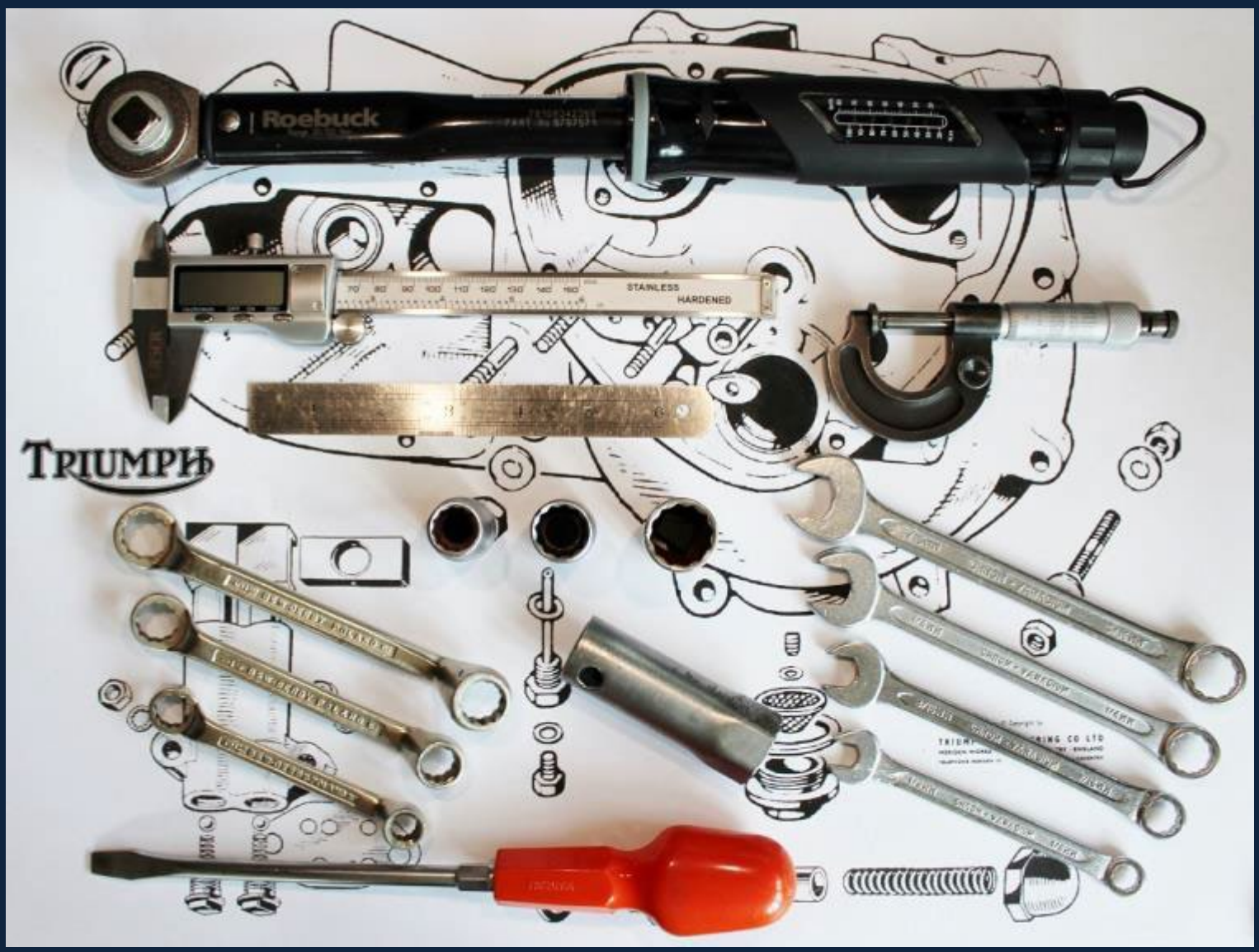
Triumph Restoration Guide



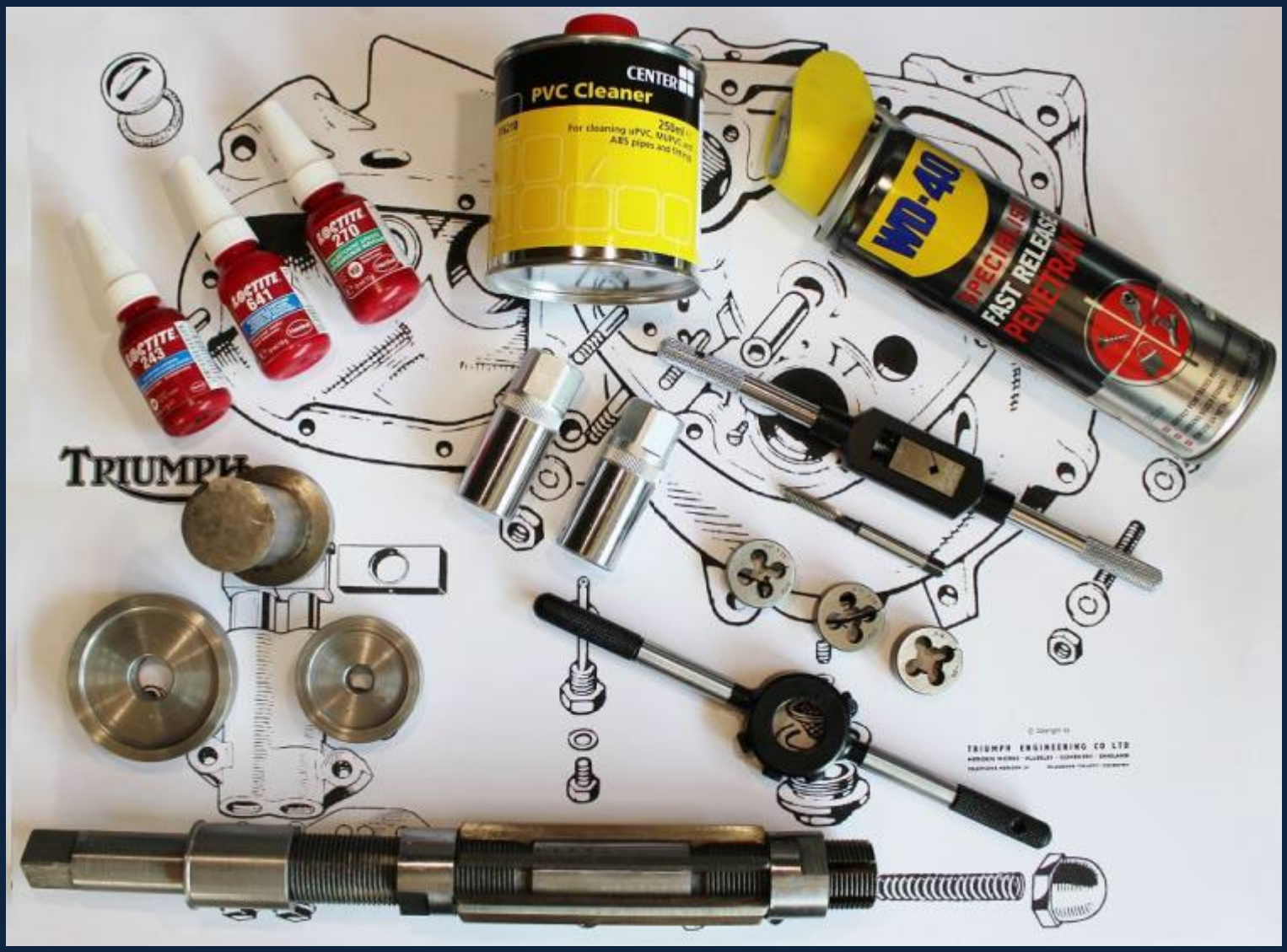
This Guide has been written with the New Owner in mind so that you can gain confidence to tackle most Service, Repair and Restoration work on your Classic Triumph
Use it in conjunction with the Parts Books and Works Manual.

The tools shown above represent the minimum needs for most service operations on Triumphs. Experienced owners will assemble a tool kit containing both open and ring and spanners with suitable sockets, screwdrivers, pliers in various types, mole grips, levers and a good quality torque wrench with a range from 20 to 80 lbf.
Measuring tools are essential for some of the more advanced work, beyond the scope of the beginner but the sooner you can use these with confidence the better.

The Works Manual provides comprehensive data and tolerances on all of the major engine components, knowledge and experience of measuring will help owners to gain confidence in their workmanship.

For owners new to classic machines and Triumphs in particular, Fasteners and Threads can be bewildering.
Prior to 1968 all fasteners (Nuts & Bolts) on Triumphs are to British Standards and you will need Whitworth spanners.
After 1968 there is a gradual change and most Fasteners and Threads change to UNF and or UNC
For these later machines AF spanners are appropriate.

Ideally your tool kit should contain both tool types as later or earlier parts may have been fitted
Resist the obvious temptation to use Metric, Universal or Adjustable Spanners
When the correct ones can be purchased inexpensively from specialists



Above is a selection of Engineering tools and Materials that are required for more advanced work.

Experienced Owners and Restorers will assemble a selection of Taps, Dies, Reamers and Special Tools that are necessary for some operations on the Engine and Frame. Most can be bought from specialist suppliers and in this guide I have illustrated the particular Tools and Techniques required for certain operations.

Owners with experience in Engineering will usually have the confidence to make their own Special Tools and Fasteners for specific tasks but some operations such as Re-boring, Re-grinding and Valve work will normally have to be passed to the appropriate experts.

Specialist Lubricants, Solvents, Chemicals and Adhesives have uses for the Restorer
Where appropriate in this guide I have indicated the materials you will need.

Loctite 243 is a medium strength locking compound, 270 is a high strength stud locker and 641 a bearing retaining compound.
I recommend that you research and obtain these products or their equlaivalents before starting your restoration.
They have limited shelf life & handling hazards so refer to the data sheets before you start to use them.

Cleaning and Preparation

Before undertaking the cleaning and preparation of the Engine and Parts using chemicals and solvents you must consider the inherent hazards. Waste oils, fuels and greases are toxic not just to the user but to the environment and before you start work you should identify an appropriate disposal route for the waste you will create. Most local authorities have facilities for used oils, tyres and hazardous chemicals and will, if not welcome your waste at least they will ensure that is recycled or dealt with safely. A small fee may be payable.

I know this will sound patronising but please take your own safety seriously, wear gloves, stout boots and safety eye wear that is appropriate for the task, you would not think of riding without a helmet so please do not work with, blasting media, power tools, solvents or chemicals without proper safety equipment and after having made a full assessment of the hazards involved.

For initial cleaning of the Engine whether in the Frame or removed, any commercially available degreaser such as Gunk will remove the bulk of oil and greases from external surfaces. Paraffin or Kerosene applied with a paintbrush or spray is useful for initial cleaning of parts such as the rear chain, sprockets, bearings, brakes and internal assemblies while Brake Cleaner (Isopropanol) will quickly remove oil and grease from partly cleaned parts and small assemblies so that they can be handled safely and stored afterwards.
A bench top Parts Cleaner is a useful investment.

The most effective method of cleaning alloy castings is by blast cleaning using either glass beads, soda or walnut shell. mild chemicals such as Acetic or Citric Acid though effective will leave a dull grey finish and under no circumstances use powerful chemicals such as Sulphuric Acid or Caustic Soda that will react with and damage alloys.

Rust can be removed from Steel and Iron components by several methods, mechanical, chemical or electrolysis. Mechanical methods include wire brushing and grit or sand blasting, chemicals such as Citric Acid and Phosphoric Acid are effective and lastly electrolysis using Steel Anodes and a suitable electrolyte such as washing soda will readily remove rust even from severely corroded parts.

For passivating and protecting steel, research Zinc Plating, Parkerising and Blacking, kits and chemicals for hobby use can be obtained from specialist suppliers.

For cleaning small and delicate parts such as carburettors an ultrasonic cleaner is useful. Inexpensive, taking up little room and easy to set up with specialist cleaning solutions you will soon find a space for one in your workshop.

Polishing parts yourself can be satisfying; you will need a suitable bench grinder, a selection of polishing mops and compounds, solvent and some safety equipment. Start on small test pieces until you master the process and with patience and skill you will achieve professional results.

Storing Parts

Plastic food containers, new or recycled make useful storage boxes for dismantled assemblies, while Zip-Loc plastic bags in small sizes can be bought inexpensively to store individual parts. VCI (volatile corrosion inhibitor) paper is excellent for long term storage of steel parts and specialist products such as ACF 50 or Ankor Wax are also useful. Silica gel, either loose or in packets if placed in your storage containers will ensure that any moisture is trapped and provide a very high level of long term corrosion protection when used in combination with VCI paper. Even in sealed containers water vapour will penetrate so if possible store them in a warm dry location

During disassembly and until you gain experience take photographs and after cleaning and examining parts label them straight away preferably with a description and the part number. Store parts together in assembly groups making a list of worn or damaged items that will need to be sourced.
Refer to my Parts Book for details on the fastener types you will need.

Upgrade Parts

Shown above is a selection of Upgrade Parts

As part of any restoration you should consider what parts you intend to upgrade if any, shown above is a selection of items that will help to improve the reliability and or performance of any classic motorcycle.
The full list of Upgrades is listed on my Website.

A 1966 Triumph 3TA, the basis for this Restoration Guide.

On the my Website you will find a Gallery of Engine Numbers images that chart the development of the Factory Stampings From the earliest days of Triumph twin production. Owners should be aware that over the years for a variety of reasons, some quite legitimate, Engine numbers can and have been changed. Above is a correct example from 1966.

The Engine

Overall view of the 350/500 cc Crankcase.

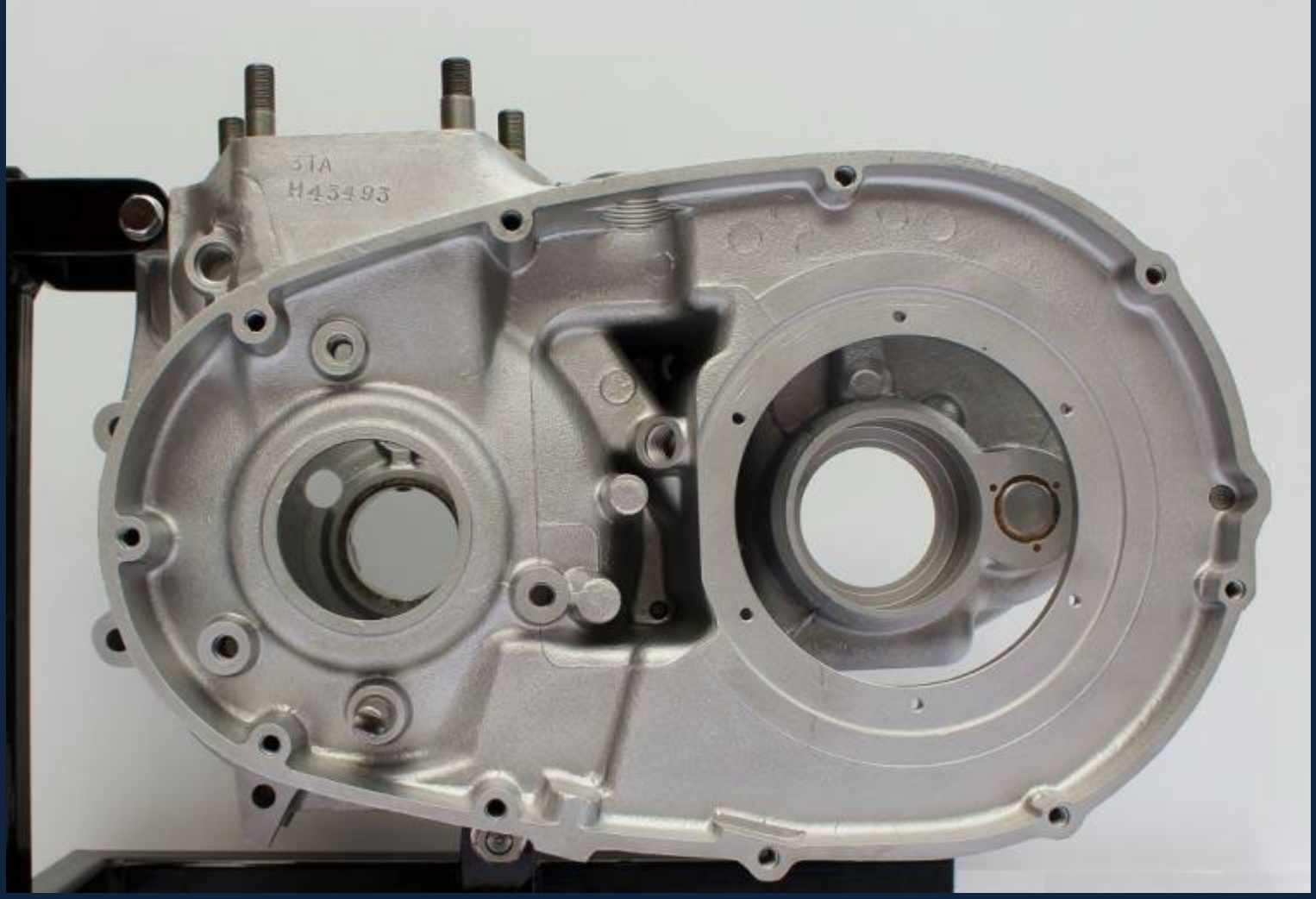
Refer to Section B34 of the Works Manual for Dismantling and Reassembly Instructions

The general design of the Crankcase changes very little over the period of production from the first T21 in 1957 to the final machines produced in 1974. The Crankcase shown above is typical of the type.

For this project an Engine Stand was made to allow the Engine to be held firmly so that it could be worked on though most operations can be carried out with the Engine in the Frame. If you have welding skills and are able to make the two mounting brackets with some accuracy a simple stand can be fabricated quite easily. The stand above was designed specifically so that the Engine could be moved and displayed effectively.

On the Engine used for this article all the bearings and their associated seals have been removed together with the alternator studs and the
Cases checked for damage before Vapour Blasting and then carefully cleaned to remove all traces of blasting media. Regardless of how the cases are cleaned all grit and metallic particles must be removed.

The Crankcase

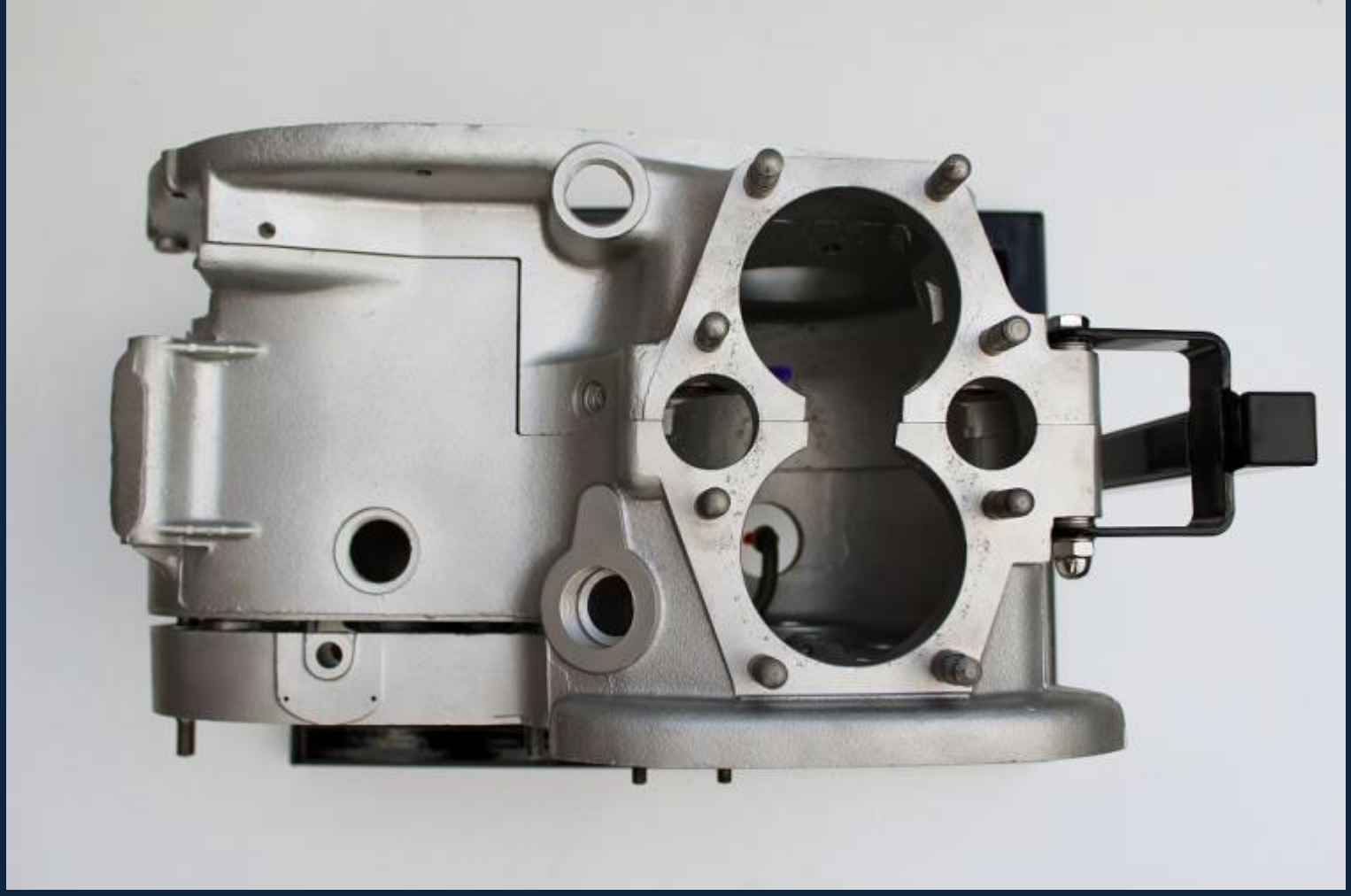


Crankcase Left Side.

The access plate for the gearbox sprocket has been removed and in the background is the Blanking disc for the layshaft bearing.
This being the 3TA it like early machines has a plain bush instead of the more common needle roller bearing in this location.
The Trunnion for the Primary Chain Adjuster was not removed during disassembly and preparation as it is a pressed in part.
Visible on the far right is the Blanking Plug for what had originally been the chain oiling system (1957 to 1964).
Crankcases made before 1963 will not have the rev counter drive port seen at top left.

Crankcase Right Side

Here the gearbox inner section has been removed and for the time being the studs have been kept in their locations.
The Layshaft Bush is still located in the gearbox ready to be assessed and removed if necessary.
It is possible to replace this bush with a needle roller bearing as long as the appropriate parts are also obtained.
Refer carefully to the parts book as the Layshaft and the Kickstart Spindle are model specific parts.

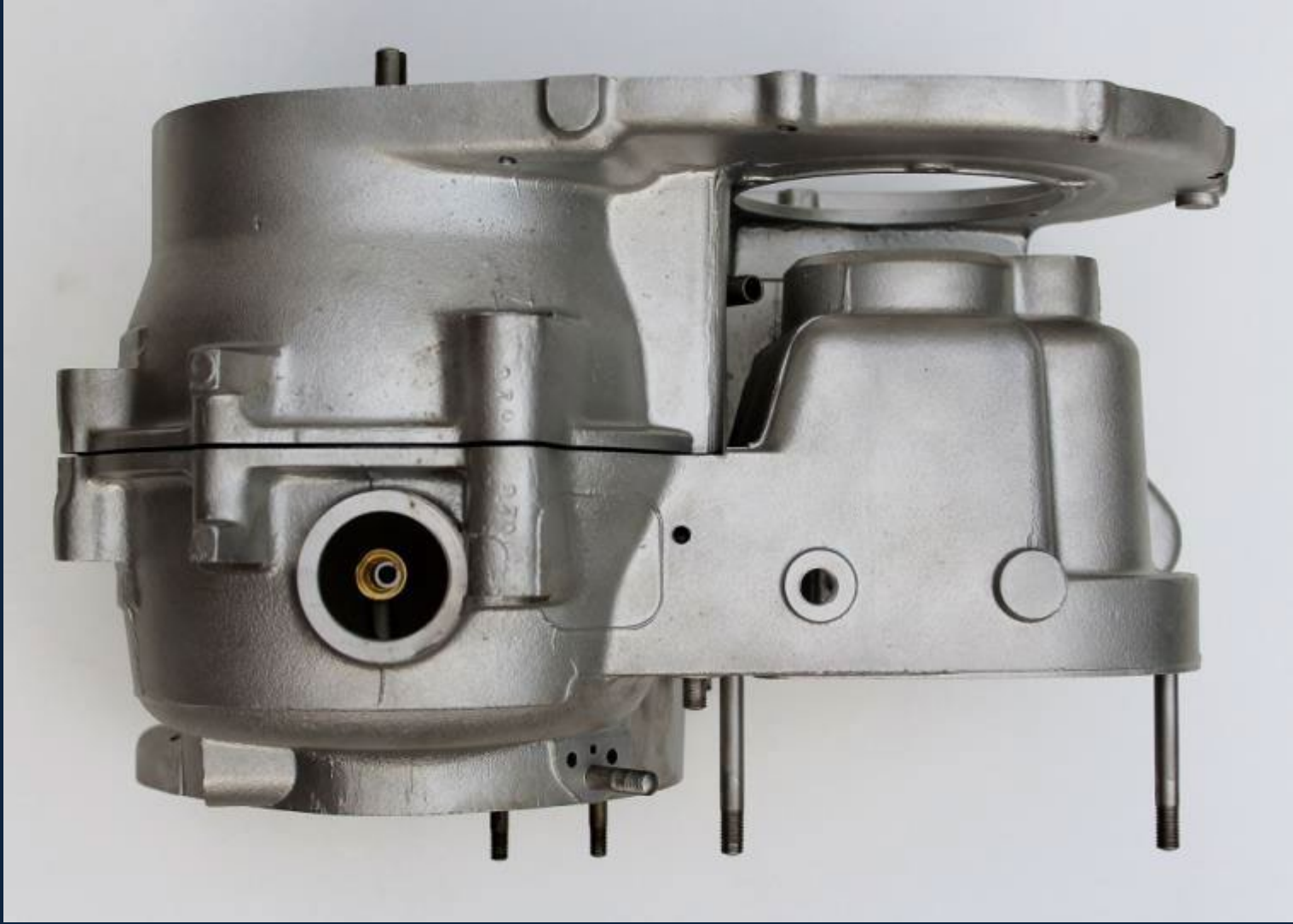


Crankcase Top View

This being an early to mid-period 1966 engine, it shows all of the standard features for the period such as the tdc access plug and the cap
where the distributor was originally located. (soon to be deleted). Over the years as the model range develops and new features are
incorporated the crankcase changes but you will still see various vestigial features of the original design. These changes can be
used as a guide to date unnumbered Crankcases or where you suspect that the Engine Number has been tampered with.

Here the Crankcase to Barrel Studs have been left undisturbed during the initial cleaning process but these will be removed and
assessed before assembly begins. Note that the studs are in two lengths with different part numbers. (2 of E3819 and 6 of E3820).
Like the other studs used on the Engine up to 1968 the thread into the crankcase is BSF in this case 3/8 in.

The four innermost studs penetrate the crankcase and can be the cause of oil leaks around the base of the barrels, while the two studs;
top left and bottom right have dowels to locate the barrels To remove the studs, heat the area around the base of each stud with a blow torch and either using a stud socket or two nuts tightened together carefully loosen them.
If the camshaft bushes are to be replaced removing the studs above them allows a drift to be inserted to collapse the bushes for removal.

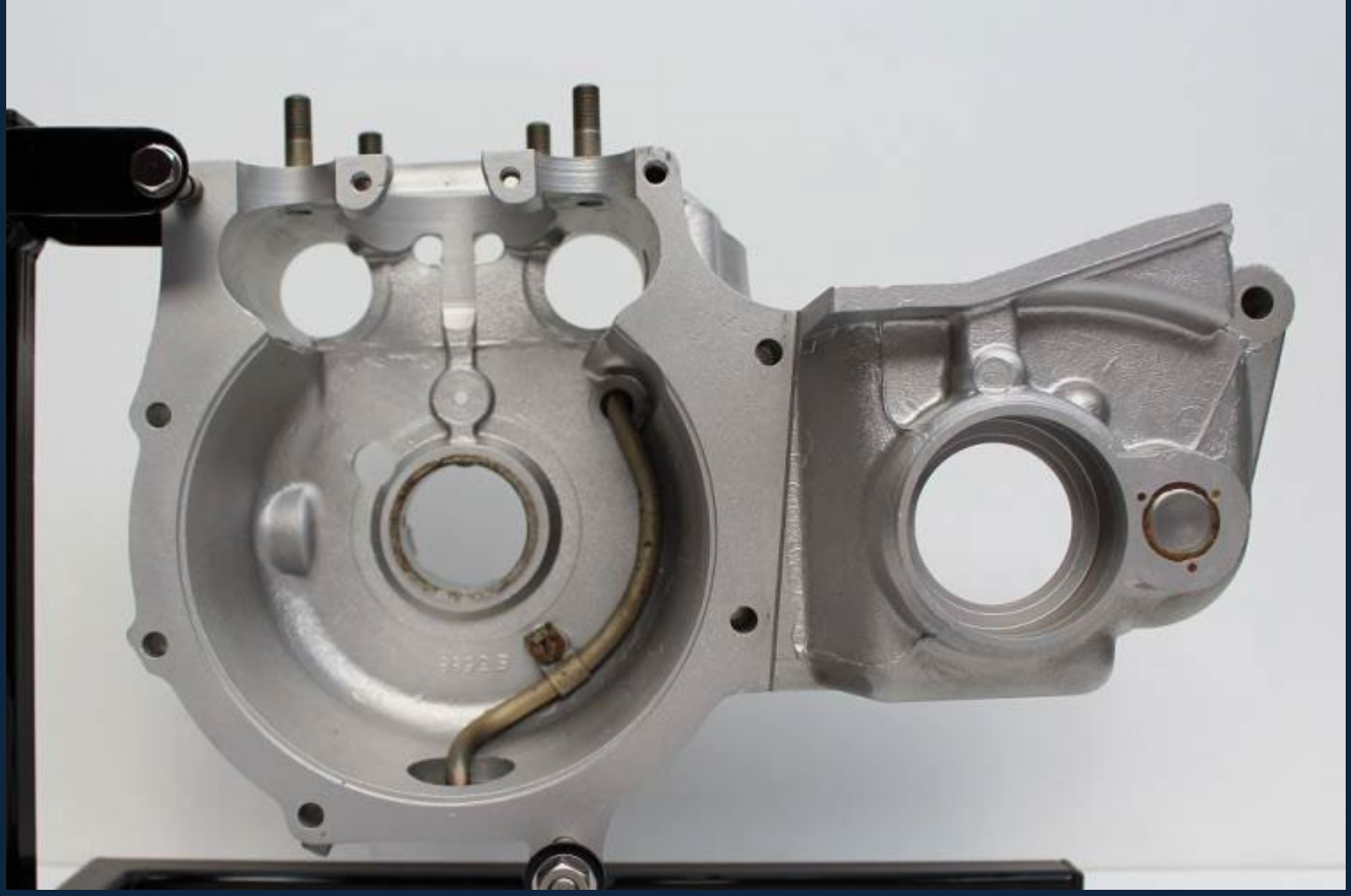


Crankcase Underneath.

Visible is the pick-up for the return oil, the oil feed and return holes, the breather exit pipe, the gearbox drain and the Crankcase
Matching Numbers on the main mounting lugs. These numbers were stamped early in the build of an engine so that matched
cases could be reunited after the various Factory boring and machining operations had been completed.

Triumph like most manufacturers did not have pressing, casting or forging facilities. Bought in unfinished components like Crankcases from Aircraft and Motor underwent a number of machining operations before being placed
in the Finished Stores where they would then be drawn from for scheduled production batches.

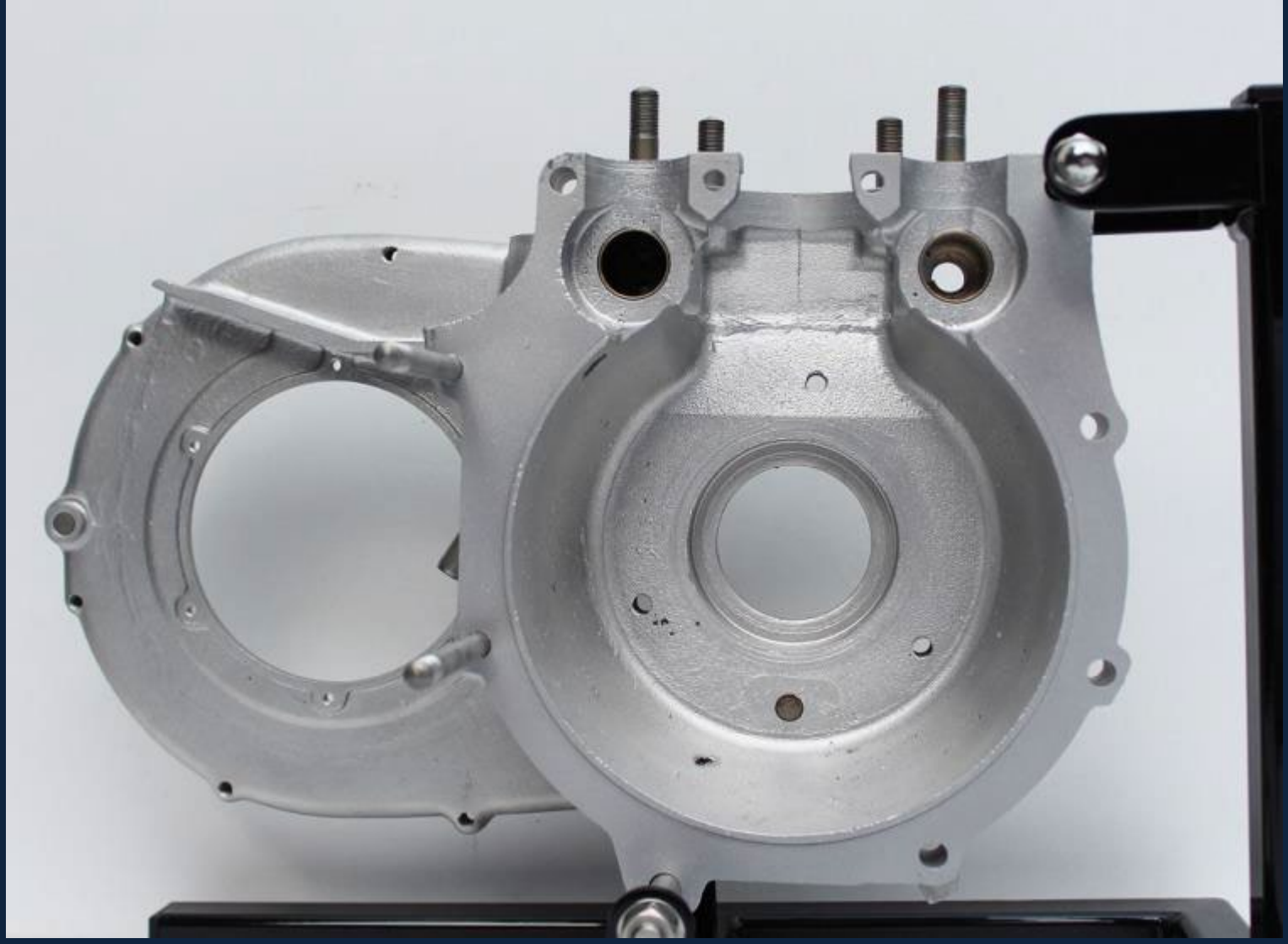
The blank boss at the top may have been the intended location of the primary chain adjuster before the final arrangement was chosen.



Crankcase Timing Side Internal View

Here you can make out the return pipe for the oil curving from the sump and held in place by a bolt that is locked with a tab.
The return pipe is a press fit and sealed into position with a sealing compound. As long as the pipe is undamaged and the seal good do not disturb it ! At the top are the two tapped ¼ BSF holes for the screws between the barrels and the tapped hole 5/16 BSF for the “Newton” crankcase bolt.

Note the recessed lip that runs around the inside of the crankcase that corresponds with the raised lip on the other crankcase half below.



Crankcase Drive Side Internal View.

The camshaft bushes have been left undisturbed and at the bottom you can see the back of the trunnion for primary chain tension.
The bushes on this engine were serviceable and it was decided not to change them, new ones are available but will require reaming once fitted, an operation generally beyond the capability of the average owner without access to engineering facilities. Refer to the Works Manual Section B39 for details of the work required.

Noticeable on the far left is the blanking plug that was originally part of a chain oiling system in the original design from 1957.
Not visible is the small weir and oil way that supplies oil to the inlet camshaft through a hole in the bush; ensure this is clean.

The Timing Side and Oil Pick Up Tube

Shown here in detail the Timing Side Bush Location and the Oil Return Tube fixed to the wall of the crankcase. The Number you can see, E3688 is not the Crankcase Part Number for 1966 it's from 1962 and Is a good example why these cast in or stamped numbers cannot be relied upon.

Early Crankcases show a raised pip on the face of the bush housing that corresponds with a slot on the Timing Bush and prevents this from rotating in the crankcase.

Timing Side Detail

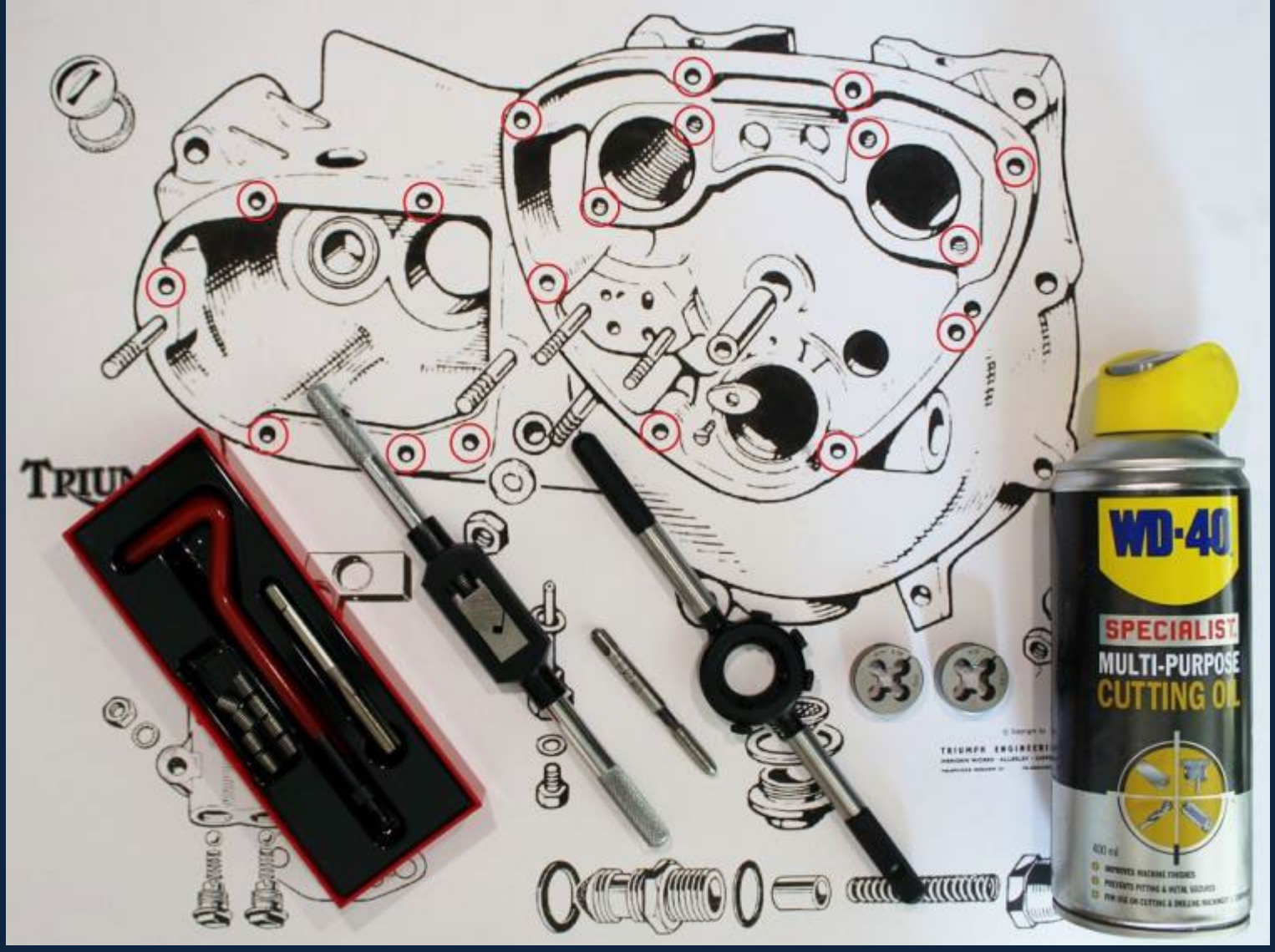
Note the numerous tapped holes, all ¼ BSF. Here the studs for the oil pump have been left undisturbed. You will also note that the camshafts at this end run directly (unbushed) in the crankcase. Just visible are the oil galleries and weirs that allow oil to collect and pass to the camshafts at this end.

The ¼ inch studs used in various locations on the Engine all have BSF threads at one end and BSCY at the other. Both threads are 26 TPI but not fully interchangeable. If you look carefully at the studs you will note that one end is rounded and the other end machined flat, the flat end is the BSF Thread and corresponds with the ¼ BSF tapped holes in the Crankcase, Cylinder Head and Rocker Boxes.

Timing Side Detail

Shown is the location for the oil pump, on the left the return holes and on the right the feed, check that these are scrupulously clean.
The small screw and plate are to retain the timing side bush, easily lost, you will note that this had been punched to prevent it unscrewing. This plate replaces the previous arrangement of the raised pip to prevent the bush turning in the housing
Also visible is the Date Mark for 1965, these are a useful guide to confirm when the crankcase was cast..

Centrally is the location for the idler pinion shaft, this is an interference fit into the crankcase and can be removed by applying a pin
punch from the back through the hole that is visible, often best done while the crankcase is heated to remove the main bearings.



Preparing the Crankcases

After cleaning the crankcases to achieve the finish you desire, in this case wet vapour blasting with soda, it is essential to check that
no blasting media or metallic particles are left behind, especially in any blind holes or within the oil ways or breather system.
By carefully re-tapping and cutting threads followed by cleaning you will be ensuring that later assembly goes smoothly and fasteners do not bind. It is not essential to remove most of the studs but as some of the barrel studs penetrate the crankcase the threads for these if not sealed can be the cause of later oil leaks around the barrel flange.

If you have access to engineering facilities or contacts, than new studs and fasteners can be made using the originals as patterns,
The Parts Book helpfully provides details for the lengths of most of the main studs and bolts.

The Taps and Dies shown above are a ¼ in BSF Plug Tap and Dies in 26 tpi BSCY one ¼ in and the other 5/16 in
Select Taps and Dies with care to match the threads that you actually have on your engine as these may differ from what you expect.
You will need them in a variety of sizes (Refer to the Parts Book). If just re-tapping use Plug Taps rather than Taper Taps.
You must lubricate Taps before use, either with cutting fluid or grease which will trap any particles as you work.
Screw the tap in one turn at a time and then reverse ½ a turn. You should never need to force a Tap or Die
any difficulty may mean that you are using the wrong size or thread form or a worn tool.
Replace worn taps rather than persevere, if one breaks in use your difficulties multiply.

The Diestock (Tool to hold Dies) allows the Die to be held firmly and also adjusted, if you are unfamiliar in using Taps and Dies,
practice first on some spare fasteners so that you understand the principles involved and your mistakes will not be costly.
Check on You Tube for Instructional Videos.

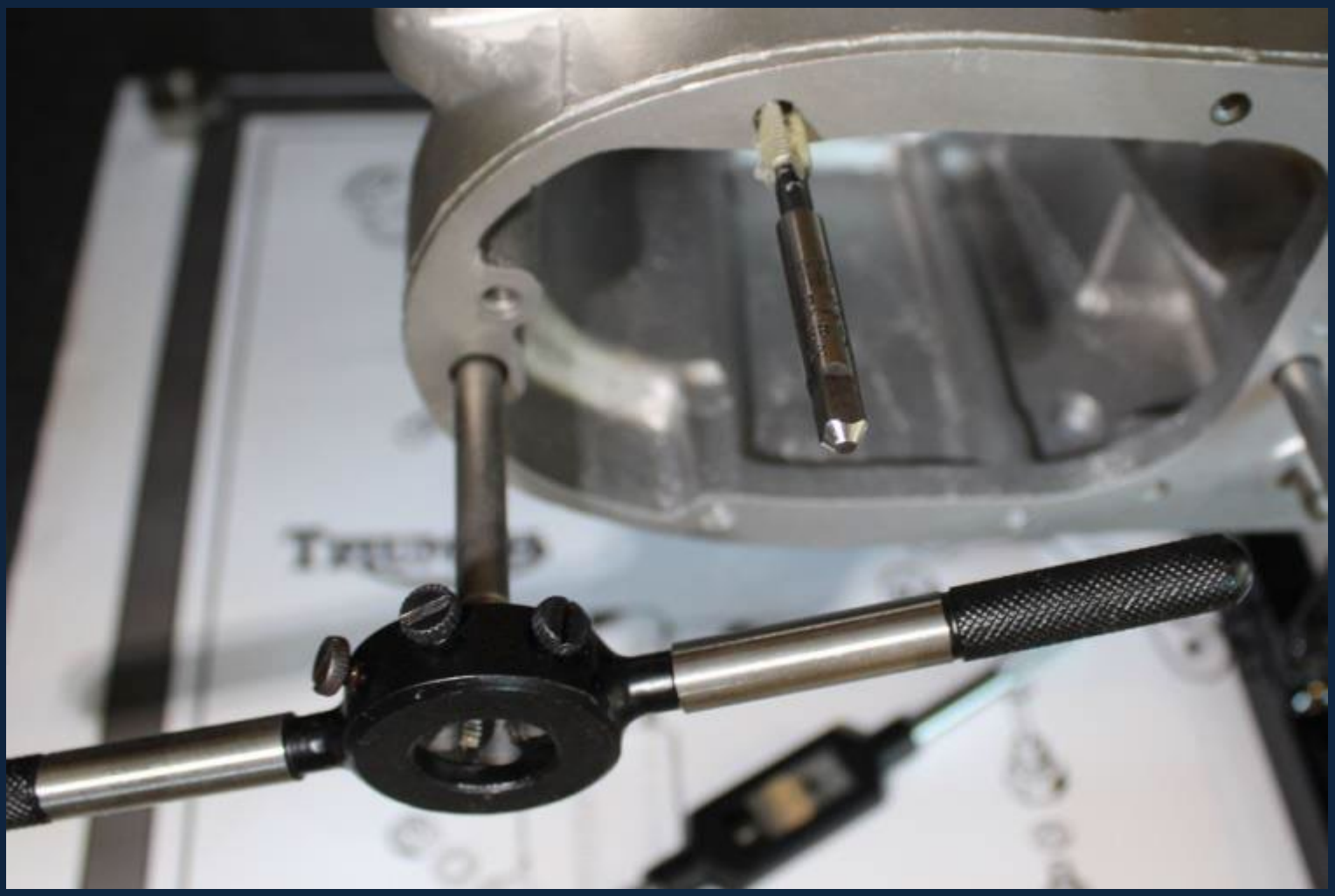
Also shown above is a ¼ BSF Helicoil Kit. Helicoils are wire inserts designed to both repair and strengthen threads in alloys; a typical kit
will come with instructions, several Helicoils and the appropriate Tap and tool to use but not always with the specific drill that is needed.
A Helicoil repair is described and illustrated below.

One of the numerous ¼ BSF Threaded Holes, here in good condition.

The Alternator Cable Exit. ½ in BSF after Tapping and Cleaning.

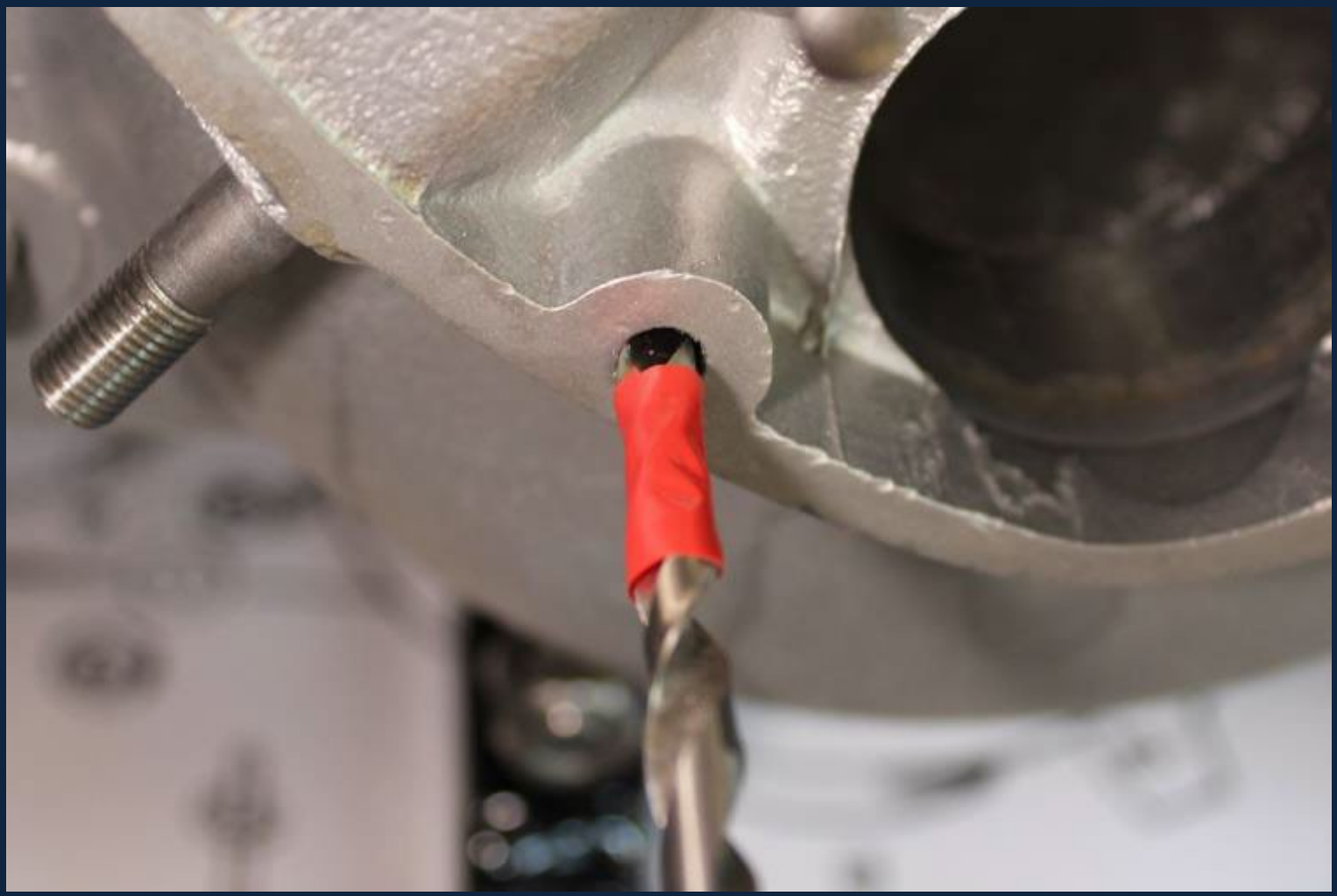
Two of the Eight Cylinder Stud Holes 3/8 BSF.

Also visible is the location for one of the two crankcase mouth screws, ensure these are removed before attempting to separate the crankcase halves. Here they had to be cut through but care was taken not to cut any further than was absolutely necessary.

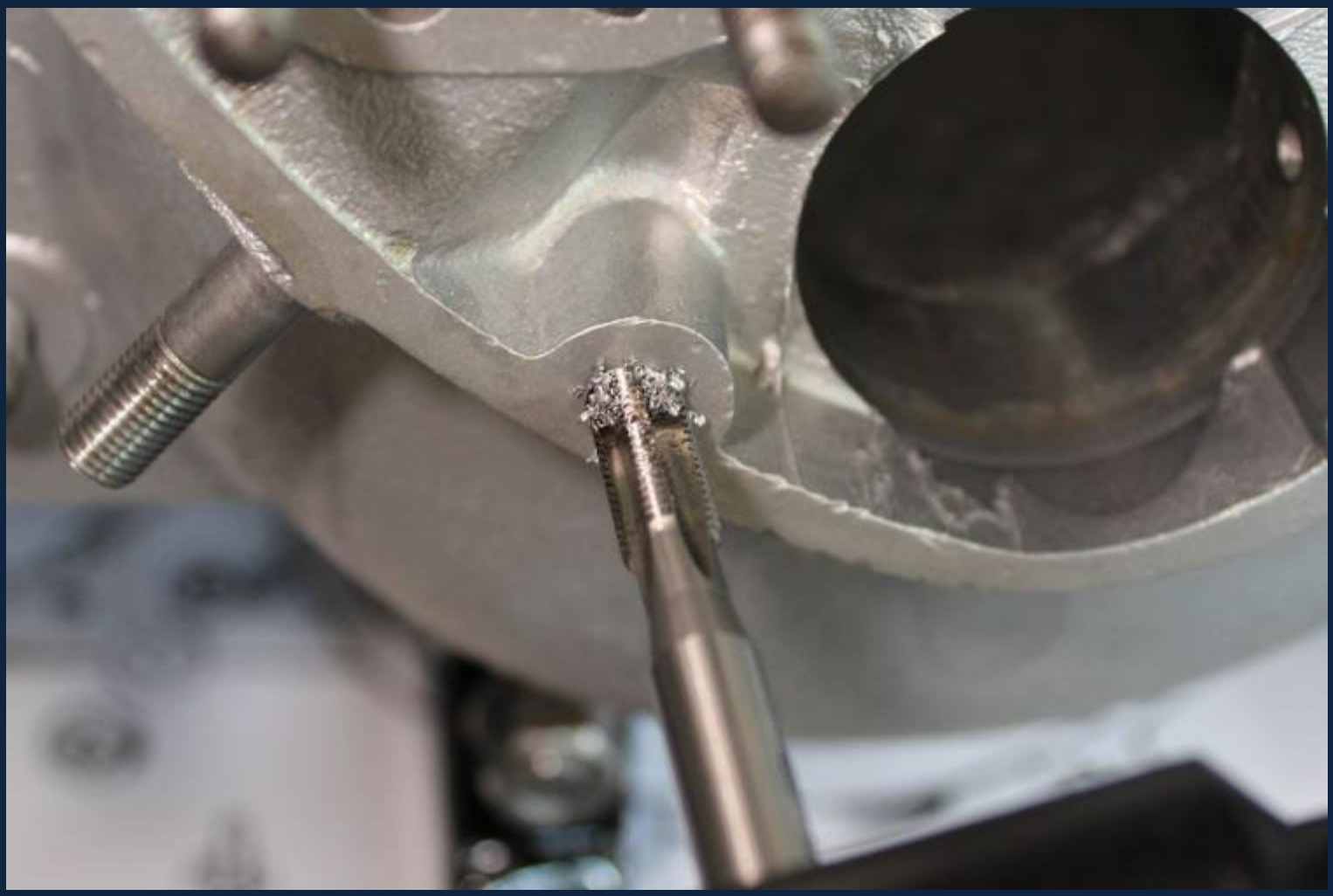


Using Taps and Dies to Cut and Clean the Threads.

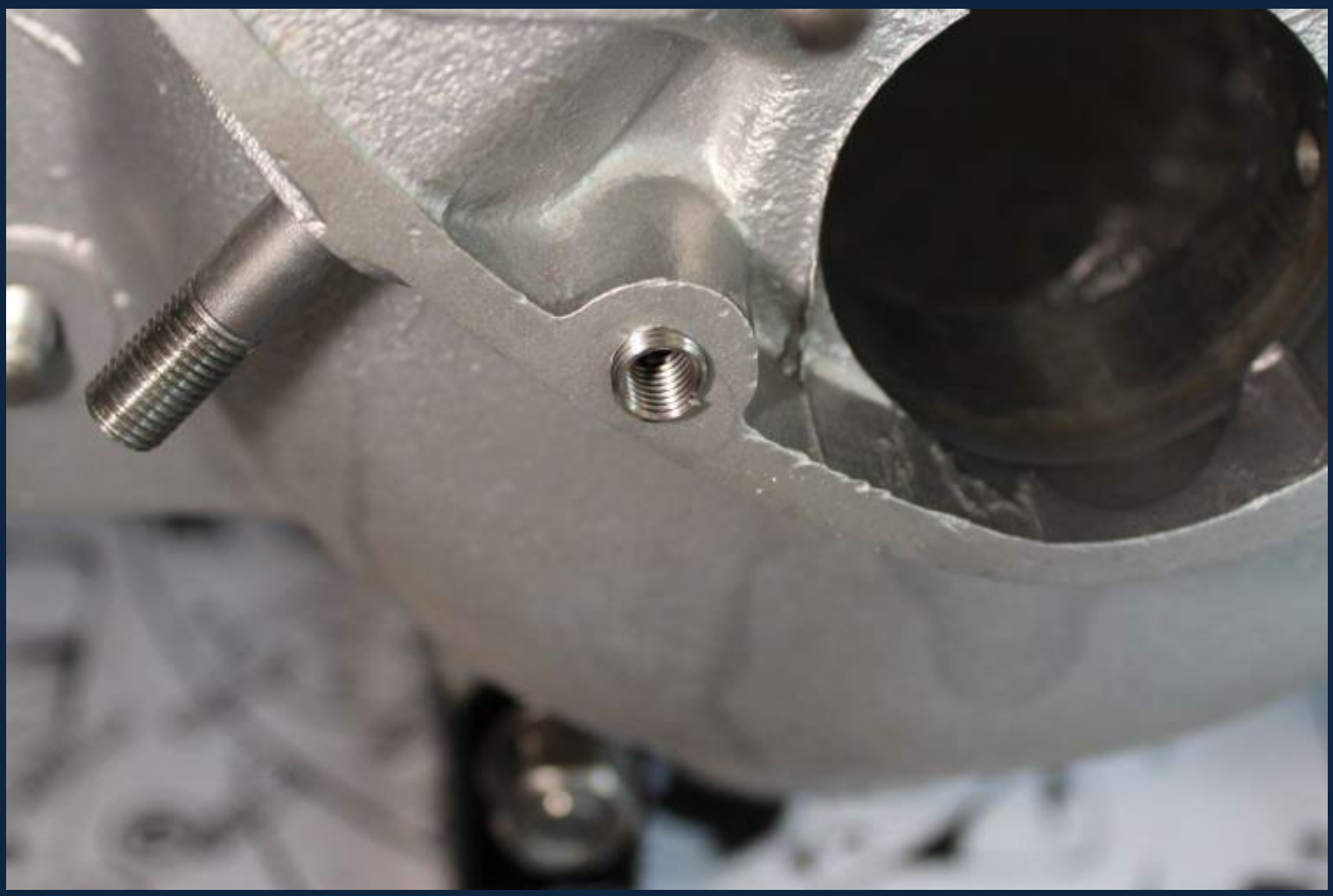
A Damaged Thread… A Helicoil will be needed.



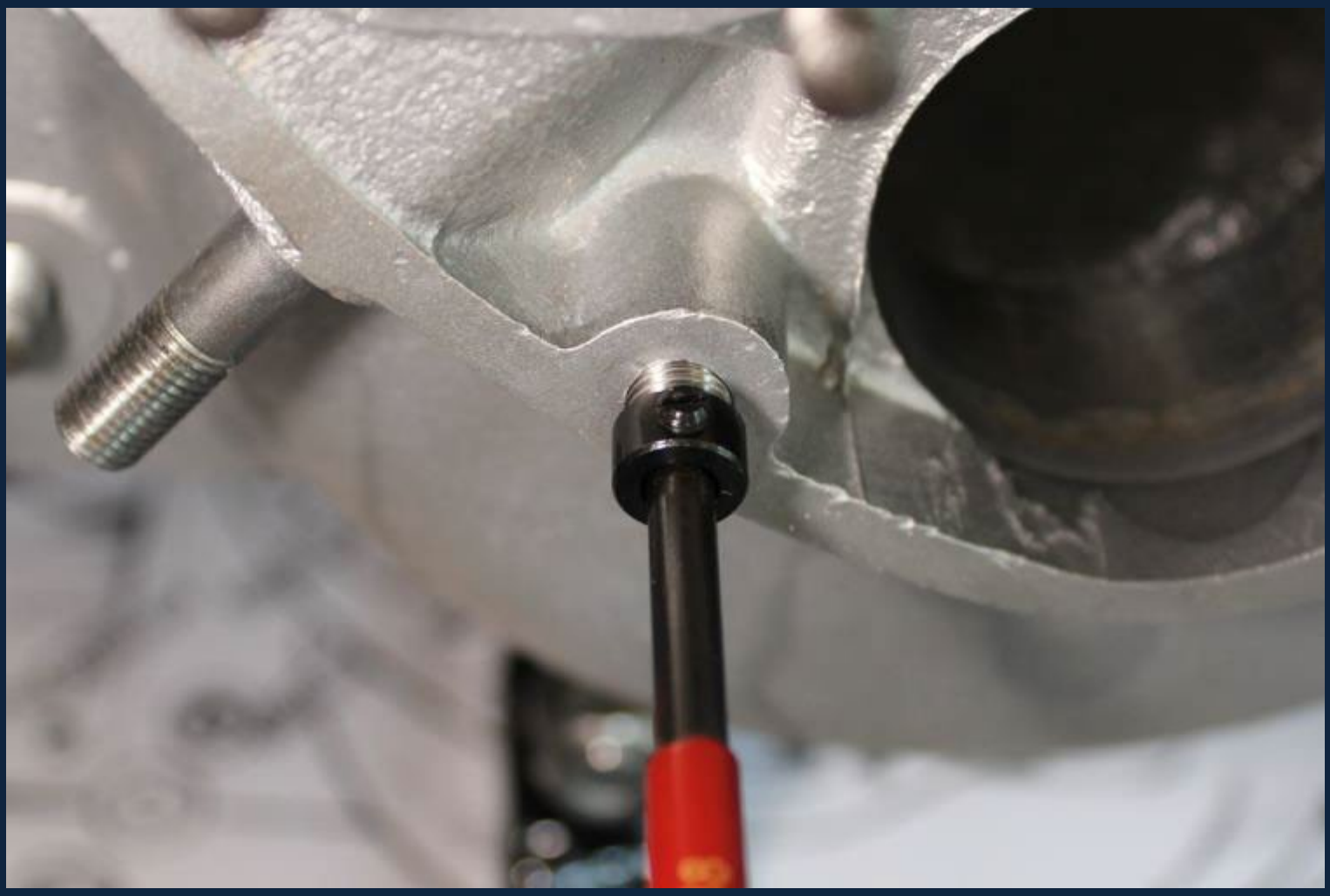
Using the drill size recommended the damaged hole is cleared, tape the drill to set the required depth.



Using the Tap from the Helicoil kit to Tap the hole.



The Helicoil partially inserted into the cleaned hole.

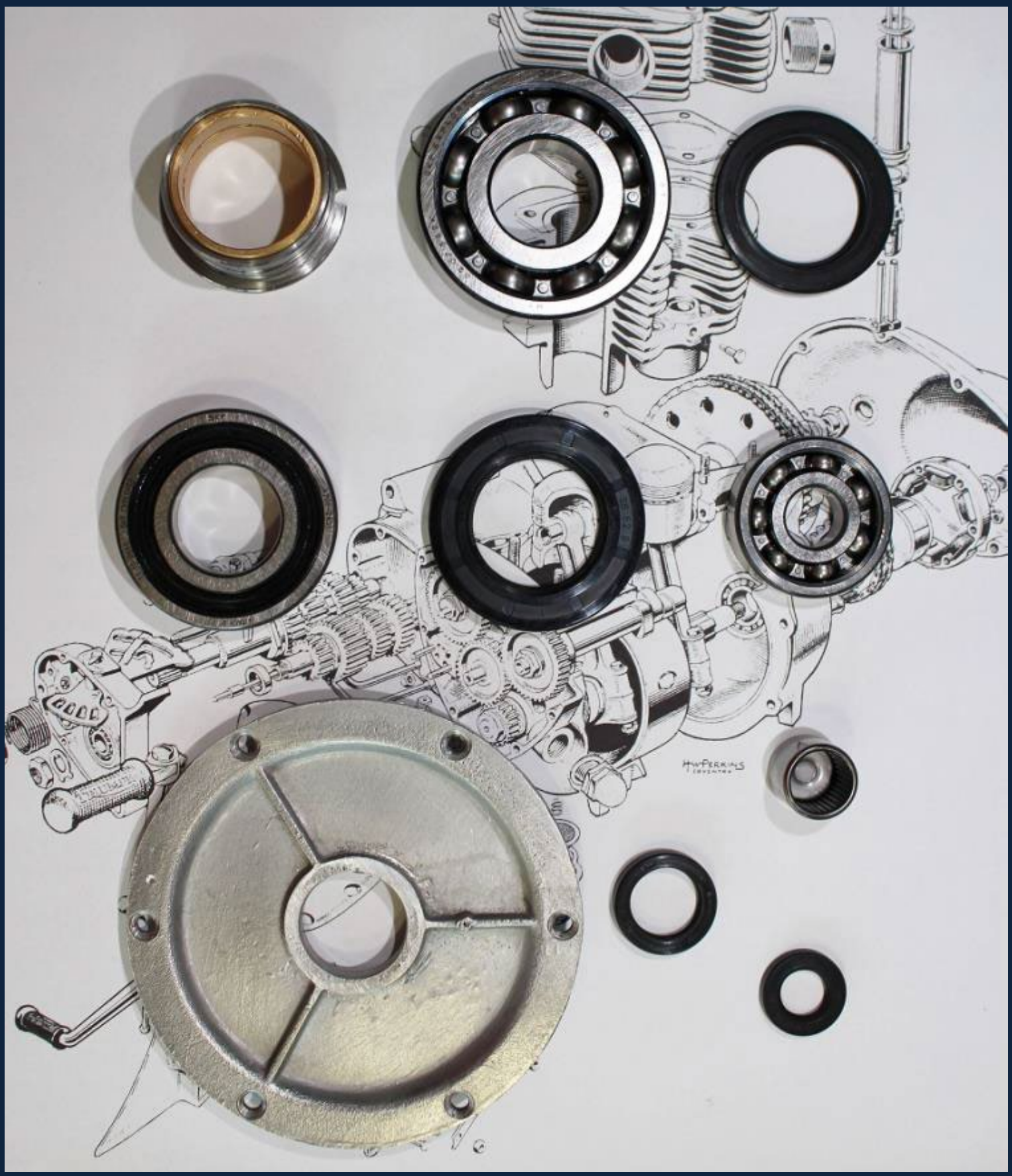


Using the supplied Tool to insert the Helicoil fully.

The completed Helicoil, the tang has been removed.

Once you have completed the crankcase preparation pack it away and set it aside.

Bearings and Seals



Above is the general Bearing and Seal group for the C Range Engines

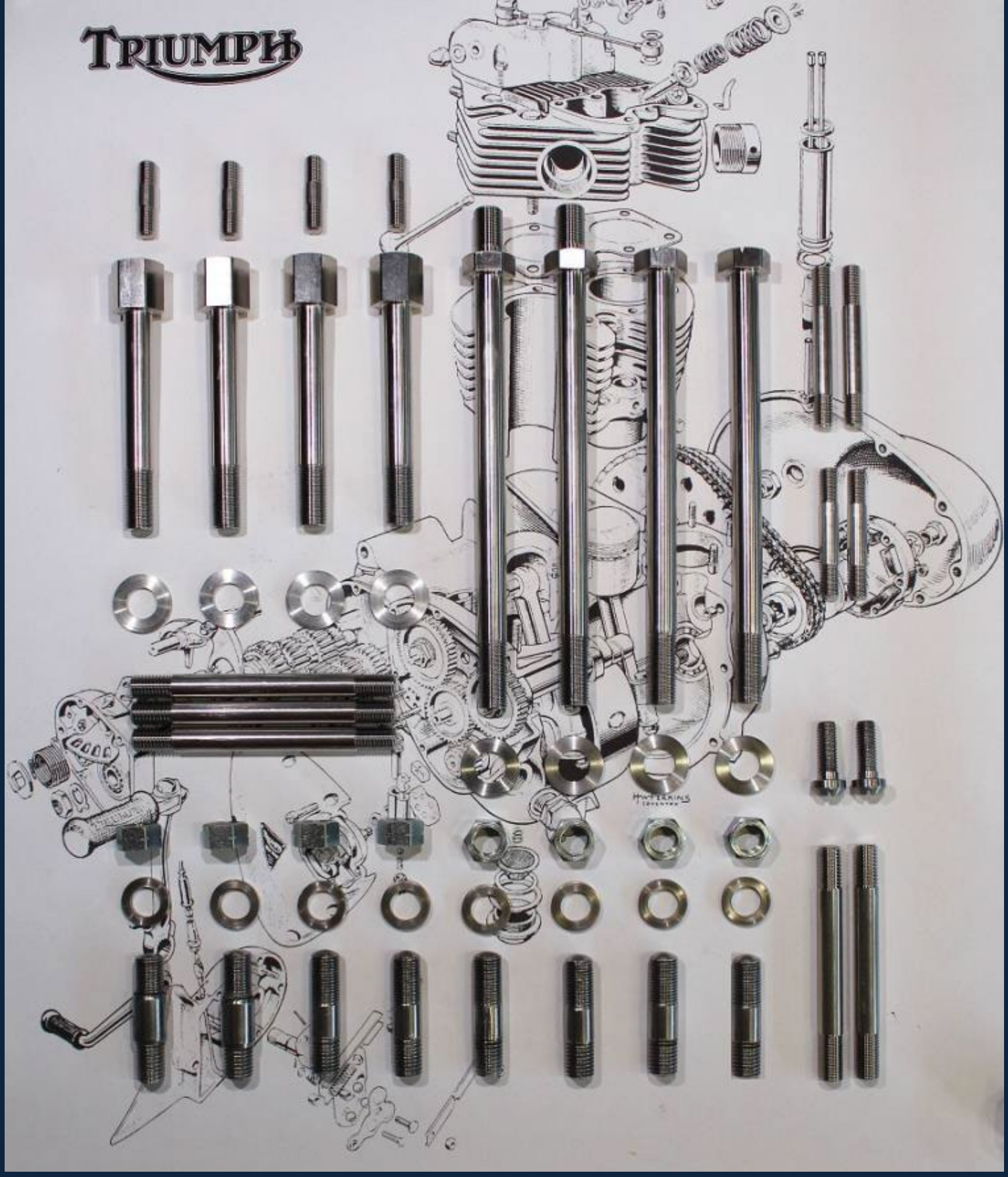
Top; the Timing side bush, available in various sizes, the Drive Side (6306 RS1) bearing and its seal (36.51 53.9 6.35)

across the middle the Gearbox Main bearing (6206 2RS1) and its seal (38 62 8). The Gearbox Inner Bearing (6303), while at the bottom the gearbox sprocket cover, its seal (70 3833) a Torrington M11121 needle roller bearing and also the oil seal for the timing cover and or crankshaft on late models (MI 062100 3/16)

Normally the Gearbox Main Bearing would be an open bearing, here a sealed bearing has been substituted with the inner most seal prised away so that the gearbox oil can lubricate the bearing in the usual manner.
Note, sealed bearings can be easily converted to open bearings by prising out the seals.

On the gearbox sprocket cover, just visible at 3'o clock is the small oil hole that passes through to the boss on the other side
The boss and hole were introduced in 1965 to oil the chain but was deleted later in 1966 though the boss remains.

Bolts, Studs, Nuts and Washers

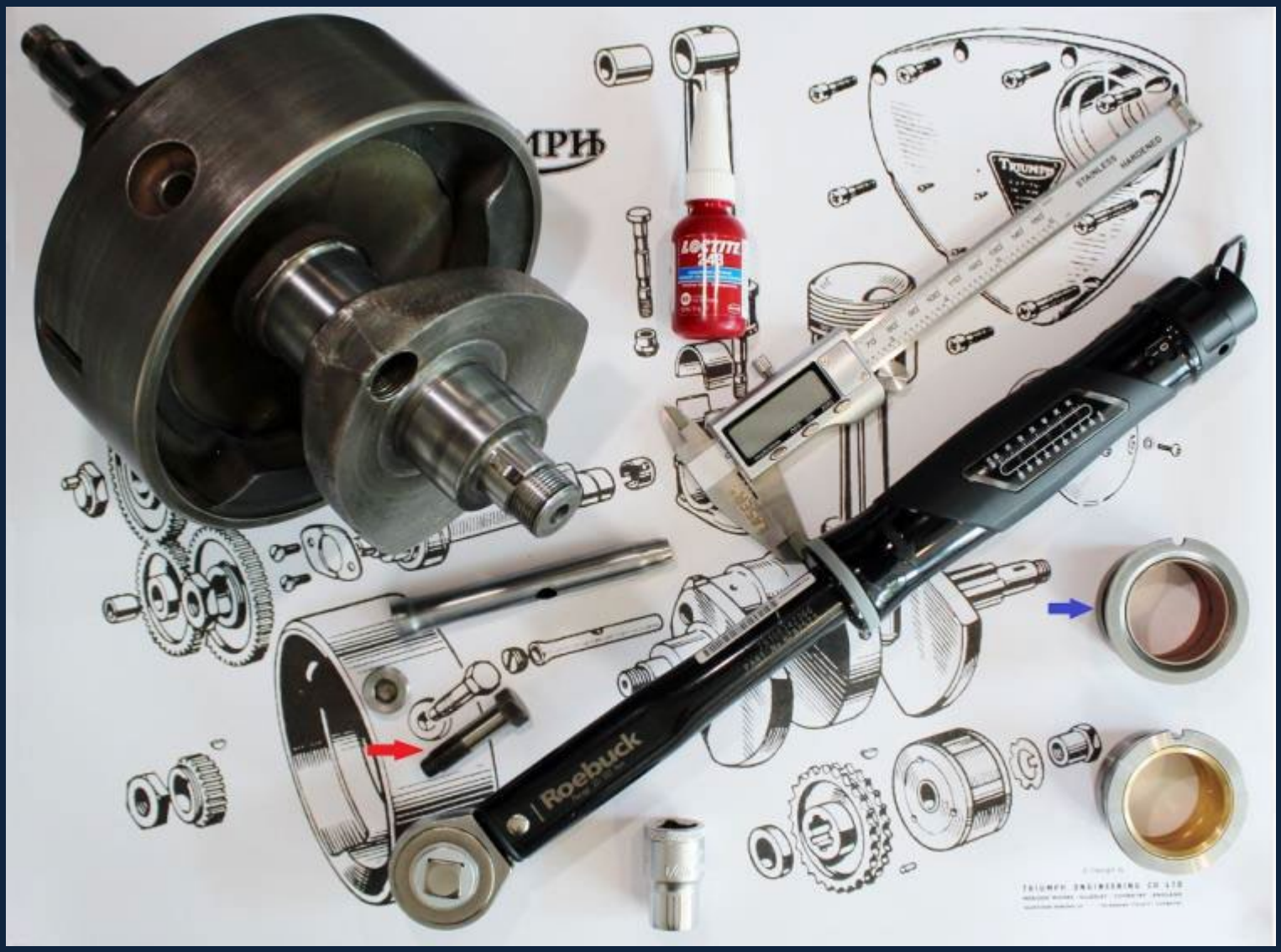


Engine and Gearbox Bolts, Studs and Special Parts

Shown above is the general arrangement of special fasteners that are applicable for the C Range Engines, not all the parts needed
are shown as the image is designed to give the new restorer a view of the range of fasteners used. Over the period of Production of the C Range Machines thread forms varied but the general appearance of the items are as displayed.

Part 1 Complete

The Crankshaft



Preparing the Crankshaft

On any Triumph Twin unless you are confident that it has been assembled and serviced properly it is vital to assess the state of the
Crankshaft and Sludge Trap at some time early in your ownership. Less important if the machine is for static display or light use but essential if you intend to use the machine regularly for commuting, racing or touring.

Cleaning the Crankshaft after degreasing is best done with fine wire wool, or Scotchbright pads so that the Bearing Surfaces cannot be damaged. There is no need usually to separate the flywheel but you will need to remove
the 3/8 in BSCY Central bolt (Red) that also holds the Sludge Trap in Place.

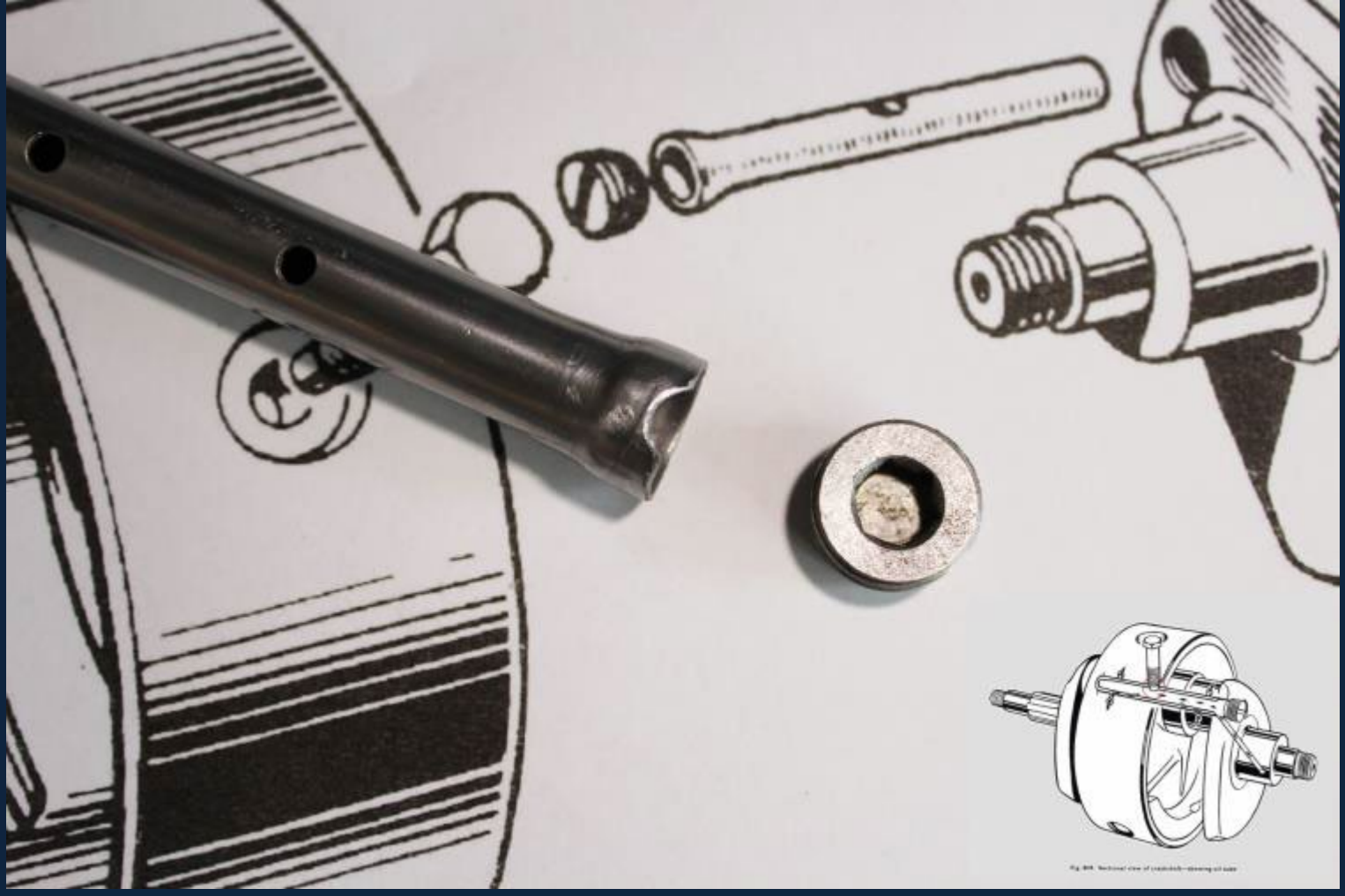
Refer to Section B35 of the Works Manual for Details

Shown above is the Crankshaft after measuring, and removal of the sludge trap, the flywheel bolt that locates the sludge trap.
will need Loctite (243 medium strength) on assembly. Arrowed in Blue is the old Timing Side Bush with the new one below it.
This Crankshaft had very little wear and did not require re-grinding. The Works Manual contains all of the data required to assess if any
of the engine components are worn, and with good measuring tools the average owner will gain confidence to assess these components.

Re-grinding of the crankshaft is a specialist job beyond the scope of the average owner but not beyond the experience of most
vehicle engineering companies and you should be able to find someone to undertake the work in your city.
The Bearings are usually available in a number of over-sizes and it is best to obtain these before passing the work to your chosen specialist.

Here showing the Timing Side, slightly worn but within Tolerance.

Here the sludge trap cap has been removed; the thread now is slightly damaged and will be re-tapped so that the next cap fits smoothly.
Removing the old cap can present problems and is often best left to someone with engineering facilities as it may need to be drilled out and a considerable amount of force and heat applied.
New Allen key caps and much easier to deal with.



The Sludge Trap and the New Cap.

The Sludge Trap is part of the Oil Filtration system and uses the centrifugal action of the crankshaft to separate out particles so that
they are deposited safely within the sludger tube while only allowing clean pressurised oil to go to the main bearing shells.

To remove the trap the central flywheel bolt must be removed and then with a coarse Tap screwed into the old tube it can be withdrawn.
Discard the old tube. Removing the remaining sludge can present problems but by carefully drilling and wire brushing the hardened
sludge can be removed. Brake cleaner is an excellent solvent to remove any residual oil.

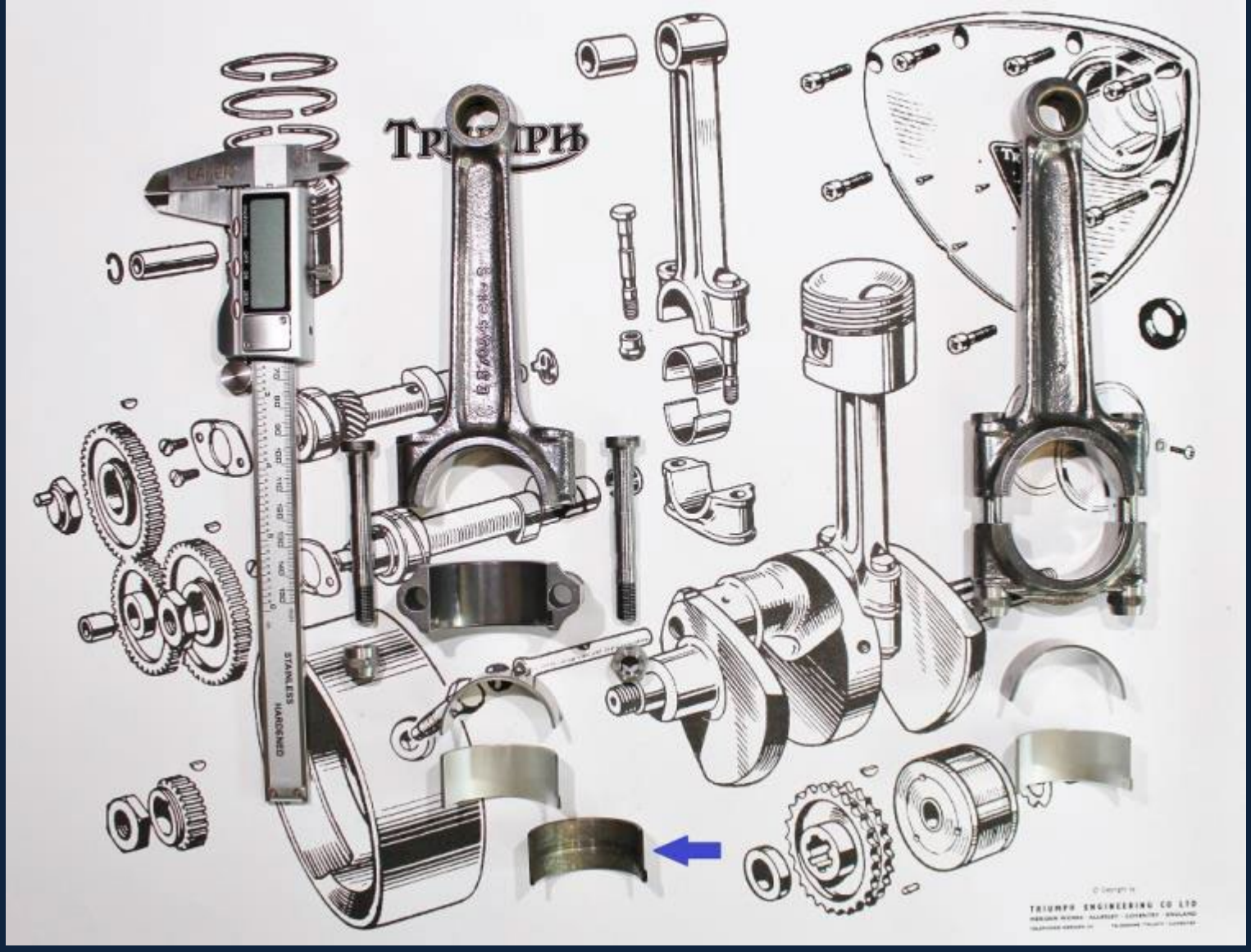
When you are satisfied that all the sludge has been removed and the oil ways are clear carefully re-tap the threads to remove any old Loctite.
Check the new sludge tube carefully and remove any burrs both inside and out and then do a dry fit to ensure that the new tube locates correctly
and is locked in place by the flywheel bolt. On this dry fit I noted that the new sludge tube partially obscured the oil way from the timing bush
I then ground this carefully away as seen above so that there would be no restriction to oil entering the sludge trap.

The Bearings and the Details.

The original bush is steel backed with a copper lead lining that bears directly onto the crankshaft. Pressurised oil from the Oil Pump is fed into
the outside annular ring and passes through four holes to the inside annular ring where it lubricates the rotating crankshaft and passes through
an angular drilling into the crankshaft itself. Over time wear in the bush and on the crankshaft, noticeable as a step, reduces the amount of oil
entering the crankshaft and reaching the main bearings, eventually leading to failure.

Failure of the crankshaft may not be entirely attributed to the bush being worn, as a failed oil supply, pump or pressure relief valve will all
contribute to low oil pressure and premature and rapid bearing wear. Engine failure is frequently caused by lack of servicing or
a poor understanding of the engineering principles applicable to Classic British Motorcycles

Both the bushes above show the recess that originally was to prevent the bush rotating in it’s housing.
Ensure that this is fitted uppermost so that the retaining slot in the bush is correctly positioned.



The Connecting Rods and Components.

Refer to Section B36 of the Works Manual

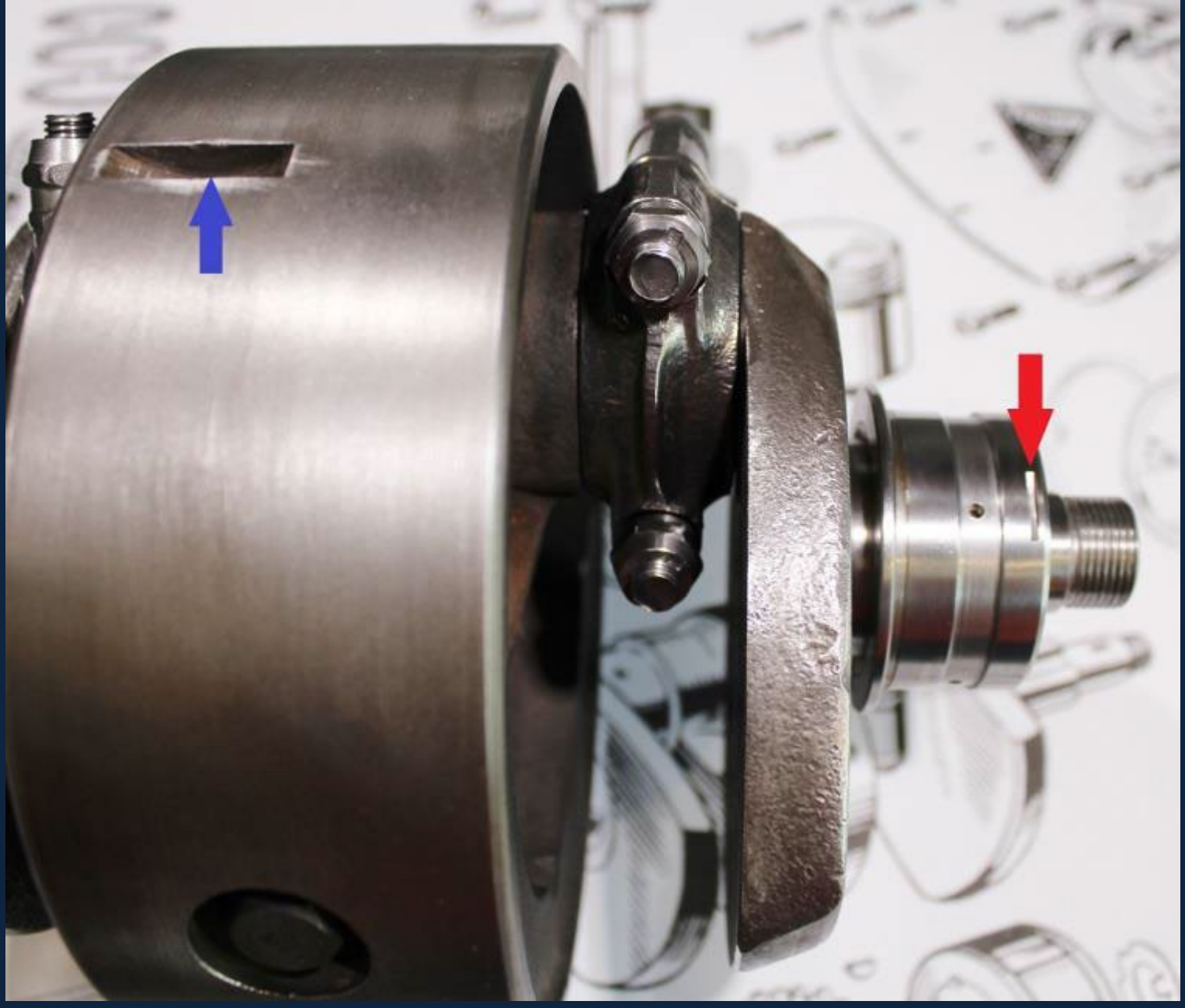
Arrowed Blue is the original bearing showing some wear but within tolerance, the primary cause of failure of this engine had been poor servicing
leading to the main drive bearing breaking up. This is the 3TA and so has Steel Conrods, you will note the specialised bolts and locking nuts.
These ought not be re-used but replaced along with the bearings. New bolts are usually of the later type with UNF threads.
The Conrods and Caps were originally marked on assembly and these must be kept together and reassembled as pairs.
It's good practice to keep components in the order of their removal and return them to their original locations.

Note above that the small end eye on the right connecting rod has been poorly machined and is off centre, the Factory passed this
as ok and the engine did some 20,000 miles before the drive bearing broke up. Many of the Machine Tools at Triumph were worn, with several "rescued" in 1940 from the bombed out old Factory on Priory Road in Coventry
Only because of the skill of the men who worked them could quality be maintained.

Crankshaft Assembly and Checking

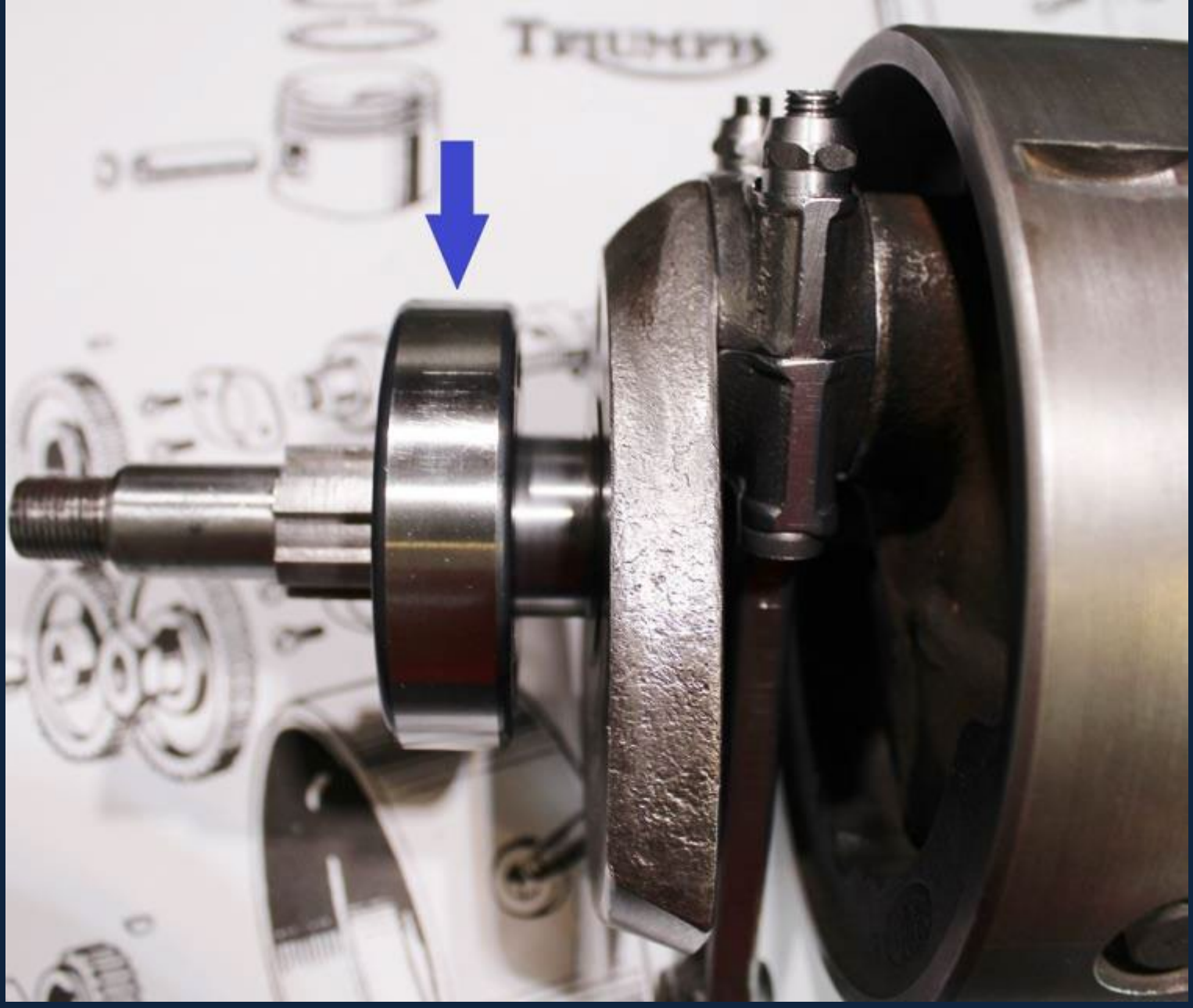
Here the sludge trap has been completed and the Conrods fitted with new bearing shells and bolts, then tightened to torque or to the stretch values shown in the works manual. Torque setting for the Bolts is 27 lb/ft… Stretch 0.004 to 0.005 in

The Timing side bush and the Drive side bearing are being checked in preparation to fitting these into the crankcase.



Crankshaft Detail Timing Side

Arrowed Blue is the TDC Slot that was introduced in 1964 and corresponds with the access plug in the crankcase.
Arrowed Red is the groove in the Timing Bush that locates with the retaining plate in the timing case.
Note the direction the Bush fits with the flange eventually against the inside of the crankcase.



The Drive Side Bearing

Here the new drive side bearing is being checked for fit, it must fit snugly (interference fit) but without any excessive force applied.
You may need to carefully polish the shaft to remove burrs until the bearing fits smoothly and presses up against the crank web.
Once the alternator is in place the arrangement of spacer, primary drive sprocket, rotor and the alternator nut are designed to lock the crankshaft in position, pulling it up against the drive bearing so that it cannot move laterally.

Lateral expansion of the crankshaft as end float is taken up within the Timing Side Bush.
It is essential that both the Drive Bearing and Bush are pressed fully home.

The Drive Side Bearing.

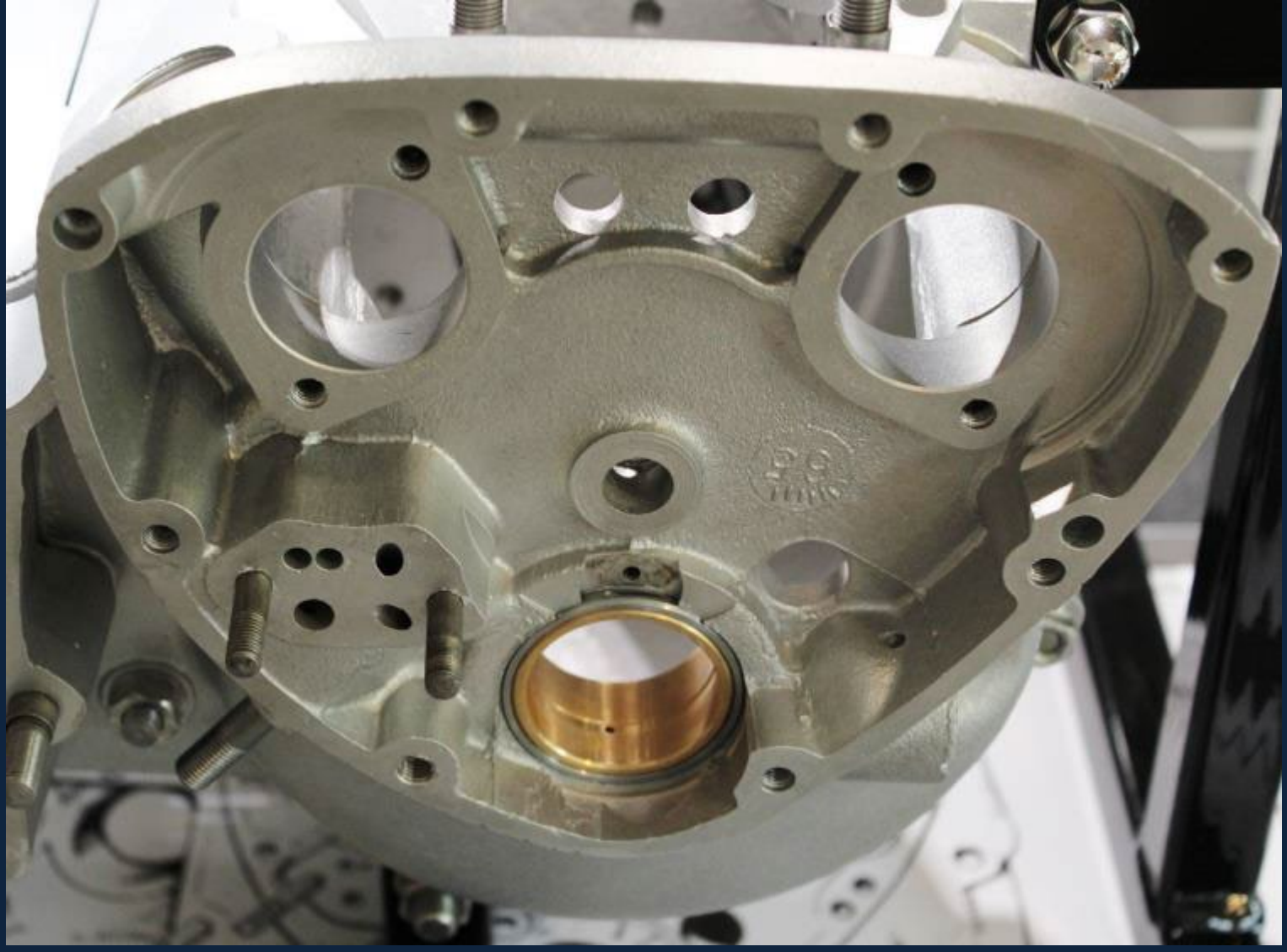
Most owners will not have access to a hydraulic or fly press and removing and replacing bearings can seem daunting.
Removing Bearings regardless of the type or location is always best done with Heat applied to the surrounding area.
To remove the bearings you will need some form of drift, a hollow tube or preferably a length of solid round bar
Drifts in alloy, copper or bronze are preferable to steel as they are less likely to cause damage.
A lump or engineers hammer will apply controlled blows better than any other type.

Heat the crankcase (150’c) and use a blocks of wood or sheets of cardboard to support the crankcase firmly.
With your drift and hammer, apply even blows around the visible circumference of the bearing.
You are aiming to drive the bearing out squarely, work carefully until the bearing drops out.
While the crankcase is still hot remove any other bearings you need to.

Label the bearings as used and retain them until you have obtained replacements.
Most of the bearings used by Triumph are Metric sizes and commonly available.
Assess and clean the bearing housing removing all traces of retaining compounds and oil.

To fit Bearings safely you will need a mandrel but with care a tubular drift will be adequate.
As before heat the crankcase to 150’c and support it firmly, the bearing if chilled (freezer) may drop in easily,
Tap home with a block of wood or a mandrel made to suit so that blows can be applied uniformly to the outer ring.
On no account hit the inner part of any bearing during assembly as this will damage the bearing track.
If you suspect that the bearing is loose in the crankcase when everything has cooled,
remove it carefully and apply a bearing retaining compound such as Loctite 641.

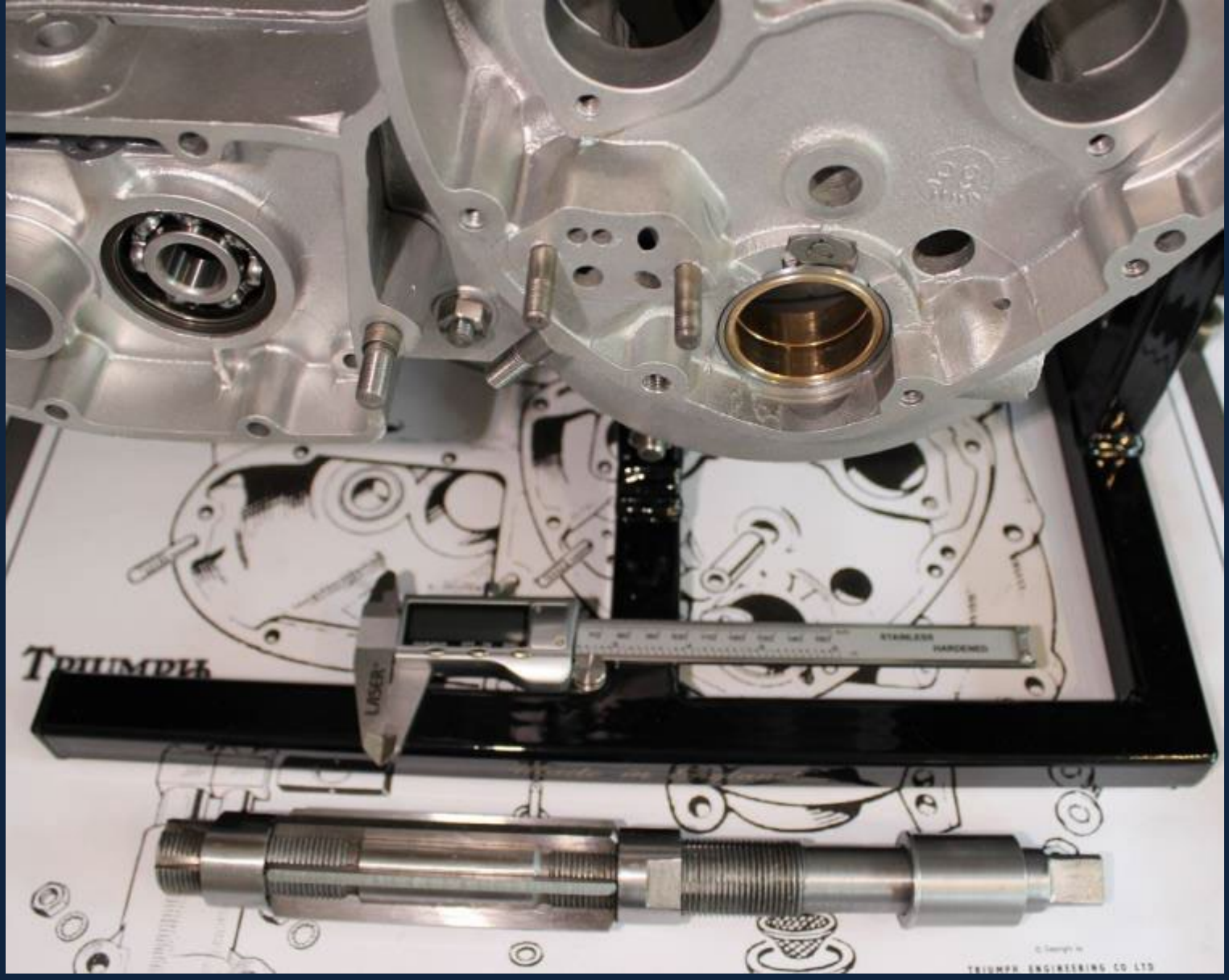
In general terms, lubrication of the drive bearing shown above is poor especially on the pre 1969 machines with the timed breather.
The bearing relies on splash lubrication which here will be limited as oil on the crankshaft will be thrown away
from the bearing by the centrifugal action of the crankshaft and flywheel.
Apply some clean engine oil once the bearing is fitted or before you fit the outer seal.



The Timing Side Bush Fitted

With the cases hot and the Timing Side bearing chilled it should drop in easily, make sure that the locating groove in the outer ring
corresponds with the locating plate. Tap home squarely with a block of wood or a mandrel made specifically for the purpose.
The same principle of heating the cases and using a mandrel or drift is used to remove the bush.

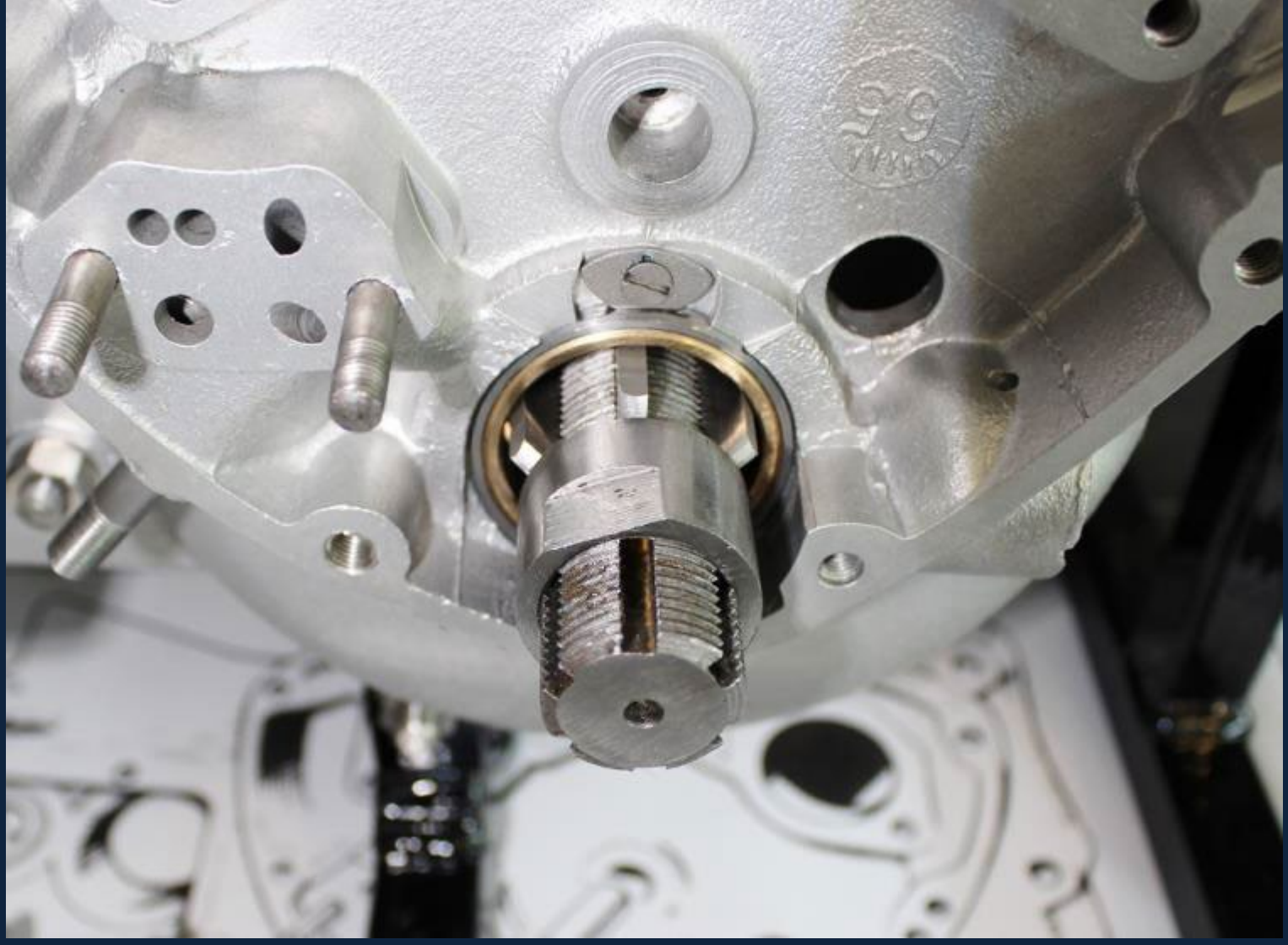
From 1969 the plain bush is replaced by a needle roller bearing but the fitting principles are the same.



Preparing to Line Ream the Timing Bush.

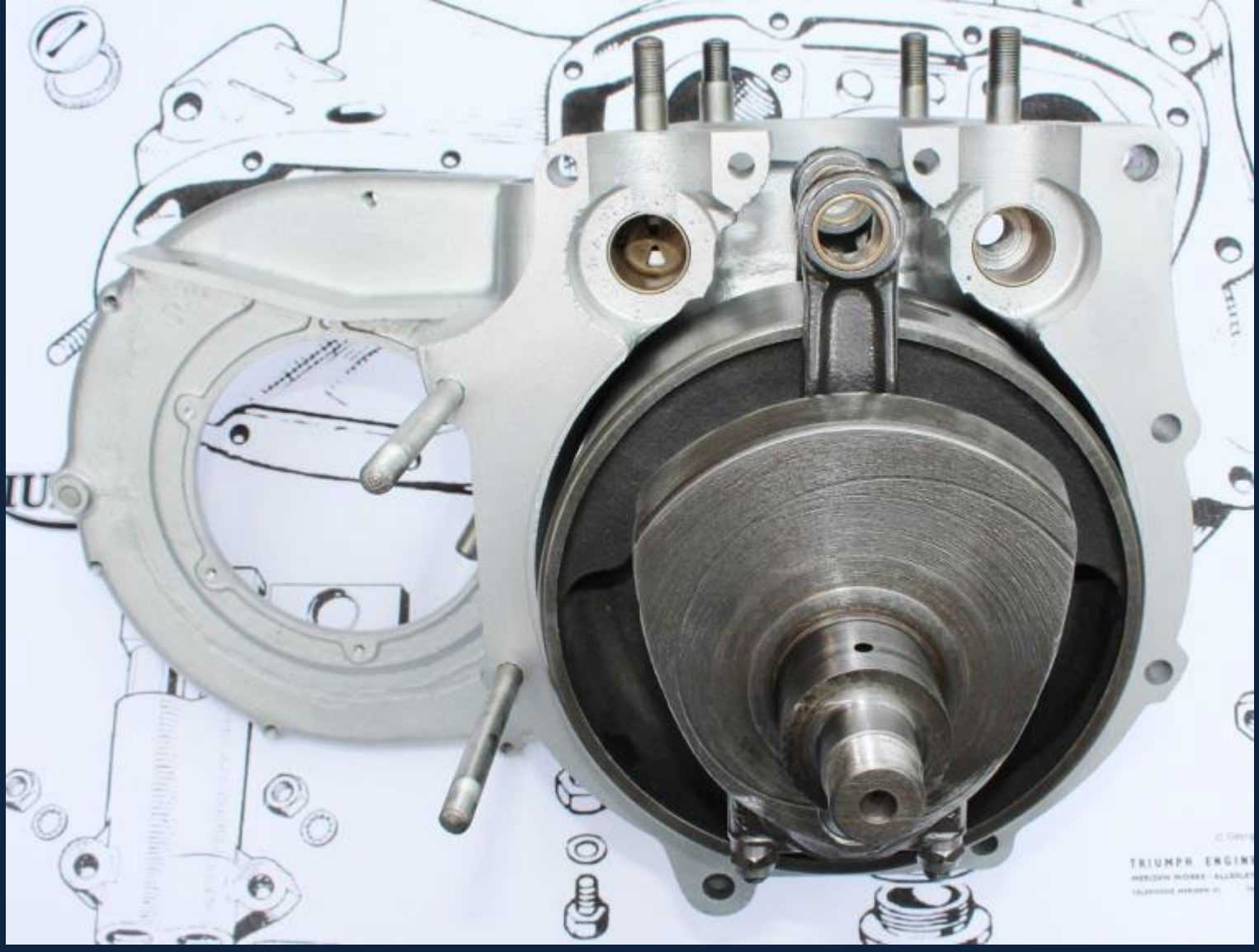
When the Engine was assembled at the Factory the Timing Bush would have been pressed in and then machined to tolerance in the knowledge that it's eventual partner crankshaft, also made to tolerance would fit.

This leaves the Restorer with a problem, as during the fitting the bush will have shrunk slightly and may have distorted. Shown here is an Adjustable Reamer together with a Locating Collar made to fit into the Drive Side Bearing. The reamer is first passed through the bush, located in the drive bearing and then adjusted so that it removes only the minimum amount of metal required to reach the specified tolerance.

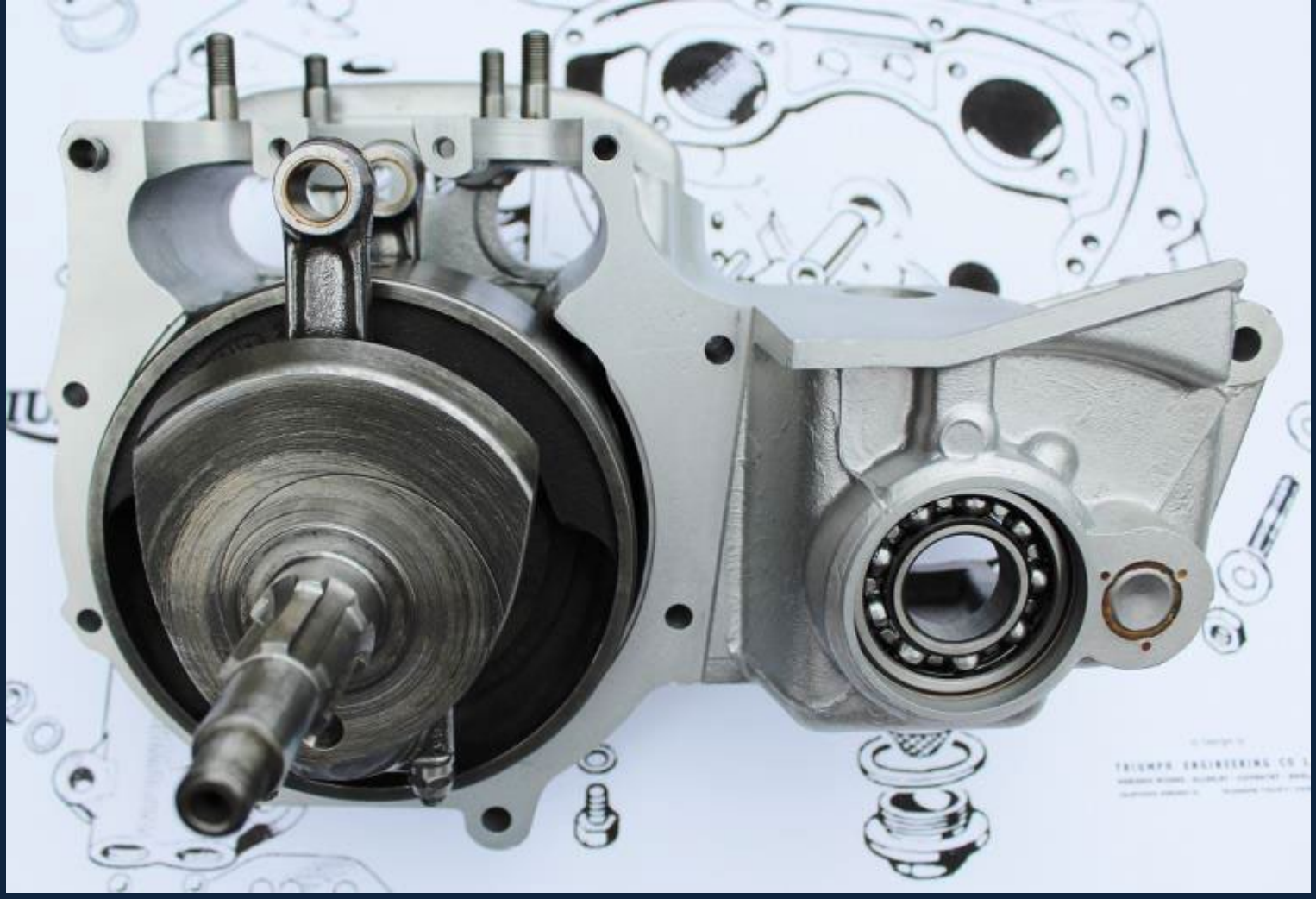


Showing the Reamer in place.

Turn the reamer slowly and evenly, you are only seeking to remove high spots where the bearing has distorted during fitting.



Test Fitting the Crankshaft into the Drive side Bearing.



Test Fitting the Crankshaft into the Timing Side Bush.

To remove old sealant use MEK (Methyl Ethyl Ketone) or Acetone both are very volatile/flammable and the only effective solvents
for silicone sealants. Available inexpensively from specialist suppliers and the chief solvent in adhesives for plastic pipes in
plumbing, a litre will last a long time but store safely in original containers and away from heat, children and paintwork.

By line reaming carefully and test fitting and repeating the process you will reach a point where you are happy with the fit of the
crankshaft into both sides. Check that the crankshaft rotates freely and does not bind when the cases are pressed firmly together,
some end-float is essential but any binding must be resolved before proceeding.
The data in the works manual shows a minimum bearing clearance of 0.010 in, with end-float between 0.008 & 0.017 in

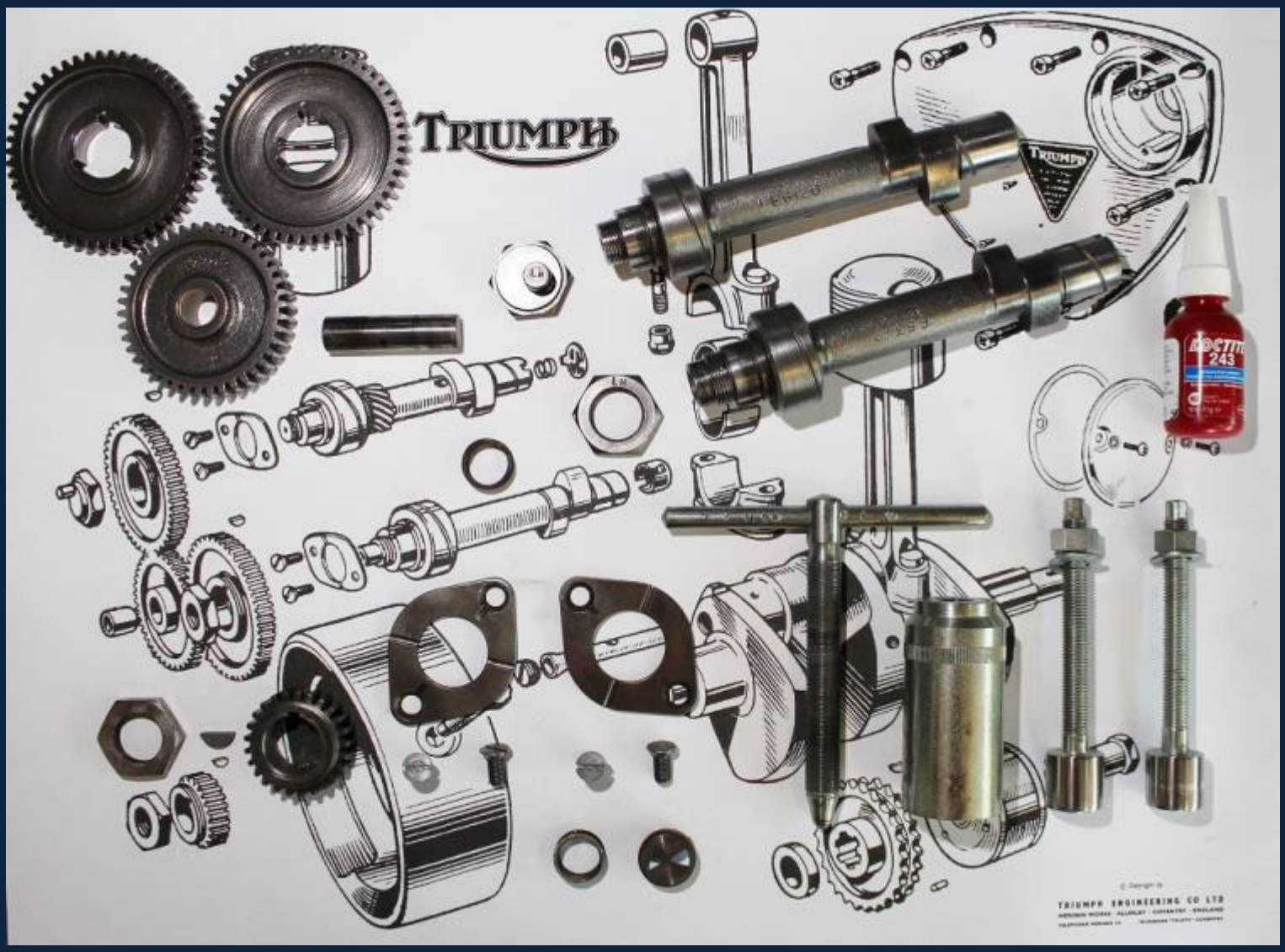
Once you are happy that the fit is good; carefully apply a thin bead of (silicone) sealant to the left crankcase half.
Only thin bead is required, practice on card or sheet metal so that you can reliably apply only what you need.
If you apply too much, wipe off with solvent and try again.

Once you have your sealant bead applied, fit the other half of the crankcase taking note of the locating dowel and then using the engine
studs and bolts clamp the two halves firmly together (Torque at 15 lb/ft), not forgetting the two screws in the crankcase mouth.

Wipe off any excess sealant with a clean cloth and solvent, check the crankshaft rotation and if all is well allow the sealant to set fully.

Part 2 Completed.

Timing Side



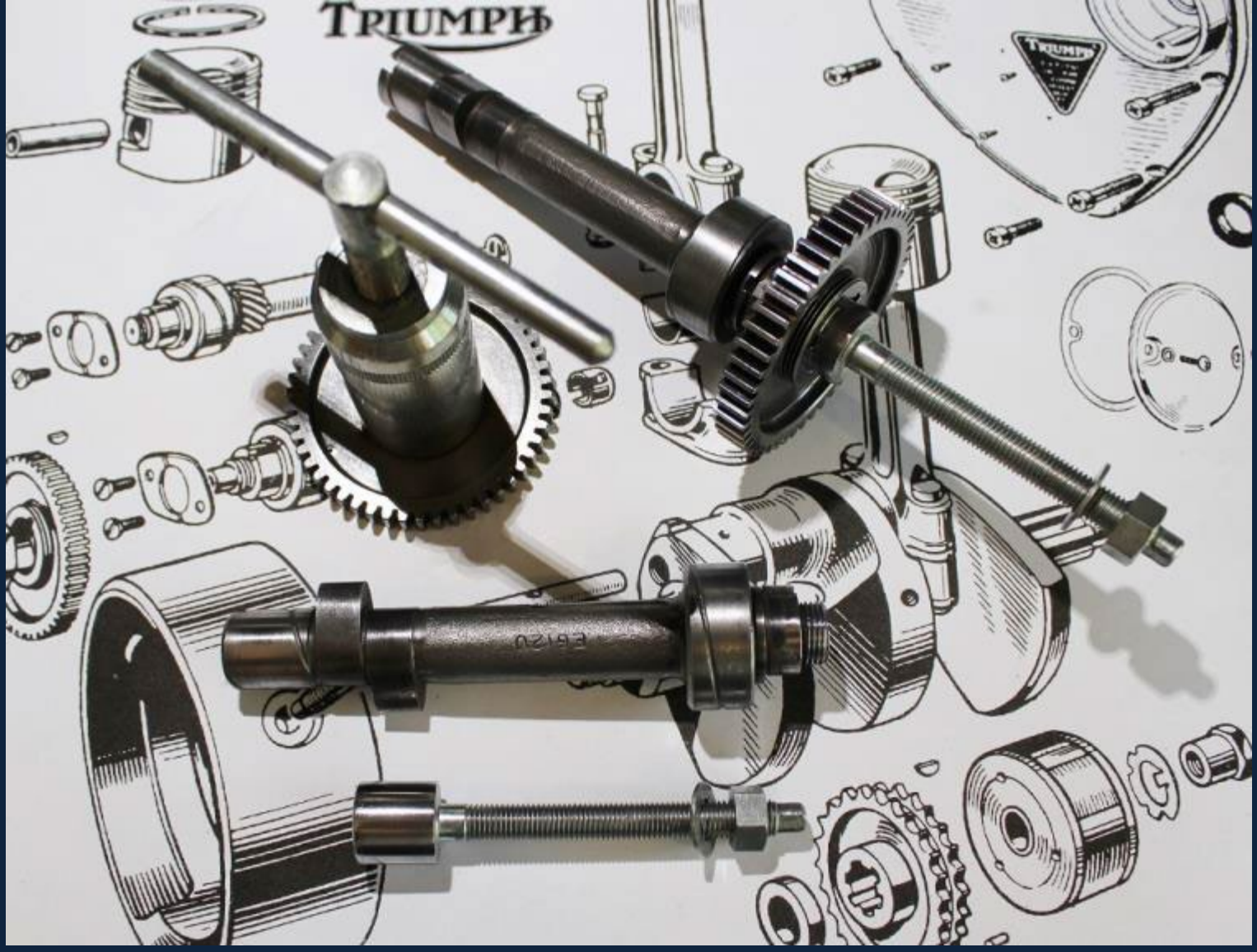
Camshaft Components and Tools

Shown above are the Camshafts, together with the parts and special tools needed to fit and remove the timing pinions.

Triumph Camshafts change gradually over the production period with the most important change coinciding with the deletion
of the distributor and the introduction of the points in the timing cover. Changes also occur with the fitting of the rev-counter
drive and then the later deletion of the timed breathing arrangement. With a project machine or when looking for parts, research the camshafts carefully to ensure that you have suitable ones for your needs.

The Camshafts can be removed and fitted with the engine in situ provided that the crankshaft can be firmly held in position and prevented from rotating. A bar passed through the small ends that can rest on the crankcase mouth is recommended or alternatively placing the machine in top gear and applying the rear brake. It will be necessary to remove the cylinder head, the push rods and tubes so that tappets can be secured and cannot drop into the crankcase once the camshaft is withdrawn.

The large nuts holding the pinions in place are Left Hand thread and may require some heat and effort to initially loosen them.



The Camshafts and the Tools required for removal and fitting

The inlet camshaft is the one at the bottom, not visible is the breather hole; but you will note the oil scrolls and the screw thread
for the pinion nut/oil pump drive. The camshafts turn clockwise and the scrolls are designed to distribute and draw oil across
the bearing surfaces. Check that the scrolls are clean and the cams are not excessively worn.

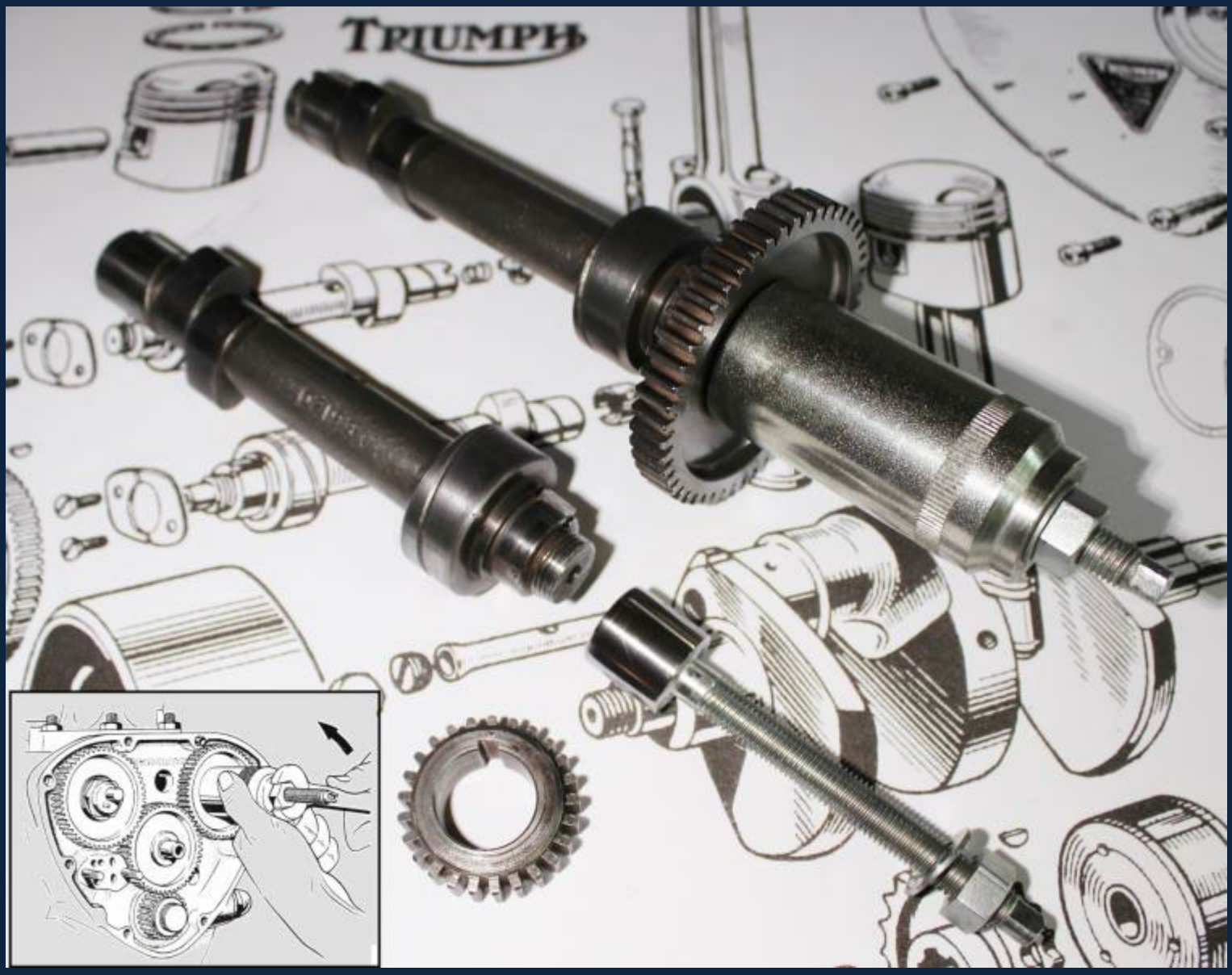
Though Camshafts display what appears to be a Part Number, these do not always match the Parts Book information. The Works Manual gives details of the valve timings and with this information the owner can ascertain what Camshafts have actually been fitted. The E6120 Cam above is specified only for the 3TA.

Once the barrels and pistons have been fitted, by using a degree disc on the crankshaft pinion it is possible to calculate the valve timing figures for the camshafts and then compare the results to the published data.

Camshaft Pinion Detail

Each Pinion features a short threaded section that allows the removal too (Z89) to be fitted and the Pinion withdrawn. Camshaft Pinions after 1961 feature three Key Ways to allow some adjustment of the valve timing if this is required.

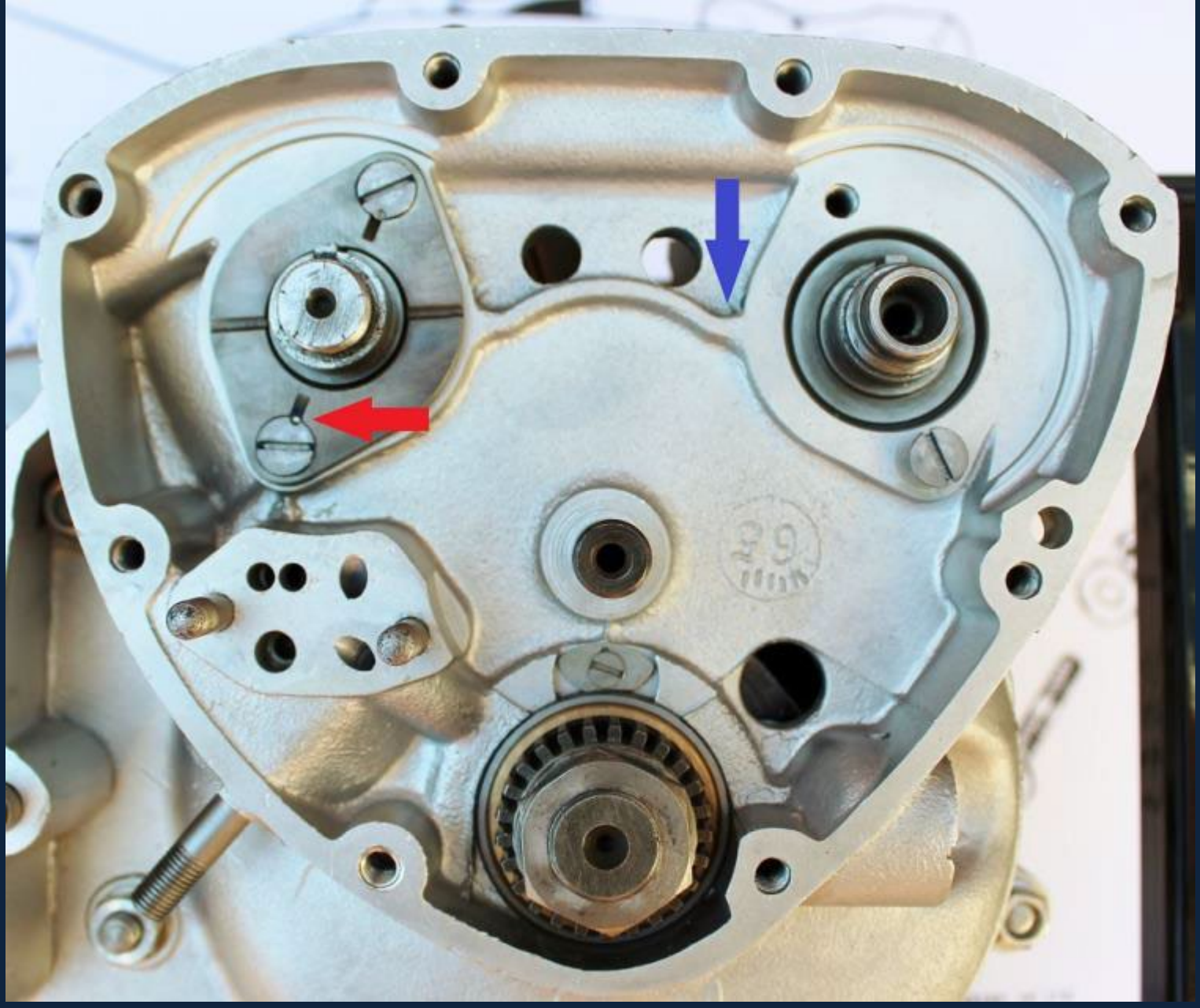
The Tools and the Pinions, note the Three Keyways.



Refitting the Pinions

Here showing the parts of the tool used to refit the pinions, on the left is the Inlet Camshaft, before this is fitted the breather disc
and its spring are located into the camshaft bush and then camshaft carefully inserted and rotated so that the breather disc locates into the slots in the camshaft end. You will feel a slight resistance from the spring.

Within the left crankcase mouth is a small weir and oil way that supplies oil to the inlet camshaft bush.
The Exhaust Camshaft bush is open at its end and lubricated by splash from the crankshaft.



Fitting the Camshaft Retaining Plates

The Blue Arrow indicates the weir and oil gallery that supplies this end of the Camshaft, check that this is clean before assembly.

The Timing Pinion (E1771) is located with a woodruff key onto the end of the crankshaft and then secured with this nut.

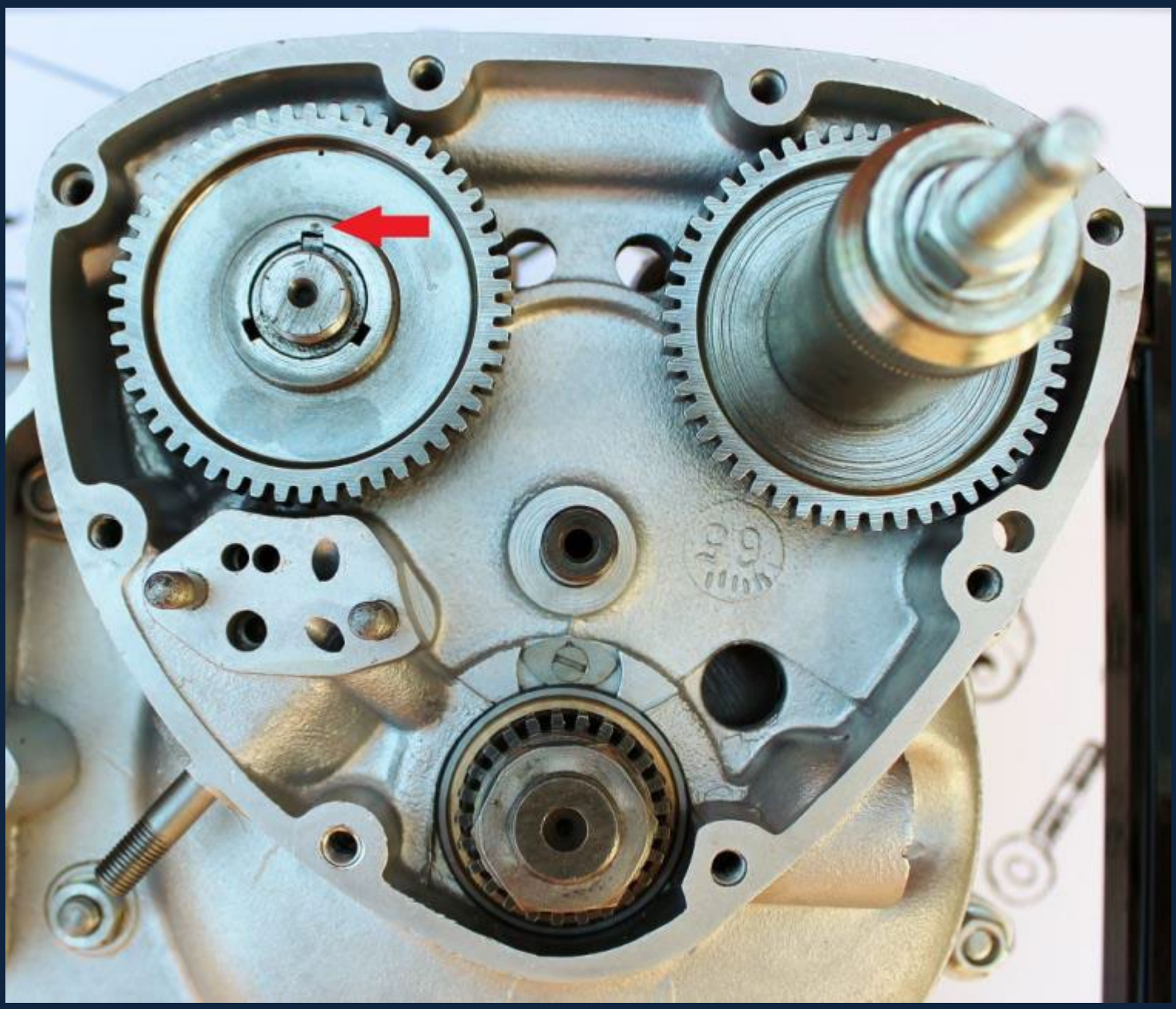
The Idler Pinion Shaft has been fitted and can be seen in the centre of the picture. This is an interference fit and warming the crankcase will allow it to fit easily, or for disassembly to drop out or be eased out by applying a punch on the reverse. Ensure that the Idler Pinion Shaft it is clean internally that the oil hole partway along is also clear.
Fit with the oil hole uppermost and note the weir and oil way in the timing cover.

The two Camshaft Retaining Plates feature shallow slots that act as oil passages to allow oil to reach both the faces of the camshafts
and the rear of the camshaft pinions. The plates are not handed and will fit either side.

The Retaining Plates are held in place with ¼ BSF countersunk screws that are then punched to prevent them loosening. On disassembly you will need to drill out the punched area before you have any chance of removing the screw and often these screws can be very difficult. Apply heat first and use a really well fitting large screwdriver, you may only get one shot! If the screw will not come undone then centre punch it and carefully drill using a ¼ in (6mm) drill bit until the countersunk portion of the screw can be prised off and the plate removed. With luck the remaining section will unscrew easily, if not you will need to drill further and use extractors and potentially Helicoils.

Resist the temptation to reuse any screws as they will now be damaged and cause problems if they need to be undone later. When fitting new screws examine them carefully and do a dry fit to ensure that the heads are flush with the camshaft plates

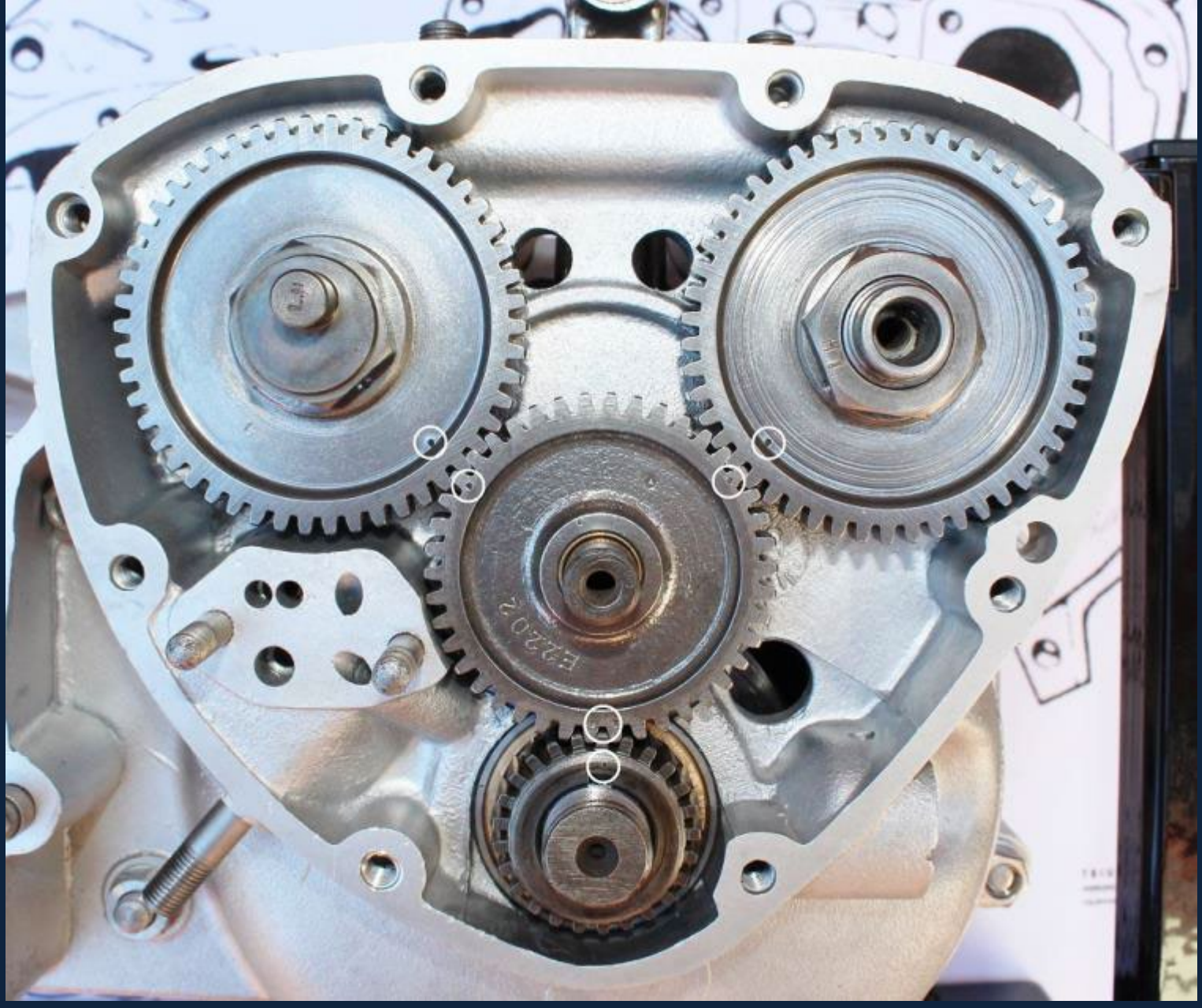
when they are fully tight, if they are excessively proud they will bind on reverse of the camshaft pinion and therefore must be machined or filed before final fitting to prevent binding. Fit the new screws with Loctite 243 (medium strength).



Showing the woodruff key, keyways and the fitting process.

Most Camshaft Pinions have three keyways to allow a degree of adjustment in the valve timing if this desired, note that the standard
keyway is directly opposite the timing mark on the pinion. I additionally punched the standard keyway position during disassembly so that there was no possibility of making an error on reassembly.

Once the camshaft pinions are fully home rotate them to ensure that they are not binding on the camshaft plates or the screws as
described above. If you experience problems remove the nuts again, fit the pinion removal tool Z89 and pull the pinion off slightly until some lateral play (end float) can be felt and then Loctite the nuts into position.



Timing Marks using the Standard Keyway

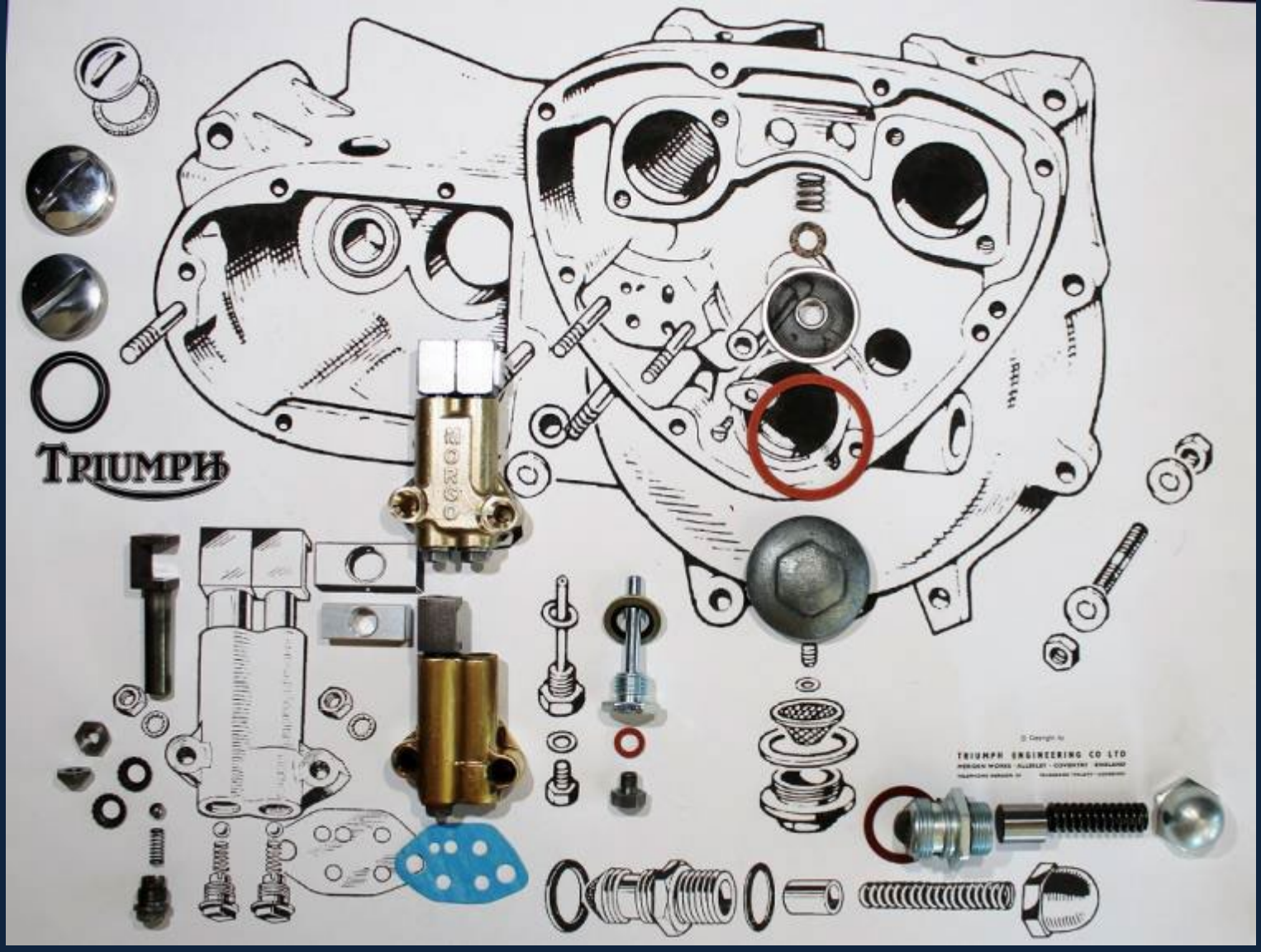
Here the main pinion nut has been removed to show the timing mark and the keyway, once the pinion nut is in place the timing mark
is easily obscured but as an aid corresponds exactly with Top Dead Centre. By using the TDC slot in the Crankshaft if this is fitted and accessible via its plug, Top Dead Centre can be quickly and easily determined.

Refer to Section B30 of the Works Manual for Details on Valve Timing

The Idler Pinion shows a number E2202 that does not correspond with the parts book, it's part number is E6160 and one of the many confusing details you will get used to. Note that the idler pinion uses the Hunting Tooth principle, i.e. having one extra tooth than is mathematically necessary, this evens the wear out on the gear teeth but also means that the timing marks only coincide once every 94 turns of the crankshaft pinion.

Note also the LH marks on the camshaft pinion nuts indicating that these are Left Hand Thread. The Inlet Camshaft Nut also drives the Oil Pump. To loosen these nuts you will need to lock the crankshaft, this can be done effectively by passing a bar through the small ends of the connecting rods and resting this on the crankcase mouth, preferably with some padding and arranged so that the crankshaft is between top dead centre and bottom dead centre.

The Works Manual does not specify a torque figure for these nuts but 25 to 30 lb/ft should be sufficient bearing in mind that both the left hand threads will be self-tightening in their locations.



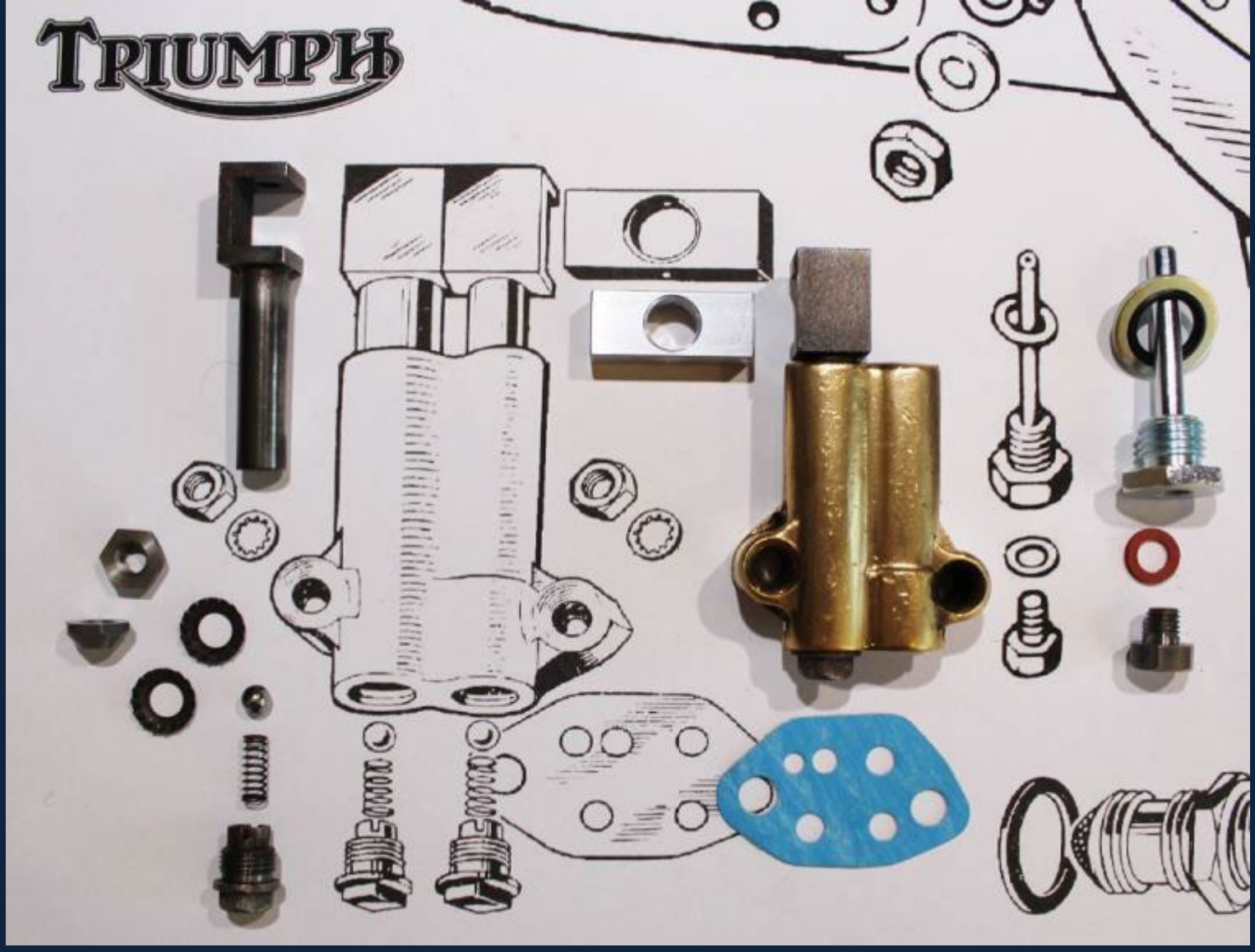
The Oil Pump, Relief Valve, Sump Filter and Gearbox Drain and Level Plug.

Shown is the standard pump disassembled and the Morgo (Big Bore) plunger pump that will be used on this project, both are interchangeable.
The Pump though simple in design and unlikely to fail can contribute to wet sumping issues when the ball valves and their associated springs wear.
The Morgo Pump in Plunger or Gear Type is well made and a good investment for any Triumph project.

The Sump Filter was a standard Triumph design for many years, and comprises of a spring loaded conical filter gauze that recesses into the Cap
Oil draining from the Crankshaft passes through the filter before entering the return pipe in the cap and then to the oil pump.
Any metallic particles that are cast off by the engine and are too large to pass through the gauze will be retained and it is therefore essential
that the gauze is in good condition and that the small cork washer illustrated is fitted. Check the gauze carefully, replace if you have concerns.

The thread for the cap into the crankcase is very fine and easily damaged as is the cap itself and owners should take care not to apply too much
torque when refitting the cap. A smear of thread sealant Loctite 542 or 'Wellseal' will help to prevent leaks or loosening of this critical part.

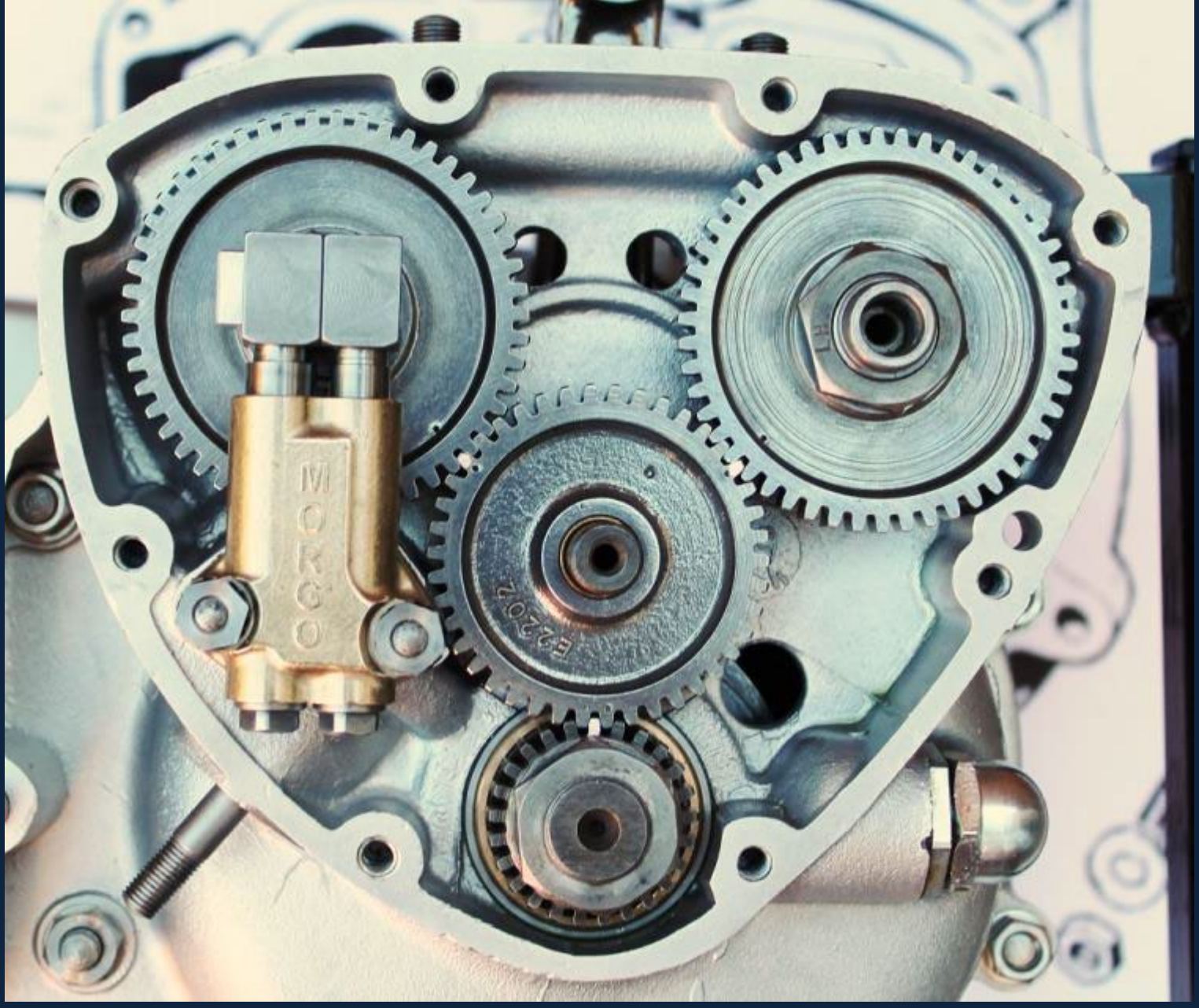
On the right is the disassembled Oil Pressure Relief Valve, excess oil pressure relieves into the timing chest and lubricates the timing gears
camshaft plates and the oil pump drive. Check that the relief valve has not stuck and that the fine gauze is both clean and complete.



The Oil Pump in detail….

Note how the holes in the Gasket must correspond to those in the crankcase and the oil pump, on the left is the return, on the right the feed pump.
The Sliding Block operates both pumps simultaneously drawing oil through the upper holes on the up stroke and then pumping through the valves
to the lower holes; any failure of the ball valves to seat will prevent the pump functioning correctly and lead to either low oil flow or wet sumping.
The pump operates at half engine speed and its output and pressure will be directly proportional to engine speed but expressed as a sign wave.
The specialised nuts and washers to locate the pump are shown on the left. ALWAYS replace the washers and gasket with new parts.

Shown on the right is the gearbox drain and level plug (1/2 in BSF). This allows the oil level to be checked, maintained and drained.



The Completed Timing Side.

The Timing Cover and Parts

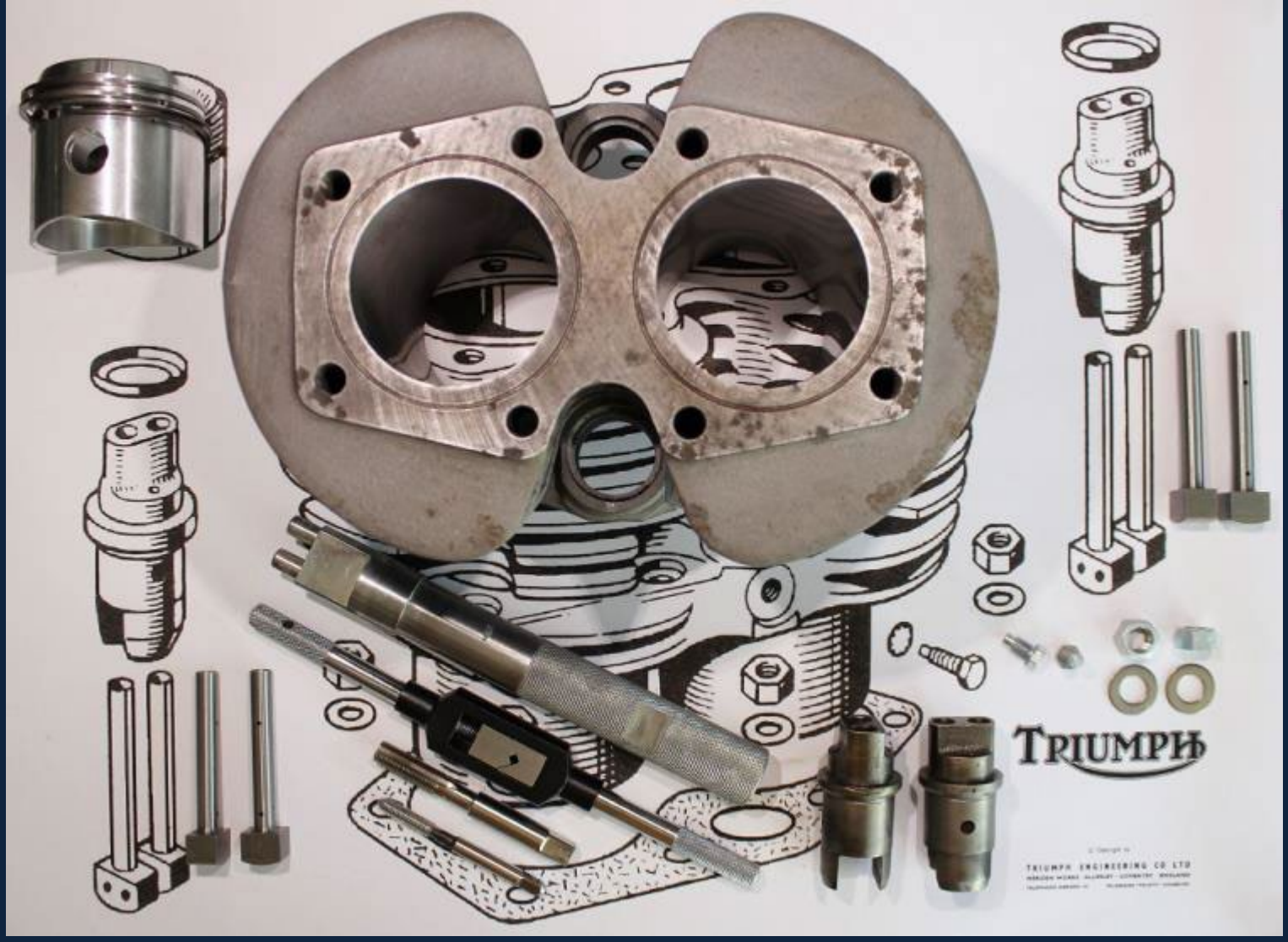
Over the period of production three types of timing cover were used, this is the most common post 1963 version with the access plate and recess
for the ignition system. The rarest parts here are the two pillar nuts that hold the points and the points cover in place, when dismantling
the timing cover store these carefully. As with the clutch cover Allen screws are being used in place of the original fasteners.

To remove the Triangular Patent Plate, insert a thin blunt blade like an Artists palette knife underneath, work gradually at each corner until
the hammer-drive screw is partially raised. Grip the head of the screw firmly with good quality pliers, and as you pull rotate anticlockwise.

To replace the Patent Plate, rest the cover face up on some cardboard or carpet, clean the holes with a fine drill and brake cleaner to
remove any polish and dirt. Offer the new plate up and then the hammer drive screws and tap each in place with a light hammer.

Part 3 Complete

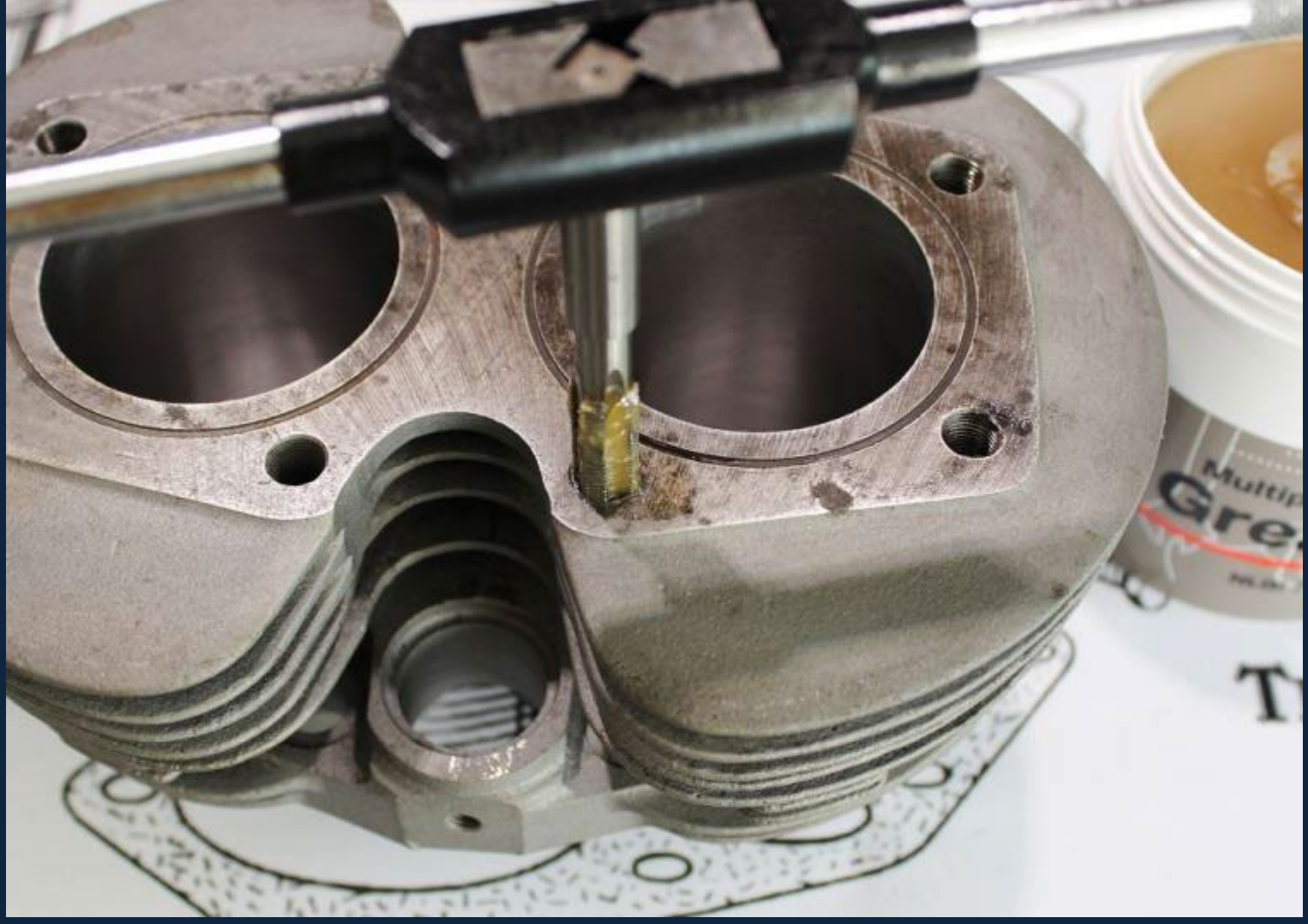
Barrels and Pistons



Preparing the Barrels.

Shown above are the 350cc Barrels, Followers, Guide Blocks, Fasteners and the Tools needed to prepare the barrels for fitting.
Here the barrels have been grit blasted, cleaned, re-bored, honed and new pistons obtained. Note that the illustration of the Cam Followers (Tappets) does not match reality and the oil holes are on the shafts. The correct tool is essential to fit and remove the Guide Blocks and must be obtained before starting work.

Wear in the tappets, guide blocks and push rods is a frequent cause of excessive noise in these engines. The oil system does not provide a pressurised feed to the tappets and infrequent servicing or poor oil supply will lead to rapid wear here. During disassembly keep parts together so that they can be returned to their original locations. Assess the Tappets and the Guide Blocks careful, checking that the Stellite faces of the Tappets are good and that the Guide Blocks are complete and not chipped. If replacing these parts, then always replace them as complete sets.



Cleaning the Threads using a 3/8 BSCY (26 TPI Cycle) Plug Tap

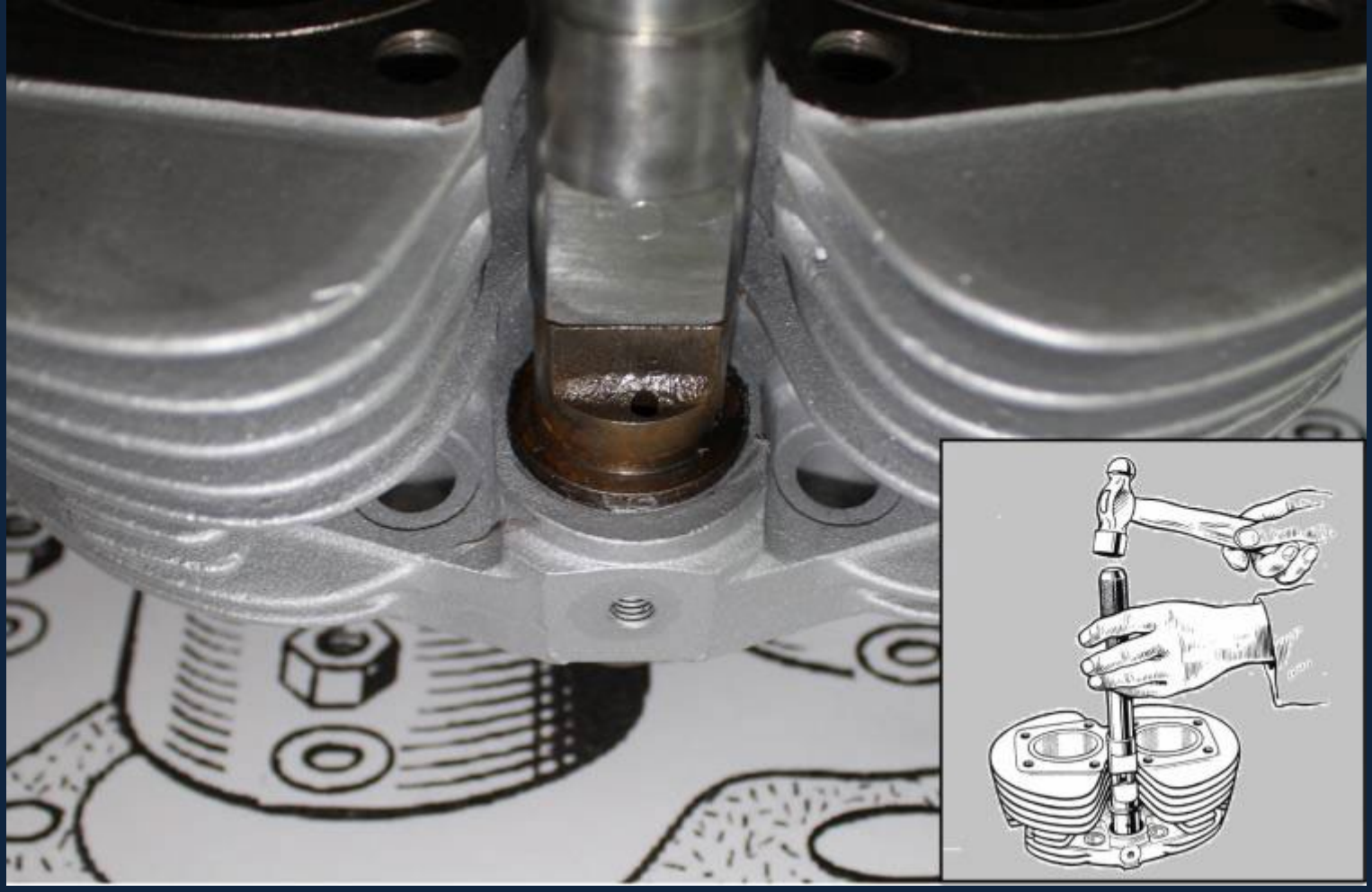
Residual blasting media and swarf sticking to the grease

Re-Tapping the threads ensures that they are clean and that the holes are not blocked in any way that would affect the torque settings of
the cylinder head bolts when these are eventually fitted. Use a HSS Plug Tap and work steadily until all eight of the holes run smoothly.

While preparing the barrels ensure that the passages between the cylinders are clear, these can often become clogged with mud.

Preparing to Spray.

On almost all of the C Range, the Cylinder Barrels were originally finished in a silver heat resistant finish, here the barrels have been carefully cleaned with brake cleaner and masked in preparation for spraying. You will note the part number E3698 is just visible together with the foundry batch mark.

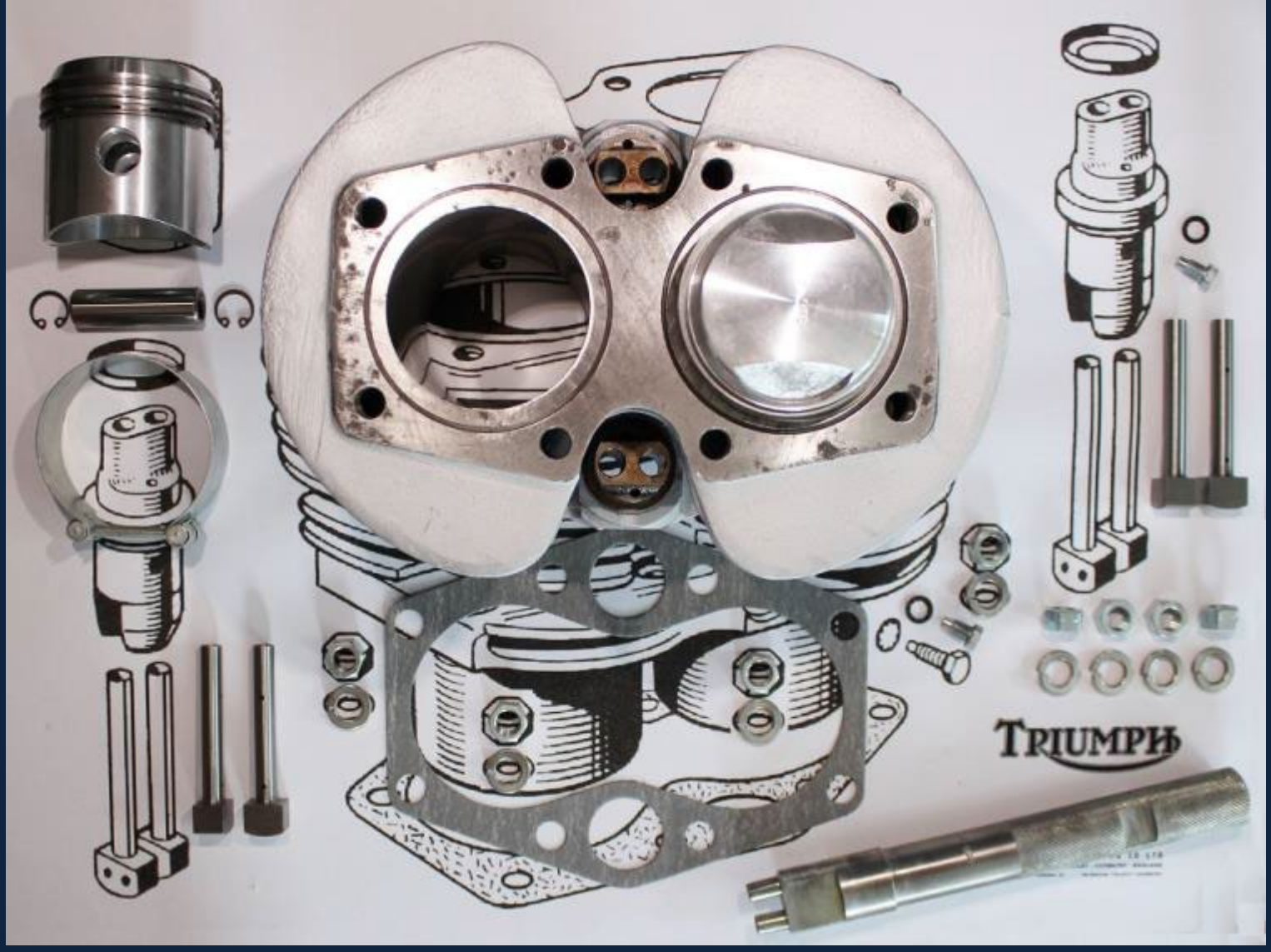


Fitting the Guide Blocks

Section B20 of the Works Manual.

By heating the barrels to 180’C fitting the Guide Block is eased, especially if these have been chilled, you must use the correct tool
as there is a danger of damaging either the Block or the Barrels. Try to avoid twisting the block during fitting and make sure that the recess in the block for the screw lines up on assembly and completion.

Oil leaks that appear to be from the push rod tubes are frequently caused by oil creeping up the Guide Block from the crankcase.
A smear of silicone on the upper part of the block or some thread sealant applied should help to prevent oil leaks at this point.
Late type Guide Blocks feature a machined groove for an O ring, it may be feasible to modify the standard ones.

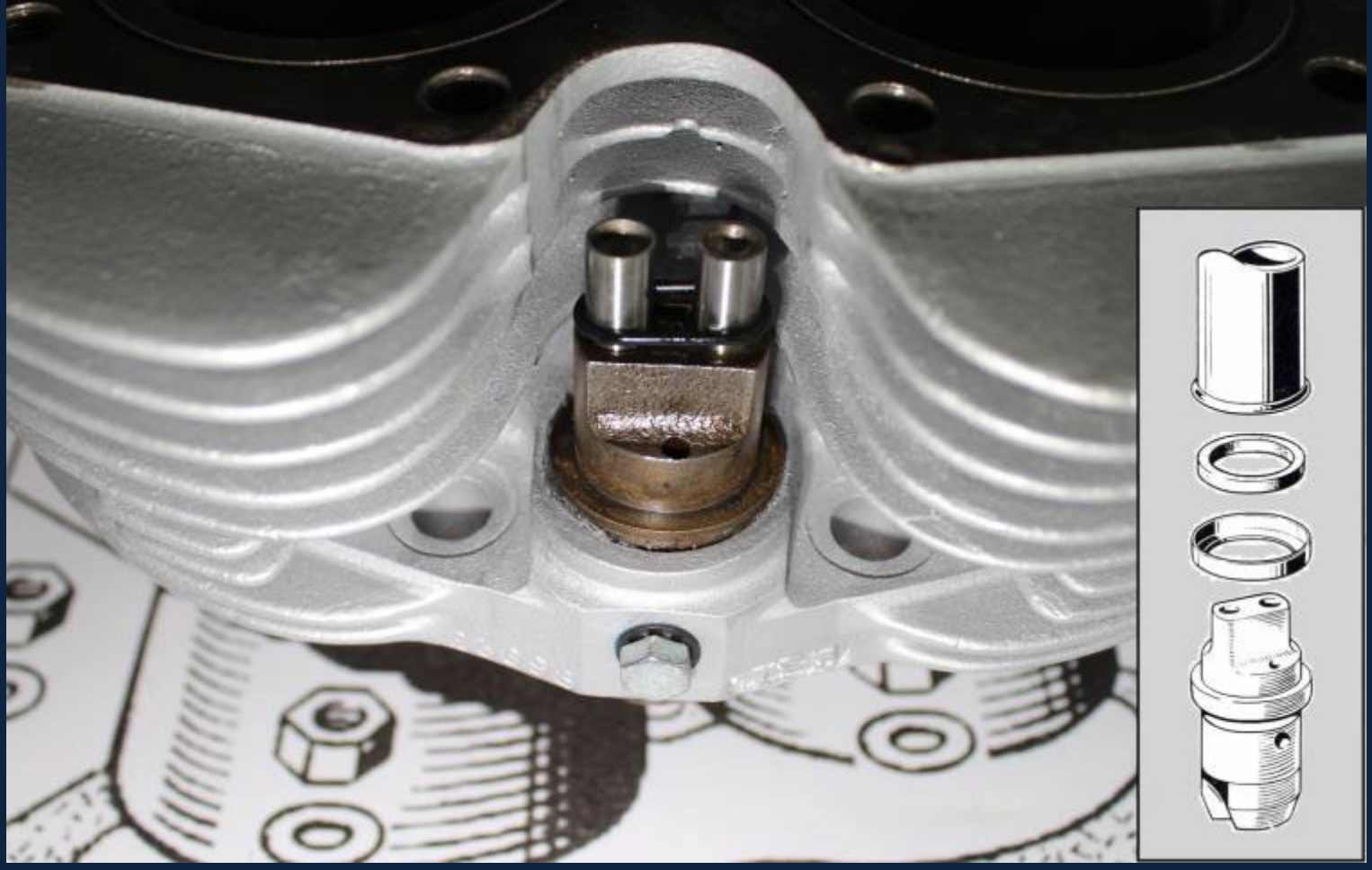


The Pistons, Pins, Gasket, Cam Followers and Tools

Section B18 of the Works Manual

The Eight thin nuts used to attach the barrels are specialised parts, 3/8 in BSCY, part number E2412 and are used with the corresponding thick washers, part number GS308. To tighten them you will need a modified 1/4 in Whitworth ring spanner.

Modify the spanner by carefully grinding off some of the outside of the 'ring' until it fits readily but do not compromise the
strength of the spanner too much as you will need to apply a considerable force to loosen or tighten these nuts. (35 lb/ft)
After 1968 the nuts become the '12 Point' type and correspond to the new barrel studs now in 3/8 UNF & AF



Holding the Cam Followers in Place with an ‘O’ Ring

Once the Cam Followers have been fitted they need to be held in place, I have found that a small ‘O’ ring is very effective. The same principle of securing the followers applies when removing the barrels or removing the camshafts. The Diagram shows the arrangement of the lower push rod tube seal and its ring.

Pistons and Rings

The Pistons, Pins, Rings and Circlips

Shown is the general arrangement of the pistons fitted across the C Range from 1957, above are a pair of genuine Triumph Pistons showing the part number and also the mark AM for Aircraft and Motor, the Redditch foundry that supplied the Factory with numerous part finished castings. Note the valve pockets on these Tiger 90 pistons and the Top marked on the upper surface of the left hand piston ring, this must be fitted uppermost.

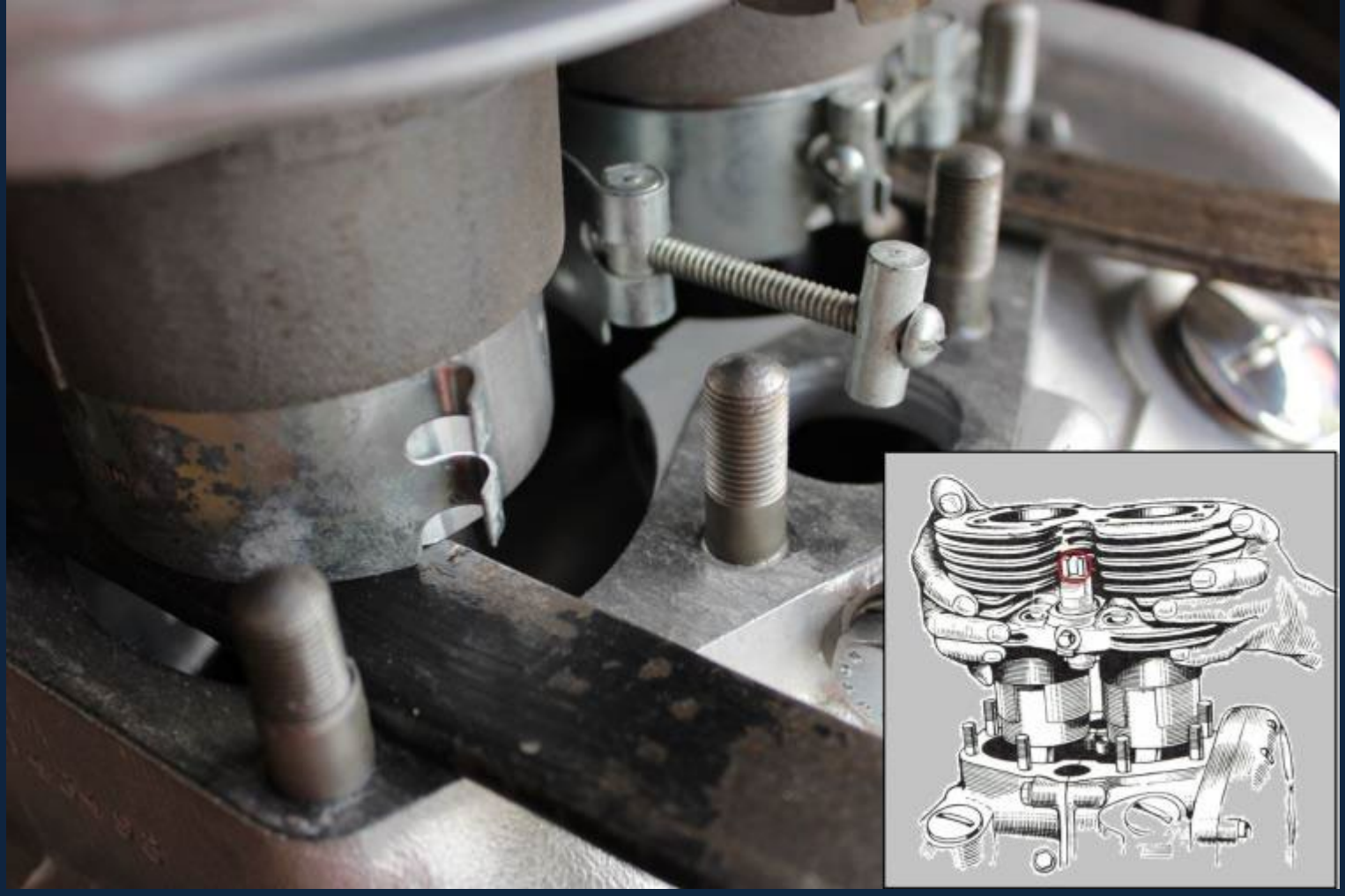
Refer to the Works Manual for details of how to measure these components to assess for wear but note that new pistons can be difficult to obtain and while you may have to compromise always replace the Circlips with new ones.
Piston removal and fitting details are below and in section B21 of the Works Manual.

The Pistons have been fitted to the Connecting Rods.

Refer to Section B21 of the Works Manual.

Here the cylinder barrel studs have been fitted along with the base gasket and the two hidden crankcase mouth screws. The four central studs that penetrate the crankcase have been sealed with thread sealant to prevent oil creeping up the threads and the gasket has been lightly coated with silicone grease and sealant on both sides to prevent it sticking.

To remove the Pistons stuff the crankcase mouth with a clean lint free cloth, support the pistons with bars as below and carefully prize off
the circlips, heat the piston crown gently to approximately 100’c and then use a gudgeon pin extractor or a punch to drive the pins out.
There is no need to drive the gudgeon (wrist) pin fully from the piston, only enough to release it from the connecting rod.



Using two Tyre Levers or Bars to support the Pistons

The Barrels will only fit one way as there is a machined face on the right, ensure that you have them the correct way round.

Examine the pistons to identify which way round they should be fitted and then carefully fit the inner circlips to each piston.
By heating the piston to 150’C and chilling the gudgeon pins they should press fit by hand and the pin will automatically press up against the fitted circlip. Fit the second circlip and then press or tap the gudgeon pin back slightly so that the both circlips are not under lateral pressure from the pin.

Turn the crankshaft so that bottom of the piston skirts are above the crankcase and insert two bars as shown above to support the pistons. Check that the piston rings are correctly positioned so that the gaps are spaced evenly and then fit the ring compressors, lightly lubricate the bores and then gradually and carefully lower the barrels onto the pistons so that the ring compressors are displaced until they can be safely removed.

The Pistons fitted to the Barrels

The Piston Ring Compressors have been released in preparation for their removal and all the studs are in place, note the spigot on the nearest stud that locates the barrel accurately and corresponds with another stud diagonally opposite. Lower the barrels, remove the bars and complete the fitting process, tapping with a mallet if necessary.

Once the barrel is fully home fit the thick washers and nuts and gradually tighten them, diagonally in opposite pairs. Refer to the Data in the Works Manual for the Torque Values.

Engine assembly can continue on the bench but you should consider fitting the Engine now before it grows any larger. The complete Engine will weigh about 47 kg (105 lb) but at this stage of assembly is much more manageable. Refer to Section B1 of the Works Manual for instructions.

Completed Barrels

Here the Engine has been fitted to the Frame and the Cylinder Head joint has been coated with ‘Wellseal’ The Push Rod Tube seals have been fitted and the Tubes rested in place in preparation for the fitting of the Copper Head Gasket and the prepared Cylinder Head.

Part 4 Complete

Cylinder Head

The Cylinder Head Assembly

Section B13 of the Works Manual

Shown above are the parts for the Cylinder Head including the push rods and tubes and the types of specialised bolts needed.
Originally the bolts would have been cadmium plated, now impossible. If you have examples of the original bolts to hand these can be re-manufactured in a suitable grade of stainless steel EN15 and will give good service for many years.

The parts book shows two part numbers for push rods, the cups are in steel or bronze and there is a slight difference in length.
Check the push rods for wear at both ends and discard any rods that have chipped cups or are bent. The rounded end can be carefully redressed to remove burrs provided that only the minimum of metal is removed and the profile retained.

Over the production period of the 'C' Range, Triumph produced several cylinder heads to suit the various models and to the
casual observer they can all look alike. The cast in number visible between the inlet ports will help to identify what model the
head is for but also assess the valve sizes and the combustion chamber size to confirm if you have a 350cc or 500cc or head.
Refer to the data sheets in the Works Manual for additional information.

There are no date marks on the C Range heads so it is impossible to identify when the cylinder head was manufactured and the alpha numeric code stamped near the right inlet valve relates to a batch number rather than a date.
Early cylinder heads can be identified by the exhaust stubs with holes rather than the later slots.

After cleaning the cylinder head look carefully for cracks and assess the condition of the valves, seats, springs, collars and the

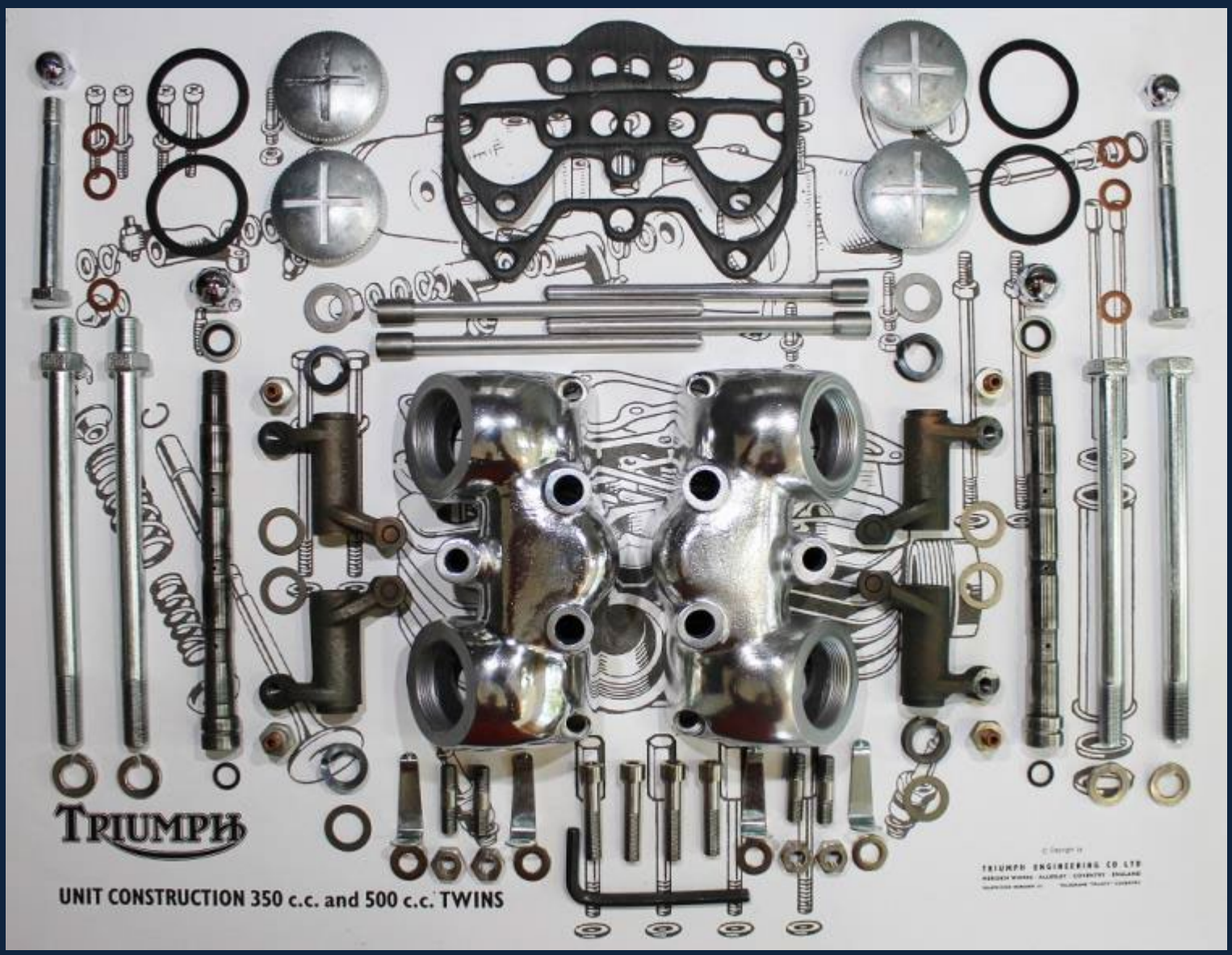
valve guides and look for damage to the cylinder fins and spark plug holes; these can be repaired but should be left to a specialist.
You should consider replacing the springs and the valve guides as the parts are inexpensive, note that two types are available
iron or bronze. Fitting will require a drift being made to both drive out the old guides and drive in the new ones and then the guides may need to be reamed and the valve seats re-cut or even replaced.

Most of this work is beyond the capability of the average owner but not of a cylinder head specialist or engineering shop. You will need a suitable G clamp type valve spring compressor in order to fit the valves, springs and collets.

Prior to fitting the head re-tap and clean the threads using a suitable Tap (1/4 BSF) and dress the faces for the rocker boxes. Press the upper seals for the push rod tubes into the head, fit the lower collars then the lower push rod tube seals.

The Copper Head Gasket should be annealed before use, even if it is new and unused. To anneal, heat the gasket over a gas flame until it is cherry red and then plunge into cold water. Use the gasket within a few hours and apply Wellseal to both surfaces so that a good gas tight fit will be created.

Rocker Boxes

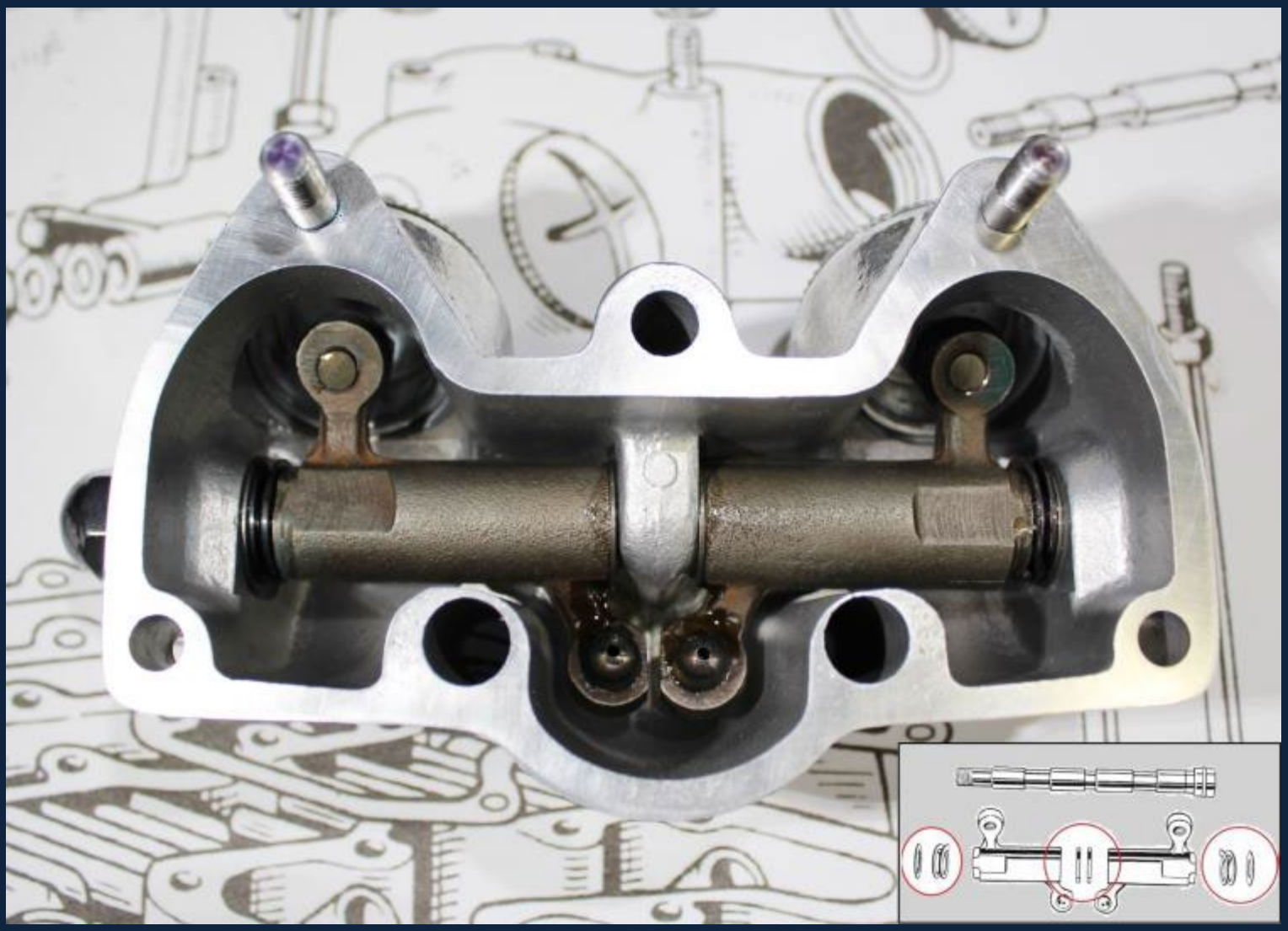


The Rocker Boxes and Parts.

Sections B2 to B5 of the Works Manual

This being a 1966 3TA shows the steel push rods and early type rockers that continue in use until 1968.
There was a gradual process of change but with the rocker boxes most of the parts are interchangeable.
Note that the rocker boxes are “handed” one for the Inlet and one for the Exhaust.

Also shown are the steel mesh lined gaskets that are an improvement over the fibre or paper types, performance Allen Key valve clearance adjusters and Allen key fasteners. All owners should consider fitting the retaining clips that became standard from 1963



Rocker Box Assembly

The studs have been replaced with versions in stainless steel; the thread into the Rocker Box is ¼ BSF while for the nut it is ¼ BSCY.
The studs were marked and then removed so that the gasket face could be Linished flat. Linish using 400 grade wet and dry paper
laid on a sheet of plate glass, remove only enough metal to achieve a flat surface and offer the rocker box up to the cylinder head
periodically to check the fit. Clean carefully, re-tap the threads and then use a suitable stud sealant to locate them securely.

Before assembly check that the oil way in the rocker box is clean, this is a diagonal drilling that connects oil feed bolt with the central support,
also check that the hollow rocker shafts and the three oil holes are clear, and in these early rockers that the oil way internally is clean.

Look for cracking around the head bolt holes, this is quite common but usually nothing to be concerned about unless excessive.

Fitting the Rockers and the washers can be tricky, try passing bar through the components before offering up the rocker shaft.

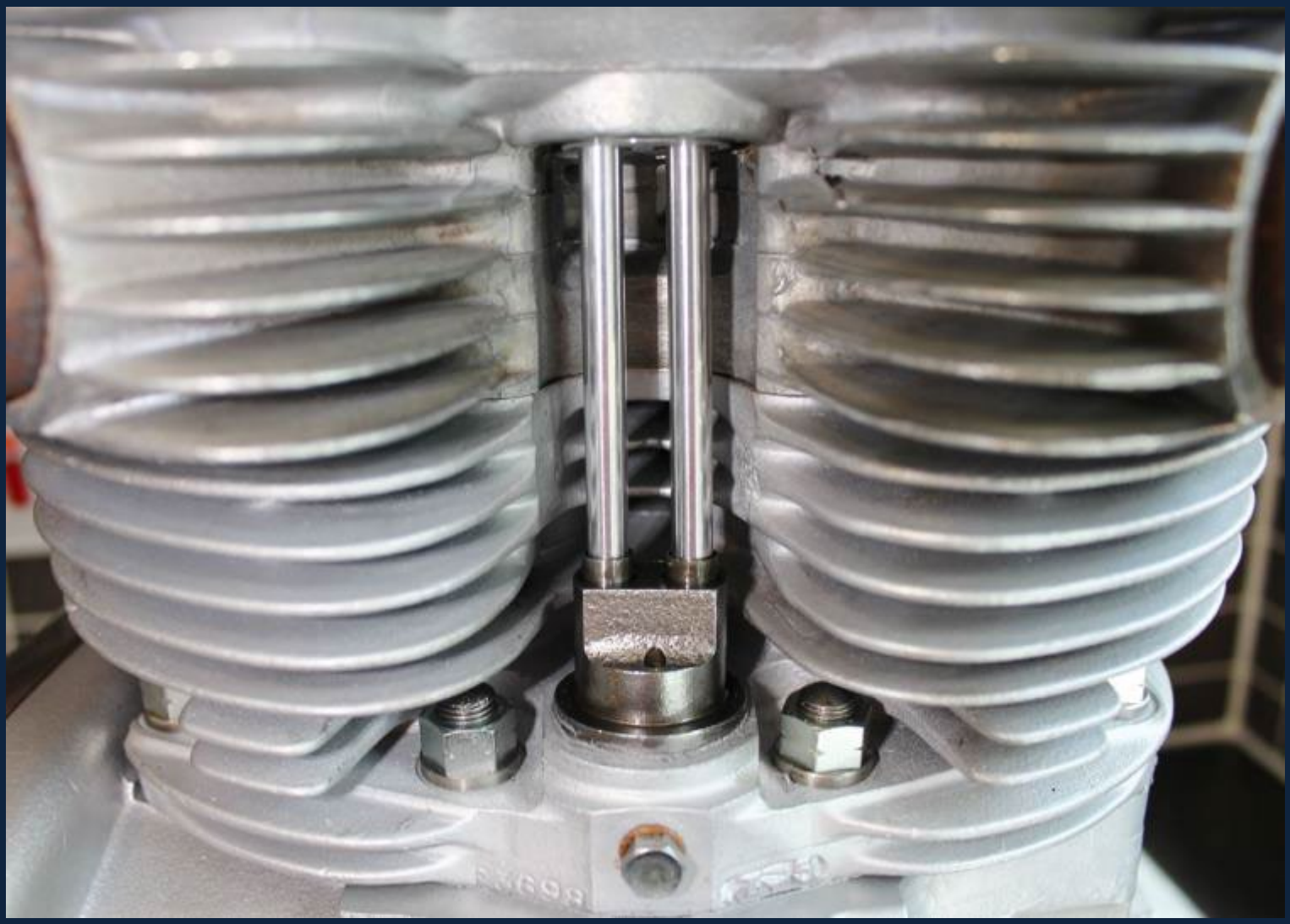
The Rocker Shaft is in two parts, a hardened shaft and a pressed/shrunk on mild steel cap that holds the small O ring seal. It is possible to machine off this cap and replace with one in stainless steel and to improve the location for the 'O' ring. Without the special tool shown in the manual when fitting the rocker shaft the O ring can be 'Cut' as it presses in.

Leaks past the O ring are quite common especially if it has been damaged during fitting.

Before fitting the Rocker Boxes ensure that the Adjusters are at their minimum settings, that the rockers move freely and evenly and are positioned to readily engage the push rods.

Fitting the Cylinder Head

Refer to Section B13 of the Works Manual



Test Fitting the Cylinder Head

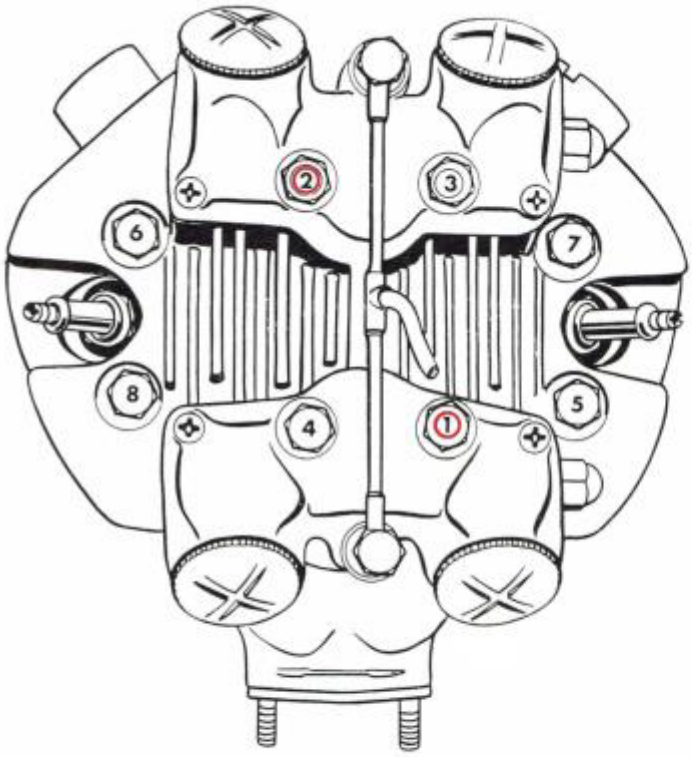
Shown is the arrangement of the Push Rods when they are fitted, note that they and the cover tubes when fitted are NOT held
vertically but pitch inwards slightly at the top. The seals when fitted are thick enough to take up the angular difference.

Fit the annealed copper cylinder head gasket appropriate for your machine, check that the push rod seals are in place and place the cylinder head loosely onto the barrels ensuring that the push rod tubes engage into their locations.
Fit the four outer bolts together with their thick washers and tighten only enough to draw the head down.

Fit the Rocker Cover Gaskets and insert the push rods, cup end upwards tipping them slightly and turning them until you feel them engage with the followers. Turn the Crankshaft until the two inlet pushrods are at the same minimum height and then fit the inlet rocker box, making sure that the push rods engage with their respective rockers.
Fit and tighten the bolts to pull the rocker box down. Repeat the process for the exhaust rocker box.
Loosely fit the oil feed bolts and copper washers, but do not fit the remaining screws and nuts.

Tighten the 8 Cylinder Head Bolts gradually following the Sequence in the Works Manual (Below)
then fit and tighten the remaining fasteners and finally adjust the valve clearances. Section B5.

Fit the Oil Feed Pipe as shown below. It is vital that the upper pair of copper washers do not restrict the flow of oil into each rocker box, as the rockers and camshafts will be starved of oil and wear rapidly.
Test the oil passages by removing both of the rocker spindle nuts and using a pressure oil can; pump in oil until it appears out of the other rocker spindle.



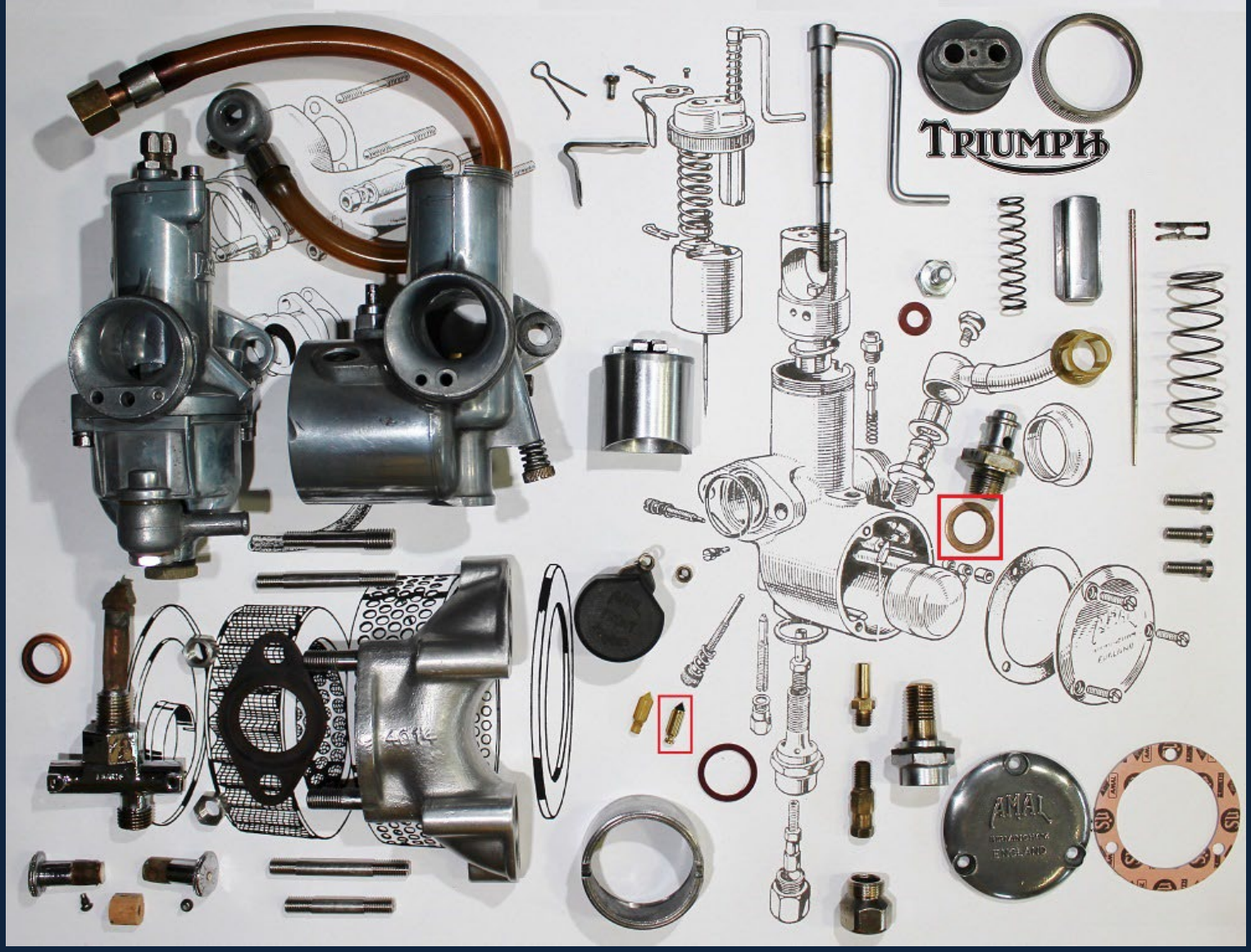
Cylinder head bolts ($\frac{3}{8}$ in. dia.)	..	25 lb./ft.
Rocker box nuts	..	5 lb./ft.
Rocker box bolts	..	5 lb./ft.
Rocker spindle domed nuts	..	25 lb./ft.

Fig. B14. Cylinder head bolt tightening sequence

Once the Cylinder Head is fitted turn the engine over carefully by hand to ensure that nothing is amiss. Before attempting to start the engine pour some oil into each rocker box and prime the oil feed pipe and the rocker shafts by removing one of the Domed Bolts and using a pressure oil can to fill the galleries, rockers and the oil pipe.

Part 5 Complete

Carburettor



The Fuel Group

Shown above is the complete Amal Concentric Carb and a dismantled Monoblock Carburettor together with the other parts that make up the Fuel and Induction system. The Inlet Manifold shows the part number, here for the Tiger 90, Note that various manifolds are available and you should check that you have the right one for your machine.

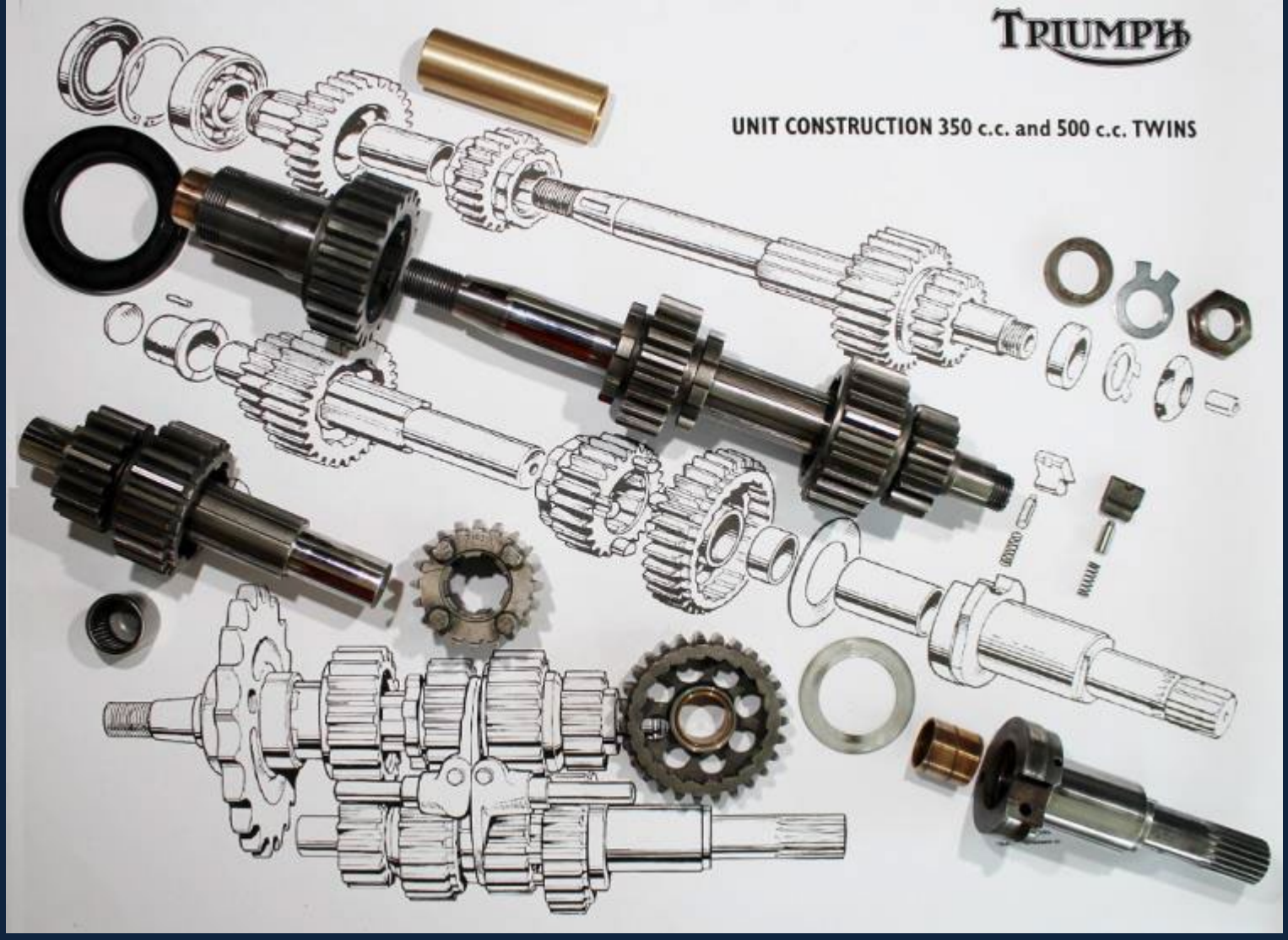
The highlighted parts are the later type float valve and a copper spacer washer. Once the float valve is fitted ensure that it shuts off correctly and that the “Tickler” when depressed will allow the carb to flood. The fuel level can be adjusted by fitting, thinning or omitting the copper washer between the float valve body and the carburettor.

Spare parts for both Carburettor types are readily available as are new replacements, check against the Data in the Works Manual for details of the various Jets, Needles and Slides, and resist the temptation to use non-standard settings. The Factory settings were optimised in conjunction with Amal to give the best results across the performance envelope for each Triumph model in its standard state of tune.

If you have changed your machine from the Standard Specification in any way, such as fitting higher compression pistons, bigger valves, non-standard camshafts and followers, exhausts and silencers. Or omitted air filters, baffles and balance pipes you cannot expect the standard carburettor settings to work and you, and you will have to undertake additional research, and experimentation to optimise the settings.

Part 6 Complete

Gearbox



Gearbox Mainshaft, Layshaft, Gears and Parts

Section D of the Works Manual

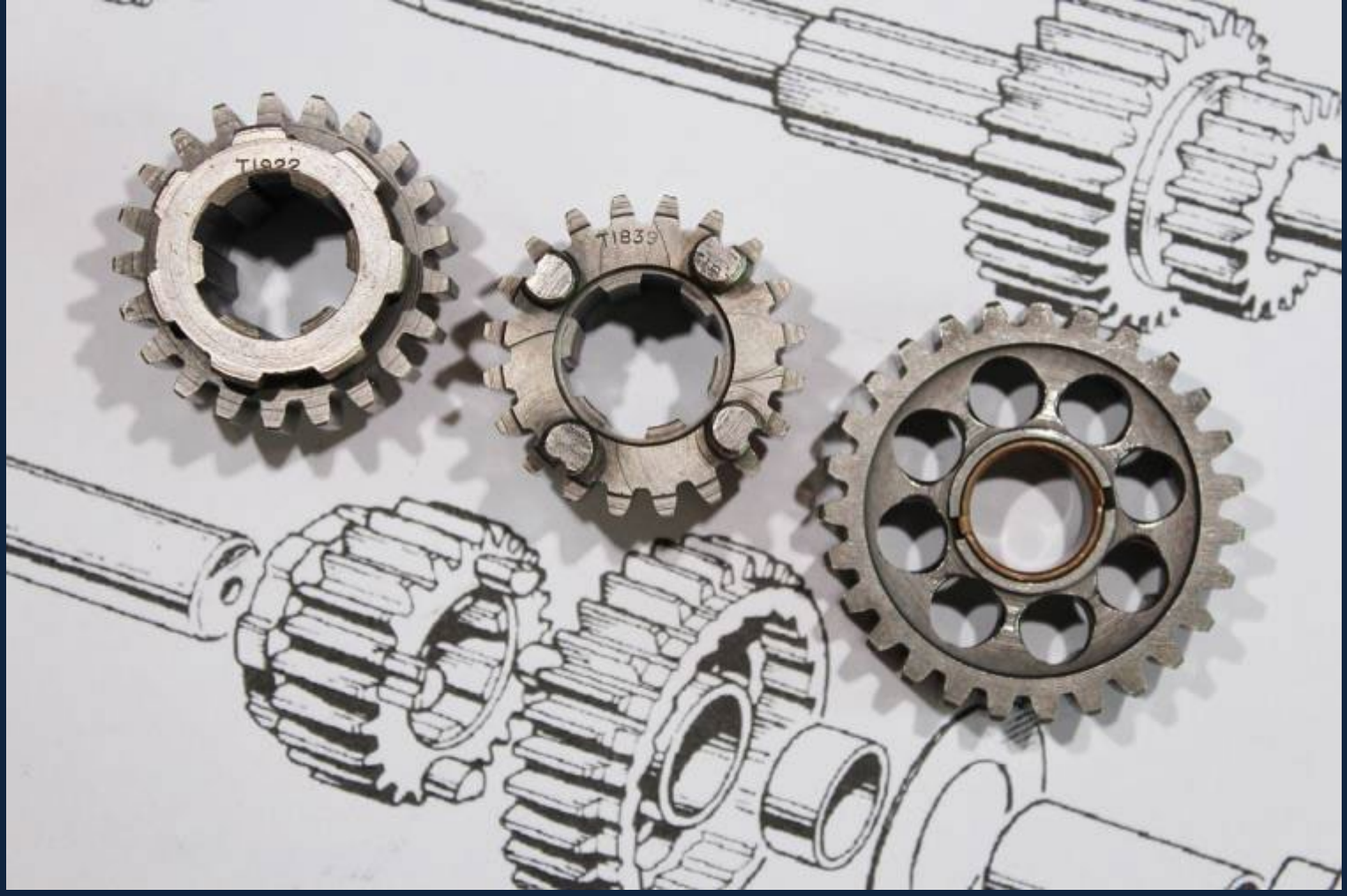
Shown above are the various gearbox components superimposed on the parts book, at the top is the Bronze Bush that is pressed into the High Gear, this is frequently damaged where it passes through the oil seal behind the clutch. Replacing this bush is generally beyond the capabilities of the average owner as the it may need to be machined or pressed out and the new one reamed after fitting.
Within the Bush is an Oil Scroll designed to draw oil across the Mainshaft and back into the gearbox.

This being the 3TA gearbox; the Kickstart Spline is arranged for a bush rather than a needle roller bearing.

Though at a glance the gearbox components used across the various models over the production period from 1957 to 1974 look
similar do not be deceived. There are several detail differences between models and after 1967 with the introduction of unified threads the differences multiply. Study the parts books with care and also refer to the supplementary information provided in the Parts Bulletins; especially when you are assembling a machine from spares.

To remove the bush or more particularly the needle roller bearing within the Kickstart Spline may require some ingenuity as the hole is blind, the works manual recommends heating the Kickstart Spline and tapping sharply on a block of wood. More often than not you will have to devise an ingenious alternative… by prizing out the rollers and filing a washer to an oval shape so that it can be inserted with a bolt, a puller can be made to extract the remains of the bearing.

No special tools are needed for the gearbox but if a spare Mainshaft 2nd gear T1922 is obtained this can be held in a vice and used to lock the Mainshaft to allow the nut to be loosened and tightened with the gearbox dismantled.



Gears and their Part Numbers

Triumph Gears usually feature the Part Number which makes identification a lot easier when you have a box of bits to work with.
Note here the excessive wear on the Layshaft low gear (right) where the holes have become elongated, this will be replaced.

T1922 is the standard Mainshaft 2nd gear, T1839 is the standard Layshaft 3rd gear, and T1950 is standard the Layshaft low gear.
On some models such as the T100C and Military Machines you will find a Wide Ratio Gearbox,
While a Close Ratio set was available as an option for the T90 and T100.

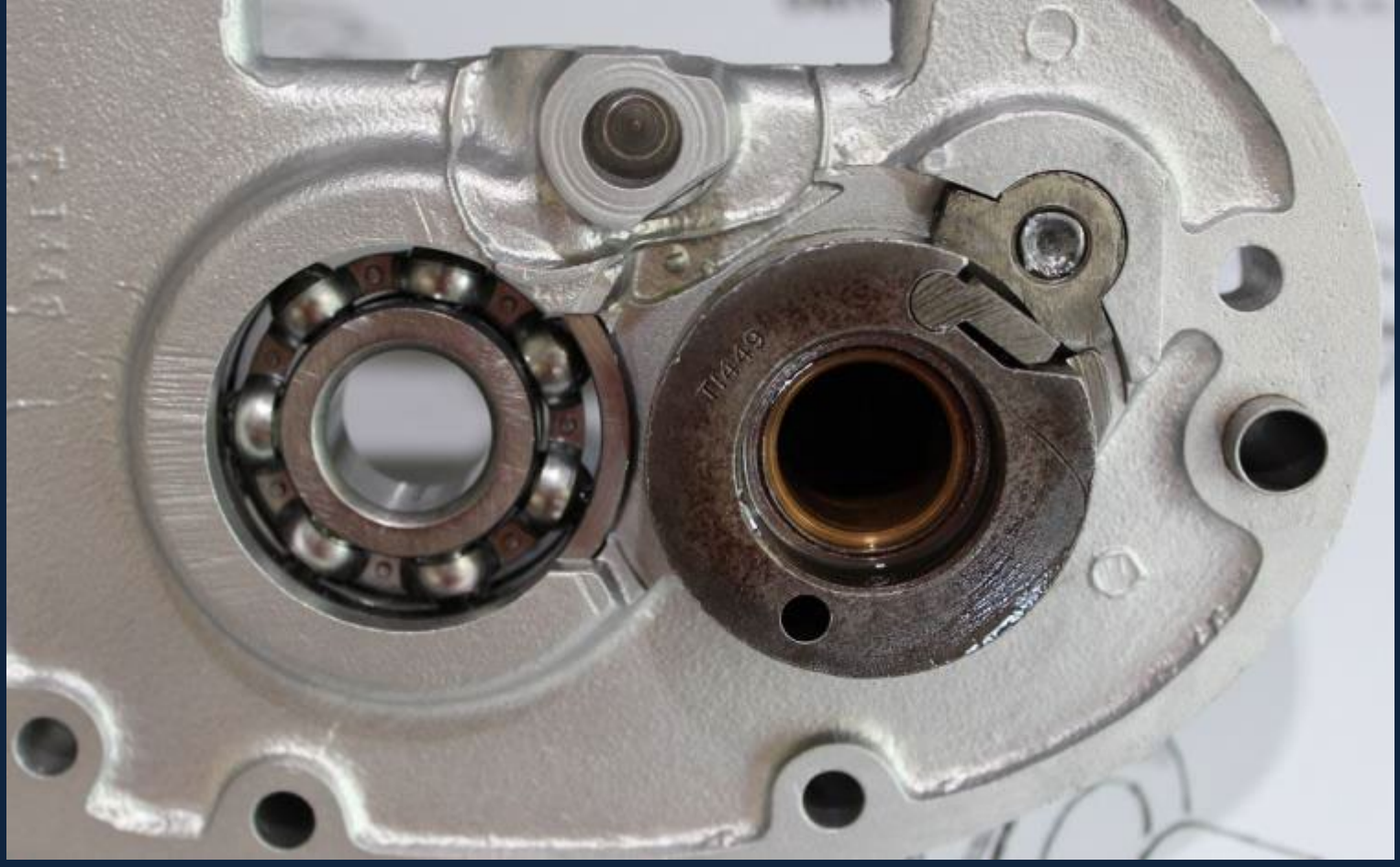
Refer to the Parts Books, Bulletins and the Works Manual for additional information.

Detail of the Gearbox Bearing and Layshaft Bush

A new gearbox bearing has been fitted during the crankcase preparation, the plain bush here was deemed serviceable.

Removal and fitting of the Layshaft bush or the more common needle roller bearing should be done while the cases are hot. Make up the drift suggested in Section D9 or alternatively use a front wheel spindle to drive the bearing squarely. The needle roller bearing must be almost flush with the back of the gearbox when it is fitted.

During preparation of the Crankcase you should have re-tapped the gearbox drain, ½ in BSF. If not do it now and check the Drain and Level Plug before fitting this with bonded or fibre washers.



Showing the Kickstart Shaft Fitted and the arrangement of the Ratchet Stop

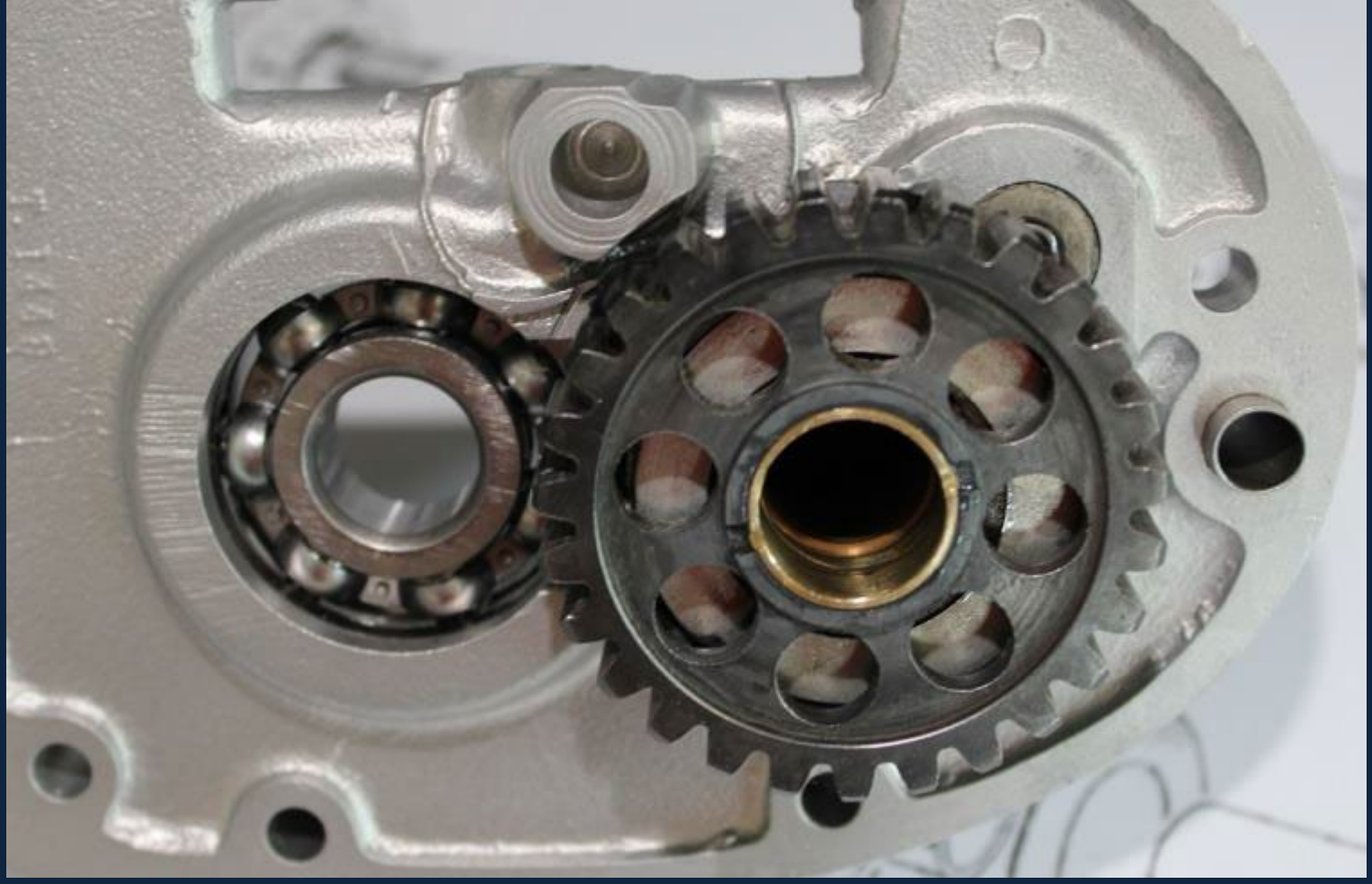
Here showing the gearbox intermediate cover from the inside with the bearing and Kickstart Spindle Fitted, on the right is the
Hollow Dowel that together with another just out of view locate the gearbox correctly, ensure that these dowels are in place in
the intermediate cover and that the corresponding locations in the crankcase are clean and free of blasting media and swarf.

The kickstart spindle shown here is type fitted with the bush and described in the parts book (No: 7) as part number T1445.
You will note that the part number stamped on the spindle is T1449 which may be a factory error !
The part number for the spindle suitable for the T90/T100 needle roller bearing is T1981.

As the Kickstart is operated, turning clockwise in this view, the Ratchet is released by a small plunger and spring and engages with one of the teeth within the Layshaft First Gear turning the whole assembly and transferring the stroke to turn the engine over. Once the engine fires the ratchet is overridden and when the kickstart lever returns to the upright position the ratchet is then pressed into its neutral position seen above.

The screw that holds the stop plate is specialised and has a dual role, acting as the locator for the Kickstart return spring. It is punched over as shown above to prevent it from coming loose and releasing the stop into the gearbox

During assembly check that the ratchet spring and its plunger have not broken, to reach the spring, depress the plunger and At the same time move the ratchet tang to the right to release it. The plunger and spring will now pop up.
Clean the recess, spring, plunger and the tang and replace and oil the assembly.



Thrust Washer and Layshaft 1st Gear Fitted

Fit the Thrust Washer and then the Gear, the ratchet described will recess once the shaft is home and the gear should turn freely.

The Mainshaft Fitted and Secured

This is the Gearbox intermediate cover from the other side showing the kickstart spline, spring locating screw and the end of the Mainshaft
now assembled into the bearing and lightly held by its nut and lock washer. The bearing is located by a large circlip just visible.
Visible within the Mainshaft is the small bush for the Clutch Pushrod.

Do not force the Mainshaft into the bearing by striking it, instead select a suitable sized socket or tube that matches the inner race
and use this to apply controlled blows and only if they are necessary. You will not be able to tighten the nut fully until the engine is back in the frame and the rear chain and rear brake can be used.

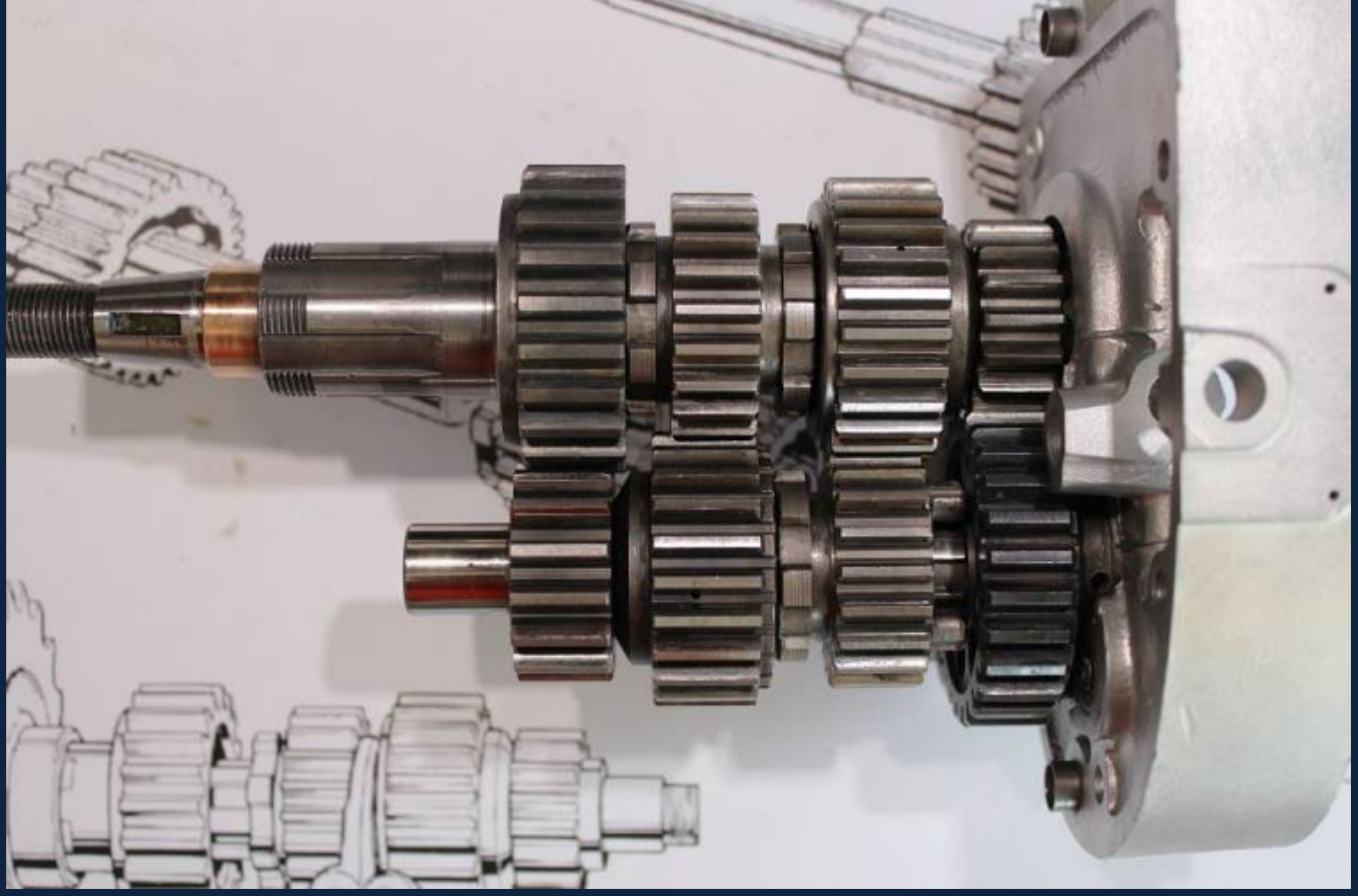
When dismantling the Gearbox do not forcibly strike the Mainshaft from the clutch side in order to break the sealant joint even though this is recommended in section D4 of the Works Manual. You risk damaging the bearing and it's housing here in the intermediate cover by forcing the bearing against the circlip.

On many gearbox covers you will see damage where impatient owners have resorted to sharp implements.
Apply heat or solvent to soften the sealant and then work gradually, striking with a hide mallet around the cover to break the seal. A change in note will tell you when you have succeeded.

Use MEK (Methyl Ethyl Ketone) or Acetone to soften or remove old sealants.

Mainshaft with First and Second Gears Fitted

The First Gear cluster is pressed onto to the Mainshaft while the Second Gear is free to rotate, check the condition of the gear teeth.
Generally the gearbox components for the 350/500 cc machines will be in a usable condition provided that the machine has been
maintained and not abused, we noted the wear earlier on the First Gear and above you will see that a new one has been fitted.



Gear Clusters Assembled onto the Intermediate Cover.

Once the Mainshaft is in place the remaining gears can be assembled to create a complete cassette as above. Note the arrangement of the two sliding gears and the annular slots for the two selector forks

.

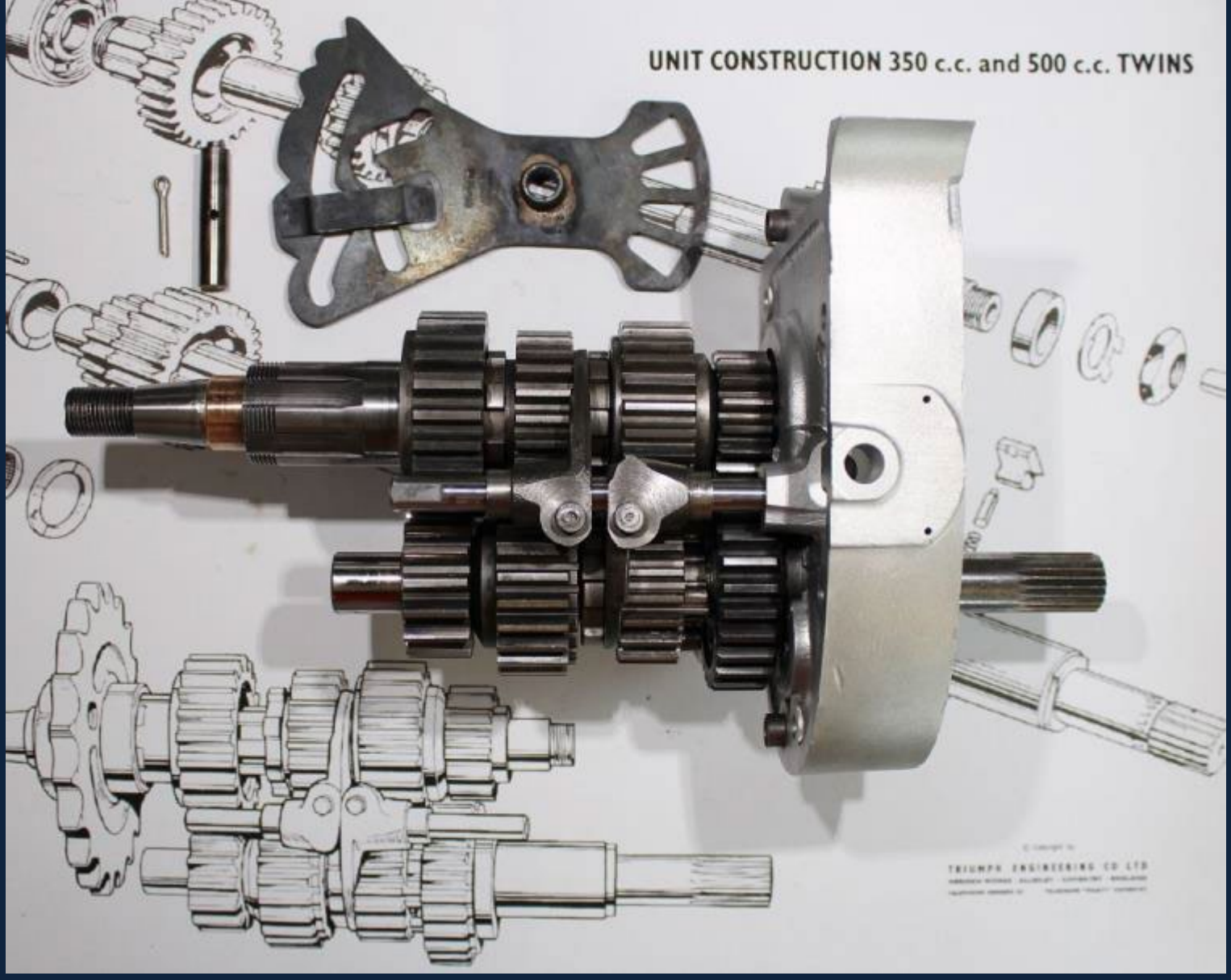
The Selector Forks and Parts

Shown are the selector forks, their shaft, the plunger and spring and the spindle for the quadrant with its split pin, pointer and screw.
The original quadrant was badly worn. Both Quadrants are of the improved type with the bridging piece introduces by 1961.

Examine the indexing plunger for wear and check that the spring is in good condition, the Gearchange can be optimised by dressing and polishing the track and indentations for the plunger in the quadrant seen at the top of the picture.

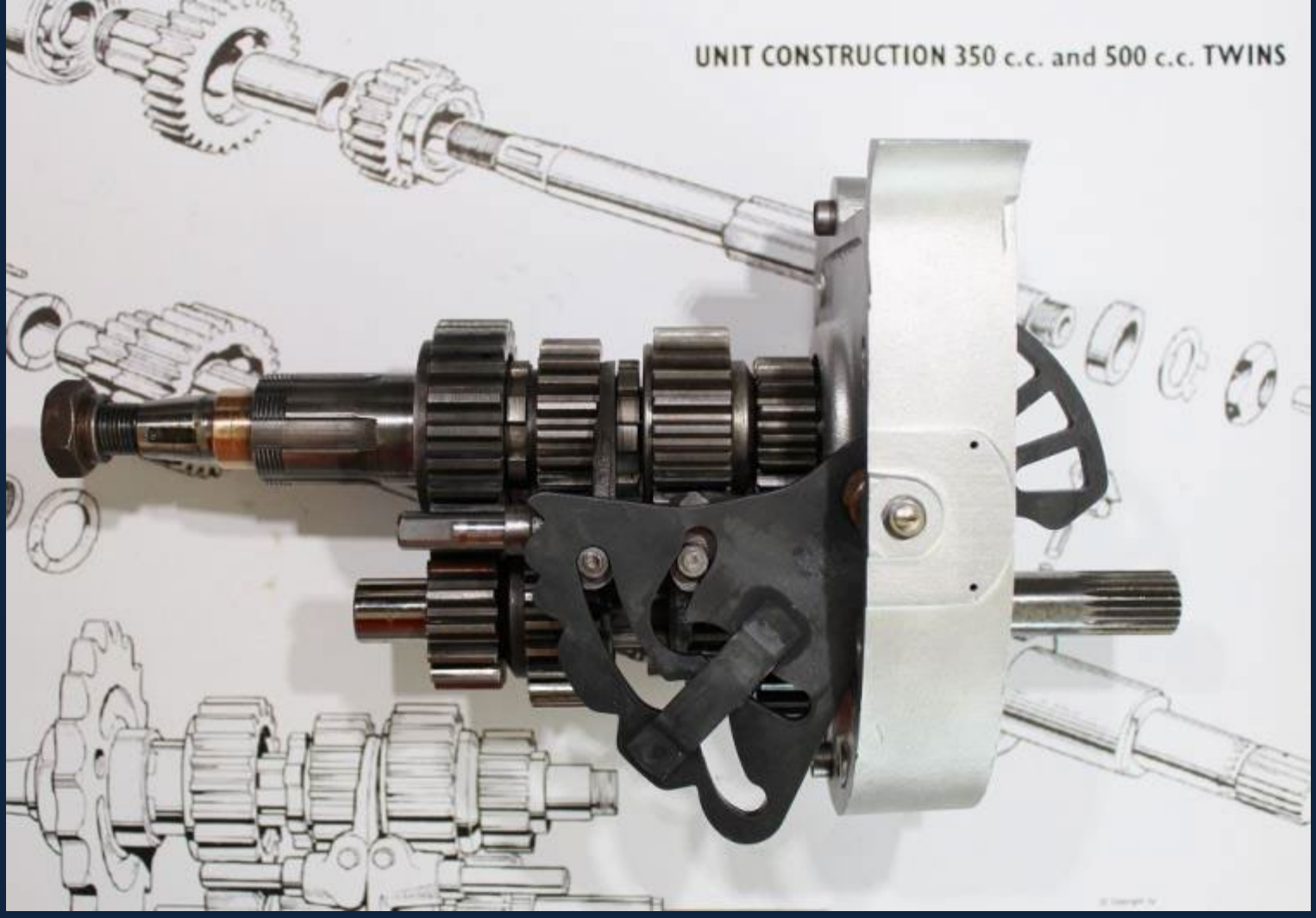
Check the selector forks are undamaged and that the small bearings that run in the tracks of the quadrant are free to turn and oiled.
When selecting a split pin for the trunnion choose one that fits snugly, don’t worry about it being too long as it can be cut to length.

Locations for the Plunger and Selector Shaft



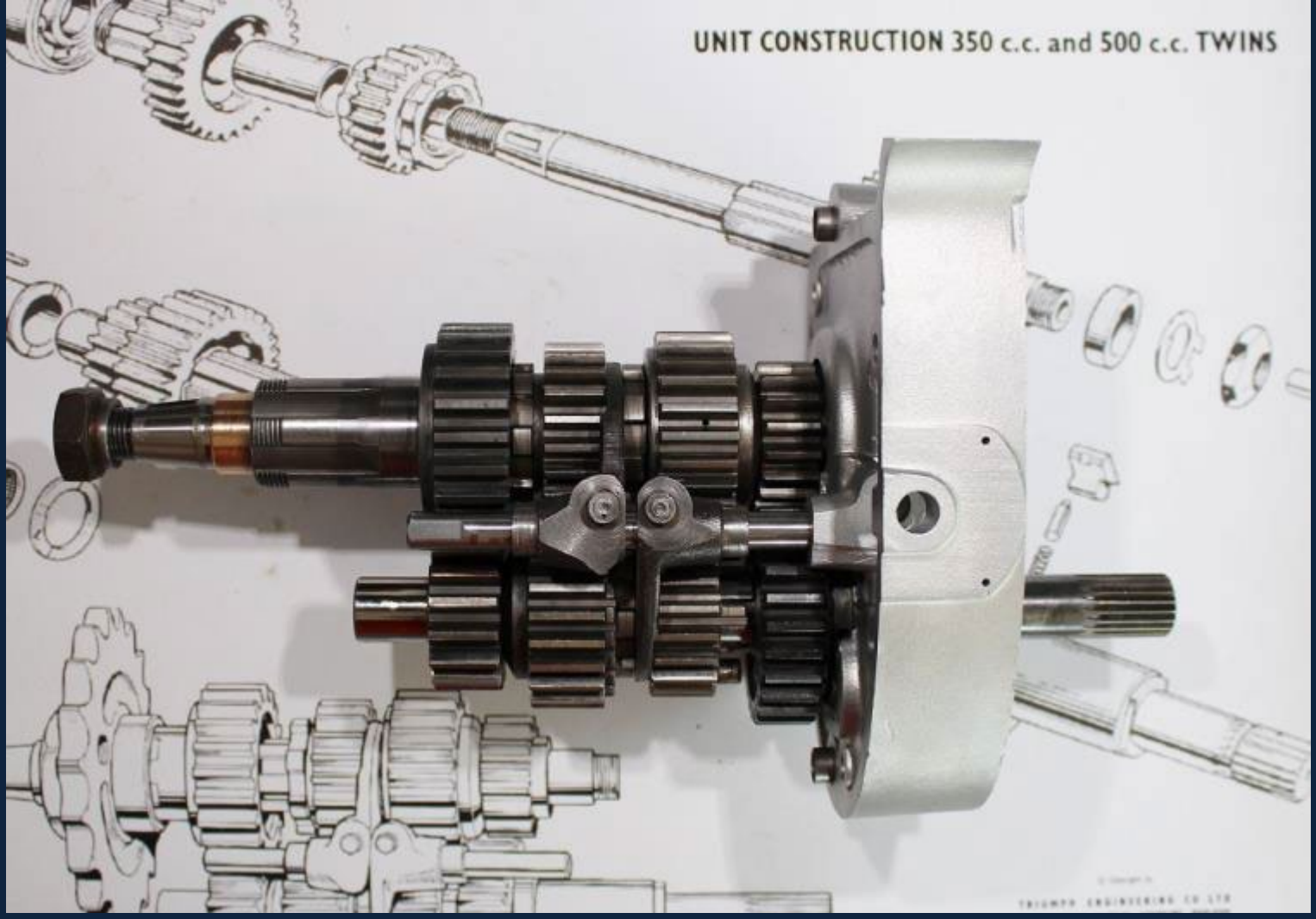
Incorrect assembly of the Selector Forks

In the image above the selector forks are the wrong way round, note the illustration on the bottom left.



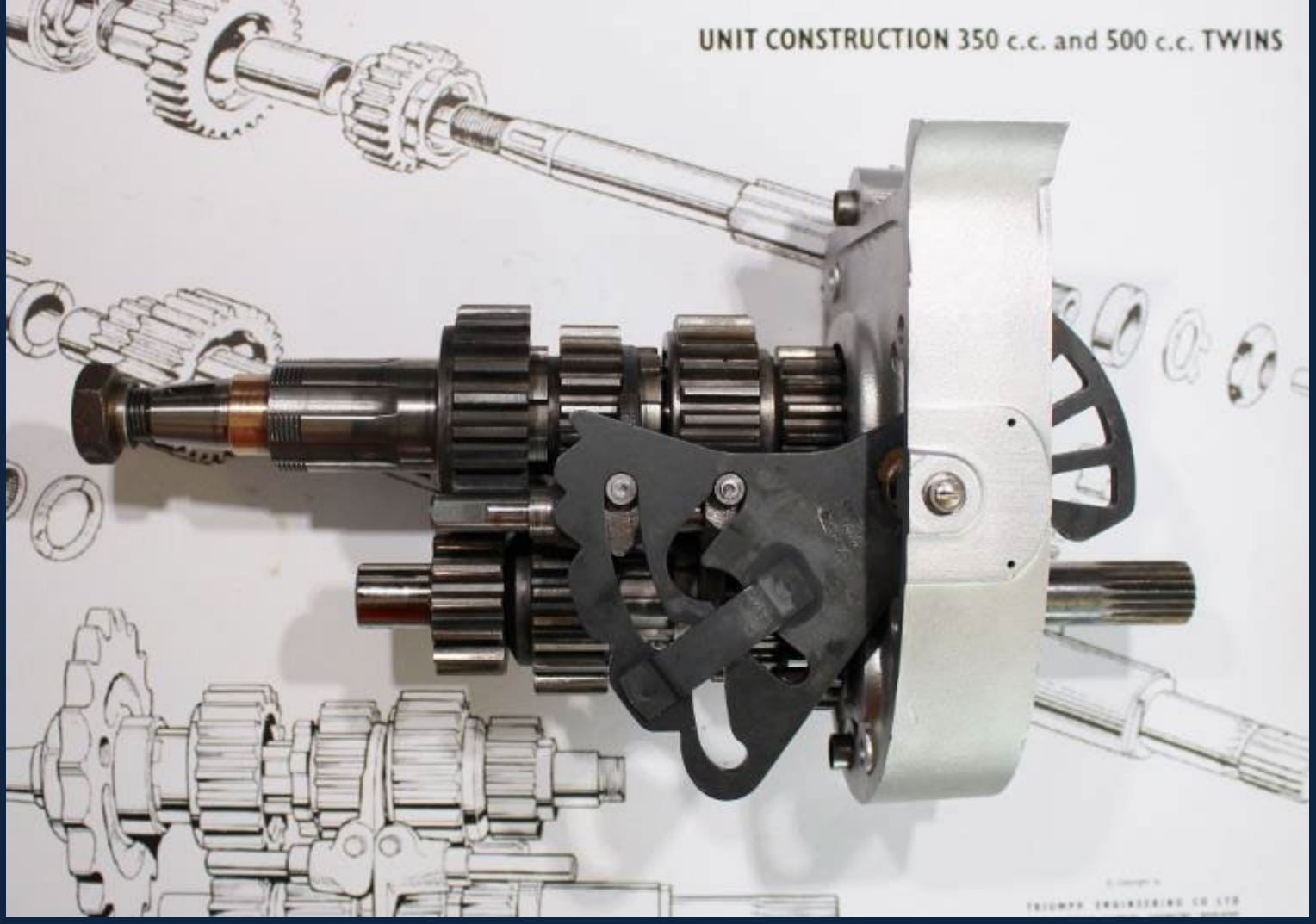
Incorrect Assembly of the Selector Forks

With incorrect assembly of the selector forks with the quadrant fitted, the gears will not select correctly as shown above.

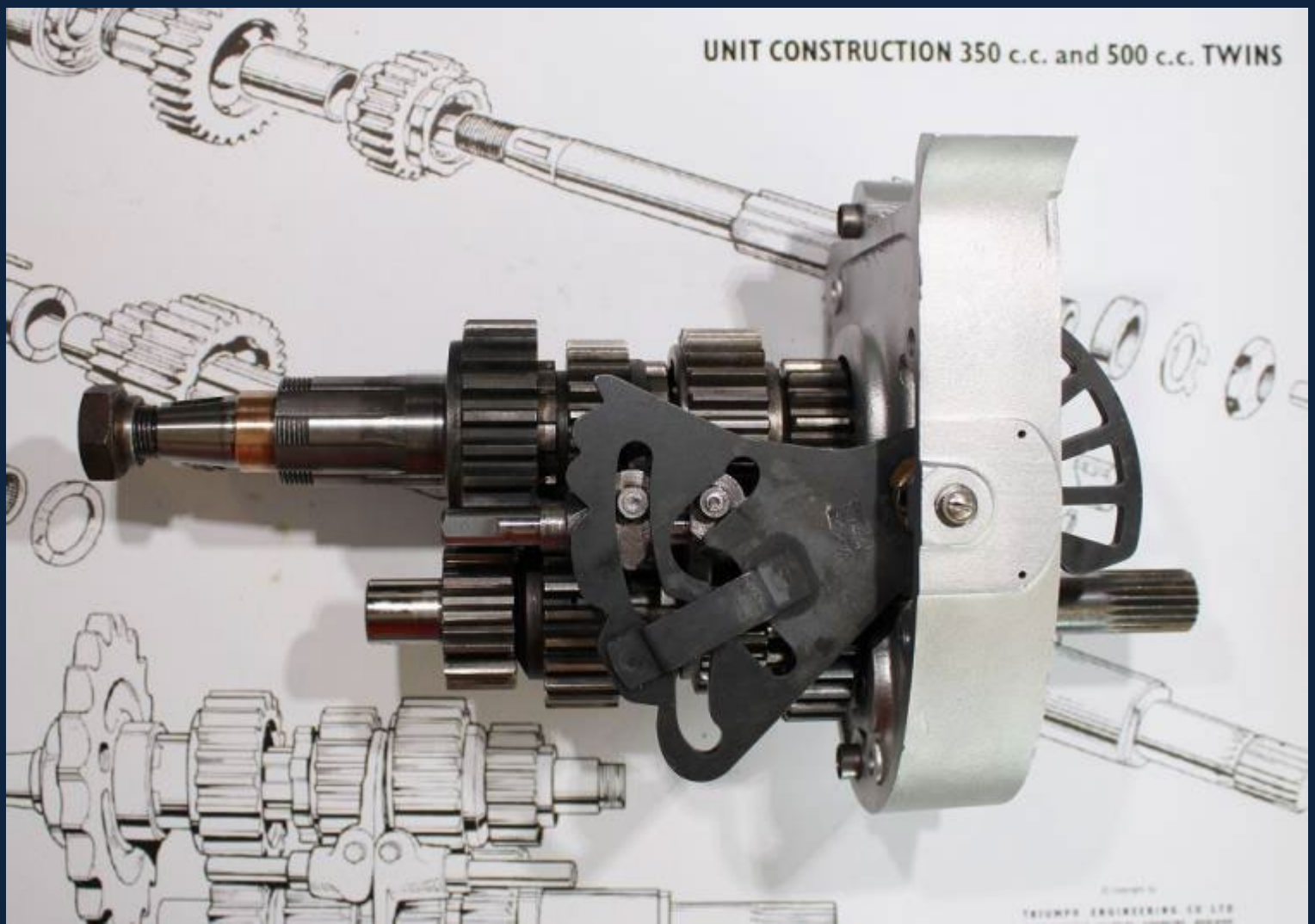


Correct Assembly of the Selector Forks

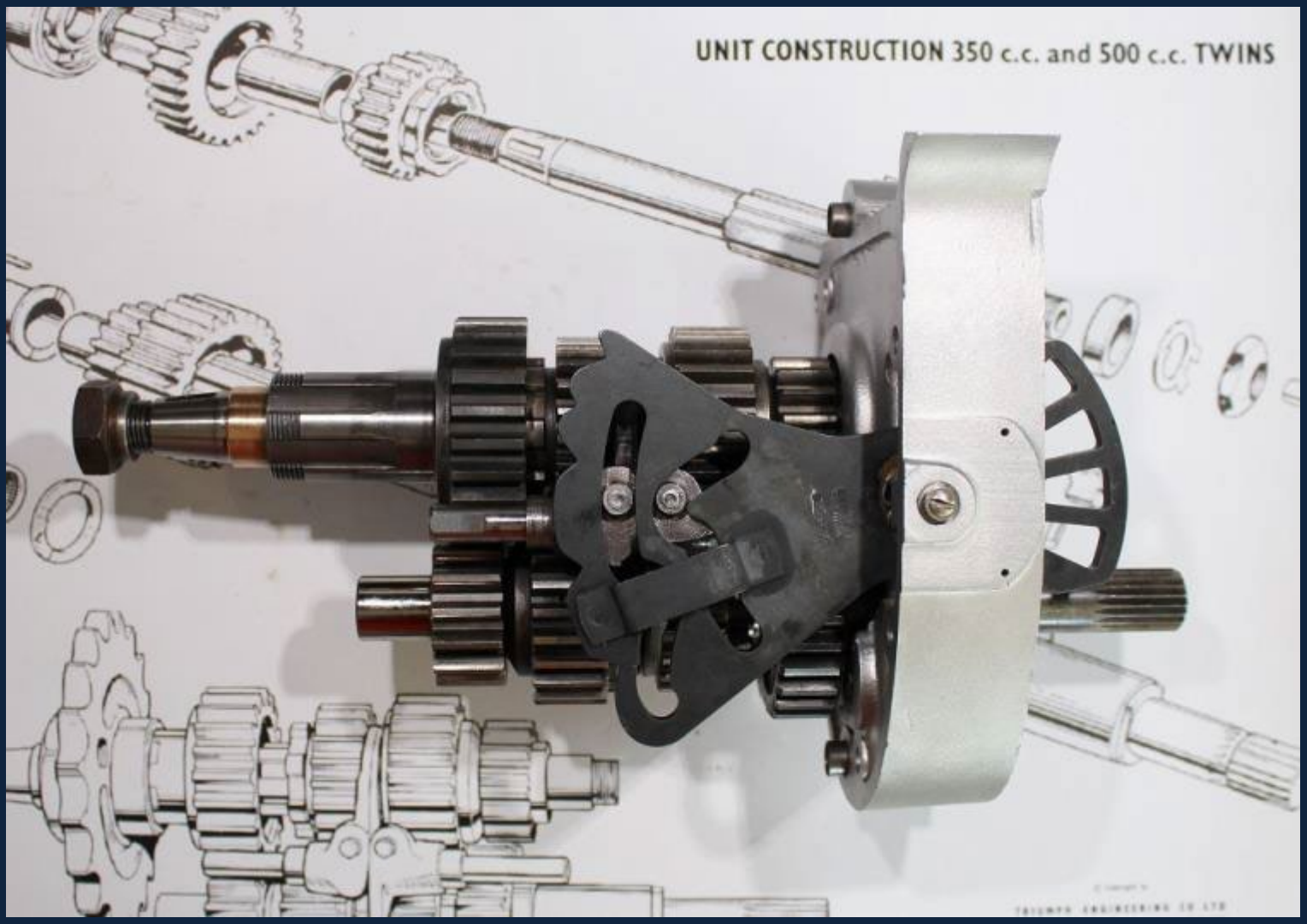
Once you are confident that the selector forks are correctly positioned; introduce the quadrant, locating the selector forks and then fit the spindle and its pin, spreading this so that it cannot come loose. Do not fit the pointer for the time being.



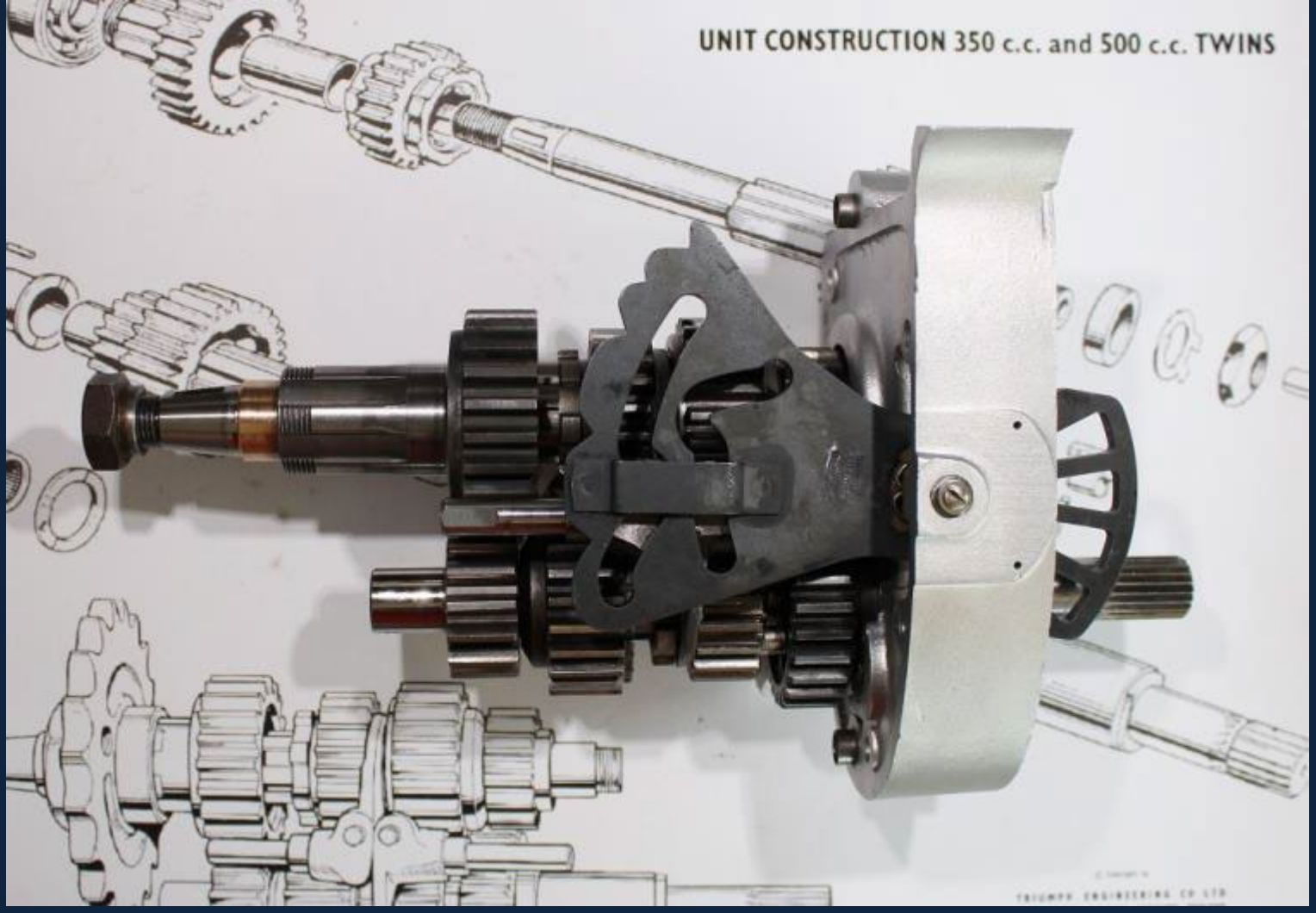
1st Gear Position



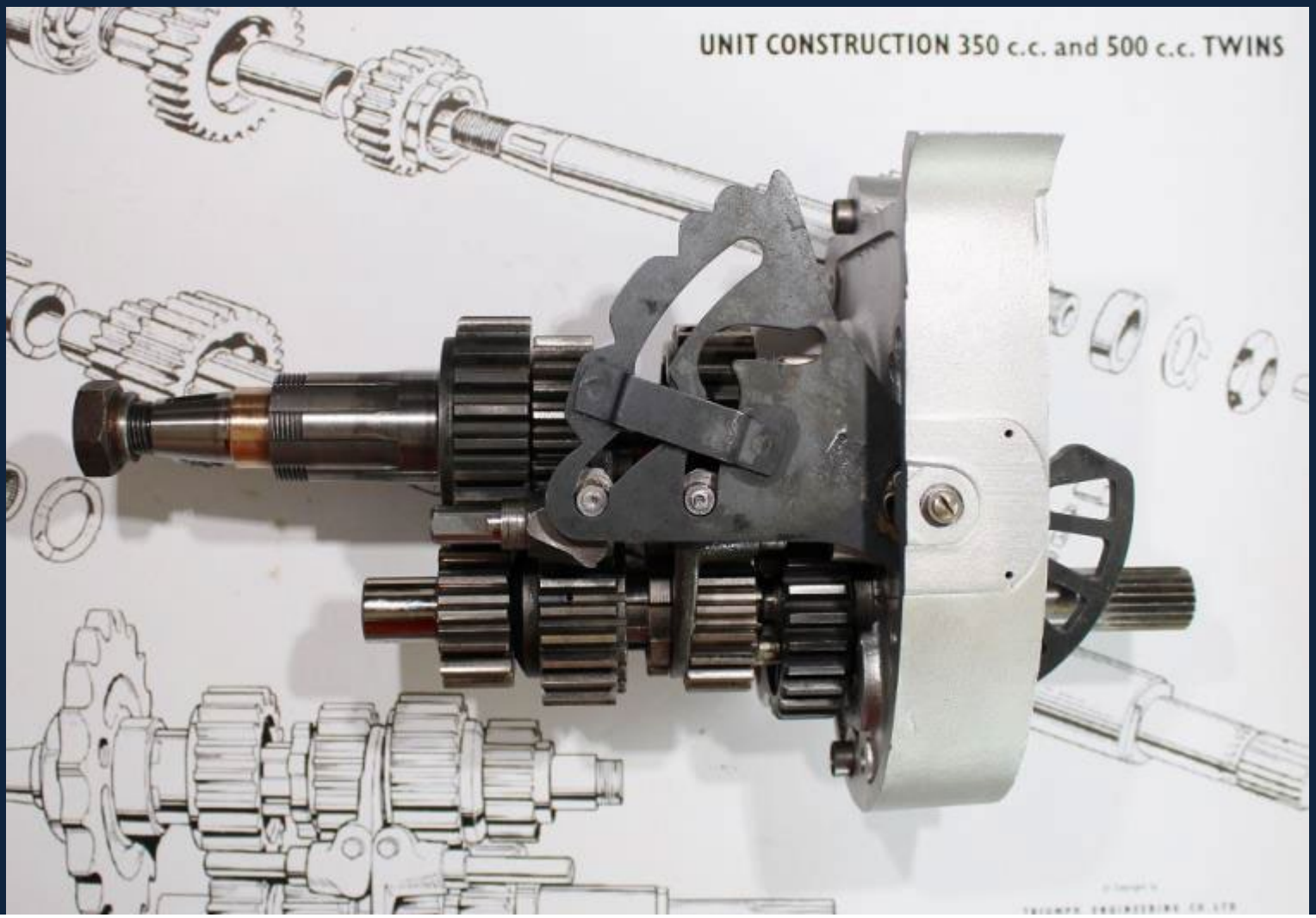
Neutral Position



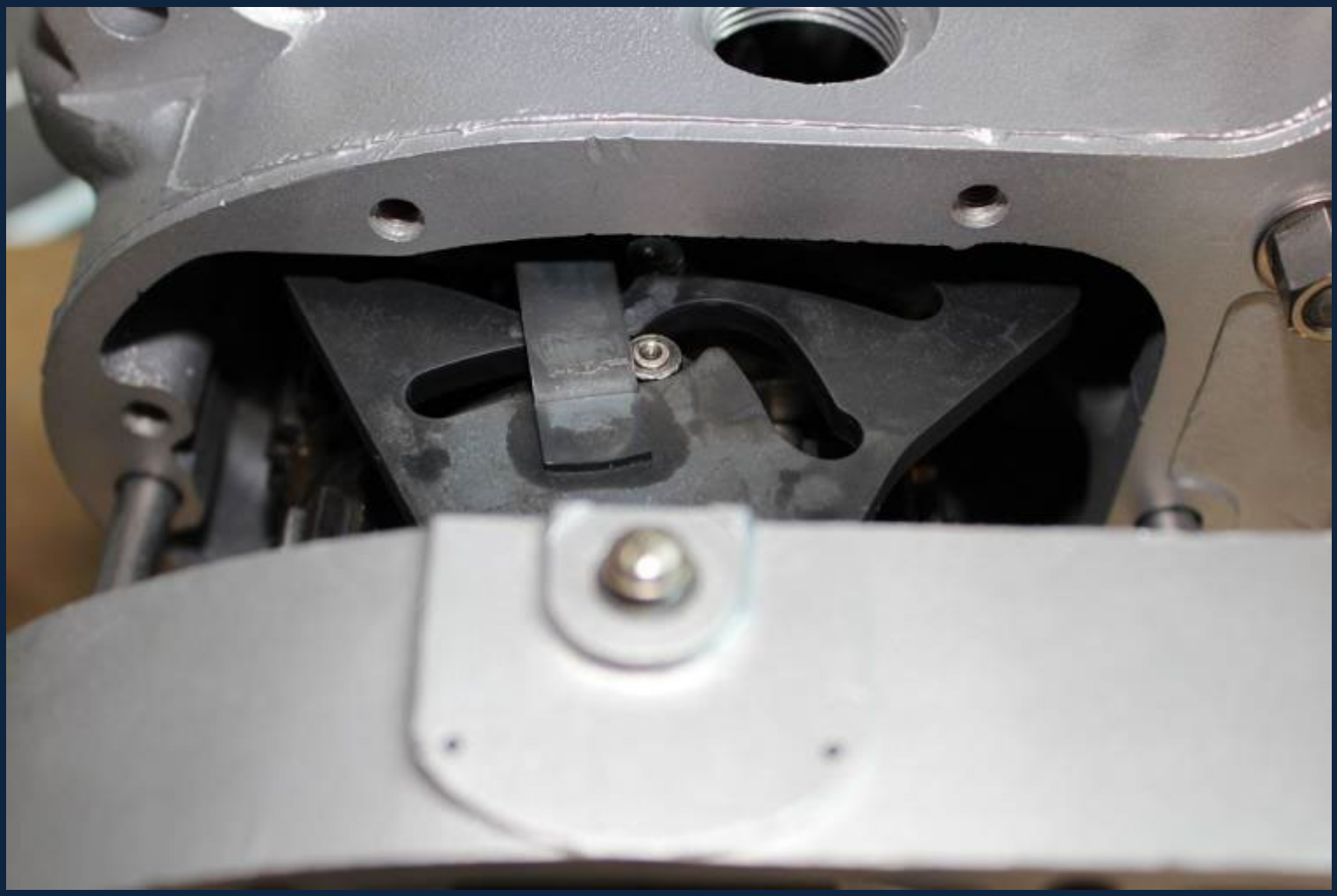
Second Gear Position



3rd Gear Position



4th (High) Gear Position



Inserting the Gear Cassette

Before inserting the gear cassette, oil and locate the indexing plunger as we saw earlier and if the gearbox has a needle roller bearing for the Layshaft, using a small amount of thick grease “Glue” the Thrust Washer into its location. Lightly oil the gears and bearings with EP90 Gear Oil and do a final check on the complete assembly.

Run a thin bead of Silicone around the casing so that an oil tight seal will result and then select 2nd or 3rd Gear so that the quadrant does not foul the casing and introduce the complete cassette; tapping gently to locate the high gear into the output bearing and the layshaft into the bush or needle roller bearing.

You should feel the resistance of the index plunger spring as the cassette goes home.

To hold the inner cover in place while the sealant sets, fit the outer cover and use its screws and nuts to apply even pressure.

Almost Home

Here the inner cover is fully home and the two internal screws have been fitted.

Not fitted yet is the Kickstart distance piece T1464, the spring T1441 or the return spring plate T1422

Clean off any excess silicone from the joint made earlier with solvent (MEK) and test the operation of the gears and Kickstart mechanism, everything should move smoothly but with some resistance from the indexing plunger.

So far we have not been able to fully tighten the gearbox nut, this cannot be completed until the Engine is in the Frame and the rear brake can be applied. Ensure that 4th Gear is selected before attempting to tighten the nut.
You risk damage to the gears and shafts if any of the other gears are selected for this operation.

Suggested Torque for the Gearbox Nut is 40 lb/ft.

Now fit the Oil Pipes !

There is very little access to the oil pipe junction once the gearbox outer cover is fitted and it is advisable to fit the pipework now. You may need to bend the pipes in order to get them to fit, apply controlled pressure preferably with a pipe bending tool or vice so that you do not introduce restrictions.
Always use a new gasket but do not use any sealant as you risk blocking the oil ways.
Note that to attach the pipe junction you will need a E1310 slimmed 5/16 nut.
Fit the nut with Loctite 243 so that it cannot come undone.

Fitting the Kickstart Spring

Here the Return Spring, the Distance Piece and the Spring Plate are located on the Kickstart shaft with the hook on the spring engaged with the specialised screw that also locks the return plate.
Using strong pliers or mole grips the spring plate tang will be engaged with the spring and turned half a turn anticlockwise until it can be made to engage with the shaft.
You may need a few attempts as this can be tricky.

The Gearbox Outer Cover and Parts

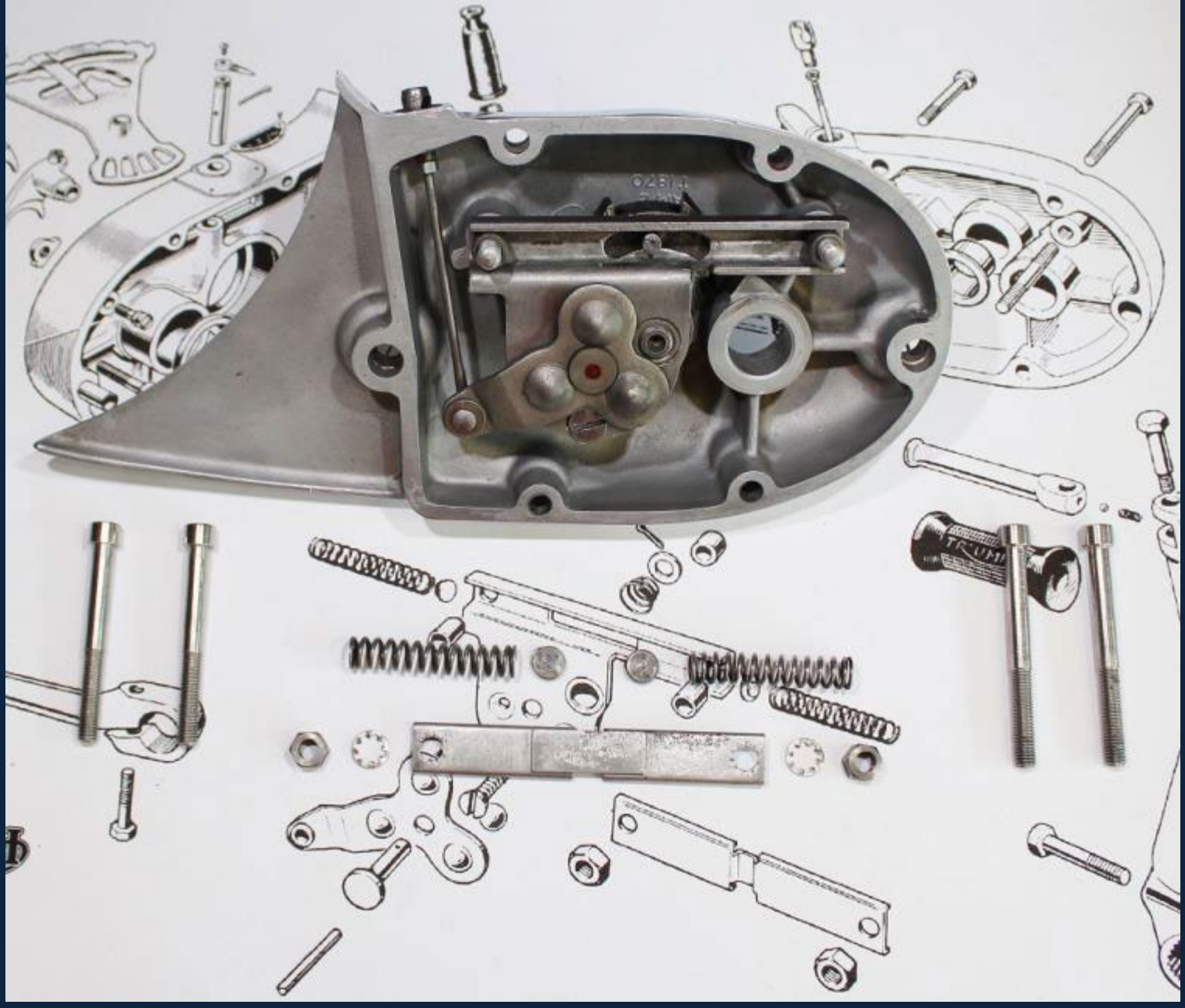
Section D1 to D3 of the Works Manual

This is the part set from 1963 onwards with the three ball clutch lifter mechanism and quick change clutch cable system. The earlier parts are robust and possibly interchangeable. One of the failings of the gearbox design is that any gearbox oil or water that accumulates between the intermediate cover and the outer cover cannot be drained as there is no interconnection with the main gearbox for oil to transfer. As the selector parts frequently receive very little lubrication and are often damp where water has penetrated down the clutch cable, rust can soon take hold especially on the selector, its plungers and springs.

The original parts were Cadmium plated but once this wears off or is removed, corrosion can quickly take hold. Owners should remove the outer cover on occasions to clean and lubricate the assemblies.

Check the Selector operation. Small split pins hold the springs and pawls in position and you should note how these have been fitted before dismantling the unit. Look for wear on the pawls and to see if the springs are complete and in a serviceable condition. Also check the operation of the three ball mechanism, looking for wear where the balls have created uneven tracks and lastly check the two lever return springs and their thrust buttons. Replace any parts that are excessively worn, broken or missing.

The early clutch release mechanism is an alloy casting and uses a screw thread type of lifter, the change to the Three Ball mechanism appears to have been made on cost grounds as the parts are now simple stampings.



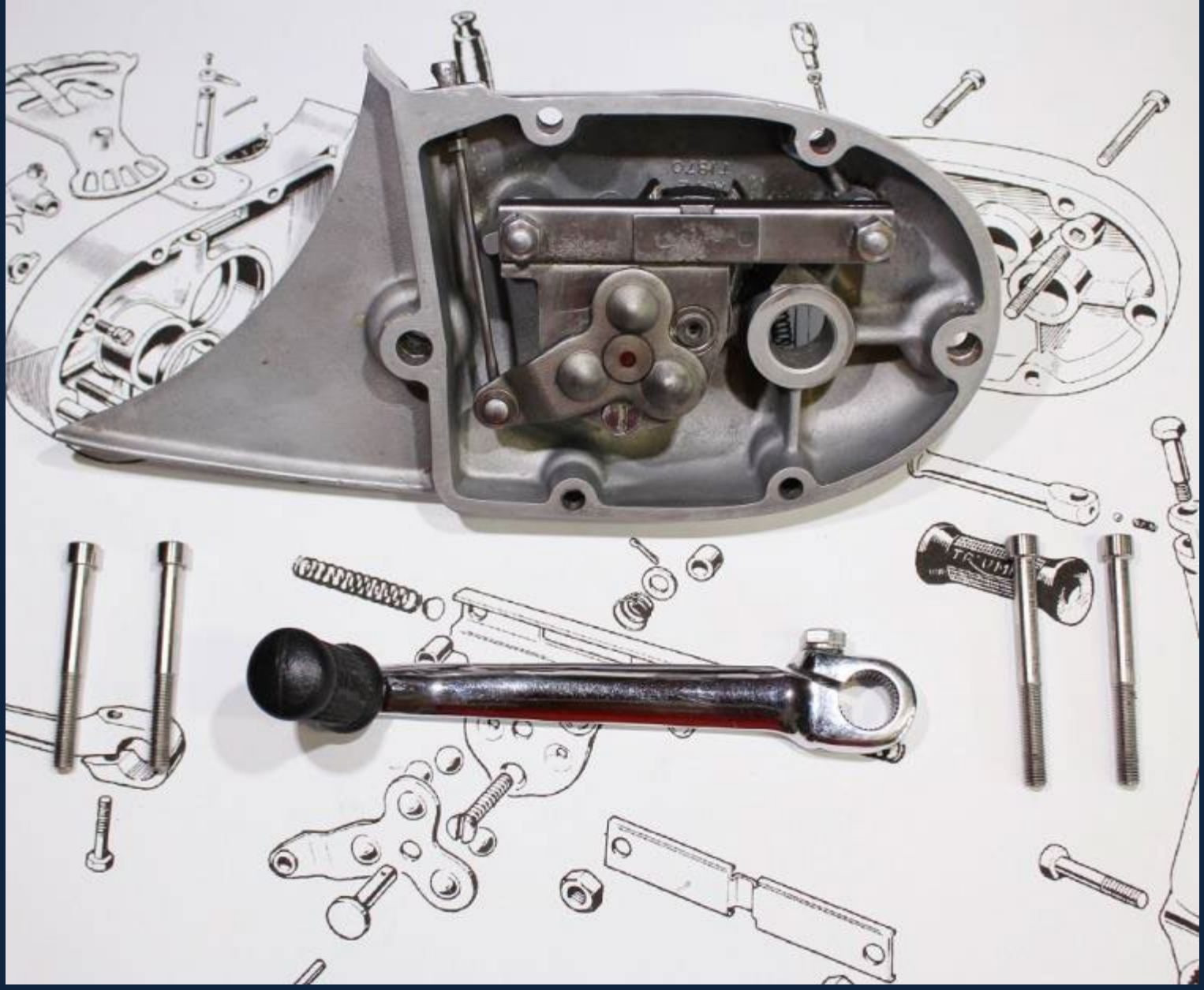
Assembly of the Gear Change Mechanism

Test the Selector by pressing in the pawls and assess the condition of the ‘O’ ring that acts as a seal. Replace this if it has worn.
Coat the Selector with a preservative grease or Waxoyl, oil the pawls and press the Selector into the bush in the outer cover.

Fit the modified spoke for the clutch cable, adjusting the length so that the clutch cable can be fitted and removed easily, noting that a degree of adjustment is available by unscrewing the nipple receiver and its lock nut.
Then offer up the clutch operating mechanism, wiggling it until it locates over the two studs.
Fit the lower spacer and the screw and locate the two shaped spacers over the studs.
Fitting the gear lever temporarily will make the next stage much easier.

With the gear lever, push the selector to one side and then insert one of the return springs with its button. Press down firmly with your thumb on the fitted spring and move the selector to the other side using the gear lever to compress the spring fully and fit the second spring and its button. Slowly release the gear lever so that the selector returns to the central position and then fit the cover plate, the serrated washers and the two slim nuts. Test the operation of the selector and the clutch release and finally coat everything with a preservative grease such as Waxoyl.

Test fit the complete clutch cable and check that the operating mechanism is fully retracted as illustrated, with a little free play left in the cable and some adjustment at the handlebar.



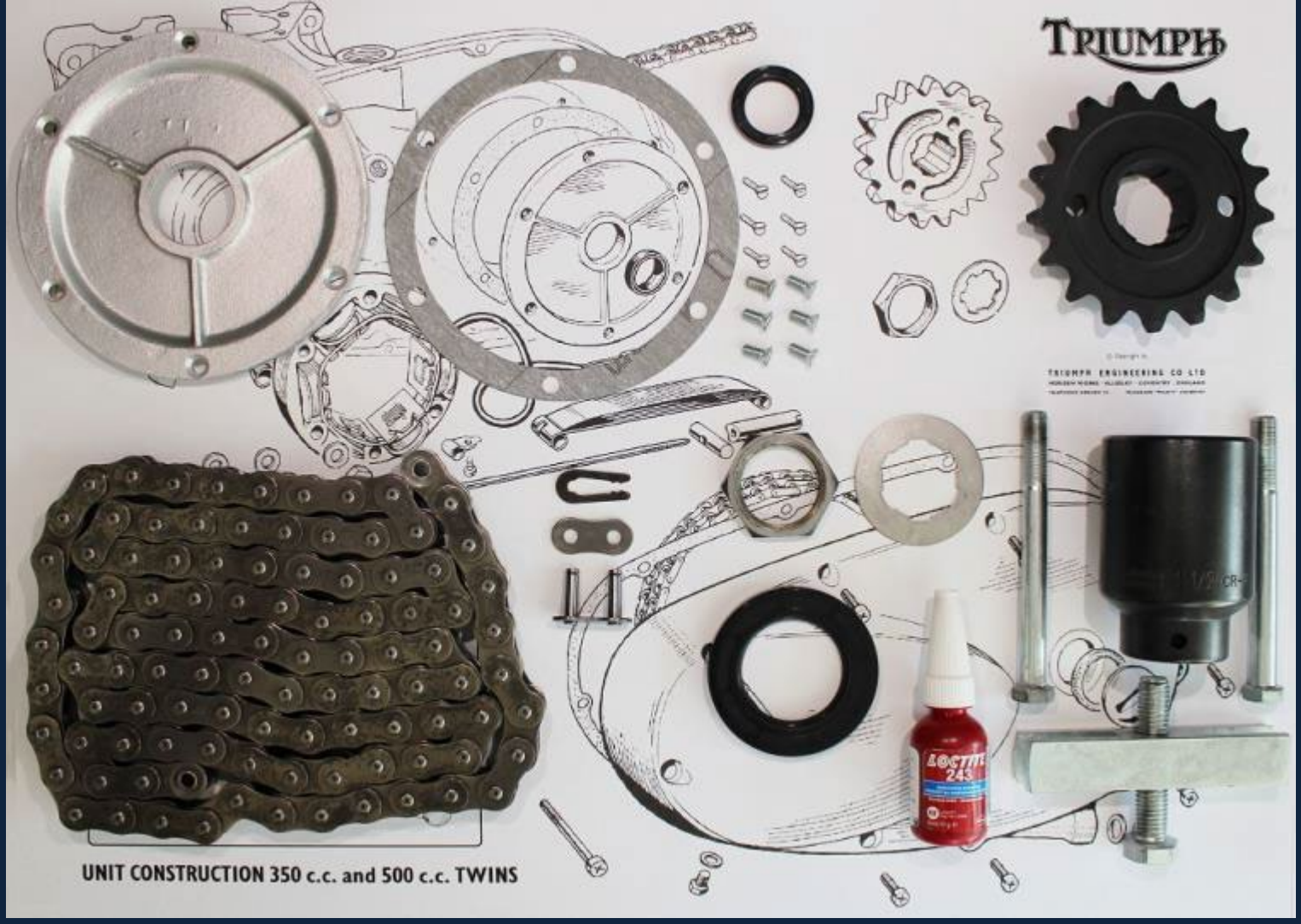
The Completed Gear Selector and Clutch Release Mechanism

Note that the gearbox screws T1401 and T1402 are differing lengths, test fit these before completing the gearbox by applying a coat of sealant to the outer cover before tapping it into place with a hide mallet. Fit the screws and the two nuts and washers, then the Kickstart oil seal if fitted and finally attach the Gear and Kickstart levers before testing and filling the gearbox with oil.

Gearbox Oil Capacity 375cc EP 90 Transmission Oil.

Part 7 Complete

Final Drive



The Gearbox Sprocket, Chain, Seals, Parts and Tools

Shown above are the various parts associated with the gearbox sprocket together with the special tools that you will need. Access to the gearbox sprocket requires the clutch assembly to be removed but the gearbox does not need to be disturbed. The Renold Chain here is 5/8 by 3/8 with 102 links. Shown is the 17 Tooth sprocket suitable for the 3TA but other sizes are available with the only limit being the size of the access hole that the plate covers. Resist the temptation to reuse an old sprocket, they are inexpensive and readily available. The deep socket shown is essential to allow the sprocket nut to be tightened while the puller has a dual role removing both this sprocket and the primary drive sprocket.

The Socket is a 1 ½ in, ½ inch drive Impact Socket

Fitting the Gearbox Seal

Here the Gearbox Seal has been partially pressed by hand into its recess, behind it is the main gearbox bearing and retaining circlip.
On the right is the blanking plate for the Layshaft bush, glued in with epoxy resin and untouched since 1966 and centrally the bronze bush within the high gear that extends through the clutch seal that we will fit shortly.

The Gearbox Sprocket reversed and used to locate the seal squarely

By reversing the gearbox sprocket and tapping with the large socket in place the gearbox seal can be pressed home squarely
The machined surface on the sprocket will fit into the seal when we turn the sprocket into its correct position.

Apply some oil to the machined surface to lubricate the oil seal before fitting.

Gearbox Seal fully home

Before fitting the sprocket attend to the breather vent that is just visible on the left, fit a short piece of rubber tubing terminating
in a length of steel or alloy pipe that can be directed so that any oil escaping is kept off the rear tyre. For off road models consider where the vent should terminate so that water or mud cannot be drawn into the pipe.
The parts book shows a T piece associated with the Oil tank vent !

The Gearbox Sprocket Located

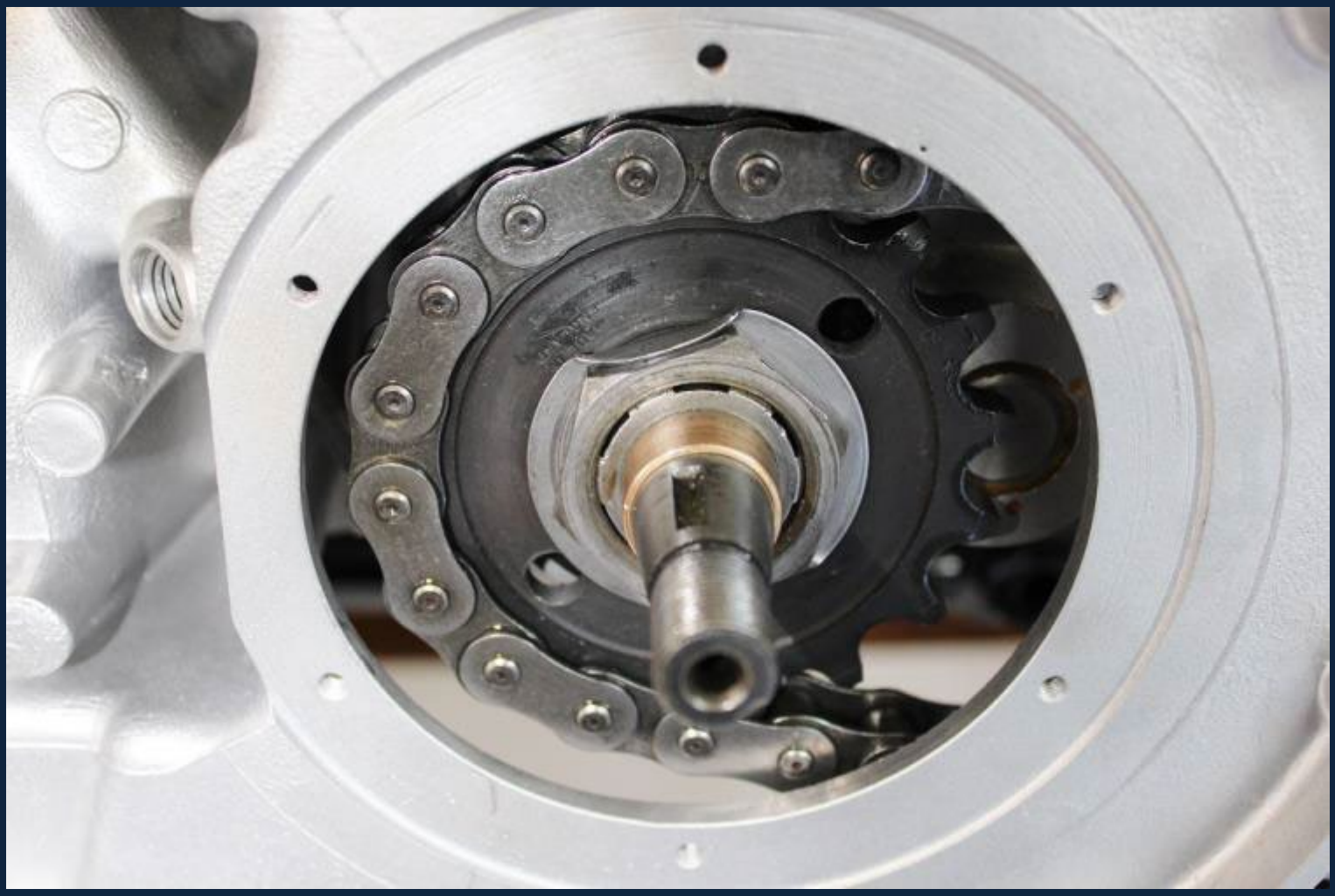
The sprocket is splined to match the high gear, it should fit easily but may have a preferred position. Note the threaded holes for the puller and the location for the woodruff key on the mainshaft.

The Lock Washer and Nut loosely fitted

You will not be able to fully tighten the nut until the chain has been fitted and the rear brake can be applied firmly.

The Chain Fitted.

Fitting the chain requires some dexterity as there is very little room to work especially if the chainguards are in place. If you have an old chain available this should be cleaned and can be used to draw on a new lubricated chain making the whole process much cleaner and pleasant and is a convenient way of servicing chains in use.



The Chain Fitted, Nut Tightened and Locked.

Once the chain is fitted apply the rear brake firmly and tighten the nut fully, 50 lb/ft, though the manual does not specify a figure.
Using a large screw driver and gentle blows, fold over the lock washer in at least two positions so that the nut is secure.

The Cover Plate and Seal Fitted

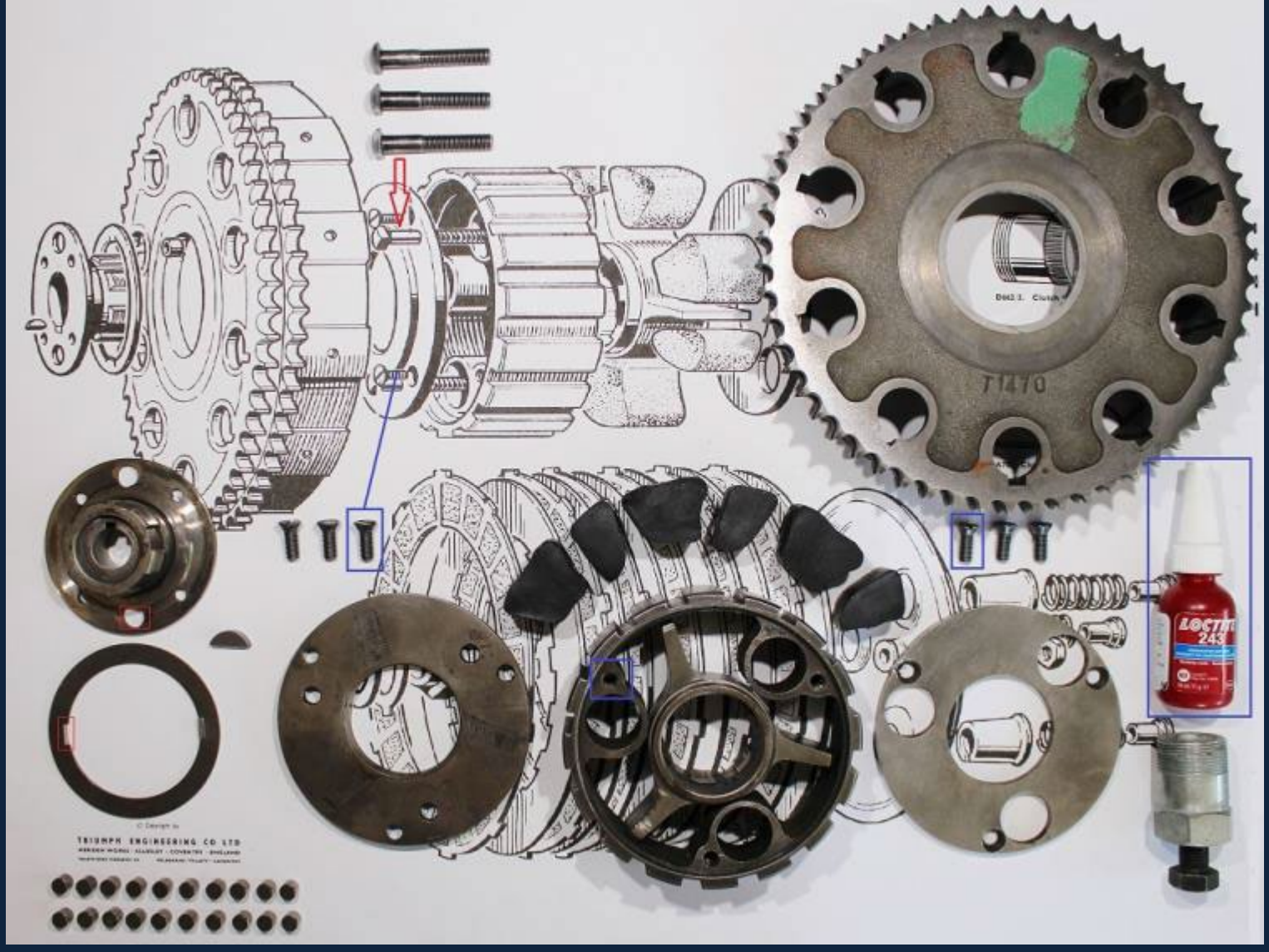
Removing the access plate can present a number of problems, select large a well-fitting screwdriver and apply heat to the area around each screw before attempting to undo it. If old screws have been re-used you may have to resort to carefully drilling the countersink away until the head of the screw can be prised off or an extractor can be fitted, and with six screws this can rapidly become a nightmare. Once the screws are removed attempt first to tap or prise the cover off from behind by inserting a flat bar located against the sprocket, do not use excessive force. If you suspect sealant has been used then apply heat or a solvent such as MEK around the circumference of the plate and try again. Resist the temptation to attempt to chisel off the plate but instead remove the gear cassette with the mainshaft so that you can use large screwdriver through the aperture to prise the cover off.
After removal carefully clean both surfaces of any remaining gasket or sealants. MEK or Acetone are suggested.

Here the access cover for the sprocket has been fitted together with a new gasket. First fit the oil seal, ensuring the spring side is to the clutch, this can usually be pressed in by hand or with a small block of wood. Treat the gasket on both sides with silicone grease or Wellseal, lubricate the bush with oil and use NEW SCREWS and Loctite to fit the plate.

On the cover above at the 10 o’clock position a small boss that extends as a spigot on the reverse can be seen, for a period of time during production this was pierced with a minute hole to provide an oil mist for the chain, here it is or has been closed.

Part 8 Complete

Primary Drive



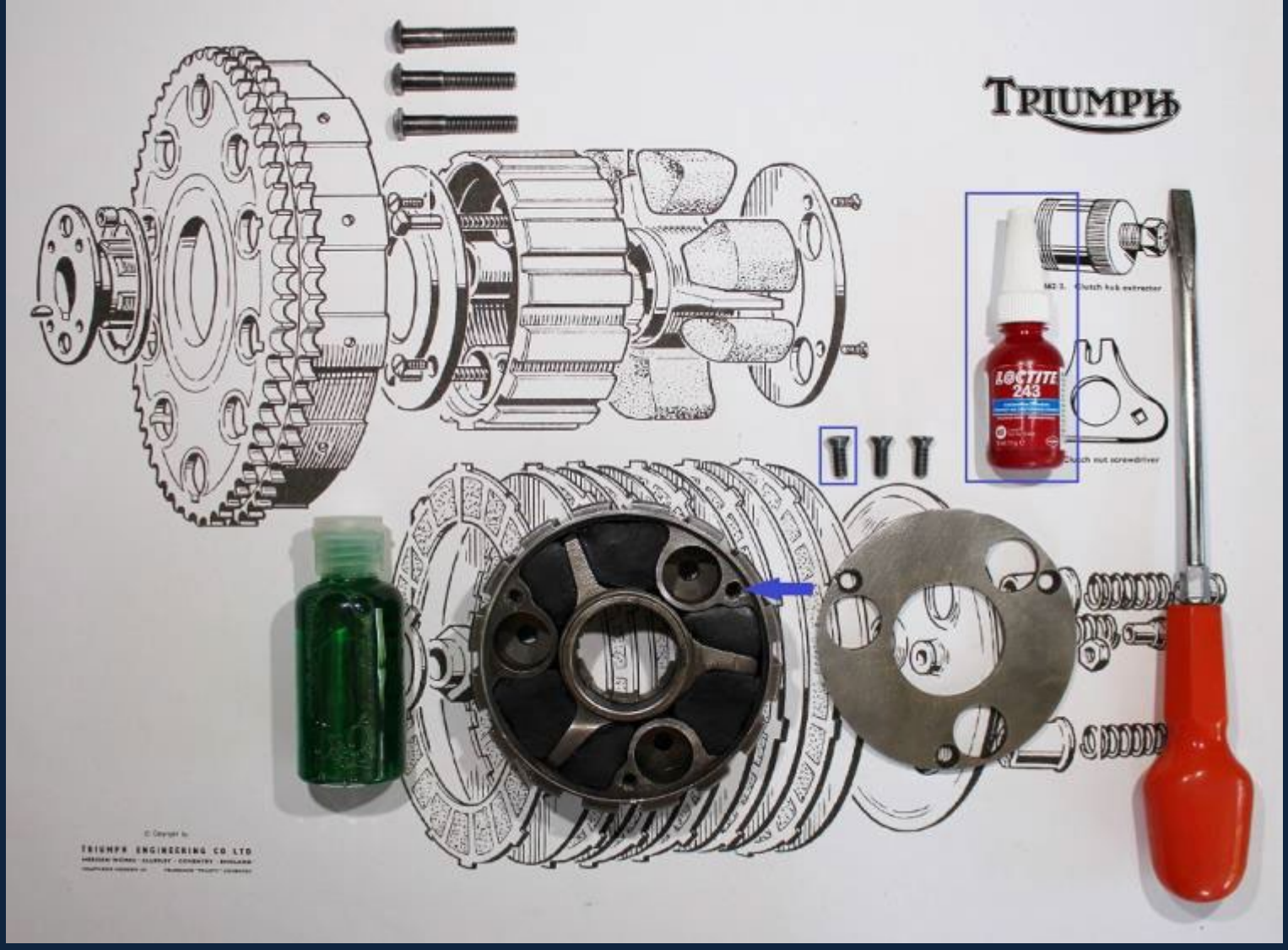
The Clutch Hub and Shock Absorber

Section C of the Works Manual

Shown above is the typical Triumph clutch, here the Three Spring version introduced in 1962. It contains a shock absorber comprising of six shaped rubber segments that bear on a machined centre; that is splined onto a central hub (Far Left).

Over the years there are several changes to the clutch components and the 3TA clutch shown above though typical in design has a number of specific parts for this model. Refer to the Parts Books and do not assume that the parts you have are the correct ones for your machine.

Parts Book Pages 30 & 31 in Books 4 to 6, Pages 36 & 37 in Book 7



Assembling the Shock Absorber

Section C7 of the Works Manual

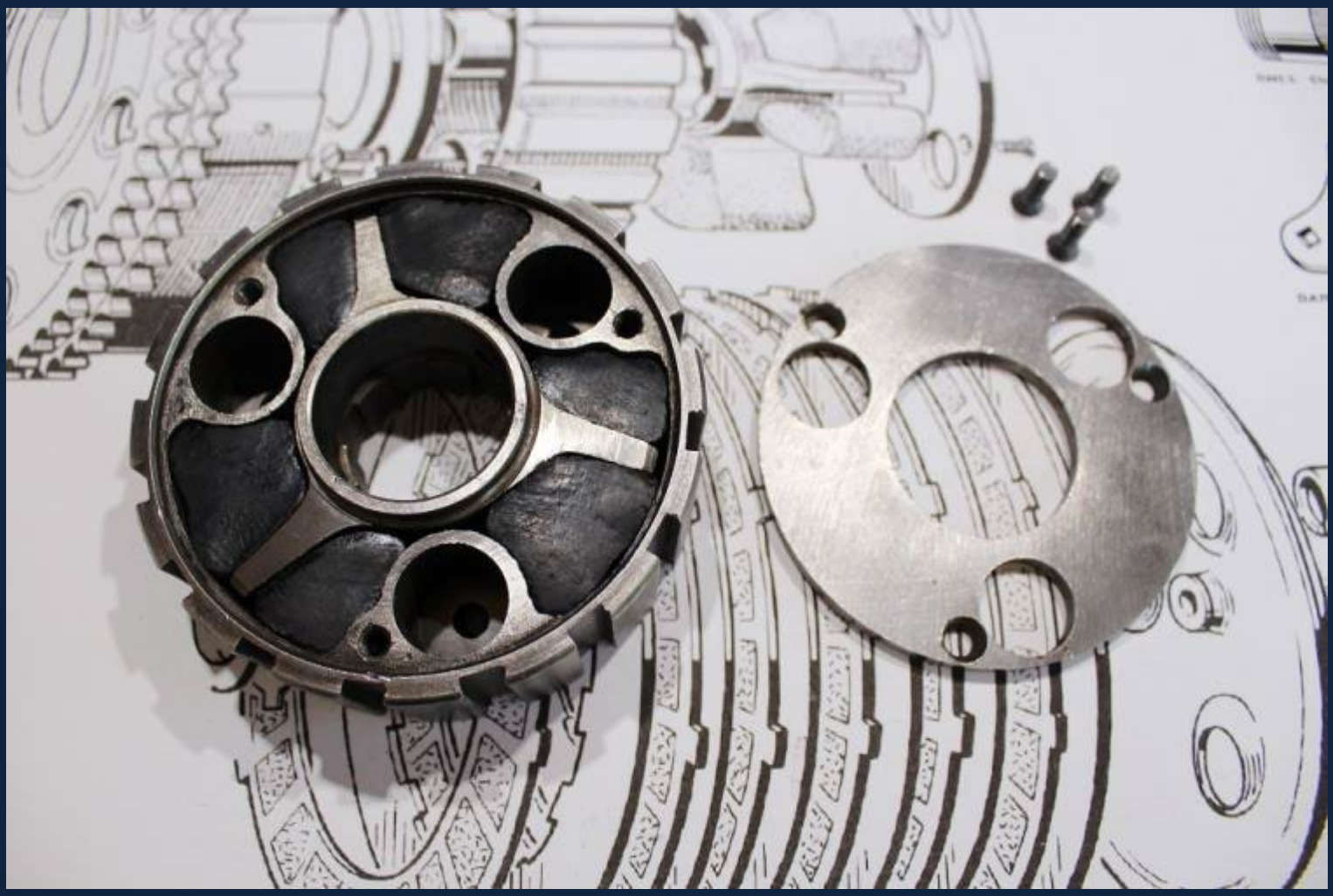
The two plates for the shock absorber are attached by six specialised 1 BA countersunk screws. When dismantling the hub these
screws can be very difficult to remove as they are punched to ensure that they cannot come undone. First, drill out the punch
marks, and then heat the screws using a soldering iron before attempting to undo them with a well-fitting screw driver.

If this is unsuccessful, centre punch the screw and drill carefully (preferably in a pillar drill) until the countersunk head can be prised
away and the plate removed. With a small hack saw cut a slot into the remaining end of the screw for a screw driver or bit and undo the remaining portion or alternatively file square, drill further and use a screw extractor.

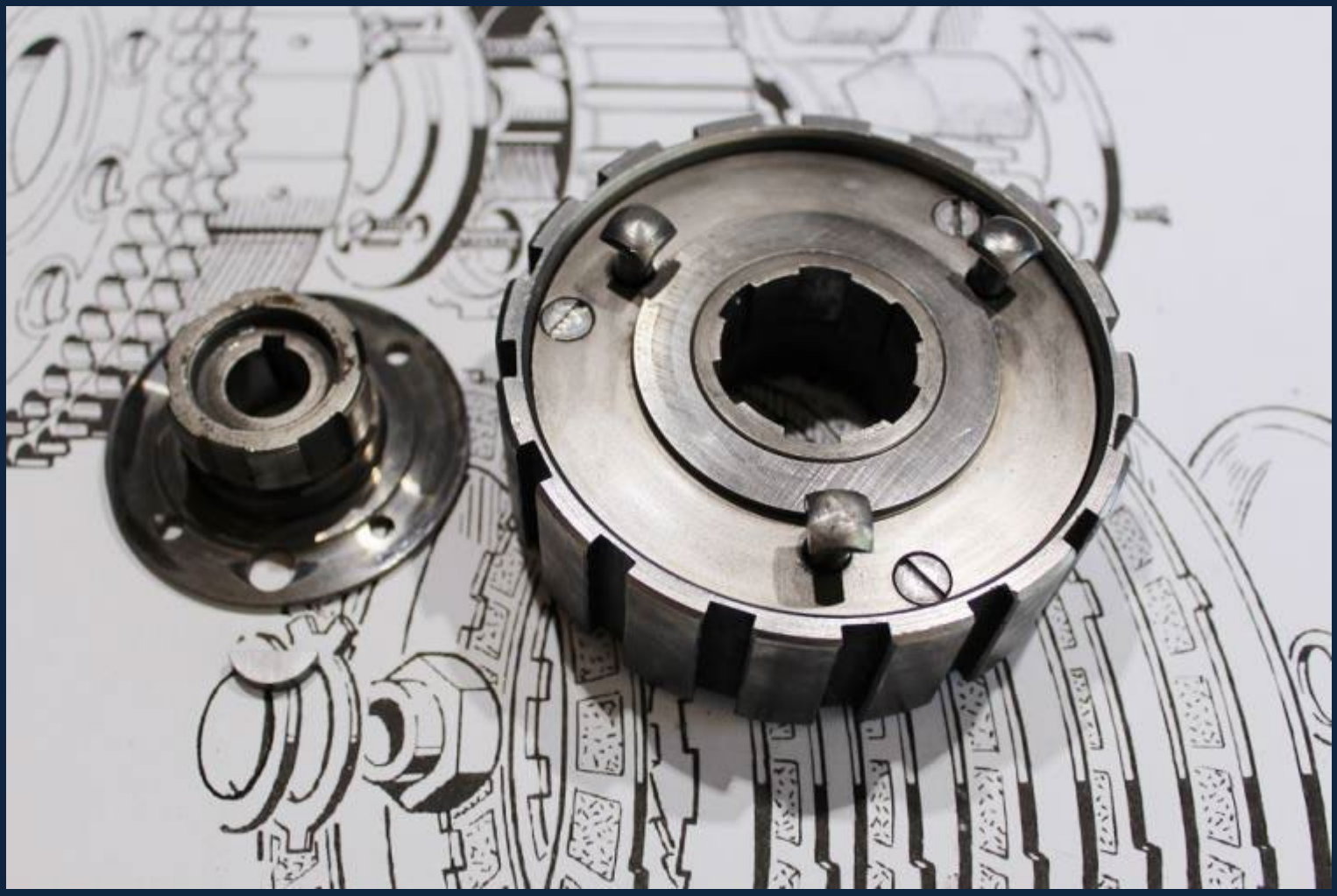
Once you have the hub dismantled and clean; check the condition of the components, the rubbers can deteriorate with age and you will
usually see wear marks in the plates where the spider has scoured the surface, to check the fit, remove the rubbers and reassemble.

The slots in the outer ring are the locations for the Driven Plates and you will frequently see an undulating wear pattern in them.
If you are reusing the parts; dress the worn areas with a file to remove any burrs and tap the screw holes to clean them.

The rubbers are shaped to correspond with their locations and once lubricated with soap can usually be pressed in by hand, start with
the three larger ones and then use a screwdriver to distort the spider to one side so that the three smaller rubbers can be fitted.



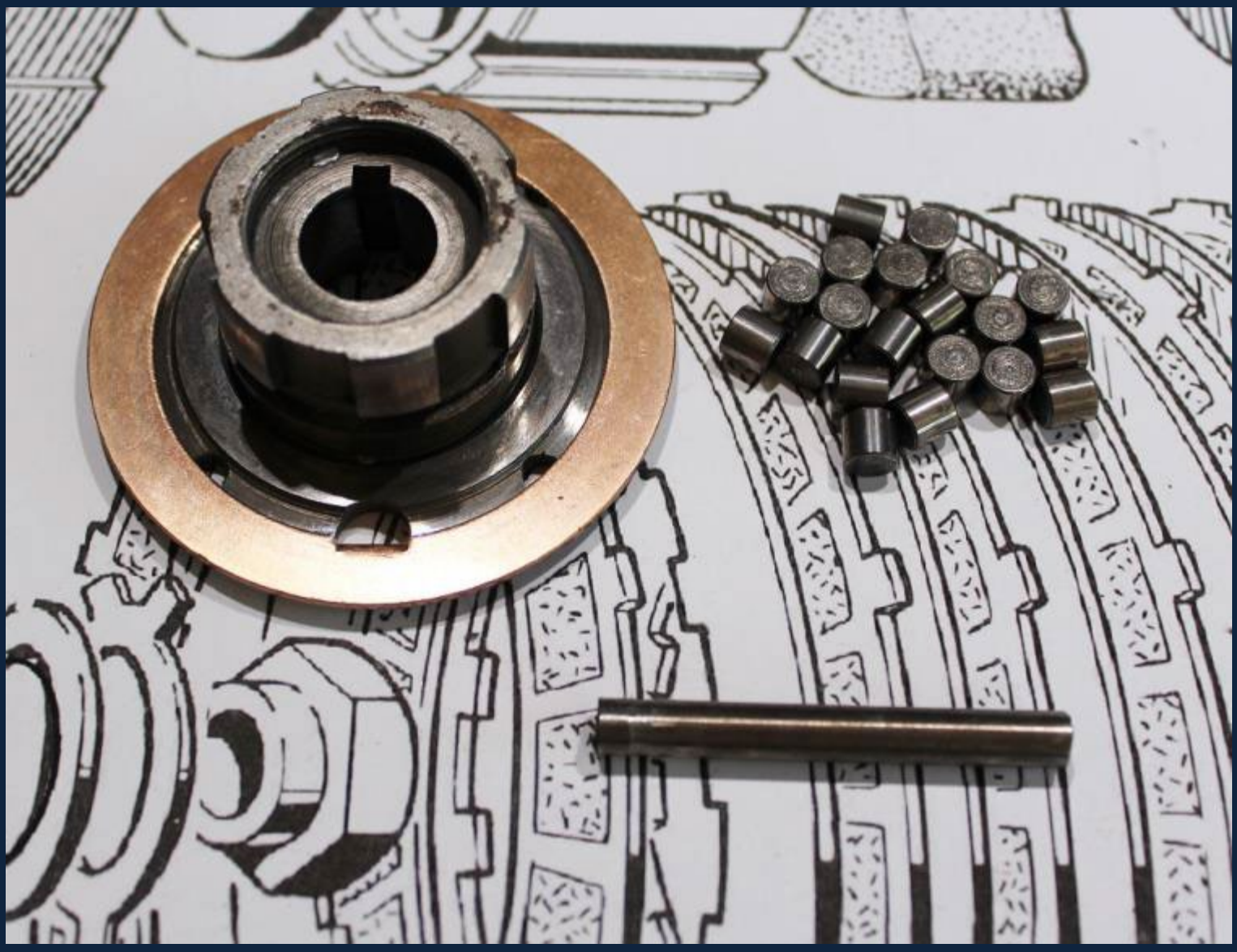
Here the rubbers have been inserted and the outer cover plate is ready to be fitted using new screws and Loctite.



The Hub and completed Shock Absorber

Shown here is the reverse of the shock absorber and the three screwed pins that will provide adjustment for the clutch springs,
the squared heads recess slightly and one edge locates against the raised lip so that the pin cannot turn.
The machined section visible and the splines should be greased and then the assembly set aside.

On the left is the splined clutch Centre Hub; Part No: T1751, this should fit snugly into the shock absorber, test fit now.
Over the period of production the Centre Hub sees some slight changes, the first version T1386 has no provision for the thrust washer with an intermediate T1751 hub showing the thrust washer but not the locating tabs.
The change in hub appears to correspond with the move from the 4 spring clutch to the 3 spring.
Refer to the parts books for details.



The Clutch Hub, Thrust washer and Rollers

Shown here in detail is the Clutch Hub the Thrust Washer and the 20, ¼ Rollers that make up the clutch bearing, being ground and hardened
they rarely show wear but make sure that all are present and select a few for measurement against the Data in the works manual.

The Hub is keyed to the Gearbox Mainshaft Taper with a Woodruff Key and features a short threaded section, just visible, that allows a Special Puller Part No: D662/3 to be fitted; this tool is shown in use later.

The Thrust washer does not feature on the early Triumph clutch hubs up to 1962; but if present should be replaced as a matter of course.
The illustration in the Parts Book above is incorrect and the thrust washer should go against the hub rather than the clutch basket.
To fit the thrust washer apply grease to the reverse so that it sticks to the hub.

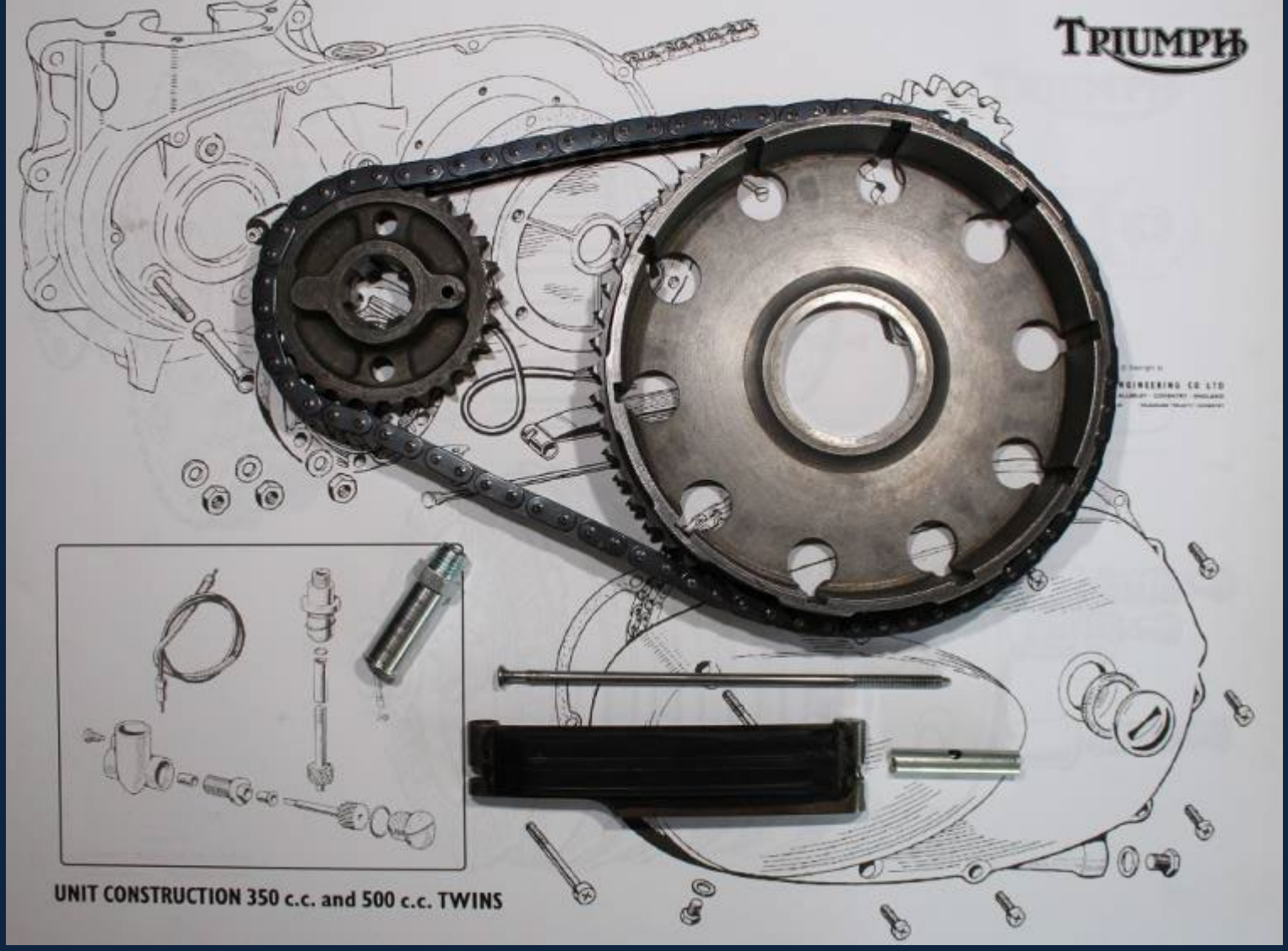
Also shown is a small bar magnet that is useful when inserting the rollers later.

Drive Sprocket

The Crankshaft Oil Seal and Ground Spacer

Before fitting the Primary Drive components you will need to fit the oil seal and the ground spacer that fits behind the drive sprocket.
The Works Manual shows the seal fitted in this way, with the spring side outside. When you consider that the breather system is
designed to create a partial vacuum within the crankcase this arrangement makes sense. After 1969 the seal is omitted due to
changes to the breathing system with the gases now passing through the bearing and venting behind the clutch,
if your engine has had the breathing modified consider whether the seal is required or not.

The ground spacer is tapered so that it will press into the oil seal without damaging it, apply some oil before fitting.



The Primary Drive Components

Shown above are the parts that make up the Primary Drive including the slipper tensioner, trunnion and screw. The tensioner was not fitted to the early models but was gradually introduced across the range in 1960 and became the standard system used on all unit construction twins until production ceased.

Provided a machine has been regularly serviced and the oil level maintained in the primary case very little wear should be visible.
Check the the chain for wear by trying to pull it off the sprockets at various points and ascertain if it has stretched section C10 of the Works Manual gives details on inspecting of the transmission components.

Drive Sprocket, Cable Grommet and Clutch Hub Fitted

Fit the cable grommet for the alternator cable now as this will be very difficult to tighten once the clutch and primary chain have been fitted. Use a thread sealant such as Loctite 542 or Wellseal.

Detail of the Drive Sprocket E4141

The drive sprocket shown above is splined to tightly fit the crankshaft and features two threaded holes that allow a puller to be fitted.
The sprocket should fit without difficulty but you may need to try several positions to find the best one.
This is the original sprocket and in remarkably good condition. Note that the early E3734 sprocket fitted to 1960 does not feature the holes for the puller.

Showing the Pullers to remove the Sprocket and the Hub
(The Puller on the left is also suitable for removing the gearbox sprocket)

The Works Manual states that the clutch basket and the drive sprocket must be removed as a pair along with the primary chain, this is not
true as it is possible to remove the clutch basket independently leaving the alternator, primary chain and sprocket in place, here's how.

Fitting the Clutch Basket and Rollers

As long as the primary chain adjuster is loose or removed, by fitting the rollers one by one, gradually into the gap between the clutch hub and the basket the clutch basket itself can be displaced enough to fit or unhook the primary chain. It can be difficult to get the last few rollers in but by rotating the basket the fitted rollers will crowd to the right.

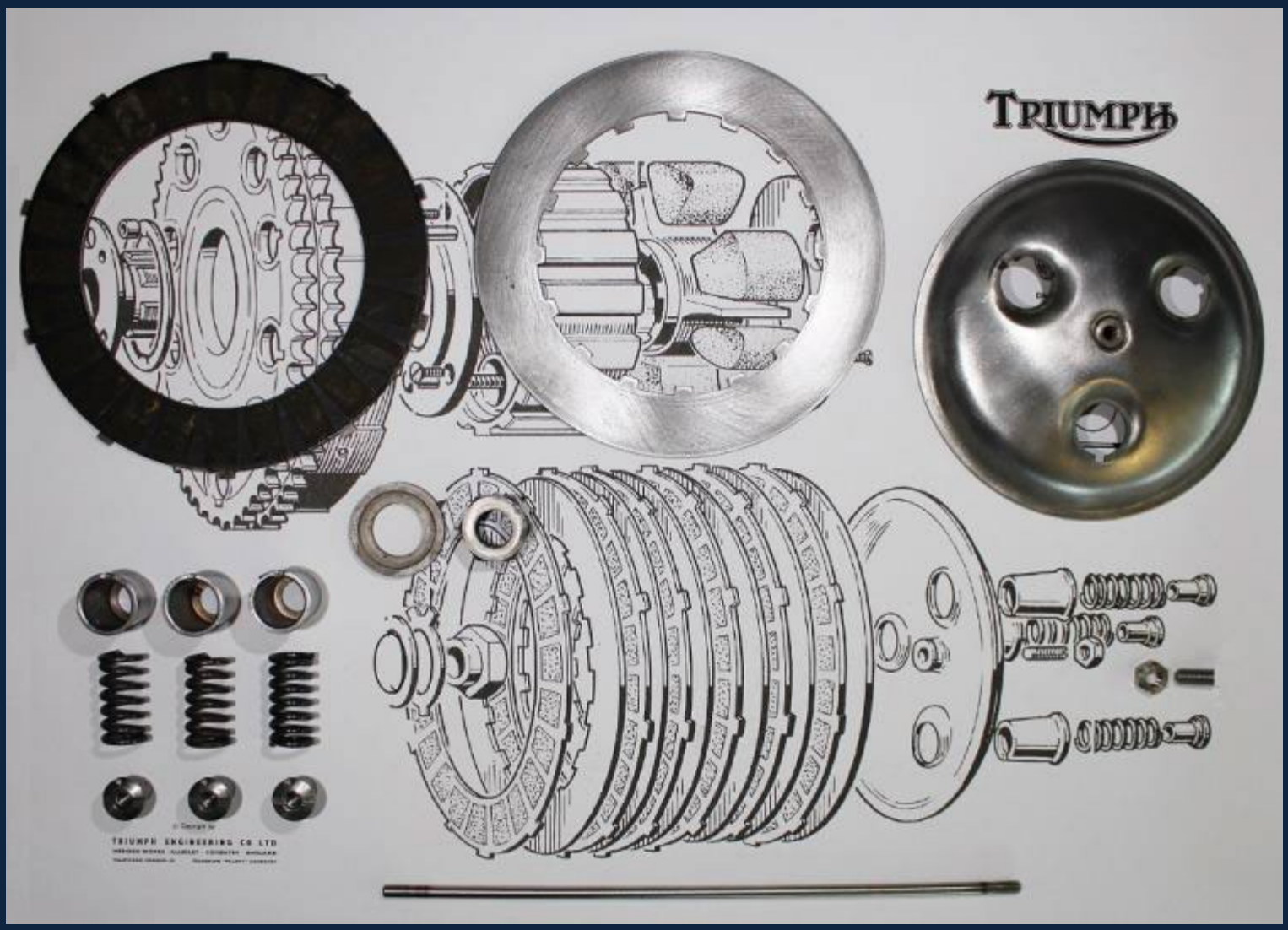
A small magnet is very useful for this task.

The Rollers Fitted

The Finished Primary Drive

Before fitting the Shock Absorber pack the clutch bearing with a small amount of grease

The Clutch



Clutch Components

Section C4 of the Works Manual

Shown above are some of the Clutch parts, one of the cork inset driving plates, one steel driven plate, the cups, springs, adjusters, clutch rod, nut, washer and the domed spring plate. This being the 3TA the Clutch has specific parts that differ in detail but not in design from the standard Triumph Clutch. Refer to the parts book.

When dismantling the clutch a magnet or pair of magnets are very useful to withdraw the clutch plates.
Clean the parts as you go with Brake Cleaner and store in the order of disassembly.

Check each part especially the plates for wear and flatness, discard any plates that are warped. Rusty (steel) plates can be cleaned by wire brushing or grit blasting and finished by linishing and treating with phosphoric acid (Jenolite)

Partially worn (cork) driving plates can usually be re-used, due to the low mileage that a classic machine will do in its lifetime.
The General Data in the Works Manual provides useful information for checking the clutch components.

Before assembling the clutch, test each part and do a dry run so that you do not need to keep referring to the instructions. Note the order of the plates and do not assume that the last person to assemble your clutch knew what they were doing.

Shock Absorber and 1st Driving Plate Fitted

All the Clutch Plates Fitted

Using a magnet the various clutch plates have been fitted (or removed) finishing with one of the steel (driven) plates. Visible above is the end of the clutch push rod the clutch nut and the end of the three screwed pins that provide the clutch adjustment.

Now is the time to complete assembly of the gearbox as the brake can be applied and the gearbox nut and clutch nut (above) can be tightened.
To do this, ensure that 4th gear is selected, temporarily fit the brake lever and use this in combination with a torque wrench and suitable sockets.
There is a tab washer that should be fitted behind the nut but this is not essential if Loctite is used instead.

The Torque setting for the Clutch Hub Nut is 50 lb/ft

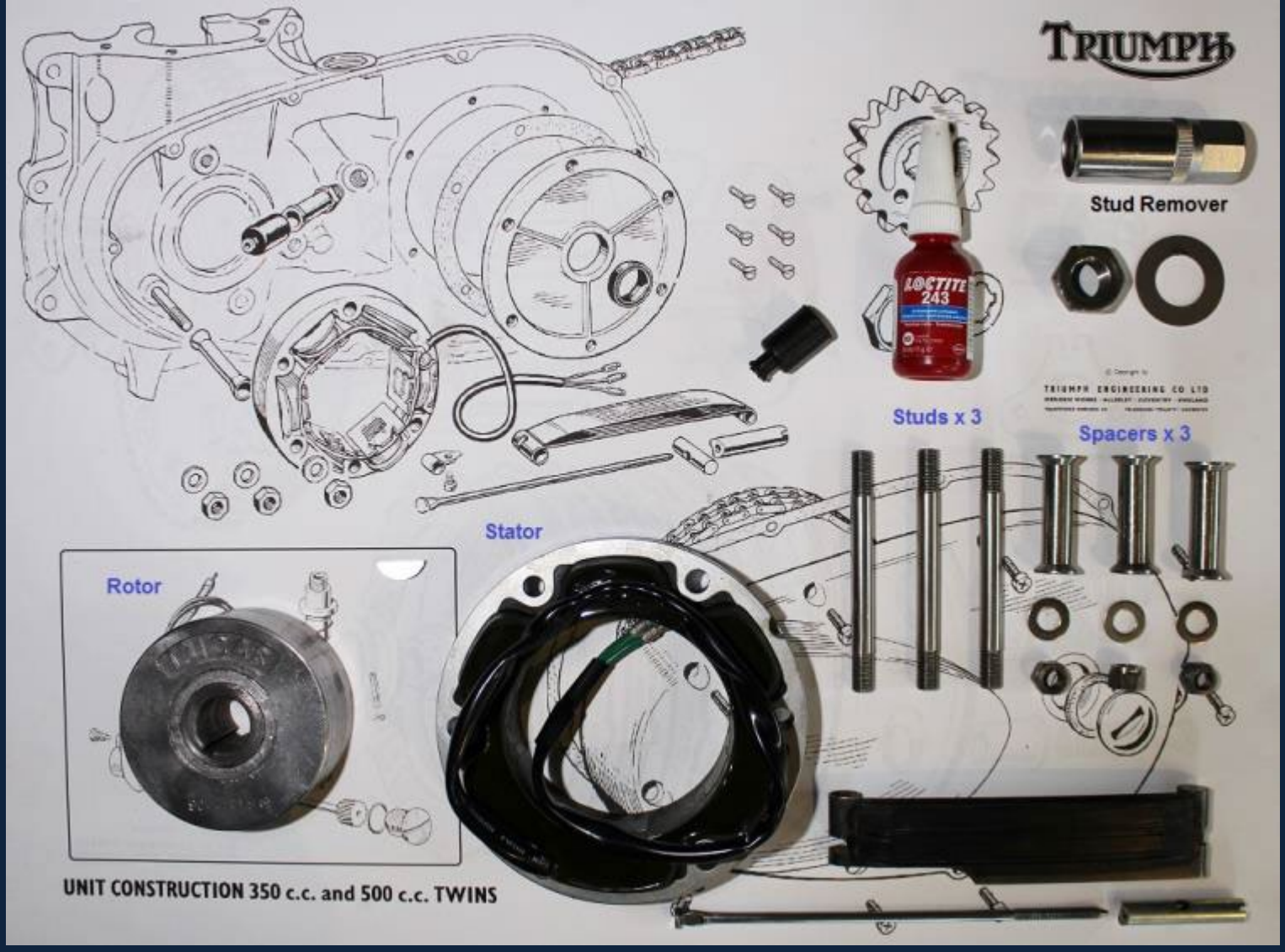
Refer to the Works Manual Data pages for all Torque Figures.

Clutch Dome, Cups Springs and Adjuster Screws fitted.

The gearchange mechanism, the gearbox outer cover and clutch cable assembly should now be completed.
Finish the clutch by fitting the remaining clutch components including the cups, springs and adjusters.
Here the parts are loosely assembled for illustration.

With the Clutch Cable Loose, screw in the Adjuster above until a slight resistance is felt and then back off one turn.
Turn the clutch spring adjusters so that an even pressure is applied to each spring and operate the clutch lever to lift the pressure plate. Using the Kickstart rotate the Clutch and adjust the springs until the pressure plate runs and returns evenly, a wire pointer temporarily fixed to one of the case screws is useful.
Finally recheck the central adjuster so that there is a small amount of play.
Refer to Section C6 of the Works Manual.

Alternator

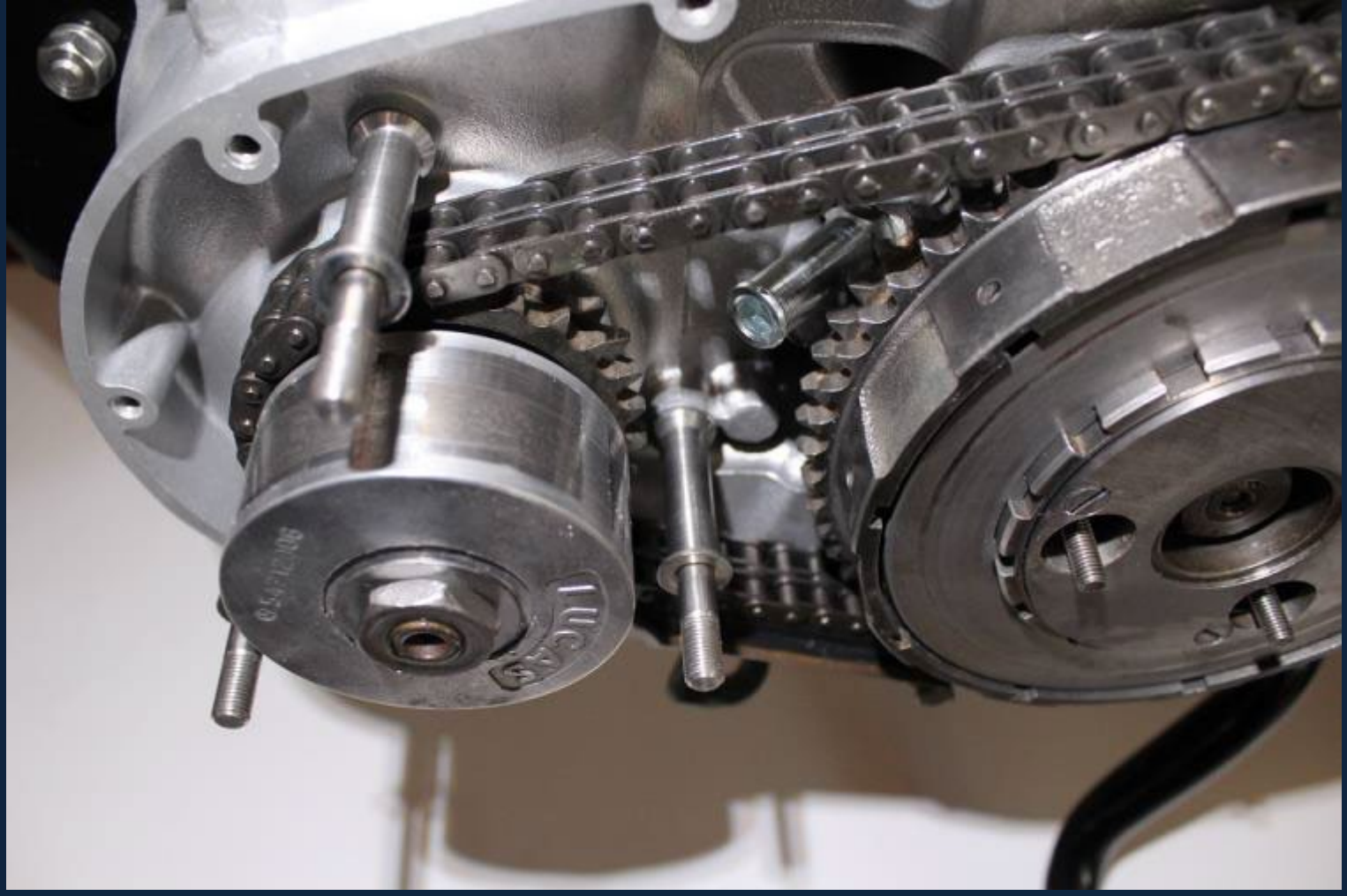


The Alternator

Shown are the various parts required to fit the alternator, not all are illustrated in the parts book. Here a two wire stator is being used
to suit the upgraded wiring loom that is planned. Note the three “cotton reel” spacers and the specialised nuts to hold the stator.
These typically are Aerotite nuts and are heat and vibration resistant locking nuts that you will only find here.

The studs show two different thread forms, 5/16 BSF into the crankcase and 5/16 (26 tpi) BSCY for the nuts.

The chain tensioner is shown at the bottom, frequently the threads on the adjuster wear and it is worth replacing these parts.
A loose chain will wear slots into the alternator spacers and it is rare to see old ones that have not been damaged in this way.
Fit the tensioner blade before fitting the alternator but do not fit the adjuster sleeve nut as this cannot be done until the outer cover has been fitted, as the adjuster sleeve nut must be fed into the outer cover as the final operation.



The Adjuster, Rotor, Studs and Spacers Located

The studs have been fitted to the crankcase and the spacers located, after fitting the woodruff key to the crankshaft the rotor is tapped
into place and the lockwasher and nut added. The nut cannot be tightened or removed unless either the rear brake can be applied
with the clutch complete or the crankshaft locked by passing a bar through the small ends of the connecting rods.
The Torque required for the Clutch Nut is 50 lb/ft and for the Stator Nut 30 lb/ft do not exceed these values!

Completed Primary Drive and Clutch

The remaining alternator parts have been fitted, first pass the cable through the rubber grommet and then feed this through the cable grommet fitted earlier, wiggling the alternator into place and simultaneously pulling the cable through underneath and behind the gearbox sprocket, often a messy job. Thread the cable through the bracket under the gearbox and bolt up. On Dutch Military machines and engines after 1969 the cable exit is easier to see as it appears on the top of the gearbox.

Before tightening the Alternator Nuts check that there is a uniform air gap between the rotor and the stator by inserting an 8 thou feeler gauge at multiple points, or inserting a sheet of laminated paper around the circumference of the rotor. Tighten the nuts gradually and evenly to the specified torque (20 lb/ft.) and check again with a feeler gauge to ensure that the rotor and the stator are not making contact at any point while rotating the crankshaft.

Here the brake lever has been fitted so that the gearbox nut, clutch nut and the alternator nut can be fully tightened. The lock washer for the alternator has also been bent over and the adjuster for the chain tensioner is being checked.

The Clutch Cover and Parts

Section C3 of the Works Manual

The clutch cover will show a part number cast inside, compare this to the parts book to ensure that you have the correct cover
as early covers for the T21 (1957-58) are not deep enough to accommodate the later clutches with more (6) clutch plates. Most original covers such as above will show damage in the area nearest the foot rest, in use this will barely be visible and any minor cracking internally can be treated with epoxy, or painted with enamel so that oil cannot leak.

Part Numbers to look for are… E3701 and E4122, the early cover though marked E3701 differs from the later version due to
the introduction of the chain tensioner and the need to provide access for adjustment. Both covers have oil level and drain holes along the bottom edge and the access hole for clutch adjustment.

Lubricate the gasket on both sides with silicone grease, this will stop it sticking and save trouble later if you need to remove the cover.
Originally the cover would have been attached with Phillips headed screws, now unobtainable and Allen key versions will be used.

Allen key fasteners for most British machines are readily available as sets; the Parts Books helpfully describe the lengths of these screws
so check those you have against this data, and make certain that the thread forms match your needs. There is no need to tighten these screws forcibly as you risk stripping the threads in the crankcase, work to tighten gradually and then check again after a few days when the gasket has settled.

Part 9 Complete

Exhaust System

The Narrow Bore Exhaust System for the 3TA and Tiger 90

The Exhaust Pipes fitted to the 3TA and Tiger 90 are a narrower bore than those fitted to the 5TA and Tiger 100
Refer to the Parts Books as there are detailed differences between models and frequent changes.

Part 10 Complete

Frame and Fittings

Engine Mounting the Complete Set of Parts

Refer to the Website Parts Book for Details of all the Fasteners

To fit the engine you will need to provide a strong support underneath the frame rails, a sturdy box will do but a small scissor or lab jack will make the job easy. Cover areas of the frame that may be damaged with cardboard or towelling taped into place and then offer the engine in from the right hand side. Once the long lower stud and the two spacers are located the engine will be stable enough to fit the rear engine mounts followed by the front plates and head steadies. Loosely fit all the studs before fitting the washers and nuts, gradually tightening them the until you are satisfied that everything is neat and secure.

When using all stainless steel fasteners apply an anti seize compound before fitting, Copper Grease is OK but not recommended as more suitable non metal alternatives are available.
Loctite LB 8009 is an example.

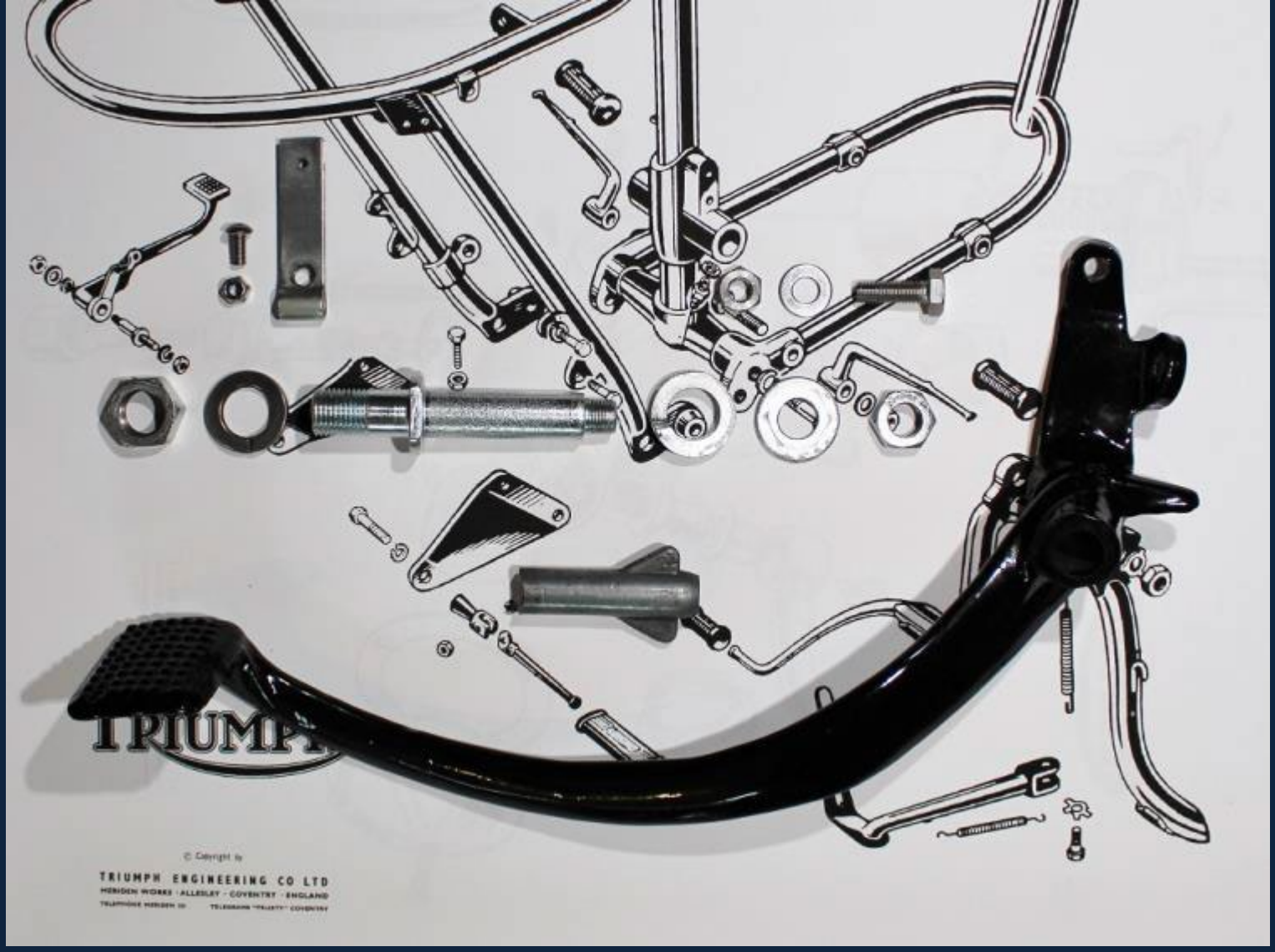
Engine Mounting Bracket

Here showing the arrangement of the rear engine mounting brackets and the oil tank support. The mudguard bracket here is specific to the late nacelle models as the more common version is square and has two bolt holes.

Frame

The Rear Frame Lug

Shown in detail is the rear frame with the swing arm, servicing of this is covered in the Works Manual, Section E at the lower right is the brazed on lug for the brake arm pivot and visible left, out of focus is the location for the right hand footrest bolt that will be used to attach the oil filter bracket, see below.

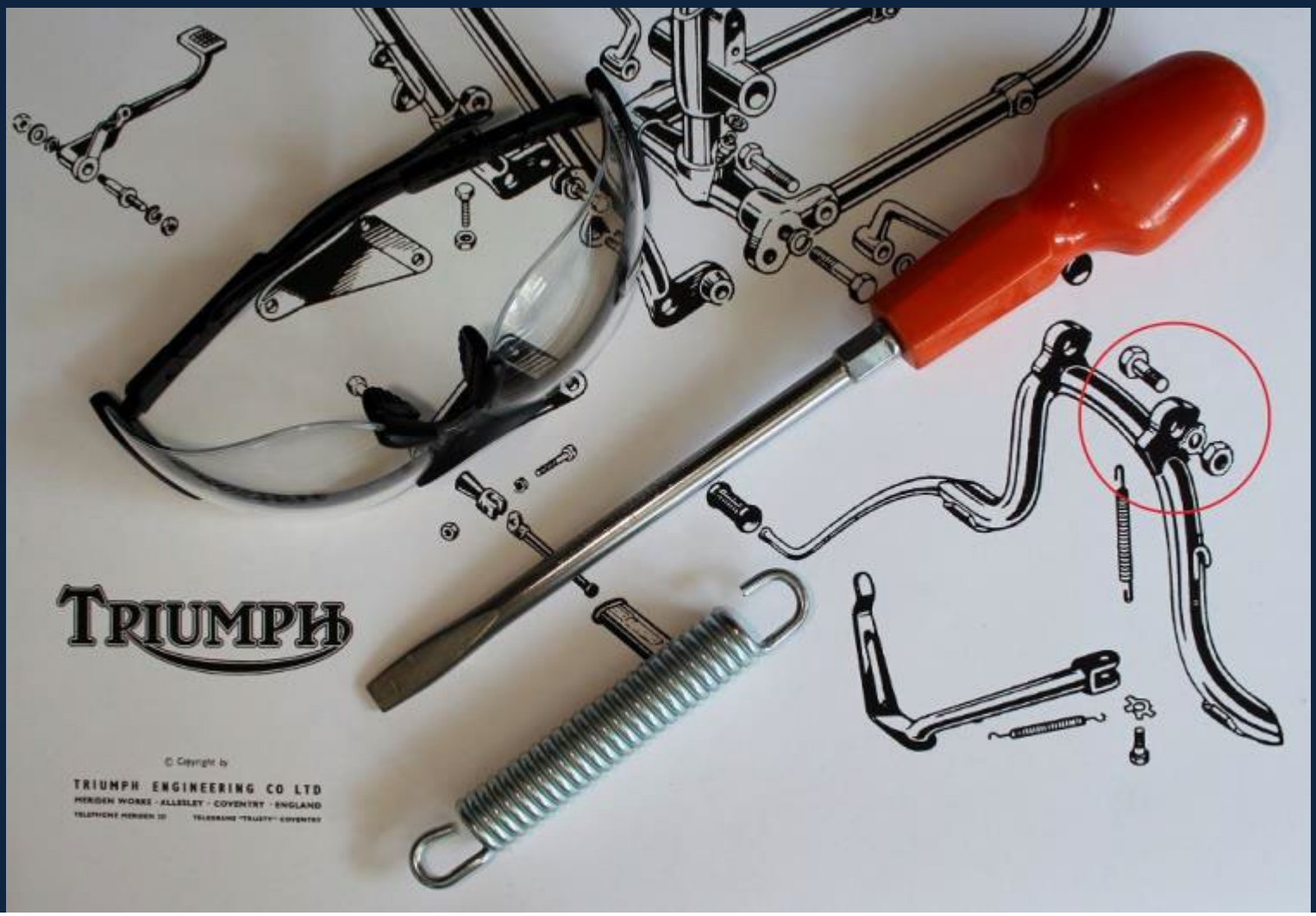


Brake Lever Parts

Here showing the Brake Lever its Pivot and the fasteners needed. The Pivot nut is slimmed and locates it firmly into an eye brazed
to the frame while at the opposite end a large thackery washer, wide plain washer and a bevelled nut hold the lever in place.
All the fasteners would originally have been cadmium plated, here in zinc.

Stands

The Fitted Mainstand and Spring



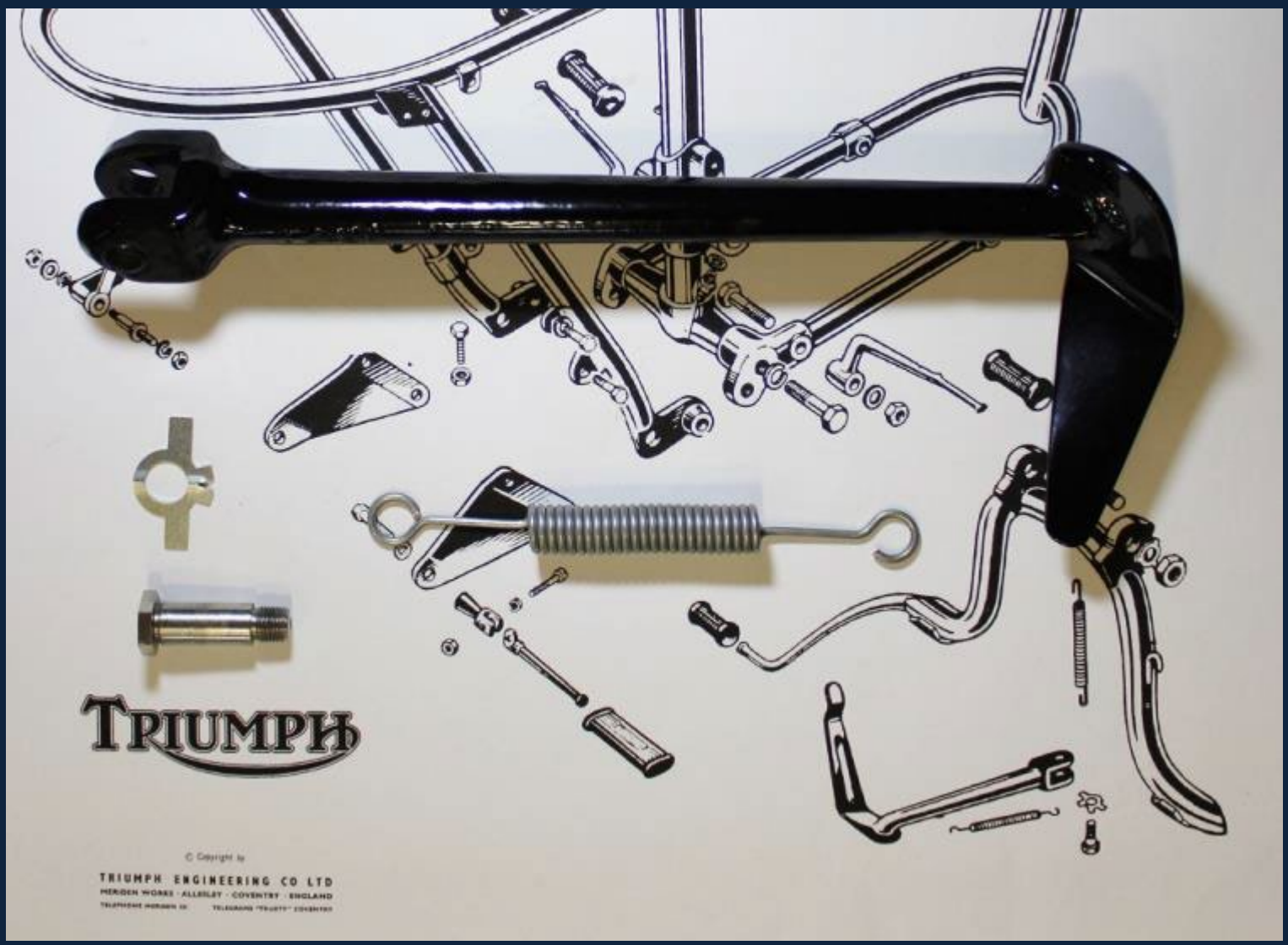
Fitting the Mainstand and Spring

The illustration for the Mainstand fitting shown in the parts book is incorrect, the Mainstand lugs (Red) if you look closely are threaded
and therefore the specialised bolt F3619 is designed to screw into them. It is very likely that the threaded holes and the bolts in your Mainstand will have worn making the action of the stand not as conceived.
Other common features are that the stand distorts with use and the left leg will bend forwards and the feet wear away.

Strip the Mainstand of paint and if you have access to a large vice and a gas torch, heat the left hand leg near the lug and bend it back
into shape, checking on a flat surface until the stand is square. For the feet if these show only light wear these can be welded up and
dressed to shape or alternatively cut the feet off and fabricate new ones and weld in place. If the holes in the stand lugs have
worn drill these out and fit bushes or alternatively weld up completely and drill again. If you are able, tap the holes to match the fasteners you intend to use noting that the later pivot bolt F5678 fitted from 1968 is in UNF.

To fit the Mainstand Spring safely you will need a strong screwdriver like the one shown above, the essential features are that the spring is able to slide smoothly along the length of the screwdriver and that the flat of the screwdriver is wide enough to rest firmly on the peg on the frame. The spring must be able to fit over peg, test first
and if needed bend the end open slightly or cut away a little from the end of the hook.

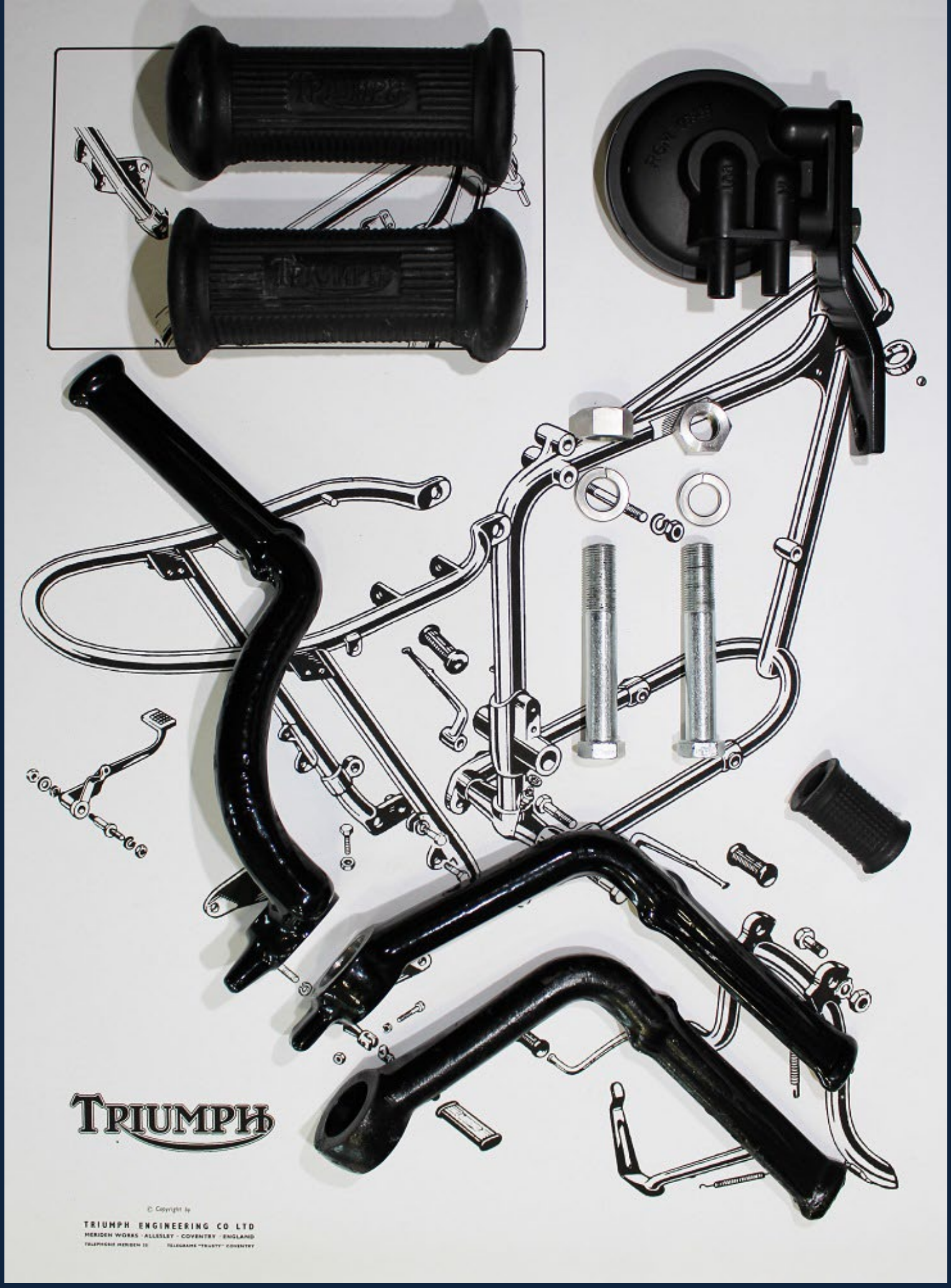
Before fitting the spring take some precautions, work outside, wear strong gloves and safety eyewear.
Fit the Mainstand with the bolts, tabs and the nuts, hook the lower end of the spring onto the stand.
Slide the top hook over the screwdriver, place the flat on the peg and keeping a firm grip lift up.
The spring will slide down the screwdriver and hopefully drop satisfying into place.



The Sidestand Parts

Like the Mainstand there were several Side Stands manufactured and the number cast onto the stand is not usually the part number.
Select a stand that suits the wheel sizes of your machine, noting that US models usually feature 19in wheels and a longer stand.
Damaged or worn stands can usually be repaired and new fasteners and springs are available.

When fitting the stand fit the spring first and then manipulate the stand onto its lug before inserting the pivot bolt.
Shim washers can be used to take up any slack at the pivot. Don’t forget to fold over the tab washer!



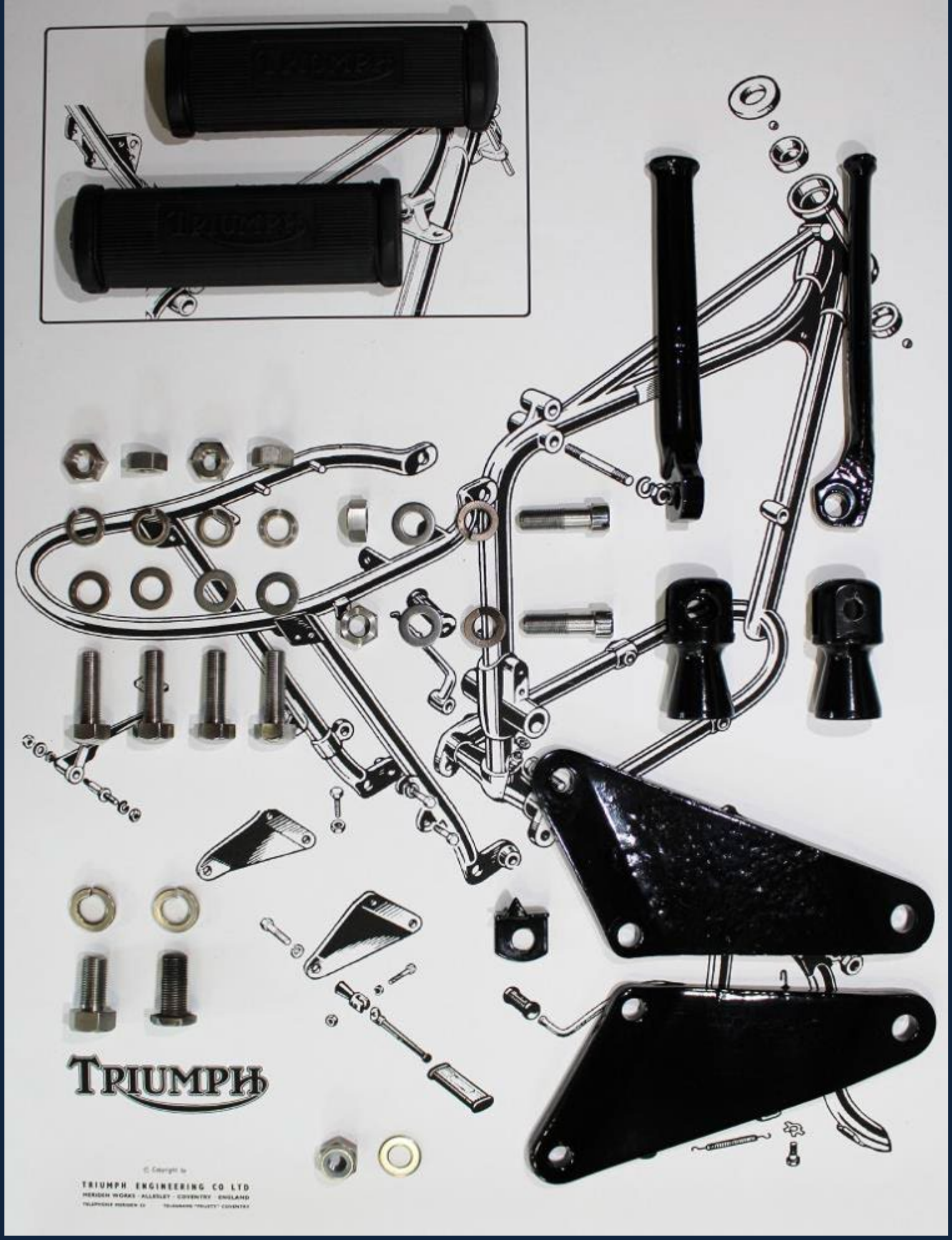
Riders Footrests, Rubbers and Oil Filter

Shown above are the Footrests, Rubbers, Fasteners and the Oil Filter and its Bracket. The Footrest Rubbers show the correct
Triumph script and are easy to fit if lubricated with a little soap. Footrests are handed and though they show the same Part Numbers (F4214/F4125) from production in 1957, there is in fact a change in 1963 when the extended tang appears on both the solid footrests shown above and the folding pattern fitted to the T100C models. The earlier footrest allows some adjustment but is more likely to slip when weight is applied.

Before fitting the footrests remove any excess paint from the taper within the rest and boss on the frame so that a good contact will be made between the two surfaces.

The footrest bolts (F4369) are specials, 7/16 in diameter but with reduced heads and threaded at the end only. The bolt head is designed to recess into the lower frame lug. The Oil Filter bracket takes advantage of this feature and uses the bolt and the lug to provide a secure mounting point.

The positioning of the oil filter centrally under the gearbox is only suitable for machines used exclusively on the road and riders using their machines in competition should experiment with alternative locations.



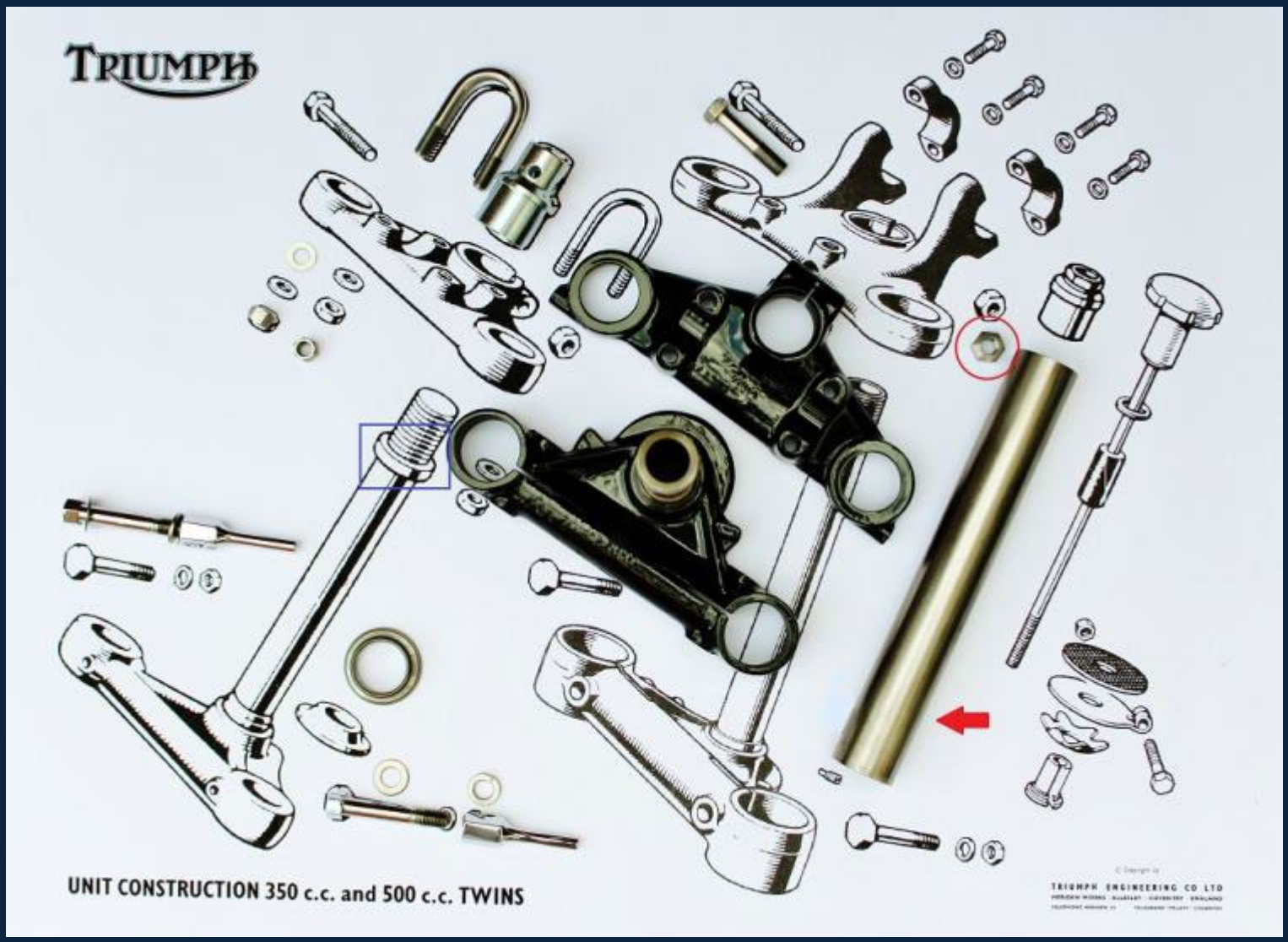
The Pillion Footrest Parts Group for 1966

The standard triangular type bracket was fitted from 1962. Up to and including 1965, attachment of the brackets to the frame
had been with studs and nuts rather than bolts. The pillion footrest attachment to the brackets also seems to have undergone

some changes, beginning with studs and thin nuts up to 1965 before changing to bolts with thinned heads, an original is shown
Refer to the Parts Books as details of the fasteners used are supplied.

Fitting the parts is straightforward but note that the pump clips may not have been fitted to export models.

Suspension & Steering



The Fork Crown

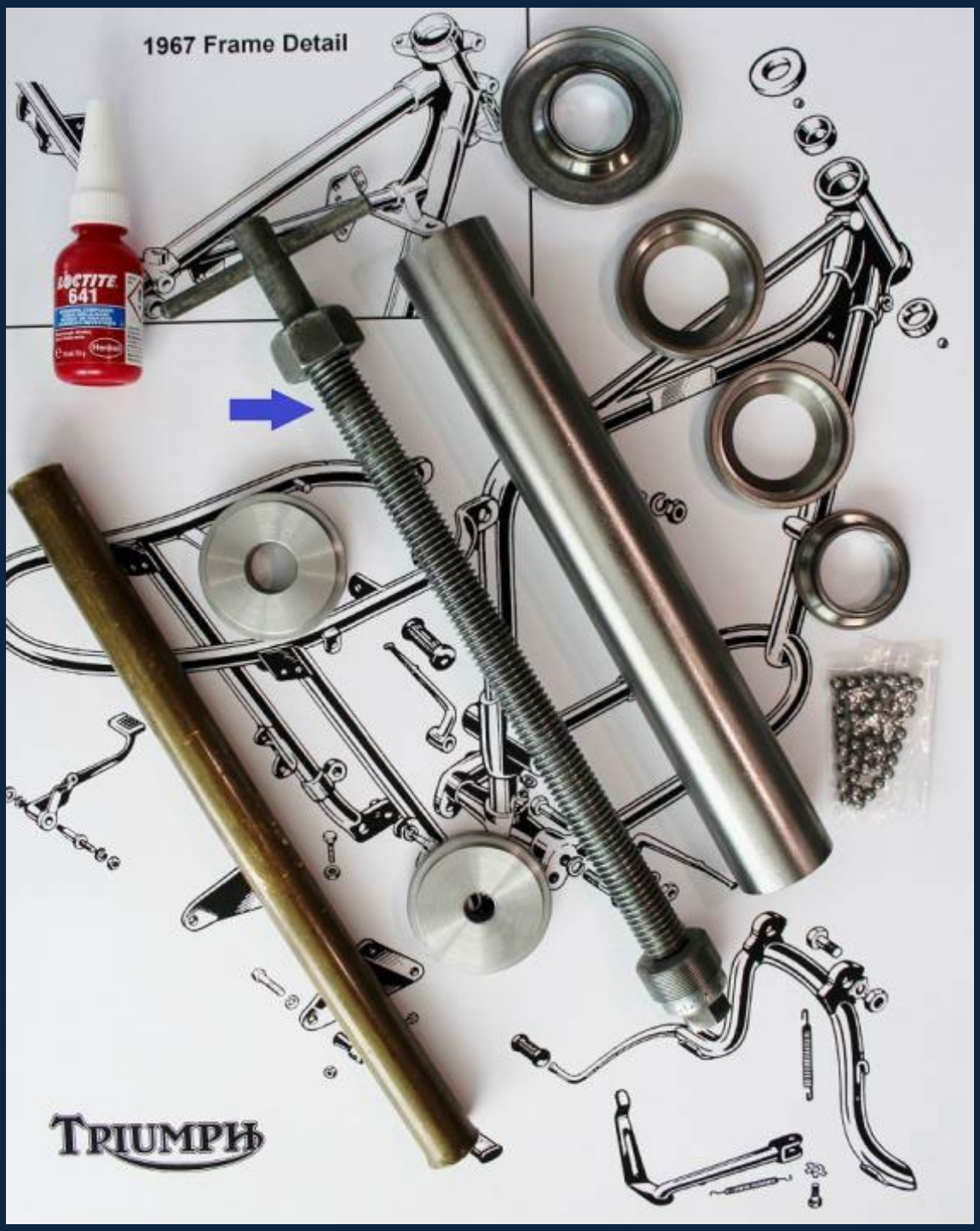
Section G of the Works Manual

Shown is the Fork Crown group for the 1966 3TA and used on the other Nacelle Models for many years.
The Tubular Drift arrowed is recommended to fit the lower cone to the Middle Lug.

Though the parts book illustrations appear to show two versions of the Middle Lug and Stem these actually have the same part number.
The section highlighted in Blue above is incorrect and a good example why the Parts Books should be used with care.
There are two types of Top Lugs up to 1967, H1287 for the sports models introduced in 1962
and here H1108 for the Nacelle Models used from 1957.

In 1967 new versions of Top Lug appear along with a new Middle Lug, incorporating a steering lock they are incompatible with earlier parts.
The New H2099 Top Lug has solid supports for the handlebar and is used on US machines while H2100 uses Isolastic bushes and P clamps.
for some models made after 1967, earlier parts may have been used by the Factory. Look for cast numbers that can help to identify them.

Dismantling the crown is straightforward after the fork stanchions have been removed. Loosen the Clamp Nut (Red) first. Place a towel under the headset to catch any ball bearings that escape and then supporting the lug unscrew the sleeve nut.



Headset Parts and Tools

Some special tools are required to work on the headset and fork assembly, these are shown above along with the headset parts.
If you have access to a lathe the two circular Cup discs can be made to use with the fork service tool Z161, (Blue Arrow), these will draw the cups simultaneously into the crown and this tool can be used to fit the gearbox bearings as well.

The Tubular Drift (+1 1/6 in or 27mm ID) is used to drive the lower cone onto the Middle Lug.

Driving the Cups out with a Drift.

Warm the crown with a hot air gun, insert the drift as above and apply controlled blows to the inside lip of the lower cup, moving the drift after each blow so that the cup is forced out gradually and evenly.
Working from underneath do the same for the upper cup until both have been removed.

The Crown with the Cups Removed

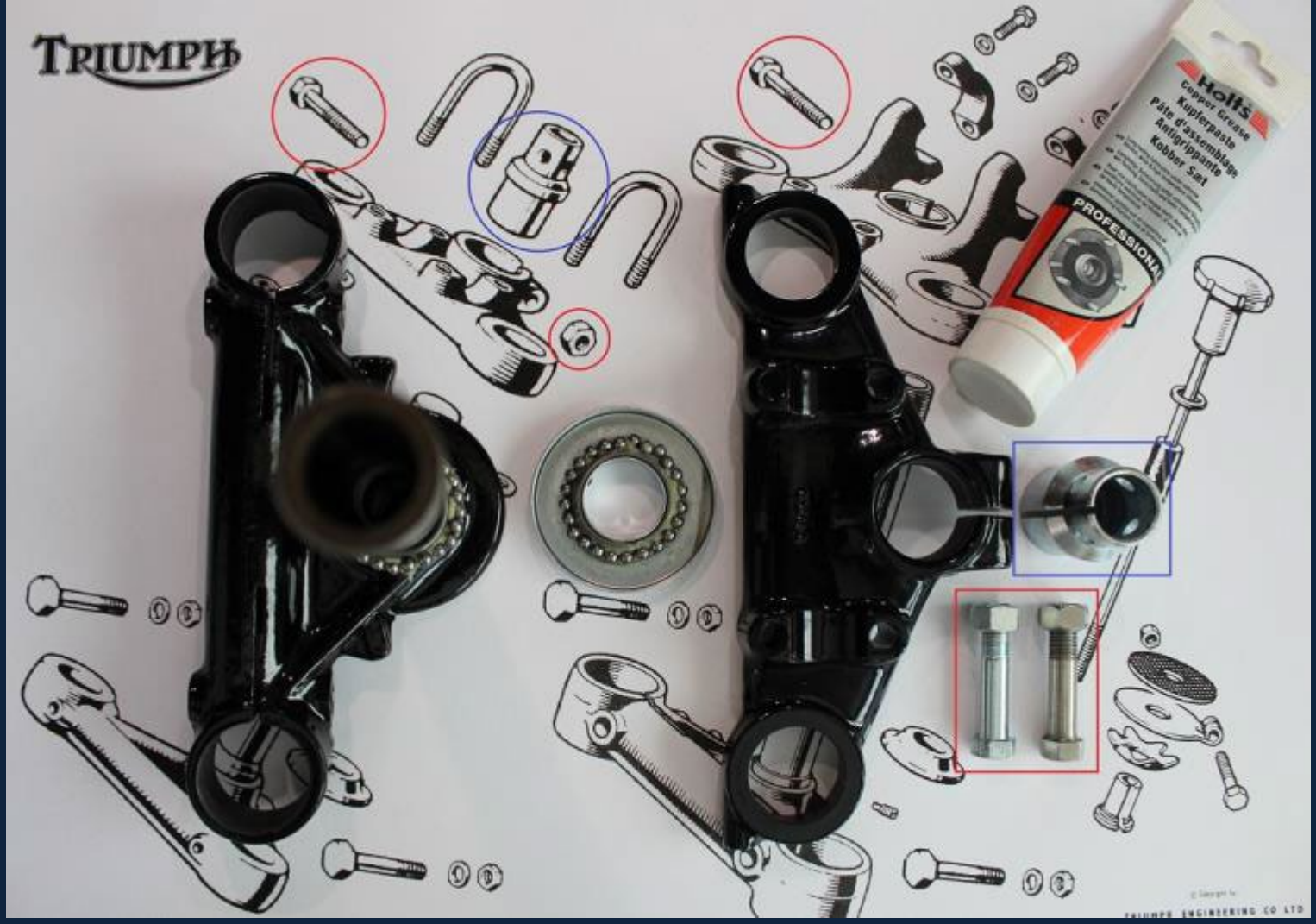
Here the crown has been cleaned with an Emery Wheel to remove all traces of paint and rust.

Using Tool Z161 and the Discs to fit the Cups Simultaneously

To Fit the Cups either use a block of hard wood or aluminium to drive them in, or the tool above but make sure that each cup enters
squarely and no burrs are created. If either cup is loose then use a bearing fit compound such as Loctite 641 to locate the cups firmly.

Fitting the Ball Bearings

Here the lower cone has been driven onto the stem, greased and now the Cones are being loaded with 48 3/16 in diameter ball bearings. A small magnet as shown will help to pick up the balls and place them in location.
Apply more grease to the Cups before completing assembly.



The Completed Headset Ready to be Fitted

Ensure that the Sleeve Nut (Blue) is lubricated before final assembly as this will be used to adjust the headset bearings once the
stanchions and front wheel have been replaced. The Clamp Bolt and Nut (Red), here the original and in stainless should not be tightened until the fork assembly has been completed.

Front Forks

The Fork Parts Nacelle Type 1965-1967

Section G3 of the Works Manual

Shown above are the fork components to suit the Nacelle Models from 1965 to 1966, they are very similar to the fork fitted across the Triumph range from 1964 when the external spring pattern is introduced. Rather than gaiters solid covers are used and the stanchion has an additional threaded hole near the top to allow the fork oil to be replenished by removing the headlamp without disturbing the nacelle.

There are several subtle changes to the stanchions over the years and also errors in the part numbering, supply issues may mean that only later types are available as replacements, so care needs to be taken with identifying parts, thread forms and interchangeability.
The later fork fitted from 1968 to the road models with its shuttle damping is an improvement over the 1964 to 1967 version and can be considered to be an upgrade. Machines fitted with later stanchions can be identified as the top nuts are slightly domed.

For the Top Nuts a 38mm Socket is suggested.

TOP TIP…Servicing the forks on any Triumph is greatly eased if a second front axle is obtained, fitted in place of the front wheel this allows the mudguard to be easily removed, the seal holders undone and the gaiters, springs and sliders serviced without having to remove the stanchions or disturb the headlamp, instruments and headset.

The Lower Stanchion Assembly

These are the parts for the non-shuttle damped fork from 1964 to 1967, the two sintered bronze bearings, damper sleeve; here the original in alloy

the bearing nut (Red) and the tool for its removal and fitting. The tool is made from a 38mm ½ in Impact Socket milled to suit the bearing nut.

Frequently the bearing nut is very difficult to remove and the tool above gives you a fighting chance, as with most disassembly

operations apply heat first, lots of it in this case and hold the stanchion firmly in a vice fitted with soft jaws.

Once the Bearing Nut is removed the lower bronze bearing (bush) should slide off or can be tapped off with the upper bearing.

Before fitting any new bearings do a dry fit as it may be necessary to machine or ream the lower bearing to fit the stanchion.

If the bearing nut has been damaged during removal, replace it with a new one and use Loctite on assembly.

The Bottom Members, Caps, Upper Bearing and Seal Holder

Shown here the standard Bottom Members fitted from 1964 to 1968, here in the machine colour rather Black. The left member has the
brake anchor and both show the mountings for the mudguard bracket. Before assembly ensure that these are clean. (5/16 BSCY Tap).
From 1968 along with Triumph practice the thread forms for the fork components change to UNF and owners should check carefully what thread is being used. A tell tail sign of later bottom members is an extended brake anchor stop.

Removing the Seal Holders during disassembly can be difficult as they are awkward to grip effectively.
Try to loosen them once you have removed the mudguard but before removing the front wheel.
Only apply force at the bottom of the holder, the metal is thin elsewhere and easily dents.
Specialist Tools are available. A spare front wheel spindle is very useful.

The upper bearing is lipped to fit the bottom member and should fit easily with the washer between it and the seal holder.
Apply a sealant such as Loctite 542 or 'Wellseal' to the threads before fitting the seal holder.
Tightening by hand is usually sufficient and can be done after the fork is reassembled.

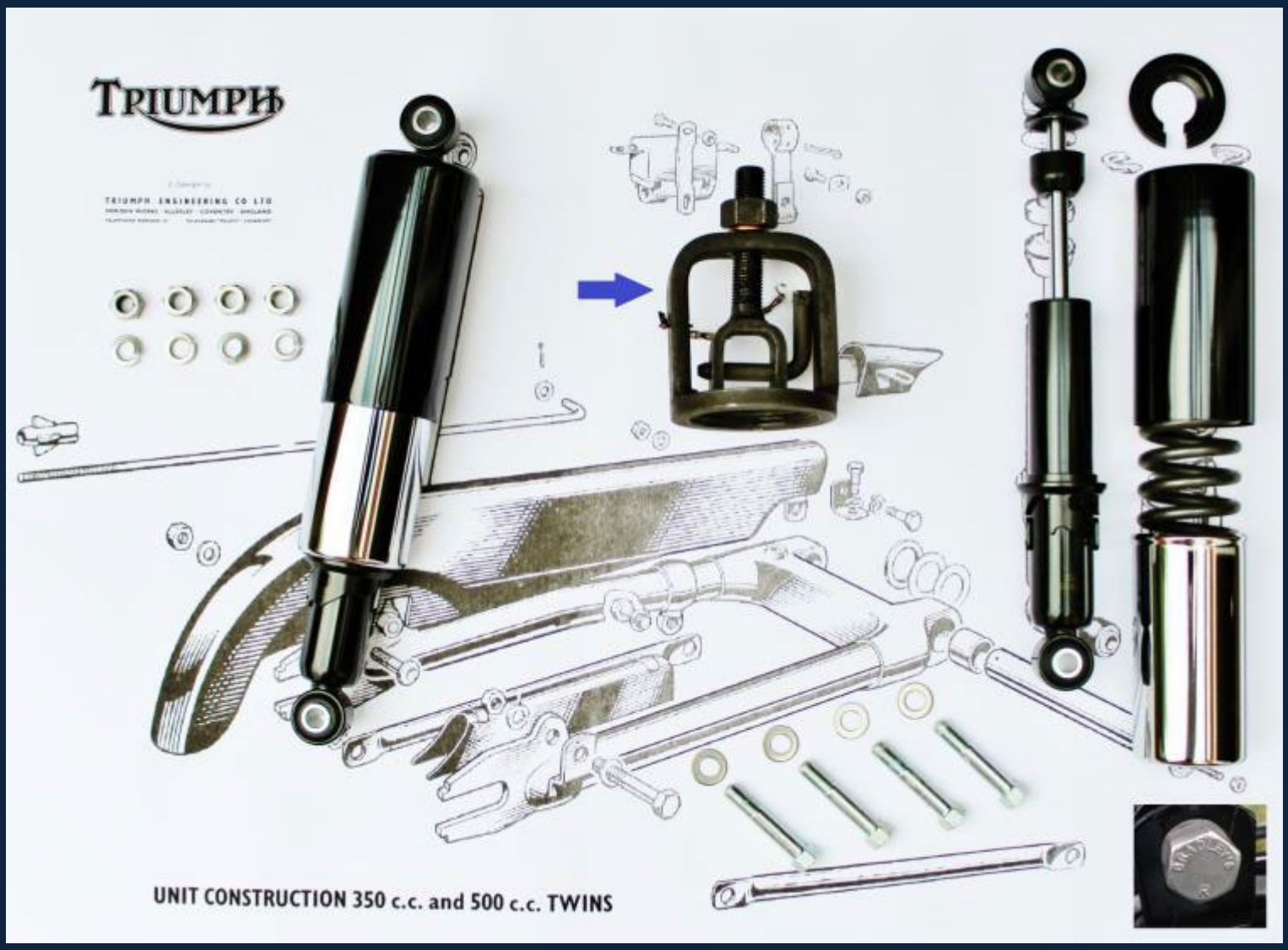
The Bottom Members still contain their Tapered Restrictors, generally these do not need to be removed.
They are secured by a flanged bolt recessed into the hollow where the front axle sits.

Fork Spring and Covers

The standard Fork Spring fitted to the road models from 1965 is the H1891 Yellow/Blue, (12 ½ working coils at 26 ½ lb/in).
The Competition and Military models, have alternative springs and owners should note any colour codes that are present.

On all machines there is a Cork Washer between the spring cover or abutment and the middle lug.
For detailed fork fitting instructions and tools refer to section G of the Works Manual.

Rear Suspension



Rear Suspension

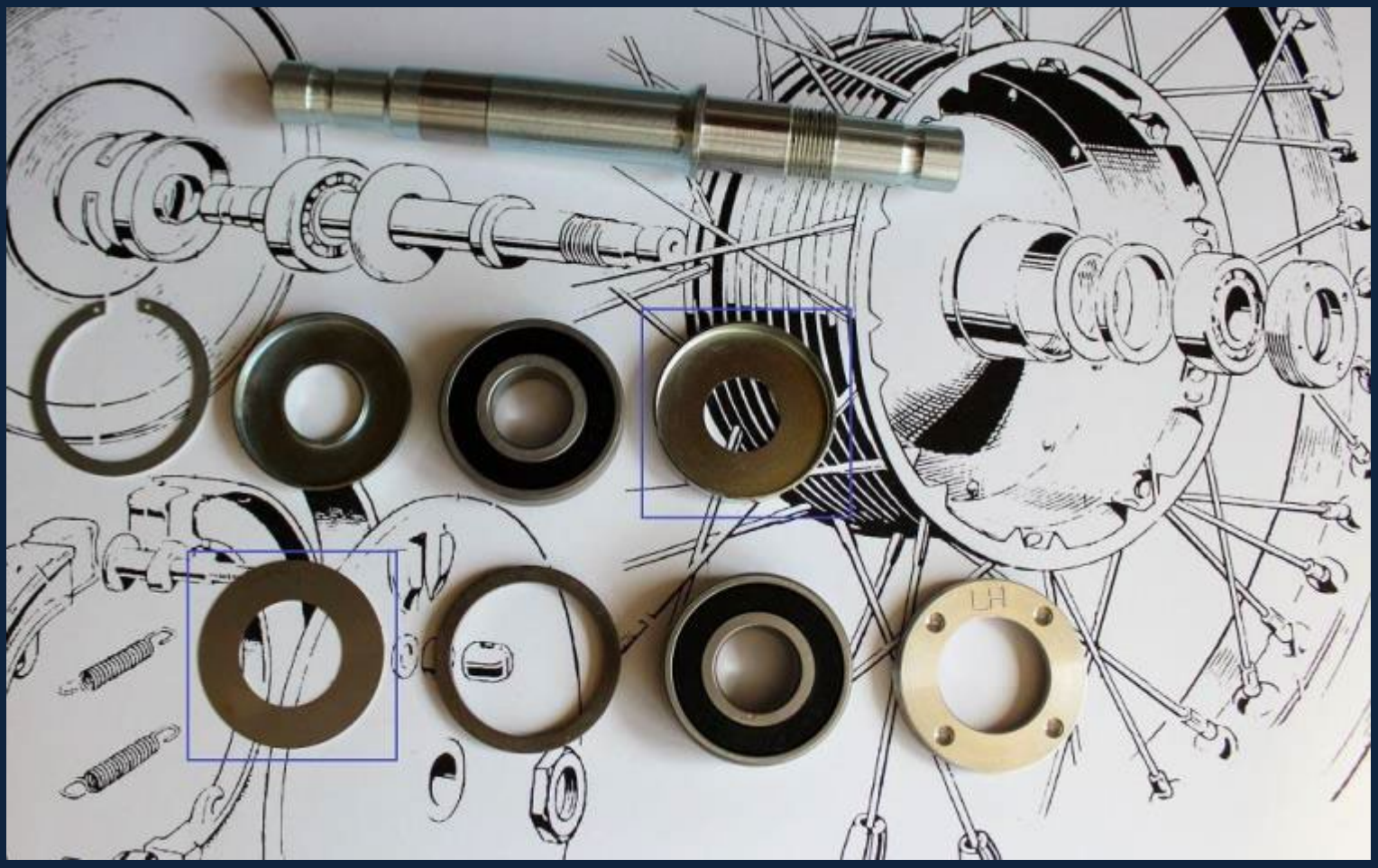
Shown above are the parts for the rear suspension including a useful tool (Blue) that allows disassembly of the shock absorber.
Pattern shock absorbers of good quality are readily available and often in a selection of spring weights to suit the owner.
For solo road riding I recommend a spring rate of 110 lb, standard is 130 lb and for competition/off road 145 lb.
With the Tool above it is easy to fit alternatives, made or supplied to your own specification.

Attachment of the shock absorbers throughout production was by bolts but over the years there were subtle changes made above are the famous “Bradley’s” bolts, so called because of the cast in name and much sought after by Restorers
On some machines from 1964 you will see the much rarer “Newton” Bolts used.

The common feature of these bolts is the reduced head size and owners seeking a nod at originality will wish to recreate this feature. Refer to the parts books for details of the various fasteners used.

Hubs & Brakes

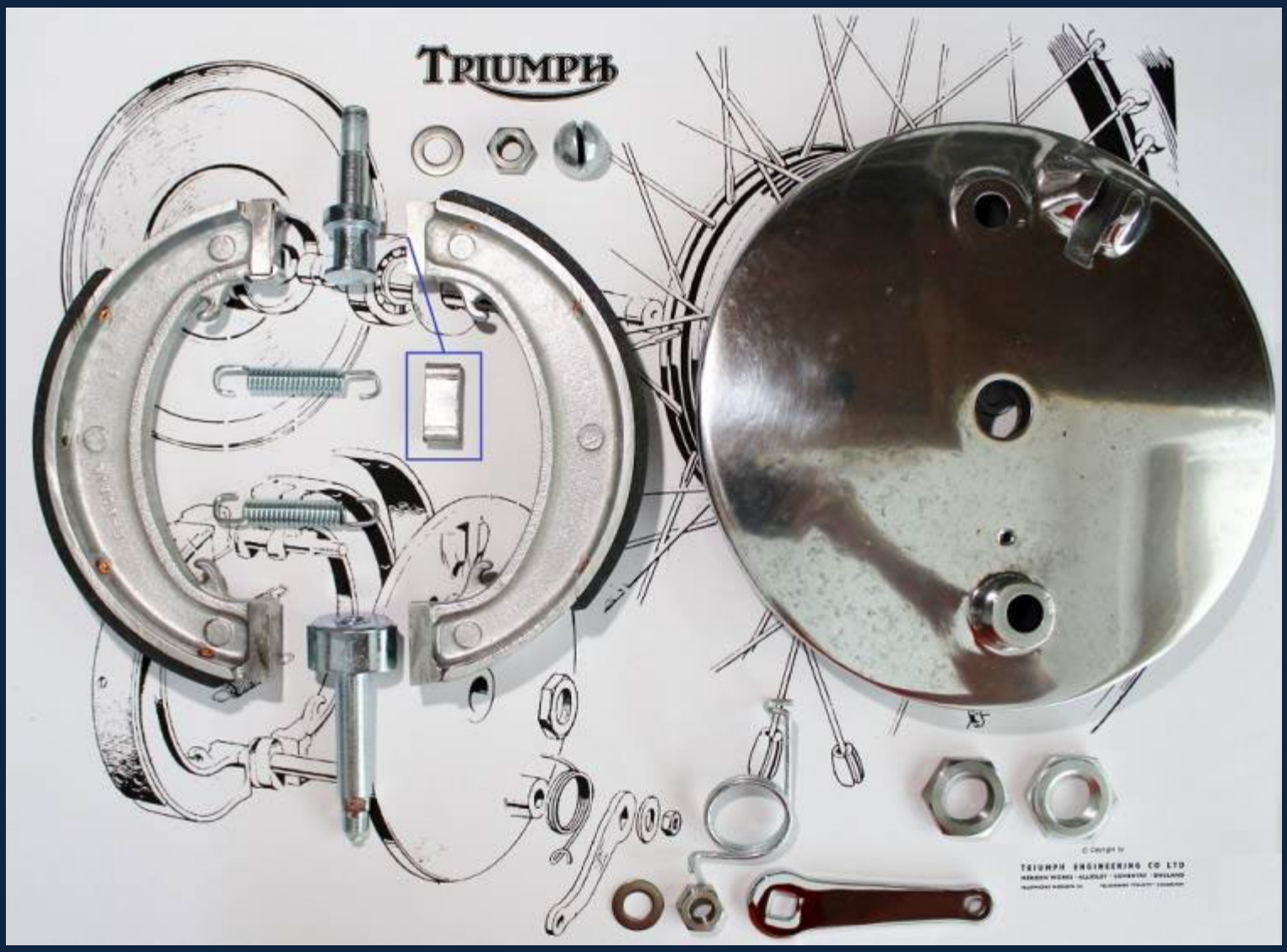
The Front Hub and Brake



Front Wheel Axle and Bearing Set

Section F of the Works Manual

Here sealed bearings are being used to replace the original open bearings and the two Grease Retainers (Blue) will be omitted.
To remove and fit the bearings refer to the Works Manual, ideally use a suitable mandrel to fit the bearings rather than a drift.
Note the Left Hand thread of the retaining ring, this has a very fine thread that can easily strip, fit using a peg spanner.

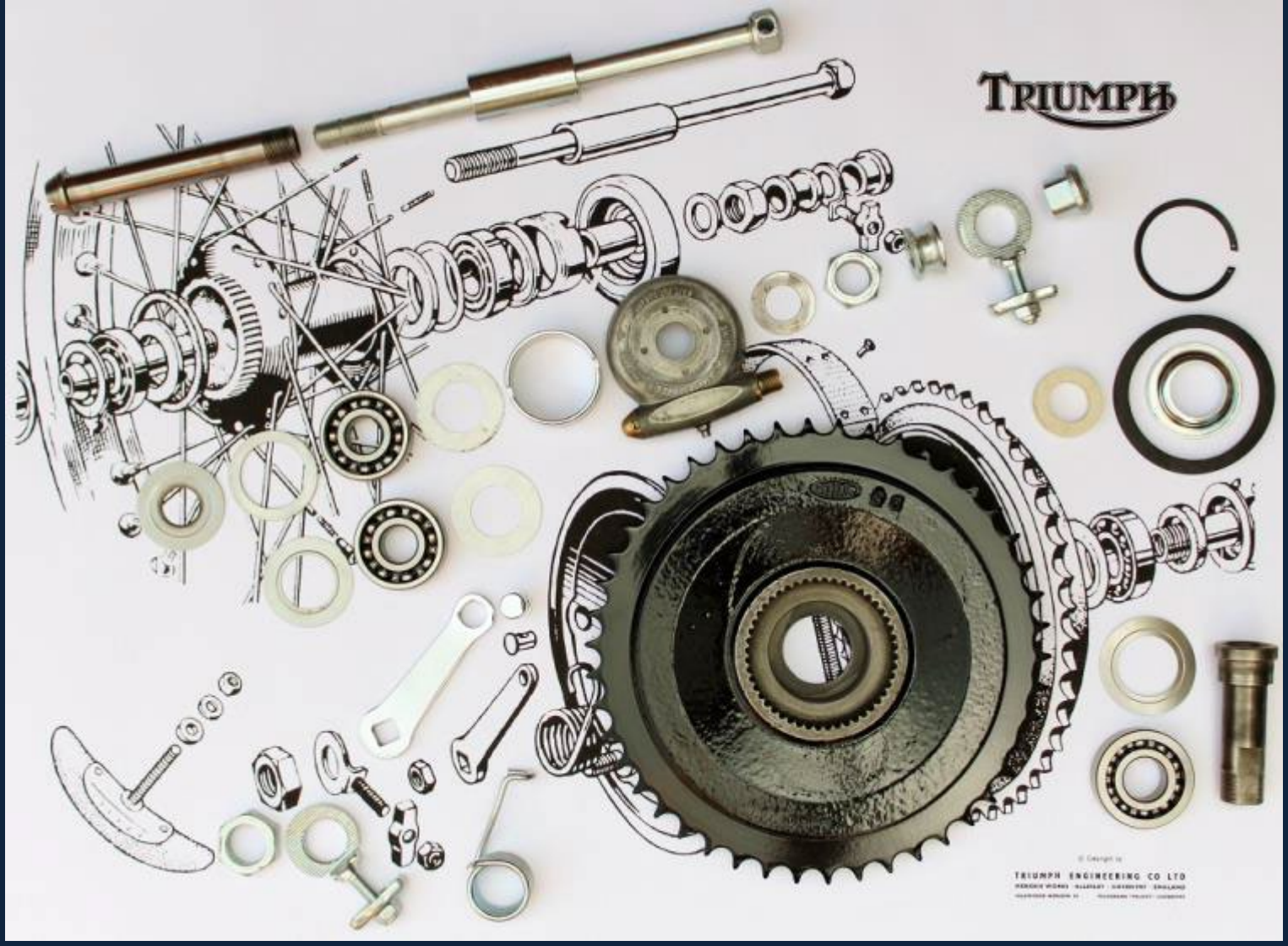


The Front Brake Components

Highlighted in Blue is one of the two Thrust Pads, these fit against the fixed pivot shown at the top left. The shoes have been
arranged in the correct position and the ends of the linings chamfered. Shown bottom right are two versions of the brake plate retaining nut, the original and a stainless version that is available as an upgrade.

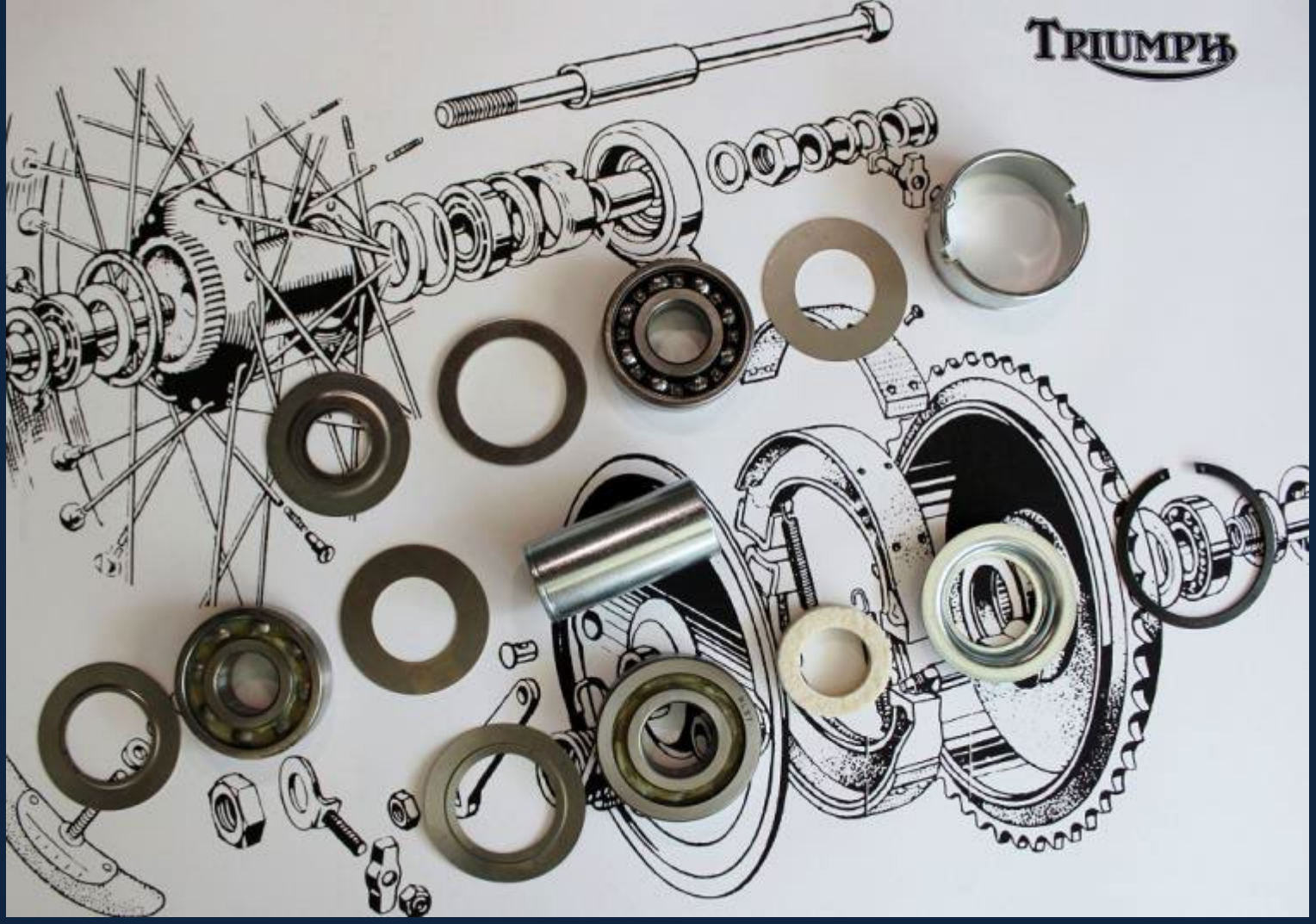
To clean the brake components use a proprietary Brake Cleaner, and before fitting the shoes deglaze them with emery paper.
Weak or damaged return springs must be replaced; if they come loose they can lock the wheel leading to an accident.

The Correctly Assembled Brake



The Rear Wheel Components QD HUB

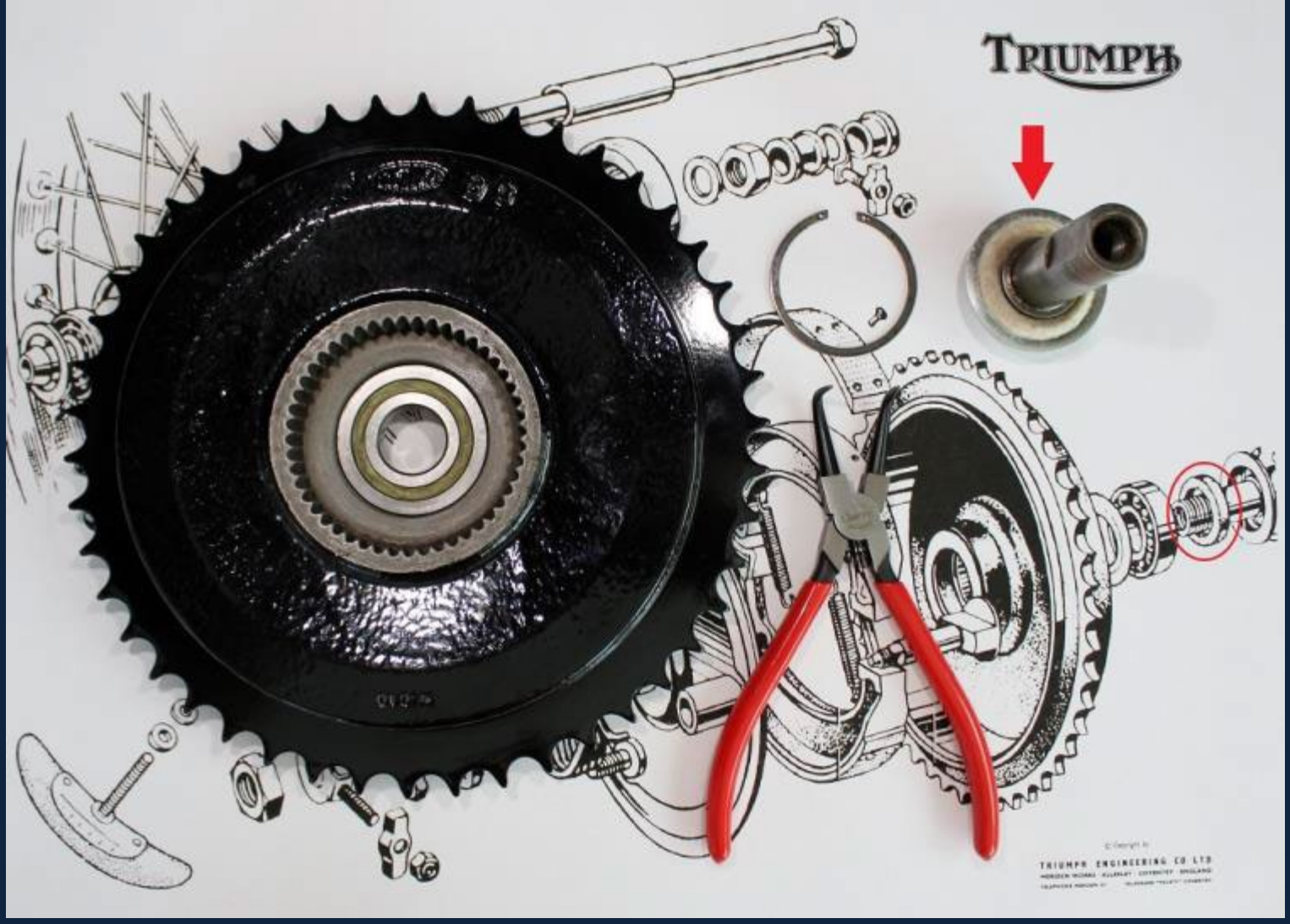
This is the complete part set for the QD (quickly detachable) hub arranged in order of assembly. Rarely fitted to export models
but the general principles apply across both hub types. Note that there are specific bearings and parts for this hub and owners are advised to consult the parts books carefully.



The Bearings, Grease Retainers and Parts

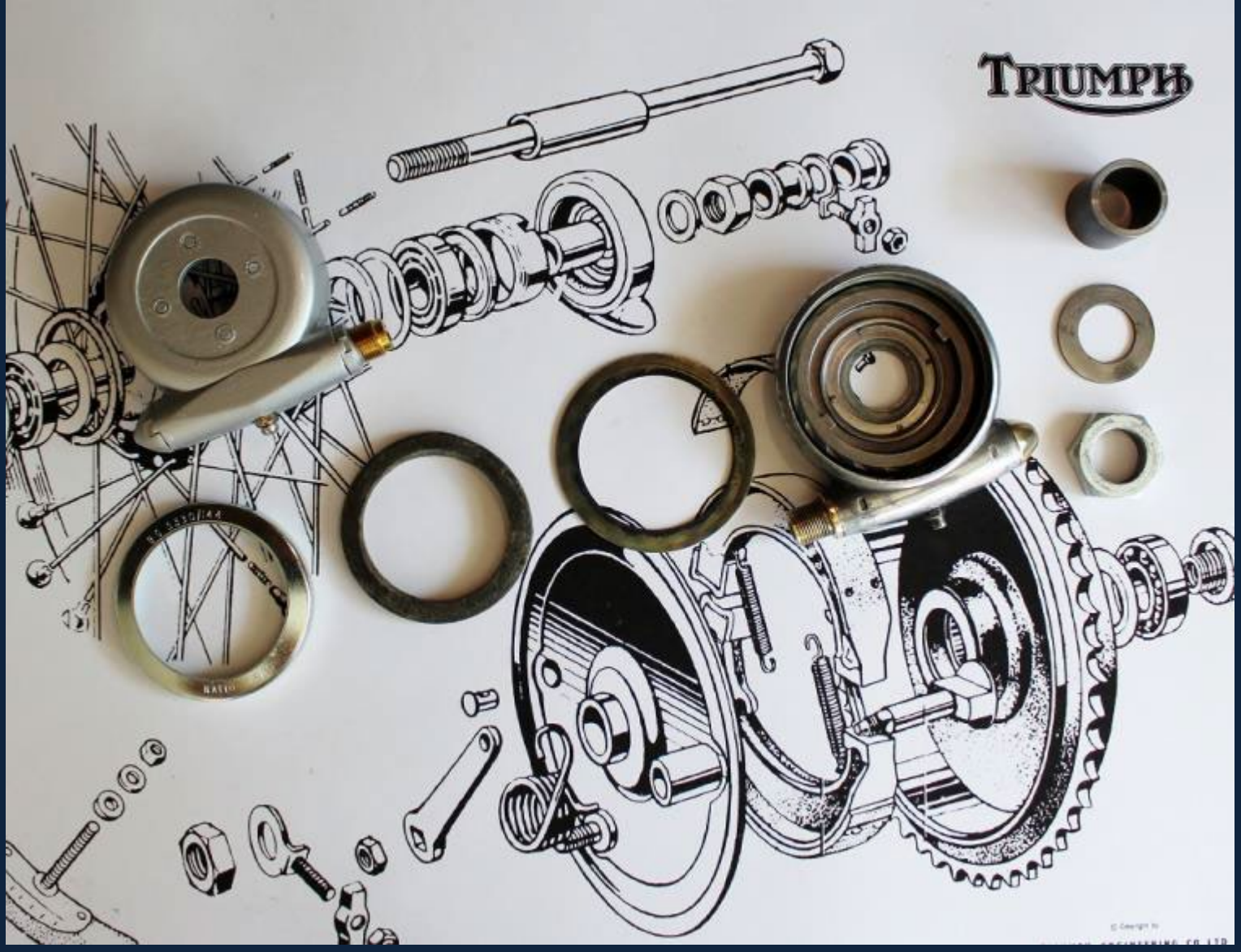
Arranged in order of assembly are the Bearings and other parts for the QD Hub. The top row is the Right Hand hub bearing set,
the centre the Left Hand bearing set (with the central spacer) and at the bottom is the set for the Sprocket/Brake Drum.
The bearings have been packed with grease and the felt washer soaked in light oil.

Prior to assembling the hub the thread for the speedometer drive sleeve has been cleaned and a test fit completed.
Refer to Part F8 of the Works Manual for dismantling and fitting instructions.



The Sprocket/Brake Drum QD Hub

The Grease Retainer and the Bearing have been fitted to the Sprocket/Drum while the Felt Washer has been fitted into the Bearing Retainer W1043 and onto the Bearing Sleeve W1045 (Red). The retaining circlip is ready to be fitted. Assemble in this order as the felt washer is inclined to distort if the bearing sleeve is pressed in afterwards.



The Speedometer Drive

The Smiths Speedometer Drive was supplied to almost all of the British Motorcycle Manufacturers and so varied are they in gear ratios, bore diameters and orientation that obtaining an original one for a restoration is almost impossible. Poor materials and maintenance doomed these originals and most that you now find do not work. The Standard Triumph unit is a 19/10 ratio with new versions only available in 2/1.

Shown above is both a complete new Drive Unit and a dismantled one with the spacer, washer and nut. To dismantle the unit for cleaning and re-greasing wrap in foil and heat to 150’C, the backing ring can then be separated from the body giving access to the felt washer and the thrust washer.

Clean first with paraffin or kerosene, finishing with brake cleaner. You will be amazed how much dirt comes out. Once dry turn the ring gear by hand and assess if there is any damage, a non-functioning unit cannot be repaired. Lubricate with grease, check that the grease nipple works and reassemble, pressing the backing ring into place.

New spare drive units are usually in a painted finish, this can be carefully stripped with a strong solvent such as Cellulose Thinners, Acetone or MEK and the unit polished. You may want to dismantle the unit first.

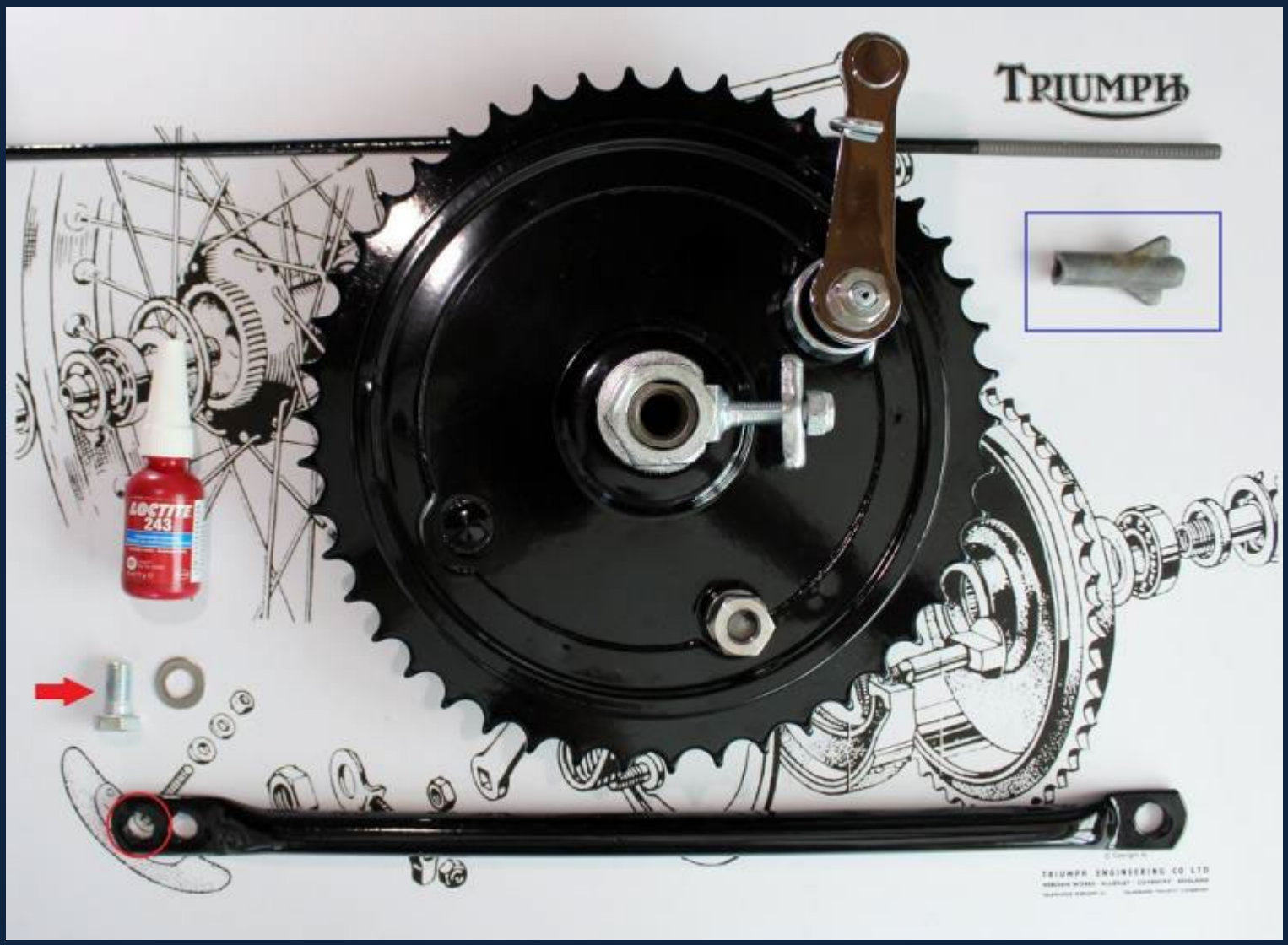
The Complete Hub showing The Speedo Drive Sleeve

Early hubs have a bolted on drive sleeve with this being the type from approximately 1961.
The thread is left hand and of quite a fine pitch that is easy to damage.
Use a flat lever such as a tyre lever to tighten or loosen the sleeve.

The QD Hub Spacer Arrangement

Rear Brake Assembly

The Rear Brake Plate assembly is common to both hub types and will fit all models from 1957.
Shown above is the assembly with the shoes correctly positioned to improve the Servo action
Also highlighted is the correct orientation of the brake return springs.



The Brake and Torque Arm

Fitting the Torque Arm is not possible with the Suspension units fitted and only possible if the correct thin headed bolt (arrowed) is used.
The bolt is specialised and designed to shoulder up against its threaded eye so that the torque arm is free to drop for wheel removal.
Ideally the Torque Arm should be fitted to the Swing Arm during frame assembly. Use the highlighted hole.

Check that the thread internally of the Brake Adjuster Screw is in good condition as these have been known to strip.

Completed QD Hub Left Side

Once the wheel and brake are fitted together with the torque arm; fit the Chainguard. This will be much easier to do before the mudguards, oil tank and side panels are fitted as the front attachment bracket and bolt become increasingly inaccessible and the task becomes almost impossible when the bike is nearly complete.

Fit the brake light screws to the Chainguard first but not the switch and then fit the Chainguard loosely using a slim headed bolt and washer through the front mounting with a lock nut and washer at the back. Do NOT tighten the nut fully as the Chainguard MUST be free to pivot upwards to allow wheel changes or brake maintenance on the QD hub.

Completed QD Hub Right Side

Ancillaries

Paintwork and Preparation

Regardless of how you intend to paint your restoration, preparation is the key to good results. Damaged and rusty parts will need extensive work to create a smooth substrate and while modern Isocyanate Paint systems give superb results they do not lend themselves to amateur use. With patience great results can be achieved with Enamels and Acrylic ‘rattle cans’ on the smaller parts but some paintwork will have to be done for you.

Powder Coating is suitable for the Frame and most Black paintwork areas as it is both durable and inexpensive but any rust pitted areas will show through and mar the final result.
Ultimately the choice is yours and your budget will make the decision.

The Petrol Tank Fittings

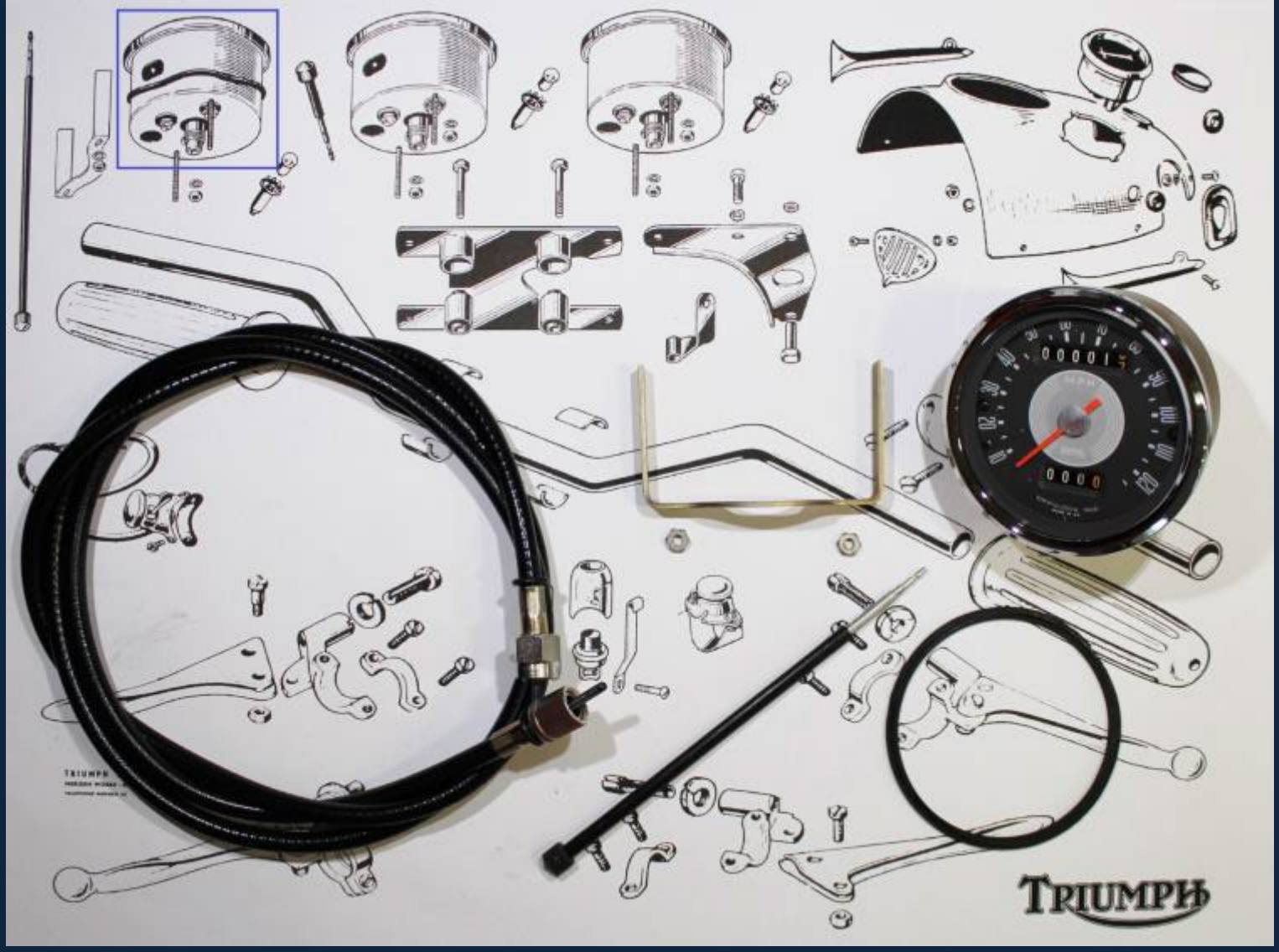
Shown is the group of fittings for the 1966 Home Market 3 Gallon Petrol (Gas) Tank
Including the Taps that are needed to clean the various threaded holes.
The Ewarts Petrol Tap is missing the gauze filter it should have.

The Petrol Tap requires a 1/4 BSPT Tap and the special sealing washer is essential.

The Ewarts Tap is reliable as long as the corks remain wetted, preferably with petrol. If they dry out, remove the two small retaining screws, pull the plungers out and soak the taps in hot water for an hour to expand the cork, coat with Vaseline and replace the plungers and screws making sure that they engage with the slots in the plungers but do not interfere with their operation. New Corks are available and usually come with fitting instructions or alternatively fit the O ring plungers sold by specialists in the USA. (Klempfs).

The 1966 Tank Badges

The original tank badges supplied to Triumph are finely finished and generally slightly better quality than modern reproductions (Above). Only noticible to experts but a mark of a quality restoration. The Badges were hand finished with Enamel at the Factory and using modelling paints and fine brushes you will be able to achieve a good finish.



The Speedometer Group for the 3TA

The servicing of Speedometers and Rev Counters is best left to experts as special tools are needed to remove and replace the bezels and to undertake the repair of non-functioning internal components.

The usual route for the speedometer cable from the drive on the C range machines is first along the swing arm before passing behind the oil tank to emerge just under the nose of the seat, then running along the right of the main frame tube and then looping down to the lower headset and up into the speedometer

Use tape, Velcro, leather straps or wide cable ties to hold the bundles of cables and wiring in place but not so tightly as to induce chafing or to prevent some flexing when the handlebars are turned. There is room in the headlamp shell for spare cables and owners should keep a few readily available to carry as spares if using your Triumph regularly.

Levers, Cables and Throttle

Electrical Components

Shown above is the component group for the 3TA, a mixture of original, pattern and upgrade parts.
Refer to the Lucas Catalogues (on my website) for details of the parts used on all Triumphs.

Electrical Tools and Connectors

Above are the Tools and the various types of connectors that you will need if you are planning to undertake any electrical work on your Classic. If you are seeking originality then select the Lucas and Bullet type connectors (the middle two groups shown above). You will also need a selection of 'Rings' and HT connections. (the two groups shown on the right).

The crimping Tools above work well across all of the connectors but are optimised for Bullets. Look for the excellent Haynes Electrical Techbook from their Techbook series and refer to the Wiring Diagrams shown in the Works Manual

Wiring colours on most British Motorcycles follow a pattern and with experience you will soon learn what colours are used for the different applications. By replicating the wiring colours used you will save trouble later for both yourself and future owners.

Creating your own Wiring Loom can be satisfying and often the final result will be better than buying and fitting a loom that may not be optimised for your project. Plan your loom aiming to minimise the number of connections and add additional earth wires especially to the headlamp and rear light. You should also consider upgrading early machines to 12 Volts. By carefully crimping and soldering you will create durable connections and a reliable loom that will give years of trouble free service.

The Finished Result

Justin Harvey-James 2022