In his carburettor tuning advice Glynn makes the statement "The only way to increase mixture strength over the full range of throttle openings, is to increase the size of the main jet." This might be misleading for those who don't know. On a correctly jetted carburettor the main jet controls the mixture from about three quarters to full throttle, and the needle controls over the range of one quarter to three quarters throttle. If you are weak on the needle at half throttle you can put in a 1000 main jet - but you will still be weak at half throttle! Increasing the main jet only enriches the mixture from three quarters to full throttle. The correct tuning sequence for the original Amals fitted to Vincents is as follows - but on a twin first make sure that the two throttles are accurately synchronised, both on initial lift, and at the full throttle position.

Adjust idle so that the engine will run properly and the bike can be ridden for the next stages. Drive at full throttle and use plug chops to arrive at the correct main jet size.

Drive at half throttle and use plug chops to Correct needle jet and needle and needle position. Recheck idle adjustment, and then correct throttle cutaway to give smooth running in low speed traffic conditions, and a good pick-up when the throttle is opened.

Re-adjust the idle setting again if the cutaway has been altered. Recheck synchronisation.

Driving pleasure and perceived engine responsiveness is very much affected by having a smooth and easy throttle action, and properly synchronised throttles on a twin. If you watch the bikes coming in slowly to any Rally field there are always a number of twins which go bonk, book instead of b'dum, b'dum, which indicates bad synchronisation. The combination of correct throttle cutaway, needle position, and synchronisation will greatly affect your fuel economy in normal traffic driving. It tends to make you feel very smug and satisfied when travelling with a group of others on a long trip, if at each tank stop your tank only takes six litres when everyone else's takes seven or nine!

My Prince has been getting extraordinary mileage this summer. On our trip to the Annual in the Isle of Skye I recorded 1506 kilometers on 61.5 litres of fuel, giving 0.4081 per 10 km (Swedish) or 4.081 per 100 km (Europe) or 69.2 mpg (England). Back in the 1960's it always used to do 65 mpg, but on modern fuels in Sweden with a raised carb needle it has run at about 62 mpg, so I could hardly believe my calculator. We didn't travel at 140 mph through the Northern Highlands (like a certain Technical Officer whose name I won't mention!) but we were getting along quite briskly, and when going much slower it was on very winding and hilly roads with lots of 2nd and 3rd gear work.

Much to my dismay I was forced to cancel from the International at the last moment due to an attack of the wobblies, but I managed to get a grip on myself in time to go to the combined Scandinavian/North German Rally up in Norway instead. This was an excellent do, and I recorded 690 km for the round trip, using 27.9 litres of fuel, which gives 0.4041 per 10 km or 70 mpg. Incidentally, the conversion factor between Swedish litres per 10 km and English mpg (which are different from American mpg) is 28.28. To get from mpg to litres per mil - divide 28.28 by the mpg. To get from litres per mil to mpg divide 28.28 by the litre per mil figure.

Now I must challenge the Prof. on his comments concerning mixture strengths throughout the throttle range. In my letter I clearly stated that the only way to increase the mixture strength throughout the range of throttle openings, assuming that there is no local weakness at any stage, is to increase the size of the Main Jet. In a previous article, Neville advised that Main Jets should be increased by one or two sizes in order to cater for the revised characteristics of unleaded fuels. From the argument he puts forward in his October piece, are we to assume that only the top quarter of the throttle range will be affected by this increase? I think not.

Standard carburettors need different main jets to suit the requirements of the engines to which they are fitted and I should think that a range of 170 to 250 would be well within the scope of 1 1/8" instruments fitted with the same sized Needle Jets.
The Needle Jet will pass the flows from the smallest to the largest designed Main Jet at full throttle. BUT the Jet Needle then reduces or increases the proportion of the fuel passing through the Pilot Jet, from the Main Jet, according to the needs of the engine when running at lower throttle openings. Consider two engines using identical carburettors, but requiring 180 and 250 Main Jets respectively. If we accept Neville's argument put forward last month, that increasing the Main Jet does not affect the mid range, then these two engines fuel demands, at half throttle, will both be the same. This just cannot be right. The engine requiring more fuel at full throttle also needs more at half throttle. Hence fuel flows at part throttle openings must be influenced by the Main Jet size.

Neville Higgins

Carburettor Tuning

Yes Mr. B. your Amal tuning sequence is correct, and mine was the wrong way round on throttle cutaway and needle setting. This is common sense, since the needle position has little or no effect on the under quarter throttle mixture, but the cutaway affects the airflow over the needle jet at half throttle - so it needs to be correct first.

On the other hand you are still wrong in claiming that the main jet affects half throttle fuel control. Fuel flows from the float chamber, through the main jet, through the needle jet, then exits into the airstream in the carb venturi area. The needle jet is a bigger diameter than the main so it can pass more fuel; it is normally prevented from doing this by the needle which reduces its effective area (diam.) to less than that of the main jet. The fuel flow is controlled by the smallest restriction in the system, irrespective of other larger ones. To understand this more easily visualise a tank full of fuel with a petrol tap at the bottom, and a large bore fuel hose leading from it to a float needle jet assembly suspended over a bucket (it will be wide open with no float to control it). Let's say the fuel tap is a quarter inch one and the float jet is one eighth. With the tap open fuel will flow at a rate determined by the float jet, since this is the major restriction in the system. If you change to a half inch tap the flow will not increase because the float jet prevents it. Similarly if you change to a one eighth tap the flow will be the same. If you then change the float jet to one quarter the flow will still be the same, because the major restriction in the system has then moved to the one eighth tap instead.

In the carburettor, at one to three quarters throttle, the main needle blocks so much of the needle jet that this is the major restriction in the system, but at three quarters to full throttle the needle is so far out of the needle jet that the area is bigger than the main jet, which then becomes the major restriction in the system and takes over the metering function. When you run at half throttle the needle and needle jet do the metering, and the main jet acts as a piece of pipe to convey the fuel to the needle jet; you can put in a bigger piece of pipe (main jet) but it still acts as a pipe and the needle and needle jet do the same metering job.

In your last paragraph Mr. B. you wish me to consider two engines using the same carburettor but with different jetting (they cannot be identical if they have different jetting - but this is nit-picking). You then say that "if increasing the main jet does not affect the mid range, then these two engines fuel demands, at half throttle, will both be the same". There is just no connection between these two claims. If the two engines require the same fueling at half throttle they will run on the same needle jet setting, but if one requires more than the other it will need a larger needle jet setting. It is pure nonsense to think that if the engine is allowed to determine the main jet size to suit its own requirement, then at half throttle you can force it to run on the same needle jet setting as another motor at your whim.

You accuse me of wrong advice on tuning for modern fuels - but I have always said increase the mains by one or two sizes AND lift the needle one notch, or more if necessary. The main jet takes care of full throttle running (and is not very often used by the majority of riders, and certainly not for more than a few seconds) and the needle position takes care of half throttle running, which is used very extensively during motorway running. The significance of time is that if you run a bit weak for a few seconds the pistons do not have time to get hot enough to seize, but if you continue for more than 30 sees they do, and you are dead in the water like HMS Invincible. Yet another point; if you increase the mains it does not affect fuel consumption at normal running speeds and throttle openings; with your theory it would.

More very clear proof from my own experience; in the halcyon days of the 1960's I tried to make my Prince go faster, and went up to 400 mains, (270 is standard) leaving the needles in the standard middle notch. I gained only a few mph in top speed, but still held my normal 65 mpg in normal cruising at 80 to 90 mph which was around the half to three quarter throttle position. (As an aside, it may well be that above a certain major main jet size increase the needle jet is the smaller, and then becomes the metering limitation, so that further main jet increases would have no effect. This could be calculated after making a few accurate measurements.) After restoring the Prince in the late '80s I put it on the road with the same carbs without thinking about the large mains, and quickly found I had to lift the needles a notch to prevent detonation under load at half throttle. When I later found the 400s I substituted 320s, but did not need to alter the needle position, and the change did not affect fuel consumption. If the Baxter theory were correct I would have been forced to lift the needles after such a large main jet reduction. The bike ran in that trim for the TT lap at the 1999 International, with a lot of full throttle work and no problems. I ran in the first (fastest) group, and in the grandstand afterwards three separate riders came up to me...
to accuse me of sailing past them on the Sulby straight sitting bolt upright behind my windscreen, when they were laid down like an extra coat of paint on the tank trying to coax an extra 1 mph out of their bikes! So my engine cannot be as slow as I thought it was. This season, with the same settings it has motored quite briskly up to northern Scotland for the Skye Annual, and up to Norway for the Scandinavian Rally, averaging 69 to 70 mpg over 2300 km, so there can't be a lot wrong with my tuning set up either.

Glyn Baxter

CARBURETTOR TUNING

I never thought that I would arrive at a situation where I was at odds with The Professor on matters of a technical nature, but after the tremendous shot across the bows which he delivered in his 'Piece' in December's MPH, I decided to pursue the matter of tuning carburettors a little further. Unfortunately, although I did have most of my response ready, other calls on my time precluded its completion in time for the January MPH. Hopefully Robert will now allow my response to appear in this issue. Previously my submissions were based purely on self reasoning but, following the attempted demolition of my theory, the results of my research are set out below.

Before I go further may I just stress that when I first raised this matter, in November’s MPH, I asked members to consider two different engines using the same carburettors which only differ in main jet size - ie 180 (I had originally intended to say 170) and 250. I don't consider this to be an unreasonable suggestion for say a 1.1/8” instrument. I'm afraid that both Neville and currently Jacqueline have actually read more into this statement than it says. And I still stand by the argument which I put forward then.

In his article Neville was quite adamant that the needle jet and jet needle created the major restriction to flow until 3/4 throttle is reached. On reading this my initial reaction was to wonder how the sudden transition would be made from the needle controlled mixture strength at 3/4 throttle to whatever main jet was fitted to suit the top part of the throttle range. And I also pondered why, in that case, is it stipulated that sizing the main jet is the first tuning operation to be carried out after the pilot adjustment? To satisfy my curiosity, I carried out a series of measurements and I have to report that my results do not support this argument.

Having ascertained the position of the jet needle in relation to the needle jet I measured the varying areas of flow through the needle jet at 1/4, 1/2 and 3/4 throttle openings. Unfortunately, the steps between sizes of my small diameter drills are not fine enough to measure jet diameters precisely but even so, I am satisfied that my findings are more than accurate enough to support my case. In the closed position the needle jet is 0.106” in dia. whilst the jet needle is 0.100” dia. The annulus between the two has almost the same cross sectional area as a 170 main jet, which was the smallest in my suggested range for a 1.1/8” carburettor.

At 1/4 throttle, the annulus is approximately the same area as a 250 main jet, the largest in the range I had suggested. By half throttle the annulus exceeds the area of the 400 main jet which Neville had tried. And at 3/4 throttle the annulus is around twice the area of a 400 main jet. From this it is clear that the needle jet and jet needle do not form the major restriction in the system, as Neville claimed. Consequently, as I suggested, they must be proportioning the amount of fuel passing through the main jet according to throttle opening.

Now let me draw your attention to Amal leaflet No. A295 - "Hints and tips for vertical, horizontal and inclined needle jet carburettors with pilot jets" which include the type 276 instrument. These have a primary air passage drilling, from the bottom of the bell mouth to the periphery of the top of the needle jet which then continues on to the pilot jet and are as fitted to Series ‘B’ and ‘C’ models. From the 'How it works' sections I quote: "The opening of the throttle brings first into action the mixture supply from the pilot jet system for idling then, as it progressively opens, via the pilot bypass, the mixture is augmented from the main jet, the earlier stages of which action is controlled by the needle in the needle jet. The main jet does not spray directly into the mixing chamber but discharges through the needle jet into the primary air chamber and goes from there as a rich petrol-air mixture through the primary air choke into the main air choke. This primary air choke has a compensating action."

In an old book which I have, written by Ricardo and Clyde, there is reference to compensating air jets in some early carburettors. These helped to correct the tendency for the mixture to richen as air speed increased across the jets and I wonder whether the primary air passage drilling and primary air choke, referred to above is a development from this practise.

I assume that Neville is running Monoblocs on his Prince consequently the above will not apply in strict detail to his carburettors. However, I should be very surprised if they did not incorporate the same basic principles of operation.

I trust that this will now convince The Professor and everyone else, that mixture strength throughout almost the whole range of operation of the carburettor is directly influenced to a greater or lesser degree, according to the size of the main jet.
Carburettor Tuning: That nice(?) Mr Baxter is beating hell out of me again, and I begin to wish I'd never got into this argument! Just like him, however, I don't take 'no' for an answer, and I remain totally unconvinced by his very convincing arguments. First I must endorse Jacqueline's January comments that the "crossover" points between the various phases are not points, but areas where one function blends smoothly into the next and both affect the mixture. Indeed, this is the whole idea of the carburettor - to obtain smooth engine response at all loads and speeds.

Glyn is correct in thinking that he is using the Series B/C 276 instruments and I am using Monoblocs; I feel I have even more experience on tuning GPs on both petrol and alcohol. These and all the later Amal slide type carburettors (Concentric Mk 1 and 2) all work in a very similar way, the main differences being changes to allow more compact installations and to get fewer parts, cheaper production, fewer joints to leak, and to get the float chamber closer to the main jet to minimise the influence of fuel level variations due to swirl and side loads. The principles and development are well presented in the Haynes Motorcycle Carburettor Manual by Pete Shoemark, in chapter 3. Tuning for Speed and Paul Richardson give further confirmation. Amal List No. 117/3 for the Series 600 and 900 carbs (which is all I have) gives the same info, and even includes the same text as Glyn has quoted from A295 for the 276! So carbs haven't changed much since Vincents were built - as the Haynes Manual says, the original designs were darn good.

Except for the little dribble of fuel which goes through the idle system at all throttle openings, all the fuel going into the engine goes through the main jet at the bottom, up through the jet holder (or the body of the needle jet in the case of the 276 carb), through the needle jet, out into the venturi and into the manifold. At a given venturi depression the fuel flow is determined by the smallest restriction in this flow path. At full throttle this is the main jet, and at half throttle it is the needle jet and needle combination which determines the flow. I explained this in detail in December and it seems unnecessary to repeat it all again now. The Amal leaflets confirm this, as do Tuning for Speed, Richardson, and the Haynes Manual. Only Baxter disagrees. I quote from page 102 of Richardson, "MAIN JET. - This does not affect the mixture strength under three-quarter throttle opening, except when the needle jet is badly worn." On page 103 we read "JET NEEDLE: This controls a wide range of throttle opening as well as acceleration, thereby materially affecting fuel consumption." Can it be any clearer? If the needle jet is badly worn the fuel flow increases until the main jet becomes the limiting factor and you run very rich at half to threequarter throttle. Similarly, if you install a main jet which is much too small you will limit the flow before it gets to the needle jet and run weak above half throttle. This is the reason why sizing the main jet has to be the first operation carried out during tuning. Ordinary common sense.

I experienced a vivid example of this way back in the 1950's when riding my 1937 350cc BSA down in Cornwall on holiday; suddenly I found that though the engine ran perfectly up to just over half throttle, on giving full throttle it just cut dead, and only came to life again when I eased the throttle back. On stripping the carb I found a thin sliver of wood stuck in the main jet, effectively reducing its size by 30 or 40%. With this removed I was away again as usual.

Next we go to Glyn's measurements of jet sizes - and I must admit this gave me cause for concern, as I thought I could rely on him to make accurate measurements. I believed the explanation to be that a pure hole of area A passes more flow than an annular ring of the same area A. This is because the hole has more favourable flow conditions than an annulus where the needle in the centre causes a lot more fluid friction so the effective area is reduced to perhaps 80%. However, a little devil somewhere urged me "Check it yourself Prof, or you'll never be satisfied". Now before starting we need to realise that the simplest form of carburettor is a calibrated tube (jet) discharging directly into a venturi; the variation of air speed through the venturi draws approximately the correct amount of fuel through the jet at all throttle openings. However, engines are temperamental and demand very accurate mixtures to perform properly, and this super simple set up is not good enough for a connoisseur like Baxter - so it has to be modified by the addition of a few little finesses and we end up with an Amal carb! Note though that these finesses are designed only to modify the flow slightly to correct it; so the differences we are looking for are small and have to be measured accurately to detect them.

Measuring jets; the Amal main jet numbers are not directly related to the diameter, but are a flow in cc per minute in an Amal test rig under standard lab conditions. On the other hand the 106 number on a Monobloc needle jet means it is 0.106" in diameter; there are also 0.107, 0.109, 0.113, 0.120 and 0.125" needle jets (and probably others!). Contrary to Glyn's optimistic claims, measuring jets with the nearest standard drill size is definitely NOT good enough - remember we are looking for very small variations, so we have to be accurate to find them. The most practical method for the home mechanic is to find a suitable pin or needle with a long straight taper, and insert this carefully into the jet, mark where it stops with a spirit pen and measure with a micrometer. Note that most needle jets have the short metering diameter down in the mid part of the jet with a larger hole above and below it - you need to measure and compensate for this. For the smaller main jets I found a large darning needle suitable; for bigger mains up to 1000 the carb needle will do the trick, and for needle jets I used a new scriber with a long smooth taper end.

First I checked a new 109 GP needle jet, which gave me 0.109" and indicated that the system worked. Then I tried a 106 needle jet from an old Monobloc, which gave me 0.108" -an acceptable error since some wear could be expected. Measuring a range of the long Monobloc main jets I got the following; No.280 (from the old carb) 0.057" dia; 320 - 0.059";
The 280 diameter seemed a bit suspicious in this series, so I got myself a new 280 and this measured up at 0.0565" dia - not much difference after all. The needle was 0.0985" dia on the parallel portion, and down at the tapered end a lengthwise movement equivalent to moving the needle one notch gave a difference of about 0.002" in diameter.

I stripped the Monobloc to remove the choke adapter (the block which slides down into the body) so that I could accurately mark the quarter, half, and three quarter throttle positions for both the slide and the needle, and measure the position of the metering diam of the needle jet when it was in place. Using these I was able to mark the position of the needle in the jet at each position ready for measuring. I found that the parallel portion of the needle was still in the jet at quarter throttle (as expected, ie. dia 0.0985"), and the needle dia at half, and three quarter, and full throttle were 0.094", 0.0835" and 0.076" respectively.

Now it is time to tabulate the cross sectional areas for comparison:

<table>
<thead>
<tr>
<th>PART AND SIZE</th>
<th>DIA MEASURED in</th>
<th>AREA sq in</th>
<th>OPERATING AREA sq in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main jet 280</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>280</td>
<td>0.057</td>
<td>0.00255</td>
<td>0.00255*</td>
</tr>
<tr>
<td>320</td>
<td>0.059</td>
<td>0.00273</td>
<td>0.00273</td>
</tr>
<tr>
<td>380</td>
<td>0.066</td>
<td>0.00342</td>
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<tr>
<td>400</td>
<td>0.070</td>
<td>0.00385</td>
<td>0.00385</td>
</tr>
<tr>
<td>Needle jet 106</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>106</td>
<td>0.106</td>
<td>0.00882</td>
<td></td>
</tr>
<tr>
<td>Needle, closed throttle</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>quarter throttle</td>
<td>0.0985</td>
<td>0.00762</td>
<td></td>
</tr>
<tr>
<td>half throttle</td>
<td>0.094</td>
<td>0.00694</td>
<td></td>
</tr>
<tr>
<td>3 quarter throttle</td>
<td>0.0835</td>
<td>0.00548</td>
<td></td>
</tr>
<tr>
<td>full throttle</td>
<td>0.076</td>
<td>0.00454</td>
<td></td>
</tr>
<tr>
<td>Needle in jet closed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>quarter</td>
<td>0.0985</td>
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<td></td>
</tr>
<tr>
<td>half</td>
<td>0.094</td>
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</tr>
<tr>
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<td>0.0835</td>
<td>0.00548</td>
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</tr>
<tr>
<td>full</td>
<td>0.076</td>
<td>0.00454</td>
<td></td>
</tr>
</tbody>
</table>

For comparison:

| Glyn's needle             | 0.100           | 0.00785    | 0.00097              |
| At quarter throttle       |                 |            |                      |

The works set up for 1.1/8" Monoblocs was 280 mains and needle in the middle notch, so we'll use this for our comparison check. (My set up for modern fuels is 320 mains and needle up one notch to the 4th from the top, which richens up the whole range slightly.) The operating areas on the needle jet were obtained by subtracting the needle area from the needle jet area 0.00882, and the relevant operation areas are starred in the table for easy reference. From this we see that at closed and quarter throttle the needle jet has only about half the area of the main jet, and will be the controlling factor in fuel flow. At half throttle it is 0.00188 compared with 0.00255, and still the controlling factor; at three quarters it is 0.00334 which is a bit bigger than the main, and at full throttle it is almost 1.7 times the size of the main, so the latter is then the controlling factor.

This gives us a very different picture from Glyn Baxter's rather suspect measurements -but I still hear him yelling "I told you so - the area at three quarter throttle is bigger than the main, so I must be right!" Yes Glyn, but we have already seen that the annular hole is less efficient than a round one, and I gave it a guess at 80%. If you are willing to give Amal credit for knowing what they were doing, we can assume that the above jet settings were correct, and further that the cross-over point between needle jet and main jet is indeed at three quarter throttle; this being so, the effective areas of the needle jet and main jet should be about the same at this point -so a main of 0.00255 sq in should pass the same amount of fuel as the annular needle jet of 0.00334 sq in. If we divide the former by the latter we get an indicated efficiency of 76% for the annulus compared with the hole. Comparing the old 276 carbs with the Monobloc, the standard 170 to 200 main jet seems very small in comparison with the latter's 280. Glyn's needle is 0.100" dia whereas mine is 0.0985"; a 1.5 thou difference in diameter here makes an increase in area of only 3%, which doesn't seem very significant -but if we compare the effective annulus area at quarter throttle we get 0.00120 and 0.00097, giving a ratio of 0.8083 -or a reduction of about 20% which is a major difference -and stresses the importance of really accurate measurements, at the same time justifying my rather unkind criticism of Glyn's drill method. My suggested explanation is that the 276 carbs perhaps produced a generally higher depression in the venturi area than Monoblocs, thus requiring smaller jetting to give the correct mixture.

I have an uneasy feeling that the above will still not convince Mr. B., and if this is the case I invite him to try the following practical test to prove it to himself. I hope you have a bike which is correctly jetted on both main and needle settings; if so mark the twistgrip carefully to enable you to drive at half throttle repeatedly, and then take it out to a good piece of road with a handful of clean plugs. Run at half throttle and do a plug chop, and repeat at full throttle to make sure you are starting from the correct settings; if not, correct them first. Next drop your needle down two notches and do a full throttle plug chop;
performance and plug readings should still be correct as on standard settings. Now do a half throttle run and plug chop, you will be running badly due to weak mixture and will see overheated plugs. Next to really prove your theory, leave the needle two notches down and fit mains two or three sizes bigger; do full throttle and half throttle runs with plug chops. If your theory is correct you will be rich at full throttle and correct at half throttle when the oversize main compensates for the low needle setting. In reality you will be rich at full throttle, but still weak at half throttle because the oversize mains do not allow more fuel to pass the weak needle restriction. Should you happen to hole a piston during this testing kindly don't blame me just put it down to experience in proving your own theory and replace pistons as required and continue the test programme to completion!

I learned all this way back in the early sixties, during my first two seasons of competition. When The Heap was first built it was set up for petrol at 9.5:1 CR and ran on the road to run it in and check it out. My record book tells me I had 109 needle jets, std needles, and 340 mains. Then I removed compression plates to get 12.5:1 and reset the carbs completely to run methanol. The record says 125 needle jets, needle in centre notch, 980 mains and no. 5 slides. My first meeting was Tregwainton Hill Climb on 3 April 1961, and throughout the 1961 season my notes record changes in needle position, slides, and mains in attempts to overcome a mid range weakness. Even going up to 1500 or 1600 mains did not fix it, though it was too rich at full bore.

Experimenting continued unsuccessfully through the '62 season until Church Lawford on 18 Aug 62. For practise I ran 1000 mains, no.5 slides, and needles in the bottom notch -but it still felt weak on the needles. For my first timed run my notes say "Tried no needles and no.6 slides. Better but gave a rich spot." The result was an 14.64 sec quarter and FTD. This set me thinking, and back in the workshop I removed and stripped both carbs to check all the settings from scratch. Imagine my surprise when I found I had fitted weak needles by mistake, and this had been the problem all along. I rebuilt with standard needles and from then on was running in the first three at almost every meeting. The point of this story is to show Mr. Baxter that no amount of juggling with other settings would overcome the weak needle setting I had made by mistake. Will he believe me now?? Wait for next month's exciting letter and see!! Spares Co., please stand by for an order on carb parts - and then for a major piston order from Stalybridge!

Three more little tidbits for your information and 'edification'. Everything about the configuration of a jet influences the flow through it; the length of the drilling - the form of the inlet and the outlet - and particularly the radius or sharpness of the corners at each end of the jet hole. The form which is easiest to produce accurately in commercial quantities is a sharp corner, so this is what is used on all fuel jets. All the books tell us not to use a piece of wire to clean jets -not so much because the wire will wear the hole a bit oversize, but more because it will damage the sharp corners which affect flow much more seriously. Even my own and Glyn's measuring exercises are in danger of doing the same thing.

All Amal carbs use a needle which hangs freely in the needle jet; sideways movement of the needle alters the form of the annulus which affects the flow through it. In the late sixties this was recognised by the manufacturers of needle carbs for cars, and Pierburg, Zenith-Stromberg, and SU all introduced the spring biased needle to improve exhaust emission control. The needle was lightly spring biased against the downstream side of the jet to keep the annulus form constant; even though this caused increased wear over long mileages it gave more consistent metering and reduced exhaust emissions. During the 1980's ever tightening exhaust emission regulations caused all the volume car manufacturers to abandon carburettors and go over to more expensive fuel injection systems, which could be steered electronically, and integrated with the catalyst function via a closed loop feed back system employing an exhaust gas sensor - a so-called lambda-sond - which adjusted the injection time to maintain minimal exhaust emissions. Modern motorcycle manufacturers are slowly being forced into going the same way to avoid being legislated out of existence.

In last month's MPH Neville went into great detail to show how my previous comments were wrong. Yes my measurements were not fully accurate - as I acknowledged at the time. But I am satisfied that they were more than adequate to confirm that the needle jet and jet needle are not the limiting criteria in controlling the flow at part throttle openings, which was (is) the essence of my argument.

Consider the following: The 1 1/8th” carburettors, fitted to Shadows and Comets, all have the same standard settings except for the throttle cutaway - but this only affects the transition from pilot to slide control of the mixture. Yet we have had three different main jets to do the same job. 200 in the Comet, 180 as standard in the Shadow and 170 - recommended in the past where it was found to better suit one of the twin's cylinders. Now if Neville is correct then each of these individual cylinders would receive exactly the same mixture strength until 3/4 throttle was reached. Does this really hold water? And which main jet is the control? The 180? In this case the Comet would be weak in the mid range (according to Neville's assertions in his last article) or the 200? In which case the Shadow will be similarly rich.
Irrespective of variations which may be required to suit a particular requirement, any carburettor with unchanged settings, i.e. needle jet, jet needle, needle notch position etc is designed to accommodate a range of main jets. It is not unreasonable to suggest that different engines can require these different main jets, but otherwise the same settings, to run properly.

Following on from this I cannot accept that the needle jet and jet needle are the limiting criteria - and I am not alone in this. An engine which requires a larger main jet at full throttle must also need more fuel at lower throttle openings as well.

And finally, on seizures and post war cylinder studs, following a discussion with Bob Dunn. The Series ‘A’ engines use the same pistons as fitted to ‘B’s, ‘C’s and ‘D’s; yet how often have you seen a seized ‘A piston which has only picked up at the quarter points?

I am conscious that this discussion has already run on far too long for some members so I shall not pursue matters any further.

Neville Higgins

Finally Justin Mackay-Smith is correct in his Ebb and Flo letter; an annulus of the same cross sectional area as a plain hole will flow less fluid (or air) simply because of friction against the needle (or wire) in the centre. This applies in the rocker feeds, but I have also mentioned it in carburettor jetting articles -the last time in a major argument with Glyn Baxter, where I explained that SU and CDSE car carburettors made for exhaust emission control were produced with spring biased needles for more consistent metering, even though the resultant eccentric annulus passes less fuel than a concentric one. In earlier carbs where the needles were suspended loosely in the jet they waggled about during running, altering the annulus shape and thus the fuel flow rate, even though the needle did not move vertically in the jet. Now I must get this sent off and move horizontally into bed!