehicles produced per year increases the local manufacture of other major items such as propellor shaft, rear axles, engine & gearboxes become a proposition.

The introduction of these major items is more or less dependent on the growth of supporting industries for the supply of castings; forgings, etc.

10.2 To assist in the introduction of these major items into the "locally made" manufacturing programme, the introductions can be "phased in" in stages, for example:-

Rear Axle Manufacture

Phase I - importing the axle complete i.e. NO local manufacture.

Phase II - importing the finished parts for the complete axle, but not assembled, i.e. - local assembly only.

Phase III - importing the raw material (i.e. casting & forgings) for the axle case axle shafts, wheel hubs, brake drums, and import the finished gears and bearings.

With this stage you would have local machining of axle case, hubs drums, shafts, etc. and local assembly.

As and when suitable plant and machinery is available the differential gears and crown wheel and pinion gears could be made locally.

Eventually the only items being imported would be the ball & roller bearings.

10.3 Similarly the other major items could be phased in a similar way for example, with the Engine - the first items to be produced would be the Induction Manifold, exhaust manifolds and later cylinder heads, etc.

10.4 With the Gearbox - the Clutch housing, gearbox casings and rear gearbox extensions would be produced first and later the shafts and gears.

10.5 The exact print of introduction of these major items depends on various circumstances such as development of supporting industries, development of the market and economic conditions.

10.6 A typical introduction programme is as follows:-

Rear Axles - vehicle production 5000 to 10,000 per year.

Propellor shafts, - vehicle production - 10,000 to 15,000 per year.

Gearboxes - vehicle production - 10,000 to 20,000 per year.

Engines - vehicle production - 15,000 to 20,000 per year.

11. <u>Summary</u>

The advantages of the "Reliant Package" are as follows:-

Low capital outlay.

High labour usage of semi and unskilled workers.

Easy and rapid incorporation of modifications to suit changing market requirements.

Commencement of production within 9 months with the consequential reduced capital risk.

Service advantage - less maintenance (i.e. GRP body cannot rust and can easily be repaired).

High resale value by virtue of the lasting qualities of the body.

12. Conclusion

The "Reliant Package Deal" offers a system which is ideally suited for newly industrialising countries and enables these countries to become self-sufficient as regards motor transport.

The low capital requirement and high labour usage overcomes the major problems facing these countries.

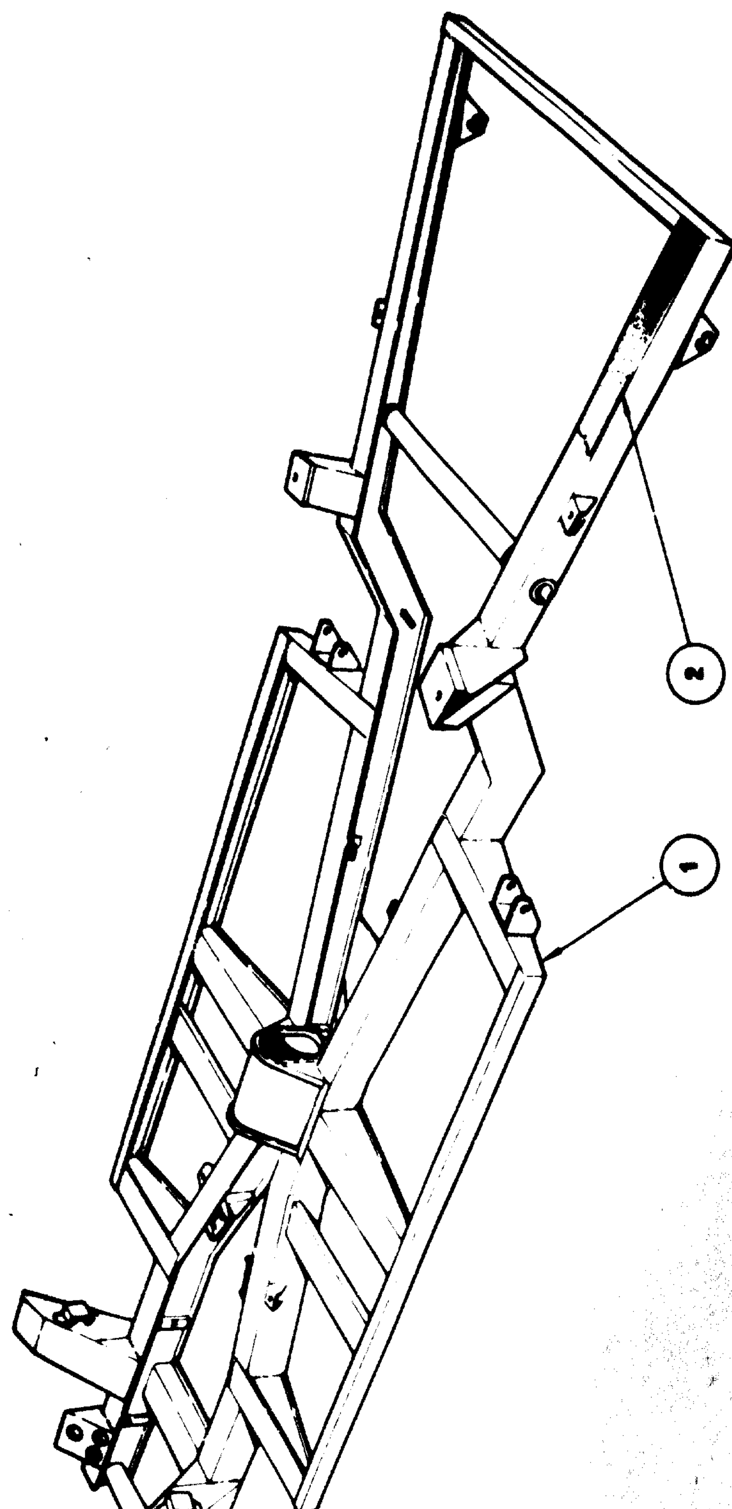


Fig. 1
Frame Assembly

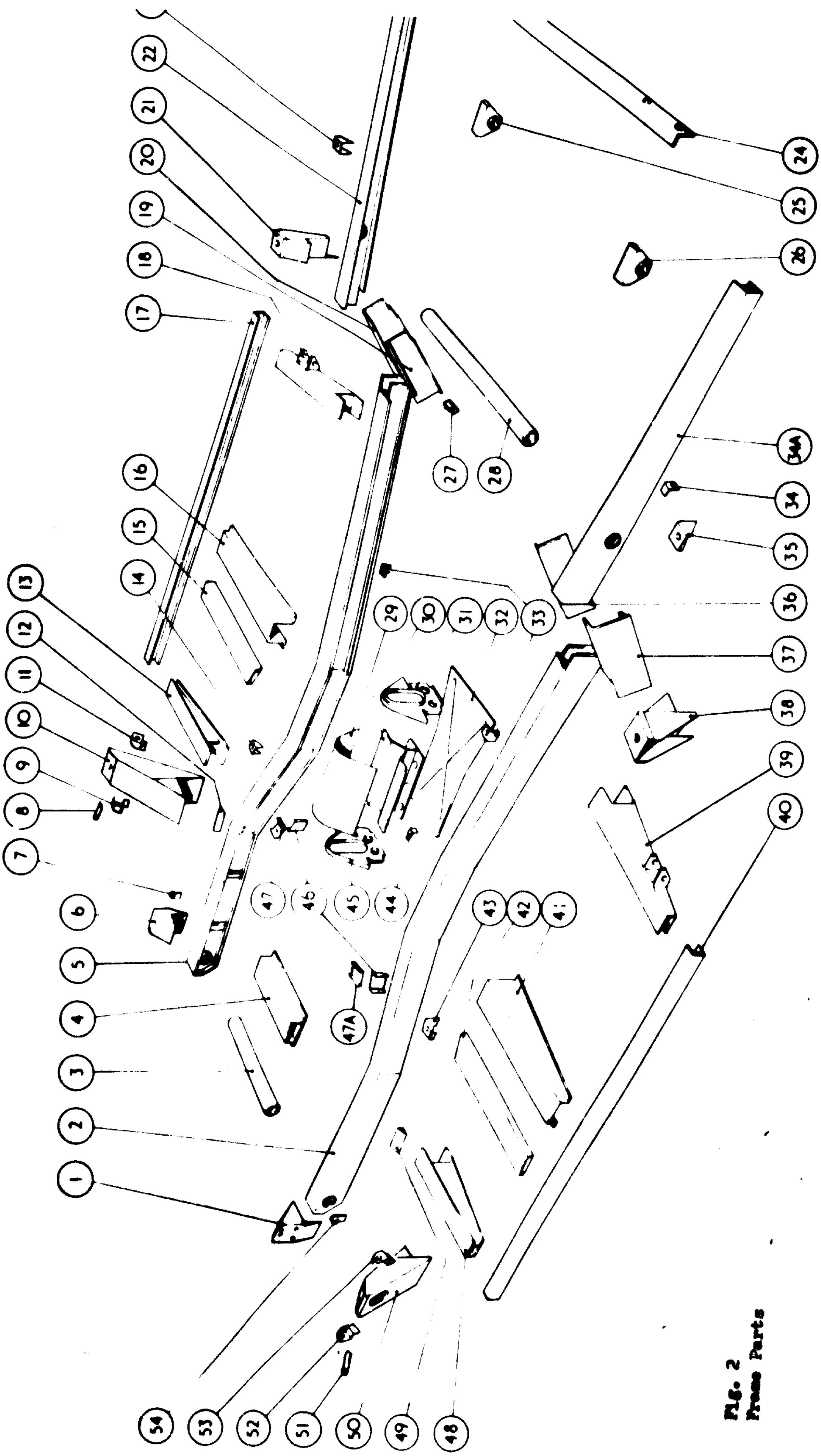


Fig. 2
Frame Parts

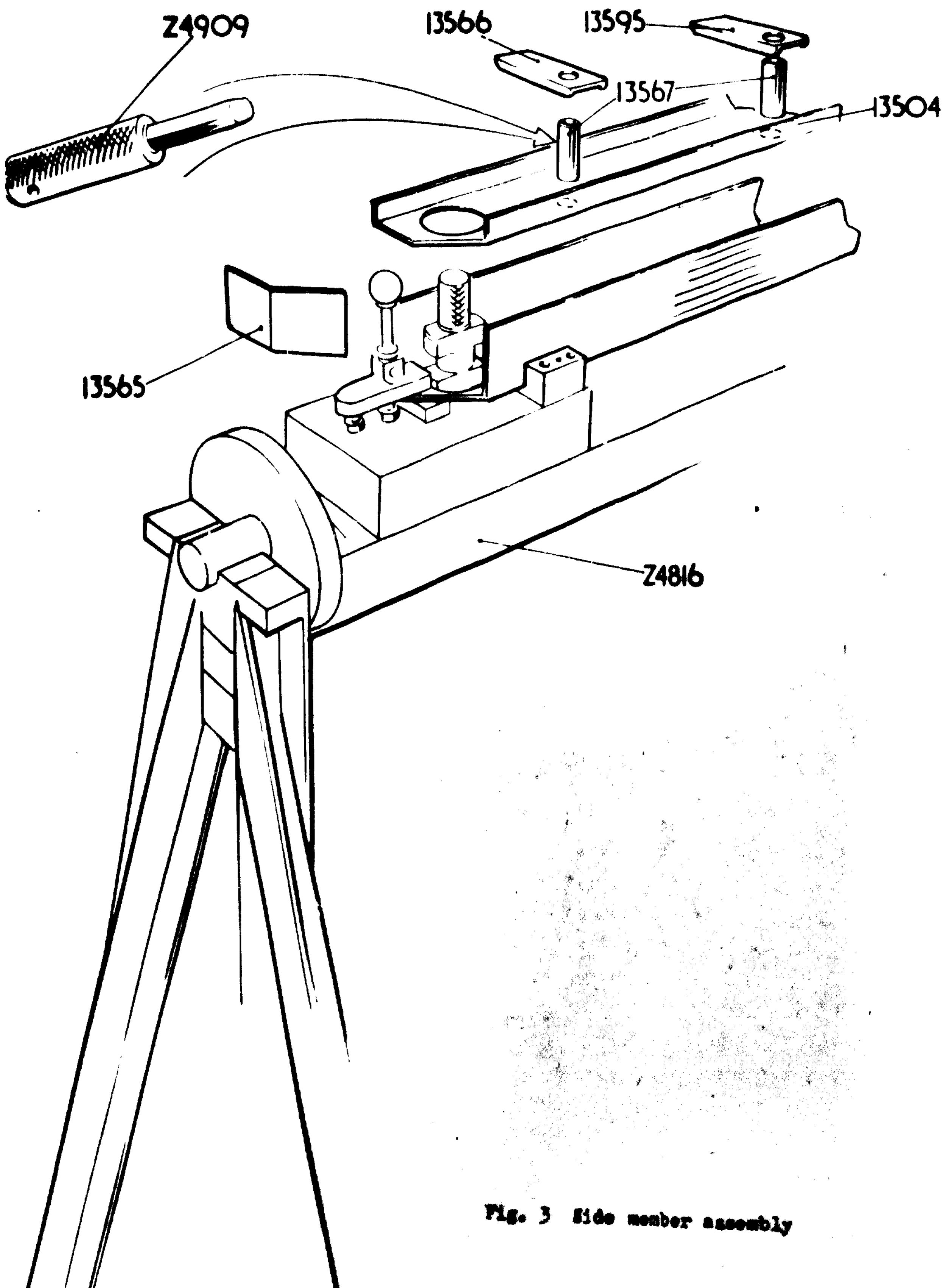
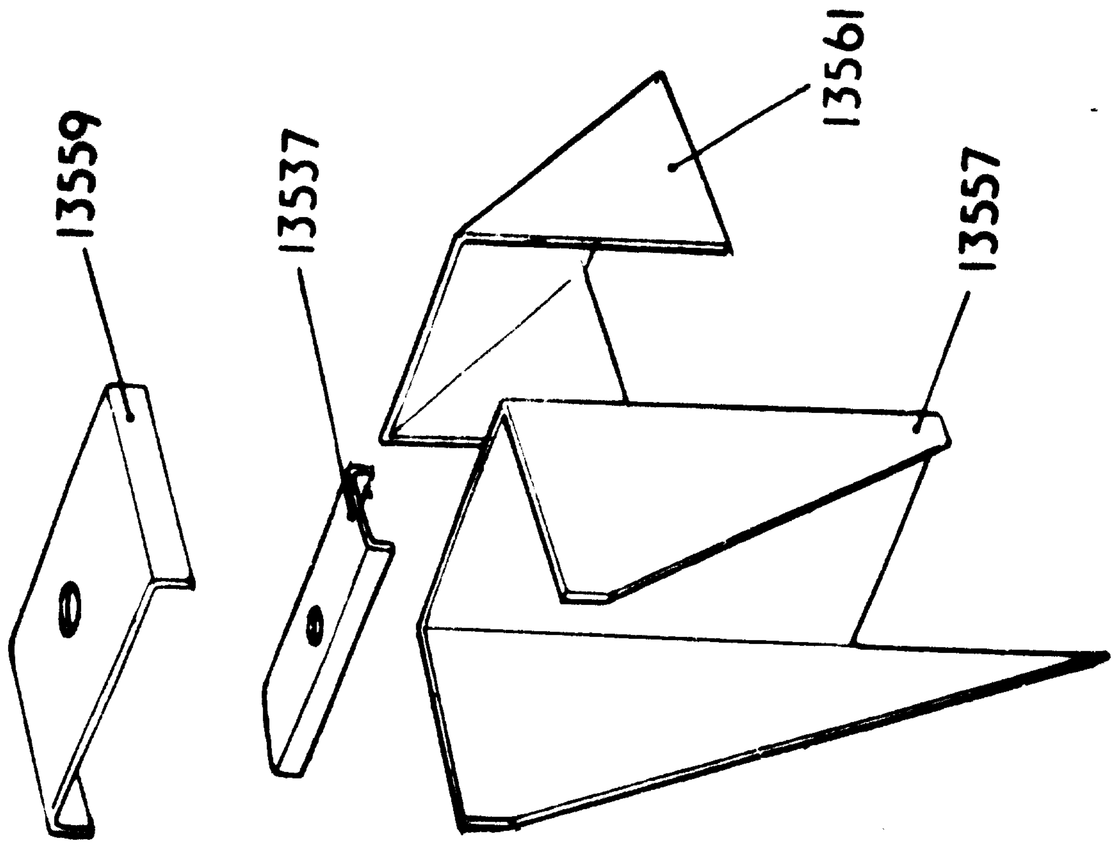


Fig. 3 Side member assembly



LEFT HAND DRAWN

Fig. 4 - Rear Damper Brackets

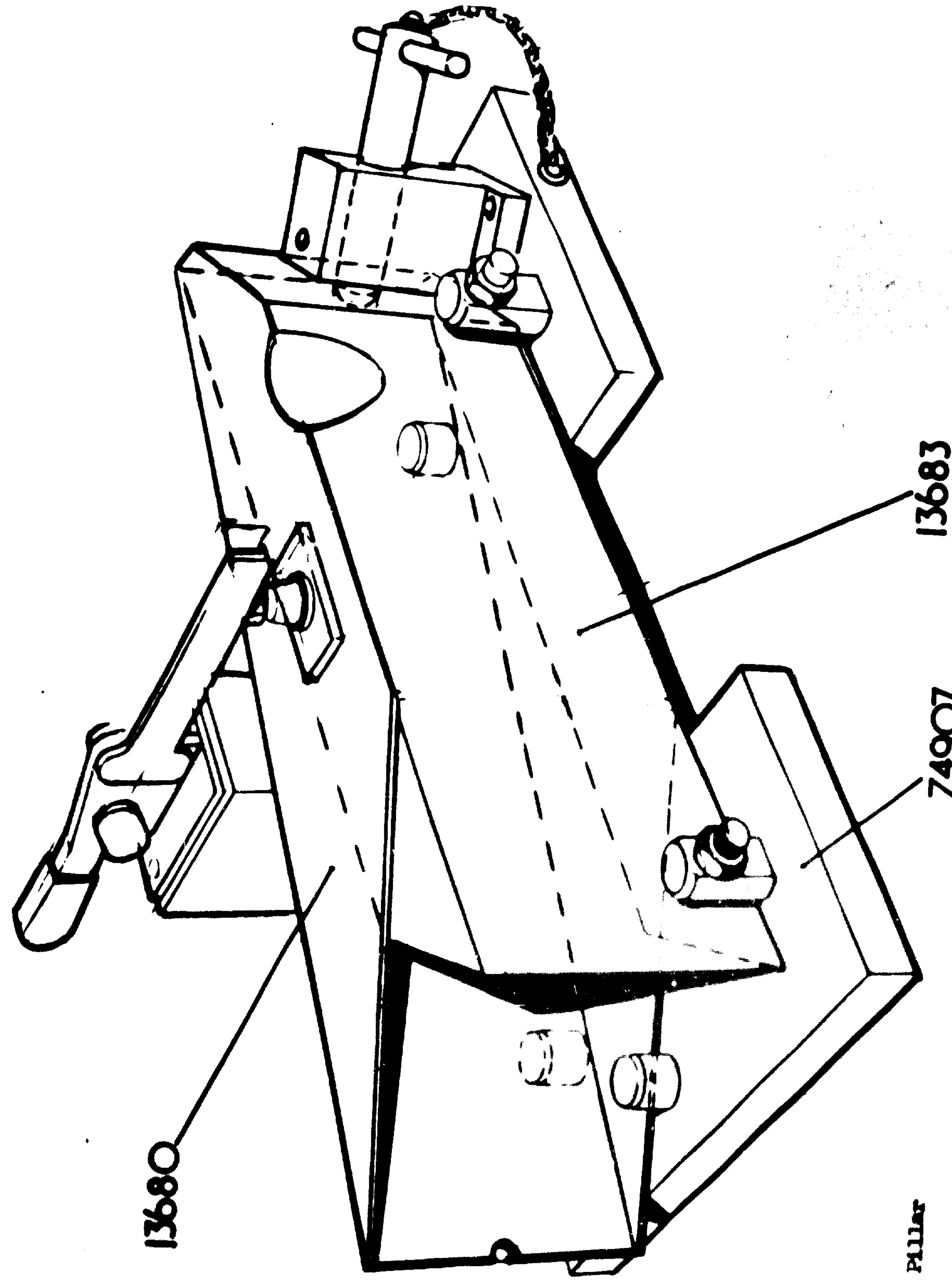


Fig. 5 - Front Suspension Pillar

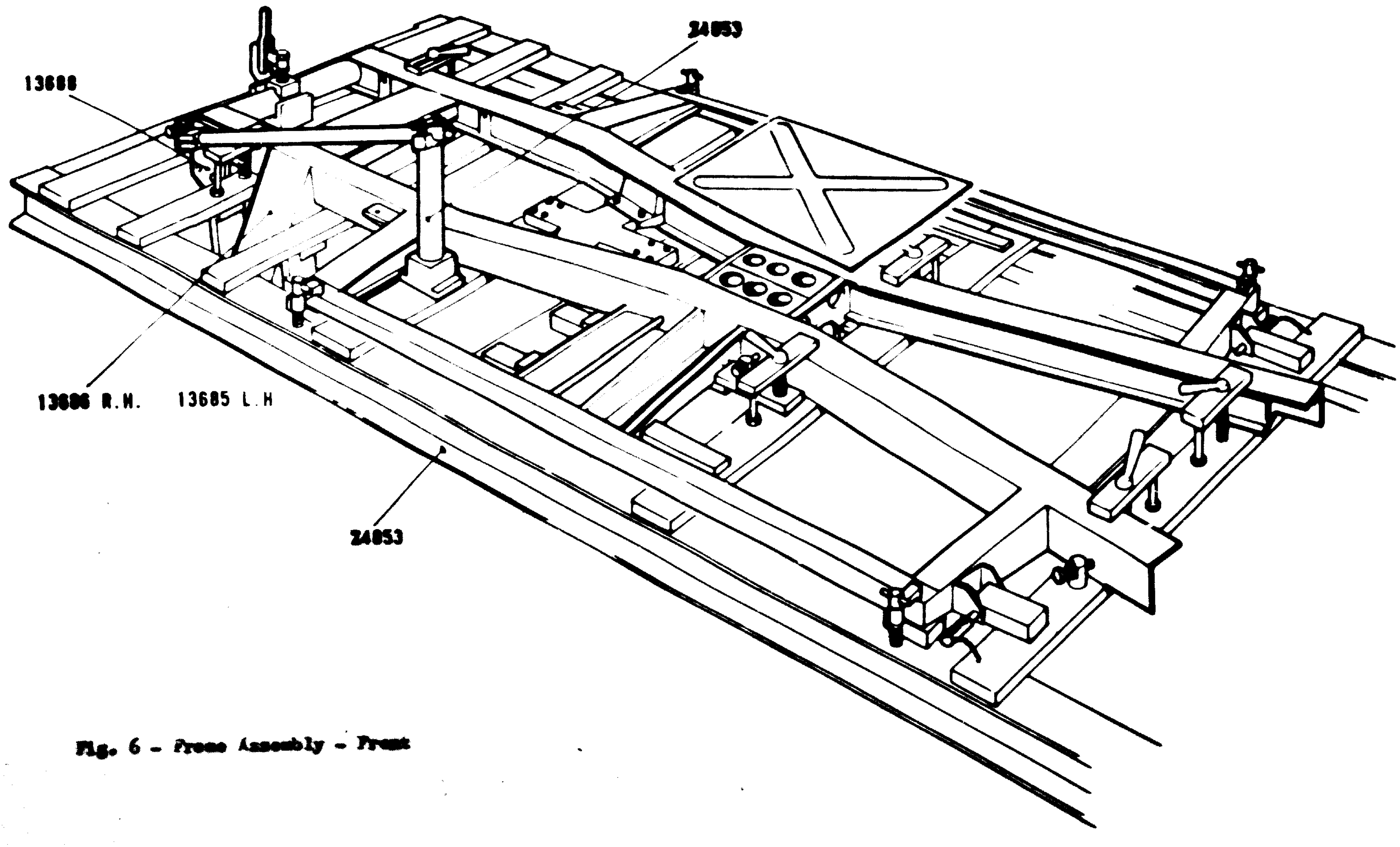


Fig. 6 - Frame Assembly - Front

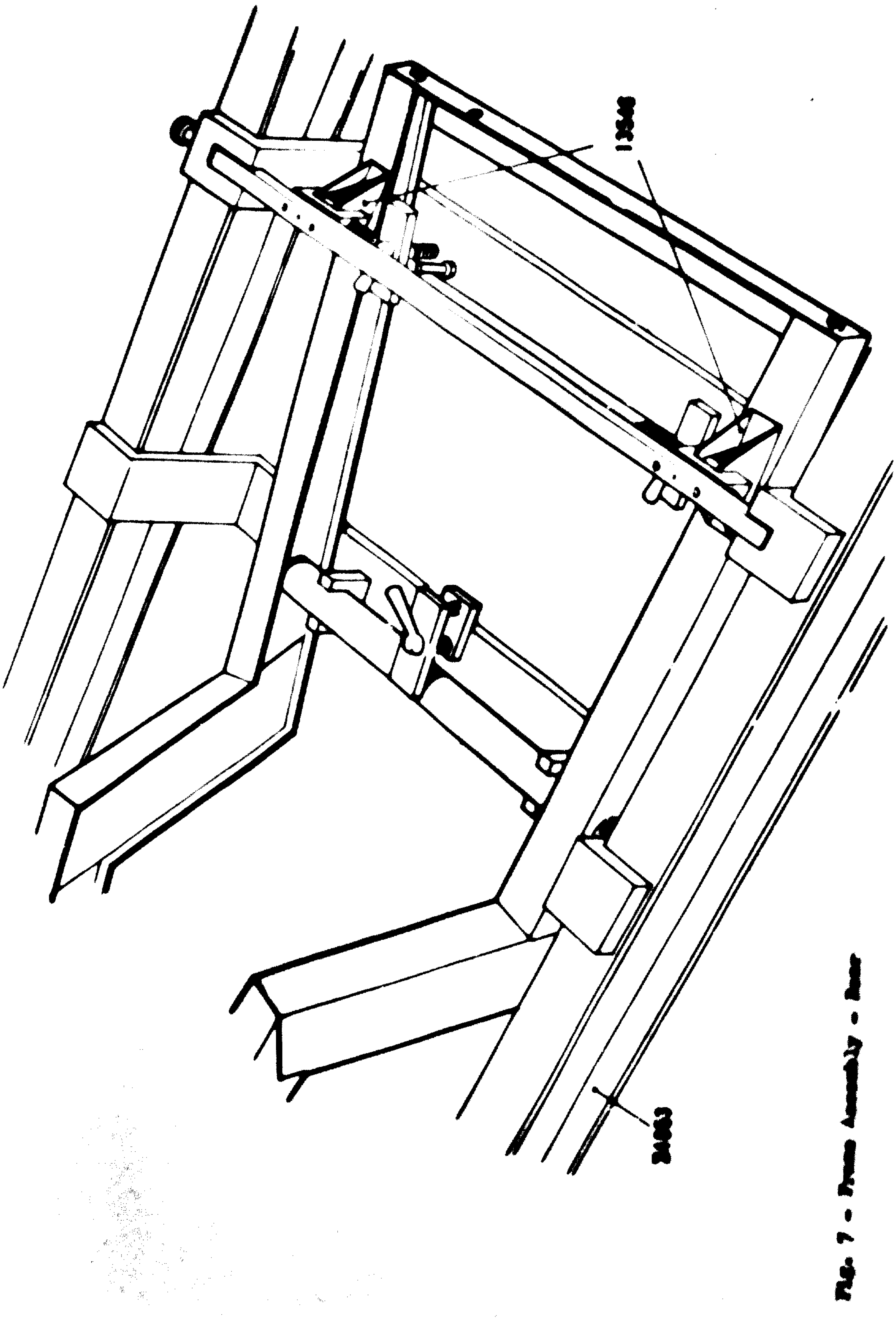
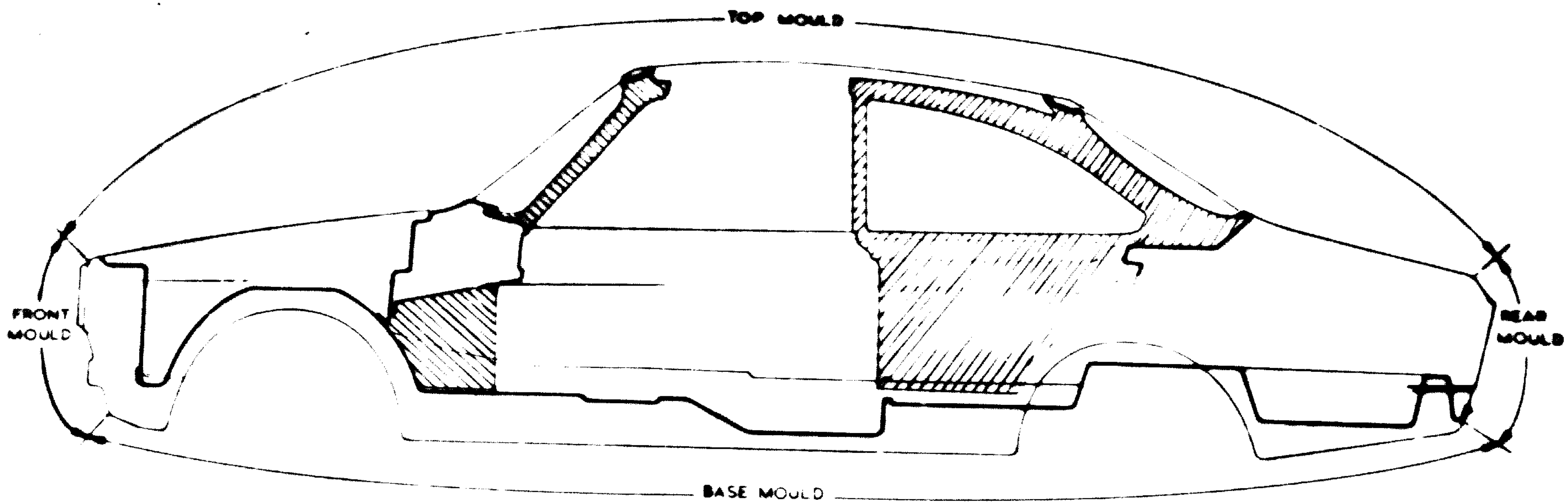


Fig. 7 - Frame Assembly - Rear



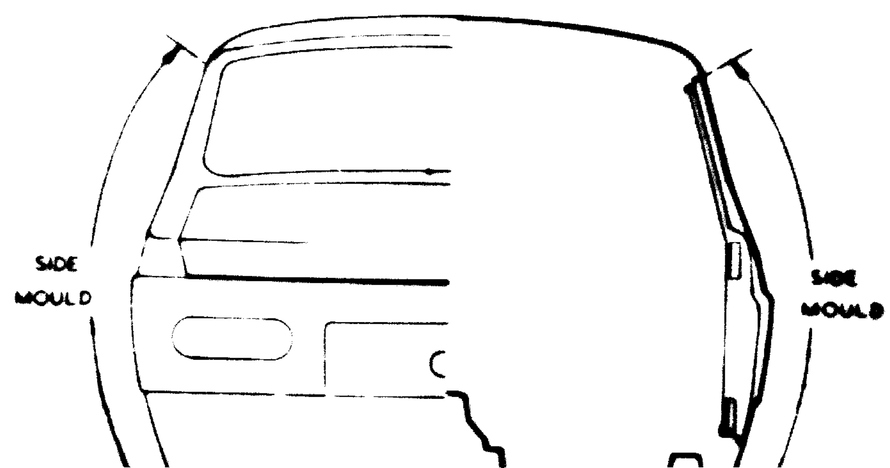


Fig. 8
Main Body - Outline

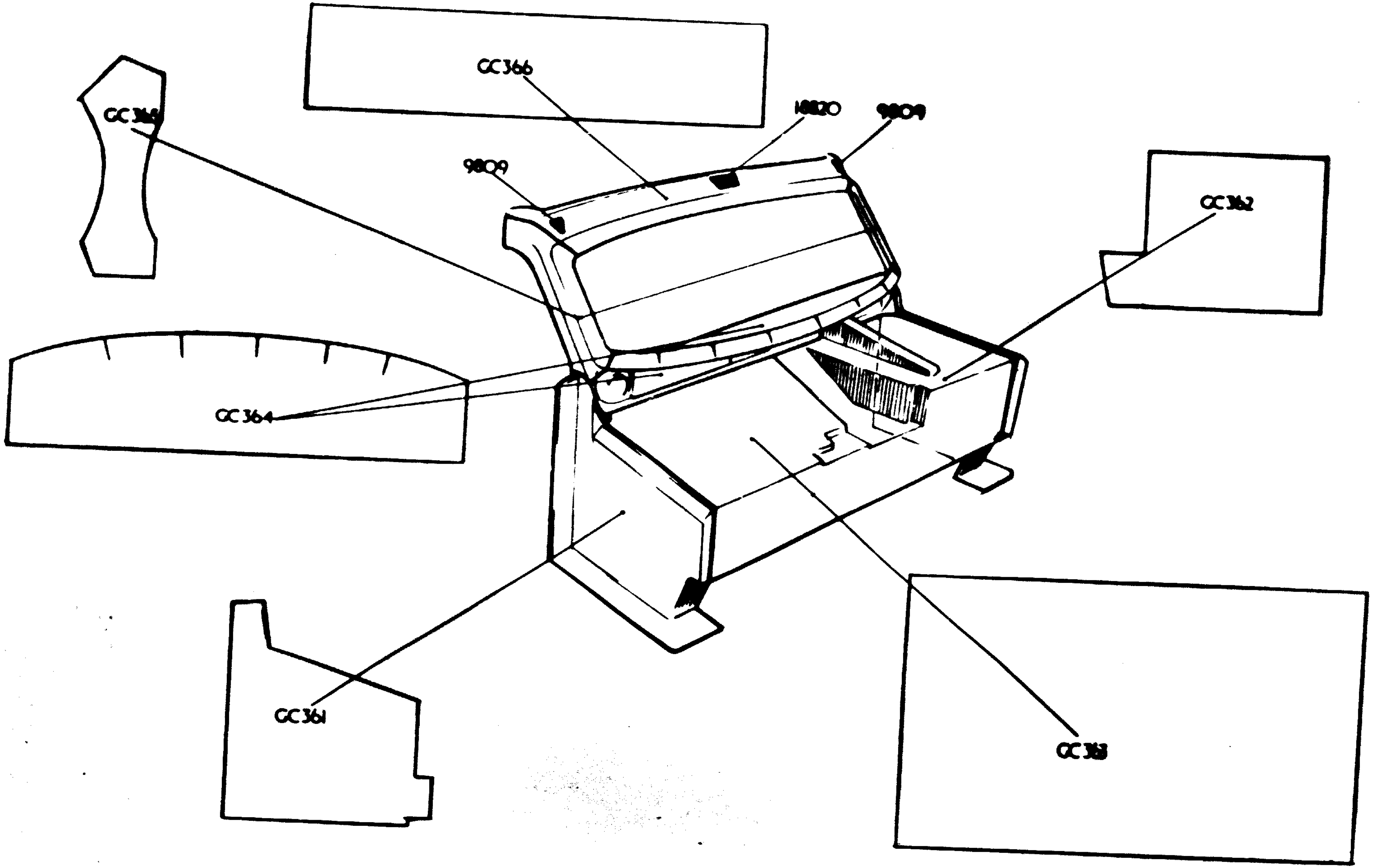


Fig. 9 - Front Bulkhead

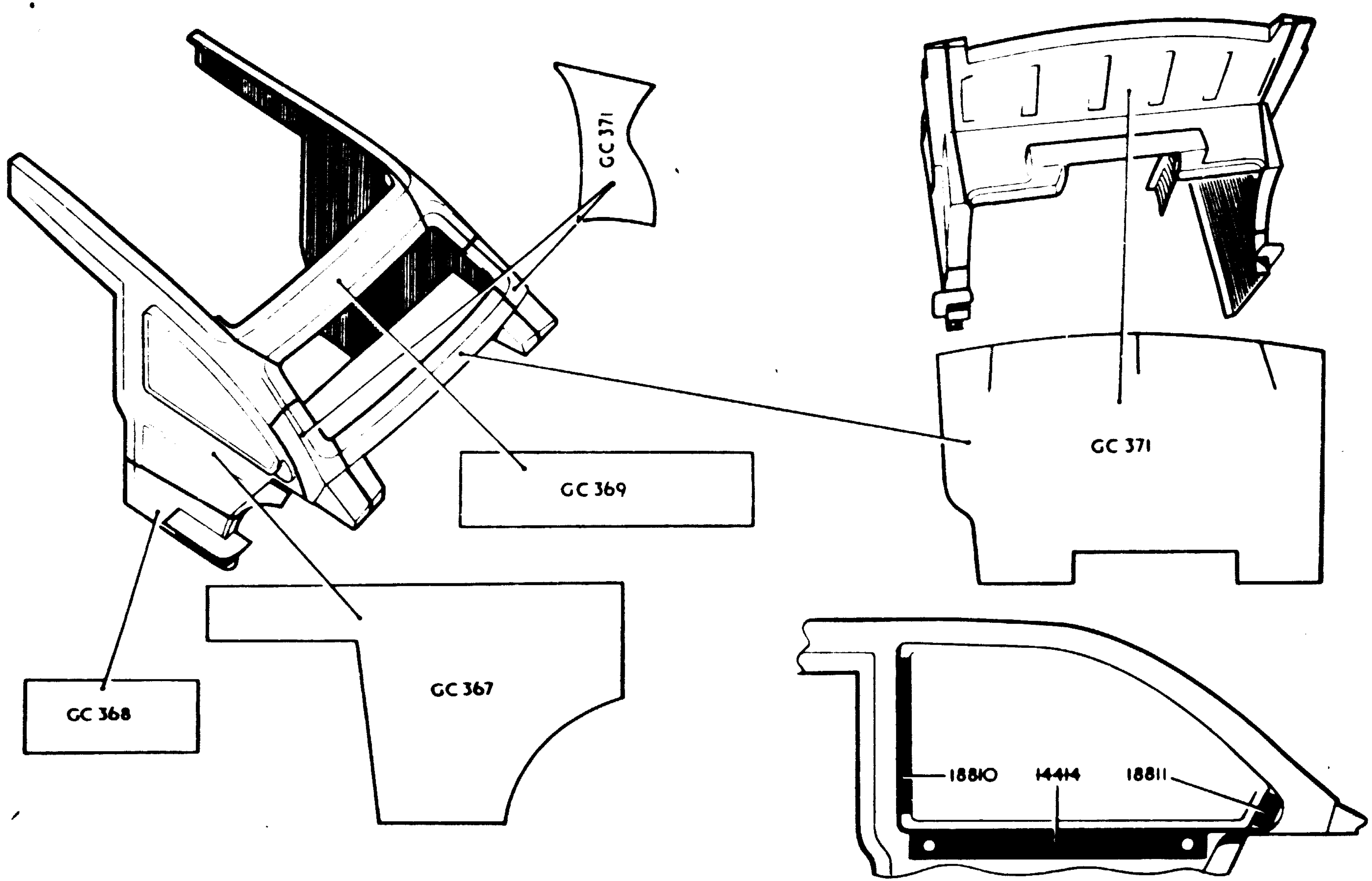


Fig. 10 - Rear Bulkhead

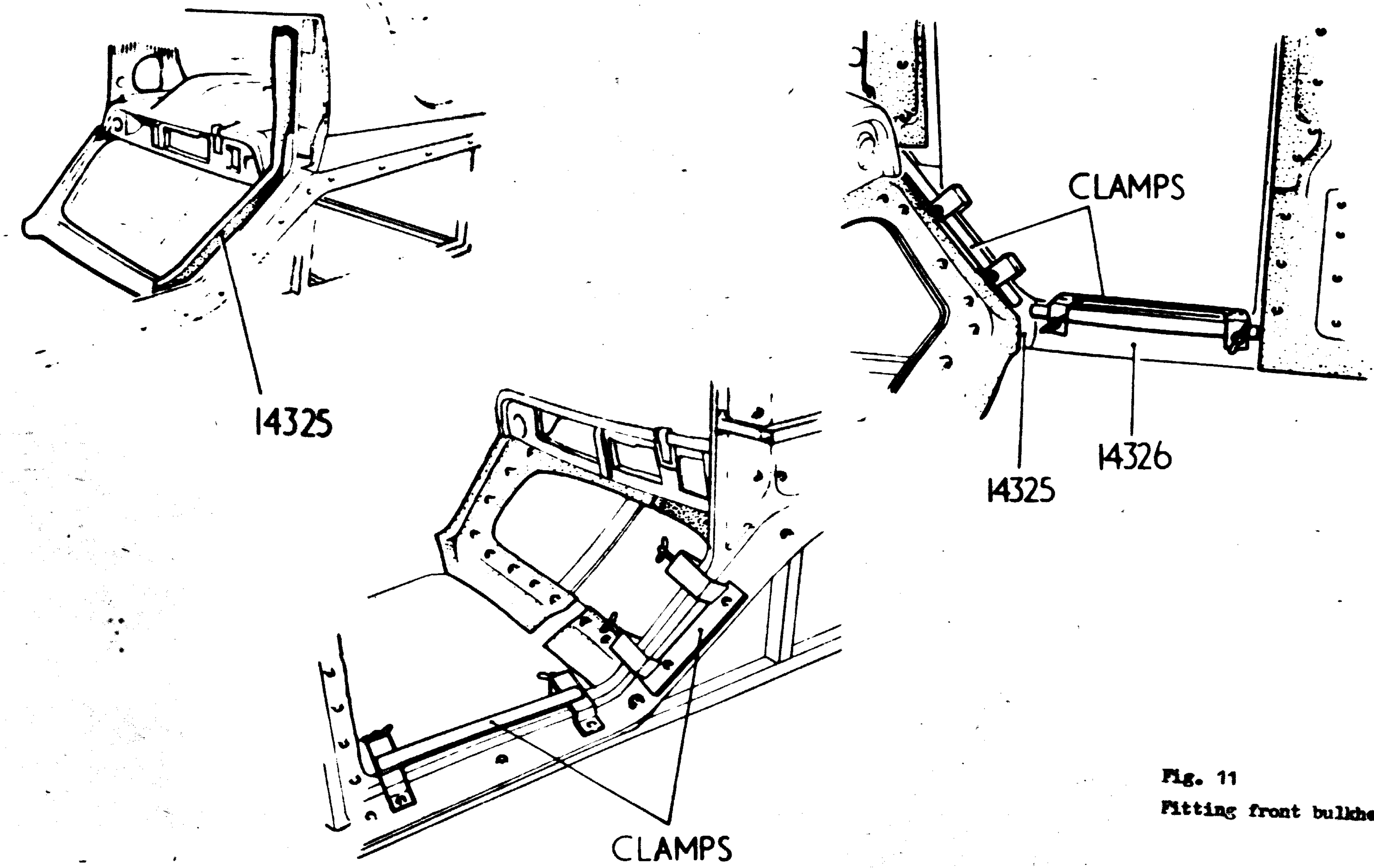


Fig. 11
Fitting front bulkhead

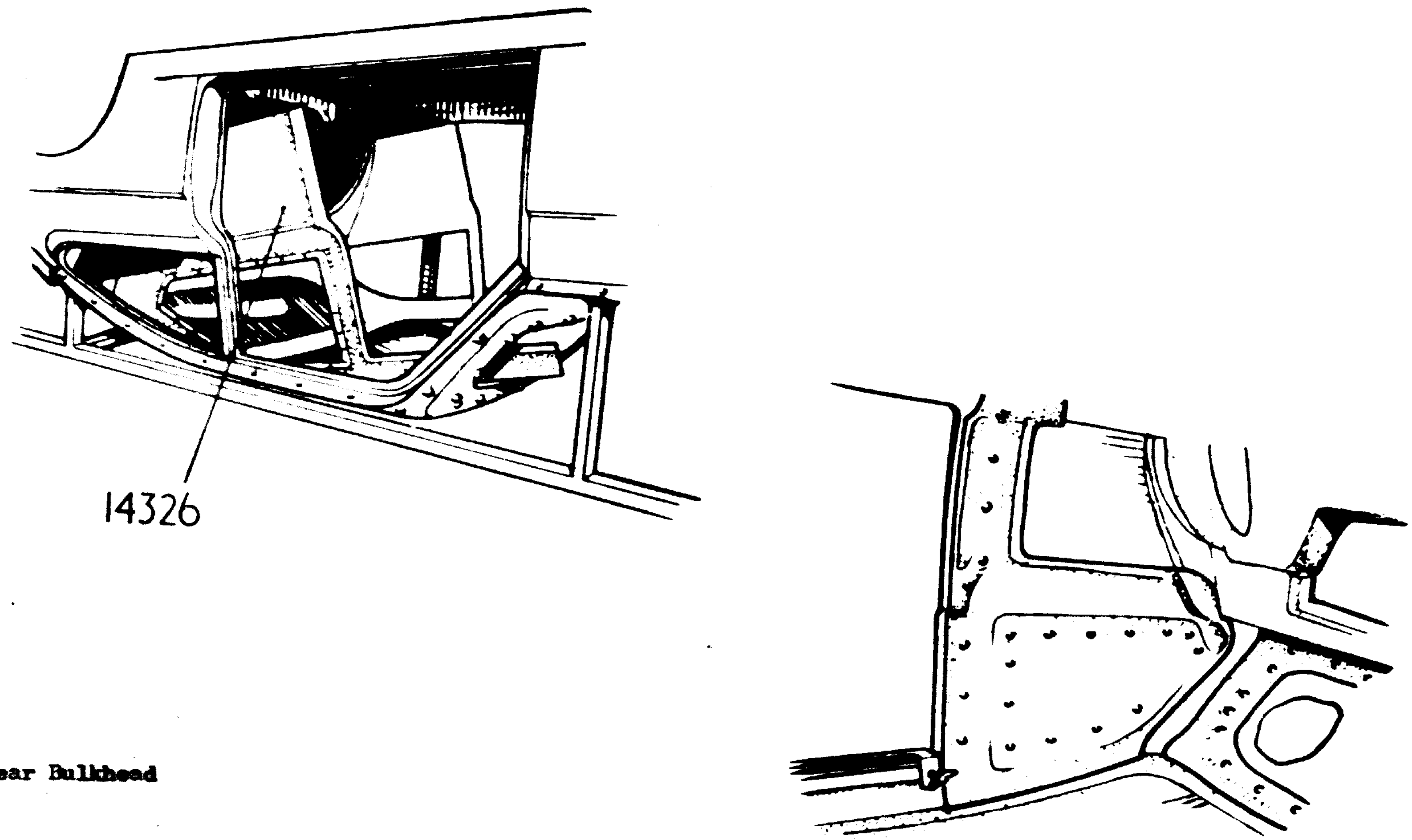
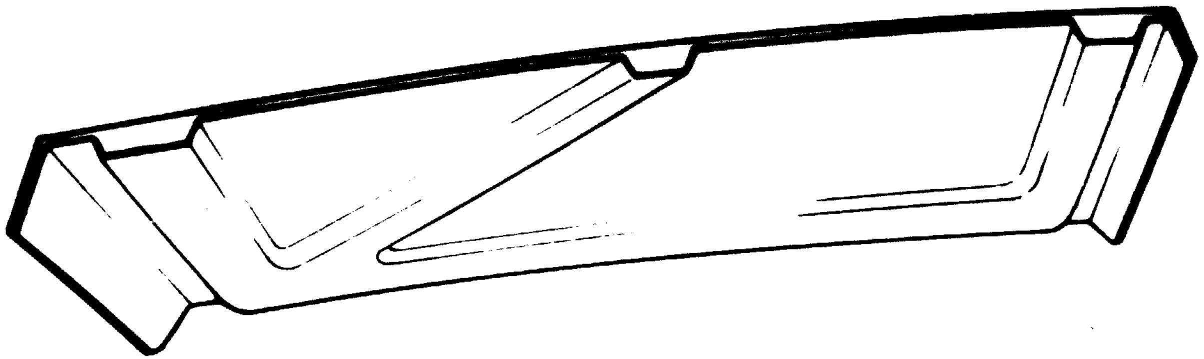
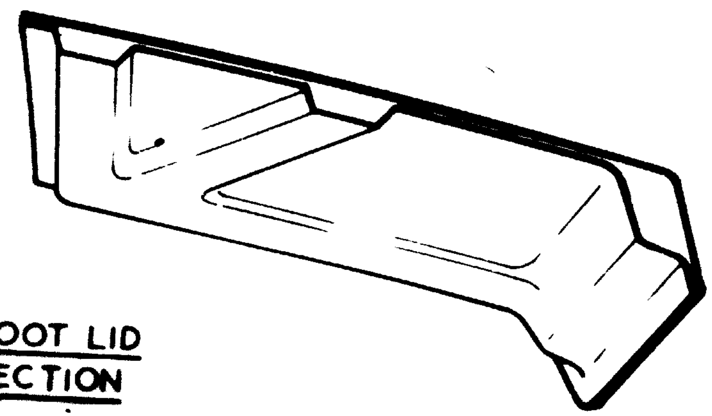


Fig. 12
Fitting Rear Bulkhead



BONNET LID
SECTION



BOOT LID
SECTION

Fig. 13
Boot and Bonnet Lids

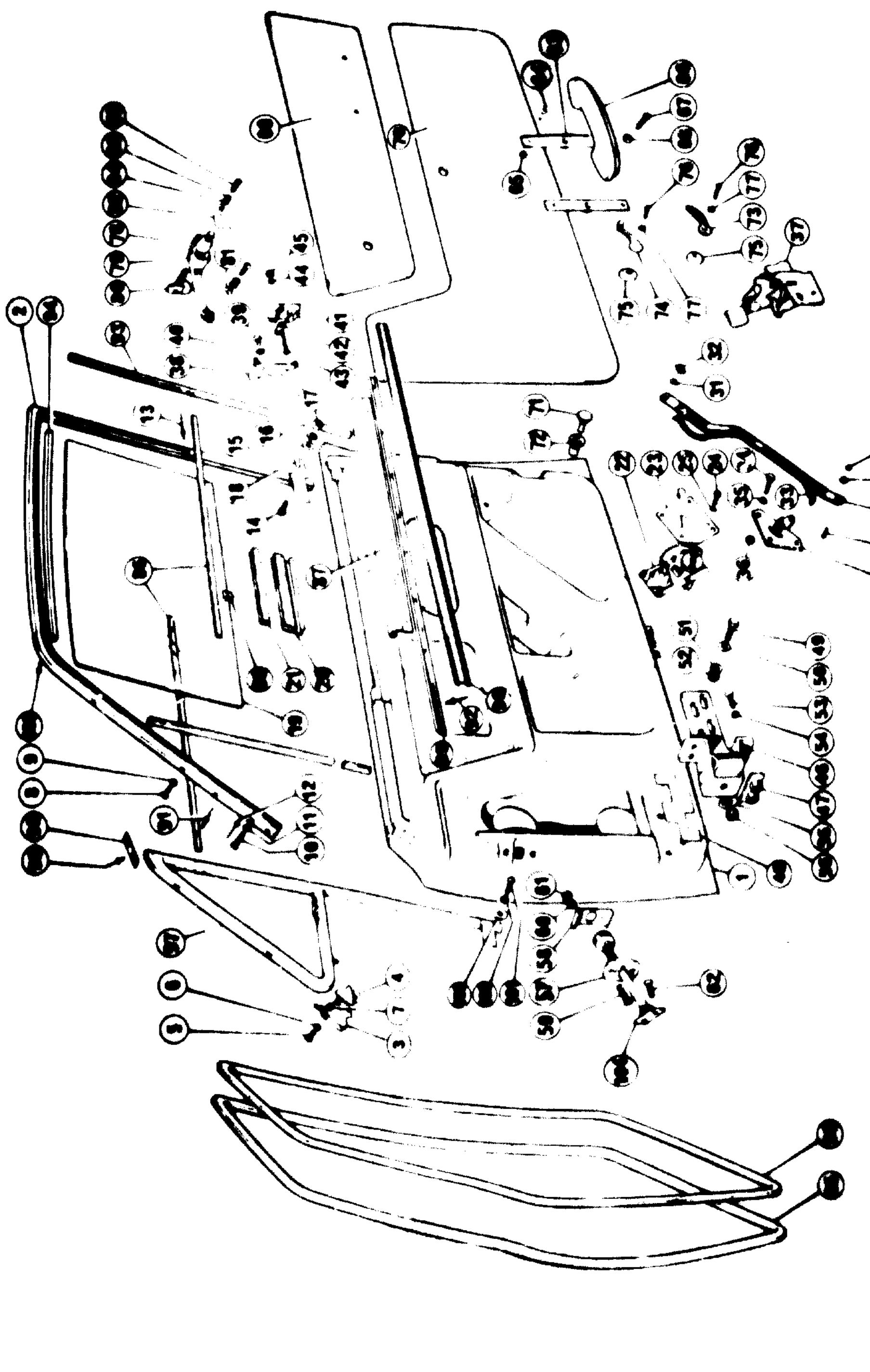


Fig. 14 - Side Doors - General construction

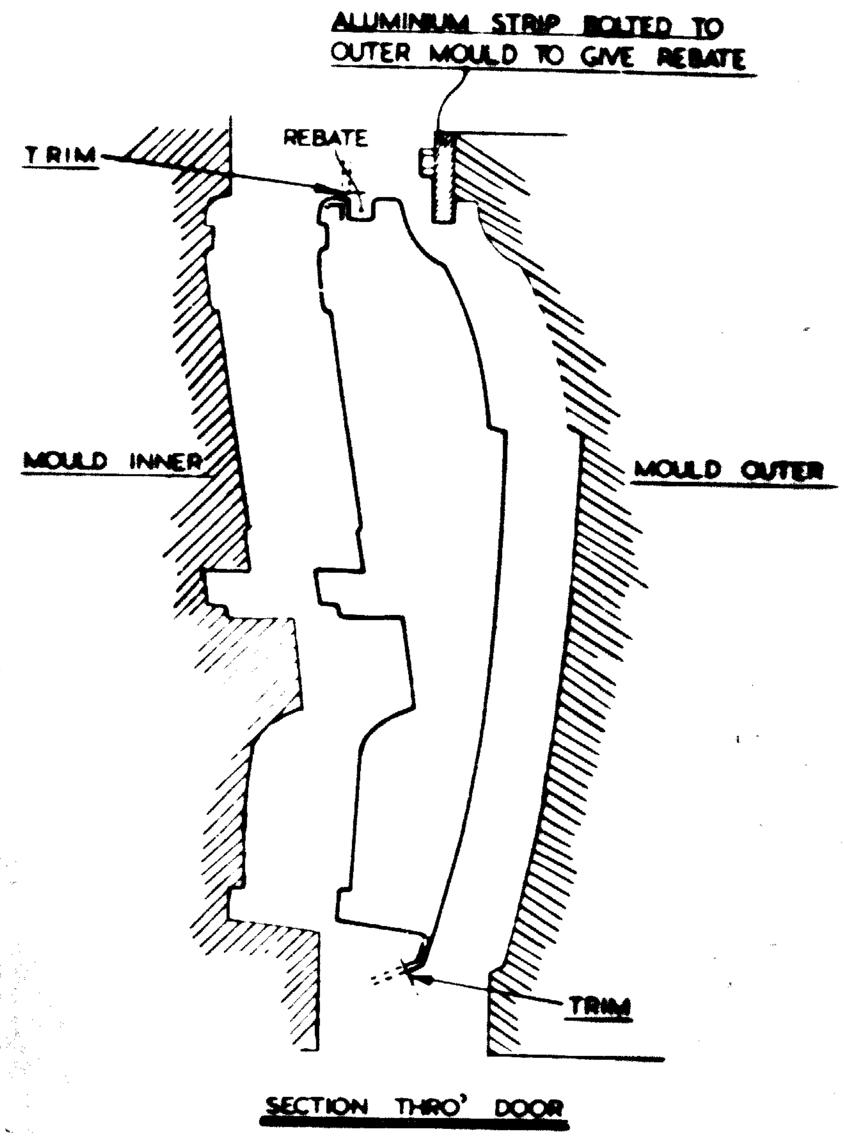


Fig. 15 - Side Door - section

Appendix 1.1

VEHICLE SPECIFICATION

RELIANT DELUXE SALOON MODEL FW5

Body

Glass reinforced plastic body, mounted on rigid box sidemember cruciform steel frame. 4/5 seater, seating within wheelbase, safety glass all round. Large single curvature windscreen and rear window.

Optional two or four door version. Zero torque locks with exterior door lock on driver's door and interior locks on passenger door/s. Combined arm-rest/door-pulls. Hinged no-draught front window ventilators.

Interior trim in vynil-coated fabric with fully-fitted carpet. Front bucket seats with 5 in. adjustment fore and aft. Separate luggage compartment, fully carpeted with self-locking lid. Spare wheel housed vertically in recess of luggage compartment.

Brakes

Four-wheel hydraulic operated. Handbrake operates mechanically on rear wheels only. Dimensions: front 9.13 in. (232 mm) disc; rear 8 in. x 1½ in. (203 mm x 38 mm) drum.

Engine

(1300cc to 2000cc) Four cylinders, overhead valves, water-cooled.

Fuel System

Petrol tank capacity

8 gals (9.6 U.S. gals, 36.3 litres)

Transmission

Diaphragm-spring type clutch, hydraulic actuated.

Gearbox has four forward speeds and reverse, baulk ring syncromesh on all forward speeds. Centrally floor-mounted remote gear change lever; ratios - first 3.746:1, second 2.158:1, third 1.394, top:1, reverse 3.9[illegible]:1.

Semi-floating heavy duty rear axle, spiral bevel final drive. Pinion and differential assembly mounted on taper bearings. Axle ratios 4.1:1. Alternative axle ratios available.

Open type two-piece propellor shaft with needle-roller-bearing universal joints.

Suspension

Front - Independent, with unequal length wishbones and rubber bushed inner pivots, vertical link steel forging with ball joint pivot at top and screwed trunnions with nylon bush pivots at bottom. Separate stub axle shafts carrying taper-wheel bearings. Coil springs controlled by telescopic direct-acting hydraulic shock-absorbers. Anti-roll bar.

Rear - longitudinal asymmetrical semi-elliptic leaf springs with telescopic direct-acting shock-absorbers. Leaf springs and shackles mounted on rubber bushes at all pivot points.

Steering

Rack and pinion

Wheels

Tyre size 590 x 13 tubeless

Electrical Equipment

Twin Horns. Dual self-parking windscreen wipers, double-dipping headlamps with pilot lamps, front and rear flashers. Twin stop/tail lamps, twin reflectors, twin rear number-plate illumination lamps, warning lamps to indicate flashers working, generator not charging, headlamp high beam position and oil pressure, door-operated courtesy lights. Negative earth 12 volt system.

Instruments. Two large instruments located directly in front of driver, incorporating speedometer, odometer, fuel gauge and temperature gauge.

General Equipment

Interior rear view mirror, interior light, ash trays, driver's sun visor, washable plastic headlining, padded top facia, bonnet lock, face-level ventilation system with adjustable nozzles, glove compartment, windscreen washer. Provision for air conditioning, fresh air heater and radio.

General Dimensions

Overall length	172.5 in (4382 mm)
Overall height (unladen)	56 in (1422.4 mm)
Overall width	64.75 in (1644.7 mm)
Ground clearance (laden)	6.5 in (165.1 mm)
Wheel base	101 in (2565.4 mm)
Track front	52.06 in (1322.4 mm)
Track rear	52 in (1320.8 mm)
Turning circle	33 ft (10 m)
Kerb weight (including fuel, oil, water and tools)	1880 lbs (853 kg)
Gross vehicle weight	2700 lbs (1225 kg)

Appendix 1.2

VEHICLE SPECIFICATION

RELIANT THREE WHEELER (800 kg) PICK UP MODEL

Engine.

1147cc four cylinder, overhead valves, water cooled.

Fuel System

Petrol tank capacity 6 gallons (27.28 litres)

Clutch

6½ in diameter diaphragm type. Hydraulically controlled, Self-lubricated withdrawal bearing.

Transmission

Four forward speeds and reverse with synchromesh on all forward gear, Overall ratios: 1st 19.3:1, 2nd 11.1:1, 3rd 7.2:1, Top 5.14:1, Reverse 19.3:1 Needle bearing propeller shaft with differential gear and large ball and taper roller bearings.

Brakes

5 Hydraulically operated internal expanding brakes on all wheels.

Size: Front 9 x 1¾ in.

Rear 9 x 1¾ in.

Footbrake operates on all wheels, handbrake on rear wheels only.

Steering

Worm and Peg type, right or left hand steering.

Springs

Leading arm suspension to front wheel controlled by heavy duty combined coil spring and hydraulic suspension unit. Long semi-elliptic rear springs, rubber mounted; double acting hydraulic shock absorber on rear axle.

Chassis

Pressed steel member with tubular cross members

Wheels

Front wheel mounted on stub axle on taper bearings. All wheels pressed steel detachable and interchangeable. Tyre size 6.40 x 13, radial-ply, or 6.70 x 13 cross-ply. Truck tyres.

Electrical Equipment

Built-in headlamp units controlled by foot-operated dipping switch, stop tail, front and rear flasher lamps. Ignition key starting. Self-parking windscreen wiper. Negative earth, 12 volt system.

Fascia Panel

Crescent shaped speedometer with radiator thermometer, fuel gauge, and ignition, oil and main beam warning lights. Finger tip control over lighting, windscreen wiper and flasher indicator switches. Choke, heater (optional) and windscreen washer controls (when fitted).

Bodywork

Coach built, all glass fibre, embodying the latest unit construction technique for increased strength and rigidity. Completely corrosion-free and highly resistant to incidental damage. Two wide opening cab doors with sliding window with sliding portion giving, unrestricted rear vision. Toughened safety glass windscreen and windows. Interior rear view mirror and exterior driver's side wing-mirror. Fascia fresh air intake.

Optional Equipment

Spare wheel, heater and demister, windscreen washer.

General Dimensions

Length overall*	147.00 ins	3734 mm
Width overall 'Body'	58.75 ins	1492 mm
Height overall (unladen)	70.00 ins	1778 mm
Wheel base	96.06 ins	2440 mm
Track - rear	49.50 ins	1257 mm
Chassis overhand - rear	33.56 ins	852 mm
Ground clearance - frame	8.50 ins	216 mm
Seating capacity	2 persons	
Unladen weight with Cargo Box	1700 lbs	770 kg
Maximum gross vehicle weight	3860 lbs	1750 kg

Cargo Box (to special order only)

Length inside*	75.75 ins	1950 mm
Width inside*	55.50 ins	1410 mm
Height inside*	15.00 ins	381 mm
Floor area	30 sq ft	2.75 sq m

* These dimensions can be varied in consultation with the manufacturer.

Maximum Permitted Rear Overhang — 43 ins — 1092 mm

Payload

Normal payload	1.792 lbs	800 kg

Basic Performance Figures

Maximum Speed

Laden: Driver, Passenger and payload (100 kph)

Fuel Consumption

(Fully laden) at 30 mph (50 kph)

Miles per gallon	44
Kilometres per gallon	70
Kilometres per litre	15.6
Litres per 100 kilometres	6.42

Appendix 1.3

VEHICLE SPECIFICATION

RELIANT 1200 KG Van Model C4VX

WEIGHTS

Gross Vehicle Weight	2400 kg
Approximate payload	1200 kg

GENERAL DIMENSION

Wheelbase	280 cm	Overall length	450 cm
Front track	165 cm	Overall width	200 cm
Rear track	160 cm	Overall height (laden)	200 cm
Front overhang	76 cm	Ground Clearance	20.3 cm
Rear Overhand	114 cm	Loading Height(unladen	66 cm

SPECIFICATION

Engine 1600cc to 2000cc Petrol. Water cooled.
Clutch 216 mm single dry plate, diaphragm - spring tyre.
Gearbox 4 speed synchromesh on all forward gears.
Propellor Shaft - Open type - needle bearing universal joints.
Rear axle - hypoid-level, three quarter floating. Capacity 3,900 lbs (1542 kg)
Ratio 4.4:1 to 5.14:1
Front Axle Solid I beam reversed Elliot capacity 2,250 lbs (1020 kg)
Section 5.2 cm x 3.8 cm x 0.6 cm
Steering:- Recirculating ball type; Ratio 2[illegible]:1
Turning circle 10.5 metres between kerbs.

Suspension

Front & rear - Asymmetric semi-elliptic springs, direct acting telescopic dampers.

Brakes

Hydraulic actuation, front 25.4 cm two leading shoes
rear 22.86 cm x 4.44 cm leading and trailing shoes
Total Area 393 cm²
Vacuum servo available.
The handbrake lever is connected to the rear brakes by rod and cable.

Wheels & Tyres

7.50 - 14 LT cross ply tyres on $5\frac{1}{2}$K x 14 - 5 stud fixing wheels.

Electrical System

12 Volt negative earth, alternator 43 amps., 57 ampler battery.

Fuel Tank

12 grille

Chassis

Large section side members, tubular cross members, all steel welded frame

BODYWORK

Van

A glass reinforced plastic body, with 2 side doors, double rear loading door. Single driving seat, single or dual passenger seats, full or half width bulkheads available. Painted front and rear bumpers.
Capacity - [illegible] with no passenger seat.

Alternative Bodies

Bus - (as Van but with 12 forward facing seats (including driver), additional side door if required..

Pick Up Truck - Approximate payload 1200 KG
Cab - Glass Reinforced Plastic cab with 2 side doors
Body - Flat track, dropsides as required

Appendix 1.4

VEHICLE SPECIFICATION

Reliant 8500 kg Rigid Truck - Model C4RX

WEIGHTS

Gross Vehicle Weight	13,000 kg	Max weight front axle	4,600 kg
Approximate payload	8,500 kg	Max weight rear axle	9,300 kg
Chassis Cab Kerb Weight	3,950 kb		

GENERAL DIMENSIONS

Wheelbase	396 cm	Overall length	719 cm
Front track	189 cm	Overall width	226 cm
Rear track	174 cm	Overall height (lab.)laden	236 cm
Front Overhang	129 cm	Ground Clearance	25 cm
Rear Overhang	193 cm		

SPECIFICATION

Engine Six cylinder direct injection deisel engine, capacity 150 BHP @ 2400 rpm, 240 lb. ft. @ 1800 rpm.

Clutch Hydraulically operated single dry plate 330 mm diameter

Gearbox Five-speed, synchromesh on 2nd, 3rd, 4th and 5th gears

Rear Axle
Single speed spiral level(alternative 2 speed axle)

Front Axle
Drop forged I beam

Brakes Hydraulically operated, two leading shoe front and rear. Front (387 mm x 108 mm) rear 394 mm x 153 mm
Air/hydraulic dual line system, power assisted parking brake on rear wheels.

Suspension
Front & Rear - Semi-elliptic leaf springs with direct acting telescopic dampers.

Steering Worm & peg

Cooling System 37.5 litre

Frame Parallel channel section. Side member section 10" x 2.9" x .27" (254 mm x 74 mm x 7mm)

Fuel Tank 180 litres

Wheels and Tyre Wheels, disc type three piece 20 x 6.5, 10 stud fixing
Tyre, Front & Rear 10.00 x 20 - 16 Pr.

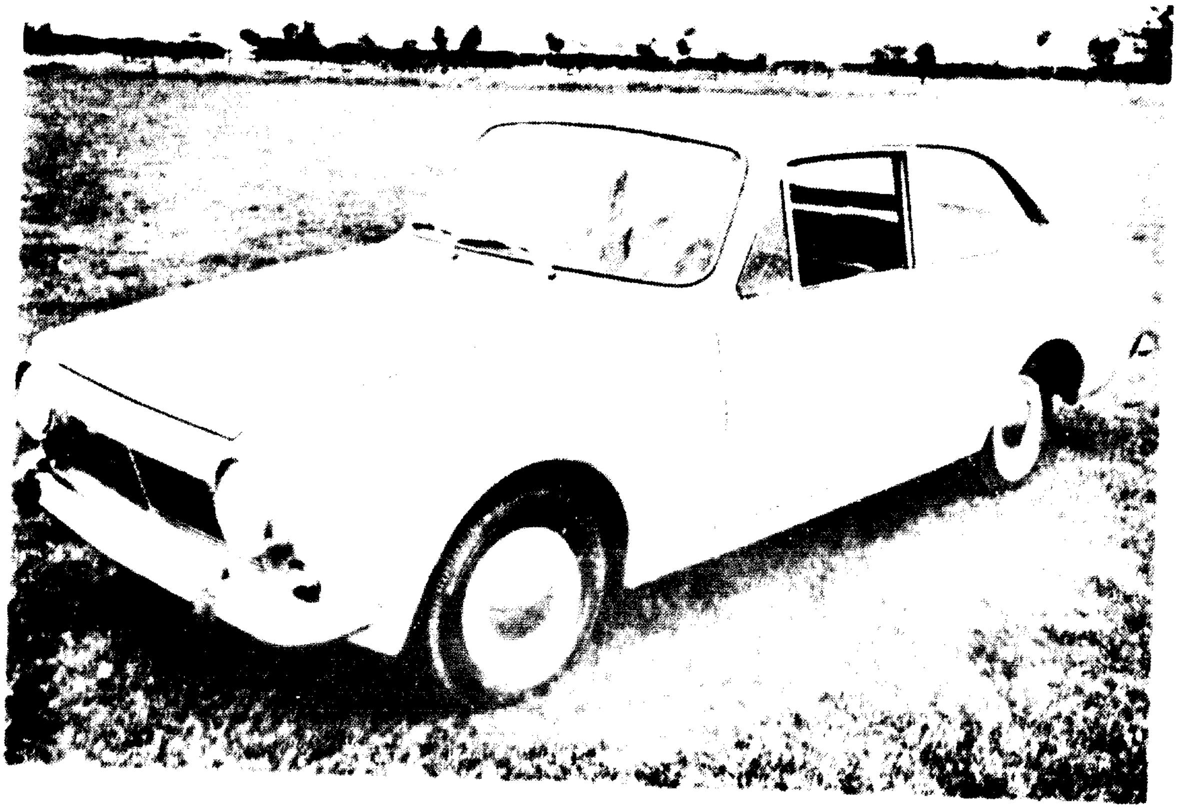
Electrical Equipment 12 Volt negative earth system 43 amp 120 ampler battery.

Cab (standard) G.R. Plastic (double skin) tilt cab with steel reinforcement, single driver's seat, single or dual passenger seat.

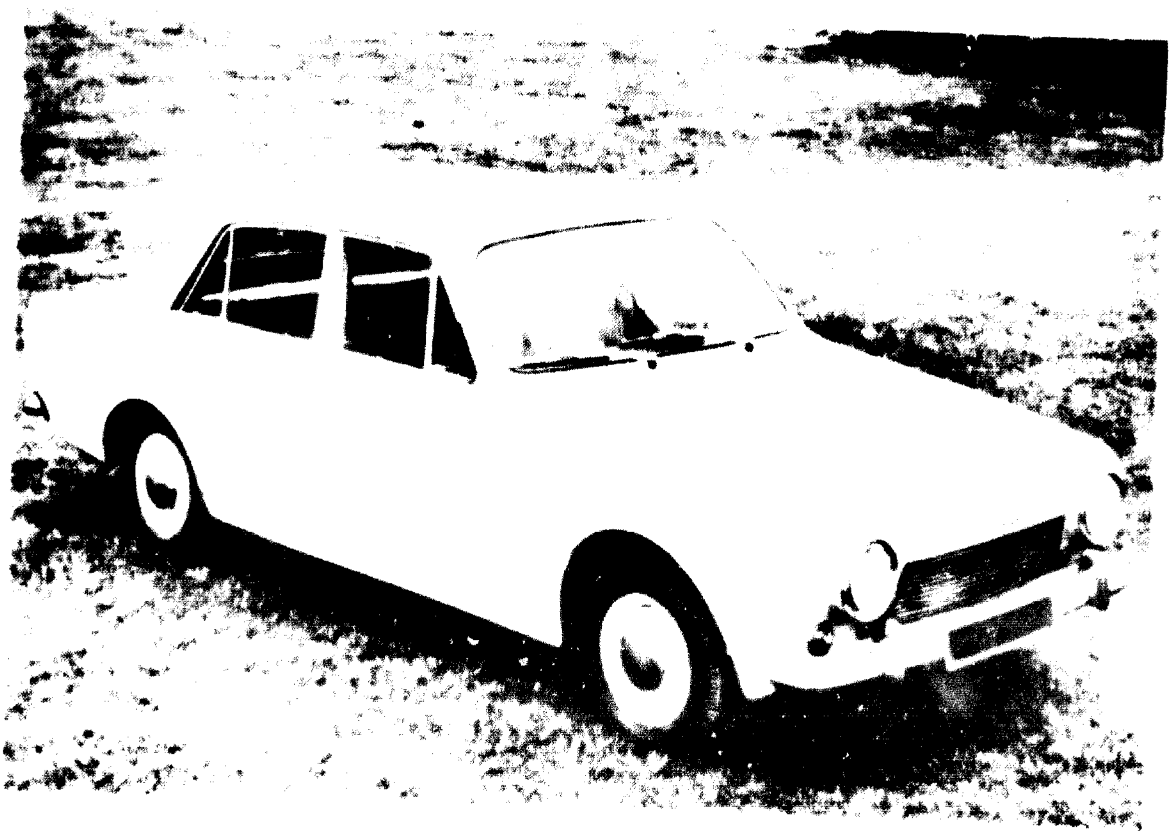
Alternative Crew Cab - Hydraulic tilting mechanism
6 seats (including driver) or 3 seat plus bunk.

Body As required - i.e. flat truck
drop ride
tanker
bus body

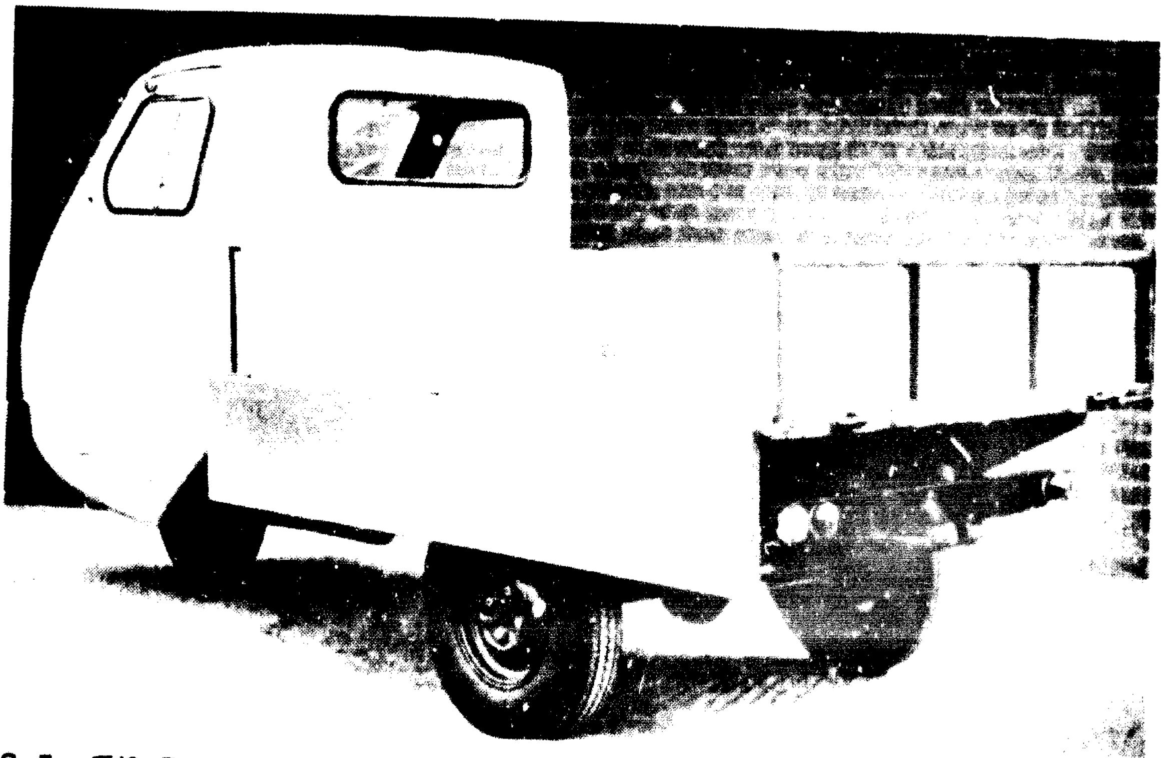
Appendix 2



2.1 FW Two Door Saloon



2.2 FW5 Four Door Saloon



2.3 TW9 Pick Up

2.4 [illegible]

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