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WEBER & DELLORTO

DCOE & DHLA CARBURETORS

Des Hammill

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INTRODUCTION

The objective of this book is to provide understandable information that will allow anyone with reasonable mechanical knowledge and aptitude to successfully strip, rebuild and tune Weber and Dellorto sidedraft carburetors.

There is no need to put up with a modified engine fitted with these fantastic carburetors that coughs and splutters or consumes huge amounts of fuel. I hope that my work will help you to quickly isolate particular problems and alter the carburetor/s to suit your engine's actual requirements.

This book contains no details of choke (as in cold start device) settings because in most cases choke is never used with these carburetors. Cold starting is usually preceded by a partial pump of the throttle pedal to activate the accelerator pumps and, once the engine has actually started, working the accelerator pedal to keep the engine going until it is able to idle. Chokes just don't seem to get used because it's so easy to use the excellent accelerator pump system fitted to these carburetors instead.

Webers and Dellortos are truly excellent carburetors to work with. Even in this day and age of high technology there still is a place for 'simple' carburetors that give high performance while basically being bolt-on items. Webers and Dellortos meet these requirements and their future is assured. One thing is for sure, on a cost-for-cost basis, Webers and Dellortos (especially if good second-hand carburetors are purchased) can give unrivalled value for money.

There is an old adage "what looks right is right" and this certainly applies to Webers and Dellortos. They always "look the part" on an engine because they are the part and, no matter what the engine size or type, they can be made to go as well as they look.

I hope that you find this book informative and a practical help in the quest to tune these carburetors to get the best possible performance from your car, allied to reasonable economy.

Weber DCOE versus Dellorto DHLA

Argument has raged for years about whether Weber or Dellorto carbs are better, however, no realistic comparison is possible unless all of the available adjustments have really been optimized on each carburetor type and on the same engine.

Fortunately both carburetors are so good it doesn't matter too much which manufacturer you choose and personal preference is as good a reason as any to buy one over the other. The main thing everyone needs to know is that you can buy either with absolute confidence in their performance. Both carburetors are able to be tuned equally well. There are no bad sidedraft Webers or Dellortos.

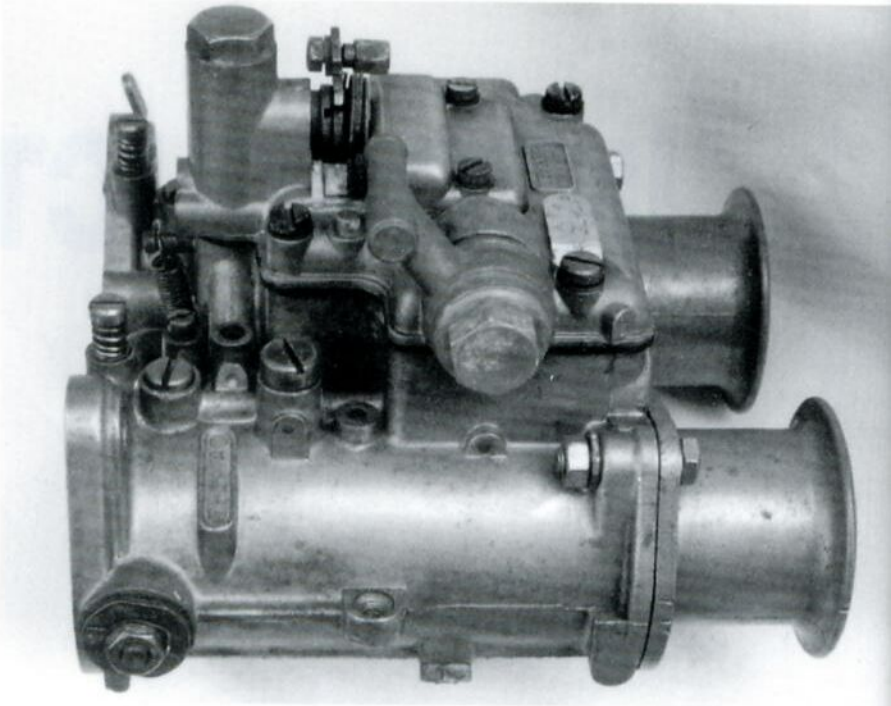
Nothing of any consequence interchanges between the two makes.

The only thing common to both is that they will bolt on to the same intake manifold.

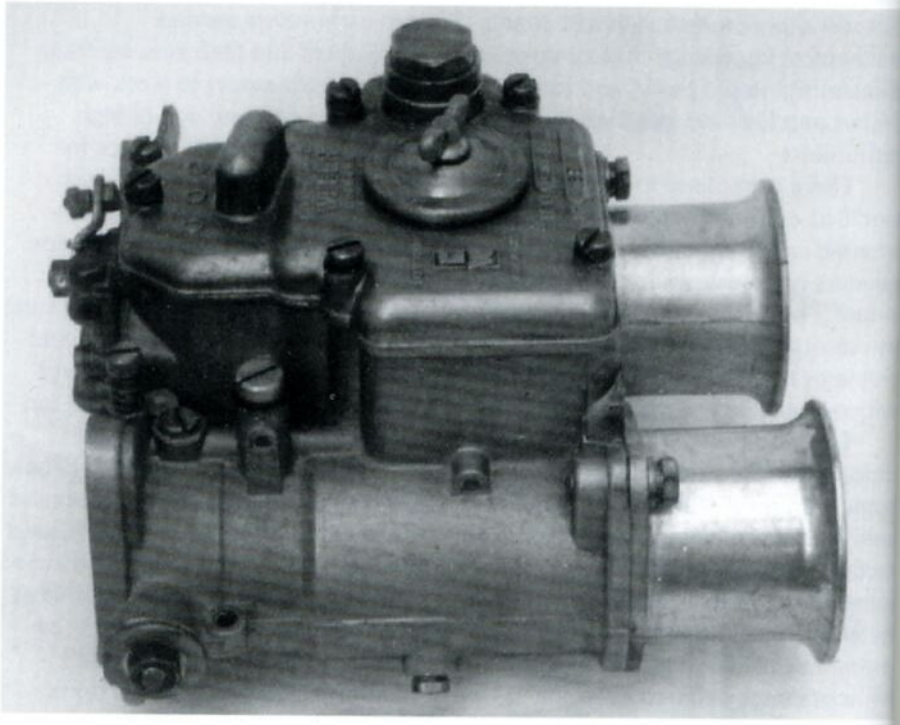
The design differences between the two carburetor makes show that their respective manufacturers have achieved the same objectives, but by different means. An example of this is the accelerator pump action. In both cases the engine receives an identical amount of fuel but one carburetor has a diaphragm and the other a plunger. The Dellorto exhibits what can be termed modern manufacturing techniques which modernize the original Weber carburetor concept to a small degree. The Weber was designed and built in the days prior to reliable fuel resistant plastics and originally had brass floats, for instance. The Weber is an all metal device designed around the materials of the time and it has remained basically unchanged since then.

The Weber was certainly the original and there is no question that the overall concept is brilliant. There is also no doubt that these facts have contributed to Weber having the best-known 'name' and performance image and the DCOE is likely to remain in this prime spot as Dellorto ceased production of the DHLA range in 1991. Second-hand prices are generally higher for Webers even though the new price of each was similar. There are literally thousands of both types of sidedraft carburetor scattered around the world and millions of tuning parts sitting in tool boxes and garage cupboards. These carburetors are going to be around for a very long time and continue to be fitted to a wide variety of engines.

The Dellorto company designed their carburetor with the view to improving the Weber formula and they have achieved this to a certain extent. The integral, plastic-caged fuel



40 DHLA Dellorto.



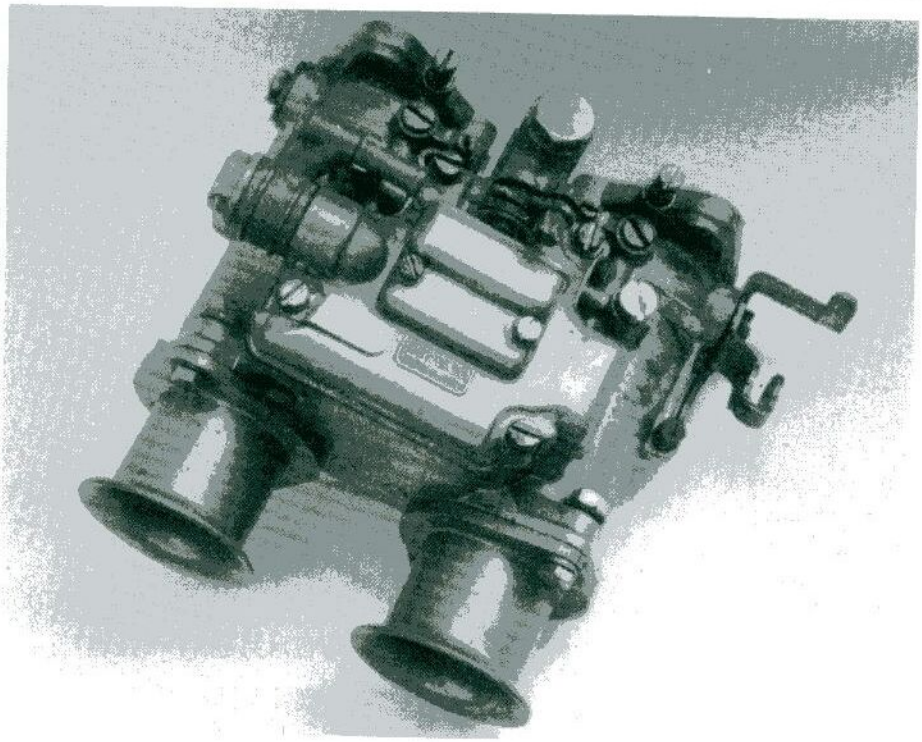
45 DCOE Weber.

filter is well done and better than the soldered brass mesh tube of the original Weber or the plastic-caged filter alternative available these days from Weber (which crushes the first time it is installed). The choke operation is certainly better on the Dellorto (same overall principle) from the standpoint of having a good shut off by way of the neoprene washer and the piston action that uncovers the holes for the fuel /air mixture to pass through (no fuel mixture leakage problems).

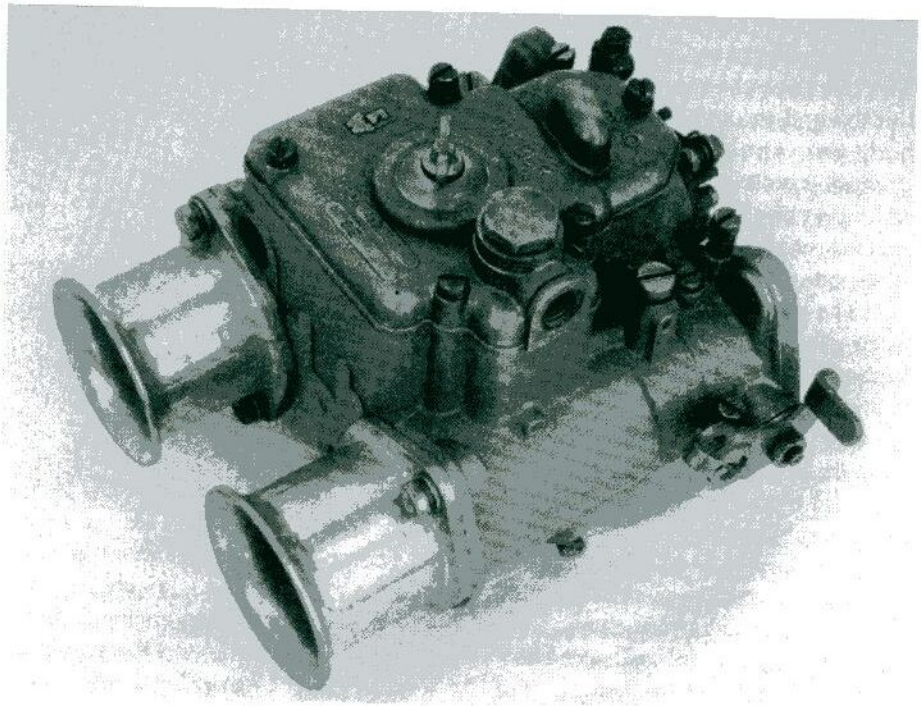
The Weber choke/fuel enrichment device can be troublesome when it gets a bit worn and can pass a huge amount of extra air/fuel mixture into the engine; in fact to such an extent that the engine may not even run. The problem being that, although the mechanism is in the off position, it only takes a bit of lever wear and a jammed starter valve (in the up position) and you have a very rich mixture. However, if the choke has never been used (most have not) this situation will not arise. The choke outlets can be blocked off permanently to preclude this happening. Note that if either of the starter valves found in a carburetor do not seal off they will allow fuel mixture to pass by.

The venturi choke and auxiliary venturi are held in position with a single taper point screw and lock nut on all Dellorto carburetors and this is an excellent retention method. The Weber uses a single taper point screw for each on 45s and 48s with a securing plate linking the two screws and bent tabs for a locking arrangement. The locking tabs must always be fitted to prevent the screws from winding out (they can be lockwired).

The DCOE 40s on the other hand have blade spring location on both the auxiliary venturi and the choke. Both are held in position by the trumpet



40 DHLA Dellorto.



45 DCOE Weber.

Contents of a basic repair kit for one carburetor.

and its two retaining clamps. On well used carburetors the trumpets can often be found to be rotating, even when the trumpet clamps are fully tightened. There are several reasons why this happens (none of them good) but the end result is that the carburetor body gets worn and even a new trumpet, choke and auxiliary venturi will not restore the situation although specially made trumpet clamps (stepped) will cure the problem.

The accelerator pump lever is not as compact on the Dellorto as the Weber's (which it is totally enclosed within the carburetor body). The Dellorto components could be damaged through lack of care but it is not usual for this to happen: in fact, both carburetors are pretty hardy units. The more modern style of the Dellorto's construction and methods it uses to duplicate the Weber principal of operation have been very successful overall. The differences between the carburetors mentioned here are all pretty minor in the overall scheme of things but worth noting to illustrate that both carburetors have strengths and weaknesses when compared to each other. Dellortos are a little bit easier to service. The Weber is more compact height-wise.

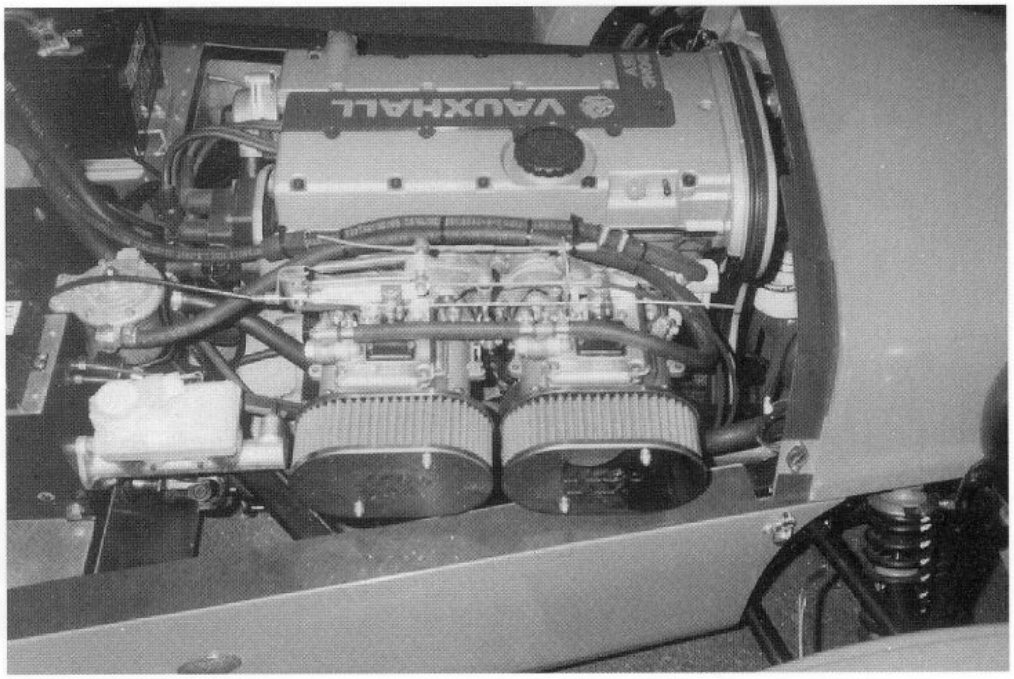
The method of tuning either carburetor is essentially the same. Unfortunately, in both cases, the axiom "bigger is better" seems to prevail but this is wrong and most engines that do not run well and prove to have carburetor problems have chokes that are too large, main jets that are too large, accelerator pump discharge jets that are too large or too much fuel pressure. It is difficult to understand why anybody would want to go to the time and trouble of fitting Webers or Dellortos and for the sake of a comparatively small amount of money put up with an uneconomical and poorly performing engine. This happens all the time and the carburetors are often blamed for it when, in fact, this is not possible as both carburetors are infinitely tunable to achieve perfection in all instances. *It is the tuning of the carburetors that is the real problem.*

The competition engine built professionally and on a big budget is run, tuned and tested by the particular concern doing the job. However, the majority of Weber and Dellorto users do not have the sophisticated equipment that a major tuning company will have, yet their car's engine still needs to be tuned correctly. In fact this is not such a big problem because the principles of Weber and Dellorto carburetors are logical and understandable so that, when sound tuning techniques are employed, both carbs can be tuned correctly with a minimum of equipment.

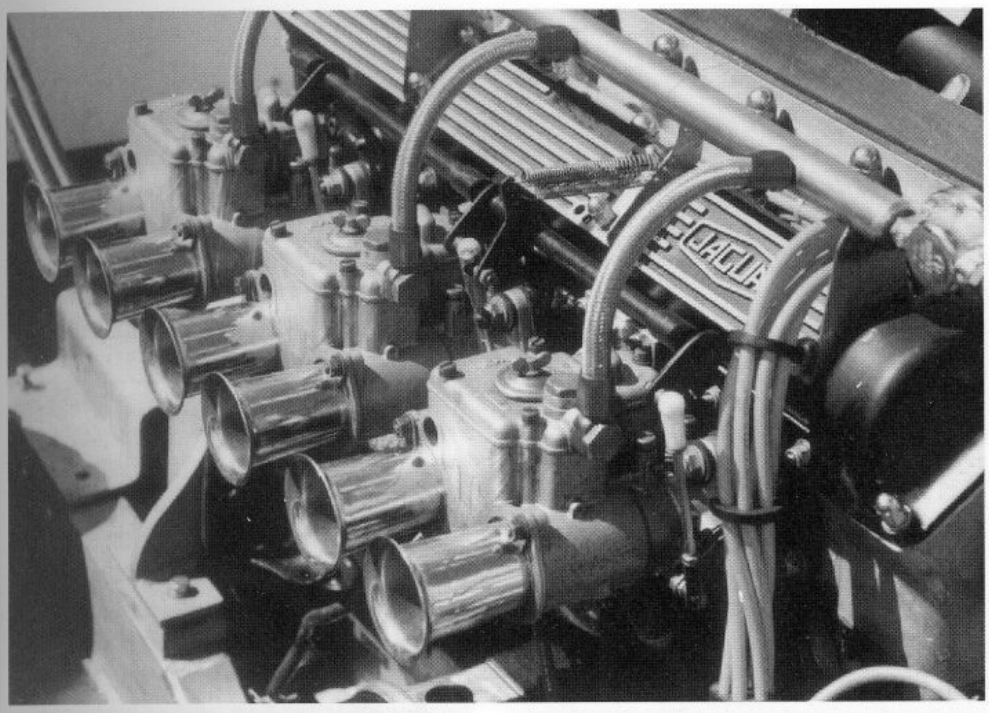
The average enthusiast will never have the same resources at their disposal as the professional but, with care and attention to detail, can get an engine tuned equally well. Of course, money can be saved if the right choice of components is made first time! All of the jet sizes given in this book are approximations because individual engines vary so much. If your engine is being rebuilt and you intend to use high revs, make sure it is built with the biggest permissible tolerance sizes on the piston to bore clearance and the main and big end bearing clearances (factory specifications, but largest sizes permissible). It is not possible to tune an engine that has some mechanical problem. Well-built engines respond perfectly to correctly tuned sidedrafts.

Note that Dellorto and Weber have both supplied their carburetors to car manufacturers as original equipment. There are some differences in these application specific carbs that can cause the second-hand price to be less, especially Dellortos. Compared to standard off-the-shelf Webers, carbs made for specific applications can feature idle mixture adjustment screws

in towers, vacuum take-offs, or provision for them, on the right hand side of the carburetor body (when viewed from above), different auxiliary venturis for fitting to an air box (no trumpets) and a smaller float vent hole. None of these features affect the tuning of these carburetors but they usually sell for less second-hand. Some application specific Dellortos have pre-drilled holes in the carburetor body that control the air bleed for idle mixture adjustment, fuel mixture strength and progression mixture strength. These carburetors are perfect on the particular engine they were built for but usually prove untunable on anything else because of the lack of adjustment.



A pair of Dellortos on the Vauxhall engine of a kit car.



A trio of Webers on a racing Jaguar engine.

The advent of electronic fuel injection systems for production engines has not replaced the sidedraft Weber or Dellorto in the eyes of many because these systems have brought in an element of complication and expense. Overall, the performance of these injection systems (if correctly set-up) is unmatched by any carburetor but the difference between fuel injection and well tuned sidedraft can be very small.

The new parts situation often favors the Weber and they always seem to be available at reasonably short notice anywhere in the world and from many sources. This is not always the case with Dellorto parts. Dellorto sub-agents never seem to have any stock on hand. It seems to be a worldwide trend that Dellorto parts are a little bit harder to get unless the main agent is approached directly. All parts are available for either carburetor from your country's main agent and the agents have direct factory access for the purchase of spare parts. Parts are, in fact, not really hard to get for either make of carburetor, you just have to know where to go for them.

Des Hammill

ESSENTIAL INFORMATION & USING THIS BOOK

ESSENTIAL INFORMATION

This book contains information on practical procedures; however, this information is intended only for those with the qualifications, experience, tools and facilities to carry out the work in safety and with appropriately high levels of skill. Although the words **Warning!** (personal danger) and **Caution!** (danger of mechanical damage) are used throughout this book, be aware that we cannot possibly foresee every possibility of danger in every circumstance. Whenever working on a car or component, remember that your personal safety must **ALWAYS** be your **FIRST** consideration. **The publisher, author, editors and retailer of this book cannot accept any responsibility for personal injury or mechanical damage which results from using this book, even if caused by errors or omissions in the information given. If this disclaimer is unacceptable to you, please return the pristine book to your retailer who will refund the purchase price.**

This book applies to all Weber DCOE series and Dellorto DHLA series sidedraft carburetors.

It is possible that changing carburetor specification will mean that your car no longer complies with exhaust emission control or other regulations in your state or country - check before you start work.

An increase in engine power and, therefore, performance, will mean that your car's braking and suspension systems will need to be kept in perfect condition and uprated as appropriate.

As these carburetors were built to metric measurements, these take priority in the text. It is essential that you work with metric wrenches, but we would also advise you to use metric measurements if you can.

The vital importance of cleaning a part before working on it cannot be overstressed. It is equally important that your tools and working area are completely clean.

Use good quality tools and make sure they are precisely the right size for every job.

USING THIS BOOK

You'll find it helpful to read the whole book before you start work or give instructions to your contractor. This is because a modification or change in specification in one area will cause the need for changes in other areas. Get the whole picture so that you can finalize specification and component requirements (as far as possible) before any work begins.

This book has been written in American English; those in any doubt over terminology will find a glossary of terms at the back of the book.

Chapter 1
KNOW YOUR CARB, STRIPDOWN & INSPECTION

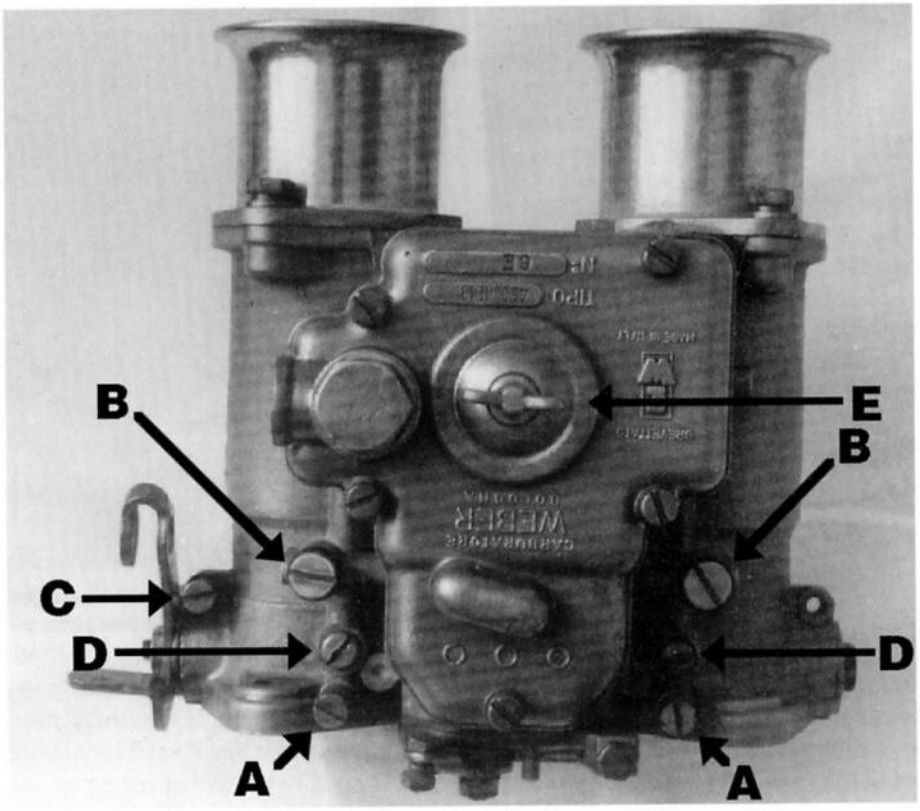
KNOW YOUR CARBURETOR - MAJOR COMPONENTS

The overall layout is almost identical for Webers and Dellortos. The principles of operation are so close that carburetors of this type couldn't really be designed any differently.

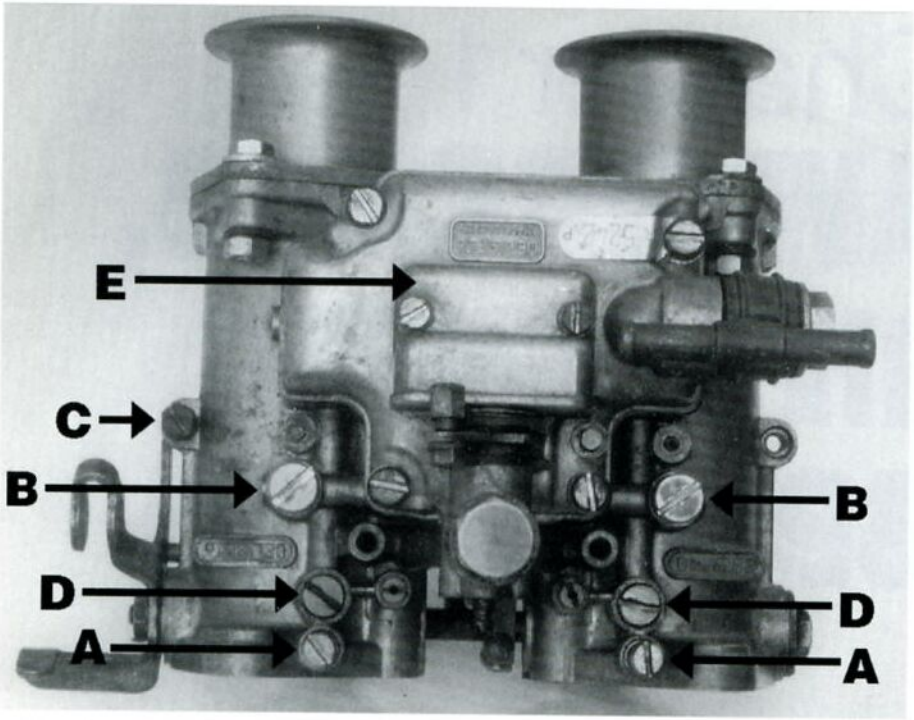
Chokes and auxiliary venturis

On all carburetors the choke is fitted into the barrel bore first and then the auxiliary venturi.

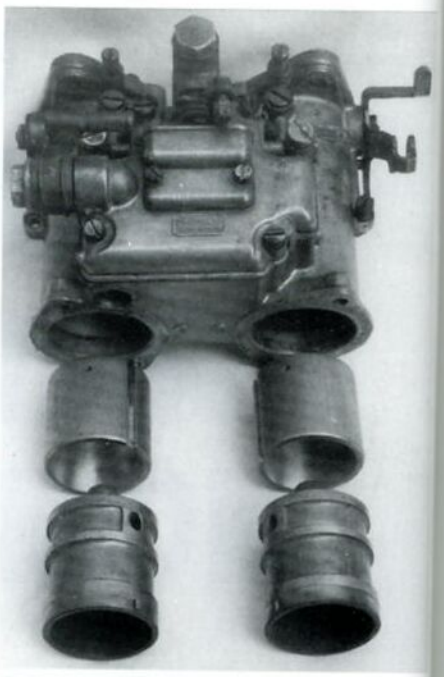
Note: it is quite possible on the 45 and 48 DCOE to put the auxiliary venturi into the carburetor body the wrong way around. The engine will run quite satisfactorily at low rpm but will run lean as the revs rise. Always check to see that the auxiliary venturi



View of a Weber showing the idle mixture adjustment screw at (A) the pump jet screw cover at (B) the throttle arm adjustment screw at (C) the progression hole screw cover at (D) the main jet and idle jet cover at (E).



View of a Dellorto showing the idle mixture adjusting screw at (A) the pump jet screw cover at (B) the throttle arm adjustment screw at (C) the progression hole screw cover at (D) the main jet and jet cover at (E).

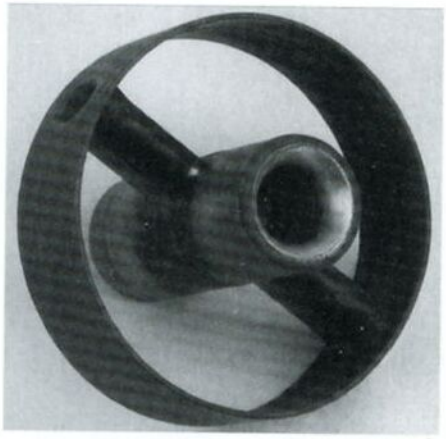


is fitted the right way around.

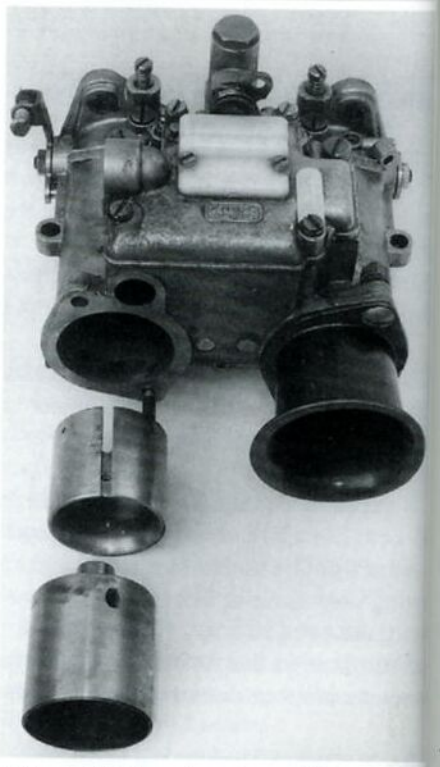
Idle mixture adjusting screws

The idle mixture adjusting screws are in a similar position on both carburetors. There are two types of adjusting screws for each carburetor. One type, used by both Dellorto and Weber, has the spring and idle mixture adjusting screw totally in the open. This type of screw has a metric course thread.

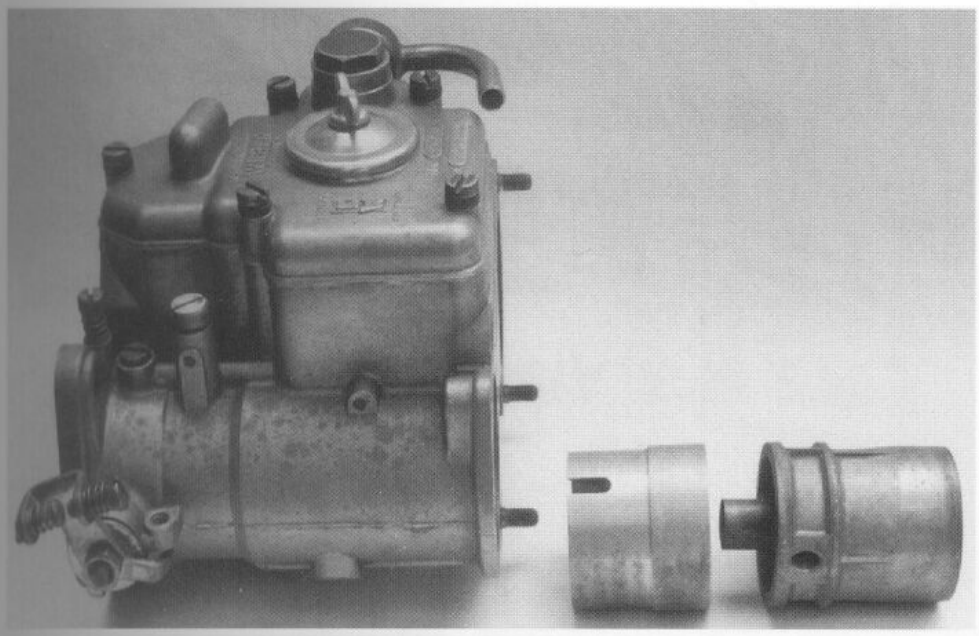
The second type of mixture adjusting screw is enclosed in a tower which is part of the body casting. The Dellorto has a fine thread cut into the tower. These threads do get damaged occasionally and can be very difficult to repair. Weber has the thread cut into the body in the usual place with an O-ring positioned at the top of the screw (to keep dirt out) and it has the

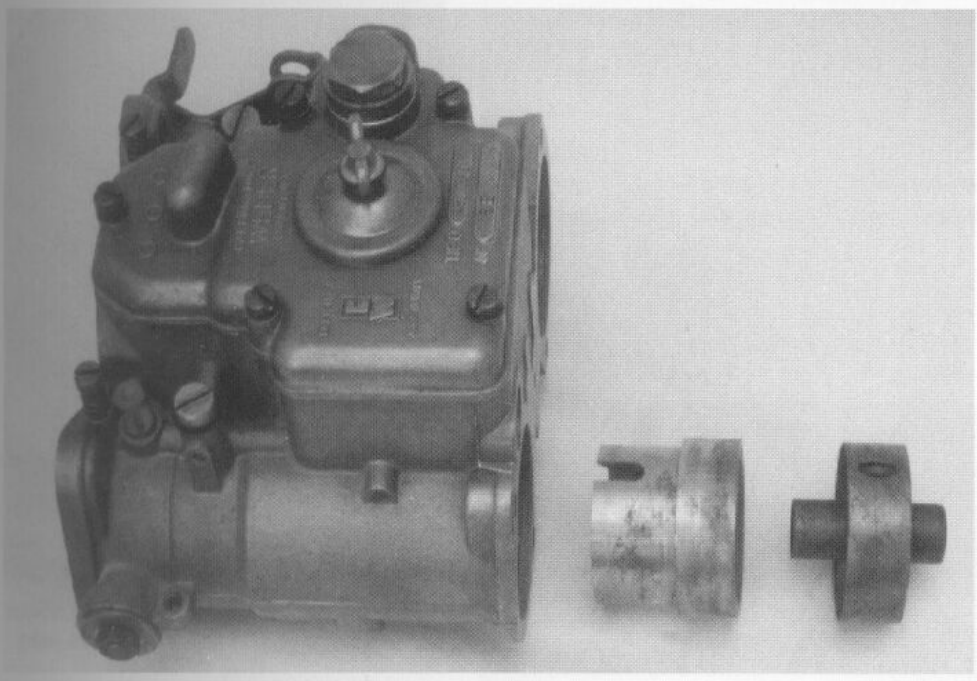


45 DCOE auxiliary venturi shown the right way around for installation in the carburetor. The small diameter of the nozzle must be front facing. Always check this.



Dellorto DHLA carburetors with the choke and auxiliary venturi in front. Note the shape of the auxiliary venturi, the 40's (top) is slightly different to the 45/48's (above).





Weber 40 DCOE carburetors with the chokes and the auxiliary venturis shown in front. The shape of the 40's (top) auxiliary venturi is different to the 45/48's (above).

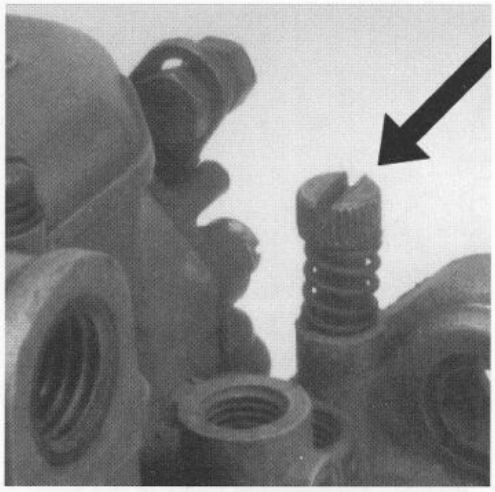
usual course metric thread.

Main jet, emulsion tube & air corrector

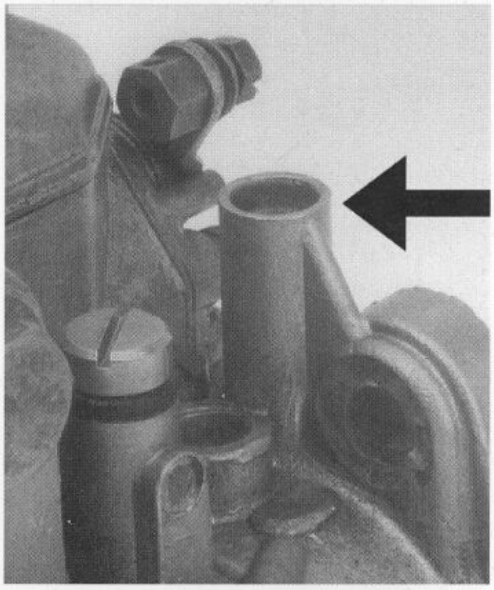
These three components form a modular component which screws into the body of the carburetor as a single unit. The main jet, emulsion tube and air corrector can be removed from either carburetor through the top cover. The Weber carburetor has a wing nut with a round cover assembly which is easily removable and which gives access to the jets. The Dellorto has a plastic or aluminum cover held by two screws which, when removed, allows access to the jets.

The jets are a push fit into the emulsion tubes on both carburetors. The air corrector on the Weber is a push fit into the emulsion tube and the emulsion tube holder is a push fit on to the emulsion tube which, in turn, covers the air corrector. This means that there are two parts involved, the actual air corrector jet and the emulsion tube holder.

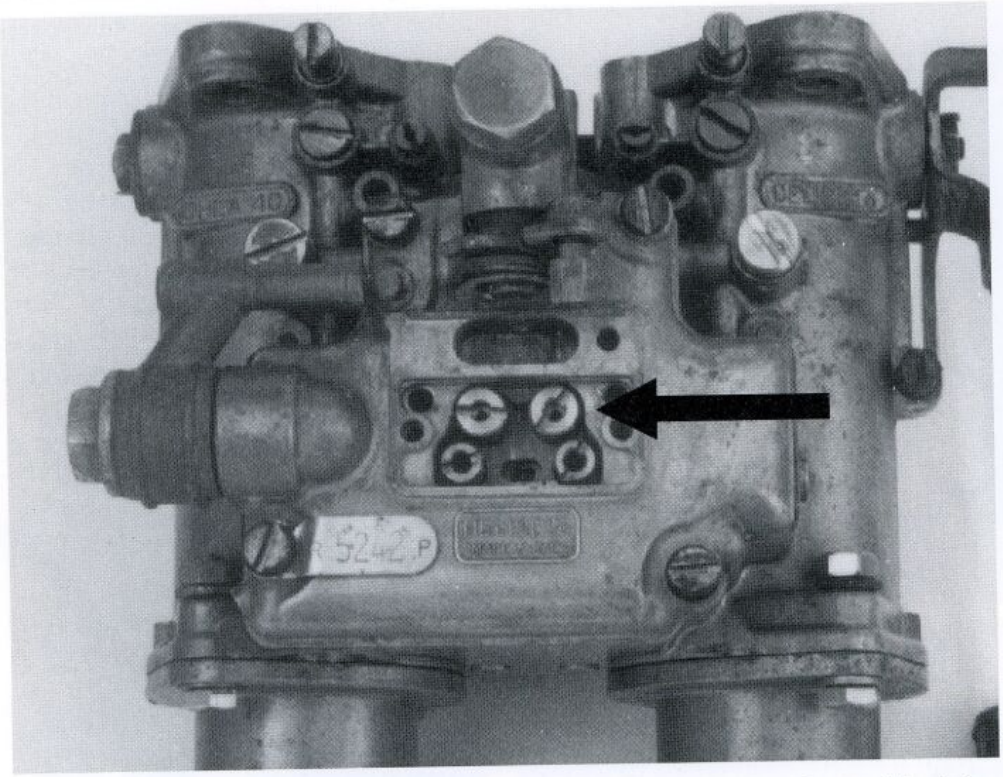
On the Dellorto the air corrector is part of the emulsion tube holder and is changed as a single component. The emulsion tube holder/air corrector is a



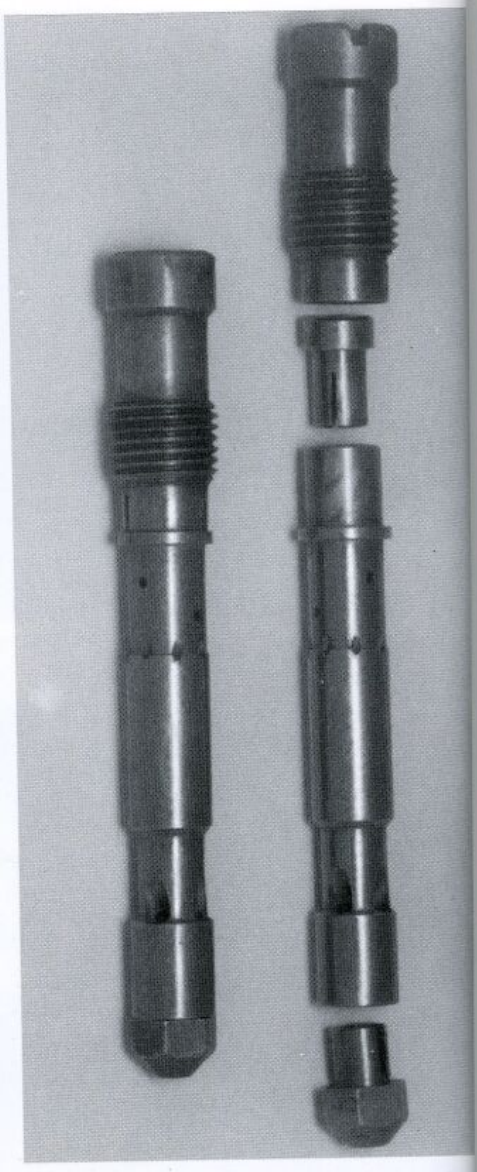
Exposed type idle mixture adjusting screw on a Weber. The Dellorto idle mixture adjusting screw is very similar.



Idle mixture adjusting screw tower of a Dellorto. The Weber tower is very similar.

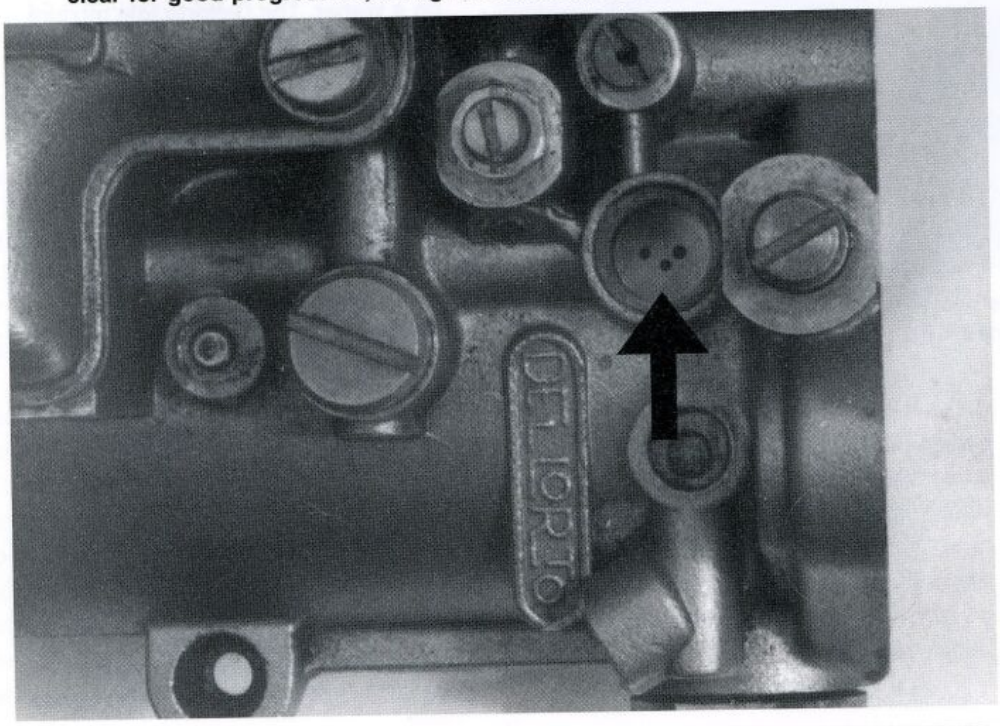


Top of a Dellorto with the jet inspection cover removed and showing the emulsion tube holder which in turn holds the actual emulsion tube, main jet and air corrector.



Weber main jet, emulsion tube, air corrector jet and an emulsion tube holder dismantled (right) and assembled (left).

Below - Progression holes in the body of a Dellorto carburetor. These holes must be clear for good progression, though it's unusual for them to become blocked.

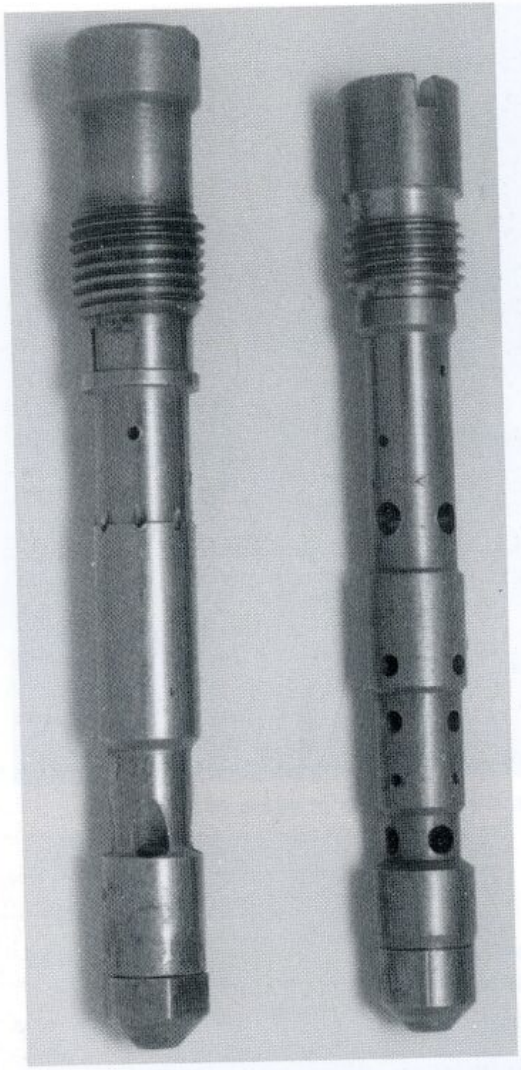


push fit on to the emulsion tube.

Progression hole inspection covers

This cover was put here in the first place to allow for the progression holes to be drilled in the carburetor body but, of course, it doubles as a removable plug for cleaning purposes or checking to see if the holes are clear. **Note**: some Weber carburetors have permanent plugs.

Dellorto main jet, emulsion tube and an emulsion tube holder dismantled (right) and assembled (left). Note that the air correction hole is part of the holder.



Left - Comparison of Weber (left) and Dellorto (right) main jets, emulsion tubes and holders.

Idle jet

The idle jet holder and the idle jet are located under the same inspection cover that gives access to the main jet, emulsion tube and air corrector jet. The idle jets are in a similar position in both carburetors. The idle jet is a push fit into the idle jet holder which, in turn, screws into the carburetor body. The air bleed and fuel jet are in the same component on the Weber. On the Dellorto the fuel jet is a separate component to the air bleed which has one or more holes drilled into the actual idle jet holder.

Accelerator pump jets

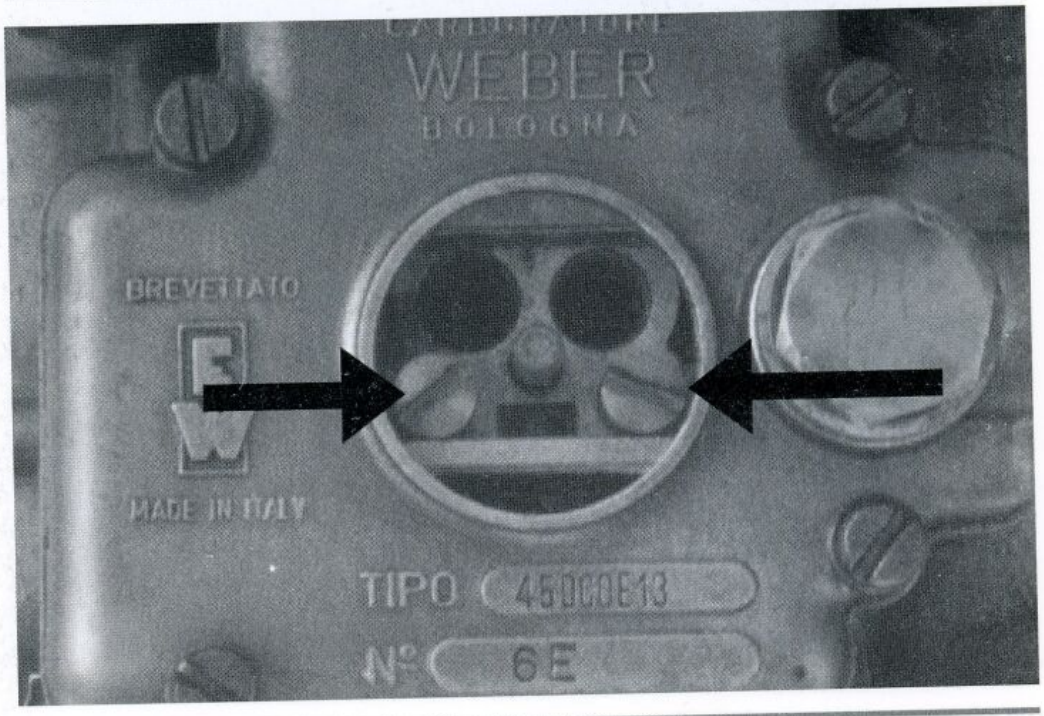
These are found under the screw plug and are lifted out. On both carburetors they can sometimes be difficult to remove. **Caution!** Extreme care is often needed to remove them without damaging or even ruining them. On Dellortos the pump jet is actually connected to the screw plug using a socket and groove arrangement for ease of removal.

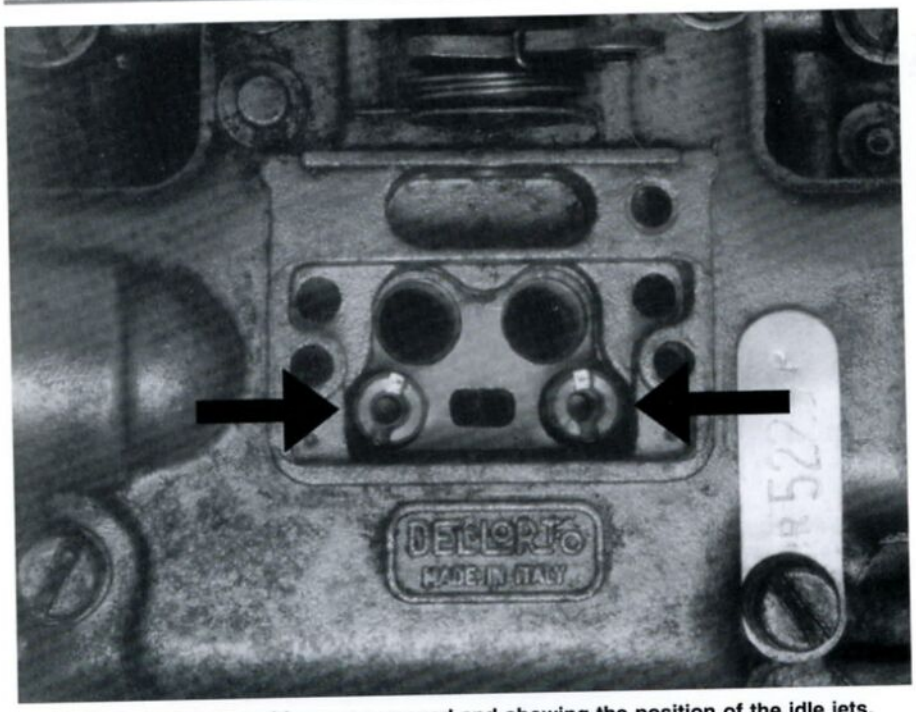
Accelerator pump

The Weber mechanism is totally enclosed in the carburetor top and body but there is also a cover at the back of the body where the throttle return spring and the accelerator pump control lever is situated.

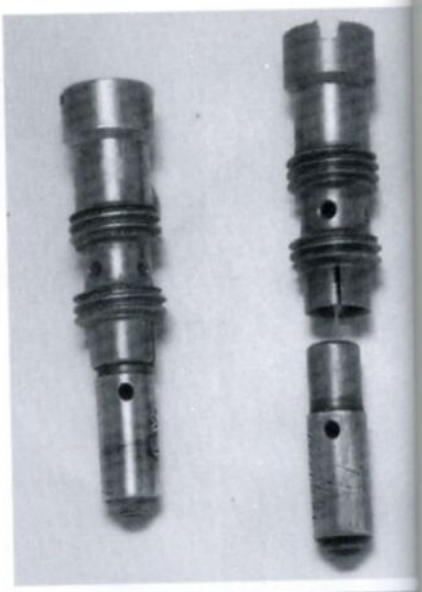
The Dellorto has an external

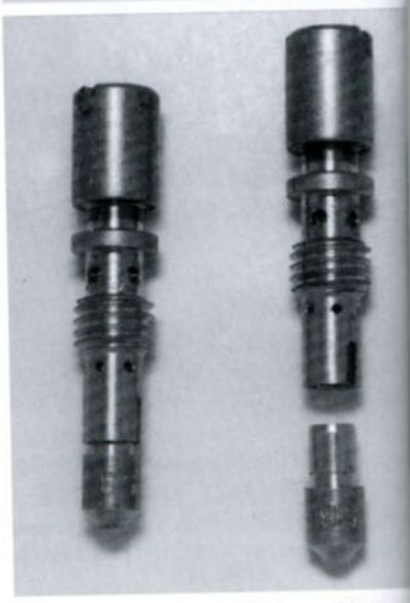
Below - Weber carburetor with cover removed showing the position of the idle jets.





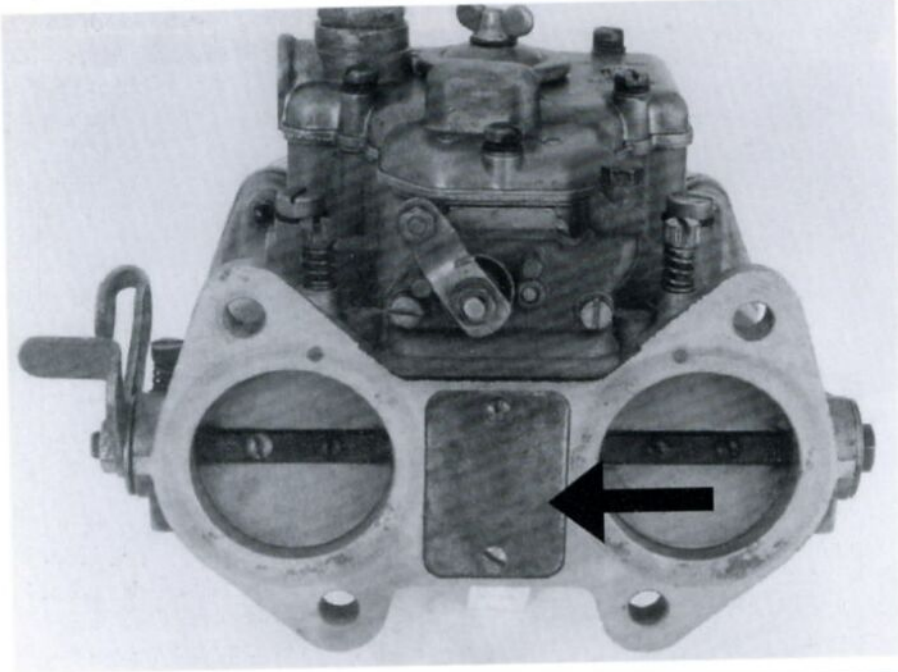
Dellorto carburetor with cover removed and showing the position of the idle jets.

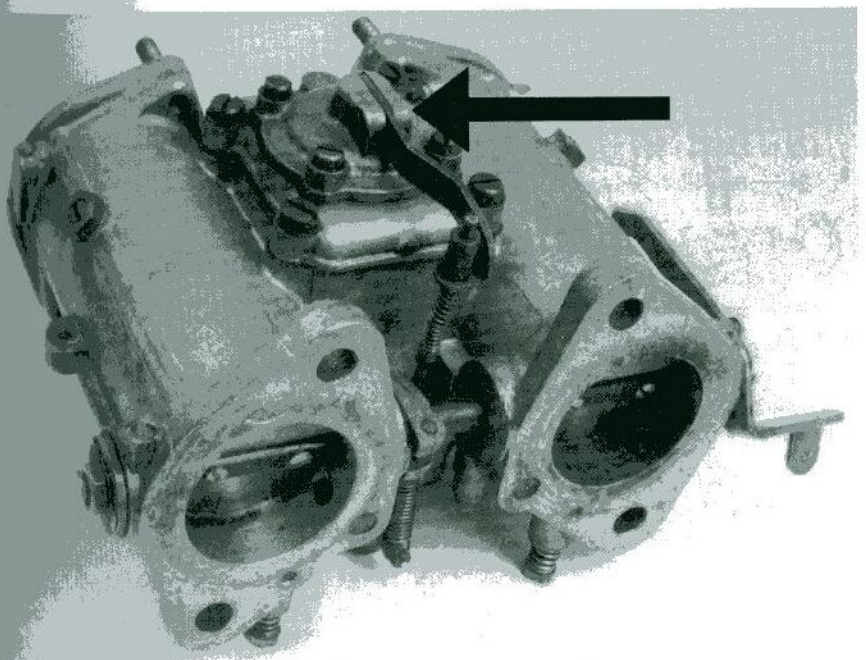




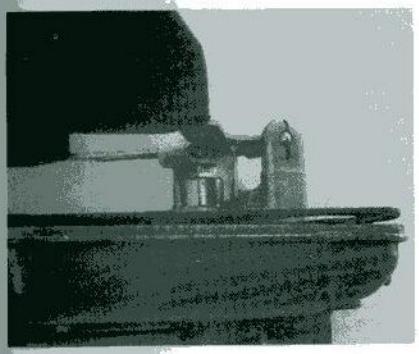
Weber (top photo) idle jet and holder assembled (left) and separated (right). Dellorto (above) idle jet and holder assembled (left) and separated (right).

Below - Weber carburetor from the back showing the inspection cover which serves to enclose the accelerator pump actuating mechanism.

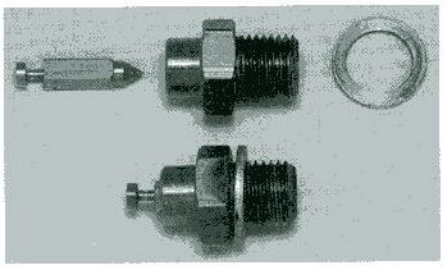




Dellorto accelerator pump mechanism.



Top cover turned upside-down to show the float arm in contact with the needle valve.



Needle and seat in assembled and component form.

system with a diaphragm operated accelerator pump and lever system. This is all located underneath the carburetor.

Floats

The floats are located under the carburetor top cover on both carburetors. **Note**: on the Weber carburetor the wing nut and round cover must be removed before the carburetor cover will come off. The floats are located on the underside of the carburetor cover and, as a consequence, the carburetor cover has to be removed to gain access to the floats for float height setting purposes. The Weber uses brass and, latterly plastic, floats and the Dellorto uses plastic floats only.

Needle & seat

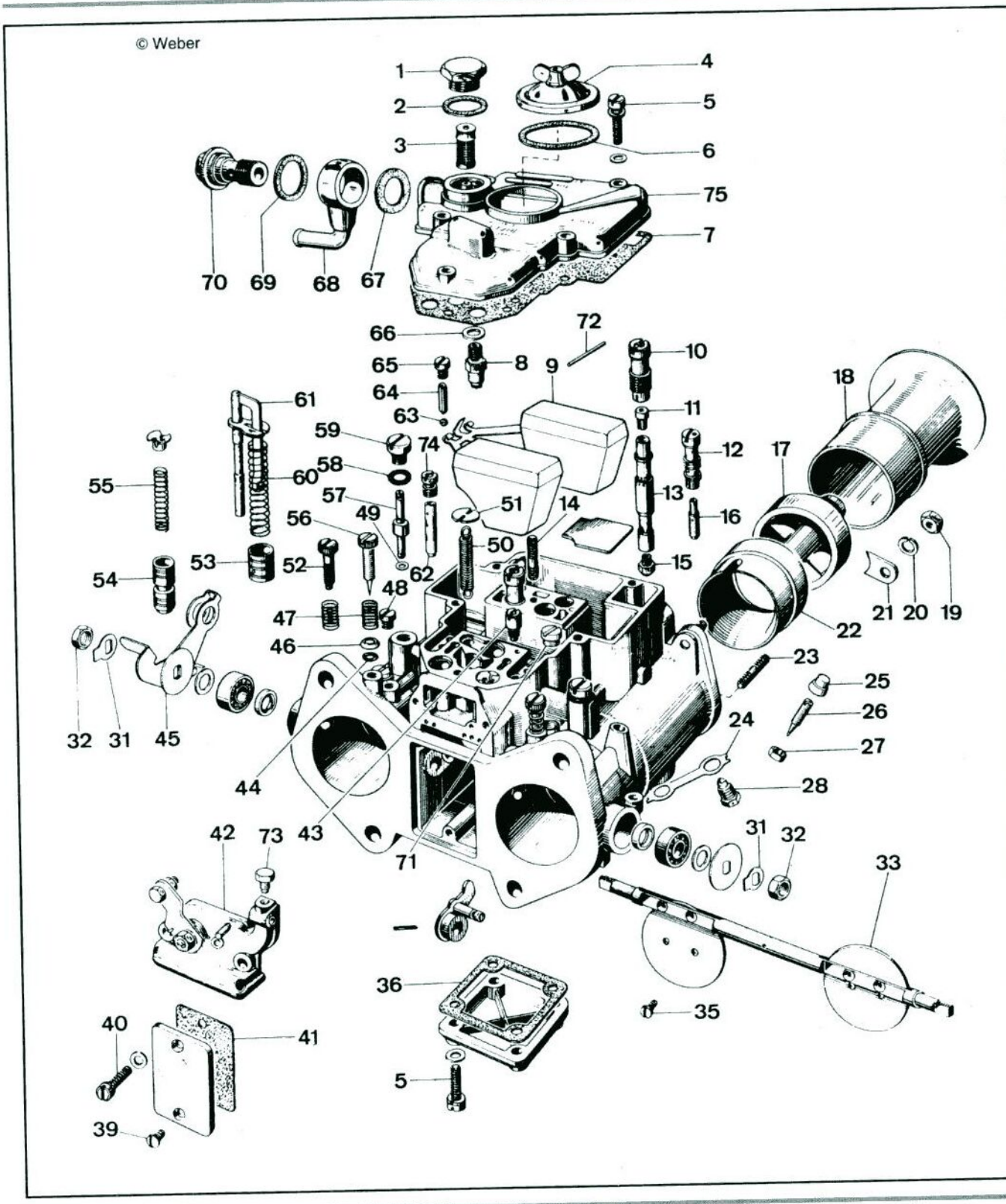
These are situated in the top cover and work in conjunction with the floats. The float must be removed before the needle and seat can be removed.

STRIPDOWN - GENERAL ADVICE

Both Weber and Dellorto carburetors can only perform to design specification if *all* component parts are in good condition. These carburetors are nearly always able to be fully rebuilt. Only severe damage will cause a carburetor body to be rejected while the majority of the other parts could still be used for spares. Carburetor rebuilding applies to used carburetors but new carburetors may have to have their settings checked if they malfunction (this is rare).

Both Weber and Dellorto carburetors are, within reason, infinitely rebuildable. Carburetors covered with road grime are not necessarily in poor condition internally. Rough handling and general abuse is what usually causes functionality problems with these carburetors. Poor examples usually feature burred or broken screwdriver slots, burred hexagon fittings and generally look knocked around. All of the parts are replaceable and the only thing that precludes a carburetor from a rebuild is a seriously damaged body. It is possible to weld certain parts on a body but this is not usually cost-effective so damaged bodies generally have to be written off.

When rebuilding either of these carburetors it is useful to refer to an exploded diagram of the carburetor. The exploded view diagrams included in this book have been kindly supplied by Dellorto and Weber main agents. In addition, another way of ensuring that you have a reference from which to check exactly where, or which way around, a part or parts go, is to dismantle only one carburetor at a time. (If you only have one carburetor, place the parts in line in their order of removal). The exploded diagrams included in this book are very good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WEBER DCOE - EXPLODED VIEW
1 Filter inspection cover, 2 Fiber washer for inspection cover, 3 Fuel filter, 4 Main jet and idle jet inspection cover, 5 Carburetor cover screw, 6 Inspection cover gasket, 7 Gasket for carburetor cover, 8 Needle and seat, 9 Plastic floats, 10 Emulsion tube holder, 11 Air corrector, 12 Idle jet holder, 13 Emulsion tube, 14 Stud, 15 Main jet, 16 Idle jet, 17 Auxiliary venturi, 18 Trumpet or ram tube, 19 Nut, 20 Spring washer, 21 Retaining plate, 22 Choke, 23 Stud, 24 Retaining screw locking tab, 25 Cap, 26 Adjusting screw, 27 Locking nut, 28 Auxiliary venturi retaining screw, 31 Locking washer, 32 Spindle retaining nut, 33 Butterfly, 35 Butterfly retaining screw, 36 Bottom well gasket, 39 Inspection cover retaining screw, 40 Choke mechanism retaining screw, 41 Inspection cover gasket, 42 Choke mechanism, 43 Accelerator pump intake and discharge valve, 44 O-ring, 45 Linked throttle arm (left-hand side), 46 Washer, 47 Idle mixture adjusting screw spring, 48 Progression holes inspection screw, 49 Accelerator pump aluminum washer, 50 Spindle return spring, 51 Spindle return spring anchoring plate, 52 Throttle arm adjusting screw, 53 Accelerator pump piston, 54 Starter valve, 55 Starter valve return spring, 56 Idle mixture adjusting screw, 57 Accelerator pump jet, 58 O-ring, 59 Pump jet screw plug, 60 Accelerator pump control rod spring, 61 Accelerator pump control rod, 62 Starter jet, 63 Check valve ball, 64 Stuffing ball, 65 Accelerator pump stuffing ball screw plug, 66 Aluminum spacer washer, 67 Small bore fibre washer, 68 Fuel union (banjo), 69 Large bore fibre washer, 70 Union bolt, 71 Progression holes cover, 72 Float fulcrum pin, 73 Choke cable retaining screw, 74 Starter jet holder, 75 Carburetor top cover. (Courtesy Weber).

and all parts are shown in order of fitting. Some of the parts are not shown directly in line with their actual fitted position in the carburetor body, but their positions are correct in the overall scheme of installation.

Cleaning components

The following will be required for cleaning the carburetors; two shallow pans, a 1 inch or 25mm paint brush, half a gallon or 2 liters of gasoline (petrol) and pint or 750ml of paint thinner and, perhaps, some specific carburetor cleaner as found and supplied in spray cans (300mls). **Warning!** These cleaning agents are highly inflammable and may be harmful to skin, or to the lungs if inhaled - always take appropriate precautions to ensure your complete safety.

In the first instance wash and clean the outside of the carburetor thoroughly with a degreasing agent such as petrol so that all loose dirt and grime is removed. It is not desirable to immerse the carburetor completely during the initial washing as dirt can be washed into the carburetor. Once the majority of dirt has been removed the outside surfaces can be cleaned with paint thinners or a proprietary carburetor degreasing agent (usually available in a spray can) which will clean the outside surfaces as well as is possible without full immersion. The outside surfaces of the carburetors do get quite badly stained with use and there is usually slight surface corrosion which can't really be removed without using a proprietary aluminum cleaning agent. **Warning!** If you do use such an agent make sure it is appropriate for this task and follow the maker's instructions fully.

One tray can be used for holding the petrol and washing down the carburetor and parts and the other for keeping the parts together once removed from the carburetor and cleaned . When the majority of the dirt and grime has been removed from the carburetor and its components, change the fluid or use another tray to give all parts a final wash so that they are completely clean.

Caution! Never clean jets or passages with wire: use compressed air, nylon bristles or a piece of appropriately thick fishing line for this purpose.

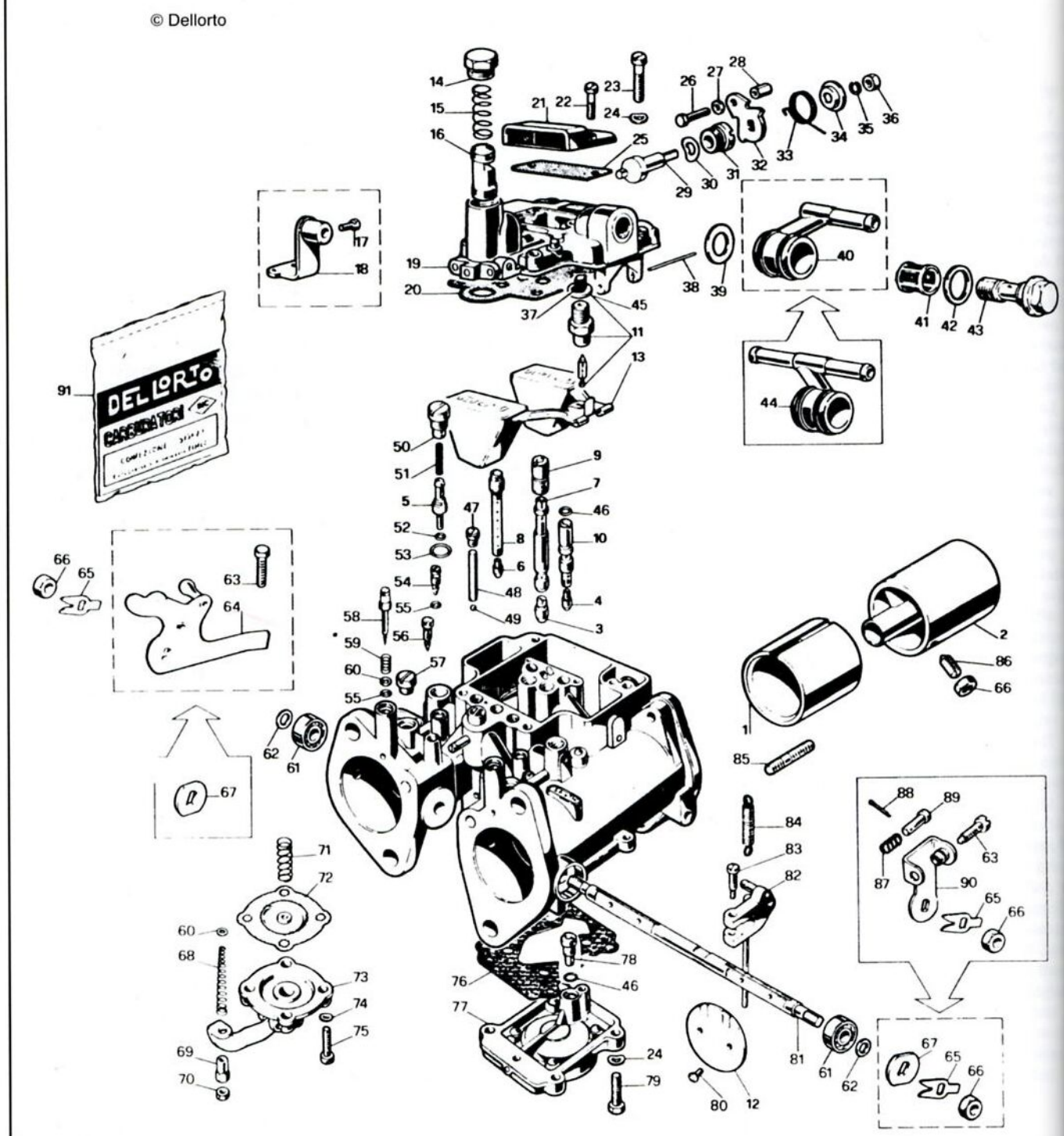
Fuel enrichment devices - special note

Because the fuel enrichment devices are never used, no details of their stripping down or assembly are given. Leave all of the fuel enrichment components installed in the carburetor. The Weber and Dellorto fuel enrichment devices work perfectly, of course, but never seem to get used. Most engines equipped with these carburetors that are well tuned need one pump (at the most) for starting and some throttle 'feathering' to keep them running for the first 10 to 20 seconds after cold start-up and then the engine will usually idle on its own account. This idle may not necessarily be up to the set idle speed while the engine is cold but will improve as the engine gets warm.

On the Weber carburetor the fuel enrichment device frequently causes problems (excessive fuel delivery) so, rather than repair the mechanism, simply block off the outlet holes in the throttle bores. The Dellorto will only allow an over-enriched fuel supply to enter the engine if the fuel enrichment device washer fails, which it seldom does.

STRIPDOWN PROCEDURE

The carburetor can now be stripped.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DELLORTO DHLA - EXPLODED VIEW
1 Choke, 2 Auxiliary venturi, 3 Main jet, 4 Idle jet, 5 Pump jet, 6 Cold start jet, 7 Emulsion tube, 8 Cold start emulsion tube, 9 Air correction jet, 10 Idle jet housing, 11 Needle and seat, 12 Throttle butterfly, 13 Float, 14 Cold start tap screw, 15 Spring, 16 Cold start piston valve, 17 Set screw, 18 Cable clamp, 19 Float bowl cover, 20 Float bowl cover gasket, 21 Vent cover, 22 Vent cover screw, 23 Cover screw, 24 Spring washer, 25 Vent cover gasket, 26 Bolt, 27 Washer, 28 Cable nut, 29 Actuator cam, 30 Spring washer, 31 Sleeve, 32 Drive link, 33 Return spring, 34 Retaining washer, 35 Retaining clip, 36 Nut, 37 Filter, 38 Float fulcrum bar, 39 Washer, 40 Banjo (single), 41 Filter, 42 Washer, 43 Banjo bolt, 44 Banjo (double), 45 Washer, 46 O-ring, 47 Cap screw, 48 Pump jet spacer rod, 49 Pump jet metering check ball, 50 Pump jet holder, 51 Spring, 52 O-ring, 53 Washer, 54 Bypass screw, 55 O-ring, 56 Pressure tap screw, 57 Progression tap screw, 58 Needle valve, 59 Spring, 60 Washer, 61 Throttle (butterfly) shaft bearing, 62 Spacer, 63 Throttle balance screw, 64 throttle drive arm, 65 Throttle shaft locknut, 66 Nut, 67 Thrust washer, 68 Spring, 69 Adjustment nut, 70 Locknut, 71 Diaphragm spring, 72 Pump diaphragm, 73 Pump cover, 74 Washer, 75 Screw, 76 Pump housing gasket, 77 Pump housing, 78 Pump check valve, 79 Screw, 80 Throttle plate screw, 81 Throttle shaft, 82 Pump drive lever, 83 Drive lever screw, 84 Spring, 85 Stud, 86 AV set screw, 87 Spring, 88 Clip pin, 89 Compression pin, 90 Throttle drive arm, 91 Gasket and seal kit. (Courtesy Dellorto).

Remove the fuel pipe union using a six-point box end wrench (ring spanner). There is not all that much hexagon to grip onto (depth-wise) on the union bolt and it is fairly usual for the hexagon to be burred. (If the carburetors are on a manifold it is usual to loosen off the union bolt and the filter inspection bolt [on Webers] before removing a carburetor as they can often be very tight - this way there is more to hold firmly while the bolt is actually undone).

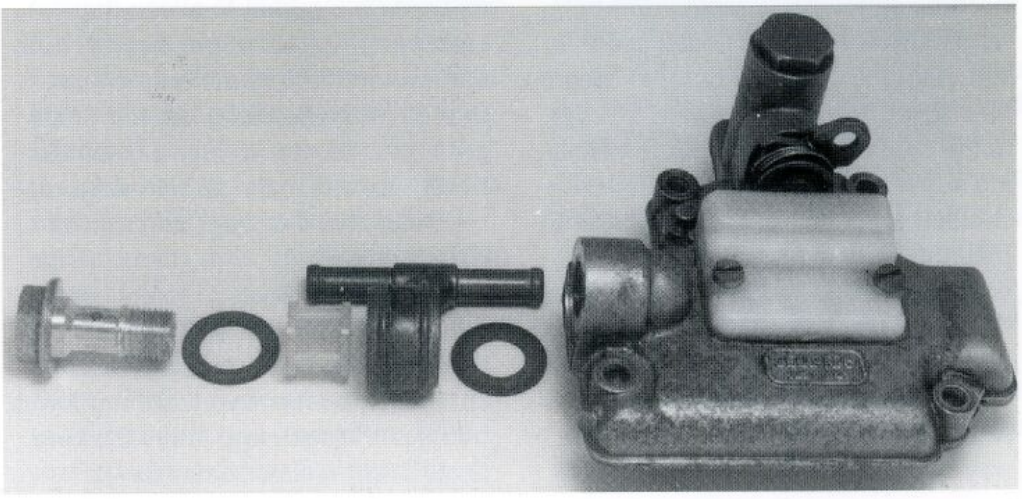
The fuel filter can now be removed and, in the case of the Weber, expect to have to replace it with a new item. The Dellorto filter can be cleaned and inspected for any damage to the screen and, if clear, re-used. **Note**: with Weber carburetors, the internal fuel filter can be left out provided there is an inline fuel filter in the system between the fuel pump and the carburetors. The Weber filter is not as good as the Dellorto and, even if the standard filters are left in place, an additional filter should be used as a precaution against dirt getting into the carburetor. Expect to fit new fibre washers to the union bolt and union, plus one for the filter inspection plug on Webers.

Remove the jet inspection covers (wing nut on Webers and two screws on Dellortos) and, using a correctly-sized screwdriver, remove the main jets and idle jets. Pull the components apart for thorough cleaning. Check each part for corrosion and use 320 wet and dry paper to clean off any stain. Damaged screwdriver slots can be cleaned up using a rectangular section needle file while holding the emulsion tube holder or idle jet holder firmly in a vice between pieces of wood (to protect the holder). Ideally, use compressed air to clean each component after washing it and check visually that each jetting hole is clear and looks clean.

Remove the accelerator pump screw plugs and lift out the pump jets. The Dellorto pump jet is designed to come out with the screw as the screw has an internal groove in it and the jet itself has a radius-edged lip at the top which fits into the screw plug. Normally this works very well, but if the pump jet has not been removed for a long time, it may be jammed in the hole in which case the screw plug parts company with the jet. The Weber screw plug simply lifts off and the pump jet can usually be removed by using pointed tweezers.

On both carburetors, if the pump

Below - Components of the integral Dellorto fuel filter.



jet is well and truly jammed in the hole a pair of long-nosed pliers can be modified (by grinding) so that the pump jet can be gripped and pulled out. The Weber pump jet has a small groove around the top edge for this very thing and the Dellorto has a radius-edged lip which can be used for the jet's extraction.

Remove the progression hole inspection screw plugs and check to see that there is no obvious dirt covering the holes. Use the correct sized screwdriver for the slot size.

Remove the idle mixture adjusting screws and check the tapered ends for any sign of damage: they should all look the same. It is unusual to find a carburetor or a pair of carburetors with all screw ends damaged so compare all screws to each other.

Some Dellortos have a tower and the idle mixture adjusting screw is located within this tower. A fine thread is cut into the tower and, because of this design, the threads are affected by dirt collecting in the recess of the tower. The idle mixture adjusting screws can be quite tight to move, initially at least. Usually, once the carburetor body has been thoroughly washed and cleaned with compressed air, the idle mixture adjusting screws can be refitted without any problem. These threads can, unfortunately, become seriously damaged and be very difficult to repair. **Note**: there is something that can be done to prevent any damage occurring to the threads in the future. The idle mixture adjusting screws are not used often so the solution to this potential problem is to plug the holes after the engine has been tuned. The simplest way is to use silicone sealer. The plug of sealer can easily be removed when an adjustment needs to be made and new sealer applied afterwards. The other way of doing this is to fit small plastic plugs that can be pushed in and then removed for idle mixture adjustment when necessary. **Caution!** If the engine is always getting dirty because of how the car is used, it is essential to seal the towers off.

If you cannot move the idle mixture screw, the screw's head has to be ground away. This is done with a high speed grinder fitted with a small ball-nosed cutter. Care must be taken so that the internal thread of the tower is not damaged any further. No attempt should be made to turn the screw out. Grind it all away and remove all traces of the screw material from the threads. Sometimes it is possible to do this and simply fit a new idle mixture adjusting screw, especially if a damaged screwdriver slot is the only reason for not being able to undo the screw. With the head removed the remaining portion of the screw is loose. Remove all metal particles.

Undo the screws from the top cover and, very carefully, remove it without any forcing of the floats to avoid damaging them. The Dellorto has a particularly close fit around the choke tower which necessitates that it be lifted vertically for a few millimeters. Turn the top over and, using a small pin punch, remove the fulcrum pin that holds the floats in position. Push the pin out of the post with the slot in it. There is a gasket between the carburetor body and the top (on both carburetors) which can only be removed and replaced while the floats are not fitted. It is always a good idea to replace this main gasket with a new one; essential if there is any sign of deterioration.

Shake the floats to make sure they contain no fuel and then check their integrity by immersing them completely in fuel and watching for air bubbles. Replace any faulty Dellorto float. Brass Weber floats can be repaired by soldering. Any soldered repair has to be reasonably small so that a minimum amount of weight is added to the float assembly. If the floats and frame look battered and well used, replace them with new components. All Dellorto floats are plastic and deteriorate over time when the aluminum of the frame has the plastic moulded around it. The floats' main function is to maintain a constant fuel level under all conditions by opening and closing the needle valve. Worn fulcrum pins and float hinges can cause fuel level to fluctuate.

The needle and seat assembly can be unscrewed and should be replaced with a new assembly unless you are working on a relatively new carburetor. The needles are prone to wear on the very tip of the needle where it contacts the seat. Worn needles have an annular groove or indentation present all the way around on the conical portion of the needle. The wear on the seat is less apparent as it is down the hole of the fitting. Replace the needle and seat as an assembly. Needles can be all metal or rubber tipped.

Remove the trumpets, auxiliary venturis and chokes. The Weber DCOE 40 has the choke and auxiliary venturi retained by the trumpet and clamps. Some models of the 40 DCOE have a different auxiliary venturi which allows an air box to be directly bolted on the carburetor without the usual clamps. The 45 and 48 DCOE Webers have a screw for each choke and auxiliary venturi and the Dellorto has one nut and screw to remove on the auxiliary venturi before anything can be removed. All of these components usually come out easily but the chokes can be difficult to remove. If the chokes won't budge refer to the information on choke removal given in the "Difficult Proce-

dures" section of this chapter.

Turn the carburetor over and remove the bottom well cover. The main jets take their fuel out of here and usually there is sediment and possibly some corrosion in the cover and the underneath cavity of the carburetor body. The sediment and corrosion must be washed and/or carefully scraped away.

On the Weber there are four screws holding the well cover on and there is a gasket between the cover and the body. Use a new gasket during the rebuild.

On the Dellorto there are two parts to the bottom cover arrangement. The accelerator pump housing is below the well cover and has to be undone first. The accelerator pump arm is part of the lower housing and, when the four screws are undone, the housing can be moved aside while the accelerator pump arm is all still attached. Do not move or undo the two nuts that secure the pushrod from the throttle spindle to the accelerator pump actuating arm. The diaphragm and spring can be removed from the housing and inspected for wear or damage. The well cover is secured by a further four screws and can be undone and removed from the carburetor body. There is a gasket between the cover and the body. The accelerator pump intake valve is screwed into the well cover housing. This is a one-way valve only.

The Weber carburetor has the accelerator pump intake and discharge valve fitted into the bottom of the float chamber and this can be removed with a large screwdriver. This valve can be quite tight and difficult to remove at times. The tapered-off top on this valve certainly reduces the size and strength of the screwdriver slot so it is important to use a screwdriver that fits the slot correctly in the first place. The Weber valve may have a small hole drilled in the side of it and this is part of the bleed-off for fuel during accelerator pump action. If there is a small hole in the side of the jet fuel escapes out of here back into the fuel bowl rather than being injected into the engine. This is part of the reason why Weber pump jets go up in 5s. The situation is alterable via the hole size found in the side of the jet. Valves are available that do not have a discharge hole. With the side hole blocked off or not present this accelerator pump intake jet is a one-way valve.

The two screw plugs above the accelerator pump check balls and weights can be removed using a correct fitting screwdriver and the carburetor turned upside-down so that the balls and weights fall out. (Use your large shallow tray for this purpose).

The Weber accelerator pump control rod is held in position by a brass retaining plate. To remove the accelerator pump control rod the retaining plate has two small indentations in it that can be used for the removal of the plate. This is carried out using long-nosed pliers that have had the ends chamfered (by grinding) so that the tips of the pliers go to the bottom of each indentation in the retaining plate so that, when the pliers are used to squeeze the plate, they have the maximum amount of contact with the sides of the indentations. **Caution!** Do not squeeze too hard or the plate will distort. The indentations' main function is to centralize the spring found underneath the retaining plate.

Stripping down for cleaning, checking and, if necessary, replacement of the basic working parts of the carburetor/s is now complete. (The fuel enrichment mechanisms can remain installed as they are not used; the Dellorto mechanism is excellent and never causes problems).

The carburetor body can now be thoroughly washed and all scale or corrosion carefully scraped off the inside of the body and all sediment removed by washing in a shallow bath of clean gasoline (petrol). Clean out the throttle bores and remove any corrosion or surface roughness with very fine wet and dry paper. If the cleaning fluid becomes dirty and appears to be carrying particles, change it. With the body washed, and clean, dry it off using compressed air (100 psi or more).

FUEL ENRICHMENT DEVICE - BLOCKING OFF DISCHARGE HOLES (WEBER ONLY)

The Weber carburetor can have the discharge holes blocked off to eliminate air/fuel mixture leakage into the main tract during normal operation if the fuel enrichment mechanism proves to be faulty (often a problem with well-used Webers), or even if you just wish to prevent future problems. This is done by tapping with a 6mm by 1mm pitch tap the outlet bore of each throttle bore for 12mm (0.5 inch) and installing suitable short grub screws into each one. The grub screws should be Allen-headed and must be securely fitted into the carburetor body. The tap used should be a taper tap or first tap which means that it will have a long lead in section. (This allows the thread of the grub screw to really wind into the thread cut into the body of the carburetor over a longer distance than if a plug tap was used). A firmly wound in grub screw coated with a sealer/ locking agent will never move. Check to see that no part of the grub screw protrudes into the throttle bore.

INSPECTING COMPONENTS FOR WEAR AND DAMAGE

Make the following checks as soon as the stripdown is complete so that you can order any parts which are not normally included in the basic repair kit. For each carburetor you'll need a new and full set of gaskets, O-rings and, advisably, diaphragms, so check what is included in the basic repair kit package. A new needle valve assembly is recommended.

Weber & Dellorto

Check to see if there is anything missing (see exploded view) from the carburetor/s you have dismantled. Check nuts for burring or damage. Check the fuel filter for damage. Check all screw heads for burring (clean them up or replace them). Ensure the floats are inspected for obvious damage and tested for leaks, their fulcrum pin checked for grooving or wear and the floats' hinge loops checked for looseness on the pin. Check needle and seat of the needle valve assembly for grooving around the point or tip (if grooved, replace both).

Check the throttle butterfly spindle for smooth and free movement (opening and shutting the butterfly). If there is any sign of 'grittiness' or 'lumpiness' remove the nuts and arms, covers or seals and check the condition of the bearings. If the bearings do not respond to the cleaning process suggested (see following text on difficult procedures), replace them with new items.

Every passageway must be checked and tested to ensure that it is clear of obstruction. Although the passageways change direction a lot, all can be shown to be clear by passing compressed air through them. If no compressed air can be felt assume until proven otherwise that the particular passageway is blocked. If a passageway has a blockage it *must* be cleared - see the following text on difficult procedures.

Weber only

Check the spindle return spring (they break frequently so it might be a good idea to fit a new one anyway). Check the accelerator pump control rod for end wear. Check the accelerator pump spring for breakage (rare).

Dellorto only

Check the diaphragm return spring for breakage (rare). Check the accelerator pump diaphragm for deterioration (very slow to deteriorate). Check the spindle return spring for breakage (rare). Check the cast aluminum accelerator pump actuation arm for cracks (occasionally happens). Check the fuel enrichment shut-off washer for deterioration (virtually never wears out).

DIFFICULT PROCEDURES

There are four procedures that often pose difficulty: 1) cleaning all of the internal passages within the carburetor body; 2) removing and refitting the throttle butterfly, spindle and bearings; 3) removing broken threaded components from the carburetor body; 4) removing jammed chokes and auxiliary venturis.

Here are workarounds -

Clearing passageways

The carburetor body has many drilled and plugged passageways and - short of removing each plug and cleaning each passageway then replacing the plug - there are two ways of cleaning them. Note that it is not usually necessary to remove any plugs to clean the passageways. There are processes available today that can clean a carburetor inside and out to near new condition and most carburetor rebuilding companies use such processes. After having a carburetor body cleaned by a contractor, check each passageway to see that it is, in fact, clear using compressed air.

The alternative to professional cleaning is to wash the stripped down body in clean gasoline (petrol) and use compressed air (100 psi plus) with a large nozzle air gun to blow through all passages. Most carburetors respond well to this treatment; however, there is always going to be the odd carburetor with something firmly lodged in a passageway which will be detectable when blowing through each passageway with the compressed air as no air will be able to pass through. When testing for clear passageways always ensure that the nozzle of the air gun is well sealed off (tapered nozzle) against the hole so that all of the compressed air has to go through the passageway. The nozzle should have a 2.0mm (0.080in) hole in it so the passageways are subjected to a large volume of air at high pressure. If one passageway will not pass any air through it, that is the time to start removing plugs and checking the passageway physically for an obstruction. New replacement lead plugs are available from main agents.

Throttle butterfly, spindle & bearings - maintenance, removal & refitting

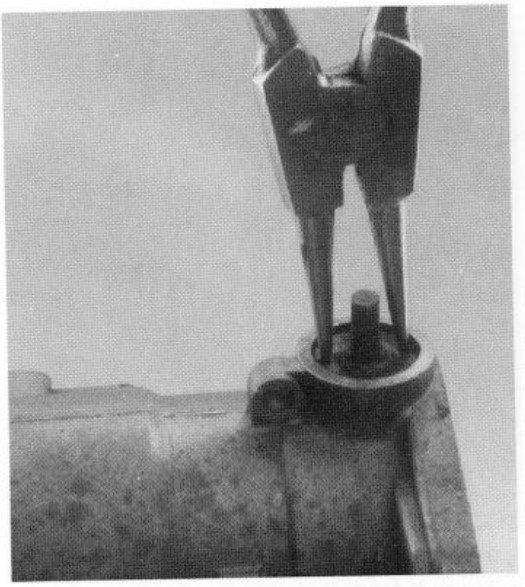
Spindle bearing maintenance. It is very unusual for bearings and spindles to actually need replacing because of wear. Frequently the spindle bearings will feel quite 'gritty' but this seldom means that the bearings are worn out.

On Dellortos the solution to 'grittiness' in the bearings' action is to

undo the spindle nuts and remove the throttle arm or cover which will expose the side of the bearing. Then, using a jeweler's small screwdriver, lever out the seal and wash the bearing out with gasoline. The seal will come out quite easily and without damage if care is taken. The gasoline will dissolve the dried grease and the action of the throttle will become smooth. Re-grease the cleaned bearings with a silicon grease or any other grease that is not affected by gasoline. Don't forget to refit the seals.

The Weber has bearings without seals, instead it has dust caps and spring covers and the spring cover is not always easy to remove. Each spring cover must be removed very carefully so as not to distort it (it's not available as a spare part). There are two small holes in the face and, ideally, a two-pronged pin wrench (spanner) is used to locate in these holes to facilitate a turning action. Suitably-sized snapring (circlip) pliers can be used to locate in the two holes and, using a small propane torch flame, apply localized heat to the bearing boss (carburetor body). With turning force being applied to the spring cover bring the torch up to the carburetor body. Once the heat expands the aluminum of the body the spring cover becomes loose and can be lifted out as it is twisted. The heat required is not great (hot to the touch will not distort the carburetor body). The dust cover will lift out and will usually have to be replaced with a new item as they do deteriorate with time and use.

Wash the bearings out and if the 'lumpy' action disappears, re-grease the bearings and replace the dust cap and cover. Replace the bearings with new items if this cleaning process fails to improve the throttle action.

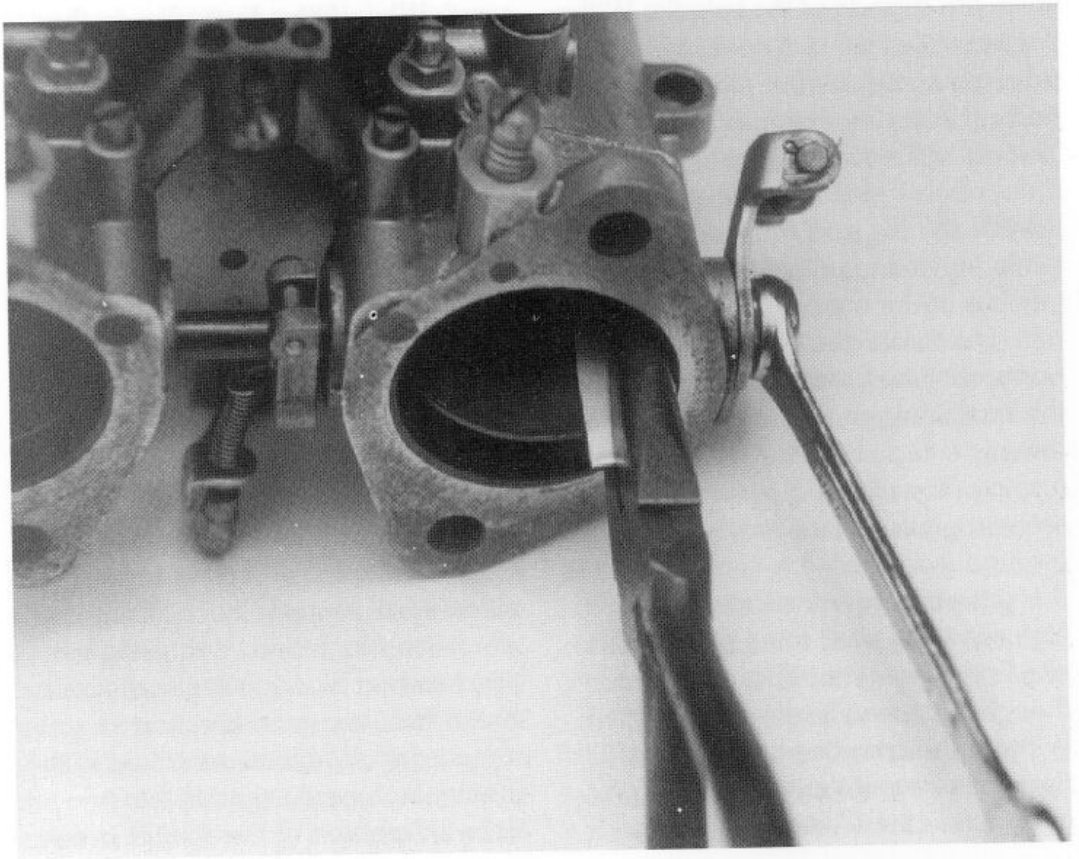


A throttle spindle dust cap being removed from a Weber using circlip pliers (after the body has been heated).

Butterfly, throttle spindle & bearings removal. The butterfly spindle bearings are not really highly loaded and bearing failure is usually caused by the sealing arrangement no longer keeping out moisture so that corrosion ruins the bearing. If the bearings have to be replaced, before starting this procedure make sure that you have new butterfly screws, nuts and locking washers on hand as well as the parts to be replaced (spindle or bearings or both).

Make sure that the washer lock tabs are bent back flat before undoing the nuts on each end of the spindle. Usually the nuts can be undone quite easily using a six-point box end wrench (ring spanner). The spindle will have to be held while the nut is undone. Use long-nosed pliers (not overly tight, just firmly enough to hold the spindle) with aluminum strip between the jaws and the spindle to protect the spindle from damage. The advantage of using the long-nosed pliers is that the spindle can be firmly

Below - Long-nosed pliers being used to hold the butterfly and spindle firmly while the nut on the end of the spindle is undone. There is aluminum shim between the pliers' jaws and the butterfly to prevent damage to the butterfly.

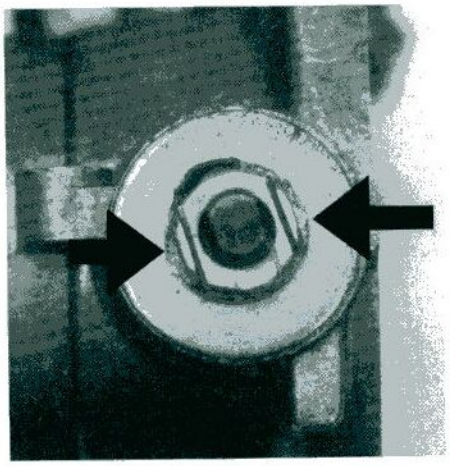


held (to preclude any twisting of the spindle) adjacent to the throttle bore wall. It seems a rough way of doing this job but it is effective and doesn't mark the spindle or butterflies.

There is no need to damage a steel spindle or the butterflies when removing the nuts at the end of the spindle. At the very worst the nut and washer are lost, but they are two of the cheapest items on the carburetor. If there is any doubt about the ability of the nut to come off easily, or if the nut fails to budge using normal force, move to the next procedure which is to cut the nut off. A brass spindle is easily damaged and will usually have to be replaced after it is removed as the threads will most likely have been damaged beyond repair.

With the carburetor clamped between bits of wood in a large vice, the throttle arm firmly hand-held, use a junior (very small) hacksaw to cut away a part of the nut adjacent to the spindle but not so close so as to cut away the threads of the spindle. With the nut cut down to the washer on one side, move to the other side of the nut and cut that side down to the washer. The nut will now be exerting a minimum of clamping pressure on the throttle spindle and can almost certainly be wound off using the remaining flats of the nut.

The throttle butterflies are held in position by two brass screws and have the protruding portion of the screw threads crimped to stop the screw turning. The crimped portion of the screw threads can be removed (ground away) using a 4mm (3/16in) diameter ball-nosed rotary file spun at high rpm in a small hand grinder. This allows the removal of the screw even though the screw is effectively ruined. Without the crimping being removed the screws are virtually impossible to get out and the screwdriver slot is



This nut has been cut in two places to release it from the spindle. Always cut off tight nuts to prevent spindle damage: nuts are cheap, spindles are not!

invariably damaged beyond further use. Once the screws are out the butterflies are slid out. Be sure to mark each butterfly for position so that it can be returned to exactly the same place (right way around, right way up) and the throttle bore from which it came. When fitting butterflies to the spindles use new screws and be sure to crimp them.

The accelerator pump arm must have its pin removed in the case of the Weber, and before the spindle can be removed from a Dellorto the screw which tensions the clamp around the spindle has to be undone, removed, and the clamp pushed over the flats and off the spindle altogether.

With the body held in a vice (between two pieces of wood) and with the spindle in the horizontal axis, the carburetor can be heated slightly around the spindle bearing housing with a small propane torch. Then the spindle can be tapped out, using very light hammer blows to the end of the thread from a copper hammer or a copper drift. With sufficient heat in the aluminum, tapping against the threaded portion of the spindle is not as bad an engineering practise as it sounds and the main resistance will, in fact, be the fit of the spindle into the bearing at the end which is being tapped. The other end will be reasonably free as the bearing will not have a full press fit with the body heated and the bearing must move with the spindle.

The spindles on Dellortos and Webers are stepped down where the bearings are fitted. The spindles are actually 8mm in diameter and step down to 7mm to fit the bearing bore's inside diameter. The threads at the end of the spindle are also 7mm diameter. The bearings are pushed into their respective bearing bores in the carburetor body until they bottom out. The length of the 8mm diameter section of the spindle matches this very closely, which gives the spindle minimal end float with near frictionless throttle action. Both carburetors are very accurately machined.

The reason for heating the carburetor slightly is to expand the aluminum. This means that for a short period of time the bore of the carburetor body has a less effective press fit on the bearing's outside diameter than when the relevant components are cold. Aluminum expands around twice the amount that steel does (coefficient of linear expansion) for the same given temperature rise. When the spindle is tapped out the bearing will come out of its housing easily and without any scoring of the internal surface of the housing bore. Whichever way the spindle is pushed out, one bearing must come out. That leaves one bearing still in the carburetor body and the other bearing fitted to the spindle.

If it is decided to replace the bearings on a Weber, the spring cover and spring and dust cover do not need to be removed separately. After the nuts and lockwashers, throttle arm,

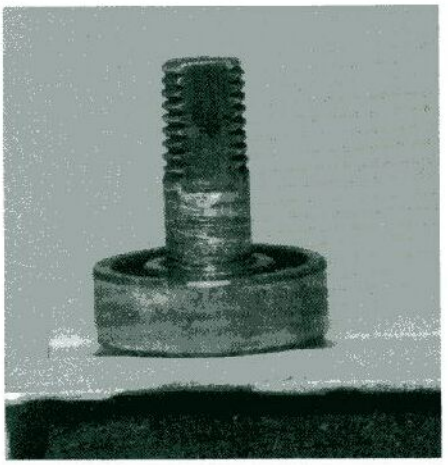
plain end cover, butterflies and accelerator pump control lever dowel have been removed, the spindle can be tapped out and these other components will automatically be pushed out. This method removes the possibility of damaging the spring cover.

The butterfly screws can usually be undone simply by turning them out, however, the screwdriver *must* be a perfect fit in the slot of the screw. Even though the screws are crimped, they'll usually wind out without damage, though it is always better to grind or file off the crimping before screw removal if you can. If you do re-use the screws, use thread locking compound and remove the protruding thread ends after installation because the previously crimped section will have become brittle and may break off and enter the engine.

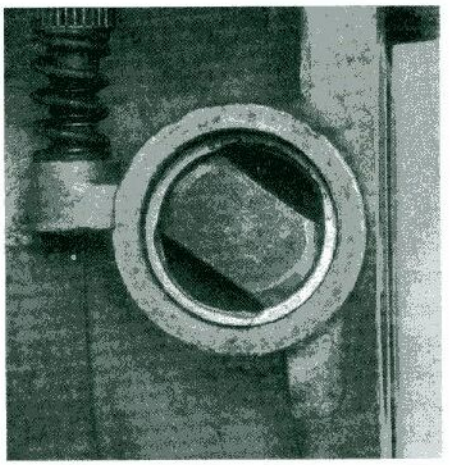
The dowel that locks the accelerator pump control arm is removed with a pin punch that is a maximum of 1.9mm (0.074in) in diameter. This lever is usually reasonably loose on the spindle.

Next, the carburetor body should be heated gently to reduce the effective fit of the non-aluminum components and the spindle can then be tapped out. The spring cover will come out first, followed by the spring, the dust cover and then the bearing still attached to the spindle. The remaining bearing is removed with a 8mm (5/16in) diameter rod with the spring cover, spring and dust cover coming out before the bearing.

The bearing fitted to the spindle can be removed by sitting the spindle loosely between vice jaws (1.5mm [1/16in] per side of the spindle) with the bearing sitting on top of the jaws and tapping the spindle out using a copper hammer or drift. The vice jaws must be flat across the top and a shim placed between the spindle and the jaws to protect the spindle.



Throttle spindle bearing resting on top of vice jaws and the spindle about to be knocked out. Use a soft copper hammer or an aluminum drift to hit the end of the spindle. Tap the spindle square on.



Outer bearing race ground away enough to allow a specially made piece of flat bar to neatly fit into the bearing and be turned 90 degrees. A long drift can be used to push against the flat bar with the knowledge that it is securely locked into the race. Heat the carburetor body before shifting the race.

To remove the last bearing polish down 8mm stock rod (or use a 5/16in diameter rod) 180mm (7in) long until it is clearanced to fit into the spindle bore and apply localized heating to the area around the bearing. The rod can then be inserted into the carburetor body until it contacts the inner part of the ball bearing and then the bearing can be tapped out using light hammer blows to the end of the rod - don't forget to heat the carburetor body.

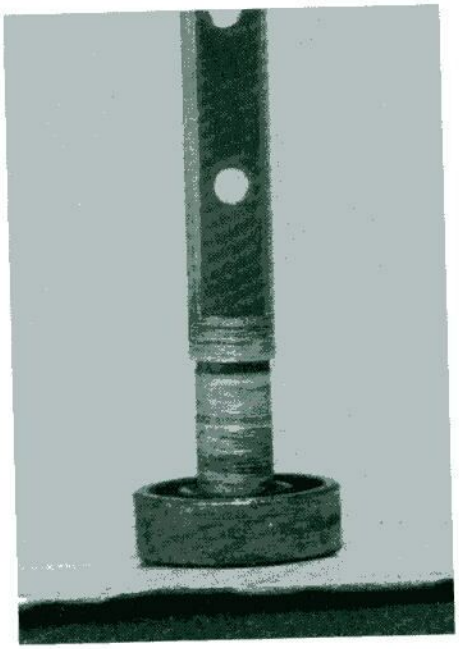
If the bearing does not come out of the housing in one piece, it has totally collapsed and the outer race may now be firmly stuck in the housing of the carburetor body. There are a few ways that the bearing outer race can be removed. The first is to hold the carburetor body in a vice, between pieces of wood, with the offending bearing facing the ground and then, using a small propane torch flame, gently heat the bearing boss area of the carburetor body (from dead cold) and see if the bearing outer race simply falls out (aluminum expands and gravity causes the outer race to fall out).

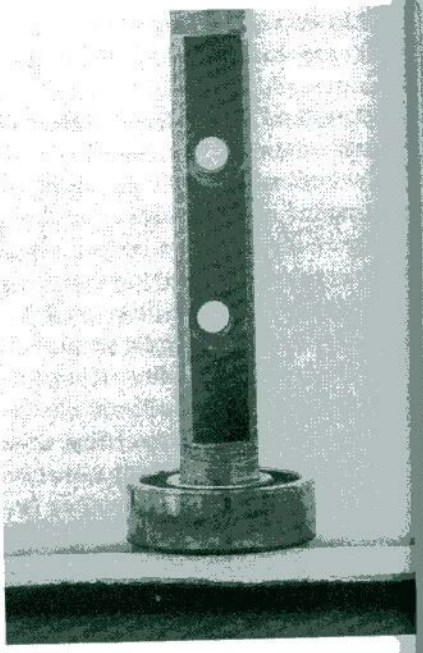
The second way is to make a special tool out of 3mm deep by 10mm (0.125 by 0.375in) wide mild steel flat bar cut to a length of 16.5mm (0.65in). Radius the ends of the tool to give it, in effect, a 16.5mm (0.65in) diameter (to fit the groove in the bearing housing). Then, using a small high-speed grinder, grind away the edge of the bearing race in two places 180 degrees apart so that the strap can be fitted into the bearing and then turned thru 90 degrees to lock into place. It can then be used, in conjunction with a thin drift, to drive the bearing race out (after heating the carb. body).

The third method of removing a stubborn outer race is to grind two grooves into the bearing outer (in line with the spindle axis) so that the bearing collapses and comes out in two halves. This requires care because it is very easy to grind too deep and

cut into the aluminum of the body. When the grooves are nearly through the steel of the bearing there will be no strength left to hold the bearing outer in the hole as a press fit. This is the last resort method of removing the bearing outer and it will always work.

The bearings should be a light press fit in the carburetor body (size for size) but invariably the odd bearing is going to be loose in the casting. Check to see if the new bearings are going to be a light press fit in the carburetor body. If the new bearings are loose and simply fall in, a proprietary retaining compound can be used to correct the situation. The fit tolerance between the bearing being a light press fit or just falling into the bearing seat in the carburetor body is only a matter of a thousandth of an inch or hundredths of a millimeter.





Photos show a spindle being tapped into a new bearing. Use a copper hammer or an aluminum drift to tap the spindle into the bearing. The spindle is guided to a large degree, but do make sure the spindle is square to the bearing and that the bearing is placed flat on the top of the vice jaws.

Spindle and bearing refitting. Assuming that all bearings have been removed from the carburetor body, proceed as follows.

On the Dellorto the spindle goes in one way only. The accelerator pump arm slot is positioned on the right hand side when the carburetor is viewed from the butterfly side.

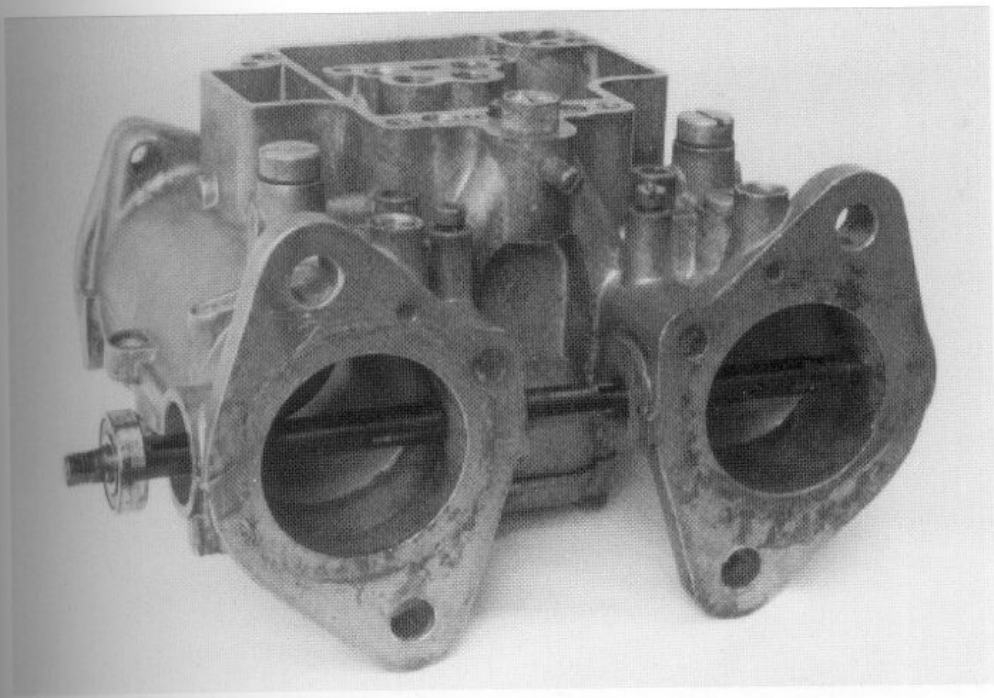
The Weber accelerator pump control arm fits on one way only and the spindle has to pass through it now but the spindle can go in either way. The lever faces inwards and must be the right way up (check the exploded diagram). If the accelerator pump control lever is new, check to see if it goes over the spindle. If it doesn't it will have to be reamed out with an adjustable reamer until it does.

Next, the spindle is fitted with a bearing (at either end). Put some oil on the end of the spindle and in the bore of the bearing. Place the bearing over the end of the spindle and you will note that a portion of the thread will protrude (about 3.3mm/0.132in). This means that the spindle is located into the bearing's bore. You will also note that the threaded portion has a flat on it. Using a good vice which has a level top, open the jaws up to 5mm (0.20in) and place the protruding threaded end of the spindle into the gap between these jaws. With the bearing on the top of the vice jaws and the spindle in the vertical position tap the spindle into the bearing. The jaws are opened wider than the spindle size to allow the spindle to pass on down without interference. Tap very gently (square on to the spindle) using a copper mallet. The spindle will go in slowly and, when it can go no further, the sound of the tap will change (heavier sound) as the spindle bottoms out on the bearing inner race.

The spindle is reasonably strong and it is acceptable to fit the bearing on to the spindle in this manner. The bearing and spindle are, more or less, self-aligned before fitting because of the thread diameter (being 7mm) acts as a pilot.

With the carburetor held in a vice between two pieces of wood, insert the spindle into the carburetor body (the correct way around) and push it all the way in until the bearing contacts the side of the carburetor. Leave the spindle in this position and place the other new bearing to be fitted on to the threaded portion of the other end of the spindle. Run some oil around the outer diameter of the bearing. Apply heat to the bearing area of the carburetor body and, using a long socket 19mm (3/4in) in diameter and a small hammer, tap the bearing into the carburetor bore. As the bearing enters the carburetor the spindle will move out of the other end of the carburetor.

The spindle is fitted in this man-



A new bearing in position on the spindle (which is there to act as a guide while the bearing is gently tapped into the carburetor body). The spindle just goes back as the bearing goes into the bore of the carburetor body.

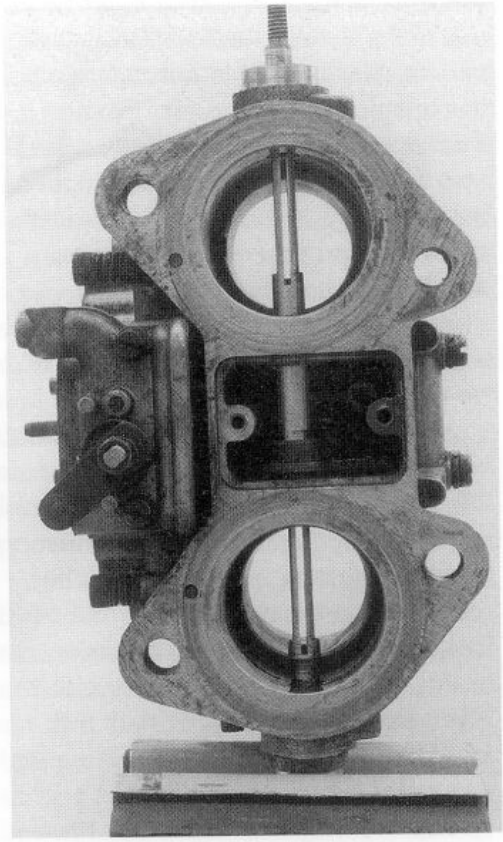
ner to act as a guide for the bearing. By being fitted to the spindle the bearing is more or less dead in line with the spindle and bearing bore axis. There is little chance of 'picking up' the aluminum of the carburetor body when it is fitted.

It is standard engineering practise to use heat when fitting steel parts into aluminum items that are supposed to be a press fit when assembled. This is done to ease fitting and make sure than the aluminum surfaces in contact are not scored during assembly and that the size of the aluminum part is always maintained. This is not to say that the spindle and bearings cannot be installed satisfactorily with all parts cold; they can be and usually are.

An alternative way of fitting the bearing (without heating) is to oil the outer surface of the bearing and the inside of the carburetor boss and, using a squared-off piece of tube or a long socket the same diameter as the bearing outside diameter, tap the bearing into the bearing housing. Not too much force is required to do this. During this process continually check to see that the bearing is square on to the bearing housing so as to avoid misalignment and possible damage to the carburetor body.

The next operation is to press the spindle into the centre of the bearing already installed in the carburetor housing and, at the same time, the bearing already fitted on the spindle is also fitted into the carburetor housing. Oil the spindle shank to be pressed into the bearing and oil the inside of the bearing bore in the carburetor body. Oil the outer surface of the bearing already fitted to the spindle and oil the aluminum of the bearing bore of the carburetor body.

The carburetor body is held manually (get assistance) in the vertical position on top of vice jaws with a 3mm (1/8in) thick washer 19mm (3/4in) diameter and a hole not less than 7mm (5/16in) in diameter or more than 9mm (3/8in) in diameter between the bearing and the top of the jaws. This is to prevent the bearing being pushed back or out of the carburetor housing as the bearing already fitted to the body is actually recessed slightly. With the washer in place and the end of the spindle between the vice jaws set at not less than 5mm (0.20in), apply heat to the area around the bearing bore in the carburetor. Using a long socket with a nominal inside diameter of 7mm (0.312in) and a depth of at least 10mm (0.400in), tap the bearing into the carburetor body. With the body heated, the main resistance is going to be the pressing of the spindle into the bore of the bearing



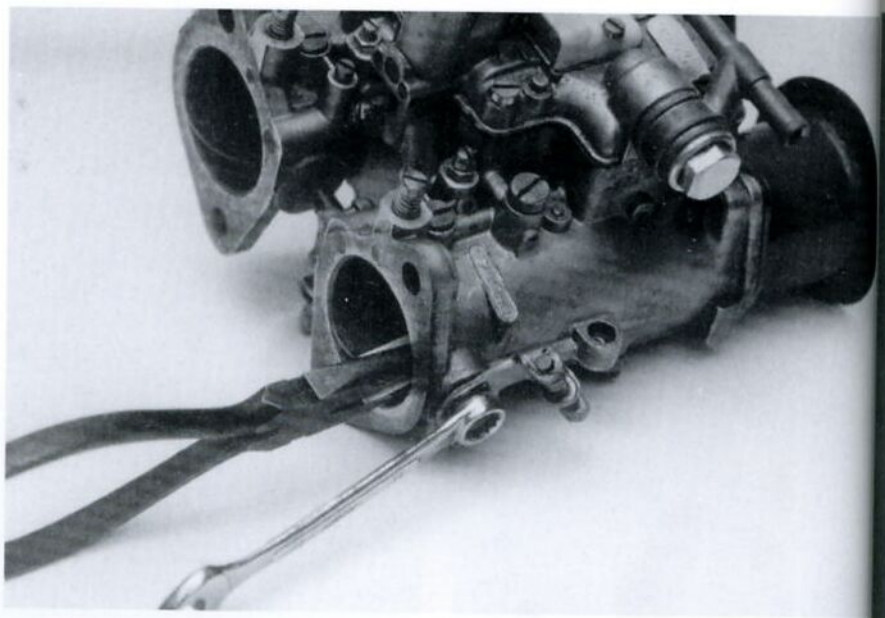
A spindle, with the bearing already pressed on, being tapped into the carburetor body. The other bearing has already been tapped into place. To prevent that bearing from moving, a washer is placed between the bearing and the flat surface of the vice top. This method requires assistance.

on top of the vice jaws. The bearing and spindle are seated when the sound of the tapping becomes more 'solid' as the spindle contacts the side of the bottom bearing and the top bearing contacts the aluminum of the carburetor body. Allow the carburetor body to cool.

On Weber carburetors make sure that the bearings are packed with grease then fit the dust cover and spring and finally the spring cover. Oil the edge of the spring cover and tap it into place using a long socket with an outside diameter of 19mm (3/4in). Tap the spring cover into the body until it is below the height of the shoulder where the 7mm diameter of the spindle starts: this way it will be out of the way of the throttle lever or end washer and will not interfere with the opening of the throttle. Fit the throttle arm to its end of the spindle and tighten the nut reasonably tight so it is easy to open and shut the throttle while checking the butterfly positioning. Make sure that the slot in the throttle arm is a tight fit on the spindle: if it isn't, the throttle arm will have to be replaced with a new item.

The Dellorto has both side bearings sealed and has a small spacer fitted between the bearing and the end cover or throttle arm. This is a much less fussy system than on the Weber.

Both carburetors have lockwashers and nuts to be tensioned and tabs to turn up to lock the nuts in place. The washers are slotted and locate on to the spindle flats. The nuts can only be tensioned while the spindle is firmly held otherwise the spindle can be damaged. Long-nosed pliers with aluminum shim (0.1mm/0.040in) between the jaws and spindle is quite satisfactory. The pliers' jaws should be positioned in the throttle bore adjacent to the nut being tightened and next to the throttle bore wall. That completes the spindle and bearing fitting.



A pair of long-nosed pliers holding butterfly/spindle (with alloy shim between the plie jaws) while the spindle nut is tightened.

The accelerator pump mechanism can now be fitted. With the Dellorto the arm slides over the spindle (full throttle position) and the screw is inserted into the hole and tightened and the top spring connected. The Weber uses a pin to locate the accelerator pump lever arm on the spindle and to hold it in place. The pin is tapped into the arm until it is flush.

Fitting throttle butterflies. Dellorto butterflies are in the correct way around when you can see the numbers below the spindle and the progression holes sweep recesses (if present) at the top of the throttle bore. Weber numbers are positioned in the same place as Dellorto and sometimes on the other side of the butterfly, which means that the numbers are inside and out of view. Some butterflies have sweep slots and some do not. If the butterflies are not centralized correctly the engine may never idle as slowly as it should because the throttle can't be fully closed (shut tight to eliminate all air passing through).

Fit one butterfly through the slo in the spindle and put the two screw in but do not tighten them yet. Ope and shut the throttle a few times to the butterfly situated as centrally as possible and then tighten the two screws. Now look in through the throttle bore from the trumpet side and see how much light there is around the outer diameter of the butterfly. The amount of light must equally distributed around the perip ery of the butterfly and be as thin a band of light as possible (0.025mm 0.001in or less). If the butterfly is offset, more light will be visible on o side than on the other. There is a certain amount of clearance betwee the holes in the butterfly and the screws to facilitate adjustment of the butterfly's position to optimum.

Once one butterfly is set correc move on to the other butterfly and

Dellorto butterflies with the progression hole sweep slots and the numbers clearly visible.

there is a problem in getting that butterfly central at least you know which butterfly is causing the problem. If the two butterflies are being set up together it can be difficult to actually see which butterfly is not central. It is quite possible to get the butterflies to shut off completely.

If a butterfly cannot be centralized this will usually be due to an unfortunate combination of manufacturing tolerances. The holes in the butterflies will have to opened out (elongated) using needle files to give more clearance to the screws. To check for which way to remove material from the butterfly remove the screws and shut the throttle carefully. It does not take much butterfly deviation from the central position to cause the throttle to jam. Depending on the amount of mismatch it will usually be possible to see a part of the butterfly through the holes in the spindle. Remove that part of the butterfly that you can see. If it proves difficult to see the butterfly, remove it and polish it so it is easier to see. Hand file the butterfly hole for more clearance until the butterfly fits properly.

The fit is correct when both butterflies have as near as possible equal bands of light around their respective diameters (view this from the trumpet side of the throttle bore). **Note**: make sure that the throttle arm stop adjusting screw is wound back well out of the way so that it is not interfering with the shutting off of the throttle during the butterfly fitting and checking procedure.

Remove each screw in turn (only one at a time) and apply some proprietary thread locking compound to the thread. Refit the screw and tension it as tightly as possible within the confines of the strength of the screwdriver slot. **Caution!** The protruding screw threads should be crimped as well just to be absolutely sure that the screws don't come out and end up going into the engine. The spindle (screw heads actually) has to be supported or rested on a bar of aluminum which goes up into the throttle bore. An aluminum flat bar 35mm by 10mm (1 5in by 0.375in) clamped in a vice with about 50mm (2in) sticking above the jaws will provide a suitable rest for the spindle. With an assistant to hold the carburetor in position, use a long pin punch to get down the carburetor throttle bore from the trumpet side and peen over the top of each side of each screw sufficiently so that, even if a screw did come loose, there is no way it could wind out of the spindle.

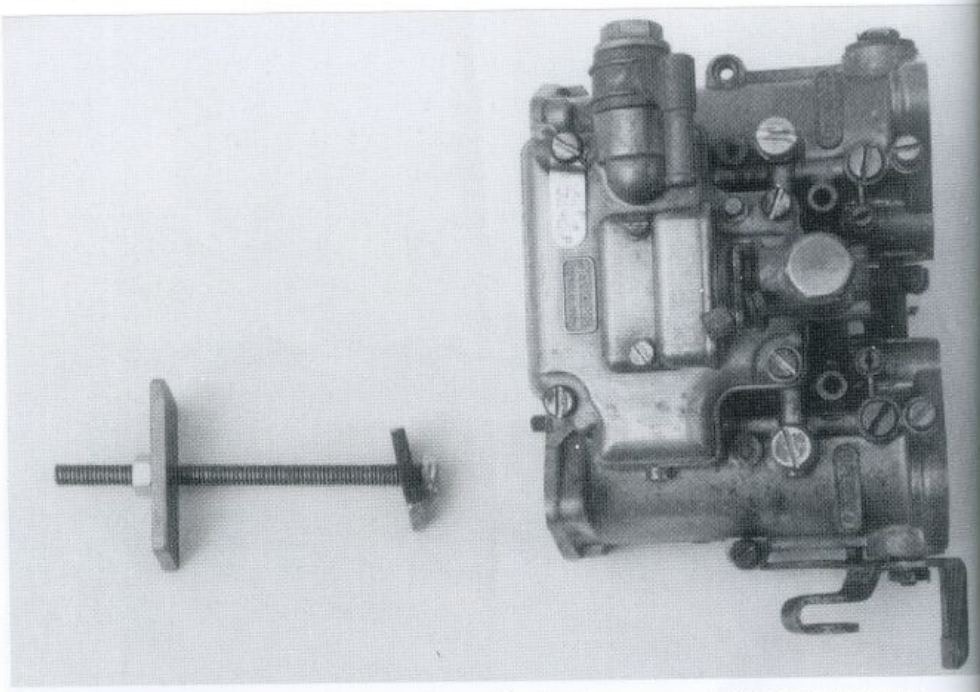
Check to see that the butterflies are at 90 degrees when the throttle is fully opened. If they are over centre the stop on the throttle arm is not in the correct position. Fit a new one or put a run of braise on the stop and file it down until the butterflies are 90 degrees with the lever on the stop.

Removing damaged threaded components

When working on these carburetors it is important to use the right screwdriver head size for the particular slot size of the screw plug and a six-sided box end wrench (ring spanner) and not a twelve-point to avoid damaging components. Reasonably well-maintained carburetors handled with reasonable care never get into a poor state of repair.

Usually threaded jets and other threaded components can be easily removed. If any component is well and truly jammed, with the screwdriver slot no longer usable or partially broken, the carburetor body will have to be taken to a precision engineer to have the damaged part bored out. To do this the carburetor body is mounted in a machine vice which is bolted to the table of a vertical milling machine (Bridgeport or similar) and the centre of the damaged part lined up (perfectly) with the spindle of the machine.

The centre of the jet is then milled out with a milling cutter and a drill used to take out the final amount of material so that all of the component is removed without damage to the threaded portion of the carburetor body. The milling cutter (three flutes) or a slot drill (two flutes) is used in the first instance as it will bore true. Twist drills tend to wander in anything less than perfect circumstances (these are not perfect circumstances) and are used only to open out an existing true bored hole. The remaining thread of the damaged part can be picked out with an engineer's scriber.



Photos show a simple-to-make puller for the removal of jammed chokes.

Removing jammed chokes and auxiliary venturis

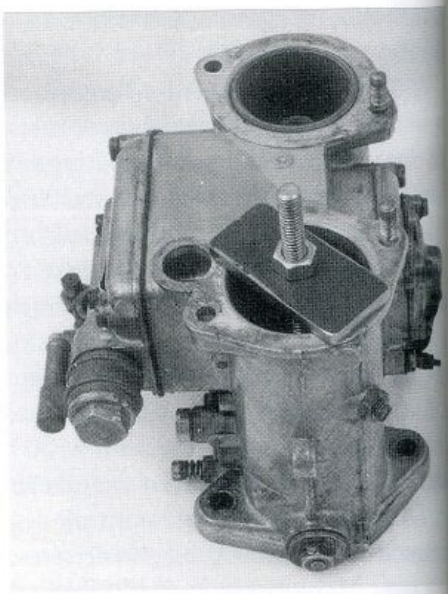
Usually the chokes and auxiliary venturis will come out easily. If they do not it is usually because of corrosion and the ensuing build-up which effectively removes the sliding fit of the choke and auxiliary venturi in the throttle bore. Chokes, and to a much lesser extent auxiliary venturis, can become severely jammed and a considerable amount of force can be required to remove them. All jammed chokes can be removed without damage to either the carburetor body or the choke.

Check to see that the locking screw has in fact been removed from the carburetor body. Auxiliary venturis are removed by inserting a length of 12.7mm (0.5in) wood dowel through the back of the carburetor throttle bore (one side of the opened butterfly) and contacting the bridge section edge that connects the outer diameter of the auxiliary venturi to the central nozzle. The Weber has two sections that join the outer diameter of the auxiliary venturi to the nozzle, while the Dellorto has one. The wood dowel can be alternated between the two sections when removing Weber auxiliary venturis, while the Dellorto only has one section.

It is not usual for the auxiliary venturi to be too tight. Spray penetrating oil down the throttle bore from the trumpet side of the carburetor and wait for ten minutes for it to soak in before continuing. The wood of the dowel will become indented and possibly split but there will be no damage to the auxiliary venturi. Light hammer blows to the end of the dowel are all that is required to remove the auxiliary venturi.

The chokes on the other hand, can be well and truly tight but once again they invariably come out. The chokes are drawn out using a custom-made puller as shown in the accompanying photos.

The plate that fits in behind the choke has to be made to suit the actual choke which is to be removed. The end plate is made 2mm (0.093in) larger than the diameter of the choke to be removed. The end plate is made out of 20mm (0.78in) by 6mm (0.236in) mild steel bar and has a hole drilled through the centre. This hole then elongated using a file so that it becomes 11mm (0.437in) long. The reason for the elongated hole or slot to allow the end plate to be angled so that it can be inserted in through the



A choke puller installed. The puller's bottom plate is behind the choke to be removed and the nut is about to be tensioned. The carburetor body may have to be heated to get the choke to move.

choke. The outer edges of the end plate are chamfered to suit the taper of the choke so that both tapers fit each other as closely as possible. As a precaution against marking the inside of the choke with the bottom plate, place some thin cardboard between the end plate and the choke's surfaces before the bottom plate is pulled up to contact the bore of the choke.

The main puller rod is 8mm (0.312in) diameter threaded bar stock and is cut to 110mm (4.25in) long. One end of the puller has a Nylock nut (a half nut or a cut down standard Nylock) and the other is just a plain hexagon nut.

The other parts of the puller are the same no matter what carburetor type or size is having a choke removed. The outer end plate is made of 20mm (0.78in) wide by 8mm (0.314in) thick mild steel flat bar and will have to be 55mm (2.16in) long and have a hole drilled through the middle with clearance on it to suit the diameter of the main puller rod.

The puller is inserted into the carburetor's throttle bore with the plate angled (as shown in the photo) and through the actual choke. The angled position of the plate allows the bottom plate to pass through the choke diameter and, when straightened, lock into the taper of the choke.

The top nut is wound down firmly on to the top plate (by hand) and then tensioned with a wrench (spanner), which will ultimately remove the choke. If the choke still refuses to move even with considerable tension on the nut, keep the tension on and heat the carburetor body (approximately where the choke is) with a small propane gas torch. The body of the carburetor will absorb the heat and expand and, in so doing, momentarily become larger than the choke's outer diameter before the heat is transferred to the choke. Minor hot-to-the-touch heat only is applied to the carburetor body (excessive heat may distort it).

With the choke removed, clean the throttle bore using 280 or 320 grit wet and dry paper and kerosene (paraffin) until the surface inside is as near to polished as possible. The surface will not usually take a polish because it will be too stained. Clean the choke's and the auxiliary venturis' outside diameter with wet and dry abrasive paper and the choke and auxiliary venturi will then be an easy fit into the throttle bores (the sliding fit or tolerance is approximately 0.1mm/ 0.004in).

Chapter 2
REBUILDING

With all parts spotlessly clean and an equally clean working area, the rebuild can begin. Check the position of all parts against the exploded view of your particular carburetor/s. The rebuild procedure that follows also lists the parts that need to be checked for wear and possible replacement.

NEEDLE VALVE & SEAT (DELLORTO)

Assembly starts with the fitting of the needle and seat body into the carburetor top. Put the aluminum washer over the seat body and screw it in. Using a six-sided box end wrench (ring spanner) tighten using reasonable tension. There is no need to go too tight as the thread is not large. Place the gasket on to the carburetor top as this must be in position before the floats are installed.

FLOATS & FULCRUM PIN (DELLORTO)

Fulcrum pin - checking

Check the floats' fulcrum pin for wear grooves and, if there is any wear, replace it. The pin, after some use, will have rub marks on its surface but this does not mean it is actually worn. Unacceptable wear can be measured with a vernier calliper or micrometer. The pin first goes into the hole in the post without a slit as this is a clearance hole for the pin. The post with the slit is the one that applies tension to the pin by lightly clamping it when the pin is pressed into position. The post is able to expand slightly when the pin is pressed in because the slit allows movement.

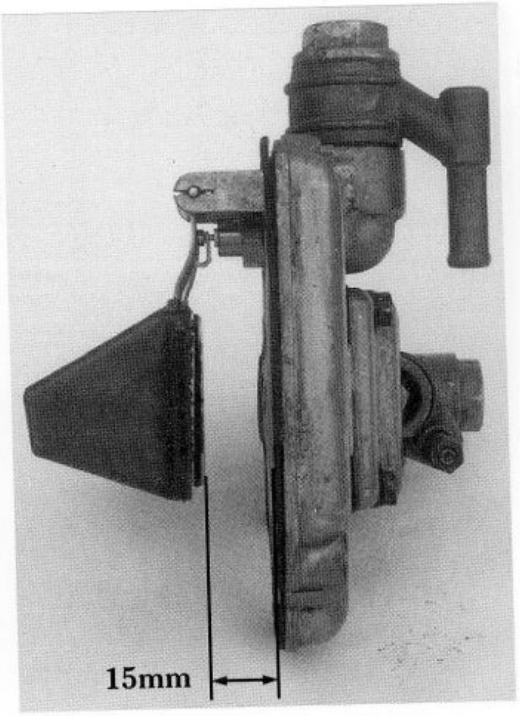
Floats - checking

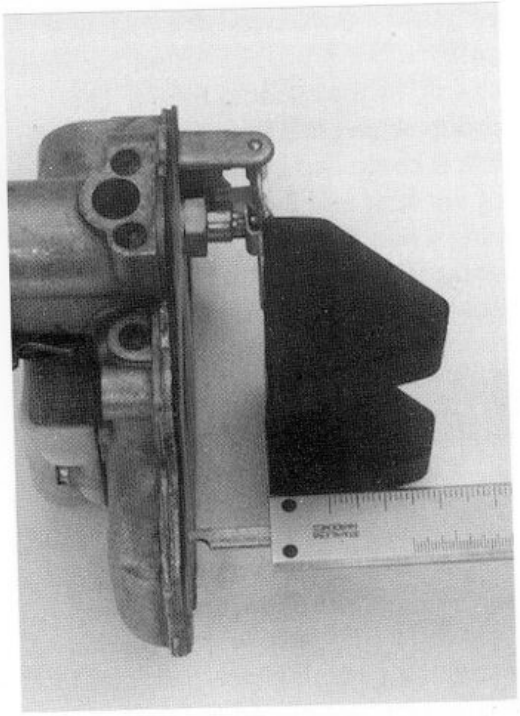
If the carburetor is known to have done a lot of work, replace the floats. If they appear to be in serviceable condition place the pin in through the eyes and check to see how much movement there is between the pin and the eyes. Shake the float and listen for the sound of fuel sloshing around inside it as this indicates a leak. Place the float in a bowl of fuel to check that it floats. Immerse the float in the fuel and check for air bubbles. Air bubbles indicate an air leak. Check new floats for leaks in the same manner, just to be sure.

The pin should be able to rotate quite freely but any excessive slackness should be removed. This is done by squeezing the floats' hinge loops using needle-nosed pliers. The aluminum can be squeezed in a progressive manner to fit the pin very closely but not too closely as this may cause the float to bind on the pin during operation, which could lead to flooding. The pin fit in some floats is very loose which is not conducive to accurate fuel metering by the floats.

Floats & pin - fitting

The needle is fitted into the seat body first, then the floats assembly is lined up with the posts and the spring-loaded head of the needle and moved across so that the two small tabs fit under the head of the needle and seat. Fit the fulcrum pin into the post (without the split in it) and push it through to the second post (the one with the split). When the pin is close to the split post, line it up exactly with the hole and carefully tap it in. The pin should be tight when fitted. If the pin goes in very easily the post may not be putting any tension on the pin. If so, place the pin between the posts so that the ends of the pin protrude an equal amount from each post and, using pliers, squeeze the split post slightly. It doesn't take much to 'tighten' the hole so that it exerts sufficient clamp to retain the pin.



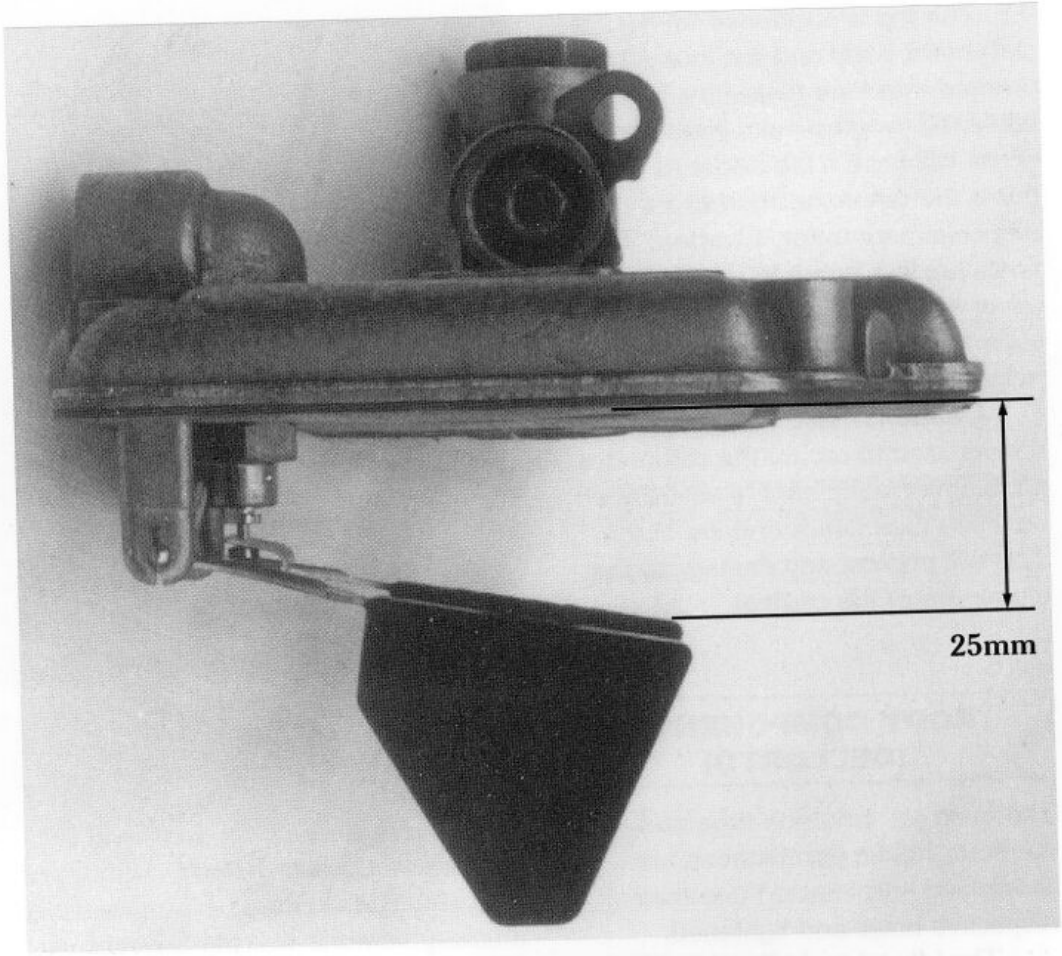


Dellorto floats being set at 15mm when the needle is just seating.

FLOAT LEVEL - SETTING (DELLORTO)

The float height is 15mm (0.594in) and it is measured with the gasket in place. A rule can be used to measure from the gasket to the top edge of the float. The needles are spring-loaded which means that the needle will seal on its seat but the float will still keep moving. The float level is measured when the needle just contacts the seat. This measurement is checked with the carburetor top held on its side. If the top is tilted the needle will be seen to move out from the seated position. If the top is slowly tilted back the needle will move in towards the seat and, when it stops moving, this is the point at which the distance between the float and the gasket must be measured.

The two floats must be set equally. This is achieved by twisting the aluminum arms using long-nosed



Dellorto floats being set to 25mm droop.

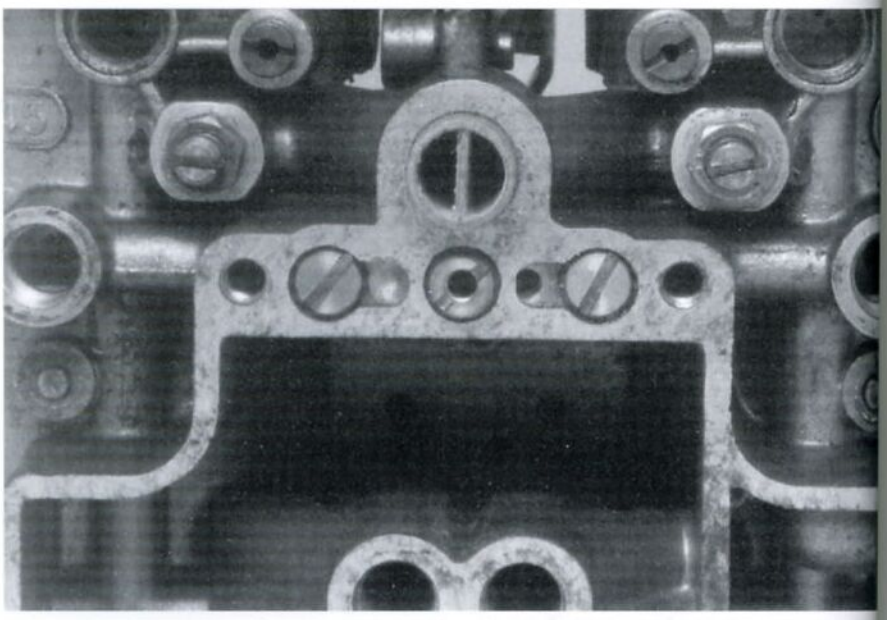
pliers. The arms bend reasonably easily and it is possible to set the floats exactly as they should be set. The droop setting is 25mm (0.985in) and this is controlled by the tab at the back of the float and the float stops dropping when this tab contacts the seat body. This tab can be bent with long-nosed pliers to reduce or increase the droop measurement.

TOP COVER (DELLORTO)

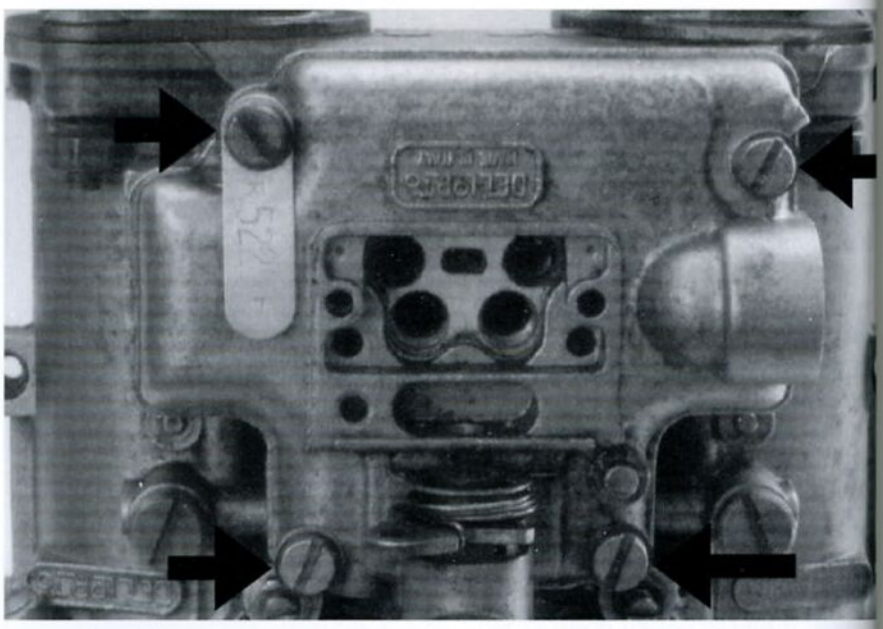
The carburetor body is prepared next so that the top can be positioned and screwed on to it. The starter jet is screwed in (if it was removed), the accelerator pump check balls and then the weights are placed in their respective holes. The screw-in plugs are fitted above these two items.

The top is positioned on the carburetor body and the four screws inserted into their respective holes and tightened progressively. Note that one screw will have a tab under its head; this is the reference number for the particular carburetor. **Caution!** The floats are less prone to damage if the cover carrying them is installed as soon as possible after setting the float height.

Caution! Make sure that all of the screws used to secure the carburetor parts to the body have washers fitted between their heads and the body. This will prevent any damage to the aluminum of the castings.



The jetting that has to be in place before the top cover is fitted.



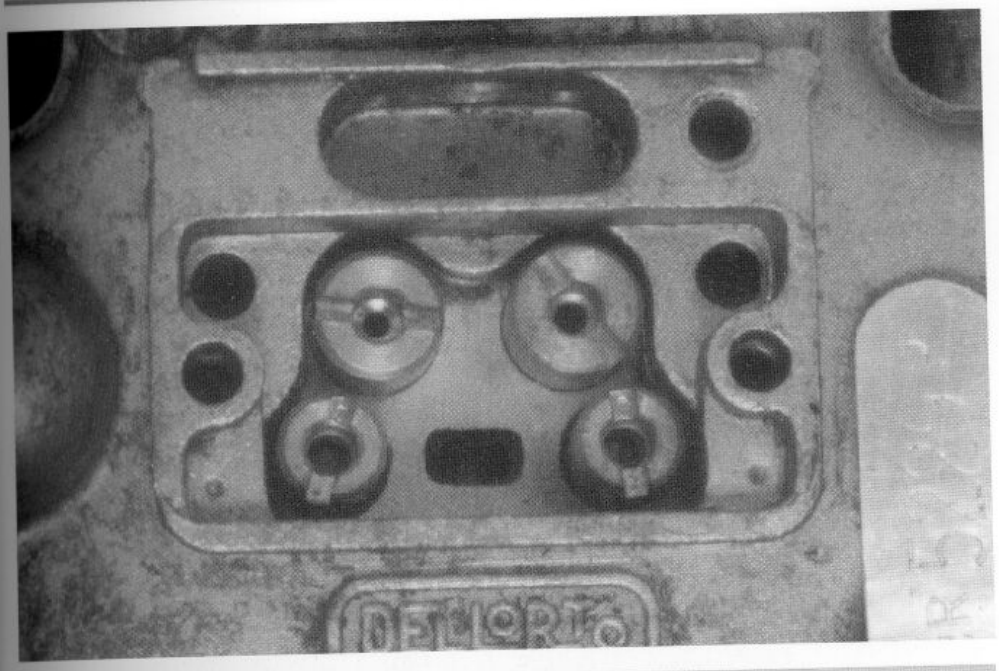
Carburetor top cover fitted and four securing screws (arrowed) tightened.

BODY COMPONENTS (DELLORTO)

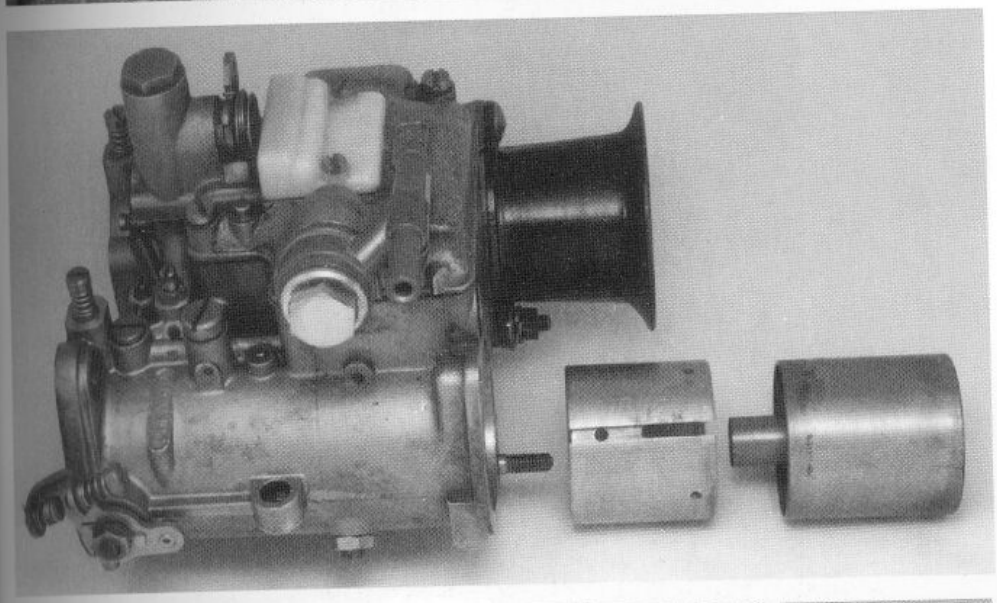
The main jet, emulsion tube and air corrector holder combination are assembled and inserted into their respective holes and tightened.

The idle jet and idle jet holder are assembled and inserted into their respective holes, tightened and then the cover is placed over them and its two screws tightened.

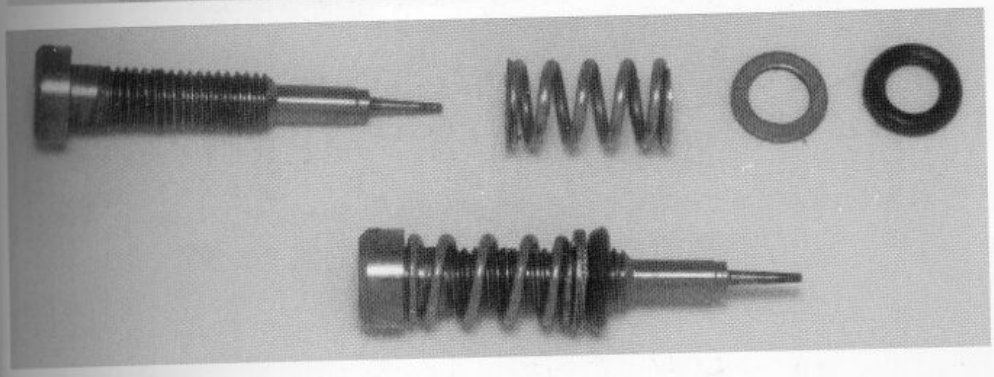
The chokes first and then the auxiliary venturis are now inserted into the carburetor body and the retaining screw turned in until it firmly contacts the auxiliary venturi. The nut is wound down till it contacts the carburetor body and tensioned using a six-point box end wrench (ring spanner). Reasonable tension is applied to the nut while the screw is held with a



Dellorto carburetor top with the inspection cover off showing the emulsion tube holders and the idle jet holders.



Choke and auxiliary venturi positioned in front of a Dellorto carburetor. Fit the choke first, then the auxiliary venturi.

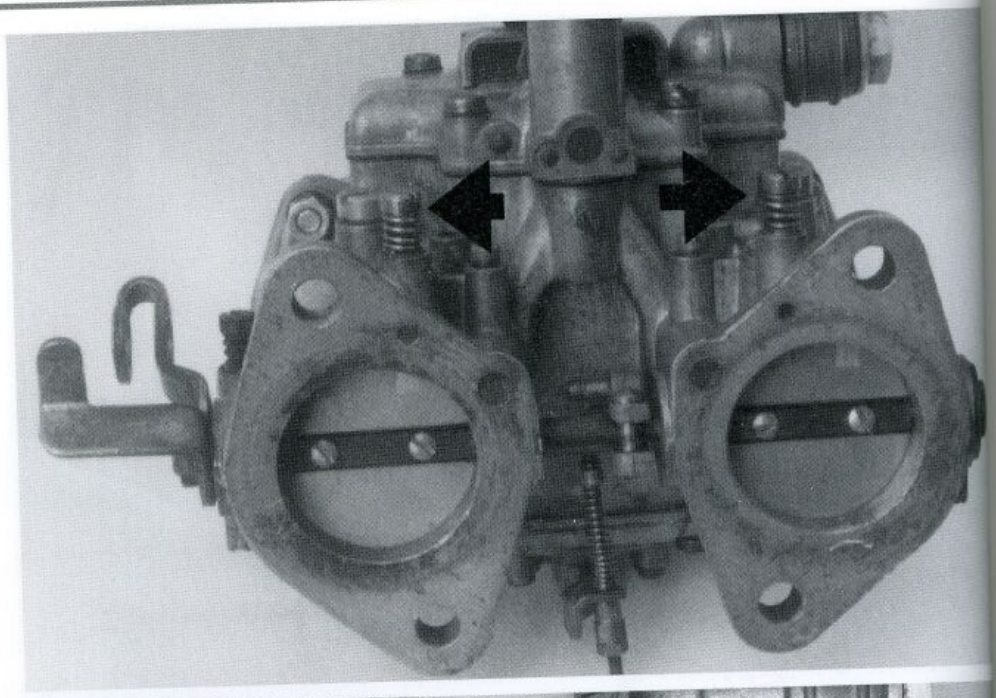


Dellorto idle mixture screw components (above) and correctly assembled (below).

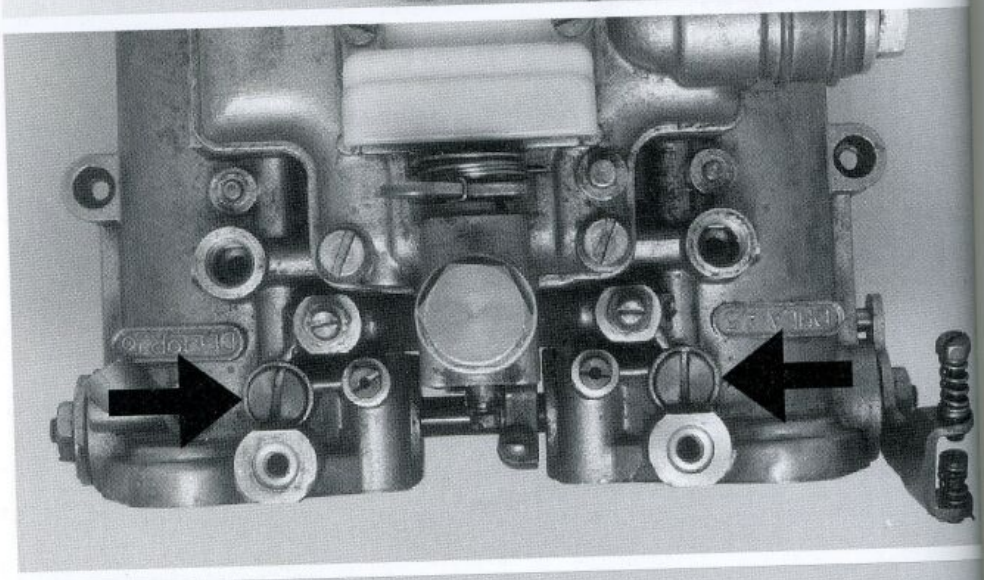
screwdriver. This method of screw and nut locking only comes loose if the nut is not secured correctly.

Screw in the idle mixture adjusting screws. Make sure that the spring, washer and the small rubber O-rings are positioned in this order before screwing them in.

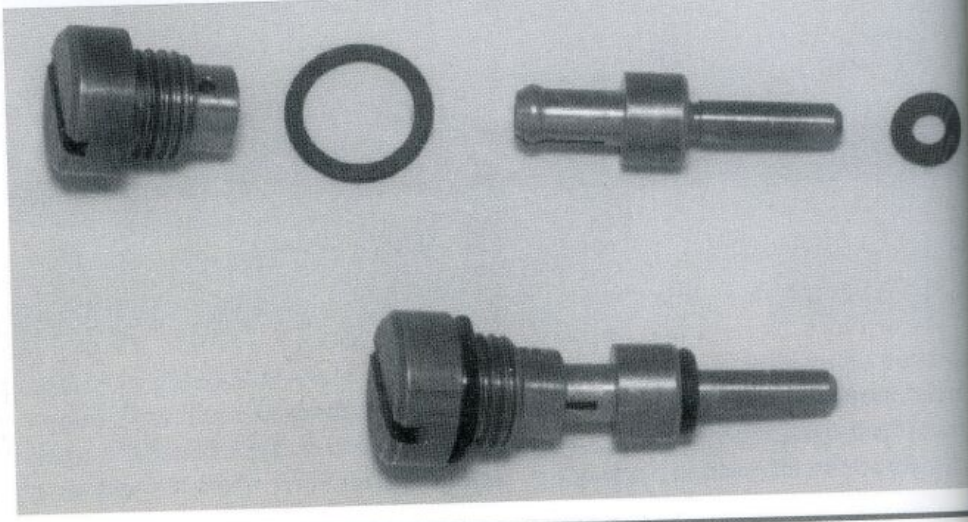
Dellorto idle mixture adjusting screws (arrowed).

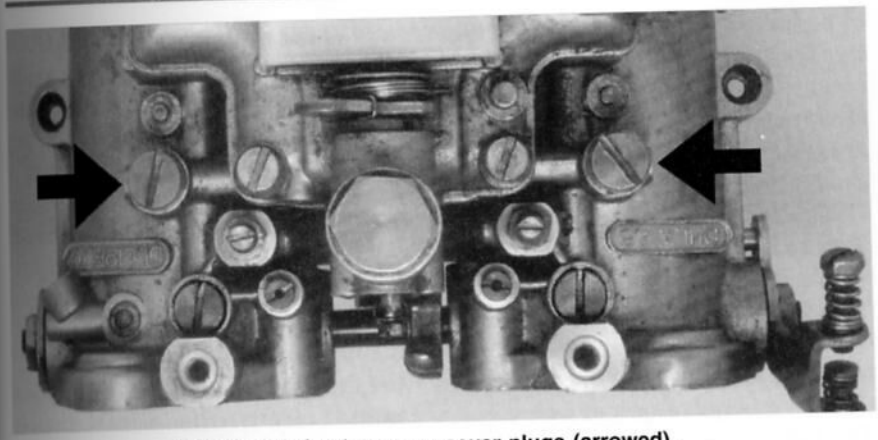


Dellorto progression hole cover plugs (arrowed).

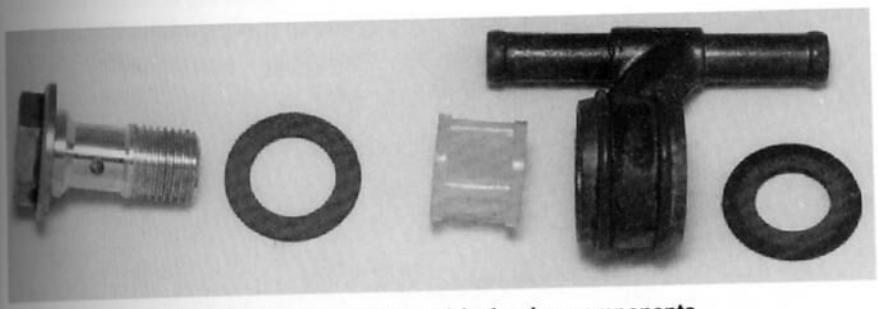


Dellorto accelerator pump jet and cover plug individual components (bottom) and assembled (top).





Dellorto accelerator pump cover plugs (arrowed).



Dellorto integral fuel filter and fuel union components.

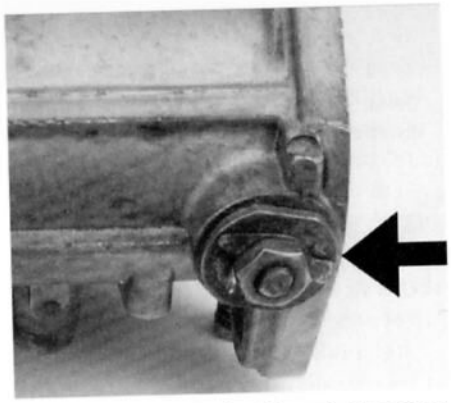
Screw in the progression hole plugs.

The accelerator pump jets are pressed into the screw plug and then inserted into their respective holes and tightened. Make sure that the small rubber O-ring is fitted to the pump jet and that the fibre washer is fitted under the screw-in plug.

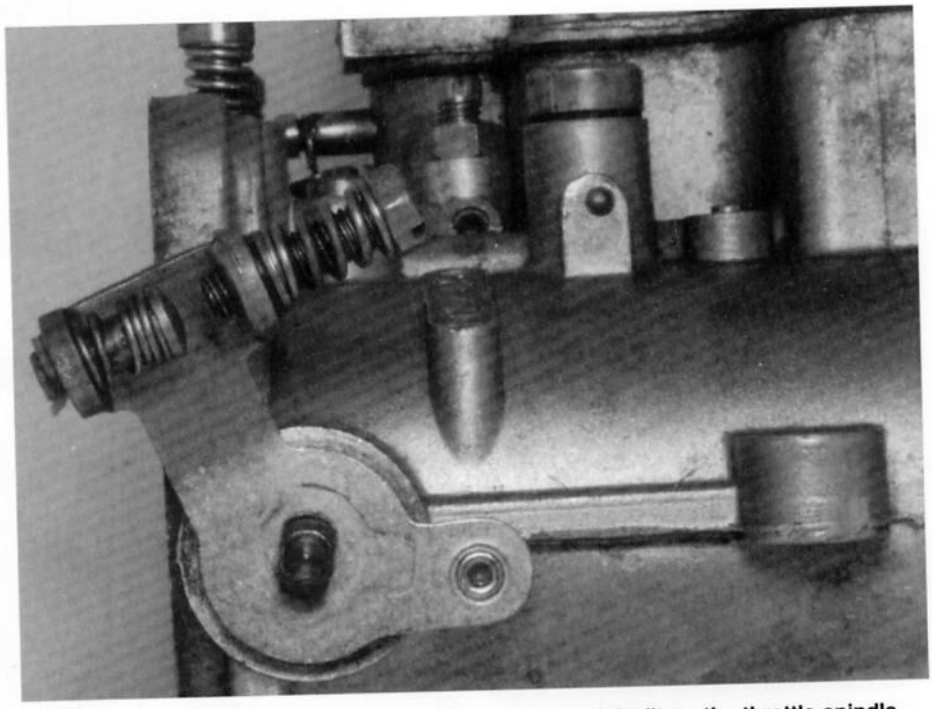
The fuel union is fitted next. If the fuel filter screen is damaged replace it with a new item. Fit new washers each side of the fuel union (sometimes called a 'banjo'). The large holed fibre washer goes against the carburetor body while the smaller holed one goes against the union bolt. Do not tighten this bolt at this point. Wait until the actual fitted position is known and always use a six-point box end wrench (ring spanner).

Fit the small washer and then a cover to the end of the spindle and fit a new lock washer before putting the nut on. The nut must be tensioned with the spindle firmly held. This is done using long-nosed pliers with some aluminum shim between the jaws and spindle to protect the spindle from damage.

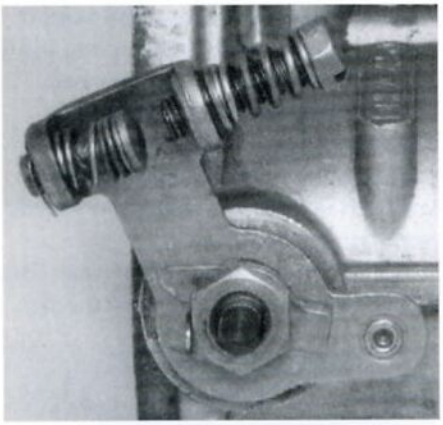
The throttle arm is fitted next. The first thing to check is the fit of the slot



Dellorto with plain throttle spindle cover (arrowed) correctly fitted. Note how tab of lockwasher is turned up to lock nut.



Dellorto. It's very important that the throttle arm is a tight fit on the throttle spindle.



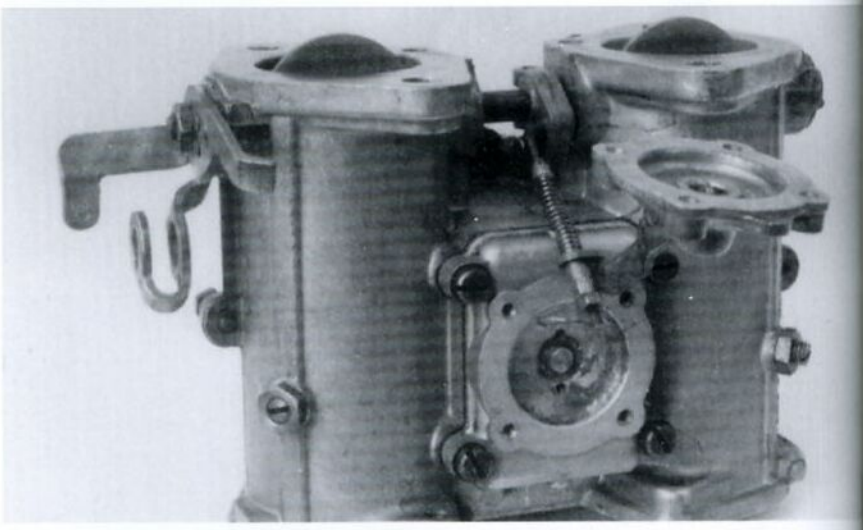
Dellorto throttle arm in position on the throttle spindle. Note raised tab to lock nut.

of the throttle arm with the flat of the spindle (the round, plain end covers are not critical here). If there is any looseness in fit the throttle arm must either be replaced or repaired. It should be a tight fit on to the spindle. Fit a new washer and tighten the nut. Use the long-nosed pliers to hold the spindle and bend the tabs over on both nuts after they are tightened.

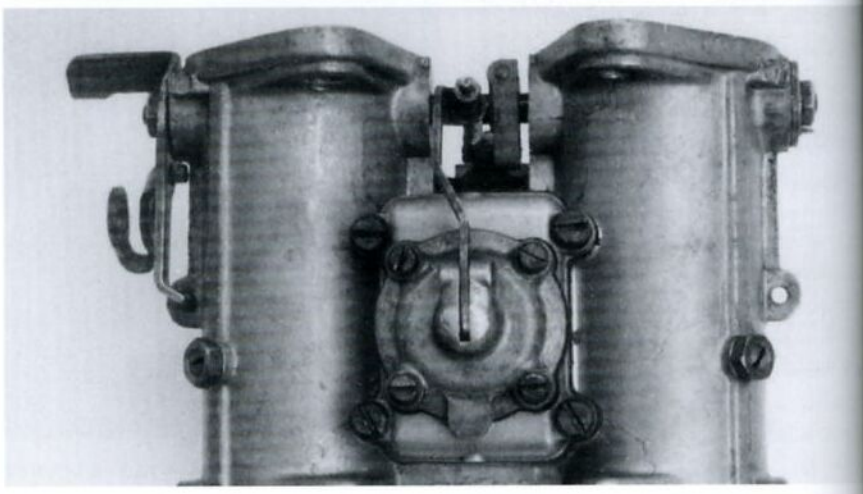
The bottom well cover is fitted next but, before it is, fit the accelerator pump intake valve or one-way valve. The ball inside the valve must be free to move. With the carburetor turned over place a new gasket on the body and fit the well cover, then fit and tighten the four screws.

The accelerator pump mechanis is fitted next. The actuating arm is connected to the diaphragm housing by a rod with a spring over it which i turn is connected to the diaphragm actuating arm. Before the diaphragm housing is screwed on to the bottom the carburetor the arm must be connected to the spindle. To do this the throttle is opened fully and the a pushed over it. When the throttle is closed the arm goes in behind the spindle. The spring is fitted into the carburetor body and the diaphragm

Dellorto accelerator pump bottom well cover fitted to actuating rod.



Dellorto accelerator pump bottom well cover fitted.

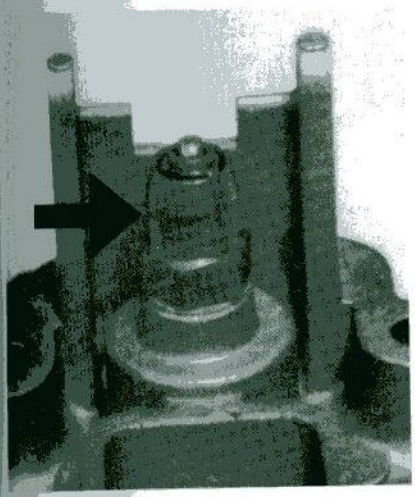


into the diaphragm housing. The housing is then fitted to the carburetor body and secured with the four screws. Fit the spindle return spring.

At this point the Dellorto carburetor is assembled ready to be fitted to the intake manifold.

NEEDLE VALVE & SEAT (WEBER)

The rebuild starts with the fitting of the needle and seat body into the carburetor top. Put the aluminum washer over the seat body and screw it in. Using a six-sided box end wrench (ring spanner) tighten it using reasonable tension. There is no need to go too tight as the thread is not large. Place the gasket on to the carburetor top as this must be in position before the floats are installed.



Weber needle valve and seat fitted into the top cover.

FLOATS & FULCRUM PIN (WEBER)

Fulcrum pin - checking

Check the floats fulcrum pin for wear grooves and, if there is any wear, replace it. The pin, after some use, will have rub marks on its surface but this does not mean it is actually worn. Unacceptable wear can be measured with a vernier calliper or micrometer. The pin goes first into the hole in the post that has no slit in it as this is a clearance hole for the pin. The post with the slit is the one that applies tension to the pin by effectively lightly clamping it when the pin is pressed into position. The post is able to expand slightly when the pin is pressed in because the slit allows movement.

Floats - checking

If the carburetor is known to have done a lot of work replace the floats with new items. If the floats appear to be in serviceable condition place the pin in through the float hinge loops and check to see how much movement there is between the pin and the floats. Shake the float and listen for the sound of fuel sloshing around inside as this indicates a leak. Place the float in a bowl of fuel to check that it floats. Immerse the float in the fuel and check for air bubbles. Air bubbles indicate an air leak. Check new floats for leaks in the same manner, just to be sure. Because Weber floats are made of brass they can, if the repair area is small, be soldered if a minor leak is found.

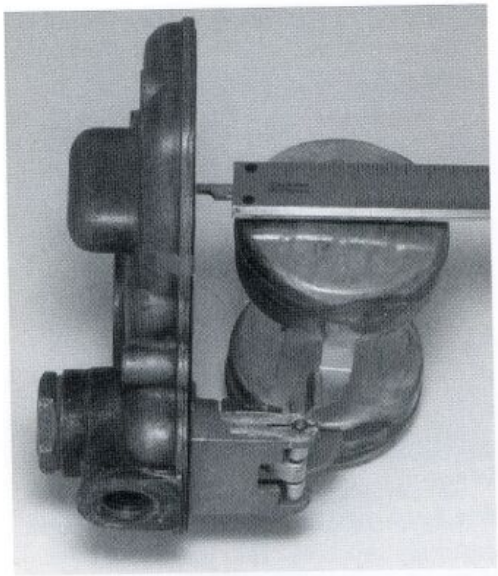
The fulcrum pin should be able to rotate quite freely in the float hinge loops but any excessive slackness should be removed. This is done by squeezing the floats' hinge loops using needle-nosed pliers. The brass can be gently squeezed in a progressive manner to fit the pin very closely but not too closely as this may cause the float to bind on the pin during operation which could lead to flooding. The pin fit in some floats is very loose and this is not conducive to accurate fuel metering by the floats.

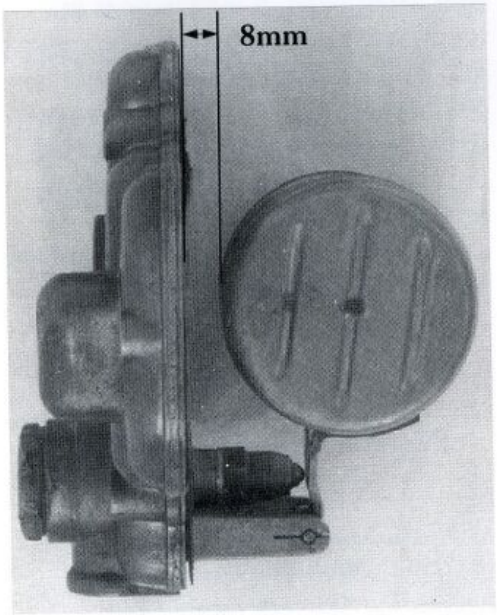
Floats and fulcrum pin - fitting

The needle is fitted into the valve seat body first and the float is lined up with the posts and the spring-loaded head of the needle and moved across so that the two small tabs fit under the head of the needle and seat. Fit the fulcrum pin into the post (without the split in it) and push it through to the second post (the one with the split). When the pin is close to the split post, line it up exactly with the hole and carefully tap it in. The pin should be tight when fitted. If the pin goes in very easily the post may not be putting any tension on the pin. If so, place the pin between the posts so that the ends of the pin protrude an equal amount out from each post and, using pliers, squeeze the split post slightly. It doesn't take much to 'tighten' the hole so that it exerts sufficient clamp to retain the pin.

FLOAT LEVEL - SETTING (WEBER)

The float height is set at 8mm (0.318in). Weber list several float heights for different models but consider 8mm (0.318in) to be average and always usable. The height is measured with the gasket in place. A rule or vernier calliper can be used to measure from the gasket to the top edge of the float. The needles have a spring-loaded ball in the end which means that the needle will seal its seat but the float will still keep moving. The float level is measured when the needle just contacts the seat. This measurement is checked with the carburetor top held on its side. If the top is tilted the needle will be seen to move out from the seated position. If

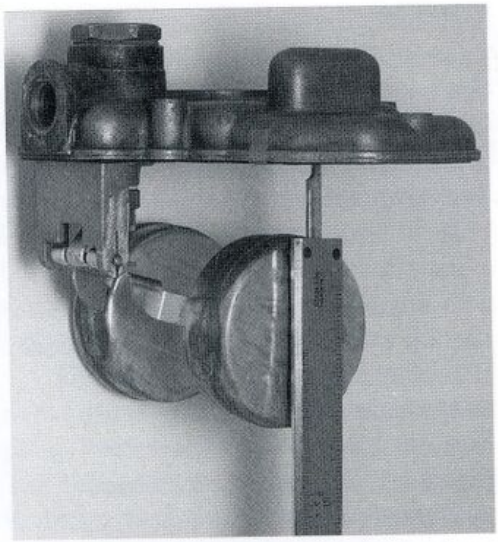


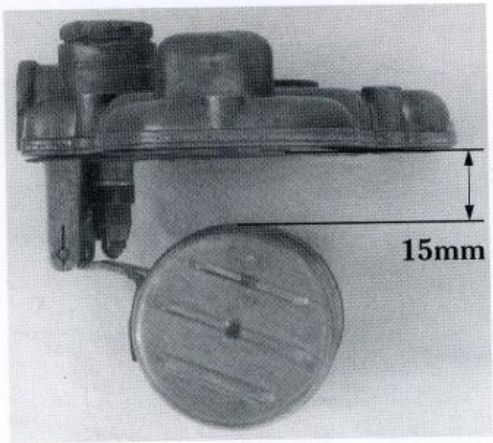


Weber floats being set to 8mm with the needle and seat just touching.

the top is slowly tilted back the needle will move in towards the seat and when it stops moving this is the point at which the distance between the float and the gasket must be measured.

The two floats must be set equally. This is achieved by twisting the brass arms using long-nosed pliers. The arms do not bend very easily but, with a little patience, it is possible to set both floats exactly as they should be set. The droop setting is 15mm (0.694in) and this is controlled by the





Weber floats being set to 15mm droop.

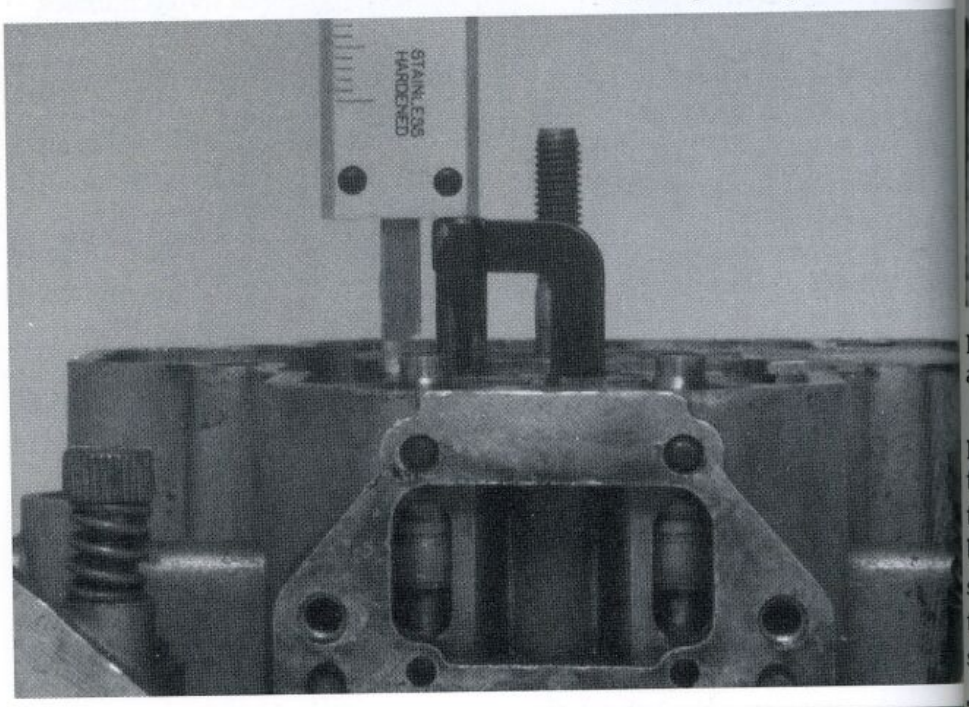
tab at the back of the float: the float stops dropping when this tab contacts the seat body. This tab can be bent with long-nosed pliers to reduce or increase the droop measurement.

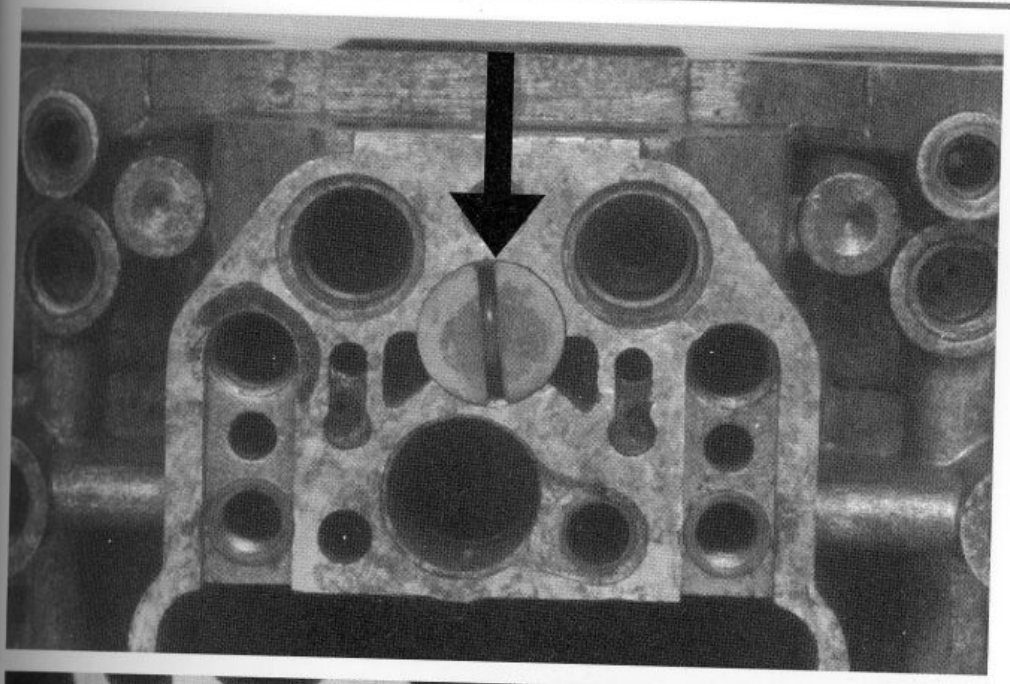
TOP COVER (WEBER)

The carburetor body is prepared next so that the top can be positioned and screwed on to it. The starter jet is screwed in (if it was removed), then the accelerator pump check balls and then the weights are placed in their respective holes. Then the screw-in plugs are fitted above these two items.

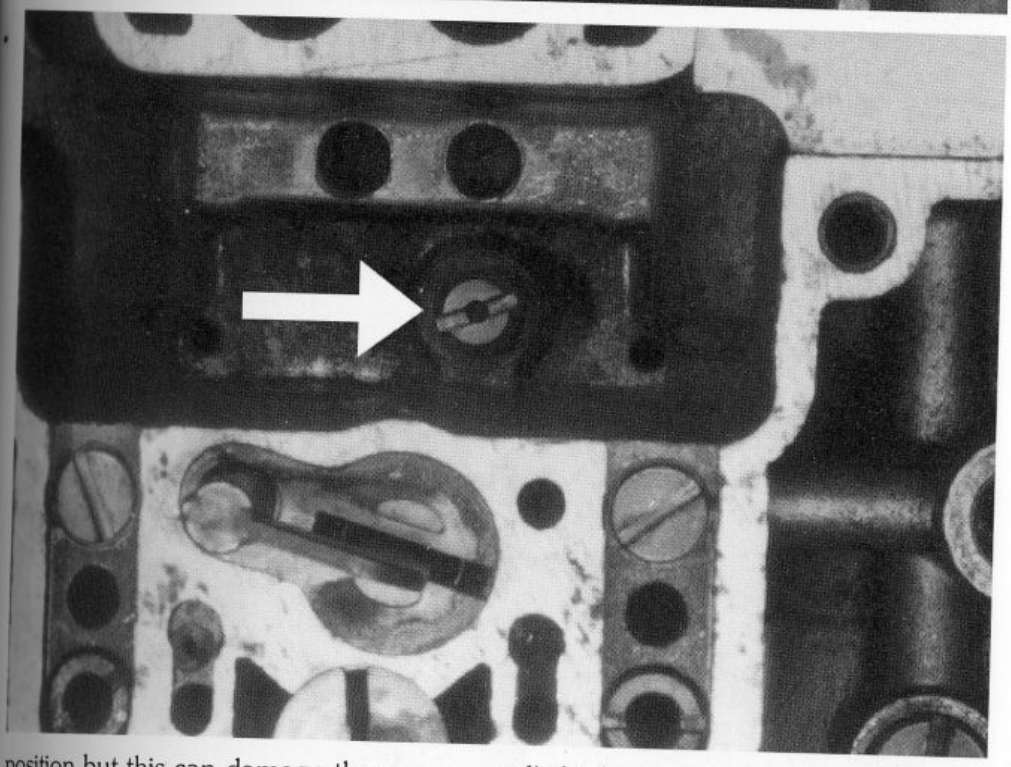
The accelerator pump control rod and piston are installed as a unit and the retaining plate snapped into position. The retaining plate can be squeezed together slightly using long nosed pliers (but not too much as it will not spring back because it is made of brass) which have had their ends chamfered so that they fit the two indentations in the plate exactly. The plate can simply be tapped into

Below - Weber accelerator pump control rod height being measured.





Weber spindle return spring anchor plate (arrowed) correctly fitted.



Weber accelerator pump intake valve (arrowed) fitted.

position but this can damage the aluminum of the carburetor body.

The stroke of the accelerator pump rod is measured for length of travel from the idle position to full throttle. Expect the stroke or travel to be 11mm (0.435in) on average. The stroke length will vary depending on the length of the rod. The longer the stroke (ultimately the length of the rod) the longer the duration of the accelerator pump's shot of fuel. Unless the rod has been tampered with it will work well at 11mm stroke. It is unusual for the rod to be too short for most applications. Try the 'standard' rod first as it can always be changed later if not satisfactory. An indication of the rod being too short is hesitation very late in the acceleration phase by

way of the fact that the extra fuel progressively required during this period simply ceases to flow. Check the tension and condition of the spring. Replace the spring it if it seems weak or is corroded.

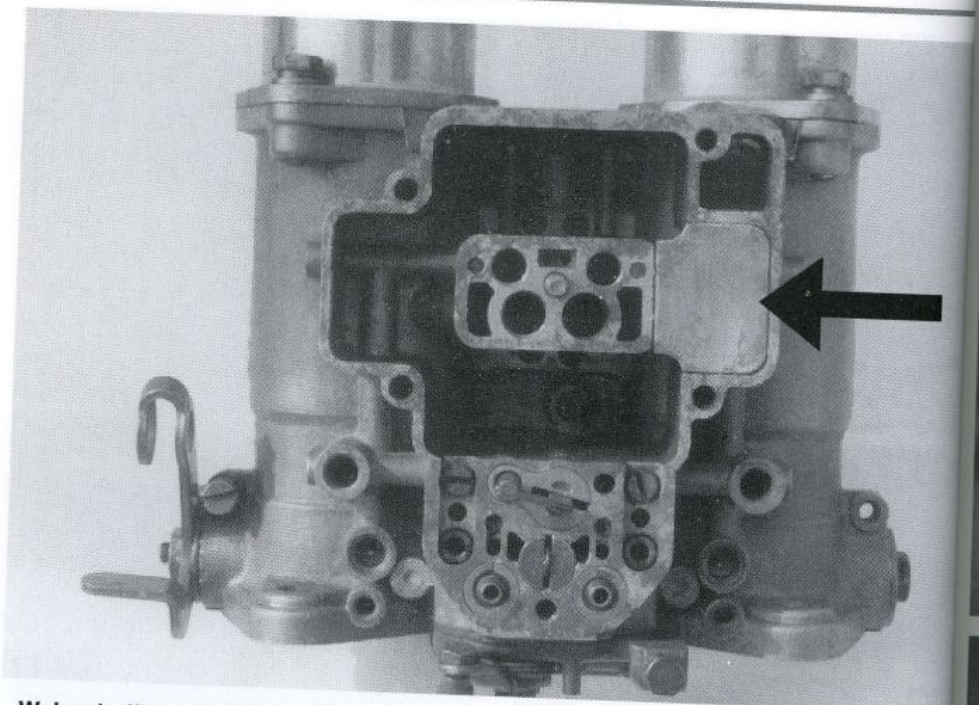
Fit the spindle return spring. The eye of the spring is fitted to the accelerator pump control lever first and the eye on the other end of the spring used to pull the spring up and through the hole where the anchoring plate is placed under the eye and the eye then let down into the register in the carburetor body. Care needs to be taken here when fitting the anchoring plate. The problem is one of holding the spring up high enough while fitting the anchoring plate. A small diameter shank screwdriver (2.5mm/0.100in diameter) with a hook bent on to its end (heated up, bent and then tempered back) is the solution and will prove to be fail-safe.

Fit the accelerator pump intake and discharge valve (if it has a hole drilled in the side of it) into the bottom of the fuel bowl. Do not over-tighten this valve as it can be very difficult to remove later. The slot size of the head is not very large and it is very easy to damage it.

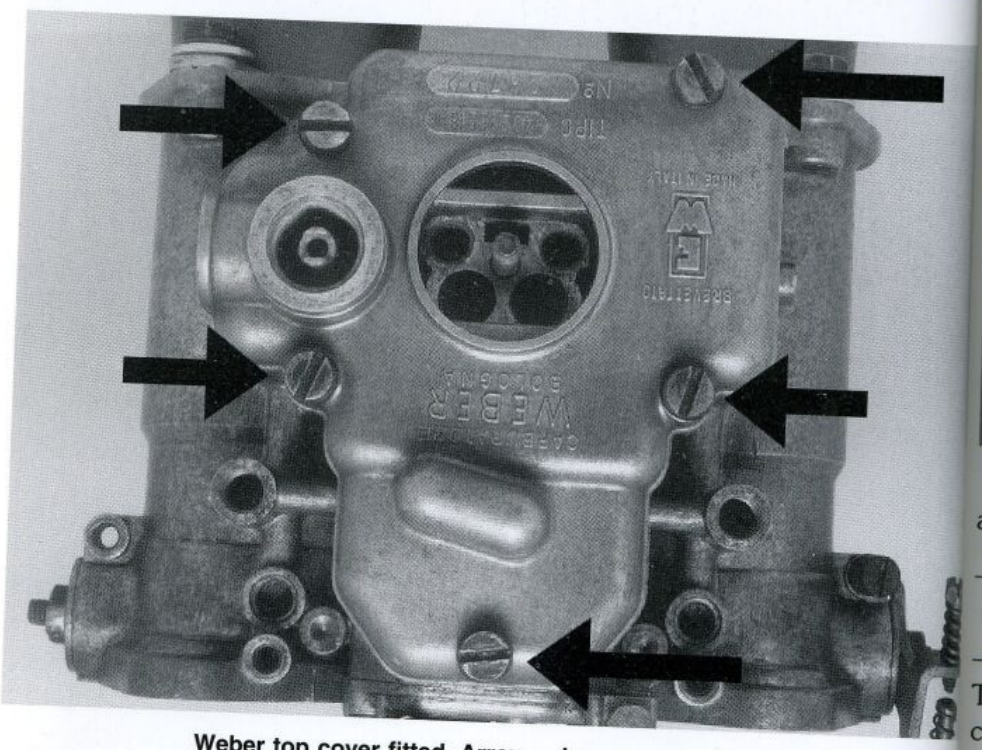
Make sure the baffle plate fits into its recess in the carburetor body.

The top is positioned on to the carburetor body and the five screws inserted into their respective holes and tightened progressively. One screw will have a tab under its head; this is the reference number for the particular carburetor. **Caution!** The floats are less prone to damage if the cover carrying them is installed as soon as possible after setting float heights.

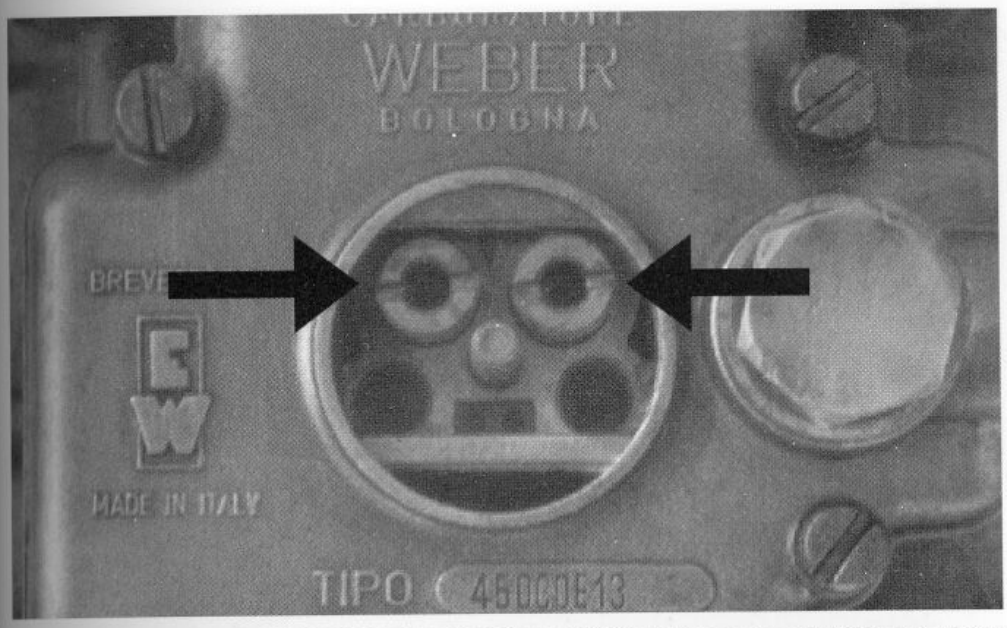
Caution! Make sure that all of the screws used to secure the carburetor parts to the body have washers fitted between their heads and the body. This will prevent any marring of the



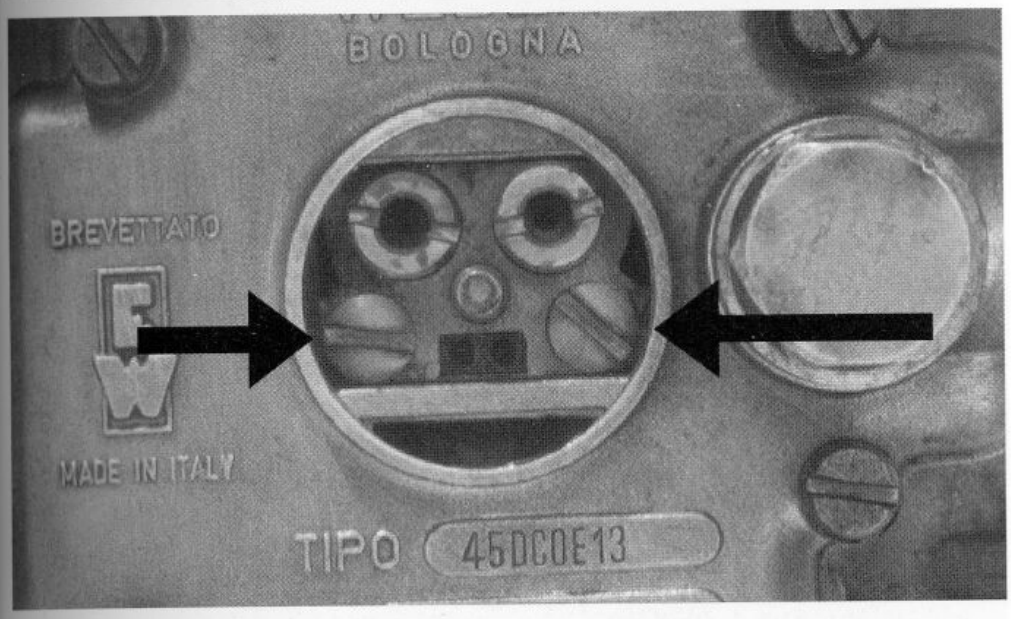
Weber baffle plate (arrowed) shown fitted. All is now ready for fitting of the top cover



Weber top cover fitted. Arrows show securing screws.



Weber emulsion tube holders (arrowed) fitted.



Weber idle jet holders (arrowed) fitted.

aluminum of the castings.

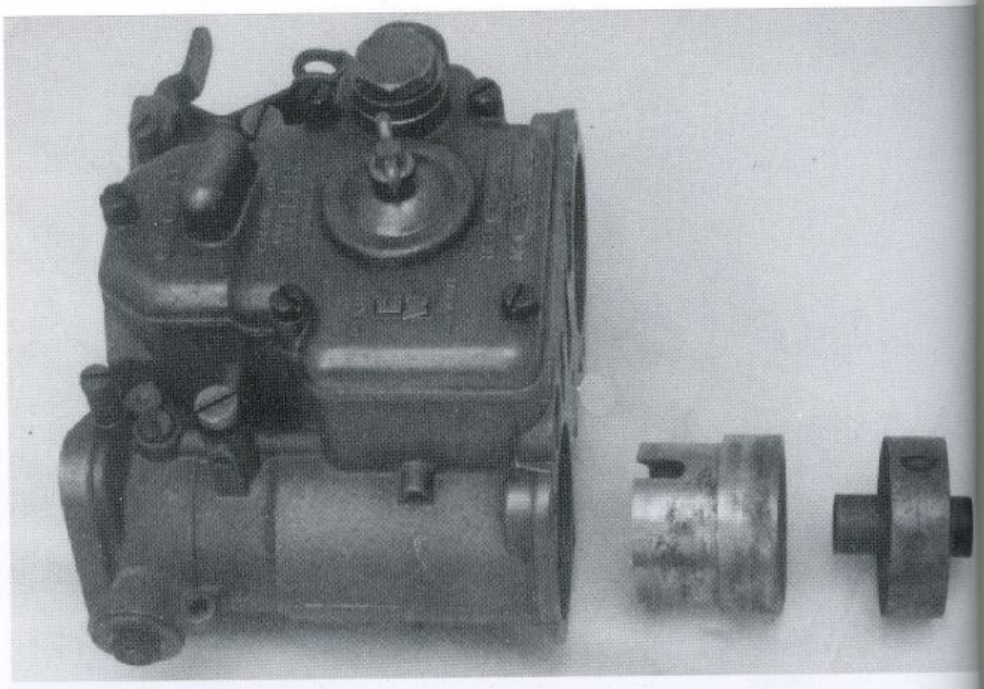
BODY COMPONENTS (WEBER)

The main jet, emulsion tube, air corrector jet and emulsion tube holder combination are assembled and inserted into their respective holes and tightened using a screwdriver with a head that fits the slots exactly to avoid any possibility of damage to the slots.

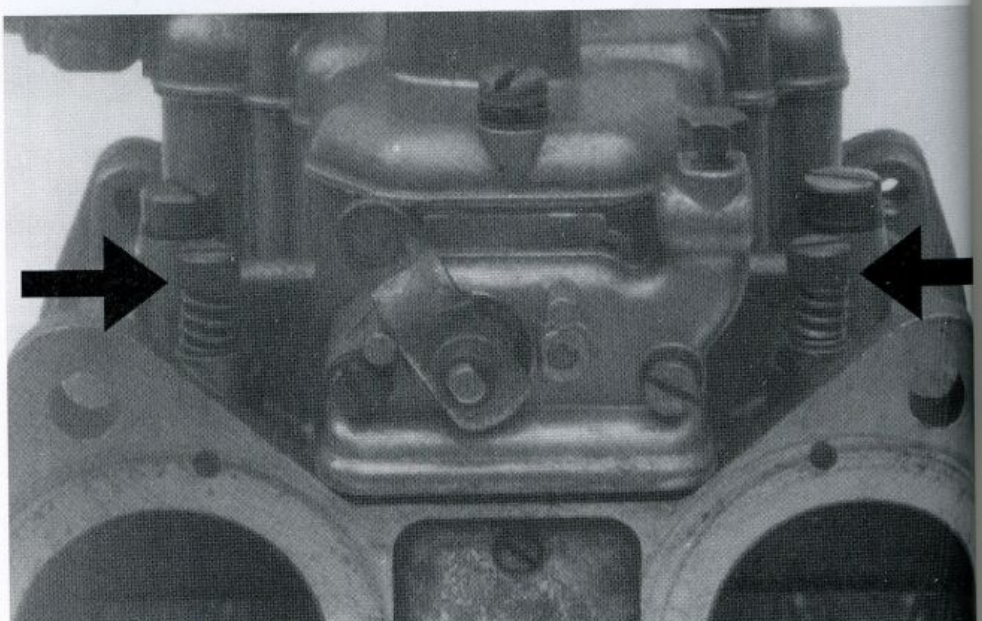
The idle jet and idle jet holder are assembled and inserted into their respective holes and tightened then the jet inspection cover is placed over them and the wing nut tightened. Make sure there is a new gasket under the jet inspection cover.

The chokes first and then the auxiliary venturis are now inserted into the carburetor body and the retaining screw turned in until it firmly contacts the auxiliary venturi. **Caution!** On 45s and 48s the retaining screw that holds the auxiliary venturi must not be done up too tight as it will distort the auxiliary venturi. **Caution!** The retaining

Weber choke and an auxiliary venturi shown positioned in front of the carburetor before being installed.



Weber idle mixture adjusting screws fitted.

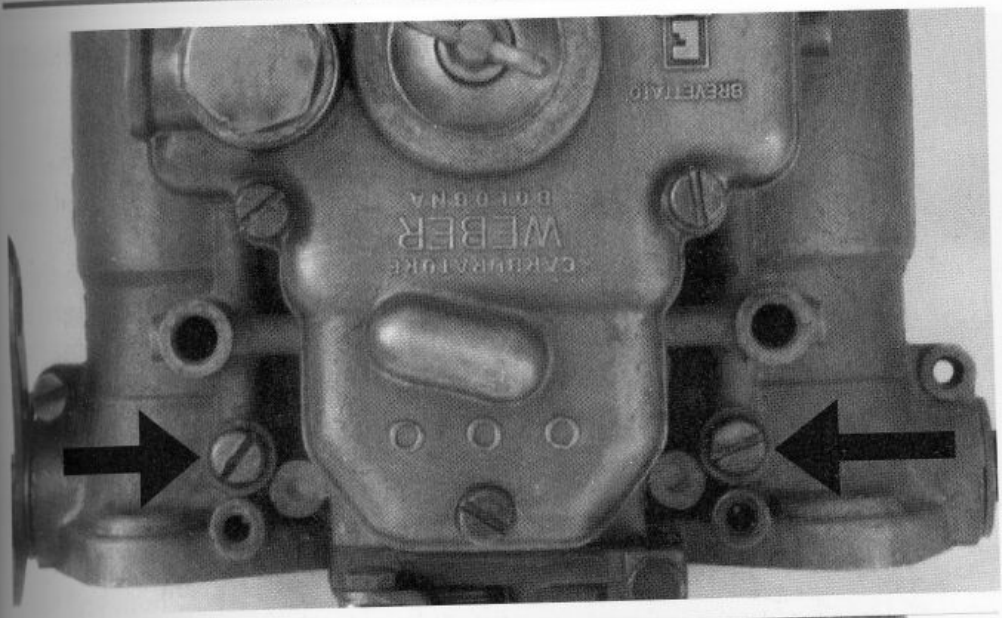


screws must be locked or they will come loose and fall out! Use the Weber clamping plate or lockwire the two screws together. Late model Webers use a screw and nut lock like Dellorto. The chokes and auxiliary venturis on the 40s push in and are retained and located by blade spring in a long slot machined into the throttle bore. They are not firmly fixed into position until the trumpets are bolted on or an air box is bolted on (carburetors supplied as original equipment t a car manufacturer).

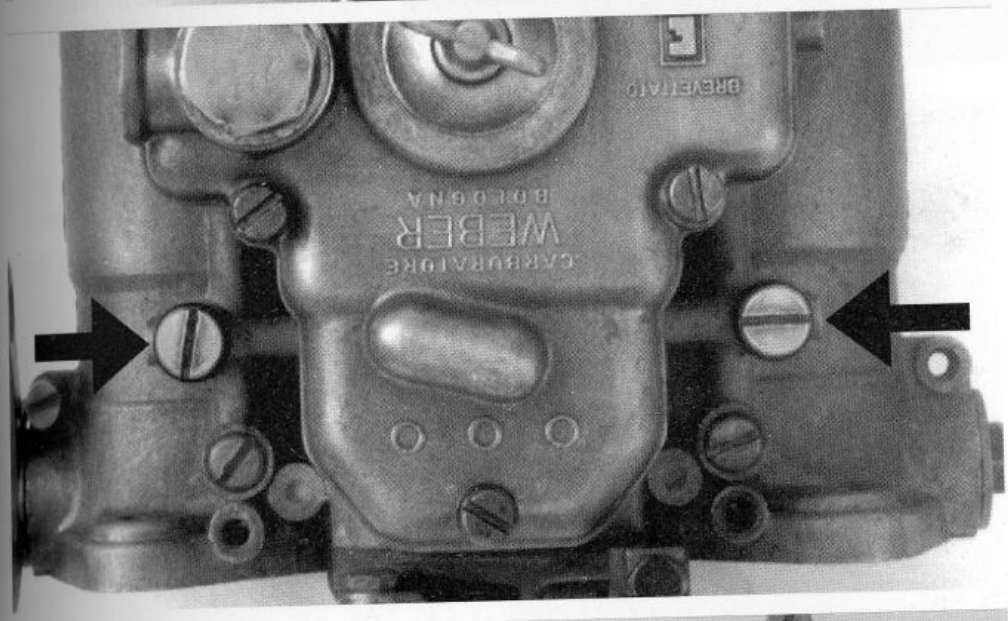
Screw in the idle mixture adjusting screws with their springs and sma washer fitted.

Screw in the progression hole plugs (new O-ring fitted).

The accelerator pump jets are inserted into their respective holes w the small aluminum washers in place The screw-in plug is then fitted with a new O-ring seal fitted under the head

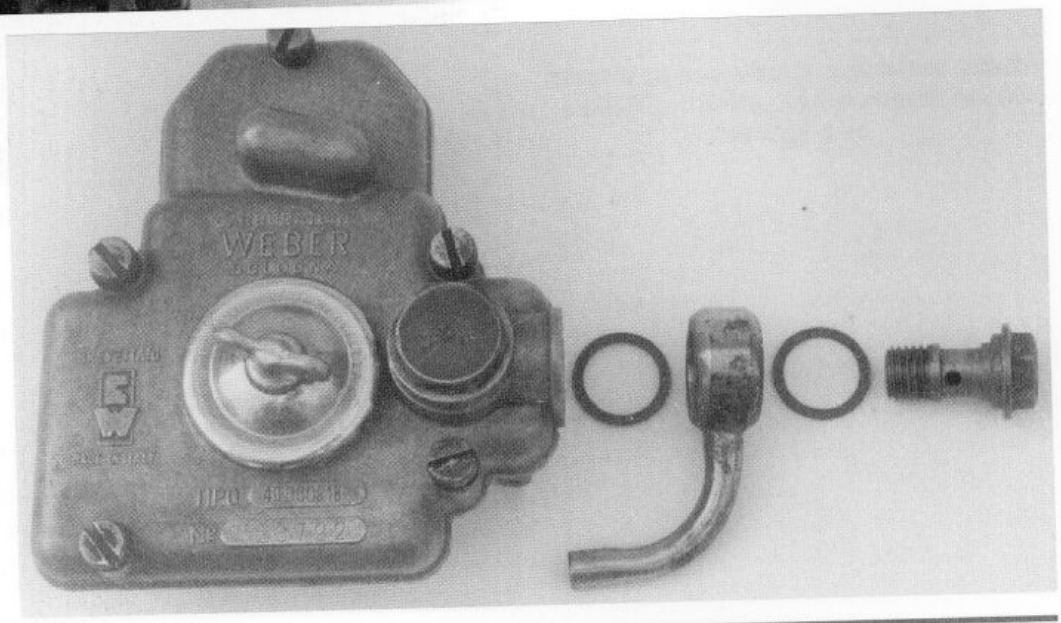


Weber progression hole cover plugs (arrowed) fitted. (Note that the idle mixture adjustment screws would normally be in place at this stage of rebuild).



Weber accelerator pump screw cover plugs (arrowed) fitted. (Note that the idle mixture adjustment screws would normally be in place at this stage of rebuild).

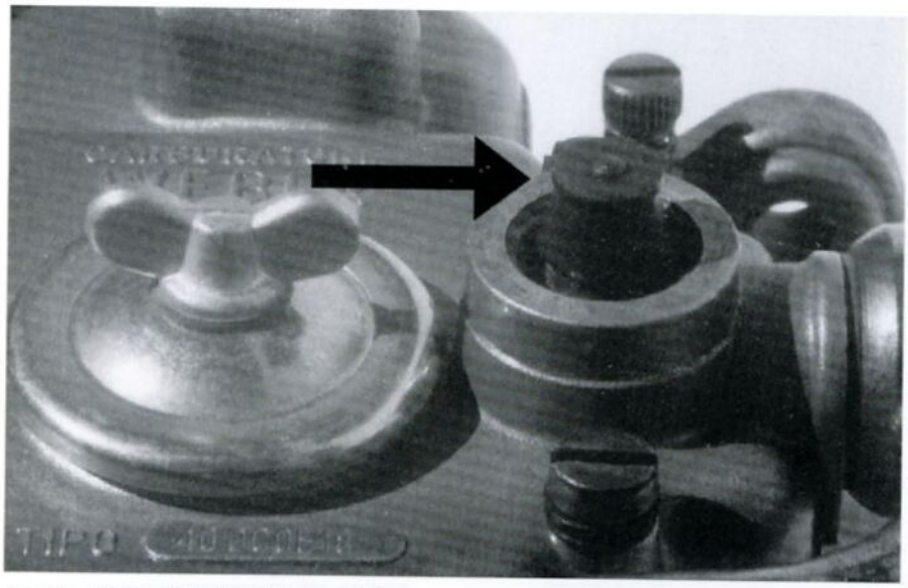
Below - Weber fuel union ('banjo'), washers and bolt shown in line as they should be fitted to the carburetor top cover.



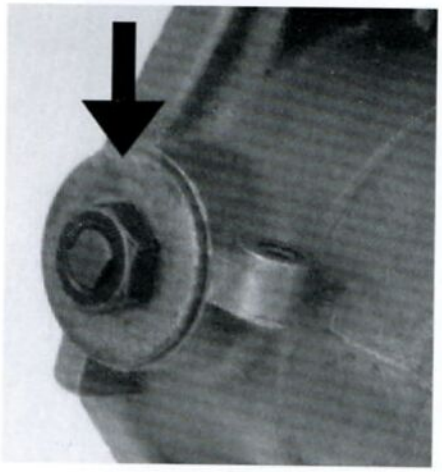
of the plug.

The fuel union is fitted next. Fit new washers each side of the fuel union (sometimes called a 'banjo'). The fibre washer with the small hole in it goes against the carburetor body while the fibre washer with the larger hole goes against the union bolt. Do not tighten this bolt up at this point. Wait until the actual fitted position is known and always use a six-point box end wrench (ring spanner).

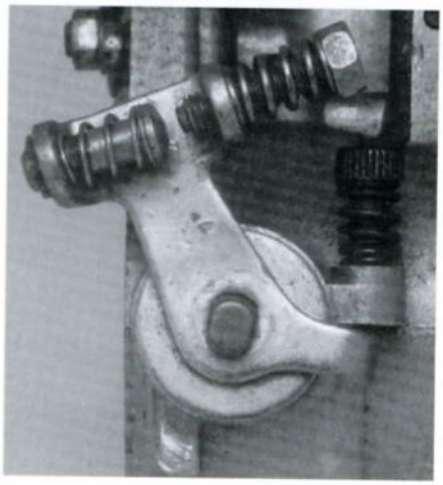
The filter inspection cover is fitted next. Fit a new filter element and a new fibre washer under the inspection



Above - Weber fuel filter (arrowed) shown in position in its housing.



Right - Weber plain cover (arrowed) and nut fitted to the end of the throttle spindle.



Weber linked-type throttle arm positioned on the throttle spindle. Note that it must be a tight fit.

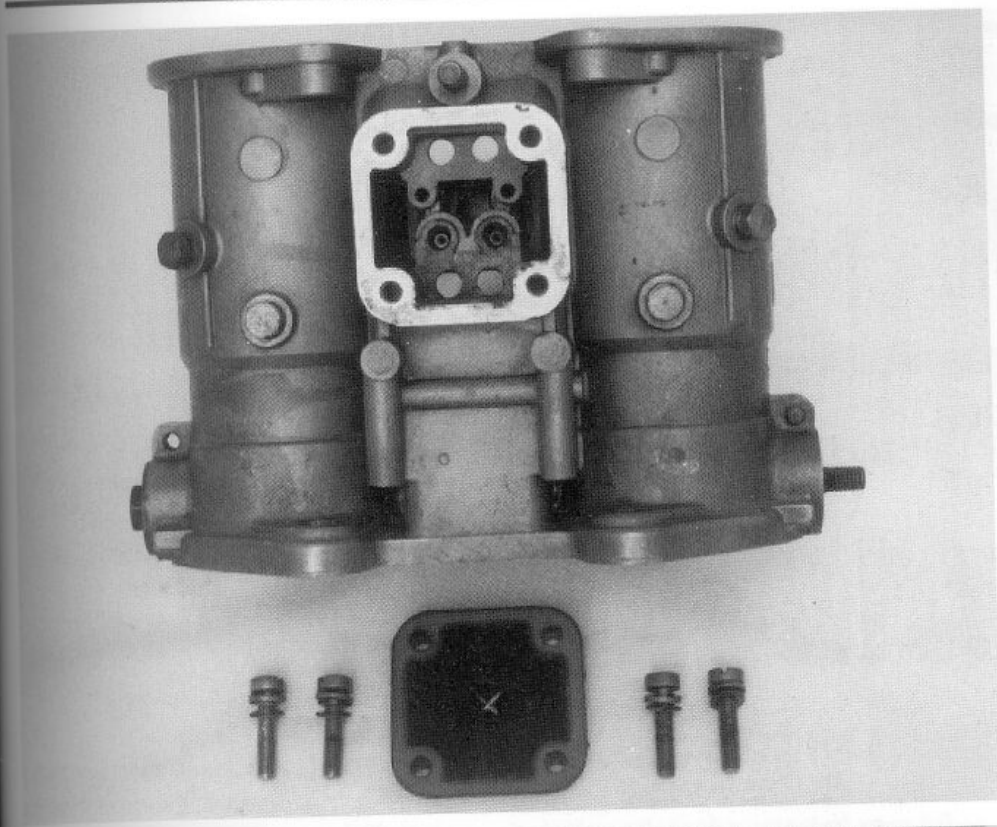
plug. The fuel is under pressure and the washer is not sealing well it will leak. Weber filters do not hold their shape so an inline filter should be fitted between the pump and the first carburetor fuel union.

Fit the small washer and then a cover to the end of the spindle and a new lock-washer before putting the nut on. The nut must be tensioned with the spindle firmly held. This is done using long-nosed pliers with some aluminum shim between the jaws and spindle to protect the spindle from damage. Hold the spindle adjacent to the throttle bore wall so there is less chance of twisting the spindle. The spindle is very strong but it is not impossible to damage it.

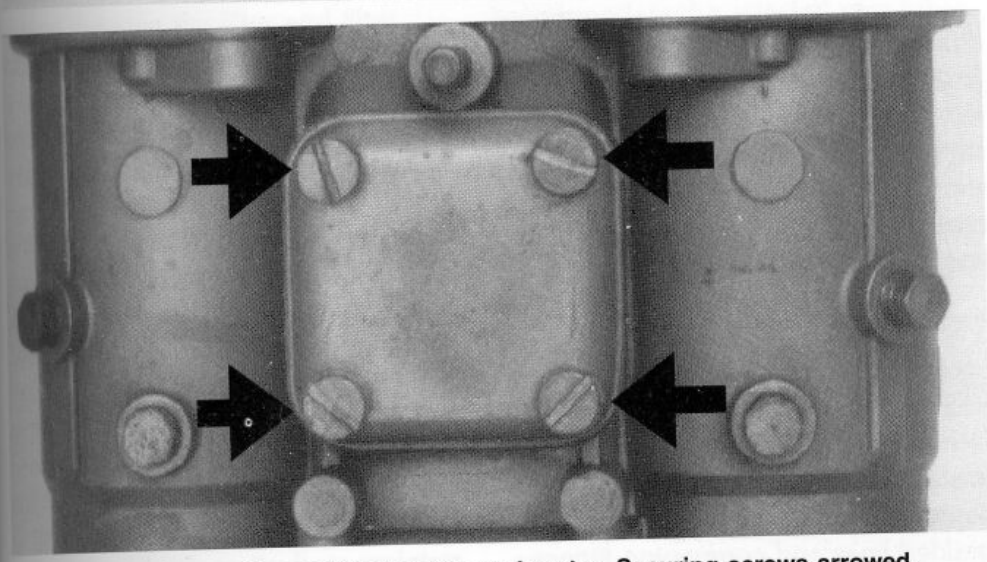
The throttle arm is fitted next. The first thing to check is the fit of the slot of the throttle arm to the flat of the spindle (the round plain end covers are not critical here). If there is any looseness in this fit the throttle arm must either be replaced or repaired. It should be a tight fit on the spindle. Fit a new washer and tighten the nut. Use the long-nosed pliers once again to hold the spindle and bend the tabs over on both nuts when they are tight.

The bottom well cover is fitted next. With the carburetor turned upside-down, place a new gasket on the body and fit the well cover, then the four screws and tighten them.

At this point the Weber carburetor is assembled and ready to be fitted to the intake manifold.



Weber bottom well cover components prior to fitting.



Weber bottom well cover fitted to the carburetor. Securing screws arrowed.

Chapter 3
FUEL MANAGEMENT, AIR FILTERS & RAM TUBES

FUEL FILTERS

Both carburetors are fitted with an integral filter. These filters should be left in place but, in the case of the Weber, they are often left out because the filter is not a particularly sturdy item and usually distorts the first time it is installed. The Dellorto system is better all round. With either carburetor set-up, install a paper element filter (throw away type) between the fuel pump and the first carburetor. These universal fitting fuel filters are available with 5/16in and 3/8in (or metric equivalent) intake and outlet diameters and they are cheap. This modification will ensure that only clean fuel is supplied to the carburetors. Note that steel cased in-line fuel filters are available and should be fitted when competition rules require it.

FUEL LINES (PIPES) & FITTINGS

Use only gasoline (petrol)-rated hose for fuel lines and, if you want the best, consider 'aircraft quality' metal-braided lines and companion fittings. The internal diameter of the standard fuel unions on these carburetors is 5.5mm (0.225in) which suits a 5/16in inside diameter fuel lines. The largest available fittings have an inside diameter of 7.5mm (0.30in) and suit 3/8in inside diameter fuel lines. Route fuel lines well away from the exhaust system and so that there are no sharp bends: secure well at frequent intervals.

Always use top quality hose clamps (clips) of the correct size for the application. The best clamps are the stainless steel worm-drive ones that close around the hose uniformly. Some of the larger types of clamp are too bulky to actually go down to the required size even though they are rated to do so.

A range of small clamps suitable for use on fuel lines (pipes). Use clamps of the correct size.

AIR FILTERS

It is a proven fact that engines last a longer if the air admitted to the engine is as clean as possible. Good quality

Typical ram tubes.

paper element filters are highly-efficient and usually feature rubber sealing between the filter and filter housing. Some air cleaner systems available (gauze and foam) do not offer good sealing between the filter and the filter housing body, so some unfiltered air is able to enter the engine. To reduce this possible problem, the filters can be sealed to their housings using silicone sealer (after testing that there is no reaction with the filter material). Always fit the very best air filtration system that you can afford to buy; it's money well spent.

Incidentally, wire mesh filters over ram stacks offer virtually no protection (except from stones) and can actually upset airflow considerably.

The most efficient filtering arrangements allow the fitting of ram tubes, a reasonable amount of internal airspace and a large good-quality paper air cleaner. The ideal may require the fabrication of an airbox using 3mm (1/8in) thick aluminum sheet. For a twin sidedraft application, for example, the airbox will measure approximately 400mm (16in) long by 140mm (5.5in) wide and a depth to accommodate the selected ram tubes plus 25mm (1in) clearance. If appropriate to your application, one of the best air filters to use is the original equipment item from the Jaguar XJ6 sedan (saloon). This filter is of the paper element type but of very sturdy construction with a rigid metal pressing all around. The filter can be fixed to the airbox by drilling a few holes around its perimeter and then bolting it into place. Remember to use silicon sealer between the filter and the airbox so that only filtered air can enter the engine.

RAM TUBES (STACKS)

Ram tubes, trumpets or air horns (or whatever you know them as) should always be fitted to a modified engine. There is a vast range of ram tubes available and recent products are usually efficient and scientifically designed. Modern ram tubes tend to be bellmouthed (the outer edge facing back to the carburetor). Ram tubes are expensive, reflecting their manufacturing costs.

Ram tubes can be bought in various lengths, a factor which can be used to good effect on modified engines. It is worth experimenting with ram tube length to find the optimum for your particular application. As a general guide, short ram tubes are usually used for high rpm applications while longer rams are usually used to maximize mid-range response.

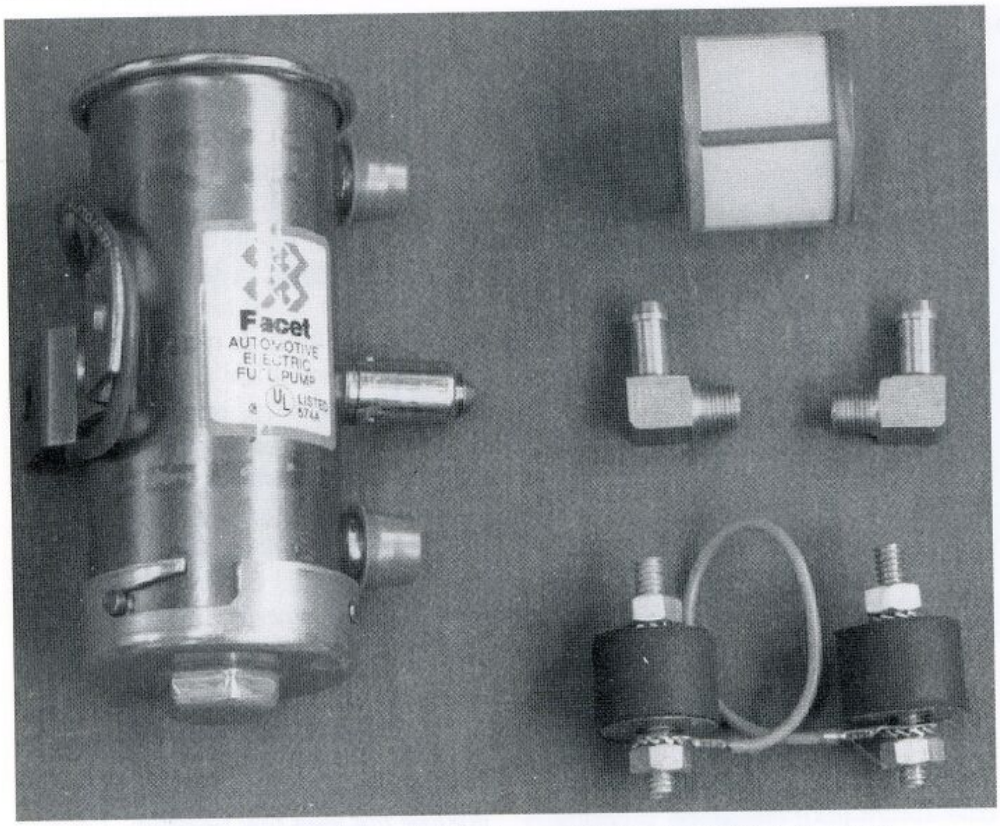
The ram tubes need to fit in the air filter housing with at least 25mm (1in) of intake clearance, so bear this in mind when making your choice unless you intend to fabricate your own housing or have a suitable proprietary brand in mind.

FUEL PRESSURE

Webers and Dellortos require high fuel *volume* not high fuel *pressure*. 1.5 to 2.5 pounds per square inch is the fuel pressure requirement. For testing purposes a fuel pressure gauge should be connected at the last fuel union (at the carburetor that receives the fuel last) and the fuel pressure monitored. Once it is established that the fuel pump can maintain the correct fuel pressure under all circumstances the fuel gauge can be removed.

To test the fuel pressure, run a pipe from the last carburetor in the fuel line through to the instrument panel and mount a gauge temporarily (or permanently) within easy view so that the fuel pressure can be monitored.

If the fuel pressure is going to fall and cause problems (starvation) it will usually do so when the engine is at full speed in top gear after a short distance has been covered. What happens is that the fuel pump does not keep up with the fuel demand of the engine under these load conditions and the



High-performance aftermarket fuel pump kit. (courtesy Peter Burgess).

pressure simply drops. The end result is an engine miss as the fuel level drops. If you have a gauge installed, as soon as the pressure goes you can stop. Do not proceed with high rpm testing until the correct fuel pressure can be maintained, otherwise the engine could be seriously damaged. Once the fuel pressure situation has been thoroughly checked out, the fuel pressure gauge and lines can be removed.

Achieving a fuel pressure of at least 1.5psi but not more than 2.5psi when the engine's fuel consumption is at its maximum is the aim. Many standard mechanical fuel pumps will keep up with the fuel requirements of Webers and Dellortos. If the fuel delivery system is in first class order but still does not deliver enough fuel, you'll need to consider fitting a mechanical pump of higher capacity than the current item. It is also possible to bypass the standard mechanical pump and use instead a larger capacity electric pump to deliver the fuel.

If a single electric fuel pump is fitted as standard and a new one cannot supply sufficient fuel, consider fitting a second electric pump of the same type in parallel with the first. The second pump must have its own pick-up line (pipe) from the tank. The outlets of the two pumps can be merged into a single fuel line with a minimum inside diameter of 3/8in (or metric equivalent). The larger line can be reduced to 5/16in just before the fuel intake of the first (or only) carburetor so that the standard carburetor unions can be used.

Large capacity single electric pumps are available from several manufacturers (Holley and Facet for example) and these can pump at up to 10psi and more, so they'll have to be used with a fuel pressure regulator. Too much pressure can overwhelm the needle valves and cause over-rich running.

Chapter 4
CHOOSING THE COMPONENTS FOR YOUR CARBURETOR/S

PONENTS - INITIAL SELECTION

wing tuning information is to assist you find a suitable and run specification for your or/s and your application. The ay not be perfect, but it will sufficient to start with and can oved upon by fine tuning. ber and Dellorto parts are high nd usually quite a few of them ded to fine tune an engine. ly parts are borrowed from ople to see if they work and w or second-hand parts bought fitting to the engine. It can get pensive having to buy jets just em out. Engine tuners usually all) have the majority of parts by way of a 'tuning kit'. hen tuning your own engine the buying parts has to be bal- gainst the actual cost of getting alist firm to carry out this work. sible to spend a considerable amount of money on jets, chokes, etc., (new or second-hand) that you will end up not using. Conversely, if the firm you are getting your engine tuned at does not have a comprehensive set of alternative parts the chances are they will not tune the engine correctly. They might get it going better than you think you can, but that doesn't mean that it's actually right.

CHOKE SIZE VERSUS CARBURETOR SIZE

The information given here will allow you to sort out any sidedraft Weber or Dellorto on any suitable engine application. The first consideration before carburetors are purchased is to know what choke sizes are likely to be used. The reason for this is that carburetor bodies of a given size have a range of chokes that will fit them. The correct range of choke sizes for both Weber and Dellorto carburetors is as follows.

40mm diameter carburetors:
choke range 28-34(36)mm.
45mm diameter carburetors:
choke range 36-40mm.
48mm diameter carburetors:
choke range 40-43mm.

There is some overlap of possible choke sizes on these carburetors. A 34mm choke is definitely the maximum size to use in a 40 DCOE or 40 DHLA body. 36mm chokes are available from Weber and Dellorto for fitting into their 40s but the flow capacity is definitely not as good as a 36mm choke in a 45 body. The 45s can have 34mm chokes fitted which, while within the sizing tolerance of a 40 body, still work well in a 45. The 48s could have 34mm chokes fitted (in the range of 40 bodies) or 36mm, 38mm and 40mm chokes fitted (in the range of 45 bodies) and also work well.

Choke size is the major consideration. Very small choke sizes in large

carburetor bodies is not a good idea so consider 34mm chokes to be the smallest size for 45s and 36mm chokes the smallest size for 48s. The range of choke sizes which are *readily* available for the most widely used carburetor bodies goes up in 2mm increments as follows.

40s: 28, 30, 32 or 34mm chokes
45s: 34, 36, 38 or 40mm chokes
48s: 36, 38, 40, 42 or 43mm chokes

The actual full choke size range for each model of carburetor is quite large as they go up in 1mm increments so the choke size can be very closely matched to the needs of any engine. Most of the sizes are listed here -

38s: 26, 27, 28, 29, 30, 31, 32mm chokes.
40s: 28, 29, 30, 31, 32, 33, 34mm chokes.
42s: 30, 31, 32, 33, 34, 35, 36mm chokes.
45s: 34, 35, 36, 37, 38, 39, 40mm chokes.
48s: 36, 37, 38. 39, 40, 41, 42, 43mm chokes.

CHOKE SIZE - SELECTING

In the first instance it is essential to know what each carburetor will take with regard to choke sizes and that is all listed in the previous section. The next stage is to decide on the choke size required for *your* particular engine and this is done on the basis of the individual cylinder capacity and the rpm range that you are likely to use.

As an overall recommendation you are advised to FIT THE SMALLEST CHOKE THAT WILL GIVE FULL POWER.

When a slight choke size reduction is necessary to achieve better low end performance (*eg:* out of a corner pulling power) then FIT A CHOKE SIZE THAT PROVES BEST FOR THE OVERALL APPLICATION. As an example, an engine may well produce most maximum rpm power with 38mm chokes but, because in reality the engine is usually used over a wide rev range, 36mm chokes will prove better all round, offering superior mid-range with only a slight loss at the top end. Testing and (golden rule number one) changing *one* thing at a time is the only way to find out which is the best overall solution for you.

Most engines that Webers or Dellortos are fitted to are modified in some way and the degree of modification will have some bearing on the choke size that will work best. The situation is not as bad as it sounds, and choke choices can be narrowed down. Be realistic on how good your engine actually is and how fast you actually are going to turn your engine on a regular basis. Road cars should be fitted with the smallest chokes possible which are conducive to good all round engine performance. Jetting should be set with good emissions in mind without being excessively lean. Webers and Dellortos can give very good economy coupled with good performance but it is also fair to say that generally they will use more fuel than the original carburetor. For a start, in most applications, there's an accelerator pump for every cylinder.

A well modified four-cylinder 2000cc or 2100cc engine fitted with twin sidedrafts will usually run best using 38mm chokes with 40mm chokes being too large. On the other side of the scale, if mid-range performance is preferred to absolute top end power 36mm diameter chokes will prove to be a better choice. The readily available range of choke sizes increases in 2mm increments and is nearly always satisfactory for achievi the 'right' size.

It is reasonably easy to establish the range of choke sizes and then know what carburetor you will requi If the engine needs 36mm or 38mm chokes then 45 carburetors are the size to buy. If the engine needs 34m chokes then 40 carburetors are usual the size to buy but this choke size is the limit of the 40 carburetor body. The latter is a good example of the choice of carburetor body versus the true requirements with regard to cho size. In most instances, unless your engine *really* is a heavily modified u the 40s with 34mm chokes will prov to be the best choice, especially for a street car.

The following recommended choke sizes are for engines that are modified and have an effective rev range from approximately 3000rpm 8000rpm for the smaller engines (1000cc to 1750cc) and 2500rpm to 7500rpm for intermediate engines (1750cc to 2400cc) and around 2000rpm to 6500rpm for larger units

Many engines are bored out beyond standard capacities; howeve when consulting the following choke size tables, use the *actual* capacity of your engine.

For your convenience the follow ing choke sizes are listed in relation t ccs per cylinder so that the sizes can be cross referenced to any engine. If your engine is an in-between capacit go to the next choke size *down*. Always be prepared to go to a smalle choke size if tuning proves difficult. The common choke sizes listed belo are basic starting points.

Choke sizes (on basis of one choke per cylinder)-

28mm chokes: 250cc per cylinder.

30mm chokes: 300cc per cylinder.
32mm chokes: 350cc per cylinder.
34mm chokes: 400cc per cylinder.
36mm chokes: 462cc per cylinder.
38mm chokes: 525cc per cylinder.
40mm chokes: 600cc per cylinder.
43mm chokes: 800cc per cylinder.

The even sized choke numbers (32, 34, 36 and so on) are far more common and easily obtained than the odd sized choke numbers (31, 33, 35 and so on) and, as a consequence, engines are generally fitted with the most suitable even numbered sized choke. A 1300cc engine can have 30mm choke fitted initially but the engine may prove to need 32mm (or even 31mm) chokes after testing. The chart above is close enough for initial setting and the 2mm increments in choke sizing not usually too large as steps up or down during fine tuning. There is a degree of latitude with choke sizes but one choke size will always work better than all of the others for a particular application.

In the first instance use the even numbered chokes simply because of their easy availability but be aware of the fact that in-between sizes do exist and an odd sized choke may ultimately prove to be the correct one for your engine.

Intermediate choke sizes (on basis of one choke per cylinder) -

29mm chokes: 278cc per cylinder.
31mm chokes: 325cc per cylinder.
33mm chokes: 375cc per cylinder.
35mm chokes: 425cc per cylinder.
37mm chokes: 475cc per cylinder.
39mm chokes: 565cc per cylinder

The list which follows is in addition to the above and for large capacity engines.

Choke sizes for large engines (on basis of one choke per cylinder) -

40mm chokes in 45s or 48s: 600cc per cylinder.
41mm chokes in 45s or 48s: 700cc per cylinder.
42mm chokes in 48s: 800cc per cylinder.
43mm chokes in 48s: 900cc per cylinder.

There is another scenario that can be applied to all engines that are modified for occasional competition yet must be used most of the time as daily transport. That is to have two sets of chokes and jets: one set for each situation. If, for instance, a 2100cc four-cylinder engine with one choke per cylinder needs 38mm chokes with suitable jetting for competition use to obtain a maximum usable rpm of 7800, there's no reason why these chokes cannot be changed later to 34mm with suitable jetting. The low end performance of the engine will actually be improved and all you will notice at the top end is a very sudden and definite flattening off at a certain rpm, beyond which the engine simply will not go. With smaller chokes fitted the jetting can be reduced without detriment. What you will have done is governed the maximum engine speed by restricting the air supply. With 34mm chokes fitted, a good 2100cc engine will usually still go well up to 5500rpm or so.

Some engines, notably the BMC/Leyland A-series and B-series four-cylinder engines, are Siamese intake port units. A single sidedraft is usually fitted to these units, each choke feeding two cylinders. The choke selection for these engines can be based on the following -

Chokes for A-series (one sidedraft) -

850cc: 30mm chokes in 40mm carburetors.
998cc: 32mm chokes in 40mm carburetors.
1098cc: 34mm chokes in 40mm carburetors.
1275cc: 36mm chokes in 45mm carburetors.
1380cc: 38mm chokes in 45mm carburetors

Chokes for B-series (one sidedraft) -

1800cc (mild state of tune): 36 or 37mm chokes in 45 carburetor.
1800cc (well modified state of tune): 38 or 39mm chokes in 45 carburetor.
1900cc (bored out, well modified state of tune): 40 or 41mm chokes in 45 carburetor.

IDLE JET - SELECTING

Idle jet selection is based on the smallest jet size being used (compatible with good idling and, most importantly, good progression), balanced against the most suitable air bleed hole being used to give the correct mixture. A richer than necessary mixture will cover the progression phase but it will be wasting fuel. If all jetting was done on the basis of the richer the better there would be little economy and the overall performance would be very poor. Rich fuel mixtures do not produce optimum power.

On all Dellortos and Webers the idle jet system feeds an air/fuel mixture to the idle mixture adjusting screw. The idle mixture adjusting screw controls the amount of air/fuel mixture admitted to the engine for idling purposes but the idle jet combination

controls the overall ratio of that air/fuel mixture. The idle mixture screw is passing an air/fuel mixture which, when entering the throttle bore, is further mixed (leaned off by dilution) with the amount of air passed by the butterfly in its slightly open state.

The idle jet chart gives reasonable first number starting point sizes for idle jet selection. It is unlikely that the idle jet would need to be smaller than the listings given and consider 5 sizes up from the given listing to be the maximum ever likely to be needed. The final sizing of the idle jet is only known after the progression phase of the engine is tested because, although the engine can be set to idle with a certain sized jet installed, that does not mean that the same jet will give good progression, especially under load. The idle jet and air bleed size is selected finally on the combination's ability to give good progression (from idle to main jet operation).

Sorting out an idle jet for idling purposes only may seem like double work as the jet combination may well have to be changed at the next stage of the tune-up. This is a correct assessment of the situation but it is helpful if the engine is able to idle well, before the progression phase is checked. It is easier if only one thing is being sorted out at a time.

Idle jet codes (Weber)

Weber uses the same idle system throughout the DCOE range. The idle jets are coded 45F6, 55F2, 60F11 and so on. The fuel component of the range is stated by the first two numbers 35, 40, 45, 50, 55 *etc.* and denotes the hole size in hundredths of a millimeter and the sizes go up in 5 hundredths of a millimeter increments. All Weber idle jets have a suffix such as F6, F9, F11, F2, and so on, which denotes the air bleed sizing or hole sizing with F6 having the smallest hole and richest mixture strength. The air bleed hole is on the side of the jet. There are two parts to the numbering and lettering on Weber idle jets and the fuel hole and the air bleed are on the same jet.

Idle jet codes (Dellorto)

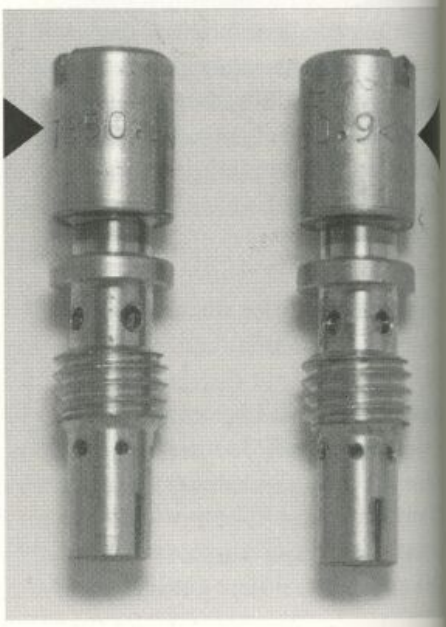
Be aware that some specially built Dellortos (DHLA 40 H and F) have only one holder and it has a top row of holes only (situated between the two threaded portions of the shank). These holes pass the fuel into the small mixing chamber which leads on into the carburetor throttle bore. The air bleed size is fixed by the size of the hole (2.00mm diameter) drilled into the actual body of the carburetor. This leaves only the fuel jet to be changed. These specially built carburetors can, in certain circumstances, be impossible to tune when fitted to other engines. The problem is the fixed sizing of the air bleed. Avoid these carburetors if complete adjustability is required for your application. Larger four-cylinder engines (1750 to 2000cc) will tune well with these carburetors, it is the smaller cc per cylinder engines that will be too lean at, and just off, idle.

The problem with 40 H and 40 F Dellortos can be fixed, however, by having small headed sleeves made up by a precision engineer. The sleeves should have a 2mm nominal outside diameter (push fit into the original hole) with an inside diameter of 1.2mm which makes the air bleed similar to a 7850.1 idle jet holder. The new hole (1.2mm) can always be opened out in 0.1mm increment sizes for correct air bleed sizing. With the size of the pre-drilled air bleed being quite large, these carburetors have more chance of being successfully tuned without any supplementary jets if the engine has at least 450cc per cylinder.

On the DHLA 40, 45 and 48 the idle jet holder has the air bleed hole (s in it and there is a separate idle jet (for fuel metering). Effectively this is very similar to the Weber arrangement. The holder has two sets of holes in it: one set to allow the air/fuel mixture to enter the carburetor body (the highest set) and another to allow the air to mix with the fuel (lower set). The lower hole/s range in size to allow more or less air to enter the central portion of the holder and then mix with the fuel.

There are ten code-numbered holders (7850.10 down to 7850.1), but there is no numerical richness/leanness sequence. The 7850.1 idle jet holder, for example, has one 1.4mm diameter hole in it while the 7850.8 idle jet holder has four 0.5mm holes in it (giving a leaner mixture with the same sized fuel jet).

The Dellorto fuel jets go up in 1s



Dellorto idle jet holder. Note the positioning of the air bleed holes which control the idle mixture and the progression phase mixture strength. Size numbers arrowed.

(40, 41, 42, 43, 44, 45 and so on) which gives a huge range to choose from. Expect to make size changes in increments of 2 or 3 (40, 42, 45, 48 and so on).

Idle jet & air bleed component - selection

The approximate idle jet sizes (Dellortos and Webers) for different applications which follow, unless otherwise stated, are based on one choke per cylinder applications. While Dellorto's jet range is far more comprehensive, the numbers of both company's jets pertain to the size of the holes in hundredths of a millimeter so with Weber the difference in hole diameter between a 45 and a 50 is 0.05mm (0.0025in) while Dellorto is 0.01mm (0.0005in).

40 idle jet: 250cc to 350cc per cylinder.
45 idle jet: 350cc to 420cc per cylinder.
50 idle jet: 420cc to 490cc per cylinder.
55 idle jet: 490cc to 560cc per cylinder.
60 idle jet: 560cc to 630cc per cylinder.
65 idle jet: 630cc to 700cc per cylinder.

With the idle fuel jet selection made, that still leaves the air bleed component of the combination to be chosen. The choice, for performance engines, can be narrowed down to F6, F9, F11, F2. (rich to lean) for Webers and 7850.8, 7850.2 or 7850.7, 7850.6, 7850.1 for Dellortos. Regardless of engine capacity, initially start with the leanest of the following (F2 the leanest in the Weber range and 7850.1 the leanest in the Dellorto range).

Air bleed component equivalents -

F2 Weber	*7850.1 Dellorto*
F11 Weber	*7850.6 Dellorto*
F9 Weber	*7850.2 or 7850.7 Dellorto (these two are nearly the same)*
F6 Weber	*7850.8 Dellorto*

The fuel and air bleed sizes given are approximations only and optimum sizes can only be found by testing the combinations. Refer to chapter 6 for details on how to narrow down the jet size so that the leanest mixture compatible with correct engine performance is obtained.

The air bleed is the cross-sectional area (by way of holes) available for an amount of air to be admitted to premix with the fuel which then becomes the air fuel mixture that is fed to the idle mixture adjusting screws and also, most importantly, the progression holes which are positioned downstream of the butterfly as it opens.

Weber idle jets with the same letter and number suffix on them all have the same sized holes in the side of the jet. That is what the code means. The fuel drilling will vary and be 45, 50, 55 etc. So each idle jet size in the F9 range for example produces a different idle mixture through having a different fuel intake hole size designated by the 45, 50, 55 prefix number.

The complete range of Dellorto 45 and 48 DHLA idle jet holder numbers are (rich to lean) as follows: *7850.8, 7850.2, 7850.7, 7850.6, 7850.3, 7850.1, 7850.4, 7850.9, 7850.10 and 7850.5.*

The Dellorto air bleed is used to fine tune the mixture. This, in principle, is identical to the Weber but in the case of the Dellorto the idle jet holder itself is changed as this component has the air bleed holes in it. With the idle jet selected from the chart given, the air bleed factor is increased or decreased by changing the holder.

Here's the complete range of DCOE idle jet air bleed suffixes listed in order (rich to lean) -

F6, F12, F9, F8, F11, F13, F2, F4, F5, F7, F1, F3.

Note that when a single sidedraft carburetor is fitted to a four-cylinder engine (BMC/Leyland Siamese intake port units), expect to use 50 idle jets for 850-1098cc, 60 idle jets for 1275-1800cc. For the air bleed component, start with F2 for Weber and 7850.1 for Dellorto.

Idle mixture and progression holes

The idle jet supplies air/fuel mixture to the progression holes. The passageway that takes the air/fuel mixture to the idle mixture screw passes over a series of holes that, when the throttle is at the idle speed opening, are positioned upstream of the butterfly. As the butterfly opens further these holes are swept over by the edge of the butterfly and are then subjected to engine vacuum as they each become downstream of the butterfly. An accelerating engine needs a richer fuel mixture and on these carburetors it gets one instantly by way of the fact that the air/fuel mixture is already flowing to the idle mixture adjusting screw, and when the throttle is opened the air/fuel mixture simply drops in through the holes as they are exposed to vacuum.

The point is that, if the engine is to accelerate smoothly, the air/fuel mixture that goes in through these holes has to be exactly right. This is why the idle jets have to suit the

progression phase perfectly. The air fuel mixture for idling has a degree of adjustment via the idle mixture adjusting screw but the progression mixture can only be altered by changing the jets for an overall mixture change.

The progression holes get their air/fuel mixture from the idle jet, as do the idle mixture adjusting screws. The idle jet supplies both the idle mixture adjusting screw and the progression holes from the same passageway. The air/fuel mixture is already flowing to the idle mixture adjusting screw and, as the progression holes are exposed (by opening the throttle), the mixture simply falls in instantly and at a suitable strength. If the mixture going to the idle jet is a very lean one it will not assist the engine in the acceleration phase as it is designed to do and will cause hesitation.

If the throttle is opened too much at idle the first of the progression holes will be in operation: this should never be necessary and is not desirable. The engine has to idle without any progression hole assistance (extra air/fuel mixture). From idle to main jet operation the progression holes fill what would otherwise be a flat spot by instantaneously adding air/fuel mixture to the main air stream. Just as the name suggests these holes are progression holes used to smooth the way between idle and main jet operation.

IDLE SCREW ADJUSTMENT PROCEDURE

The idle screw adjustment procedure is the same for both carburetors. Turn the screw in to lean the mixture off and turn it out to richen the mixture. The idle screws themselves vary quite a bit. The Weber uses a fairly coarse thread which is technically quite correct for something tapped into a soft material such as an aluminum carburetor body. The later Dellorto carburetor uses a very fine pitched thread which is not really good practice when used in cast aluminum. The spring and the idle screw is enclosed in a tower. The earlier Dellortos had coarse threads and are very similar to the Weber. The Weber will characteristically require 2.5 turns out from the fully in position while the Dellorto will usually require 3 turns out from the fully in position. Of course, the objective is to find a position - by progressively turning the screw outwards - which allows the engine to accelerate from idle speed without hesitation.

MAIN JET - SELECTION

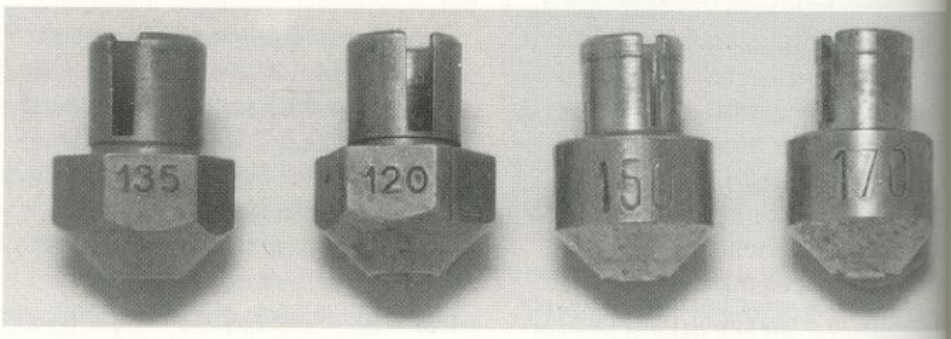
Both carburetors have a numbering system for the main jets but, whereas Weber uses 135, 140, 145, 150 and so on, Dellorto uses 135, 136, 137, 138, 139, 140 and so on. A considerable range of sizes is available from both companies but the Weber size increments are usually satisfactory, Dellorto's bigger range via smaller incremental increases is a very useful feature. For example, with a Weber the main jets may be 140 and not rich enough for the application so 145 will have to be fitted; however, this size increase may be slightly more than is necessary. With a Dellorto, going from 140 to 142 may well prove to be exactly right. It's a small point, but it works in favor of Dellorto.

The following chart gives main jet sizes for modified engines with choke sizes chosen as indicated earlier. The recommendations represent the rich side or 'jetted up' side for the given applications so jetting down may be necessary for optimum results - but only after testing. The main jet *must* be sized correctly because over-rich mixtures wash the oil film off the cylinder bores and cause high cylinder wear; conversely, lean mixtures can damage the engine through overheating. For mildly tuned engines, expect to drop up to 5 in jet size from the following recommendations -

Main jet recommendations (one choke per cylinder) -

120: 250cc per cylinder.
125: 275cc per cylinder.
130: 300cc per cylinder.
135: 350cc per cylinder.
140: 400cc per cylinder.
145: 475cc per cylinder.
150: 550cc per cylinder.
155: 625cc per cylinder.
160: 700cc per cylinder

Siamese intake port engines from the BMC/Leyland range should work with the following main jet sizes.



Weber main jets (left) and Dellorto main jets (right) showing the position of the sizing numbers.

Main jet recommendations (BMC/ Leyland Siamese port engines) -

30mm choke: 130 main jet.
32mm choke: 140 main jet.
34mm choke: 150 main jet.
36mm choke: 160 main jet.
38mm choke: 175 main jet.
40mm choke: 195 main jet

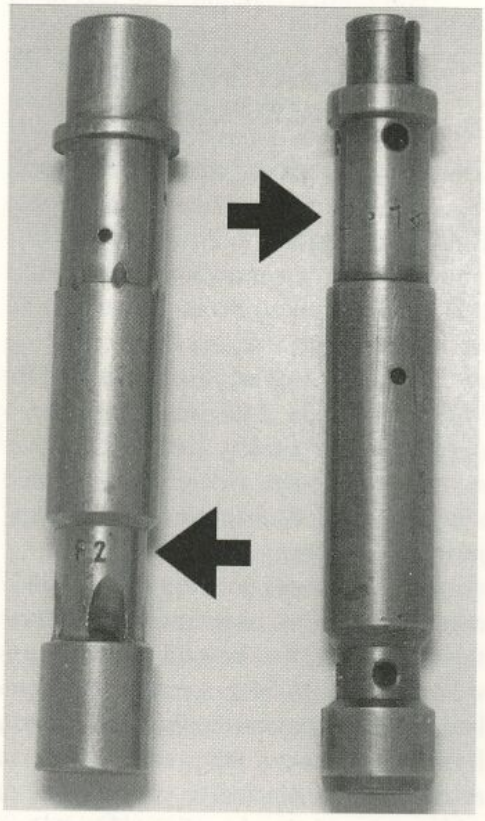
EMULSION TUBE - SELECTION

This tube affects the acceleration phase as the main jets are activated. If the emulsion tube is incorrect the engine simply will not accelerate cleanly. The Weber emulsion tubes are all the same length and have the same fitting diameters for the main jets and the air corrector jets. The Dellorto emulsion tubes are all the same overall length and their main jet and air corrector fitting diameters are all the same.

The emulsion tubes of both carburetors are graded according to their diameters, number of holes, size of these holes and the position of these holes. The Weber tubes are listed as F7, F8, F2, F11, F16, F15, etc. while the Dellorto listing goes 7772.3, 7772.4, 7772.5, 7772.6, 7772.7, *etc.* The Dellorto listing has the first four digits as the part number and the .3, .4, .5, .6, .7, *etc.* denotes the richness or leanness factor of the particular emulsion tube. The Dellorto goes rich to lean with .5 being richer than .6 for example. The higher the last number is on the emulsion tube the leaner overall the tube will be.

The Weber, on the other hand, does not have a numerical sequence but the tubes can be put into a listed sequence. What follows deals only with the requirements of modified engines so the complete listing of Dellorto and Weber emulsion tubes is not included. The following shows the Weber listing going rich to lean or large cylinder capacity to small cylinder capacity: *F7, F8, F2, F11, F16, F15, F9.*

There is a considerable likeness between several of the Weber emulsion tubes. The F2, F16, F11, F9 and F15, for example, are all of similar dimension except for the diameter of the central portion (the F2 is 7.5mm in diameter, the F15 8.0mm, the F16 8.0mm, the F9 8.2mm and the F11 8.0mm). The F9, F15 and F2 are only different in main diameter, all small holes being of similar size and position. F7 and F8 are the same except for the F8's two small holes positioned near the top. There *is* logic in the richness/ leanness factor between the emulsion tubes, it's just that the identification system seems alphabetically and numerically illogical.



Weber emulsion tube (left) and Dellorto emulsion tube (right). Position of sizing numbers arrowed.

Dellorto is listed in sequence with .16 supplying the weakest mixture and .1 supplying the richest mixture. Their system is easier to follow in some respects. The following shows the Dellorto listing going rich to lean or large cylinder capacity to small cylinder capacity: *7772.2, 7772.3, 7772.4, 7772.5, 7772.6, 77772.7*

The following is a guide to what are likely to be the right emulsion tubes for modified engines. Modified engines need more fuel mixture than stock engines (the cross references between Weber and Dellorto as listed here are close approximations) -

Emulsion tube selection (one choke per cylinder) -

F11/7772.8 for cylinder capacities of 250cc to 325cc.
F15/7772.7 for cylinder capacities of 275cc to 400cc.
F16/7772.6 for cylinder capacities of 350cc to 475cc.
F2/7772.5 for cylinder capacities of 450cc to 575cc.
F8/7772.4 for cylinder capacities of 550cc to 675cc.
F7/7772.3 for cylinder capacities of 675cc and above

There is some overlapping in the foregoing list because air/fuel mixture demands of well modified, high efficiency engines are more like they would be for larger capacity engines. For example, the F15 tube is very similar to the F16 except for four small holes drilled very high up near the air corrector. If F15s are used on a well modified 1600cc four-cylinder engine, for example, they usually cause the engine to miss at high rpm and substitution of an F16 emulsion tube fixes the problem immediately.

Siamesed intake port engines, as found in the BMC/Leyland range, should be happy with the following tubes -

Emulsion tube selection (BMC/ Leyland Siamese port engines) -

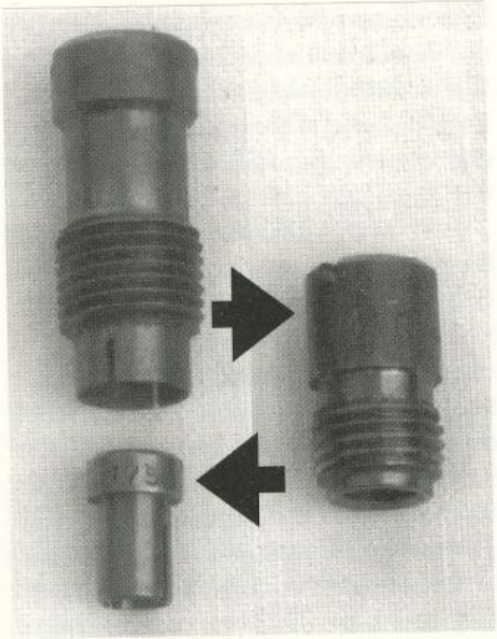
F16/7772.6 for smaller engines (850cc to 1098cc).
F2/7772.5 for larger engines (1275cc and up).

AIR CORRECTOR - SELECTION

The air corrector is used to tune top end performance but only over a very small range. Changes in air corrector size are made in increments of 10 at the very least and, more often, 20. Expect the range of air correctors to be from 150 to 230 for use with the main jets previously listed. Start with 160s and go leaner (a larger air corrector number). If the air corrector is too lean (large diameter) the engine will miss as it nears maximum rpm, and if too rich (too small a diameter) the engine will not produce optimum power. Within a small range of these two extremes will be the optimum size.

For example, if 180 gives good power and going to a 200 causes the engine to misfire, while a 190 gives good power and no missing, the choice is either 180 or 190. Go with the 180 provided the power output remains the same. The Weber range of air correctors is 140, 145, 150, 155 and so on. The Dellorto range is the same except between 140 and 205 where they go up in .25 divisions (which is too fine and not really necessary). Weber have it right here.

BMC/Leyland Siamese intake port engines all start with 180 air correctors.



Weber air corrector (left) and Dellorto holder (right). Position of the sizing numbers arrowed.

AUXILIARY VENTURI - SELECTION

The Weber number sequence is 3.5, 4.0, 4.5, 5.0 and so on, while the Dellorto is a suffix of .1, .2, .3 and .4. The numbers are stamped on the auxiliary venturi on the outer surface of the diameter near the entry of the air/fuel mixture passage way on Webers and cast in on the outside diameter on Dellortos. If the auxiliary venturi is not large enough the engine will falter at a certain point in the rpm range. What happens is that the engine just cannot get enough air/fuel mixture, so go up to the next size if this happens. The size of the auxiliary venturi has to be large enough but not larger than what is actually necessary. It is more a case of fitting the smallest auxiliary venturi possible compatible with top engine performance. Do not fit a 5.0 auxiliary venturi when a 4.5 is able to flow the necessary air/fuel mixture requirements. The table below gives the approximate numbers required on the basis of the ccs per cylinder of any engine -

Weber carburetors -

3.5 auxiliary venturi for up to 250cc per cylinder.
4.0 auxiliary venturi for up to 400cc per cylinder.
4.5 auxiliary venturi for up to 550cc per cylinder.
5.0 auxiliary venturi for 550cc per cylinder and up.

Note: Weber use a totally different shape of auxiliary venturi for the 40 DCOE as compared to the 45 and 48 DCOE. Be aware of this fact when ordering auxiliary venturis.

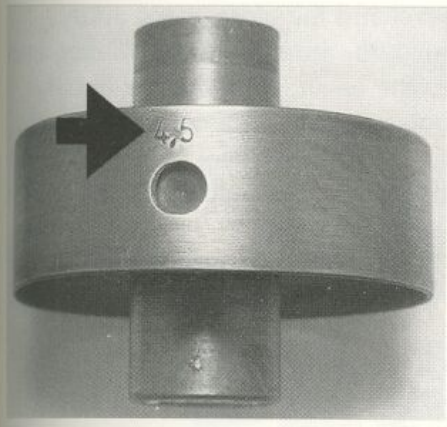
Dellorto DHLA 40 carburetors (venturi number prefix 7848) -

.4 auxiliary venturi for up to 250cc per cylinder.
.3 auxiliary venturi for up to 400cc per cylinder.
.2 auxiliary venturi for up to 550cc per cylinder.
.1 auxiliary venturi for 550cc per cylinder and up.

Dellorto DHLA 45 & 48 carburetors (venturi number prefix 8011) -

.4 auxiliary venturi for up to 250cc per cylinder.
.3 auxiliary venturi for up to 400cc per cylinder.
.2 auxiliary venturi for up to 550cc per cylinder.
.1 auxiliary venturi for 550cc per cylinder and up.

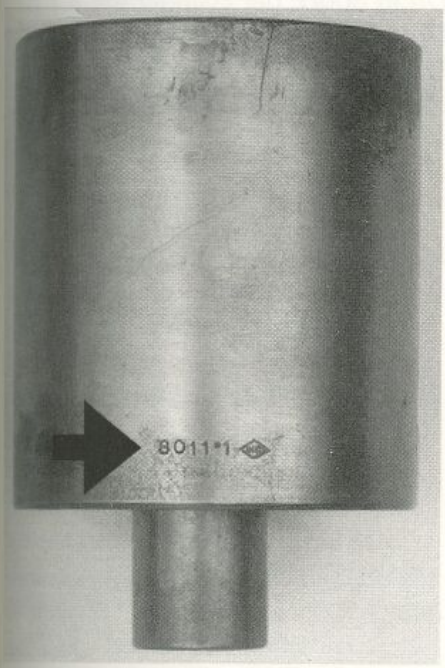
Note that while the full number of the Dellorto auxiliary venturi may be, say, 7848.3, only the last number



Weber auxiliary venturi. Position of sizing numbers arrowed.

refers to the size of the venturi and, therefore, it's customary to refer to the auxiliary venturi simply as a .1, .2, .3 or .4.

On auxiliary venturis from either company the slot in the side of the venturi that carries the air/fuel mixture



Dellorto auxiliary venturi. Position of sizing numbers arrowed.

to the nozzle varies in size. The slot of the 3.5 Weber venturi is much smaller in cross-sectional area than the slot of the 5.0. The .4 Dellorto is smaller in cross-sectional area than the slot of the .1. The bigger the flow capacity of the engine the bigger the cross-sectional area of the slot in the auxiliary venturi.

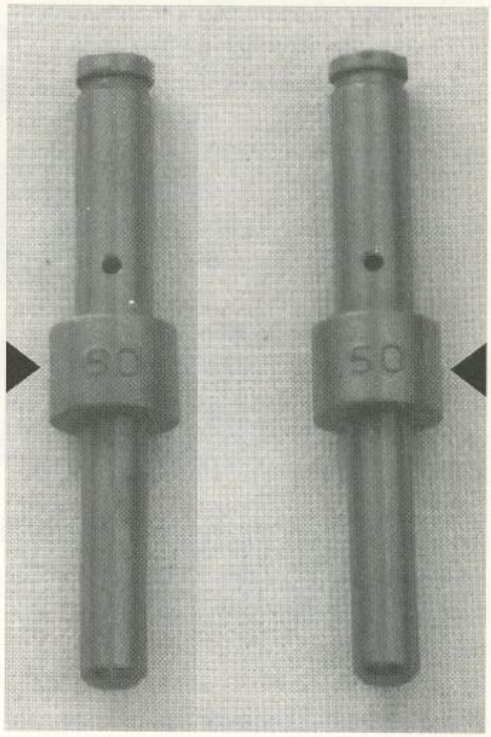
BMC/Leyland Siamese intake port engines use Weber 4.5 auxiliary venturis or Dellorto .1 or .2 (the larger engines will use .1s but the smaller engines - up to 1000cc - usually accept .2s).

ACCELERATOR PUMP JET - SELECTION

The Weber range for average use is 30, 35, 40, 45, 50, 55 and 60 (the number referring to the hole size in hundredths of a millimeter). Dellorto have a wider range using the same principle of the given size being in hundredths of a millimeter, their range includes all of the Weber sizes and what can be arbitrarily termed half sizes. You can get 40, 41, 42, 43, 44, 45, and so on, from Dellorto which further assists fine tuning.

For all engines the accelerator pump jets have to be large enough to remove any trace of hesitation or stumbling when the accelerator pedal is depressed but not more than this. Find by trial and error the smallest pump jet that gives the best performance. Even with long duration camshafts it is possible to have smooth acceleration from quite low rpm in a high gear (full load) without any 'spitting back' or engine hesitation.

Overlarge accelerator pump jets will certainly cause excessive fuel use and to no advantage. A too small accelerator pump jet will cause the engine to die momentarily when the accelerator is depressed. Too large an accelerator pump jet causes the engine to 'bog' which effectively amounts to the same thing (a slow car) and then pick up after the excess mixture has been removed from the engine.



Weber accelerator pump jets. Position of size numbers arrowed.

The following list gives a basic starting range of accelerator pump jet sizes for modified engines (*ie* with long-duration camshafts, worked cylinder heads, high compression, extractor exhaust systems). Try the smallest sizes first. The accelerator pump jets listed are average, so expect to come down on the recommended sizes for engines that are not overly modified (*ie* stock ports, stock compression, mild camshaft). There is a degree of overlapping with accelerator pump jets and sometimes a larger jet just has to be used. Dellorto have the edge here with their larger range.

Accelerator pump jet selection -

300cc per cylinder: 35s on the high side and 30s on the low side.
400cc per cylinder: 40s on the high side and 35s on the low side.
500cc per cylinder: 45s on the high side and 40s on the low side.

600cc per cylinder: 50s on the high side and 45s on the low side.
700cc per cylinder: 55s on the high side and 50s on the low side.
800cc per cylinder: 60s on the high side and 55s on the low side.
900cc per cylinder: 65s on the high side and 60s on the low side.

Note that with the Weber, the pump jet sizes go up in increments of 5 but they also use an accelerator pump discharge bleed to reduce the size of the shot. With this device there is adjustment to increase, or decrease, the fuel volume delivered. The intake and discharge valve is found in the bottom of the float chamber. This valve can have a large hole in it (maximum bleed-off) down to a small hole (minimal bleed-off) or no hole at all, in which case the full shot is delivered. Dellorto do not use this type of arrangement and offer full shot fuel delivery all the time, however, their pump jets go up in increments of 1 which allows correct calibration within the confines of a full shot. Both systems work perfectly. When tuning a Weber, if, for instance, a 45 pump jet is too large and a 40 too small, fit the 45 pump jet and check the size of the bleed and increase the bleed size by 5 (larger hole to reduce shot size).

On BMC/Leyland Siamese intake port engines expect the pump jet sizes to range from 40 on the smaller engines (850cc) to 50 on medium size engines (1380cc) and 60 on the larger engines (1800cc).

NEEDLE VALVE - SELECTION

The needle valve has to be large enough to keep up with the fuel demand of the engine; however, it should not be larger than is necessary. A large needle valve tends to gush the fuel in more than a small needle valve. If the needle valve is too large for the particular application, the valve will allow fresh fuel in very fast causing the float to rise and the needle valve to close but not fast enough to prevent the fuel level rising above the specified level and therefore giving a rich mixture. Sure, the level will drop again as the engine uses the fuel but what you have here is a constantly altering fuel level in the float chamber (up and down over the optimum level) and this is not desirable.

The following are recommended needle valve sizes for different engines:

One choke per cylinder applications -

Up to 300cc per cylinder use a 1.50.
Up to 400cc per cylinder use a 1.75.
Up to 500cc per cylinder use a 2.00.
Up to 600cc per cylinder use a 2.25.
Over 600cc per cylinder use a 2.50.

One choke per two cylinder applications -

Up to 250cc per cylinder use a 1.50.
Up to 300cc per cylinder use a 1.75.
Up to 350cc per cylinder use a 2.00.
Up to 400cc per cylinder use a 2.25.
Over 400cc per cylinder use a 2.50.

Chapter 5
MANIFOLD PREPARATION & CARBURETOR FITTING

INTAKE MANIFOLD - CHECKING & PREPARATION

Good progression, snappy mid-range performance and optimum top end power requires identical throttle opening in multiple carburetors from idle to full throttle. There is *no* substitute for absolute accuracy.

Intake manifold alignment is critical when linked throttle arms are used and this aspect of carburetor tuning is vital if maximum performance is required from engines with two or more carburetors. To take a common situation with twin sidedrafts on an in-line four-cylinder engine, the carburetor butterflies can be set perfectly at idle and just off idle yet, at half throttle and more, one set of butterflies can start to lag behind. At full throttle the situation is not usually so bad because the throttle spindle obscures the actual butterfly through its own physical size, so a bit of incorrect butterfly angle between the carburetors does not always affect wide open throttle performance but the mid-range power will however be down in this situation. A common fault that causes butterflies to become unsynchronized at part throttle is poor intake stud to carburetor body alignment. This is a seriuos indictment of some manufacturers of intake manifolds who should know how important this feature is.

Importance of stud alignment

All intake manifolds must be checked for accuracy. There are various multiple carburetor linkages available but the most common is the linked throttle adjuster arrangement. However, this system will only be as good as the alignment of the intake manifold. If your manifold does not prove to be accurately made return it to the manufacturer for replacement or have the offending studs repositioned. The following simple test can be carried out anywhere using an engineer's rule or a straight edge. If the manifold does not have any studs fitted just screw in some bolts. Lay the rule edge along the studs (see photo). If the studs are out you will be able to see it at a glance. The maximum allowable error is about 0.25mm (0.010in) but there should really be no perceptible alignment error.

If your manifold has two or three stud holes out by a reasonably small amount (1mm/0.040in) the easiest way of having a stud hole repositioned is to either 1) have the complete hole filled by TIG welding, reface the manifold surface and then re-drill and tap the hole in the correct position or 2) move the centre of the hole over by offset boring using a milling machine and fit a Helicoil which will correct the situation. Clearly the best thing to do is check the manifold properly before buying it and make sure you get a good one in the first place.

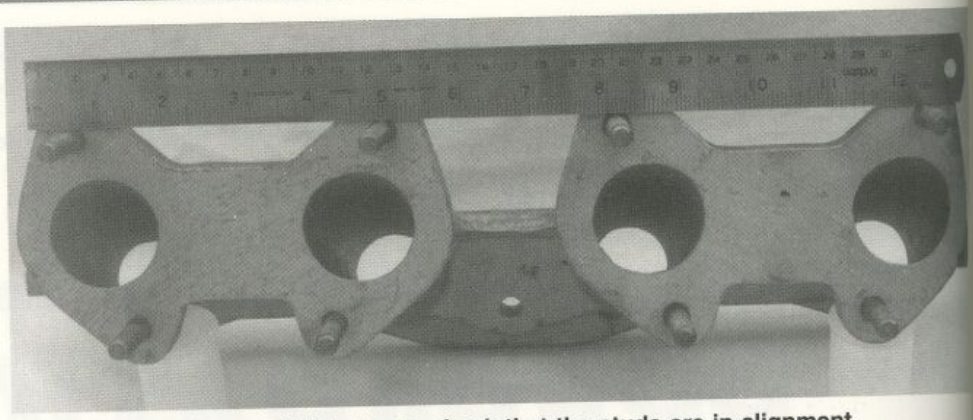
With the linked type of joining

system the carburetors must be parallel (within 0.1mm/0.004in) to the intake manifold when O-ring gaskets are in place and the studs nuts are all tightened. They must also be perfectly in-line when looking straight down the throttle bores, or spindle to spindle, in both planes.

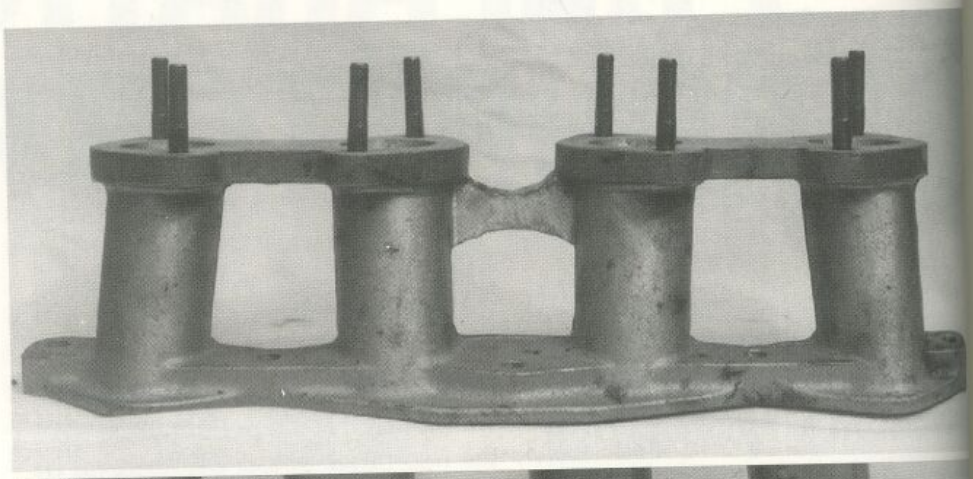
Another method of throttle action involves pushrods with balls and sockets at each end. This is quite common on six-cylinder in-line engines and comprises a sturdy, full length throttle bar with lever arms positioned directly above each carburetor's throttle arm. Once again component accuracy plays a large part in making sure all butterflies are operating in unison. The throttle bar lever arms must all be of equal pitch (within 0.1mm/0.004in). Otherwise if one arm has a shorter pitch, for instance, that particular carburetor will have advanced butterfly opening. The balls and sockets have to be kept in perfect condition if settings are to be reliably maintained. Manifold stud alignment is less critical when compared to the direct linkage system but, ideally, *all* intake manifolds should have accurate stud alignment.

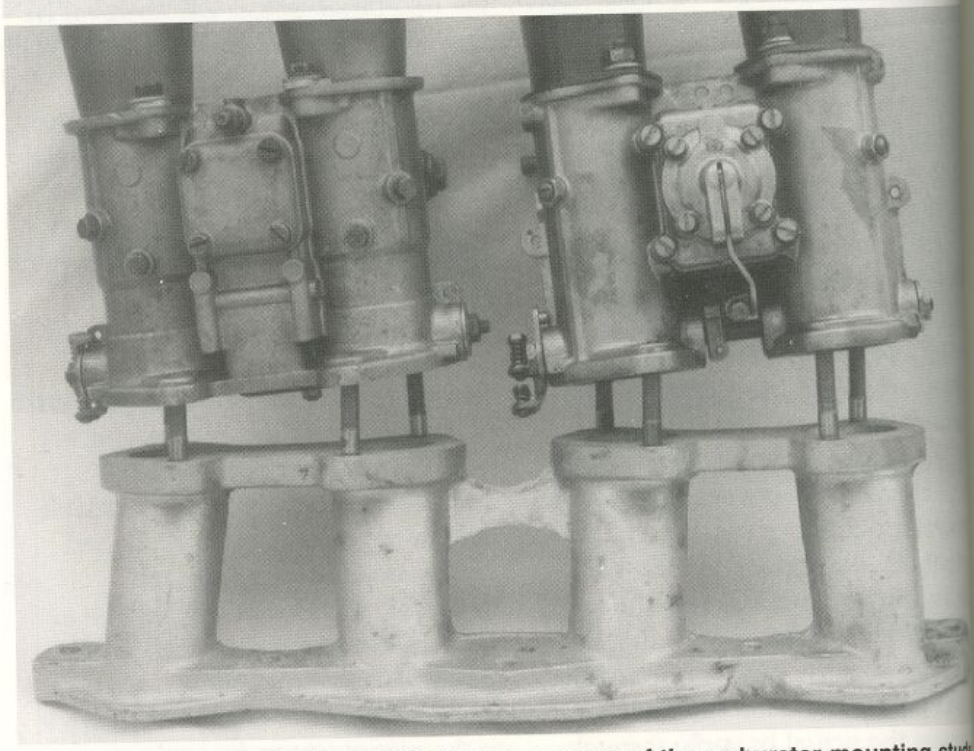
Carburetor - checking fit

It is actually better to fit the carburetors to the manifold off the engine. With the integrity of the intake manifold checked (stud alignment and face flatness) fit all studs to the manifold and use Loctite (or any other suitable retaining compound) on the threads. Torque the studs to about 7 foot pounds using locked nuts. Check that all studs are at 90 degrees to the manifold face in all planes. This is to ensure that the carburetors will fit over the studs easily. All studs must protrude from the manifold's surface a minimum of 38mm (1.5in). The top

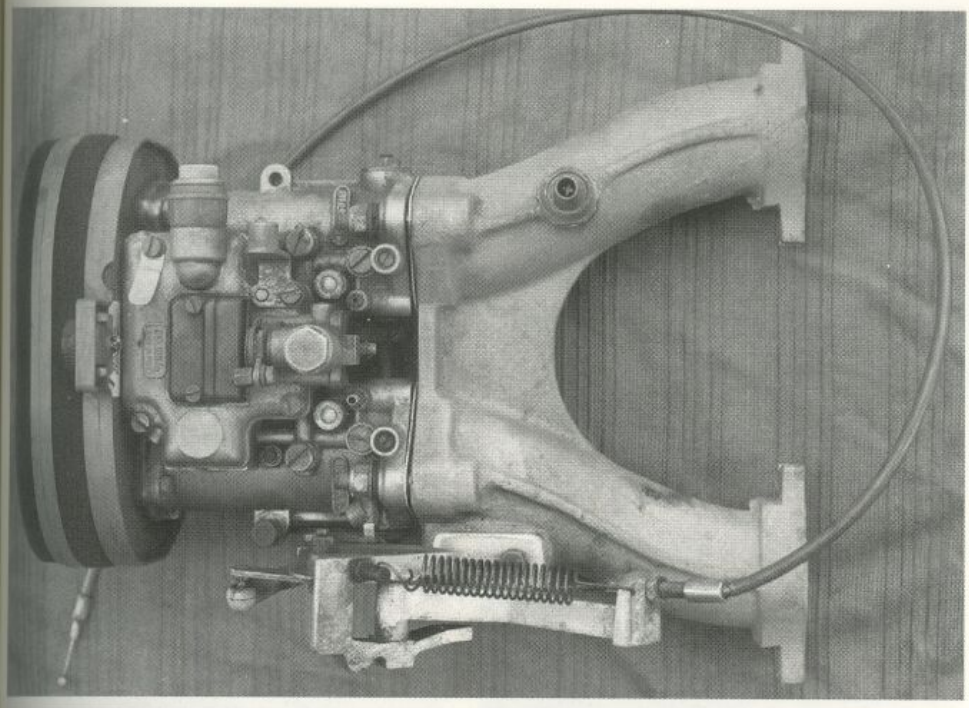


Use a straight edge to check that the studs are in alignment.

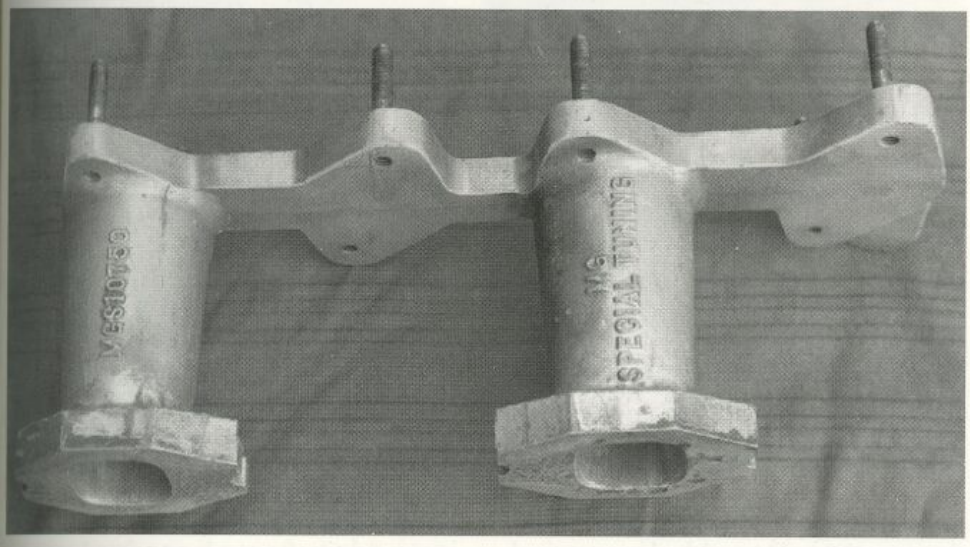




The typical twin-sidedraft manifold. Note how some of the carburetor mounting studs are angled and how, in the second picture, the carburetors (a Weber and a Dellorto) won't slide over the studs.



Typical intake manifold for single carbuburetor, siamesed intake port applications. (Courtesy Peter Burgess).



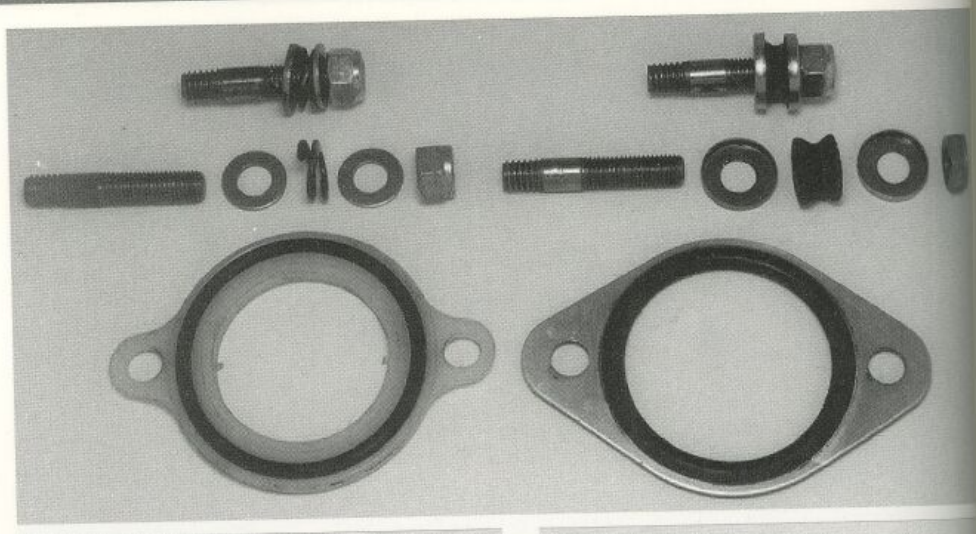
Special manifold to allow twin sidedrafts (only one choke of each carburetor is used) to be fitted to a siamese intake port engine. The advantage of this set-up is that the operative carburetor chokes are in line with the head ports. (Courtesy Peter Burgess).

ones should not be longer than 38mm but the bottom ones can be up to 40mm (1.57in) as there is plenty of clearance. Fit a carburetor to each set of studs. It must fit easily and not bind on the studs all the way down to the manifold surface.

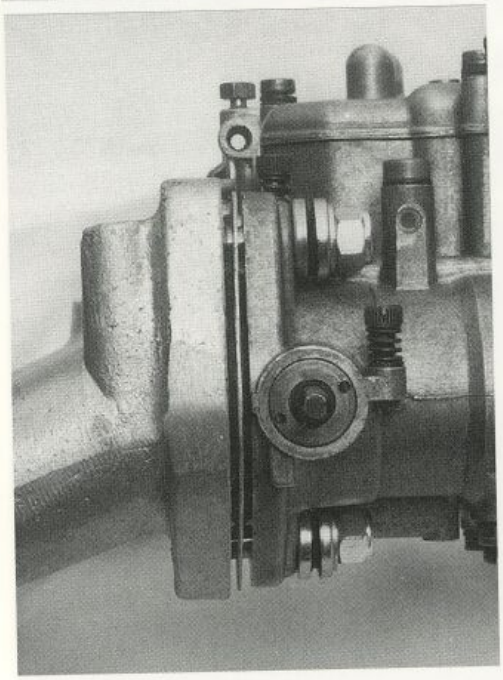
Anti-vibration mountings

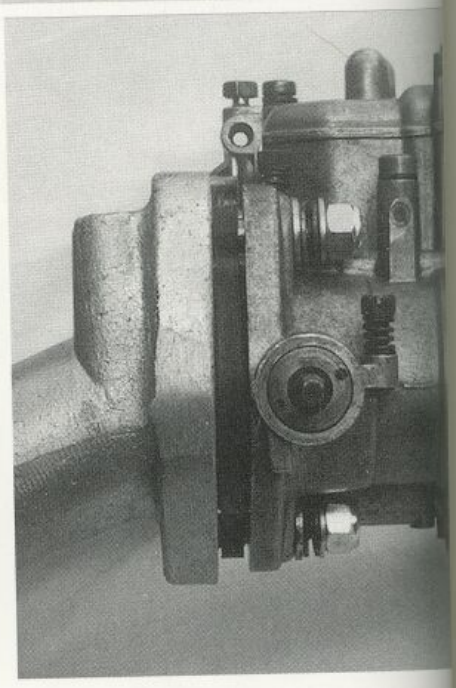
Because they are susceptible to fuel frothing, Weber and Dellorto carburetors are installed with anti-vibration O-ring gaskets and related componentry. Kits comprise the large O-ring gasket (one per choke) and rubber grommets, metal caps and nylock nuts. In some applications "Thackery" washers (short flat wound coil springs) are used beneath the carburetor securing nuts and these washers apply tension, via the carburetor body, to the O-rings.

Engines fitted with Webers or Dellortos as original equipment usually feature moulded rubber mounting



MISAB spacer (bottom left) and a O-ring carrier (bottom right). Stud, rubber grommet and a nylock nut assembled (top right). Stud, flat washer, thackery washer, flat washer and a nylock nut assembled (top left).





Right - Carburetor bolted to manifold showing the MISAB spacer in position. When the carburetor is finally bolted up, the distance between carburetor flange and the intake manifold flange must be equal in all positions to prevent air leakage. Note that the rubber grommets on the studs must not be completely compressed.
Far right - Carburetor bolted to manifold showing O-ring and carrier in position. It often pays to use a small amount of silicon sealer to hold the O-ring in the plastic carrier to prevent the O-ring from falling out while fitting the carburetors. Note that Thackery washers must not be completely compressed.

blocks between the carburetor/s and the manifold. These blocks are excellent, but cannot usually be adapted to any other application.

CARBURETOR/S - FITTING TO MANIFOLD

Ensure that throttle levers are fitted to the carburetor spindles and that the new lockwashers have their tabs bent over against their nuts. Place the O-rings over the studs and then fit the carburetors over the studs and settle them down onto the rubber O-rings. If twin sidedrafts are being fitted with a linked throttle bar arrangement, interlink the throttle bars while the carburetors are on the bench and then carefully offer the manifold up to the sitting carburetors (not the other way around). If the carburetors are operated by an auxiliary bar then this is not a problem. Either way settle the carburetors on to O-rings, then fit the rubber grommets over the studs and then fit the metal grommet covers over the studs

Fitting the Nylock nuts is next and

the top four nuts should be engaged first because there is the possibility of some interference with the carburetor body. All four nuts on the underside of the carburetors go on next and they will fit as there is plenty of clearance available. The carburetors may have to be lifted slightly to facilitate starting the nuts on the stud threads. Once all the nuts are wound on about three turns or so they will be clear of the carburetor body. The nuts are all wound down evenly until all are in contact with the metal grommet caps but the rubber grommet is still at its uncompressed height. In other words, no tension has been applied to the rubber grommet. Now wind down all nuts evenly, that is, one turn on each at a time until the metal grommet caps are within 1.5mm (0.059in) of the carburetor lugs. The O-rings will now be compressed and the distance between the carburetor and the intake manifold will be approximately 5mm (0.196in). This clearance must be checked reasonably frequently if the rubbers are brand new. The aim is to tighten all the nuts so that a distance of 1.5mm between each grommet washer and the carburetor lug is achieved. If the rubber O-rings are not under sufficient tension the carburetors may not have a good effective seal and any loose carburetor could run lean through the ensuing air leak.

To check the installation measure the distance between the carburetor flange and the intake manifold face at the top and bottom; the measurement must be equal (within 0.25mm/ 0.004in). If this is not the case expect possible leakage in the area with the largest measurement. The second reason for having the measurements equal is to ensure spindle alignment. It is vital to have the spindles exactly in line if a linked throttle arm system is used.

Irrespective of the type of throttle linkage used or the number of carburetors involved each carburetor must be mounted parallel to the manifold face. This is to preclude air leaks, which, if they exist, will interfere with the fuel/air mixture and general running of the engine. Check each carburetor frequently and especially if new rubbers have been fitted as they settle over time and what was quite tight can end up quite loose.

Chapter 6
TESTING & SET-UP

What follows is a tuning sequence that can be applied to any Weber/ Dellorto sidedraft carburetor installation irrespective of how many carburetors are involved. From this point on only tuning technique is discussed. Your carburetor/s should now be fitted with the chokes, venturis and jets chosen from the recommendations given in chapter 4 and, although alterations may well have to be made, the basic set-up should be nearly correct.

IDLE SPEED

The duration and overlap of the camshaft has a huge affect on the idling speed. The range of reasonable idling speeds for different camshaft configurations is as follows.

Standard camshaft (about 240 degrees duration, 30 degree overlap): 500rpm.

Mild performance camshaft (265 to 270 degrees duration, 50 degrees overlap): 800rpm.

Medium performance camshaft (270 to 290 degrees duration, 70 degrees overlap): 1000rpm.

Racing camshaft (290 to 320 degrees duration, 90 degrees overlap): 1200 rpm.

FUEL LEVEL & NEEDLE VALVE OPERATION - CHECKING

Make sure float levels are correctly adjusted; the float level setting procedure is given in chapter 2.

If the engine has a mechanical fuel pump it should be cranked over or, if equipped with an electric fuel pump, the ignition turned on to allow the carburetor float bowls to fill with fuel. Check to see whether the needle valves are actually shutting off. The first indication of flooding will be fuel pouring out of the fuel bowl vent. This can happen with new carburetors but is more usual with used carburetors that have not been rebuilt correctly. Flooding can be caused by dirt or debris in the needle valve body which prevents the needle from seating. With older, or badly rebuilt, carburetors the problem is more likely to be that the needle's tapered section is worn (grooved). Conversely, if the fuel bowls do not fill up, the needle could be jammed in the off position (dirt) and not allow the fuel to go into the float chamber. It is also possible for fuel line debris to block the mouth of the valve.

In the case of multiple carburetors, the next check is to remove the carburetor tops to see if the fuel levels of each carburetor look the same. Despite the fact that the floats are set to exacting measurements the ultimate aim of the procedure is to ensure that the fuel levels of each carburetor are the same and within optimal range on multiple carburetor set-ups. If neces-

sary, set the floats of individual carburetors to give identical fuel levels, even if it means setting the floats to slightly non-standard settings.

THROTTLE - INITIAL ADJUSTMENT AND SYNCHRONIZATION

This involves the setting of each set of butterflies so that, no matter how many carburetors are fitted, all will be flowing the same amount of air at idle and throughout their entire operating range. The engine has to be running to synchronize the carburetors so the next thing that has to be done is get the engine running so that adjustments can be made.

Throttle arm fit

Note that each carburetor has a throttle arm of some description and this throttle arm fits on to the spindle at that point where two flats have been machined on it. The throttle arm has a precision fitting slot in it that allows the throttle arm to be a tight fit on to the spindle. If the throttle arm is a used one, check the fit of the throttle arm on to the spindle. The fit must be tight. If it isn't, the carburetor could have been used with the securing nut loose. This will mean that, although the nut and washer are tight, the throttle arm and spindle are not accurately located and could move. If this happens the carburetor will go out of synchronization. Replace any throttle arm that is not a good fit on the spindle. (An alternative to replacing the throttle arm is to braise the flats of the throttle arm slot and then, using needle files, file the slot out to fit the spindle. If the spindle is also worn this is often the only way of restoring the fit unless the spindle and throttle arm is to be replaced).

Throttle - initial setting (single carburetor)

On single carburetor set-ups, simply turn the throttle arm adjusting screw clockwise until you see the throttle arm just begin to move and then turn the screw a quarter turn. If you are not sure of the throttle arm's state, turn the adjusting screw anti-clockwise and note if the arm moves. If the arm moves up then the throttle was cracked open. Turn the adjusting screw until the throttle arm stops moving. Slowly turn the adjusting screw clockwise until it contacts the throttle arm and then turn the adjusting screw a further quarter turn.

Throttle - initial set-up & synchronization (multiple carburetors)

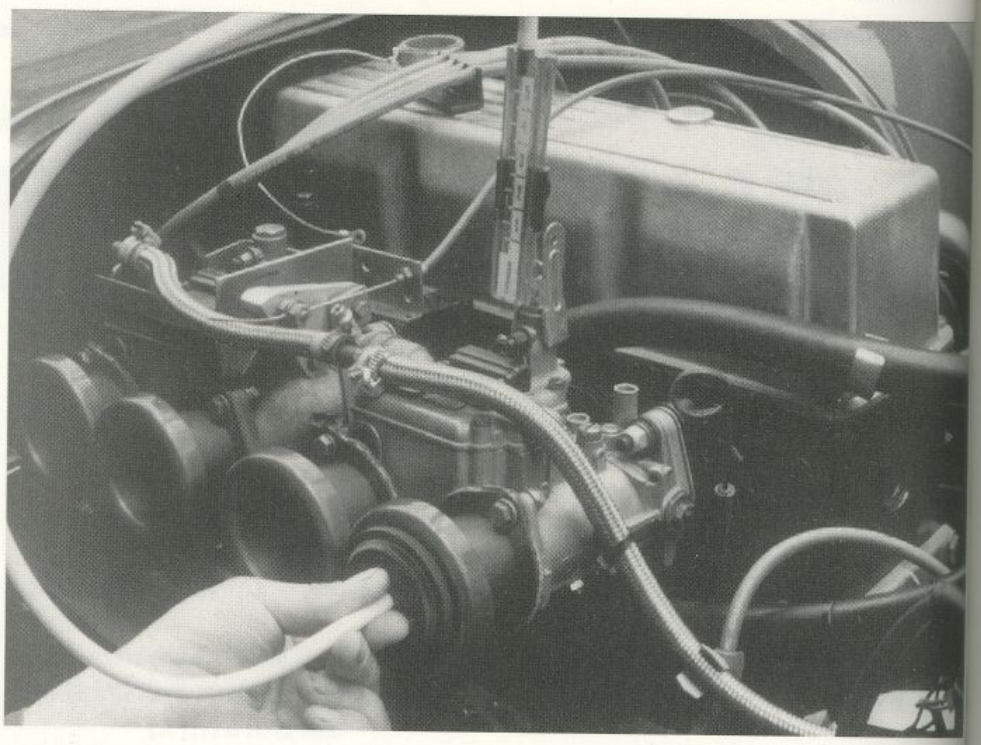
For multiple carburetors linked by individual pushrods with socketed balls, undo the linkage arms on the main throttle bar. Check that the rods from socket center to socket center are equal in length (to within 0.5mm/ 0.020in). Turn each throttle arm adjusting screw anti-clockwise until there is no movement of the throttle arm and then turn each throttle arm adjusting screw clockwise until it just contacts the throttle arm. Now turn the throttle arm adjusting screw of each carburetor a quarter turn clockwise. Go to the main throttle arm and put light downward hand pressure on each throttle rod in turn and tighten to the securing nut. Do this to each throttle rod so that there is little or no play in the mechanism. The throttle synchronization will not be exactly right but close enough to start the engine.

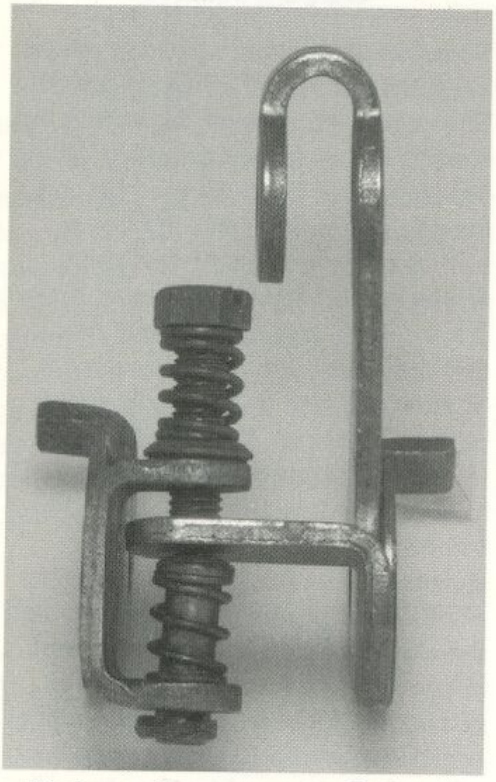
For multiple carburetors using the more common linked throttle arm joining mechanism, turn the synchronizing screw on the joining link anti-clockwise until the end of the screw is clear of the central lever. Turn the adjusting screw on the throttle arm anti-clockwise until the arm does not move. Then turn the throttle arm adjusting screw clockwise until it just contacts the throttle arm. Now turn the synchronizing adjustment screw clockwise until it contacts the central lever. Go back to the throttle arm adjusting screw and turn it a quarter turn. The throttle is now sufficiently synchronized to start the engine. At this point the throttle will work and all throttle arms will have a small amount of throttle wound on to effect an idle. The idle may not be smooth but it will be an idle.

IDLE MIXTURE - INITIAL ADJUSTMENT

Turn the idle mixture adjusting screws 2.5 turns out from the fully in position. The engine will start on this setting but it may not run all that smoothly. When the engine has been warmed up and the idle screw set to give 1000rpm, turn all of the idle mixture adjusting screws out a further 1.5 turns to make 3 turns in all. If the idle smoothness and rpm improves leave the number of turns at 3 and reset the idle speed back to 1000rpm. Turn the idle mixture adjustment screws out to a total of 3.5 turns and note if the idle smoothness and engine speed increases. If it does, leave the number of turns at 3.5; however, it is likely that the idle jets will have to be increased in size later on. For the purposes of getting the engine to idle as smoothly as possible within the confines of the selected idle jet combination, turn all of the idle screws equally to the number of turns and part turns that give the best possible idle smoothness. This could range (at this point in the proceedings) from 2.5 turns out to 3.5

Gunson synchronizing meter being used on a Dellorto carburetor.





The two main components of a linked throttle arm adjusting mechanism as used with multiple carburetors. One part of the arm fits to one carburetor's throttle spindle while the other piece of the arm fits to the throttle spindle of the adjacent carburetor.

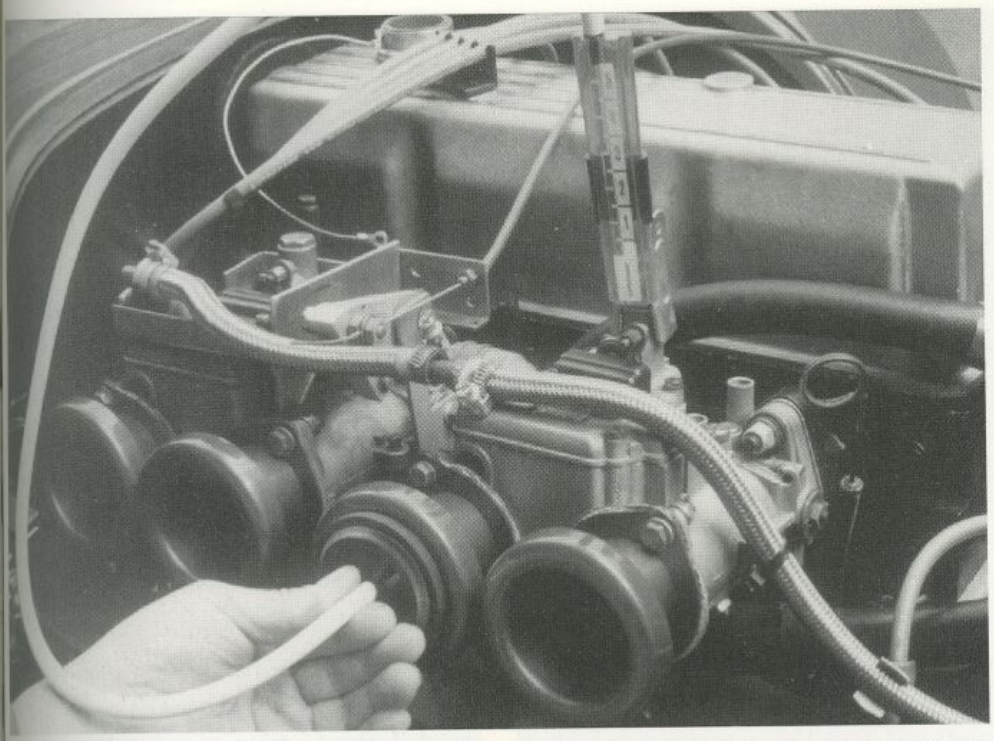
turns out from the lightly seated (turned in) position. The object of this exercise is just to get the engine idling sufficiently well to be able to synchronize the carburetors. The idle mixture strength can be finely adjusted later.

THROTTLE (LINKED THROTTLE ARM TYPE) - FINAL SYNCHRONIZATION

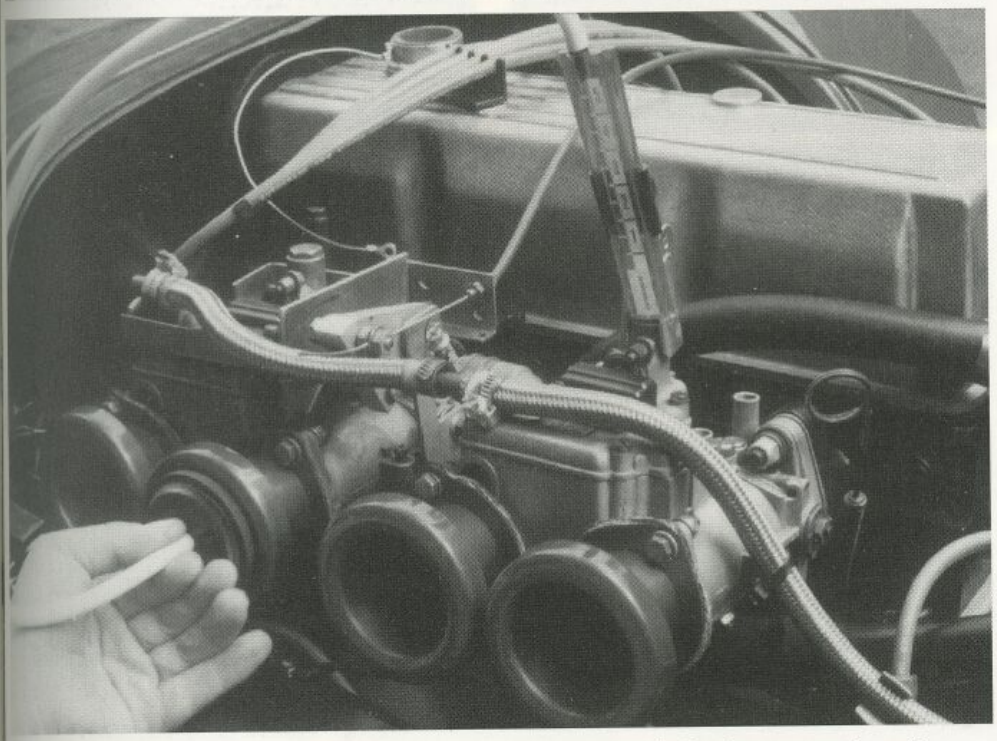
The linked throttle arm system is the most common for twin sidedraft installations. With the engine warmed-up and running at approximately 1200rpm, the two adjacent chokes of each carburetor pair are checked for air flow using a meter, of which there are several on the market. These meters give direct readings via a scale which is a part of the meter. This the only way to go for a consistently accurate result.

On these linked throttle arm systems there will be only one screw for adjusting the idle speed (on the basis of moving the throttle arm away from the carburetor body) and this is on the left-hand carburetor (looking at the carburetors intakes). Other carburetors are linked to this arm via the synchronizing screw mechanism. The synchronizing screw is used to equalize the airflow of the adjacent carburetors to the left-hand carburetor. The left-hand carburetor is the lead carburetor and the other is adjusted to match it. The adjusting screw of the right-hand carburetor can be adjusted to cause the right-hand carburetor to receive more or less air than the adjacent carburetor and cause engine rpm to rise or fall. Turning the adjusting screw clockwise increases the airflow into the right-hand carburetor and turning the adjusting screw anti-clockwise reduces the airflow. When the linkage is synchronized correctly, the throttle arm adjusting screw on the left-hand carburetor is used to adjust the idle speed of the engine.

Readings can be taken from any



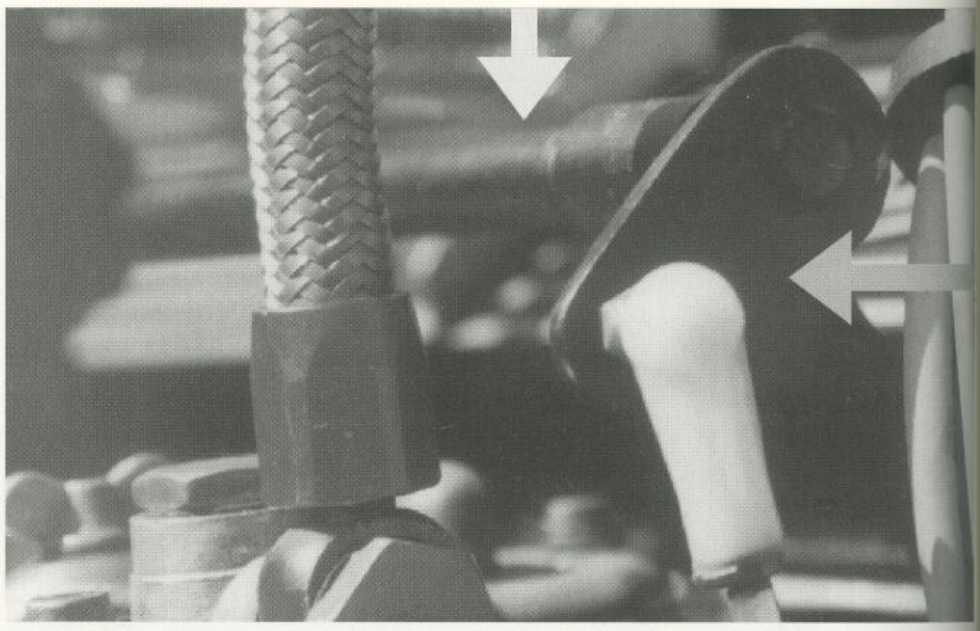
Gunson meter being used to synchronize a pair of carburetors. Here, the left-hand choke is being checked in the right-hand carburetor.

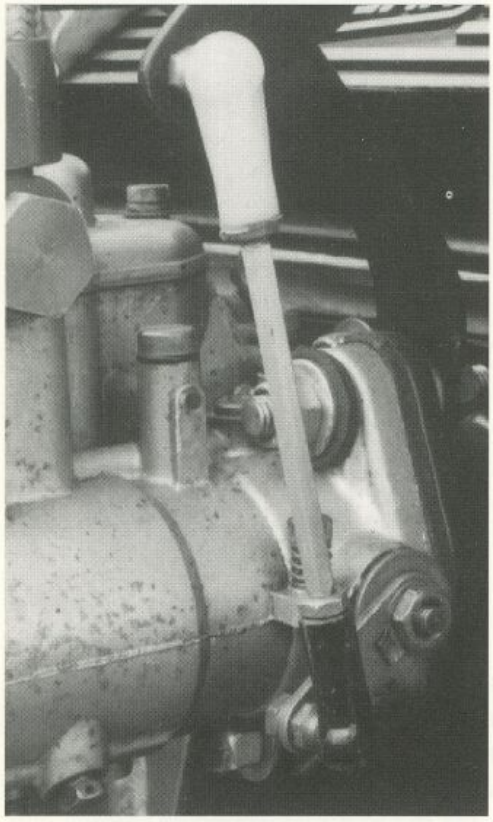


Gunson meter being used on a left-hand carburetor. Here, the right-hand choke of the left-hand carburetor is being checked.

choke on either carburetor but make sure the readings are taken from the same choke each time because there are often slight variations from choke to choke in the same carburetor. Adjust the meter's setting so that the indicator is in the middle of the scale. Do not leave the meter over the carburetor choke for more than five seconds. Check each carburetor for flow and then adjust the second carburetor to equal the airflow of the left-hand 'datum' carburetor. If, for instance, the meter shows that the right-hand carburetor is flowing more air, turn the synchronizing screw of the adjacent carburetor anti-clockwise a small amount and take another pair of readings with the meter. Carry on adjusting the right-hand carburetor until the readings are equal. Flow meters are quite accurate and allow virtually perfect throttle synchronization to be achieved. **Note**: expect to

Main throttle bar (arrowed) with pushrod connected. The bar must be strong and mounted in good bearings. Each of the actuating arms (arrowed) must be of the same length (bar center to ball).





A typical double-socket pushrod as commonly used on throttle bar systems. It is essential that the socket-to-socket dimensions of all pushrods are identical.

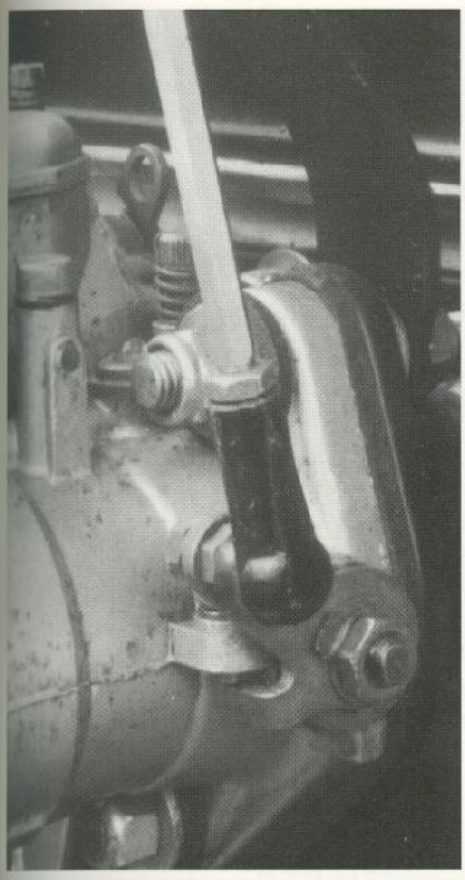
have to check and re-adjust the synchronization every six months on a road car and before *every* meeting on a competition car.

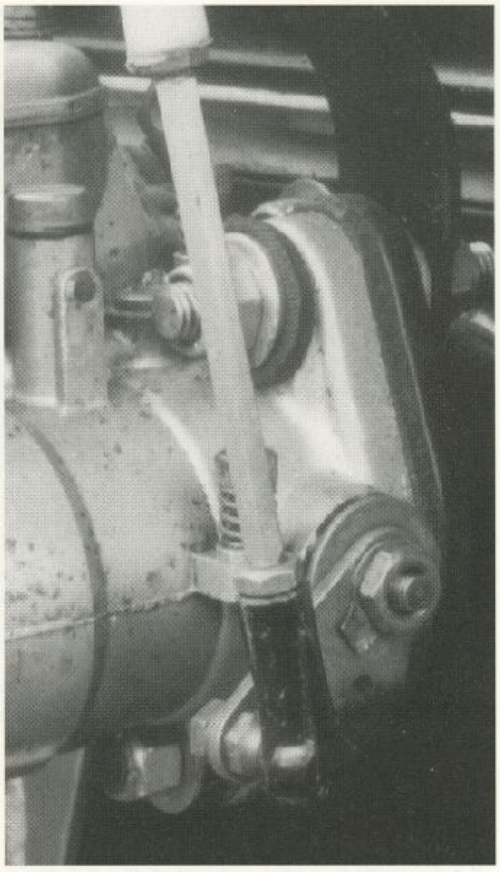
THROTTLE (BAR & PUSHROD TYPE) - FINAL SYNCHRONIZATION

For multiple carburetors operated by a main throttle bar with arms and pushrods (balls and sockets at each end), the idle is set by undoing the clamps on the arms of the main throttle bar and adjusting each carburetor in turn. Each carburetor will have its own throttle adjustment screw and arm. With the engine fully-warmed and idling, place the meter over a choke on each adjacent carburetor and take a reading. Turn the screw(s) of the carburetor(s) that has the lowest reading on the scale and increase the flow of that carburetor(s) by turning the adjustment screw clockwise. When all carburetors are equal in air flow check the rev counter to see what the rpm is. If the revs are too high the rpm will have to be reduced by turning out each throttle adjusting screw an equal amount to cut the airflow down. Use the meter to check each carburetor so that when the engine is finally idling at the correct speed each carburetor is flowing exactly the same amount of air. The next stage is to synchronize the carburetors' throttles off idle.

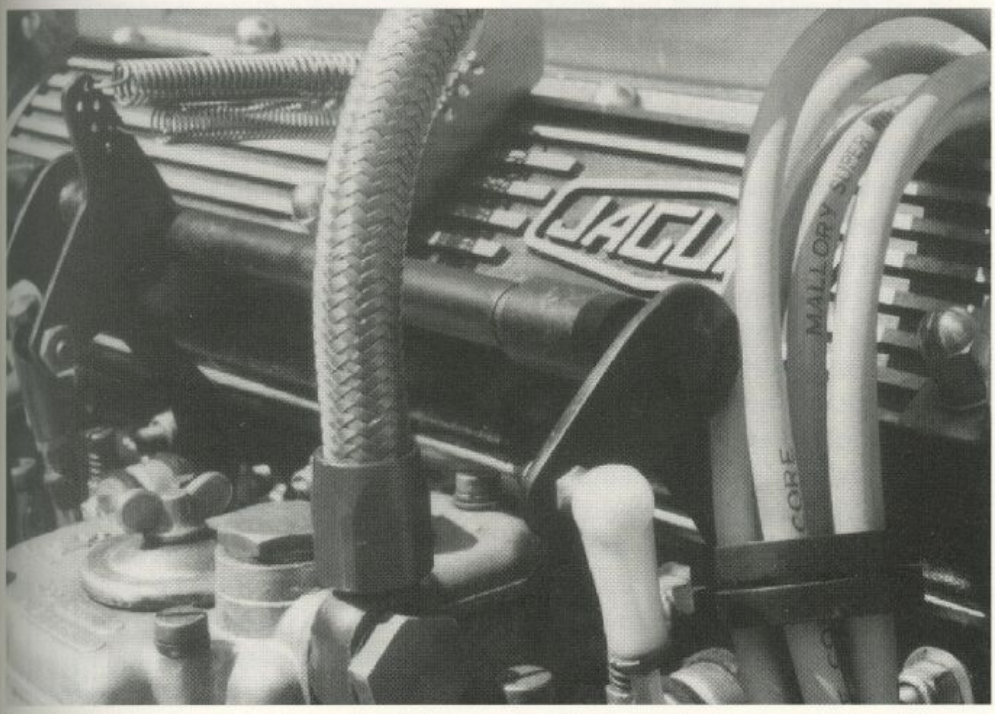
It is essential to get an equal amount of air through each carburetor right up to and including full throttle. To achieve this the pushrods must each be identical in length (socket-to-socket) as must all the actuating arms of the throttle rod and all the actuating arms of the carburetor throttle spindles (from rod/spindle center to ball center). Throttle arms made by Weber or Dellorto will be correct.

The main throttle bar must be sturdy and mounted firmly on to the engine so that there is no twist in the bar. If the bar is not strong enough the carburetors may not all receive equal movement. On six-cylinder in-line engines throttle bar flexing can be a problem. If the readily available arms which have a 7.9mm (0.312in) hole in them are used, the throttle bar must be made of high tensile steel and the throttle shaft must be well supported





Far left - Throttle spindle in the idle position.
Left - Throttle spindle in the full-throttle position at which point the throttle butterflies must be fully open.

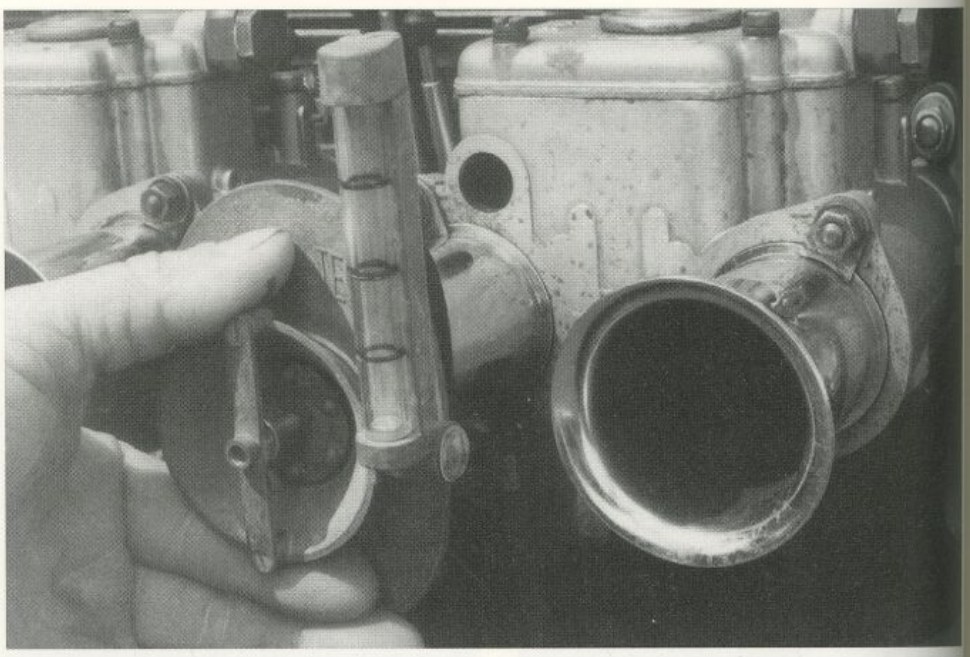


Main throttle bar at full throttle position. Note the downward angle of the main bar's throttle arms. Ideally, the arm's arc of travel is set so that the arc's center coincides with the horizontal plane.

by at least four bearings (rose joints). This specification will eliminate the usual problems associated with long throttle shafts, arms and rods. The arc of travel of the throttle bar and arms must be equally dispersed about the horizontal plane to preclude any form of strain on the mechanism. The lengths of the adjustable rods can be altered to achieve this.

The carburetors can only be fully synchronized if all of the above requirements are met. The next stage is to slacken off the tensioning screws that clamp the arms to the throttle bar and, using light hand pressure, push down on the top socket. Maintain the pressure on the socket and do up the screw on the throttle bar arm. Do this to all of the throttle arms. The reason for this is to position the mechanism so that there is no play in it anywhere and that any movement of the accelerator pedal results in equal carburetor throttle arm movement (equal air flow). To check this mechanically, wedge the accelerator pedal so that it gives a steady 2000 to 2500rpm and take meter readings from the same chokes that were used before to set the idle speed. The meter will have to be adjusted so that at the 2000 to 2500rpm the indicator is centrally situated in the scale. The Gunson unit, for example, has a vent adjustment that is twisted around to either reduce or increase the air flow and, in turn, raises or lowers the indicator on the scale. The Motometer has a screw adjustment that can be turned in or out to achieve a reduction or an increase in air flow. Do not hold the meter over a choke for more than five seconds.

If the readings are all identical the throttle bar and pushrod system is giving equal movement to the carburetor throttle arms: if not, the pushrods can be adjusted by lengthening or shortening them. The pushrods have right-hand and left-hand threads on their ends so turning the rod anti-clockwise shortens it and turning the rod clockwise increases the rod's length. This facility is now used to make minor adjustments to the length of the rods to give more or less carburetor throttle arm movement and to increase or decrease the air flow of a particular carburetor as required. Choose one carburetor as the standard, or datum, to which the other carburetors will be matched. Undo the locking nuts (slightly but not completely) and then turn the central rod anti-clockwise or clockwise. Check the airflow with the meter after each rod length alteration. Once the adjustments have been made and all carburetors are giving equal readings on the meter, turn the engine off and tighten all locknuts on the rods. While the engine is running during the tuning process keep an eye on its temperature. With all of the locking nuts tightened, start the engine and check all of the readings again just to make sure that none of the rods have moved which could have caused the settings to be lost.



"Motometer" being used. This type of flow meter fits over the end of the trumpet. The sight reading glass is integral with the meter.

At this point the idle has been set (equal meter readings on the chokes) and when the accelerator pedal is depressed the mechanism has been adjusted to give equal meter readings once again. The engine should be idling at 800 to1200rpm and have equal air flowing through each carburetor, which will not necessarily mean that the engine is idling smoothly.

If the engine will not accelerate in the free running state it certainly will not accelerate well under load. Also, just because the engine accelerates smoothly under no load conditions, it does not mean it will accelerate under load (being driven down the road or tested on a rolling road).

At this point carburetors have the correct float levels and the throttles have been synchronized at idle and off idle. The idle mixture screws have been adjusted in or out to give the smoothest idle possible.

IDLE JET - FINAL SELECTION

At this point the idle fuel jet choice can be optimized. Turn the idle mixture adjustment screws to 2.5 turns out from the lightly seated position.

With Weber/s, if the engine just

does not want to idle at all with, say, a 45 idle jet, increase the fuel jet component of the idle jet to 50 and run the engine again. If the idle improves increase to 55 and run the engine again. The likely outcome of this is that the engine will run but have a 'heavy' sound (too rich). It is not usual for any engine to ever need more than plus 10 over the recommended idle jet sizes given in chapter 4. Decrease to the 50 idle jet size if that jet gave the best overall idle or if the idle improved stick with the 55 idle jet.

With Dellorto/s, if the engine does not idle with, say, a 45 idle jet fitted, increase the jet size to 50 and run the engine again. If the idle improves, increase to 55 and run the engine again. It is unlikely that an engine will use more than plus 10 over the recommended sizes given in chapter 4. If the 55 improved the idle but the engine developed a 'heavy' sound, decrease the jet size to a 52 or 53.

IGNITION TIMING - GENERAL

At this point it must be pointed out that your engine could be idling quite unevenly and be spitting back through the carburetors. This problem can be evident from all carburetor chokes consistently or at random or it may affect just one choke constantly. In the first instance, check the amount of spark advance at idling rpm with a strobe light. If the advance is 8 degrees BTDC this may well be the sole cause of the spitting back through the carburetors. The problem is, in fact, nothing to do with the carburetors or their settings, though the carburetors are often wrongly blamed for this common fault. Before any further adjustments are made to the carburetors, the ignition timing *must* be checked.

Modified engines nearly always need a considerable amount of initial spark advance. If the engine being tuned does not have sufficient idle speed advance it will be impossible to get good clean performance below 2700 to 3500rpm (depending on the camshaft) without resorting to very large idle jets and lots of turns out on the idle screws, after which the richness of the mixture will tend to cover the lack of spark advance and reduce the spitting back but the engine will lack 'snap'. Low speed performance can be greatly improved, but the distributor advance mechanism will usually have to be altered to achieve this.

A reasonable idle speed for a modified engine is generally between 1000rpm and 1200rpm but some may require more rpm than this. If the engines rpm increases as advance is increased there is not enough advance built into the engine. At a 1200rpm idle speed the maximum amount of advance allowable would be on average about 16 degrees BTDC. Some engines like up to 18 degrees BTDC and some could stand even more, but getting the starter to turn the engine over can be a problem. Obviously, the starter is the limiting factor in any given situation, but 16 degrees static advance is nearly always within the capability of the starter motor. If the engine runs best with 18 degrees static advance but the starter motor has trouble turning the engine over, retard the spark in one degree increments until the starter will actually turn the engine over and start it.

If the engine performs well everywhere except at or near maximum rpm (design strength maximum of the engine, that is) yet a misfire persists, check that the engine has enough spark advance. To test this, fit the carburetors with a small air corrector (160) and run the engine with two degrees more advance than before.

As a guide the following are maximum full advance degrees for a range of engines with a various combustion chamber shapes (it is the combustion chamber shape that determines the optimum amount of total spark advance).

Bowl in piston: 35-36 degrees BTDC.
Hemi-head: 44-45 degrees BTDC.
Bathtub head: 36- 37 degrees BTDC.
Pent roof: 32 degrees BTDC.
Wedge head: 34-36 degrees BTDC.

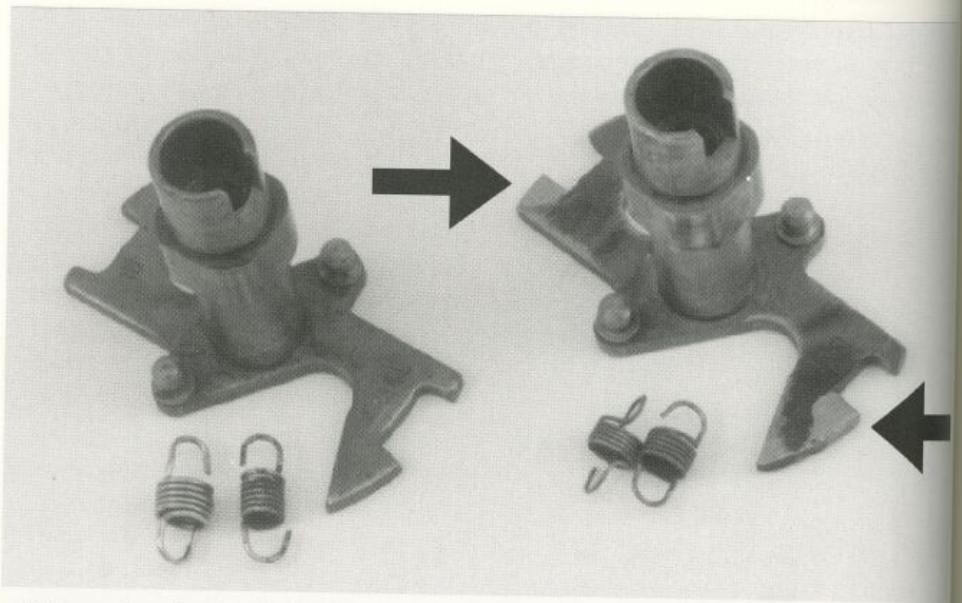
The correct amount of idle advance for any given engine is found by setting the idle speed to 1000 to 1200rpm with the advance set at 12 degrees BTDC (the author has yet to see a modified engine that uses less than 12 degrees static advance). Then increase the advance by two degrees (using a strobe light) and note the engine rpm. If the engine rpm does not increase, the advance is correct. If the rpm increased with the two degrees advance, advance the spark another two degrees to 16 degrees BTDC. Stop advancing the engine if the rpm does not increase. If the engine rpm increases to, say, 1700rpm by the time you have 16 degrees BTDC registering, reduce the idle speed back to 1200 via the carburetor idle screw.

Essentially, the final result should see the engine idling at the reasonable rate of about 1000 to 1200rpm with optimum spark advance so that it idles as smoothly as possible.

The downside of this increase in static advance is that, while the advance has been increased from, say, 8 degrees static advance to 16 degrees, the total advance has also gone up. So what used to be 8 degrees static and 38 degrees total advance (via the

automatic advance mechanism), for example, suddenly becomes 16 degrees static and 46 degrees total advance. This must be altered to 16 degrees static and 38 degrees total advance. The amount of total advance required usually remains similar to standard even when an engine is modified.

This extra advance will have to be removed from the distributor because, if left, it could lead to poor top end performance and engine damage. The solution is to reduce the mechanical advance mechanism's travel. This entails welding (tig welding or braising) the advance slot and remachining it. The slot will look the same but offer less travel. Checking and testing after welding is carried out using a strobe light. Basically, the advance added to the initial timing must be removed from the total timing. Note that some aftermarket distributors are adjustable and can be altered in five minutes, an example the being Mallory YL dual point.



If the engine is set up with 15 or 16 degrees of advance at idle, the total advance will have to be limited. This is achieved by braising the advance slot (arrowed right) which reduces the amount of travel. In this case the slot is reduced by 2mm so that the total advance does not exceed 35 or 36 degrees. Note the light springs which allow total advance at about 3300rpm.

IDLE JETS/AIR BLEEDS - FINAL SELECTION

The next stage is to check the idle mixture strength requirements for good progression. The idle mixture strength for idling purposes is not really in question because it is adjustable via the idle mixture adjusting screw. The mixture strength for progression has to be correct over a band, which means that the engine will run quite acceptably anywhere within this band. One side of the band will be towards the lean side and the other nearer the rich side. The objective of the fine tuning is to make sure that the mixture strength is in the middle of the band because, not only will the engine be as crisp as possible, it will give the maximum economy possible without any sacrifice in power.

Weber

The idle mixture screws are set at 2.5 turns out for this test. With the engine idling as smoothly as possible, *very slowly* increase the engine speed. The object of this exercise is to check if the mixture strength is sufficient to match the slowly opening throttle without any assistance from the accelerator pump jets. If the engine 'stumbles' or hesitates the mixture is too weak so go to a richer combination from, say, F2 to an F11 with the same prefix numbers (a jump richer by two). If the engine still stumbles go to an F9 and finally to an F6.

If none of these air bleed reductions cure the problem go up in prefix numbers, for example, from 45 to 50 and start again with an F2 and work down in two stage increments (F2, F11, F9, F8, F6). If, for example, the jetting fitted to the engine was started at 45F2 and after proceeding down the range from there to 45F11, 45F9, 45F8 and, finally, 45F6 and the stumble is still present, change the fuel jet number to 50F2 and proceed to go through the range again 50F11, 50F9, 50F8 and 50F6. Repeat this procedure until a suitable combination is found.

The converse is also true that if the idle selected is too rich and there is no hesitation the mixture can be leaned off until the engine does hesitate. The mixture strength can then be made richer by jetting up until the hesitation ceases. An over-rich mixture does not give top performance.

The idle screws have remained untouched so far during this test. With a jet found that gives no hesitation, turn all idle mixture screws in a quarter turn and note any difference to the idle (smoother) then turn them back to where they were before and then turn them out a quarter turn and note any

differences. The smoother the engine runs the better. All screws must be set to the same number of turns and part turns out. Remember to allow ten seconds once the last screw has been turned for the engine to settle and stabilize using the new mixture. Find the best position for the idle mixture adjusting screw for the smoothest idle possible (least exhaust pulsing as felt by hand at the end of the exhaust pipe).

By leaving the idle mixture screws in a set position and changing the jetting to suit, the richness/leanness factor is narrowed right down to the equivalent of about a quarter turn of the idle mixture screws; ideal for idling purposes and offering good progression with the engine in the free revving state.

Under load, the setting may prove to be not quite rich enough. Just because the engine accelerates smoothly under no load conditions it does not mean it will accelerate cleanly under load (being driven down the road or tested on a rolling road). If this happens move richer again until the hesitation stops under load conditions. The best test for a road vehicle is on an inclined section of road (not too steep) using top gear. If the engine mixture strength is too weak this sort of test will show it up. Jet up enough, but only enough, to provide for good progression. High speed is not necessary for this testing, rather low end pulling power.

If the idle jet (prefix number) is changed to overcome hesitation under load, the idle mixture will be richer and the idle mixture adjusting screws will have to be altered (turned in). This is exactly what they are designed for; turn them in a half turn or whatever is necessary to restore idle smoothness or remove the 'heaviness' that a too rich mixture gives.

Dellorto

For Dellortos the range of air bleed and fuel jet combinations is vast. In the interests of cost, availability and overall efficiency, the range can be narrowed down for modified engines by using just five idle jet holders the 7850.1, 7850.6, 7850.2 or 7850.7, 7850.8 (richest supplied).

In the first instance, fit the fuel jet suggested in chapter 4, a 7850.1 idle jet holder and, with the idle mixture adjusting screws set at 2.5 turns out from the lightly-seated position, start the engine. Check the progression phase by *very slowly* increasing the engine rpm (to no more than 2300 to 2500rpm).

The 7850.1 idle jet holder has a 1.4mm diameter hole in the side of the idle jet holder and an axial bore diameter of 3.0mm. Any engine that has 400cc per cylinder and above will usually use this idle jet holder. The amount of air bleed from a 7850.1 is actually very similar to an F2 from the Weber range and the F2 is only a middle of the range air bleed (when applied to richness and leanness capabilities with a given fuel jet).

If there is no hesitation with the recommended idle jet leave the jetting just as it is and see how the engine performs under road or track conditions. The fuel jet size may prove to be too large but this is not likely. The idle jets recommended tend toward leanness so, if anything, will require increasing in jet size to overcome obvious leanness (hesitation during the progression phase).

If there is hesitation, increase the idle jet size by 2 or 3 and test again; continue to increase the jet size as necessary but not beyond reasonable limits (plus 10 or 12 above the originally recommended size). If necessary change the idle jet holder to a 7850.6 and increase jet sizes from the recommended starting size up to plus 10 or 12.

Continue to change the fuel jet sizes by going up in 2s or 3s over the range suggested with each idle jet holder. The first combination that gives no acceleration phase hesitation will be very near and road or rolling road testing will narrow the choice down to the correct idle jet holder and fuel jet.

There is nothing like actual load conditions to show up mixture weakness. The fitting of larger jets (one or two sizes up) may be necessary to eliminate this weakness and ensure the engine is supplied with the correct mixture strength, which will result in best performance anywhere in the rpm range under any load condition.

The 7850.1 is a middle of the range air bleed from Dellorto and all other idle jet holders are going to supply a richer mixture strength in sequence for a given fuel jet size.

The method of tuning the Dellorto varies from that for the Weber because the idle jet and the air bleed is separate on the Dellorto. Weber has the air bleed sizes altered through the range while the fuel component stays the same. The Dellorto has the jet sizes altered while the air bleed stays the same. Ultimately, the end result is the same.

IDLE MIXTURE SCREWS - FINAL SETTING

Usually the idle screws on both Weber and Dellorto carburetors are turned out 2.5 to 3 turns. The progression phase smoothness is the main criteria for idle jet selection and the idle mixture strength is adjustable via the adjustment screw.

With the static ignition advance determined and set, the progression

phase checked and the idle jets optimized, the idle screws can now be adjusted so that the engine has the smoothest possible idle.

With the engine warm and running at a suitable idle speed, screw all the mixture adjusting screws in a half turn and note the difference to the engine's idling speed and smoothness. If the idle becomes smoother and the rpm increases the engine has responded to the leaner mixture. Continue to turn all of the idle mixture screws in (a quarter turn at a time) until the idle perceptively roughens. At this point the mixture has gone too lean. Turn the screws back to the position that produced the smoothest idle so far (make a note of how many turns out this position represents). Now turn all the screws out (a half turn at a time) from that position until the idle becomes 'heavy.' Work out the middle position between over-weakness and over-richness and set all the screws to that position.

It is fairly usual for the optimum setting to be the same for each mixture screw but this is not always the case, so do the following test. Go to the end of the exhaust pipe and place the palm of your hand about 50mm/2in away from it and feel the individual exhaust pulses against your hand. If the engine has a wild camshaft, the engine may idle roughly but it should still idle uniformly. If one cylinder is a bit lean, that cylinder will miss occasionally and this will be noticeable as a missed exhaust pulse against your hand; you may also be able to see 'spit back' from the carburetor/s.

To locate the offending cylinder, start by turning the idle mixture screw of the choke nearest the front of the engine one full turn from its current position. Then go to the exhaust pipe and feel the exhaust pulses. If the miss has gone the cylinder (or cylinders) fed by this choke is the offending one. If the exhaust pulse is unchanged, turn the idle mixture screw back to its previous position and move to the next idle screw and repeat the procedure. Once the offending cylinder (or cylinders) has been located, set that idle mixture screw out a sufficient number of turns or part turns to stop the miss, but no more. Obviously this particular cylinder is always going to have an odd number of turns out compared to the other cylinders.

The ideal position for each idle screw is between when the mixture strength weakens perceptively (engine misses) and when it turns rich (idle sounds 'heavy'), or that point that gives the highest idle speed with the maximum idle smoothness.

When engine idle is at its smoothest via the idle mixture adjustment, if necessary, reset the idle rpm by adjusting the throttle arm (slow the engine down).

Once the engine is warm it should start at the turn of the key without any depressing of the throttle to activate the accelerator pumps. If the engine is a bit reluctant to start, depress the accelerator pedal quickly to quarter distance to activate the accelerator pumps and the engine should start. Cold engines will usually respond to one full pump of the accelerator pedal or full depression.

ACCELERATOR PUMP JETS - FINAL SELECTION

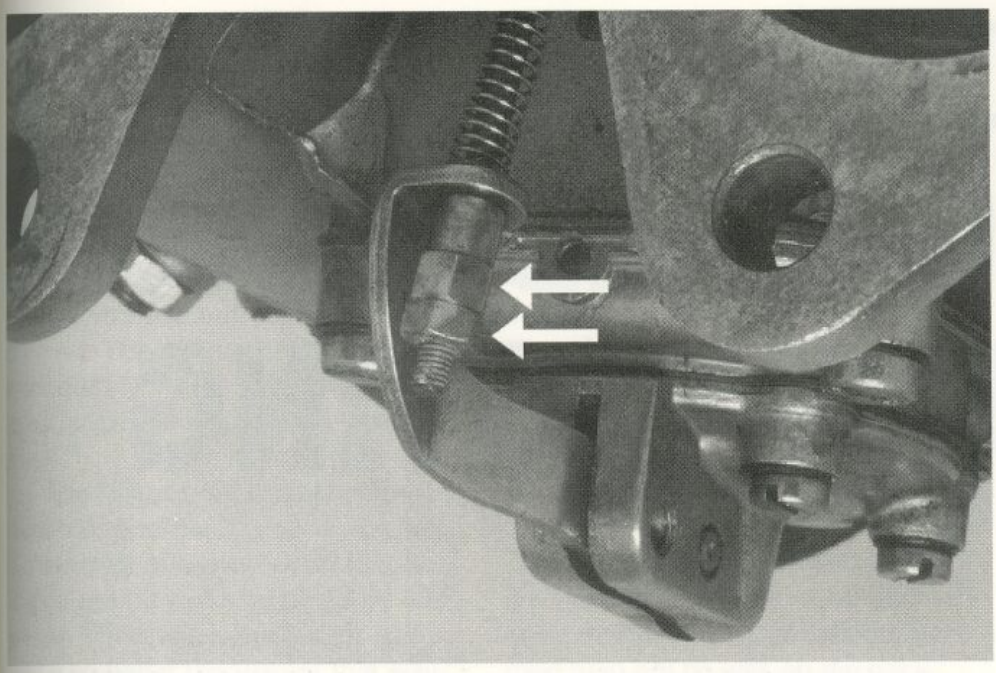
The fixed jetting of the carburetor cannot respond quickly when the throttle is opened rapidly. The accelerator pump supplies fuel immediately and in sufficient volume to match the amount of air available to the engine when the throttle is opened quickly. Because the fuel injected by the accelerator pumps is not emulsified, more than is strictly necessary is injected into the air stream and much of it is passed out of the engine unburnt.

Once the main circuit comes into operation and the auxiliary venturi is flowing air/fuel mixture, the accelerator pump is no longer needed. If the engine emits a lot of black smoke when the throttle is suddenly opened this is a sign that the accelerator pump jets are too large. However, the next size down in pump jets (for Weber) may well cause the engine to hesitate. On Dellortos the larger range of jet sizes allows for very fine adjustment.

Fit the accelerator pump jet that is the smallest possible compatible with the engine having good acceleration without any hesitation. Try the recommended pump jet and increase the jet size if it proves to be insufficient. Conversely, try the next size down from the recommended size just to see if the engine can operate with that size. If the test proves successful, change down a size.

If the engine hesitates irrespective of the pump jet size installed in the carburetor, check the timing of the fuel delivery from the accelerator pump discharge nozzles compared to the throttle movement. This action has to be simultaneous.

On Dellortos check that the arm that operates the diaphragm is in fact in contact with the diaphragm base. These arms are factory set and usually correct but if the carburetor is second-hand they may have been altered. If during quick throttle movement no fuel is ejected, the arm may well be moving but not moving the diaphragm. The two locking nuts will have to be re-adjusted to take out the play that exists so that the diaphragm is activated *immediately* the throttle arm is moved



Dellorto accelerator pump actuating rod and arm showing the two nuts (arrowed) that are used to adjust the position of the arm which contacts the accelerator pump diaphragm.

When Weber or Dellorto carburetors are full of fuel they will squirt fuel well over a meter when the throttle is opened quickly. If there is any doubt about accelerator pump effectiveness, remove the carburetors from the engine (making sure that no fuel is spilled from them) and set them up level on a bench. To check the pump action depress the throttle about 20 per cent very quickly. Each nozzle should squirt fuel out of the choke and onto the bench and there should be a puddle of fuel in the throttle bore. There is a limited number of times that this can be done as the float chamber will empty itself. Pump action has to be instantaneous for correct engine acceleration. The quantity of fuel is correct when one full throttle arm depression sends two long streams of fuel out of the carburetor immediately and for a full one second duration. **Warning!** Take appropriate fire precautions when testing accelerator pump action and protect your eyes and skin too.

Chapter 7
ROLLING ROAD (DYNO) & TRACK TESTING

The ultimate test of any engine is how well it goes in its particular application. Competition brings out the best in engines and the worst in faults. That is because of the conditions and stresses and strains that the machinery is being subjected to. For example, hundreds of cars are taken to the track each weekend and they are driven around lap after lap missing and banging. The drivers invariably are mystified at the antics of the engine: after all, they drove the car to the track and all was well. Bonnets are up and, usually, the carburetors are being scrutinized even though they are probably not to blame.

The real problem is usually one of preparation. Track conditions always show how well the work on the engine has been done. Sometimes, what should be really good engines have been run for years with what is, eventually, proved to be quite minor tuning problems.

For an engine to give top performance, every component must be proved to be in a serviceable condition. That goes for new parts too: never assume that because a part is new that it's good. Even top quality parts can be proved faulty by the stress of competition work but these same parts could be put into a standard road-going car and operate perfectly. The conditions in competition are just not the same. Problems often stem from spark plugs. Plugs used on a road-going car have no place on an engine being raced. Take a perfect set of plugs with you and fit them at the track but only when the engine is going to be subjected to high rpm (no idling and so on). Remove them from the engine when the racing is finished and pack them away until next time. Note: if a spark plug is dropped to the ground don't use it in a racing engine again.

During testing and final adjustments, the question of choke sizes may arise, particularly whether there might be any power benefit derived from fitting bigger chokes. By all means increase (or decrease) the size of the chokes by 1mm at a time; however, it's unlikely that deviations of over 2mm from the recommendations given in chapter 4 will prove successful. Note, too, that if choke size is altered, the main jet/air corrector combination and idle jet will have to be rechecked in the original sequence and may need to be altered (richness/leanness factor). Chokes that are too large for the particular application will not allow the engine to produce maximum power (down at maximum rpm) and chokes that are too small will limit maximum rpm quite sharply.

ROLLING ROAD (DYNO) TESTING PROCEDURE

Rolling roads are only as good as the person operating the machine and making the adjustments to the engine.

True, the machine tells the operator what is happening (power loss or power gain) but that still leaves the decision on what is to be changed and so on to obtain optimum engine performance. The advantage of the rolling road is, of course, that any vehicle can be tested in a workshop environment without driving fast on the road. The testing can be done more quickly and the changes made more quickly as all parts are readily at hand.

The rolling road simulates road conditions and there is no doubt that, in the hands of a good operator, the engine can be perfectly tuned by this means. There is no guesswork, as in, "did it go better this way or that way?" Readings can be taken and even if the machine is a little bit out in calibration it doesn't matter too much because the machine will be out by a consistent amount. The consistency of the readings is all important and the rolling road's main asset. The rolling road, as the name suggests, is as near to a normal road as is possible. When using a rolling road, use a fan in front of the radiator, keep checking the water temperature and tie the car down!

The tendency with the rolling road is to run the engine up to full revs and take a power reading. Maximum power is useful to know as a check on whether the engine has come up to specification or expectations, but there is more to it than this. The objective should be an engine which performs strongly from off idle through to maximum rpm.

The best way to test the top end performance of the engine is to run it in top gear from just above the power band rpm through to maximum rpm and measure the time taken to get from, say, 3500rpm to 7000rpm. If the engine is not 'crisp' it will be heard and the time taken to get from 3500rpm to 7000rpm will be excessive. The initial test times can be used as a baseline figure and all future adjustments measured against them.

Most workshops with rolling roads also have electronic tune-up equipment and this should be connected to the engine just to check the integrity of the electrical system. Use every scientific aid available to you in the quest to get an engine tuned correctly.

TRACK TESTING PROCEDURE

The ultimate test of any tune-up is how well the engine runs on the road or track. But what goes well on the road may not go well on the track. This is because on the race track the engine will be operating from mid-range up to maximum rpm. All sorts of things happen in a track environment that will seldom happen elsewhere. For example, insufficient fuel pressure or volume will cause the engine to miss as the fuel level in the carburetors falls. In other words the high load and sustained high rpm of track life will show up problems that would not be encountered on the road. Another example is that pulling out of turns using full throttle can make an engine hesitate and misfire, yet before the vehicle was tried on the track it was perfect. What all this means is that carburetor set-up may have to be altered to compensate for the demands of full bore track work. Luckily Dellorto and Weber carburetors are totally adjustable for all conditions and applications. However, they can only be made to suit one application at a time!

When track testing, use top gear to check the top end performance and this is achieved by running the car over a set distance using top gear only. If the engine has a maximum rpm of 7000 and is on the power band (camshaft working) at, say, 3300rpm check acceleration over two set points. When the first set point (flag on a stick at the side of the track) is reached the engine must be at 3500rpm and in top gear. At the set point depress the accelerator to the floor and leave it there until the second set point (another flag on a stick at the side of the track) is reached. At the second set point note the rpm. If at the first trial the rpm was 6600rpm this is the datum against which all future adjustments are measured. The second set point can be moved (if space allows) so that the engine just makes maximum rpm. Also from the first set point a stop watch should be used to check the time taken to get from the first set point to the second set point. Note the rpm and the times. Make only one engine adjustment or change at a time and measure the value of each change by the rpm and the time taken over the test distance.

When testing such as this is carried out, the engine is under the highest load possible and the rpm range is more than would usually be used. If the engine is going to falter it will do so under these conditions. There are no gearchanges to make (they could interfere with the consistency of the results) and the flexibility of the engine is fully tested.

SOLVING PROBLEMS - LOW TO MID-RANGE RPM

If the main jet is too small the engine will not produce good power anywhere in the range. An excessively lean overall mixture will see the engine missing and backfiring through the carburetor chokes under load. Continue to increase the main jet size as long as the power keeps going up.

For 'flat spots' or hesitation check the accelerator pump jet sizes. Firstly, increase the pump jet by up to 5 and see if this improves the situation. If this works to a very small degree and the misfire or hesitation is still present but now slightly higher up in the rpm range, the problem is not with the accelerator pump jet, so go back to the original size. What is happening in this scenario is that the accelerator pump is masking the real problem. Next, change the emulsion tube to a richer one (see chapter 4 for details).

If the emulsion tube is wrong for the engine it will show up during acceleration. With the engine in top gear, accelerate the engine *slowly* from 3500rpm (or from the rev range at which your engine starts to make power, comes 'on cam'), slowly so that the engine does not get a full shot of fuel from the accelerator pumps. If the emulsion is wrong the engine will 'stumble' then clear as the revs rise. This 'stumble' is caused by acceleration phase leanness and a richer mixture can be provided by changing to an emulsion tube that will supply a richer air/fuel mixture.

SOLVING PROBLEMS - HIGH RPM

If the engine has a high speed misfire reduce the size of the air corrector by 20, 40 and 60 but not to less than the size of the main jet (if the main jet is a 160, don't go less than 160 for the air corrector). If this fails go back to the largest air corrector that you used previously and increase the main jet size by 5 and then reduce the sizes of the air correctors again.

Check the total spark advance again and increase it by 2 degrees for the purposes of the test. If further spark advancing is contemplated do not persist with high rpm and over advanced ignition timing (no more than 5 seconds under full throttle when the engine is misfiring). If the engine responds to the increased spark advance, go back and check the TDC position marks and the advance degree markings for accuracy before continuing running the engine with what could be excessive total spark advance (engine damage could result).

Hook up a rig and check the fuel pressure at the time of engine misfire. Check all ignition components (even if the parts are new). This is often best done in conjunction with an auto-electrician who will usually have the latest test equipment. Avoid prolonged running of the engine up to full rpm with no load on it (free revving). This serves no useful purpose but go high momentarily to see if any breakdown of the spark can be detected. If an engine has a misfire in the free revving situation (no load) it will most certainly have the miss - and worse - under load.

Failing this the vehicle will have to be put on a rolling road (which puts the engine under load) and the engine run up with the electrical testing equipment connected to it. This will remove all doubt as to the integrity of the electrical system. Things like plug leads and spark plugs (even if new) can cause problems and this is the quickest way to isolate and fix an electrical problem.

MAINTENANCE

Once the carburetors have been set-up to give optimum performance, you'll still need to check them occasionally to keep them working at their best. This checking will involve throttle spindle synchronization, float level checking and possible re-setting (note that rough terrain work will upset the float levels very quickly) and idle mixture screw adjustment, ensuring the throttles open fully and changing the fuel filter at regular intervals.