

A guide to CRANKSHAFT RECONDITIONING

SPECIAL NOTICE

In this booklet we have endeavoured to cover all aspects of crankshaft reconditioning but it remains only a brief survey.

However, we are always happy to see traders at our factory and to demonstrate in close detail the work that is outlined in this booklet.

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CRANKSHAFT RECONDITIONING

The process of reconditioning a crankshaft is essentially a matter of dismantling and re-assembling. This is a specialised job and properly designed tools are needed if the work is to be executed correctly. The majority of these tools work on the principle of a steel plate, suitably supported, which fits between two flywheels so that a crankpin or mainshaft may be pressed into or out of one of the flywheels.

Quite a large number of crankshafts are such that, when assembled, there is considerable distance between the inner faces of the flywheels so that a really thick plate can be introduced between them and in such cases by far the most satisfactory dismantling jig is as shown in figure 1 and where, for the sake of economy, it is usual to fit a different plate at each end in order to accommodate the maximum number of models with any one particular jig. The part numbers of Alpha double ended jigs and the models which they will accommodate are shown on a separate sheet.

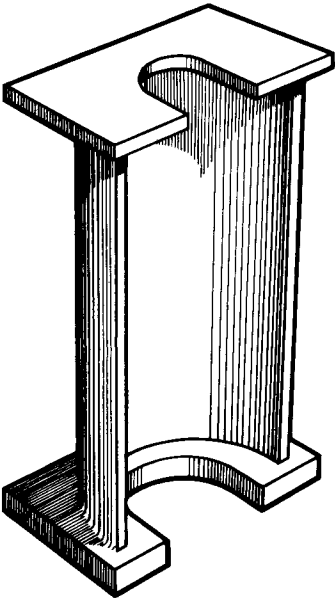
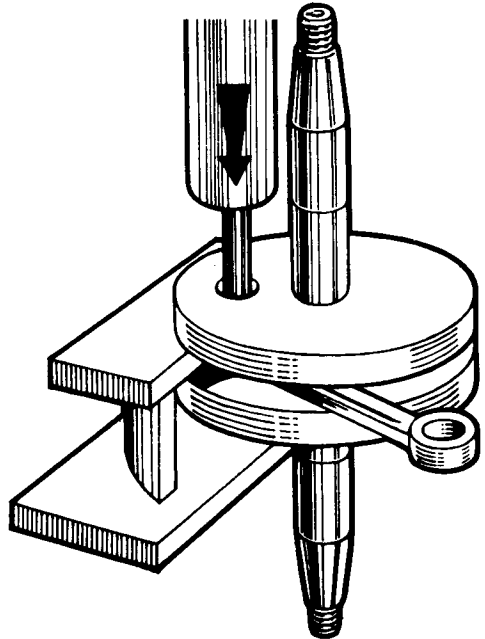


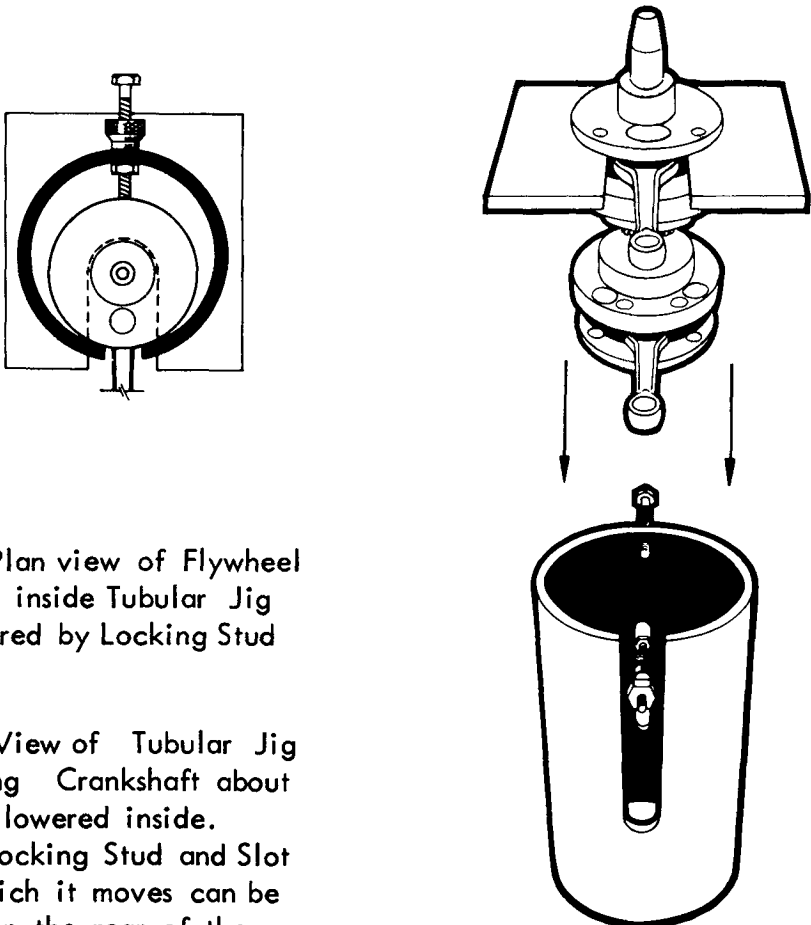
Fig. 1

Illustration of typical
'Alpha' Double Ended
Jig.



Diagrammatic view of
Single Cylinder
Crankshaft on a
Double Ended Jig.

A much more difficult type of crankshaft to dismantle is one which has flywheels running so close together that only a thin plate will pass between them and which will not be strong enough to withstand the force of the press without bending. These types can be handled on the Alpha Tubular Jig. The principle of this jig is to employ a piece of tubing into which the crankshaft can be introduced and having a slot in order that the connecting rod may protrude. A top plate is fitted between one pair of flywheels and then the complete crankshaft is passed into the tube and locked into position by one of two adjustable set screws. The purpose of the tube and these set screws is to restrain the crankshaft from moving out of the vertical axis and so long as it remains in this proper vertical position then the top plate will not bend (see illustrations).



(Above) Plan view of Flywheel Assembly inside Tubular Jig and secured by Locking Stud

(Right) View of Tubular Jig showing Crankshaft about to be lowered inside. The Locking Stud and Slot in which it moves can be seen in the rear of the Tube.

(Right)
Cut away view showing
Twin Crankshaft fitted
into a Tubular Jig and
with the lowest Fly-
wheel held by set pin.
Note that upper pin
is not used in this
operation.

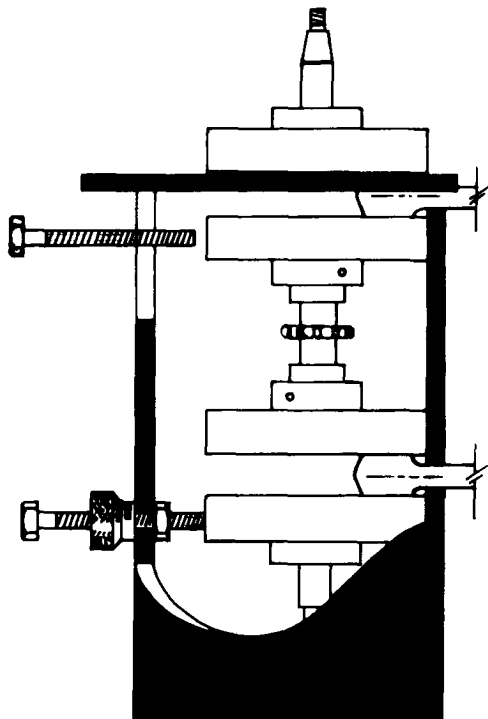


Fig. 2

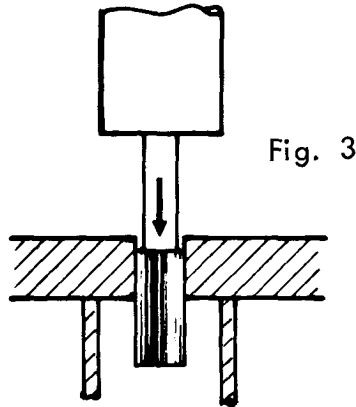
When dismantling a crankshaft with a tubular jig the procedure should be as follows. First select a tubular jig large enough for the crankshaft to be fitted inside but no larger than is necessary for this — the smaller the difference between the diameter of the flywheel and the internal diameter of the tube the better. Secondly, select the thickest top plate that can be introduced between two flywheels and with this in position lower the crankshaft into the tube with the connecting rods emerging through the slot in the side. When in this position adjust the height of the lower set pin in order that the pin will engage on the lowest flywheel or, if dealing with a single cylinder machine tighten the top, non-adjustable, set pin onto the flywheel.

With the jig in this position the entire assembly can be placed under a press and the crankpin can be pressed down out of the top flywheel. It is very important to remember that as soon as the crankpin is moved by the press then the set screws at the side should be loosened so that the flywheels may slide down inside the tube as the top pin is pressed away.

With the above procedures in mind the remaining portion of this booklet dealing with the actual separate operations should not present any particular difficulty but we are always ready to give advice on any individual problem that customers may meet.

PART ONE — Single Cylinder Types

Firstly, choose the appropriate jig with which to dismantle the crankshaft. This may be a double ended type or a tubular one or of course, a repairer may have tools of his own that meet the necessary requirement. It is a simple matter to fit the crankshaft over such a jig and press the crankpin through the uppermost flywheel with a suitable press (*Figure 2*). At this point the connecting rod, rollers and cage can be removed after which the crankpin can be pressed out of the other flywheel by supporting this with a piece of suitably sized tubing and pressing the pin through with a steel dolly slightly smaller in diameter than the crankpin (*Figure 3*).

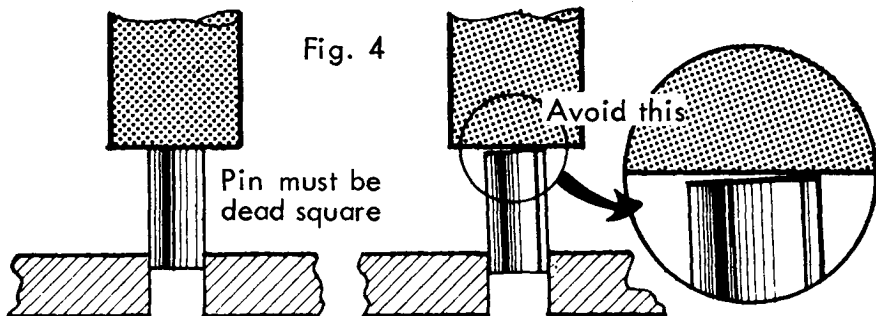


Careful attention should be paid whilst the crankshaft is being dismantled in order to be quite sure where every separate component fits, especially regarding the position of thrust or spacer washers and shims, etc. Once the complete crankshaft is fully dismantled all parts should be thoroughly cleaned and examined. It may be necessary to renew one of the drive shafts which is quite a simple procedure except that particular care must be taken to ensure that the position of key ways or oil holes are properly marked so that the new component is fitted in the proper position.

Alpha connecting rod kits have the big end protected by 'Gloscoat' which must be stripped off. Be sure to see that any small threads of this material that may have formed between the rollers are removed.

The new crankpin should now be pressed in to one of the flywheels. Some flywheels are slightly tapered in the crankpin eye which makes the alignment of the crankpin very easy but where no taper is present considerable care must be taken to ensure that the crankpin is pressed in in a completely square manner (*see Figure 4*). In such cases it is a disadvantage to press the crankpin right home with one operation of the press as the press arbour may easily be distorted out of parallelism if the pin is slightly misaligned, and much better results will be obtained if the pin is pressed home with a number of separate applications of the press because releasing the pressure momentarily allows the press arbour to

resume its normal position. Crankpins with raised centre tracks should be pressed right home into the flywheel so that the shoulder is tight against

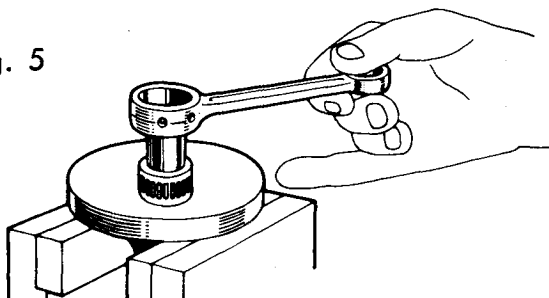


the inside flywheel face. Straight type crankpins should be pressed in until the end of the pin is flush with the outside face of the flywheel unless the design is unconventional in which case the position of the crankpin should have been noted during the dismantling procedure.

The cage, rollers and connecting rod should now be fitted to the crankpin taking care that all parts are scrupulously clean (*Figure 5*).

The remaining flywheel must now be pressed on to the crankpin. Firstly, it should be positioned by holding a straight edge across the sides of the flywheels at a point 90° from the crankpin and bringing the loose flywheel in to such a position that the straight edge lies flat across the edges of both flywheels (*Figure 6*). With the crankshaft in this position the flywheels should now be pressed home by standing the lower flywheel on a suitable metal block and pressing the top flywheel down on to the pin. This operation will be made easy if a small piece of flat steel is placed

Fig. 5



across the crankpin eye of the top flywheel as it will ensure that the top flywheel will only be pressed on far enough to bring the end of the crankpin flush with the outside face of the flywheel (*Figure 7*).

A number of factors affect the point to which flywheels should be pressed together. If the crankpin has a raised centre then the width of this will be accurately produced by Alpha in order to provide correct side float on the connecting rod when the flywheels are both pressed home against the raised centre. However it is necessary once the flywheels are properly fitted to check the side float and if this is incorrect then some attention may have to be given to the thickness of the side washers or other parts as it is not satisfactory to employ a crankpin with a raised centre track unless the flywheels are pressed home tightly against the raised portion.

Fig. 7

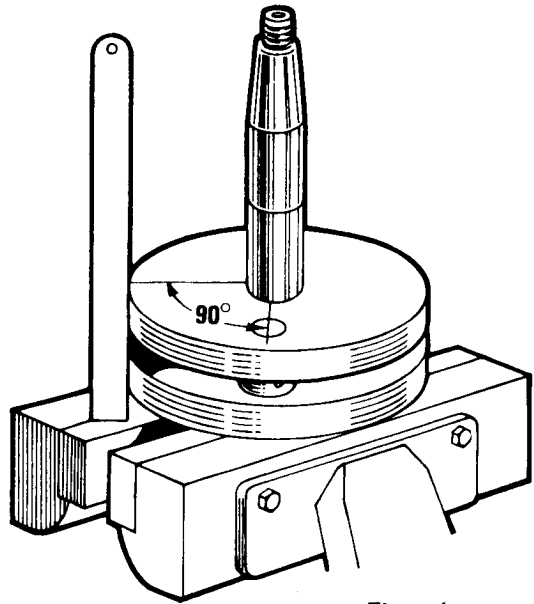
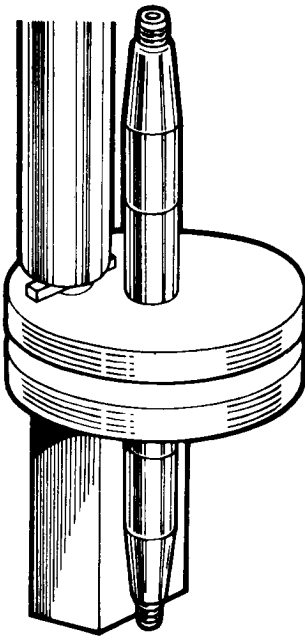


Fig. 6

In the case of parallel type crankpins a useful guide is to press-up the flywheel assembly until the end of the crankpin is flush with the outside face of each flywheel and at this point to check the side float of the connecting rod. Any correction on side float with this type of crankpin can be made by very slightly pressing the crankpin either in or out of one of the flywheels but if satisfactory end float on the connecting rod can only be obtained by pressing flywheels together to a point where the end of the crankpin protrudes markedly through a flywheel then further thought should be given to this problem as it may be the result of the absence of some side thrust washer.

ALIGNMENT AND BALANCE

Considerable confusion exists in the matter of re-alignment and re-balancing. These are quite separate matters and have no relation to each other. A crankshaft is designed so that some parts are heavier than others to counteract or balance the reciprocating weight of the piston and any dismantling and re-assembling of the crankshaft will not alter this balance factor unless non-standard parts having different weights to the original are fitted. All Alpha replacement kits are specially produced in order to preserve the existing balance so that no work in this direction is necessary.

Re-alignment is the process of bringing the two mainshafts on to the same axis so that the crankshaft can run smoothly in its main-bearings (*Figure 8*). The accurate alignment of crankshafts is a highly skilled operation and there is no substitute for the experience that a skilled operator acquires in regularly performing this work. However, the following guide lines may be of some assistance.

Fig. 8.
Typical Misaligned Crankshaft

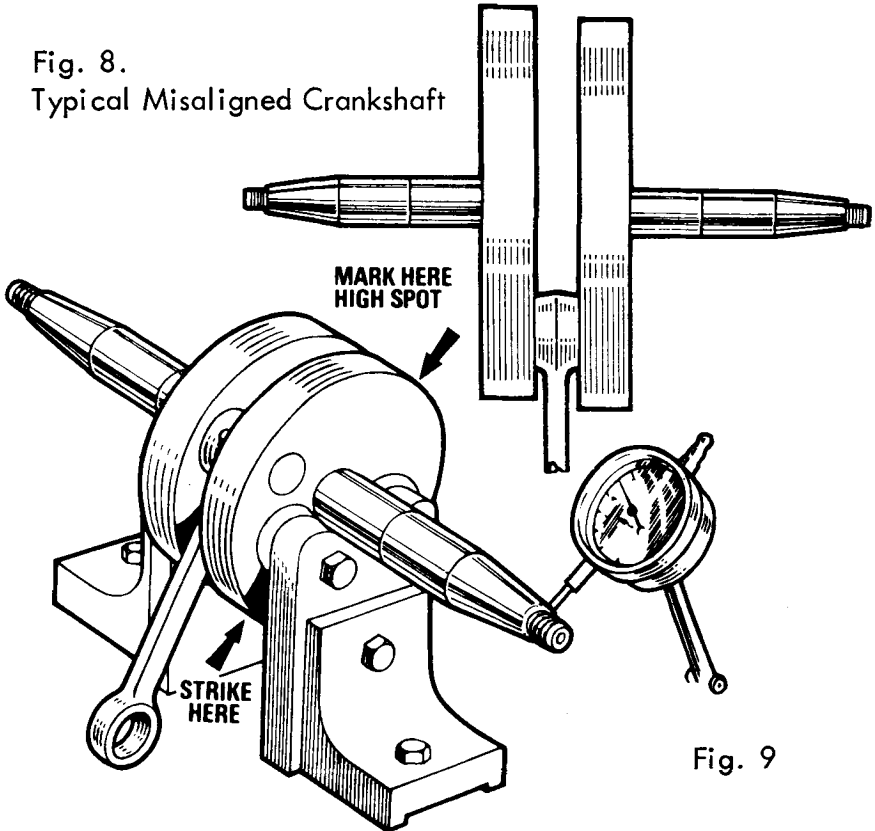


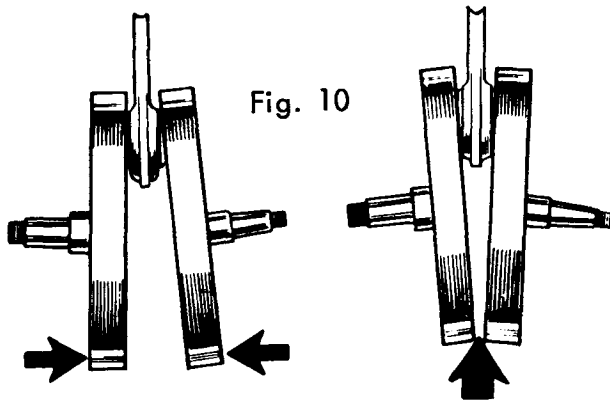
Fig. 9

The first essential is to have suitable equipment that will indicate accurately the alignment or otherwise of the crankshaft. Alpha Bearings produce a special tool for this purpose known as Alpha Tru suitable for all single cylinder cranks and also a larger, more complex version — the

Twin Tru, suitable for all single and twin types of crankshaft. This equipment is fully described in separate leaflets.

A newly assembled crankshaft should be placed on an Alpha Tru and the rotating knife edges adjusted so that they are running as closely as possible to the two flywheels and the clock-micrometer positioned at the very end of one mainshaft, avoiding any thread or key way. As the crankshaft is rotated the clock will indicate the highest point of the end of the shaft and the flywheel should be marked with this position as shown in *Figure 9*. The crankshaft should be removed from the Alpha Tru and the flywheel knocked with a heavy, soft faced, hammer at a point immediately opposite the high mark. This will have the effect of twisting the flywheel round on the crankpin and bringing the mainshaft more in to line with the other side. This process must be repeated until the total indicator reading at the end of either mainshaft does not exceed 2 to 3 thou. It should be emphasised that the accuracy of the reading of Alpha Tru is dependent on the rotating knife edges being positioned as closely as possible to the flywheels and the clock-micrometer as near as possible to the end of the mainshaft. Additionally, it must be remembered that Alpha Tru is a tool for indicating alignment of a crankshaft and that the actual correction of this lies in the hands of a skilled operator.

Most misalignment is the result of one flywheel being twisted on the crankpin in relation to the other but another form of misalignment results from flywheels being slightly tipped on the crankpin either in or out as shown in *Figure 10*. Correction of this fault lies in gently pinching together the open ends of the flywheels or driving them apart gently by using suitable steel wedges.



PART TWO — Twin Cylinder Types

Part one of this booklet dealt with single cylinder crankshafts. The servicing of twin crankshafts follows broadly the same procedure but additional techniques are involved and the following instruction therefore should be read in conjunction with Section 1.

Throughout these notes the word flywheel refers equally to full circle flywheels or part circle balance weights.

OPERATION No. 1

Carefully study the crankshaft and all its components, if necessary make a rough sketch showing the position of oil seals, main bearings, oil thrower plates, etc. Note that main bearings frequently have circlip grooves that are offset or peg holes or slots in the outer races. Note also that on some Kawasaki crankshafts the timing side main bearing is held by a circlip that is not easily visible.

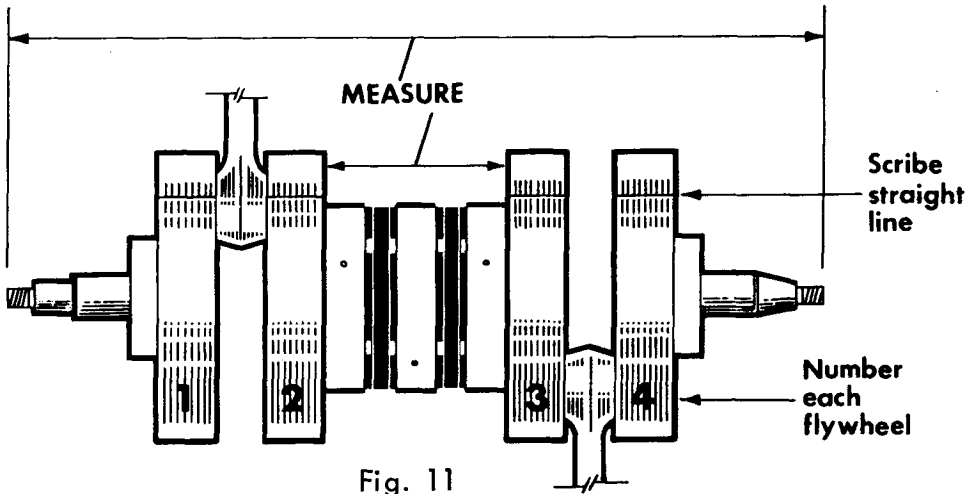


Fig. 11

Measure the distance between the two inner flywheels and the overall length of the crankshaft. Mark or label each flywheel and scribe a straight line along the flywheel edges parallel to the mainshafts. See *Figure 11*. Considerable advantage will be gained, if at this point, two pieces of steel bar, of a convenient diameter—say 1" to 1½"—are obtained of such a length that they just fit between the inner faces of the two inner flywheels (*Figure 12*). These bars can be used repeatedly and, as will be shown later, have a number of important uses.

OPERATION No. 2

Using suitable extractors remove the main bearings from the two outer shafts. On some engines an oil throwing plate is fitted behind one of the mains which also should be removed taking care to ensure that the bearing extractor does not damage the oil plate.

OPERATION No. 3

Using a suitable jig and following the procedure described for single cylinder engines, remove one end-flywheel and shaft (it is usually preferable to remove first the side having the longest mainshaft). Remove next the connecting rod, needle cage and any thrust washers. Repeat the

above procedure by removing the outer flywheel from the opposite end of the crankshaft together with the con rod and other bearing parts.

OPERATION No. 4

We now have the 'centre fly wheel assembly' (see Figure 12). This is shown with the two spacer pieces fitted in.

The majority of these assemblies have one or both flywheels pressed on to the centre mainshaft and close inspection will show which end or ends can be pressed apart. This is done with the Alpha jig as shown (Figure 13) and using the top plate marked 'centre'. But before doing so, notice the position of the ends of the centre mainshaft relative to the outer faces of the flywheels. In some models the centre shaft, when properly fitted, may not reach the outer face. Usually, the amount of recess is not critical and slight differences when the crankshaft is rebuilt may not be important but unnecessary trouble can be avoided if notice is taken of this point before dismantling.

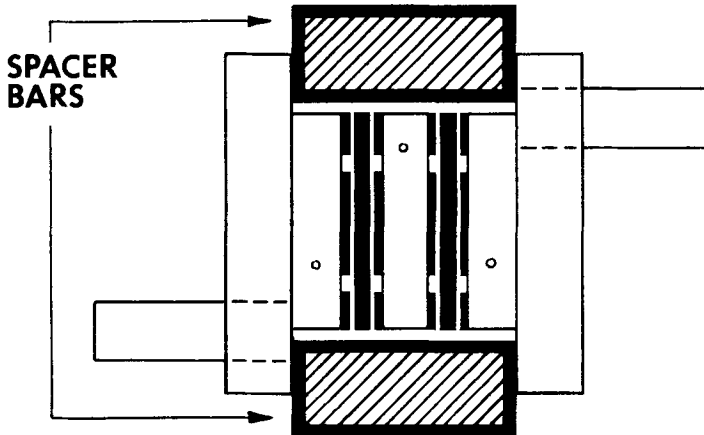


Fig. 12

The main bearings and oil seals may now be removed either by using a suitable extractor or — where this is possible — by removing the other flywheel and then pressing the centre shaft right through the main bearings. Be sure to observe the order and position of all centre mains and oil seals.

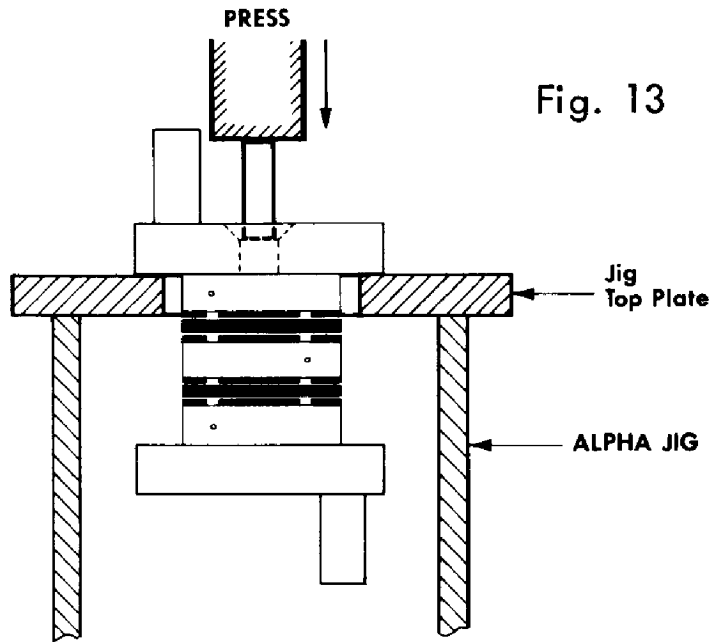


Fig. 13

OPERATION No. 5

Now remove the crankpin from each inner flywheel. The crankshaft is now completely dismantled and all parts should be thoroughly cleaned and replaced as necessary ready for reassembly.

OPERATION No. 6

Take the crankpins from two connecting rod kits and press one into each of the inner flywheels. Crankpins are not always interchangeable so keep remaining parts of each kit separate for use with the crankpin to which they belong.

Very Important. Some big end bearings are lubricated by means of an oil throwing plate and in these cases one end of the crankpin will be drilled so that it will fit over a small spout in the oil thrower. It is therefore very important when fitting pins of this type to ensure that the drilled end is on the correct side and, further to assist oil flow to the big end, it is advisable to position the oil hole in the bearing track in the same position that the original crankpin was fitted before the crankshaft was dismantled. If this point had not been noted it is usual for the oil hole in the track to be in the position shown in *Figure 18*.

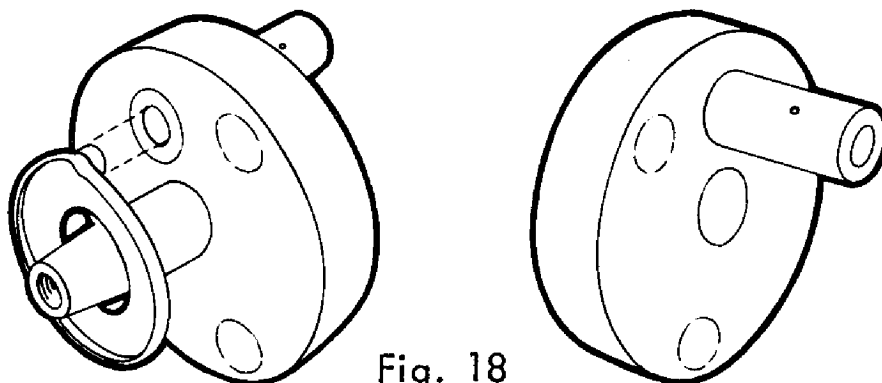


Fig. 18

OPERATION No. 7

The centre flywheel assembly may now be pressed together. This is usually a straightforward operation, the exact method depending on the shape of the various components and of the actual design but no special techniques are needed here except to bear in mind that the two crankpins must be diametrically opposite. The straight line drawn prior to dismantling will be a sufficient guide to this. When this operation is completed, the two inner flywheels should be the same distance apart that they were prior to dismantling. Some centre mainshafts are shouldered which makes this quite simple but otherwise the necessary adjustment is obtained by pressing one of the flywheels a little closer on the shaft or for the reverse effect by pressing the shaft out of the flywheel as necessary.

Mention was made earlier that centre mainshafts do not always reach the outer face of the flywheels and in such cases, when pressing on the second flywheel, the end of the centre mainshaft should be supported as shown in order to avoid the shaft being pushed too far through the lower flywheel (*see Figure 19*).

OPERATION No. 8

Fit to one crankpin the new rollers and cage, con rod and any thrust washers, etc., and then press on the appropriate outer flywheel. If the crankpin is parallel this operation may push the pin through the centre flywheel and some provision must be made to avoid this. The design of some crankshafts is such that this can be done simply by selecting a jig top plate (generally the one marked 'centre' is most suitable) that when used as shown in *Figure 20* will support a sufficient area of the crankpin end to hold it from being pushed through the flywheel. An extra pair of holes drilled in the top plate, closer to the back, will increase the amount of depth that can be employed which, in turn will increase the number of types that it will accommodate. But the above procedure cannot always be adopted and the following method must then be employed.

Fit two short steel bars (as referred to in operation No. 1) positioned so that they are in contact with the inside ends of the two crankpins between the two inner flywheels (*see Figure 12*).

With these bars in position (which also serve to control the clearance between the inner flywheels) the first of the outer flywheels can be pressed on without difficulty. Remember to observe the amount of side float on the connecting rod as this operation proceeds, stopping when the desired amount of float (usually 12 to 14 thou.) is achieved.

We now have the centre flywheel assembly complete with one outer flywheel (*see Figure 21*) and at this point, some fitters prefer to remove the steel packing pieces and complete the alignment of this partly assembled unit.

This is a useful procedure as it will reduce considerably the problem of aligning the complete crankshaft, but it is not absolutely necessary and if desired, all of the realigning can be done after the unit has been fully assembled.

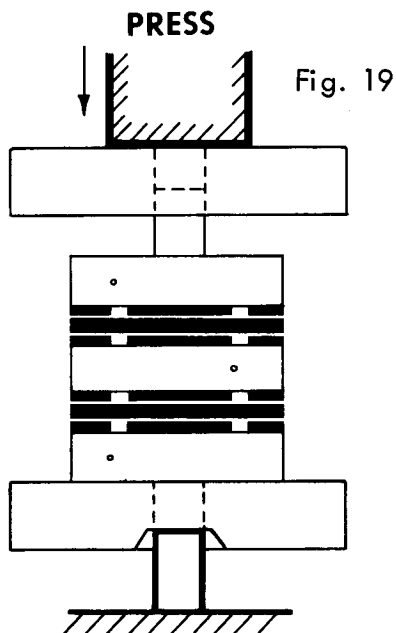


Fig. 19

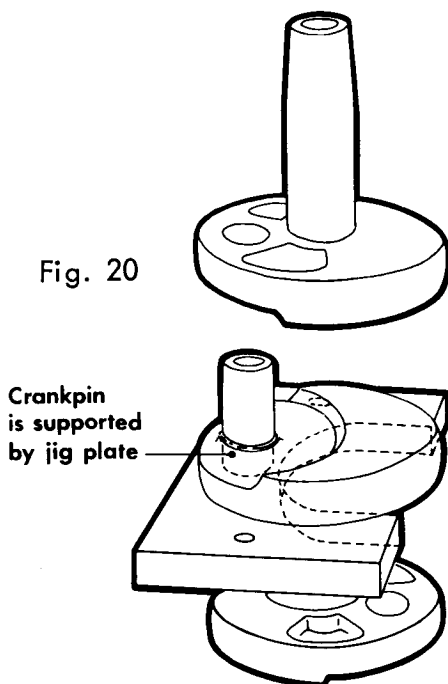


Fig. 20

Crankpin
is supported
by jig plate

However if the partly assembled unit is aligned at this point it will have to be held on centres and not knife edges. The Alpha Twin Tru is designed to accommodate this, but before proceeding, the two centres concerned, i.e. in the ends of the inner and outer mainshafts, must be examined and this operation should only proceed if these centres are in good condition. The method of aligning cranks shafts when held on centres is quite different from the procedure when using knife edges — this is fully explained in a later part of this booklet.

OPERATION No. 9

The next operation will be to fit the remaining con rod and needle cage, etc., and to press on the final outer flywheel. If the steel spacing bars were removed for the purpose of aligning they must now be refitted and also some packing must be fitted between the two assembled flywheels, opposite the crankpin and in line with the packing piece on the other side of the assembly. This additional packing piece is needed to transfer the load of the press and avoid distorting the alignment of the lower pair of flywheels (see Figure 22).

Having completed the fitting of the fourth flywheel the crankshaft should now be checked and the overall length adjusted to the figure that was obtained by measurement prior to dismantling.

OPERATION No. 10

The crankshaft must now be realigned but before describing the details of this operation it is necessary to consider certain technical points.

It should first be recognised that there are two, quite distinct, methods of measuring crankshaft misalignment and, much more important, the direction in which flywheels need to be knocked, relative to the highest point as shown by the dial indicator, is opposite in one method when compared with the other.

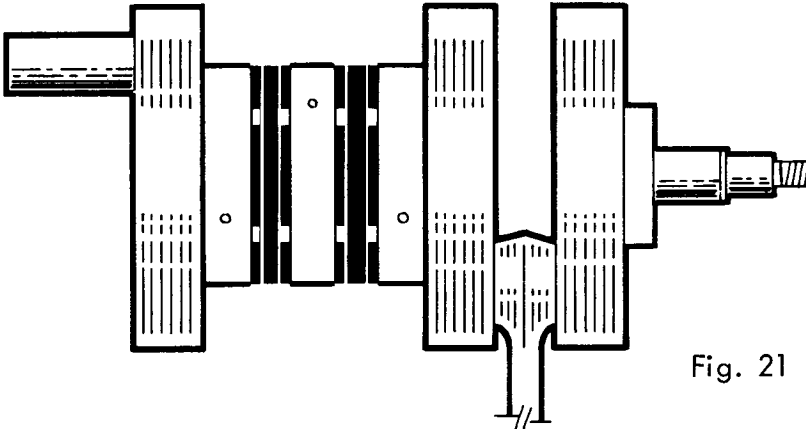


Fig. 21

Reference to part one of this booklet shows how flywheels that are held on knife edges need to be knocked round from a point exactly opposite the high spot, but when held on centres, the reverse of this is the case and each flywheel has to be knocked actually at the point of the highest reading.

The next, and possibly most important, point is that in the case of twin cylinder crankshafts the two outside flywheels and mainshafts must be treated in accordance with the above depending on whether the crank is held on centres or knife edges. But this relates only to the two outer flywheels and shafts. The centre mainshaft and two inner flywheels will always behave as if held on centres, even though the crank may be supported on knife edges.

With the above in mind the fitter must choose the most practicable method of dealing with each individual shaft. As was mentioned earlier, it is a great advantage to complete the alignment of one half of the crankshaft during the process of assembly and held on the centres if these are in good condition although the operation can be performed equally well on knife edges. If this is done then it only remains to fit the fourth flywheel with great care in order not to disturb the alignment of the three flywheels and finally, the alignment of the complete shaft will only be confined to work on the fourth flywheel which should be moved one way or another until complete alignment of the shaft has been obtained. If for any reason it is impracticable to align part of the crankshaft during assembly then we

recommend that the entire unit be held on centres and the four flywheels be observed in conjunction with each other but this can be a tedious business and fitters are strongly urged to complete the alignment of half of the crankshaft during assembly, if at all possible.

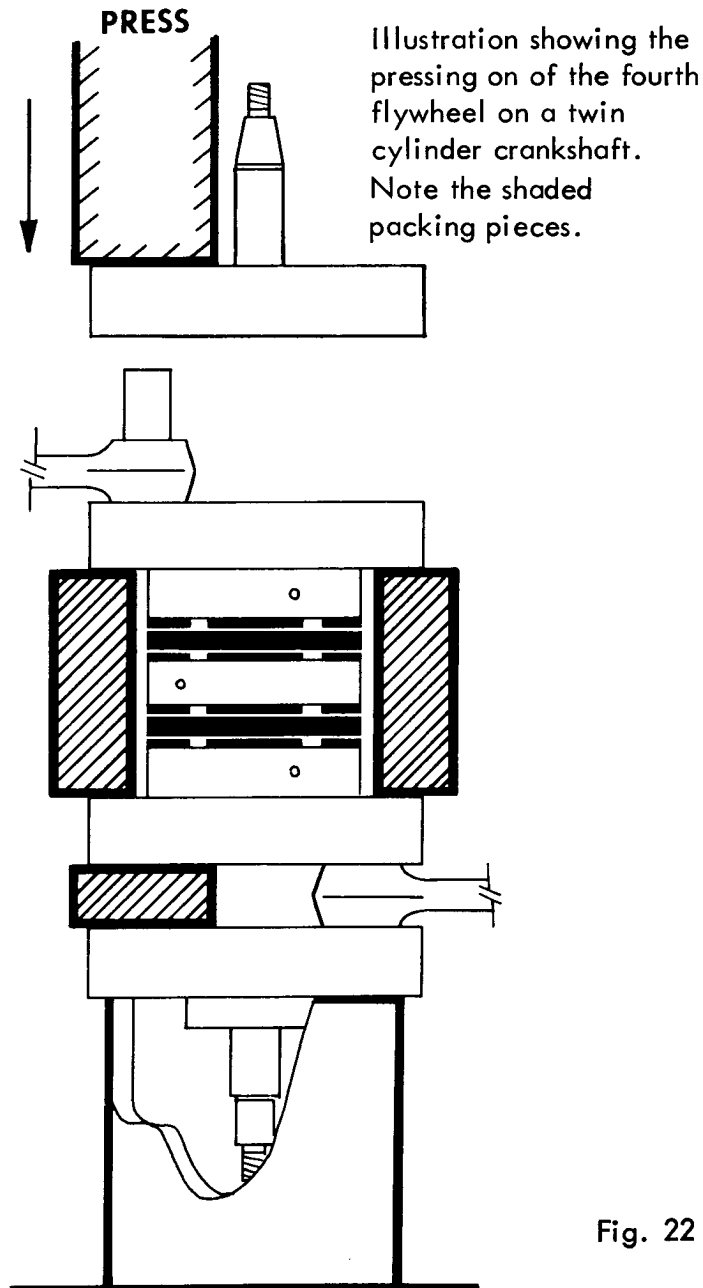


Fig. 22

'NON-DETACHABLE CENTRE MAINSHAFTS'

There is an alternative type of centre flywheel assembly to that described above. This is where each centre flywheel has a non-detachable mainshaft that is machined to form a mating half with the other (see *Figure 14*).

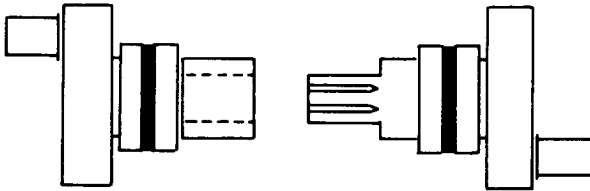


Fig 14

A special dismantling tool is necessary to handle this kind. This tool consists of a cylindrical steel body, a specially shaped 'Horseshoe piece' and 2 flat strips of metal (see *Figure 15*). It is employed as follows:—

- (a) Fit horseshoe piece over centre flywheel assembly (*Figure 16*).
- (b) In this position lower into the outer body allowing the horseshoe piece to slide down the two milled slots.
- (c) Insert strips to lie across the top of the body and underneath the top flywheel.
- (d) Put complete assembly under a press. Press down the horseshoe piece thus removing the lower flywheel and splitting the centre assembly (*Figure 17*).

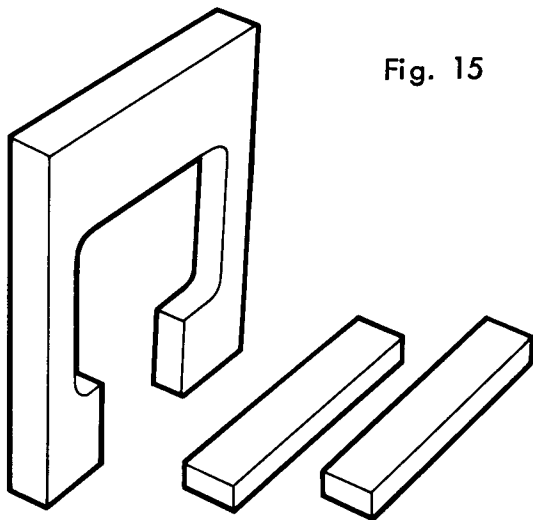
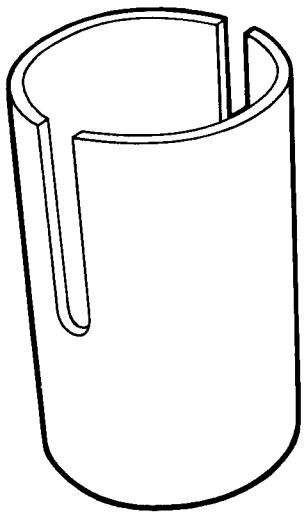


Fig. 15

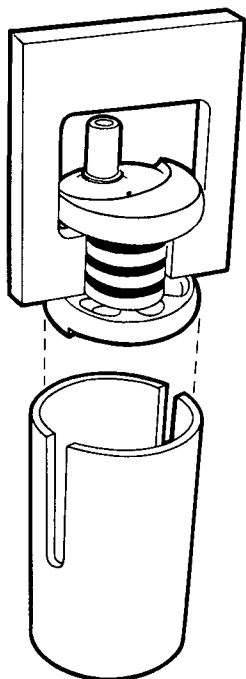


Fig. 16

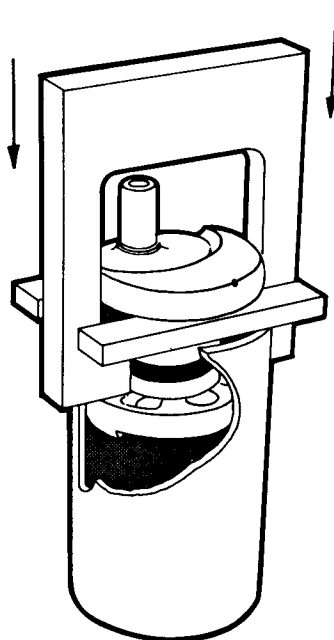


Fig. 17

The Alpha factory is easily accessible from various junctions on the M5 motorway.

