Triumph Restoration Guide

350 cc and 500 cc Twins 1957 to 1974

This guide has been written for the new owner, so that you can gain confidence to undertake the service, repair and restoration of Classic Triumph Motorcycles.

Use it in conjunction with the Parts Books and Works Manuals.

Justin Harvey-James

Introduction

One of several images taken at Meriden by noted photographer Howard Grey.

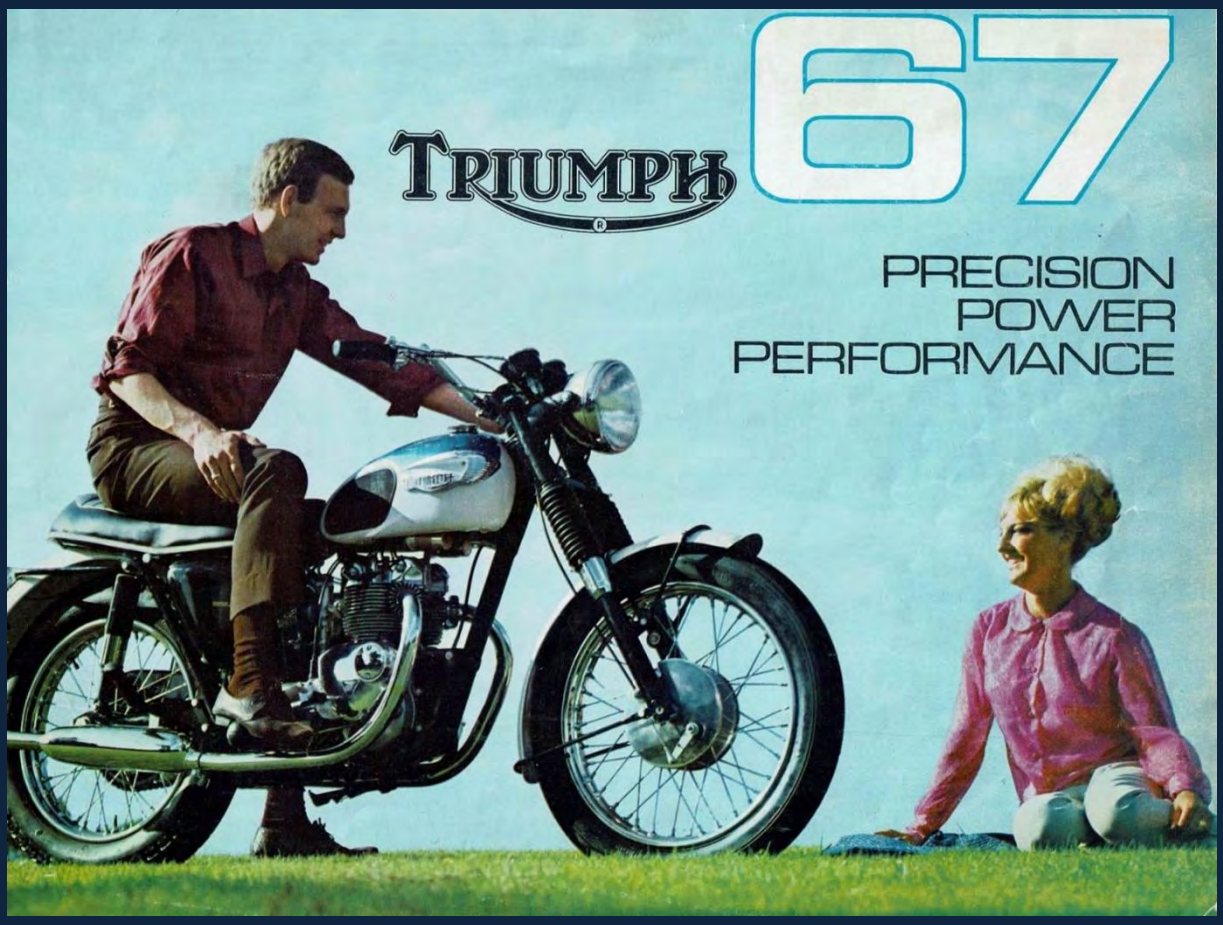
After the destruction of the original Triumph works in the Coventry blitz of 1940; a new factory was built on a greenfield site adjacent to the Birmingham road near the english village of Meriden. This became the home and birthplace of almost every Triumph motorcycle built until the closure of the factory in 1983. Exported worldwide these machines helped to create the global Triumph brand that prospers today.

This guide has been written for the new or prospective owner of any Classic Meriden Triumph who has little or no previous knowledge or experience of these British motorcycles, or in the service, repair or restoration techniques required for classic motorcycles.

Prospective owners of any veteran, vintage, antique, classic car or motorcycle are advised to read and research throughly before making a purchase. Join the appropriate club and gain experience in identifying the various models, production years, engine and frame/vin numbers and the original specification applicable for the vehicle you are interested in buying.
Beginners should avoid imported, unregistered and modified vehicles.

Throughout this guide I have recommended authors, books, magazines and other literature that are a starting point for for your Triumph research.
Use this guide with the Parts Books and Works Manual.

Introduction



The cover of the rare 1967 full colour catalogue featuring the Daytona T100R.

If you don't have the space for a classic motorcycle, there are still plenty of collectables like the original catalogues old magazines, rare books and sales leaflets, posters, signs, clothing and point of sale items to look out for. For restorers of any make, the original catalogues and road tests are very useful information sources.

After the war British industry rapidly revives, instructed to "export or die" and keen to provide up to date machines for the young customer that is on the move. Pre war designs rapidly give way to new technology, ideas and fashions. 1960 is the peak of UK motorcycle production and registration, with over 1.5 million new machines on the road. Four million motorcycles and scooters are in use on Britains roads with many of these made in England.

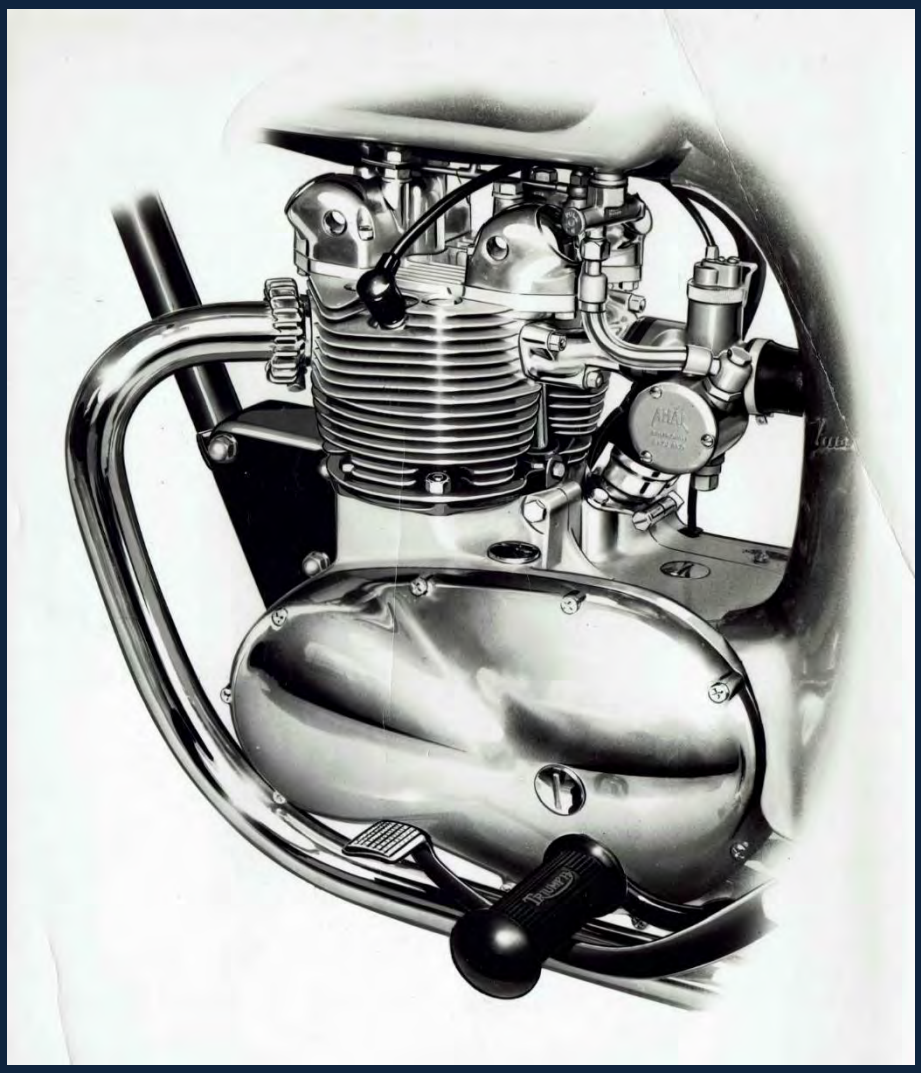
Companies such as AJS, Ariel, BSA, Greeves, Royal Enfield, Matchless, Norton, Triumph, Velocette and Vincent become household names, producing a wide range of motorcycles for customers at home and abroad. Motorcycle sport is booming and huge crowds attend events both in the UK and the USA where motorcycling is promoted as a healthy and engaging pastime.

Veteran, pre-war and early classic motorcycles (1945-60), have a keen following with specialist collectors, but for the beginner the later British motorcycles built between 1960 and 1974 are plentiful, easy to maintain and rebuild; with excellent parts availability and support available. Desirable models can be expensive to buy and demanding to restore. All Classics be upgraded with modern components and when carefully assembled and understood, are reliable and rewarding to ride. Note that restoration costs are the same regardless of it being a Bantam, Tiger, Bonneville, or Vincent.

Values always fluctuate and it is not possible for me to advise on the merits of one machine against another. Usable machines in good original condition, or with a history will always command a premium amongst knowledgeable buyers. The inexperienced are often swayed by appearance, such as shiny but inaccurate paintwork, new fasteners, over-clean engines and unworn tires. For the restorer seeking to return a machine to its original 'as it left the factory condition' a rough but original, complete machine with correct and matching numbers is preferable.

Learn to recognise and appreciate machines that are original and require symphathetic preservation rather than restoration. Museums are often the worst culprits and regularly feature over-restored, non functioning and inaccurate examples.

Introduction



Factory Portrait of the T21 Engine.

The C Range.. Unit Construction 350cc and 500cc Twin Cylinder Models built from 1957 to 1974
The Model Range covers the T21, 3TA, 5TA, T90, T100A, T100SS, T100SC, T100T, T100R.
And the Export, Competition, Military and Police versions of these models.

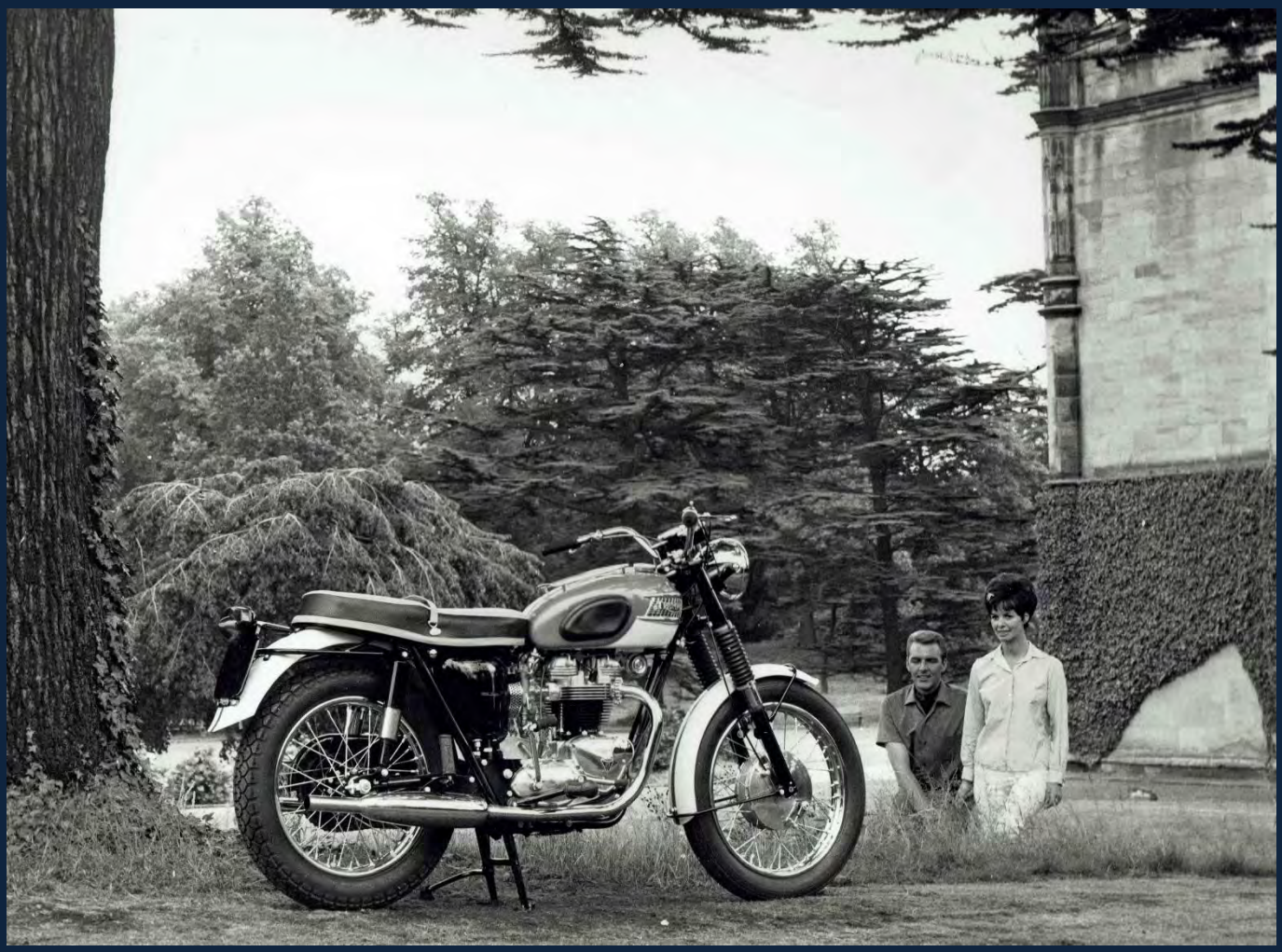
The 350cc and 500cc Triumphs, though never achieving the popularity and status of the larger models such as the Bonneville are still very capable motorcycles. Light, adaptable and reliable once understood, with predictable handling. Readily available parts, upgrades and information make these middleweight machines an excellent choice for anyone looking for a classic Triumph to restore and ride.

No single restoration book can hope to cover the vast range of machines that Britain produced or the multiple skills, terms, tools and techniques that the first time owner will need to learn. This is not meant to be a comprehensive work on its own and would-be restorers should read, research and obtain the additional materials that are appropriate for the specific task, model and period of classic or vintage Trimph they are working on.

I have included some basic explanations that the more experienced owner and engineer will know automatically, but that the beginner will need to research and grasp before and during the restoration process.
Information is available on my complimentary website.

Triumph-Tiger-90.Com

The Factory Records



Triumph B Range, 1965 650cc TR6R, USA West Coast Specification in a publicity portrait.

The factory records of much of the British motorcycle industry survive, held by the Vintage Motor Cycle Club as part of their extensive motorcycle archive. A microfilm copy of the Triumph factory records are retained by the dating officer of the Triumph Owners Motor Cycle Club, along with additional materials and photographs held by the club archivist. As part of my ongoing research I have been fortunate to view original materials currently in private hands that include detailed specifications for certain models, where appropriate this information is on my website.

The Triumph account books and a quantity of other materials are held in the modern records centre at Warwick university. From the account books I have been able to determine the annual sales figures for each of the post war models up to 1968, these are published on my website.

For owners seeking the provenance, date of manufacture and destination of their machine, they should contact either the VMCC or the TOMCC; a small fee for a factory dating certificate is applicable. Private research of the factory records or account books is permitted on request.

The Triumph factory records unlike others, do NOT show details of the specification applied to individual machines they do show the date of assembly and the destination, usually a specific dealer or agency or in the case of the USA, either Johnson Motors in Pasadena (West Coast), or Tri-Cor in Baltimore.

No information is known to exist that traces the final destination of machines sent to the USA but there are published lists of dealerships for the UK, overseas and the USA which can assist owners in tracing the history of their machine. Some research and luck is involved.

Engine and Frame Numbers

Gill Stratton of CBS checking out his Triumph; assisted by Hillie Mahoney.

From 1950 all Triumphs left the Meriden factory with matching engine and frame numbers. The engines built in pre-arranged batches on a separate assembly line, were stamped with the model code and a sequential number and occaisionally addition letters to indicate an alternate engine specification. W for high output alternator (Police) and C for sidecar gearing. The finished engine would then be fitted into an appropriate unnumbered frame at the start of the machine assembly process. Near the end of assembly an operator would then stamp the frame with the appropriate and corresponding frame number. Once machines were complete they were tested passed, or sent to rectification and re-tested before being packed and dispatched.

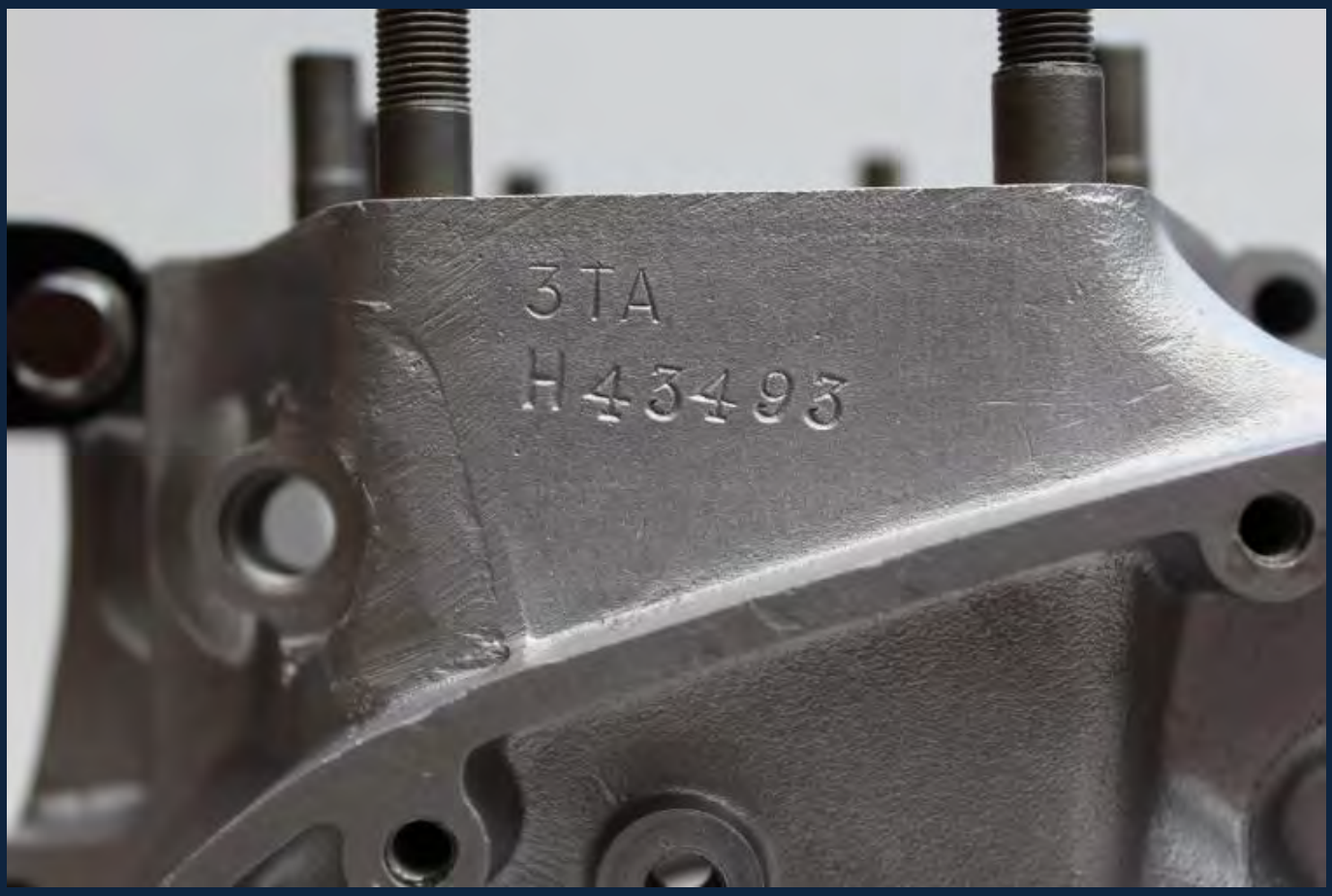
With production of 120 machines a day on two assembly lines, some stamping and recording errors are inevitable and even though these are stamps each person responsible exibits a writing style. Over time the stamps would wear and be changed introducing new fonts and practices while staff sickness and changes add another layer of complexity for the historian.

There are changes to the format of the engine and frame numbers over time, particularly from 1968 and a set of stamps used for the engines are unlikely to match those used on the frames.

Over the years many Engines and Frames that left the factory as complete machines have become seperated for a variety of reasons and have had their numbers removed or altered; mostly for good reason. To the Triumph beginner with all of the complexity described above, these altered numbers can at first be difficult or impossible to spot; some are so convincing that only experts detect them. Non matching or altered numbers should be a warning particularly if the machine is potentially historic, valuable, imported and or unregistered.

On my website you will find a gallery of engine numbers that cover the general progression of engine numbering from 1947 until 1974, together with additional information that shows the manufacturing process of Triumph motorcycles.

Engine and Frame Numbers



On all Triumph twins the Engine Number is in this location and provided it is genuine will date the motorcycle to a specific day, date and batch of machines. Above is a correct example for a 3TA from 1966.

The Frame Number is found near the headstock on the left hand side. For all Triumphs built after November 1949 the Engine Number should match. Up to 1964 the Model Code is not stamped on the frame.

Literature

Very few surviving classic Triumphs will be in complete and original condition and therefore need to be assessed before starting a restoration. You should try to obtain copies of the Parts Books, Catalogues and Road Tests that are appropriate for your machine and model year. The Works Manuals produced from 1966 are very useful even for earlier models, as many of the workshop techniques described can be transferred to any classic 1960's Triumph or British Motorcycle.

Many of the parts books and brochures can be downloaded from the Internet and for owners seeking an accurate restoration, a great deal of supplementary information is available. Factory information, period photographs, parts catalogues from suppliers like Lucas, Girling and Smiths, together with magazine articles and specialist books all help, but the information from all of these sources still needs to be checked and treated sensitively to complete a winning restoration.

Specifications

TECHNICAL DATA

MODEL	Tiger Cub (T20)	Sports Cub (T20S/H)	Twenty-one (3TA)	Tiger 90 (T90)	Speed Twin (5TA)	Tiger 100 (T100S/S)	Thunder-bird (6T)	Trophy (TR6)	Bonneville 120 (T120)
Engine Type	O.H.V.	O.H.V.	O.H.V.	O.H.V.	O.H.V.	O.H.V.	O.H.V.	O.H.V.	O.H.V.
Number of Cylinders	1	1	2	2	2	2	2	2	2
Bore/Stroke, mm.	63×64	63×64	58.25×65.5	58.25×65.5	69×65.5	69×65.5	71×82	71×82	71×82
Bore/Stroke, ins.	2.48×2.52	2.48×2.52	2.29×2.58	2.29×2.58	2.72×2.58	2.72×2.58	2.79×3.23	2.79×3.23	2.79×3.23
Capacity, cu. cms.	199	199	349	349	490	490	649	649	649
Capacity, cu. ins.	12.2	12.2	21.2	21.2	30	30	40	40	40
Compression ratio	7:1	9:1	7.5:1	9:1	7:1	9:1	7.5:1	8.5:1	8.5:1
B.H.P. and R.P.M.	10@6,000	14.5@6,500	18.5@6,500	27@7,500	27@6,500	34@7,000	34@6,300	40@6,500	46@6,500
Engine Sprocket Teeth—Solo	19	19	26	26	26	26	29	29	29
Clutch Sprocket Teeth	48	48	58	58	58	58	58	58	58
Gearbox Sprocket Teeth	17	17	18	17	19	18	20	19	19
Sidecar (G/Box Sprocket)	—	—	—	—	—	—	18	17	17
Rear Sprocket Teeth	46	48	43	46	43	46	46	46	46
R.P.M. 10 M.P.H. Top Gear	985	960	742	810	702	763	616	630	648
							Solo / S/C	Solo / S/C	Solo / S/C
Gear Ratios—Top	6.84	7.13	5.33	6.04	5.05	5.70	4.60 / 5.11	4.84 / 5.41	4.84 / 5.41
" " —Third	9.04	8.56	6.32	7.15	6.0	6.75	5.47 / 6.08	5.76 / 6.44	5.76 / 6.44
" " —Second	14.05	13.37	9.37	9.80	8.88	9.26	7.77 / 8.64	8.17 / 9.15	8.17 / 9.15
" " —First	20.40	19.8	12.96	14.67	12.28	13.86	11.43 / 12.48	11.81 / 13.40	11.81 / 13.40
Carburetter—Make	Amal	Amal	Amal	Amal	Amal	Amal	Amal	Amal	Twin Amal
Carburetter—Type	32/1	376/272	375/62	376/300	375/35	376/273	376/285	376/40	376/286–287
Front Chain Size	⅜"×.225"×.25" Duplex	⅜"×.225"×.25" Duplex	⅜"×.225"×.25" Duplex	⅜"×.225"×.25" Duplex	⅜"×.225"×.25" Duplex	⅜"×.225"×.25" Duplex	⅜"×.225"×.25" Duplex	⅜"×.225"×.25" Duplex	⅜"×.225"×.25" Duplex
Rear Chain Size	½"×.205"×.335"	½"×.205"×.335"	⅝"×⅜"×.40"	⅝"×⅜"×.40"	⅝"×⅜"×.40"	⅝"×⅜"×.40"	⅝"×⅜"×.40"	⅝"×⅜"	⅝"×⅜"
Dunlop Tyres—Front, ins.	3.25×17	3.00×19	3.25×17	3.25×18	3.25×17	3.25×18	3.25×18	3.25×19	3.25×18
" " —Rear, ins.	3.25×17	3.50×18	3.50×17	3.50×18	3.50×17	3.50×18	3.50×18	4.00×18	3.50×18
Brake Diameter-ins. (cms.)	5½" (13.97)	5½" (13.97)	7" (17.78)	7" (17.78)	7" (17.78)	7" (17.78)	8" F (20.32) 7" R (17.78)	8" F (20.32) 7" R (17.78)	8" F (20.32) 7" R (17.78)
Finish	Flame/Silver Grey	Burgundy Red/Silver Grey	Shell Blue or Silver/Bronze	Alaskan White	Ruby Red	Regal Purple/Silver	Black/Silver	Regal Purple/Silver	Alaskan White
Seat Height—ins.	29"	30"	29¼"	30"	29¼"	30"	30"	30½"	30½"
" " —cms.	(73.7)	(76.2)	(74.5)	(76.2)	(74.5)	(76.2)	(76.2)	(77.5)	(77.5)
Wheelbase—ins.	49"	50"	52¾"	53½"	52¾"	53½"	55"	55½"	55"
" —cms.	(124.5)	(124.5)	(134)	(136)	(134)	(136)	(139.6)	(141)	(139.6)
Length—ins.	77"	78½"	81"	82¼"	81"	84¼"	84"	84½"	84"
" —cms.	(195.5)	(199.3)	(206)	(209)	(206)	(213.9)	(213.5)	(214.5)	(213.5)
Width—ins.	25"	26"	27"	26½"	27"	26½"	27½"	27"	27"
" —cms.	(63.5)	(66)	(68.5)	(67.3)	(68.5)	(67.3)	(70)	(68.5)	(68.5)
Clearance—ins.	5"	8¼"	5"	7.5"	5"	7.5"	5"	5"	5"
" —cms.	(12.7)	(21)	(12.7)	(19)	(12.7)	(19)	(12.7)	(12.7)	(12.7)
Weight—lbs.	215	223	340	336	341	336	369	363	363
" —kilos	(94)	(101)	(154.6)	(152.8)	(155)	(152.8)	(167)	(165)	(165)
Petrol—Galls.	3	3	3	3	3	3	4	4	4
" —Litres	(13.5)	(13.5)	(13.5)	(13.5)	(13.5)	(13.5)	(18)	(18)	(18)
Oil—Pints	2¾	2¾	5	5	5	5	5	5	5
" —Litres	(1.55)	(1.55)	(2.8)	(2.8)	(2.8)	(2.8)	(2.8)	(2.8)	(2.8)

Details of high performance equipment for certain models published separately

THERE IS NOTHING QUITE LIKE IT!

Motorcycling is a wonderful, healthy open air sport of absorbing interest. It gives you a wide experience of peoples and places at home and abroad—to the mechanically minded it is a constant joy and to those who revel in the fierce battle of competition, it provides a wide range of activities—road racing, trials riding, scrambling, etc., etc.

To the newcomer to motorcycling thrilled at the purchase of his first powered vehicle, we say, learn all you can about the new model, treat it with respect and maintain it in good condition and you will have an asset which will make your life fuller and more enjoyable in every way.

Above all, learn to ride it skilfully and be proud of your skill when you have acquired it. Don't learn "the hard way", get expert training right from the start. Your dealer will help you—there is probably a training class in your locality where first class tuition can be obtained for a very modest cost. Always ride with care and consideration for others and you will get the maximum enjoyment from the finest sport of all.

Specifications from the 1963 UK (Home) Market Catalogue.

The Catalogues frequently have the specifications for the models in the range, including the colour schemes. They were designed, produced and issued some months before machine production actually began and the specification of the production machines does not always match the images in the publicity materials!

The detailed specifications for each model in the range were recorded and costed down to the last washer before production began. New or modified parts were designed, prototyped, tested and manufactured in the initial quantities required for the build shedule and everyone at the factory knew what their role was and knew what the build shedule was going to be.

Service Bulletins

The TRIUMPH Corporation

TOWSON, BALTIMORE 4, MD., U. S. A.

SALES DISTRIBUTION · PARTS AND SERVICE · FOR THE WORLDS BEST MOTORCYCLE

TELEPHONE
VALLEY 3-7338

CABLE ADDRESS
TRIUMPH · BALTIMORE

January 10, 1958

TO ALL EASTERN TRIUMPH DEALERS WHO HAVE TAKEN DELIVERY OF THEIR FIRST 1958 "TWENTY-ONE" MODELS

Re: Service Notes on New 1958 "Twenty-One" Model

SET-UP Fit twenty-four 3/16" balls to the top and bottom steering head bearings. Each fork leg requires 150c.c. of SAE20 oil.

Make certain that there is no rubbing or binding between the inside surface of the nacelle cover tubes and the lower fork sliding tubes. This is extremely important as any binding of the fork movement will seriously affect the handling of the machine.

Be sure to tighten all drain and filler plugs as fiber washers tend to shrink after initial assembly.

Tighten center stand bolts and center punch threads to prevent the nuts from loosening.

Center front brake shoes (see item #12, bulletin #57/7).

Carefully tighten the 3/8" nuts at both ends of bottom engine mounting stud. (This is the long stud between the bottom frame tubes which also holds the two exhaust pipe brackets in position).

BATTERY We recommend the use of a special plastic cover for the battery which we have developed to prevent acid and fumes from collecting under the twinseat of the "Twenty-One" and corroding tools, paint and chrome. Use the handy order coupon below for this battery cover which should be fitted to every "Twenty-One" model.

IMPORTANT NOTE: Be very careful about servicing the battery of the "Twenty-One" model. Under no conditions should the electrolyte level come above the fiberglass mat or pad on top of the battery plates. The fiberglass pad should be just moist with electrolyte with no free liquid above it. Overfilling the "Twenty-One" battery will cause extensive damage to the paint and chrome. Damage of this sort is not covered by the new machine guarantee.

Oil level - Primary drive - Level plug located under outer cover in front of exhaust pipe bracket.

Oil level - Gearbox - Level plug (similar to T20 model) located under gearbox behind clip for alternator wires. While checking gearbox oil level tape alternator wires to bottom frame tube.

- -

January 10, 1958

Send me one sample CD91 battery cover for "Twenty-One" model.

(Price - $1.95 B)

Dealer's Signature

This is one of hundreds of Service Bulletins issued from 1948 onwards.

On the Website you will find a comprehensive index together with many useful bulletins. Restorers should particularly refer to those that detail part number changes and fitments.

Photographs

Factory Photograph of a prototype machine (Tiger 90) from 1962.

All photographs even original factory portraits as above must be considered with care. They frequently DO NOT show standard production machines. If you are seeking a restoration of a machine to “As it left the Factory” condition you will need to do a great deal of careful research. Be wary of any recent photographs of restored machines, as no matter how carefully they have been researched and prepared errors can still happen. Do seek out the work of expert restorers such as Graham Bowen, or Leroy Turner.

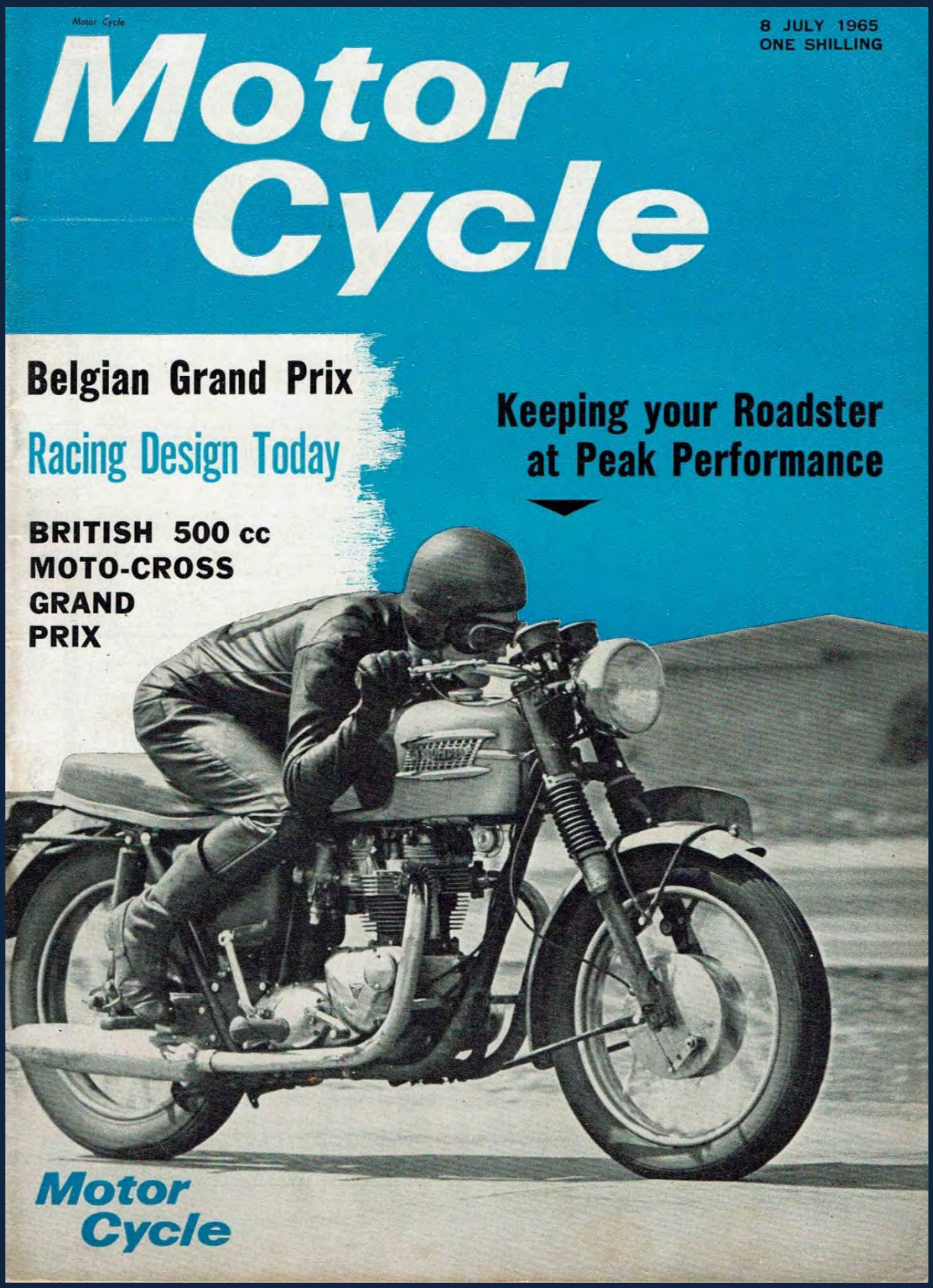
Many motorcycles were supplied to Governments, organisations, Police forces and to military or defence contracts that differ substantially from models featured in the brochures. Motorcycles supplied to some export markets are fitted with alternative frames, instruments, lights, electrical components, handlebars, air filters, seats silencers and accessories that are not usually recorded in the parts books and rarely in other literature.

For the American market the problems for the restorer multiply as there are specific models for East and West coast dealers. Some specifications are recorded in supplementary parts sheets and factory bulletins; but many machines now in the USA and UK were not originally destined there and can be to English, European, Canadian, South American, Police or military specifications. In 1968 USA customers could buy a machine from the factory Tax Free under a government personal export scheme; usually these would be given a British registration.

There are also many machines that were dealer modified after leaving the factory to create new models such as the famous T120RT, or the Sunset Tripper and machines were frequently customised or fitted with later parts due to accidents or personal taste. Other machines are raced successfully, created, ridden or owned by famous people and if you are lucky and can verify it your project machine may be one of these.

All owners and buyers are recommended to contact the Triumph Owners Club.

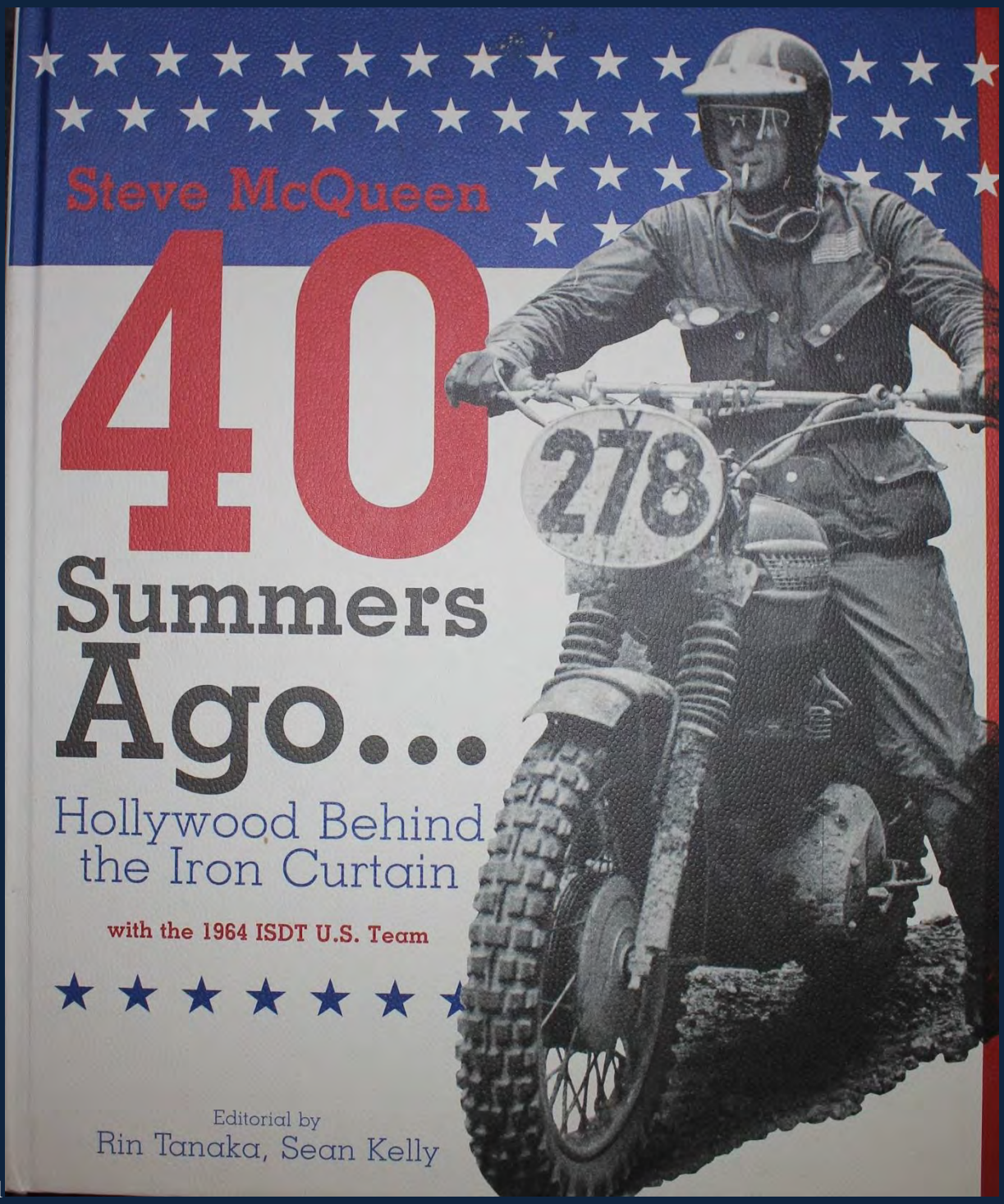
Period Magazines



Motor Cycle 8th July 1965.

Numerous period publications from around the world feature articles on Triumphs as shown above.
Frequently new models were road tested and new features described or pictured.
Service and technical articles were common and are still useful.
An index of magazine articles can be found on my website
or is obtainable from the Triumph Owners Club.

Books



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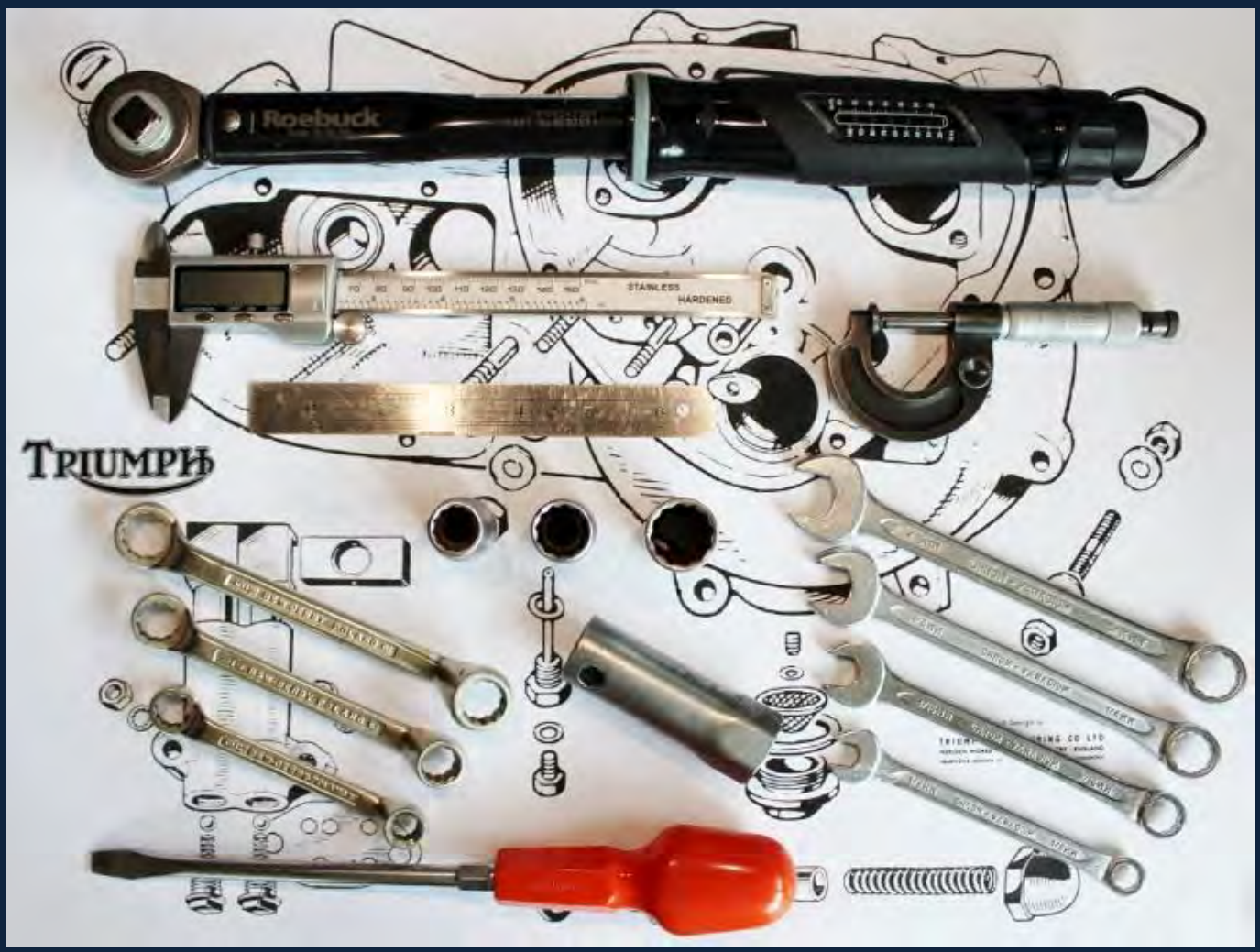
‘40 Summers Ago’ by Sean Kelly and Rin Tanaka, a rare and now valuable book.

Throughout this guide I have illustrated books and magazines that the collector and restorer should try to obtain; some are long out of print and difficult to find but contain great stories or interesting information useful to the owner, historian and restorer alike. Authors such as John Nelson Ivor Davies, Harry Woolridge, Hughie Hancox and Sid Shilton worked at Meriden in various roles. While Roy Bacon, Jeff Clew, David Gaylin, Lindsay Brooke, Mike Estall, Claudio Sintich, myself and others are experts in their own fields.

Aspiring expert restorers should try to assemble a library of books by the authors I have listed above together with copies of the various period magazines. Very few public libraries hold extensive collections of motorcycle related materials and you will need patience and perserverance to build up your own collection of suitable reference materials.

Basic Tools



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 spanners with suitable sockets, screwdrivers, pliers in various types, mole grips, levers and a good quality torque wrench with a range from 10 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.
Tip: Good quality antique tools can often be a wise investment.

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

Throughout the world differing engineering thread standards were and are used and there is a myriad array of threads, bolts, nuts and screws for the beginner to grasp, preferably before they start on a restoration.
Never assume that the parts on your project are original until you gain experience. See next page.

For owners new to British machines and Triumphs in particular, fasteners and threads can be bewildering. Before 1968 all fasteners (nuts & bolts) on Triumphs are British Standards and you will need Whitworth spanners and sockets. After 1968 across British industry there is a gradual change to the more common American (unified) UNF or UNC types. 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

For working comfortably and safely, a hydraulic workbench that allows the machine to be raised and lowered is useful and all would-be restorers should invest in one. For engine work a good quality engineers vice and bench are essential, along with an engine stand and for cleaning and preparing components, magnets, a parts washer station and fixed bench grinder with a wire brush replacing one of the grinding wheels will get you started.

Fasteners

The first standardized treads for fasteners were developed in Britain in 1841 by Joseph Whitworth, followed in America by William Sellers in 1864; giving the world the Whitworth and US Standards that were subsequently developed into Unified Standard Course (UNC) and Unified Standard Fine (UNF). Other 'Standards' soon followed such as British Standard Fine (BSF), British Association (BA), British Standard Cycle, developed by the Cycle Engineers Institute in 1898 and in Europe the development of Metric standards based on German and French data. Post war the Japanese introduced their own standards based on the Metric ISO (International Standards Organisation) Standard with some deviations on fine pitches.

These varying Standards have been used across Industry for the production of watches, models, instruments guns, bicycles, cars, motorcycles, locomotives, ships and aircraft. With each application and country using usually their own Standards, so that European fasteners differ from American which differ from Japanese and also British threads. During the War efforts were made by Britain and the USA to use some common standards, but this process was not active until after 1965 when the British manufacturers were encouraged to convert to Metric and UNC/UNF. Triumph at Meriden did not make the change until 1968!

Modern Triumph motorcycles, i.e. those manufactured since 1990 are standardized to metric threads, or more accurately ISO Metric (International Standard) and therefore, the selection of fasteners used and the tools needed for the modern Triumphs such as Speed 400 range are greatly simplified.

Fasteners and especially bolts come in a differing materials, qualities and strength grades and for some critical applications such as brake components, connecting rods and flywheels, high strength bolts will be specified. Bolt grades can be identified by referring to the markings you will usually find on the heads expressed as numbers or symbols.

Look closely the fasteners on your project to identify originality and the grades used and only replace fasteners with similar tensile grades, especially on components such as the brakes, suspension and engine, where their fitment is safety critical. Stainless steel fasteners are available in a number of grades the most common; marine grade A2 70 (316) is not fully suitable for high tensile use.

Fasteners

The TRIUMPH Corporation

SERVICE BULLETIN

September 22, 1967 67/12

TO ALL EASTERN TRIUMPH DEALERS:

SUBJECT: Unified Thread Changeover

As the existing threaded parts on all Triumph motorcycles are gradually modified to a unified thread it becomes a matter of necessity to know the threads you are dealing with.

Most threads on Triumphs conform to the Cycle Engineers Institute or Whitworth thread standards. Unified threads have been in use in America for some time and are gradually being adopted in all English countries. A table of common thread sizes is shown below listing common CEI, Whitworth and Unified thread sizes.

THREADS PER INCH

		UNIFIED		WHITWORTH	
Size	Cycle Engineers Institute (C.E.I.)	Unified Fine (UNF)	Unified Coarse (UNC)	British Standard Fine (BSF)	British Standard Whitworth (coarse) (BSW)
1/4"	26	28	20	26	20
5/16"	26	24	18	22	18
3/8"	26	24	16	20	16
7/16"	26	20	14	18	14
1/2"	20	20	13	16	12
9/16"	20	18	12	16	12
5/8"	20	18	11	14	11

A Craftsman thread gauge (#9M4048) is available from any Sears Roebuck store for $2.49 and contains all T.P.I.'s shown above. Always check thread sizes when there is a doubt about the proper fastener to use.

Very truly yours,

THE TRIUMPH CORPORATION

Rod Coates

Service Manager

Rod Coates:bjh

Tri-Cor Bulletin from 1967 detailing thread forms.

Use this sheet to identify the fasteners that have been fitted to your classic Triumph
Additional information and sheets can be downloaded from the website.

Fasteners

Lubrication of fasteners and especially those made from stainless steel is essential; use a specialist ceramic lubricant grease is ineffective and copper grease should be avoided due to its issues with differential metal corrosion. Research galvanic corrosion for an explanation.

Unlubricated stainless-steel fasteners when used in aluminum; can after a period of time & depending on conditions such as the presence of water and salt; will form a strong galvanic corrosion weld. “Galling” is another known issue; unlubricated stainless fasteners used together can seize and become impossible to undo; larger size bolts are especially prone and must be lubricated, preferably with a ceramic lubricant. Magnesium Hydroxide found as ‘Milk of Magnesia’ is a suitable lubricant!

If fasteners are lubricated the torque required to reach the point where the bolt will fail is reduced; any quoted torque values are usually for unlubricated fasteners and therefore care must be taken not to exceed the quoted figures. Research materials and bolt failure torque and refer to the values quoted in the Works Manual.

A selection of useful Loctite Products.

If a fastener is proving difficult to remove or you suspect that Loctite has been used; if possible and taking appropriate precautions apply heat to the fastener to break down any Loctite/corrosion before attempting to undo it with well-fitting tools. A gas blowtorch, with a self-igniter is a very useful tool in careful hands.

Thread locking compounds have a useful role to play in preventing fasteners loosening if used intelligently. They are available in multiple differing grades and owners are advised to research the various properties of these products before obtaining and using them. Some have a limited shelf life and all should be considered as potentially hazardous materials; used and disposed of accordingly.

Loctite 222 purple a low strength thread locker suitable for small fasteners.
Loctite 243 blue a medium strength thread locker for general use.
Loctite 270 green a high strength stud locking compound.
Loctite 641 a bearing retaining compound (low strength)
Loctite 542 thread sealant, resistant to oils and coolants.

Traditional sealing products such as waxes, resins, enamels, Red Hermatite, Hylomar and Wellseal, still have a role to play in specific applications, along with the more modern silicone sealants and epoxy adhesives. Research and obtain these products to add to your restoration toolkit as you need them.

For more information on the history of fasteners, including dimensional drawings refer to the excellent work of Dr Bill Eccles at boltscience.com

Corrosion Protection

Depending on the material, finish and location of fasteners together with the environment that they are exposed to the fasteners along with other components be that rubber, plastic, iron, steel, chrome and cast alloys will suffer from corrosion and decay over time; especially if little or no preventative precautions are taken.

Original fasteners used by Triumph were Cadmium plated which provided superb corrosion resistance as well as being a natural assembly lubricant! The dull light grey appearance of Cadmium plating is distinctive but as a toxic material it is now banned and care should be taken not to grind or blast these original fasteners in an environment where you will be exposed to the dust.

Salts and acids are particularly corrosive to steel, chromed parts and alloys; strong sunlight damages plastics and paintwork while high temperatures affect rubber and electronic components, copper and plastics. Dust, vibration and any granular particles will quickly compromise moving and sliding parts. Inexpensive internet parts are often made from inferior materials and should be avoided.

Products to research and obtain to improve corrosion protection of metals are Ankor Wax, ACF 50, Waxol, WD40 and their derivatives, duck oils, gun oils, bluing and blacking products and the numerous polishes and waxes for painted, plastic and rubber parts.

For passivating and protecting steel, research Nickel and Zinc plating, phosphating, parkerising and blacking; kits and chemicals for home and hobby use can be obtained from specialist suppliers.

Specialist Tools

A general-purpose Tap and Die Set here in UNF and UNC.

If just servicing your Triumph, it is unlikely that you will need to use any taps and dies but these items are a useful addition to your tool kit if you are undertaking a full restoration; especially of a neglected or abused machine. Restorers should obtain a small selection of taps and dies that are suitable for their project together with die and tap stocks (to hold the tap and dies). Always use a suitable lubricant such as Trefolex or cutting oil working the tap/die forwards and backwards incrementally by hand and without excessive force.

Specialist Tools

A selection of measuring tools.

Shown above, a digital vernier caliper, feeler gauges, a steel rule, a bore gauge and vintage micrometers; here in 1-inch and 2-inch sizes. For the novice mechanic measuring and especially accurately is a black art but the sooner you can gain experience with using the tools shown above the greater your confidence will be in your work and the fewer your mistakes!

Vintage tools by Mercer, Moore and Wright or Mitutoyo are a good investment.

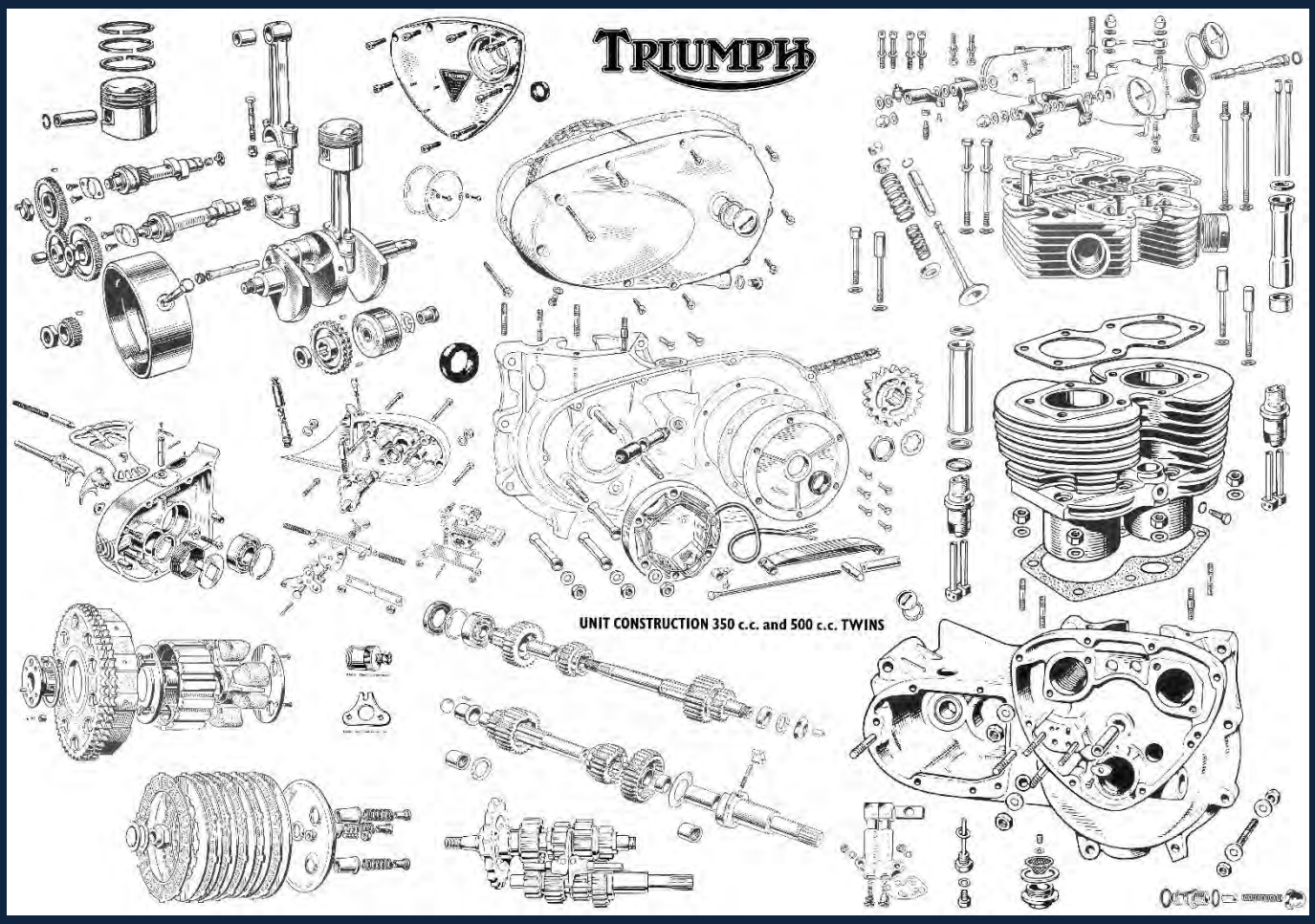
Experienced owners and restorers will assemble a selection of taps, dies, helicoils, reamers and special tools that are essential for some operations on the engine and frame. Most can be bought from specialist suppliers and in this guide I have illustrated the particular tools and techniques required for certain operations. Refer to the Works Manual for the full list of Triumph workshop tools.

Owners with experience in engineering will usually have the confidence to make their own special tools and fasteners for specific tasks but some engine operations such as re-boring, re-grinding, valve work and alloy welding will normally have to be passed to the appropriate experts.

Repairs to petrol and oil tanks, mudguards and panels (the tinware), are usually beyond the ability of most restorers, but some basic panel repair tools such as a sand bag, mallets and some dollys are a useful investment to remove small dents from any accessable areas. Skills such as forge work, casting lead loading, metal shrinking, metal pressing, metal spinning, the English wheel and upholstery are occaisionally taught to small groups by appropriate experts.

Repair of threads is covered later but research Helicoils and Time-Serts.

Dismantling



If you are working on your new Triumph or this is your first restoration, than take time to study the appropriate parts book for your machine together with the Works Manual; you should by now have assembled a tool kit. For dismantling the machine and especially a neglected one you will also need a blow torch, a hide mallet an angle grinder with cutting and grinding discs an impact wrench, sockets and a large engineers vice. Specific tools and techniques for dismantling some assemblies are described in the sections below and in the Works Manual a copy of which you will find on my Website. Triumph-Tiger-90.com.

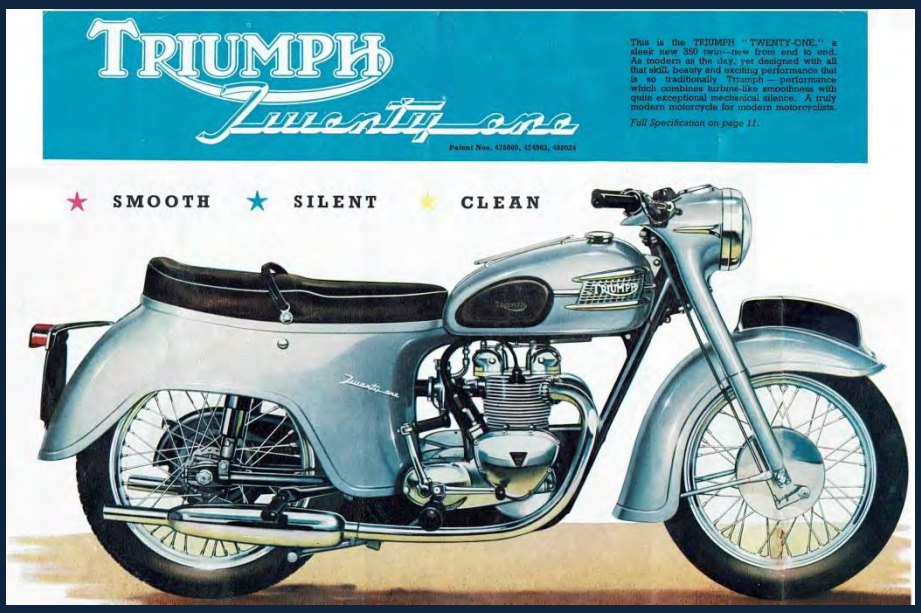
Before starting any work especially if this is your first restoration take photographs of not just the overall machine but of detailed areas, so that if need be you can refer to these pictures at a later date. Pay particular attention to surviving original parts, finishes, fasteners and assemblies and make additional notes as required.

Clean the machine and then drain the petrol and oil tanks, gearbox, primary drive and forks. Remove the battery. Liberally apply a penetrating oil like Plus Gas, diesel, ATF or a light oil to any rusted parts, leave to act. For loosening rusted fasteners (nuts & bolts) heat is your best friend together with an impact driver. Always heat corroded fasteners before trying to undo them; the heat will break down the chemical bonds in the corrosion and in any sealant, loctite or epoxy that has been used on the machine. Heat the fastener but not excessively; apply penetrating oil and allow to cool slightly so that the oil is drawn into the threads before trying to undo it with well fitting tools.

A gas blowtorch with Propane or Butane canisters preferably with a self igniter is ideal; the flame size and heat can be controlled and directed only where it is needed. If you have to cut off a nut or grind off a bolt work in small steps so that you do not build up too much heat in the surrounding area. Protect delicate parts, glass and paintwork with non flammable insulation. Wear protective clothing, eyewear and durable gloves. Tip: Read up on galvanic corrosion, fastener corrosion and induction coils.

To separate the cylinder head, barrels or any other joints, apply controlled heat, boiling water or hot air first. Use a hide or wooden mallet only with careful blows and NEVER use a screwdriver, chisel or lever to prize joints apart. Stanley knife (Box Cutter) blades are useful as wedges, these can be tapped into difficult joints preferably several simultaneously so that the parts are seperated evenly. Seek advice first before resorting to force.

Cleaning and Preparation



The 1957 Triumph 21. Smooth Silent Clean.

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 metals, batteries, 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. Collect the waste in a pan and do not allow it to enter drains and watercourses. A bench top parts cleaner is a useful investment.

The most effective method of cleaning degreased alloy castings is by blast cleaning using glass beads, soda or walnut shell. Mild chemicals such as washing soda, acetic or citric acid though effective will leave a dull grey finish and never 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.

Grit or bead blasting is very effective for cleaning steel parts as long as care is taken to ensure that all traces of blasting media are removed and the parts washed and dried with solvent afterwards. It's great for clutch plates, camshafts, cam wheels and non-critical components. Cadmium plated parts must be handled separately and sensitively.

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 powerful 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

Labelling and preparing parts for storage.

Even when parts are damaged or broken do not throw them away until you have completed your project.

Plastic food and partitioned containers new or recycled make useful storage boxes for dismantled assemblies while Zip-Loc or tie plastic bags in multiple sizes can be bought inexpensively to store individual parts. VCI (volatile corrosion inhibitor) paper or bags are 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, if possible; store them in a warm dry location. Store parts preferably together where they will not be moved or disturbed as unlabelled parts are readily lost and misplaced; more through carelessness than by any other means.

Wrap and store delicate parts in their own containers so that they cannot be damaged by the movement of heavier items like the gear shafts, clutch and crankshaft, this is particularly important for critical components like the instruments, conrods and pistons. Often owners rush and neglect this simple step and parts then become damaged broken or lost. Protect exposed threads with insulating tape or cardboard sleeves.

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 that are fitted. For the time being label and keep all the fasteners you remove many will be special parts that cannot be replaced.

Tip: Print off pages of the Parts Book and use these to highlight parts that need replacing.

Upgrade Parts and Spares

Shown above is a selection of Upgrade Parts.

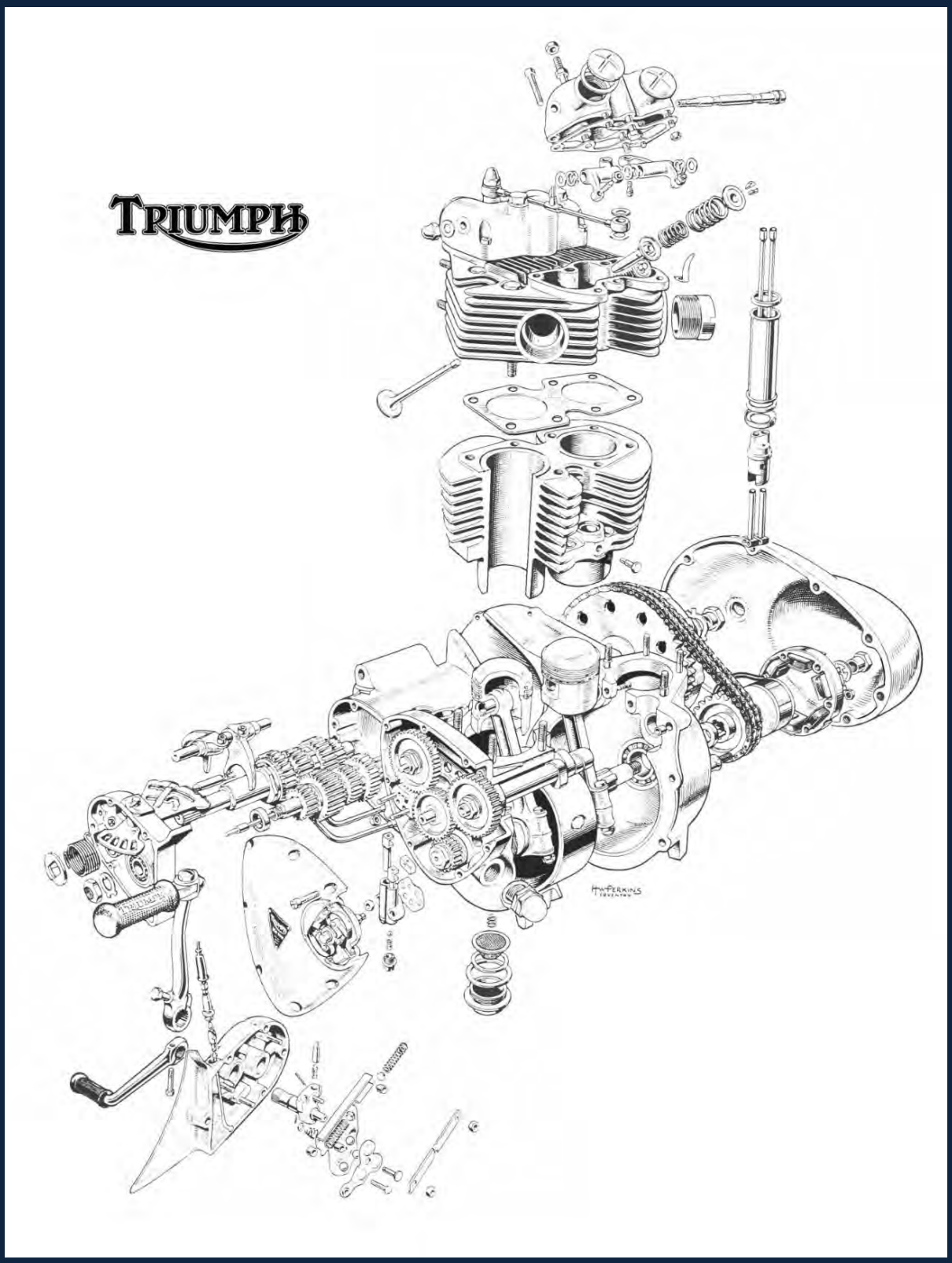
As part of any restoration you should consider what parts you intend to upgrade if any; shown above is a selection of items that will help to improve the reliability and or performance of any classic motorcycle.
The full list of upgrades is listed on my Website.

The availability of spares for classic Triumphs especially bearings, seals, gaskets, engine, gearbox, clutch, suspension, brakes and electrical components is generally excellent. Second hand parts are regularly traded at swapmeets and on the internet and provided you know exactly what part you are looking for you should not have too much trouble finding it for the more common models and parts.

Experienced owners will also assemble stocks of service items such as oils, air cleaners, gaskets, spark plugs bulbs, connectors, electrical components, cables, chains, fasteners, abrasives, polishes, chemicals and solvents so that service operations are not delayed by waiting for stocks or deliveries.
The Works Manual contains the specifications for lubricants and consumables and should be referred to in preference to other sources of information.

The 1965 Tiger 100

The Engine



The Engine Cutaway Drawing (1963 onwards).

Edward Turners Triumph 500cc Speed Twin of 1937, although not the first twin cylinder motorcycle engine produced by the company, popularised the concept of the parallel twin. A 360’ crankshaft with both pistons rising and falling at the same time. Dry sump lubrication, pushrod operated valves from gear driven twin camshafts; with a chain driven wet multiplate clutch, incorporating a shock absorber, combined with a foot operated positive stop four speed gearbox. These features are the concept of all Triumph twins built from 1937 to 1988

This guide is specifically for the 350 and 500cc unit construction twins built from 1957 to 1974 but many of the techniques will transfer to the other models and periods of Triumph production.

The Engine

Portrait of the (Right) Timing Side of the T21 Engine (1958).

Here showing the timing gears, oil pump, the release valve, oil pipes, distributor and the gearbox inner cover with the kickstart shaft and inner bearing.

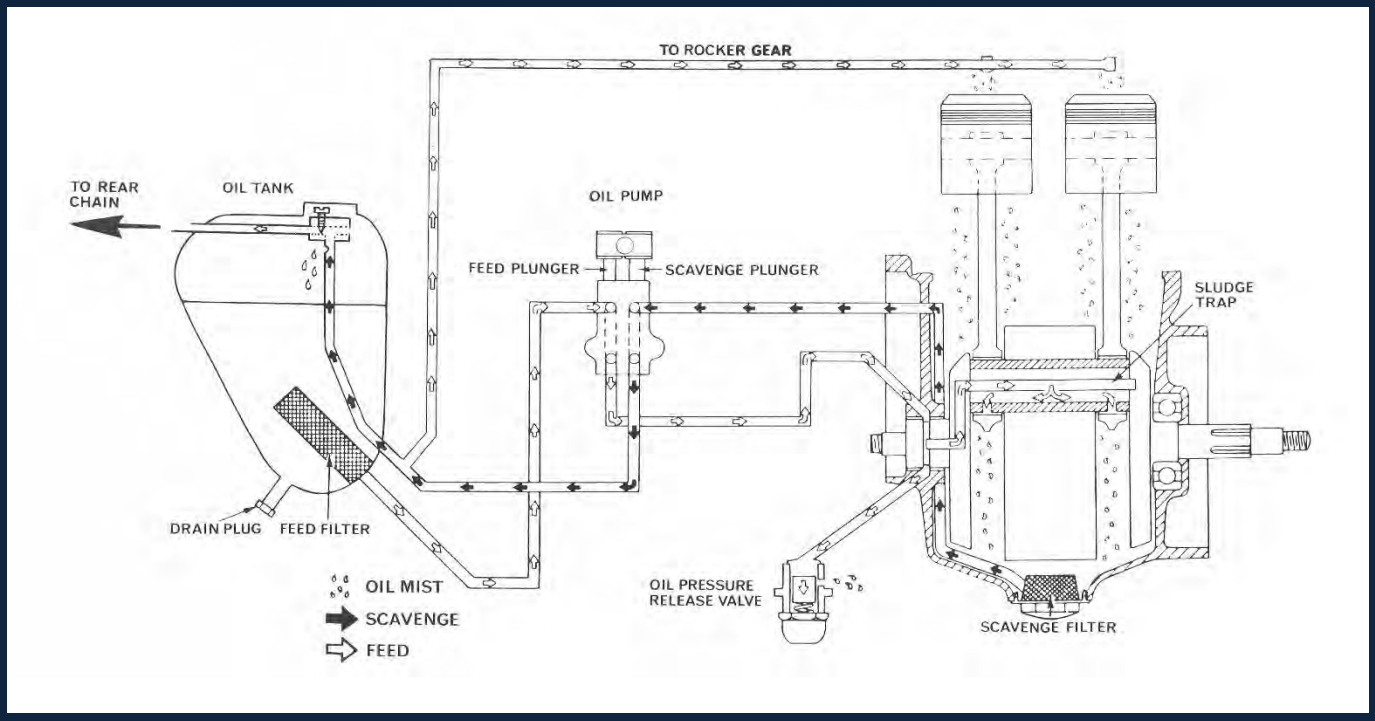
The Engine

Portrait of the (Left) Drive Side of the T21 Engine (1958).

Here showing the alternator, primary chain, clutch and carburettor.

The arrangement of the T21 engine is the basis for all of the Triumph C range 350 and 500cc machines and though improvements are introduced over time, the same basic design and principles are retained.

The Oil System



The Lubrication System.

All Triumph twins and many other classic British motorcycles use a dry sump oil system. Oil stored in a separate tank; though this can be the frame as on later Triumph and BSA machines, is piped to the feed side of a dual piston oil pump and then onwards under pressure to the crankshaft, sludge trap and the main bearings. A spring loaded oil pressure release valve regulates flow controlling the pressure within set limits and passes excess oil into the timing chest where it lubricates the camshaft gears and oil pump.

The oil under high pressure lubricates the big ends bearings; is thrown out onto the rotating crankshaft and collects at the bottom of the crankcase where it passes through the scavenge filter gauze and into a small sump. Here it is collected by a pipe to return through the scavenge side of the oil pump and then back to the oil tank.

The pistons, camshafts and other crankcase parts (not the clutch or gearbox) are lubricated by the oil thrown from from the crankshaft or escaping from the release valve. While the rockers, valves, tappets and pushrods receive their oil from a branch taken from the oil returning to the oil tank. (low pressure).

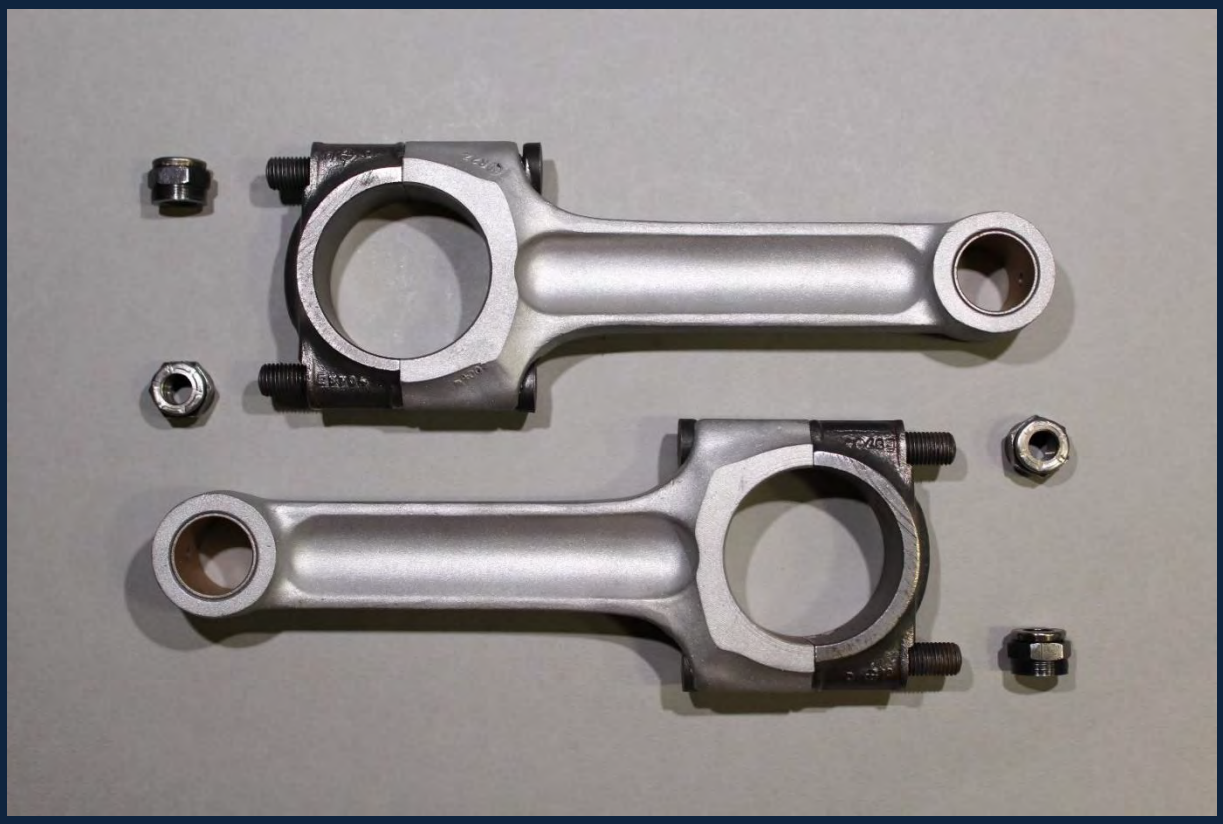
The illustration above, is only a guide as over time there are detailed changes made to the lubrication and breathing systems on the Triumph twins. On unmodified machines made up to 1969, the primary drive and clutch have a separate oil supply while on later machines the breathing system is altered and engine oil is now allowed to pass between the primary case and the crankcase.

In modern terms the filtration of the oil appears rudimentary; with only wire gauzes in the oil tank and the sump but this ignores the efficient centrifugal filtration that is undertaken by the crankshaft, rotating frequently at 5000+ RPM. The system suited the monograde, low detergent oils of the period and the frequent oil changes recommended ensured that sludge and damaging particulates were removed.

Provided that your Triumph has been well maintained and regularly serviced by someone experienced with the basic needs of these classic motorcycles; you should find no horrors. Unfortunately, many project machines have not been so fortunate and you will have a mountain to climb to undo poor work and create a reliable and enjoyable machine.

Refer to the Works Manual for suitable oil grades.

Engine Parts



For Illustration, a Pair of 500cc Connecting Rods.

Below is a suggested list of parts that you should obtain if you are intending to dismantle and re-build the engine and gearbox unit. It is not an exhaustive list but covers most of the small consumable parts; from my experience that you will usually need to replace.

A gasket set; this will usually include the appropriate cylinder head gasket together with all of the engine gaskets and specialist sealing washers that you will need for your re-build. You will need to specify to your supplier which model and year the set is for.

Bearings and seals, including the drive side bearing and its seal, the gearbox bearings and seals. The seal behind the clutch and the seal for the points (1963 Onwards).

Tab washers (4), for the gearbox sprocket, Mainshaft, clutch and alternator and the corresponding Woodruff keys (4). You will also need the (2) serrated washers for the oil pump.

Screws for the camshaft plates (4), clutch shock adsorber (6-8), sprocket cover plate (6) and the two specialised screws, Part No E3859 for the crankcase mouth.

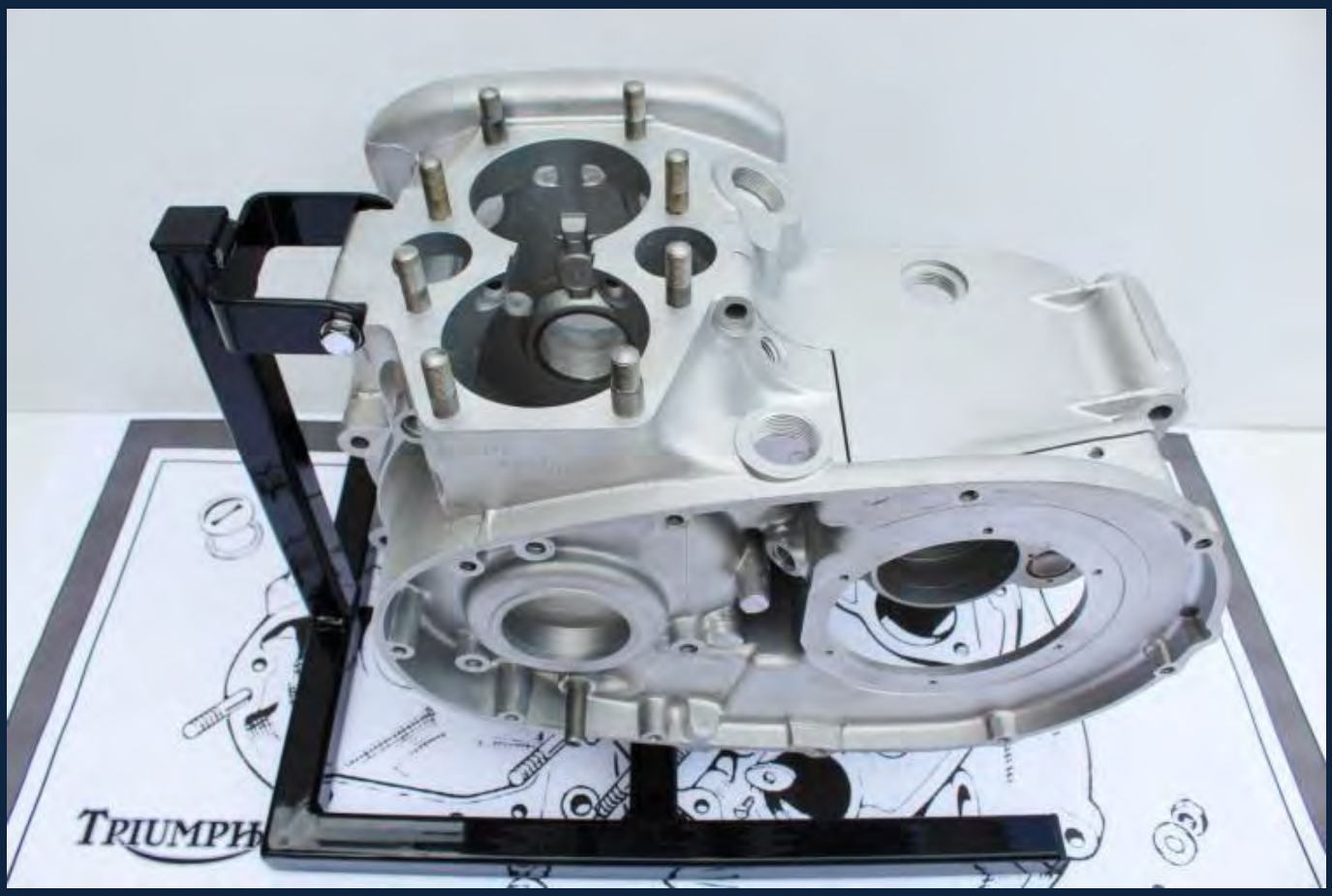
Thackeray (spring washers), thrust washers and seals (2) for the rocker boxes.

The crankshaft oil tube (sludge trap), the screwed plug and also new connecting rod bolts and nuts. It is a false economy to not replace these critical items

Piston circlips and valve springs as appropriate for your machine.

Take your time to study the appropriate parts book for your machine, the Works Manual, and the sections in this guide where the parts above are shown being fitted.

The Crankcase



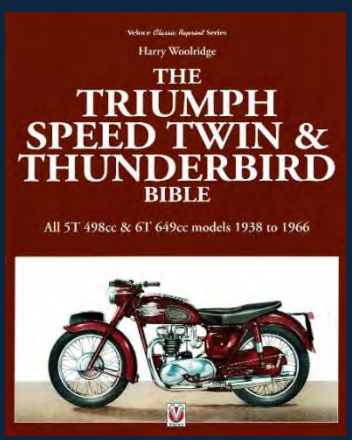
Overall view of the 350/500 cc Crankcase (1966).

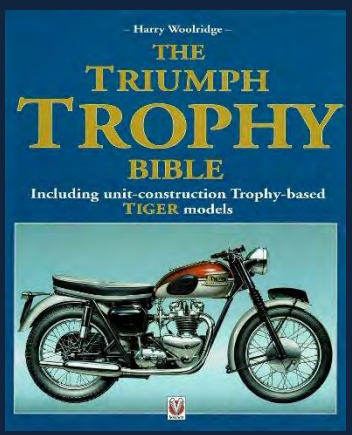
Refer to section B34 of the Works Manual for dismantling and reassembly instructions.
The general design of the crankcase changes very little over the period of production from the first T21 in 1957 to the final machines produced in 1974; the crankcase shown above is typical of the type.

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 guide 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 with brake cleaner to remove all traces of blasting media.

Regardless of how the cases are cleaned, all grit and metallic particles must be eliminated.





Recommended books by Harry Woolridge

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 1965). Crankcases made before 1963 will not have the rev counter drive port seen at top left.

Here the three alternator studs have been removed, look for cracking around the threaded locations and also for damage caused by broken or loose drive chains that in some cases will be too severe to affect a good repair. Specialist alloy welding can save a crankcase that would otherwise have to be scrapped.

Detail of the Chain Tensioner Trunnion.

The Crankcase

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 obtained.

This is the standard bush timing side, engine crankcase used until 1969, later machines or those converted to Devimead specification show some slight differences associated with the change to the oil feed system near the pressure relief valve location.

For Illustration, a 1967 crankcase showing the distinct “knobble”, a blank oil way and the location for a pressure switch or pressure gauge.

The Crankcase

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; 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. It is essential that the threads are in good condition.

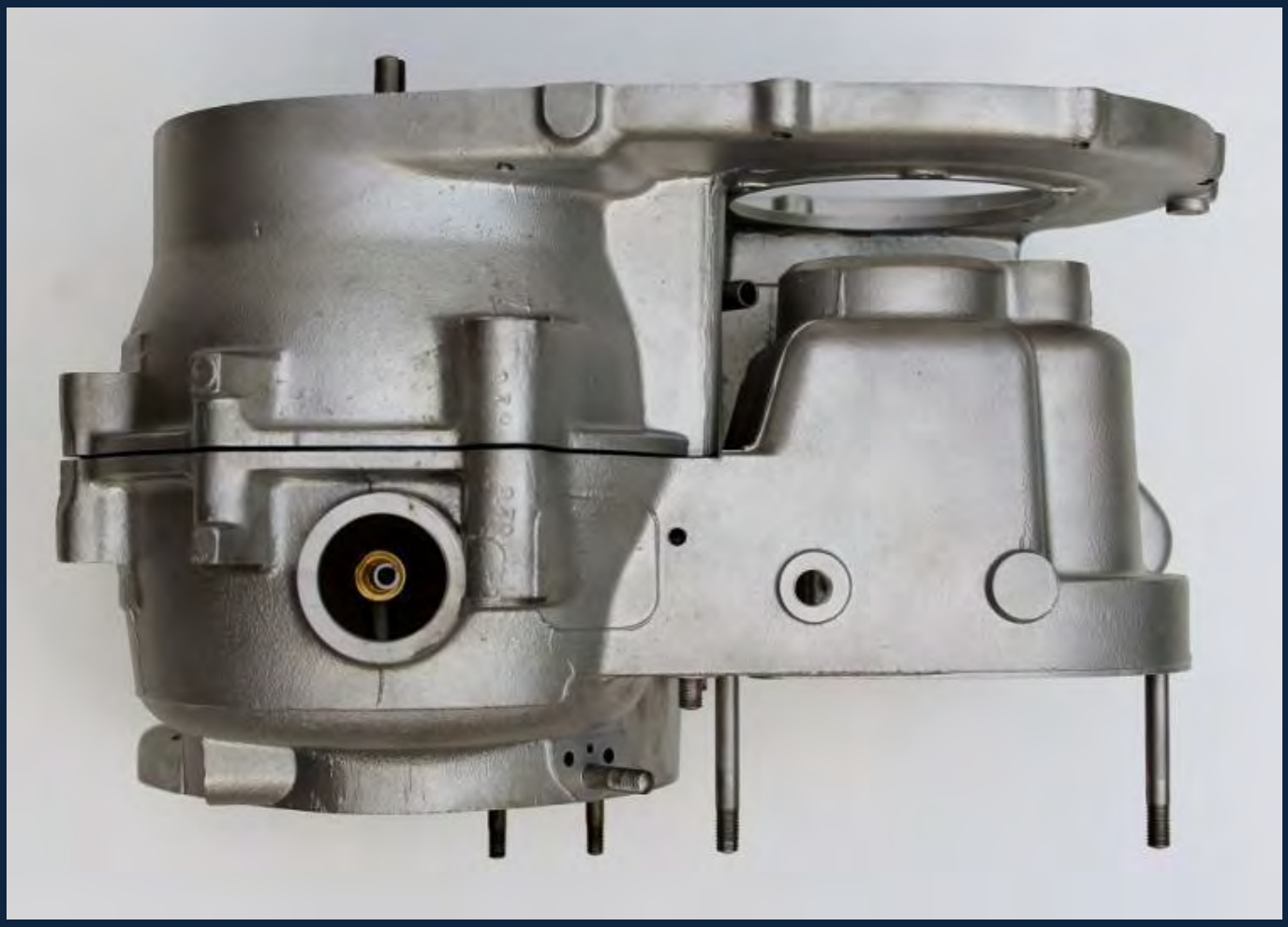
Like the other studs used on the engine up to 1968 the thread into the crankcase is BSF (British Standard Fine).

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 against each other carefully loosen them. The threads must be in good condition if you intend to re-use these studs later. Here in 3/8 BSF and 26 TPI Cycle.

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. Do this only after assessing them for wear as special tools will be needed to fit and ream the new bushes afterwards.

Between the barrels are two hidden screws that must be removed before attempting to separate the crankcase many first time owners miss these and end up breaking the casting adjacent to the cam followers. You will see many crankcases with this fatal damage caused by ignorance or impatience. These screws can be difficult to remove; support the crankcase firmly, apply heat and always use a well-fitting large, long screw driver. You may get only one attempt!

The Crankcase



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. On early machines the crankcase matching numbers are found towards the front of the crankcase. Expert restorers will seek matching cases.

Triumph like most manufacturers did not have pressing, casting or forging facilities. Bought in unfinished components like crankcases from Aeroplane 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. The earlier Terrier engine design has a similar vestigial feature!

Separating the crankcases is best done with a suitable tool, the Works Manual details one that uses the alternator studs but a version that is designed for general motorcycle use and utilises the peripheral screws will work almost as well, as long as the fasteners are replaced or modified to suit the crankcase threads. Resist the temptation to use chisels or blades as you risk damaging the mating surfaces. But note the hollow steel dowel at the top left of the crankcase in the image below. This is easily damaged if you insert a blade into the gap between the cases here.

Tip…The crankcases can be split with the camshafts in place but not usually with the gearbox intact as access to the two nuts for the main crankcase studs is restricted. The camshafts cannot drop out or be withdrawn inwards as there is a small lip that prevents this happening.

Aircraft and Motor based in Redditch and High Duty Alloys from Slough, were Triumphs usual suppliers for die cast alloy castings including the crankcases and cylinder heads. Look for the cast in marks AM or HDA, to identify the supplier of your crankcase or cylinder head.

The Crankcase

Crankcase Timing Side Internal View.

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 (read the safety data).

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 described above 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 mates with the raised lip on the other crankcase half

For Illustration an early crankcase showing the gearbox bearing area.

The Crankcase

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 may require reaming once fitted an operation generally beyond the capability of the average owner without access to engineering facilities or special tools. Refer to the Works Manual Section B39 for details.
Within with the inlet camshaft bush is the timed breather disc and locating peg.

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.

Emerging from the crankcase are the two 5/16 in studs that pass through the right crankcase half and help to bolt the halves firmly together; these do not usually need to be removed.

For illustration, the early chain oiling peg and metering jet; initially this jet is screwed in but later is pressed in.

The Crankcase

The Timing Side and Oil Pick Up Tube.

Shown here in detail the timing tide bush location and the oil return pipe 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.

The raised pip on the early crankcase.

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, in the larger unit construction 650 cc / 750 cc (B Range Models) the camshafts run in bronze bushes at this end. Just visible are the oil galleries and weirs that allow oil to collect and pass to the camshafts.

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.

Detail of the oil weirs and galleries as described above.

The Crankcase

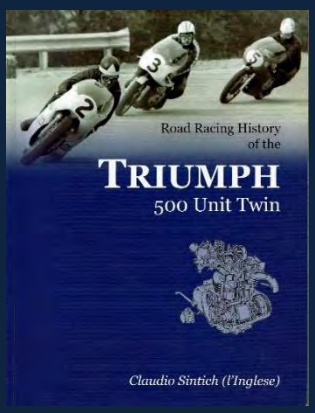
Timing Side Detail.

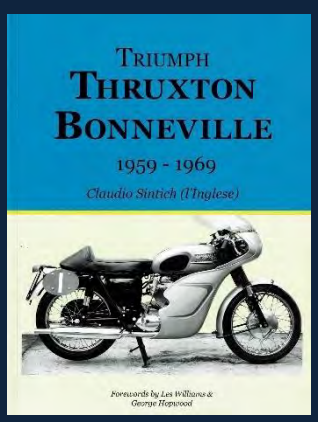
Shown is the location for the oil pump on the left the return holes and on the right the feed, check that these are scrupulously clean. On Pre-Unit Triumphs the holes are reversed.

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. Not all machines have the date mark so its absence should not be treated with suspicion.

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.

On the right just visible is the oil passage from the pressure release valve check that this is clear as oil must be able to flow through when the relief valve opens. The timing chest is arranged so that a level of oil is maintained and collected by the timing pinion to lubricate the timing gears, oil pump drive and camshafts before overflowing into the crankcase where it will be collected and returned.





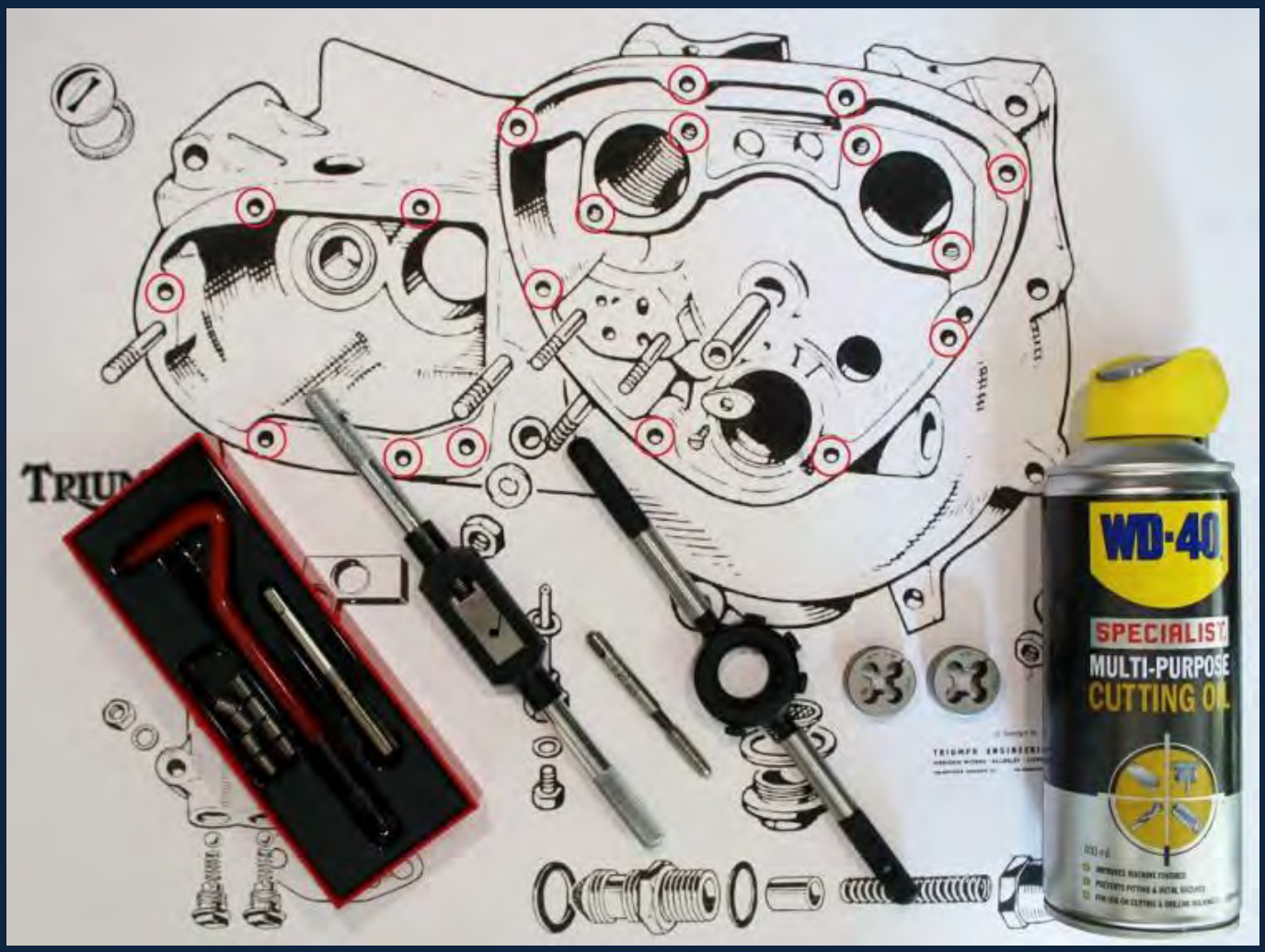
Recommended books by Claudio Sintich.

The Crankcase

Detail of the gearbox casting, here an early engine (1958).

And from 1966, note the increased strength provided by the full width ribs.
It is not possible to fully drain these later boxes and metallic particles
or debris can collect in the recess seen here.

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.

To remove studs, heat the area around the base of the stud with a blow torch and use either a stud socket or two nuts tightened against each other so that the stud can be unscrewed.
Use Loctite 270 (stud lock) when replacing your studs.

If you have access to engineering facilities or contacts, then new studs and fasteners can be made using the originals as patterns. The parts books helpfully provide 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 or bottoming taps rather than taper taps.

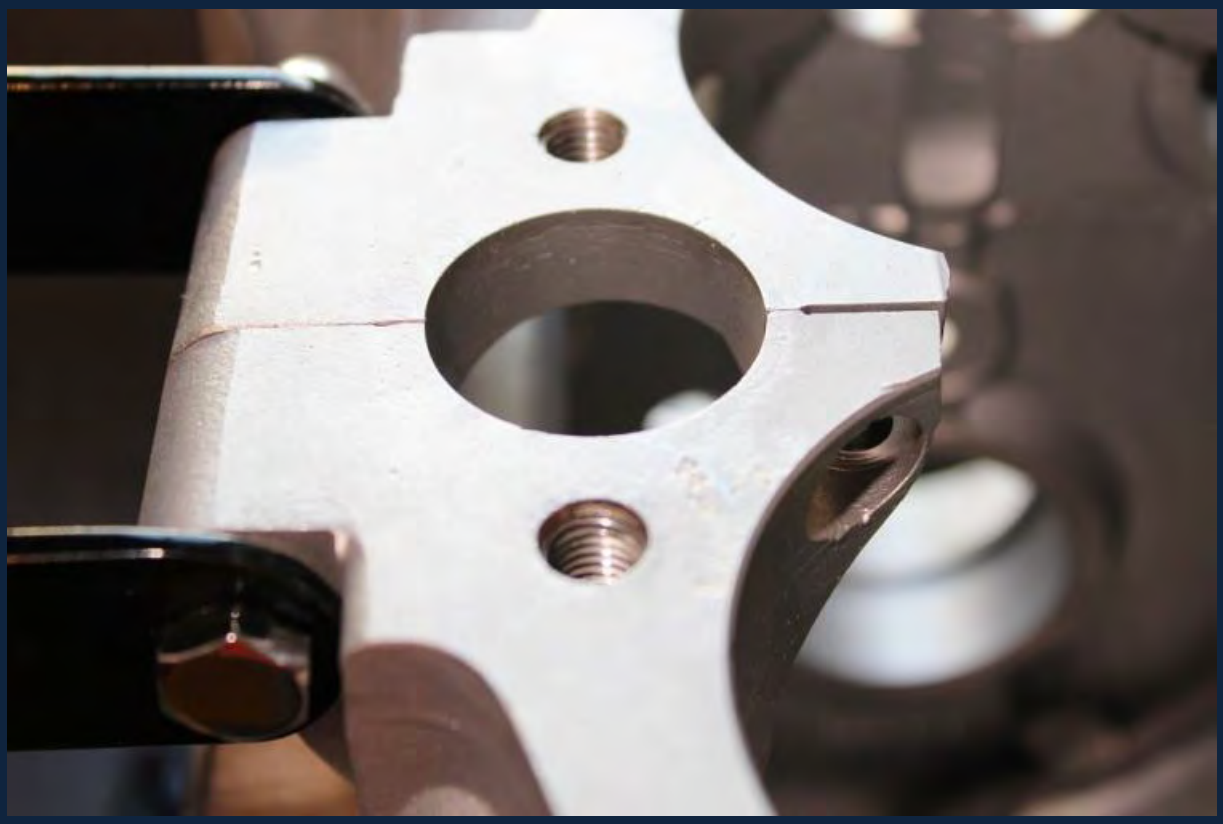
Do not use taps with a power drill; there is little control and you risk damaging the threads especially those in alloy. You must lubricate taps before use, use a cutting oil or grease (Trefolex) which will trap any particles as you work. Screw the tap in one turn at a time and then reverse ½ a turn. 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 (a 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 principals involved and your mistakes will not be costly. Check on You Tube for instructional videos.

Also shown above is a ¼ BSF Helicoil kit.

One of the numerous ¼ BSF threaded holes, here in good condition.

The alternator cable exit. ½ in BSF after tapping and cleaning, also
½ in BSF the TDC plug, gearbox drain point and rev counter location.



Two of the eight cylinder stud holes, here in 3/8 in BSF.

Also visible is the location for one of the two crankcase mouth screws ¼ BSF; on this engine they proved impossible to remove initially and had to be cut through with a fine (junior) hack saw blade… but care was taken not to cut any deeper into the casting than was absolutely necessary.

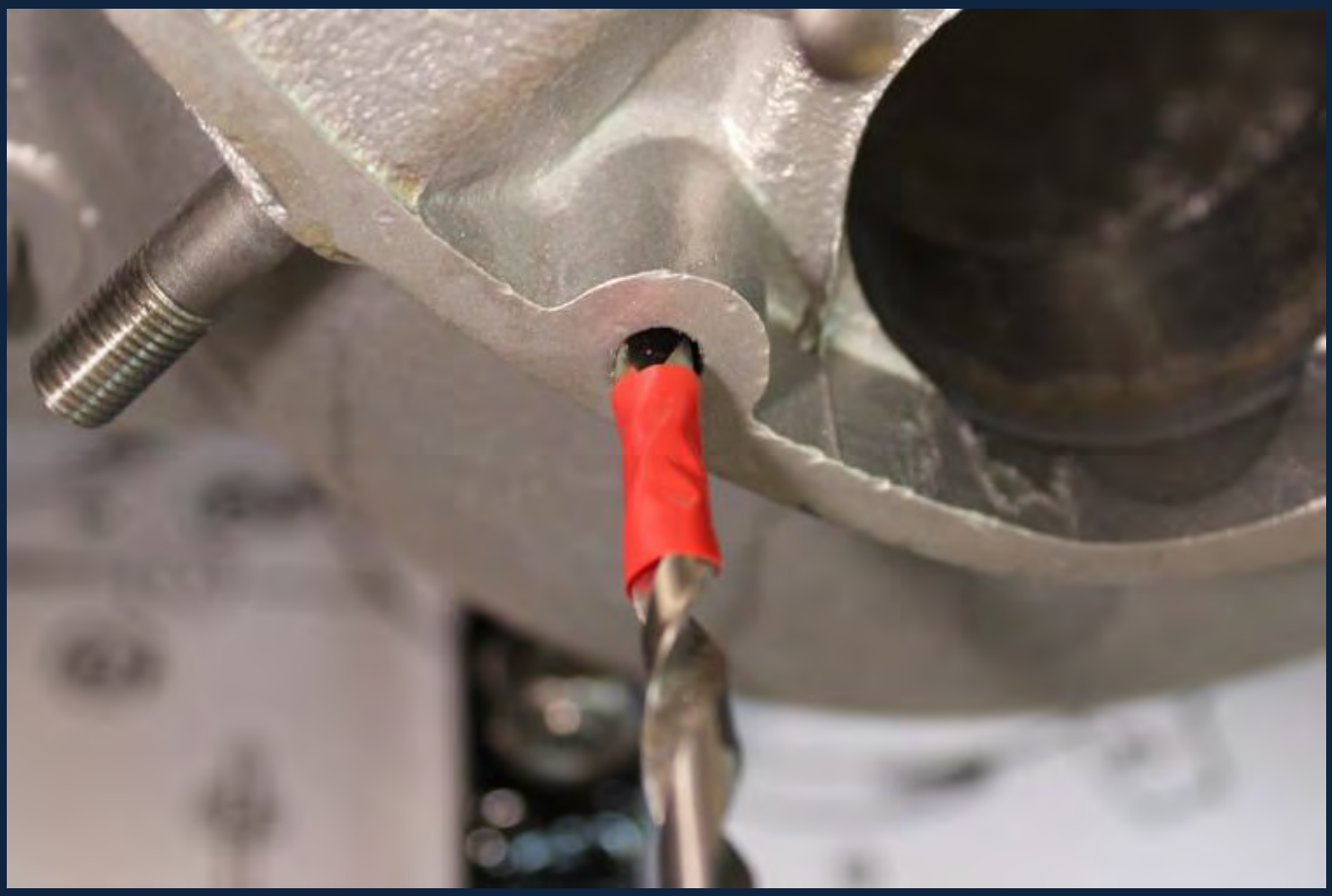
You must use the correct type of screw especially on the 500cc engines where the barrels are a close fit into the machined recesses, Loctite 243 (medium strength) is recommended and essential on the 350cc engines where the screw can potentially fall out and into the crankcase.

Using taps and dies to cut and clean the threads.

A cracked stud location, quite common; this will need specialist welding.

A damaged thread… a Helicoil will be needed.

Helicoils



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

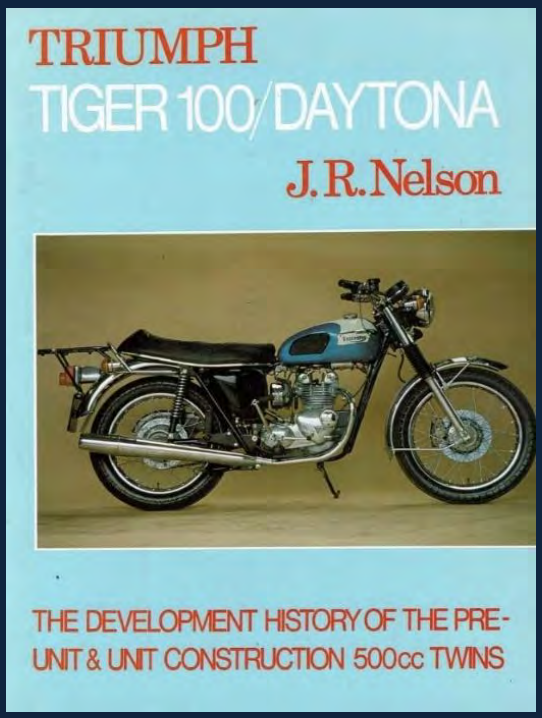
Using the tap from the Helicoil kit to tap the hole.

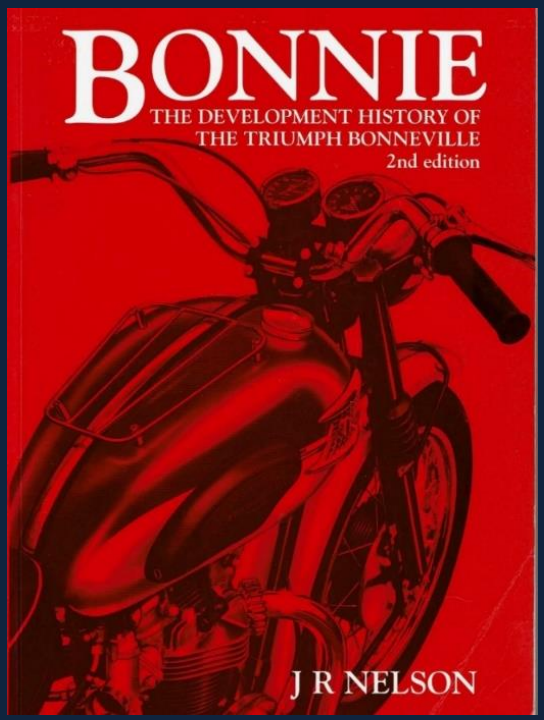
The Helicoil partially inserted into the cleaned hole.

Using the supplied tool to insert the Helicoil fully.

The completed Helicoil, the tang has been removed.

Helicoil kits and inserts are available in BSCY, BSF, BA, UNF, UNC and Metric sizes
Time-Serts a stronger type of insert, are also suitable but are not available in all sizes.





Recommended books by John Nelson, John worked at Triumph for many years
and his great knowledge and experience is reflected in his books.
A must for any serious restorers library.

For authors, John's extensive archive survives and is an invaluable source
of information and photographs. Contact the Triumph Owners Club.

Bearings and Seals

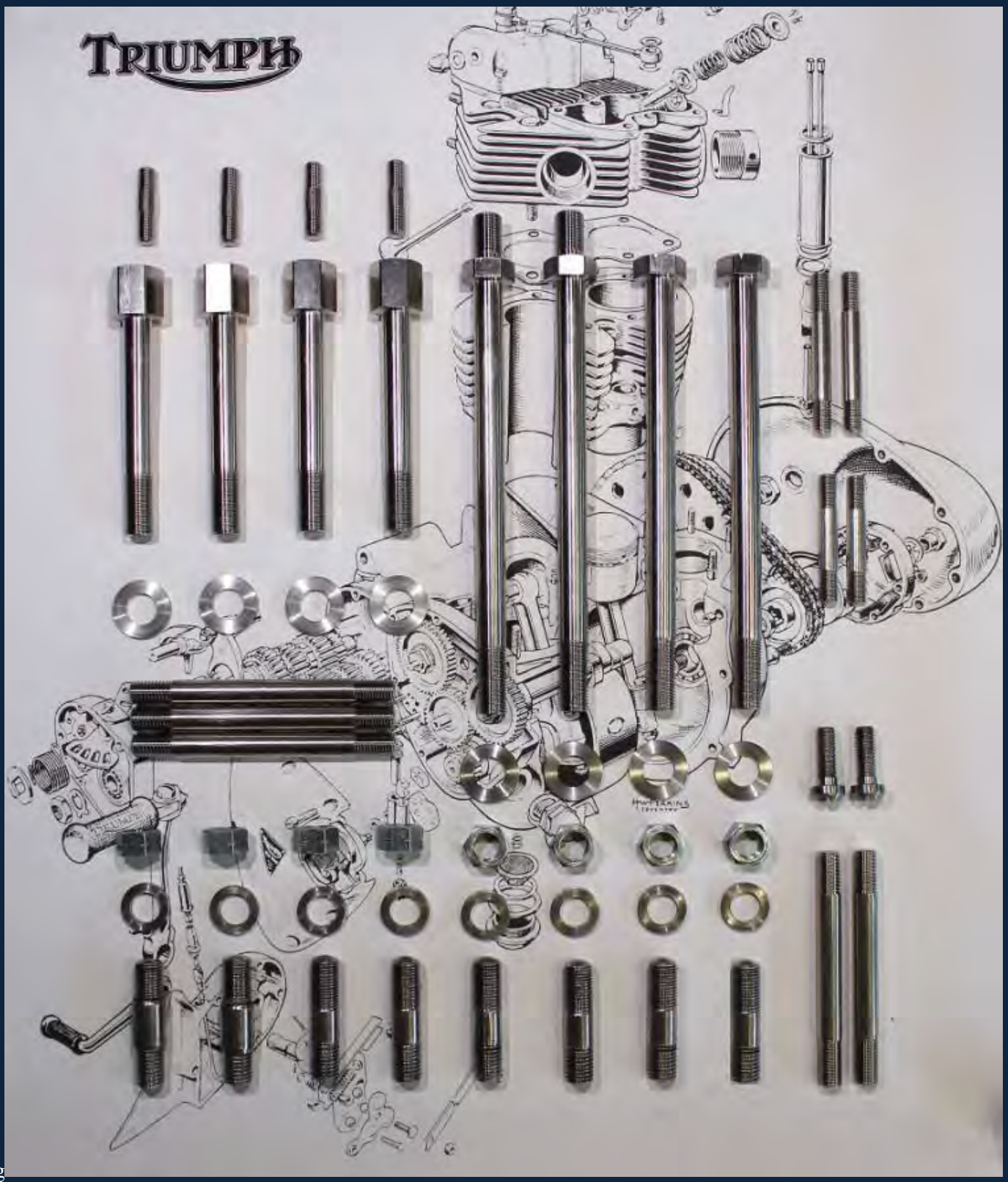
Above is the general bearing and seal group for the C Range engines.

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 the oil seal for the timing cover and or crankshaft on late (1968+) 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



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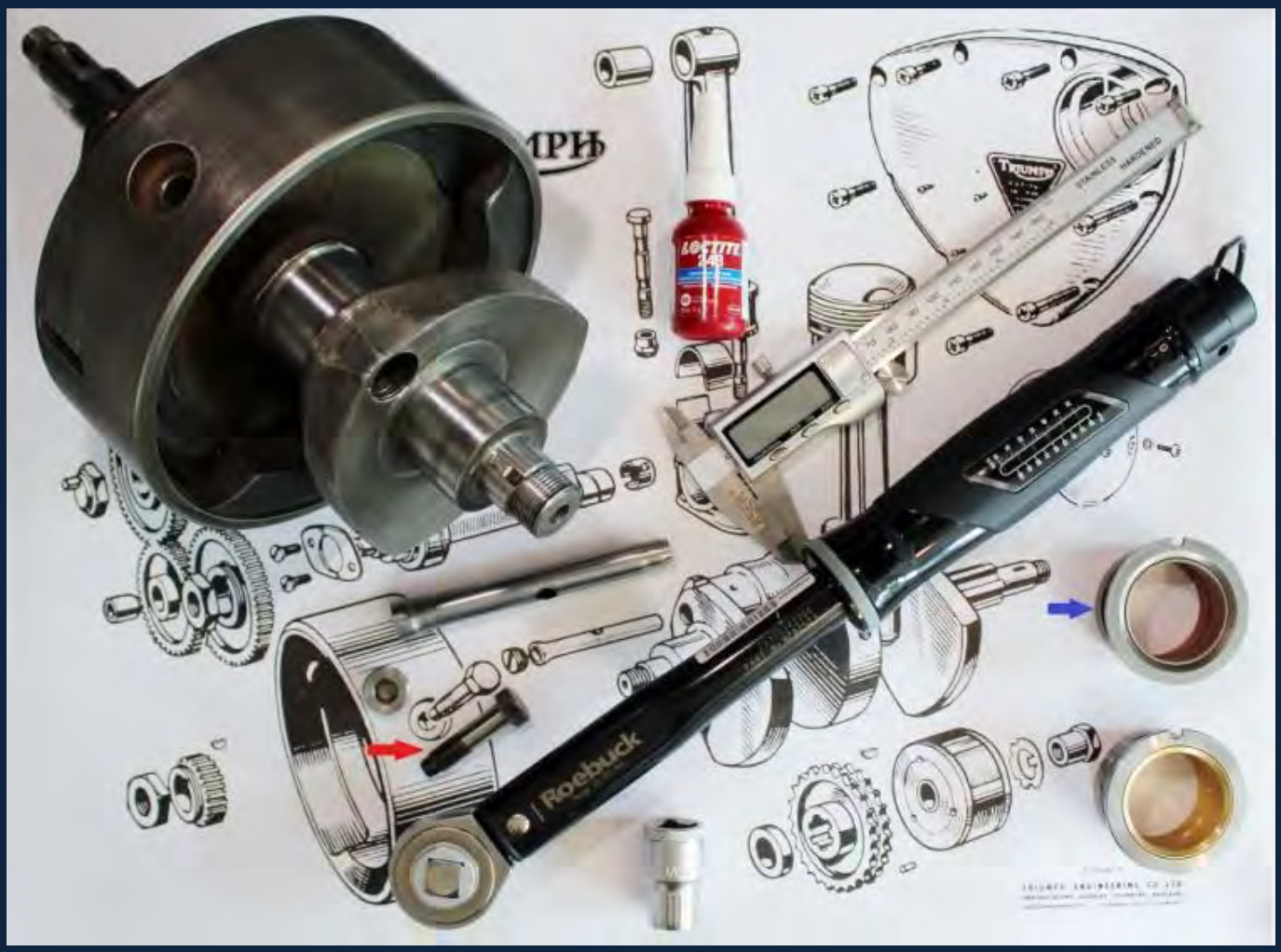
Engine and gearbox bolts, washers, studs and special parts.

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.

When using stainless steel fasteners, you must use a suitable anti seize compound, either copper grease or preferably a non-metallic compound such as Magnesium Hydroxide (available as Milk of Magnesia) or specialist products such as Moly slip Ceramslip. Loctite LB 8036 or Jet Lube Marine Grade Anti Seize.
Read articles on galvanic and dissimilar metal corrosion for an explanation.

Part 1 Complete

The Crankshaft



Preparing the Crankshaft.

On any Triumph twin unless you are completely confident that it has been assembled and serviced properly it is vital to assess the state of the crankshaft and sludge trap at some-point 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.

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 tube in place.

Refer to Section B35 of the Works Manual for Details.

Shown above is the crankshaft after basic measuring and removal of the sludge tube, the flywheel bolt that locates the sludge tube will need Loctite on assembly. Arrowed in blue is the old timing side bush with the new one below it. Tip… Once checked protect the exposed threads of the crankshaft with cardboard sleeves or insulating tape.

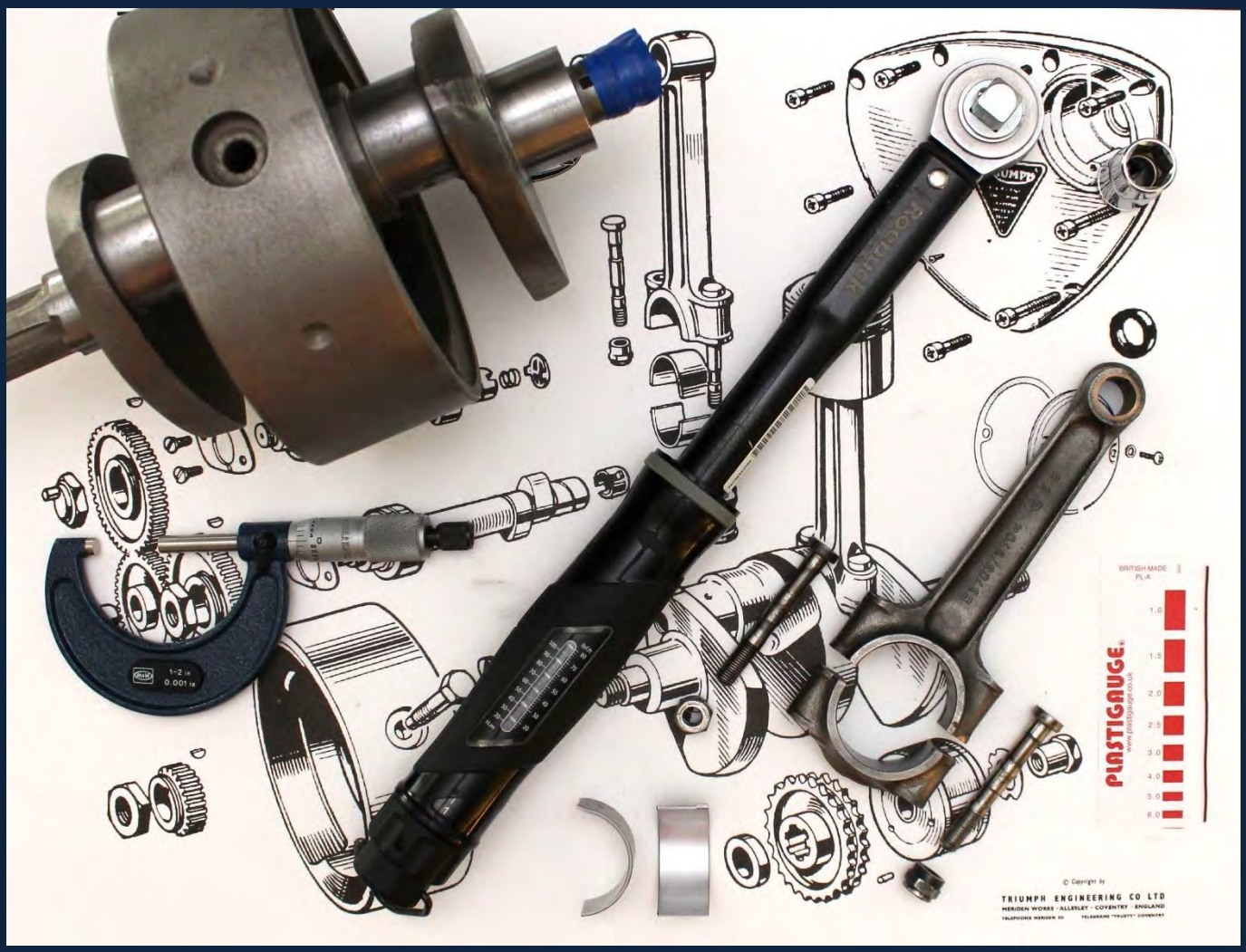
This crankshaft had very little wear and did not require re-grinding. The Works Manual contains all of the data required to assess if any of the engine components are worn and with good measuring tools the average owner will gain sufficient confidence to assess these critical components; see below.

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 shell bearings and timing side bush are available in a number of over-sizes and it is best to obtain these parts before passing regrind work to your chosen specialist.

There are several Internet guides and YouTube Videos that deal with sludge trap removal.
Paul Hopewell's "The Shed Dweller" You Tube Channel is one I recommend
Also look for articles and videos by Kyle at Classic British Spares.

The Crankshaft



Measuring the Crankshaft.

Shown above are tools suitable for measuring the crankshaft main bearings, you will need a suitable micrometre here a vintage Moore and Wright 1 to 2 inch micrometre, a set of new bearing shells, the connecting rods, the old bolts and nuts, a torque wrench and Plastiguage.

Plastiguage is specially designed to accurately measure the working clearance of shell bearings, available in a variety of sizes and easy to use, it is an invaluable tool for novices and experts alike.

First measure the crankshaft against the data published in the Works Manual to assess if it has been re-ground. Then with suitable bearing shells and using the Plastiguage measure the working clearance of the big end journals to assess if a re-grind is necessary; any clearance over 0.002 (2 thou) would indicate that a re-grind may be required. Note the minimum regrind size in the data below.

CRANKSHAFT

Type	Forged two throw crank with bolt-on flywheel
Left main bearing, size and type	72×30×19 mm. Ball Journal
Right crankshaft main bearing journal dia.	1·4375/1·4380 in.
Right main bearing bore, size and type	1·4390/1·4385 in. Steel backed copper lead lined bush. Under sizes available: —0·010 in., —0·020 in., —0·030 in.
Left main bearing housing dia.	2·8321/2·8336 in.
Right main bearing housing dia	1·8135/1·8140 in.
Big end journal dia.	1·4375/1·4380 in.
Min. regrind dia.	1·4075/1·4080 in.
Crankshaft end float	·008/·017 in.

CONNECTING RODS

Material	Alloy 'H' Section RR.56
Length (centres)	5·311/5·313 in.
Big end bearings type	Steel backed white metal
Bearing side clearance	·013/·017 in.
Bearing diametral clearance	·0005/·0020 in. minimum.

The Crankshaft

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/machined out and a considerable amount of force and heat applied.
New Allen key caps are much easier to deal with.

Tip… The thread for the cap (BSCY) is 11/16 20 TPI and 20 TPI in 9/16 and 3/4 inch sizes for the Crankshaft.

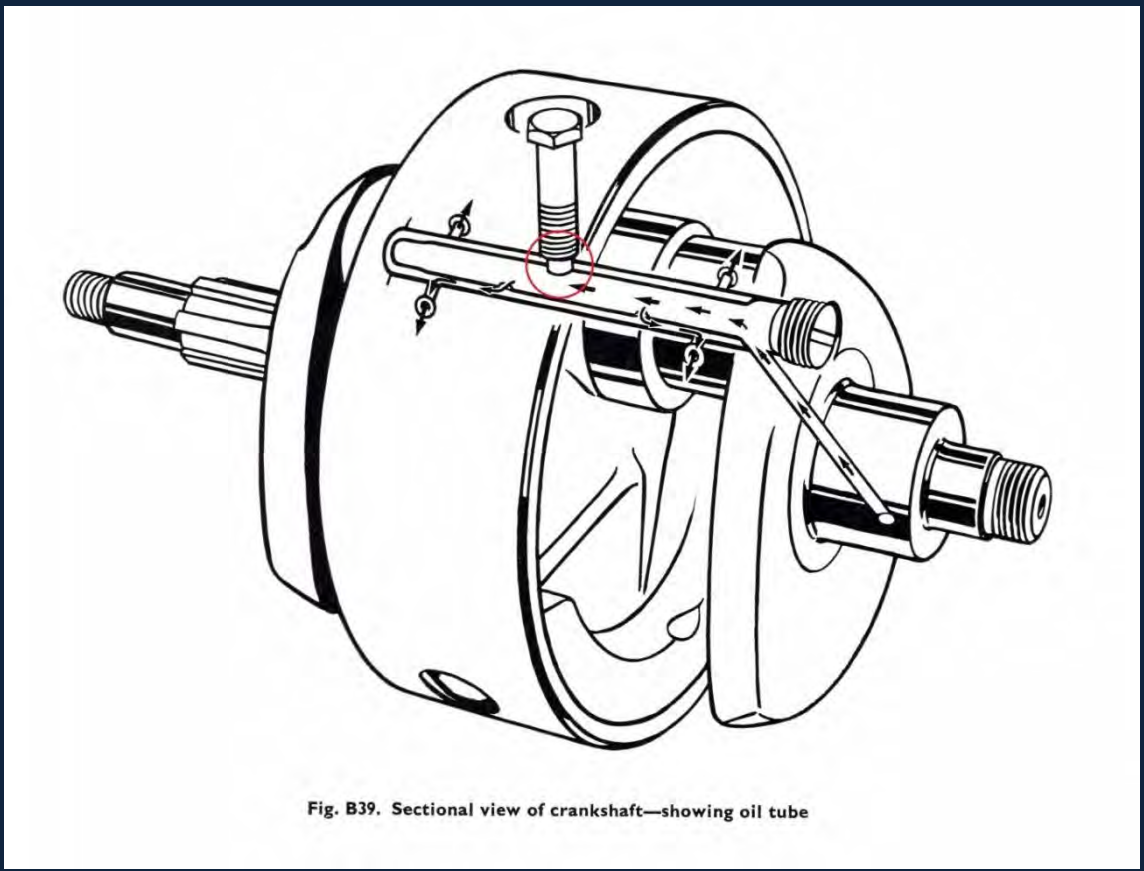
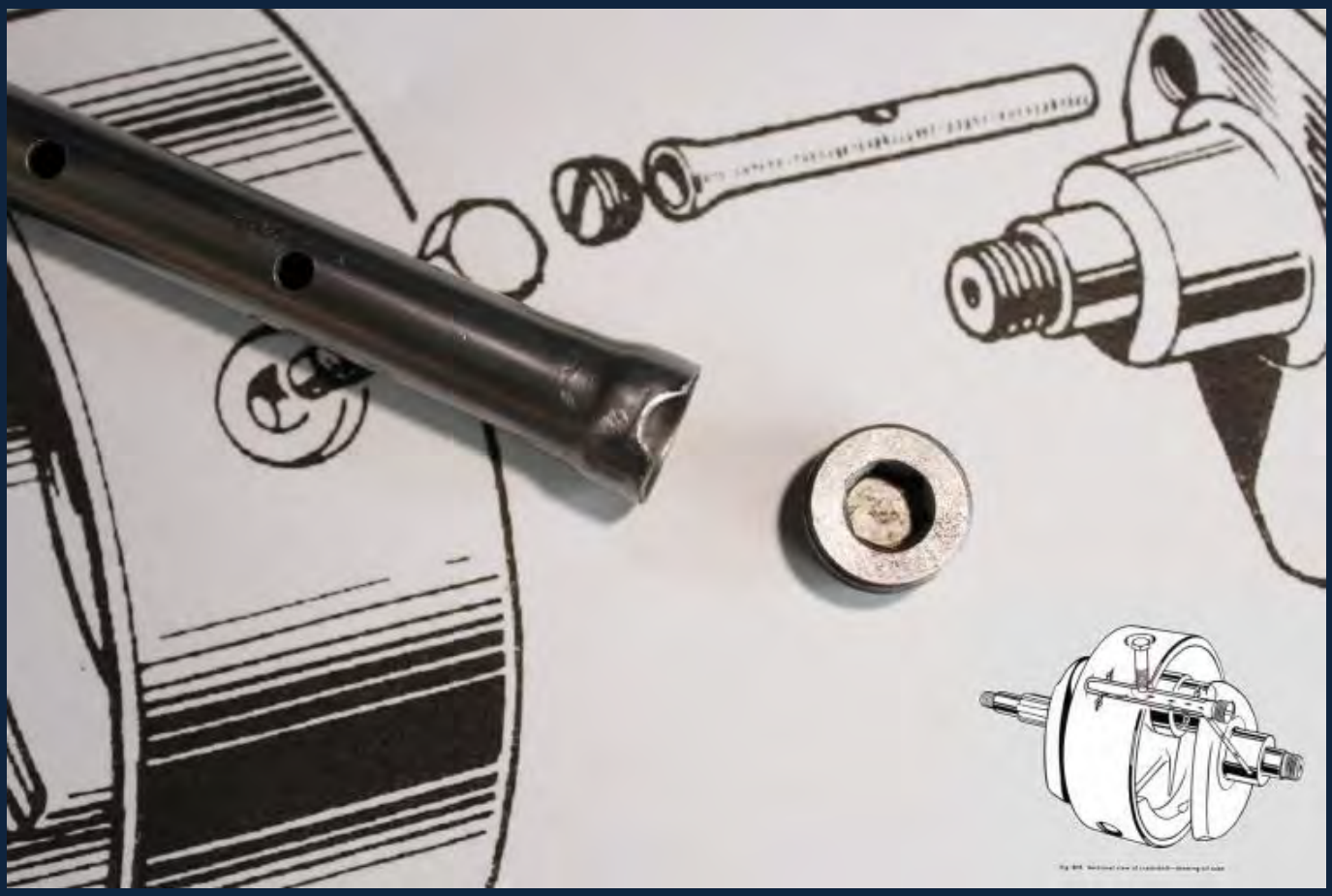


Fig. B39. Sectional view of crankshaft—showing oil tube

The Sludge Trap comprises the oil tube and the recess it sits in!

The Crankshaft



The Sludge Tube 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 sludge tube, while only allowing clean pressurised oil to go to the main bearing shells. Introduced by Ariel in 1933 the sludge trap is a common feature on most classic British motorcycles.

To remove the sludge tube, the central flywheel bolt must be removed and 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 followed by wire brushing (gun cleaning brushes), the hardened sludge can be removed. Brake cleaner, lighter fluid (Naptha) or Toluene are excellent solvents 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 ground this carefully away as seen above so that there would be no restriction to oil entering the sludge trap. Use Loctite when reassembling and refer to the works manual for the details on both the sludge trap and crankshaft assembly.

Complete the sludge trap by replacing the cap using Loctite, centre punch this as previously and also, Loctite in the flywheel bolt. Torque to 33 lb/ft.

The bolt-on flywheel limits the safe rotational speed of the crankshaft to approximately 8000 rpm as the three attachment bolts are stretched by the centrifugal forces generated. The Factory experimented with better bolt grades and crankshafts from 1967 may be fitted with these.

Early T21 Models have a second tapered plug at the left (drive) end of the sludge trap. There should be no need to remove this during servicing. Refer to the Instruction Manuals rather than the Works Manual for these early engines.

The Timing Side Bush and Shell Bearings

Bushes, 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 moisture, 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 its housing ensure that this is fitted correctly so that the retaining slot in the bush is correctly positioned.

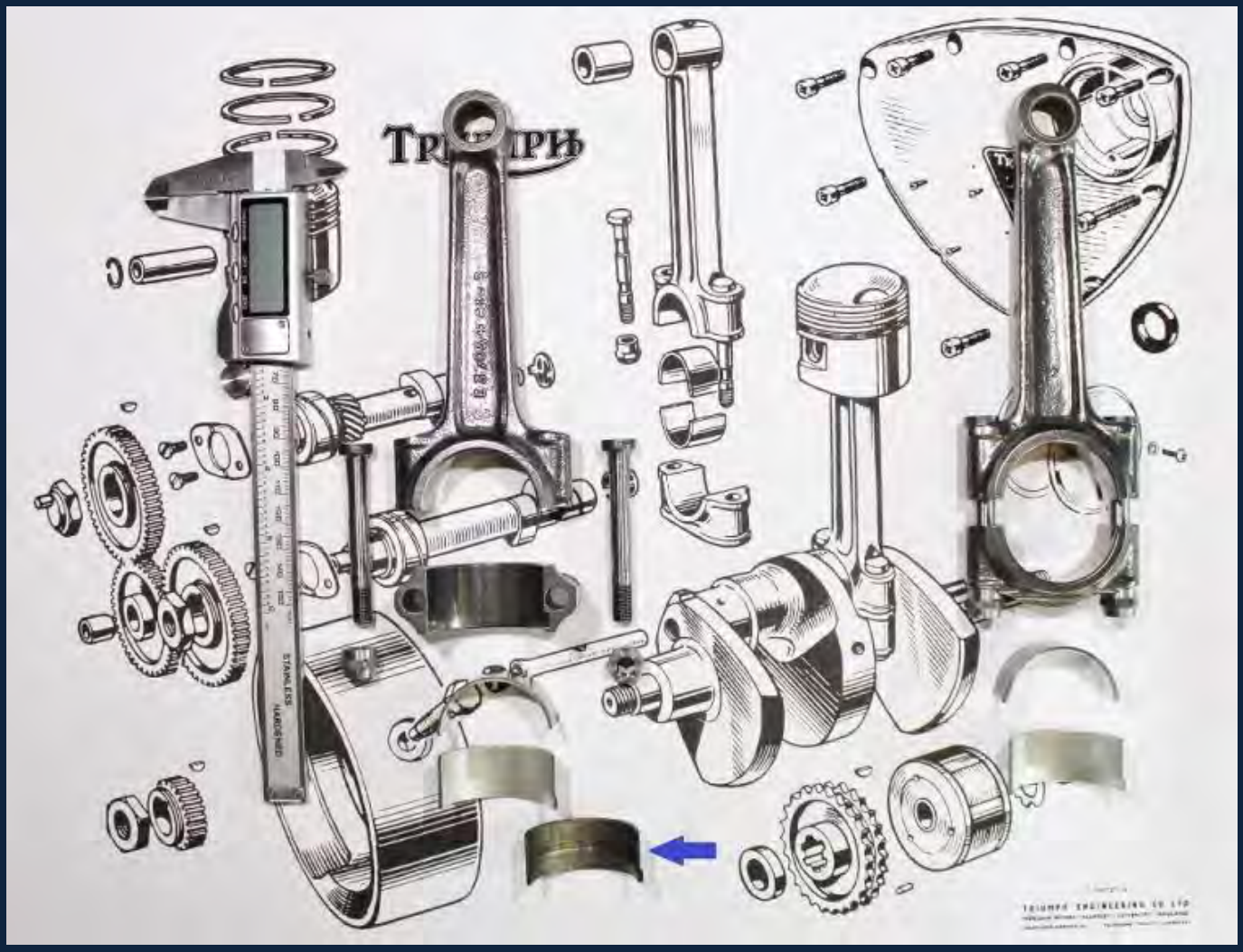
The shell bearings are available in a number of oversizes to accommodate crankshaft wear and you should check that any new bearings are the correct size for your needs. The small tang on each one corresponds with a recess on the connecting rod or cap and prevents the bearing from turning. Fitting is simple and requires no specialist skills or tools.

To accurately measure the shell bearing clearances; look for Plastigauge, (described earlier) this clever product is easy to use and available in several sizes to suit multiple engine applications.

The shell bearings will be marked STD for standard and +10 or +20 for oversizes in thousands of an Inch; the bearings are inexpensive and worth changing but do not substitute them for the next oversize without undertaking a suitable crankshaft regrind. Bearings can be ‘Scraped’ to fit but this is not recommended!

I recommend using a specialist assembly lube when fitting both the bush and the shells this will prevent damage to the bearing surfaces on initial engine start-up.

The Connecting Rods



The Connecting Rods, Caps, Shell Bearings and Bolts.

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 MUST not to be re-used but replaced along with the bearings New bolts are usually of the later type with UNF threads and require AF tools.

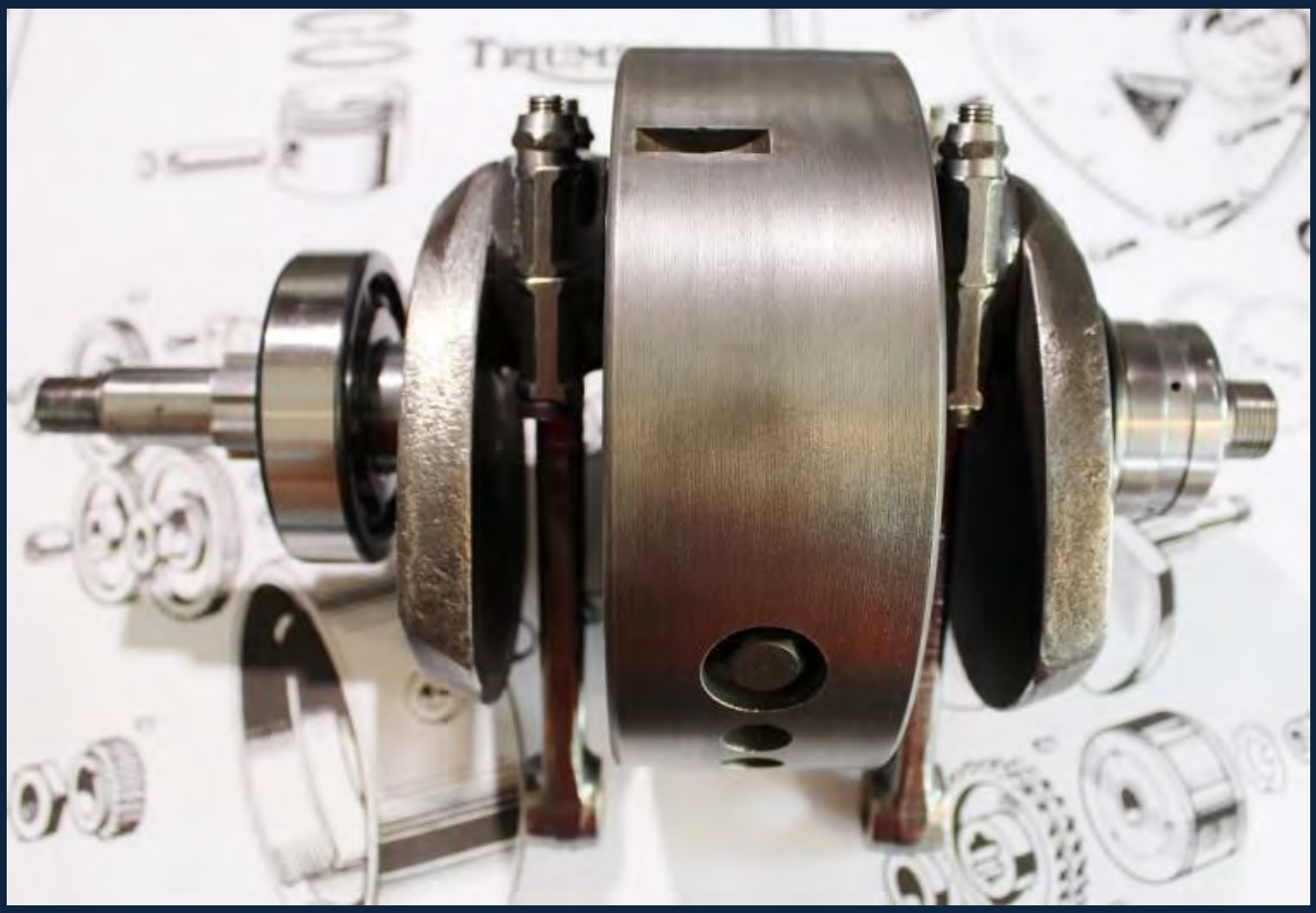
The conrods and caps were originally marked on assembly and these MUST be kept together and reassembled as pairs. It's good practice to keep components in the order of their removal and return them to their original locations.

During production at the factory the conrods and their caps were selected, assembled, marked and then bored together to the correct tolerance for the crankshaft using the standard big end shells. If you mix up or fit the caps the wrong way round you are very likely to find that one of the conrod assemblies will now bind onto the crankshaft when torqued, even if the crankshaft has been reground and oversized bearings are used.
Check that the caps and rods are matched and if in doubt swap the caps over and test fit until you are satisfied that everything is ok.

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 there could quality be maintained.

The Part Numbers shown on Triumph parts do not always correlate with the parts book for the year, shown above are the steel conrods used on the 350cc models until 1967, the 500 cc models use alloy connecting rods with steel caps. Both types use common connecting rod bolts with specialised locking nuts.
The connecting rods are not interchangeable due to differences in the gudgeon pin diameters, 350cc models use 9/16 in gudgeon pins while 500cc models use 11/16 in gudgeon pins.

Crankshaft Preparation



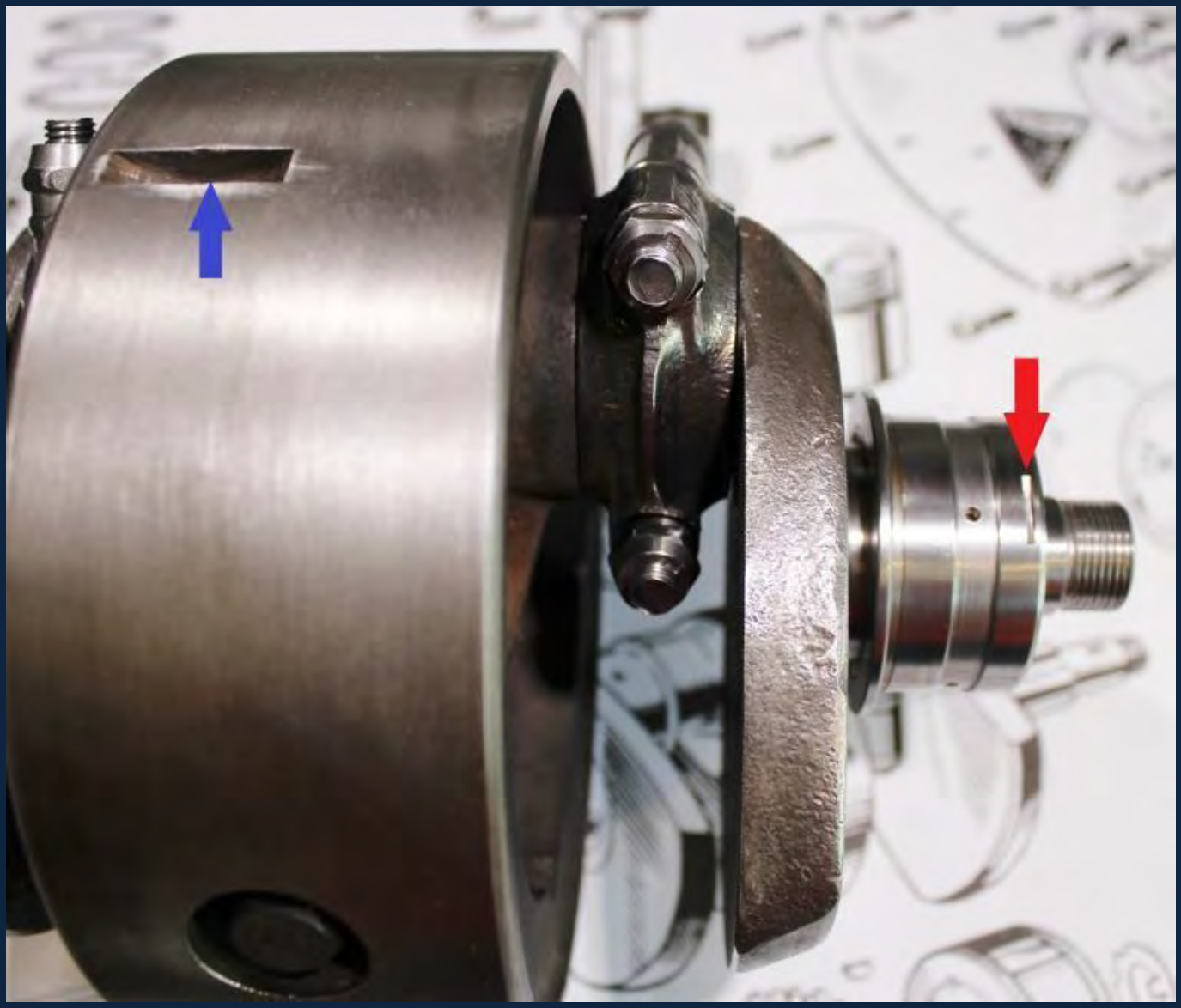
Crankshaft assembly and checking for fit.

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. Failure to check the fit of components now may lead to problems in assembly later and it is best to test fit all the bearings and parts before completing the crankcase assembly.

Detail of the crankshaft showing the part number E3712 (1962)
This is a 1965 crankshaft made by Qualcast of Wolverhampton.

Crankshaft Preparation

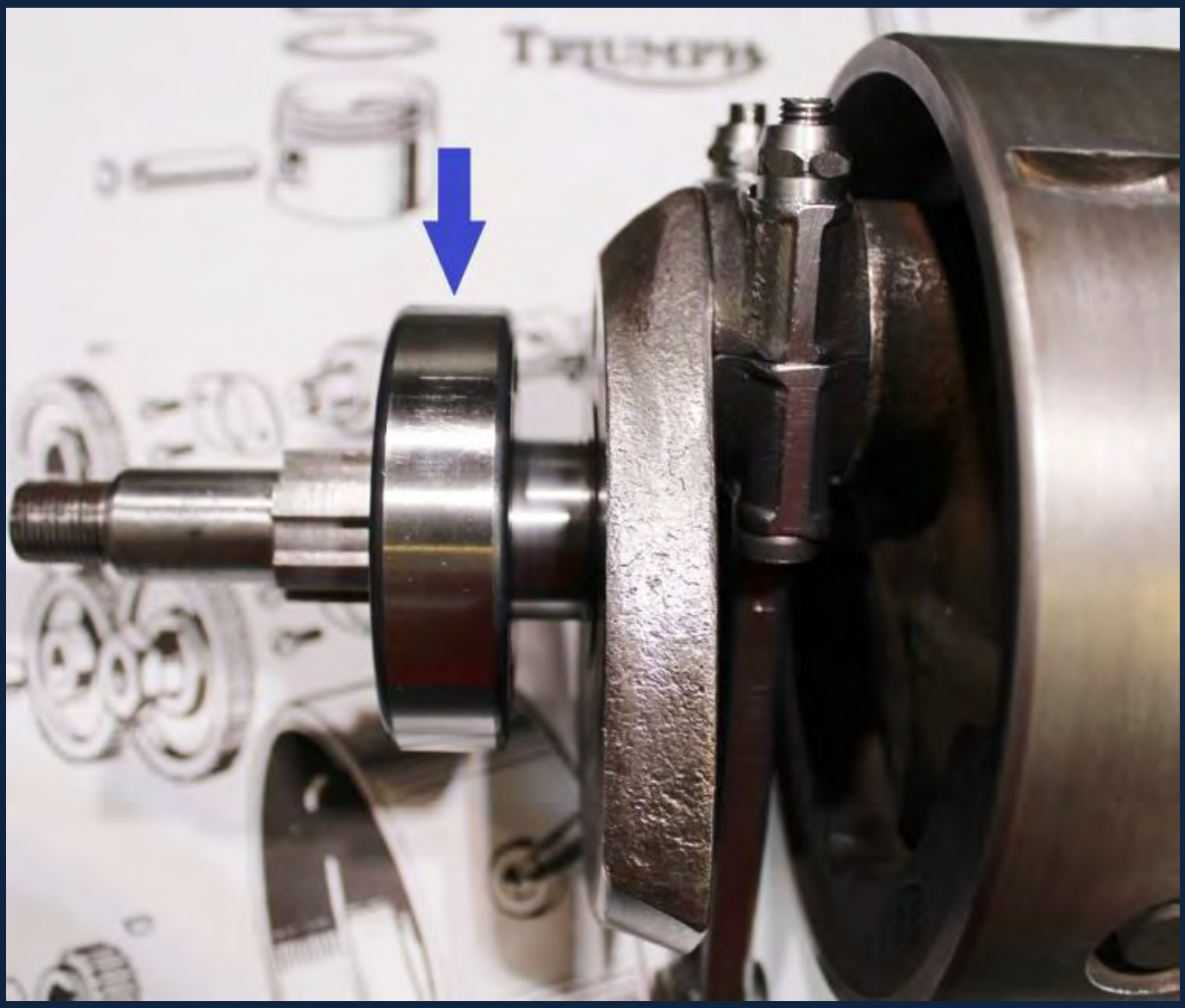


Crankshaft Detail Timing Side.

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 bush should be a smooth fit with very little perceptible play.

Detail of the steel connecting rod for the 350cc Models (1965 T90).

Crankshaft Preparation



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; use some light oil to prevent binding during the test fitting!

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 is designed to lock the crankshaft in position, pulling it up against the drive bearing so that it cannot move laterally.

Remove minor burrs with some emery cloth cut into strips and soaked with a thin oil or cutting fluid before finishing with metal polish and then clean off any residues with brake cleaner.

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.
Fitting of the bearing and bush is described below.

Complete the preparation of the crankshaft by test fitting the timing pinion, engine sprocket alternator rotor and the two large associated nuts so that later assembly goes smoothly.
Make sure that the threads are in good condition and re-tap them if required.

The Crankshaft threads are 9/16 and 3/4 inch 20 TPI BSCY.

Drive Side Bearing

The fitted 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 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 old bearing.
In this case from the other (alternator) side once the seal has been prised out. 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.

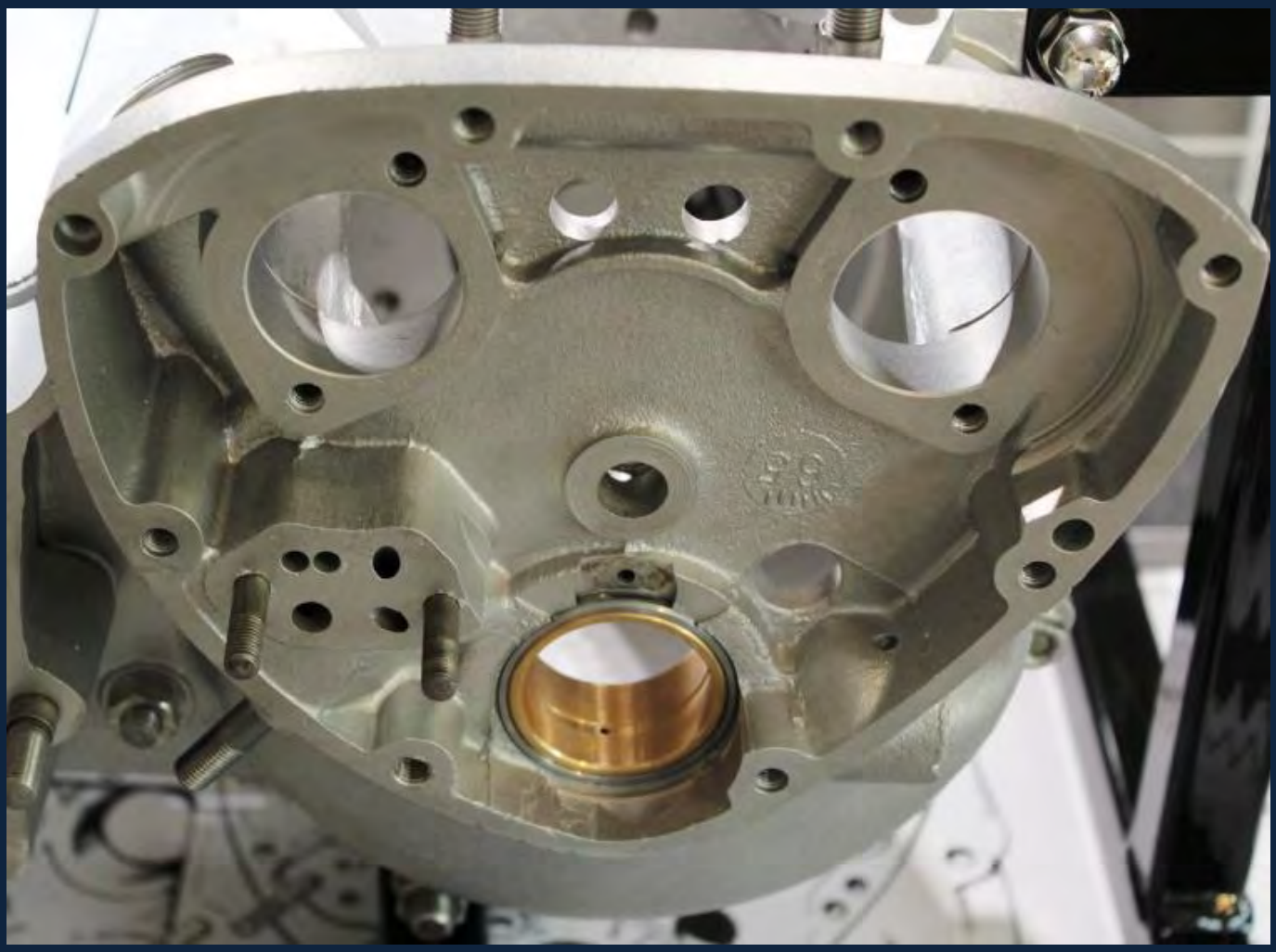
Label the bearings as used and retain them until you have obtained replacements.
Most of the bearings used by Triumph are Metric sizes and commonly available.
Assess and clean the bearing housing removing all traces of retaining compounds and oil.

To fit Bearings safely you will need a mandrel but with care a large diameter 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.

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.

If storing the crankcase for some time with the bearings in place, mask these off first with duct or gaffer tape
so that dirt and especially metallic particles cannot enter these critical components.

Timing Side Bush



The Timing Side Bush Fitted.

If the timing side of the crankshaft has been re-ground you will need to fit and ream an oversize bush.
Removing or fitting the bush is best done with a press as a controlled force can be applied.
Support the crankcase so that the machined face for the timing cover cannot be damaged
removing the various studs like those for the oil pump shown above.
As for the other bearings heat the crankcase to 150’c

With the cases hot and the timing side bush chilled it should fit easily, make sure that the locating groove in the outer ring corresponds with the locating plate, or on early engines that the recess in the internal flange corresponds with the pip.
Tap or press home squarely with a block of hard wood or a mandrel made specifically for the purpose.

The same principle of heating the cases, supporting it 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.

SECTION B38

RENEWING THE MAIN BEARINGS

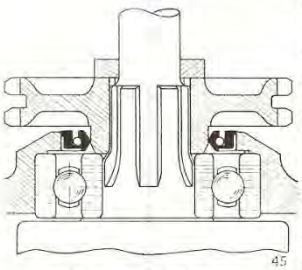


Fig. B43. Oil seal—left hand crankcase

To remove the left side bearing, heat the crankcase to approximately 100° centigrade and drive the bearing inwards using service tool Z14. The right side main bearing is of a bronze bush type and is removed by first removing the lock plate and then heating the crankcase to 100° centigrade, and then driving the bearing out using a suitable shouldered drift.

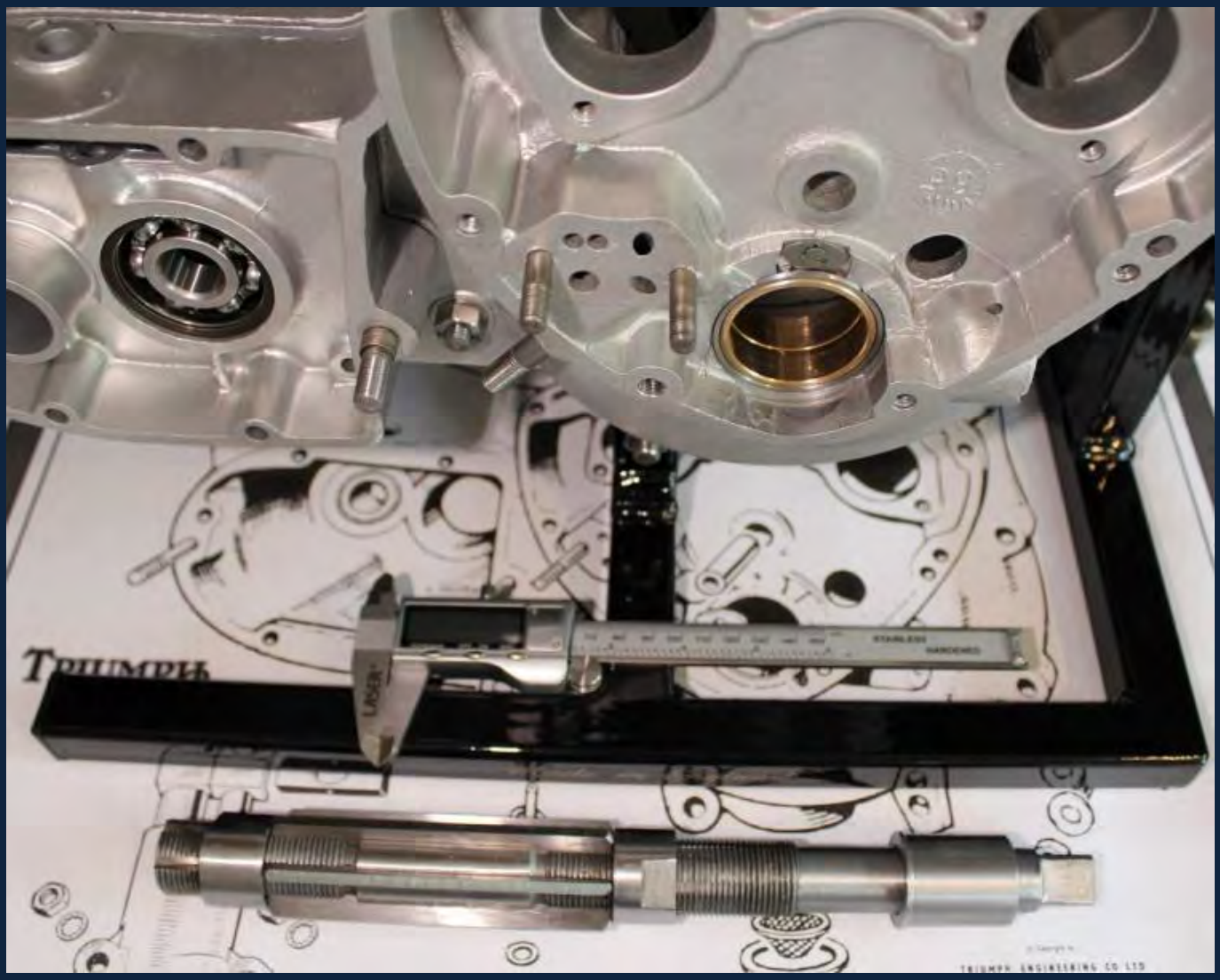
The oil seal can be removed from the left half crankcase by driving it outwards, in the opposite direction to the bearing after the bearing is removed. It is advisable to renew the oil seal, even if it does not appear badly worn.

To assemble the left bearing first ensure that the main bearing housing is clean, then heat the crankcase to approximately 100° centigrade and drive in the bearing using a tubular drift onto the outer race. Ensure that the bearing enters its housing squarely. If possible, use a press. Suitable dimensions for the drift are 2⅜ ins. outside diameter by 6 ins. long.

To assemble the right main bearing, heat the crankcase to 100° centigrade and press the plain bearing into its housing. When the bearing has been located in the correct position allow the crankcase to cool and then the bearing has to be line reamed to give the correct clearance with the crankshaft journal. Workshop tool Z134 is available for line reaming the bearing and is utilised by bolting the crankcase halves together with the main bearings in place and inserting the reamer through the right main bearing and locating the pilot end of the reamer in the left main bearing and the cutter in the right main bearing. The reamer Z134 is also available in ·010, ·020 and ·030 in. undersizes.

When the bearings are in position, press the oil seal into place in the left half crankcase.

Timing Side Bush



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 line bored 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. The Works Manual shows a very small bearing clearance of 1.0 to 1.5 thou.

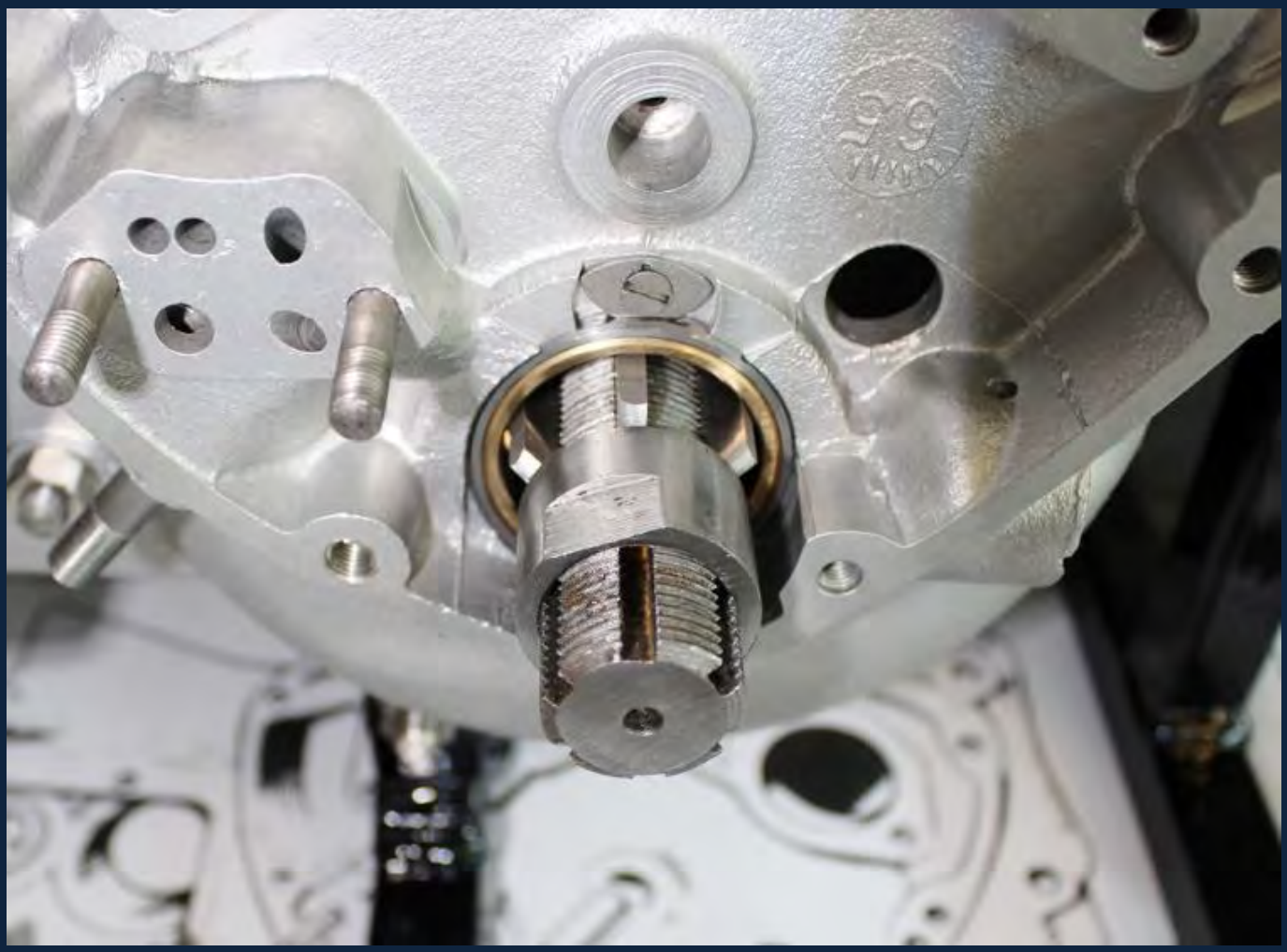
Before starting to ream the bush ensure that the crankcase halves are firmly bolted or clamped together. Measure the reamer carefully to determine if it is parallel along its length as this will affect how the tool will work in use and where the starting cut should be made.

Most adjustable reamers have a tapered lead, by 0.020 in across the initial length of the cutters, it's not ideal but in this guide, I am trying to show tools and techniques that are available to the average owner. An alternative is to have the bush bored on a milling machine. Refer to the videos by Classic British Spares and expert articles by JRC Engineering and John Healey.

The key to success is to remove very gradually, small quantities of metal from the bush at a time and then to measure and test the crankshaft before machining again; you are aiming for no perceptible play in the bush but with the crankshaft free to rotate!

Do not use any abrasives on the bush as grains will be left within the soft metal surface of the bush and rapidly damage the bearing surface of the crankshaft.

Timing Side Bush

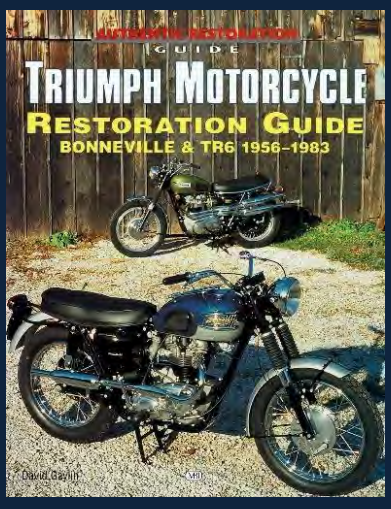


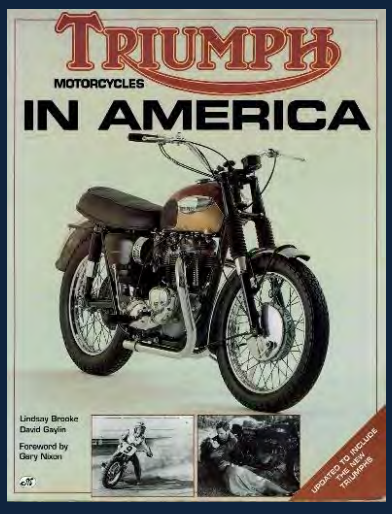
Showing the Reamer in place.

Adjust the reamer initially so that there is no perceptible play, use cutting oil and turn the reamer slowly and evenly; you will feel some resistance (anticlockwise above) where the reamer is “cutting” metal from the bush. Work very carefully as you are only seeking to remove high spots where the bearing has distorted during fitting.

With the reamer above, account for the tapered lead and ensure that this has passed fully through the bush. The original Z134 service tool supplied by Triumph and illustrated in the works manual was supplied with three parallel cutters to suit the three under-sizes of timing bush that were available.

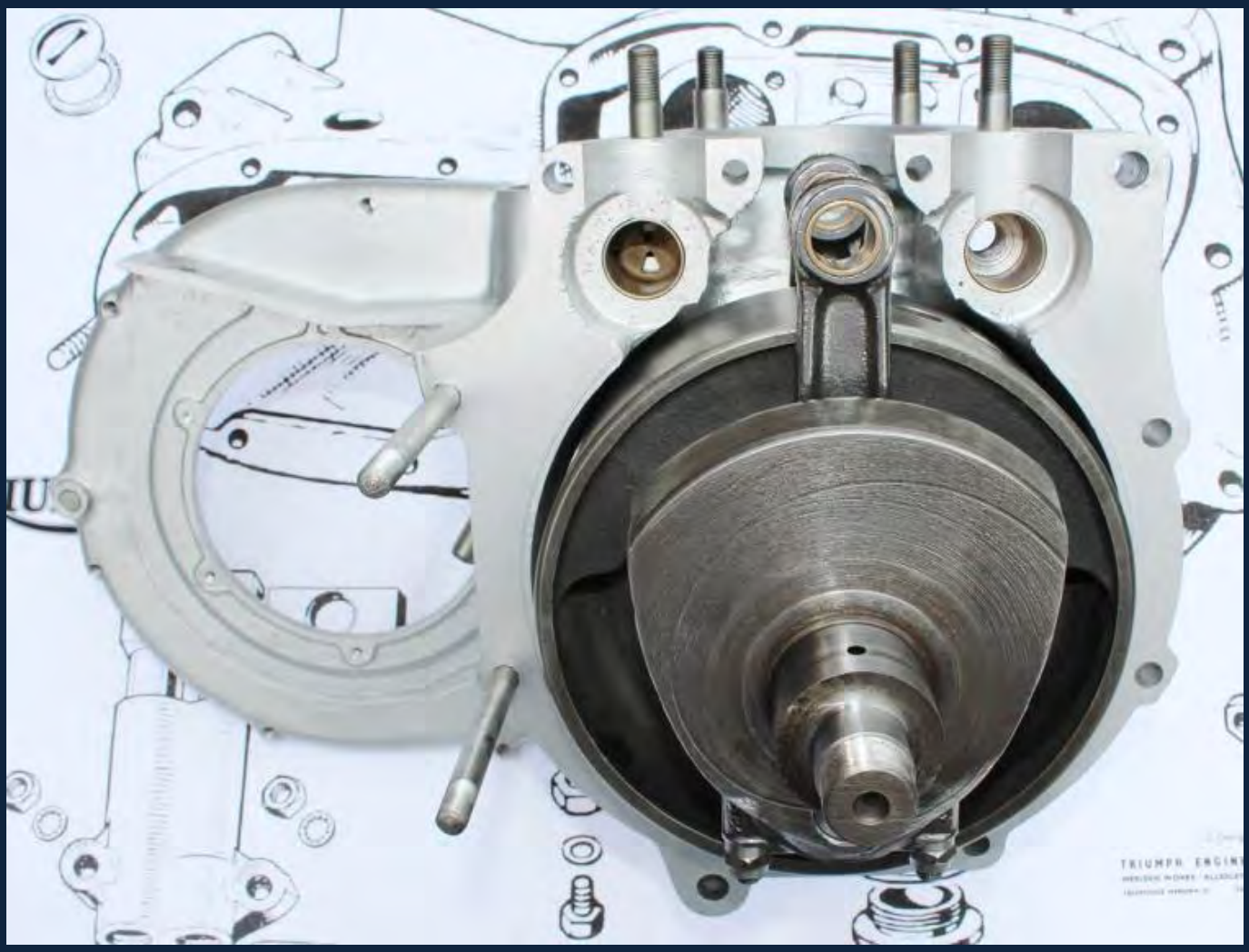
Whatever method you eventually choose to ream the bush, the crankshaft must fit and turn smoothly and without any noticeable play. Any tightness will lead to the bush likely seizing (as I discovered) when the engine is started and care taken now will be rewarded later.





Recommended books by David Gaylin / Lindsay Brooke.

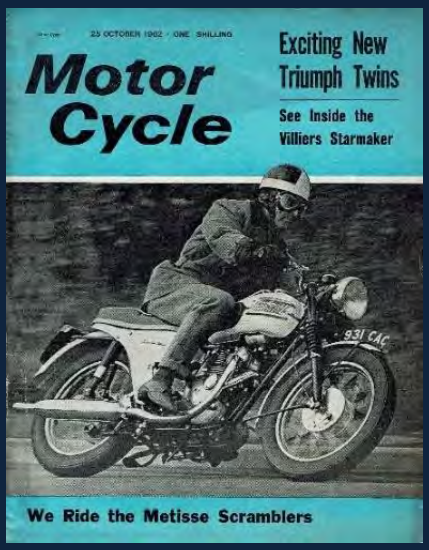
Fitting the Crankshaft

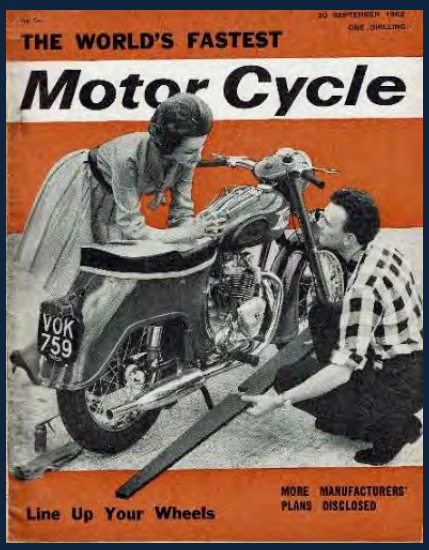


Test Fitting the Crankshaft into the Drive side Bearing.

Here the crankshaft is at BDC (bottom bead centre) and you can make out the oil way taking oil to the sludge trap and onwards to the main bearings.

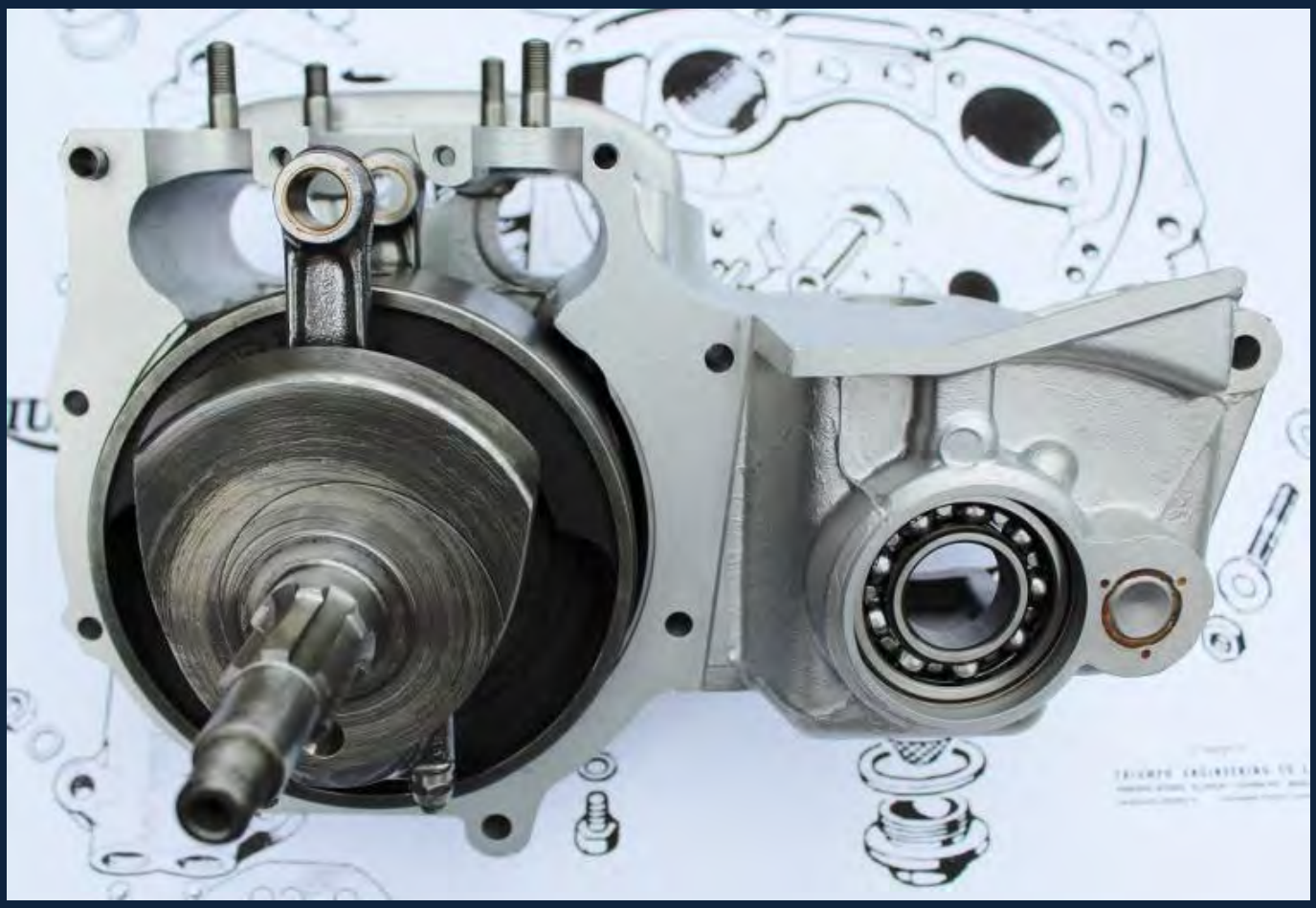
Tip: Cut two lengths of 4 by 2 softwood timber 9 ins long. Use these to support each crankcase half horizontally while you introduce the crankshaft.





The Motor Cycle, published almost every week from 1912 and filled with new models, road tests, workshop tips, stories and more.
An invaluable source for restorers of British motorcycles.

Fitting the Crankshaft



Test Fitting the Crankshaft into the Timing Side Bush.

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 working clearance of 0.0015 in with end-float between 0.008 & 0.017 in.

When the reaming process is completed, thoroughly clean the bearings with brake cleaner and blow through the oil passages to ensure that all metallic particles have been removed. Collect together the engine bolts, studs, screws camshafts and the breather disc and test fit these in preparation for completing the crankcase assembly.
Resolve any issues NOW before proceeding!

Before the final assembly it is vital to fill the crankshaft and sludge trap with oil using a pressure oil can at least until oil is seen to be escaping from the main bearings. On start-up these critical components must have an adequate oil supply already in place to prevent immediate damage.

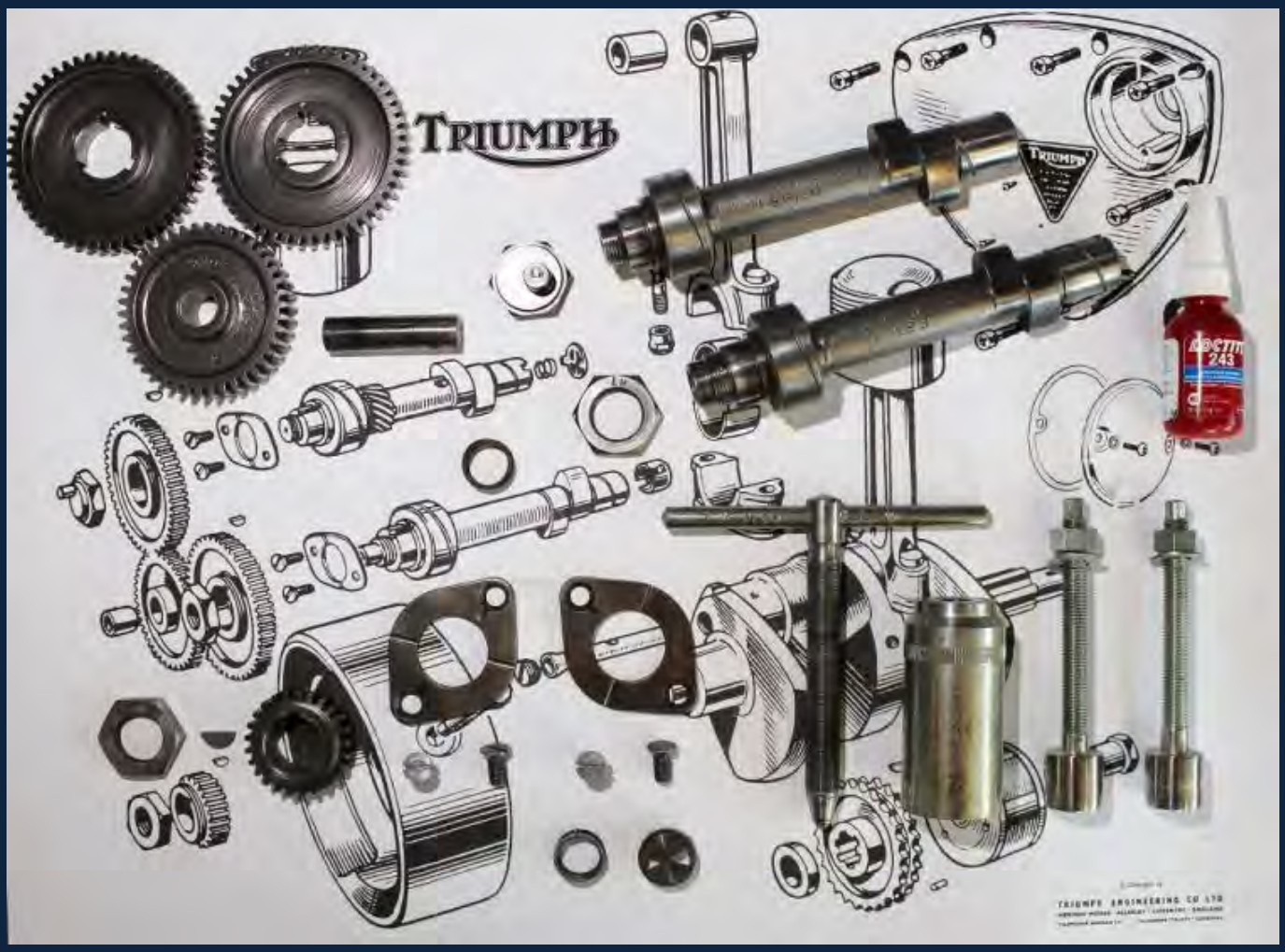
Once you are happy that everything fits, carefully apply a thin bead of (silicone) sealant to the LEFT crankcase half only thin bead is required, practice on card or sheet metal so that you can reliably apply only what you need.
(Other sealants that are suitable are Hylomar, Wellseal and Red Hermatite)
If you apply too much, wipe off with solvent and try again.

Once you have your sealant bead applied, fit the right 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 (Methyl Ethyl Ketone, MEK), check the crankshaft rotation and if all is well; allow time for the sealant to set fully. If storing the completed crankcase wrap the connecting rods and stuff the crankcase mouth with a clean lint free cloth.

Part 2 Completed.

Camshafts



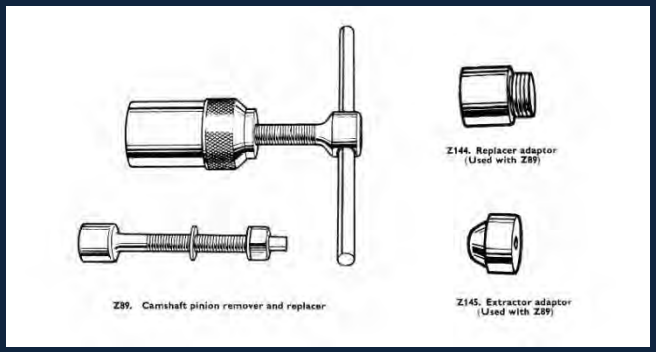
Camshaft Components and Tools.

Shown above are the camshafts together with the parts and special tools needed to fit and remove the timing pinions. 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, check the camshafts carefully to ensure that you have suitable ones for your needs.

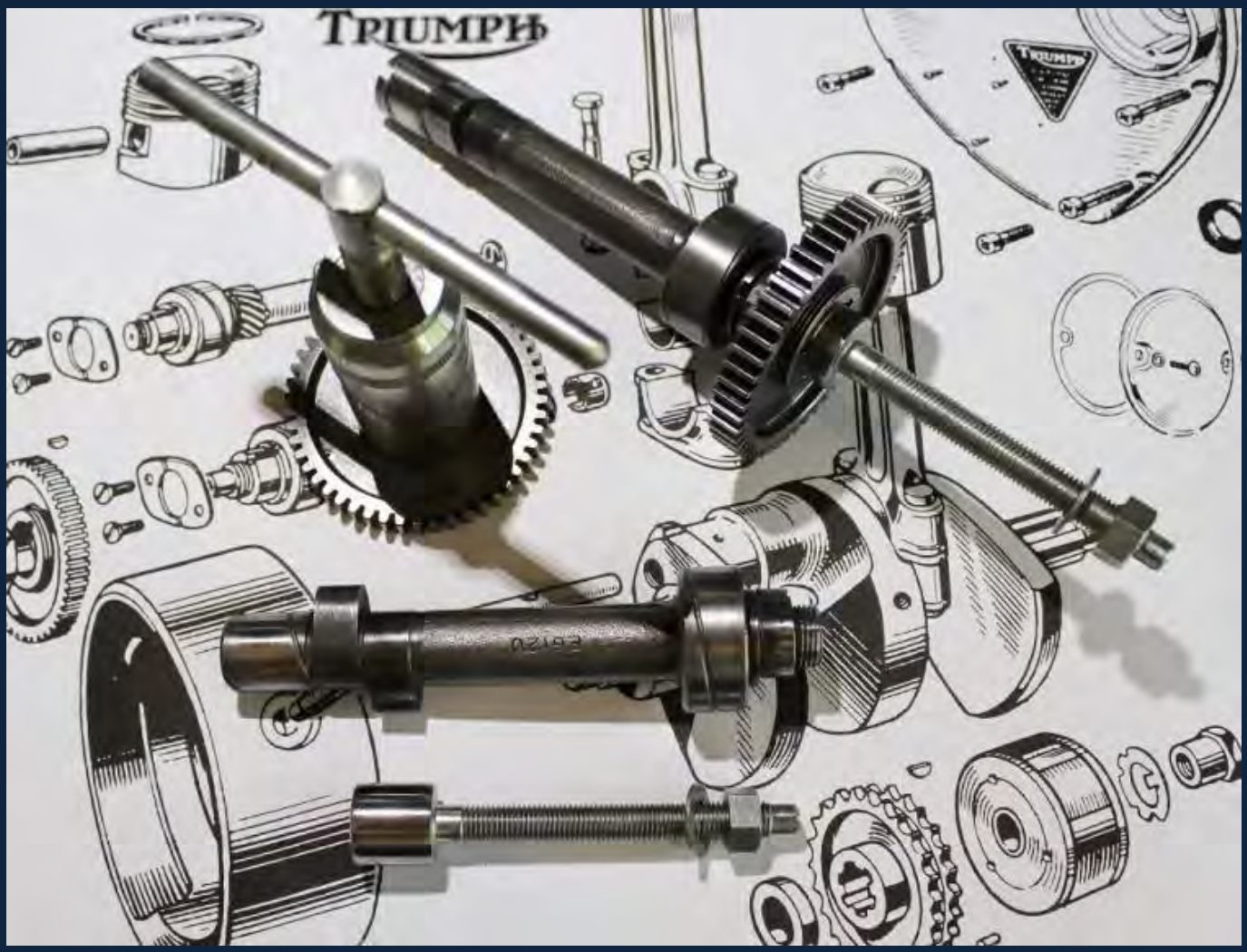
The camshafts and the various pinions can be removed and fitted with the engine still in the frame. It will be necessary to remove the cylinder head the push rods and tubes, so that tappets can be secured and cannot drop into the crankcase once each camshaft is withdrawn.

To loosen the crankshaft pinion nut (Right Hand thread) the crankshaft must be locked in position and prevented from rotating. A solid bar passed through the small ends that can rest on the crankcase mouth is recommended or placing the machine in top gear and applying the rear brake.

The large nuts holding the camshaft pinions in place are Left Hand thread and may require some heat and effort to initially loosen them; do not insert a screwdriver between the gear teeth or use a sprag to lock the gears to the crankcase, instead either lock the crankshaft or insert some rag between the pinions. Jar the nuts loose with an impact driver/wrench rather than applying torque.



Camshafts



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 for your needs.

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.

Always handle camshafts with care and wrap them so that they do not become damaged, look for chips, scoring, damage to the threads and keyways and deal with these issues if you find them, noting that the threads are left hand 20 tpi. Bead blasting or wire brushing are effective cleaning methods.

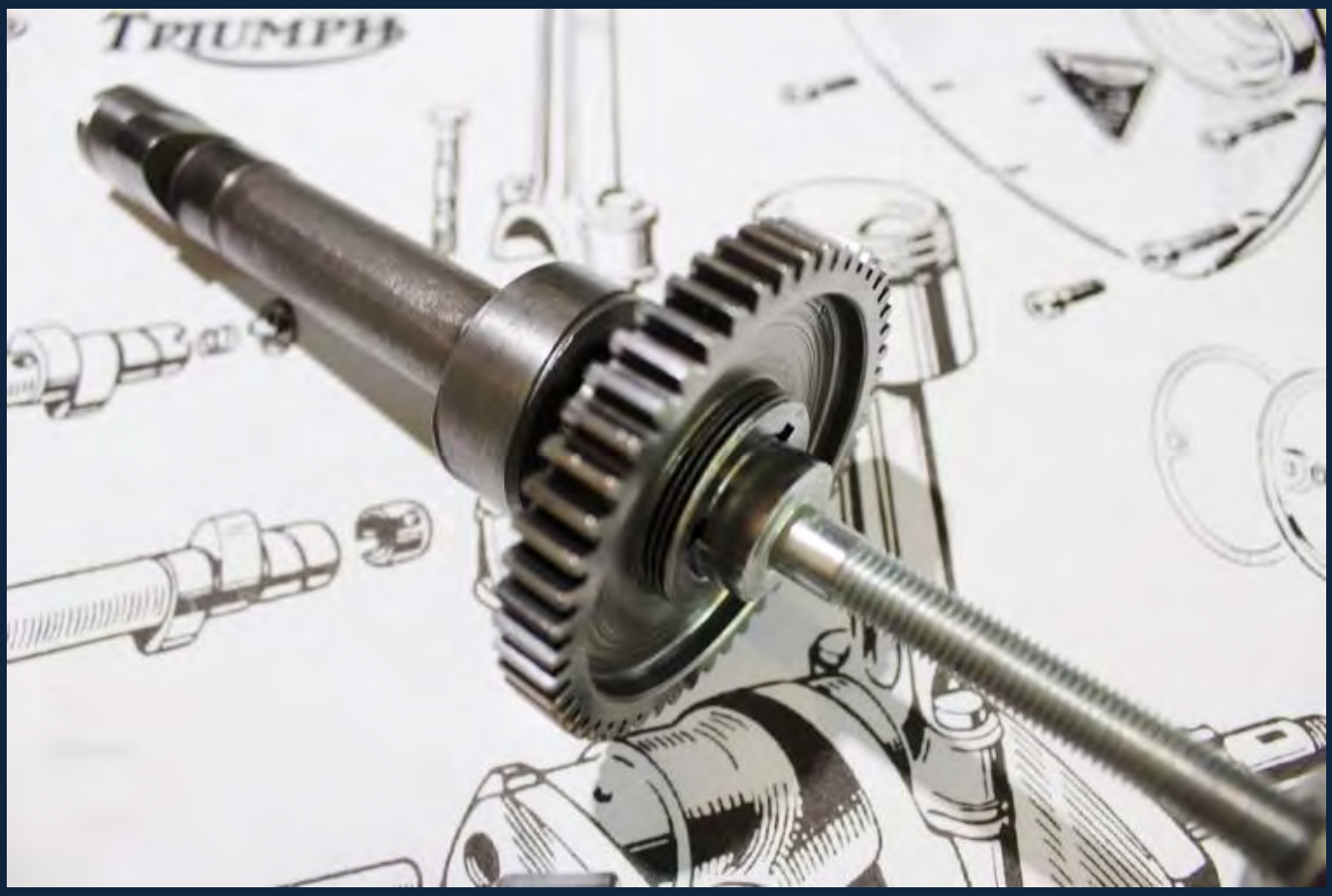
Once the barrels and pistons have been fitted by using a degree disc on the crankshaft pinion it is possible to calculate the valve timing figures for the camshafts and then compare the results to the published data.

Tip: If you are not able to support the crankcase in an Engine Stand to remove or fit the camshafts and pinions then support the crankcase horizontally using the two blocks of softwood prepared earlier.

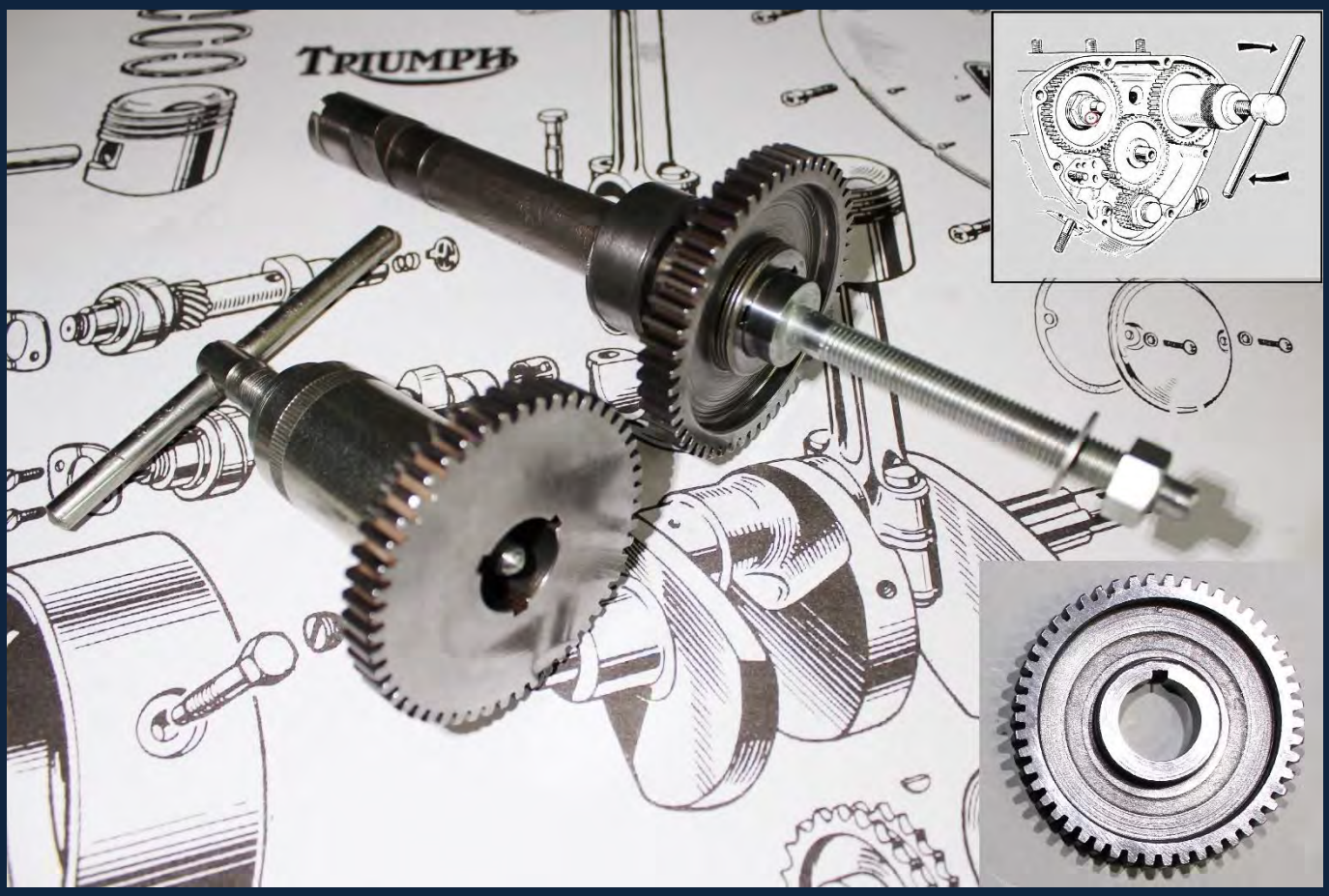
It is recommended that the tools are test fitted first so that you understand how they work, a small collar; not illustrated (Z145) will be needed to be used in conjunction with Tool Z89 when removing the pinion from the exhaust camshaft fitted from 1963 to the points models. Z89 also fits the crankshaft pinion and can be used to drive it onto the crankshaft the if the central screw is withdrawn first.

For more details on camshafts, timing and tuning refer to Stan Shenton's book Triumph Tuning
Triumph Technical Information Bulletin #13 and Tri-Cor Bulletin #684 of March 27th 1968.
Also refer to Triumph Service Bulletin 310 from 1971.

Camshafts

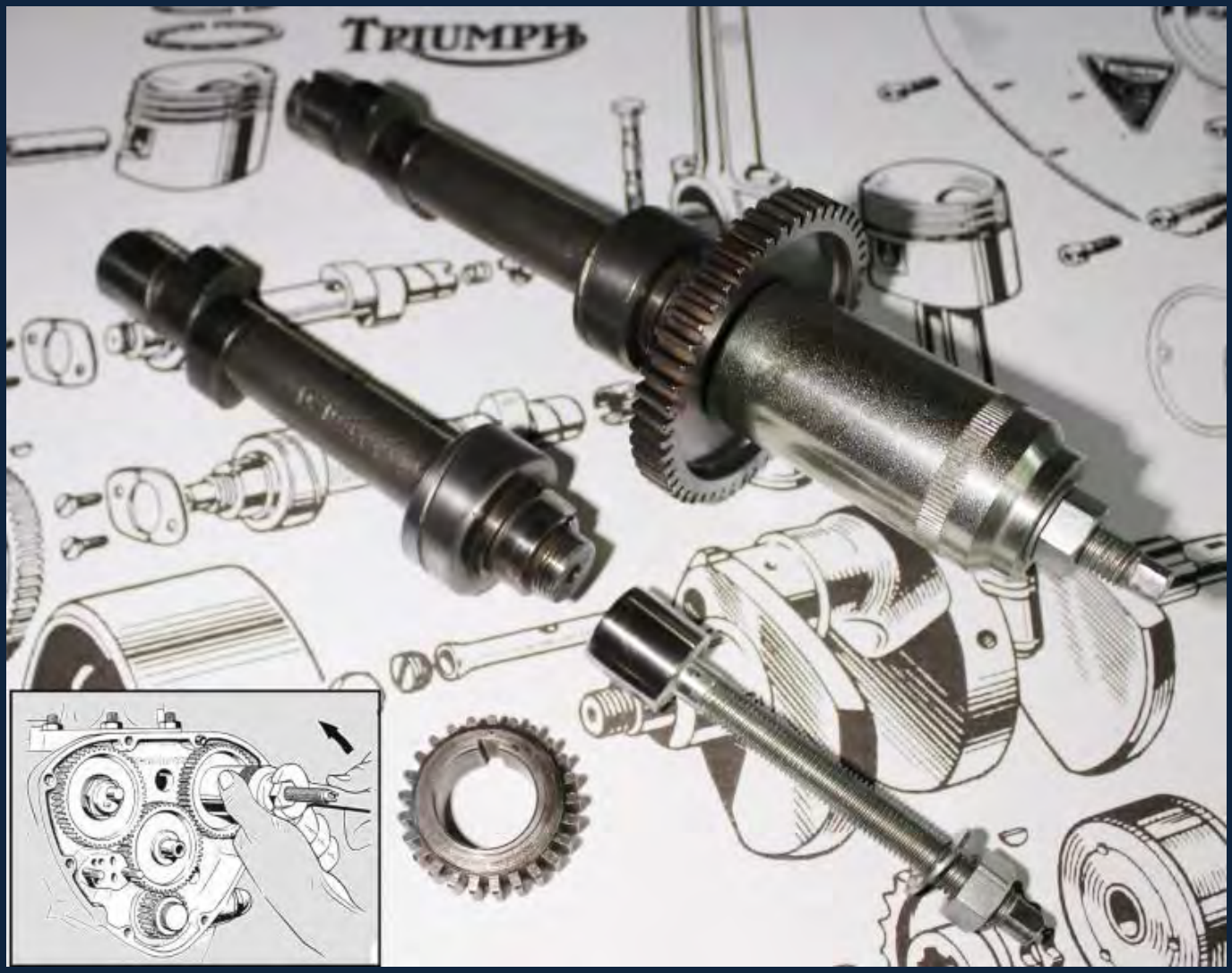


Each pinion features a short threaded section that allows the removal too (Z89) to be fitted and the pinion withdrawn. Check that the threads are in good condition; dress with a small file.



The Tools and the Pinions, note the keyways; shown inset is an early single-keyway pinion.

Camshafts



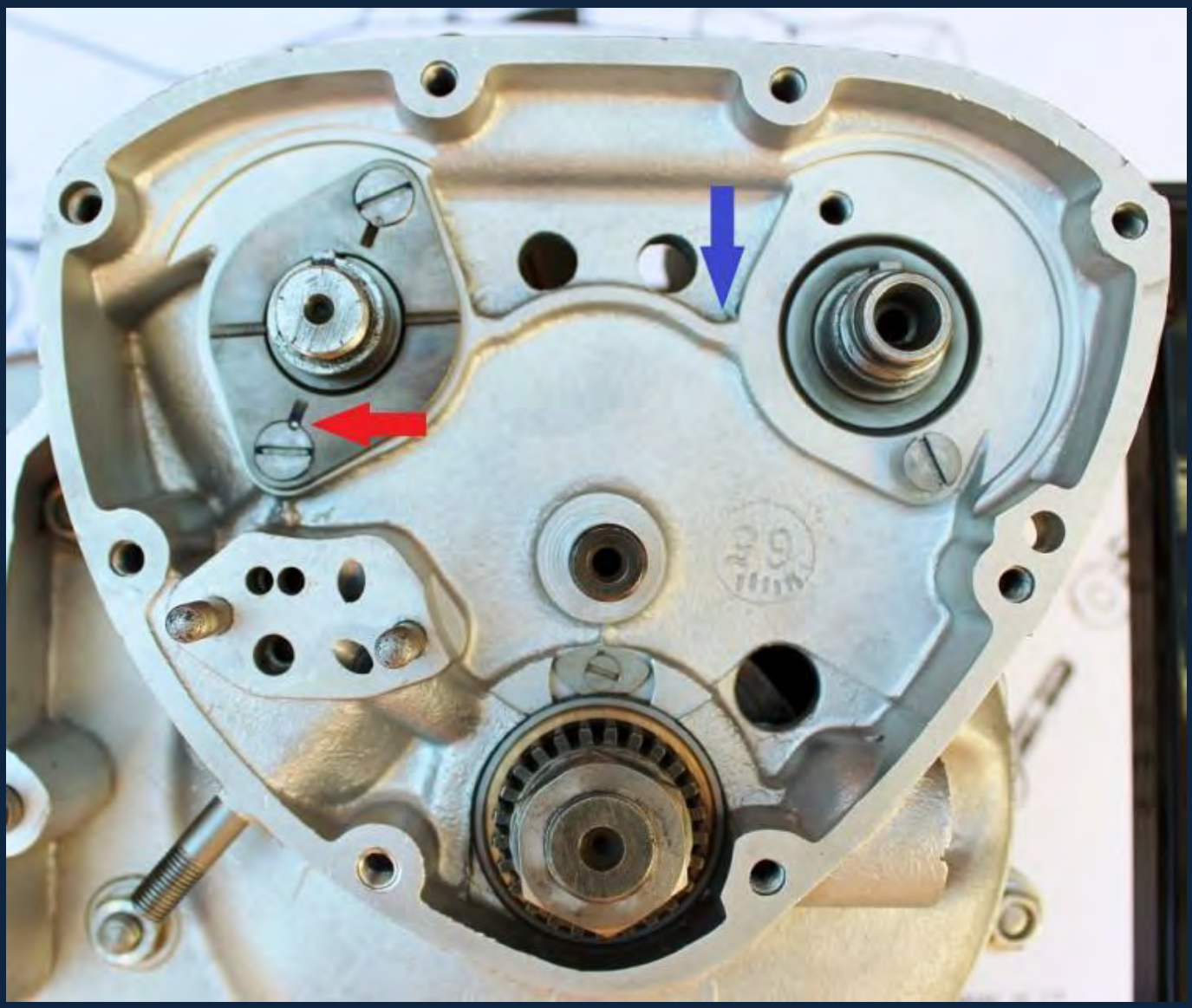
Refitting the Pinions.

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 the camshaft carefully inserted and rotated so that the breather disc locates into the slots in the camshaft end. You should feel a slight resistance from the spring!
If the tangs of the breather disc are bent or damaged, they will interfere with the fitting of the spring, or the camshaft or potentially shear and prevent the engine breathing correctly. Replace the breather disc if it is damaged.

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.

A Pair of Camshafts for the Distributor Models (to 1963).

Camshafts



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.

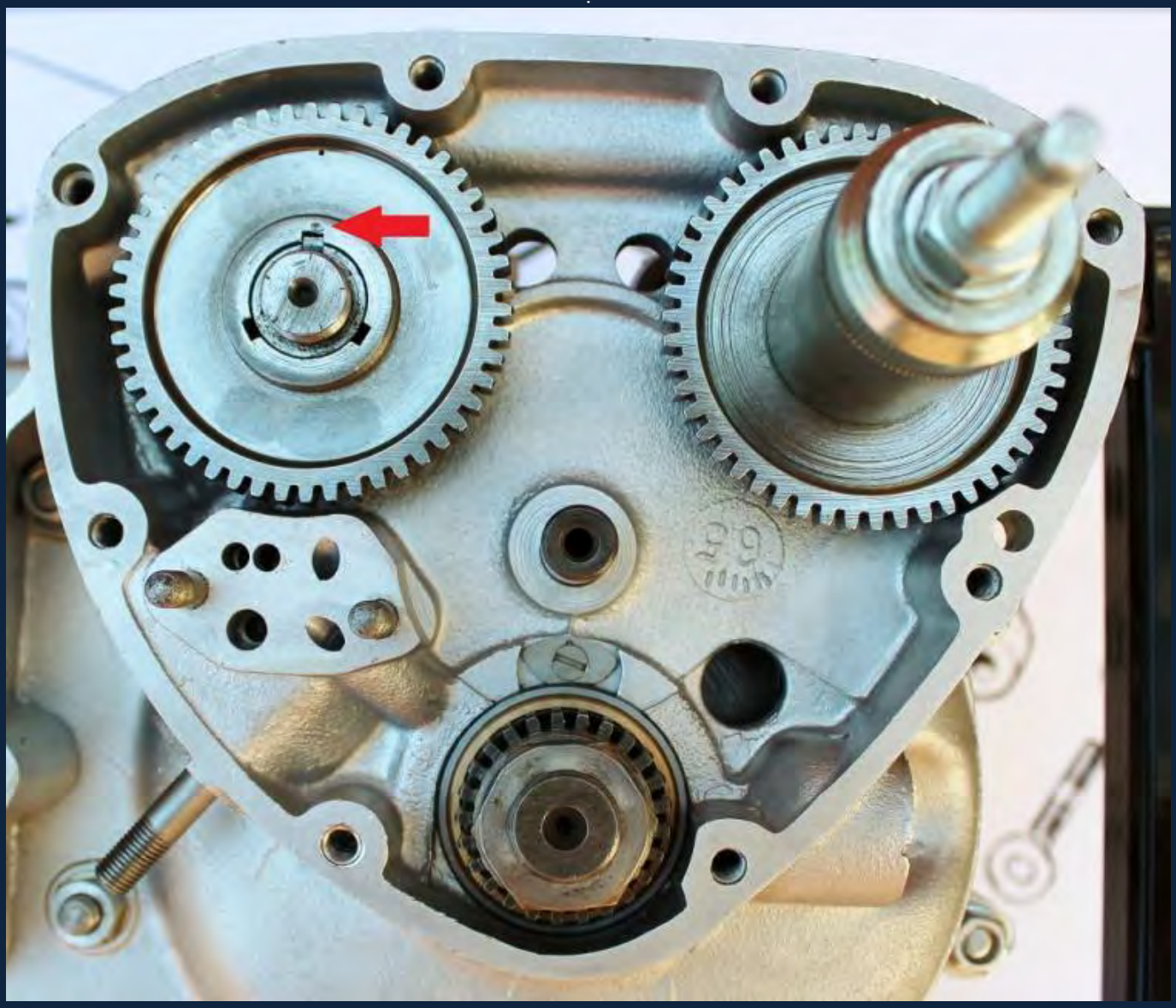
The idler pinion shaft has been fitted and can be seen in the centre of the picture. This is an interference fit and warming the crankcase will allow it to fit easily, or for disassembly to drop out or be eased out by applying a punch on the reverse. Ensure that the idler pinion shaft is clean internally and 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. You will need to drill a small depression adjacent to the punched area before you have any chance of removing the screw and 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 pinions and therefore must be machined or filed before final fitting to prevent binding. Fit the new screws with Loctite 243 (medium strength).

Camshaft Drive



Showing the Woodruff key, keyways and the fitting process.

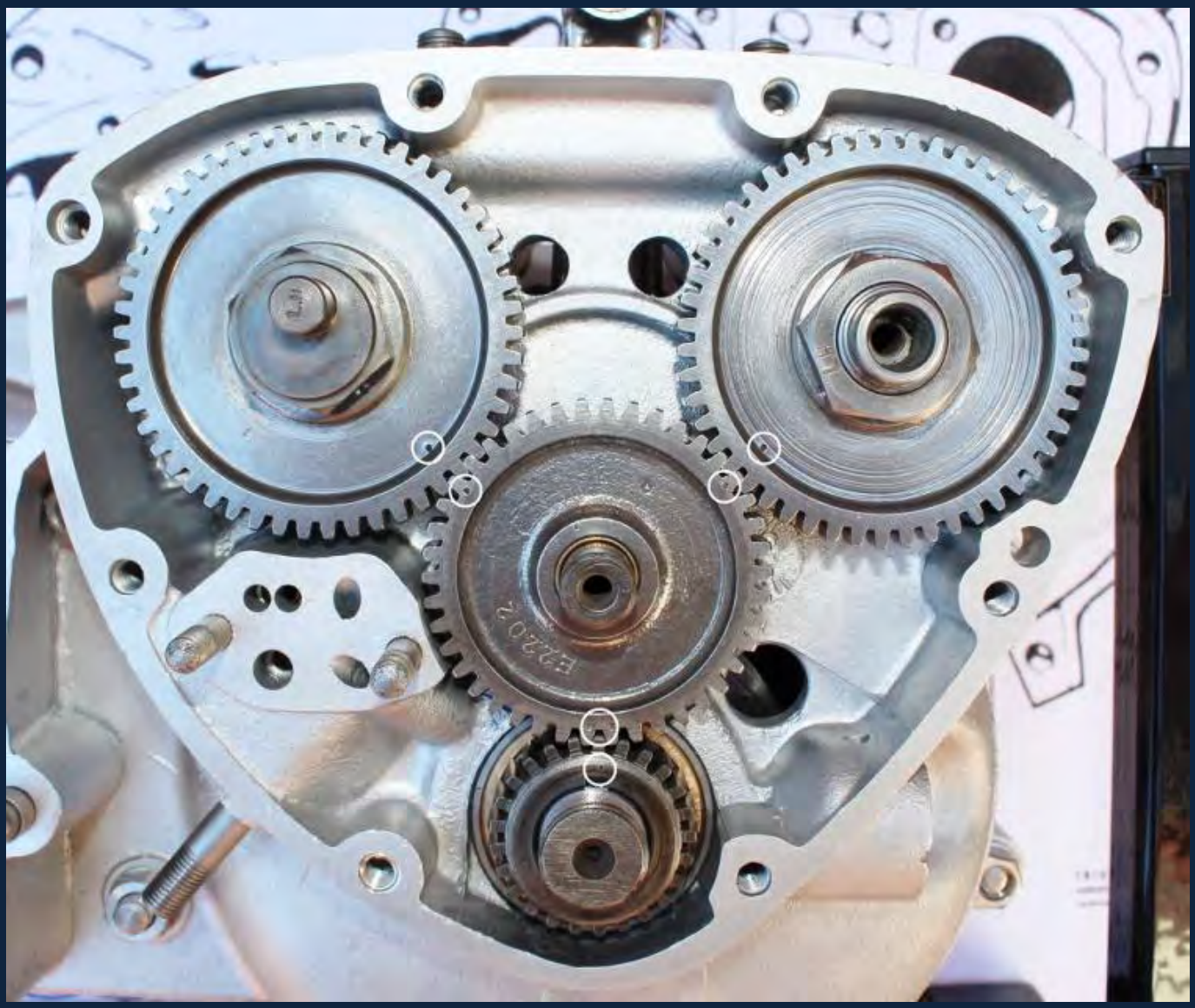
Most camshaft pinions have three keyways to allow a degree of adjustment in the valve timing if this desired, note that the standard keyway is directly opposite the timing mark on the pinion. I additionally punched the standard keyway position (above) during disassembly so that there was no possibility of making an error on reassembly. It is advisable when removing the pinions to permanently mark them (I & E), so that they can be returned to their original locations 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 fit the pinion removal tool Z89 and pull the pinion off slightly until a small degree of lateral play (end float) can be felt.

Fitting the nuts is described later and assumes that when the pinions are fully home that they are not binding. If you cannot resolve the binding, then fit the nuts using Loctite and do not torque them up. They are both Left Hand thread and cannot come undone in use.

On engines that have been modified for racing you will usually find that the pinions have been drilled to lighten them, not a task to be taken lightly and especially by beginners as you risk compromising the strength of the pinions. Assess pinions that have been modified and check the engine carefully to find out what other performance modifications have been applied.
Very few Factory Works Machines were built and those that were, are mostly recorded and known about, but do try to check the history of any machine you purchase.

Camshaft Drive



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.

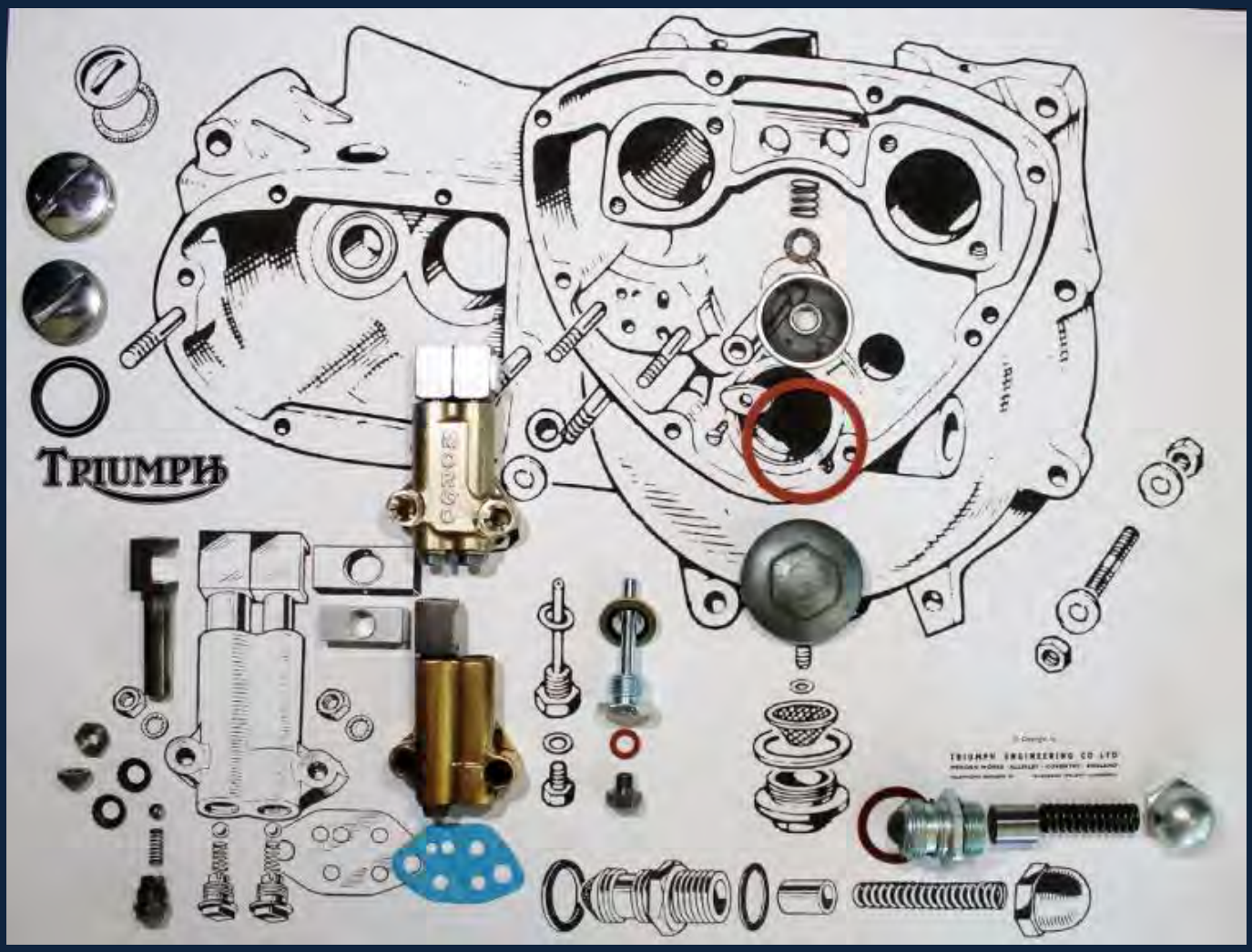
The idler pinion shows a number E2202 that does not correspond with the parts book, its part number is E6160 and one of the many confusing details you will get used to. Note that the idler pinion uses the Hunting Tooth principle, i.e., having one extra tooth than is mathematically necessary, this evens the wear out on the gear teeth, but also means that the three 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 tighten 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 20 lb/ft should be sufficient bearing in mind that both the left-hand threads will be self-tightening in their locations.
Once tight check again that the camshaft pinions are not binding.

Spanner/Socket Sizes are 5/8 W / 11/16 BS and 9/16 W / 5/8 BS.
28 mm and 1in AF are equivalent Sockets.

The Oil System



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

Triumph along with many classic British motorcycles use a ‘dry sump’ oil system where the oil tank is separate from the engine and uses two pumps, frequently combined in the same unit to both feed and return the oil.

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 a well-made product and a good investment for any Triumph project.

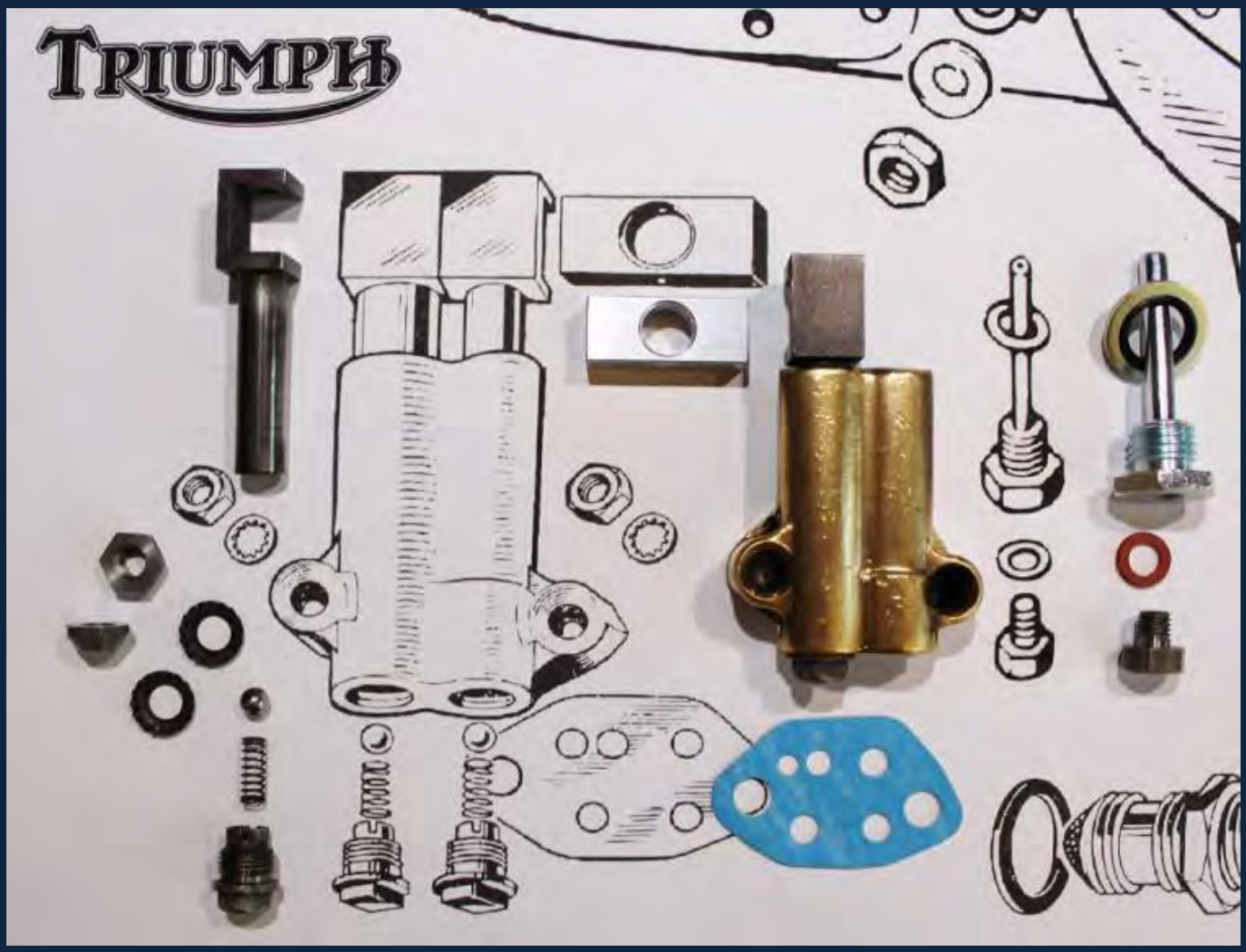
The sump filter was a standard Triumph design for many years and comprises of a spring-loaded conical filter gauze that recesses into the cap. Oil draining from the crankshaft passes through the filter before entering the return pipe in the cap; and then to the oil pump. Any metallic particles that are cast off by the engine and are too large to pass through the gauze will be retained; 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’ and a new fibre washer will help to prevent leaks, or loosening of this critical part.

On the right is the disassembled oil pressure release valve, excess oil pressure relieves into the timing chest and lubricates the timing gears, camshaft plates and the oil pump drive. Check that the release valve has not stuck and that the fine gauze is both clean and complete. Replace the complete unit if you have concerns.
Check that the threads both on the unit and in the crankcase are perfectly clean!

Early release valves feature a ‘Tell Tale’ Plunger that uses a small weak spring in tandem with the main spring. The plunger extends when the engine is running to show the presence of oil pressure; sealing the plunger is a short length of rubber tube and O ring, but this often fails causing an oil leak.
Refer to the parts books for details. Illustration Below.

The Oil Pump



The Oil Pump in detail…. Unit Construction models.

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. Never use silicone sealants here!

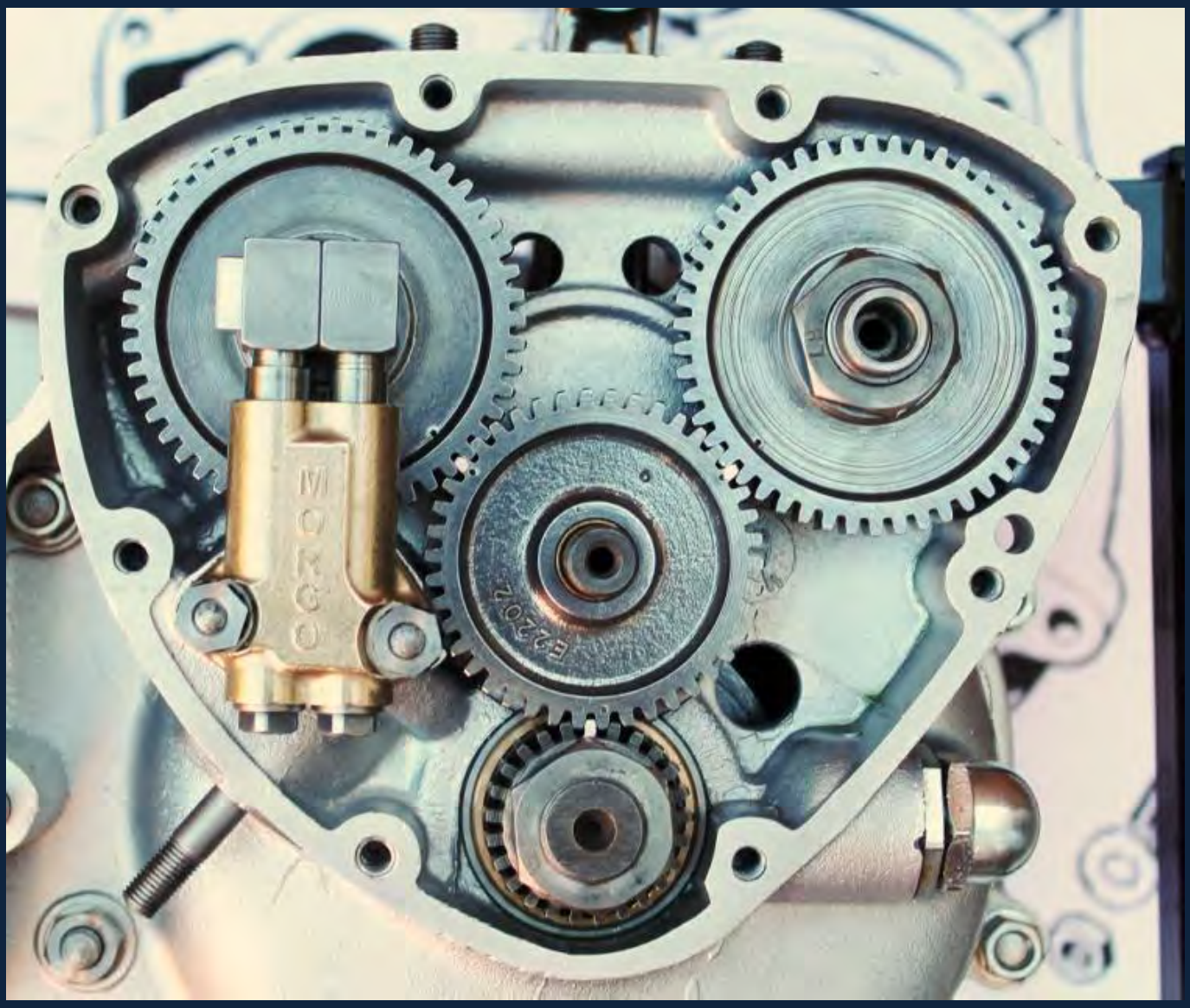
Shown on the right is the gearbox drain and level plug (1/2 in BSF). This allows the oil level to be checked, maintained and drained. A Dowty or bonded washer provides a good seal provided that the face of the drain point is in good condition and not scored.

Over the period of production of Triumphs, the oil pump sees a number of changes mostly associated with the capacity of the pump, but there are also detail changes made to the valves and inlet ports. Take time to research as the pump fitted to your machine may not be the one originally specified. Pumps from the earlier Pre Unit Twins are not interchangeable with those from Unit Twins!

Refer to the Data printed in the Works Manual for the dimensions of the pump pistons. The early pump has a feed piston of 0.3744 in and a scavenge size of 0.4369 in The later pump (1967) increases the scavenge size to 0.4869 in.

The diameter of the pump ball bearing is 7/32 in, the springs frequently weaken and rust can take hold on these small parts; especially on a neglected machine where water has entered the oil tank. To dismantle the valves, apply heat to the pump body and use a well-fitting spanner some considerable force may be needed to overcome the galvanic corrosion.

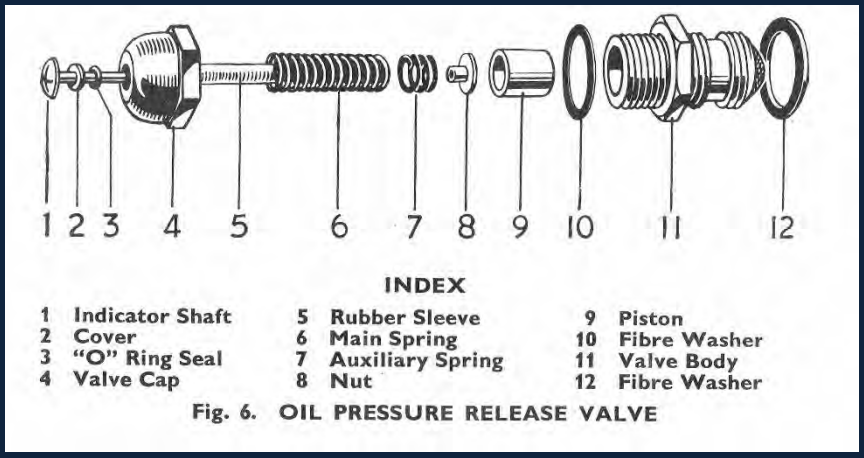
The Completed Timing Side



Highlighted are the Timing Marks with the crankshaft at TDC (Top Dead Centre).

On early machines the oil pump features a recess that allows the central idler pinion to be removed without disturbing the pump and its fixings, later pumps and the Morgo pump above usually need to be removed first.

Before fitting the timing cover apply oil to the camwheels and the oil pump drive block and do a final check on the tapped threads so that assembly goes smoothly.



The early oil pressure release valve parts.

The Timing Cover

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. Always replace the oil seal if this is fitted; they become brittle with age.

If working on a distributor model do not fit the timing cover until you have fitted and tested the distributor you will need to use a degree disc to obtain the static advance position for the crankshaft / spark. Refer to section B32 of the Works Manual for more details but note these instructions are for the post 63 machines fitted with points not electronic ignition.

As with the clutch cover Allen screws are being used in place of the original fasteners, note the two different lengths required, here 7/8 in and 1 1/8 in (1//4 BSF). The parts book details most of the common fasteners needed for a restoration. You will need to use a sealant when fitting the cover, apply this sparingly and wipe off any excess with Acetone or MEK once the cover has been fitted.

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 twist 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.

Note that most replacement patent plates are of a generic design and may not be appropriate for a concourse restoration, especially for early models where the plate will detail the model code.

Ignition

Electronic Ignition (Boyer Bransden).

Above is the part set for the Electronic Ignition that is suitable for all models from 1963, or early machines modified to the points in the timing cover instead of the distributor. Not shown are the coils and the ignition control box that are fitted to the frame, usually under the petrol (gas) tank.

Shown is the Magnet Holder, the PCB with the two small coils, the ¼ BSF Allen screw, key and the 5/16 UNF Bolt that is required to release the magnet holder from the taper if needed.
To waterproof the cover effectively, use the specialised gasket shown.

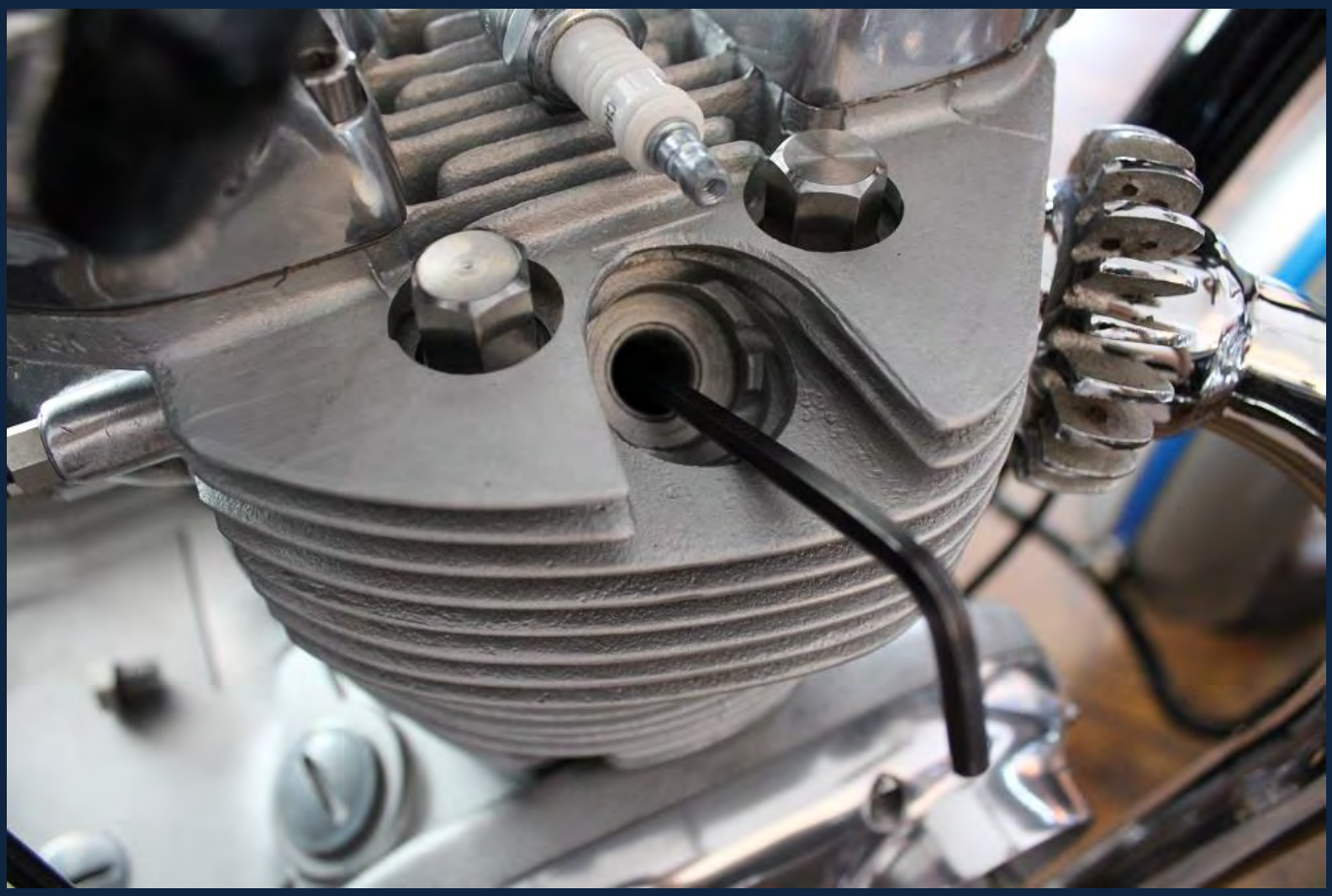
The basic principle of any ignition system is to trigger the spark at the optimum moment before the piston reaches the top of the compression cycle relative to crankshaft speed. Sophisticated modern engines with fuel injection will adjust the ignition firing to take into account engine load, fuel quality and emissions.

Most of the electronic ignition systems available use the principle of the “hall effect” of a moving magnet triggering the ignition pulse as it passes a coil of wire. These systems also harness the idle spark principle where a spark is generated towards the end of the exhaust cycle in a four-stroke engine, and therefore in machines using these electronic ignitions both spark plugs fire together continually.

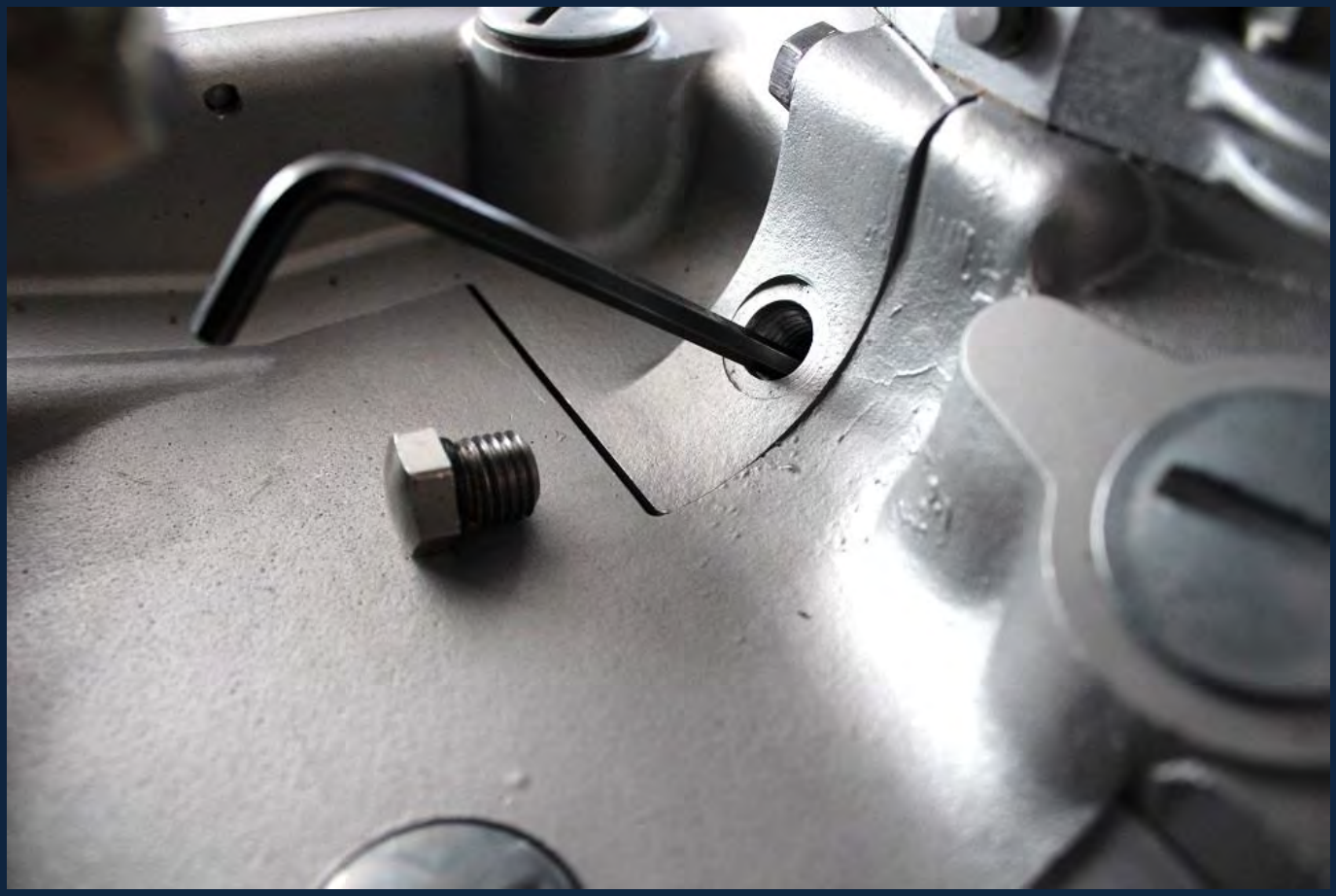
The various models in the range use slightly differing timing settings and in the Works Manual in the general data you will find the detailed values for static timing and full advance.
Refer to sections B31 and B32 noting that these refer to points ignition and do not readily apply to electronic ignition systems.

Many owners struggle to set the ignition and below I have described a simple method that works for all models of the unit twin range and is particularly suitable for machines from 1964 onwards that feature the TDC slot in the crankshaft and access point behind the cylinders.
No special tools are required and servicing is easy.

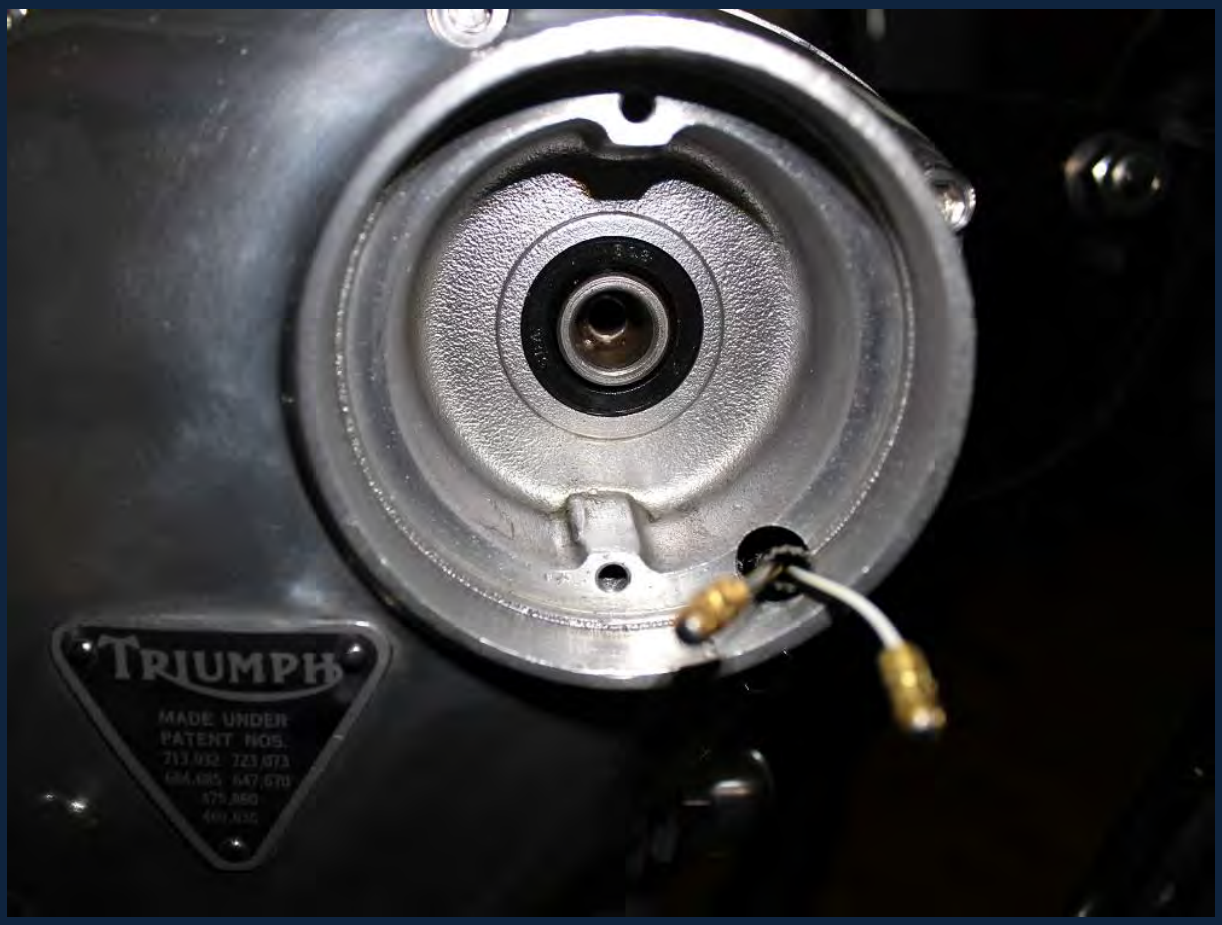
First place your bike on the centre stand ensuring that the rear wheel is off the ground, select top gear remove both spark plugs and the plug for the TDC point behind the cylinders, set these aside.



Working from the right-hand side, insert the Allen key into the spark plug hole and turning the rear wheel ‘forwards’ slowly; feel for the piston rising but stop before you reach the top.

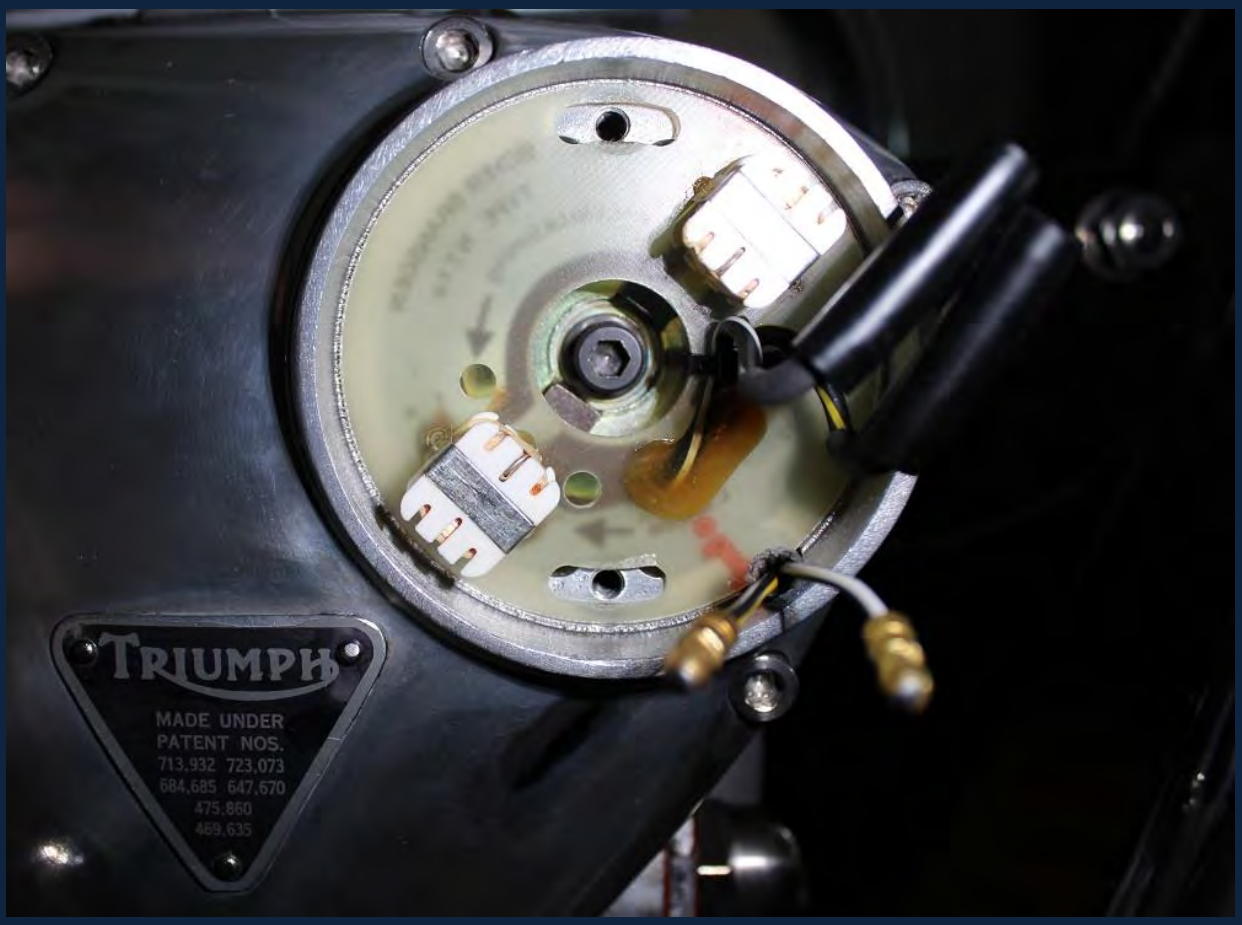


Insert the Allen key into the TDC point, continue turning the rear wheel forward and ‘feel’ for the TDC slot in the crankshaft; stop when you are confident that TDC has been identified.
There is no need to ‘lock’ the crankshaft with this method.

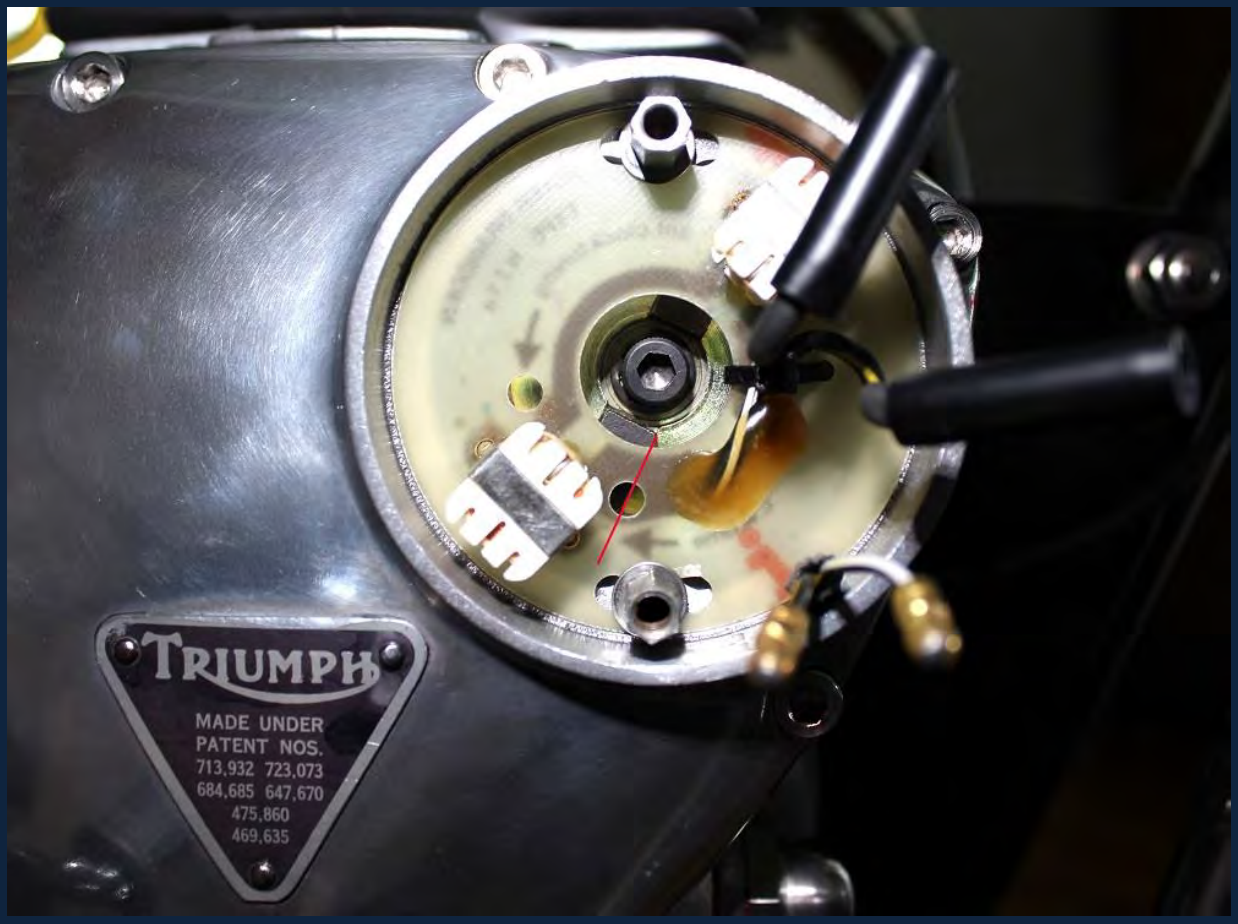


Pass the cables through the access hole and terminate the ends with suitable connectors, in this case crimped and soldered Bullets. Test fit the screws and parts into their respective locations working through any issues before you continue.

Apply a thin smear of Loctite to the taper of the magnet holder, fit and then tighten the screw lightly so that the magnet holder can still be rotated. Set the magnets at the position above.
this is the initial setting but it is not critical!



Fit the PCB as above with the locations for the pillar nuts centrally in the slots. Note that turning The PCB anticlockwise will ‘Advance’ the ignition.



With the magnet holder still loose turn it with a small screwdriver until the edge of the magnet lines up as shown above, then tighten the Allen screw to lock the magnet base in the taper. Complete the connections, test the ignition for sparks at the plugs and then replace them in preparation for starting and testing the machine; replace the TDC plug.

To complete the Ignition setting for your machine you will need to undertake a period of road testing take some basic tools with you so that you can adjust the PCB position to Advance or Retard the ignition to suit your needs. The setting above only gives a starting point but the machine should start and allow you to make initial adjustments.

During testing keep an eye on the plug colour and exhaust pipes, make only gradual changes to the ignition setting in conjunction with carburettor adjustments until the performance is optimised throughout the rev range. With a “fresh” engine it is better to run slightly rich at least for the five hundred miles to prevent the engine overheating.

Once you have optimised the ignition settings re-set the bike to TDC, take photographs of the positions of the PCB/magnet holder for future reference and if need be, make any final adjustments before marking up, sealing the cable entry and fitting the gasket and cover.

On post 1968 Machines or earlier models that use a later primary drive cover it is possible to strobe time the ignition as an access plate is provided. In general terms the Boyer Bransden kit is extremely reliable as long as the battery, connections and the charging system are in good condition.
Note: Loose cables can burn through on the exhaust!

SECTION B31

IGNITION TIMING—INITIAL PROCEDURE

INITIAL ASSEMBLY OF THE CONTACT BREAKER MECHANISM AND AUTO ADVANCE UNIT PRIOR TO FINAL TIMING THE ENGINE

(1) Remove both sparking plugs and all four rocker box caps. Set the engine at T.D.C. with both valves closed in the right hand cylinder.

(2) Assemble the auto advance unit into the exhaust camshaft, locating on the camshaft peg where it is fitted.

(3) Assemble the C.B. plate, taking care not to trap the C.B. leads, assembling the plate so that the C.B. points connected to the black/yellow leads are located at 7 o'clock. Loosely assemble the hexagon pillar bolts and flat washers.

(4) Lock the auto advance cam into the taper, using the central fixing bolt.

NOTE: When the degree disc is attached to the exhaust camshaft, the indicated setting and advance range will be half that of the engine, as the camshaft rotates at half engine speed.

ESTABLISHING TOP DEAD CENTRE POSITION

When setting the ignition timing, the T.D.C. position can be quickly found using workshop tool D571/2. The blanking plug on top of the crankcase immediately behind the cylinder block is removed and the body of the tool is screwed into its place. Having removed both sparking plugs and engaged top gear, rotate the rear wheel forwards until the pistons are just coming up towards T.D.C. Then the plunger is inserted in the body of the tool and the rear wheel is rotated forwards slowly until the plunger locates itself in the centre flywheel. The T.D.C. position has now been established.

Fig. B32. Showing T.D.C. locating tool in use

IGNITION TIMING USING A STROBOSCOPIC LIGHT

After establishing T.D.C. as described in Section B0, fit the timing disc adaptor shaft and timing disc into the camshaft auto advance unit and set the pointer, fixed to a convenient bolt on the engine to rear T.D.C.

NOTE: When using a stroboscope powered by 6 or 12 volt batteries as an external power source, do not use the machine's own battery equipment. (A.C. pulses in the low tension machine wiring, can trigger the stroboscope, and give false readings).

(1) Connect the stroboscope to the right hand spark plug lead and start the engine. Read the strobo-light on the disc, revving the engine up until the auto advance range is fully achieved. Check against the correct specification and adjust the C.B. back plate on its slots until the correct advanced timing is accurately set.

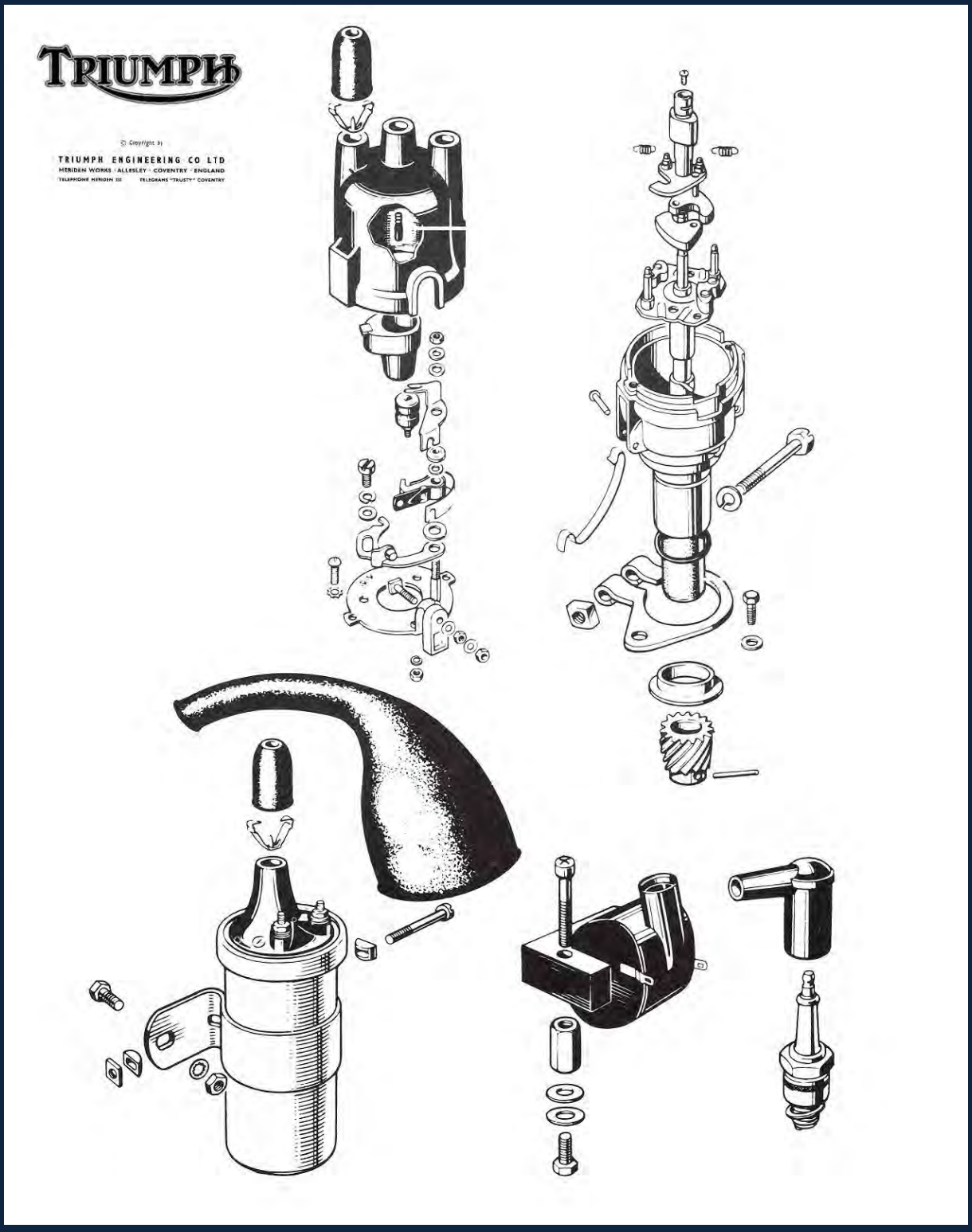
(2) Repeat for L.H. plug and adjust the accuracy of the spark on the C.B. points adjustment.

NOTE: To advance the spark, open the points, approximately 0·001 in. for each engine degree required, and to retard, close the points setting similarly. Minor adjustments to the left cylinder C.B. points gap setting, to ensure accurate ignition timing are permissible.

(3) Check back on the stroboscopic reading and slow tickover for range of advance on both cylinders, for efficient action of the auto advance unit, remembering the most important final setting is at fully advanced, both cylinders. Timing the engine stroboscopically with a timing disc ensures that both plugs are firing at exactly similar angular crank rotation (i.e. piston movement), at fully advanced ignition, that is at full power, thereby ensuring the smoothest, most vibration free engine running condition and ensuring maximum engine power output.
It also eliminates variations encountered in differing auto advance ranges due to possible non-standard components, uneven wear, etc., etc.

Details from the Works Manual.

The Distributor

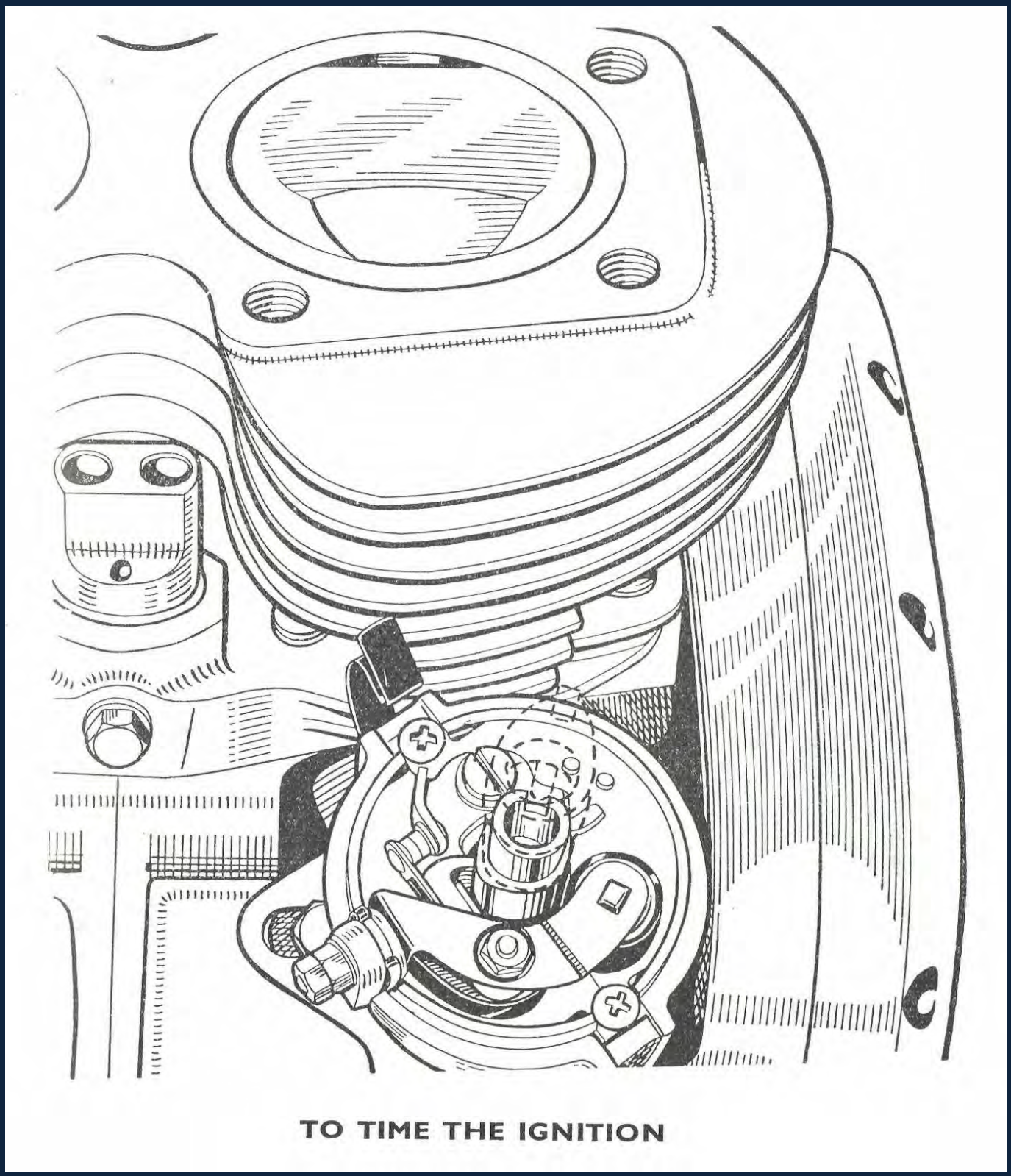


Lucas 18D2 Distributor, Coils and Spark Plug.

This is the general part set for the distributor fitted up to 1963, the fitting and timing principles are not covered in the Works Manual but are shown in the Owners Booklet and with only the single set of points setting up is relatively straightforward, once the static timing position before TDC has been set.

There are several part numbers for the Lucas 18D distributor that correspond with the various Triumph models The number is readily visible and includes these, 40573 (3TA), 40646 (5TA/T100A/TR5AR/T100SS), 40710 (T100A/TR5AC/TR5AR ET Ignition), 40820 (T100SC) and 40690 (6T),

It is advisable to have the distributor checked and re-built by an expert as there are subtle differences between the cams and advance springs across the various models in the range. Refer to the Lucas Sheets and Parts Books for details. The points can be replaced with a more modern Powerspark unit and using a twin output ignition coil the wiring can be simplified as the distributor cap itself becomes unnecessary.



TO TIME THE IGNITION

Timing the Ignition.

If using the original distributor and points or an electronic trigger, first identify TDC and set the distributor as shown in the image above. This is the initial setting and some degree of adjustment can be made by turning the distributor body to optimise the ignition.

TDC on these early models can be found by removing the timing cover and noting the position of the keyway and timing mark on the crankshaft pinion. Both correspond with TDC.
Tip: Add additional marks to the alternator rotor and stator once TDC is set.

A third ignition option is to use one of the Electrex World units (shown next), that replaces the alternator and provides Ignition and some lighting current while at the same time greatly simplifying the wiring. Suited especially for the distributor models as it simplifies the setting of accurate ignition timing.

Ignition

The Electrex World Ignition Pack.

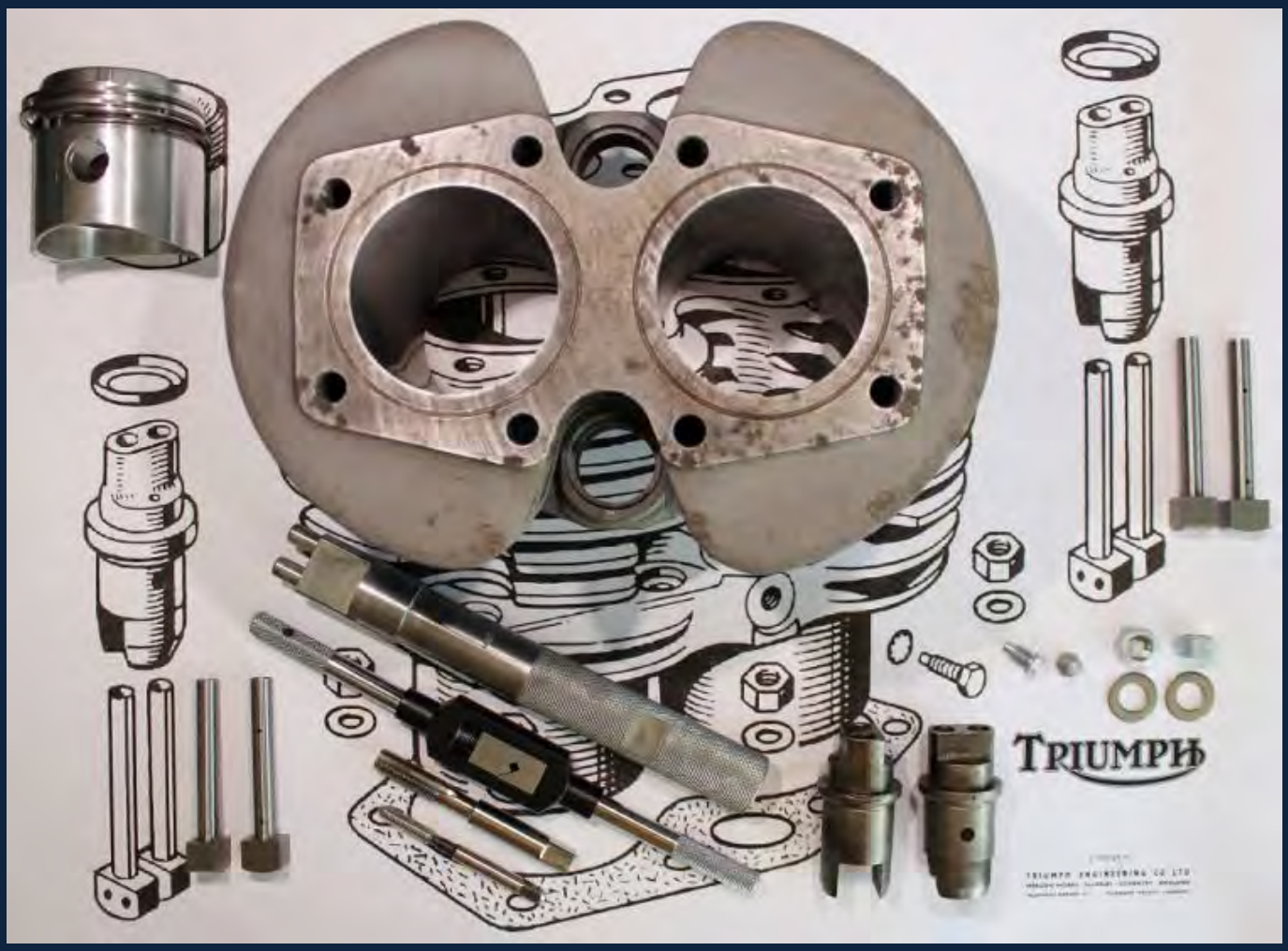
Electrex World have created ignition systems for a wide variety of Classic Motorcycles, these are either ignition only, suitable for off road and racing use, or systems that provide additional current to operate lighting and or charge a battery. 12 volt and 6 volt systems in positive or negative earth can be created with the various components that they supply including battery free systems using a suitable capacitor.

Full instructions are supplied with each pack and must be followed carefully to obtain satisfactory results. For beginners, take the time to first understand the electrical principles that the system uses, so that you can decide which system best suits your riding needs.

The components can be discreetly hidden away while retaining the original Lucas parts if desired so that your restoration looks original but has the benefits of a reliable modern ignition system.

Part 3 Complete

Barrels and Pistons



Preparing the Barrels.

Removing the barrels is covered in Section B18 of the Workshop Manual. If you experience difficulty releasing the barrels from the crankcase, check again that all eight fasteners are removed and tap the barrels in several places with a hide mallet to break the seal. If you continue to have problems, loosely refit four of the outer barrel nuts, pack the space between the top of the studs and the barrels with washers and undo the nuts gradually to “jack” the barrels off.
Never insert a chisel or blade at the base flange as you will permanently scar the soft alloy.

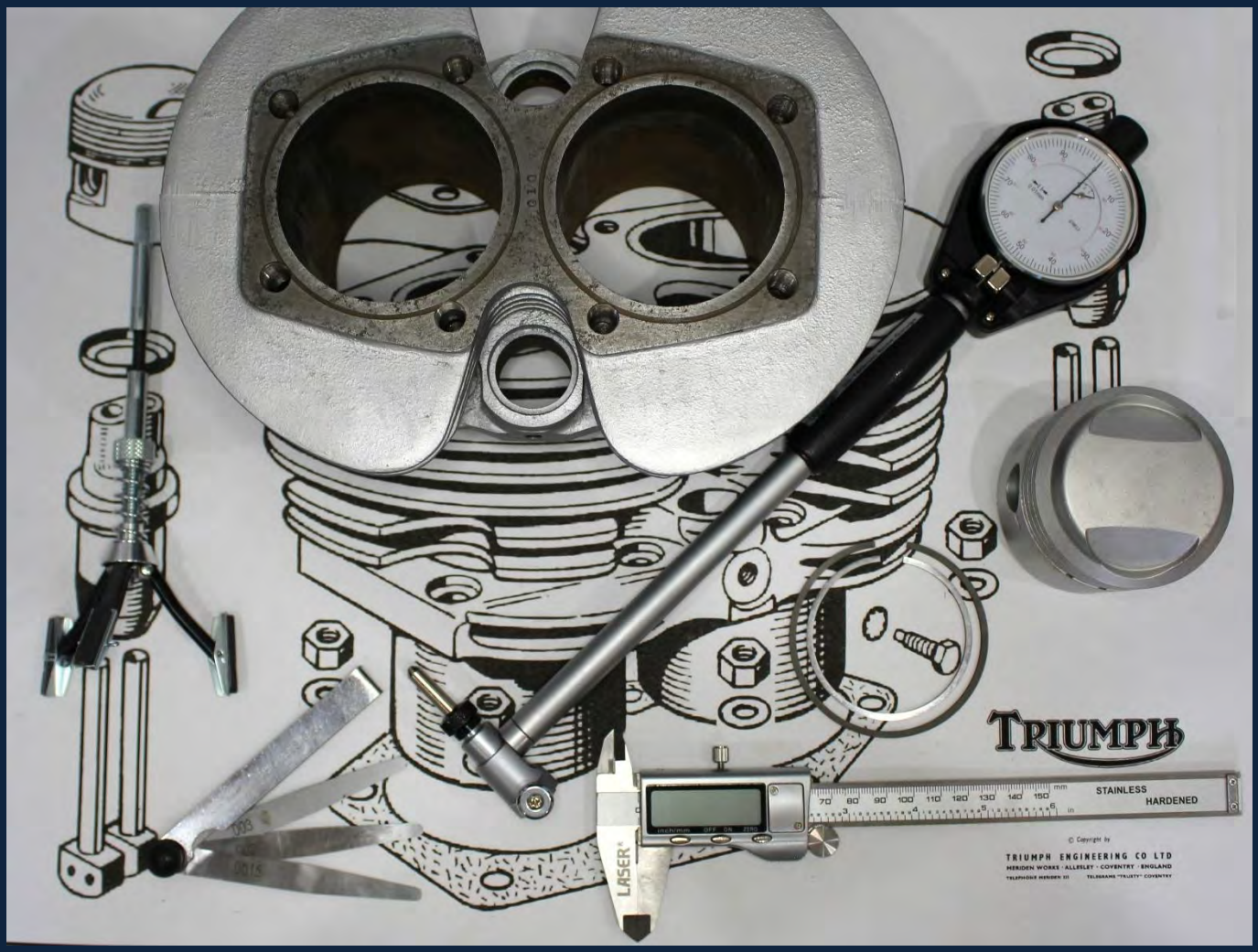
Shown above are the 350cc barrels, followers, guide blocks, fasteners and the tools needed to prepare the barrels for fitting. Here the barrels have been Grit blasted, cleaned, re-bored, honed and new pistons obtained. Note that the illustration of the cam followers (Tappets), does not match reality 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.

The 500 CC Barrels for many years are distinctive as there is a pronounced “Scallop” in the fins at the rear of the right hand cylinder, originally to allow the distributor room to be fitted and adjusted. As usual there were detail changes to these parts over the years and restorers should refer carefully to the parts books; only ordering or seeking parts that are compatible as sets. This applies especially to engines made after 1963 when numerous changes were made in the pursuit of improved reliability and oil tightness.

Wear in the tappets, guide blocks and push rods are a frequent cause of excessive noise in these engines. The oil system does not usually use 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 guide blocks carefully, 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.

Re-Tapping the threads ensures that they are clean and that the holes are not blocked in any way that would affect the torque applied to the cylinder head bolts; when these are eventually fitted. Use a HSS (high speed steel) plug or bottoming tap with a lubricant such as Trefolex. Work steadily until all eight of the holes run smoothly.
Finally, clean the tapped holes with a small bar magnet, paraffin, then brake cleaner and blow dry.
Also ensure that the passages between the cylinders are clear of debris.

Measuring the Parts



Tools for measuring the barrels and pistons.

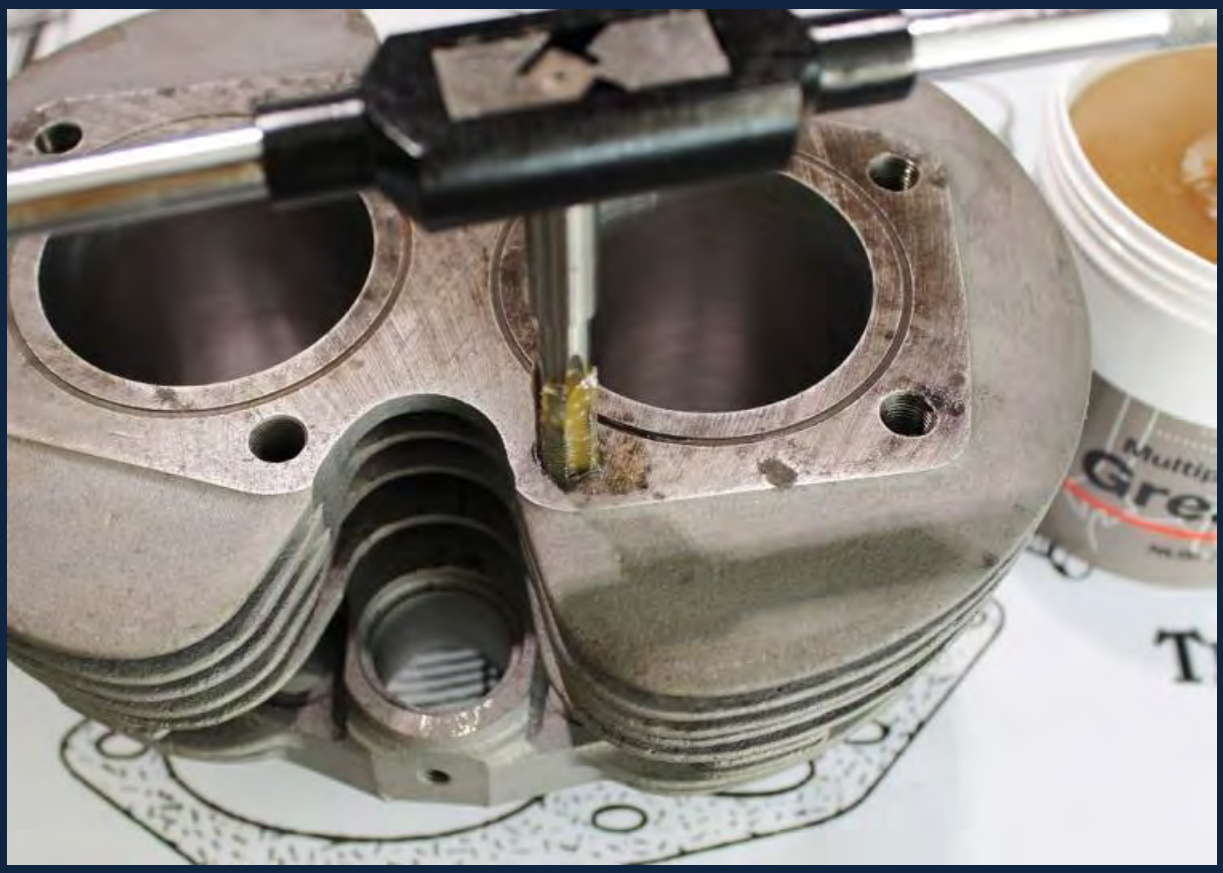
Shown above are the tools for measuring the barrels and pistons, a Bore Gauge is not essential but will provide an accurate indication of the bore wear. The 500cc Barrels above have previously been bored to +20 and the piston shown is an original part (+20). Also shown is a suitable honing tool and the top piston rings.

Sections B22 to B24 of the Works Manual cover basic measurement of the bores but also refer to the General Data specific to the model you are working on. The critical dimensions to check are the shirt clearances and the piston ring gaps which can be done simply using feeler gauges. Do not use Metric ones!

Note: Before resorting to a re-bore and new parts, assess how much you intend to use the machine as lightly worn parts will still have 1000's of miles of use left in them and a careful clean and decoke will frequently be enough to restore performance.

The 500cc barrels with the distinctive 'Scallop'.

Preparing the Barrels



Cleaning the threads using a 3/8 BSCY (26 TPI Cycle) plug tap and grease.

Residual blasting media and swarf sticking to the grease. A strong magnet attached to the Tap will magnetise it and help to draw out the cast off (iron) swarf.

Painting the Barrels

Preparing to spray.

On almost all of the C Range Models the cylinder barrels were originally finished in a silver heat resistant finish.
Here the prepared 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.
Do not use Powder coat, it will prevent heat dissipation and promote overheating.
'Kephos' black is an excellent alternative finish for black barrels.

The 1966 3TA showing the correct silver cylinder fins.
Early 5TA's usually feature black cylinders!

The Tappet Guide Blocks

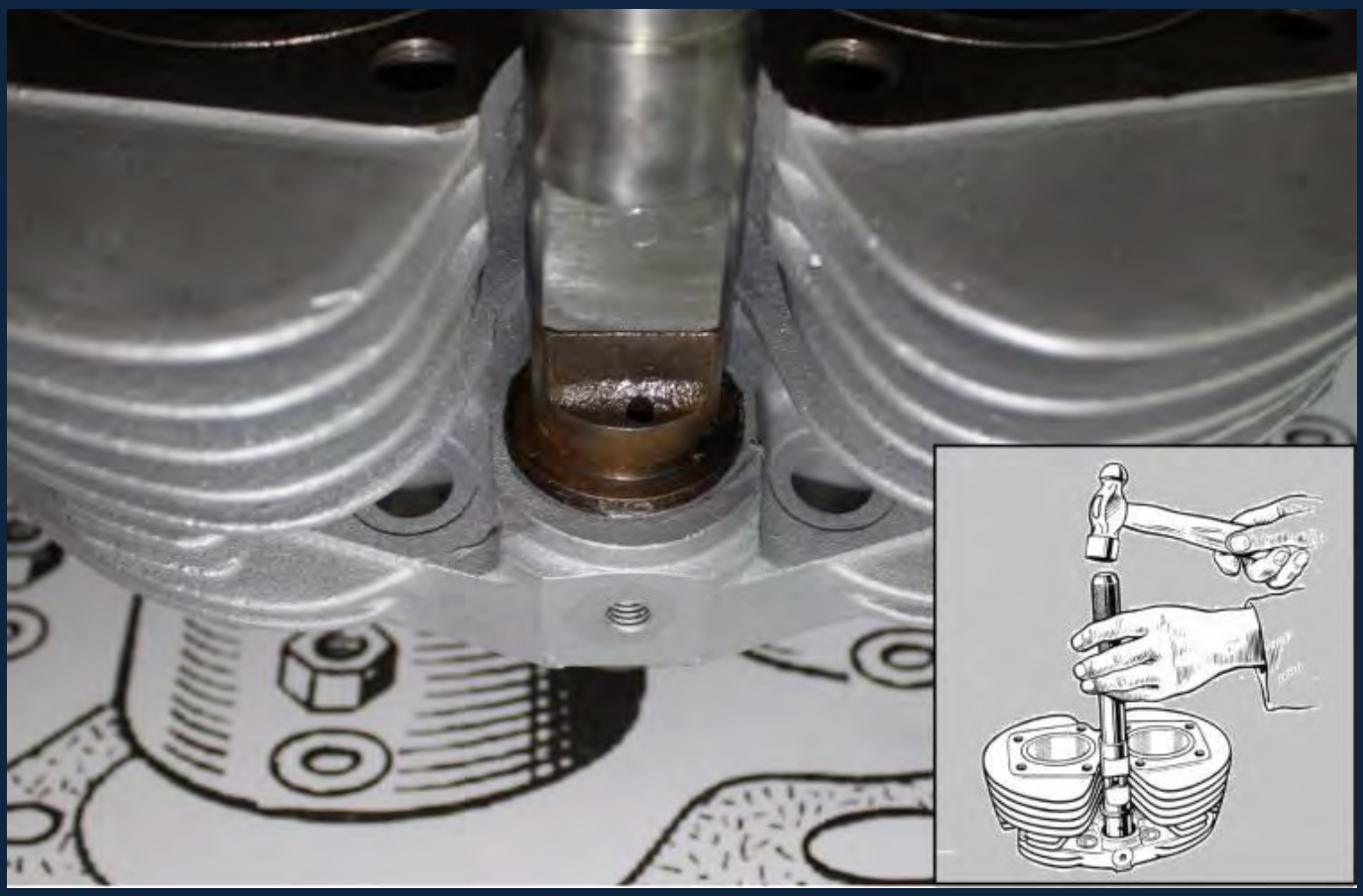
There are several patterns of guide block fitted and care needs to be taken to identify them, shown above left is the very early guide block for machines to 1959 (H8141) and the guide block (E4676) fitted from 1964, when the arrangement of the pushrod seals and the push rod covers change. Also shown is one of the standard E3753 tappets; here with the distinctive pattern of wear, that forms over time as the tappet twists and slides in the block.

Here the post 1963 block and the later improved 1969 ‘O’ ring type, shown with E4040 ‘R’ tappets.

Note the location for the O ring on the later improved block and the paired oil holes in the tappets ensure these are clear. When reusing these parts always return them to their original locations and the same way round! The later O ring block will fit all post 1963 machines

Tip: Always replace guide blocks and the tappets as sets rather than mix new parts with worn! On early type blocks make sure that any sharp edges are removed/chamfered so that the oil seal will not be damaged during the fitting of the pushrod tubes.

Fitting the Tappet Blocks



Fitting the tappet 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.
It is essential that the correct locking screws are fitted to prevent the block rotating in use.

Oil leaks that appear to be from the push rod tubes are frequently caused by oil creeping up the guide block from below. A smear of silicone sealant on the upper part of the block should help to prevent oil leaks at this point.
Alternately use the Later ‘O’ ring guide blocks or modify the standard blocks to fit ‘O’ rings.

SECTION B20

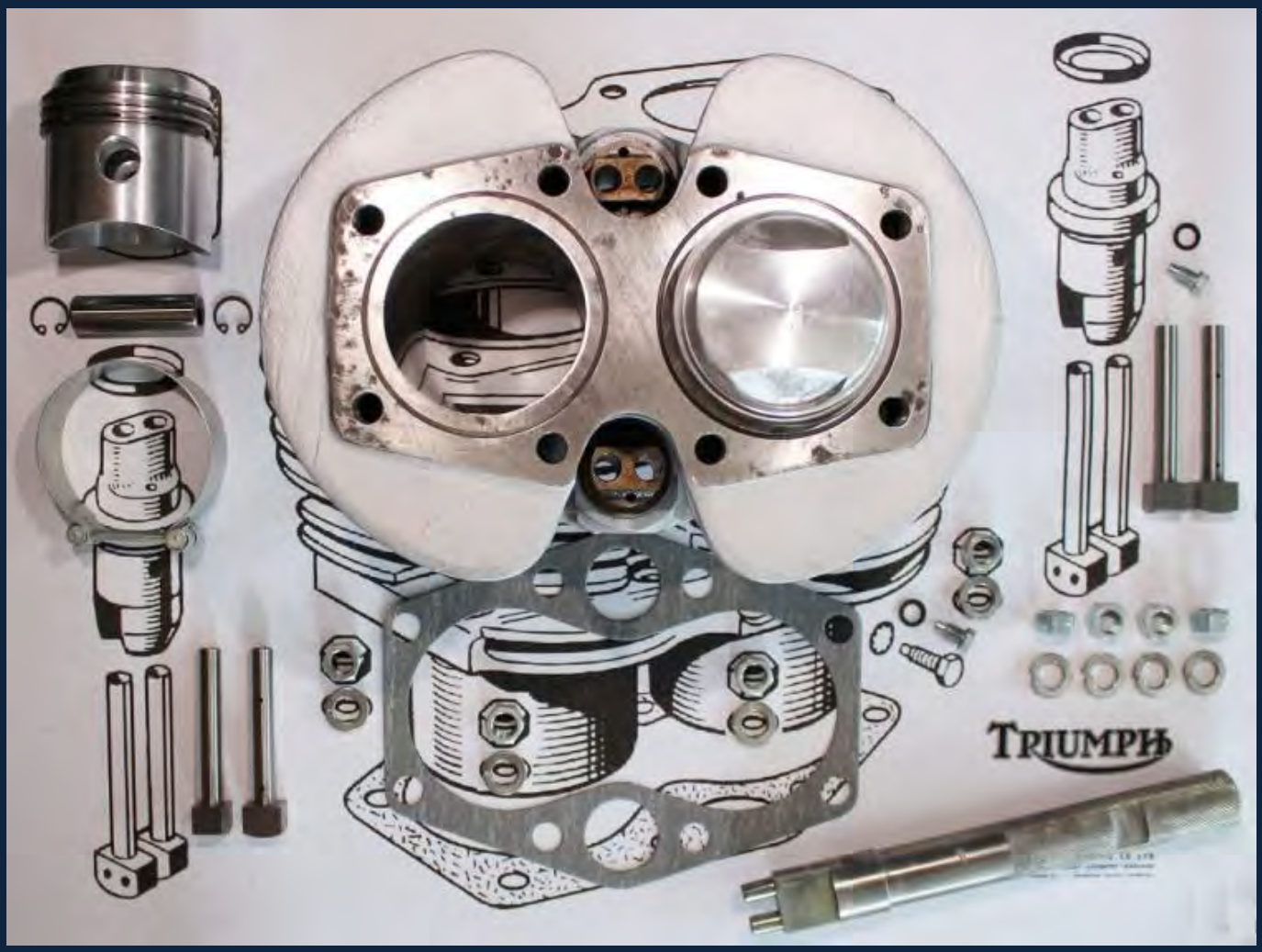
RENEWING THE TAPPET GUIDE BLOCKS

Place the cylinder block in an inverted position on the bench. Remove the locking screw and drift out the guide block using service tool Z23.

To fit the new guide block, ensure the cylinder block is firmly supported by the base flange. Grease the outer surface of the guide block to assist assembly, then align the location hole in the guide block and cylinder block base, and drive in the guide block using service tool Z23, as shewn in Fig. B19, until the shoulder is flush with the flange. Do not attempt to align the tappet block by means of the ears on the guide block. They can easily be cracked.

Instructions from the Works Manual.

Barrel Parts



The Pistons, Pins, Gasket, Cam Followers and Tools.

Section B18 of the Works Manual.

Complete the preparation of the barrels by assembling the remaining parts and tools.

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. After 1968 the nuts become the '12 Point' type and correspond to the new barrel studs now in 3/8 UNF and AF tools.

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).

On the left is one of two piston ring compressors, these are designed to compress the piston rings as the pistons are fitted and are useful tools to add to your tool kit. Available in a variety of sizes to suit different piston diameters. Shown here, those suitable for the 350 cc engine.

Always use a new cylinder base gasket and store it carefully (flat) so that it does not get damaged. Painting the gasket on both sides with Wellseal or silicone grease will improve its performance ensuring a better seal and reducing the chance of it sticking.

Tip. Store gaskets separately from other parts. Either between sheets of cardboard or in card backed envelopes that can be labelled with the contents. A complete gasket set will contain all of the gaskets, seals copper and fibre washers required for the engine except for the crankcase and gearbox oil seals.

Note: Some gaskets are in garish colours and mar a restoration, marker pen or black ink works well.

Supporting the Tappets

Holding the Cam Followers in place with an ‘O’ Ring.

Once the cam followers have been fitted, they need to be held in place. Small ‘O’ rings or short lengths of rubber pipe, are very effective. The same principle of securing the followers applies when removing the barrels or the camshafts. The diagram shows the arrangement of the post 1963 lower push rod tube seal and the backing ring. Coat the lower surface of the backing ring with silicone sealant when fitting.

The TRIUMPH Corporation

SERVICE BULLETIN

December 23, 1959

No. 59/22

TO ALL EASTERN TRIUMPH DEALERS:

Re: Push Rod Cover Tube Seals for All Twenty-One Models and 1959 5T/A Models up to Engine #H7141

Oil Leaks

SYMPTOM: Oil leaking from bottom of chrome-plated push rod cover tubes.

CAUSE: Original rubber rings, E3758, in some cases, can fold over the top edge of the tappet guide block and allow oil to leak at the bottom of the P/R cover tubes.

CURE: Remove both rocker boxes, cylinder head and push rod cover tubes. Throw the top and bottom seals away and replace these with new parts to be fitted to each cover tube as follows:

Slide a new narrow rubber ring, EL074, over the tappet guide block. On top of this rubber ring, fit a steel ring, EL073, and then assemble the chrome-plated push rod cover tube in place.

Replace the standard top seal with special "O" ring, EL197RT. Fit head gasket and cylinder head in position. Draw down on the four outer cylinder head bolts, E3793, carefully until a slight pressure is developed against the push rod cover tubes. At this point there should be no more than 1/16" space between cylinder head and cylinder head gasket.

If there is less than 1/16" gap between the cylinder and head, it will be necessary to use the standard "white" top seal (E3547).

If there is more than 1/16" gap between cylinder and head, examine the inside of cover tube at bottom end. A lump of bronze at bottom edge of the sleeve brazed in the tube could cause trouble. Fit a new cover tube and send old one in on claim.

It is very important to next fit the two rocker boxes and draw down all eight cylinder head bolts evenly, working from the center and criss-crossing in order to eliminate unequal stress on the cylinder head caused by pressure of the push rod cover tubes and the "compression" of the rubber rings.

If you have experienced oil leaks with the subject 1959 models, send us the engine numbers and we will furnish the new rubber rings and steel spacer rings free of charge so that you can completely eliminate this trouble.

SPECIAL NOTE: 1960 Twenty-One, 5T/A and T100/A models after engine #H8111 have modified tappet guide blocks and use the standard bottom rubber rings,(E3758), without spacer.

Very truly yours,

THE TRIUMPH CORPORATION

Service Manager

Rod Coates:vhm

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 Aeroplane and Motor, the Redditch foundry that supplied the factory with numerous partially 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.

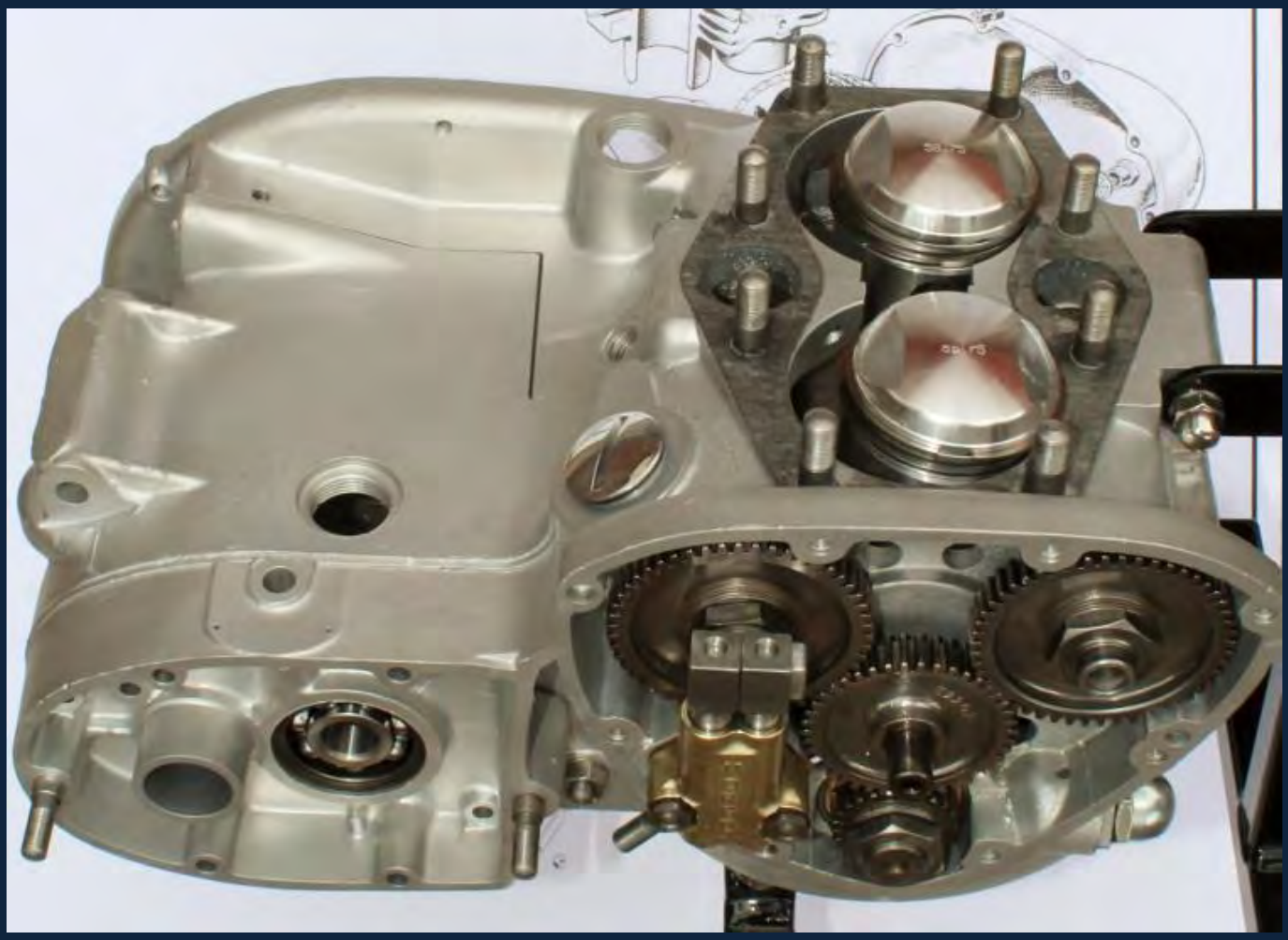
Pistons must always be handled and stored with care so that they are not damaged. To remove carbon and oil deposits, wash (brake cleaner) then bead blast gently, or using a soft metal or wooden tool scrape off carbon deposits, paying particular attention to the valve pockets and piston ring lands. Finish with fine wire wool, Scotchbright or 1200 grade wet and dry paper. Renew the piston rings and the circlips, these are inexpensive.

Fitting the piston rings takes a little care as they need to be expanded over the piston skirt, special pliers are available that make the job easy. Once fitted, space the ring gaps evenly so that do not align.

Small circlips as above, can be difficult to fit and especially remove. Use either very fine long-nosed pliers, forceps or a small but sharp screwdriver to prize the circlip out of its groove. Fitting is easier but work in a clean area with the crankcase mouth masked off, or stuffed with a clean rag so that if the circlip slips from your grasp it can easily be found and cannot enter the crankcase.

To fit or remove the pistons and the barrels you will need to find two flat bars, preferably in alloy and about 8ins (20cm) long by ¾ in (20mm) wide. Flat Tyre Levers are OK.

Removing & Fitting Pistons

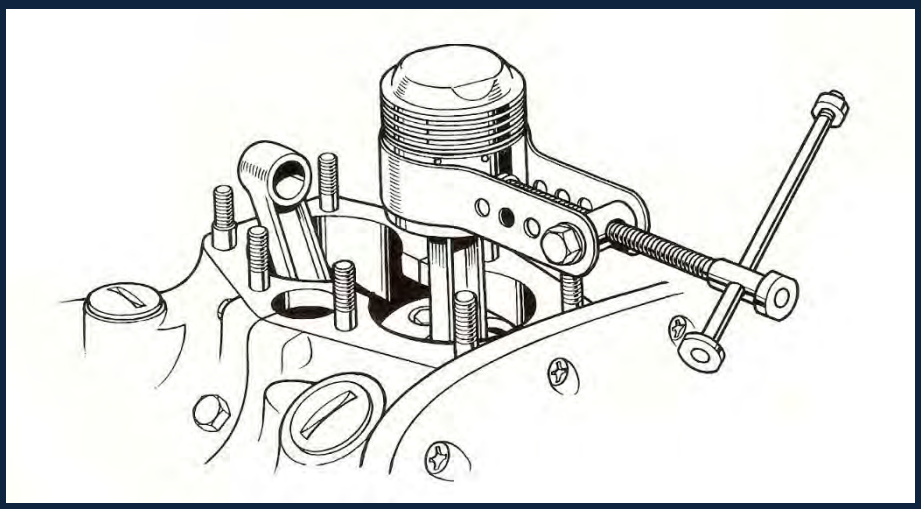


The pistons have been fitted to the connecting rods.

Refer to Section B21 of the Works Manual.

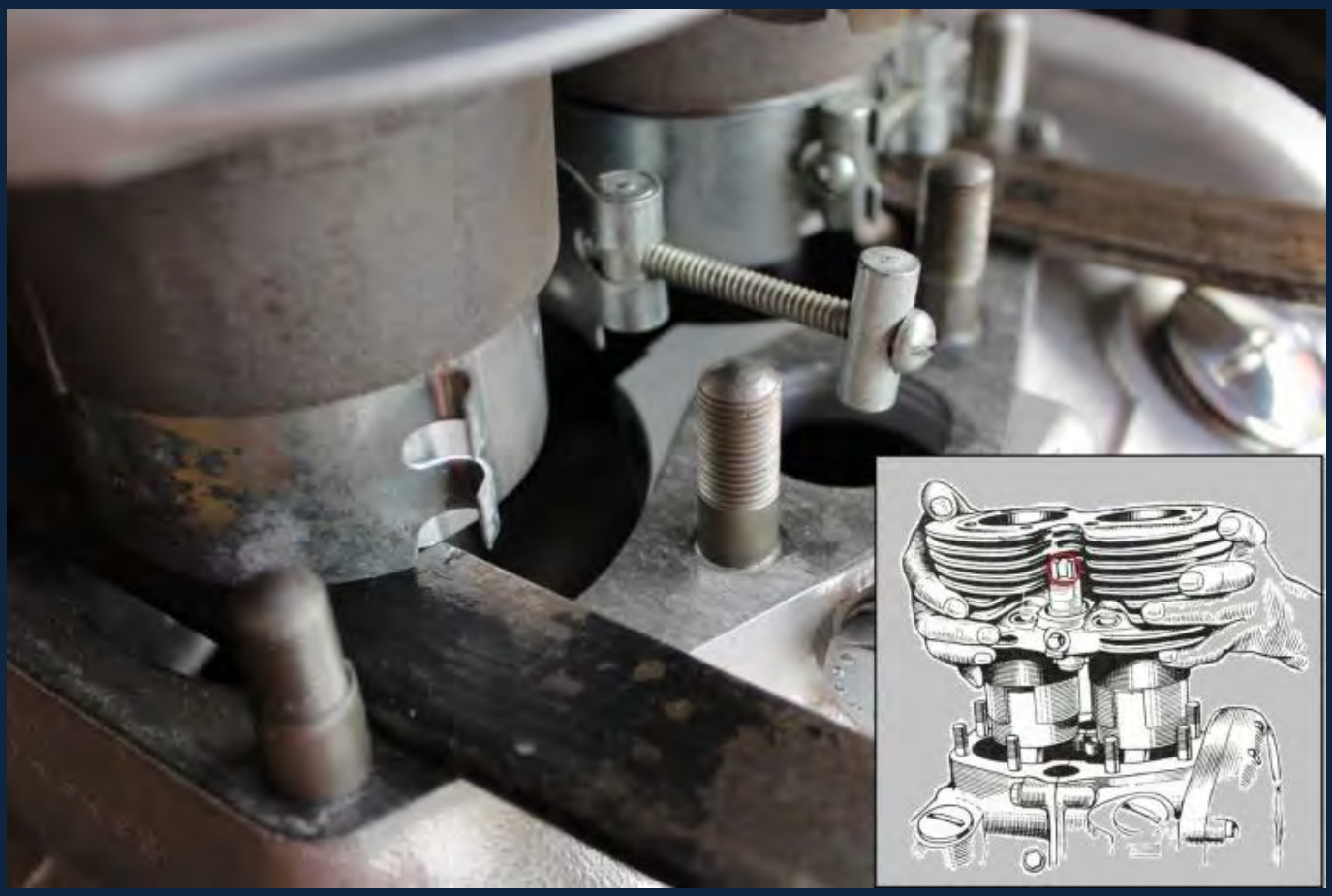
Here the cylinder barrel studs have been fitted along with the base gasket and the two hidden crankcase mouth screws. The four central studs that penetrate the crankcase have been sealed with thread sealant to prevent oil creeping up the Threads, and the gasket has been lightly coated with Wellseal,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

Before removing the pistons, mark them so that they can be replaced later in their original locations and orientation. 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 (inner) circlips. Heat the piston crown gently to approximately 100’c and then use a 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 a gudgeon pin extractor.

Fitting the Barrels

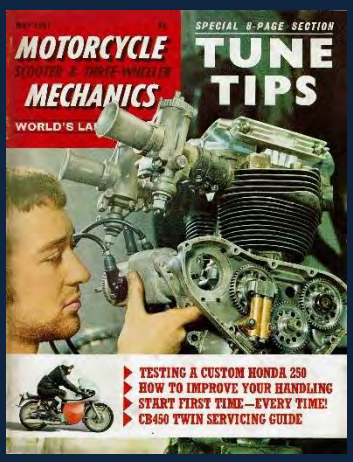


Using two tyre levers or bars to support the pistons.

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 (wrist) pin back slightly so that both circlips are not under lateral pressure from the pin.

Turn the crankshaft so that bottom of the piston skirts are above the crankcase, then 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 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. If you do not have suitable piston ring compressors, paired jubilee clips work well.

The bottom of each barrel is usually machined with a taper to assist in compressing the rings, with care and help the pistons can be fitted without ring compressors, but this is not advised.



Motorcycle Mechanics. Published from 1959.

Fitting the Barrels

The pistons being fitted into 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. See that the tappets are in place, fully retracted and still secured with the O rings or small pieces of rubber. Lower the barrels, remove the bars and complete the seating 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 General Data in the Works Manual for details but 35 lb/ft is the recommended torque.

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 below or to Section B1 of the Works Manual for instructions.

Seen above is the special ‘Newton’ Bolt in 5/16 BSF that bolts the crankcases together.
These were supplied by L H Newton and Co Ltd of Nechells, Birmingham
Suppliers of precision fasteners to the Aircraft and Motor industries.
‘Newton’ bolts are rare to find, but sought by expert restorers.

If undertaking a full restoration of a project machine you should by now have completed the preparation of the basic frame, the swingarm, stands, fork components, handlebars, wheels, brake parts and tyres. With these build a Rolling Chassis, but do not fit the mudguards, seat, or any other painted parts just yet as you risk damaging them while fitting and completing the engine.

Complete preparation of the engine brackets and collect together the various studs, spacers, washers and nuts that you will need to fit the engine, engine fitting is detailed next.

Tip: Do a final check on the fitting of the various fasteners while the engine is still on the bench and can be worked on easily. The gearbox, clutch and primary drive can be test assembled now but note that the rear brake and drive chain will be used to tighten several important nuts.

If this is your first restoration a practice assembly on the bench will do no harm.

Barrels Fitted

Completed Barrels.

Here the engine has been fitted to the chassis and the cylinder head joint has been coated with ‘Wellseal’ The push rod tube seals have been fitted together with the prepared support rings, and the tubes rested in place in preparation for the fitting of the copper head gasket and the cylinder head.

The Engine Fittings are shown and described later… Frame & Fittings.

To transport the engine safely and ease fitting, thread some heavy wire, rope or thick cord through the upper front stud aperture and also the rear engine mount to create ‘Handles’. Removal and fitting of the engine can be done single handed but is not recommended with a completed engine.

To fit the engine, you will need to provide a strong support underneath the frame rails; a sturdy box will do but a scissor or hydraulic 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. Supporting the engine firmly on the main mounting lug. 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. Remove the jack and then loosely fit all the studs before fitting the washers and nuts, gradually tightening them until you are satisfied that everything is neat and secure. If using stainless steel fasteners make sure you use a suitable thread lubricant, ideally not copper based.

As described elsewhere there are several operations that require the crankshaft, clutch and gearbox to be “locked” in order to loosen or tighten their fasteners by using the rear brake and for tightening the cylinder head bolts and barrel nuts, it can be very helpful if the engine is already secured in the frame as above.

During the initial running in process periodically check and re-torque the cylinder base nuts, the cylinder head bolts, rocker box fasteners, tappets and the engine mountings, as there is a process of bedding in for the gaskets and components and failure to check can lead to damage and unwanted oil leaks.

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, cups are in steel or bronze and there are slight differences in length. Check the four push rods are matched and look for wear, discard any rods that are chipped or bent. The rounded end can be carefully redressed to remove burrs provided that only the minimum of metal is removed and the profile retained.

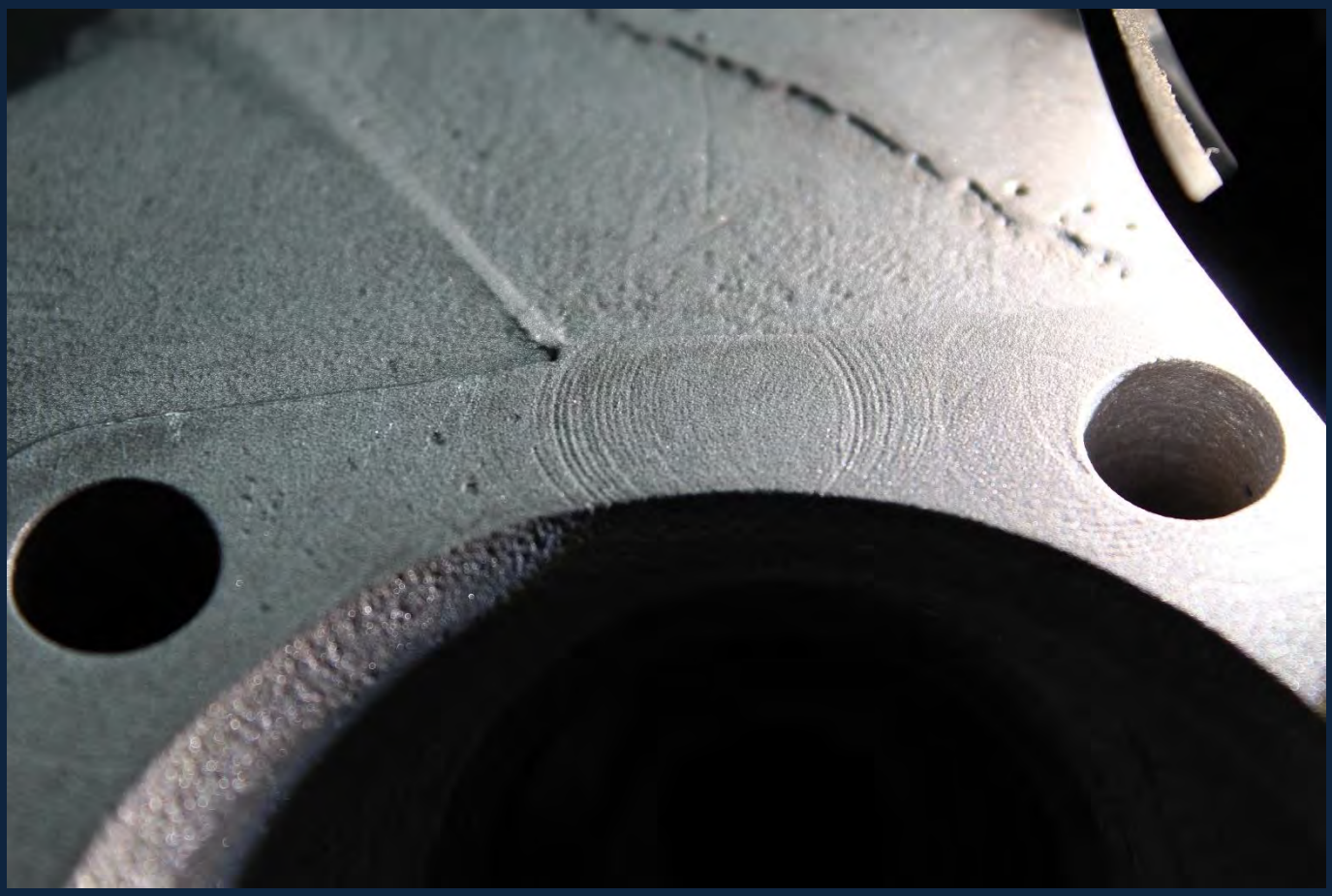
Over the production period of the ‘C’ range, Triumph produced several cylinder heads to suit the various models, and to the casual observer they can all look alike. The cast in number visible between the inlet ports will help to identify what model the head is for, but also assess the valve sizes and the combustion chamber size to confirm if you have a 350cc or 500cc or head. Refer to the data sheets in the Works Manual or Tech Bulletin 13 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 guides, also 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 (below). Fitting will require a shouldered drift being made to both press out the old guides and drive in the new ones, see below. You will also need a 5/16 parallel reamer to ream the new guides once fitted.

Some 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 safely fit the valves, springs and collets.

Cylinder Head



Damage to the face of the cylinder head.

Assess the face of the cylinder head very carefully, as even slight damage will prevent a gas tight seal between the head and the cylinder head gasket. Also look for scoring to the faces where the rocker boxes fit, less critical but can still lead to unsightly oil leaks. Light scoring can be removed by linishing but damage as shown above will require the head to be 'Skimmed', a specialist job!

Assessing the valves and guides requires some experience; once the valve springs, collets, spring holders and cups have been removed and cleaned, feel for any play between each valve and its guide. Even a small degree of rocking indicates the guide is worn. Addition tell-tail signs are uneven wear of the valve stem shown by partial polishing and the presence of oily residues on the back of the inlet valves and in the exhaust system; with excessive carbon build up on the pistons!

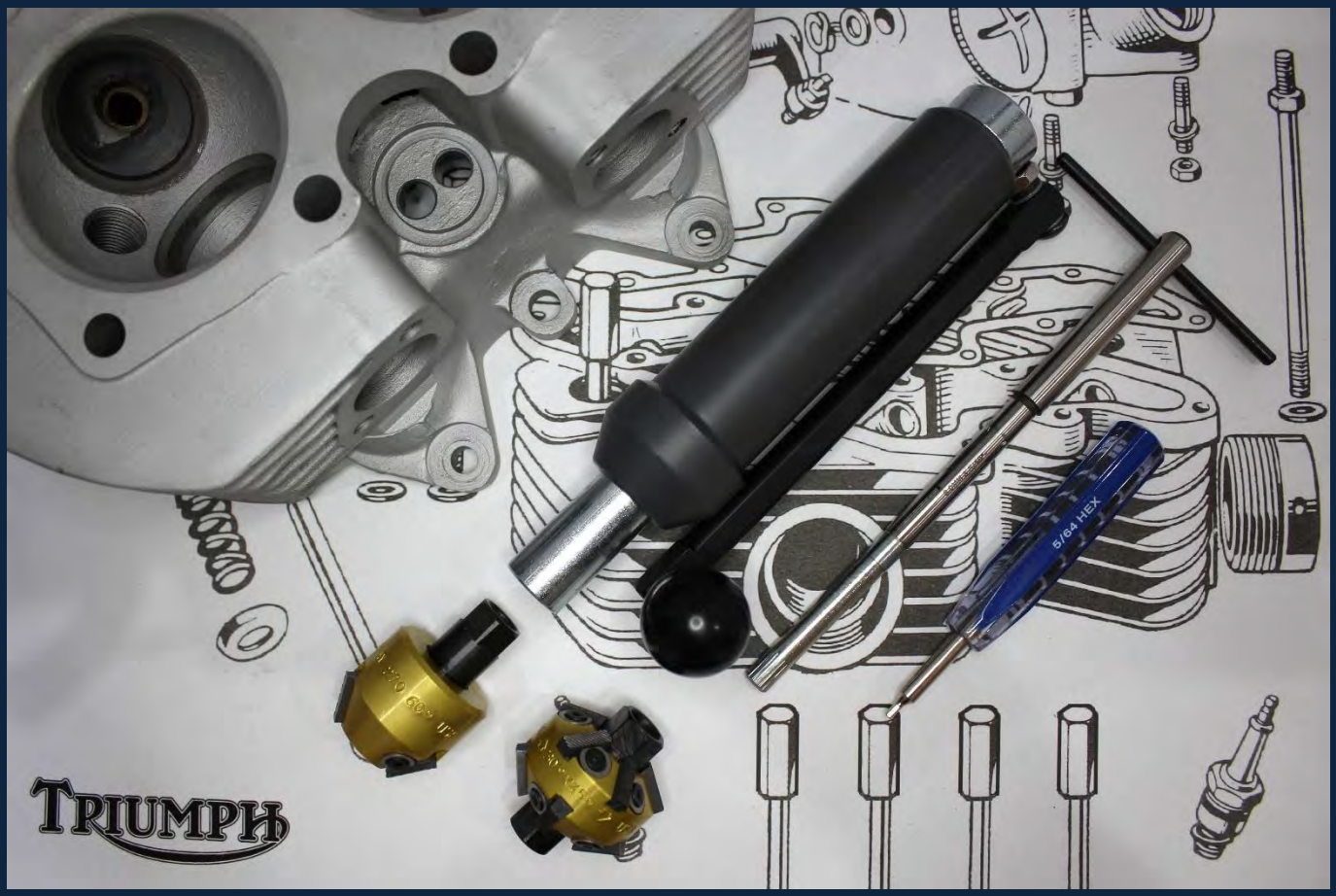
Roll the stems of the valves on a sheet of plate glass to check if they are straight, look for chips and damage especially on the edges where the valve contacts the valve seat in the cylinder head and check that the seats in the head are not excessively recessed. The valve seats can be replaced and with hardened seats suitable for unleaded fuel but this is a specialist job beyond the skills of most owners.

To remove the old guides without risking damaging the cylinder head you will need a hydraulic press and access to a lathe in order to make up a simple stepped drift and support piece. A suitable drift for the guides is 5 ins of ½ diameter bar, turned down to 0.307 in for 1 inch. The support piece is effectively a thick walled tube made from solid (alloy) round bar (25mm / 1inch od), some 4 inches long and drilled to allow the guide to pass through it while at the same time supporting the cylinder head on the press.

Before removing each guide, apply heat with a blowtorch to the area of the cylinder head around the guide and use some penetrating oil to lubricate the guide before applying force. Once the guides are out clean the head thoroughly by blasting with glass beads, walnut shell or soda; or have the head vapour blasted. A final clean before assembly with brake cleaner will remove any residual media, oils and dirt.

When fitting new guides (oversized guides are available), fit the circlips, lubricate the guides with a little grease and then chill them with the drift in a freezer. Pre-heat the cylinder head (150'C), support the head firmly and drive the chilled guides carefully into place with the drift until the circlips recess into their locations! Let the head cool and complete the job by reaming the new guides to size (5/16) in.

New bronze and iron valve guides and circlips.

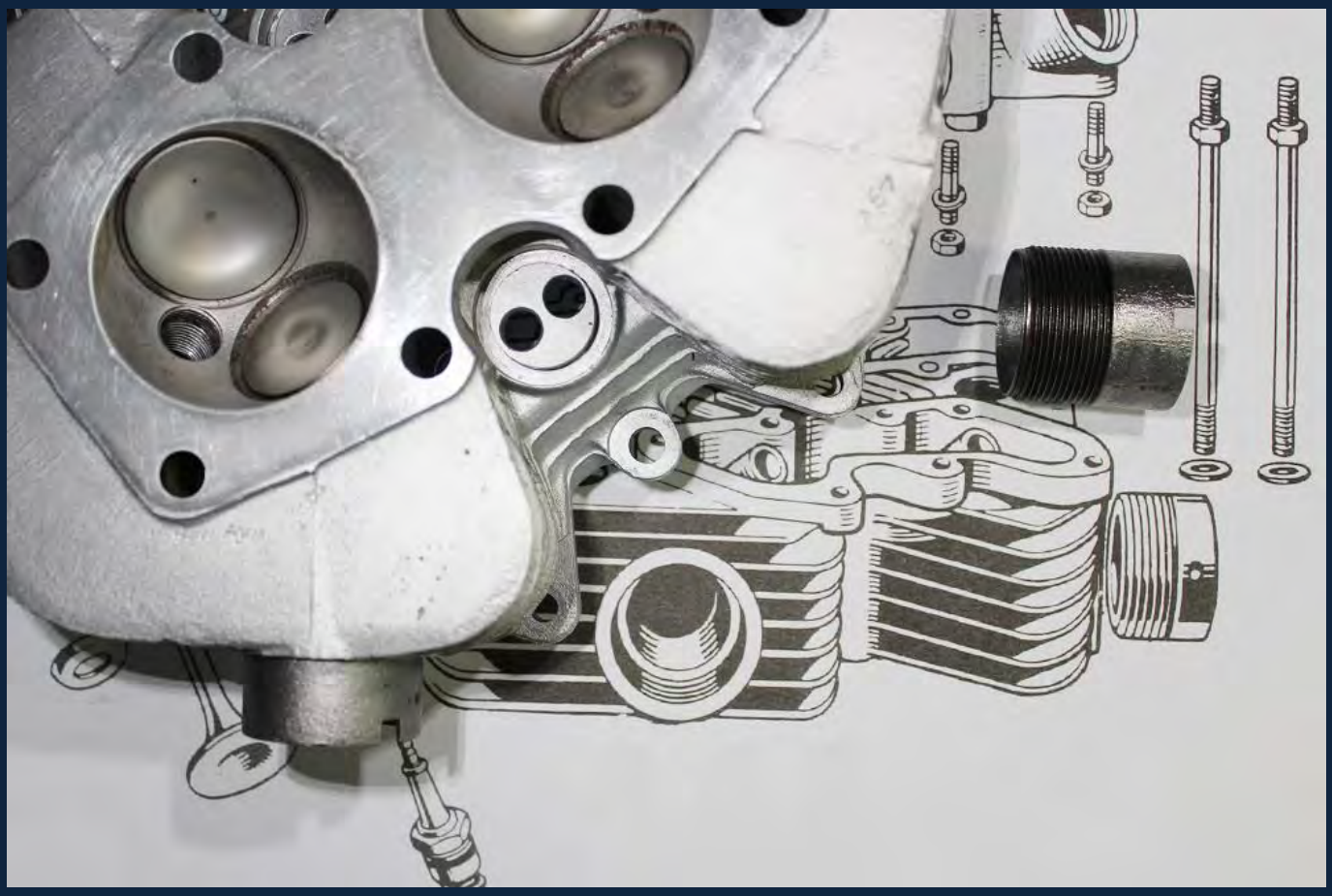


A Neway valve seat cutting kit.

Once new guides and or seats have been fitted you will need to re-cut the seats and blend in the valves with grinding paste to obtain a gas tight fit and to ensure that the engine performance is maximised.

Shown above are the cutters suitable for most of the C range engines, here in 30', 45' and 60' together with the appropriate guide and the tool to rotate the cutters evenly. After cutting the seats use Valve Grinding Paste and a suction tool to blend in each valve until a contact area of approximately 3/32 in (2.38 mm) is formed evenly around the circumference.

Exhaust Stubs



Here showing the Exhaust Stub removed and the recess for the seal, ensure that this is perfectly clean.

Before finally fitting the valves and springs, re-tap and clean the remaining threads using suitable taps (1/4 BSF) and dress the faces for the rocker boxes and inlet manifold to remove any burrs and high spots. Collect all the parts together and do a dry assembly to ensure that you understand how everything fits together. Check that the push rod tubes fit readily into their locations in the head and onto the tappet blocks and also check; without any seals, but with the correct head gasket that the cylinder head seats nicely on the barrels. The push rod tubes MUST have a small degree of vertical movement!

Over the production period a variety of push rod tubes were fitted, each with their own specific sealing arrangements and seals, and you must ensure that the correct sets are fitted.
The design specification is for 0.030 in of 'squash' for the seals.

Note that two thicknesses of white seals and head gaskets are available (0.050 and 0.025), with the thinner gasket suitable for cylinder heads from 1964 (H32465) and those machines with the later (E4751) push rod tubes and the later (E4676) types of tappet blocks. (Unless the head has been Skimmed!)
Do not expose the (White) seals to solvents as they will expand and fail.

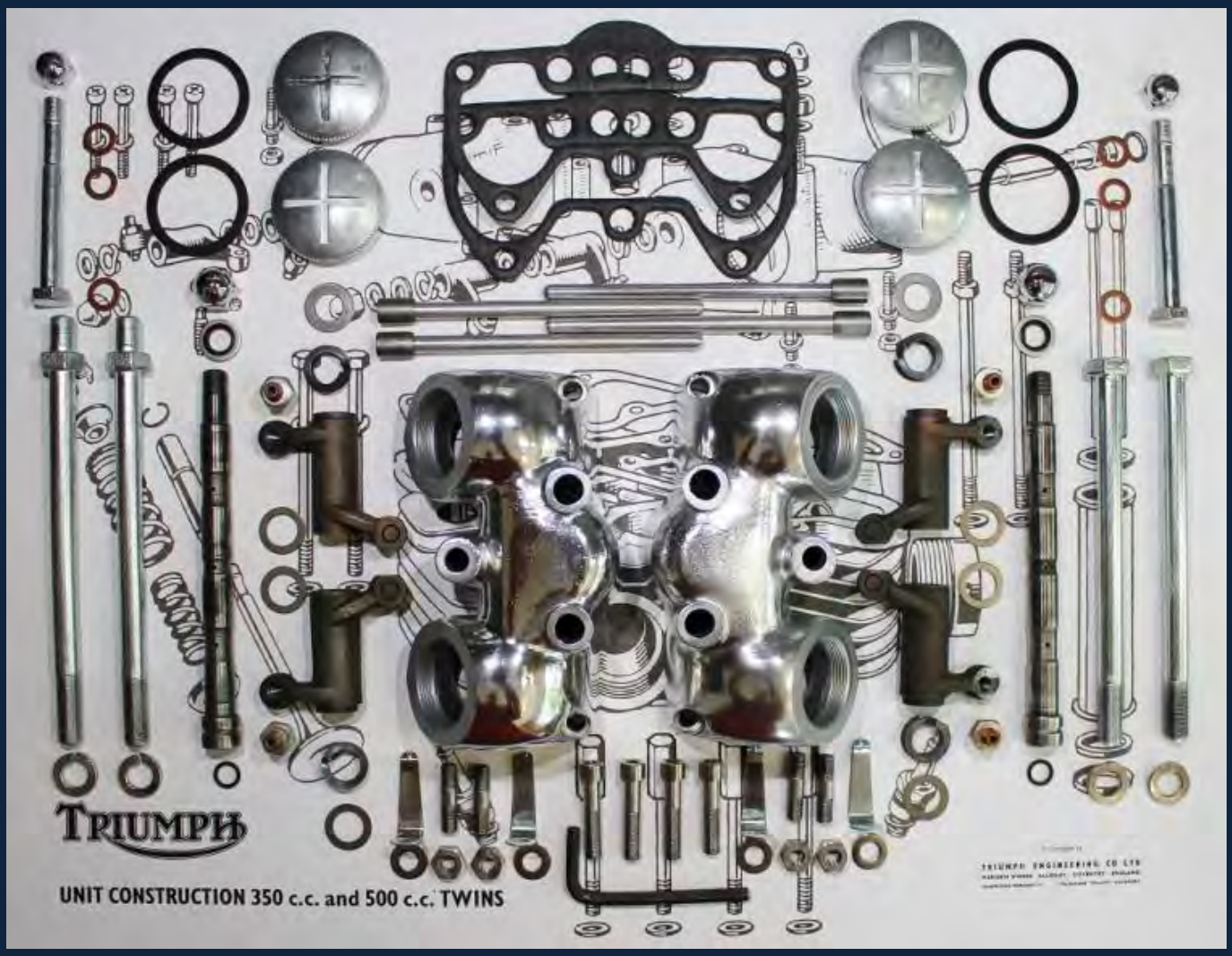
The copper head gasket should be annealed before use, even if it is new and unused. To anneal, heat the gasket over a gas flame until it is cherry red and then plunge into cold water. Use the gasket within a few hours and apply Wellseal thinly to both surfaces so that a good gas tight fit will be created.

When fitting the early push rod tubes care needs to be taken not to damage the seal during fitting. If the guide block has any sharp edges these will easily cut the seal if excessive force is used. Lubricate the seal with rubber grease/soap and then fit it into the push rod tube so that it is fully home, a lip inside the tube locates it. Oil the guide block and wiggle and rotate the push rod tube into place but do use excessive force.

All machines: Fit the upper seal into the recesses in the cylinder head and (post 1963), apply a thin coating of sealant to the face of guide block or the bottom of the backing ring/bottom cup (E4647) and fit the now lower seal assembly.

For performance engines refer to the work done by Doug Hele in preparing the Daytona machines, Stan Shenton's book Triumph Tuning ISBN 085077053X or Triumph Technical Bulletin 13

Rocker Boxes



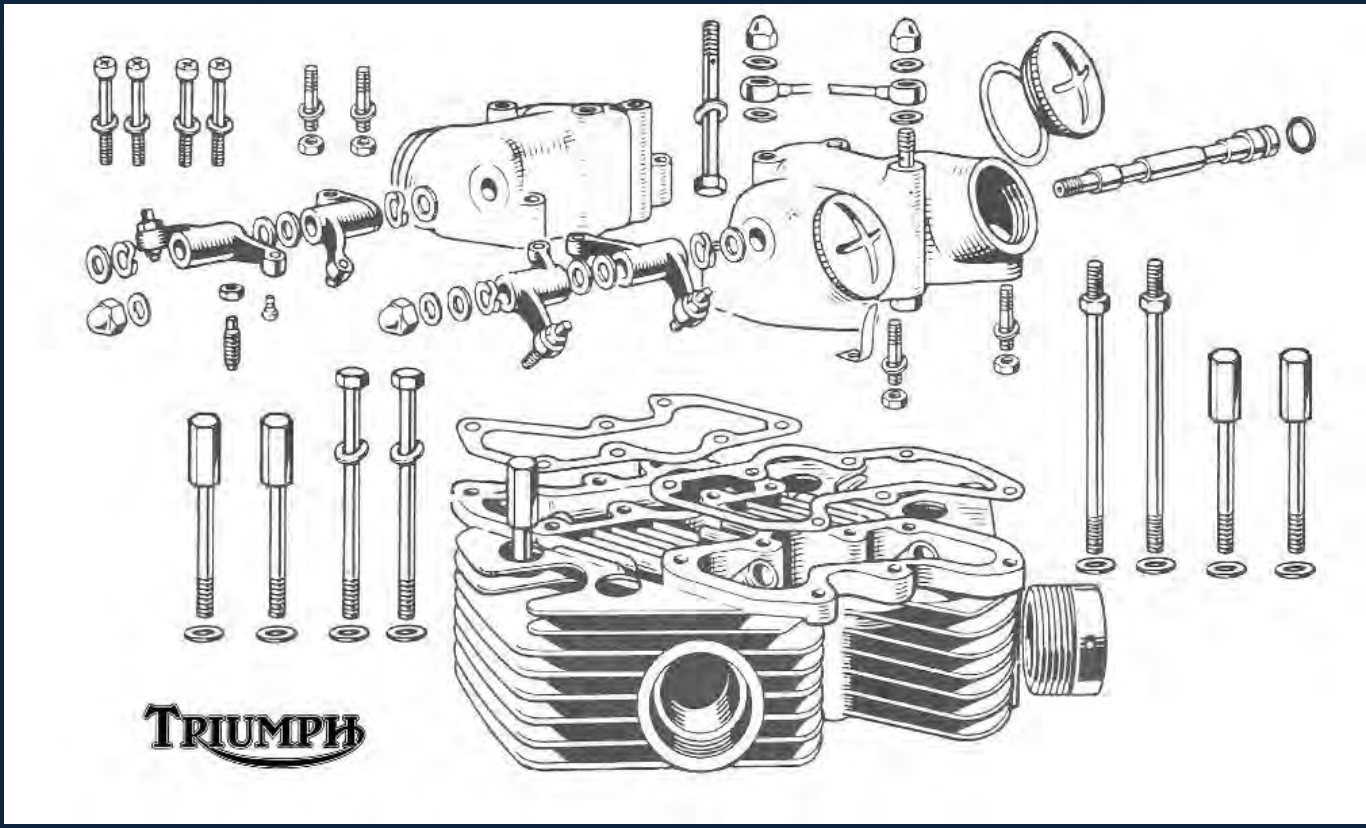
The Rocker Boxes and Parts.
Sections B2 to B5 of the Works Manual.

This being 1966 3TA shows the steel push rod cups 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, unless for a show machine should consider fitting the retaining clips that became standard from 1963.

The Early (left) and Late (right) rocker, fit only matched sets.
The early rocker features an oil feed to the pushrod cup.

Rocker Box Parts



The Parts Arrangement of the Triumph Rocker Box.

The detachable Triumph Rocker Box is a distinctive feature for many years and provided that there is an adequate oil supply, the parts rarely wear. Check the rocker shafts for straightness and the rockers themselves for cracks and damaged threads. On the C range 350 and 500 machines, cracks can develop internally on the rocker boxes especially if the main bolts have been overtightened. This was later resolved by increasing the strength of the boxes (1970) and later boxes also feature removable plugs as assess points for feeler gauges.

The assembly principles for the C range rocker boxes apply to almost all Triumph models and many other British motorcycles and confidence you gain here is transferable.

Before assembling the boxes ensure that you have a complete set of suitable parts. Obtain new O ring seals for the rocker shafts, Thackeray, thrust and copper washers and the gaskets as a matter of course. Do a dry assembly of each part to test fit and practice before you commit to final assembly.

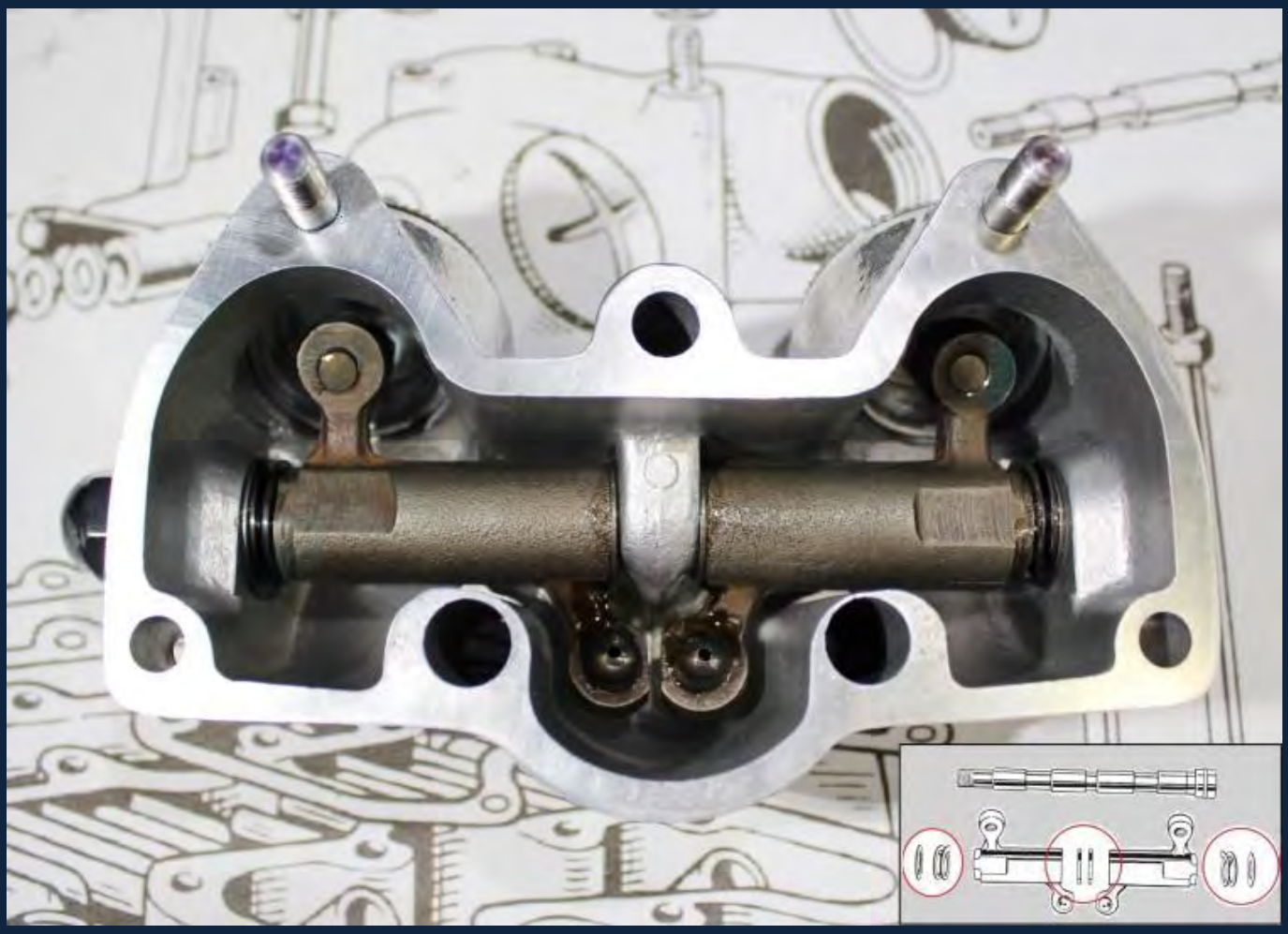
Originally the rocker boxes would have been only lightly polished and expert restorers will seek to recreate this original finish, while many owners prefer to have a highly polished finish. The rocker boxes make excellent test pieces to practice your polishing skills! Before polishing remove the studs and the caps and after wash the boxes thoroughly in solvent (Acetone) to remove any residues.

Assembling the rocker boxes can be frustrating but is greatly eased if a bar or Allen key is used, select one that is about the same diameter as the rocker shaft and long enough to pass through the box. A small flat screwdriver will help to fit the Thackeray washers as these need to be compressed and manipulated into their locations as each rocker is introduced. Place the rocker box on some clean cardboard or carpet so that you don't mar the surface as you work.

To Linish the faces of the rocker boxes effectively you will need a sheet of thick plate glass some sheets of 400 grade wet and dry paper, soapy water and masking tape.

Linish: To improve the flatness, smoothness and uniformity of a surface and its finish.

Rocker Box Preparation



Rocker Box Assembly. Section B4 of the Works Manual.

To dismantle the rocker box and remove the rocker shaft undo the end nut, and with a hammer and centre punch strike the end of the shaft while supporting the other end on the rocker box with a short tubular drift (alloy) or a socket.

The studs above have been replaced 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 or Helicoil the threads and then use a suitable stud sealant such as Loctite 270 to locate them securely.

Before assembly check that the oil way in the rocker box is clean; this is a diagonal drilling that connects the oil feed bolt channel 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. Do not use blasting media on these parts.

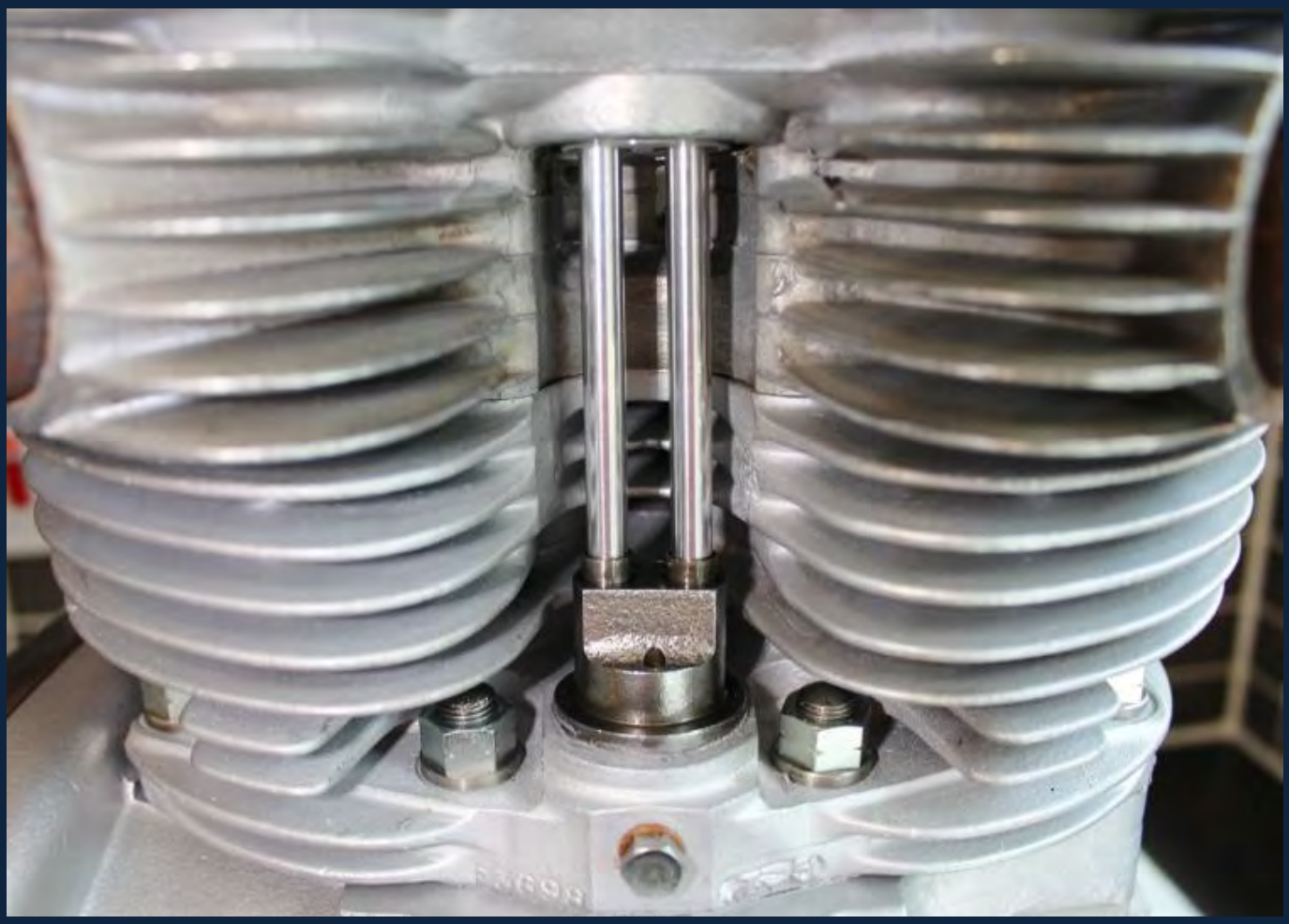
Look for cracking, internally around the central head bolts, this is common but usually nothing to be concerned about. Cracked rocker boxes will show themselves by oil leaking onto the barrel fins where the cylinder head bolts break through. Keep an eye out for good spare or later rocker boxes at jumbles and swap meets.

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. Use Red Grease.

Before fitting the rocker boxes ensure that the adjusters are loose, at their minimum settings and that the rockers move freely and evenly. Position them to readily engage the push rods.

When tuning for performance, replace the Thackeray washers with spacers and shims and use lightweight Dural or half nuts for the adjusters. Do not attempt to lighten the rockers but they can be polished to reduce the chance of stress fractures developing.
Triumph experimented with Titanium rockers but never fitted them.

Fitting the Cylinder Head



Test fitting the cylinder head.
Refer to Section B13 of the Works Manual.

Shown is the arrangement of the push rods when they are fitted, note that they, the guide blocks and the cover tubes when fitted are not held vertically but pitch inwards slightly at the top. The seals are designed to compress and seal the cover tubes as the cylinder head is torqued down. You must use matched sets of parts!

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. Do not apply any torque at this point but check that the cylinder head is correctly located with a small gap in between the cylinder head and the gasket and that the push rod tubes are correctly located. Ideally the head should rest on the seals leaving a 0.030 in gap between the head and the cylinder head gasket. If you have too much or too little gap use the alternate thickness (white) seals in whatever combination seems to give the best result.

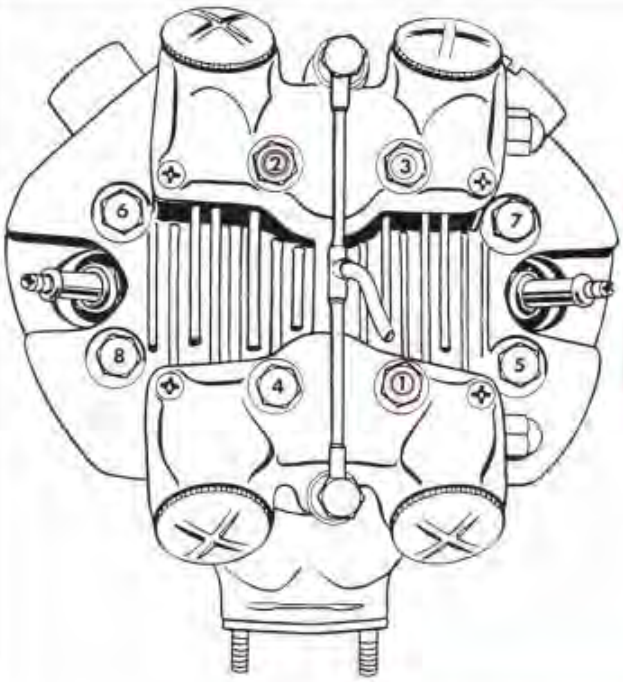
Fit the inlet rocker cover gasket and insert the inlet push rods; cup end upwards tipping them slightly while rotating them until you feel them engage with the followers. Turn the crankshaft until the two inlet pushrods are at the same minimum height and then fit the inlet rocker box, making sure that the push rods engage with their respective rockers. You may need to make a “Comb” from some card or tinplate to guide the pushrods into place.

Fit and partially tighten the two main bolts to pull the rocker box down. Loosely fit the oil feed bolt with a new copper washer and then the remaining screws, clips and nuts. Repeat the process for the exhaust rocker box.

Tighten the 8 cylinder head bolts gradually following the sequence in the Works Manual (Below/Overleaf) then tighten the remaining fasteners (to torque) and then adjust the valve clearances. Section B5.

Once the cylinder head is fitted, turn the engine over carefully by hand to ensure nothing is amiss, listening and watching; particularly that the rockers move evenly. If one or more of the pushrods is not correctly located then the rocker will not open fully and you will need to remove the rocker box to try again.

Cylinder Head Torque



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

Cylinder Head Tightening.

Once the cylinder head is fitted, adjust the tappets to the settings appropriate for the model. Refer to the Instruction Manual or the Works Manual.

Fit the oil feed pipe as shown above. 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 and also, from the open end of the oil pipe or tank return.

Before attempting to start the engine pour some oil into each rocker box to lubricate the tappets, and prime the oil feed pipe and the rocker shafts and rockers by removing one of the domed end nuts and using a pressure oil can to fill the galleries, shafts, rockers and the oil pipe.

The crankshaft can be primed, if this was not done earlier by removing the pressure relief valve and using a pressure oil can to fill the sludge trap and lubricate the main bearings and timing gear before attempting to start the freshly rebuilt engine for the first time.

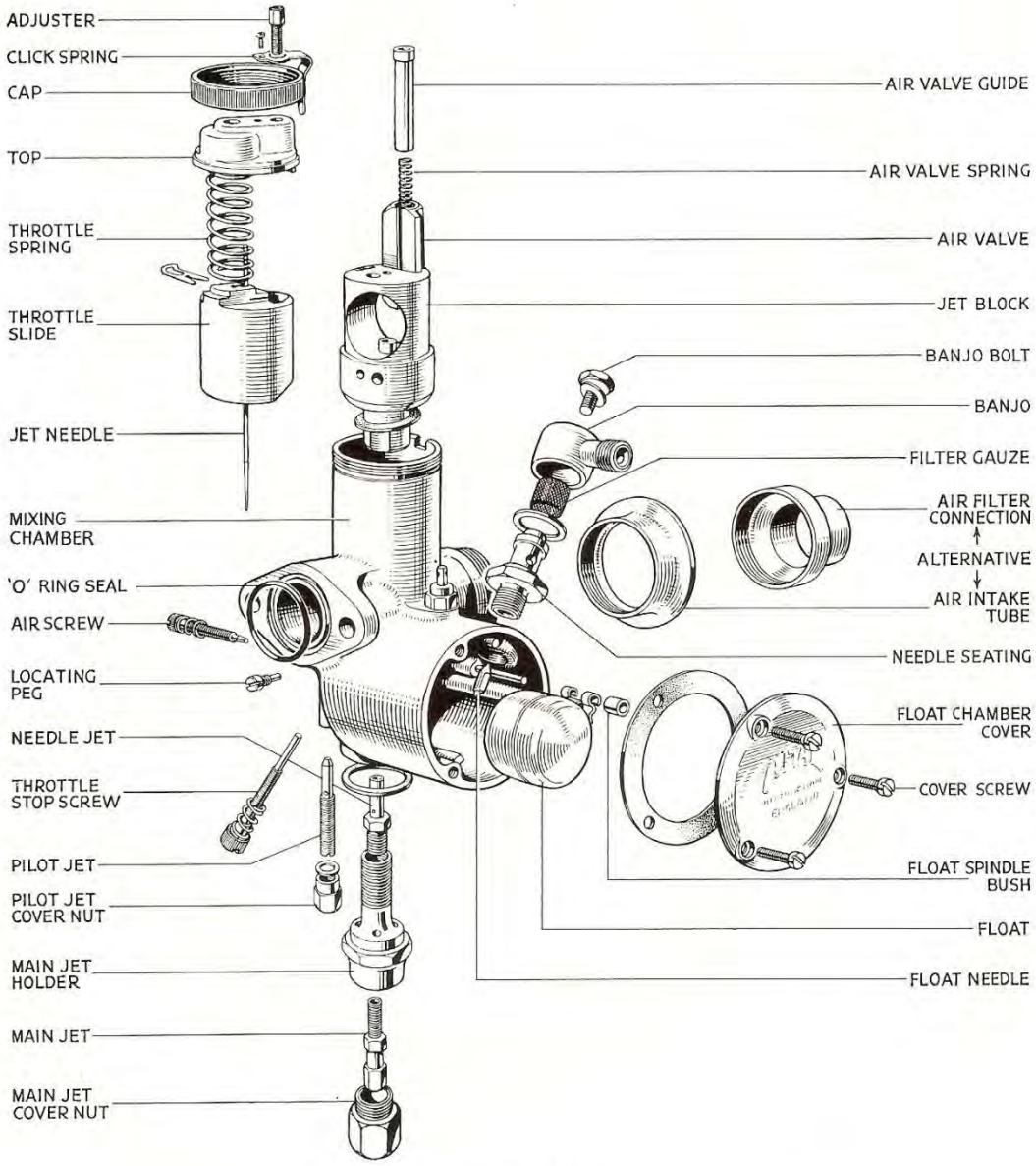
Originally Triumph ran the machines initially on a rolling road to ensure that oil was fully distributed around the engine and returning to the oil tank. By removing the plugs, engaging top gear and pushing the machine around until oil is seen to return, you are replicating this process and minimising initial wear on starting the engine for the first time.

When starting the engine for the first time or after an oil change or service, look for the oil returning to the oil tank, the flow (intermittent) should be visible with the cap removed. If you see no return after 30 seconds stop the engine and investigate as the crankshaft may be receiving no oil.

You can prime the rocker assemblies and tappets by temporarily blocking the return flow with your finger, check for leaks at the same time. Do not permanently block or restrict the return as oil will build up in the crankcase and escape from the breather and seals.

Part 5 Complete

Carburettor



Exploded view of carburetter

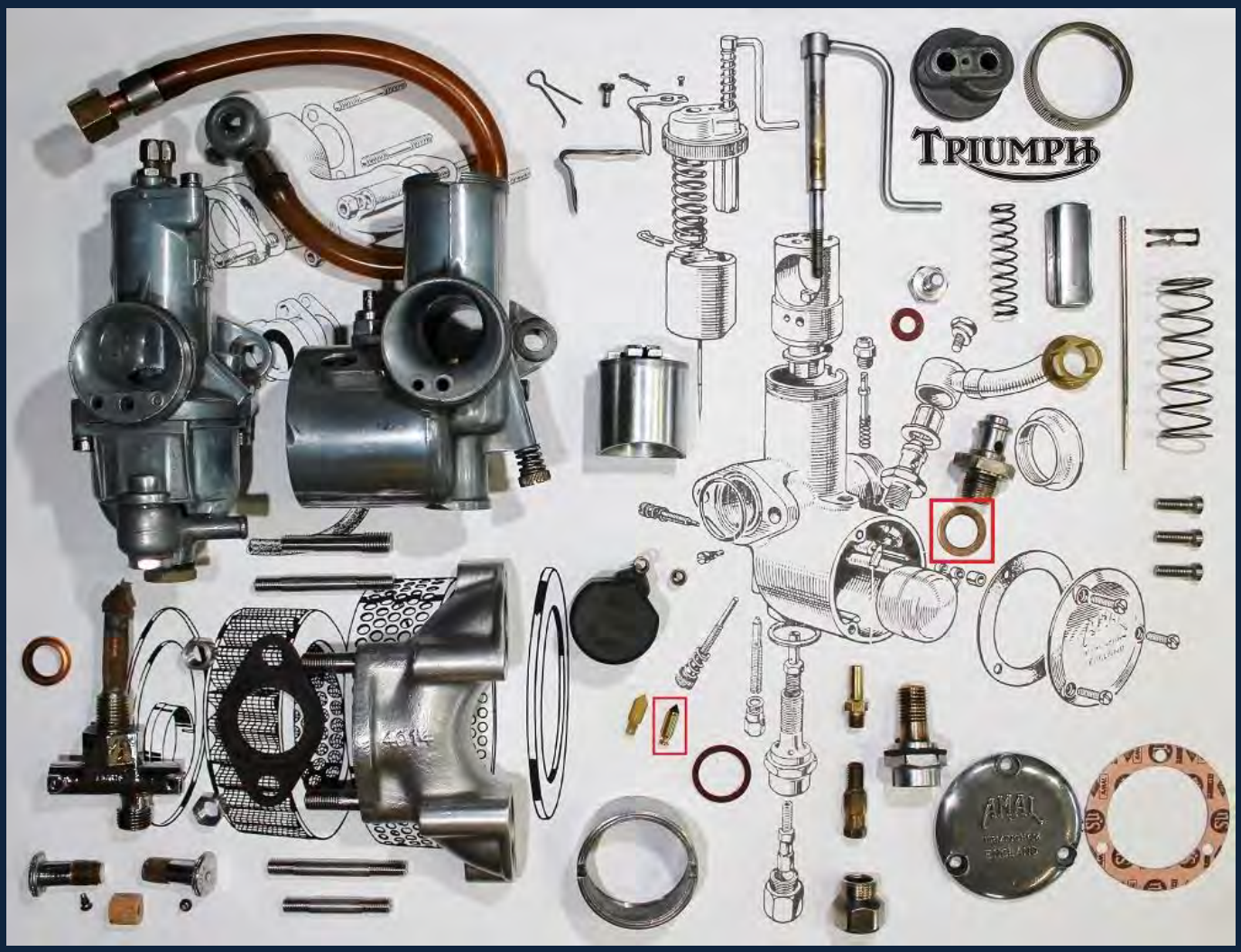
The Amal Monoblock Carburettor.

For beginners the operating principles of Carburettor type fuel systems are a mystery and create a great deal of concern. The simple aim of any fuel system is to provide the optimised amount of atomised fuel to the engine at given throttle openings and account, if possible, for fuel quality and atmospheric conditions.

Shown above is an exploded view of the Amal Monoblock Carburettor. Filtered petrol is maintained at a constant level within the float chamber by the float and its action on the float needle. Passages within the carb transfer petrol to the main jet holder and as the throttle is opened the vacuum created pulls a measured amount of petrol through the needle jet, spraying this into the passing airflow. Opening the throttle more, further raises the needle and increases the fuel flow relative to the quantity of air passing through the carburettor.

Features such as the tickler, air valve (choke) and the pilot jet, control fuel flow for starting and idling, while the air screw and throttle stop screw give a fine degree of adjustment to the fuel flow and air flow set by the needle, jets and air slide.
All the parts of any carburettor are precision parts!

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 of 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.

The thickness of the fibre washer for the (Monoblock) needle and main-jet body is critical and changes here will alter the fuel ratio. A thicker washer will enrich the mixture, a thinner one will weaken it, for the same needle, needle jet and main jet settings and values. Do not overtighten the nut!

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 for you and you will have to undertake additional research and experimentation to optimise the settings.

Top Tip: Once the side cover gasket on the Monoblock carb is disturbed it can be difficult to achieve a petrol tight seal, try using two gaskets instead of one.

Part 6 Complete

Gearbox

Gearbox Mainshaft, Layshaft, gears and parts. Section D of the Works Manual

Though the 350/500 cc machines share many similarities with the other models, the gearboxes are quite different in several areas, notably the arrangement of the shafts, kickstart and the method of gear selection.

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.

To replace the bush, you will need a hydraulic press and a lathe to make a drift to both press out the old bush and to support the new one as it is pressed in. Refer to section D9 of the Works Manual for details.

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

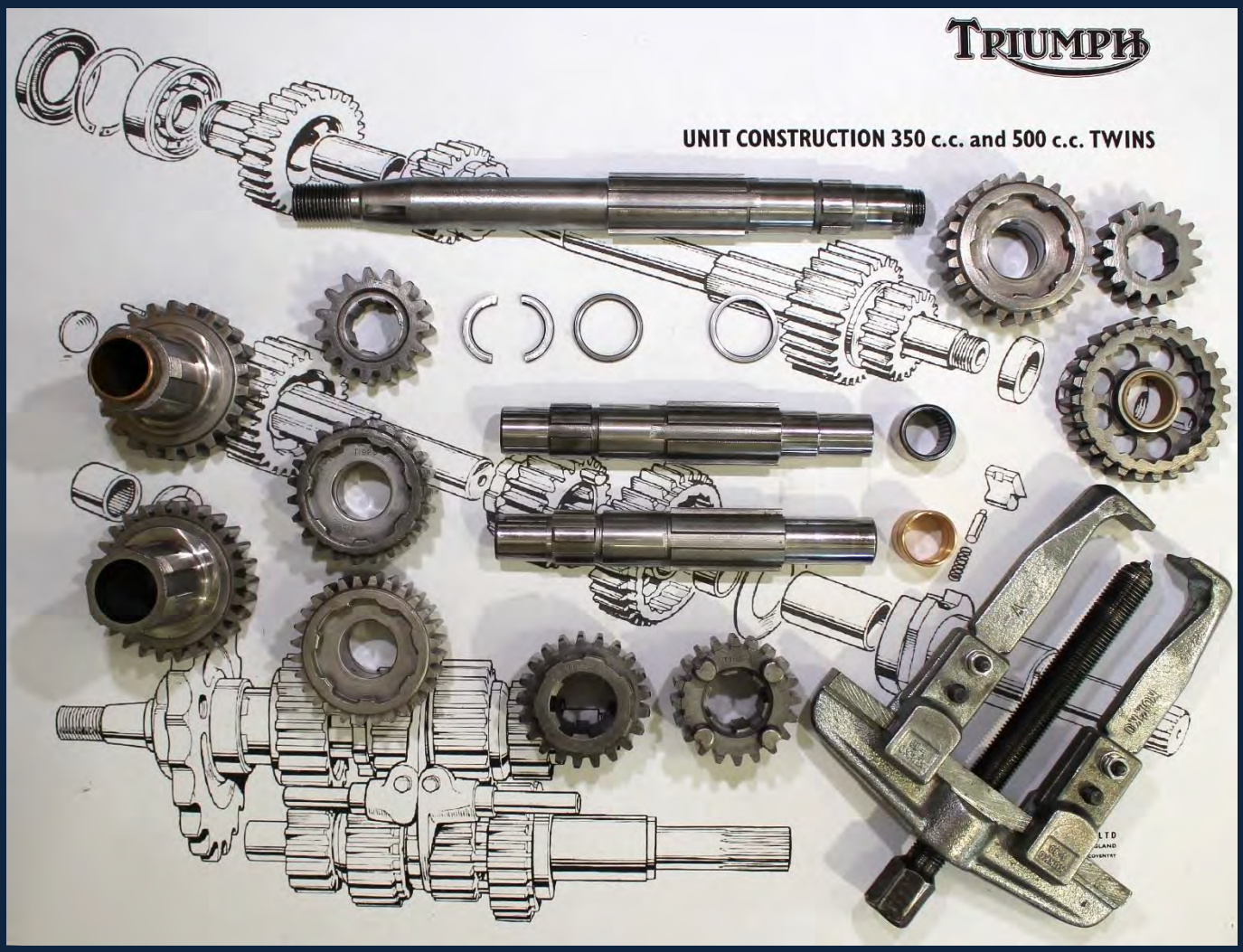
To remove the bush or the needle roller bearing within the kickstart spline may require some ingenuity, as the hole is blind. The works manual recommends heating the kickstart spline and tapping sharply on a block of wood. More often than not you will have to devise an ingenious alternative… By prizing 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. The bronze bush may have to be drilled (19mm drill) or machined out on a lathe.

To fit a new bearing or bush heat the kickstart spline to 150’c and use a drift, vice or a press with a suitable mandrel to fit the pre greased bearing/bush until it is a flush fit within the recess in the spline.

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 or welded to a substantial bar and used to lock the Mainshaft to allow the end nut to be loosened and tightened with the gearbox dismantled.

Tip: Check the fit of the sliding gears, the clutch hub, gearbox sprocket and the nuts Now! (9/16 x 20 TPI BSCY)

Gearbox Parts



The gearbox shafts (stripped) and gears, here showing both types.

You MUST research thoroughly if assembling a gearbox from parts, as a failure to match components will at the least lead to problems and more likely disaster if you attempt to run the machine.

At a glance the gearbox components used across the various models over the production period from 1957 to 1974 look similar, but do not be deceived. From 1964 stronger gears are introduced and are not interchangeable with the earlier sets and there are also two types of Mainshaft and Layshaft. Study the parts books with care and also refer to the supplementary information provided in the Parts Bulletins and Tech Bulletin 13, especially when you are assembling a machine with an unknown history or obtaining spares.

Parts Bulletins 62/4 from May 1962, #3 from the 8th July 1964 and #251 from 1966 are essential reading.

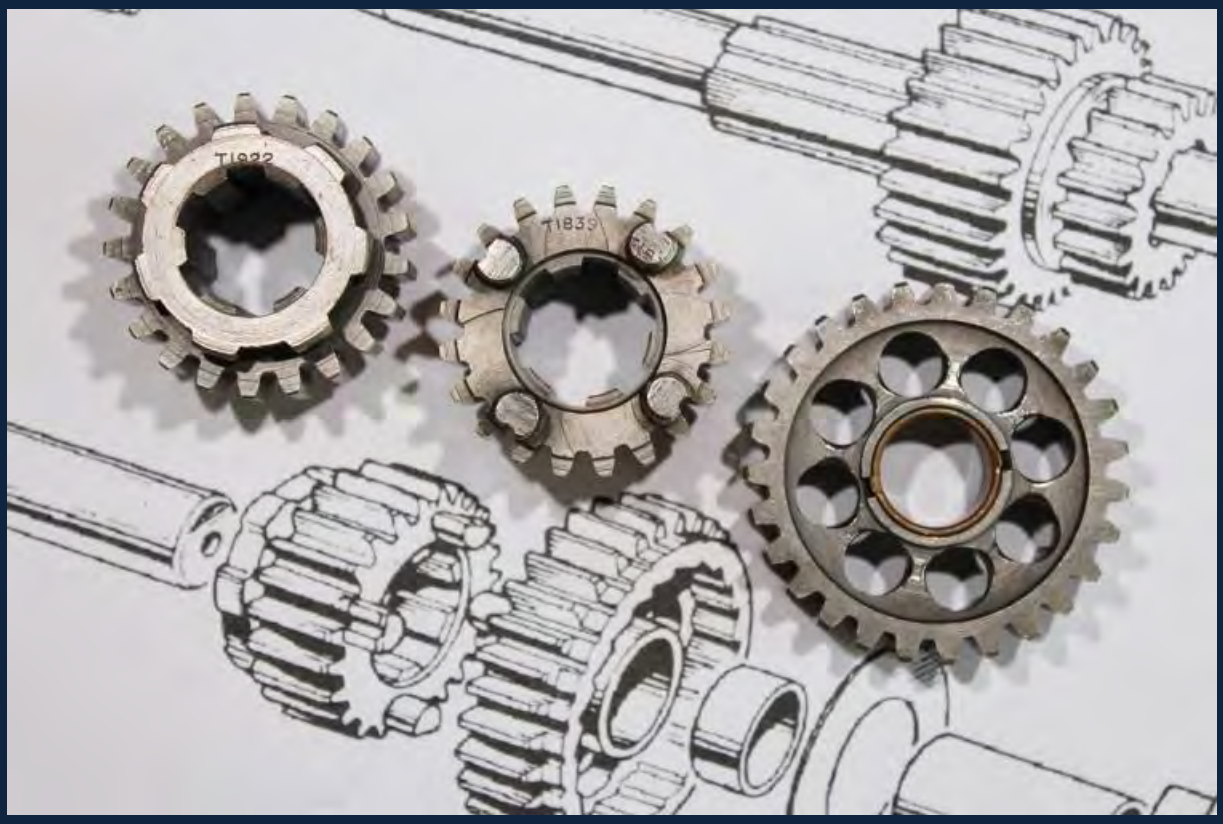
The gearbox Mainshaft and Layshaft are usually complete assemblies and apart from a general check will not need to be dismantled unless there are broken teeth. The Mainshaft gears can be removed with a press but for the layshaft you will need a suitable puller to remove the top gear as a pair of obscured split-rings retain and locate the third gear in position.

Do not attempt to cut the gears off as there is a high risk of scoring the shafts!
A hydraulic press will be needed to reassemble the gears to the shafts.

Additionally on both shafts adjacent to the (free) gears are slim thrust washers, not shown in the parts book. Not shown in the parts books are the individual part numbers for the shaft gears and while the post 1964 coarse gears show the part numbers (see below), the earlier ones do not and you will have to count the numbers of teeth to confirm which parts you have against the parts book.
John Nelsons data booklet is useful for the T100 and Daytona models.

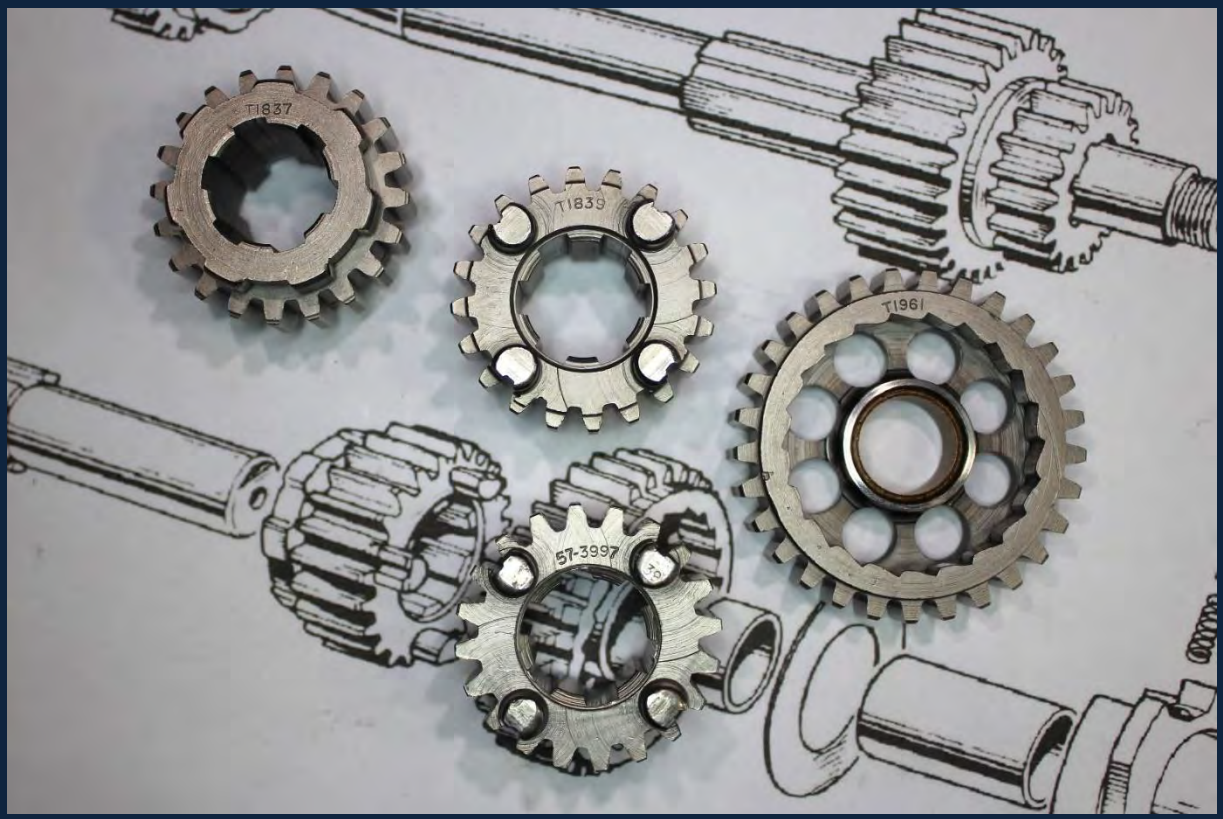
The Layshafts shown above, though similar in appearance are not fully interchangeable, always fit the appropriate bearings or bushes that match the layshaft you have.

Gearbox Parts



T1922 is the standard Mainshaft 2nd gear, T1839 is the standard/common Layshaft 3rd gear, and T1950 is the standard Layshaft low gear. Refer to parts books 7 and onwards.

Gears from 1964 show the part number which makes identification a lot easier when you have a box of bits to work with. Note the excessive wear on the Layshaft low gear (right) where the holes have become elongated, this will be replaced. The internal bush can be replaced separately!



Wide Ratio Gears. Parts from 1964 and 1970.

Wide ratio gears were usually fitted to the T100C and Military models.

Gearbox Parts

July 8, 1964

"C" RANGE STANDARD RATIO GEARS

	Needle Bearing		1963 T100S/R Needle Bearing		1964 T100S/R Double Needle Bearing	
	Part No.	No. of Teeth	Part No.	No. of Teeth	Part No.	No. of Teeth
Mainshaft High	T1403	26	T1403	26	T1947	22
Mainshaft Cluster	T1406	19/28	T1406	19/28	T1948	16/24
Mainshaft Second	T1410	23	T1628	24	T1922	21
Layshaft Cluster	T1615	18/28	T1617	18/27	T1949	15/23
Layshaft Third	T1413	23	T1413	23	T1839	20
Layshaft Low	T1414	32	T1414	32	T1950	27
GEAR RATIOS						
Fourth	1		1		1	
Third	1.19		1.19		1.22	
Second	1.76		1.62		1.61	
First	2.43		2.43		2.48	
Original Equipment on:	TR5 and T100SS from H18612 up to H32465		T100S/R from H29733 to H32465		T100S/R from H32465	

-6-

July 8, 1964

"C" RANGE WIDE RATIO GEARS

	Needle Bearing 1st Condition		Needle Bearing 2nd Condition		Double Needle Bearing***	
	Part No.	No. of Teeth	Part No.	No. of Teeth	Part No.	No. of Teeth
Mainshaft High	T1618	27*	T1684	23**	T1684	23
Mainshaft Cluster	T1624	18/28	T1624	18/28	T1959	15/24
Mainshaft Second	T1410	23	T1410	23	T1837	20
Layshaft Cluster	T1616	17/28*	T1686	14/28	T1960	14/24
Layshaft Third	T1413	23	T1413	23	T1839	20
Layshaft Low	T1622	33	T1622	33	T1961	29
GEAR RATIOS						
Fourth	1		1		1	
Third	1.30		1.35		1.37	
Second	1.94		2.0		1.97	
First	2.88		3.01		3.18	
Original Equipment on:	TR5AC from H18612 to H25251		T100S/C from H25252 to H32465		T100S/C from H32465	

*When 1st Condition Replacements are required Mainshaft High and the Layshaft Cluster MUST be replaced as a pair by Second Condition Gears T1684 and T1686 which have superseded Gears T1618 and T1616.

**Heavy Duty Stub Tooth Gear

***All Double Needle Bearing Gears are Heavy Duty, Stub Tooth Type.

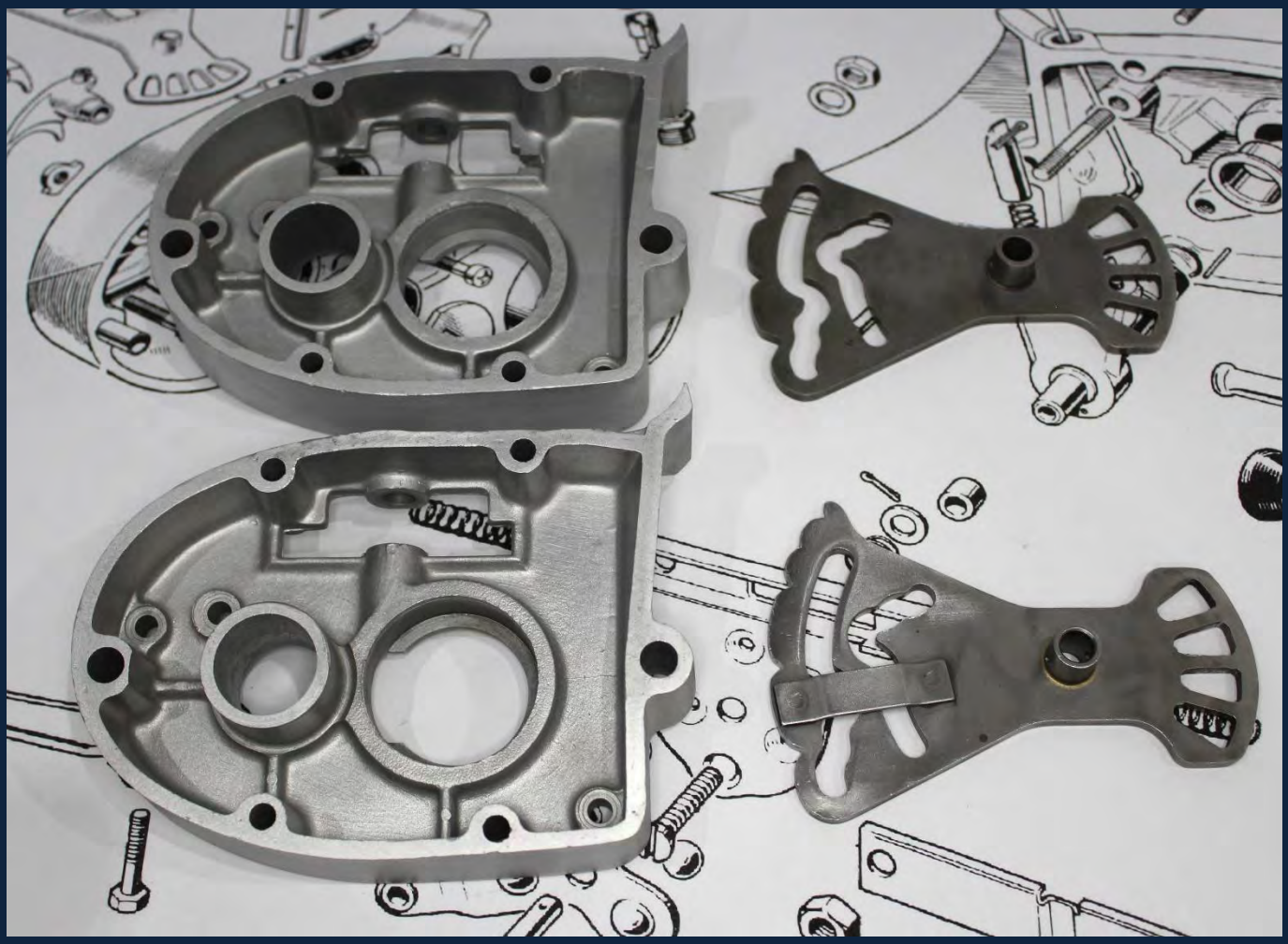
-7-

Service Bulletins for the Standard and Wide Ratio gearsets.

Two pages from a set of Tri-Cor Service Bulletins from the 8th July 1964 detailing the part numbers and number of gear teeth for both the standard and wide ratio gearboxes fitted to various models and the specific changes made for 1963 (H29733 to H32465).
An additional sheet No:8 covers Close Ratio gears.

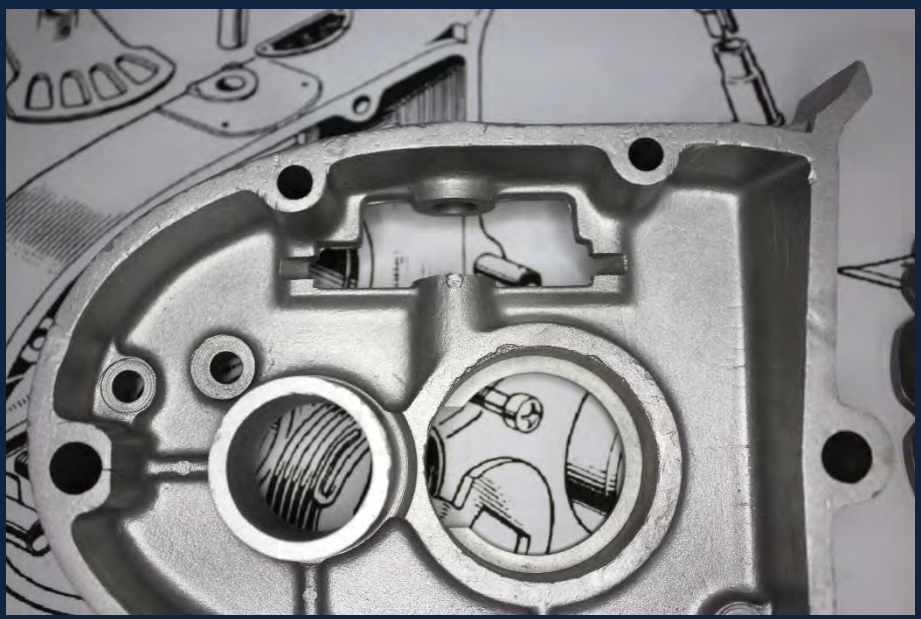
A composite image showing the different gear types.

Gearbox Parts



Early intermediate cover and quadrant (top), later below.

As we saw earlier (crankcase) there are gradual improvements to strengthen the gearbox and improve parts. There are some slight differences between the early gearbox inner cover and the later one though the part number remains the same (T1449). If replacing the quadrant or seeking greater reliability always fit the improved later bridged quadrant T1768 shown above.



Detail of the early gearbox intermediate cover.

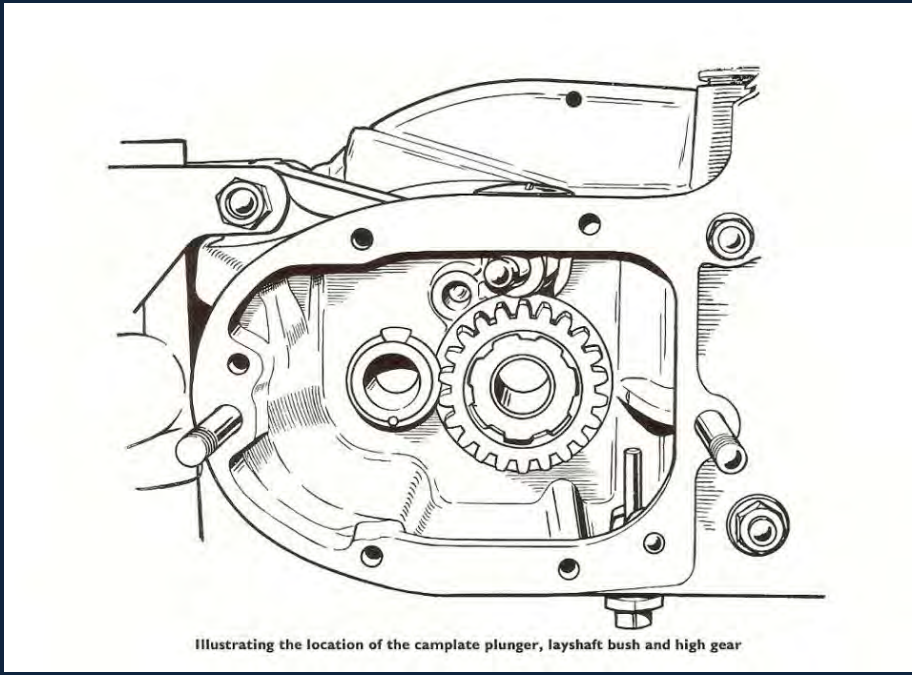
Gearbox

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.

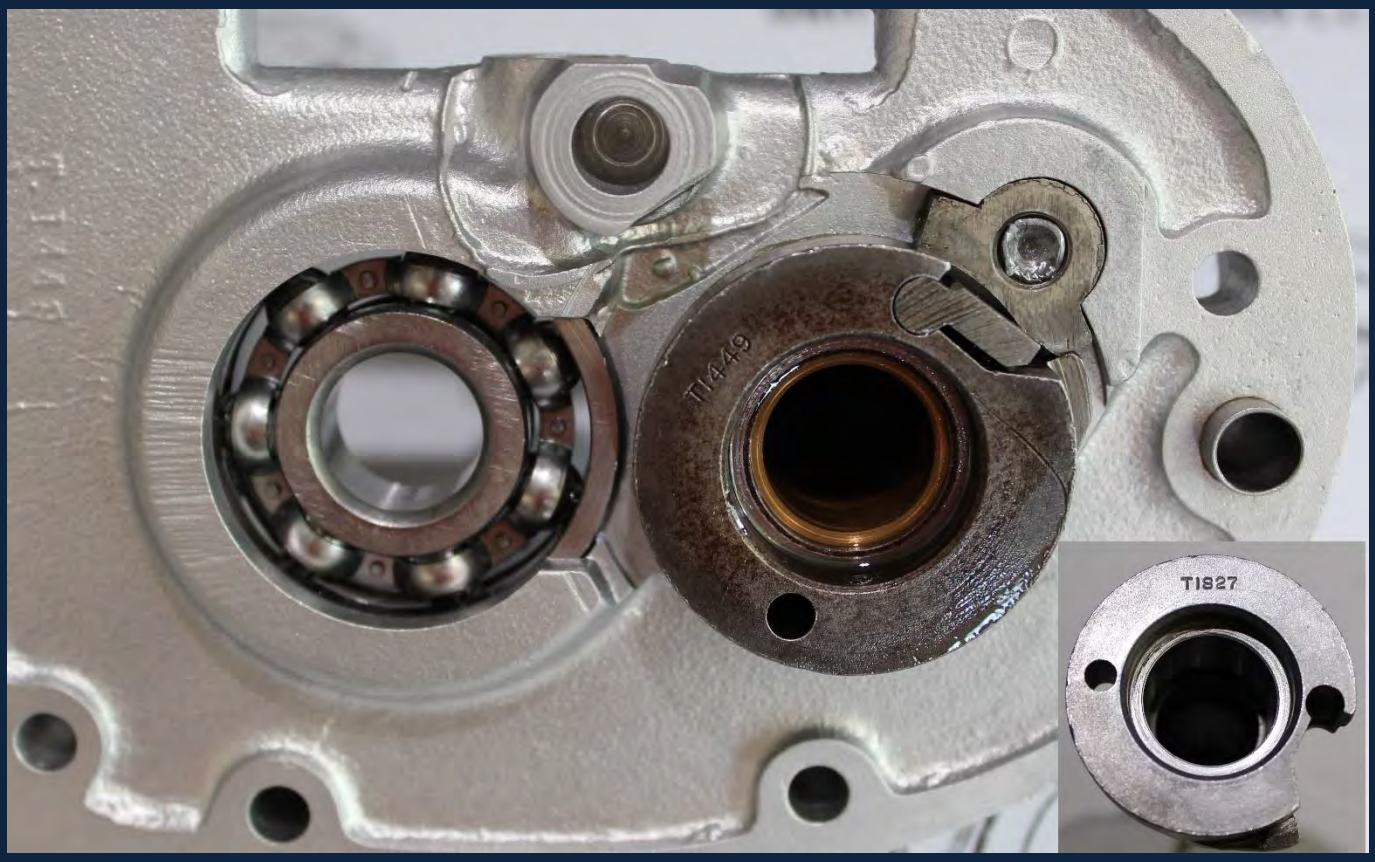
Removal and fitting of the Layshaft Bush or the more common needle roller bearing should be done while the cases are hot.
Make up the drift suggested in Section D9 or alternatively use a front wheel spindle to drive the bearing squarely.
The needle roller bearing must be almost flush with the back of the gearbox when it is fitted.
It may be necessary to ream the layshaft bush after it has been fitted, test fit the
layshaft before continuing with the gearbox assembly

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 Wellseal and bonded or fibre washers.



Illustrating the location of the camplate plunger, layshaft bush and high gear

Gearbox



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.

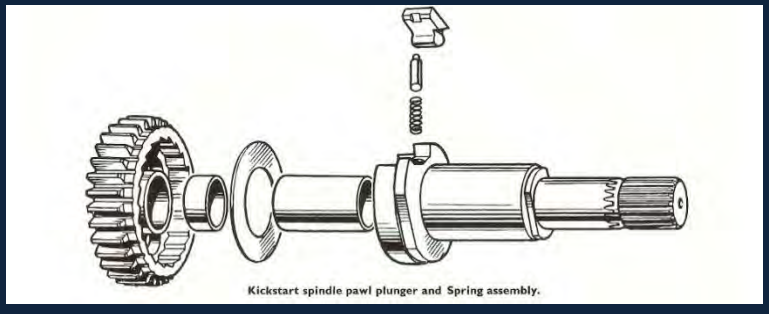
The kickstart spindle shown here is fitted with the bush and described in the parts book (No: 7) as part number T1445. You will note that the part number stamped on the spindle is T1449, while the part number for the kickstart spindle suitable for the T90/T100 needle roller bearing (pictured inset) is T1981 not T1827. Confusing!

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 kick-start 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.

Note: The difference in the Layshaft between the models ‘appears’ to be solely at the kick-start end where the shaft diameter is reduced to suit the needle roller bearing recessed into the kick-start gear. Refer to the parts books or the Triumph Technical Bulletin 3 for details.


Kickstart spindle pawl plunger and Spring assembly.

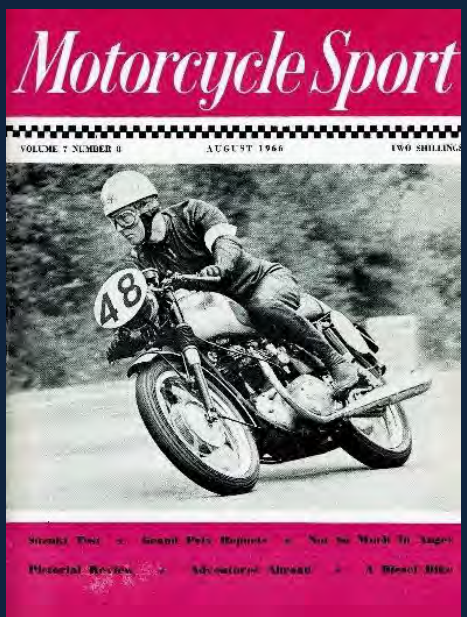
Gearbox

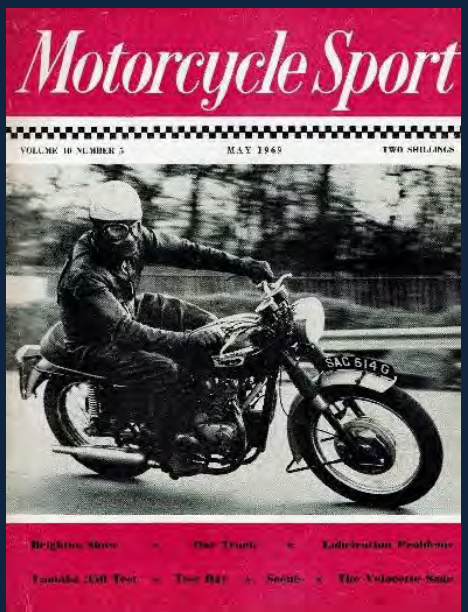
Thrust Washer and Layshaft 1st gear fitted.

Fit the thrust washer and then the gear, the ratchet described will recess once the shaft is home and the gear should turn freely. Note how the bush within the 1st gear is ‘peened’ to prevent it rotating independently of the gear.

The recess just above and to the left of the gear is the location for the shaft that carries the selector forks, check that the hole is clean and that the shaft fits snugly.

On the far left of the image is the part number for the inner cover T1449





Motorcycle Sport. A relatively rare magazine published from 1963. A discerning read.

Gearbox

The Mainshaft fitted and secured.

This is the gearbox intermediate cover from the other side showing the kick-start 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 of these 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.

If you are still struggling then use Stanley knife or box cutter blades and gently tap them into the gearbox joint at several points simultaneously, working gradually, while continuing to strike the gearbox cover with a hide or rubber mallet.

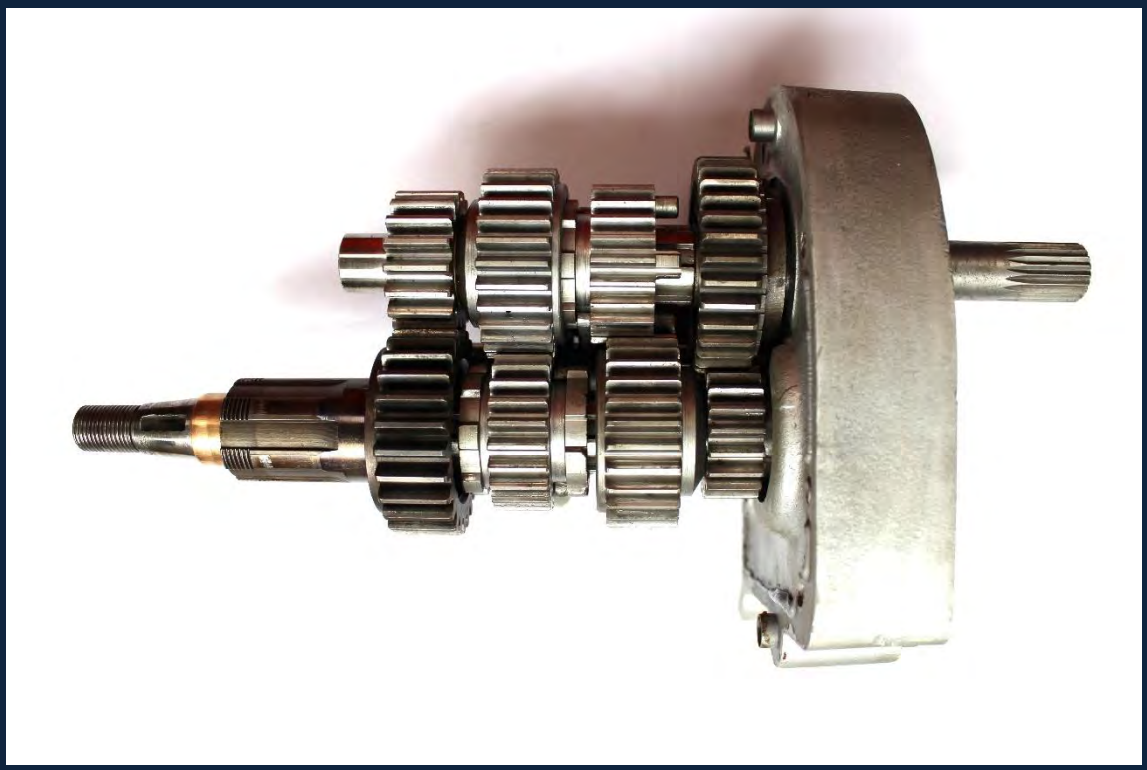
Use MEK (Methyl Ethyl Ketone) or Acetone to soften or remove old sealants.

The threads on the gearbox Mainshaft here are 9/16 20 TPI BSCY
Note that later Mainshafts are UNF threads and correspond with the general change to UNF/UNC threads from 1968.
(Illustrated later)

Gearbox

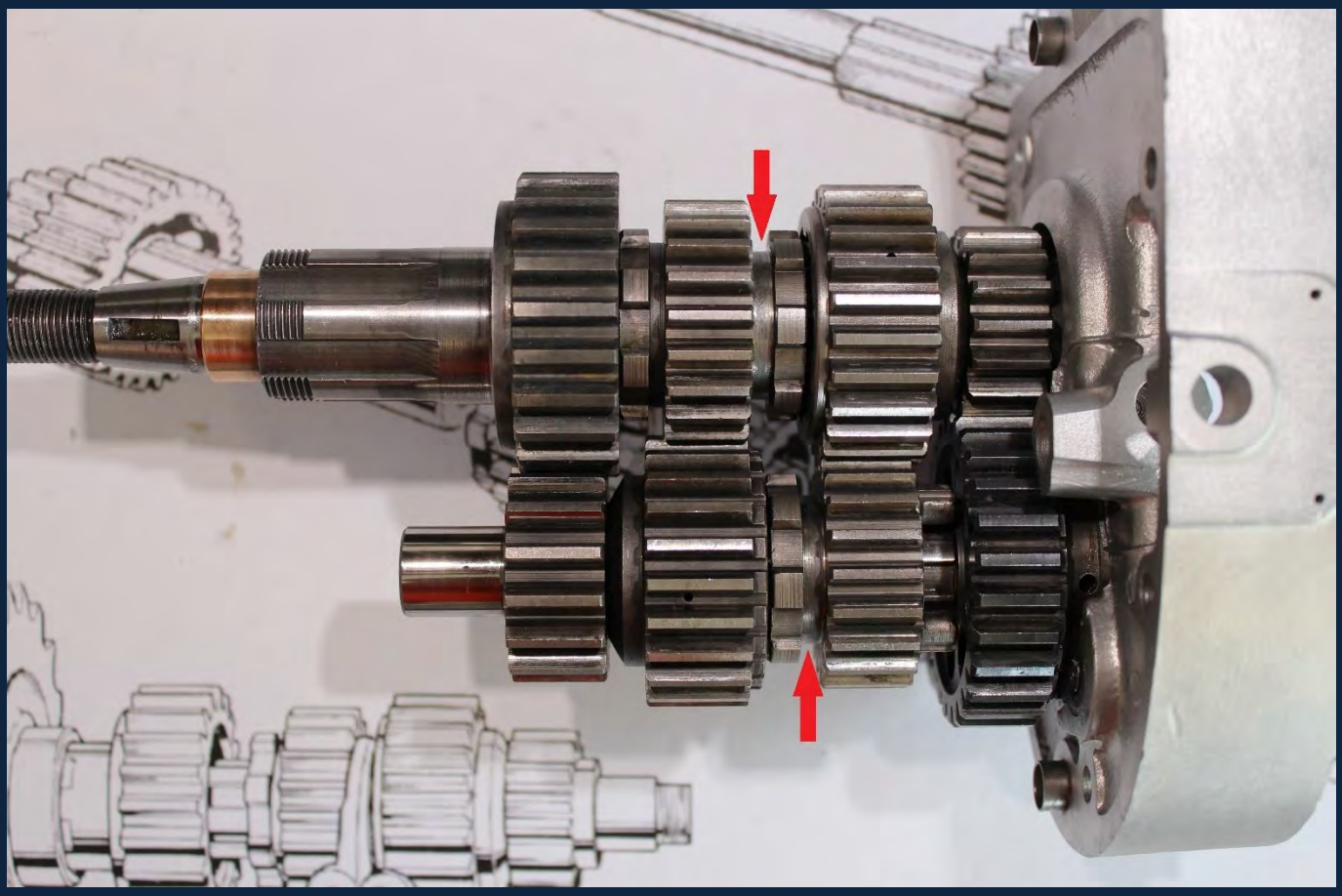
Mainshaft with First and Third Gears fitted.

The First Gear cluster is pressed onto to the Mainshaft while the Third 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.



From below an early (fine tooth) standard gear cassette showing the arrangement of the gears in neutral. A new bush has been pressed into the high gear and everything is being checked for fit and selection.

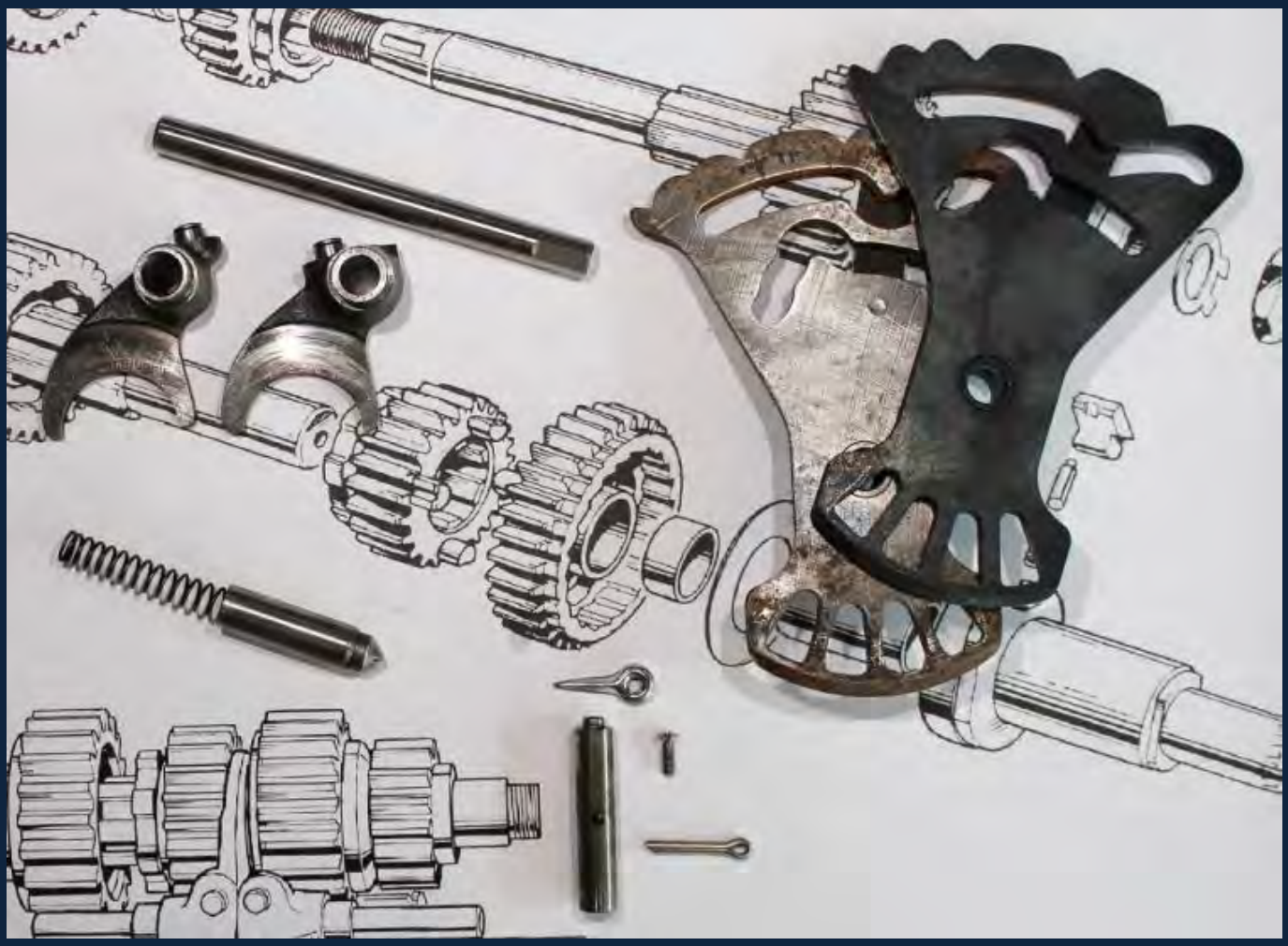
Gearbox



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.

Locations for the plunger and selector Shaft.

Gearbox



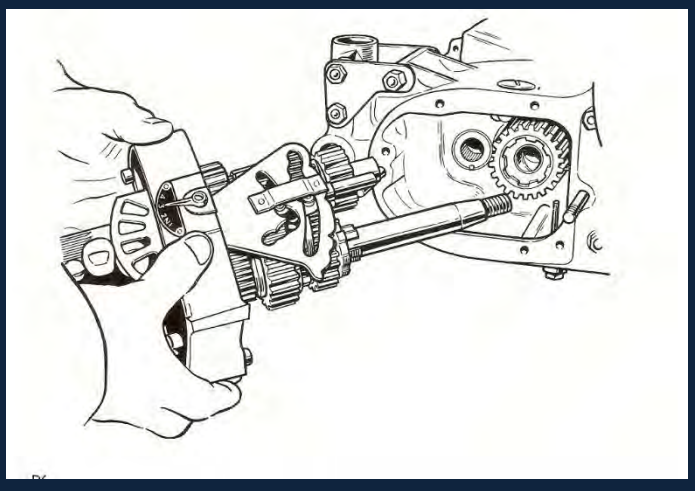
The Selector Forks and parts.

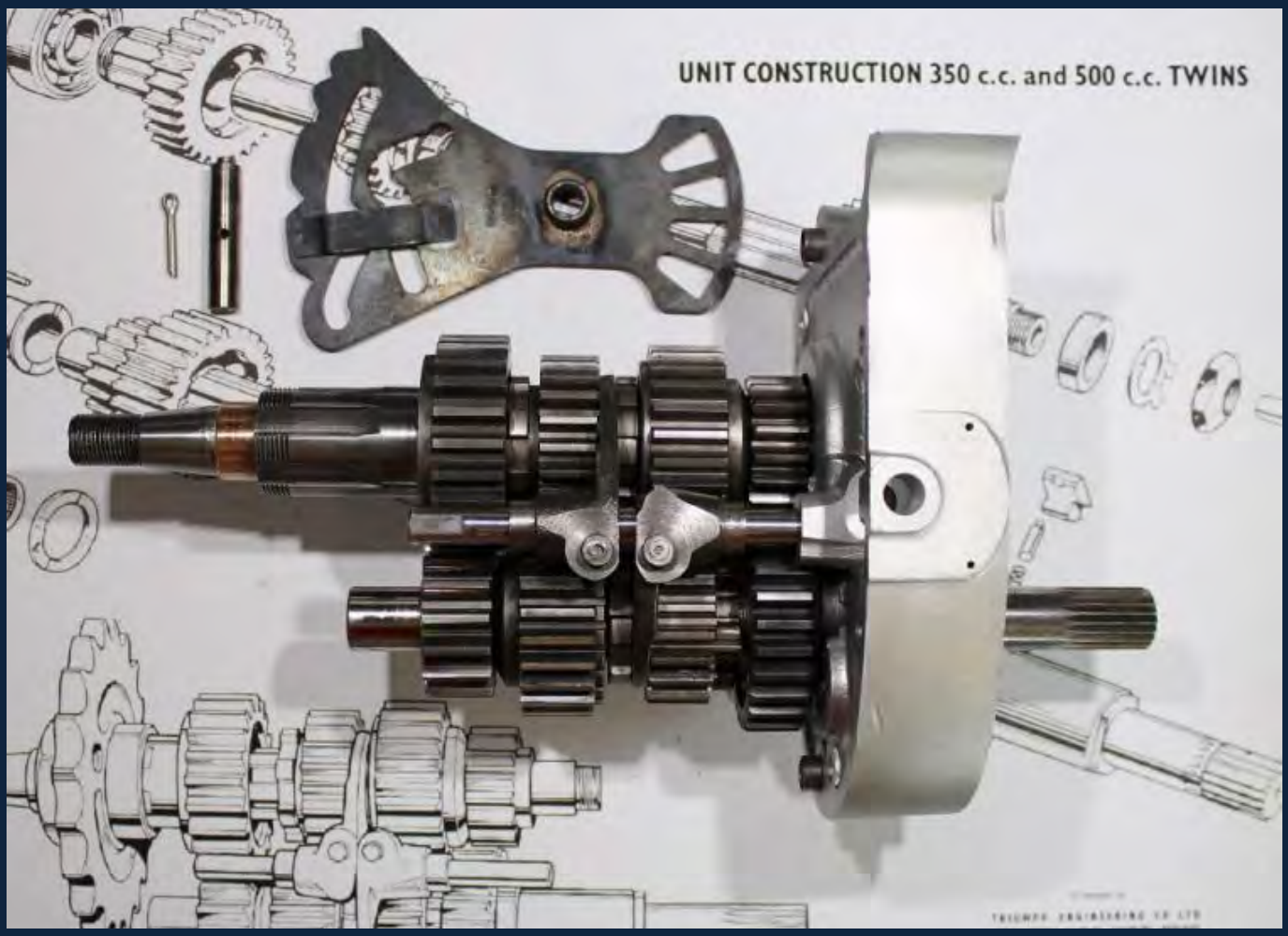
The selector forks, their shaft, the plunger and spring and the spindle for the quadrant with its split pin, pointer and screw. The original quadrant above was badly worn. Both quadrants are of the improved T1768 type with the bridging piece.

Examine the indexing plunger for wear, check that the spring is in good condition and that the plunger retracts and extends smoothly in its housing. The gear change can be optimised by dressing and polishing the track and indentations for the plunger in the quadrant seen at the top of the picture.

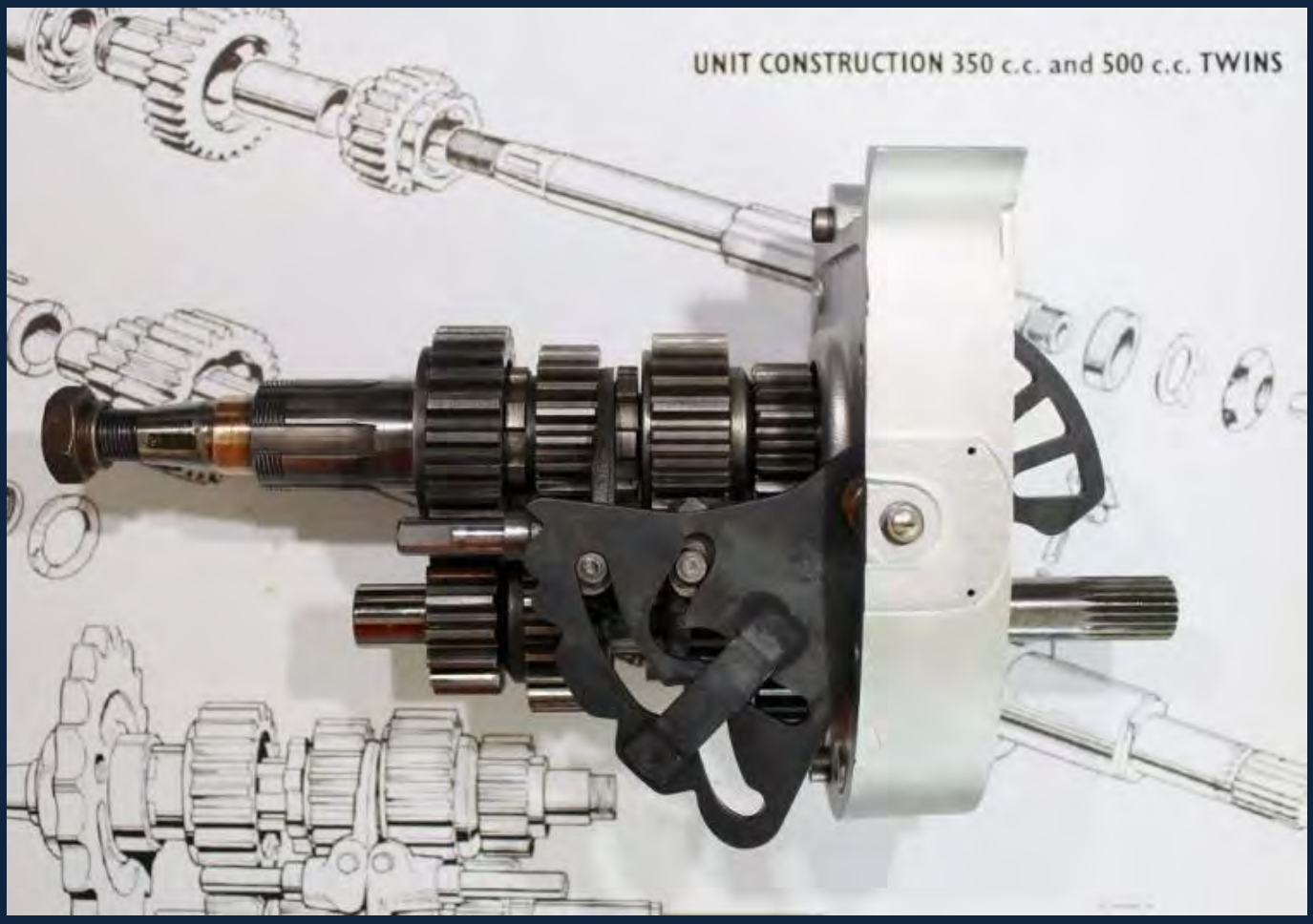
Check the selector forks are undamaged and that the small bearings that run in the tracks of the quadrant are free to turn and oiled. When selecting a split pin for the shaft choose one that fits snugly, don't worry about it being too long, it can be cut to length.

Assembly of the gear cassette can be achieved with the quadrant in place if the selector shaft is fitted last or alternatively removed first when dismantling. On early engines it may not be possible to release the selector shaft from the gearbox and the selector forks will have to be coaxed onto it as the cassette is installed.

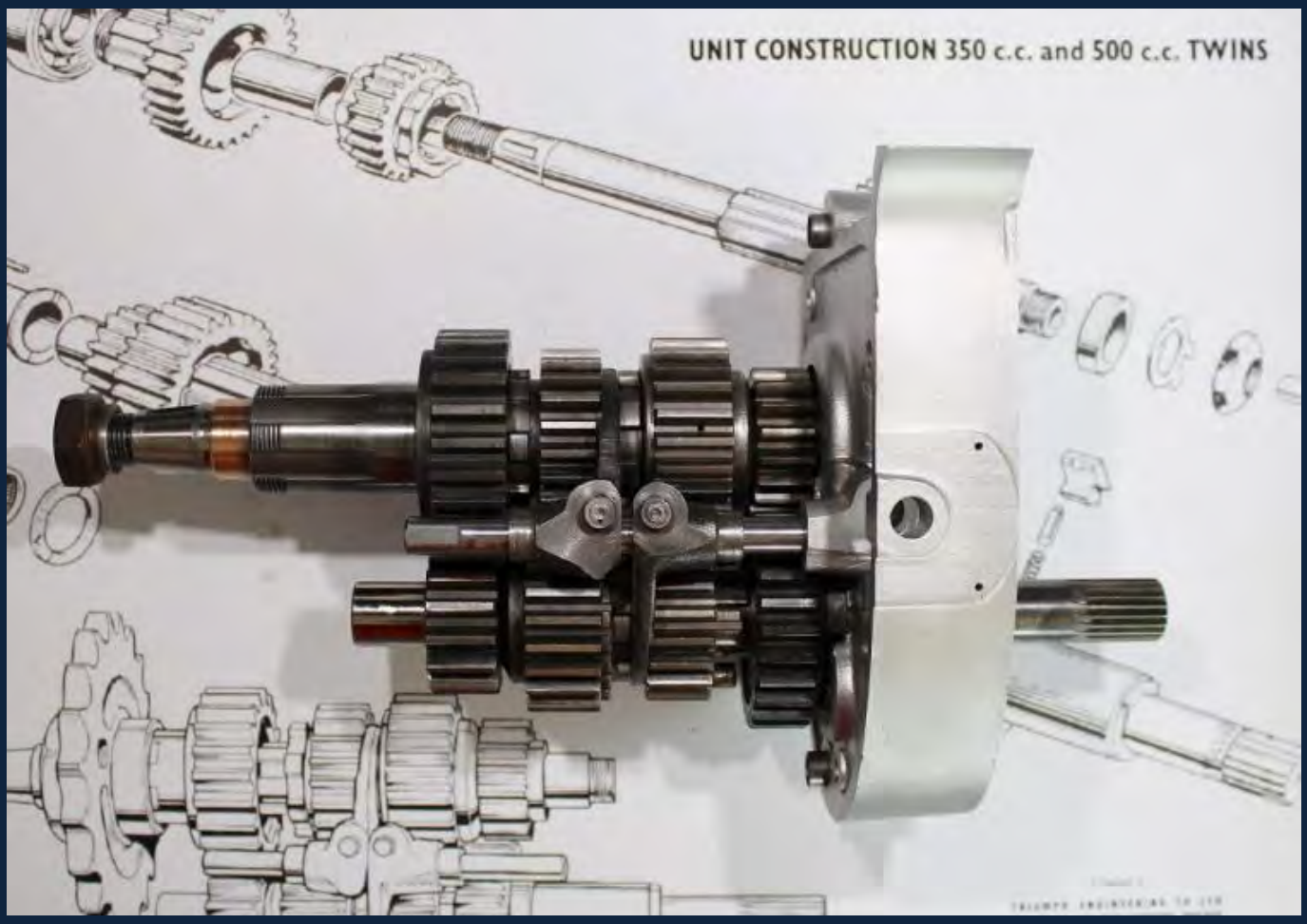




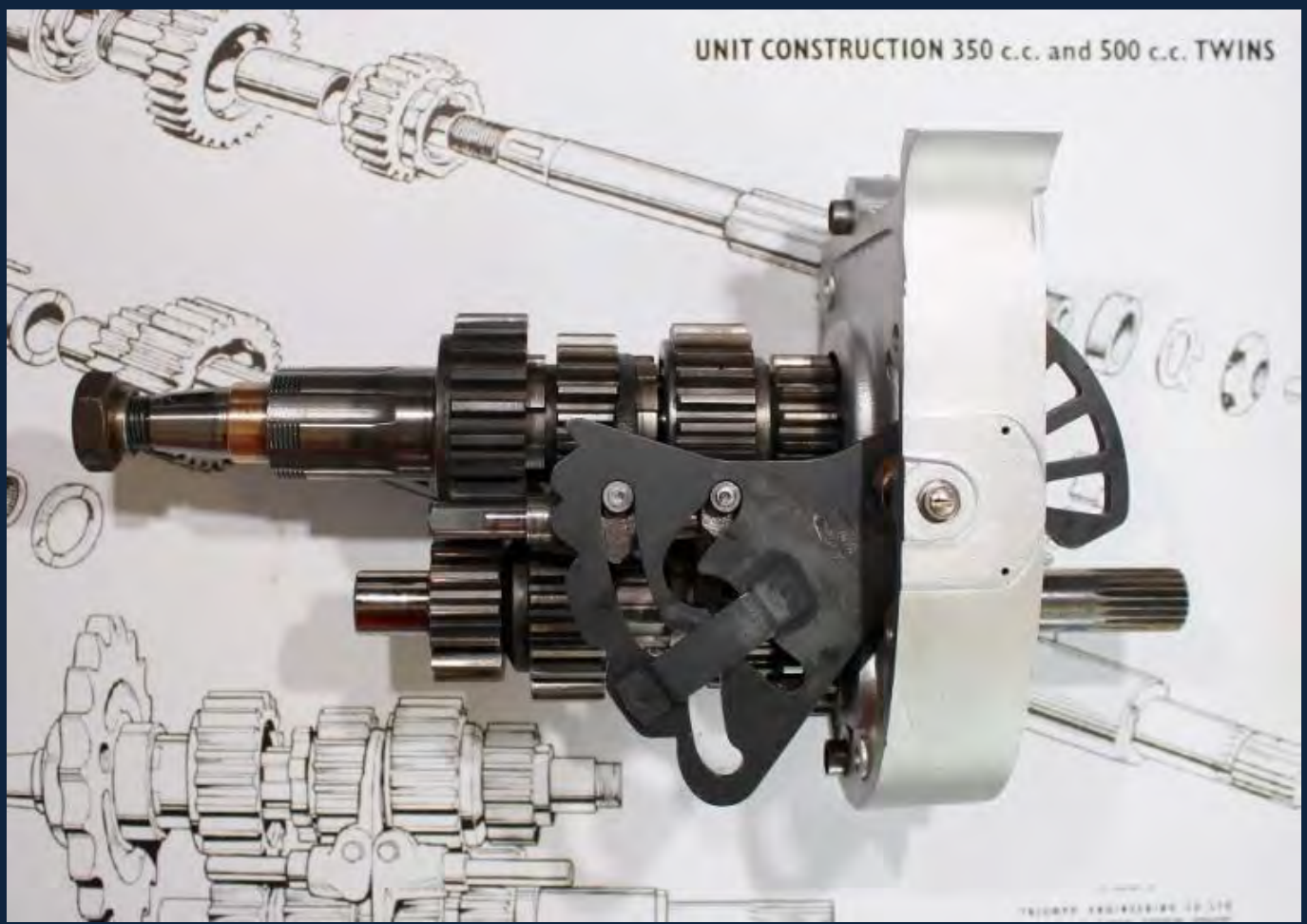
Incorrect assembly of the Selector Forks, compare to the illustration (left).



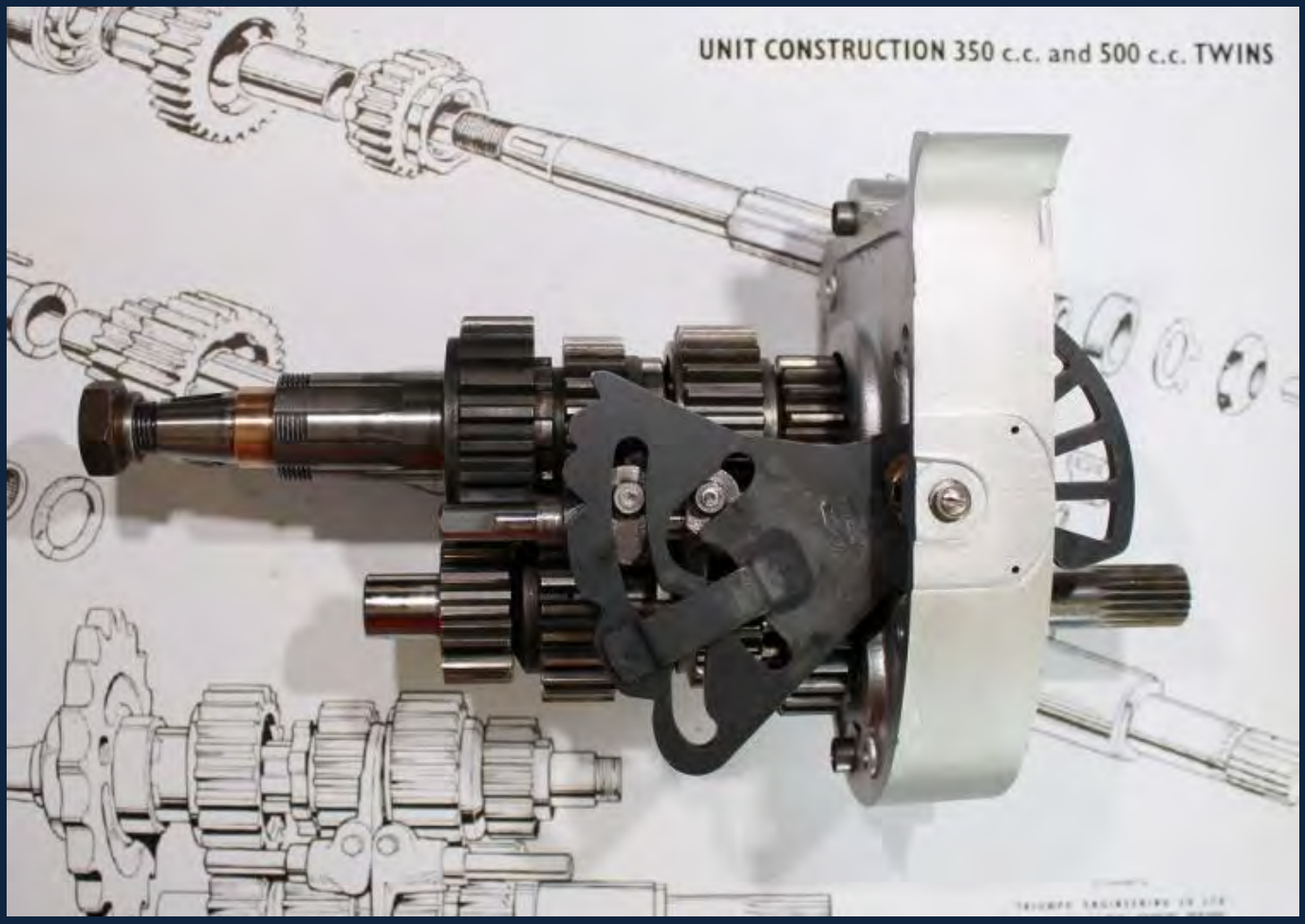
With incorrect assembly of the selector forks with the quadrant fitted, the gears will not select correctly.



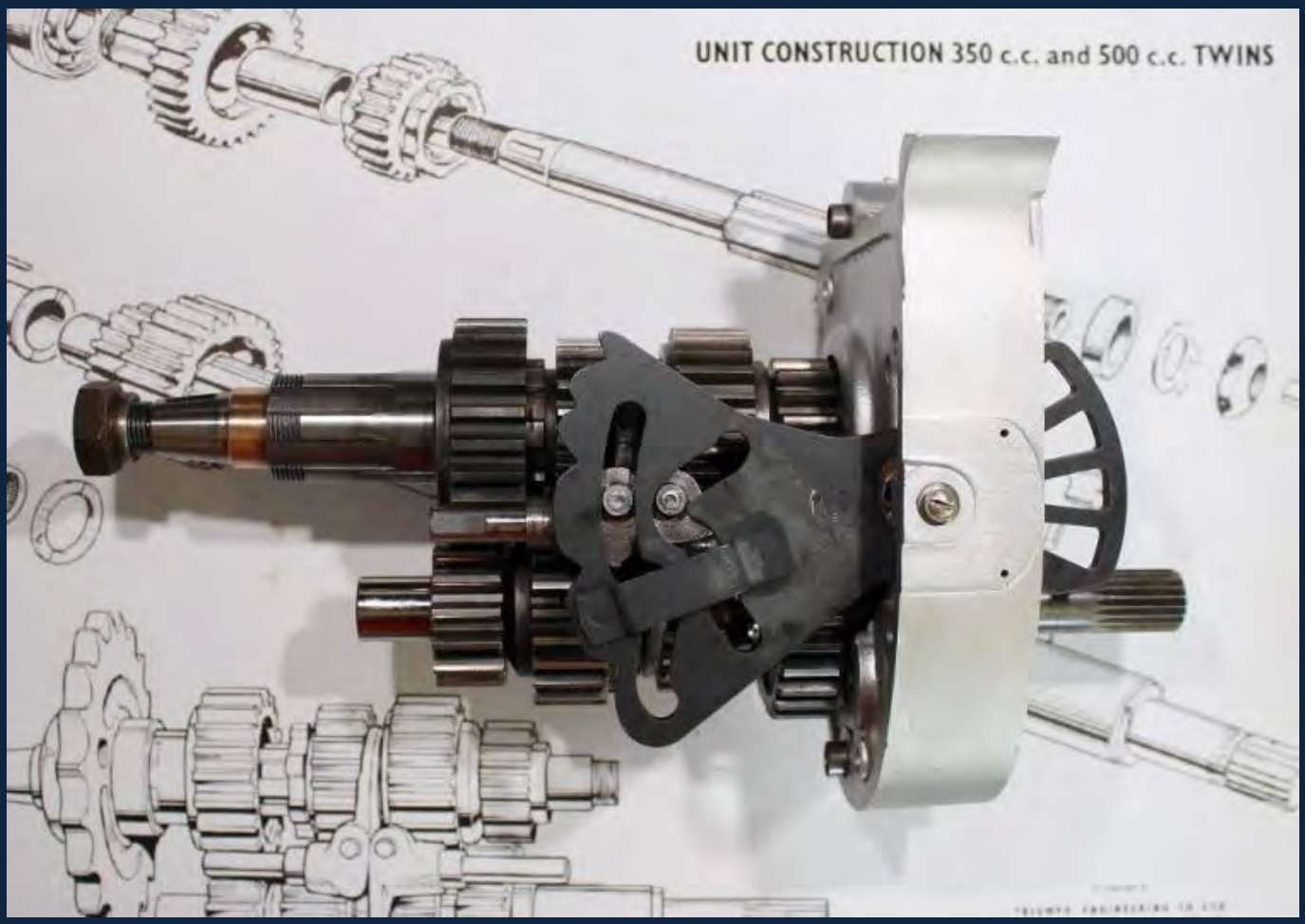
Correct assembly of the Selector Forks.
Once you are confident that the selector forks are correctly positioned; introduce the quadrant, locating the selector forks and then fit the spindle and its pin, spreading this so that it cannot come loose. Do not fit the pointer for the time being.



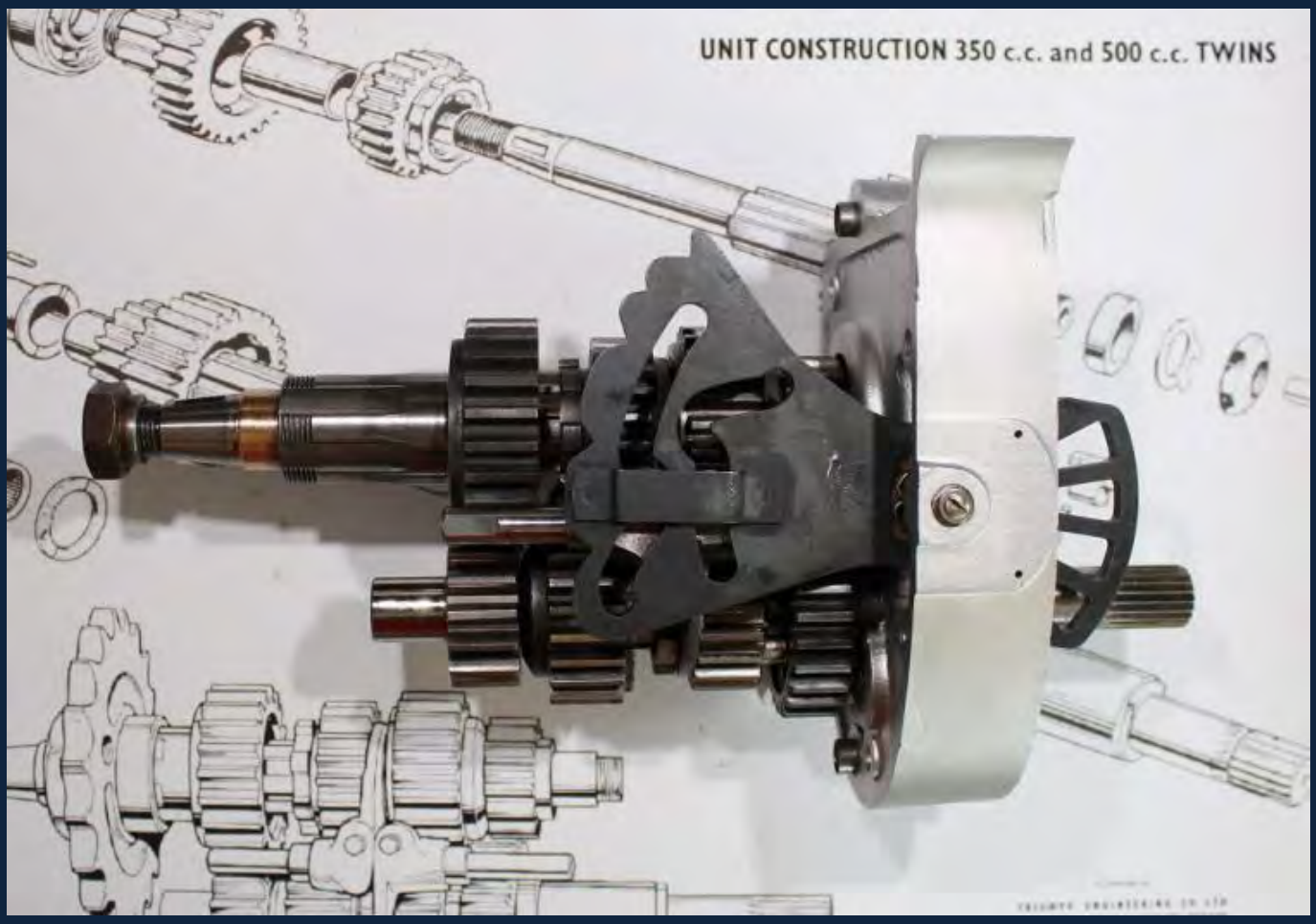
First Gear position.



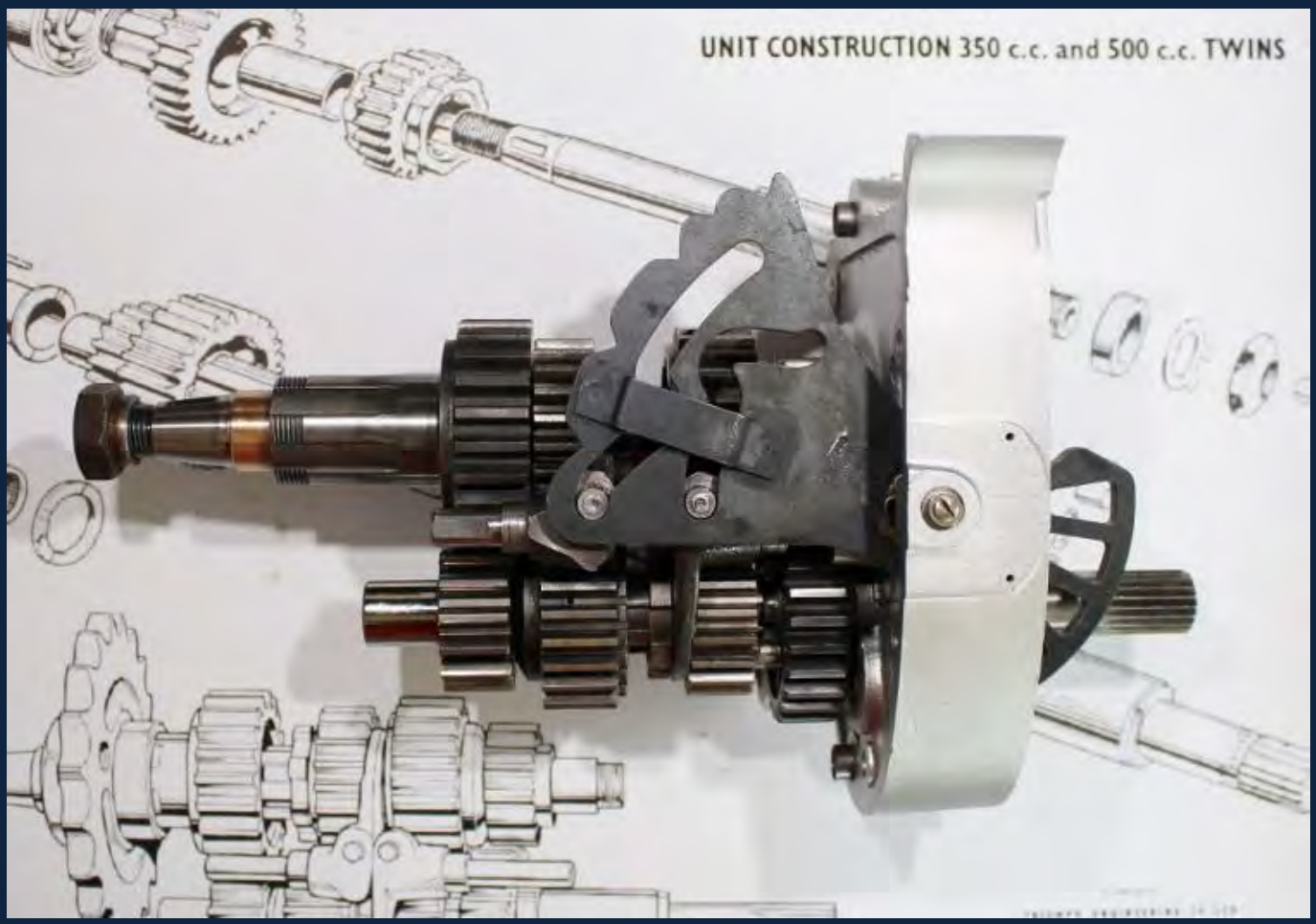
Neutral position.



Second Gear position.

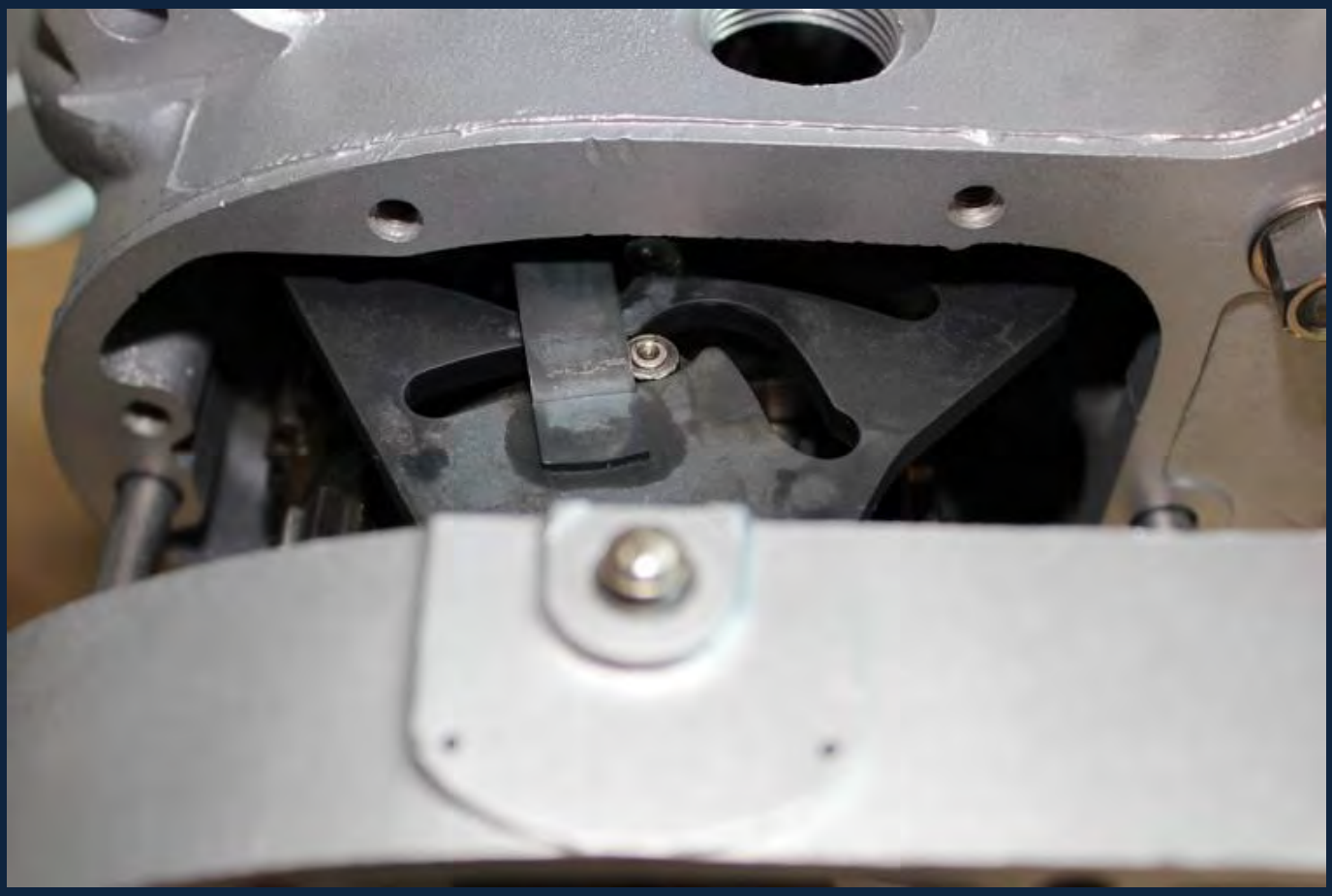


Third Gear position.



Fourth (high) Gear position.

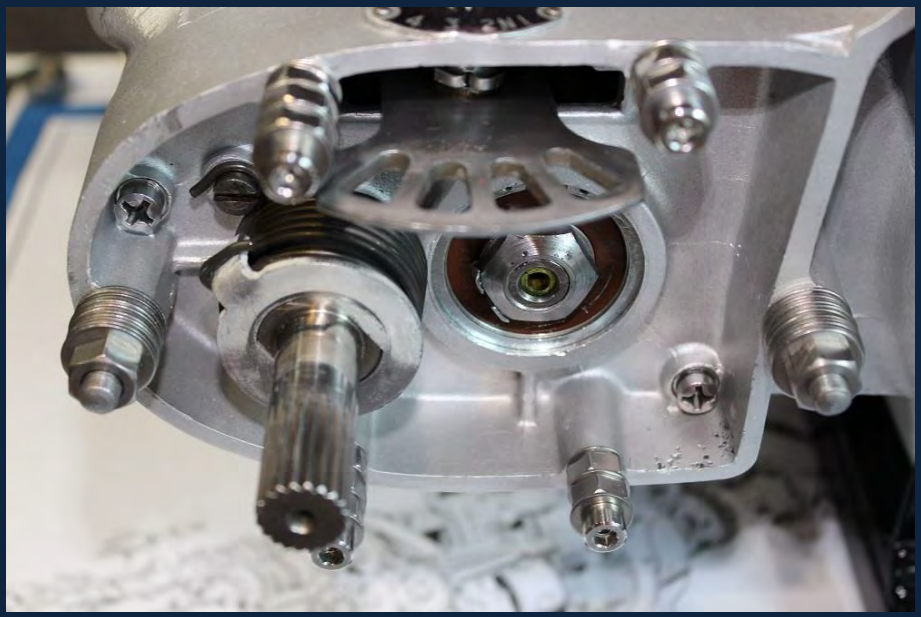
Fitting the Gear Assembly



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, then 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.



Holding the inner cover in place while the sealant sets, alternatively fit the outer cover even if only temporarily.

Gearbox Inner Cover Fitted

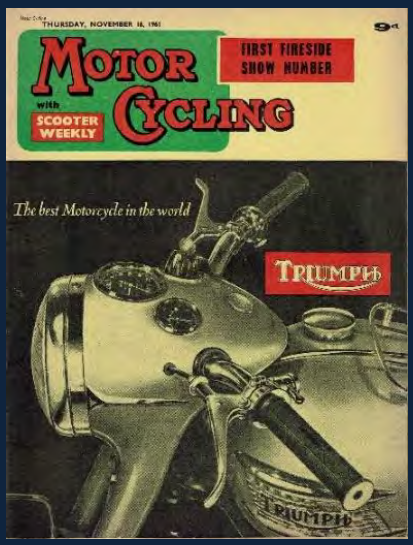
Here the inner cover is fully home and the two internal screws have been fitted.
(On the far right is the stud for the oil feed and return pipe junction block).

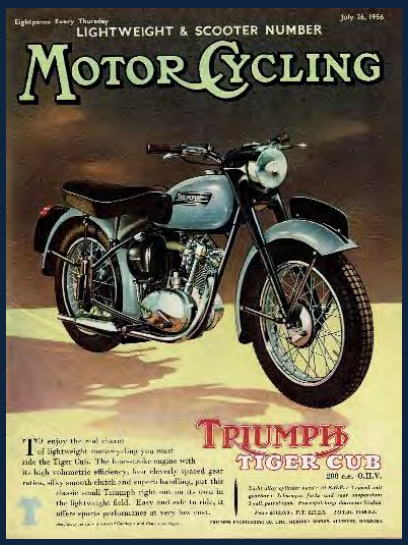
Not fitted yet is the kickstart distance piece T1464, the spring T1441 or the return spring plate T1422

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 (quadrant fully left) before attempting to tighten the nut as you risk damage to the gears and shafts if any of the other gears are selected for this operation.

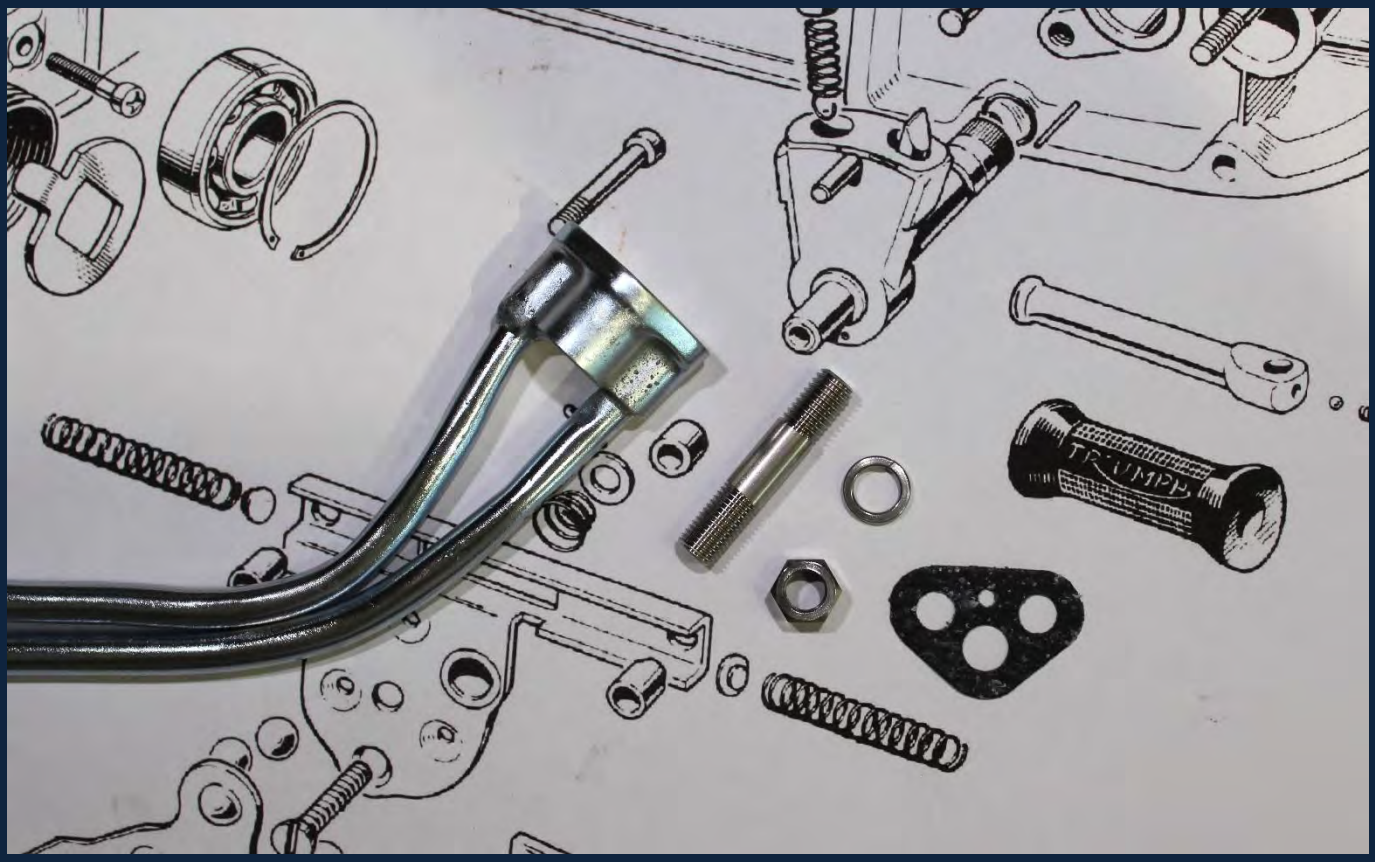
Suggested torque for the gearbox nut is 40 lb/ft.





Motor Cycling Magazine. Published weekly from 1909

The Oil Pipes



The oil pipes, gasket, stud, washer and nut. (5/16 slim-nut).

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. Heat them first with a blowtorch or a hot air gun to make the metal workable; apply controlled pressure preferably with a pipe bending tool or vice so that you do not introduce restrictions or damage the brazed the joint at the junction block.

If you did not remove the oil pipe stud earlier, do so now; clean the threads and apply stud lock. (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 loose and tighten carefully as you risk stripping the thread.

Top Tip… Test the oil pipes carefully for leaks before fitting and test fit the gasket to ensure that it cannot block the oil ways. Check that there is access to the nut with a socket or box spanner as once the gearbox outer cover is in place leaks from the pipe junction are difficult to cure if the nut cannot be reached.

A Warning… Do not omit or substitute the gasket with one made of thicker or inferior material, especially cork/rubber as the pressure pulses from the pump are high enough to burst the gasket and rapid oil loss or starvation will occur. “Wellseal” is suitable as a sealant but never use Hermatite, Hylomar or a silicone sealant here!

Label the pipes “Feed” and “Return” so that they can be identified later, noting that the forward most pipe at the junction block (on unit engines) is the feed pipe from the oil tank. If you are fitting a spin-on or cartridge oil filter as an upgrade, connect this only to the return oil pipe.

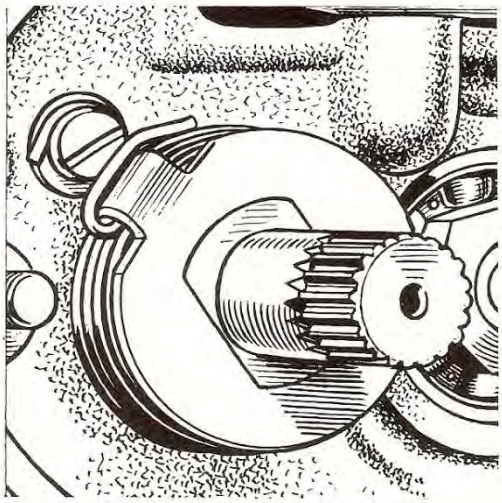
During initial running of the completed engine and for the first 100 miles check the oil pipes for leaks you will get very little warning of the pipes or the joint failing, but once you are confident that everything is ok, no further attention should be needed.

On Trials and Scrambles machines the oil pipes may require re-routing or modifying so that they are less exposed. On race machines frequently the section of the gearbox outer cover that covers the oil pipe junction is cut away; so that the junction and pipes are accessible.

Kickstart

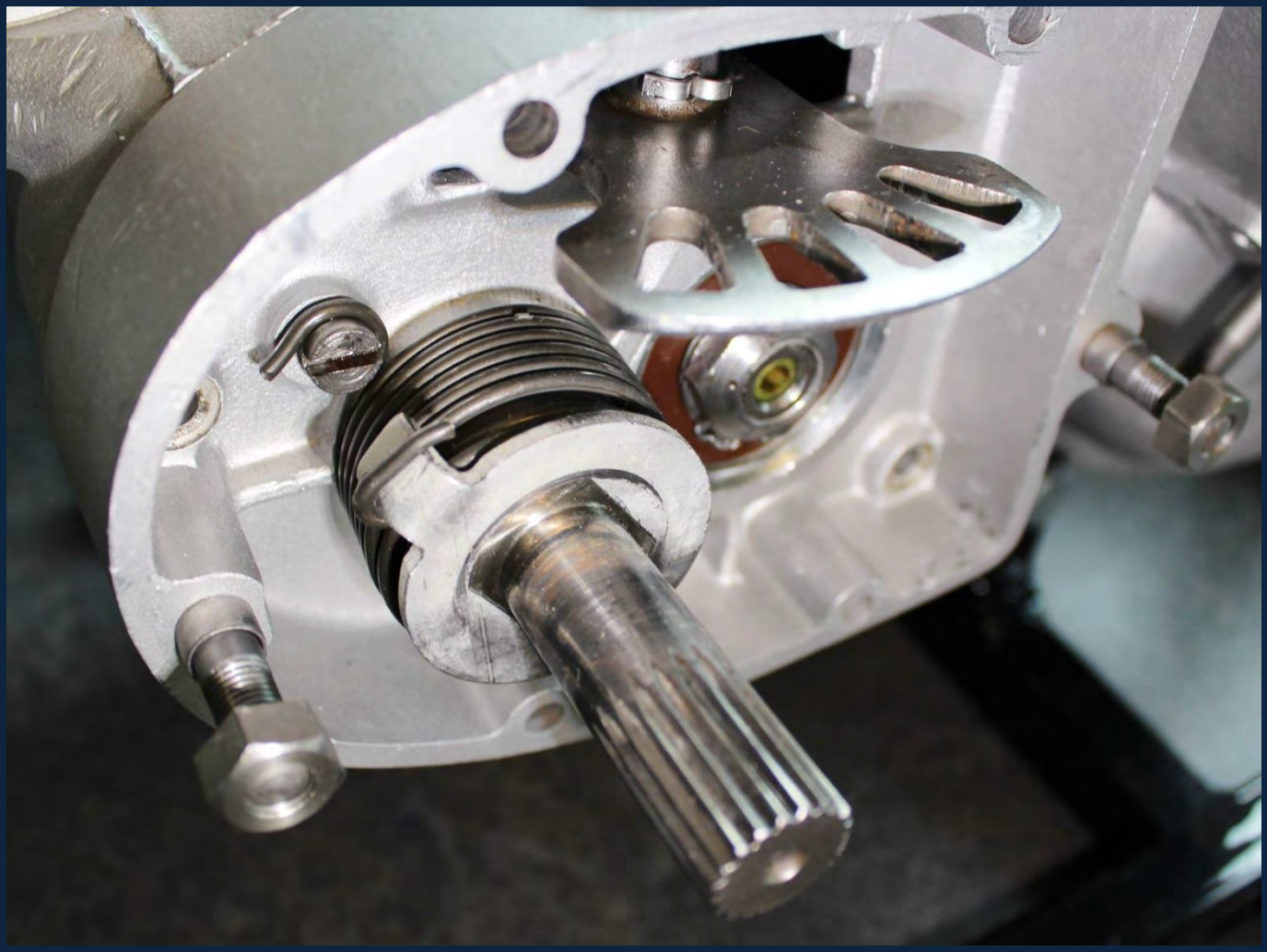
Fitting the kickstart spring.

Here the return spring, the distance piece and the spring plate have been 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.



Replace the distance piece over the kickstarter shaft, then secure the end of the kickstarter spring with the anchor screw. Use a screwdriver to tension the kickstarter spring and replace the return spring plate locating the hook on the spring with the lip on the return spring plate.

Kickstart



The kickstart spring fitted.

Here the gearbox studs have also been located and the nuts checked for fit before the outer cover is assembled.

This photograph is from a 1965 T90 engine that is being used as a test bed for build techniques and upgrades to improve the overall performance and especially oil tightness of the early engines. Here a sealed bearing has been substituted for the standard gearbox open bearing, the inner seal removed. The intention is to monitor the performance of this and other modifications in order to assist restorers.

Once you have reached this point move on to fitting the rear wheel and brake and the final drive sprocket clutch and alternator. The rear brake is needed to tighten several important engine fasteners.

Tip: Gearchanges can be made for now by inserting a bar through the holes of the quadrant and prizing it to either side you will need to turn the Mainshaft to get the gears to select correctly.

For illustration an early Mainshaft (to 1968) top, later below.

Gearbox Outer Cover

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 unit, 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 (annually) to clean and lubricate the assemblies.

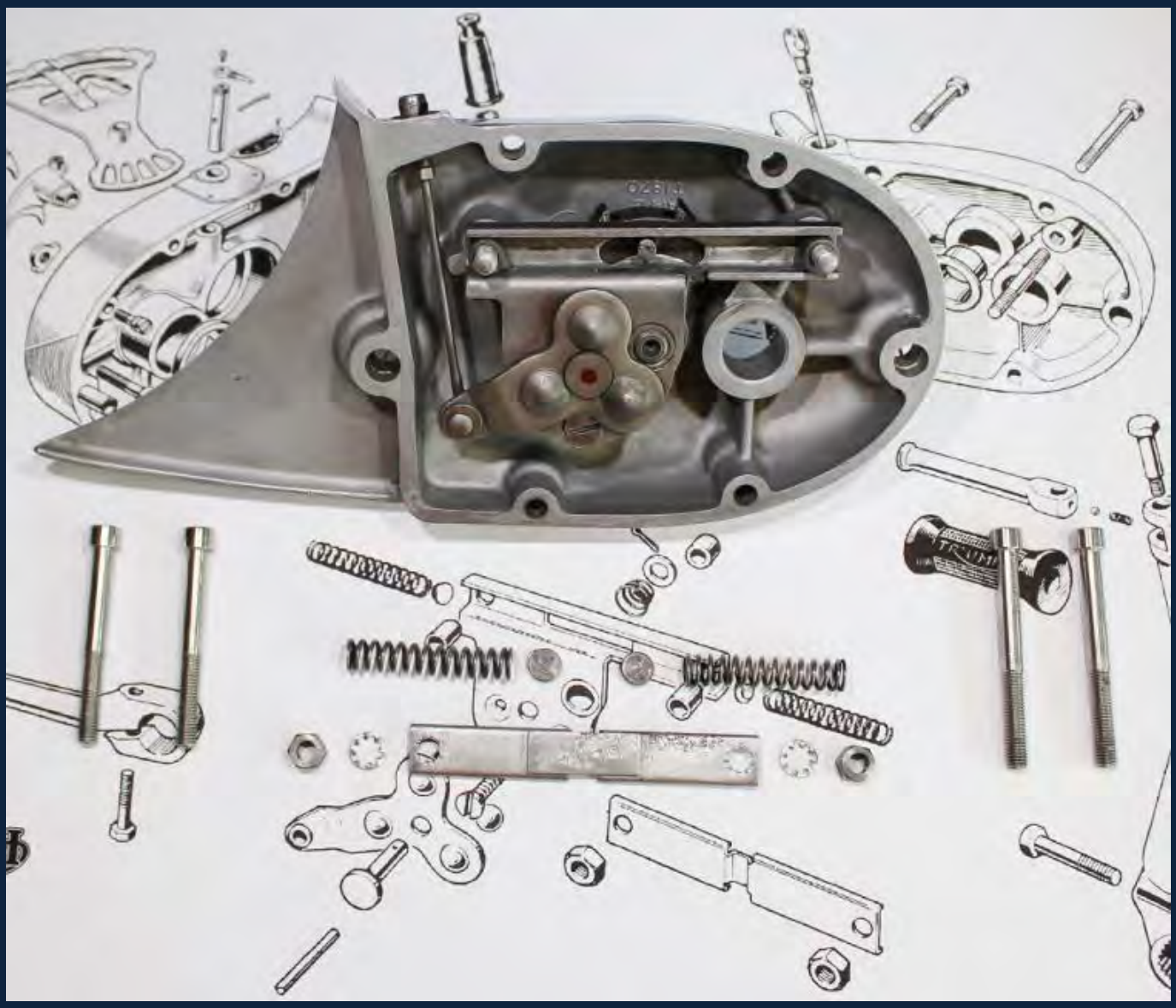
Check the selector operation. Small split pins hold the springs and pawls in position and you should note how these have been fitted before dismantling the unit. Look for wear on the pawls and to see if the springs are complete and in a serviceable condition. Also check the operation of the three-ball 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. The early cover is illustrated later.

Shown above is the clutch push rod, this is the one specific for the 3TA and restorers should note that there are several part numbers used for what visually is the same item. The push rods vary in length and correspond specifically with the clutch parts, but no lengths are given in the parts books.

The Part Number for this later cover is T1870.

Gearbox Outer Cover



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.

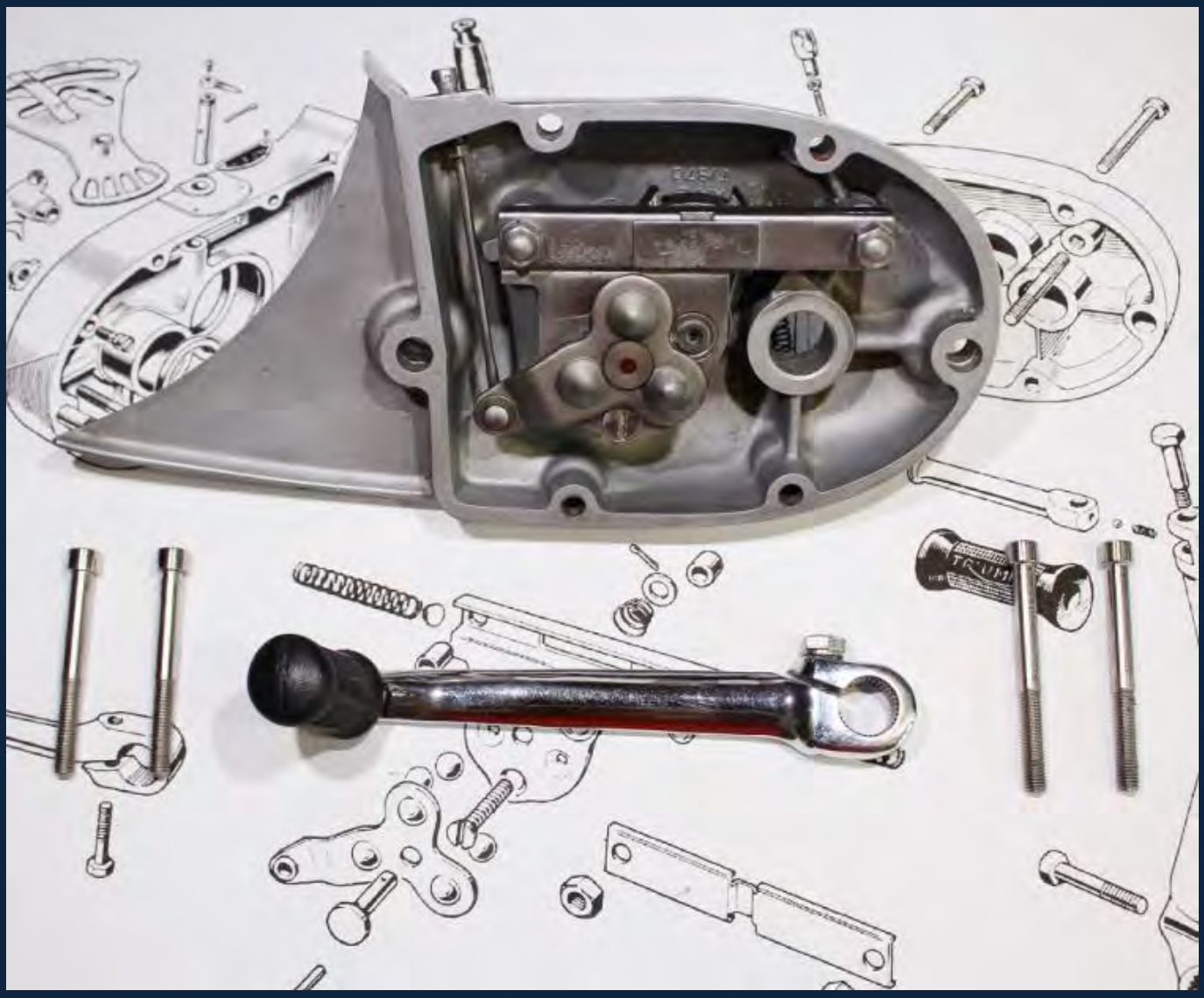
Fit the modified spoke for the clutch cable, adjusting the length so that the clutch cable can be fitted and removed easily noting that a degree of adjustment is available by unscrewing the nipple receiver and its lock nut.
Then offer up the clutch operating mechanism, wiggling it until it locates over 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 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. Poor clutch operation can often be traced to adjustment issues here in the gearbox outer cover or unwittingly, a worn, bent or incorrect clutch push rod has been fitted.

Tip: Seal the thread of the of the clutch cable abutment with PTFE tape or thread sealant to reduce the chance of water penetrating the gearbox.

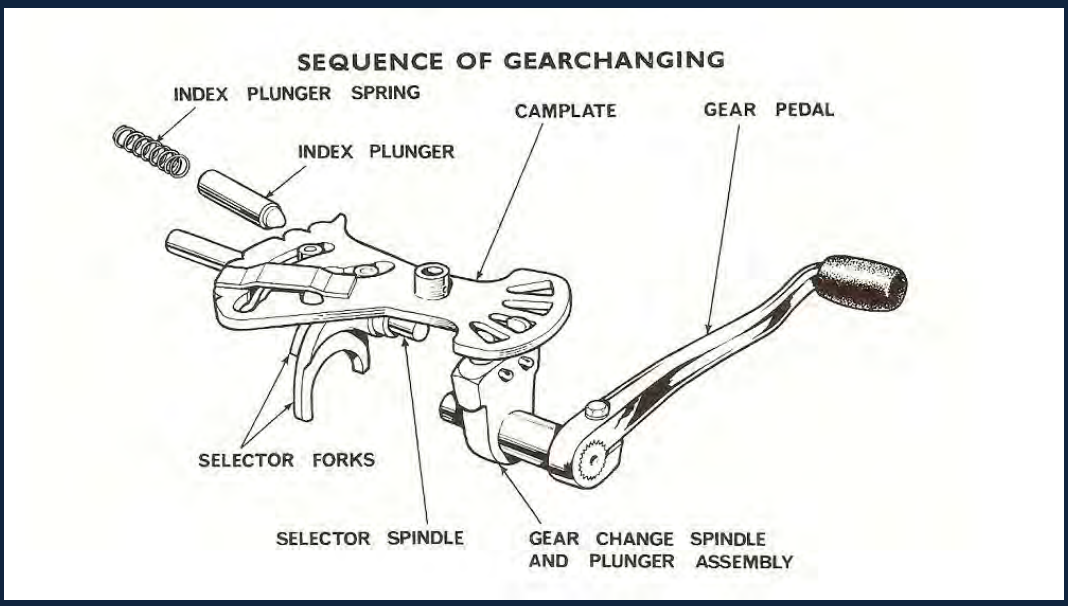
Gearbox Outer Cover



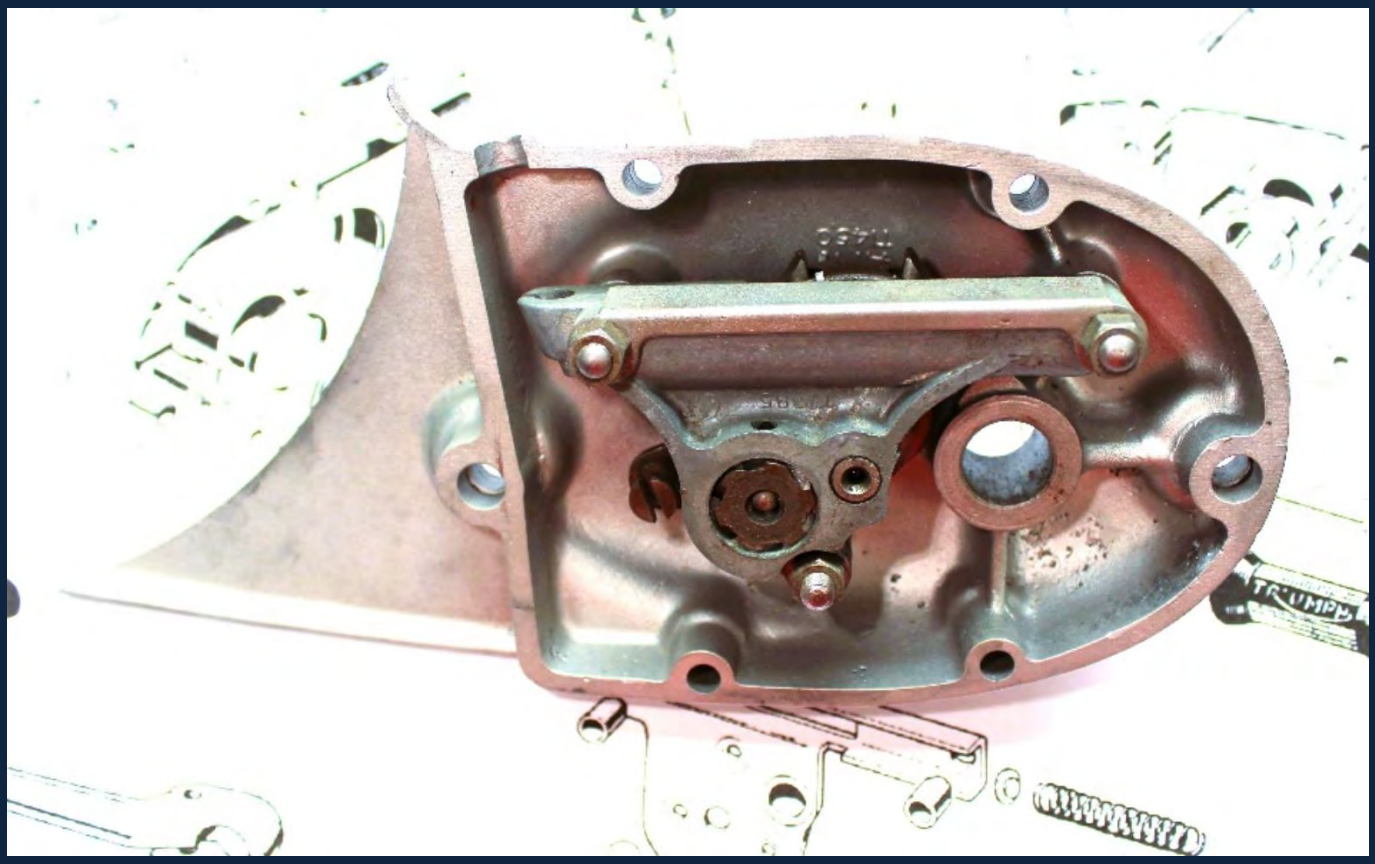
The completed gear selector and clutch release mechanism.

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.



Gearbox Outer Cover



The 1957 to 1962 Gearbox Cover assembly.

Shown above is the gearbox outer cover T1450 assembly used before 1962 across the range. The operating and assembly principles are exactly the same and it is likely that the parts are to a great extent interchangeable.

There is an intermediate cover T1637 that features the quick-change clutch cable parts and this cover is appropriate for only 1962 machines. Refer to Parts Book 4 pages 28/29

The spring holder for the return springs is an alloy casting and more durable than the later pressed version with the three-ball ramp and it is likely as described above that the change was made on cost grounds rather than for durability. As before the components suffer from corrosion due to the unsealed nature of the cover and periodically owners should remove it to clean, lubricate and check the components.

SECTION D1

REMOVING AND REPLACING THE GEARBOX OUTER COVER ASSEMBLY

Slacken the right exhaust pipe finned clip bolt, silencer clip bolt and remove the nut and bolt securing the lower bracket of the right exhaust pipe underneath the engine. Remove the right exhaust pipe by driving it in a forward direction with a hide mallet. Unscrew the right footrest securing nut and remove the footrest.

Slacken off the clutch cable adjustment at the handlebar and remove the slotted adaptor from the abutment at the gearbox. Unscrew the abutment and disconnect the cable from the clutch actuating spoke. Place a drip tray underneath the gearbox and unscrew the gearbox filler plug and drain plug.

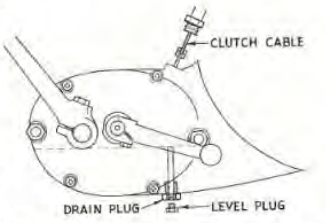


Fig. D2. Showing gearbox oil level and oil drain plugs

Engage fourth (top) gear. This will allow several otherwise difficult nuts to be unscrewed by subsequent application of the rear brake when required.

Unscrew the two nuts and four recessed screws from the periphery of the gearbox cover; remove the kickstarter lever. Grasp the footchange lever with the left hand, and holding a hide mallet in the right hand, tap the gearbox outer cover until it is withdrawn from the machine.

When the cover is removed, the gearchange mechanism and clutch operating mechanism will be accessible.

D3

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.

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 sprockets specified for the models, and shown in the data in the Works Manual and general specification sheets are selected to match the performance of the differing engine specifications used across the range and are a good starting point when choosing one for your restoration.

Many owners seek to ‘gear up’ by fitting a larger sprocket, note that on the lower performance engines a one tooth change represents a 6% increase and may be too much for a machine regularly used ‘two up’, off road, or in mountainous terrain.

Note on early machines the parts book does not show the lock washer though this can and should be fitted to prevent the nut coming loose. Fitting is described below.

Top Tip: Keep a clean but worn chain in your service toolkit, use it when changing drive chains on your bike. Once the split link is disconnected the service chain can be attached and the dirty chain drawn off for cleaning and maintenance as the rear wheel is rotated.
Use a traditional Chain Wax rather than oil.

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.

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.

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. The parts book shows a T piece associated with the oil tank vent! I also suggest threading the alternator wires through now while there is access, as this becomes increasingly difficult and messy later.

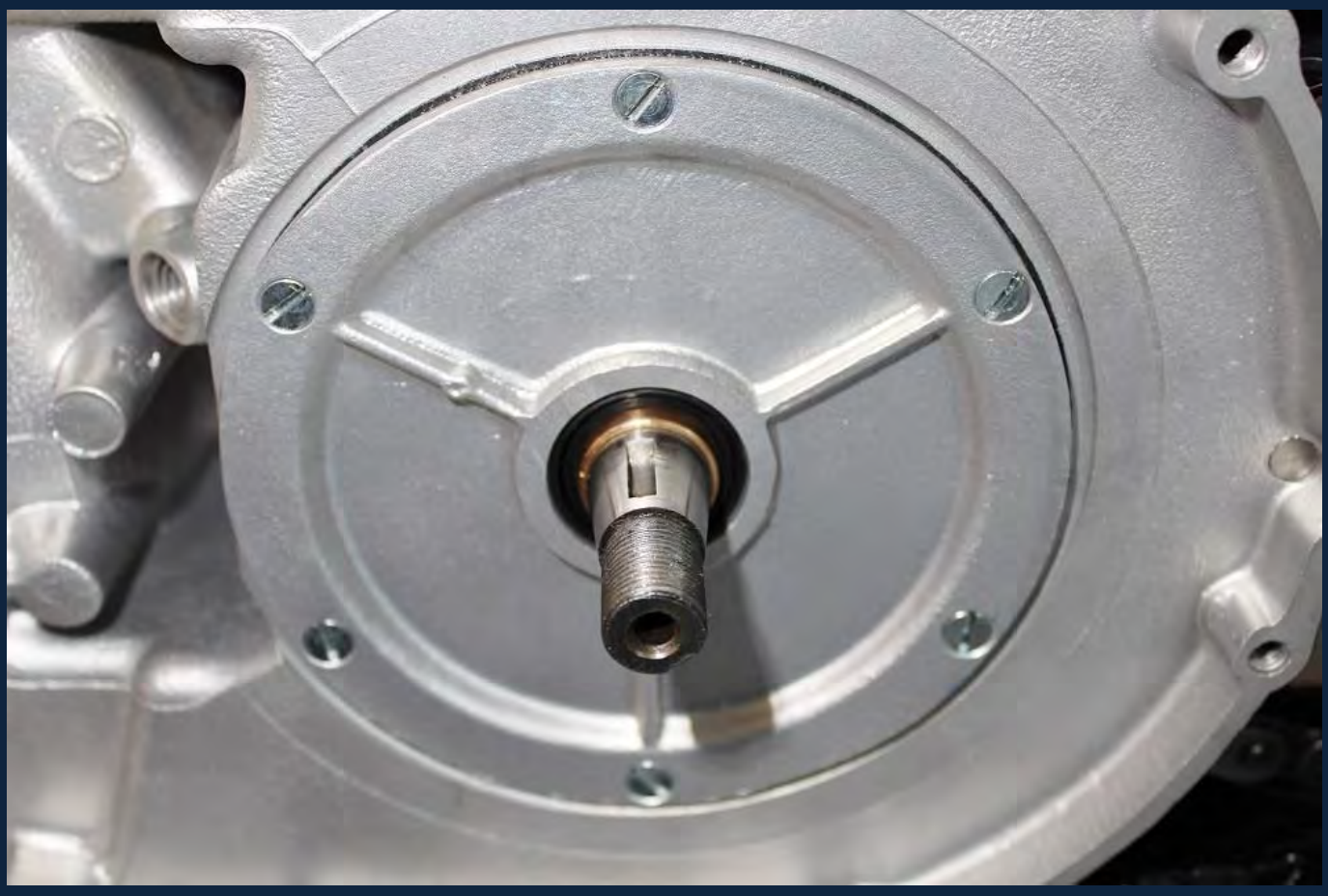
Apply some heavy grease to the splines and oil to the machined surface of the sprocket before fitting. Gearbox oil can/will leak along the splines if nothing is there to stop it!

The recommended 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.

Fitting the chain requires some dexterity as there is very little room to work especially if the chain guards 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 and tighten the nut fully, 50 lb/ft, though the manual does not specify a figure. Using Pipe Pliers or a Drift and gentle blows, fold over the lock washer in at least two positions so that the nut is secure.



The 1966 Access Plate and the blanked off Chain Oil Feed Quill.

The Cover Plate and Seal Fitted

Access Plate and Chain Oil Feed Quill for engines up to 1965.

For illustration this is the earlier arrangement of Access Plate and the Oil Feed Quill that are appropriate for most machines made up to 1965, the boss is shown but it is not pierced. The access plate for the early machines at least to 1961 do not show the boss, but all plates are effectively interchangeable. Note the cast part number.

On early machines the quill has a screwed in metering jet, similar to a pilot jet while later machines up to 1966 show a pressed in metering jet, ensure that these are clear but do not enlarge the hole as excessive oil loss from the primary case will occur. From 1966 and onwards chain oil is taken from the main oil tank and piped to the drop onto the chain near the rear sprocket from the brake torque stay.

Removing the access plate can present a number of problems, select long 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.

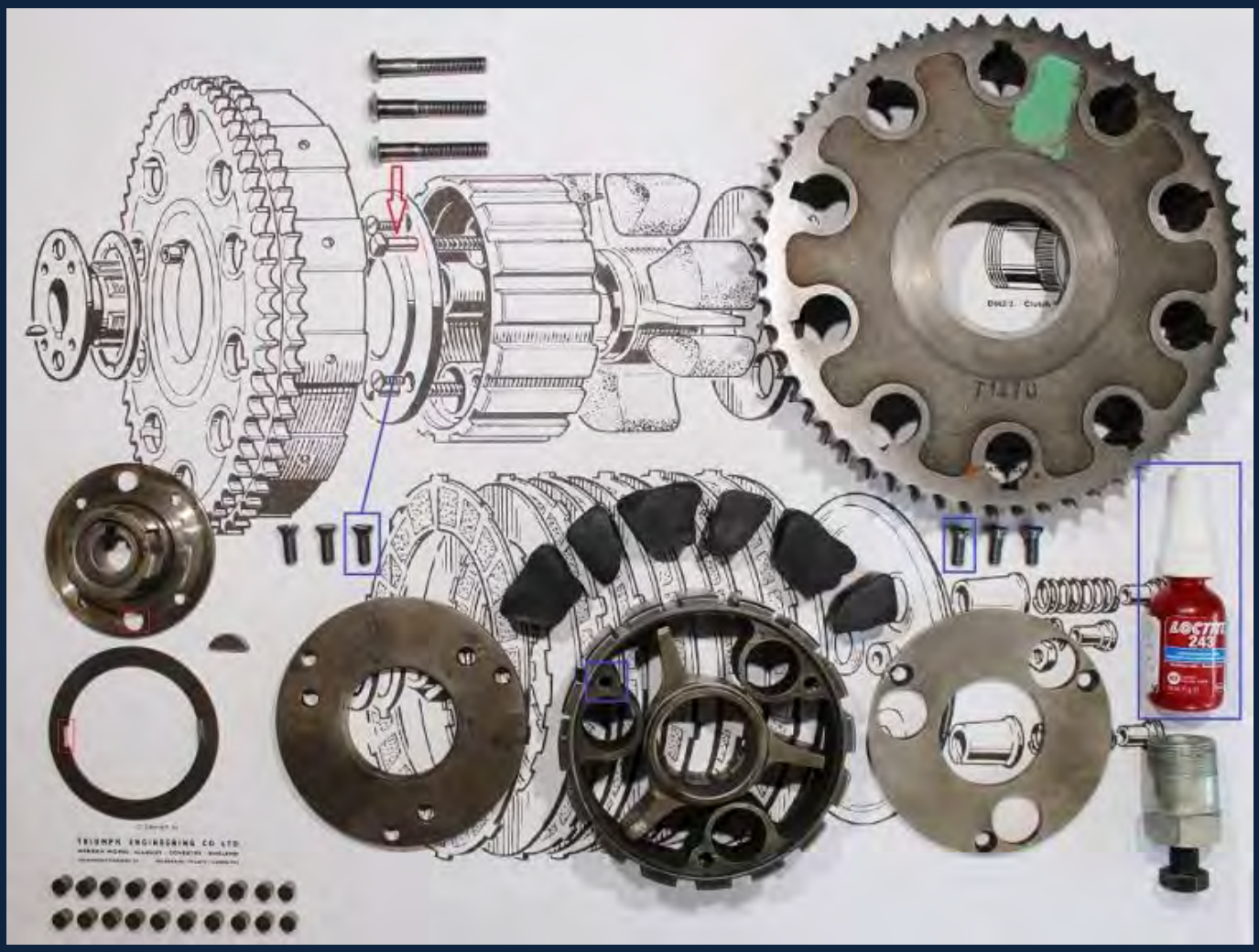
After removal carefully clean both surfaces of any remaining gasket or sealants. MEK or Acetone is suggested.

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 vice or G clamp. 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 covers above a small boss that extends as a spigot on the reverse can be seen, for a period of time during 1966 this was pierced with a minute hole to provide an oil mist for the chain, here it is or has been closed. This change appears to correspond with the blanking off of the chain oil feed quill. Frequently these plates show the part number E3789.

Part 8 Complete

The Clutch Assembly

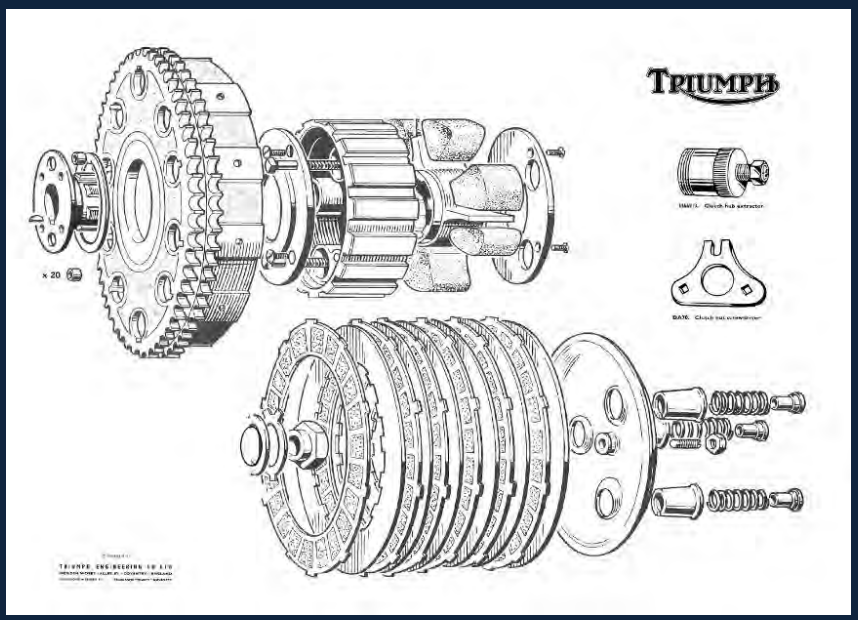


The Clutch Hub, Sprocket Housing and Shock Absorber.

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 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.



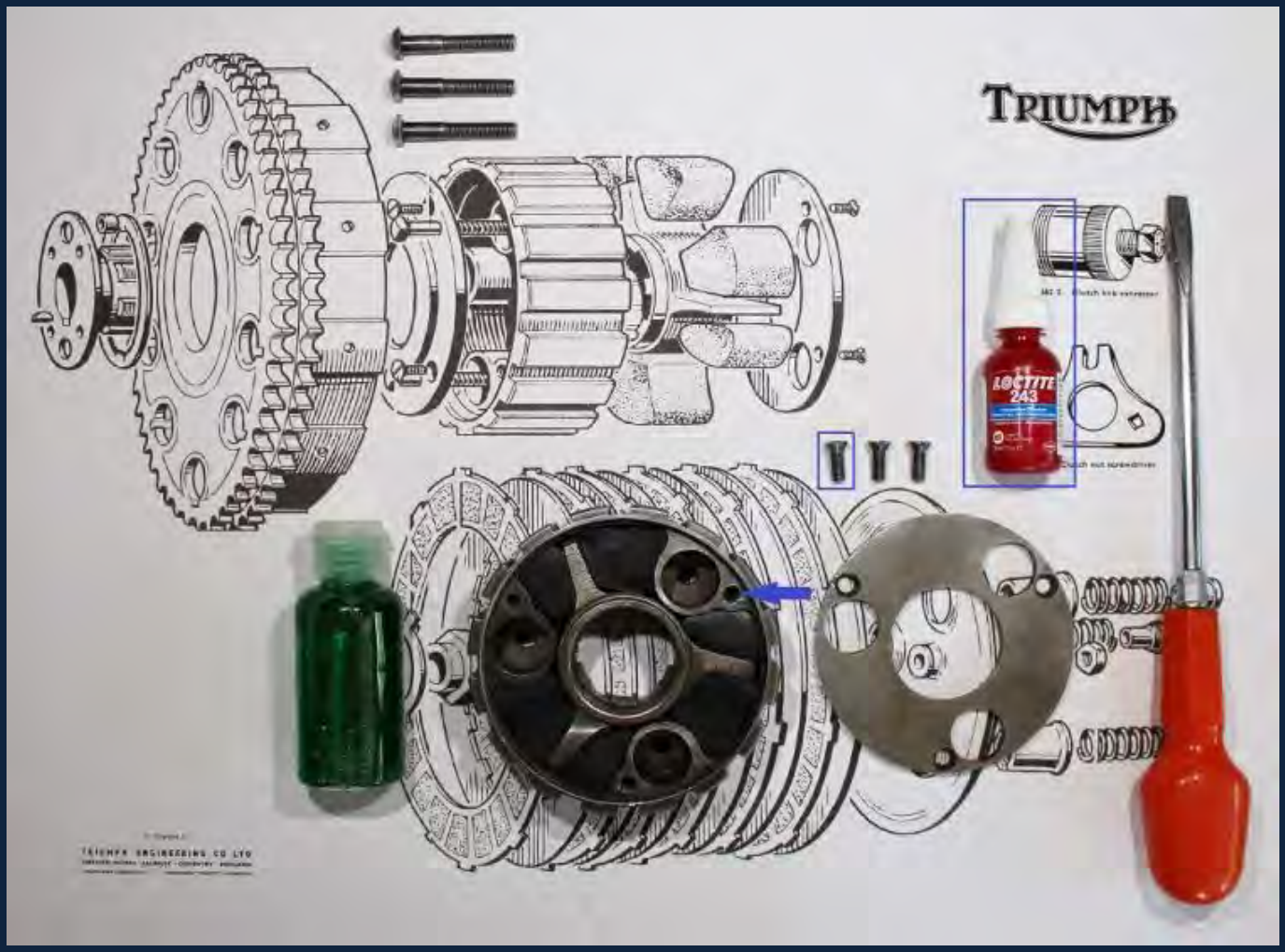
Clutch Parts

Early Four Spring to 1963 and later Three Spring clutch parts.

Note the distinctive holes in the perimeter of the later basket and the flange on the early shock absorber.
Intermediate parts are fitted to the T100A, T100AR, AC and early T100C models to 1963.

Here a severely worn later Clutch Basket, beyond repair!
The ridges will prevent the bonded plates from sliding.

The Shock Absorber



Assembling the Shock Absorber.

Section C7 of the Works Manual.

There are detail differences to the shock absorber fitted across the range; especially between models and also with the change from the four spring clutch to the tree spring version for 1963. Check the parts books carefully and familiarise yourself with these differences before commencing work, or seeking to obtain parts for your project.

The two plates for the shock absorber are attached by 6-8 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 heavy soldering iron, before attempting to undo them with a well-fitting screwdriver.

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.

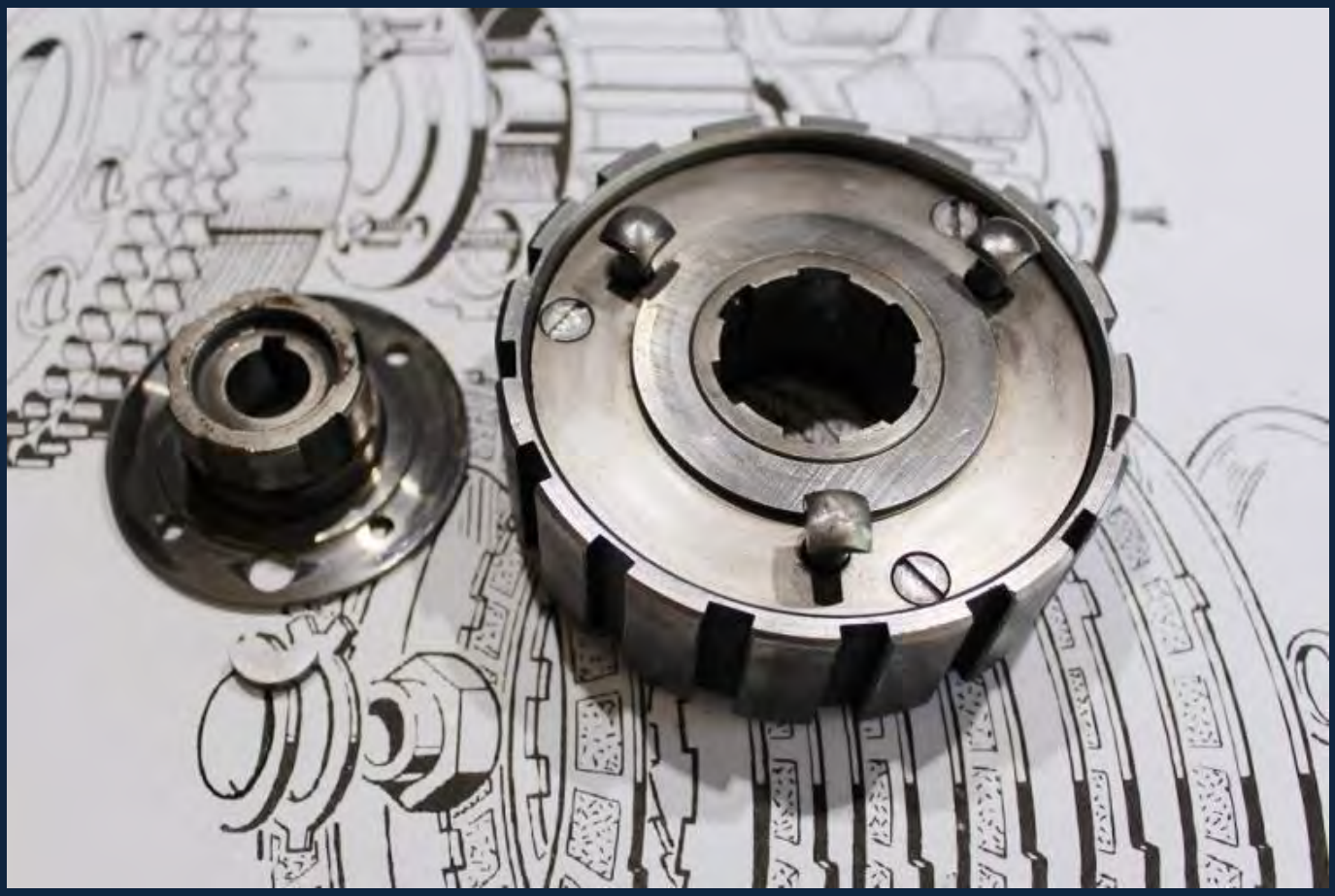
Once you have the hub dismantled and clean check the parts. The rubbers will deteriorate with age and you will usually see wear marks in the plates where the Spider has scoured the surface. To check the fit, remove the rubbers and reassemble the hub checking for play and binding. Dress any damage with a file or Linish!

The slots in the outer ring are 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 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 larger ones and then use a screwdriver to distort the spider to one side so that the smaller rubbers can be fitted by pressing them in.

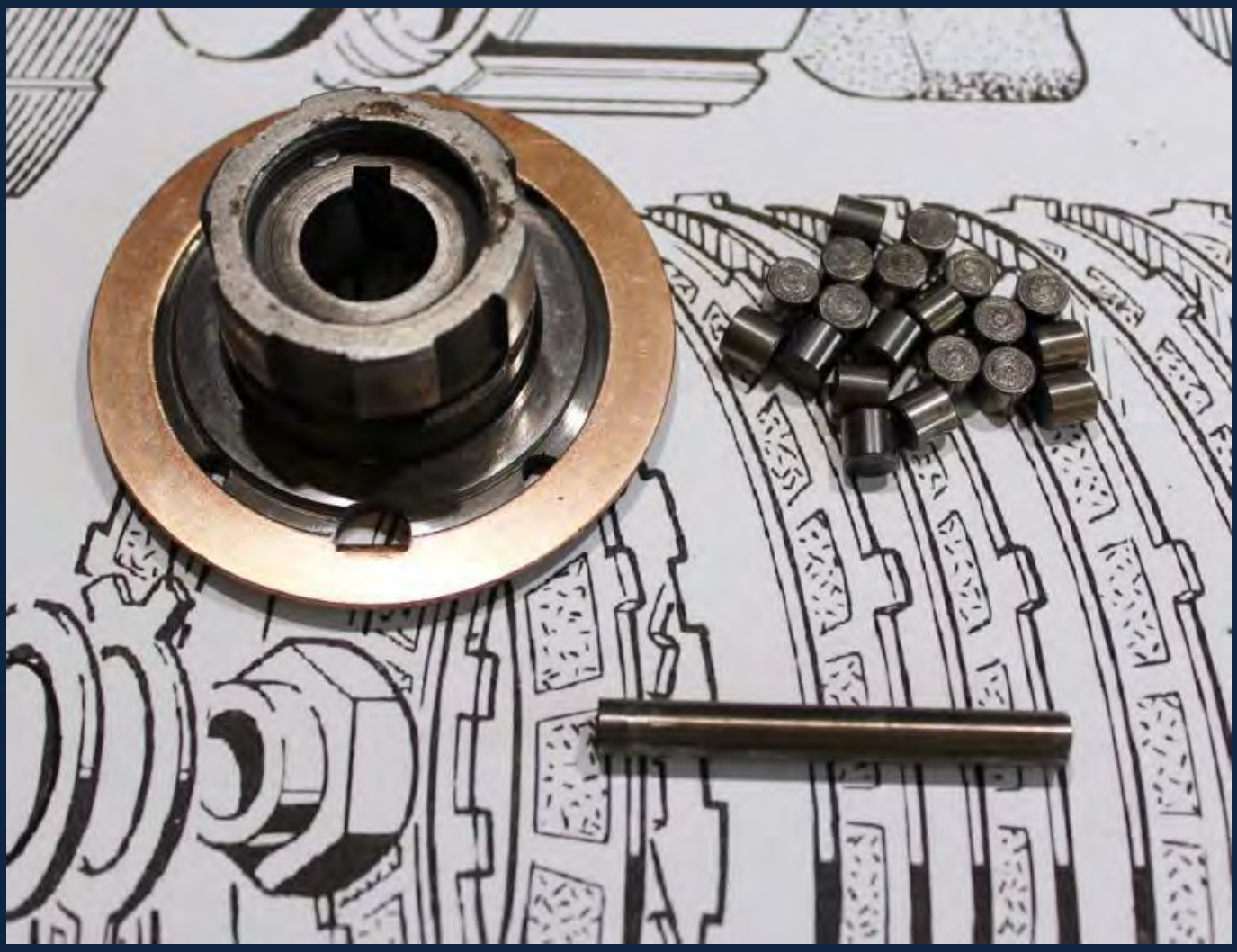
The Screwed Pins should all be the same length, the parts book gives dimensions for these. Check that they are not bent and that the threads are in good condition.

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



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.

The Clutch Hub Bearing



The Clutch Hub, Thrust Washer and Rollers.

Over the period of production, the Clutch 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. Replace the thrust washer if present as a matter of course. Refer to the parts books for details.

From Engine CC 18734 (March 1969) the thrust washer loses the locating tabs and the hub loses the locating holes, therefore returning to the early design form. There is also change to the clutch nut, this becomes self-locking and corresponds with the later Mainshaft.

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. Also shown is a small bar magnet that you will find useful when fitting the rollers into the hub.

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. A Warning: Do not substitute a two or three jawed puller for the correct tool!

The illustration in the Parts Book 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.

Top Tip: Test fit the Clutch Adjuster Nuts T427 to the Screwed Pins before assembly as a miss-match in threads will make fitting and adjusting the clutch springs difficult if not impossible. Resolve any issues now in case new parts are needed.

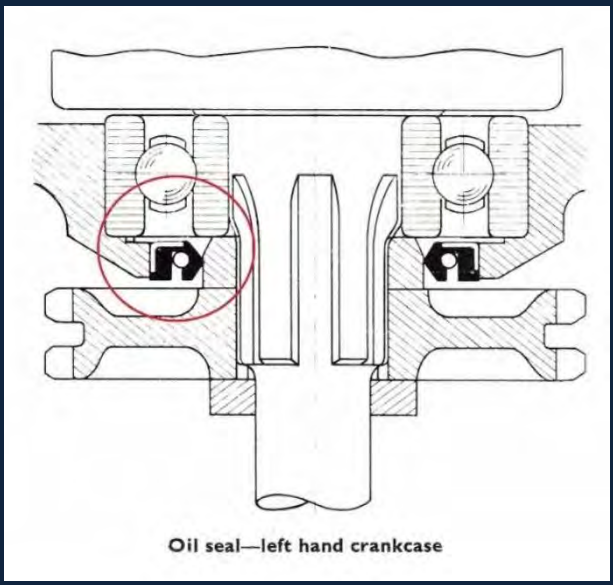
The Oil Seal

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. Note: There are two thicknesses of ground spacer #E3733 (1957-59) at 0.379 in and #E4006 at 0.411 in.

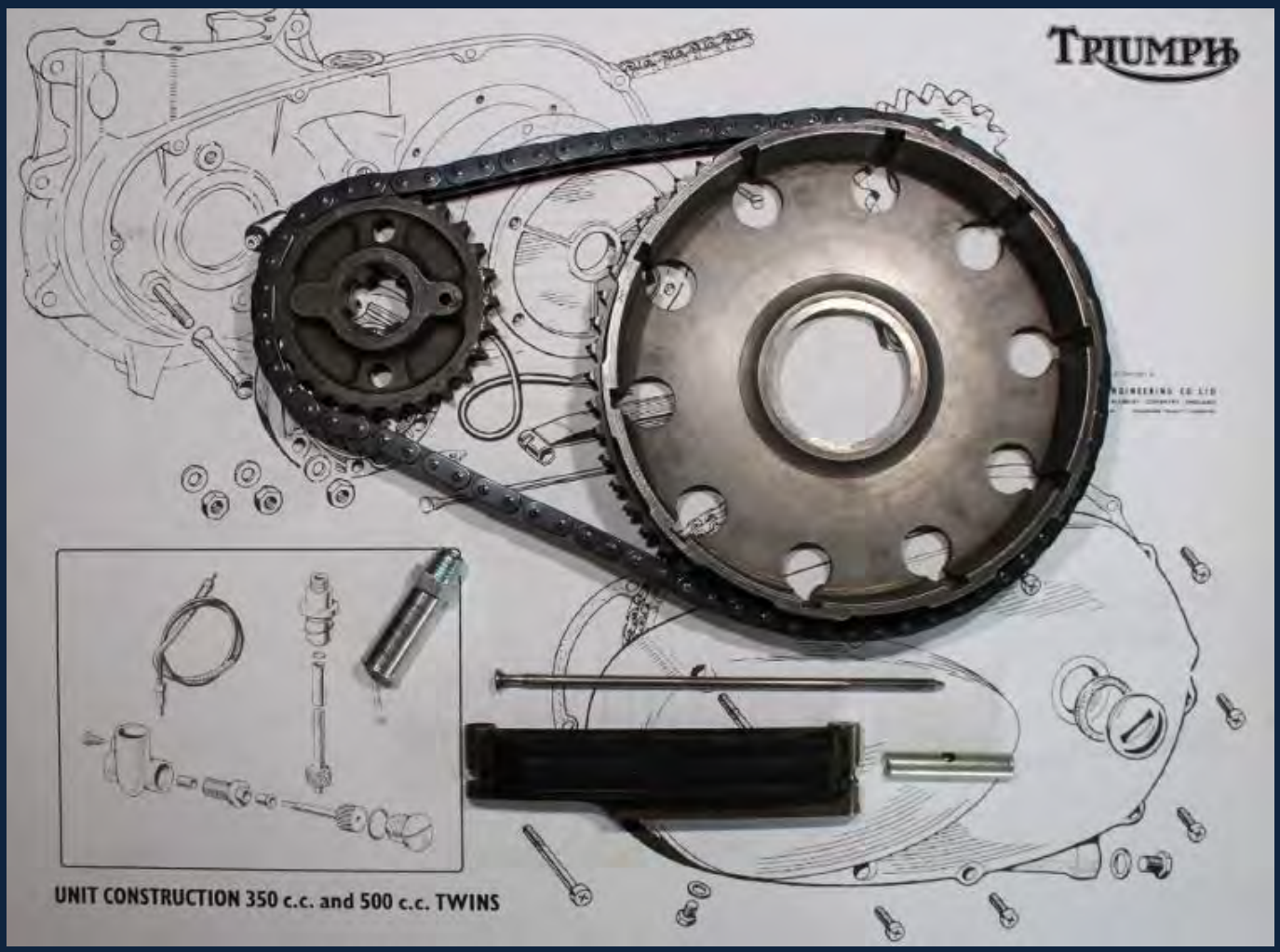
When you consider that the breather system is designed to create a partial vacuum within the crankcase, this seal arrangement makes sense. After 1969 the seal is omitted due to changes to the breathing system with the gases now passing through the bearing and venting behind the clutch, if your engine has had the breathing modified consider whether the seal is required or not.

If you failed to lubricate the drive bearing during crankcase assembly, do it before fitting the seal and apply oil to the outside of the ground spacer before fitting it so that the seal is correctly lubricated.



The Oil Seal detail from the Works Manual.

The Primary Drive

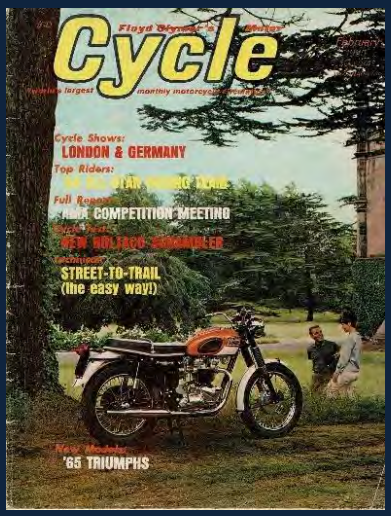


The Primary Drive Components.

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.

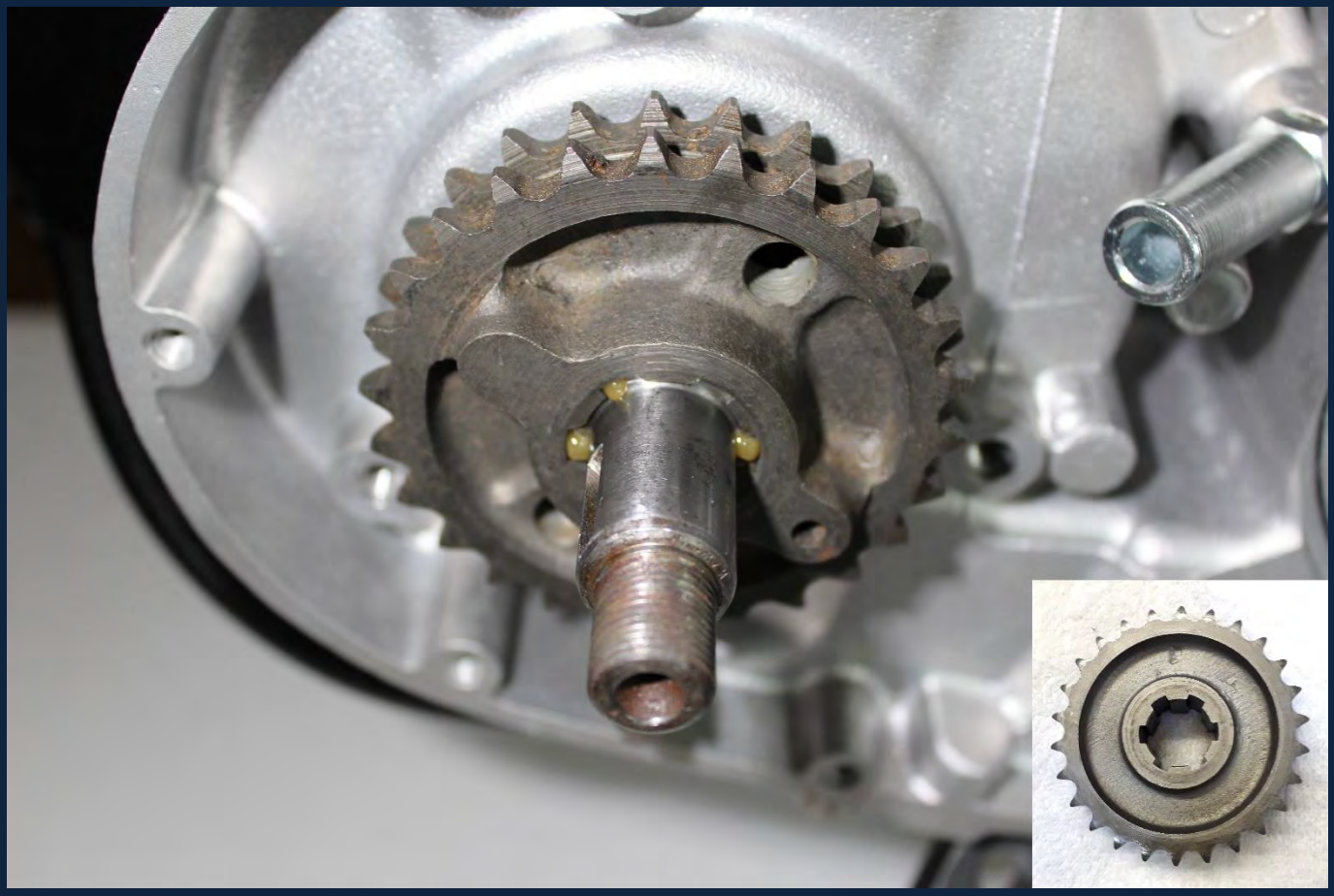
Provided a machine has been regularly serviced and the oil level maintained in the primary case, very little wear should be visible. Check the chain for wear by trying to pull it off the sprockets at various points and ascertain if it has stretched. Section C10 of the Works Manual gives details on inspecting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

Test fit the drive sprocket and the clutch hub not forgetting the woodruff key.



Cycle Magazine USA, Published by the irrepressable Floyd Clymer.

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 fitted, with the early (to 1960) E3734 Sprocket.

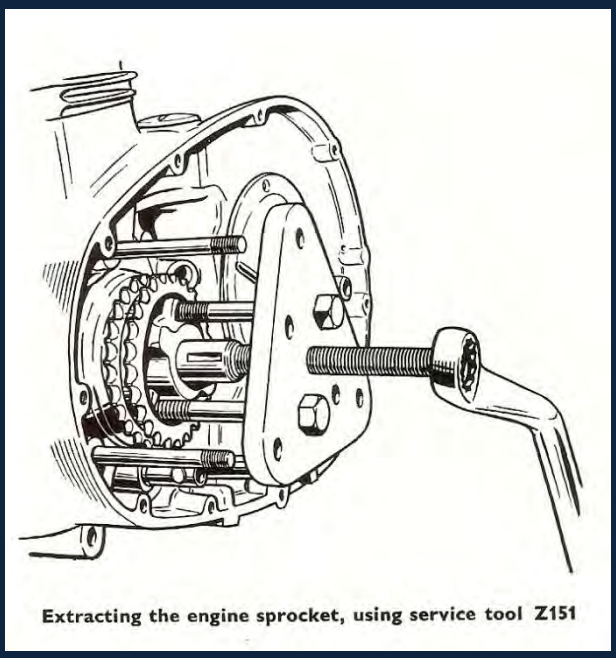
The sprocket should fit without difficulty, but you may need to try several positions to find the best one. Ensure it is fitted this way round, if required, drive home with a tubular drift.

Removing the Sprocket

Showing the pullers to remove the sprocket and the hub.
(The Puller on the left is also suitable for removing the gearbox sprocket).

The drive sprocket shown is splined to tightly fit the crankshaft and features two threaded holes that allow a puller to be fitted. 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, a two-jaw puller may be required.

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!



Extracting the engine sprocket, using service tool Z151

Showing the service tool Z151, for removing the drive sprockets and separating the crankcases, this handy tool is relatively easy to make with CAD, (Cardboard Aided Design).

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, weak magnet is very useful for this task or ‘Glue’ the rollers in place with thick grease!

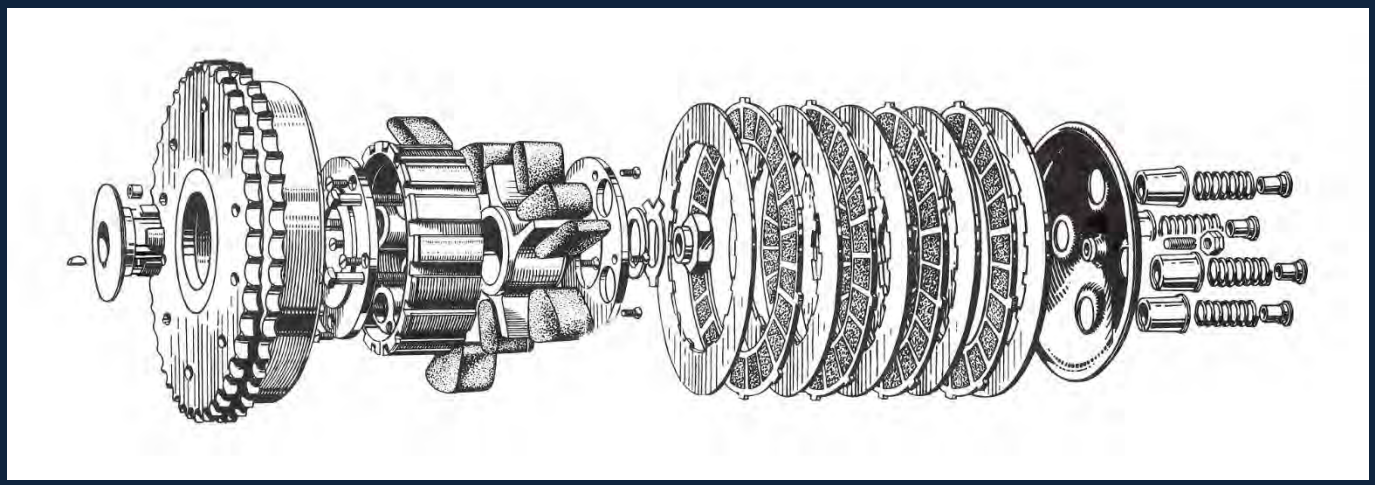
The Rollers Fitted.

Primary Drive Finished

The finished Primary Drive.

Before fitting the shock absorber prepared earlier, pack the clutch bearing with a small amount of grease.

The Clutch



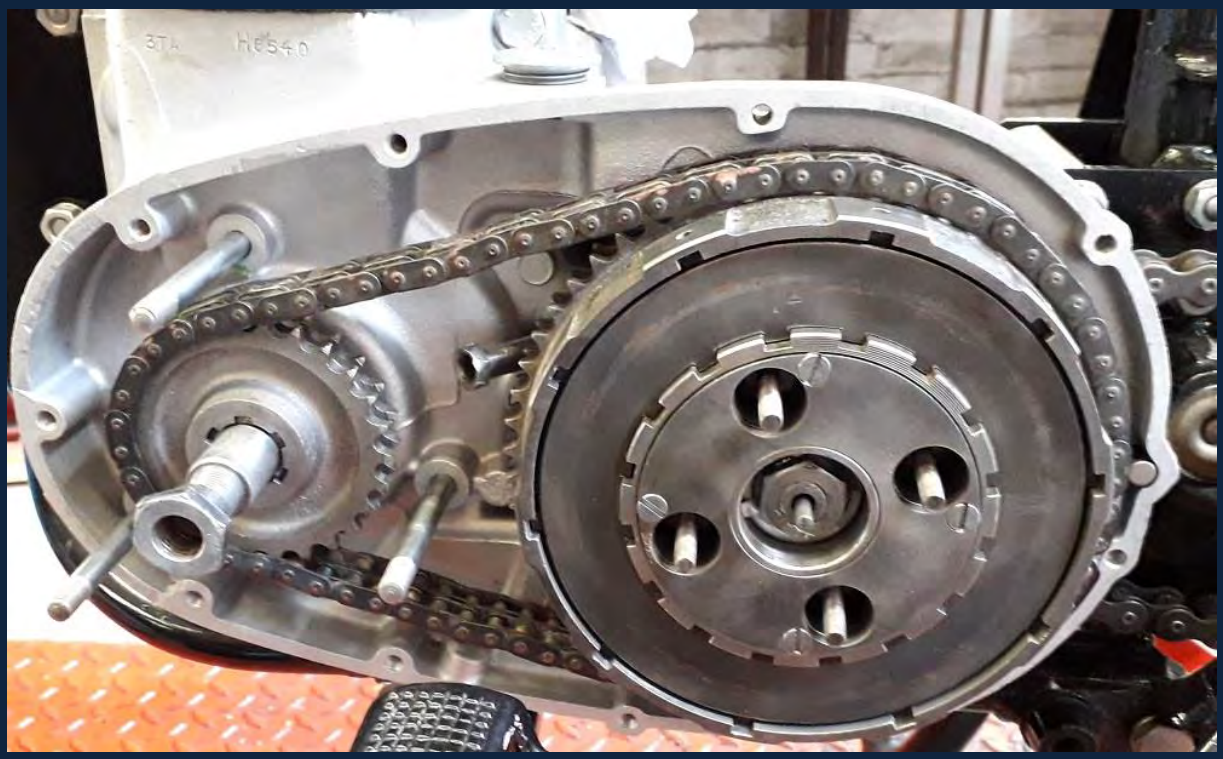
The 1957 to 1963 Four Spring Clutch.

The illustration above is misleading as this arrangement is only suitable for the touring models like the 3TA. We indicated earlier that there are detail design differences between the early four spring and the later three spring-clutch, these relate not just to the hub and the shock adsorber but also to the number of clutch plates and more importantly the order in which they are fitted.

The four spring clutch can be modified to fit additional plates by machining off the flange at the back of the shock absorber. The T100A from 1960 uses this arrangement, shock absorber part No T1038 and the order of the plates is changed with a friction plate fitted first followed by a driven plate.
The T100S, TR5AR and TR5AC use the T100A parts (Parts book 4).

For illustration, the Four Spring Hub and Shock Absorber parts.

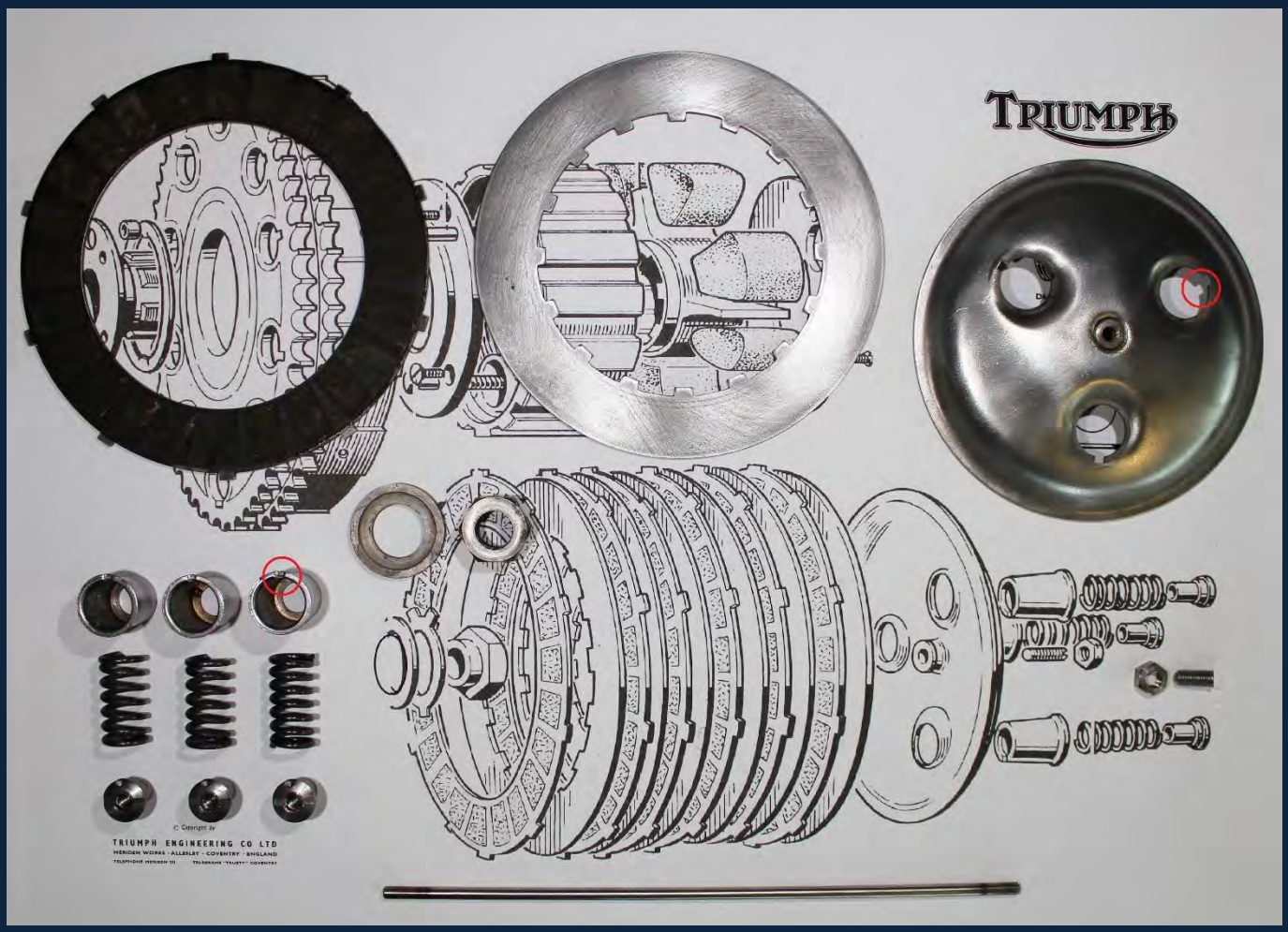
On the four spring 21 & 3TA clutch above, a plain plate is fitted first, followed by a friction plate.
On the four spring T100 clutch a friction or driving plate is fitted first, followed by a plain plate.
On the three Spring clutch a friction or driving plate is fitted first, followed by a plain plate.
The last plate to be fitted to all clutches is a plain or driven plate as below.



The Early Primary Drive and Four Spring Clutch.

Shown above is the partially assembled four spring clutch that was fitted across the range until 1963
This relatively early 3TA engine H6540 lacks the primary chain tensioner and the drive sprocket
does not feature the holes that allow the extractor to be fitted. The assembly procedure
for both clutches is very similar and is detailed below.

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 pressure 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.

As an example of the issue with clutch parts there are four different types of spring cups and pressure plates multiple clutch springs, two shock absorbers and push rods, two hubs, two lengths of screwed pins and the number of plates varies as well. When searching for and ordering spares you must check and specify which clutch you want them for!

One of the subtle changes concerns the spring cups and the pressure plate. On the three spring clutch above the holes for the spring cups also feature a small cut out, these correspond with ‘pips’ on the cups that prevent them turning during adjustment or disassembly. The cut outs and pips do not feature on the four spring clutch and therefore can be used as a guide to identifying matching components.
Refer to John Nelsons Tiger 100/Daytona Cross Reference Guide for help.

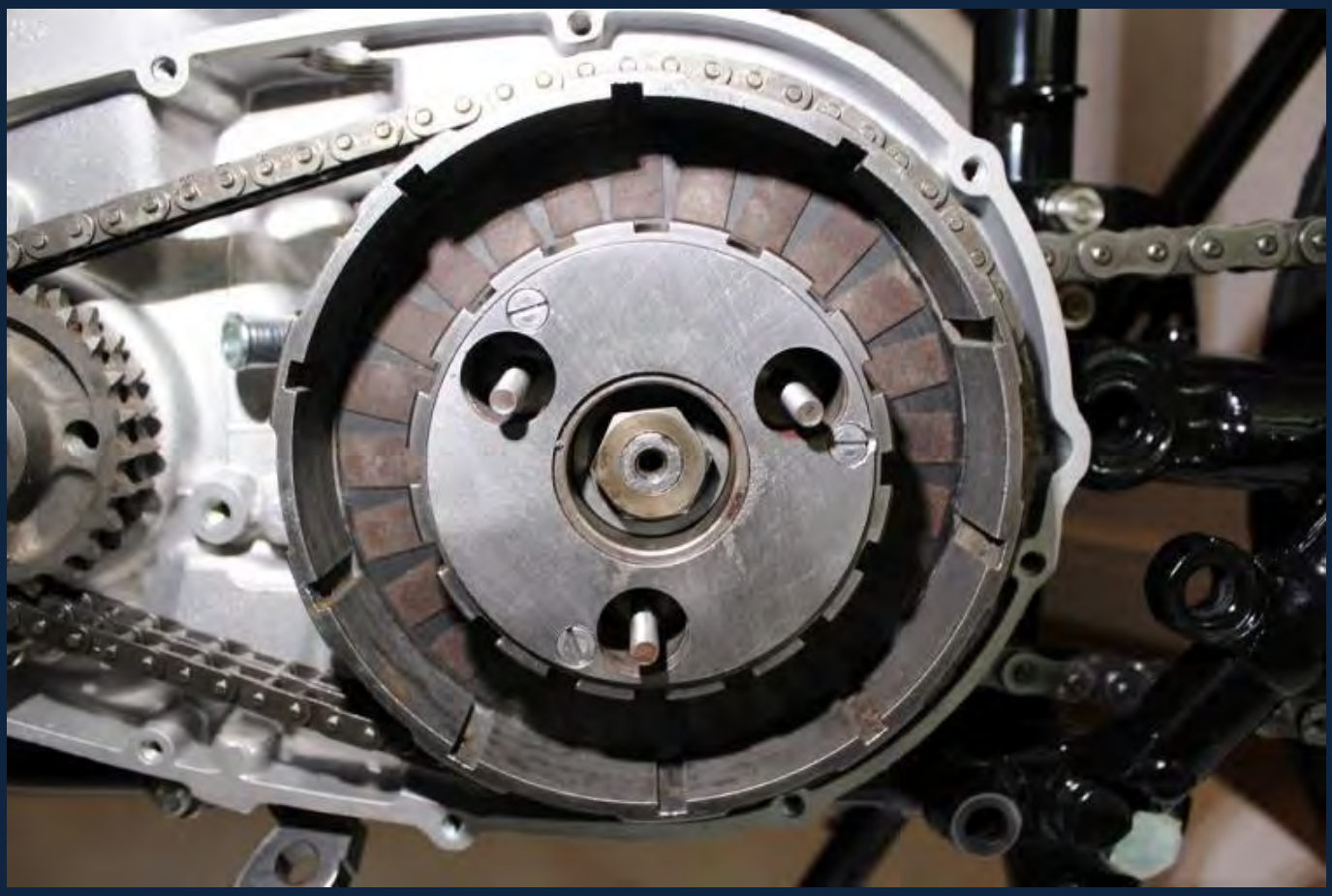
Tip: When dismantling the clutch, a magnet or pair of magnets are very useful to withdraw the clutch plates. Clean the parts as you go with brake cleaner and store in the order of disassembly.

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 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.

The Clutch



Shock Absorber and 1st Driving Plate Fitted.

Here the thick washer and the clutch nut have been loosely fitted to retain the shock absorber, not shown is the lock washer that recesses into a hole in the shock absorber and will be bent over to lock the nut later.
The first of the friction plates for this clutch has been fitted. A plain plate will be next.
On the earlier four spring clutch, a plain (driven) plate is fitted first!

Here showing how the lock washer locates in the shock absorber hub.
When the nut is tightened it distorts slightly allowing one of the two larger ears to be bent forward against a ‘flat’ of the nut.

The Clutch

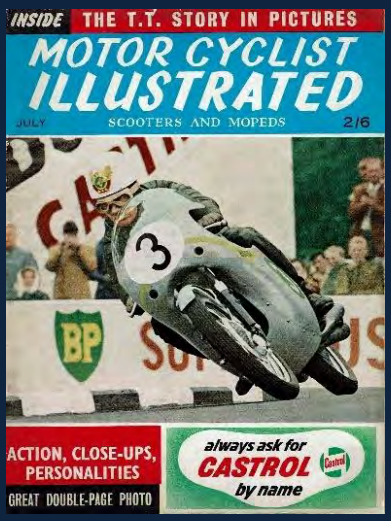
All the clutch plates fitted.

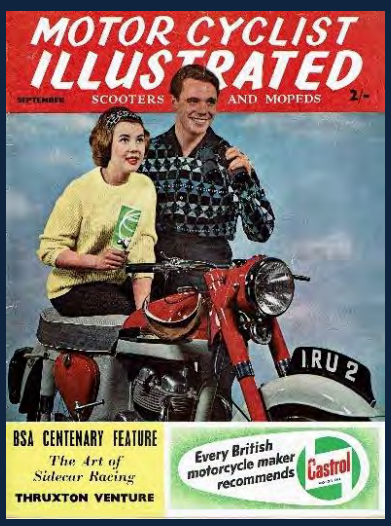
Using a magnet, the various clutch plates have been fitted (or removed) finishing with one of the Steel (driven) plates. Visible above is the end of the clutch push rod the clutch nut and the end of the three screwed pins that provide the clutch adjustment.

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. You may need assistance for this task.

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

Don't forget to bend over the lock washer tab to ensure the nut cannot work loose.





Motor Cyclist Illustrated, quite a rare magazine, full colour covers and centre pages. Published in England.

The Clutch

Clutch Pressure Plate (T1929), Cups Springs and Adjuster Screws fitted.

The gear change 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 and testing.

With the clutch cable loose, screw in the central adjuster until a slight resistance is felt and then back off half a turn. The clutch spring adjusters are designed so they cannot readily come undone; tighten the adjusters incrementally testing the feel at the clutch lever. Reasonable but not excessive force is required to operate the clutch. Do not tighten the adjusters so much that the springs become coil bound.

Note: It is easier to tighten the adjuster screws than loosen them; aim for a light feel at the clutch lever first because you can make adjustments later to remove clutch slip when the machine is being road tested. This clutch was shared with the more powerful 650's and is unstressed with the smaller engines.

When you have arrived at the final setting, turn the spring adjusters individually until the pressure plate lifts cleanly and returns evenly, while turning the engine over with the kickstart. 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 at the clutch lever, enough to be able to disengage the clutch cable easily so that it can be removed for maintenance or replacement.

The three pressure plate springs are locked in position by means of location pips in the cups and on the drive adjuster nuts. To facilitate removal of the slotted adjuster nuts, insert a knife blade under the head of the nut whilst the nut is unscrewed using tool kit screw driver part number D364 or a screw driver of the type shown in Fig. C5. Withdraw the springs, cup and pressure plate assembly. Removal of the clutch plates is facilitated by means of two narrow hook tools which can be made from a piece of $\frac{1}{32}$ in. diameter wire by bending to form a hook at one end. Thoroughly clean all parts in paraffin (kerosene) and inspect the clutch springs and plates for excessive wear (see Section C5).

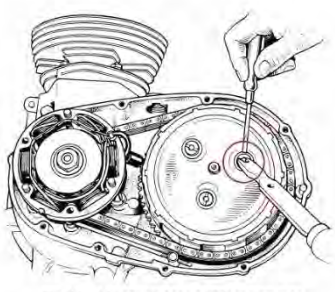
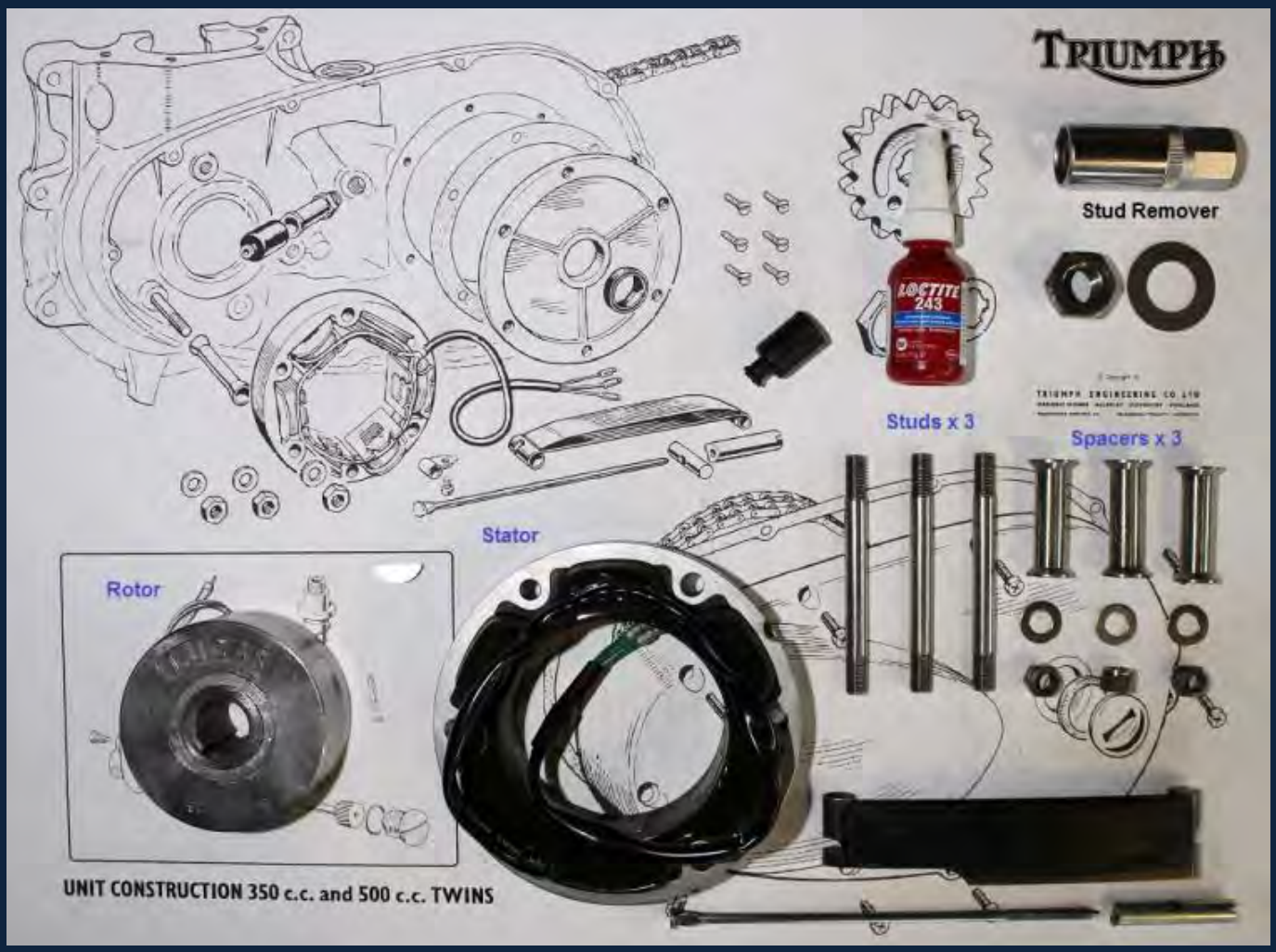


Fig. C5. Unscrewing the clutch spring nuts

Refer to Section C6 of the Works Manual.

The Alternator



The Alternator.

Shown are the various parts required to fit the alternator (to 1966), 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.

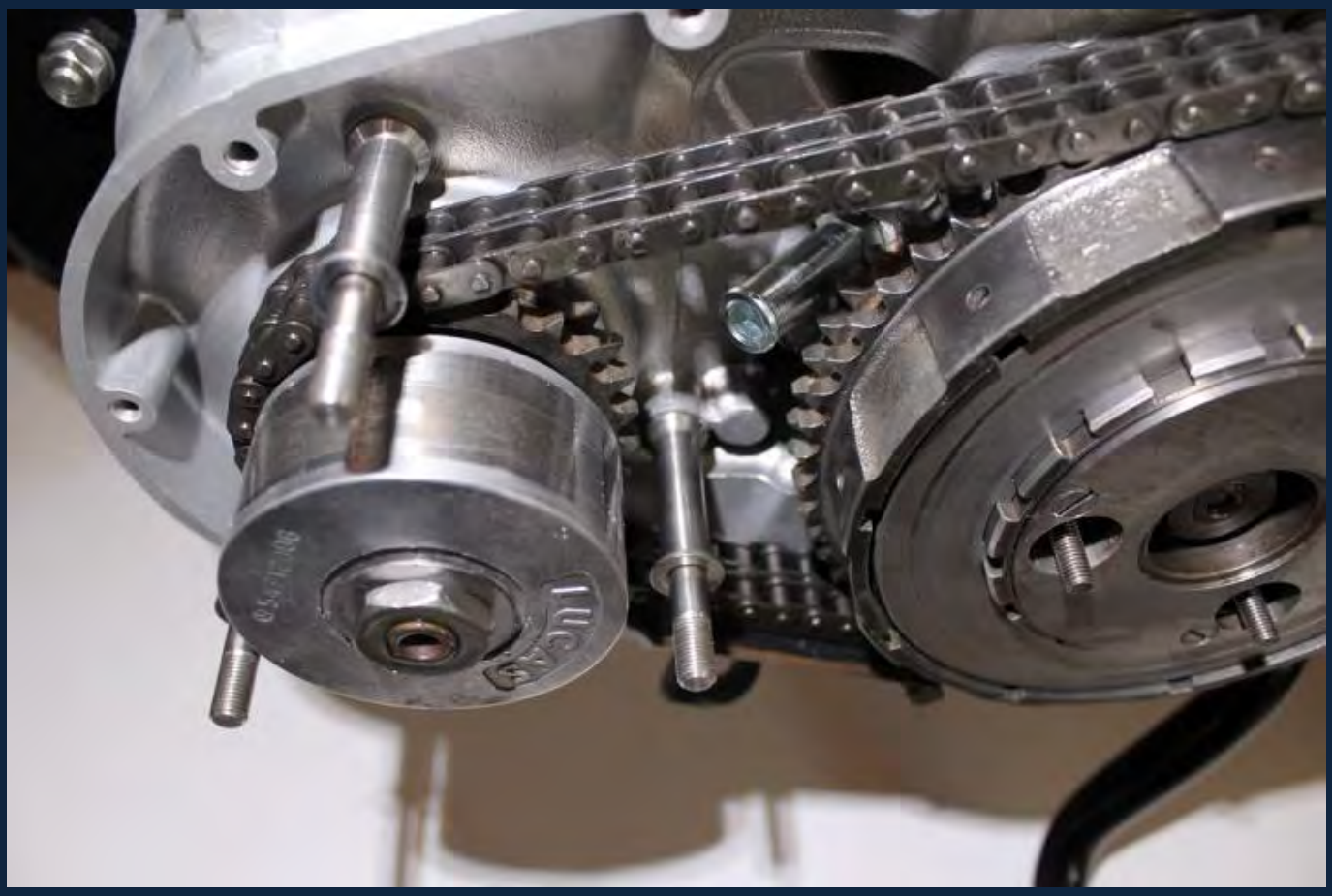
The studs show two different thread forms, 5/16 BSF into the crankcase and 5/16 (26 tpi) BSCY for the nuts. From 1967 the studs and spacers are combined in a new part (not shown) initially in BSCY/BSF but later with the change of threads applied in 1968 onwards to UNF and UNC

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. The adjuster sleeve nut must be fed into the outer cover as the final operation.

Over the period of production, a variety of slightly differing alternator and stator combinations were fitted depending on the model and power requirements of the machine. Police models indicated by an engine number with a W suffix were fitted with a high output alternator pack, while the Energy Transfer Models like the T100C use a five wire alternator and other parts optimised for this application. Look for the Lucas part numbers and the date marks and cross reference these to the appropriate Lucas Catalogues that can be found on my website.

The original 6V wiring for models before 1966 uses the lighting switch to bring in more coils in an attempt to balance the charge rate and output. If you are recreating the original system, it is important to match the alternator and stator carefully and follow the original wiring pattern, including the fitting of period wattage bulbs. Any deviation will likely lead to charging and battery problems.

The Alternator



The Adjuster, Rotor, Studs and Spacers located.

Before fitting the alternator check the condition of the crankshaft so that the rotor will fit smoothly, remove any burrs and test fit the woodruff key and also the rotor nut. The thread for the crankshaft and for the rotor nut on this 1966 and earlier engines is 9/16 20 TPI BSCY.

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 lock washer 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 Rotor Nut 30 lb/ft do not exceed this value!

The rotor can usually be removed without difficulty and rarely is it necessary to use a puller, tap the rotor gently with a hide mallet in several positions to break the seal and then ease the rotor off before prizing out the Woodruff key. Clean the rotor of metallic particles and check it for wear, especially scoring and store the rotor separately where it cannot be damaged.

Rotors that have become scored can be re-dressed in a lathe as long as only the minimum amount of material is removed. Occasionally the centre of the rotor can become loose or detached!

Tip… The Connecting Rod nuts make good substitutes for the Aerotite nuts used to attach the Stator and can be safely re-used here if they are not damaged.

If you are upgrading the Alternator or wish to improve the ignition system, especially on the pre 1963 models look for the ignition packs from Electrex World that eliminate the distributor and points. Especially suitable for competition or off road machines, they are an excellent alternative.

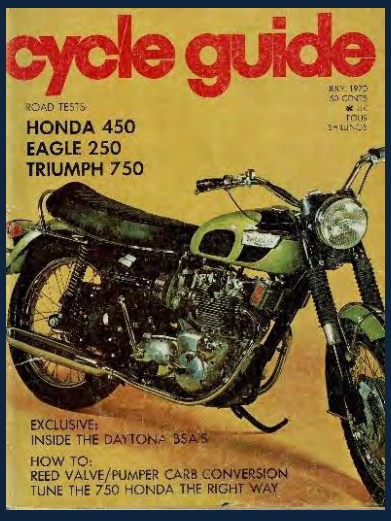
Completed Primary Side

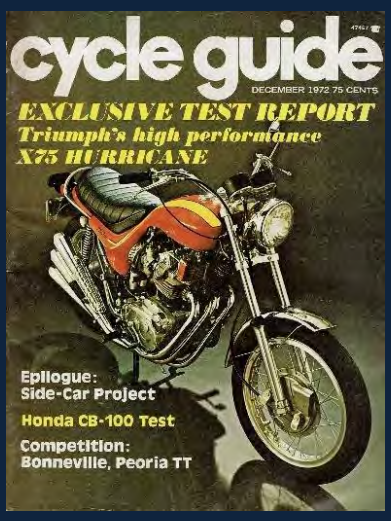
Completed Primary Drive and Clutch.

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.





Cycle Guide. A rare magazine from the USA. Published from 1968, usually with excellent photographs.

The Clutch Cover

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 footrest; in use this will barely be visible and any minor cracking internally can be treated with silicone, epoxy or painted with enamel so that oil cannot leak. Check the threads for the oil level bolt and the drain plug, these may need attention and if you can, lightly Linish the mating surface of the cover using 400 grade Wet-n-Dry.

Part Numbers to look for are… E3701 and E4122. The early cover 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 points along the bottom edge and the access hole for clutch adjustment screw. For an improved seal use two sealing washers on the oil level screw.

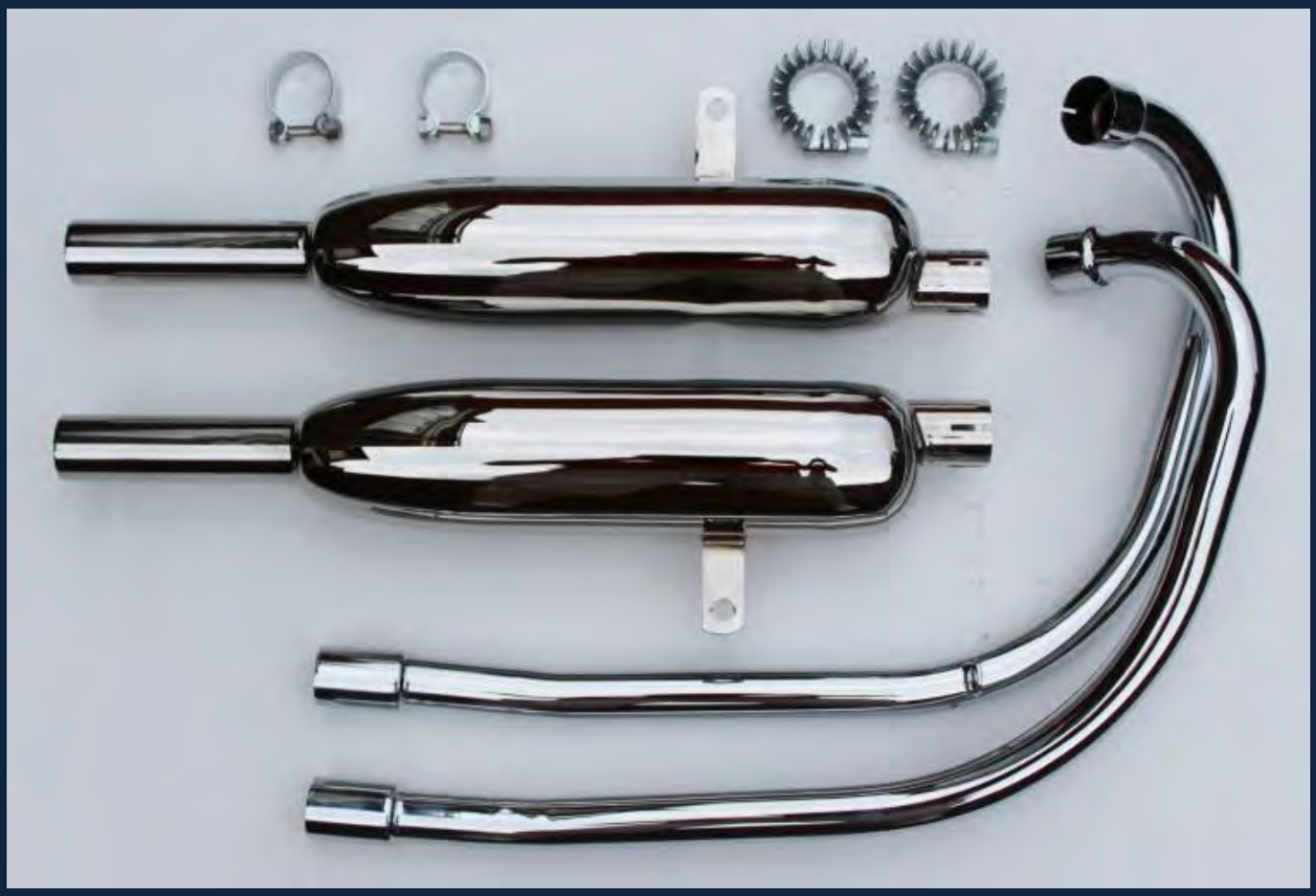
Lubricate the gasket on both sides with silicone grease, this will stop it sticking and save trouble later if you need to remove the cover. Leaks can arise from damaged holes for the screws and you may need to use some sealant. Originally the cover would have been attached with Phillips headed screws, now generally unobtainable. Allen key versions in 1/4 BSF will be used for this project.

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.

Tip: The thin white seals for the pushrod tubes work well on the filler and adjuster caps.

Part 9 Complete

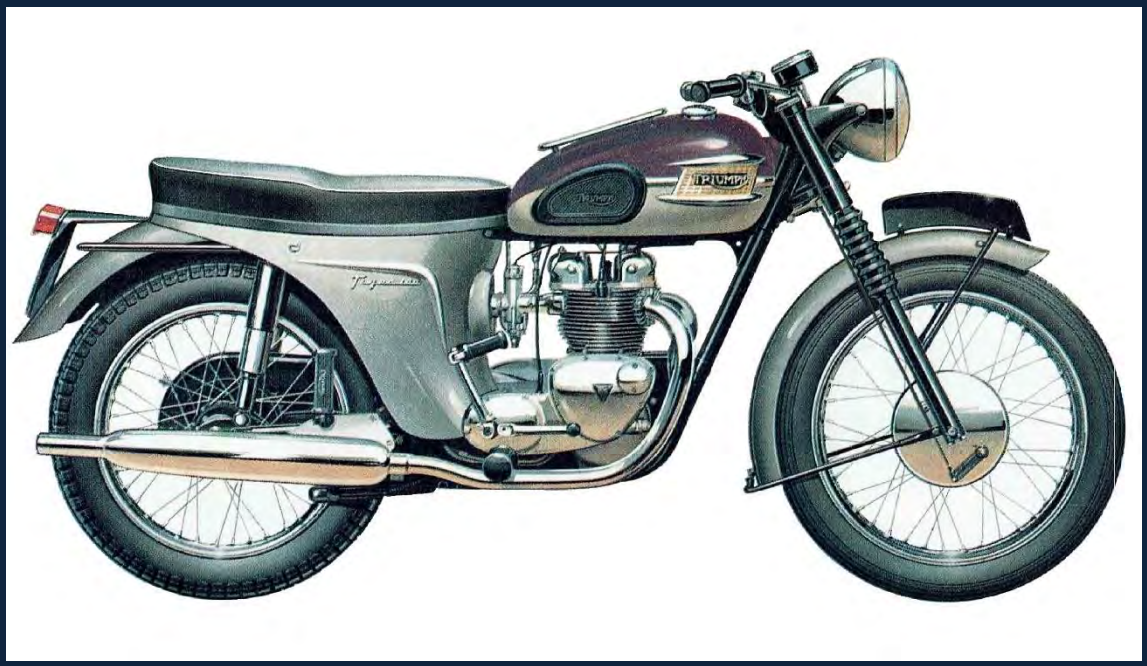
Exhaust System



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.

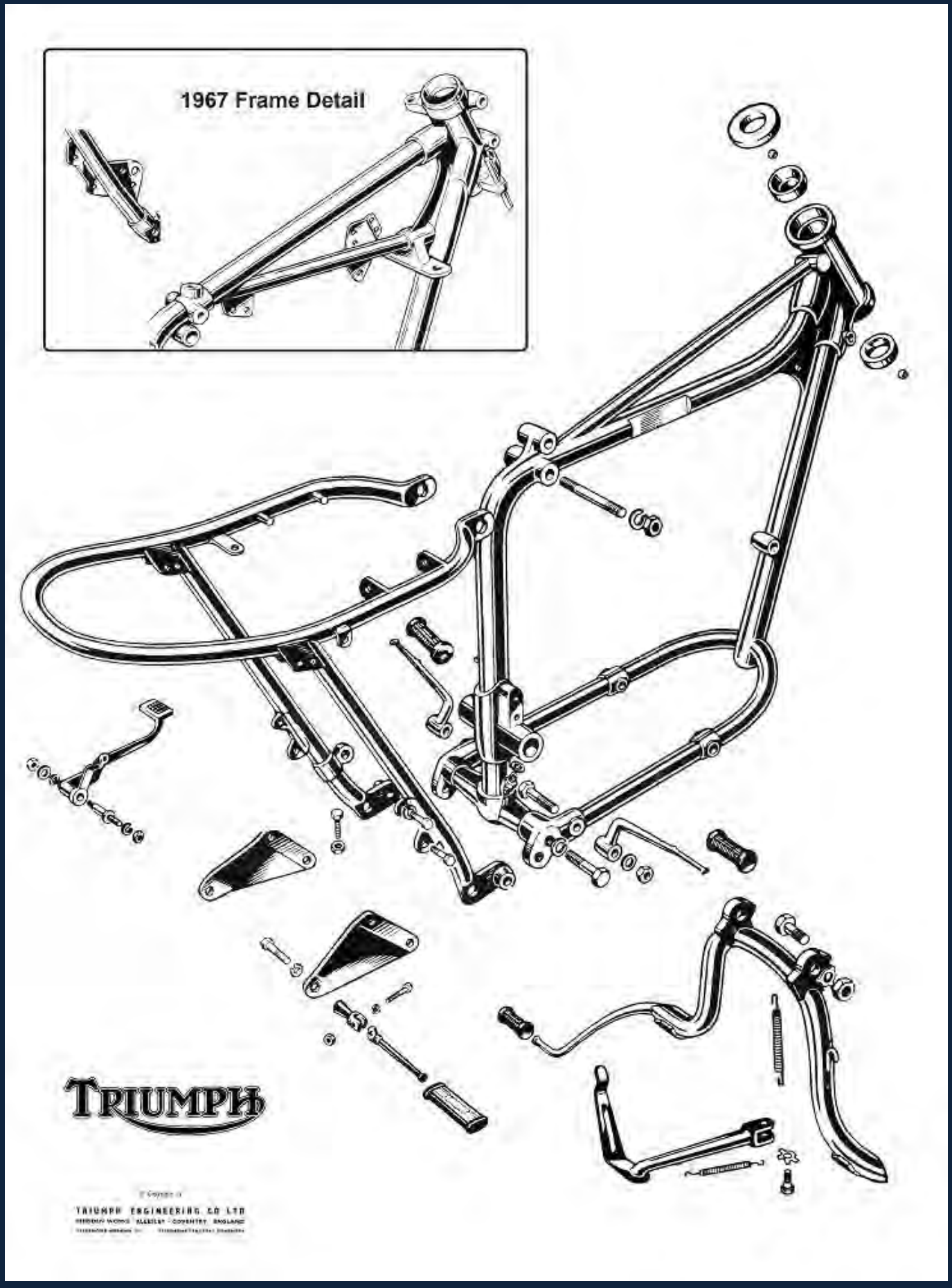
Fitting the exhaust pipes is relatively straightforward, apply a thin coat of ‘Gun Gum’ to each exhaust stub to ensure a gas tight seal before easing on the pipe and tightening the collar.



The 1963 T100S (Home Market) Model. Siamesed Pipes, Single ‘Resonator’ Silencer.

Part 10 Complete

Frame and Fittings

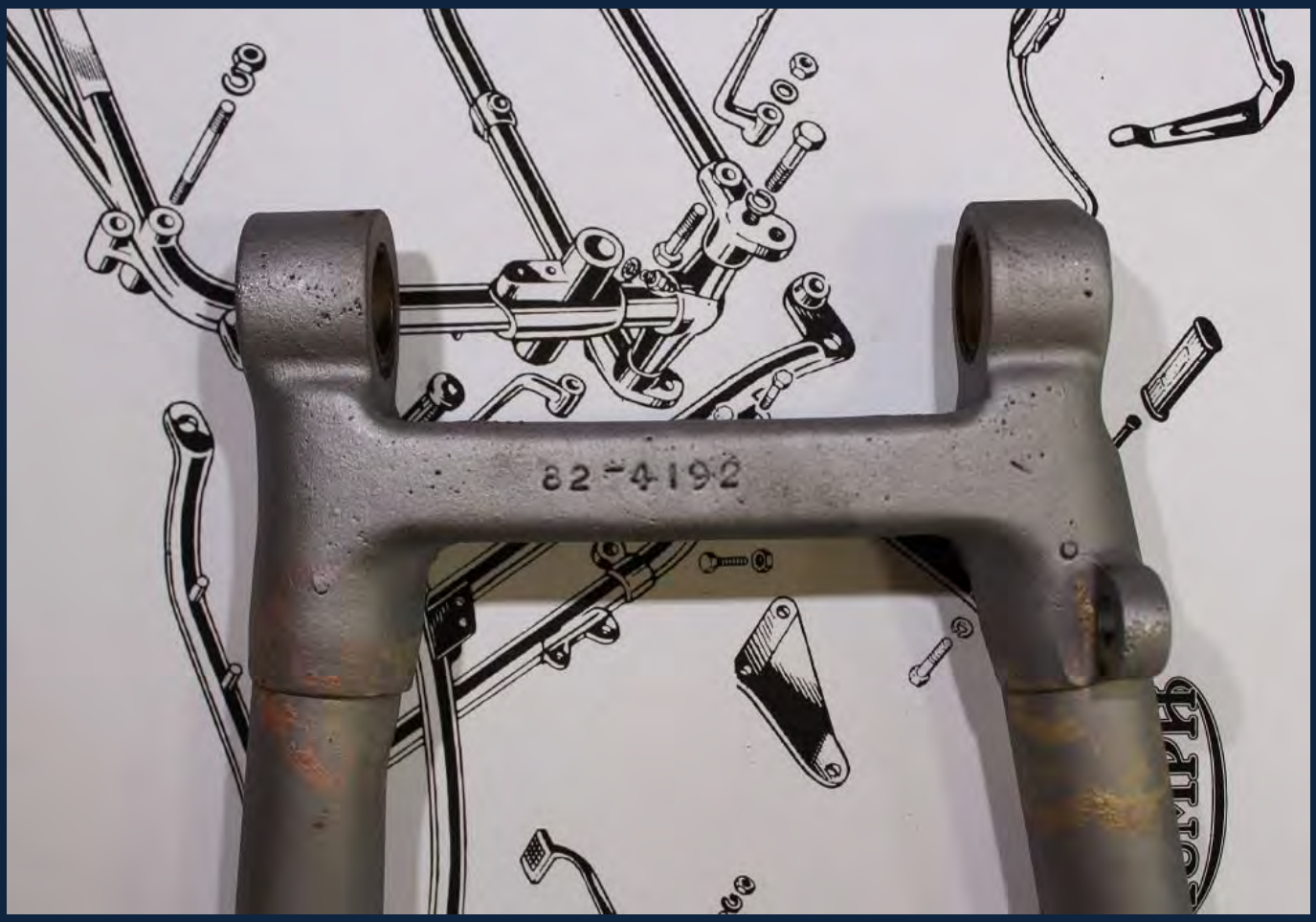


The general frame arrangement for the C Range Machines.
Here showing both the 1966 and 1967 Types.

Full images and dimensional details are provided in the Works Manual.
Police and Military Models show modified and or reinforced frames.

Frame

Over the course of production, the Frame undergoes a series of modifications in pursuit of improvement to the overall handling and stiffness, while retaining the basic dimensions and methods of construction. Refer to Section E of the Works Manual for details on assessing the Frame and Swing Arm components.



A later Swing Arm showing the Pinned and Brazed construction.

The frame is made up of tubular sections pinned and brazed into forged malleable castings, before final machining operations such as the headset and swing arm bushes are undertaken. Complete frames should be checked carefully for damage with repairs only undertaken by knowledgeable experts.

There are detailed differences to the frames between models, that only the experienced Triumph restorer will identify. Dating the frame is relatively straightforward even if the frame number is obscured as the changes are more visible and with experience you will soon be able to identify the production year of any frame you come across. Tip… Look for part numbers on the head lug and the swing arm and check against the parts books.

Originally frames were dip coated in gloss black enamel or sprayed in the machine colour for some models such as the 5TA. Most owners now choose to have the frame powder coated, this gives a durable finish but can hide underlying problems and is not effective on rusty components. Any rust pitting will show through on the finished parts. Good results can be achieved with coach enamels applied over a suitable primer and award-winning restorers will take considerable care to finish the frame to a high standard before completing the build.

If assembling a machine from parts, or a project it is advisable to do a dry run before starting the painting, so that any fitting issues can be resolved before they mar the build. This is particularly important with the Nacelle and Bathtub panels, where even slight damage can cause fit issues that will be frustrating to resolve later.

Look for filler, rust, damage and where additional holes have been drilled for accessories, as you will need to decide how much work you intend to do and the style/type of restoration you want. Overcoming missed issues once the build has started is incredibly frustrating!

Replacing the Swing Arm Bushes

Swing Arm Spindle, Bushes, Shims and tools.

On project machines or when servicing the chain, check the state of the wear in the bushes by placing the bike on the main stand so that the rear wheel is off the ground. Grasp the rear tyre at the top and feel for knocking and unnatural movement at the swingarm pivot, while pulling and pushing the wheel. Note that worn wheel bearings may give a false reading. If all seems ok then make an assessment if you need to replace the bushes now, or whether to wait until you are undertaking a full restoration later in your ownership.

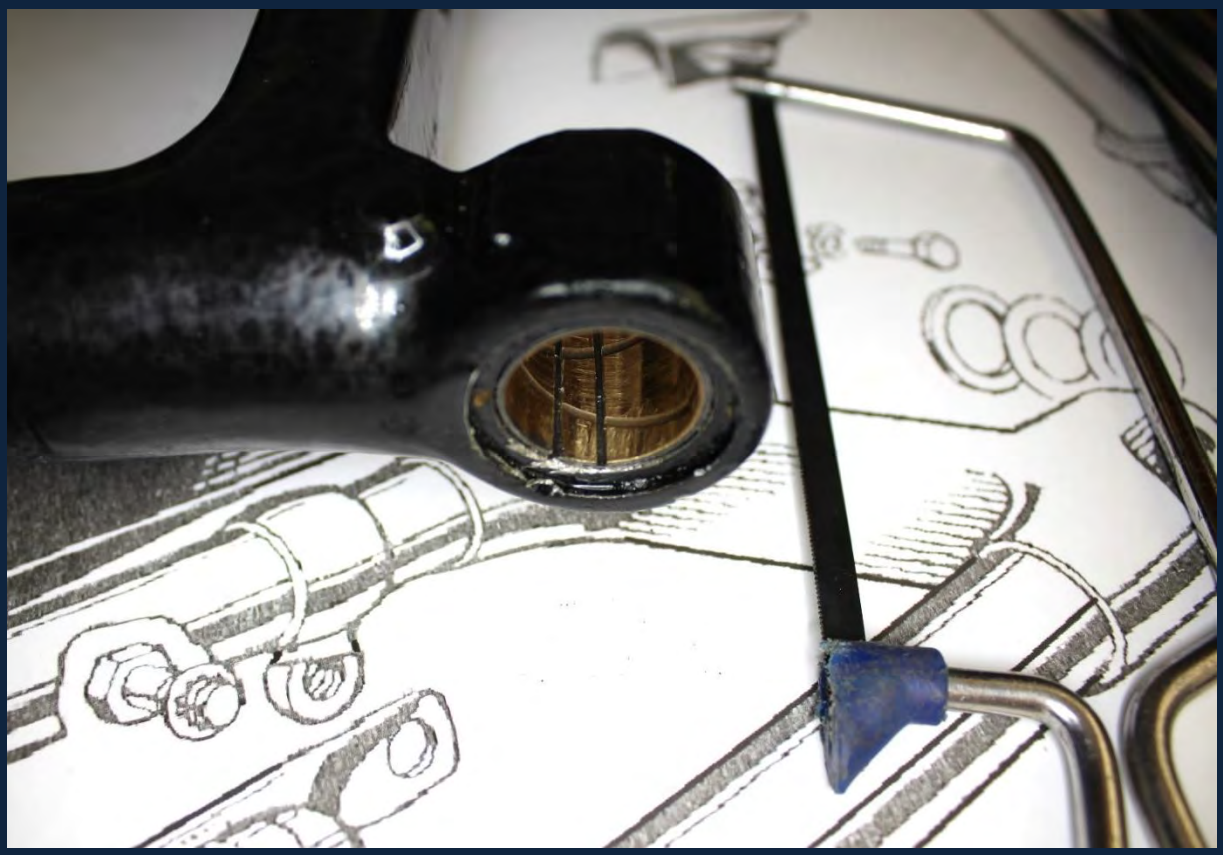
Shown above is the swing arm, spindle, bushes, shims and a selection of the tools needed to replace the bushes. Not shown are the end caps and spoke and from 1967 the additional parts appropriate for later models. Refer to the Works Manual sections E12-E14 for details but note that on most surviving machines removing the spindle will prove almost impossible with the methods and tools described and you will need to dismantle the machine until you have a bare frame and can press the spindle out with a hydraulic press. Some considerable heat and force may be needed, make sure the frame lug is fully supported!

The tools shown above are a 7/8in parallel reamer, hack saw, fine chisel, a large bolt (18mm) nut and washers, small flap wheel and a bar modified to fit the square shank of the reamer. The bushes are a press fit into their respective locations and were originally line reamed. Select a reamer that is long enough to pass through/cut both bushes simultaneously.

When replacing the swingarm bushes it is essential to work on ONE bush at a time so that the old bush even though worn will hold the reamer parallel during cutting. Fail to follow this advice and you will very likely end up with a spindle that will not fit into the opposite bush!

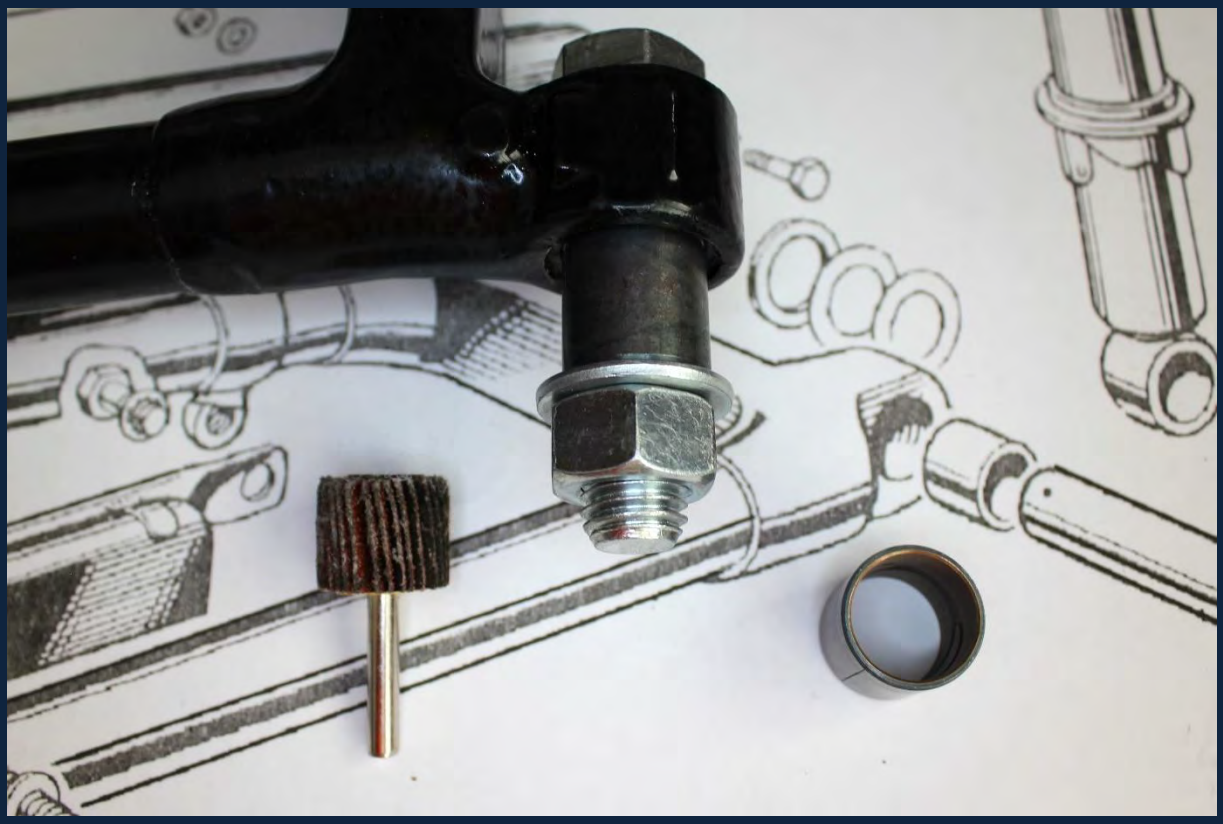
The bushes are steel backed, copper/bronze lined and a tight interference fit into machined recesses. You will note that the bushes have a seam and are grooved internally to distribute grease. Replacement instructions follow…

Tip: Fit the brake torque arm to the swingarm before fitting it back into the frame. There is very little room later to get the bolt located and tightened. Use Loctite 243.



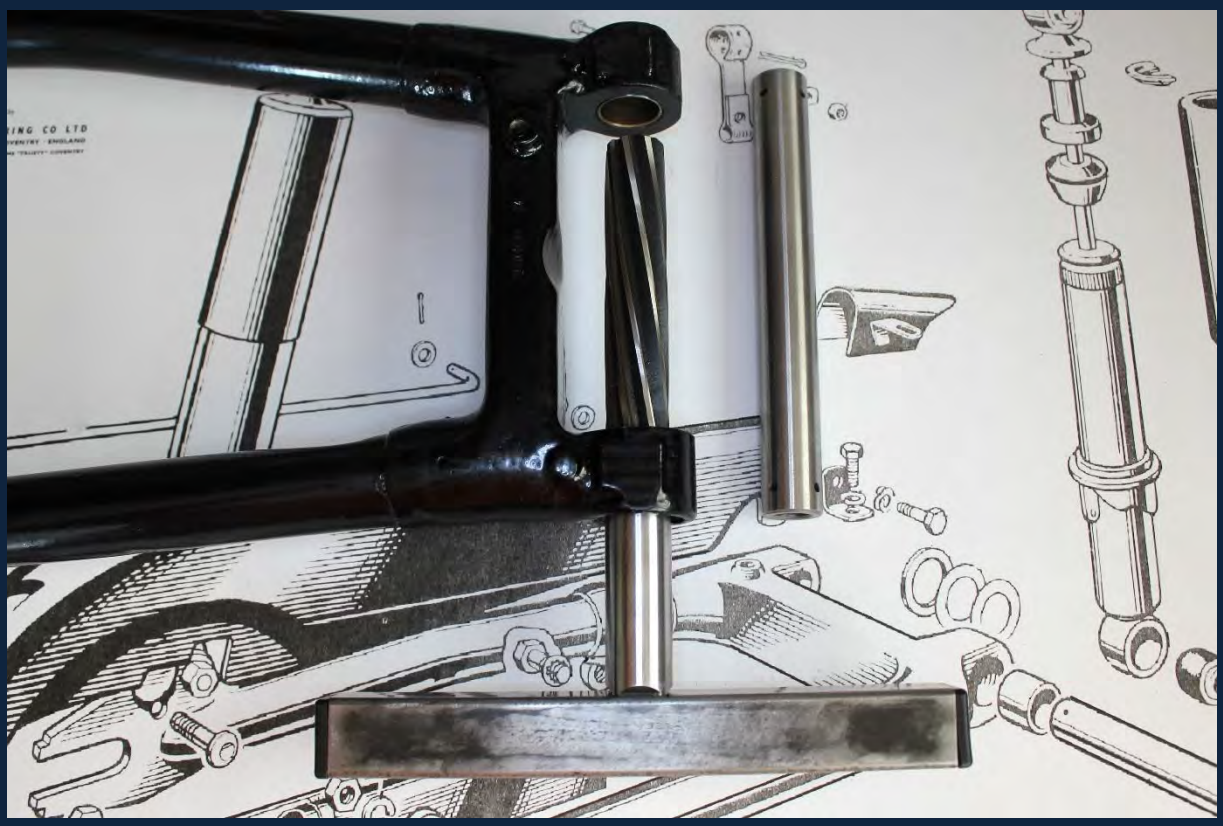
Cutting through the bush to collapse it.

Using the small hacksaw carefully cut two parallel grooves through the bush, taking care not to damage the swing arm but noting that the bushes are copper/bronze lined with a steel backing.
Once the grooves are cut use the chisel and a mallet to peel away the cut section.
You should now be able to push/tap out the rest of the bush. Set it aside.



Pressing in the new bush with the large bolt, nut and washers.

After the bush is removed, shake out any rust in the swing arm; clean the recess lightly with the flap wheel or a wire brush and apply some corrosion protection like Waxol or ACF 50 if available.
Grease and press in one of the bushes as above, until it is flush with the inner face.



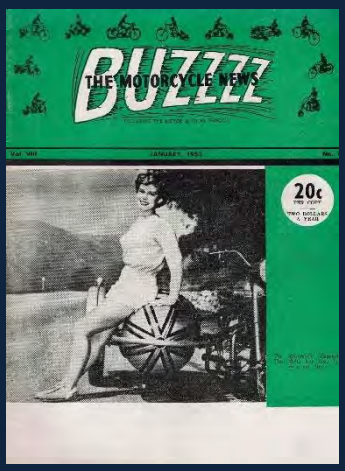
Reaming the new bush.

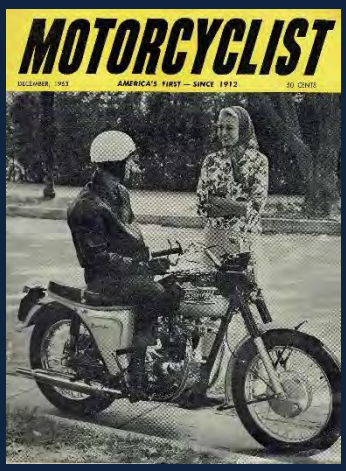
Using the reamer supported in the opposite (old) bush, ream the new bush to size. Turning the reamer clockwise steadily and evenly while using a cutting oil, until you have completed one pass through the new bush.
Check the fit of the spindle, it must be a smooth fit and locate into both bushes.
Repeat the process of cutting, fitting and reaming with the second bush.

Complete assembly of the swing arm to the frame, selecting the shims illustrated so that there is no perceptible side to side movement of the assembly. You may need to clean the spindle recess in the frame but do so carefully so that the spindle remains an interference fit. Apply Waxol or ACF 50 as suitable to any accessible frame internal sections. Fit the brake torque arm now!

Prior to fitting the end caps and other parts, check the operation of the grease nipple and fill the spindle with grease, now fit the caps and spoke and pump in more grease until you are confident that the new bushes are fully lubricated.

On all machines periodically remove the chromed caps and clean the spindle core of dirt and old grease and check that the grease nipple is working as it should. Fit the caps and the spoke and pump in fresh grease through the nipple until the spindle is completely filled.
If you can, regularly spray some penetrating oil or WD40 onto the pivot points and into the open main frame tube, visible underneath the bike to minimise the build-up of corrosion and ease later servicing.





Buzzzz and Motorcyclist, rare magazines from the USA.

Engine Mountings

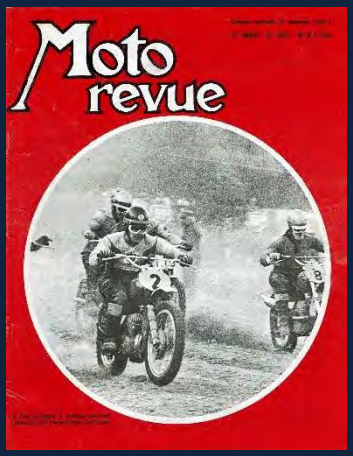
m

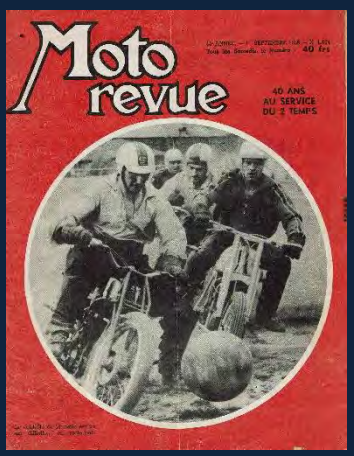
Engine Mounting the Complete Set of Parts.

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 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.





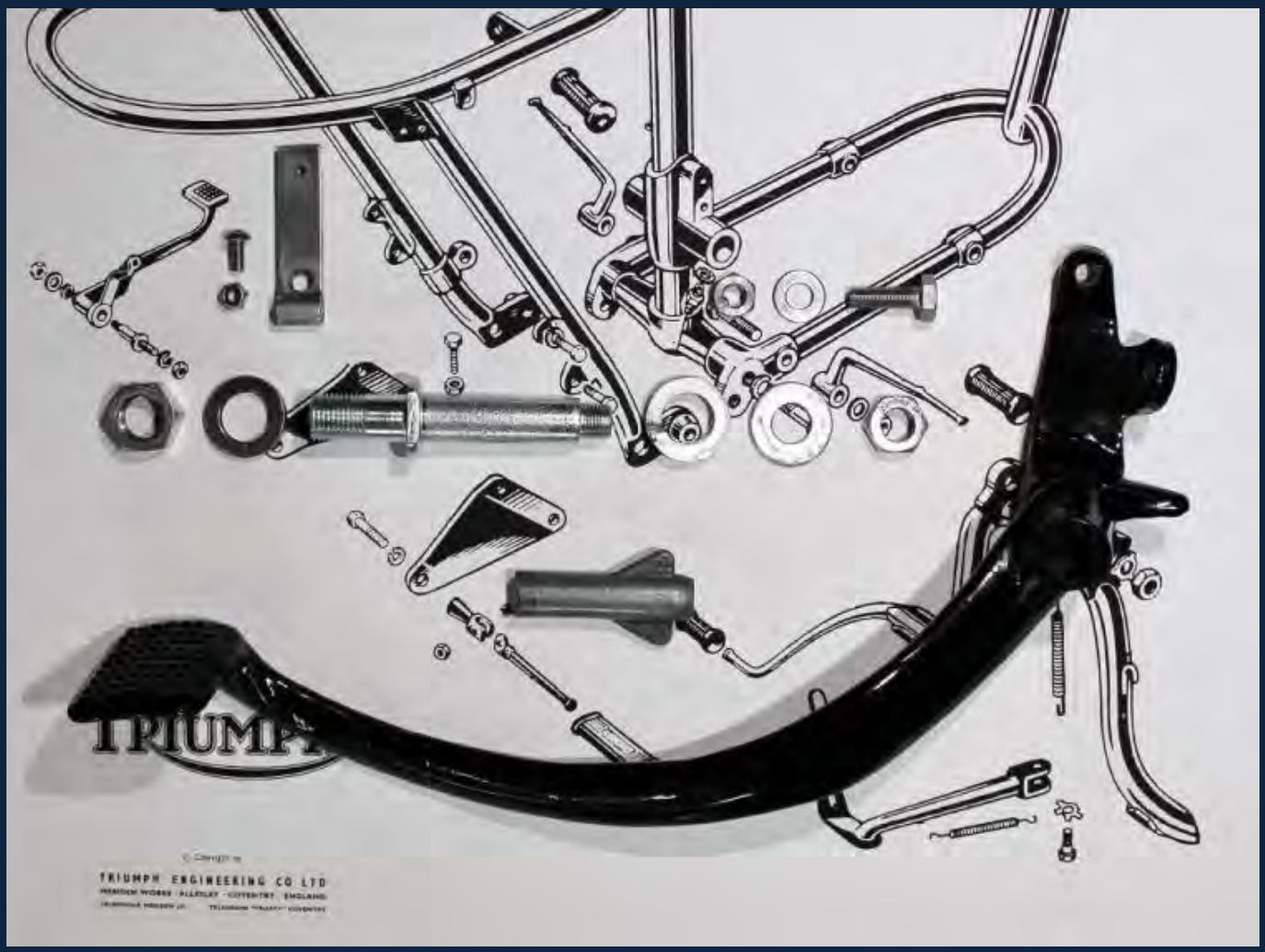
Moto Revue. Published from 1913, the French equivalent of The Motor Cycle or Motorcycling.

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.

The Rear Frame and Swing Arm Pivot.

Shown in detail is the rear frame with the swing arm, servicing of this is covered above and in the Works Manual. 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.

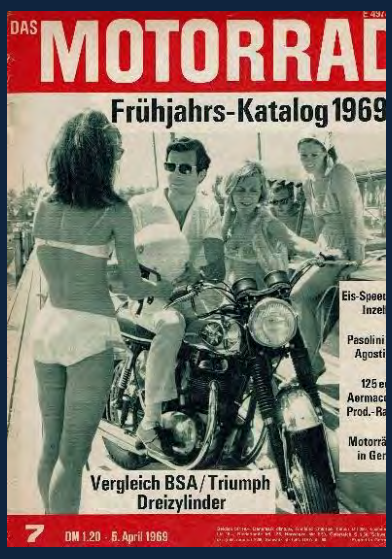
The Brake Lever

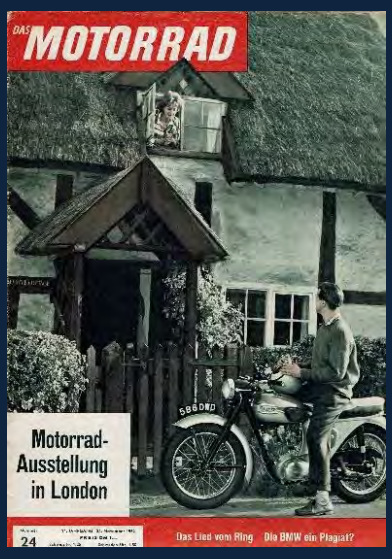


Brake Lever Parts.

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.

There are several types of brake rod, brake light clips and adjusters, most are illustrated in the parts books. The earliest adjuster is a simple T shaped one, later in alloy and with four ‘wings’ and from 1966 the version shown above. Check that the internal threads are in good condition, do not use an adjuster that is worn as the thread may fail when you need it most!

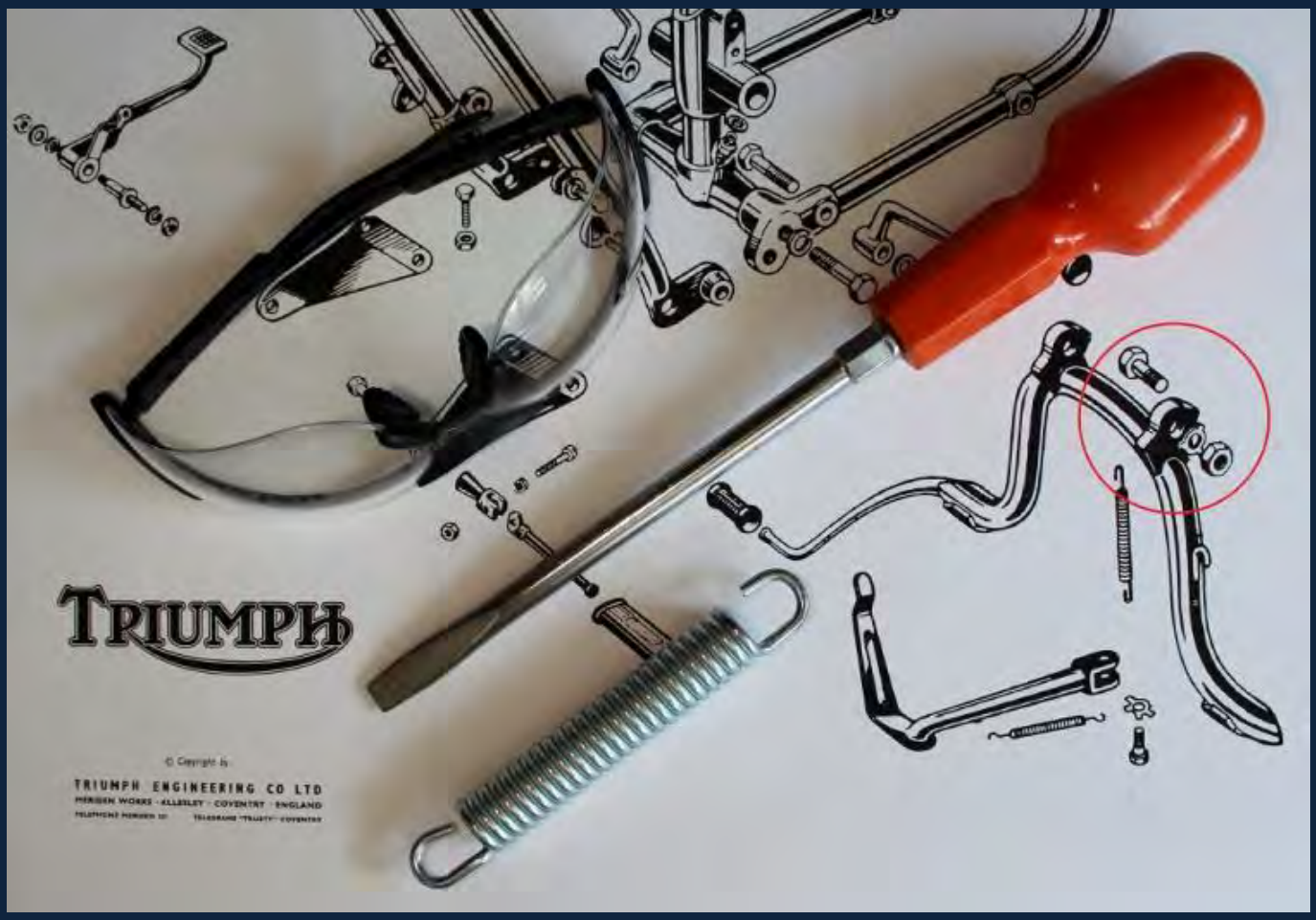




Das Motorrad. Published from 1903 in Germany.

Stands

The fitted Main Stand and Spring.



Fitting the Main Stand and Spring.

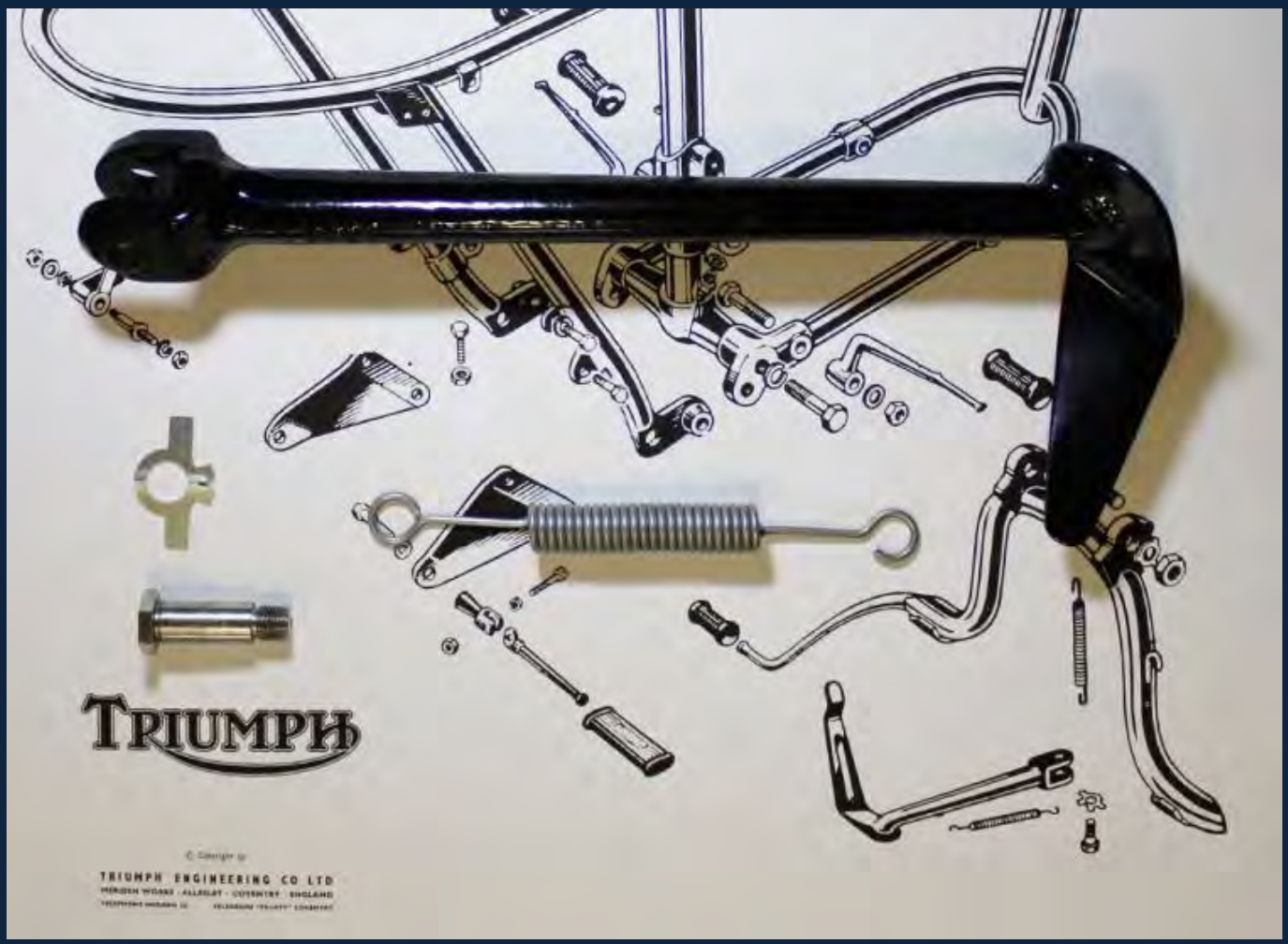
The illustration for the main stand fitting shown in the parts book is incorrect, the main stand lugs if you look closely are threaded and therefore the specialised bolt F3619 is designed to screw into them. It is very likely that the threaded holes and the bolts in your main stand will have worn making 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 main stand 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 they 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 main stand 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 and wear strong gloves and safety eyewear. Fit the main stand 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 Side Stand parts.

Like the main stand 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!

The Foot Rests

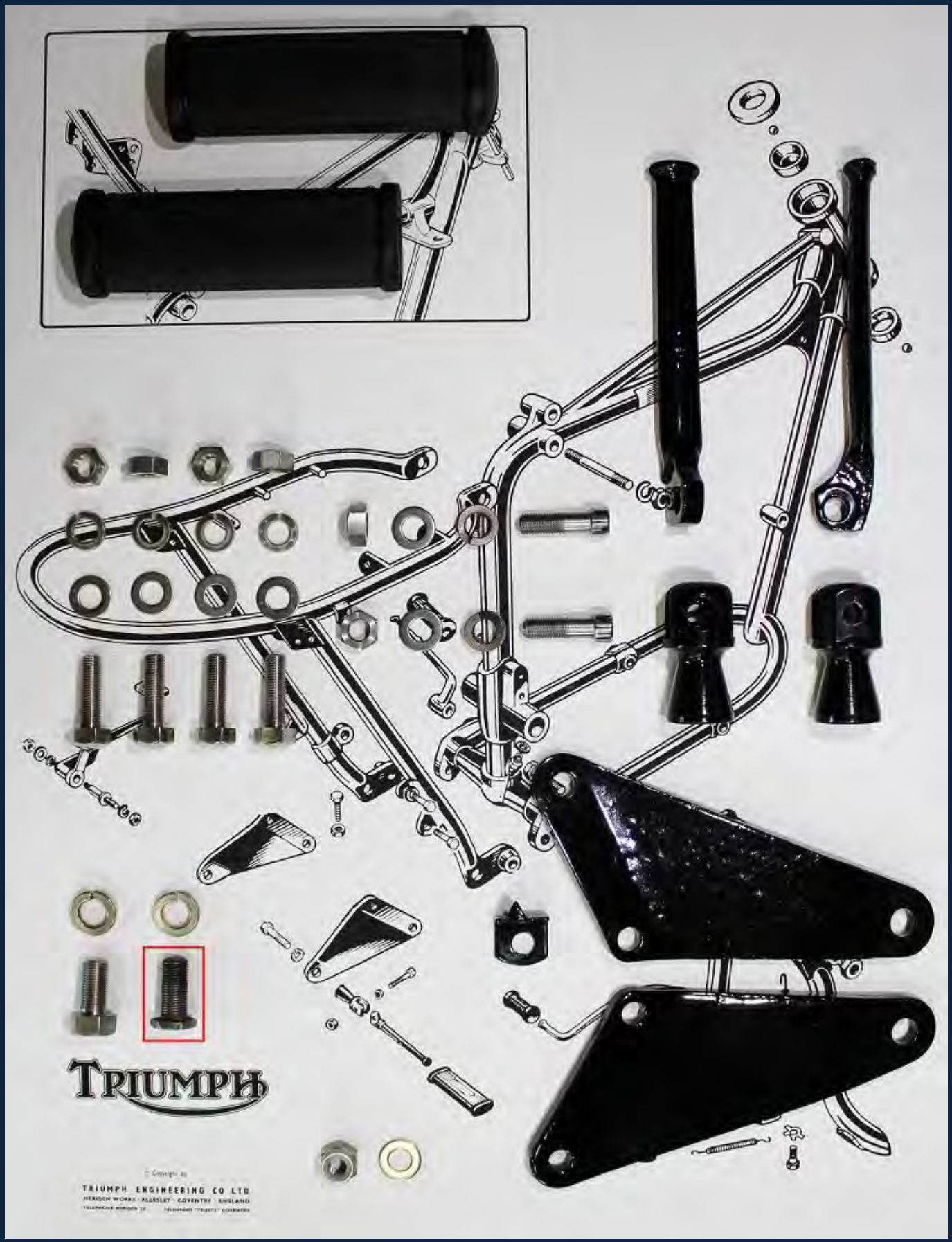
Riders Footrests, Rubbers and Oil Filter (Upgrade).

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 (bottom) allows adjustment but is more likely to slip when weight is applied. Some Police and Military models feature a stronger reinforced footrest!

Before fitting the footrests, remove any excess paint from the taper within the footrest with a flap wheel, and clean the boss on the frame so that a good contact will be made between the two surfaces. Do not use any grease.

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. It is advisable to machine a small amount of metal from under the bolt head to compensate for the thickness of the bracket for the filter unit.

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 oil filter head used here will require some suitable flexible pipe, use 8mm or 5/16 in pipe and fit this securely with clamps or small jubilee clips. Note which is the inlet junction and route this to the oil return pipe from the engine. Suitable filters for this unit are the Champion H101 or Purflux LS131 filters fitted to the Citroen 2CV.

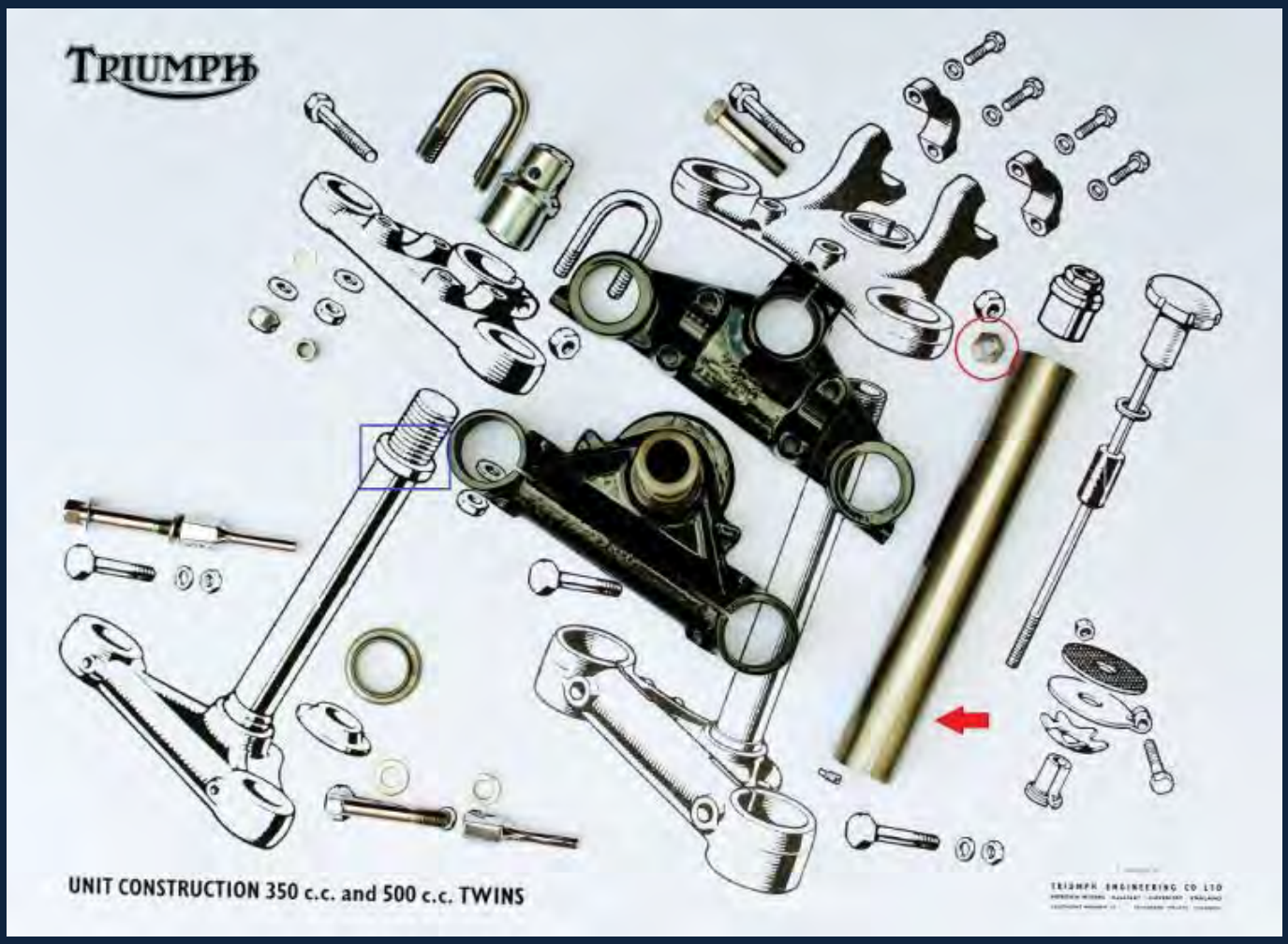


The Pillion Footrest Parts Group for 1966.

The standard triangular type of 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 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 (1 1/6 in or 27mm ID) 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 of 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.
Note the distinctive lugs for the screws that attach the nacelle!

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, alternate parts may have been used. Look for cast numbers that can help to identify them.

Not all models are fitted with the steering damper and this is eventually deleted. The lower plate features a hole that may appear vestigial, but corresponds with a hole on the early lug that allows a padlock to be fitted as a steering lock. To both prevent the lower nut turning or falling out a small grub screw or bolt is used and fits into the middle lug at the bottom, remove this first to dismantle the unit.

Dismantling the crown is straightforward after the fork stanchions and steering damper have been removed. Loosen the clamp nut (Red) first. Place a towel or a bucket under the headset to catch any ball bearings that escape and then supporting the lug unscrew the sleeve nut. Clean the parts with paraffin then brake cleaner and carefully examine the headset bearing surfaces for pitting. Removing the lower cone can present problems, apply heat first and prize the cone upwards with a chisel applying even pressure at several points. As a last resort cut through the cone carefully with a Dremel cutting disc or hack saw but do not score the lug if you can help it.

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 fork service tool Z161 is usually supplied with a set of threaded caps that allow it to be used across a variety of British motorcycles, it can be adapted as above for other uses.

The tubular drift (+1 1/6 in or 27mm ID) will be 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.

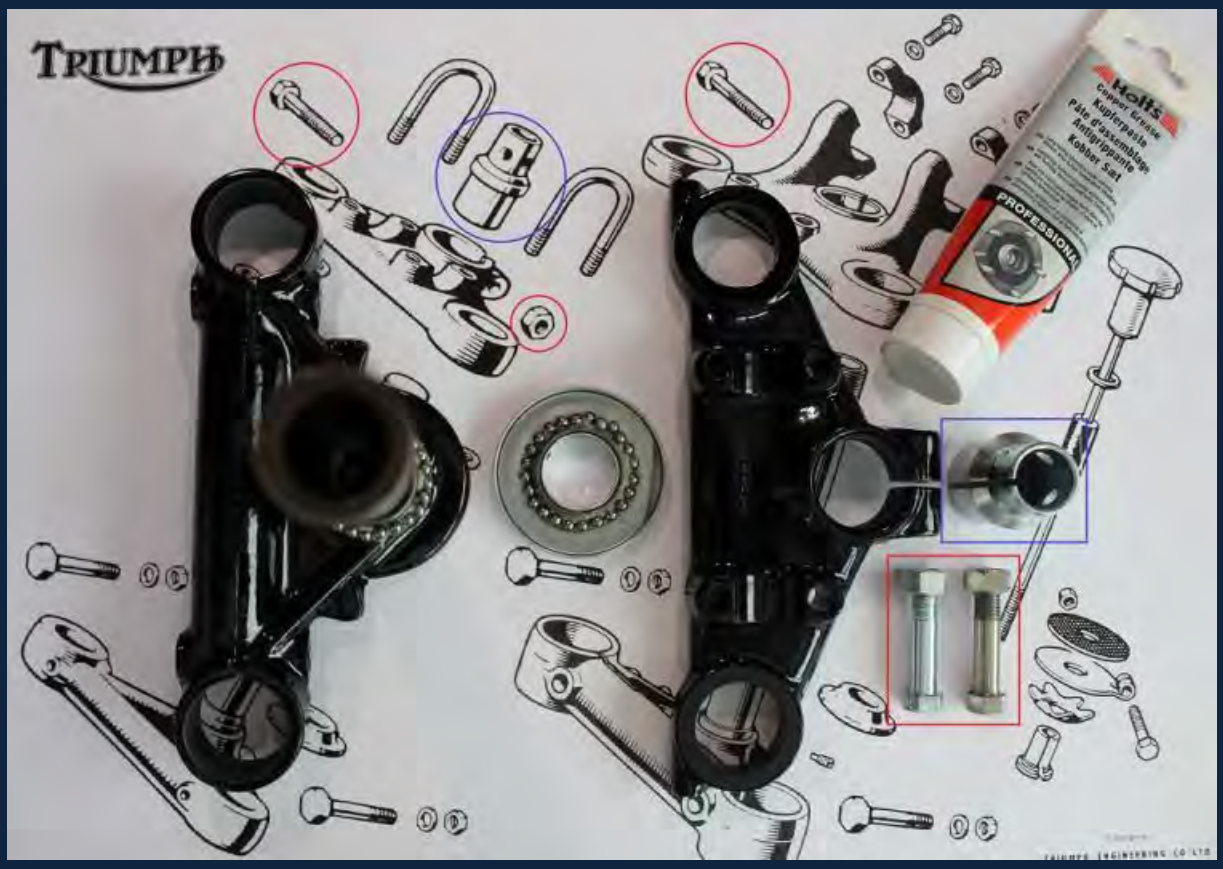
Here the crown has been cleaned with an emery wheel to remove all traces of paint and rust.
Before continuing, treat the inside of the frame tubes with ACF50, Waxoil, or Ankor Wax.

Using Tool Z161 and the Discs to fit the Cups Simultaneously.

To fit the cups chill them and 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.

For Illustration, The complete Nacelle Model, Headset and Stanchions.
Assembly Instructions follow.

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 and tested.

Front Forks 1964 to 1967

The Fork Parts Nacelle Type 1965-1966. (Not Dutch Military).

Section G3 of the Works Manual.

Shown above are the fork components to suit the Nacelle models from 1965 to 1967; 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 or side grommets 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. Care needs to be taken with identifying parts, thread forms and interchangeability. The stanchion (check you have a matched pair) shown is 22 inches long overall.

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 and are marked on the edge with four concentric rings (indicating UNF threads).

For the Top Nuts a 38mm Impact Socket is suggested, a bar welded on makes a useful tool.

The early fork fitted from 1957 though it has internal springs operates in the same way as the later versions with the oil acting both as a lubricant and as a hydraulic stop for both compression and rebound. Both types feature hard chromed stanchions, sintered bronze bushes, sleeves, restrictors and chromed seal holders and some parts are interchangeable across the types. Refer to the parts books for assembly details and part numbers.

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. It is usually possible to replace the gaiters on the post 1964 fork with the sliders in place if the gaiter is lubricated with a little soap to ease it over the seal holder.

Fork Assembly 1964 to 1967

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 drive Impact Socket, milled to suit the bearing nut.

Frequently the bearing nut is very difficult to remove and the tool 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. Fit the damper sleeve with the internally reduced section at the bottom.

Note that the illustrations for the fork components in the parts books become increasingly inaccurate over time and should be treated as a guide rather than gospel. Assemblies varied across the range depending on the year, model and the eventual destination of the motorcycle. For example, the 1964 fork uses a shorter spring (H1660) and longer damper sleeve (H1653) than the parts above which are suitable for 1965 onwards.

The Bottom Members, Caps, Upper Bearing and Seal Holder.

Shown here the standard bottom members fitted from 1965 to 1971, 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 all the threads are viable and clean. (5/16 BSCY or UNF Plug or Bottoming Taps, see below).

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. Only apply force at the bottom of the holder, the metal is thin elsewhere and easily dents. Specialist tools are available. The seals within the holders can be replaced, some effort may be needed to drive the old seal out as they frequently rust into place; use a narrow drift to extract them and then press the new seals in.

The upper bearing is lipped to fit the bottom member and should fit easily with the thin 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. A specialised aluminium washer acts as an oil seal.

Fork Arrangement 1957 to 1963

For Illustration, the early Bottom Members fitted to 1964.

Up to 1964/5 the fork sliders show distinctive forged ends, note that the part numbers shown H1119 and H1120 do not correspond with the parts books where these are described as parts H1117 and H1118. The right hand member (left) shows the stop for the front brake cable that moves later to the brake plate.

Assembly principles and action of the early forks is very similar to the later ones and should not present any problems even for the beginner once you understand the design.

Showing the brake cable stop and forged caps of the early fork.

Fitting the Springs

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.

When restoring a project bike with worn, missing or damaged parts you may have to compromise or upgrade to a later specification if the correct period parts are unavailable. Study the parts books carefully noting changes to part numbers and check the catalogue specifications for your machine year.

Tip: Once the forks are fully assembled and wheels fitted, slacken off the various pinch bolts and the top nuts. Push the machine several times against a solid object like a wall so that the forks settle, fully compress and rebound. The action should be smooth without any sticking or knocking, recheck the alignment, adjust the top sleeve nut to remove play and finally tighten the top nuts and then the pinch bolts.

The handling of machines can be tuned by carefully selecting fork components, tyres and oils, so that the ride height damping and trail are optimised to your particular needs and riding style. See the bulletin from 18th Jan 65

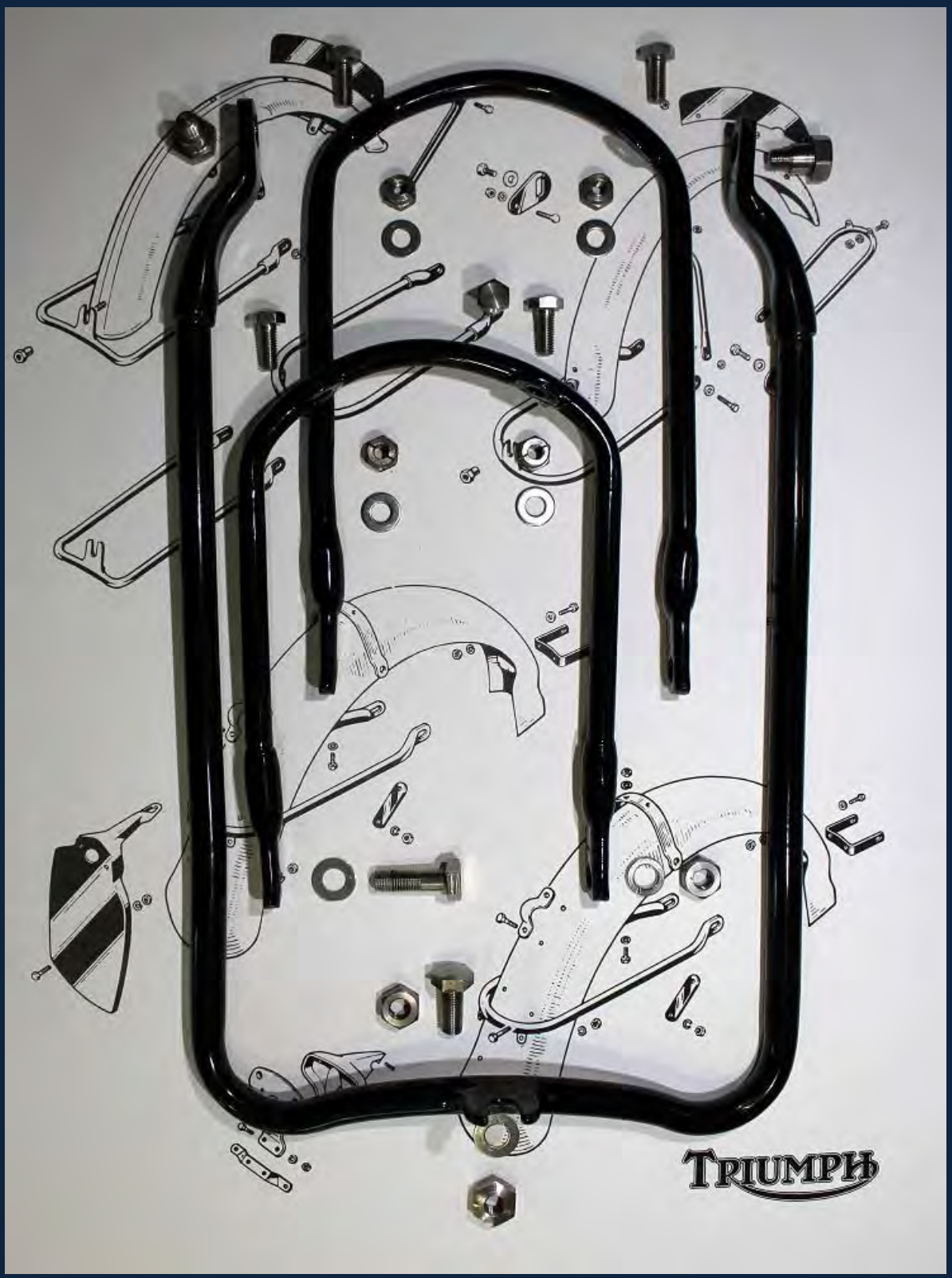
Nacelle Parts

Some of the parts of the Nacelle for the 1966 3TA.

The Nacelle was a distinctive feature across the Triumph model range for many years, comprising of two covers for the stanchions and an upper panel for the instruments and switchgear. The joins are concealed by the decorative trims. Subtle changes are made to the parts over the years and it can be difficult to date and identify the components particularly if you are searching for Nacelle parts for a project machine. Refer to the parts books.

Parts Book 4, published in December 1961 is particularly useful at it shows the evolving fork design and parts for the sports models including the T100SS. Restorers should study the pages carefully noting the information on page 45. Not shown are the special parts fitted to Police machines and owners should first check the Factory Records before committing to a restoration. Police machines with high output alternators use the engine number suffix W and feature additional wiring and switchgear in the Nacelle.

Front Mudguard Stays

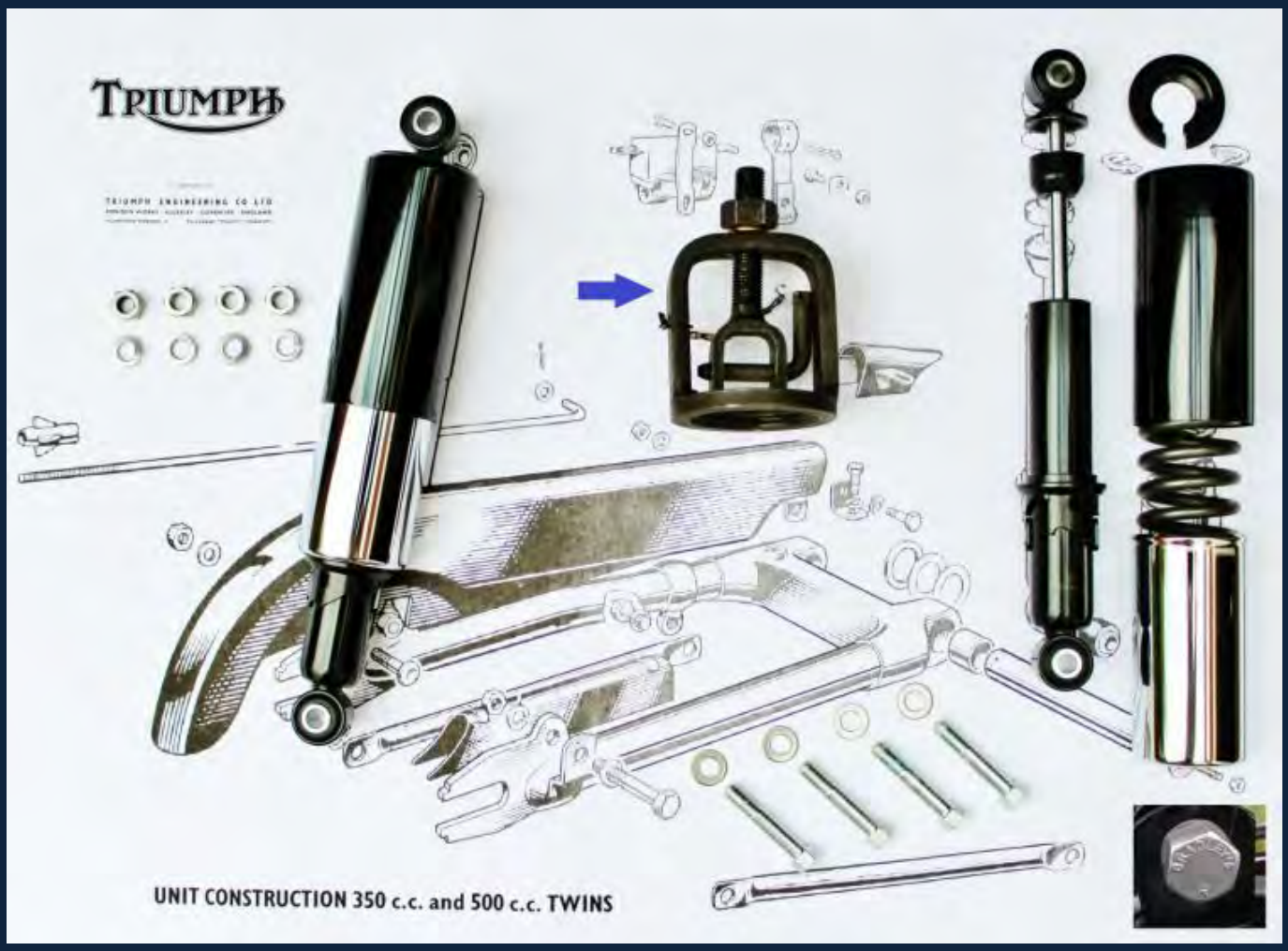


Front Mudguard Stays for the Sports Models 1966.

This is the Mudguard Stay group fitted to the Sports Models, i.e., those without the Nacelle.
Many variations of what appear to the same parts were fitted over the years and it can be very difficult to confirm that you have the correct set for your project.
Check the parts books carefully and compare Part Numbers.

Fitting can be fiddly and several special fasteners are used such as the DS57 bolts shown above.
Do a dry run first, loosely assembling all of the stays to the mudguard and checking the fit.
A degree of adjustment is available as the mounting brackets are reversable and slotted.
Use locking nuts or Loctite so that a controlled torque and be maintained as you risk damaging the delicate paintwork on the mudguard and the lower sliders.

Rear Suspension



Rear Suspension.

Shown are the parts for the rear suspension including a useful tool (arrowed), 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 3/8in bolts but over the years there were subtle changes. Above are the famous “Bradley’s” bolts, so called because of the cast in name and much sought after by restorers. On machines built before 1965 you will see the much rarer “Newton” bolts used, look out for these!

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.

Note: When fitting replacement pattern shock adsorbers, it is sometimes necessary to grind or file the bushes to size so that they will fit into the existing frame and swing arm mountings. Resist the temptation to bend the brackets as this will weaken them.

The Chainguard

The Chainguard, illustrated above, was a common part across the range. Rarely available as spares it may be necessary to repair or fabricate one if your project is missing this vital part. The Bathtub models also have a lower chainguard associated with the brake torque arm, see above. This is also a rare part and difficult to fabricate without special tools and skills.

There are some subtle changes to the design over the years, notably with the location holes for the brake light switch. Fitting the chainguard and torque arm can be very frustrating and is best done early in a restoration project before the battery, oil tank air filter and side panels have been completed. Refer to the section later on the Rear Brake.

Hubs, Wheels & Brakes

The Front Hub and Brake.

7 in Full Width Front Hub, Rim, Spokes and Nipples.

The TRIUMPH Corporation

SERVICE BULLETIN

January 16, 1958

No. 58/2

TO ALL EASTERN TRIUMPH DEALERS:

Re: Complete List of Spokes Used on All Current Triumph Models

Butted Spokes for 16" Lightweight Rear Wheels					
W1259	Spoke and nipple	6-15/16" - 90°	(12/10 Gauge)	R.H.	(20 ea.)
W1213	Spoke and nipple	5-15/32" - 100°	(12/10 Gauge)	L.H.	(10 ea.)
W1214	Spoke and nipple	5-15/32" - 80°	(12/10 Gauge)	L.H.	(10 ea.)
Butted Spokes for 18" Lightweight Rear Wheels					
W1293	Spoke and nipple	8" - 90°	(12/10 Gauge)	R.H.	(20 ea.)
W1294	Spoke and nipple	6-3/8" - 100°	(12/10 Gauge)	L.H.	(10 ea.)
W1295	Spoke and nipple	6-3/8" - 80°	(12/10 Gauge)	L.H.	(10 ea.)
Butted Spokes for 19" Lightweight Front Wheels					
W1289	Spoke and nipple	8-1/2" - 90°	(12/10 Gauge)	L.H.	(20 ea.)
W1205	Spoke and nipple	6-7/8" - 100°	(12/10 Gauge)	R.H.	(10 ea.)
W1206	Spoke and nipple	6-7/8" - 80°	(12/10 Gauge)	R.H.	(10 ea.)
Butted Spokes for 19" Lightweight Rear Wheels					
W1289	Spoke and nipple	8-1/2" - 90°	(12/10 Gauge)	R.H.	(20 ea.)
W1205	Spoke and nipple	6-7/8" - 100°	(12/10 Gauge)	L.H.	(10 ea.)
W1206	Spoke and nipple	6-7/8" - 80°	(12/10 Gauge)	L.H.	(10 ea.)
Butted Spokes for 18" Twin Rear Wheels					
W1107	Spoke and nipple	7-9/16" - 90°	(10/8 Gauge)	L.H.	(20 ea.)
W1108	Spoke and nipple	7-7/8" - 90°	(10/8 Gauge)	R.H.	(20 ea.)
Butted Spokes for 19" Twin Rear Wheels					
W1104	Spoke and nipple	8" - 90°	(10/8 Gauge)	L.H.	(20 ea.)
W1106	Spoke and nipple	8-3/8" - 90°	(10/8 Gauge)	R.H.	(20 ea.)
Butted Spokes for 19" Twin Front Wheel (8" Air Cooled Brake)					
W1166	Spoke and nipple	6" - 80°	(10/8 Gauge)	R.H.	(10 ea.)
W1167	Spoke and nipple	6" - 95°	(10/8 Gauge)	R.H.	(10 ea.)
(Note: L.H. Butted Spokes not Supplied)					
W660	Spoke and nipple	8-11/32" - 88°	(10 Gauge)	L.H.	(10 ea.)
W661	Spoke and nipple	8-11/32" - 90°	(10 Gauge)	L.H.	(10 ea.)
Butted Spokes for 19" Twin Front Wheel (7" Full Hub Brake)					
W1236	Spoke and nipple	6" Straight	(10/8 Gauge)	All	(40 ea.)
Butted Spokes for 19" Twin Front Wheel (8" Full Hub Brake)					
W1328	Spoke and nipple	5-5/8" Straight	(10/8 Gauge)	All	(40 ea.)
Butted Spokes for 17" "Twenty-One" Front Wheel					
W1275C	Spoke and nipple	5⅝ Straight	(10/8 Gauge)	All	(40 ea.)
Butted Spokes for 17" "Twenty-One" Rear Wheel					
W1270C	Spoke and nipple	7-3/16" - 110°	(10/8 Gauge)	Inner	(20 ea.)
W1271C	Spoke and nipple	7-3/16" - 90°	(10/8 Gauge)	Outer	(20 ea.)

WARNING: Do not mix butted spokes with straight shank spokes when repairing a wheel. When a wheel is being completely respoked, it is recommended that a complete set of butted spokes be installed. (See Triumph Corporation Service Bulletin No. 57/2).

Wheel Building

The TRIUMPH Corporation

SERVICE BULLETIN

October 30, 1964 64/4

TO ALL EASTERN TRIUMPH DEALERS

SUBJECT: Wheel Building Dimensions

The following locating dimensions should be used when respoking Triumph wheels. Front wheel dimension is the distance from outside edge of brake drum to outside edge of steel rim on that side. Rear wheel dimension is the distance from outside edge of sprocket teeth to outside edge of steel rim on that side.

	FRONT	REAR
"A" RANGE	WM1 Steel Rim 5/8" WM2 " " 7/16"	WM1 Steel Rim 1-7/32" WM2 " " 1-5/32" WM3 " " 1-1/16"

	FRONT	REAR
"B" RANGE	Full Width Hub 7" brake 3/16" " " " 8" " Minus 1/64" Early Hub 7" brake 13/16" " " 8" " 7/16" (All "B" Range Front Wheels Use WM2 Steel Rim)	WM2 Steel Rim 1-27/32" WM3 " " 1-11/16"

	FRONT	REAR
"C" RANGE	Full Width Hub 7" brake 3/16" " " " 8" " Minus 1/64" (All "C" Range Front Wheels Use WM2 Steel Rim)	WM2 Steel Rim 1-13/16" WM3 " " 1-21/32"

Very truly yours,

THE TRIUMPH CORPORATION

Rod Coates

Service Manager

Rod Coates:bjh

Service Sheets with Wheel Building information.

Several of the Service Sheets as above give the dimensions for spoke lengths and wheel offset for the standard models in the Triumph range. Police and Military models can be specified with and feature heavy duty straight spokes.

Wheel Building

Wheel Building is generally beyond the scope of the beginner but can be a rewarding skill to master. A few specialist tools are needed but these can either be made or bought. You will need space to work, a wheel truing jig and spoke tool in addition to the hubs, rims, spokes and nipples.
The Rear Swing Arm makes an acceptable jig if held firmly in a vice.

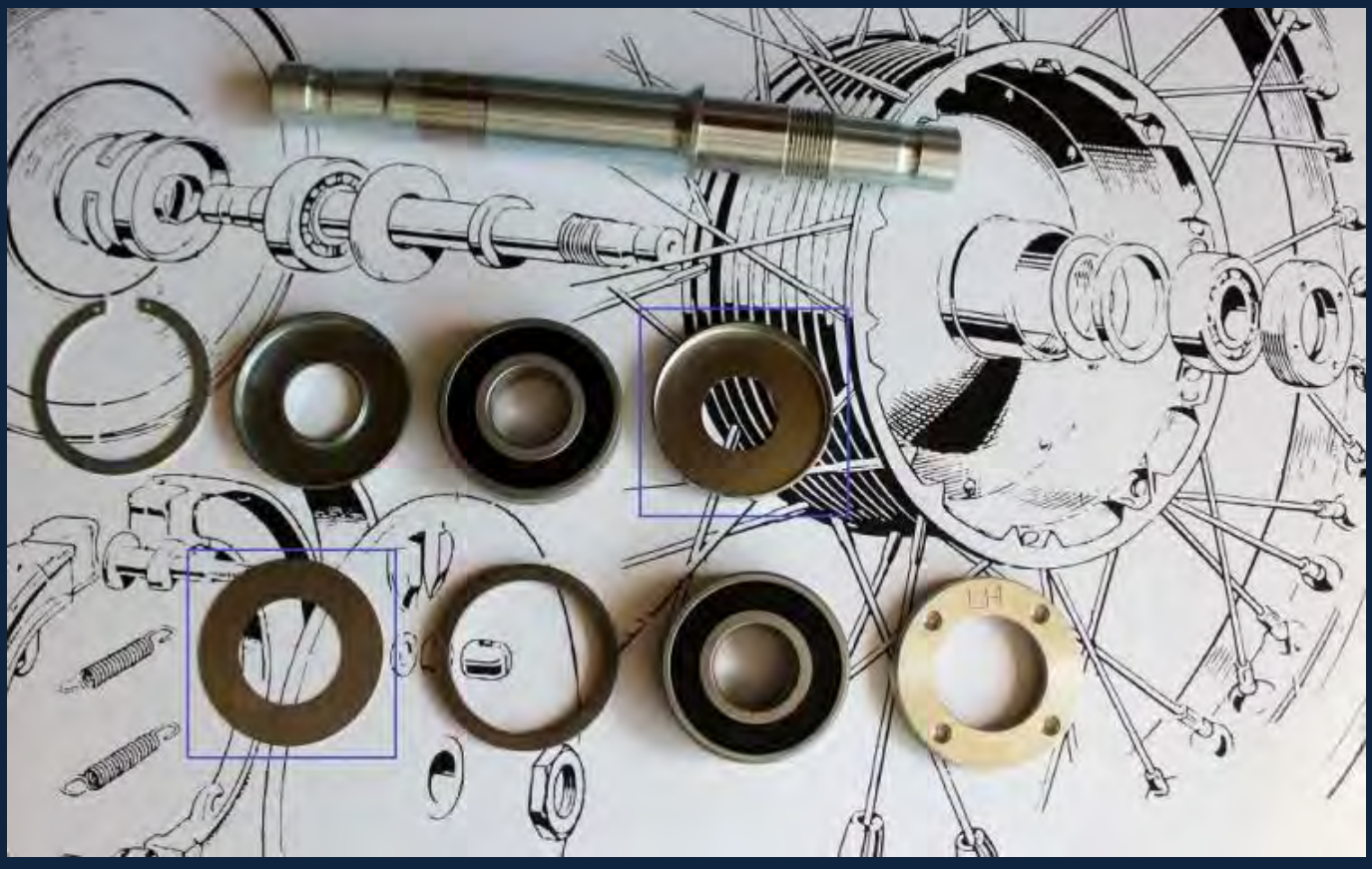
The C range machines mostly use the full width 7 inch front hub and either the bolt on or QD rear hub shown later. You will find detailed information in the Factory Bulletins that cover spoke types lengths and offset dimensions for most Triumph wheels fitted to standard models and your supplier will usually have this data to hand and provide the correct items for you to successfully build your first set of wheels.

Do not expect to get perfect results the first time as wheel building is an art, think of it as a learning exercise and treat both your successes and failures as part of the process.
Instructional videos, articles and books are readily available.

Tri-Cor Factory Bulletins 58/2 (16 Jan 1958) and 64/4 (30 Oct 1964) are above.

For the 18 in front wheel for this project, a WM2 40 hole chrome rim was obtained along with 40 of 5 inch, 8/10 butted polished stainless steel spokes with suitable nipples.

Note in the illustration below the Lacing Pattern of the Spokes.

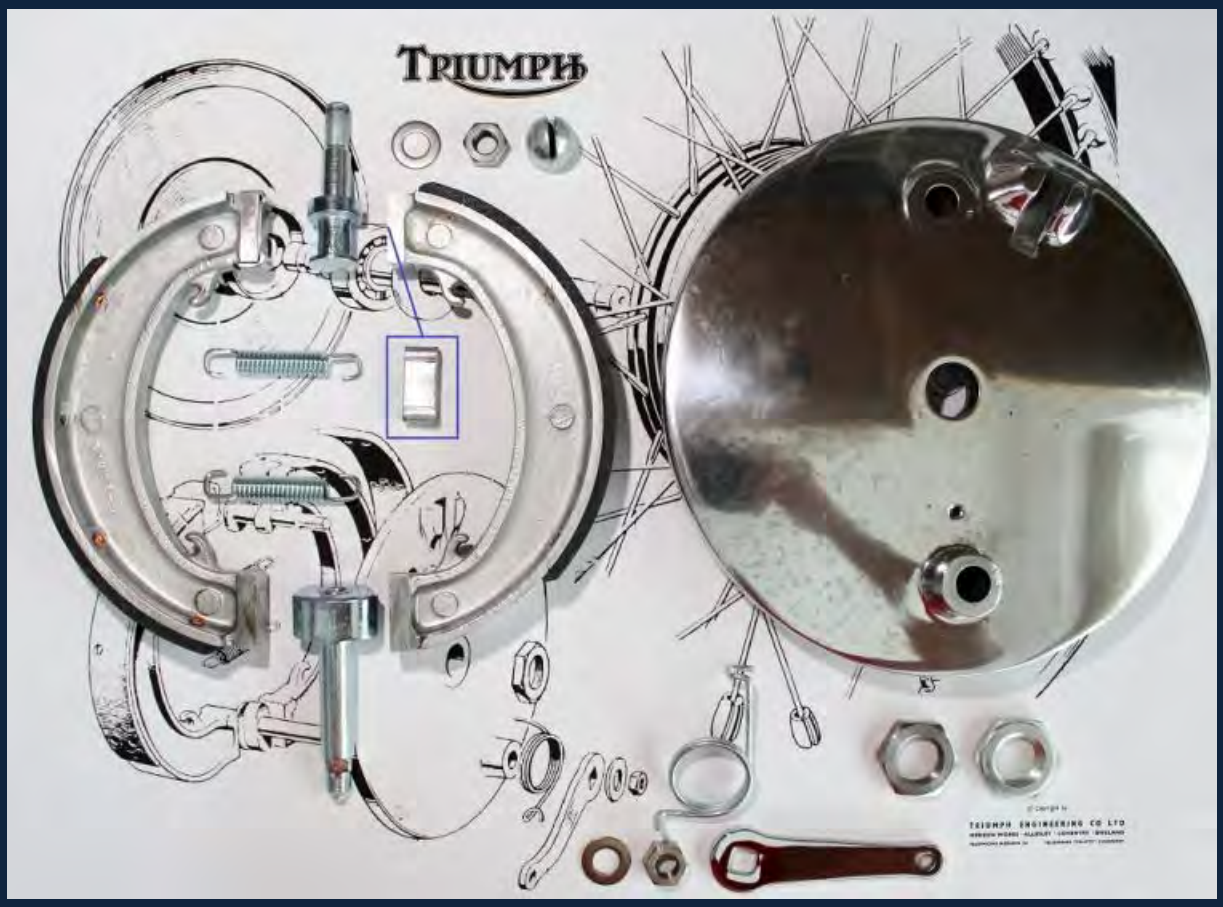


Front Wheel Axle and Bearing Set. Section F of the Works Manual.

Here sealed bearings are being used to replace the original open bearings and the two grease retainers (Blue) will be omitted. Sealed bearings can benefit from being re-packed with a bearing grease before fitting, prize out the seals with a small pick. To remove and fit the bearings refer to the Works Manual; ideally use a suitable mandrel and press 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, test fit this first as any damaged threads in the hub will have to be re-dressed. Fit using a suitable peg spanner, it may be necessary to make a tool specifically for this job as we did for the forks.

A wide flat alloy bar, shaped, drilled and tapped for two/four suitable bolts that correspond with the recesses in the retaining ring will work well, noting that the front axle has to be in place as well.

The Front Brake



The Front Brake parts for the 7in single leading shoe brake.

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.

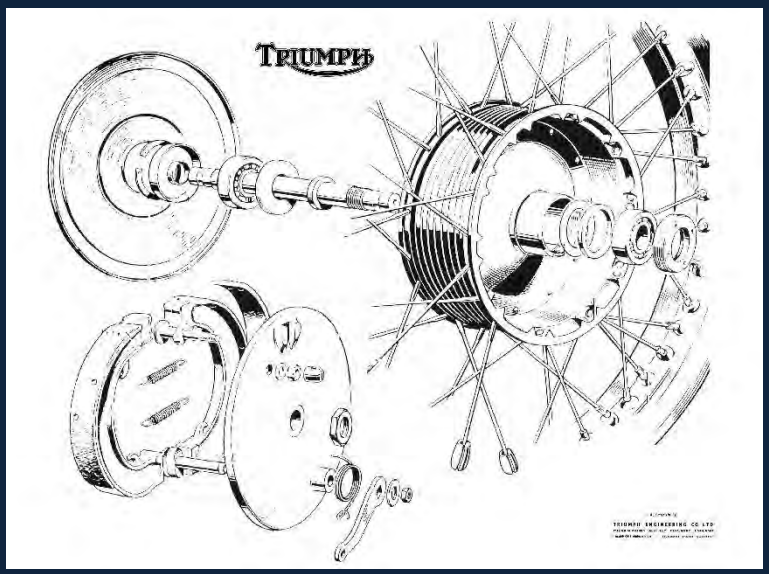
Early W1301 brake plate showing the additional support lugs not usually seen after 1960. There are several types of 7 in brake plate fitted across the range including the sought-after twin leading shoe type.
Some Daytona models use the 8in brake and hub from the larger B range machines.

Brake Shoes

There are two designs of brake shoes fitted to the C Range 350/500 machines, the early non floating type part number W93 above left and the later shoes Part No's W1406 and W1407 (right). Shown also are original lining materials (Asbestos) and water resistant (Red), held in place with copper rivets and two types of the (improved) modern bonded linings, grey and copper filled fibre.

The (Red) water resistant lining was fitted to the Dutch Military machines as these were designed to wade and may have been specified on some other models such as Mercury's and T100C's.

During a restoration it is prudent to replace the brake linings, especially if they are worn, damaged or contaminated. Old linings should be handled with care as they may contain Asbestos.
A brake specialist will be able to reline the shoes for you, usually at a reasonable cost.
Or alternatively obtain new shoes together with springs and cams.



Front Wheel, Hub and Brake Parts.

Refer to the Works Manual for Fitting Instructions

Front Brake

The correctly assembled brake.

The standard 7in brake is by modern standards only just adequate, even when correctly assembled and adjusted. Improved braking performance can be achieved by fitting the later 7in twin leading shoe unit.

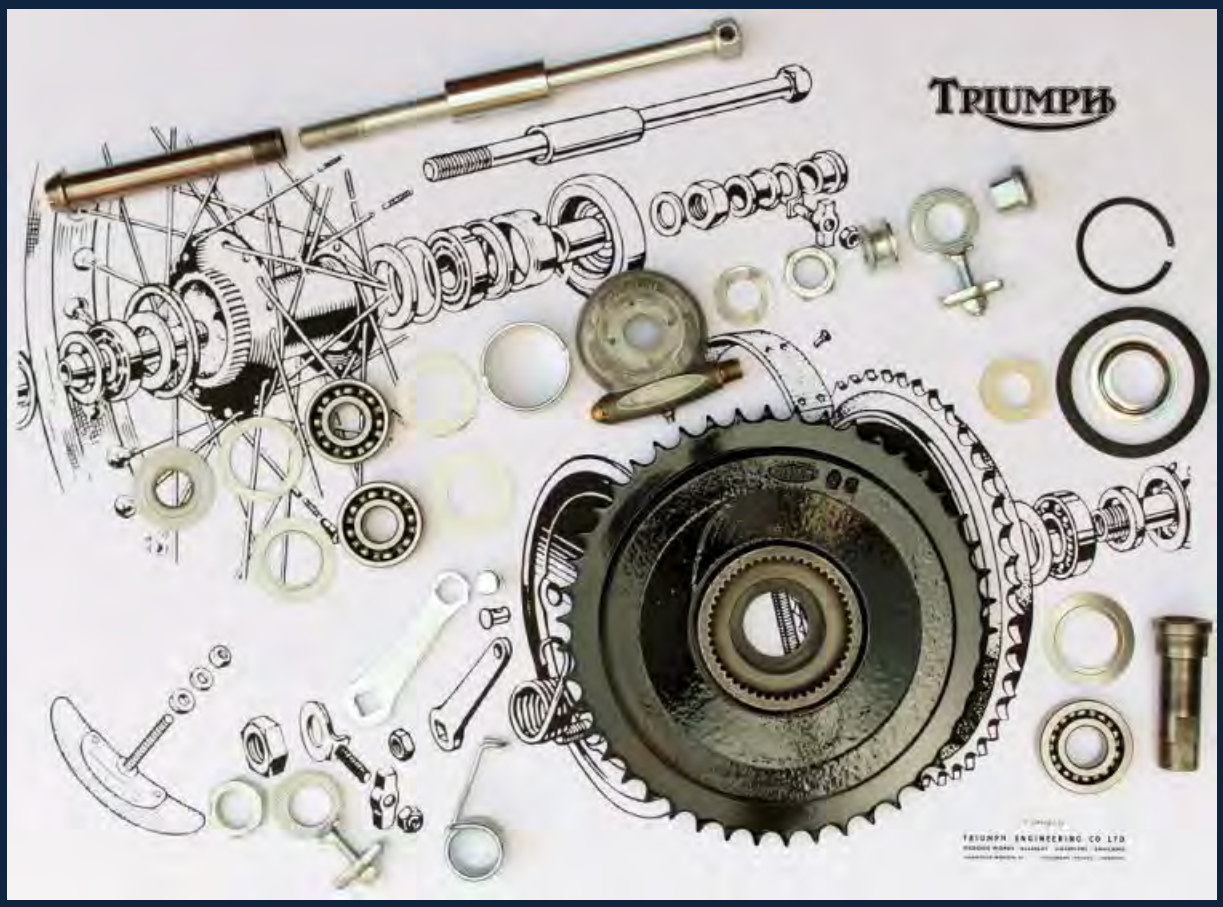
The Twin Leading Shoe Brake.

The Rear Hub

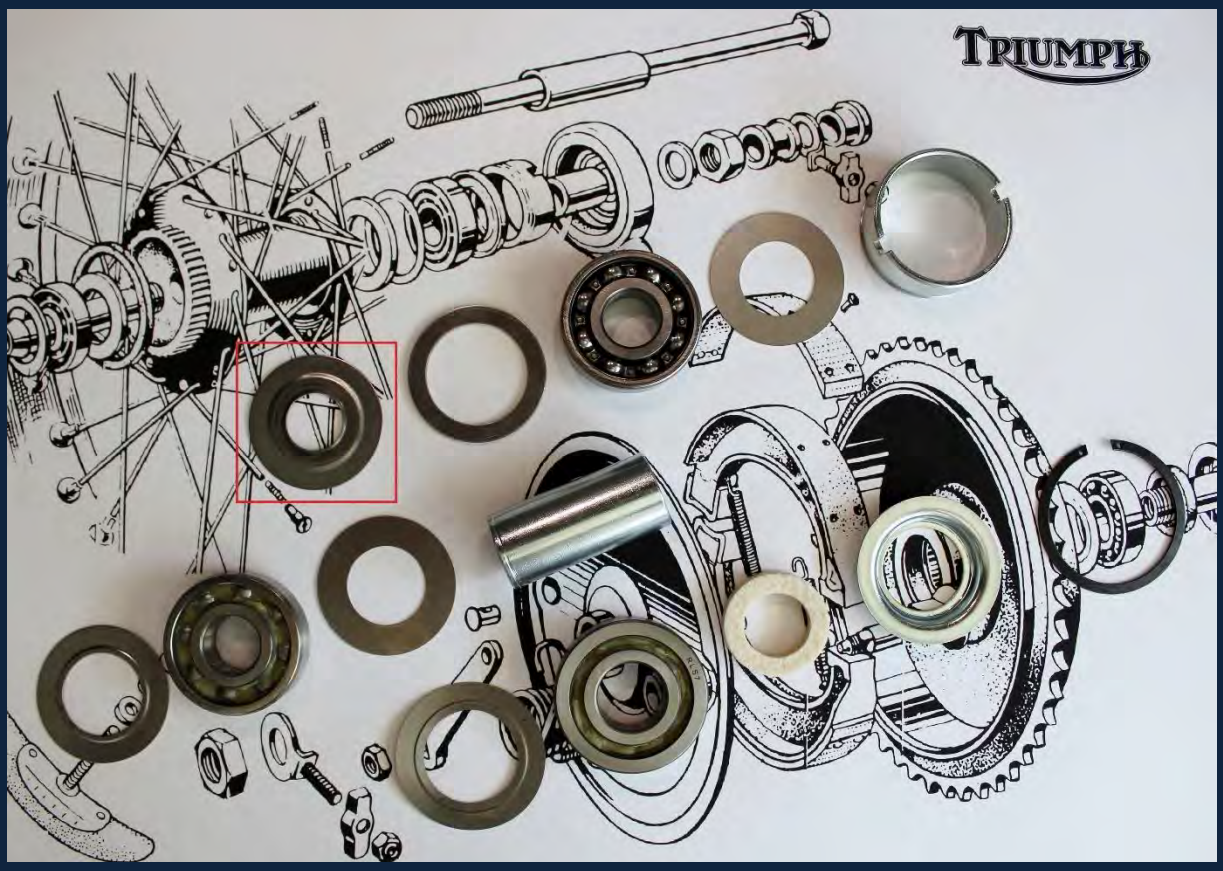
The Triumph rear hub as shown above is constructed from three parts spot welded together, a central tube machined to take the bearings and locate them and cast/pressed ends that are pierced for the spokes.

Showing the bearing and seal arrangement for the C Range ‘Bolt Up’ Hub.

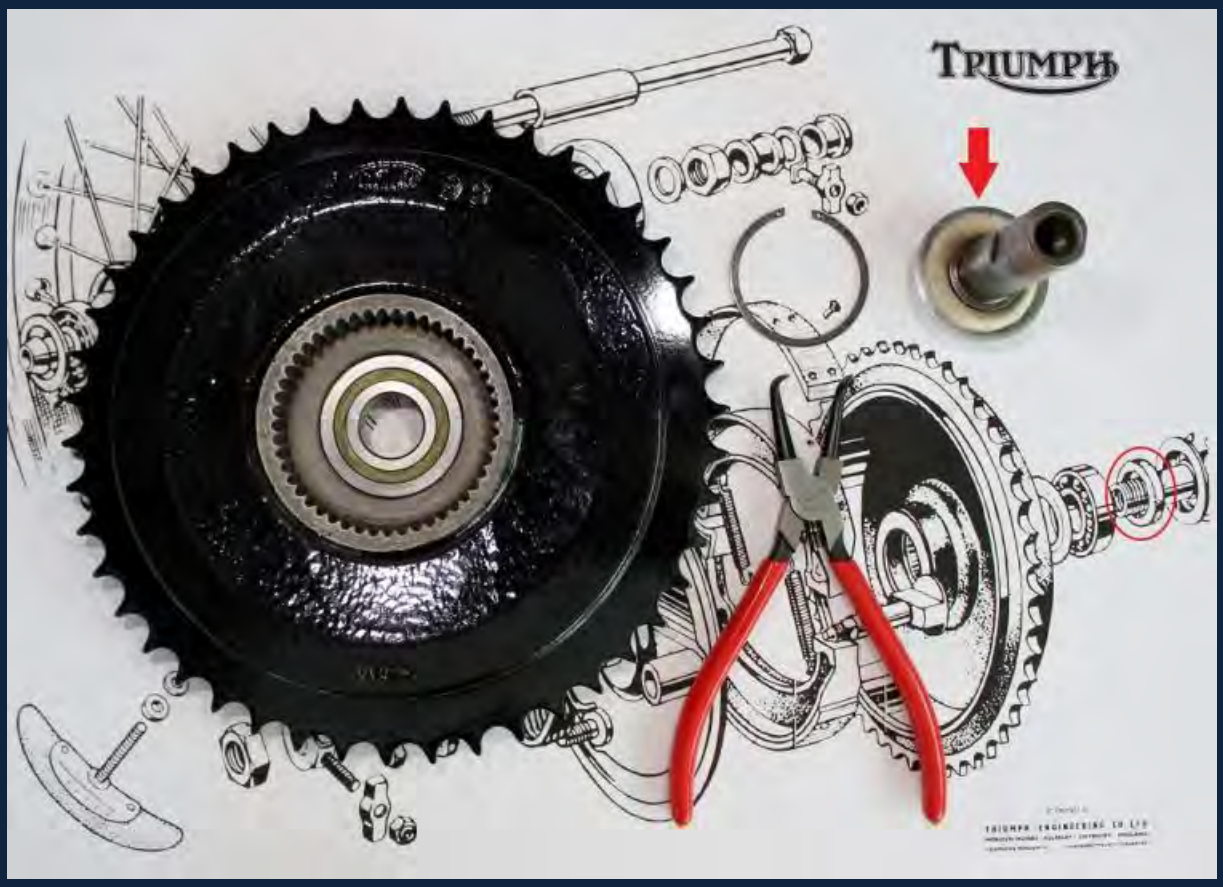
Here Sealed Bearings are being used instead of the standard open bearings.
The Hub will be painted and the wheel built before assembly is completed.



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.

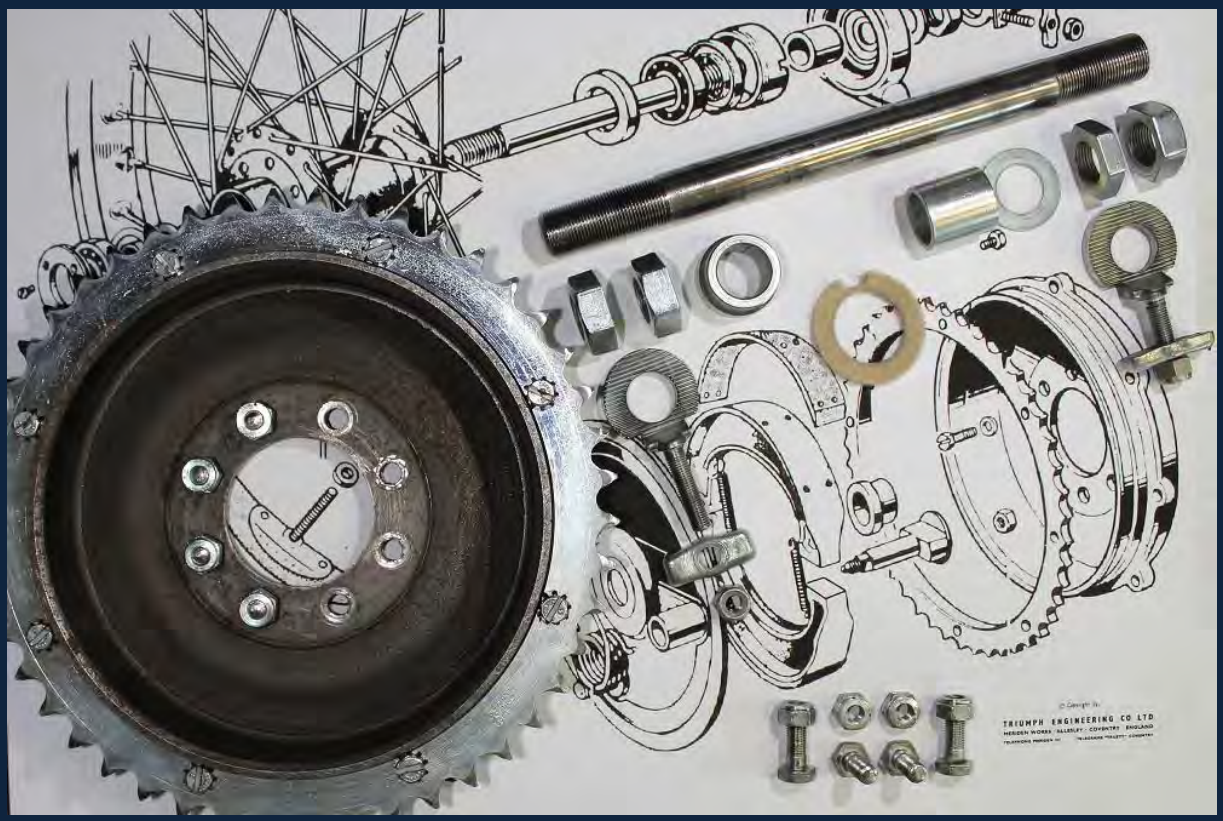


Arranged in order of assembly are the bearings and other parts for the QD Hub. The top row is the Right Hand hub bearing set, the centre the Left Hand bearing set (with the central spacer) and at the bottom is the set for the Sprocket/Brake Drum. The bearings have been packed with grease and the felt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



The Sprocket/Brake Drum reverse. QD Hub.

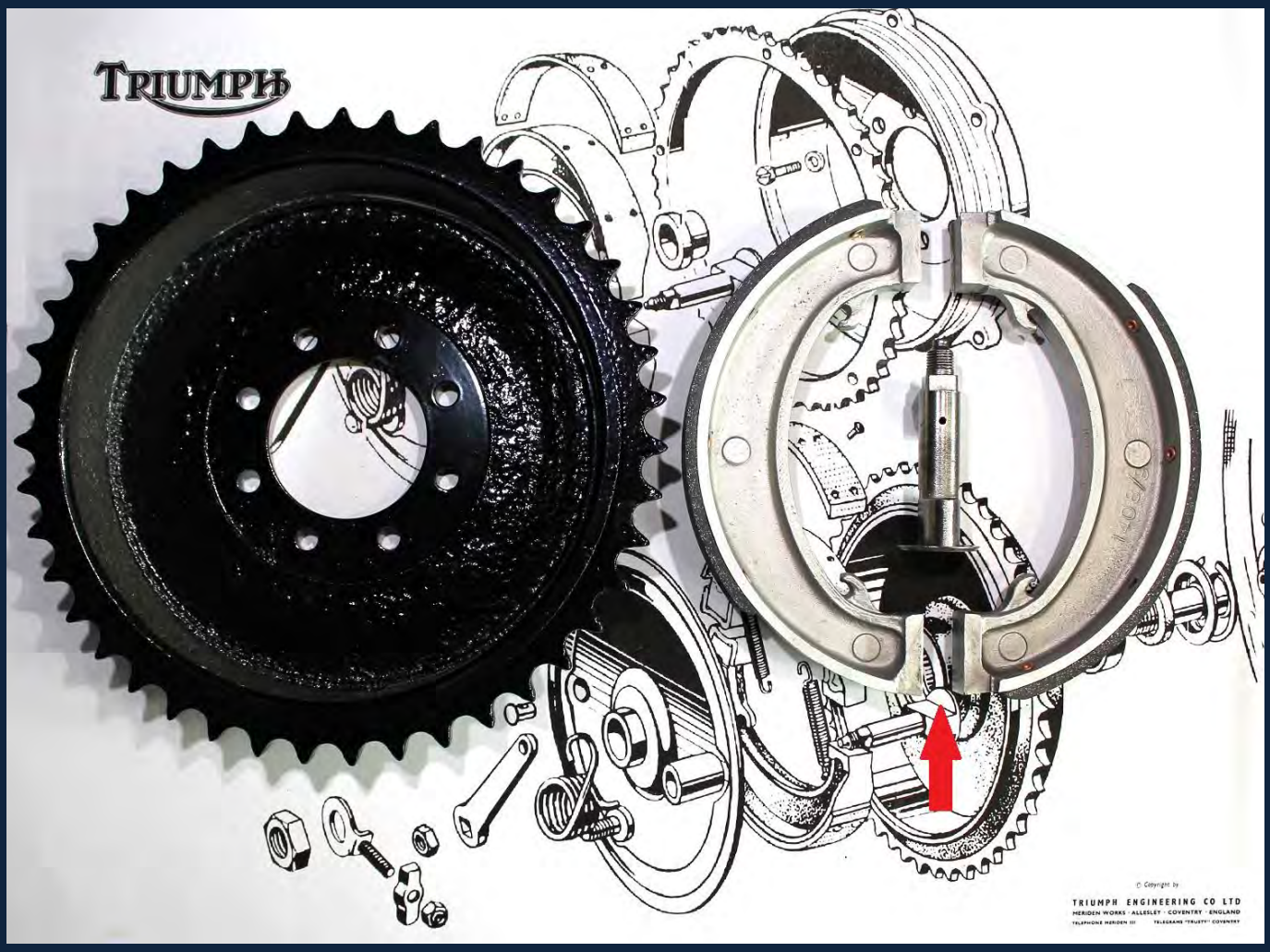
The grease retainer and the bearing have been fitted to the sprocket/drum while the felt washer has been fitted into the bearing retainer W1043 and onto the bearing sleeve W1045 (Red). The retaining circlip is ready to be fitted. Assemble in this order as the felt washer is inclined to distort if the bearing sleeve is pressed in afterwards.



The Standard drum (non QD) and the arrangement of the axle, parts and fasteners.

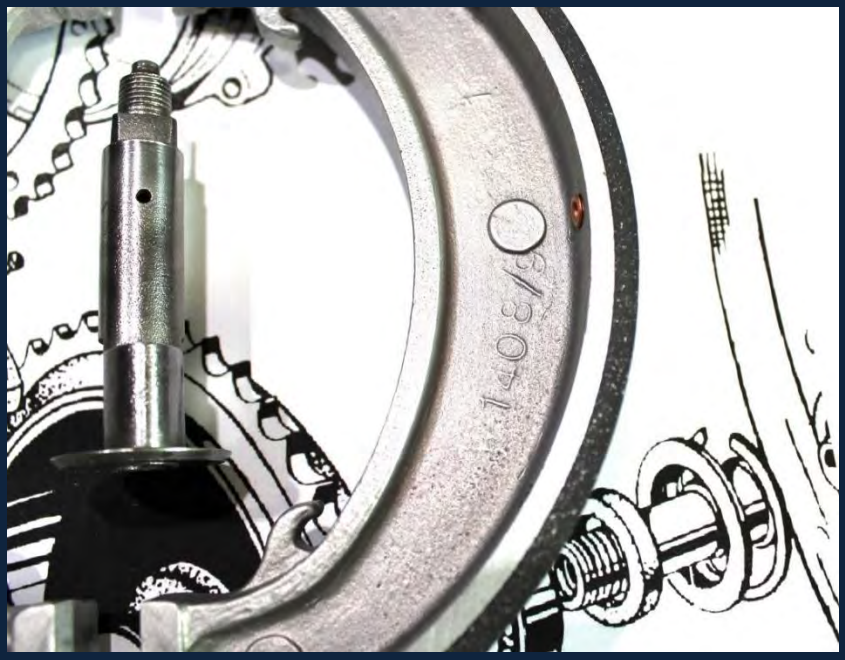
This being the 1966 drum, has the bolted-on sprocket. The felt dust seal is optional.
As with the QD hub & below, do not overtighten the nut securing the speedo drive
Early drums use eight special lock tabs instead of the locking nuts above.

The Dutch Military machines use a QD Hub with an enlarged bolt on sprocket.



The pre 1966 Drum (non QD) and Shoes

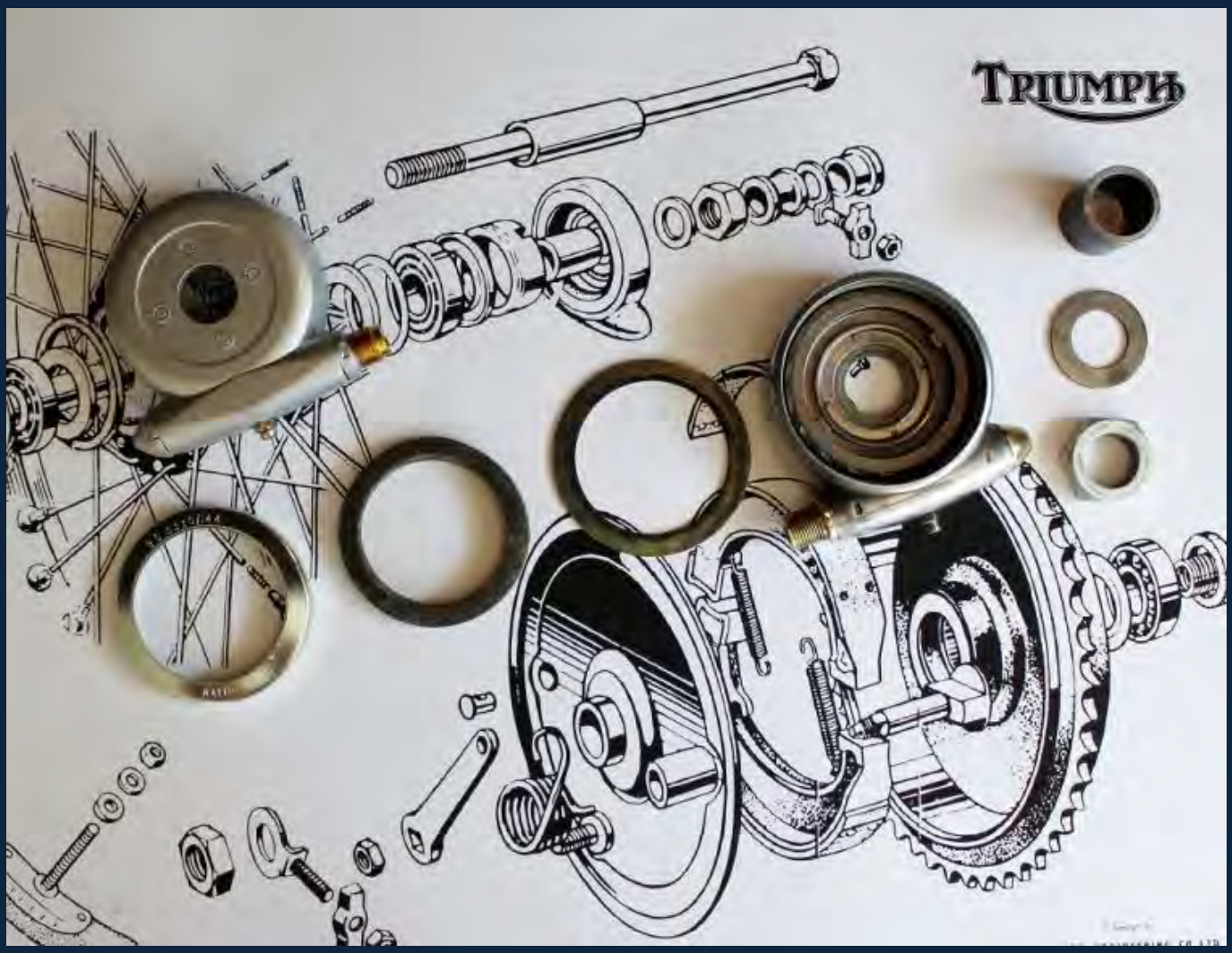
Shown above is the standard brake drum fitted for many years together with the brake shoes and the operating cam fitting is detailed later. Here the brake shoes have been re-lined with a modern compound, the lining is slightly thicker than standard and may cause fitting issues requiring the faces (arrowed) to be filed. Scored drums can be refaced, worn drums relined and the sprocket teeth replaced, if necessary, by specialists.



The Brake Shoe and Cam in detail.

The part number 1408/9 is incorrect! With the grease hole and “Nipple” on the operating cam, check that this is cleared of dirt and old grease with a piece of stiff wire before fitting. In use, lubricate sparingly so that grease does not enter the brake drum and contaminate the shoes. Service annually!

Speedometer Drive



The Speedometer Drive.

The Illustration above shows in detail the brake plate for the QD Hub, note the extended central boss.
The brake plate for the standard hub does not have the boss and uses a spacer and nut instead.
Check that you have the right parts for your machine by referring to the Parts Books.

Prior to fitting the speedo drive, the thread for the speedometer drive sleeve must been cleaned and a test fit completed.
See Below. Refer to Part F8 of the Works Manual for dismantling and fitting instructions.

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 its functionality. If there is any sign of failure, replace the unit.
Lubricate (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.

Checking the accuracy of the speedometer is easy with a GPS navigation app or Sat Nav.

For more information refer to the appropriate Smiths Instruments Catalogue.

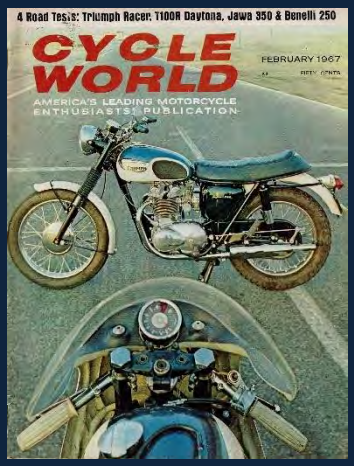
The (Later) Complete Hub showing the Speedo Drive Sleeve.

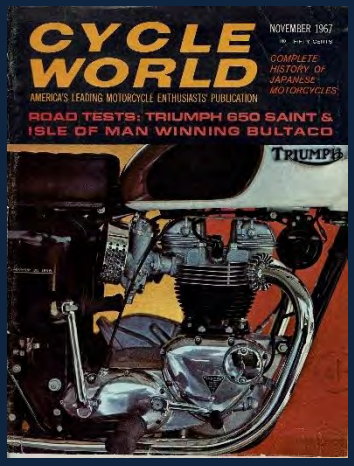
The thread is LEFT HAND and of quite a fine pitch that is easy to damage. Use a flat lever such as a tyre lever to tighten or loosen the sleeve. Note the spoke flange allows “quick fitting” of the spokes compare this to the earlier hub below.

Early hubs as above, have a bolted-on drive sleeve and a different spoke flange.

Wheel Fitting, checking the QD Hub Spacer arrangement.

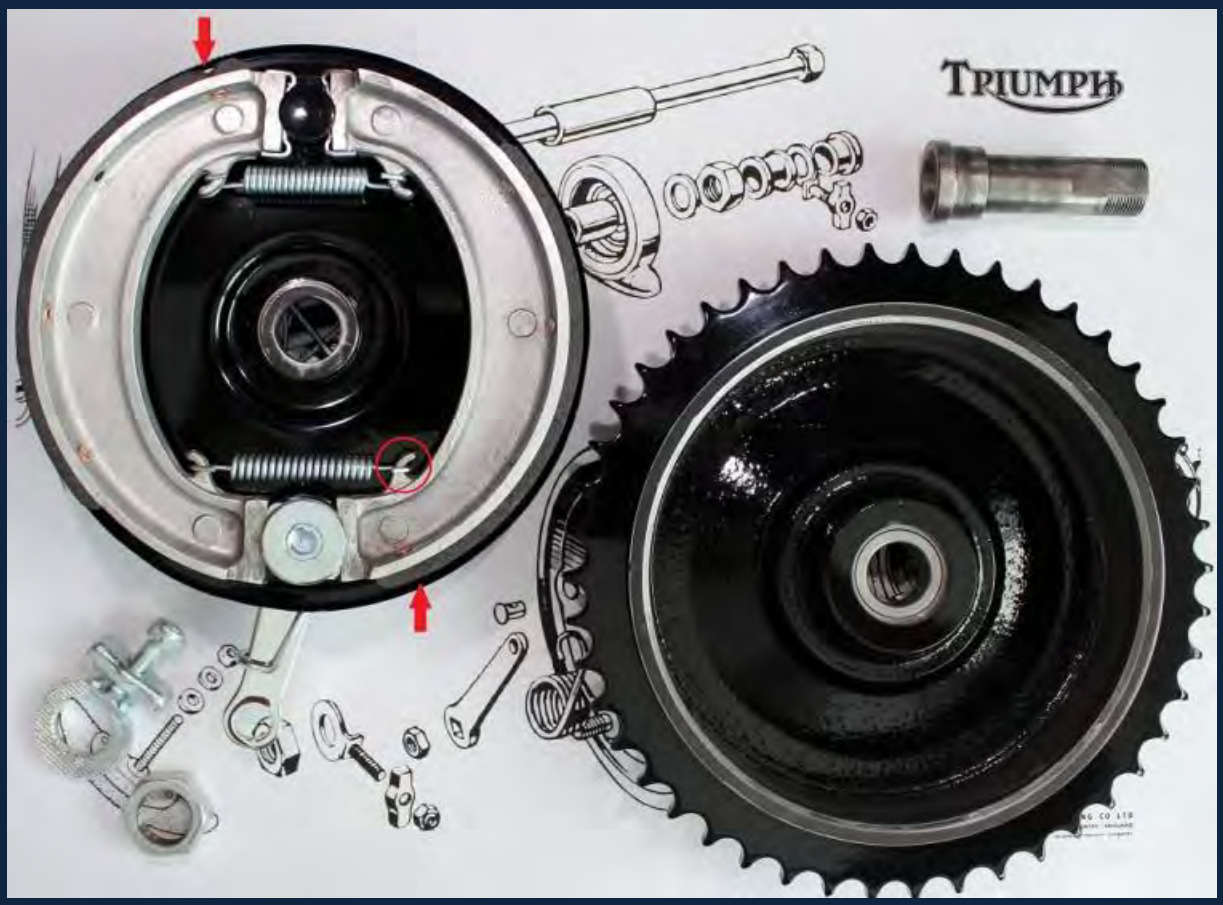
Do not overtighten the nut that shoulders up against the speedo drive unit. The drive unit needs to be secure but will distort if too much torque is applied. You should be able to move it by hand but not easily.
Test the wheel rotation, it should run centrally, smoothly and without rumbling or hesitation.
Attend to any issues before completing the brake assembly.



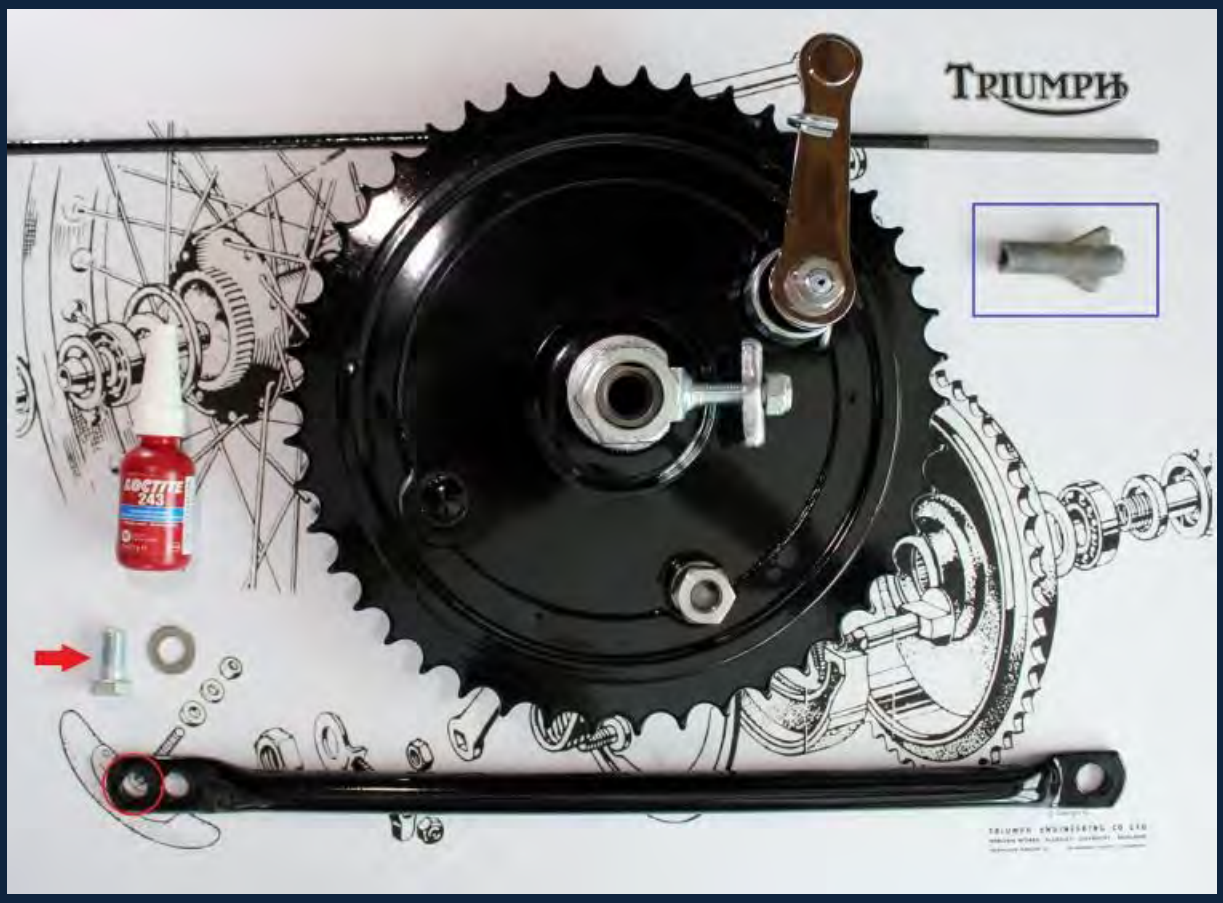


Cycle World. A popular Magazine in the USA

The Rear Brake



There are two types of rear brake plate, one for QD Hub, shown here and one for the standard hub.
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.



Fitting the torque arm is not possible with the suspension units fitted and only possible if the correct thin headed bolt 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 have been fitted to the swing arm during frame assembly. Use the highlighted hole.

Once the wheel and brake are fitted together with the torque arm; fit the chain guard. 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 chain guard first but not the switch, and then fit the chain guard loosely using a slim headed 5/16 bolt and washer through the front mounting, with a lock nut and washer at the back. Do NOT tighten the nut fully as the chain guard MUST be free to pivot upwards to allow wheel changes or brake or sprocket maintenance.

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. Available in nearly 200 colours from the RAL charts, it can be successfully used on non-frame areas of your restoration if you are prepared to compromise on the finish. Preferably use a company that is used to dealing with motorcycle parts and go and see their workmanship for yourself beforehand.

Powder coat will polish to a high gloss with the application of any good quality car polish and though frowned upon by professional restorers, it is both economic and durable when correctly applied over a perfectly clean and prepared steel substrate. It is also environmentally friendly being solvent free.

Good results can be obtained on small components with aerosol enamels such as Hammerite. Stoving these at 150’c will greatly speed up the drying process and allow you to re-coat parts effectively. It can give an impressive and durable finish, even to pitted parts.

The key to aerosol enamelling is to apply several thin coats, allowing the previous coat to partially dry (10 minutes) so that ‘runs’ do not form. Suspend the part with wire, turning it as you spray using short blasts, so that you can monitor coverage and obtain an even finish. Hang the wet part in a warm, dust and draught free location. A clean cardboard box specifically for the purpose is ideal. Larger boxes make effective “Spray Booths” minimising waste and with some simple modifications to improve lighting and extraction have a permanent place in any workshop.

Triumph Colour Schemes

The Period Brochures contain the basic colour schemes for the standard models but not machines supplied to Military or Police customers, or those made to a special order. Occasionally the Factory Records detail the colour scheme for specific machines but this is uncommon. Note that from 1966 several of the colour schemes changed during the year, making a truly accurate Triumph restoration more difficult. Unless your project machine is known to have its original paintwork, take time to research thoroughly using original materials and period photographs.

If you are lucky, you will find traces of the original finish preserved in some areas, such as under the tank badges and these can be used to colour match from. Less likely to survive are the details of the scheme such as lining positions, widths and finishes on the mudguards, petrol tank and frame, and the position of original decals and stickers. Study the road tests and especially, good original unrestored machines from the same production period and preferably the same model and batch. Your reference for this work is the engine and or frame number.

Contact the known experts in Triumph paints and schemes and seek out the work of the small group of highly regarded restorers, before making your final choice.

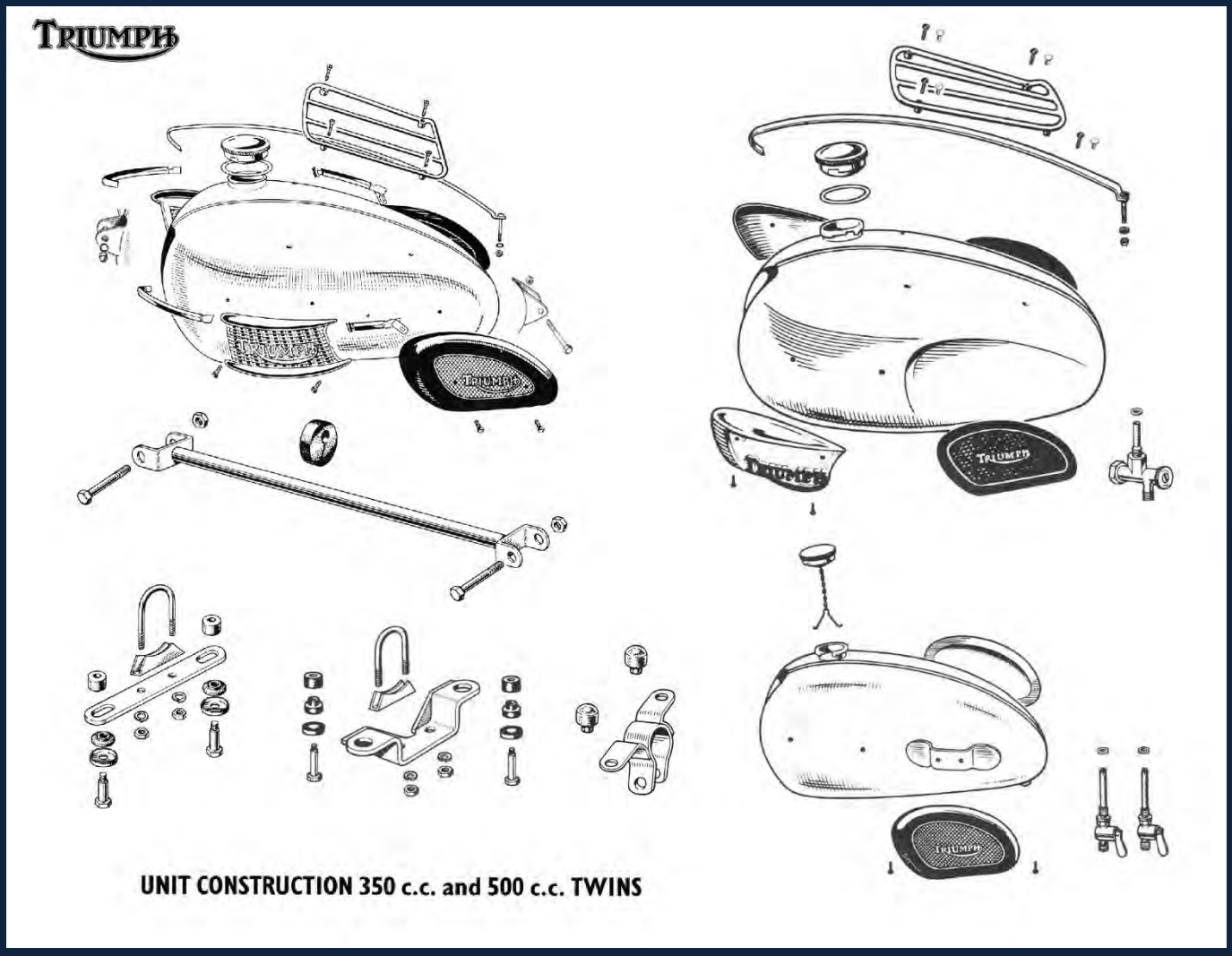
My personal career background has been in auto paints, paint research, technology and colour matching and I continue to take a keen interest in coatings technology. Modern vehicle paints are infinitely superior to those used originally, especially for durability and colour stability. Though they do not lend themselves to amateur use, they can in expert hands faithfully recreate original finishes.

I have with the help of some period materials and my experience, been able to match some of the more common Triumph colours to those of other period (Car) manufacturers; the results are detailed below. All of the colours described are good/close matches to either original finishes or known good examples from expert restorations.

Silver Sheen or Silver Grey	Volkswagen Silver Metallic L96D or Peugeot Gris Clair 1321
Alaskan White	Datsun White 655 or Peugeot Courcheval White 1079
Shell Blue Sheen	Peugeot Blue Clair Metallic 1158 or Chrysler Haze Blue 170
Amaranth Red	Peugeot Bordeaux 1335, BMW Malaga 021 or Volvo Maroon 103
Grenadier Red	Daf National 70/72 or Chrysler Wardance/Sure Fire Red 156
Gold	Toyota Gold Metallic 520
Silver Bronze	Volvo Beige Metallic 119 or Ford Venetian Gold Metallic CT

Original Colours such as Kingfisher Blue and HI-Fi Scarlet were translucent finishes that were applied over the base colour, be that Silver Sheen or Alaskan White. These finishes along with Sherborne Green Pacific Blue, Aquamarine and Purple are especially difficult to match and recreate.

Petrol Tank / Gas Tank



Petrol / Gas Tanks and Fittings.

Over the period of production several types of tanks are fitted and identifying the correct one for your machine can be difficult. Many export machines, especially to the USA are fitted with smaller tanks than the home market or general export models and these small tanks often use some parts from the Tiger Cub, such as badges and knee grips.

At least five different methods of fitting the tanks were tried and from 1963 there was a definite process to isolate the tank from the machine by mounting it on rubber bushes. Some of the brackets and parts are shown above, not all are available as spares and may have to be fabricated.

Study the parts books, bulletins and period road tests carefully to identify what parts were fitted to particular models and markets; but note that Police and Military machines were fitted with special parts that do not always feature in any of the parts books or literature.

Repairing damaged or leaking tanks is a specialist task beyond the skills of the beginner and frequently involves cutting out the bottom of the tank, panel beating and then re-welding and leak testing. Small dents can be restored with filler before stopping, priming and painting.

To create a faithful restoration the paintwork should match the model, market and production period, noting that after 1966 even the factory finish was inconsistent and they changed the design and sometimes the colour schemes during the production year. Research thoroughly, referring to the period road tests and the work of respected authors such as John Nelson, Harry Woolridge, Ivor Davies, Lindsay Brooke and David Gaylin.

The Petrol Tank Fittings.

Shown is the group of fittings for the 1966 home market 3 gallon petrol (gas) tank.
Including the taps (1/4 & 5/16) that are needed to clean the various threaded holes.
The Ewarts petrol tap is missing the gauze filter it should have.

The Ewarts tap is reliable as long as the corks remain wetted. Ethanol in modern fuels due to its hydroscopic nature will dry the corks out! If they dry out and leaks occur 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 the corks 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.
Spares including the corks and retaining screws are available.

The petrol tap needs a ¼ BSPT (British Standard Pipe Thread) tap and the special sealing washer is essential.

The Tank Badges

The 1966 ‘Eyebrow’ Tank Badges.

The original tank badges supplied to Triumph (top, above) are finely finished and generally slightly better quality than modern reproductions (lower, above). Only noticeable to experts but a mark of a quality restoration. The badges were hand finished with enamel at the factory and using modelling enamels and fine brushes you will be able to achieve a good finish.

The earlier ‘Mouth Organ’ badge, here with the styling strips. Not always fitted!
The colour of the Triumph script usually in white, here in red (1965 T90).

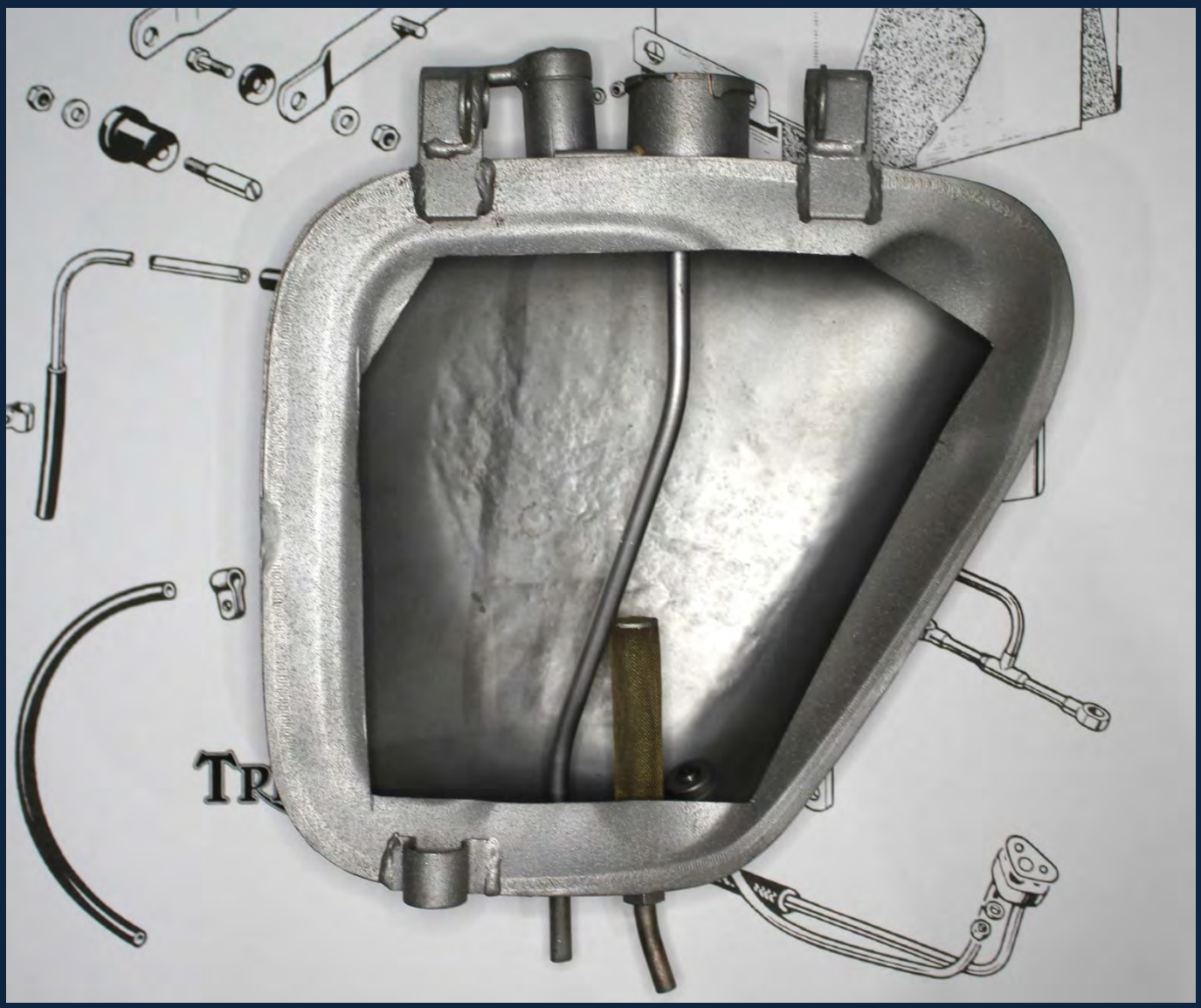
Oil Tank

Oil Tank and Parts.

Shown is the 1966 oil tank and parts. As with the petrol tanks there are several designs fitted over the production period and some experience is needed to identify the changes.

The most important thing is to make sure the tank is clean inside. Do not use any blasting media, instead bung up the holes, partially fill the tank with paraffin and some loose nuts or steel shot and then shake vigorously for several minutes, drain and repeat until the tank is clean. Rinse with brake cleaner. Any remaining rust can be removed and stabilised with a solution of Phosphoric acid. Finally check for leaks and that all the pipework and vents are clear.

Oil Tank



For illustration, showing the internal arrangement of the 1966 oil tank.

This is the general internal arrangement of the oil tank fitted to the Triumph Twins. Shown is the removable gauze filter, the drain point and the return tube that has an exit hole just under the filler cap.

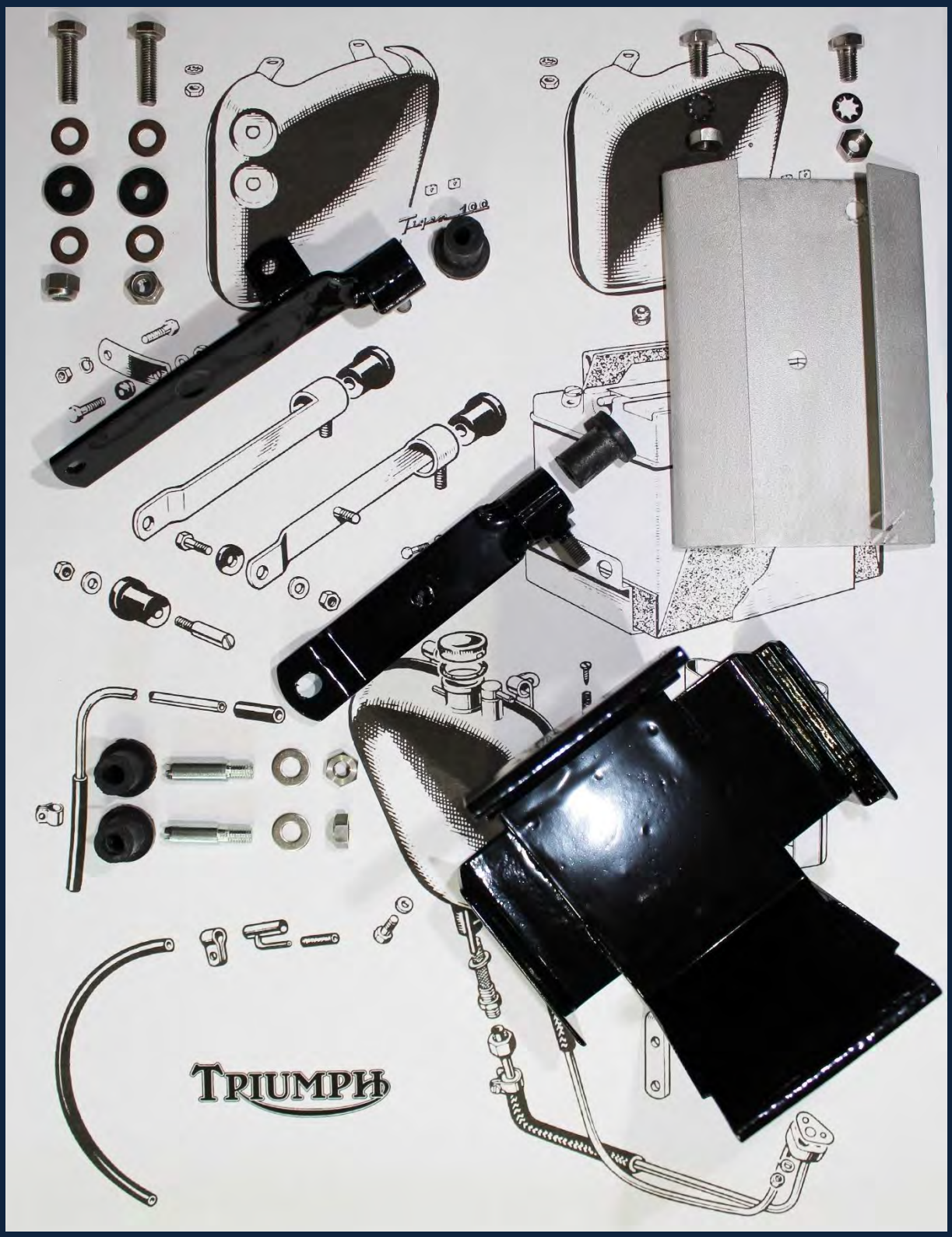
The oil tank is made of two pressed halves, continuously machine welded together, with the various brackets and ports either welded or brazed on as required. The seam leaves a thin gap between the halves, that if any blasting media is introduced is very difficult to remove completely. This tank was chemically stripped and cleaned by a specialist company.

Badly dented tanks may require the rear panel to be cut out in order to make repairs. Use a thin slitting disc fitted to an angle grinder, mark up and then cut carefully taking care to keep lines straight and not to cut so deeply that you damage the return tube. Once repairs have been made the back can be welded on.

Once fitted, the oil tank can rub on the air filter housing and many tanks show this wear on the forward inside edge, as above. To prevent this, an additional solid spacer (2-3mm) can be made and fitted discreetly on the inside of the lower oil tank mounting bracket.

Use a T piece and connect the oil tank vent to the engine breather pipe in any suitable way, so that oil escaping from the engine breather has a chance to be return to the oil tank. The vent pipe from the T piece should terminate over the rear drive chain near to the engine sprocket.

The Battery Carrier

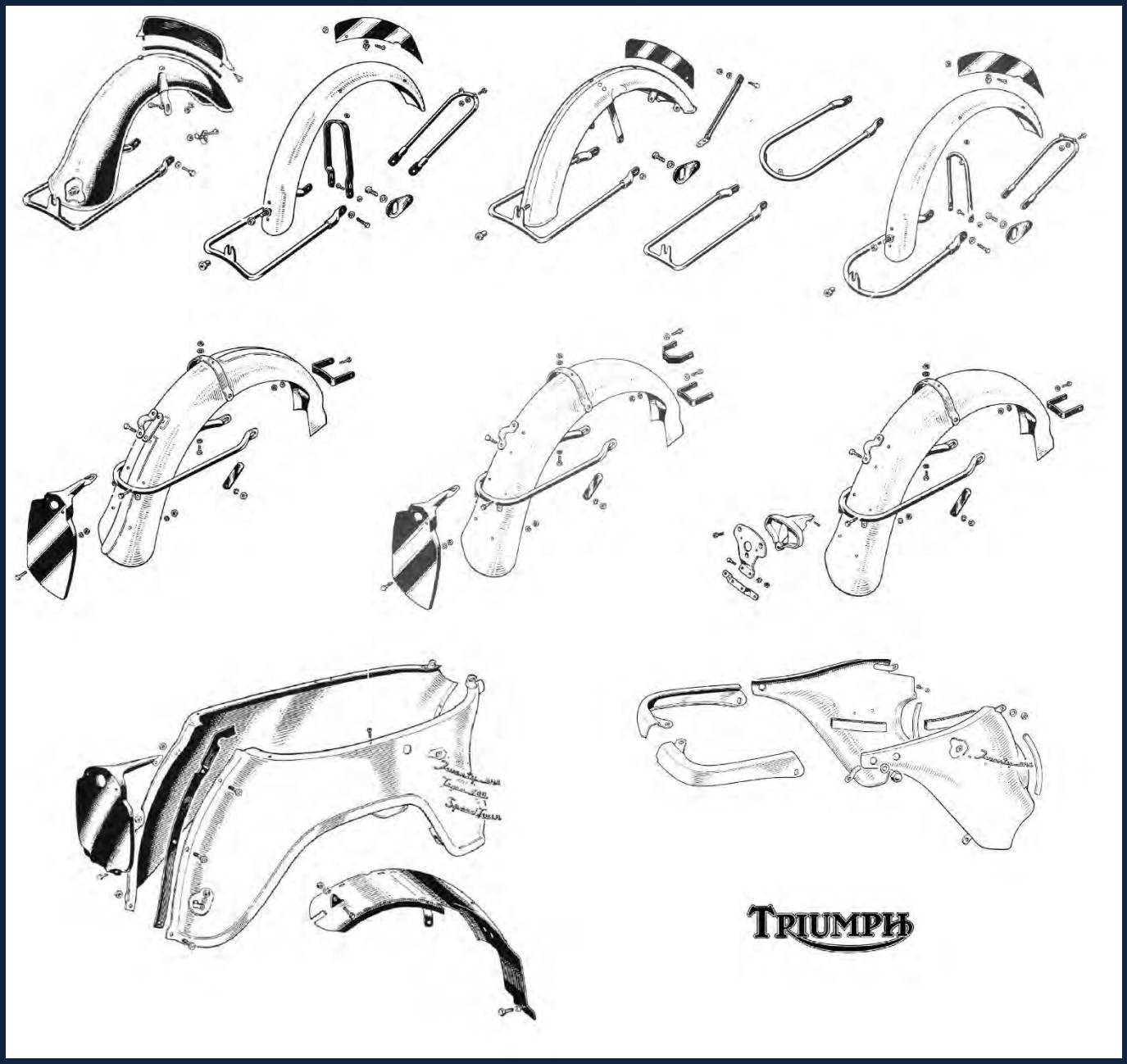


The 1966 Battery Carrier and Parts (Not fitted to T100C models).

As with the petrol tanks and oil tank there are detail changes made to the battery carrier over the production period from 1957 to 1974, and identifying the correct one for a project requires expertise. Very few period pictures are available and the parts book images are at best inaccurate. Again, the common change is isolating the battery from vibration. With the introduction of 12 Volt systems the battery is usually larger and the carrier is redesigned to suit, with the tool storage relocated.

Also shown above is the early heat-sink for the Zener Diode appropriate only for 1966 and changed during the year to a simpler bracket shown in the Workshop Manual.

Mudguards/Fenders



The Bathtub, Bikini and Mudguards.

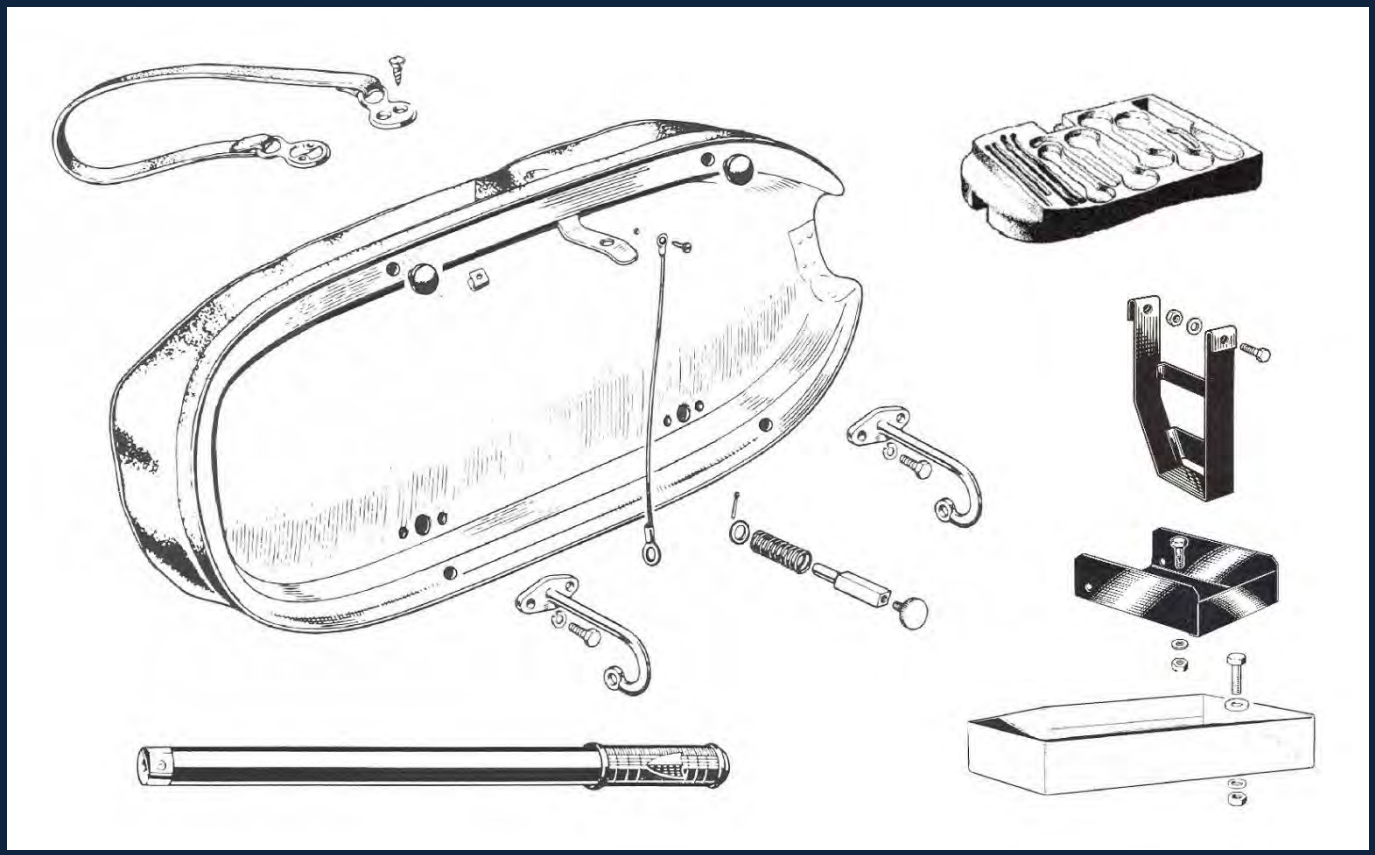
The illustration above shows the Bathtub, Bikini and the various types of mudguards/fenders fitted across the range from 1957 to 1969. Again, there are detailed changes to these parts over time that are not generally recorded and the illustrations in the parts book are frequently inaccurate. Mudguards in aluminium, painted steel and polished stainless were used.

While many original petrol and oil tanks survive in useable condition, the same cannot be said of the mudguards/fenders and finding good examples especially for early models, or those machines made in small numbers is really a matter of patience and luck.

Damaged mudguards can be successfully repaired and with expert help, training and suitable tools (The English Wheel), new mudguards as faithful replicas can be made.

The paintwork issues described for the petrol/gas tanks apply also to the mudguards and restorers seeking to have a factory specification machine, will need to undertake extensive research to confirm the colour schemes and designs for the Triumph model, and year they are working on.

Seats and Tool Tray



The Seat parts and the various Tool Trays.

The dual seats fitted to the ‘C’ range Triumph twins come with two basic types of seat bases; up to 1967 there is a common base used across the range, shown in the illustration above. From 1967 a longer seat is introduced that now overhangs the rear frame loop; it uses different hinges but still lifts up to give access to the battery, oil tank, electrical components and tools (up to 1968).

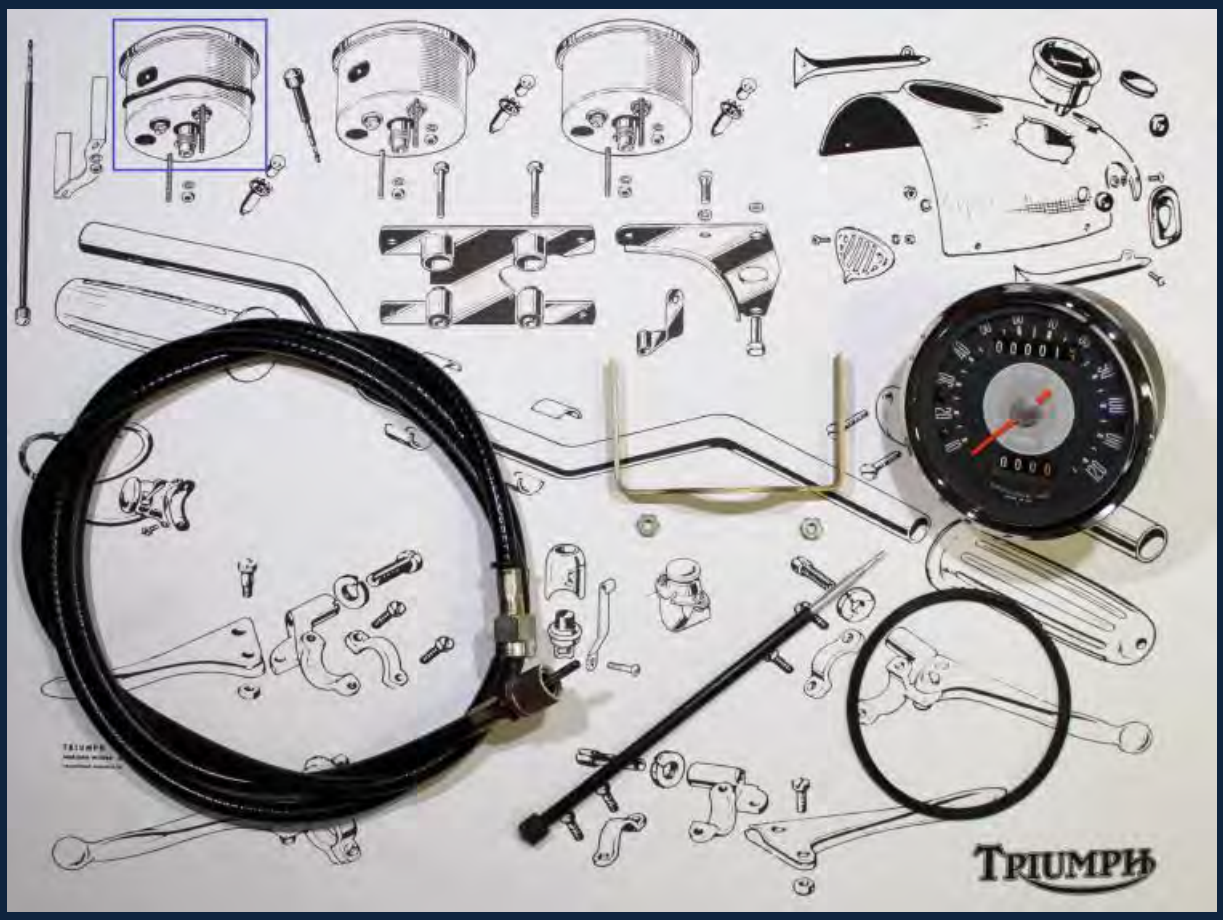
Original seat bases are quite distinctive and with some experience you will soon be able to recognise one against a pattern spare; especially if you are seeking originality for your restoration. Many Police, military and service models use a single seat that is quite common but is not illustrated in the parts books. The paint finish of the seat base varies from gloss to satin black over time.

Though the seat base for the models is standardised the seat coverings are not and there are several variations applied over the years. The top surface is either black or grey, with black or grey sides separated by piping usually in white. A valence trim in black or grey is also used. Study the brochure images for examples but note that models supplied to the USA can show deviations from the catalogue specification and there are differences between machines supplied to the East and West Coast dealers.

The tool trays/holders used from 1957 to 1967 are mostly shown above, starting from the top with the moulded rubber tool tray fitted to the bathtub models. In 1961 the simpler tool holder is introduced and attaches to the battery rails next to the oil tank. In 1964 the third type, “Fag packet” tray is fitted, bolted to the rear mudguard just behind the battery. In 1965 the “Fag packet” becomes partially closed off and in 1966 a tool tray in grey or black plastic (above) mounts on brackets across the frame. From 1968 the tools move to a location inside the left side panel.

With the introduction of the simple tool tray in 1961 the tools, illustrated in the Parts Books are stored in a small, initially leatherette and later a plastic pouch. Replicas can be made or are sometimes available.

Speedometer & Drive Cable



The Speedometer Group for the 3TA.

Up to 1964 speedometers and rev counters fitted to British motorcycles are chronometric, with Smiths being the main supplier. From 1964 magnetic instruments are introduced and used across the range. There are numerous types and restorers should refer to the Smiths catalogues for details.

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, before looping down to the lower headset and up into the speedometer.

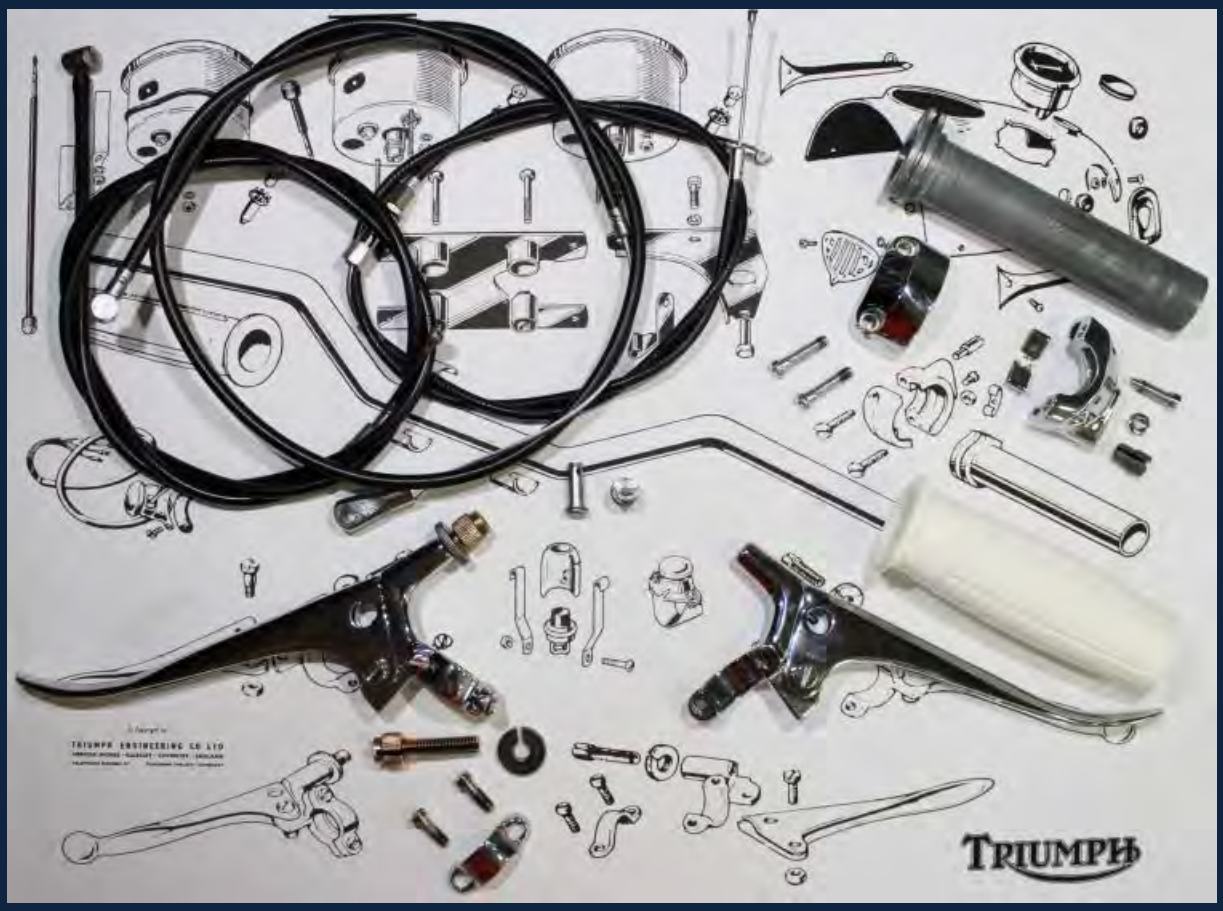
Use tape, Velcro, leather straps or wide cable ties to hold the bundles of cables and wiring in place but not so tightly as to induce chafing or to prevent some flexing when the handlebars are turned. There is room in the headlamp shell for a spare brake, clutch and throttle cable and owners should keep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

To prolong the life of the cable and the instruments, regularly check that the outer is not being trapped and damaged especially by the steering stops or rear tyre. Clean the inner cable by withdrawing it washing it in paraffin and then re-lubricate with a heavy grease; but not the last few inches nearest to the instrument. If you experience the cable attachment continually coming loose due to vibration, use some Wellseal or thread sealant on the threads.

Retaining the speedometer into the Nacelle requires a single, shaped bracket, often unavailable but shown top left in the illustration above. Two small L shaped brackets can be fabricated to hold the unit into place instead and will be unobtrusive once the headlamp is fitted. Fitting can be fiddly; take care not to short across the connections of the nearby Ammeter as you work, by disconnecting the battery.

Also fiddly to fit on the Nacelle models is the trip control, this extends to just above the petrol tank reachable to the fingers, but hidden from view by the Nacelle top on most models.

Handlebars and Controls



Handlebar Levers, Cables and Throttle.

Shown here are the original levers and throttle assembly from the 1966 3TA project bike these are rare survivors and most original parts will have long since been lost.

Amal, were the original supplier of control levers for much of the British motorcycle industry and as with other components there are detailed changes applied over the years. Up to 1966 plain levers were usually fitted except for machines destined for export and particularly America where legislation required safer ball ended levers to be fitted. Identifying original items is complicated by the many period after-market parts supplied by other British and US manufacturers and fitted after accidents, or to enhance machine appearance.

Handlebars like the levers were available in a variety of styles with the factory fitting differing types depending on both the model of machine, year and the market. Machines for the USA were typically fitted with the “American bar”, a high rise handlebar popular with dealers and customers alike.

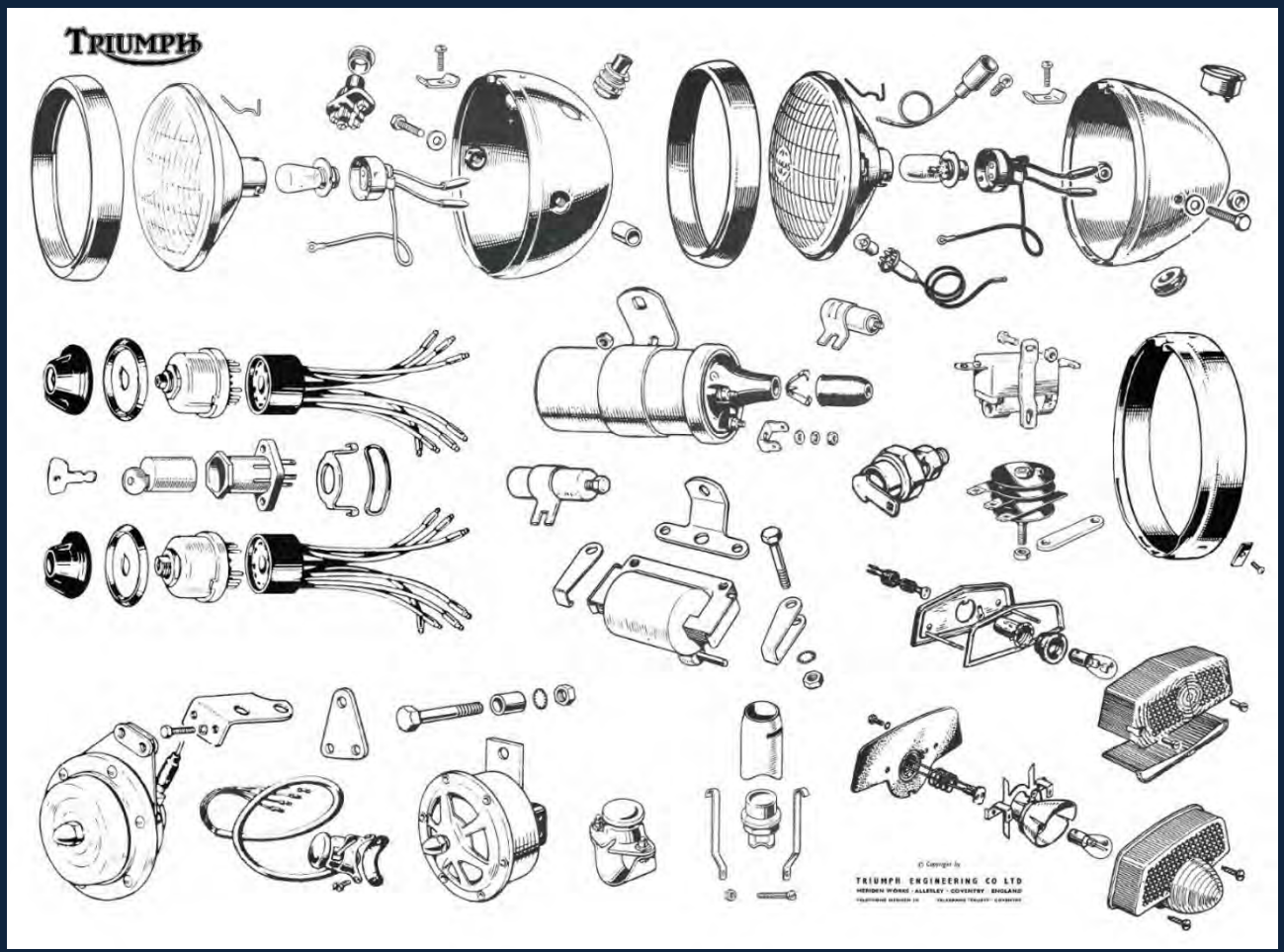
Early Triumph handlebars are 1 inch in diameter, with levers to suit. On the right the bar is swaged down to 7/8 inch for the Amal twistgrip throttle assembly, with the bar clamping directly to the fork crown using U bolts. With the introduction of the sports models, a new fork crown part number H1287 is used and shortly afterwards the overall diameter of the Triumph handlebar is reduced to 7/8 in. U shaped spacers are used to fit these handlebars to the two types of fork crown. From 1967 to coincide with the new frame a new fork crown is introduced, that allows the handlebars to be rubber mounted; but not all models use this feature and use the previous parts.

Pattern handlebars of excellent quality are usually available, together with good replica levers but getting the right length of control cable(s) is complicated by the variety and the small variations in design between the different manufacturers. Frequently cables will need to be modified to suit the handlebars and control levers fitted to your particular machine. With some specialist tools making your own cables is within the reach of most restorers.

As with many Triumph parts, study the parts books, period photographs and road tests rather than relying on more recent restorations for your information. Unless you know that the machine pictured has been restored by a knowledgeable and reputable Triumph restorer.

Electrical Components

The component group for the 3TA, a mixture of original, pattern and upgrade parts.



Lucas Parts suitable for the 1966 Triumph Range.

EQUIPMENT SPECIFICATIONS AND PAGE INDEX

UNIT	See page	200 c.c. T20 "Tiger Cub"		200 c.c. T20 SH 200 c.c. T20 SR "Sports Cub"		200 c.c. T20 SM		200 c.c. T20 TR T10 Automatic Scooter (Ignition Coil only)	
		Model	Part No.	Model	Part No.	Model	Part No.	Model	Part No.
ALTERNATOR (serviced by)									
Rotor	4	RM18	54213903	RM18	54213903	RM19	54213901	RM19	54213901
Stator	4	RM18	47161B	RM18	47161B	RM19	47173B	RM19	47173B
AMMETER	4	CZU27	36084F	—	—	—	—	—	—
BATTERY	—	PUZ5E 11	24082094	PUZ5E 11	24082094	—	—	—	—
BATTERY (Later)	—	MLZ9E	54028459	—	—	—	—	—	—
HARNESS	8	—	54934996	—	54933224	—	54932326	—	54943884
HARNESS (Later)	8	—	54939733	—	—	—	—	—	—
COIL, IGNITION	4	MA6	45152B	MA6	45152B	3ET (L.H.) 3ET (R.H.)	*45150A *45149A	3ET (L.H.) 3ET (R.H.)	*45150A *45149A
CONTACT BREAKER	4	4CA	*47621A/D (54415296 & 54416405)	4CA	*47621A/D (54415296 & 54416405)	4CA	*47624A (54415296 & 54417989)	4CA	*47625A (54415296 & 54415748)
HORN	5	8H	70169D	8H	70169D	—	—	—	—
HORN PUSH AND DIPPER SWITCH	5	25SA	31563D	—	—	—	—	—	—
HORN PUSH	5	—	—	4A	76204D	—	—	—	—
HORN-PUSH-PAD	5	—	380459	—	—	—	—	—	—
LAMPS									
Head									
Home — Export	6 and 7	MCF575P	58975B	MCH66	58935D	MCH66	58395F	—	—
Later	7	MCH56	59629A	—	—	—	—	—	—
Export — France	6	MCF575P	58977B	—	—	—	—	—	—
Export — U.S.A.	6	MCF575	59004B	—	—	—	—	—	—
Stop tail, number plate and reflex	7	564	53394D	564	53394D	679	53972B	—	—
Stop tail, number plate and reflex U.S.A.	7	—	—	679	†53972B	—	—	—	—
RECTIFIER	4	2DS506	49072A	2DS506	49072A	—	—	—	—
SWITCHES									
Dipper	5	—	—	PS9	31620F	PS9	31620F	—	—
Engine cut-out	5	—	—	—	—	4A	76204D	4A	76204D
Ignition	5	88SA	34427B	88SA	34427B	—	—	—	—
Cover	5	—	54336178	—	54336178	—	—	—	—
Escutcheon plate	5	—	*54330485 (54330576)	—	*54330485 (54330576)	—	—	—	—
Lighting	5	88SA	34289A	88SA	34289A	PS6	°°31356B	—	—
Knob	5	—	54330934	—	54330934	—	—	—	—
Escutcheon plate	5	—	*54330485 (54330576)	—	*54330485 (54330576)	—	—	—	—
Stop Lamp	5	22B	*31437B (54033234)	22B	*31437B (54033234)	22B	*31437B (54033234)	—	—
Spring	5	—	—	—	315738	—	315738	—	—
REAR SUSPENSION UNIT (Serviced by Girling Ltd.)	—	—	3112	—	3112	—	3112	—	3112

UNIT	See page	650 c.c. 6T "Thunderbird" 500 c.c. 5TA "Speed Twin" 350 c.c. 3TA "Twenty-One"		350 c.c. T90 "Tiger 90" 500 c.c. T100 "Tiger 100" 650 c.c. TR6 "Trophy" 650 c.c. T120 "Bonneville"		650 c.c. T120R "Bonneville" 650 c.c. TR6R "Trophy" 500 c.c. T100R "Tiger 100" (Export U.S.A.)		650 c.c. TR6C "Trophy" 650 c.c. T120 TT "Special" 500 c.c. T100C "Tiger 100" (Export U.S.A.)	
		Model	Part No.	Model	Part No.	Model	Part No.	Model	Part No.
ALTERNATOR (serviced by)									
Rotor	4	RM19	54213901	RM19	54213901	RM19	54213901	RM19	54213901
Stator	4	RM19	47162A	RM19	47162A	RM19	47162A	RM19	47188B
AMMETER	4	2AR	36296A	2AR	36296A	2AR	36296A	—	—
BATTERY	—	MKZ9E/2	54028050	MKZ9E/2	54028050	MKZ9E/2	54028050	—	—
BATTERY (Later)	—	PUZ5A	54027029	PUZ5A	54027029	PUZ5A	54027029	—	—
HARNESS	8	—	54938942	—	54938941	—	54938941	—	54937097
CONDENSER	4	—	—	—	—	—	‡54441582	—	54441582
COIL, IGNITION	4	MA12	45110D	MA12	45110D	†MA12	‡45110D	3ET (L.H.) 3ET (R.H.)	45150A 45149A
CONTACT BREAKER	4	4CA	47605D	4CA	47605D	4CA	47605D	4CA	*47602D (425379 54415746)
DIODE, ZENER	4	ZD715	49345A	ZD7152	49345A	ZD715	49345A	—	—
FUSED EARTH LEAD	8	—	54938986	—	54938986	—	54938986	—	—
HORN	5	8H	70164D	8H	70164D	8H	70164D	—	—
HORN PUSH AND DIPPER SWITCH	5	25SA	31563D	25SA	31563D	25SA	31563D	—	—
LAMPS									
Head									
Home — Export	6 and 7	MCF700P	59176A	SS700P	59579A	SS700P	59579A	MCH66	58395F
Export — Europe	6	MCF700P	59177A	SS700P	59602A	—	—	—	—
Export — France	6	MCF700P	59178B	SS700P	59601A	—	—	—	—
Stop tail, number plate and reflex	7	564	53454D	564	53454D	—	—	—	—
Stop tail, number plate and reflex U.S.A.	7	679	53973B	—	—	679	53973B	679	53972B
RECTIFIER	4	2DS506	49072A	2DS506	49072A	2DS506	49072A	—	—
SWITCHES									
Dipper	5	—	—	—	—	—	—	PS9	†31620F
Engine cut-out	5	SS5	35601A	SS5	35601A	SS5	35601A	SS5	*31071D (31107D)
Ignition	5	88SA	34427B	S45	31899B	S45	31899B	—	—
Cover	5	—	54336178	—	—	—	—	—	—
Escutcheon plate	5	—	54330576	—	—	—	—	—	—
Lighting	5	88SA	34289A	88SA	34289A	88SA	34289A	PS6	†31356B
Knob	5	—	54330934	—	54330934	—	54330934	—	—
Escutcheon plate	5	—	54330576	—	54330576	—	54330576	—	—
Stop lamp	5	22B	*31437B (54033234)	22B	*31437B (54033234)	22B	*31437B (54033234)	22B	*31437B (54033234)
Spring	5	—	315738	—	315738	—	315738	—	315738
WARNING LIGHT	8	—	—	WL15	†38189A	WL15	†38189A	—	—
REAR SUSPENSION UNIT (Serviced by Girling Ltd.)	—	—	3964 (SB3) 4200 (SB3)	—	4506 (SB4)	—	—	—	—

† Also fitted to T10 Automatic Scooter * When ordering, quote part number shown in brackets ‡ T20SR only ° Part of headlamp
* Alternative fitting on single cyl. machines ‡ T100R and TR6R only 5TA only

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This publication incorporates Spares Lists NVS 2278 and 2284 which should be destroyed.

The 1966 Lucas Specification sheet for all Triumph Models, from the Lucas Catalogue.

Lucas produced these catalogues for all the manufacturers they supplied, together with wiring diagrams. The Lucas catalogues from 1957 to 1970 can be found on the Website or obtained from specialists. Original Lucas parts in good condition are rare but the sign of an expert restoration!

Electrical

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 always use 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 at the top 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 information in section H in the Works Manual.

Lucas supplied parts for the majority of the British motor industry along with Miller, Wipac and British Thomson-Houston (BTH). Most Triumphs use Lucas parts and by referring to the Lucas catalogues you will be able to identify the parts fitted originally.

Wiring colours on most British motorcycles follow a pattern and with experience you will soon learn which colours are used for the different applications. By replicating the wiring loom faithfully, 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.

With a machine for regular use, owners should consider fitting additional components such as indicators, daytime running lights, USB power points and wiring for items such as heated grips and sat nav. The overall intention is to build a reliable bike you enjoy riding as well as owning.

There are numerous publications on wiring classic machines, take time to read and understand the basic principles and though initially daunting, with a bit of practice the new restorer will soon gain confidence to work on more complicated projects.

Wiring Diagram

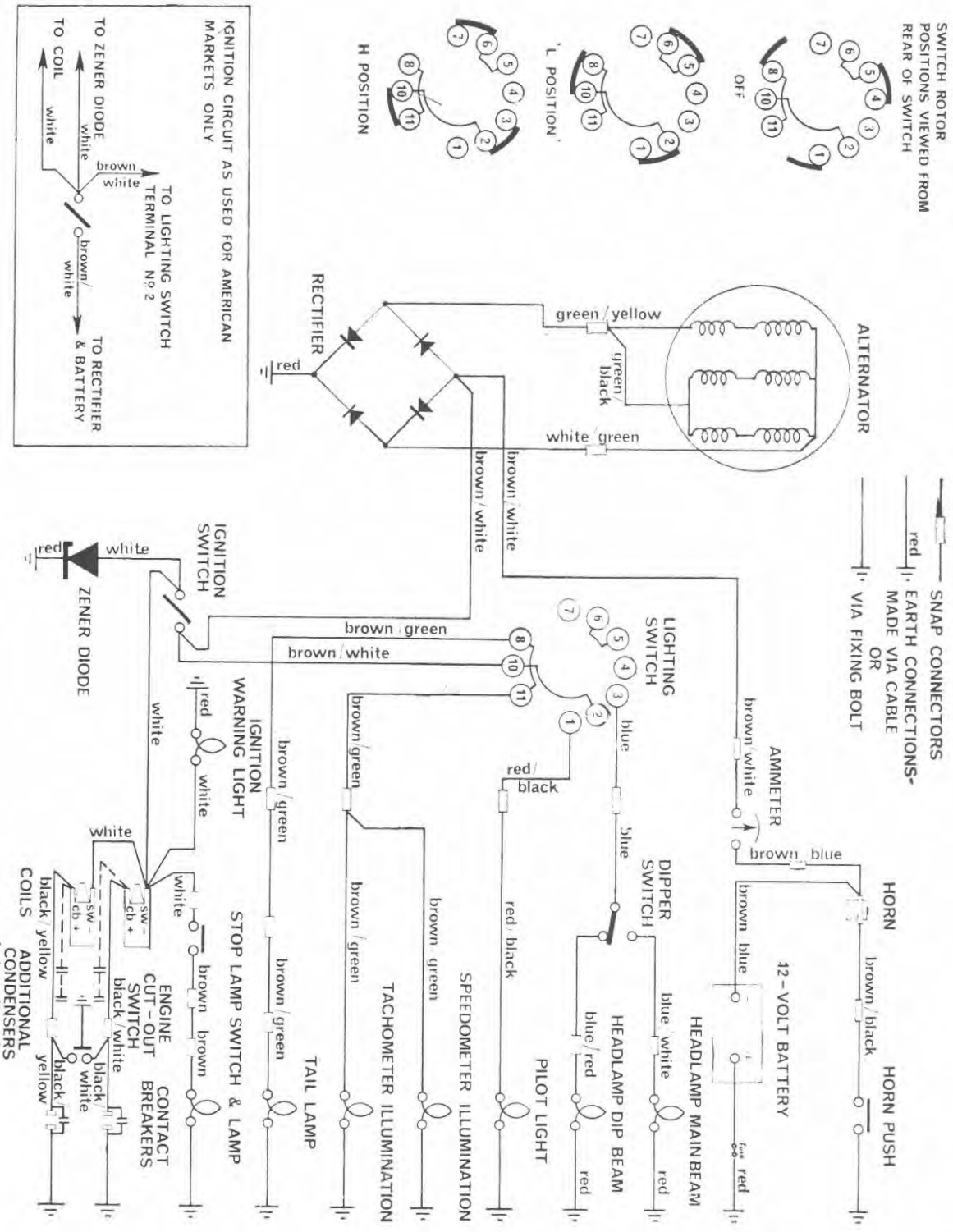


Fig. H22. Wiring diagram—Coil ignition 12 volt models without nacelle up to H.49832 (Home and Export)

Note. The main beam warning lamp (where fitted) is connected to the headlamp main beam wire (blue/white) by a double snap connector. The ignition warning lamp is connected to an ignition coil by a white wire incorporated in the wiring harness.

A Wiring Diagram, for 12V Models 1966-1967.

The Wiring Diagram above from the Works Manual is a good example and shows the wiring colours and the general arrangement of the components and connections that are appropriate for Triumph twins. It provides a good basis when converting any 1963 to 1965 Triumph Motorcycle to 12 volts together with replacing the points with electronic ignition. When using an electronic ignition pack (Boyer Bransden), paired 6V coils wired in Series or paired or a dual output 12V coil can be used as the Idle Spark principle applies and both spark plugs ‘fire’ together.

Electrical

2 wire (full output) 10Amp Stator, Rectifier and Zener Diode pack for 12V.

Up to 1966 the majority of British motorcycles use 6V battery and charging systems with parts supplied predominately by Lucas. Ignition initially is by magneto and charging using chain driven dynamos with mechanical voltage control. From the mid 1950's Coil Ignition systems and Alternators with Selenium rectifiers begin to supersede these earlier parts. On these machines voltage control is achieved by balancing the alternator output with the load and the lighting and ignition switch is arranged so that it automatically switches additional circuits when the lights are on or the owner is trying to start the machine with a flat battery.

For first time restorers I recommend reading through section H of the Works Manual, as this covers in some detail the working principles of the electrical system and the various components; together with trouble shooting and testing methods that are appropriate not just for classic machines, but modern ones too.

Owners seeking to convert to 12 volts have a number of options and you should consider each one before starting work. There are systems that replace the alternator and provide both ignition and some lighting current without the need to fit a battery, perfect for off road, competition and leisure machines.

A modern rectifier/Zener unit, combined with a full output stator (as above) can also be used without a battery but is more suited to standard machines used regularly for commuting or touring and fitted with additional items such as halogen headlights, indicators, heated grips, satellite navigation, USB points etc.
Tip… Fit the largest battery you can find for the space available.

The original (three or five wire) alternator and rectifier, are both capable of coping with 12 volts without a Zener diode provided that the principle of switching additional coils is adhered to. By fitting a standard relay into the headlamp circuit, the lighting switch can be bypassed, or replaced and a simpler three position toggle switch (off/side/main) used instead. The relay will easily fit into the headlamp shell and connects in the additional (four) alternator coils when the headlamp is used.

With ALL of the systems, the choice of bulbs is critical and the fitting of LED bulbs that create very little electrical load, or high wattage headlamp bulbs and accessories can lead to issues and early failure of the system; if the balance of alternator output versus load has not been matched.
The Table above from section H14 of the Works Manual provides useful information.

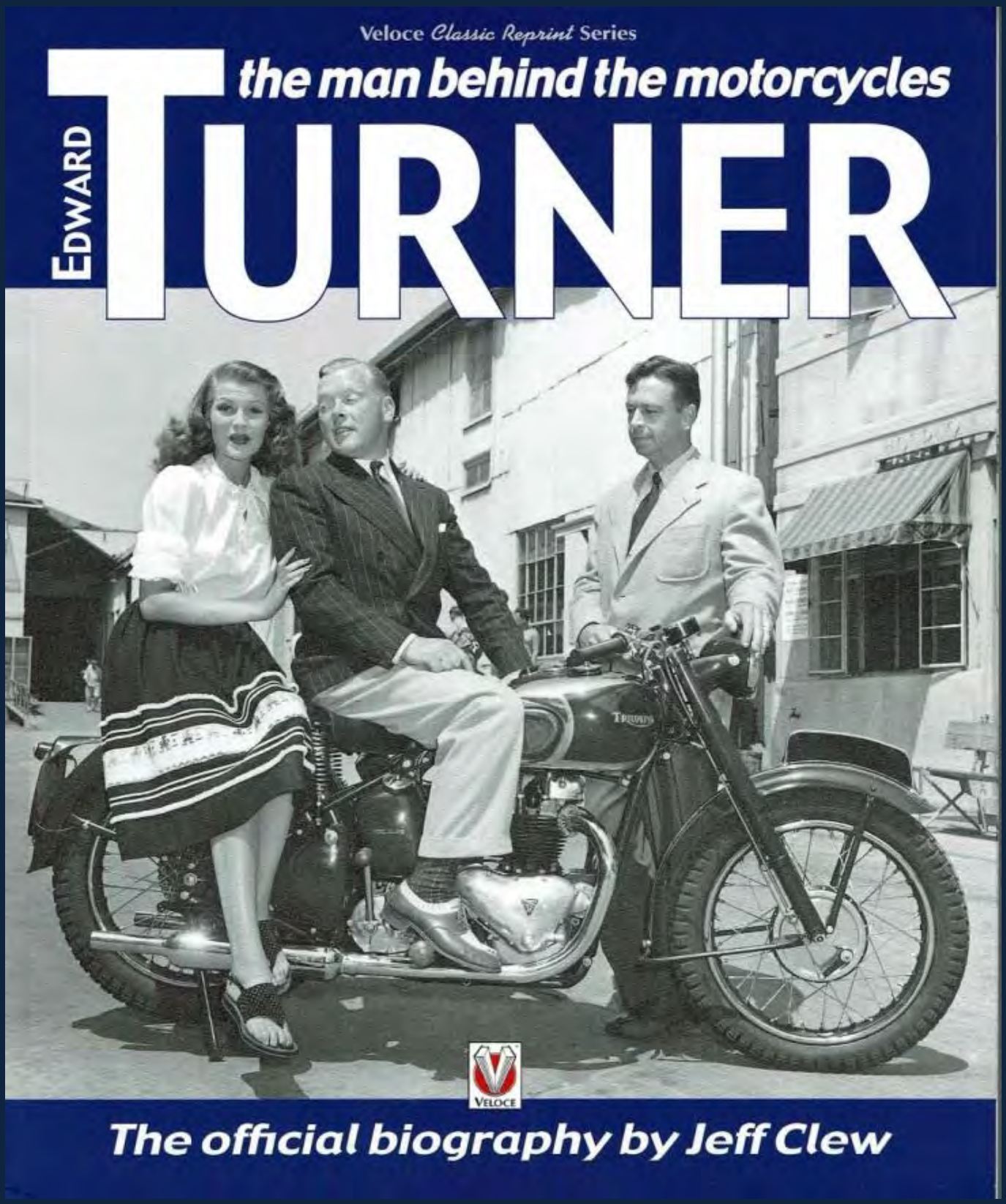
Original components like the horn and rectifier can be left in place to give the appearance of originality and the illusion can be enhanced by "dummy wiring" these with a non-functioning wiring loom.

Motorcycle Mechanics. Charles Deane testing the new Trident.

A Period Magazine specialising in articles to help the owner rebuild and work on his machine.
Check out the Magazine Index on my website for details of the articles on Triumphs.
Even though "out of date" these magazines can make enjoyable reading
and provide an invaluable source for serious motorcycle restorers.

Roy Bacons Triumph Restoration Guide.

This is the seminal restoration book that all owners should obtain, it does contain errors but more as a reflection of the improved information that has become available to restorers since the book was first published (1985). Many of the photographs are from the Emap Archive now held by Mortons Media.



The Official Biography, Edward Turner by Geoff Clew

A great book and one that every Triumph enthusiast should own, look for other titles by Harry Woolridge, John Nelson, Claudio Sintich, David Gaylin and Lindsay Brooke.

On my website and others, you will find the Catalogues, Parts Books, Factory Bulletins Road Tests, original photographs and lots of videos, images and articles To help you with your Triumph restoration.

The Author

The Finished 1966 Triumph 3TA.

This guide is dedicated to my many Triumph friends and owners everywhere who promote, collect and preserve Vintage Motorcycles for future generations to appreciate, enjoy, restore and ride long after we have gone!

I have been encouraged and inspired by restorers, authors, collectors, Triumph experts, ex-factory employees, dealers and famous riders, whom I have been lucky enough to meet and interview. Many have now passed but hopefully they and their achievements will not be forgotten. All willingly contributed in spirit, conversation and writing and without their generous help my efforts would have been less enjoyable. I graciously thank them all.

About the Author

I collect and have owned, restored and ridden Triumphs for many years specialising mainly in the 350cc and 500cc models from 1957 onwards. I have a general interest in all Triumphs, but a special interest in the history of the Meriden Factory and the location of the surviving original literature, road tests and period photographs. I don't consider myself an expert or an engineer and this guide has been written from my limited experience to help the new owner to work on their bike with confidence.

Justin Harvey-James 2026

Triumph-Tiger-90.com