TUNING THE EXCELSIOR TALISMAN 328cc AND 492 cc ENGINE

CONTENTS

INTRODUCTION

This book has been published because many Berkeley owners have asked for it. Apart from some essential basic information it is not for the tuning expert but rather more for the enthusiastic owner, who wants to improve the performance of the car, for racing, rallies and other competitive motoring. So we would ask the expert to excuse us if we quote a lot of information that he already has.

A considerable amount of 'trial and error', observation and research has been applied, both by private owners and Berkeley Cars Ltd. to arrive at these recommendations.

During 1957 private owners, driving their own cars, have had a great deal of success in sports car races rallies and other competition motoring in Great Britain, and it is hoped that this book will help enthusiasts to join their ranks.

At the time of publication, tuned 329cc Berkeley cars had the lap record in the 350 class, for four British circuits and the advent of the 492cc three cylinder, two stroke engine in early 1958 introduced some interesting opportunities.

Although most two-stroke engines work on the same principle, there are many different designs, so the first step is to explain the principal and general design of the Excelsior engine. This is shown in Fig 1. from which it is obvious that,

a. The opening and closing 0+ the inlet and exhaust ports is accomplished by the movement of the piston, and

b. That the mixture is transferred from the inlet port to the combustion chamber via the crankcase where it is compressed by the descending piston and then via 'transfer' ports.

It follows that the operation and performance is largely governed by a. the location of the inlet transfer and exhaust ports in relation to the combustion chamber, and
c. The shape, length of skirt and general form of the piston.

These factors, as determined by the makers, are designed to produce the best possible general performance, where economy, durability and smooth running are important points.
In common with most car engines, it must be realised that when the engine is tuned for more power, economy and smooth running at lower speeds will be affected.

Generally if the instructions in the book are carefully followed, the durability and reliability of the engine will not be affected to any appreciable degree and in fact, more advanced tuning and alterations can be carried out, but this work should be done by experts who have the necessary equipment and knowledge.

In any event, we must point out that any alteration to the engine cancels the makers warranty or guarantee for the engine and its components and for the transmission, as mistakes may be made in tuning the engine and advanced tuning may subject the transmission to stresses beyond its capacity.

TUNING EXCELSIOR ENGINES FOR BERKELEY'S

These notes published late in 1957 are presented in all goad faith. However, neither the Berkeley Enthusiasts Club nor any of its officials are responsible far either the correctness of the information or consequential loss or damage caused as a result of following the advice given here. If you are in doubt about any point please ask. Having read these notes you may feel the modifications are more difficult than you can manage. If you return them in good condition a refund (less expenses) will be sent, you are advised to consult your insurers before you start the modification, if you run a modified car without telling them it will invalidate your insurance. The kit of parts which originally accompanied these notes is no longer available. A description of the parts is given here, together with some additional remarks about the instructions.

Part No TMB 100 should be made using a cylinder gasket as a pattern. Use a thin piece of metal (eg 1132 thick aluminium 4 square) cut a circular hole the size of the cylinder skirt. When using the gasket as a pattern, drill four small holes where the cylinder studs are. These holes can then be enlarged until they are a good and a true fit on the studs. The outside shape of the template is unimportant. Do not cut the transfer port cutaways yet, mark an arrow on the upper surface facing forward, make one for each cylinder.

Part No TMB 101 need not be made if you have a 6 steel rule which has markings starting from one end (eg no margin before 0). A piece of thin aluminium about 2 square is also needed for resting inside the bore whilst scribing.

DO NOT DO MODIFICATION 4b unless you are going to be able to machine the cylinder head.

Standard pistons may be modified but sustained high revolutions will be more likely to lead to seizure due to lubrication starvation,

Part No TMB 102 are templates for marking the piston crowns. Reference to Fig 7 shows their form,

Part No TMB 103 is a narrow strip of metal to fit down the bore to measure the bore, if your steel rule is narrow and thin it could be used. The packing pieces referred to must all be the same height exactly or the cylinder will he tilted, o not assume that both cylinders are identical.

Care should be taken when marking the position of bodywork cutouts with pattern TMB 105 that the holes are not cut too near to the bulkheads. A clearance of 1 is suggested to allow space for the bolts securing mesh part No
TMB 118.

Part No TMB 107 are curved aluminium deflector plates fitted to the back and rear of the rear wheel arches. It is pointed out that the modifications to the bodywork may look very sporty but they reduce

the strength of the shell of the car and cause staining to the outside of the car in wet weather, however, fitting air vents Part No 108 is recommended for all cars as it reduces the tendency for the bonnet to fly open and helps with the general overheating problem which Berkeley's have.

Do not make the holes in the bonnet lid too big or rain will get in while stationary. No mention is made of the inlet manifold, this should be shaped and polished inside so that air/petrol flow is not turbulent. Modify the gaskets if necessary to obtain a. smooth contour.

It is of course, necessary to carefully run in the engine in accordance with the maker's recommendations before tuning.

Before starting work, the reader is advised to study carefully the engine makers handbook, and again refer to Fig 1, when it will be appreciated that one of the most important points is to ensure that there is a free uninterrupted flow of gas from the carburettor, through the inlet manifold (which is fitted only to two cylinder engines fitted with one carburettor), through the crankcase and via the transfer ports to the combustion chamber.
In addition to helping the gas flow freely, the volume has to be increased, and the time at which it enters the crankcase and is transferred to the combustion chamber has to be changed, that is, advances in relation to the piston position.

It is also essential to ensure that the transfer ports, which are part of the cylinder casting, line up exactly with the section which is machined away from the crankcase when these two components are bolted together.

It is also necessary to cut away the base of the cylinder casting so that the flow of gas from the crankcase to the point of entry of the transfer port is unobstructed and, therefore, there are three jobs to do which entail alterations to the shape of the cylinder.

They are as follows, and we suggest you do them in this order: -

1. Remove surplus metal at transfer port entry to ensure it lines up with the aperture in the crankcase.

2. Cut away the cylinder base to remove obstruction from crankcase to transfer port entry.

3. Cut away inlet port to allow earlier entry of a larger volume of gas.

MODIFICATIONS TO CYLINDERS

Presuming that the cylinder head, cylinder barrel and piston complete with rings, and gudgeon pin, have been removed from the engine, first thoroughly clean all parts by washing in Paraffin and proceed as follows: -

1a. Locate the enclosed template part No TMB 100 on the crankcase by fitting it over the cylinder fitting studs and pressing it down firmly on the crankcase, ensuring that the arrow on the template is facing forward on the upper surface.

1b. By using a bent scriber, scribe the shape of the transfer aperture on to the underside of the template, (part No TMB 100). See Fig 2.

1c. Remove the template, and carefully cut and file away to the scribe marks.

Id. Locate the finished template on to the cylinder barrel by placing four locating bolts through it and in to the holes in the cylinder. Ensure that the arrow is facing forward i.e. in the direction of the exhaust port and that it is contact with the flange. See Fig 3.

1e. Scribe a line around the section of the template that has been cut away thus exactly reproducing the size arid shape of the section cut away on the crankcase. See Fig 3.

1f. Carefully file away surplus metal in the cylinder using a fine file, until the scribed line is almost reached. It is advisable to leave a little surplus1 bearing in mind that a polished finish is wanted later. The above operations are illustrated in Fig 3.

2a. With the top of the cylinder resting on flat surface, mark off two vertical lines on the cylinder skirt, to the dimensions exactly corresponding to the width of the modified transfer port as shown in Fig 4.

2b. Mark off a horizontal line exactly 1/16” from the cylinder flange, which joins the two vertical lines referred to in 2a.

2c. Mark off the curve and radii quoted In Fig 4.

2d. Cut and file away surplus metal to the scribed lines. It is essential that the curve and radii be maintained, as otherwise the cylinder skirt will be weakened.

3a. With the cylinder top resting on a flat surface place the enclosed gauge part No TMB 101 in position inside the cylinder with its base resting on the flat surface and its side lining up with one side of the inlet port. See Fig 5.

3b. Scribe a mark on the bore of the cylinder at the top of the pointer and repeat on the other side of the inlet port.

3c. Bend the gauge part No TMB 101 to the approximate inside diameter of the cylinder and line it up with the two scribe marks. Using it as a guide, scribe a line to connect the two scribe marks.

3d. Using a thin steel rule, scribe two lines connecting the vertical section of the inlet port with the scribe line referred to in ‘C’.

3e. Carefully file away surplus metal to the scribe line, maintaining a 1/8" radius at the corner. This inlet port is not very easy to get at. The job will be easier with a fine ‘Rifler’ or curved file, first remove any, High Spots, and blend in any scores or pits to obtain a surface as uniform and smooth as possible. The exhaust port must be treated In a similar manner, that is, smooth any high spots and blend in any pits or scores, but on no account must this port be enlarged on the cylinder bore side. Care should be taken not to radius the ports at either the inlet or exhaust flanges, as this may affect the efficiency of the joints when the carburettor and exhaust manifolds are fitted, and particular care should be taken not to radius the Inlet ports at the point where they enter the cylinder base. When the smoothest possible finish has been obtained with a ‘Rifler’ file, finally polish the ports using a fine emery cloth, but when the best possible finish has been obtained, do not forget to wash and thoroughly clean all parts and make sure that the abrasive compound is left in them.

This job of polishing the ports is one of the most important in tuning a two stroke engine, and whereas it is almost impossible to obtain a perfect finish, particularly in the transfer ports which are difficult to reach, patience and care are well repaid in an improved performance.

MODIFICATIONS TO PISTONS

A study of the drawings in the book will reveal that it is now necessary to modify the pistons, so that it conforms to the modifications applied to the cylinder. A ‘Super Sports type of piston should be used, the description and part No of which is listed elsewhere in this book. The ‘Super Sports piston has five grooves in the skirt, one above and four below the gudgeon pin. These grooves ensure adequate lubrication at high RPM. The piston ring grooves are narrower than those on a standard piston, and therefore narrower piston rings are used with the object of reducing ‘flutter at high RPM.

Proceed with modifying the pistons as follows:

4a. Remove the piston rings and fit the piston to the connecting rod by inserting the gudgeon pin. Make sure that the arrow marked on the piston's facing forward, that is towards the exhaust port. Place the sealing gasket in place on the crankcase and fit the cylinder in place. Next, line up the inlet port

facings on each cylinder with the aid of a steel rule. Reference to the Excelsior engine handbook, page 14 will clarify this operation. At this juncture it is as well to point out that this lining up procedure, must always be carried out when scribing positions are required and of course on final assembly of the engine. Press cylinder barrel firmly down into position, or better still, place distance pieces over the studs and fit the nuts that normally hold down the cylinder head so that the cylinder is held firmly in place, but do not put too much tension on the nuts.

4b. Rotate the crankshaft so that the top of the transfer ports are just exposed and mark off the piston crown so that the location and exact width of the transfer ports are shown. Firm scribe marks can be made, as this part will be filed away later, See Fig 6. Now remove the cylinder and then the piston from the connecting rod and mark off the dimension of 1/16" as shown in Fig 1. Next place into position the templates part No TMB 102 so that they line up with the marks made on the piston crown that show the location and the exact width of the transfer ports. Also see that the arrows marked on the template are facing the same way as the arrow marked on the piston crown, If the templates are too wide, file away surplus metal on each side until their width corresponds to the marks on the piston crown.
Hold the templates firmly into position with the arrows facing towards the front (i.e. towards the exhaust port) of the piston and mark off the shape of the templates on the piston crown. Using a smooth file, now file away the piston to a depth of 1/16' as previously marked and file a cavity in the piston crown to a shape and contour corresponding to the template.

The depth of the cavity should be gradually and evenly reduced so that no metal is removed from the centre of the crown (top) of the piston. The object of forming this cavity or irregular groove is to open the transfer ports earlier and to induce the gas away from the exhaust port when it enters the combustion chamber. The sharp edges at the edge of the cavity should be removed; but do not fore a radius and do not under any circumstances use any fore of abrasive material on the piston crown. Any file marks can be removed by the careful use of a bearing scraper, but make sure that the dimension of 1/16" at the top edge of the piston, that is, the depth of the cavity is not exceeded.

4c. The piston skirt now has to be cut away to conform with the modified inlet port on the cylinder. First assemble the piston and cylinder as quoted in 'A' ensuring that the piston is facing in the right direction. Rotate the crankshaft until the piston is at the exact top of its stroke, that is TDC, not forgetting to line up the cylinders as aforementioned. Mark off the piston skirt where it is showing through the inlet port, thereby marking the exact location and width of the port aperture on the piston. Remove the piston from the connecting rod and mark off the piston as shown in Fig 1.

The dimension of 3/16" should not he exceeded and the shape of the section to be cut away should be to the radius quoted. A fins file should be used for this job and all sharp edges should he removed. A number of 'Super Sports' pistons have this modification Incorporated in which case, the details referring to piston skirt modification marked 'X' in Fig 7 can be ignored.

4d. The final modification to the pistons consists off cutting away the skirt so that there is no obstruction to the gas passing from the crankcase to the transfer ports. Again assemble the piston as in 'A'. Place the cylinder in position and line up, but do not fix it with distance pieces and nuts. Now rotate the crankshaft until the piston is at the exact bottom of the stroke. Next, place the enclosed strip of aluminium part No TMB 103 inside the cylinder so that one end Is firmly in contact with the cylinder wall and at the top of the piston, and scribe a mark on the strip at the point where it nets the top of the cylinder bore. Now carefully lift the cylinder without rotating the crankshaft, and fit the enclosed packing plates part No TMB 104 between the lower cylinder flange and the crankcase so that the cylinder is supported on the packing plates, which should he located so that they do not obstruct the section of the cylinder previously cut away, and as detailed in paragraph 2.

The crankshaft should now be turned until the piston has reached the point in the cylinder exactly corresponding to BDC, when the cylinder was In contact with the crankcase this can be checked by replacing the marked off gauge inside the cylinder and moving the piston until the mark on the gauge lines up with the top of the cylinder bore.

It is now possible to mark off the piston skirt to determine the amount to be cut away so that is corresponds with the section previously cut away from the cylinder. When this has been done, remove the cylinder and piston and cut away and file the surplus metal from the piston. The top of this section

cut away should be to the radius quoted and the maximum height of the section should not exceed the scribed line as shown in Fig / so that the section cut away exactly corresponds to that cut away from the cylinder. Finally remove the sharp corners and edges.

MODIFICATIONS TO CYLINDER HEAD

The next job is to increase the compression ratio when the gas is under compression in the combustion chamber, see Fig 1 sketch B. This is done by removing part of the cylinder head flange, but this work can only he undertaken by a skilled lathe or milling machine operator. The highest dimension from the flange to the highest point in the combustion chamber is 21/32 and we recommend in the first instance that not more than 1/16 should be removed from the flange of the cylinder head, that is the overall dimension should not be reduced to less than 35/32' and to insure even compression on all cylinders this dimension should be equal on all cylinder heads. See Fig B.

Higher compression ratios have been introduced with success by tuning experts, but it must be remembered that the higher the ratio the higher the running temperature of the engine, and this factor must be offset by the use of special fuels, carburettor tuning and the climate temperature, or else overheating and seizure will result. Therefore the amateur should keep to the above recommendations, until sufficient experience has been gained, to experiment with higher ratios. In this event it is wise to have spare cylinder heads of different dimensions, so that the performance of each can be checked. In fact, it is a good scheme to keep a. log of the alterations and adjustments made to the engine and fuel used etc, so that an owner will be able to know the particular engines characteristics fairly intimately.

ASSEMBLY OF MODIFIED CYLINDERS. PISTONS AND CYLINDER HEADS TO THE CRANKCASE

First, cake sure that every part is absolutely clean. Place the crankcase cylinder gaskets into position on the cylinder flange and check that the gasket does not overlap the modified transfer port aperture. If it does as it probably will, mark it off and carefully cut away the surplus with a sharp knife. After truing up the gasket, apply a little grease to the upper and lower surfaces, place it into position, then proceed to assemble the parts as instructed in the excelsior engine instruction book, paying particular attention to the alignment of the cylinder barrels.

CARBURETTOR TUNING ADJUSTMENT

First, the section in the excelsior handbook, dealing with the Amal carburettor, should be carefully studied.
The following schedule quotes the part fitted as standard and the recommended changes to be made for tuned engines.

CARBURETTOR SCHEDULE

Type — AMAL Monobloc — type no.376
328 cc Excelsior engine

	Main Jet	Needle Jet	Pilot Jet	Throttle Cutaway
Standard car with 1 carb	230	105	25	no.4
Tuned engine with 1 carb	320	105	25	no.3
Tuned engine with 2 carbs	270 or 300	105	25	no.3
Tuned engine with 3 carbs	220	105	25	no.4

However, as tuned two stroke engine carburation is very critical the only effective method to obtain the best possible performance is trial and error, as the type of fuel used, climatic conditions, altitude and humidity all have to be considered.
It is, therefore, advisable for the enthusiast to fit the parts recommended above and Invest in a few larger jets and slides for experimental purposes, but under no circumstances should smaller jets be fitted as they will result in oil starvation with disastrous after effects.

When carburettors are fitted, care should be taken to see that gaskets fitted to the carburettor and/or induction manifold does not overlap the inlet port, or carburettor induction bore. If they do, mark off and cut away surplus gasket material.
The carburettor fixing nuts should not be over tensioned, as this can result in distorting the flange and causing air leaks at this point.

If the car is used for competitive events, and in particular racing, it is recommended that swill pots be fitted to each carburettor. The reason for this is that the centrifugal action set up by fast clockwise cornering can result in fuel starvation and swill pots are essential to maintain an adequate supply - see Fig 9. Under these circumstances, it is also advisable to fit a petrol pump. These items of equipment are available from Berkeley dealers and are listed elsewhere in this book.

EXHAUST SYSTEM

A number of cars made during 1951 and early 1958 are fitted with exhaust systems not suitable for use with tuned engines. The type recommended incorporates an expansion chamber extending across the front of the engine and is prominently marked part No TMB 751 2 cylinder TMB 1115 3 cylinder

This type of exhaust system, which embodies adequate silencing with a minimum of backpressure is designed in such a manner that very little carbon wi11 form inside it. However, as it is not possible to dismantle the exhaust system, any excess carbon deposit can be removed as follows: -Put about twenty 1/4" steel nuts, or any other irregularly shaped metal sections of the same size into the expansion chamber, through one of the exhaust stubs. Seal the stubs with pieces at- rag, or better still blanking plates made for the purpose and vigorously shake the expansion chamber.

The carbon deposit can be broken up and shaken out through the stubs.

As there are no baffles fitted to the silencer attached to the outlet pipe and as the outlet pipe dimension is maintained to the point where it is attached to the expansion chamber, a metal scraper can be used for removing any excess carbon deposit that cannot be shaken out,

SPARKING PLUGS

Selecting the correct sparking plugs is directly related to the type of event envisaged — from the Club Rallies to high-speed track work.

Generally speaking, a hot engine' which would he one driven at higher than cruising RPM for long periods, requires a hard sparking plug, on the other hand, an engine which is being used for ordinary road work needs a soft plug.
The accompanying table gives a selection of various makes. Those at the top of the table are "standard or general road work sparking plugs, and those at the bottom of the table are 'cold' or "hard" and will stand the most heat.

REFERENCE CHART

KLG	LODGE	CHAMPION	BOSCH	NGK
FE70 FE80	HLN HLNP	N5 OR NA8	W225 T2	B8ES
FE100 FE200	RL 47, 3 HLN	NA10, N3	W260 T2	
			W240 T2	

IGNITION

First make the simple device referred to in Fig 10. The method of manufacture is as follows: -

a. Connect a wire to the negative side of a flashlight bulb.

b. Connect a wire from the positive side of a flashlight bulb.

c. Fit a wire from the other battery terminal.

The end of the wire referred to in ‘a’, should be connected to the appropriate condenser and the end of the wire referred to in ‘c’ should be connected to earth, at any convenient spot on the engine, his device now provides a circuit through the contact breaker, and the bulb will be extinguished when the contact breakers open. To check the timing, remove the cylinder heads arid rotate the crankshaft until the piston of the cylinder concerned is at TOC. Next rotate the crankshaft in anti—operational direction of the engine, until the light goes on, and then a bit more. Then turn the engine back in the operational direction until the light goes out.

The standard dimension between the piston at this time and top dead centre should be 11/64” but this should never be more than 3/16” before T.D.C.

The most efficient setting will be relative to the standard of workmanship applied to general tuning, arid cart only be arrived at by trial and error,

The contact breakers are adjusted by removing the cover plate, slackening the retaining screws, and rotating the assembly relative to the cam. The contact breaker clearance when fully opened should be between .016 and .020.

FUEL AND OIL

The fuel and oil mixture should be maintained in proportion recommended in the Excelsior Handbook. We will not endeavour to give you any advice on the grade or make of fuel and oil that should be used, as this i.e. a matter of individual preference. Most manufacturers are conversant with the engine, and will be able to give you specialised advice in this matter.

BODYWORK

Upon completion of the work described in the foregoing chapters, there remains one more aspect of tuning which can make an appreciable improvement to the performance and this is to cut down the air resistance to a minimum.

The Berkeley is so designed that the airflow over the bodywork is smooth and as uninterrupted as possible, but experiments have shown that there can be a build up of air at various positions within the car. The main points are behind each wheel where the air impinges on the vertical bulkheads, and on the bulkhead immediately behind and above the engine. It must be emphasised that these experiments were carried out on cars used for racing, and the speeds from which the above conclusions were reached, entailed keeping the cars well above 10mph. To overcome this waste of available BHP, the following modifications to the body may be carried out.

Reference to Figs 11 and 12 will familiarise the reader to the general scheme.

First make a paper card or template to the part No TMB 105, next place the template In position rear of the front wheels and mark the shape on the bodywork. Next drill a number of holes on the waste side of the line to enable a hacksaw blade to be used for cutting to template. The same procedure applies to the rear air outlets. When this has been done, the air deflectors part No TMB 101 can be screwed into position as shown in Fig 11.

Finally, the aluminium mesh part No TMB 118 front rear, can be bolted into position, together with the air deflector strips part No TMB 120.

The final modification to the body concerns the bonnet lid and in this case, the reader has a choice of two alternatives.

The standard bonnet can be modified to take the two metal air outlets, part No TMB 108 or a bonnet incorporating the extra louvres can be purchased from Berkeley Cars Limited, part No TMB 109.

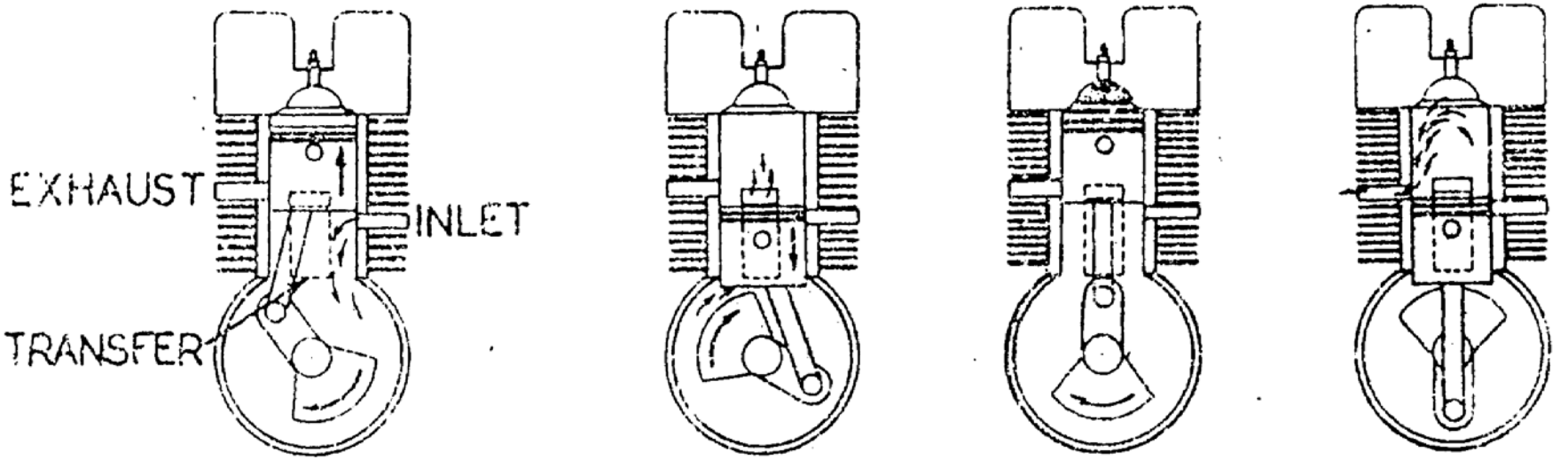

EXHAUST
INLET
TRANSFER
INLET
A
TRANSFER
B
FIRING
C
EXHAUST
D

FIG 1

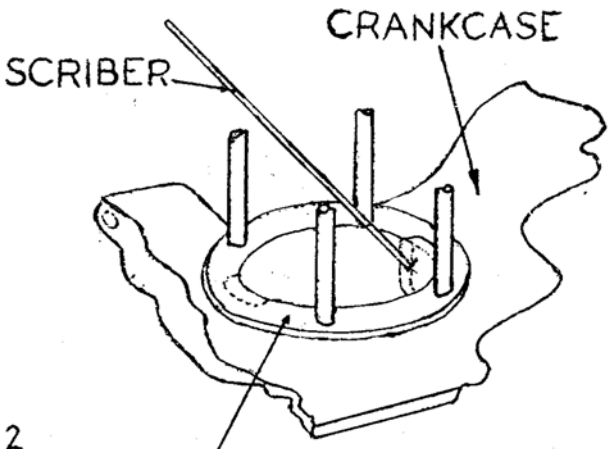
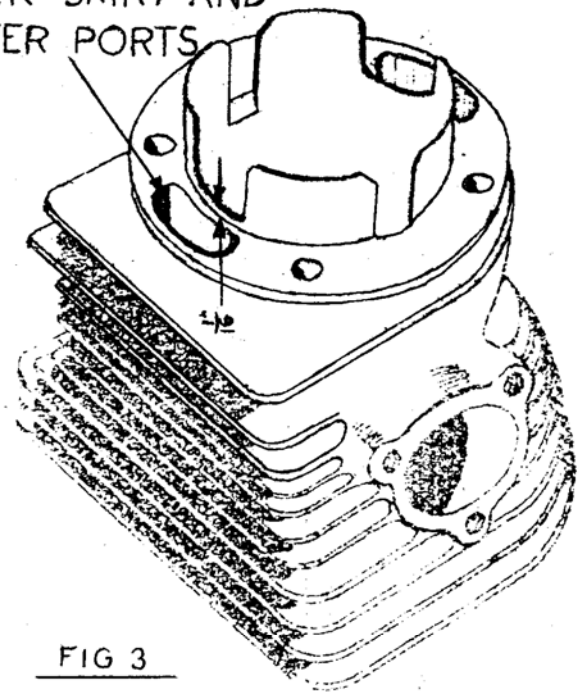
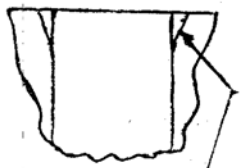


FIG 2

TEMPLATE TBM.100

PLACE TEMPLATE PART Nº T.M.B.100 OVER CYLINDER SKIRT AND MARK. TRANSFER PORTS





DOTTED LINE SHOWS FILING ANGLE

FIG 3

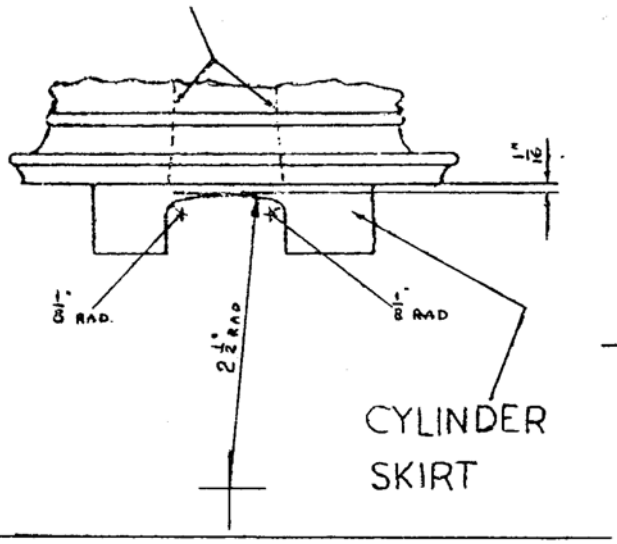


FIG 4

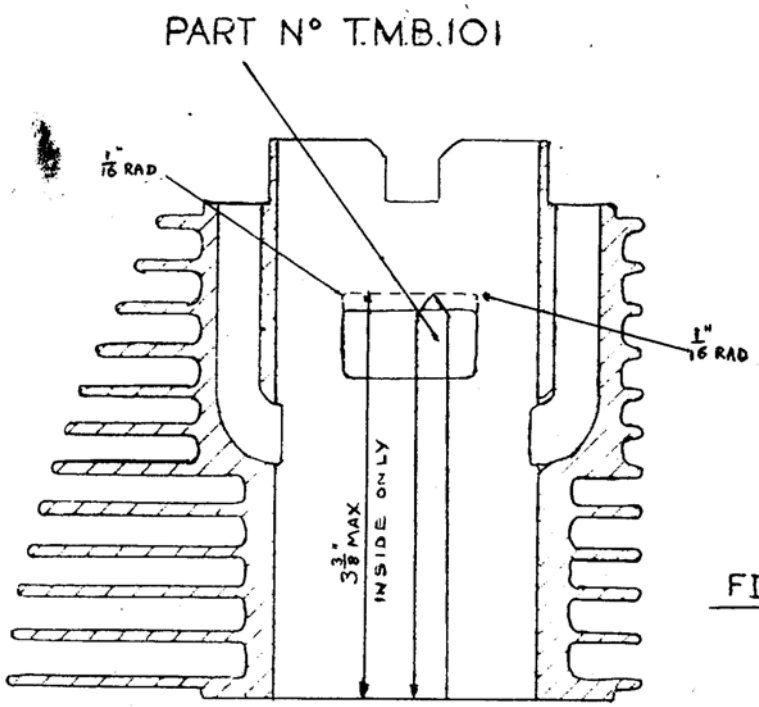


FIG 5

SECTION THROUGH CYLINDER
SHOWING INLET GAUGE PART N° T.M.B.101

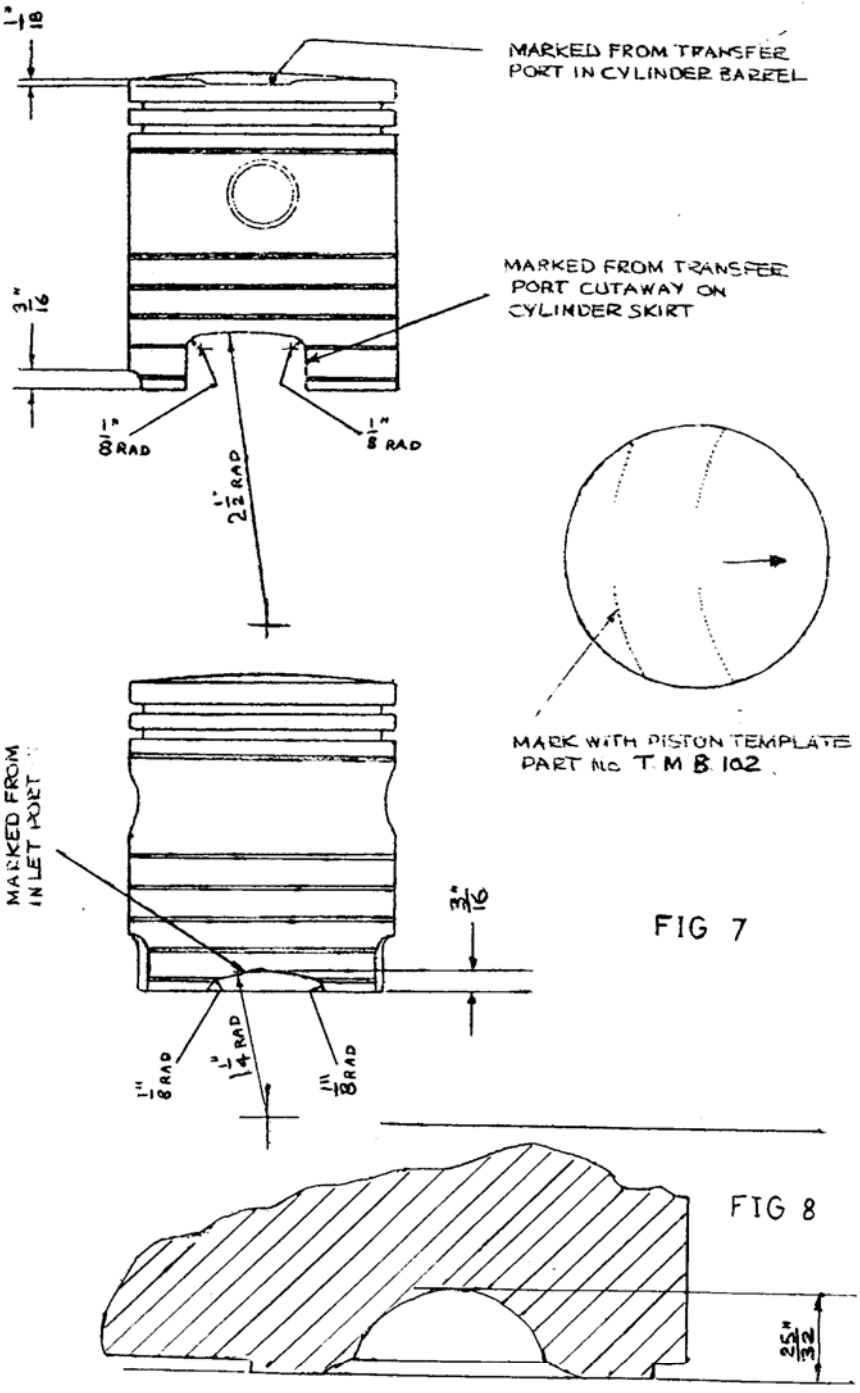

1/16
MARKED FROM TRANSFER PORT IN CYLINDER BARREL
3/16
MARKED FROM TRANSFER PORT CUTAWAY ON CYLINDER SKIRT
1/8 RAD
1/8 RAD
1 1/2 RAD
MARK WITH PISTON TEMPLATE PART No T.M.B. 102.
MARKED FROM INLET PORT
3/16
1/8 RAD
1/4 RAD
1/8 RAD

FIG 7

25/32

FIG 8

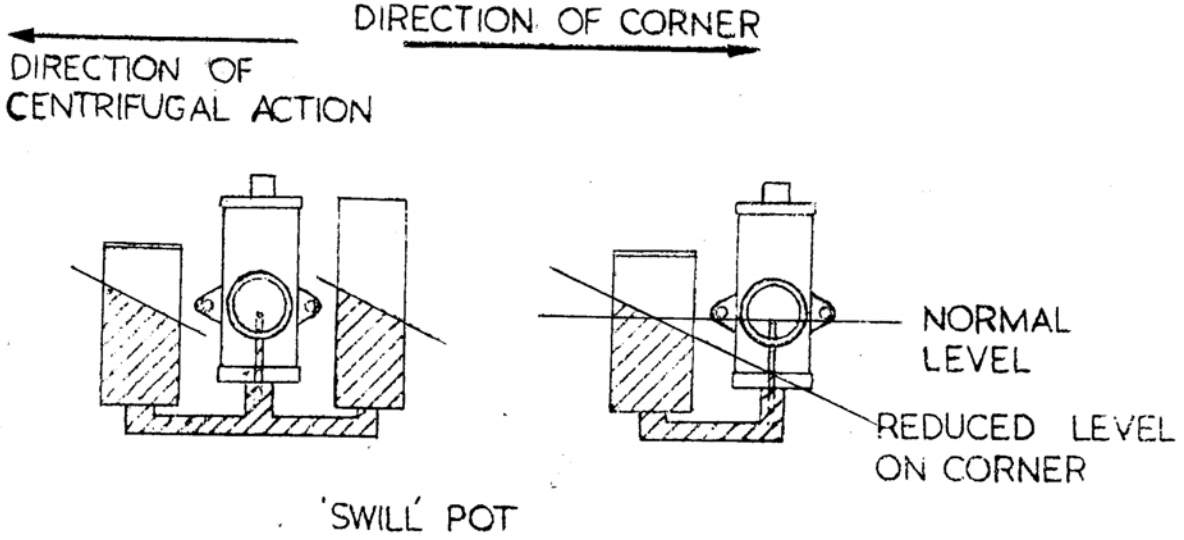

DIRECTION OF CORNER
DIRECTION OF CENTRIFUGAL ACTION
NORMAL LEVEL
REDUCED LEVEL ON CORNER
'SWILL' POT

FIGURE 9

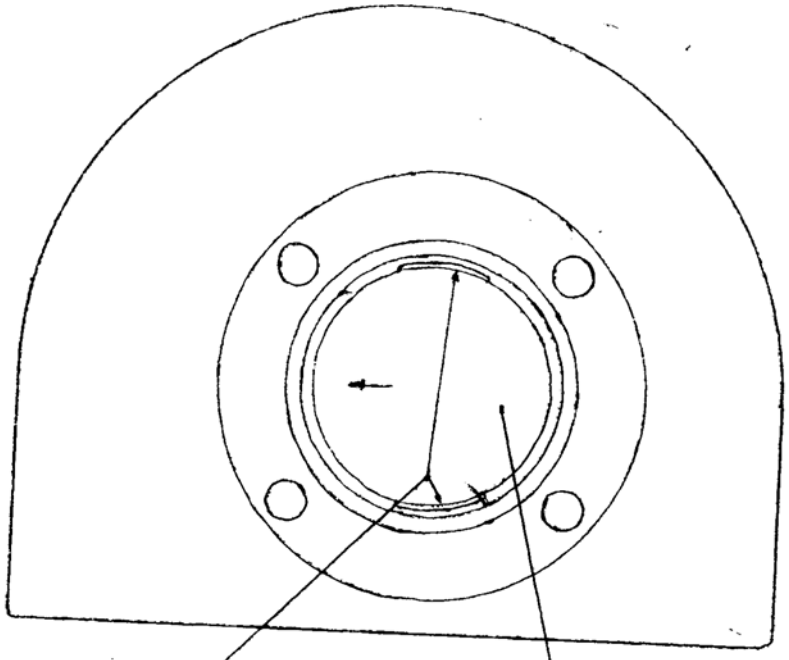
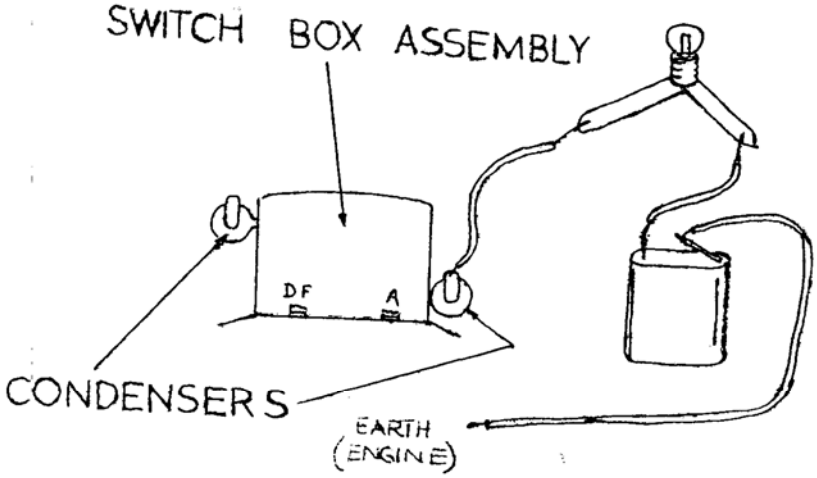
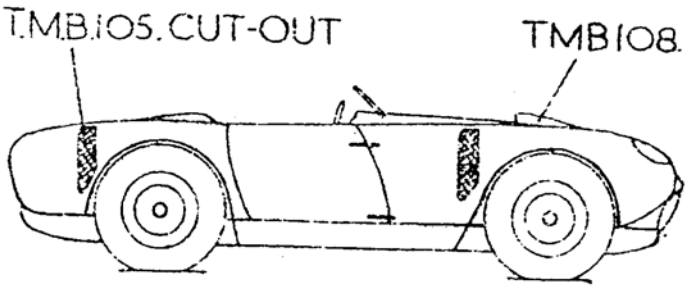
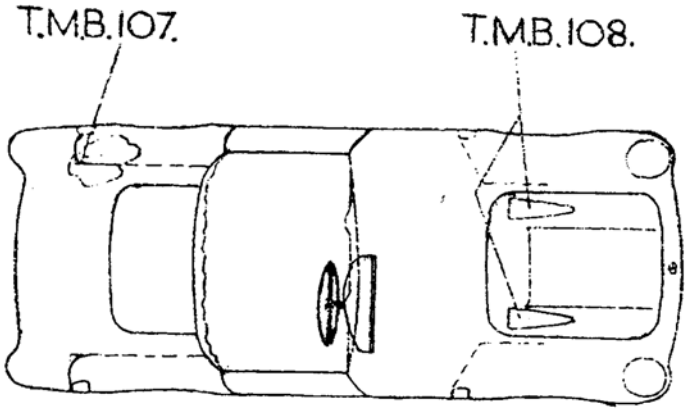

TRANSFER PORTS
PISTON CROWN

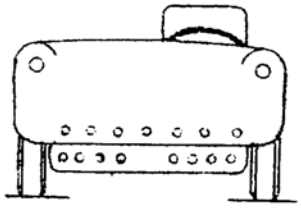
FIG 6

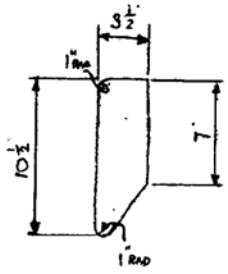
FIG 10


SWITCH BOX ASSEMBLY
DF
A
CONDENSERS
EARTH (ENGINE)



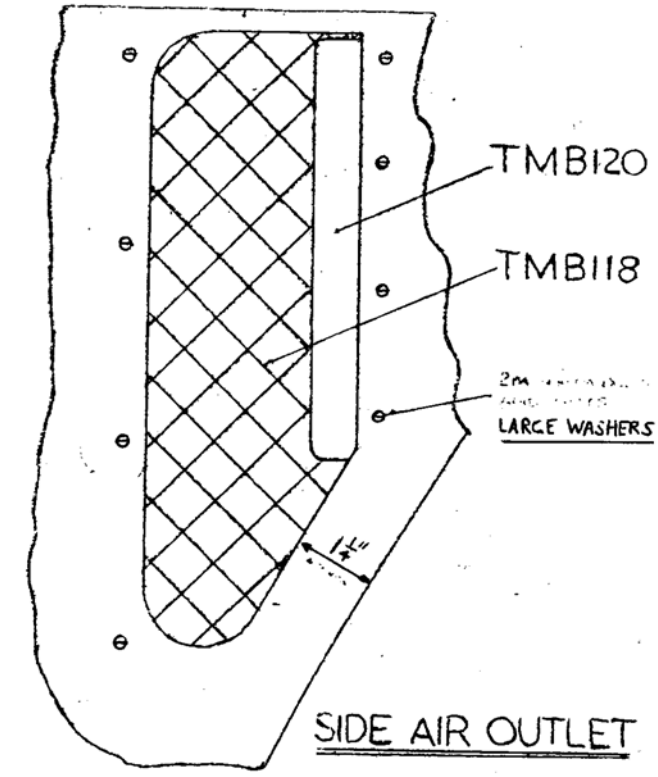


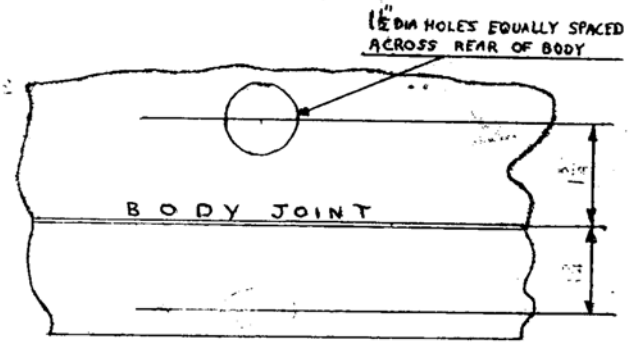




CUT-OUT PATTERN
T.M.B.105.

FIGURE 11





REAR AIR OUTLET

FIGURE 12.