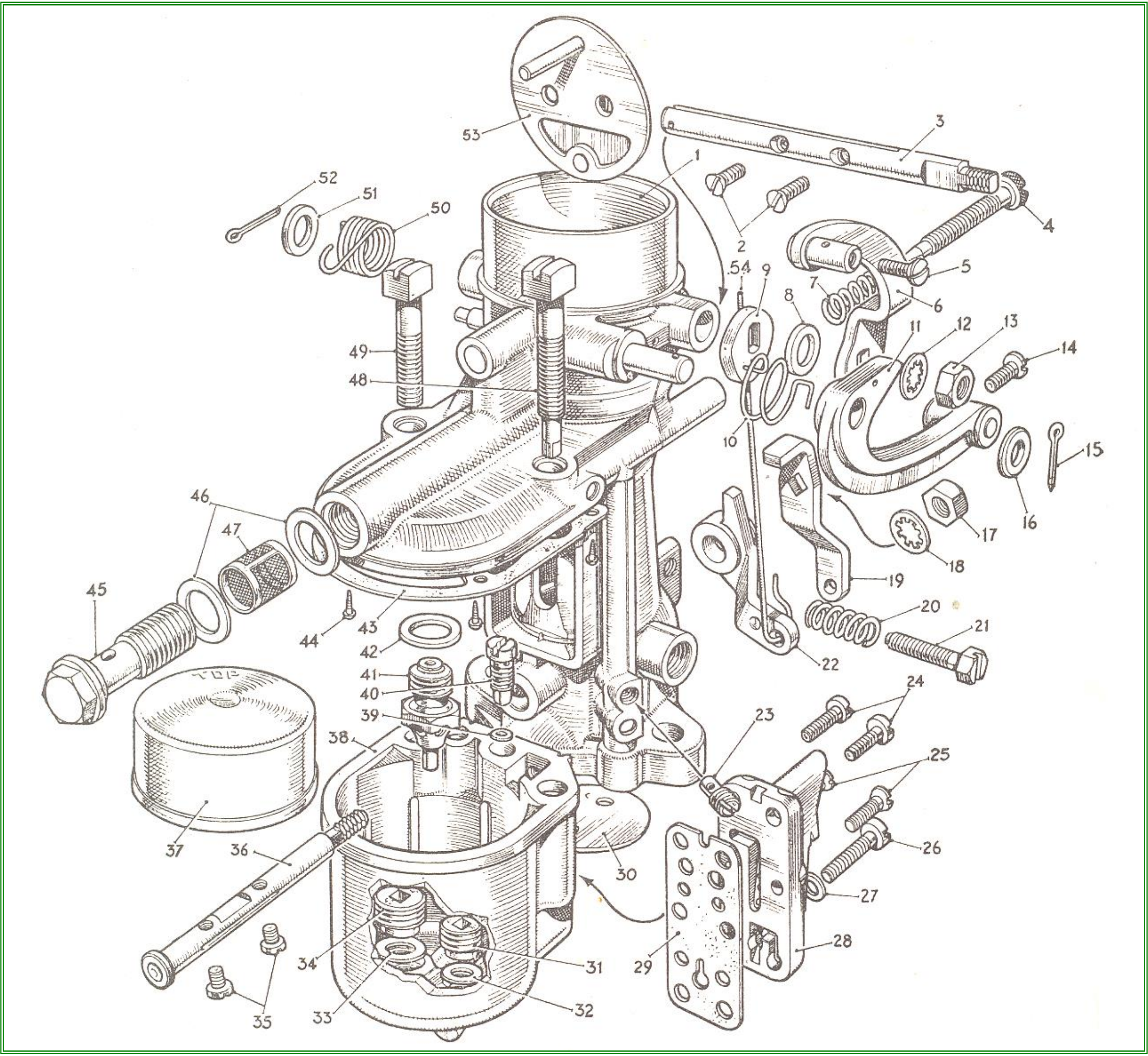
TECHNICAL NOTES SERIES

JOWETT JAVELIN – PA, PB, PC, PD & PE
JOWETT JUPITER – SA & SC



Above: Exploded view of a Zenith carburettor as used by Jowett.

PART XXI – ZENITH CARBURETTORS, PETROL KING FUEL PRESSURE CONTROL

The Jowett Car Club of Australia Incorporated is not responsible for any inaccuracies or changes that may occur within this document. Every effort has been made to ensure accuracy. It is not a Jowett Car Club publication and, therefore, the Club has no control over its contents. These Technical Notes have been compiled by using the information that was available, which was deemed accurate at the time.

Compiled by Mike Allfrey – January, 2007.

Revised – February, 2024.

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INTRODUCTORY COMMENT FOR TECHNICAL NOTES

These introductory notes should be read prior to reading Part XXI of the Technical Notes Series.

The Jowett Technical Notes Series have been an ongoing activity for several years. That means that some techniques and specifications may have been superseded in later notes on the same, or associated topics in the series. Also be aware that some topics and recommendations may be specific to certain Engine Serial Number ranges. It appears that, in Australia, the various State Main Agents did not carry out Service Bulletin information during Jowett active times. A set of known Service Bulletins is in Part III.

Some of the notes are restorations of what was written by members of the Jowett Car Club (UK), the Jowett Car Club (NZ) and by members of the JCCA.

Over the years of involvement with matters Jowett, and with the dawning of the personal computer age, a personal decision was made to help members of the Jowett Car Club of Australia Inc. with technical information. Included with the Technical Notes are ‘restored’ versions of the Javelin and Jupiter Maintenance Manuals and the associated Spare Parts Catalogues. Future generations will prefer to flick through images on their personal device screens, rather than leafing through pages in a tattered and oil stained book to access information.

The term ‘restored’ has been used because it soon became apparent that, as with our efforts in restoring Jowett vehicles, we desire excellent quality of workmanship in the reproduction of Jowett related documentation. Not for us the crude, and crooked, photocopies that have been issued over the years. These have, even though accurate at their time, become partly out of date.

Hence the decision to ‘restore’ the publications and documents that have come to hand.

It should be noted that the Javelin and Jupiter Spare Parts Catalogue is a combination of all the catalogues that were to hand (from 1948 to 1953).

The Maintenance Manuals were originally written on the assumption that they would be used by skilled motor mechanics who had attended service training courses conducted by Jowett Cars Limited and after works closure, were made available for owners who had reasonable mechanical knowledge of motor car maintenance and overhaul.

Included with the Technical Notes Series is a Lucas Overseas Correspondence Course, which can be of great assistance when trouble-shooting electrical problems related to your Jowett, or any other British vehicle of the same period.

Please be aware that this is an ongoing project . . . .

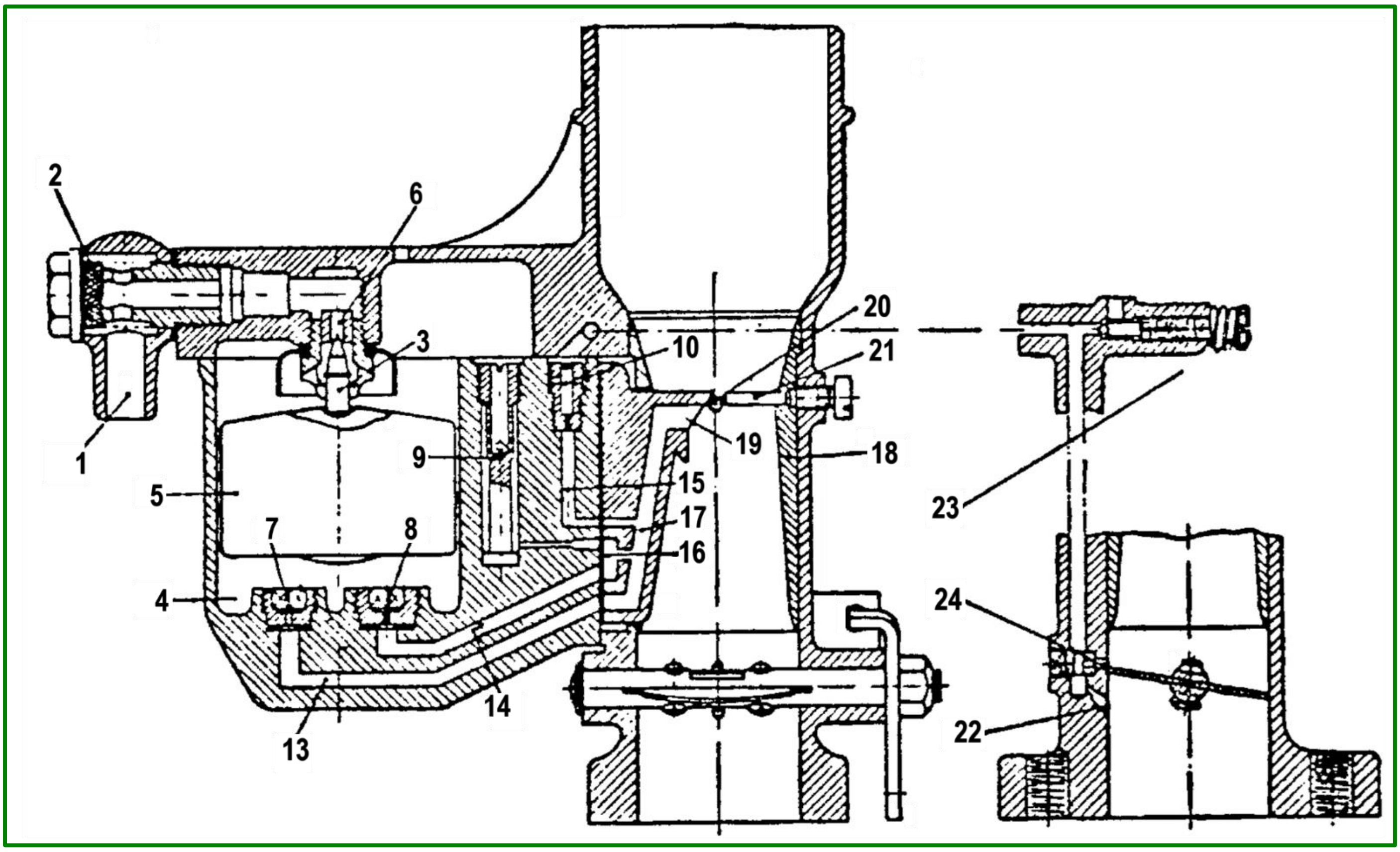
Mike Allfrey – February, 2024

The Zenith V-Type Down-Draft Carburettor

This carburettor is made in several models; the general principles are the same for all of these models, which differ only in detail design, dimensions and arrangement. *Figure 1*. shows the Zenith Type 30VM in diagrammatic cross-sectional view. This model was used on Jowett Javelin and Jupiter motorcars in the types 30VM-4 (early Javelin), 30VM-5 (later Javelin models) and 30VM (very late production Jupiter and Javelin models). The early model Jupiter used Zenith 30VIG-5 carburettors, which are essentially the same as the Zenith types described here. The major difference is that the Zenith 30VIG-5 carburettor features an accelerator pump to boost the amount of petrol entering the choke tube while the throttle plates are opened. Jowett Cars Limited were amongst very few manufacturers who used the Zenith V type of carburettor in pairs, and they were very likely the only vehicle manufacturer who placed the carburettors directly onto the cylinder heads.

Referring to *Figure 1*. at Item 3, a shroud is illustrated. This shroud was only used on 30VM type carburettors (very late production Jupiter and Javelin models).

The Zenith Type 30VM-4 carburettor the capacity tube, Item 9, *Figure 1*, does not feature the separate screwed in capacity tube – it was a direct drilling to size. Consequently the choke screw, Item 21, Figure 1, is not required in the 30VM-4 carburettor. The 30VM-4 carburettor was used on Javelins to D8 PA 1753, it was also used on the Austin A40 of the same period.



Above: Figure 1. Sectional views of the Zenith Type-30VM carburettor.

Legend for *Figure 1*. Major Components: 1, Petrol Union. 2, Filter Gauze. 3, Needle. 4, Float Chamber. 5, Float. 6, Needle Seating. 7, Main Jet. 8, Compensating Jet. 9, Capacity Tube. 10, Slow Running Jet. 16, Emulsion Block. 18, Choke Tube. 20, Distributor Bar. 21, Choke Screw & Third Bar. 23, Slow-running Air-adjustment Screw. 24, Progression Jet.

Normal Operation: Referring to *Figure 1*, with the throttles closed down to the low idle position the mixture will be supplied from the slow-running jet, Item 10. Depression will be concentrated upon the outlet, Item 22, and will, in turn, be directed on to the slow-running jet, Item 10. Here there is a controlled depression fall because of the leak at the slow-running air-regulating screw, Item 23. Air is also being drawn in through the progression jet, Item 24.

Petrol will be drawn from the well, Item 15, beneath the jet and measured on passing through, before continuing to the throttle edge. At the throttle edge there is a further outlet, Item 24, which breaks into the slow-running passage. Upon the throttle being opened from the low idle position depression will be concentrated here and a progressive getaway from slow running is assured.

The depression at this throttle position is drawing petrol and air through both outlet, Item 22, and the progression jet, Item 24. This is now a rich mixture which, when mixed with the air passing the throttle butterfly, gives the correct proportions of fuel and air.

Upon the throttle being opened still further the depression will be concentrated upon the nozzle, Item 19, of the emulsion block, which projects into the narrowest part of the choke tube. This will result in petrol being drawn from the passages, Items 9, 13, 14, 16 and 17, as there must be a ready reserve of petrol available for instant acceleration. The source of petrol supply is eventually through the main and compensating jets, Items 7 and 8. It will be observed that the petrol in the well of the capacity tube, Item 9, has been consumed, and as the top of the well is open to atmosphere, petrol issuing from the compensating jet along the passage, Item 14, is now under atmospheric pressure. As a result, petrol drawn from the jet will be broken up at Item 16, by air from the capacity tube. Petrol issuing from the main jet, Item 7, along the passage, Item 13, will meet the emulsified petrol from the compensating jet in the common channel, Item 17. This will tend to break up the petrol from the main jet also. The supply from both sources will then be drawn from the emulsion block nozzle into the choke tube. It will be realised that as soon as petrol in the float chamber falls below the predetermined level the float will fall, permitting the needle, Item 3, to drop, and petrol will pass into the chamber through the seating, Item 6.

Starting: Let it now be supposed that the engine is to be started from ‘cold’. The strangler (choke) control on the dashboard is extended, which causes the strangler flap to close off the air intake of the carburettor. With the ignition switched on the engine should now be turned over by means of the starter, or by hand crank handle, ensuring at the same time that the throttle position is not altered. The necessary part-opening of the throttle for 'cold' starting has been provided automatically by the interconnection mechanism between the strangler and the throttle.

Practically all of the depression caused by the rotation of the engine is now concentrated upon the progression and slow running outlet, Items 22 and 24, and, because of the partly opened throttle plate, upon the outlet, Item 19, of the emulsion block. Very little air enters, and consequently a very rich mixture, as required for 'cold' starting purposes, is made available for the engine. The engine will now 'fire', and as soon as it does so engine speed will increase and the heavier depression created will cause the valve in the strangler flap to open. The result will be to weaken the mixture and ensure that the engine will continue to run once it has 'fired'. If necessary the car can now be driven away immediately with the strangler still in action. As the engine warms to its work the strangler may be released, and the engine will be operating on the normal mixture.

Adjustments: Slow running is adjusted by means of the throttle stop screws and the air-regulating screws. The stop screws determine the speed of slow running (low idle), i.e. they adjust the throttle position for idling. To increase the slow running speed the stop screws must be turned in a clockwise direction by equal amounts. If turned with the opposite rotation a slower tick-over will be given. If the engine is inclined to ‘hunt’ when running slowly the mixture is too rich, and must be weakened by turning the air-regulating screws in an anti clockwise direction. This will cause a reduced depression upon the slow running jet and result in reduced output from this part.

If weakness at slow running speeds is suspected, then the air adjustment screws should be turned in a clockwise direction. This will reduce the air leak at the screw and give a greater depression upon the slow running jet. When the carburettors are worn it will be impossible to obtain good slow running, but it must be remembered that there are other factors quite apart from the carburettors that have an influence upon slow running, i.e. slow running when the car is out of gear. These factors include non airtight joints (one to look for is joint between cylinder head face and sparking-plug weather shield), worn valve guides, valves not seating, ignition over-advanced, incorrect setting of the sparking-plug points.

General: To remove the float bowl of the carburettor, take out the fixing bolts. It will then be found that, Items 7 and 8, the main and compensating jets located in the bottom of the bowl of the carburettor have squared recesses into which the squared end of one of the fixing bolts can be inserted in order to remove the two jets.

Do not pass anything through the drillings of the carburettors or the jets that is likely to damage these parts. The safest way of clearing any obstruction is to swill in petrol and clear with a carefully directed jet of compressed air. Inspect periodically the screws of the emulsion block, the needle seating and the jets etc., for tightness.

Note: It has been found that with high mileage carburettors which are in otherwise sound condition, i.e. negligible wear at the throttle spindle, good gaskets, not flooding etc., that the car has a tendency to snatchy running or hesitation when moving away from rest. This is a rich phase which appears to be caused by wear (or indiscriminate probing with wire of the very fine hole at Item 22.

A dramatic improvement was found to be achieved by replacing progression jet, Item 24, with a smaller one. If no smaller jet is available try filling the original hole with solder or ‘Easyfile’ and redrilling with a 1 mm drill. This gives a jet orifice of 0·040-in. as compared with genuine jets – Number 110 1·15 mm (0·045-in.), Number 120 1·19 mm (0·047-in.).

To Synchronise the Zenith Carburettors: Reference should be made to the Javelin Models PA and PB Maintenance Manual, Page 13 (Page 12 in PDF edition), and the Models PC, PD and PE Maintenance Manual, Page 12 (Page 10 in PDF Edition). These procedures also apply to the Jowett Jupiter model. It should be noted that on some carburettor types, the location of the slow running air-adjustment screws, Item 23, *Figure 1* (this article), could be as shown or be located close to the carburettor mounting flange.

It is impossible to achieve an even tick-over (low idle, specification 800 erpm), with the Javelin and Jupiter engines unless the following conditions are achieved:

a) Good compression on all four cylinders.
b) There are no air leaks at the entire induction system, including the breather valve pipe connections.
c) The engine valve stems and guides must have no excessive wear.
d) The engine valves are seating correctly.
e) The tappet clearances are adjusted correctly.
f) The ignition timing is adjusted correctly.
g) The distributor contact breaker points and sparking-plugs are in good condition and gapped correctly.
h) The carburettor throttle spindles are not excessively worn.
i) The tappet chest mounted air vent filter felts are in place and are clean.

If slow even running is not satisfactory the carburettors are not the only components to be suspected. Before any attempt is made to synchronise the carburettors, the following items that relate to the throttle linkage and strangler (choke) controls must be checked.

i) The carburettor spindles must be free moving and the butterflies must completely close the choke tubes.
ii) The throttle arm balls must be smooth and spherical without any deep indentations or flat spots.
iii) The springs and plungers in the ends of the throttle link rod must be free and properly lubricated with light oil.
iv) The short throttle rod must be a free sliding fit in the female portion of the throttle rod assembly. While the carburettor synchronising procedure is being carried out, the adjustment to one carburettor must not influence the other carburettor *via* the throttle link rod at all. The clamping device should securely lock the two portions of the throttle link rod without affecting the adjustment of either carburettor.
v) The inner and outer throttle cables must be in good condition.
vi) No part of the throttle link rod should touch the tappet chest cover plate flanges or the centre joint of the engine crankcase set. Such a condition would interfere with the throttle link rod's free movement.

Providing the above-mentioned provisions have been met in their entirety, the instructions in the Javelin Models PC, PD and PE, and Jupiter SA and SC, Maintenance Manual for synchronising the carburettors can now be carried out. For those with a Javelin Models Pa and PB Maintenance Manual, the instructions are as follows:

1. Remove the throttle link rod pull off spring.
2. Release the locknut or bolt which secures the throttle cable in the throttle link rod centre stud and withdraw the cable.
3. Release the throttle link rod nut, allowing the rod to be lengthened or shortened as required.
4. Turn out the throttle stop screws until the throttle arms are in the **fully** closed position.
5. Now, holding the throttle arms **securely** in the closed position, turn the throttle stop screws so that they just contact the arms, and then turn a further full turn. This ensures that both throttle plates (butterflies) are open exactly the same amount.
6. Again ensuring that both the throttle arms are resting on the stop screws (use a couple of strong elastic bands) carefully retighten the throttle link rod nut, thereby securing the throttle rod at its correct length.
7. Connect the throttle cable and the throttle link rod return spring. Make sure that, whilst no excessive slack exists in the cable, it does allow the throttle arms to rest against the throttle stop screws.
8. Make sure that there is no accumulated dirt in the air-regulating screw springs. Screw in fully the air-regulating screws, do not force into the jet drilling, and loosen out two full turns, which is the approximate slow running position.

9. Start the engine and allow to warm to normal operating temperature. If the engine speed is too slow turn the throttle stop screws **equally**, in a clockwise direction until the desired speed (specification is 800 erpm) is obtained. If the engine refuses to run for any length of time and gradually dies it indicates the mixture is too weak. To enrich turn the air-regulating screws inwards **equally**. If the engine tends to 'hunt' (alternatively speeding up and slowing) the mixture is too rich, and the air-regulator screws should be turned outwards **equally**.

   Note: Thoroughly warming the engine is very important, because the purpose of balancing the carburettors is to have a smooth idle when driving the car under normal working conditions. In colder climates, it is necessary to drive the car so that the gearbox oil is thoroughly warmed as well. In extreme cold temperatures the gearbox oil can be thick enough, even though neutral has been selected, to affect the engine's low idle speed.

   A fairly accurate but time consuming method of checking the fuel mixture at tick-over is to remove and thoroughly clean both front sparking-plugs and then replace. Run the engine when it is thoroughly warmed up at tick-over for 5 – 10 minutes. Remove and inspect the two sparking-plugs. They should be slightly blackened. If very black and sooty the mixture is too rich and if light grey to light brown the mixture is too weak. Adjust the air-regulator screws as required, clean the sparking-plugs, screw them back into the cylinder heads and run the engine at tick-over for a further 5 – 10 minutes and re-check the appearance of the plug ends. *Modern Note: This method may not, with some unleaded petrol brands, work as described. There would be varying degrees of blackness – depending on the petrol used.*

One of the causes of ‘flat spots’ on accelerating is the absence or cracking of the rubber ferrules between the air filter and the carburettor downpipes. These ferrules and the rubber bellows must be in good condition. If not, replace as the carburettors are designed to run with the air cleaner in operation.

Synchronising The Carburettors Using The Gunson Carbalancer: The procedure shown above, taken from the Jowett Javelin Maintenance Manual, can be seen to be fairly crude because it relies on mechanical contact of the idle adjusting screws against the stop lug on the throttle arms. From this point the synchronising procedure suffers from a degree of guesswork because the screwdriver slots in the throttle stop screws are never on the same plane, and can be difficult to see in a Javelin’s engine compartment. A carburettor synchronising device, such as the Gunson Carbalancer, can assist in obtaining equal adjustment of the two Zenith carburettors.

It must be understood that the Gunson device is not a meter for measuring the quantity of air being sucked into the engine. The synchroniser is simply a device for comparing one carburettor with another. The Gunson Carbalancer features a lightweight float that moves up and down inside a clear tube with graduations etched into it. The float position in the tube varies with the amount of suction through the plate held against the carburettor's air intake. This plate has slots in it that are adjustable so that the amount of suction to the float can be set so that the float hovers in about the centre position in the tube. This initial calibration is carried out on one carburettor only, and this setting is not critical because the carburettor throttle butterflies are being adjusted to achieve the same reading on each. The provision of this adjustment at the plate permits the Carbalancer to be used on a variety of engine sizes.

As mentioned before, prior to any carburettor synchronising adjustments, the engine has to be thoroughly warmed to normal operating temperature. Once the engine is warm, remove the air intake pipe and hose assemblies from the carburettors. Make sure that the strangler butterflies are in the full open position. The Carbalancer has to be used direct on the carburettor's air intake. This reduces to a minimum any suction leaks that could be present in the intake system. Step by step instructions follow:

1. Warm the engine and gearbox to normal operating temperature.
2. Remove the intake pipes and bellows.
3. Release the throttle cable lock screw or nut, remove the throttle cable from the link rod assembly and make sure that the L.H.S. throttle link rod slides freely within the connector.
4. Start the engine and allow to idle.

DANGER! During the synchronising procedure the engine will be running – keep hands, clothing, rags and hand tools well away from rotating fan blades.

5. Clip the Carbalancer's indicator scale to a convenient part of the car, so that it is vertical and can easily be seen. Set the inner bezel to the fully opened position and press the Carbalancer venturi adaptor firmly into the first carburettor, holding the outer rim.

   Caution: As with any plastic component, the Carbalancer indicator scale will soften if allowed to come into contact with hot engine components, particularly the exhaust manifolds. Care should be taken, therefore, to ensure that the unit is not mounted in contact with hot parts of the engine.
6. While holding the outer rim with one hand, adjust the inner bezel to give a reading on the scale at any convenient mark. Do not restrict the breathing of the engine by over-adjustment causing the engine speed to drop. The speed should be constant.

   Note: Over-restricting air flow into the carburettor will cause the air/fuel mixture to be drawn from the other carburettor via the balance pipe assembly.
7. Then, without altering the adjustment on the inner bezel, remove the Carbalancer from the first carburettor and press it into the venturi of the second carburettor. The indicator will have to be moved to a similar position on the other side of the engine compartment.
8. Now adjust the throttle stop screw on the second carburettor until the same reading is obtained on the indicator scale.
9. If the low idle speed, which should be 800 erpm, is too fast, repeat the steps 5 – 8. Starting with the first carburettor its throttle stop screw, re-adjusting the inner bezel to provide a suitable reading at the indicator scale. Use the indicator scale to adjust each throttle stop screw until the correct idle speed is achieved.
10. While holding the throttle arms against their stop screws, tighten the throttle link rod connector clamp. Then re-check that both carburettors are still synchronised.
11. Re-connect the throttle cable ensuring that the return spring can hold the throttle arms against their stop screws. Ideally, there should be a small amount of slack in the inner cable.
12. This completes the balancing operation, the carburettors should now be passing the same quantity of air throughout their operating range. They should reach the full throttle position simultaneously.
13. Adjustment of the air regulating screws should be carried out after balancing the carburettors.
14. Clean and replace the air intake pipes, ferrules, bellows hoses and air filter assembly.

Zenith Carburettors To Suit The Jowett Javelin

Note: Early engines had two Zenith 30VM-4, later engines 30VM-5 carburettors. The Jowett Competition Tuning Notes booklet suggested use of Zenith 30VM carburettors as used in the later Jupiter.

	30VM-4*	**30VM-5****	**30VM-5**	**30VM**
Zenith Contract Sheet Number	C1084	C1130	C1161	C1316
Carburettor, Jet Sizes:				
Main	90	90	90	120
Compensating	50	50	50	65
Progression	170#	170+	110	120
Capacity Tube	2	2	2	2
Screw Over Capacity Well	2.6	2.6	2.6	2.5
Slow Running	50	50	45	45
Choke	23	23	23	27
Needle Seat	2 mm	2 mm	1.5 mm	1.5 mm
Needle Seating Washer	1 mm	1 mm	1 mm	1 mm (2x)

* Before Engine Number D8 PA 1753   ** After Engine Number D8 PA 1753

With 2 mm outlet hole in barrel   + With 180 drilling

Zenith Carburettors To Suit The Jowett Jupiter

Note: Before Engine No. E2/SA/657 two – type 30VIG-5, from Engine No. E2/SA/657 two – type 30VM

	30VIG-5	30VM
Zenith Contract Sheet Number	C1245	C1316
Carburettors, Jet Sizes:		
Main	105	120
Compensating	60	65
Pump Jet	90	–
Progression	–	120
Leak	70	–
Vent	–	2.5
Slow Running	45	45
Choke	26	27
Needle Seat	1.5 mm	1.5 mm
Needle Seating Washer	1 mm	1 mm (Plus Deflector)

Zenith Carburettors – Function & Servicing – Jowett 1948-1953

The following information has been sourced from a 1972 publication by Interauto Book Company Limited. Our thanks to the publisher and their sources of information.

This is not at all a Jowett-related publication however, a great amount of the information applies to the various Zenith carburettors installed by Jowett Cars Limited.

This document has been prepared solely for sharing with fellow Jowett enthusiasts.

***Important:** Mostly, these notes refer to the 'choke' meaning the venturi in the carburettor barrel (main body), not the choke control inside the car. The action of that control is referred to here as a strangler flap.*

NOTE: The Compiler would like to acknowledge the invaluable assistance given by the Zenith Carburettor Company in providing the information contained in this *Technical Note Series*, with the following proviso:

The Compiler has taken every care to make this publication as complete and accurate as possible, but no liability can be accepted for any Omissions or Inaccuracies.

Foreword

Carburettors and carburettor tuning whether for high performance or the family motor car, has a special appeal to the motor engineer and do-it-yourself motorist who is looking for responsive engine operation and good fuel economy.

The increased complexity of modern engine design and fuel system makes it all the more important that the engineer is fully conversant with the particular carburettor(s), its/their overhaul and tuning.

This publication, in keeping with others in the series, sets out in a well illustrated and neatly styled format, the essential practical knowledge required to maintain the Zenith carburettor(s) in top form.

1. Introduction

The purpose of these notes is to set out the working, testing procedure, tuning and maintenance of the carburettor as applied to the spark ignition multi-cylinder internal combustion motor car engine. Before getting into such detail however, the duty of the carburettor will be considered in general terms, also the engine requirements and the influence of the induction system will be commented upon.

2. Carburettor Duty

Literally, to carburet means to chemically combine another element with carbon. In the present context the term carburettor defines an apparatus designed to physically mix air and (usually) a hydrocarbon fuel (petrol or tractor vaporising oil) in metered proportions to ensure ready ignition and complete combustion. This definition over-simplifies the true duty of the carburettor which is to proportion the petroleum vapour/combustion air (i.e. fuel/air) mixture according to the demand of engine load/speed requirements at any time.

2.1. Basic Form

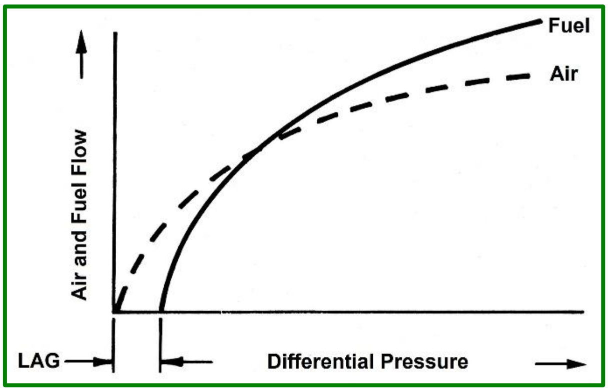
Basically, the carburettor consists of an arrangement of an air inlet passage with a restriction (choke), throttle valve, and a constant fluid level fuel chamber. A fuel metering jet or jets submerged by the fuel are connected by passages to the choke. Air flow through the duct creates a pressure differential across the choke causing fuel to flow through the jets. The pressure differential (and hence fuel flow) is regulated by the throttle valve position.

Mixture strength adjustments for cold starting, idling, acceleration and cruising are automatically controlled by various design and operational features depending upon the type and make of carburettor. Difficulties arise however from the dissimilar physical properties of fuel and air, and from the need to provide a negative head of fuel from the fuel chamber to prevent flooding.

2.2. Mixture Response

Whereas fuel is practically incompressible and has a high density, air is readily compressible and is of low density.

Right: Figure 2. Differences in Flow Response



Consequently, there is not an equal response between the fuel and air to differential pressure changes occurring throughout the operating range; the fuel will also lag relative to air movement and resist changes in flow direction. Differences in flow response are illustrated in *Figure 2*.

As the volumetric proportion of liquid fuel to air required is approximately 1 to 9,000 the need for a high degree of accuracy of carburettors as metering instruments will be appreciated.

2.3. Carburettor Basic Designs

Developments by various manufacturers to meet performance requirements have resulted in a variety of carburettor designs which, though differing considerably in matters of detail, invariably operate according to one of the two basic principles, or (occasionally) these in combination. The principles are:

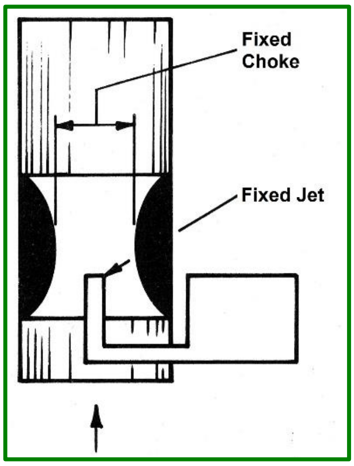
- Variable pressure differential
- Constant pressure differential

In practice these are referred to as a fixed choke (or fixed venturi) system, and a variable choke system, respectively.

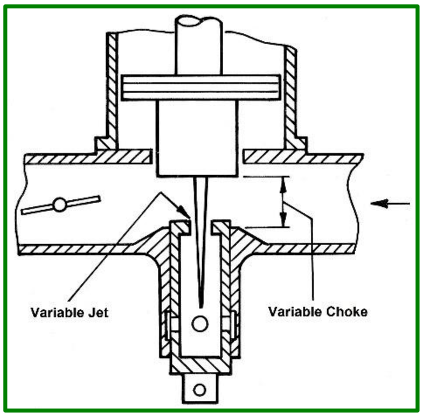
2.4. Fixed Choke System (*Figure 2*)

When air is passed through a fixed choke system the pressure differential acting on the fuel jets will vary with engine demand. This variation in pressure differential requires compensating devices to produce the correct fuel flow, and a compromise on the size of choke to satisfy performance at the extremes of the engine operating range.

Right: Figure 3. Elementary fixed choke system, up-draught carburettor shown here.



2.5. Variable Choke System (*Figure 4*)



The variable choke system uses a method by which the effective choke and fuel jet areas increase as engine demand increases, and reduce when the demand is reduced.

Right: Figure 4. Elementary variable choke system, with air entering from R.H.S.

The variation in choke area results in a constant air velocity and pressure differential across the jet. Compensating devices are not normally required.

3. Engine Requirements

The duty of the carburettor to proportion the fuel/air mixture according to engine demands has been stated.

These demands are that the engine should be supplied with an ignitable mixture of appropriate strength (fuel/air ratio) to suit the load/speed requirement at any time.

3.1. Mixture Ratio – Theoretical

The mixture strength is conventionally defined by its fuel to air ratio, usually expressed on a weight basis. The theoretically correct ratio (releasing maximum energy potential) can be calculated from principles of fuel combustion if the hydrogen and carbon content of the fuel are known.

TABLE 1. – PETROL FOR MOTOR VEHICLES [a]					
Grade Designation	**2-Star**	**3-Star**	**4-Star**	**5-Star**	**Heptane [d]**
Composition:					
% Carbon % Hydrogen	85·4 14·6	85·6 14·4	85·8 14·2	85·9 14·1	83·9 16·1
Density @ 15·5 °C:					
lbs. per gallon grammes per litre	7·56 755	7·50 750	7·35 735	7·30 730	6·91 691
Distillation:					
10% Evaporation at: 50% Evaporation at: 90% Evaporation at:	70 °C maximum 125 °C maximum 220 °C maximum				– 98 °C –
Latent Heat of Evaporation:					
Cal/gram @ 100 °C BTU/lb.	Approximately 70 Approximately 126				76 137
Combustion Air Required: [b]					
Weight/Unit Weight Fuel Volume Cubic ft./lb. Fuel	14·84 164·2	14·79 183·6	14·75 183·1	14·72 182·8	15·18 188·5
Research Octane Number: [c]					
Not less than:	90	94	97	100	–

Notes for Table 1:

a. Typical values only are listed; variations occur depending on crude source, refinery processing and seasonal requirements.

b. At 0 °C and 760 mm. Hg.

c. The R.O.N. gives an indication of the relative anti-knock qualities of petrols on the market.
d. Heptane is often used as a standard fuel used in engine tests.

3.1.1. Normal Fuels

For the grades of fuel normally used (Table 1) this ratio does not vary widely and is usually in the range 14·8:1 to 15·2:1. Generalising, approximately fifteen parts of air to one part of fuel by weight are required for theoretically optimum combustion.

3.1.2. Special Fuels

Exceptions to the above ratio occur for special fuels comprising alcohol derivatives, or blends thereof with petroleum spirit. In these cases the chemically correct fuel to air ratio by weight may range between 6·5:1 to 11·5:1 i.e. so different from the general case for their use to need special engine design considerations. In fact the use of these fuels is usually limited to racing engines and they are unlikely to be found satisfactory for normal purposes.

3.2. Mixture Ratio – Practical

Although combustion at the chemically optimum ratio (fuel/air approximately 15:1) releases the maximum energy potential of the fuel, in practice variations from this ratio are required either to the rich side or weak side to give a mixture strength appropriate to the engine needs:

Engine State	Mixture Required
Cold starting, idling, acceleration, maximum power.	Rich (more than 15:1)
Part throttle conditions, cruising, maximum economy.	Weak (less than 15:1)

3.2.1. Maximum Power: Maximum Economy

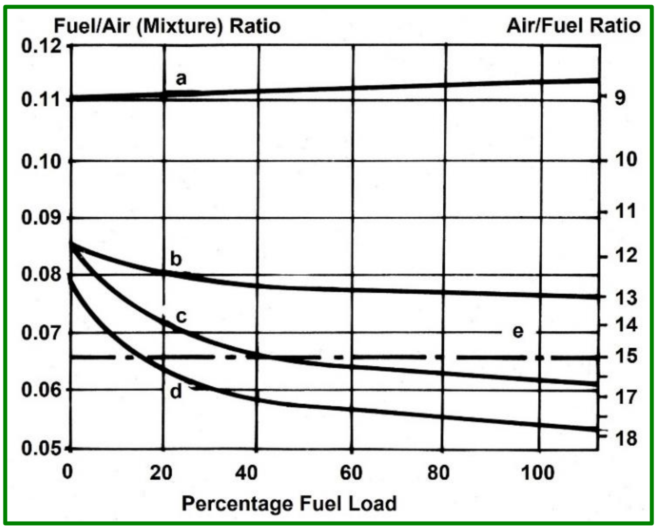
When the accelerator is fully depressed to give full throttle opening maximum power is obviously being called for and this is obtained at the expense of economy. At part throttle conditions (which cover approximately 80% of the engine running time) only that amount of fuel should be supplied to meet the condition and so achieve maximum economy.

3.2.2. Slow Speed Conditions – Cold Start: Idling

The requirement for enrichment at varying slow engine speed conditions arises from several factors. Under the cold starting regime (virtually closed throttle) low air velocities result in poor fuel atomisation further aggravating mixture condensation on the inlet manifold walls; insufficient light fractions of the fuel reach the cylinders to evaporate and sustain ignition unless enrichment is provided. At the somewhat higher (yet still relatively low) engine idling speed condition carburation is better, but poor scavenging at this speed leaves a higher percentage of exhaust gases in the cylinder resulting in poor combustion of the mixture unless considerable enrichment has been given.

3.3. Mixture Ratios – Operating Limits

The need for a readily ignitable mixture at varying fuel/air ratio throughout the engine load range has been described. The relationship at any time between these factors is typically illustrated in *Figure 5* (actual values vary from engine to engine). The upper and lower limits of flammability will be noted; whereas the upper limit is well above normal operating requirements and is therefore of little concern, the lower limit is close to the maximum economy line of operation and also indicates the ultimate limit of ignition of the cylinder receiving the weakest mixture.



Right: Figure 5. Mixture Ratios – Operating Limits.

Figure 5 also shows a line representing the chemically optimum mixture ratio, clearly indicating that for the greater part of the load range this ratio would be too rich for maximum economy and too weak for maximum power. The need for progressive enrichment (because of reduced exhaust products clearance) as the load is decreased will also be noted.

Line captions in *Figure 5*:

- **a** Rich limit of flammability.
- **b** Maximum power.
- **c** Maximum economy.
- **d** Lean limit of flammability.
- **e** Chemically optimum ratio.

4. Influence Of Induction System

The carburettor is an integral part of the air induction system; upstream of the unit air flow is conditioned by the air inlet pipe and filter/silencer arrangement whilst downstream, evaporation of the mixture and its distribution to individual cylinders is governed by the air inlet manifold geometry.

4.1. Conditioning Of Mixture

It should be noted that the Carburettor is responsible for atomisation, not vaporisation of the fuel; vaporisation occurs largely in the induction manifold and air inlet port in the cylinder head, the heaviest components of the fuel finally evaporating in the engine cylinder. In the process of evaporation the fuel absorbs considerable heat from the combustion air and the manifold; to minimise the condensation of fuel which would otherwise occur on the manifold walls, a ‘hot spot’ contact is usually arranged between the inlet and exhaust manifolds opposite the carburettor mounting flange, although water jacketing is sometimes used.

Hot spots are particularly critical for those engines that operate on tractor vaporising oil or lamp oil after being warmed through on cold start using petrol.

4.2. Design Restrictions

The continuing (as at 1972) trend to more compact engines and lower bonnet profiles make it increasingly difficult to satisfy all requirements for induction and carburettor system designs in an ideal manner. Consequently, existing arrangements invariably represent the best *compromise* found after exhaustive development work by the manufacturers to give the best all-round performance.

As the physical arrangement and air flow characteristics of the system are for all practical purposes fixed, best performance can only be realised by testing, tuning and maintenance of the carburettor as indicated in this manual.

5. Other Factors

Other factors controlling combustion performance are certain mechanical and electrical features of the engine. Briefly, these are:

Battery	Advance/retard mechanism
High tension coil	Spark plug gap
Distributor	Ignition timing
Contact breaker gap	Valve clearances (includes valve and seat condition).
Cylinder compressions	Elimination of air leaks if present – carburettor body, flange joint and inlet manifold.

These should all be checked against the engine manufacturer’s recommendations and corrected if required BEFORE carrying out work on the carburettor.

TABLE 2 – ZENITH CARBURETTORS SERIES SUMMARY FOR MOTOR CARS, COMMERCIAL VEHICLES, INDUSTRIAL AND TRACTOR TYPE APPLICATIONS												
Series	**Choke Size mm Diameter**											**Modification**
Reference	26	28	30	32	33	34	36	37	38	42	48	Reference
G		●										2
IZ			●									2
IV				●		●	●		●			D, N, R, T
V	●		●									
VM	●		●									E, 6, 8
VI			●				●			●	●	5, G-10, R, S, S-2, S-4
VN			●	●	●	●	●			●		2, D, N, P, R, T, TD
VE			●				●			●		A, HG
WIA						●	●			●		2, 3, T, TD
WIP						●	●			●		2, 3

TABLE 3 – ZENITH CARBURETTORS - GENERAL AND VARIABLE FEATURES		
General Features - Most Models	**Variable Features***	**Models As Noted**
Downdraught Strangler, Automatic	Horizontal and updraught Strangler, Semi Automatic	26V. 30V. Series 26V. 30V. 30VIG. - 5,7,9,11,36, & 42 VIS. Models
Strangler/Throttle Link Throttle Stop Screw Fast Idling Jet		
Volume Control Screw	Auxiliary Idling Jet Ball Check Idling Jet Air Regulation Screw	42VN. & Some 32VN .Models Some IV Series 26V. 30V. 36WIA3. 36WIP3. 30 VIG. 8,9,10. 36 & 42 VIS Models
Economy Device	Economy Device *not* fitted Economy Device on Fuel Chamber Cover	VNN. VNP. 26V. 3OV. WIA & WIP Series VIS Models
Accelerating Pump, Mechanically Operated	Accelerating Pump, Diaphragm Operated Accelerating Pump *not* fitted	30 IZ. Series 26V. 30V. Series
Float, Lever Acting Float Chamber Vent to Atmosphere Choke, Removable Emulsion Block	Float, direct acting Vent to Air Inlet Choke Integral Calibrated Air Bleed Emulsion Tube	26V. 30V, VIG & VIS Models Some VN Series 30IZ & IV Series Some VN Models WIA & WIP Series
Automatic Ignition Vacuum Connection	Vacuum Connection *not* fitted	26V. 30V.

* See Also Table 4 For Special Features (Limited Applications)

6. The Zenith Carburettor

Zenith carburettors are manufactured in a wide range of designs suitable for most motor vehicle and industrial engine applications; they are probably the best-known carburettor and their popularity may be gauged from the list of applications given in the Appendix (not included here).

The many models available, together with their variable and special features, preclude a single tabular presentation of all size and feature relationships, but reference to Tables 2 to 4 will enable most of these to be identified against carburettor types.

Table 2 summarises the carburettor series for motor cars, commercial vehicles, industrial and tractor type applications, with reference to the choke size; modification references are also given, and where possible later identified under individual series detail.

General features that apply in most models are given in Table 3; variations from these do however occur and these are noted. In addition, a limited number of models have special features as shown in Table 4.

6.1. Operating Principle

Modern automotive engine performance requirements of ease of starting, wide speed range, high maximum rpm, high power and economy call for precise fuel metering and mixing at all times. This is achieved in Zenith carburettors – which are of the fixed choke design – generally by the use of an air-bled fuel emulsifying multi-jet system assisted by economy and accelerating fuel-jet devices.

Although many physical forms of carburettor exist in the series – some with special control features – from the point of view of preparation and metering of the fuel, all employ the same general principles.

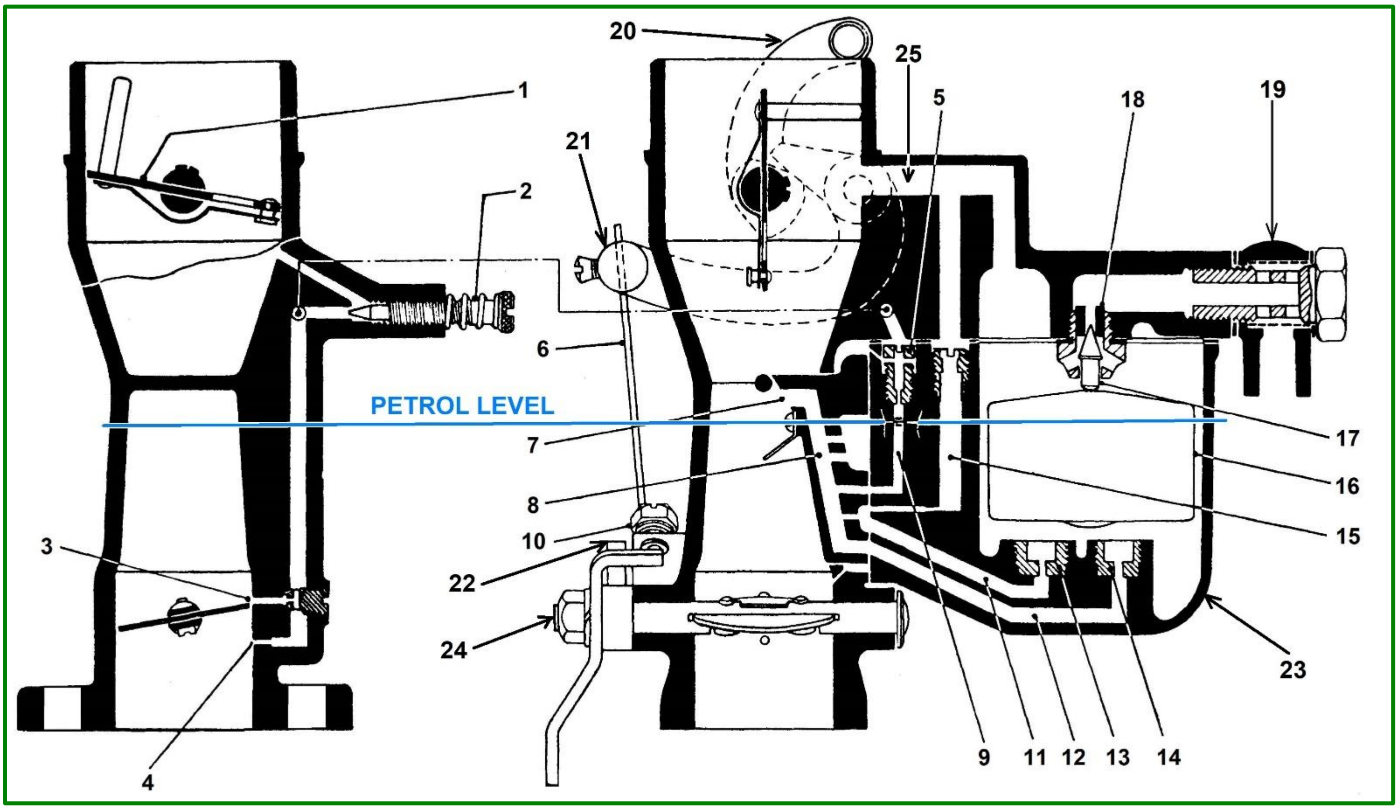
The basic operation is described by reference to the sectional drawings in *Fig. 5*, which represent in fact the popular Series IV carburettor; important variations in operation are noted. The physical and working features appropriate to each design series are dealt with separately and appear in independent sections.

TABLE 4 – ZENITH CARBURETTORS – SPECIAL FEATURES (LIMITED APPLICATIONS)	
Special Feature	**Application**
Thermostatic Strangler	VNT. Model
Throttle Damper	42 WIATD Model
Insulated Throttle Body	WIA and WIP Series
Velocity Governor	VNR. Model
Automatic Starting Device	Some 26V & 30V. Models
Twin Floats	Series IV.
Depression Operated Power Jet	WIA & WIP Series
Three Screw Body Fixing	Initial 34 WIA & 36 WIP Models
Four Screw Body Fitting	34 WIA2 and 36 WIP2 Models
Short Throttle Body	42WIA2

IMPORTANT: The blue line in *Figure 6* is the petrol level that the carburettor is designed to operate at. The petrol level has been determined after a great amount of research, in fact the carburettor is a master of a very fine balancing act. Incorrect petrol level can have serious effects on how petrol droplets are drawn into the carburettor's venturi. Level too high – over-rich running; level too low – engine could starve for petrol.

Changing the aluminium washer that is located between the float needle seat, Item 18, *Figure 6*, will affect the level of petrol in the carburettor. The washer thicknesses are stated in the carburettor build specifications – that single specification must ne maintained.

6.2. Fuel Level Control



Above: Figure 6. Section Through Zenith 30 VM-4(5) Jowett Javelin Carburettor (Sections are for illustrative purposes).

Figure 6. Legend:

1. Strangler Flap
2. Slow Running Air Screw
3. Progression Jet
4. Slow Running Outlet
5. Slow Running Jet
6. Connecting Wire
7. Emulsion Block
8. Emulsion Block Gallery
9. Slow Running Well
10. Throttle Stop Screws
11. Compensating Jet Passage
12. Main Jet Passage
13. Compensating Jet
14. Main Jet
15. Capacity Well
16. Float
17. Needle Valve
18. Needle Seating
19. Banjo Union & Gauze Filter
20. Strangler Flap Arm
21. Fast Idle Lever
22. Fast Idle Actuator
23. Float Chamber (Bowl)
24. Throttle Valve Assembly
25. Wells Vent

Referring to *Figure 6*, fuel from the fuel pump enters the float chamber **23** *via* **19** and the needle valve assembly **17** and **18**. The fuel supply is shut off when the float **16** reaches a pre-determined level; this level is automatically maintained during engine operation, all passages and jets sub-merged by the fuel becoming filled. The Blue Petrol Level line shown in *Figure 6* is critical.

The arrangement shown has the needle operated by the float which is termed 'direct-acting'. Other arrangements have the float fulcrum point offset from the valve centre line, hence the float is termed 'lever-acting'.

The Jowett installation features a banjo-bolted fuel inlet pipe connection **19**, which carries a fine gauze filter. Modern versions have a simple stub pipe for hose connection, used with a paper ele-ment petrol filter placed in the fuel line to the carburettors.

6.3. Cold Starting

6.3.1. Preferred Method

Operation from the dashboard of the Strangler (Choke) Control Lever **20** rotates the Strangler Disc and Spindle Assembly **1** (*Figure 6*) *via* an override spring, so closing the air intake; at the same time the fast idle arm **21** (operated by a cam), Interconnecting Rod **6** and Loose Lever **22** open the throttle beyond the normal idling position to give fast-idling. When the engine has fired and picked up speed the resulting depression in the carburettor causes the strangler flap to automatically open against the override spring and allow increased air supply to meet the engine requirements and weaken the mixture to prevent over-rich operation.

Some models are fitted with a semi-automatic strangler control; this consists of a spring loaded flap incorporated in the strangler disc **1** and operating from carburettor depression in a similar way.

The accelerator should not be operated during this starting sequence.

6.3.2. Alternative Method

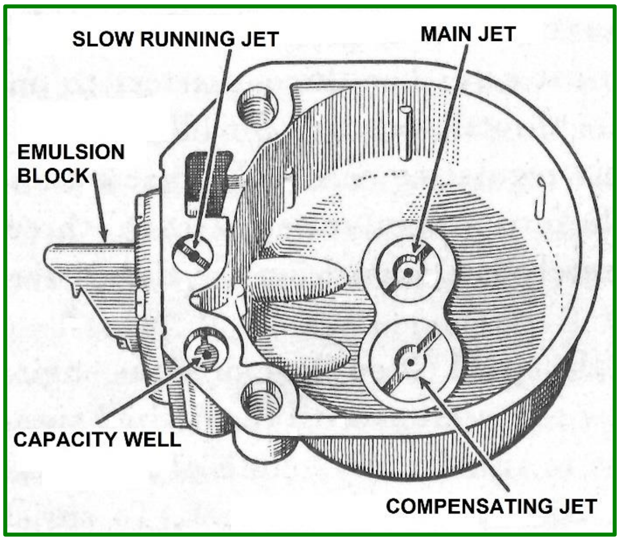
Where carburettors are fitted with a mechanically operated accelerator pump, this can be used for an alternative method of starting, the accelerator pedal is fully depressed once or twice sharply, before or during the starter turn-over of the engine. After ignition has occurred sufficient throttle opening is maintained to give fast idling rpm, clear the injected fuel, and promote rapid engine warm-up. The accelerator is released when normal idling R.P.M. can be sustained by the engine. If a quick drive-away is desired (i.e. without engine warm-up) after using this method of starting, a small amount of choke will usually be necessary.

Important: Use one method or the other; do not combine the use of accelerator pump with the full choke method of starting.

Dispense with the choke control as soon as possible.

6.4. Idling Jet Circuit

An air-control system, of the volume control system illustrated in *Figure 6* is used for idling mixture control. With the Throttle **24** in the normal idling position, the engine side depression will be effective on Idling Drilling **4**, Fixed Emulsifying Air Bleed **8**, and Slow Running Jet **5** which is fed from the metered side of Main Jet **14**; some idling jets incorporate a non-return ball valve to prevent 'back bleeding' of air into the main jet circuit.



Right: Figure 7. Jet positions, Jowett Javelin & Bradford.

Where the air control system is used an Air Regulating Screw **2** controls the depression on the slow running jet; adjustment of the screw will vary the amount of fuel issuing from the jet. Note that similar adjustment of the air-control or volume-control screws has opposite effects – closing the air-control screw increases the depression on the idling jet and results in more fuel, whereas closing the volume control screw reduces the idling fuel supply. Opening the control screws will have the reverse effects.

Idling speed setting is obtained by adjustment of the Throttle Stop Screw **10** in conjunction with the Air or Volume Control Screw, whichever may apply.

6.5. Progression To Main Circuit

When the throttle is opened from the idling position a short delay occurs before the increased choke depression becomes effective in drawing fuel from the main jet circuit. This is compensated for by providing additional mixture at the point of throttle opening through Drillings **3** communicating with the idling mixture channel, to ensure smooth progressive acceleration. These drillings are known as Progression Holes; they are not adjustable and their size and position relative to the throttle edge are extremely critical. They should not be altered in any way.

6.6. Main Carburettor Circuit

The main Fuel Outlet at **7** (*Figure 6*) is arranged to discharge at the throat of the choke tube {or auxiliary venturi, where fitted). With progressive throttle opening the increasing depression will draw fuel from the outlet via the Main Jet **14** and Compensating Jet **13**.

Permanent air bleeding through Orifice at the Capacity Well **15** occurs as the fuel level in the Capacity Wells **15** and **9** falls. When fitted, the diaphragm operated Economy Valve allows additional bleed air through Ventilation Orifice in the carburettor body **25** under part throttle cruising conditions. In the figure shown the preliminary mixing of air and fuel described takes place in what is termed the Emulsion Block **7**, other models operate with an Emulsion Tube.

The mixture emerges from the fuel outlet **7** in an emulsified state and is readily atomised by the depression and high velocity air stream existing in the choke tube.

6.6.1. Power Jet

Not applicable to Zenith carburettors employed by Jowett Cars Limited.

In some models the main jet is tuned for lean mixture running at part throttle conditions, being augmented at full load by fuel from a normally open power valve jet. The power valve is diaphragm operated; at part throttle conditions carburettor depression is communicated to the diaphragm, causing the power valve to close so that the main jet only is in operation.

Essentially, the device operates as an economy system.

6.7. Economy Valve

Not applicable to Zenith carburettors employed by Jowett Cars Limited.

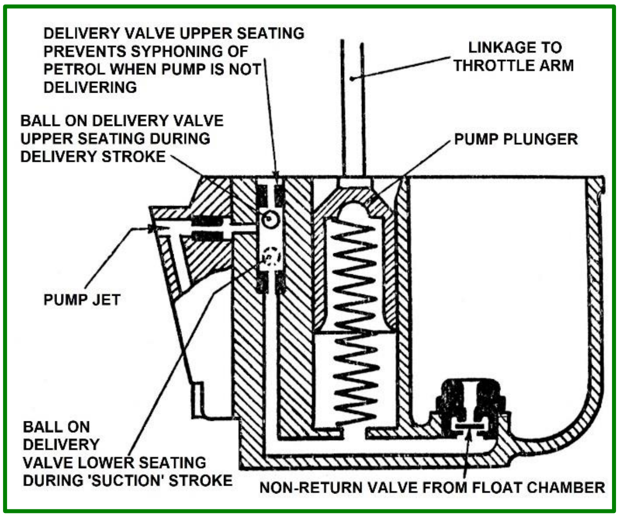
For economic operation it is necessary to weaken the mixture during cruising conditions; this is automatically carried out by a spring-loaded diaphragm operated Economy Valve according to engine demand. Two types of valve are in use. Whilst both similarly respond to depression conditions in the carburettor throttle region, one design operates to weaken the mixture by reducing the fuel supply, whereas the other operates to increase the air bleed. The air bleed method is described.

When cruising the depression in the carburettor is high; this depression is communicated to the spring-loaded side of the diaphragm so, reducing the effective load and allowing the valve to lift under atmospheric pressure from the air intake through a Passage. The mixture will now be weakened to the extent of the flow allowed by the Air Bleed Orifice. The economy valve remains closed at all other conditions.

6.8. Accelerating Pump

This applies to some Jowett Jupiters.

When carburettors are adjusted to give economic operation at normal speeds, acceleration performance may be sluggish. This is overcome by the use of a throttle linked pump which injects a slug of fuel into the carburettor during the acceleration procedure. The fuel may be displaced by a diaphragm or plunger type of pump; the latter is described here.



Right: Figure 8. Typical accelerator pump installation, Jowett Jupiter.

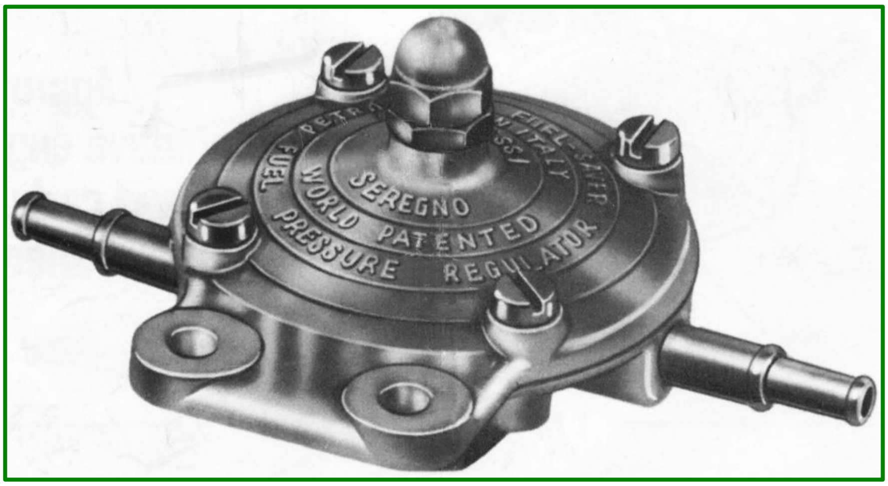
The Accelerating Pump is connected to the throttle spindle by Linkage. Normally, the pump cylinder is full, under the head of petrol from the float chamber through Suction Valve. On rapid opening of the throttle for acceleration, the Piston Rod is depressed through the Piston (some compression of the inner coil spring taking place) displacing petrol through the Delivery Valve and Pump Jet, the ball meanwhile sealing off the upper (air bleed) seating. Follow-up expansion of the inner coil spring forces the Piston down so that petrol injection continues after throttle movement has stopped. The pump rod and piston are returned to the top of the stroke by the outer coil spring, the cylinder re-charging with fuel through the suction valve. The delivery valve ball drops back on to the lower seating allowing air to bleed through the upper seating and prevent fuel being drawn from the accelerator pump circuit by carburettor depression.

6.9. Ignition Advance Connection

The connection for communicating the inlet manifold depression to the distributor automatic advance/retard vacuum mechanism is not shown in *Figure 6*. This is very carefully sized and positioned and should not be altered.

Petrol King Fuel-Saver – Fuel Device For True Fuel Savings

The carburettors can be very easily performing in an over-rich petrol-air mixture due to various reasons. A new kit fitted to a petrol pump can increase delivery pressure above that specified by Jowett Cars Ltd.



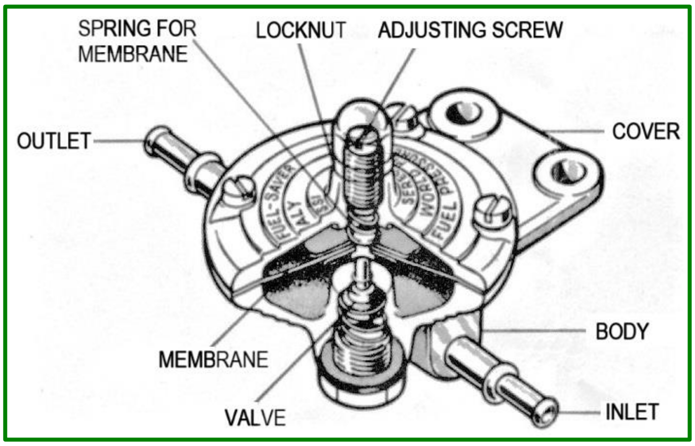
Right: Figure 9. The Petrol King Fuel Saver apparatus.

That specification is for 1·5 to 2·0 psi, and has been found to most suitable at the lower value. Before installing a pressure control device it is advisable to check the float, needle and seat in the carburettor for flooding confirmation.

The following information has been sourced from the instruction sheet that was supplied with a recently purchased fuel regulating unit – the *Petrol King Fuel Saver*, hereafter the apparatus. The text is somewhat of an advertising nature, but it can be tolerated.

The fuel pressure regulator apparatus has been specially designed to provide a constant and steady flow of fuel under all driving circumstances. The special advantage is that the ‘Petrol King-Fuel-Saver’ compensates by means of its large and competently reacting membrane the differences of climate and altitude. It can develop a pressure up to 3-times as much as necessary to provide the carburettor with the necessary quantity of fuel. If the carburettor will be overcharged, there will be waste of fuel, stalling or starvation of the engine.

The apparatus has to avoid these difficulties as it is reducing and normalising the fuel pressure. This pressure regulation grants at the same time perfect idling and immediate starting. Furthermore the elasticity of the car will be improved without lowering the performance of the engine at high revolutions. The setting of the pressure controller has been exactly calculated according to engine power, plus an additional safety margin.



Right: Figure 10. Component identification.

The apparatus regulates the pulsation of the fuel pump, prevents unwanted air bubbles, reduces the formation of carbon residues, diminishes the danger of fire in the car, improves the performance of the engine, enables fuel savings from 5 – 10 percent, gives regular and consistent idling, makes easier driving in long queues, prevents overflowing of carburettor.

The apparatus has been adjusted for pressure corresponding to the top performance of the relative engine. The pressure from the petrol pump may need adjustment, for which a suitable pressure gauge will need to be connected at the outlet fitting. The fuel-flow has been calculated by taking into consideration the diameter of the float needle valve and the capacity of the float bowl of the carburettor. If it should prove necessary to alter the fuel pressure to the carburettor, act as follows:

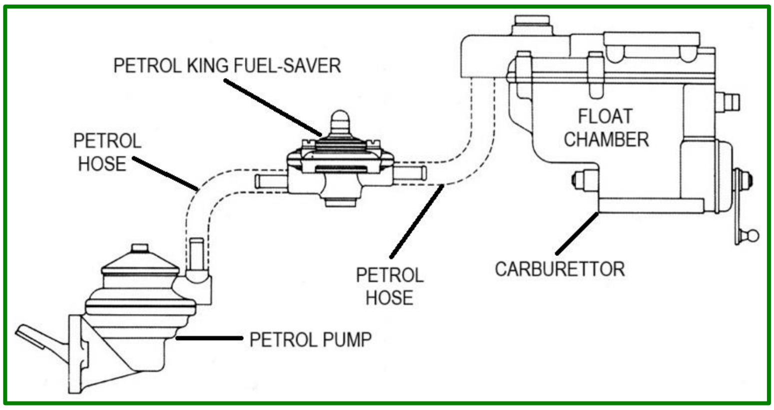
If the fuel pressure is too low take off the blind cap nut, loosen the thin jam nut and turn the adjusting screw half a turn in a clockwise direction. If however the pressure should be too high act as before but turn the adjusting screw counter-clockwise always only for half a turn. This adjustment has to be done gradually until the ideal pressure will be achieved. If there should be stalling or starvation under acceleration, or at high speeds, the pressure always has to be increased by turning the adjusting screw gradually by half a turn in a clockwise direction.

When the setting of the screw is made, be sure to tighten the jam nut carefully, so that the position of the adjustment screw is not changed, then install cap nut and tighten.

The apparatus is manufactured for perfect function. It is made under control of the best of materials and workmanship and will perform, giving benefits of economy and performance for many years of trouble-free-service.

Installing The Petrol King Pressure Regulator

Note: Before mounting the apparatus, be sure that the engine is in perfect condition. Check the ignition system, contacts and the spark plugs.



Right: Figure 11. Installation diagram.

These actions are necessary for the engine to reach its top performance, The apparatus has to be installed on the car's body at distance from all sources of warmth and engine vibrations. For installation use the special support bracket delivered together with the apparatus, make sure that the apparatus is mounted in horizontal position. After having installed the apparatus, make sure that there will be no leakage between the fuel pump and the carburettor, fastening the pipe to the inlet and outlet hose fittings by the hose clips.

Check the idling and if necessary, adjust it.

Acknowledgements

The writer expresses due thanks to the Zenith Carburettor Co. for information takeb from Data Sheets (with changes to reflect the Jowett application.

Thanks are also due to Interauto Books for the general Zenith carburettor information.

Thanks are also due to the manufacturer of the Petrol King Fuel-Saver apparatus for the operating and installation instructions.

The Jowett Car Club of Australia has a Ryco vacuum/pressure gauge that can be borrowed by those members of the Club who are currently financial with the club. The Ryco is a delicate instrument, it requires care with handling – in use and in transport.

Technical Note Revised – February, 2024.

WARNING!
ASBESTOS COULD BE PRESENT IN GASKETS AND FIBRE WASHERS