(xiii) Reconnect mixture control rod to the bottom of the front carburetter jet lever.

(xiv) Remove and clean the small filter located in each of the float chamber covers, and then reconnect the petrol feed pipe to the carburetters fitting new C and A washers if found necessary.

(xv) Replace ignition wire tubes, and secure with the nuts and washers. Reconnect the wires from the distributor to the ignition coil, and the high tension cables to the sparking plugs. The firing order is 1, 4, 2, 6, 3, 5.

(xvi) Fit a new C and A washer to each joint face and replace the exhaust manifold.

(xvii) Reconnect car heater pipe to the tap on the cylinder head. Do not fit the breather pipe to the rocker cover at this stage.

(xviii) Fill the cooling system with the anti-freeze mixture previously removed, first making sure that the cylinder coolant jacket drain tap is closed. The "off" position of the tap is when the handle is in a horizontal position. Also make sure that the radiator drain tap is closed. The "off" position of the tap is when it is pointing downwards.

(xix) Change the engine oil if considered necessary.

Remove temporary cover and replace the oil dipstick and check the oil level.

(xx) Reconnect the positive earthing lead to the battery.

(xxi) Start up engine and check for leakages etc.

(xxii) Stop the engine and remove the rocker cover, restart the engine and ascertain that oil is escaping from both ends of all the rockers. Fig.3 Sub-Section BE.1 shows the oilways in the rocker. Replace the rocker cover.

(xxiii) Refit breather to rocker cover (this only applies to chassis B-198 BH and onwards) by placing the plain aluminium washer on to the special fixing bolt and lightly screwing it in. Line up the breather pipe until the clip on the pipe can be slipped on to the stud on the crankcase. Secure clip in position and tighten up the fixing bolt.

(xxiv) Refit bonnet and secure by fitting the small bolt into the hinge pin bracket on the dashboard.

(xxv) It is very important that the cylinder head nuts should be tightened again (in the correct sequence as shown in Fig.9) after the engine has done sufficient running to become thoroughly warmed, and then allowed to completely cool off.

To carry out the above it will be necessary to remove the rocker shaft. It will also be necessary to re-set the inlet valve rocker clearances as already described (i.e. .006" cold), owing to the fact that the joint gasket will have become further compressed, with a consequent reduction in inlet tappet clearances.

The inlet valve rocker clearances should again be checked after approximately 500 miles of running and re-adjusted if necessary.

DECARBONISING

REFACING VALVES AND VALVE SEATS.

GENERAL.

There should be no need to decarbonise the engine or reface the valves and seats, unless one or more of the following symptoms are in evidence:-

(a) Poor slow running associated with lack of compression.

(b) Detonation even when good fuel is being used and the ignition timing correct.

(c) Loss of power attributable to poor condition of valves.

REMOVAL OF CYLINDER HEAD.

Remove the cylinder head as per instructions in Sub-Section BE.6.

Note, when parts are numbered for re-assembling, the numbering commences at the front of the engine.

TO REMOVE THE EXHAUST VALVES.

Before removing the exhaust valves, temporarily fit suitable corks to, or cover up with clean rag, the four oil return holes in the bottom of the tappet chamber. Also, cover up large hole leading from side of tappet chamber to wheelcase. This will prevent the wedges from falling into the crankcase or wheelcase if they are accidentally dropped when removing the exhaust valves.

Leave the holes covered up until the exhaust valves have been re-assembled to the engine and then remove the corks or rag.

Fig.11 shows the exhaust valve spring compressing tool (RF.4385) in position. To remove valves proceed as follows:-

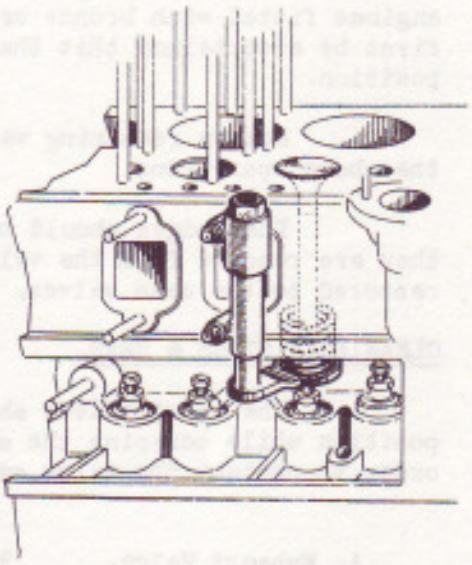
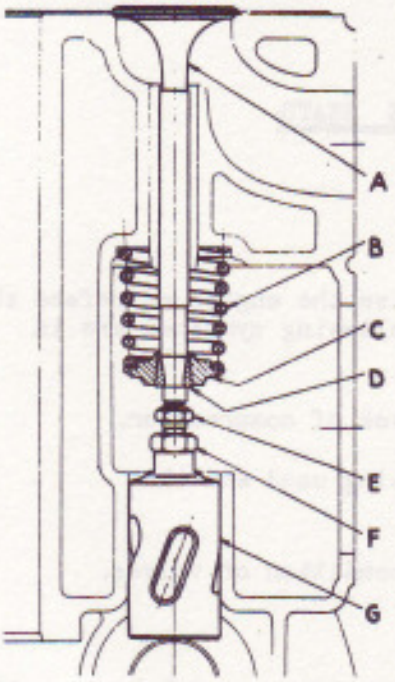


FIG.11. EXHAUST VALVE SPRING COMPRESSING TOOL IN POSITION.

Unscrew sleeve nut of compressing tool sufficiently to allow the fork to be placed under bottom washer (C, Fig. 12) of the valve to be removed.



A. Exhaust Valve.
B. Spring.
C. Bottom Washer.
D. Wedge.
E. Adjusting Screw.
F. Locking Nut.
G. Exhaust Tappet.

FIG. 12. ARRANGEMENT OF EXHAUST VALVE WITH CAST IRON GUIDE.

With the valve closed, place the tool on the appropriate exhaust manifold retaining studs, and engage the fork piece under the bottom washer of the exhaust valve. Secure tool in position with two nuts, and then with a suitable spanner, turn the sleeve nut to compress the valve spring sufficiently to remove the wedges. Slacken off sleeve nut and remove tool, then withdraw the valve from its guide and remove the valve spring together with the bottom washer.

NOTE: On certain early chassis, cast iron valve guides were fitted. Subsequently, bronze valve guides (B, Fig.13) with retaining flanges were introduced together with a top washer (C).

Should this washer become dislodged when removing the valve spring, smear with grease and replace it in position as shown in Fig.13.

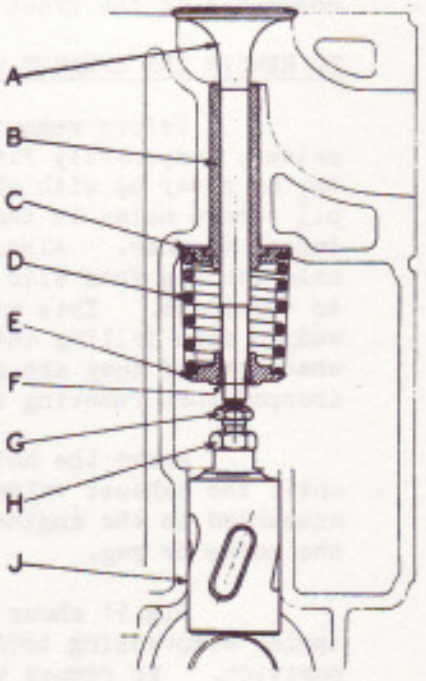
When replacing an exhaust valve on engines fitted with bronze valve guides, it must first be ascertained that the top washer is in position.

Remove remaining valves by repeating the above operations.

The wedges should be kept in pairs as they are removed from the valve stems, and restored to the same valves.

CLEANING PISTONS & HEAD.

The inlet valves should be left in position while scraping the cylinder head, in order to protect the valve seats.



A. Exhaust Valve.
B. Valve Guide.
C. Top Washer.
D. Spring.
E. Bottom Washer.
F. Wedge.
G. Adjusting Screw.
H. Locking Nut.
J. Exhaust Tappet.

FIG. 13. ARRANGEMENT OF EXHAUST VALVE WITH BRONZE GUIDE.

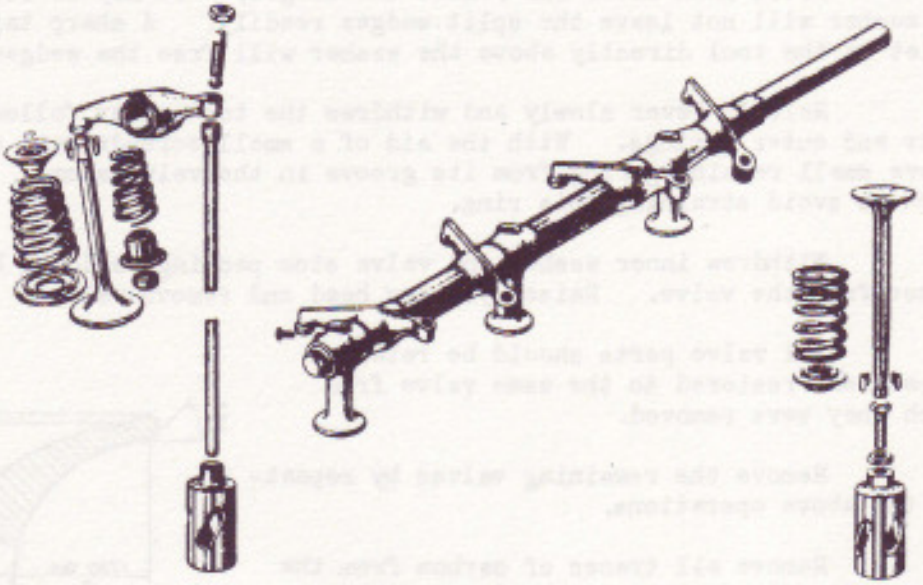


FIG. 14. EXPLODED VIEW OF INLET AND EXHAUST VALVE MECHANISM.

As the pistons and cylinder head are made of an aluminium alloy, take great care not to score them when scraping away the carbon deposit.

Only a blunt rounded tool should be used and applied with very moderate pressure. Precautions must be taken to prevent carbon getting into the coolant holes of the cylinder block.

Emery cloth, sandpaper or other abrasives must not be used for cleaning the pistons or cylinder head.

TO REMOVE THE INLET VALVES.

Insert a block of wood of suitable size in the combustion chamber to support the valve. Place inlet valve spring compressing tool (RF.4391) on to the appropriate rocker shaft pedestal stud as shown in Fig. 19 Sub-Section BE.8 and attach it by screwing

A. Top Washer.
B. Retaining Ring.
C. Inner Spring.
D. Outer Spring.
E. Inner Washer.
F. Outer Washer.
G. Valve Stem packing.
H. Inlet Valve.
J. Wedge.
K. Adjusting Screw.
L. Locking Nut.
M. Push Rod.

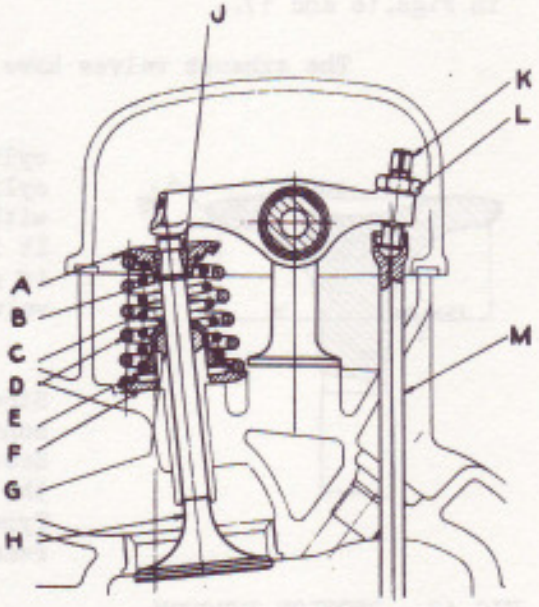


FIG 15. ARRANGEMENT OF INLET VALVE.

down the fulcrum pillar (B) on to the stud. Place the stirrup (C) over the top washer (A, Fig.15) of the valve and lock slide in position by means of the thumb screw.

Press down lever and remove the wedges. It may be found that the top washer will not leave the split wedges readily. A sharp tap with a hide mallet on the tool directly above the washer will free the wedges.

Release lever slowly and withdraw the top washer followed by the inner and outer springs. With the aid of a small screwdriver, carefully remove small retaining ring from its groove in the valve stem. Care must be taken to avoid straining this ring.

Withdraw inner washer and valve stem packing followed by the outer washer from the valve. Raise cylinder head and remove valve.

All valve parts should be retained in sets and restored to the same valve from which they were removed.

Remove the remaining valves by repeating the above operations.

Remove all traces of carbon from the valves with fine emery cloth and paraffin, taking care not to scratch the seats or stems.

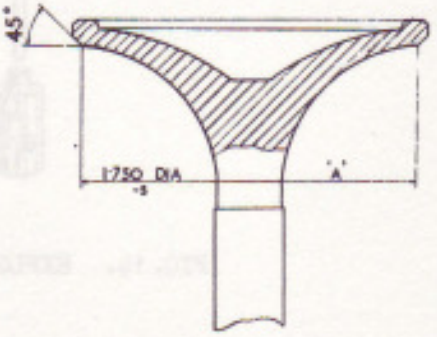


FIG.16. SECTION THROUGH HEAD OF INLET VALVE

REFACING THE VALVES AND VALVE SEATS.

The inlet and exhaust valves are numbered (etched) 1 to 6 near the bottom of the valve stem. The numbering commences at the front of the engine.

The valve face angle of both inlet and exhaust valve is 45° as shown in Figs.16 and 17.

The exhaust valves have stellite seats, see Fig.17.

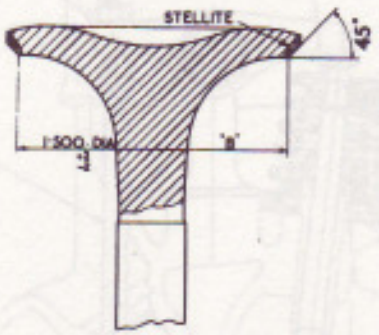


FIG.17. SECTION THROUGH HEAD OF EXHAUST VALVE.

The inlet valve seat inserts in the cylinder head and the exhaust valve seats of the cylinder block, should be refaced by grinding with standard valve seat reconditioning equipment. It is assumed that this equipment is available, if not, it will be necessary to grind-in the valve by hand as described later.

Bentley Motors (1931) Ltd., recommend a Sioux Valve Face Grinder type No.662 for reconditioning the valves, a Hall's Portable Valve Seat Grinder type No.E J.A.10 for reconditioning the exhaust valve seats and a Hall's Production Type Valve Seat Grinder type No.V.P.A.36 for the reconditioning of the inlet valve seats.

When retrimming the seating of the inlet valve, it is necessary to grind off the material to the correct angle (i.e. 45° as shown in Fig.16) and sufficiently to remove pitting. Metal must then be removed from the underside of the valve in order to maintain the dimension 'A' also shown in Fig.16.

When retrimming the seating of the exhaust valve, grind off the material to the correct angle (i.e. 45° as shown in Fig.17) and sufficiently to remove pitting and then remove metal from the underside of the valve as in the case of the inlet valve, in order to maintain dimension 'B' as shown in Fig.17. However, prior to carrying this out, the locking nut (F, Fig.12) of each exhaust valve tappet should be released and the adjusting screw (E), screwed down several turns. To carry out this operation, slip the special exhaust tappet holding spanner (RF.3838 Fig.18) on to the flats provided at the top of the exhaust tappet, and placing the other end of the spanner on to the inlet tappet. Then, with the aid of the two $\frac{1}{4}$" and 5/16" B S.F. single ended spanners (RF 3834 and RF.4372), the locking nut can be released and the adjusting screw screwed down.

FIG.18. TOOL FOR HOLDING EXHAUST TAPPET.

It should be observed that when using the recommended equipment for reconditioning the valve seats of the block, and the valve seat inserts of the head,

(a) Valve guides must be clean.

(b) It is most important that the pilot to be used should be tightened securely in place, and must be a close fit in the valve guide, (i.e. Diameter of stem of pilot for inlet valve guide must be .343" dia. Diameter of stem of pilot for exhaust valve guide must be .375" dia.). The portion of the stem of the pilot which fits into the valve guides should be about 3.250" long.

(c) Precautions must be taken not to allow any grinding dust or foreign matter to find its way on to the tappets or into the valve tappet chamber and the cylinder bores.

(d) The grinding stone should be frequently cleaned up with the diamond dressing tool to ensure a correct angle and a true and clean cutting face.

The seat face angle in the cylinder head and the cylinder block is also 45°. After grinding the valves and seats, test by smearing the seating on the valve with a small amount of prussian blue and then pressing the valve on to its seating and lifting away again, without rotating it. A complete circle of marking should appear on both valve face and seating indicating a good bedding.

When refacing valves and seats, remove the least amount necessary to give a clean face.

The inlet valve seats which are made of nickel chrome steel, tend to harden with use.

After these operations have been carried out, great care must be taken to make certain that all grinding dust and foreign matter is removed from the valves, seatings, guides and ports of both the cylinder head and the cylinder block, and also the tappet chamber.

HAND "GRINDING-IN" THE VALVES.

In the event of standard electrical valve seat reconditioning equipment not being available, then the valves will have to be ground-in by hand. A suction type valve holding tool will be needed for this operation.

Good quality grinding paste should be used, the valve being rotated backwards and forwards in different positions and pushed from its seat occasionally. Only a light pressure should be applied, to prevent scoring of the valve and seat. Care must be taken not to allow any grinding paste to get on the valve stems or in the guides.

Test seatings with prussian blue as previously explained.

After this operation, it is essential that all traces of grinding compound are removed from the engine.

TESTING VALVE SPRINGS.

The inlet and exhaust valve springs should be cleaned and examined for visible defects and also checked for poundage. Fatigue cracks commence on the inside diameter of the coils. Normally the springs should give long service.

The springs should be tested for poundage on an accurate Valve Spring Tester. When testing, the springs should be compressed to the valve closed length, i.e.:

Inlet Valve Spring - inner.

(i) Compress the spring to 1.300", in this condition the spring should exert a load (poundage) of not less than 12 lbs.

Inlet Valve Spring - outer.

(ii) Compress the spring to 1.600", in this condition the spring should exert a load of not less than 39 lbs.

Exhaust Valve Spring.

(iii) Compress the spring to 1.525", in this condition the spring should exert a load of not less than 40 lbs.

TO REPLACE INLET VALVES.

With all parts thoroughly cleaned including the valve guides, replace the first valve after smearing the stem with grease and then place the wooden block beneath the cylinder head in the combustion chamber, to keep the valve in position.

Mount the inlet valve spring compressing tool on the appropriate rocker shaft pedestal stud.

Replace the outer washer (See Fig.15) followed by a new valve stem packing and the inner washer.

Replace the retaining ring in its groove on the valve stem. Should the ring be damaged or sprung open, then a new ring must be fitted. It is preferable to fit a new set of retaining rings.

Replace the inner and outer valve springs, and fit the top washer. Compress the springs and fit the wedges.

Repeat the above procedure for the remaining valves, making sure that each valve is replaced in its corresponding guide together with a new valve stem packing.

After the valves have been replaced and the wooden block removed, tap on the top of each valve with a hide mallet to ensure that the valve wedges are seating correctly.

TO REPLACE THE EXHAUST VALVES.

First, make sure that the four oil return holes in the bottom of the tappet chamber and the hole leading through to the wheelcase are still covered up, then, with all parts including the valve guides thoroughly clean, proceed as follows to fit the first exhaust valve.

Ascertain that the tappet is at its lowest position of travel in its guide. Place the bottom washer on the valve spring and then place the washer and spring in position in the tappet chamber. Lubricate the stem with grease and then drop the valve into place.

Mount the exhaust valve spring compressing tool in position, and while the valve is held down, compress the spring and refit the wedges making sure that they are correctly located. This can be done with the aid of a hand lamp and mirror. Repeat the above procedure for the remaining valves making sure that each valve is replaced in the guide from which it was removed.

When all the exhaust valves have been assembled, proceed to set the exhaust tappet clearance as described in the following paragraph.

ADJUSTING THE EXHAUST VALVE TAPPET CLEARANCES.

The correct clearance for the exhaust tappets is .012" (.305 m/m) with the engine cold.

Before commencing to adjust a tappet clearance it should be ascertained that that particular tappet is on the base of the cam, (i.e. not on the cam contour), which is best done by turning the crankshaft by hand until the valve has opened and closed, and then cranking round half a revolution beyond this point.

The following tools, provided in the tool kit, will be required for this operation:-

Tool No.	Description	Fig.No.
RF.4277	Set of feeler gauges.	-
RF.3838	Exhaust tappet spanner.	18
RF.3834	¼" B.S.F. Single ended jaw spanner.	-
RF.4372	5/16" B.S.F. Single ended jaw spanner.	-

The method of adjusting the exhaust tappet clearances is:-

Place the exhaust tappet spanner on to the exhaust and inlet tappets to prevent the exhaust tappets from turning while adjusting. Slacken the locknut (F, Fig.12) and then adjust the adjusting screw (E), to give the correct clearance.

As each adjusting screw is adjusted, its locknut should be securely tightened up.

Check that the setting of the tappet clearance has not been disturbed by the tightening of the locknut.

Repeat these operations for the remaining valves.

Remove all the corks or rag covering up the oil return holes in the tappet chamber.

Replace the two side tappet covers, first ascertaining that the cork joints are in good condition and that the distance pieces are in position. No distance pieces are required with cast aluminium tappet covers.

Normally the exhaust valve tappet clearances should not need attention between decarbonising periods of the engine.

Refit the cylinder head and other parts as described in Sub-Section BE.6.

CHANGING VALVE SPRINGS IN SITU.

TO CHANGE INLET VALVE SPRING.

Remove the rocker cover and rocker shaft assembly as described in Sub-Section BE.6.

Place the inlet valve spring compressing tool (RF 4391) and the valve holder (RF.5214) in position on the engine as shown in Fig.19.

The locking nut (D) on the valve holder should first be unscrewed sufficiently to release a split taper collet which grips the spindle (E) and the bent portion of the latter inserted through the sparking plug hole, after which the holder (F) should be screwed into position.

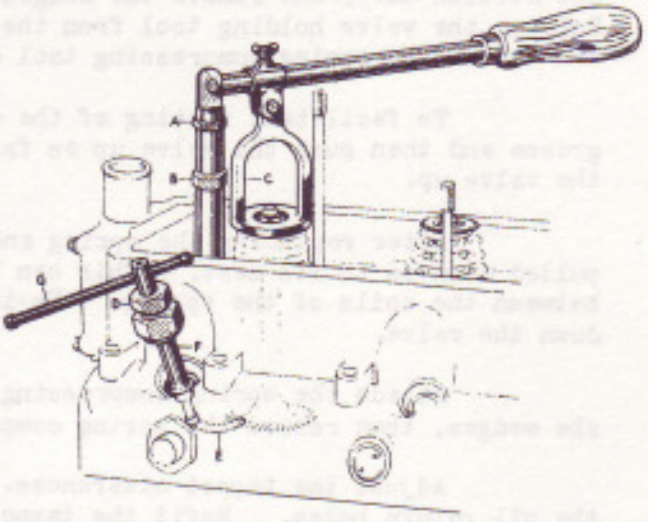


FIG.19. VALVE SPRING COMPRESSING TOOL AND VALVE HOLDER IN POSITION.

The spindle should then be turned and simultaneously pulled away from the head, so that it is bearing in the hollow of the appropriate valve head of the spring to be removed, as shown in the illustration, and the locking nut (D) tightened while holding the spindle in position by means of the tommy bar (G).

Remove the valve spring as described in Sub-Section BE.7.

Should it be found necessary to replace the valve stem packing, then the small retaining ring will have to be removed from its groove in the valve stem and subsequently refitted or replaced by a new one as found necessary.

If the spring ring has been removed, care must be taken not to disturb the valve holder until it has been replaced, otherwise the valve would fall into the cylinder.

Replace valve spring etc. as described in Sub-Section BE.7. Adjust the rocker clearance and then replace the rocker cover etc.

TO CHANGE AN EXHAUST VALVE SPRING.

Remove the exhaust manifolds and tappet covers as described in Sub-Section BE.6, and cover up the oil return holes in the tappet chamber. Release the locking nut of the tappet adjusting screw concerned and screw down the tappet screw as far as it will go. Place the valve holder in position. It should be

noted, however, that whereas the inlet valves have a deep hollow in the head, the head of the exhaust valves have a shallow hollow (See Figs.16 and 17, Sub-Section BE.7) and care will therefore have to be taken to ensure that the curved portion of the spindle of the valve holder correctly locates on the valve head.

Attach the exhaust valve spring compressing tool as shown in Fig.11, Sub-Section BE.7, and remove the wedges and then remove the valve holder. Release the valve holding tool from the valve head. Push the valve upwards and remove the spring compressing tool and the spring and washer.

To facilitate fitting of the new spring, smear the valve stem with grease and then push the valve up as far as it will go. The grease will hold the valve up.

After replacing the spring and bottom washer, the valve should be pulled down on to its seat. This can be done by passing a small screwdriver between the coils of the spring. Re-insert the valve holding-tool, to hold down the valve.

Attach the spring compressing tool, compress the spring and replace the wedges, then remove the spring compressing tool and the holding down tool.

Adjust the tappet clearances. Remove the corks or rag covering up the oil return holes. Refit the tappet covers. Refit the exhaust manifolds.

- . -

SPRING DRIVES - "WRAITH" & "BENCH" TYPES

(CRANKSHAFT VIBRATION DAMPERS)

1. DESCRIPTION:

There are two types of Low Inertia Spring Drives, known for production purposes as the "Wraith" and "Bench" type. The "Wraith" type has to be fitted to the crankshaft in a partly assembled condition, whereas the "Bench" type can be assembled on the bench and offered up to the crankshaft as a complete unit.

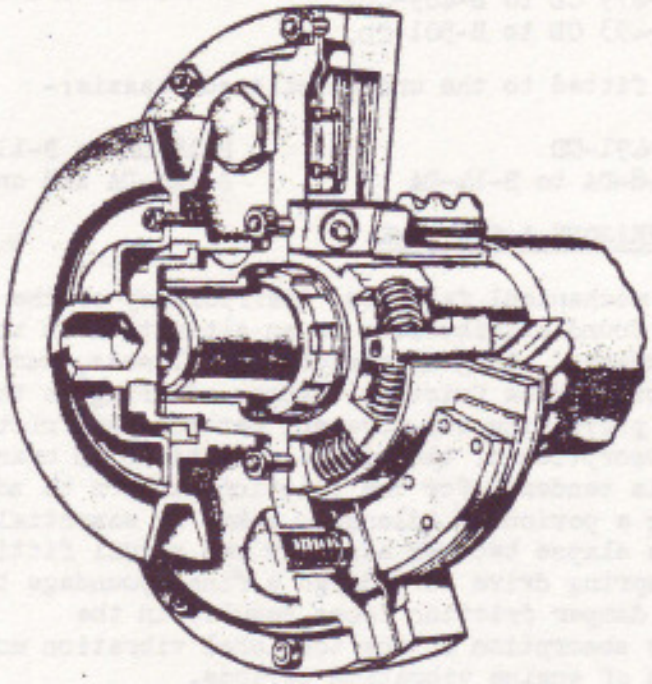


FIG. 20. "CUT-AWAY" VIEW - SPRING DRIVE "WRAITH" TYPE.

The device is a composite component which deals with two different and distinct conditions.

THE SPRING DRIVE provides a flexible coupling between the Crankshaft and the Crankshaft Pinion, its function being to maintain a constant pressure at the driving teeth irrespective of the variations in load - as imposed by the camshaft. The pinion is driven by radially disposed Coil Springs (32 & 33 Fig.21 and 24 & 25 Fig.28).These springs are interposed between Dog members which are attached to the Crankshaft and the Pinion.

THE VIBRATION DAMPER deals with torsional oscillations of the Crankshaft which are overcome by friction imposed by the inertia of a small Flywheel. To keep the natural oscillation frequency of the front end of the crankshaft as high as possible, the weight of material rigidly attached to the Crankshaft at this point must be and is kept to a minimum. It will be noted that this is the friction drum only (29 Fig. 21 and 20 Fig. 28). On both types of Spring Drives, the Pinion, Fan Pulley, Damper Flywheels and Starter Dog, are the floating mass parts for inertia effect.

With this arrangement, movement of the Damper Flywheel is limited to within the radial movement of the Spring Driven Pinion, as the periodic movements of the Damper are considerably less than the deflections of the Springs (caused by load variations) no restriction to the Damper action takes place.

Friction is provided between the Damper Flywheel and the Crankshaft by Cotton Duck Friction Washers loaded by Coil Springs. (28 & 20 Fig. 22 & 21 & 18 Fig. 29). This friction is also effective between Pinion and Crankshaft

movement and serves to damp out any periodic occillations of the Pinion Drive Springs.

NOTE. As the Starter Dog is attached to the floating part of the device, it is essential that the engine is turned from the rear at the main Flywheel, and in its normal direction of rotation when checking the timing or timing the engine.

The "Wraith" type is fitted to the following chassis:-

B-2-AK to B-254-A.K.	B-2-CF to B-500-CF.	B-2-DA to B-6-DA.
B-1-AJ to B-247-A.J.	B-1-CD to B-473-CD.	B-16-DA.
B-2-BH to B-400-B.H.	B-479 CD to B-489-CD.	B-118-DA to B.126-D.A
B-1- B.G to B-401.BG.	B-493 CD to B-501-CD.	

The "Bench" type is fitted to the undermenticned chassis:-

B-475-CD	B-491-CD	B-18-DA to B-116-DA
B-477-CD	B-8-DA to B-14-DA	B-128-DA and onwards

2. DERANGEMENT OF THE DAMPER - REASONS & SYMPTOMS.

Apart from unlikely mechanical failures, inefficiency of the damper will, in the main, be found attributable to an alteration in the pre-determined slipper drive poundage. Lengthy periods of idleness, such as car storage, may result in the cotton duck friction washers adhering to the damper friction plates, thus preventing the movement between the friction faces so necessary for the absorption of the minute variations in crank-shaft angular movement. This tendency for the friction washers to adhere to the friction plates during a period of idleness, makes it essential. should some considerable time elapse between assembly and actual fitting to the engine for an assembled spring drive to undergo a final poundage test. Loss of movement between the damper friction faces results in the accentuation, rather than the absorption of the torsional vibration movement, thus causing the introduction of engine vibration periods.

These periods produce engine gear rattle which can be heard most noticeably at 2500 engine R.P.M. - this is the half torsional period of the crankshaft. In top gear, 2500 engine R.P.M. = approximately 55 M.P.H. or 88 K.P.H.

3. TOOLS (Special)

The undermentioned special tools, will be required:-

Tool No.	Description	Application
1617/ T1001	Box Spanner.	Withdrawal Nut - Fan Pulley - Spring Drive "Wraith" type.

or use a standard box spanner having 1.581" width across flats.

1649/T3.	Box spanner.	Starting Dog-Spring Drive ("Bench" type)

or, use a standard 7/8" B.S.F. Box Spanner.

STD-504 Key For use with 1617/T1001 & 1649/T3, Box Spanners.

3759/T1007 Serrated Spanner. Nut-Crankshaft-Spring Drive(Both types).

1617/T1003 Extractor Spring Drive ("Wraith" type)

This extractor can be used on the "Bench" type Spring Drive, providing the four 13/32" dia. holes in the clamp plate of the tool are elongated to suit the 2.900" (73.66 m/m) dia. hub stud centres as against the 2.800"(71.12 m/m) stud centres of the "Wraith" type. Future supplies of this Extractor, which has been commonised to suit both types of spring drives, will bear the Part No: 3759/T1016.

1617/F1005 Mandril. Spring Drive Assembly (Both types)

1617/G1003 Poundage Checking Lever. Damper-Spring Drive (Both types)

Before this lever can be used on the "Bench" type Spring Drive, it will be necessary to elongate the 17/64" dia. holes in the lever to suit the 2.900" dia. hub stud centres. (See "Note" and further tools over.)

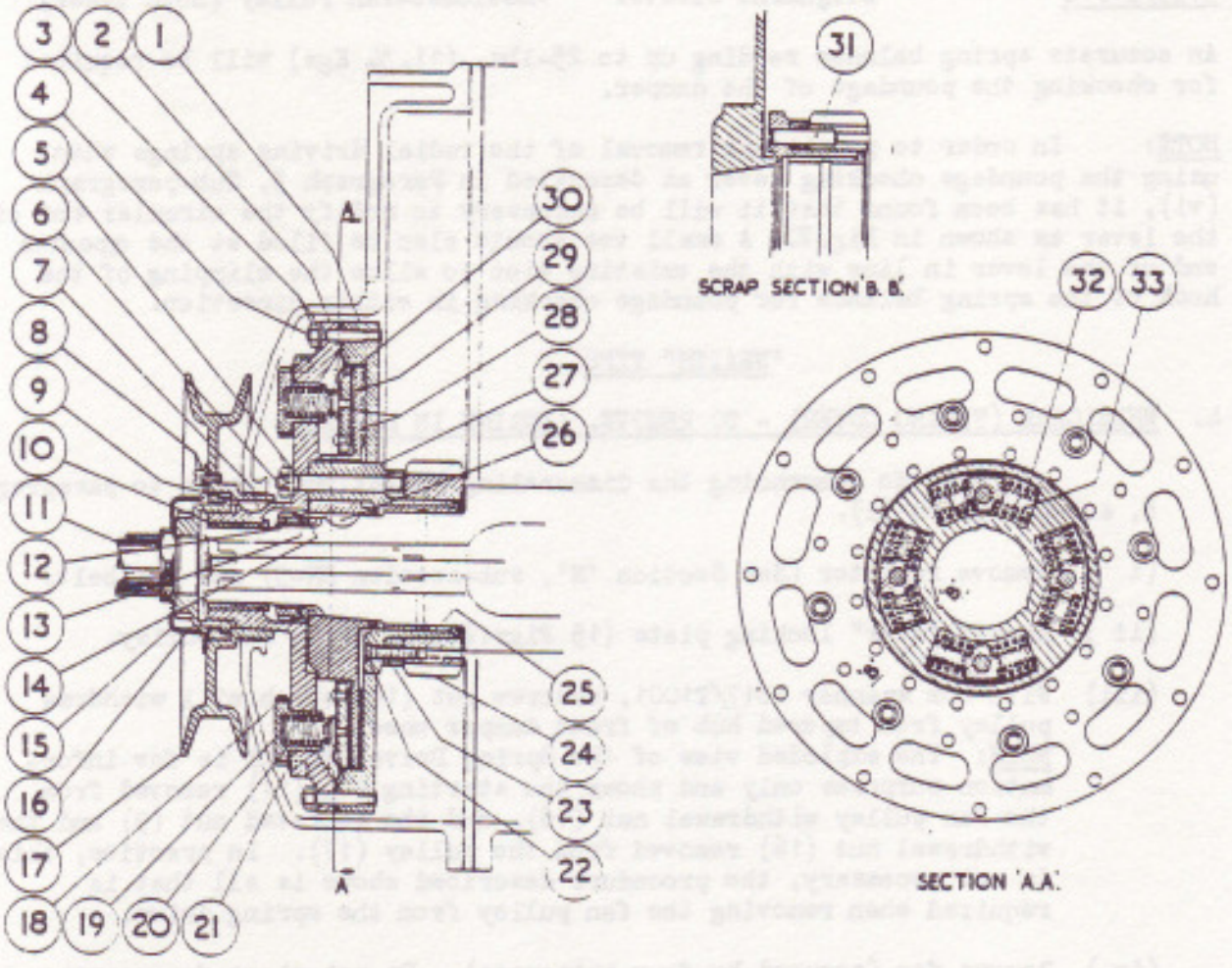


FIG. 21. SECTION - SPRING DRIVE ("WRAITH" TYPE.)

Notation List for Fig.21.

1. Damper Wheel (rear)
2. Damper Wheel (front)
3. Nut and Lockwasher.
4. Stud.
5. Nut and Lockwasher.
6. Stud.
7. Woodruff Key.
8. Screw & F.S. Washer.
9. Nut (serrated)
10. Bush. (front)
11. Starting Dog.
12. Nut. (serrated)
13. Lockwasher.
14. Washer. (plain)
15. Star Locking Plate.
16. Withdrawal nut-fan pulley.
17. Fan Pulley.
18. Plug.
19. Adjusting Washer.
20. Damping Spring.
21. Lockwasher.
22. Countersunk Screw.
23. Distance Piece.
24. Crankshaft Pinion.
25. Bush (rear)
26. Woodruff Key. (3 Off)
27. Driven Dog.
28. Friction Washers. (2 Off)
29. Friction Drum.
30. Presser Plate Assembly.
31. Driving Pin - Pinion.
32. Driving Spring. (outer)
33. Driving Spring. (inner)

3759/T1018 Alignment Sleeve. Wheelcase-Fan Pulley (Both types)

An accurate spring balance reading up to 25-lbs. (11.34 Kgs) will be required for checking the poundage of the damper.

NOTE: In order to permit the removal of the radial driving springs when using the poundage checking lever as described in Paragraph 5, Sub-paragraph (vi), it has been found that it will be necessary to modify the circular end of the lever as shown in Fig.27. A small vee should also be filed at the opposite end of the lever in line with the existing slot to allow the clipping of the hook of the spring balance for poundage checking in either direction.

"WRAITH" TYPE.

4. WHEELCASE (TIMING COVER) - TO REMOVE. (ENGINE IN FRAME.)

Prior to commencing the dismantling operations, refer to paragraph 8, sub-paragraph (i).

(i) Remove radiator (See Section 'N', sub-section EN-5) and fan belt.

(ii) Remove "star" locking plate (15 Figs.21 & 22) from fan pulley.

(iii) With box spanner 1617/T1001, unscrew nut (16) which will withdraw pulley from tapered hub of front damper wheel.
NOTE: The exploded view of the Spring Drive (Fig.22) is for information purposes only and shows the starting dog (11) removed from the fan pulley withdrawal nut (16), and the serrated nut (9) and the withdrawal nut (16) removed from the pulley (17). In practice, this is not necessary, the procedure described above is all that is required when removing the fan pulley from the spring drive.

(iv) Remove fan (secured by four setscrews). Do not place fan reverse way round when refitting it.

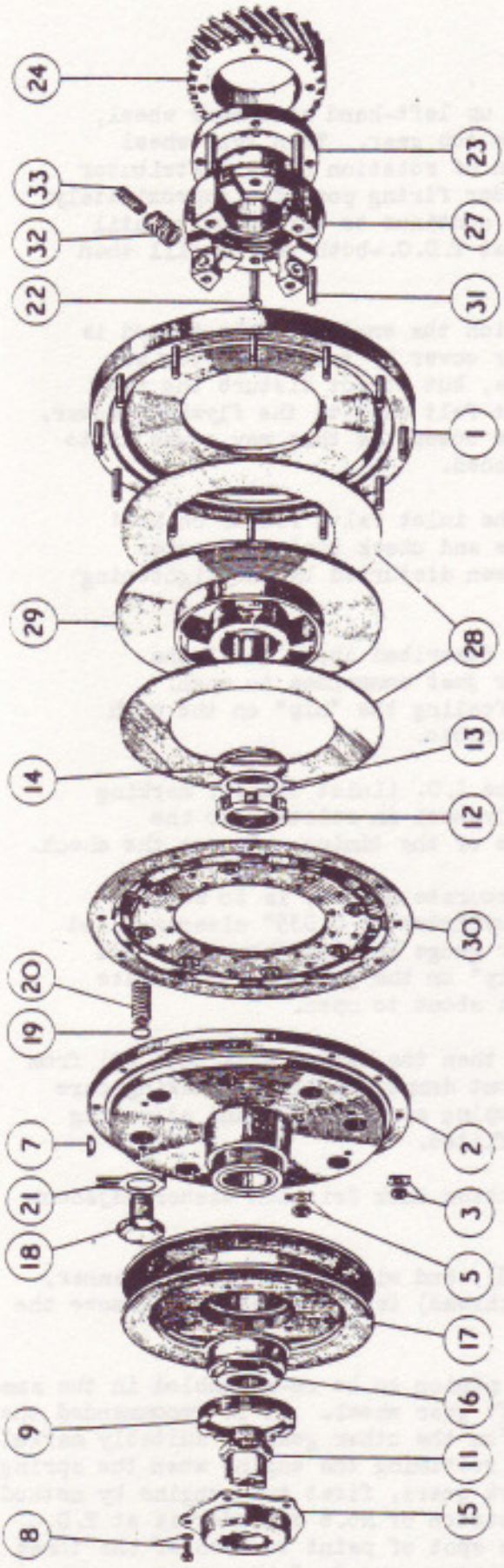


FIG. 22. Exploded View - Spring Drive("Wraith" Type)

(v) Place a jack under front end of crankcase lower half, interposing a wooden board between lower half and jack to spread load. Screw up jack just sufficiently to take load off engine front support arch.

(vi) Remove the four bolts (two on either side) securing support arch to frame cross-member brackets.

(vii) Undo the two 5/16" B.S.F. nuts from the nose bearing at top of arch, remove front plate, arch and rubber bushes.
NOTE: Temporarily attach each packing piece, fitted between ends of support arch and frame cross-member brackets, to their respective bracket.

(viii) Remove nose bearing from wheelcase secured by four 5/16" B.S.F. nuts.

(ix) Disconnect oil feed pipe from oil nozzle on wheelcase, unscrew nozzle and remove it.

(x) Remove nuts, setscrews and bolts securing wheelcase to crankcase and remove wheelcase. On early type engines, two dowels are fitted to the crankcase face for wheelcase alignment, whereas on later type engines, three close fitting bolts are fitted in place of the dowels.

5. SPRING DRIVE, TO REMOVE FROM CRANKSHAFT:

(i) Before removing the spring drive, it will be advisable to check and note the valve timing as this will assist when checking it after refitting the spring drive.

Valve timing is carried out on No.1 cylinder on I.O. i.e. inlet opens. To check, proceed as follows:-

a) Open cover of flywheel marking inspection hole.

b) Remove sparking plugs, jack up left-hand side rear wheel, release handbrake and engage top gear. Turn rear wheel (engine) in normal direction of rotation until distributor rotor approaches No.1 cylinder firing position(approximately 11-o'clock on distributor), continue to turn slowly until piston of No.1 cylinder is at T.D.C.-both valves will then be closed.

NOTE: Another method by which the engine can be turned is to remove the flywheel lower cover by taking off the six nuts and flat spring washers, but do not disturb the two small bolts which secure the felt seal to the flywheel cover. Take care not to distort the cover, as this may cause it to foul the flywheel when replaced.

c) With the engine cold, set the inlet valve rocker on No.1 cylinder to 0.030" clearance and check that the rocker clearance setting has not been disturbed by the tightening of the locknut.

d) Again turn engine by method described above until the inlet valve on No.1 cylinder just commences to open. This can be ascertained by feeling the "nip" on the push rod which should be just turnable.

e) Now check the position of the I.O. (Inlet Opens), marking scribed on the rim of the flywheel in relation to the timing pointer and take note of the timing. Repeat the check.

f) Another, and perhaps more accurate method, is to set the inlet valve rocker on No.1 cylinder to 0.035" clearance and insert a 0.005" thick feeler gauge between the rocker and the valve stem. A light "nip" on the gauge will indicate that the inlet valve is just about to open.

(ii) Remove the four nuts (5 Fig.21), then the twelve 2-BA nuts (3) from rim of damper wheel. Remove front damper wheel (2), taking care not to lose any of the eight damping springs (20) and adjusting washers (19) if the latter are fitted.

(iii) Remove presser plate (30) and cotton duck friction washer adjacent to it.

(iv) Bend back tabs of lockwasher (13), and with the serrated spanner, 3759/T1007, remove nut 12 (R.H. thread) from crankshaft. Remove the plain washer (14).

NOTE: To enable the crankshaft pinion to be re-assembled in the same position relative to the camshaft gear wheel. It is recommended that a tooth on one gear and a"space"on the other gear be suitably marked. This will also save the work of re-timing the engine when the spring drive is being refitted. To mark gears, first turn engine by method previously described until the piston of No.6 cylinder is at T.D.C. on the firing stroke and apply a spot of paint to each of the three mating teeth prior to complete disengagement of the gears.

(v) Attach the extractor, 1617/T1003 to the four hub studs (6 Fig. 21) and remove "rear half" of spring drive complete with pinion from crankshaft.

NOTE: It will be observed upon reference to Fig. 22, that Items 22, 23, 24, 27 and 31, comprising the crankshaft pinion assembly, are shown "exploded". It is not necessary to separate these parts.

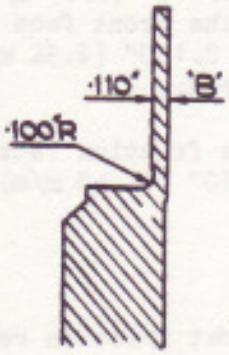
(vi) The next operation is to remove the outer and inner radial driving springs (32 & 33) from the friction drum (29) and the driven dog (27). Proceed as follows:-

a) Place the mandril, 1617/F1005 in a vice and firmly secure.

b) Place "rear half" of spring drive on the mandril, making sure it is keyed in position.

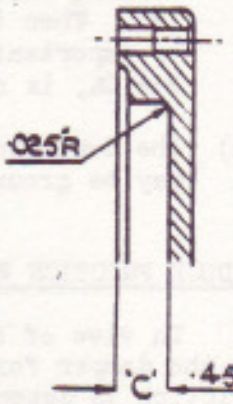
PRESSER PLATE

FIG. 23.



FRICTION DRUM

FIG. 24.



REAR DAMPER WHEEL

FIG. 25.

c) Attach the poundage checking lever, 1617/G1003 to two of the four 1/4" B.S.F. hub studs and take the strain one way which will ease the tension on four pairs of springs and make removal of them easier. It should be noted that the driving springs are retained in position at one end only (See "Section A.A." Fig. 21)and thus require to be compressed before they can be extracted. To effect this, the blade of a suitable screwdriver should be inserted between a spring and the corresponding driving dog of the friction drum (29) and the spring compressed and prised upwards until it is clear of the friction drum. Take care not to distort springs during their removal.

(vii) Discard used cotton duck friction washers. Clean dismantled parts.

6. FRICTION FACES (GRINDING LIMITS):

(i) Examine all friction faces for scoring and regrind or turn where necessary.

(ii) The sectional drawings, Figs.23, 24, 25, illustrate the limits to which the various friction faces may safely be ground or turned. All friction faces must have a smooth and highly polished surface. Grinding or turning of the faces should only be carried out should they be found to be pitted or scored and the least amount of metal possible should be removed to give a clean face. In most cases, it should be possible to recondition the friction faces by polishing only.

a) The minimum permissible working thickness for the presser plate is 0.150" (3.81 m/m). See Fig.23, Dimension 'A'. This dimension does not include the thickness of the spring plate.

b) The flange of the friction drum must not be ground below a working thickness of 0.110" (2.79 m/m). See Fig.24, Dimension 'B'. When truing up the front face of the friction drum. it is important that the 0.100" (2.54 m/m) radius as shown on Fig.24, is not destroyed.

c) The depth to which the friction face of the rear damper wheel may be ground, is 0.450" (11.43 m/m). See Fig.25, Dimension 'C'.

7. COTTON DUCK FRICTION WASHERS:

In view of the fact that friction represents the main principle used in the damper for the absorption of torsional oscillation, and that this friction is dependent upon the washers themselves, it is obvious that the efficient functioning of the damper will be governed by the condition of these washers.

The tendency for these to become hard, ingrained with carbon and superficially glazed, thus losing their original properties, makes it essential for the existing friction washers to be replaced by new ones at each overhaul period. Before assembly, the replacement friction washers must be reduced to a state approximating to that in which they will operate when actually assembled, and, as this entails a reduction in material thickness, care should be taken to ensure uniformity in all-round working thickness, particularly at the scarf joint. This is of the utmost importance, as the fitting of unevenly ironed friction washers will only result in rapid deterioration in damper efficiency.

8. PREPARATION OF NEW FRICTION WASHERS PRIOR TO FINAL ASSEMBLY & SETTING THE DAMPER POUNDAGE (SLIPPING LOAD).

In order to prepare the friction washers for final assembly, the following procedure should be carried out:-

(i) Soak washers in a first quality oil of viscosity S.A.E. 20, overnight and then place them under a press (between flat surfaces) for about twelve hours to flatten.

(ii) Place the mandril, 1617/F1005 in a vice and firmly secure.
NOTE: The radial driving springs (32 & 33 Fig. 21) must be omitted during these operations.

(iii) Place the crankshaft pinion assembly on to the mandril.
NOTE: The following parts are stamped with a co-relation mark 'O' and on assembly, all these marks should coincide.
Driven Dog (27 Fig.22), Rear Damper Wheel (1), Friction Drum (29), Spring Plate (30) and the Front Damper Wheel (2)

(iv) Place rear damper wheel on to driven dog. Liberally oil first replacement washer and place it on to rear damper wheel.

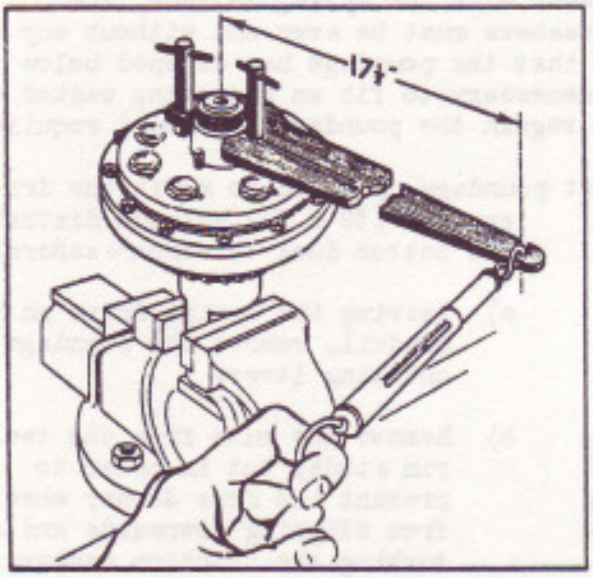


FIG. 26. CHECKING DAMPER POUNDAGE.

(v) Place friction drum on mandril and push it fully home.

(vi) Liberally oil second replacement washer and place it on flange of friction drum. It is important that the two washers are assembled concentrically and that the scarf joints are fitted diametrically opposite to one another.

(vii) Fit presser and spring plate assembly on to rear damper wheel. NOTE: If it is found that an adjusting washer or washers (19) have been fitted behind each of the damping springs (20), then they should be removed.

(viii) With damping springs in position on front damper wheel, fit it to rear damper wheel. The springs should be smeared with a soft type of grease to keep them in position in the hollow plugs (18).

(ix) Tighten up the four nuts of the hub studs (6 Fig. 21) and then evenly tighten up nuts of the twelve rim studs and leave friction washers under compression for about twelve hours if time permits.

(x) Attach poundage testing lever to spring drive as shown in Fig. 26 and with the lever, rotate damper wheels backwards and forwards through the limit of their travel for about 15 to 20 minutes in order to iron the washers. NOTE: The recommended slipping load of the damper wheels is 14-lbs.+ 1-lb.(6.35 Kgs) applied at a radial distance of 17½" (44.45 cms). The load is checked with the spring drive assembled but less the driving springs (32 & 33).

The above represents the force necessary to overcome the friction between the cotton duck washers and the corresponding friction faces of the friction drum, the rear damper wheel and the presser plate. The effort required to overcome the frictional drag exerted by the damping springs (20) is measured on a spring balance(See Fig. 26).

(xi) Slip the spring balance on to the lever at a radial distance of 17½"

(xii) Pull on free end of balance and read poundage required to cause damper wheels to move relative to the friction drum. The poundage should always be checked in both directions. Should the poundage be found to be 16-lbs. for example, then continue the ironing process for a further period of about ten minutes. Again check poundage. It should be noted that the ironing process should be continued until two or three consecutive readings (poundage test) show no further fall in poundage which indicates that the friction washers are ironed to their limit.

NOTE: When pulling the lever with the spring balance, the frictional drag from the washers must be even and without any signs of judder. If it is found that the poundage has dropped below 14-lbs., it will then be necessary to fit an adjusting washer or washers to each spring to regain the poundage (14-lbs.) required.

(xiii) Having obtained the correct poundage, proceed to refit the driving springs (32 & 33) without disturbing the cotton duck friction washers.

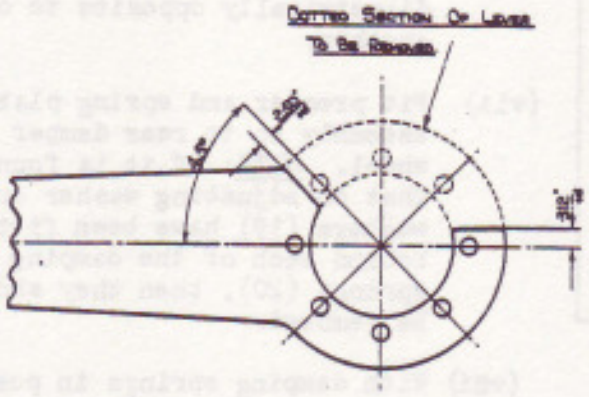


FIG. 27. POUNDAGE CHECKING LEVER MODIFIED.

a) Leaving the spring drive on the mandril, remove the poundage checking lever.

b) Remove the nuts from the twelve rim studs, but in order to prevent the rear damper wheel (1) from slipping downwards and disturbing the friction washers, hold it upwards prior to removing all the nuts.

c) Remove the front damper wheel with damping springs (20 Fig. 21), taking care not to disturb or lose any adjusting washers (19) that may be fitted.

d) To keep the remaining parts from coming adrift, temporarily secure the spring plate (30) to the rear damper wheel by means of two nuts and washers as necessary.

e) Again place the poundage lever in position, refit the driving springs by reversing the procedure for removal. Remove the lever.

9. TO REFIT THE "REAR HALF" OF THE SPRING DRIVE & CHECK THE VALVE TIMING:

(i) Fit the "rear half" of the spring drive to the crankshaft as described in Service Bulletin No.BB-91 "Valve Timing" (Section E) and check the valve timing.

(ii) After finally tightening up and locking the large serrated nut(12), refit the front damper wheel, making sure that the co-relation marks 'O' on both damper wheels coincide. Tighten up the hub nuts first and then the rim nuts and lock.

10. TO ALIGN & REFIT THE WHEELCASE & THE REMAINING DISMANTLED PARTS:

NOTE: Prior to refitting the wheelcase, inspect that all nuts etc. are correctly locked.

(i) There is a working clearance of 0.006" to 0.008" (0.15 - 0.2 m/m) between the outer diameter of the Acme oil return thread of the fan pulley and the corresponding bore in the wheelcase which must be maintained when refitting the wheelcase to the engine. To obtain this clearance, proceed as follows:-

a) Place a new Vellumoid joint on to front face of crankcase.

b) Fit wheelcase in position and lightly tighten nuts and setscrews.

c) Place the tapered end of Alignment Sleeve, Tool No. 3759/T1018, on to hub of front damper wheel and over Woodruff Key and tap it fully home. With a 0.002" (0.05 m/m) thick feeler gauge, check the clearance between the Alignment Sleeve and corresponding bore in wheelcase in about six different positions - the clearance should be equal the whole way round, if not, centralise wheelcase as necessary.

NOTE: The diameter of the bore in the wheelcase is, 2.4375" + .002 (61.91 m/m). The outside diameter of the Alignment Sleeve (both ends) is 2.435" - .001 (61.85 m/m). The outer diameter of the Acme oil return thread on the fan pulley is 2.425" - .002 (61.6 m/m).

d) Progressively tighten the three close fitting bolts (if fitted, see paragraph 4, sub-paragraph x) and then tighten setscrews and remaining nuts and re-check clearance. Remove the Alignment Sleeve.
NOTE: If tapered dowels were previously fitted, these should be tapped back into position from wheelcase side.

(ii) Refit the fan pulley and the starting dog and lock.

NOTE IMPORTANT: If the serrations of the star locking plate (15), do not coincide with the hexagon of the starting dog (11) when assembled, the cap nut (16) should be hammered up. On no account should the nut or dog be slackened back in order to fit the locking plate.

(iii) Check the ignition timing and reset if found necessary. (Refer to Service Bulletin No. BB-77, Section 'E').

(iv) Refit the radiator and reset the inlet rocker clearance on No.1 cylinder to .006" With the engine fully warmed up, inspect that there are no oil leakages from the wheelcase and also no coolant leakages.

"BENCH" TYPE.

11. DESCRIPTION:

For the description, refer to paragraph 1. It will be observed upon reference to Fig. 28, that in order to remove the serrated nut(14) retaining the spring drive to the crankshaft, it is not necessary to first remove the front damper wheel (2) as in the case of the "Wraith" type. The serrated nut is exposed by removing the hub (23) secured by four nuts.

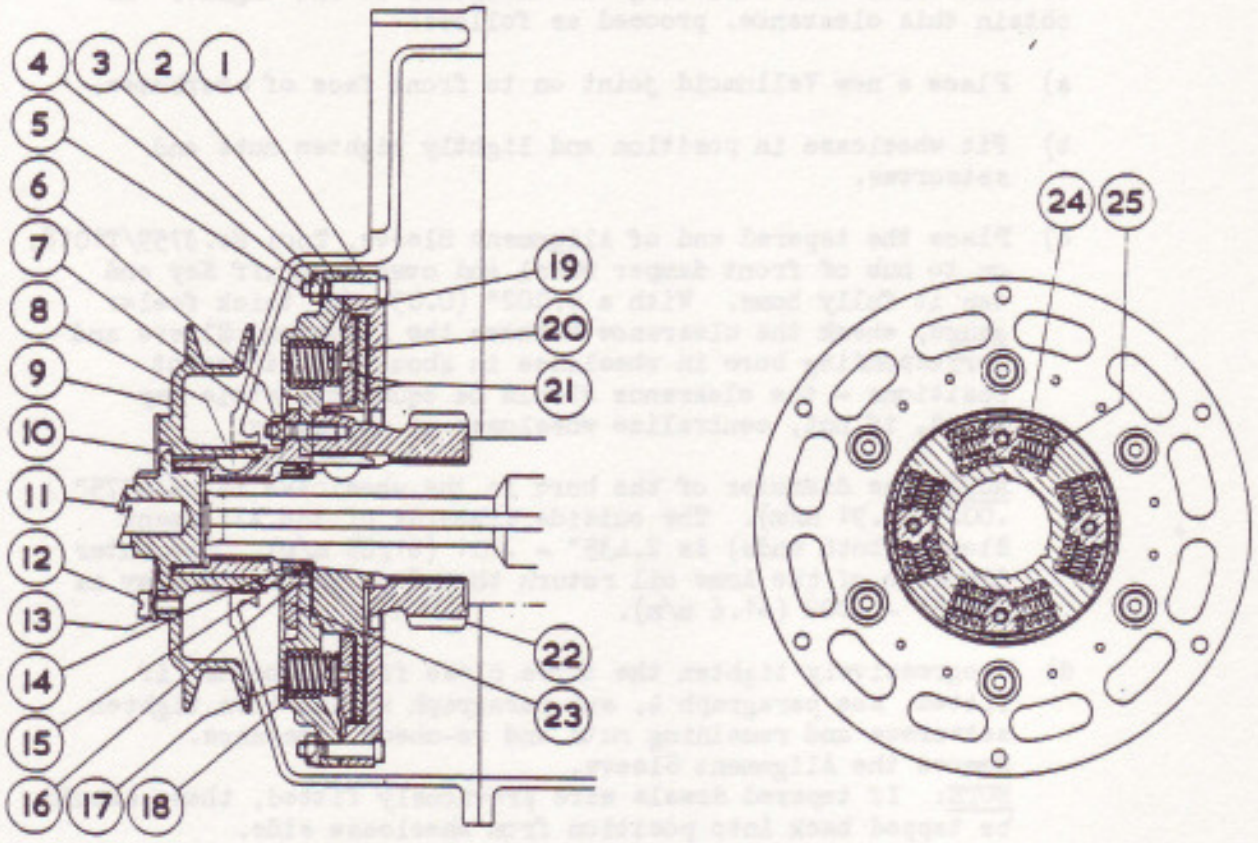


FIG. 28. SECTION - SPRING DRIVE ("BENCH" TYPE).

1. Damper Wheel (Rear)
2. Damper Wheel (Front)
3. Lock Washer.
4. Nut.
5. Bolt.
6. Tab Washer.
7. Nut.
8. Woodruff Key.
9. Pulley.
10. Locking Plate.
11. Starting Dog.
12. Screw.
13. Spring Washer.
14. Nut (Serrated)
15. Locking Washer.
16. Plain Washer.
17. Washer (Adjusting)
18. Damper Spring.
19. Presser Plate Assembly.
20. Friction Drum.
21. Friction Washer (2 Off)
22. Crankshaft Pinion Assembly.
23. Hub.
24. Driving Spring (outer.)
25. Driving Spring (inner.)

12. DERANGEMENT OF THE DAMPER - REASONS & SYMPTOMS:

Refer to paragraph 2.

13. TOOLS (SPECIAL) REQUIRED:

Refer to paragraph 3.

14. WHEELCASE (TIMING COVER) - TO REMOVE. (ENGINE IN FRAME)

(i) Remove radiator (See Section N, Sub-section EN-5) and fan belt.

(ii) Remove star locking plate (10 Figs. 28 & 29) from fan pulley.

(iii) With box spanner 1649/T3, unscrew starting dog (11) from hub (23) and pull off the fan pulley - if necessary, ease it back with two small levers.

(iv) Remove fan, engine front support arch and wheelcase, as described in paragraph 4, sub-paragraphs (iv) to (x).

(v) Remove the four nuts (7 Fig. 28) and withdraw hub.

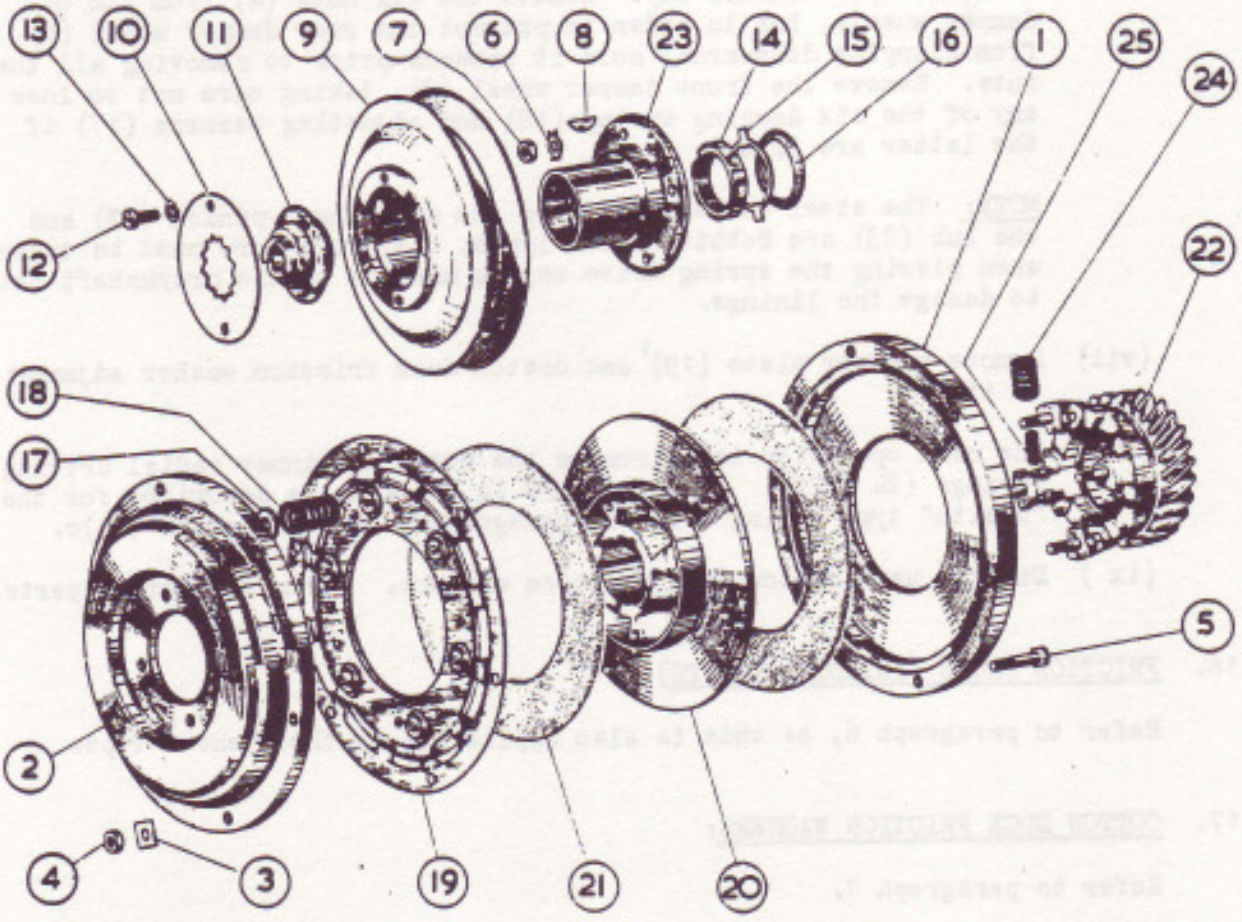


FIG. 29. EXPLODED VIEW - DRIVE ("BENCH" TYPE).

15. SPRING DRIVE - TO REMOVE FROM CRANKSHAFT:

(i) Before removing the Spring Drive, it will be advisable to check and note the valve timing as described in paragraph 5, sub-paragraph (i).

(ii) Bend back tabs of lockwasher (15 Fig.28), and with the serrated spanner 3759/T1007, remove nut 14, (R.H. thread) from crankshaft. Remove the plain washer (16).

(iii) Mark crankshaft pinion and camshaft gear wheel as described under "NOTE" in paragraph 5.

(iv) Attach the extractor 1617/T1003, to the four hub studs and withdraw spring drive from Crankshaft.

(v) Place the mandril 1617/F1005, in a vice and firmly secure. Make sure that the mandril is clean and free from damage marks.

(vi) Carefully place the spring drive on the mandril (see "NOTE" below) and over the Woodruff key. Remove the six nuts (4) from rim of damper wheels, but in order to prevent the rear damper wheel (1) from slipping downwards, hold it upwards prior to removing all the nuts. Remove the front damper wheel (2), taking care not to lose any of the six damping springs(18) and adjusting washers (17) if the latter are fitted.

NOTE: The steel bushes fitted to the crankshaft pinion (22) and the hub (23) are Babbitt metal lined, therefore care must be taken when placing the spring drive on the mandril or the crankshaft not to damage the linings.

(vii) Remove presser plate (19) and cotton duck friction washer adjacent to it.

(viii) The next operation is to remove the outer and inner radial driving springs (24 & 25). The procedure is the same as described for the "Wraith" type spring drive in paragraph 5, sub-paragraph (vi)c.

(ix) Discard used cotton duck friction washers. Clean dismantled parts.

16. FRICTION FACES (GRINDING LIMITS):

Refer to paragraph 6, as this is also applicable to the "Bench" type.

17. COTTON DUCK FRICTION WASHERS:

Refer to paragraph 7.

18. PREPARATION OF NEW FRICTION WASHERS PRIOR TO FINAL ASSEMBLY & SETTING THE DAMPER FOUNDAGE. (SLIPPING LOAD)

NOTE: The following parts are stamped with a co-relation mark '0', and on assembly, all these marks should coincide.
Crankshaft Pinion Assembly (22 Fig.29), Rear Damper Wheel (1), Friction Drum (20), Spring Plate (19), Front Damper Wheel (2) and Hub (23).
The recommended slipping load of the damper wheels is 14-lbs. + 1-lb. (6.35 Kgs) applied at a radial distance of 17½" (44.45 cms). The load is checked with the spring drive assembled, but less the driving springs (24 & 25 Fig. 28).

The procedure of preparing, fitting and ironing the friction washers and the checking of the damper slipping load is basically the same as paragraph 8. Note should be taken of the fact that it will be necessary to temporarily fit the hub (23 Fig.28) securing it with two nuts placed diametrically opposite to one another prior to ironing the washers and the subsequent checking of the slipping load.

19. TO REFIT THE SPRING DRIVE & CHECK THE VALVE TIMING:

(i) Fit the spring drive to the crankshaft as described in Service Bulletin No.BB-91 "Valve Timing" (Section E) and check the valve timing.

(ii) After finally tightening up and locking the large serrated nut(14), refit the hub (23), making sure that the co-relation marks on the front damper wheel and hub coincide. Tighten up the hub nuts first and then the rim nuts and lock.

20. TO ALIGN & REFIT THE WHEELCASE & THE REMAINING DISMANTLED PARTS:

NOTE: Prior to refitting the wheelcase, inspect that all nuts etc. are correctly locked.

(i) Refer to paragraph 10, Sub-paragraph i, as this is also applicable to the "Bench" type with the exception of the positioning of the Alignment Sleeve 3759/T1018, which should be reversed, i.e. the non-tapered end should be placed on the hub.

(ii) Refit the fan pulley and the starting dog and lock.

NOTE IMPORTANT: If the serrations of the star locking plate (10) do not coincide with the hexagon of the starting dog (11) when assembled, the starting dog should be hammered up. On no account, should the dog be slackened back in order to fit the locking plate.

(iii) Check the ignition timing and reset if found necessary. (Refer to Service Bulletin No.BB-77, Section 'E').

(iv) Refit the radiator and reset the inlet rocker clearance on No.1 cylinder to .006". With the engine fully warmed up, inspect that there are no oil leakages from the wheelcase and also no coolant leakages.