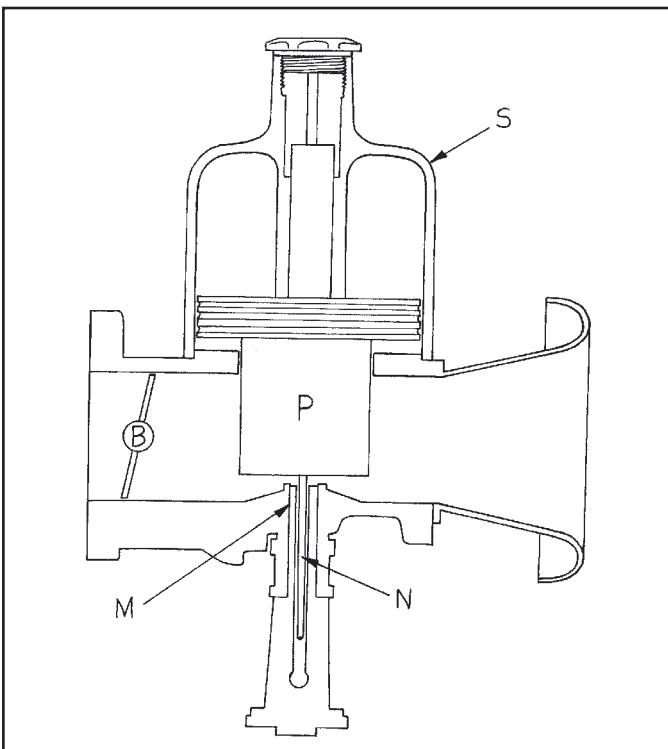


Chapter 1

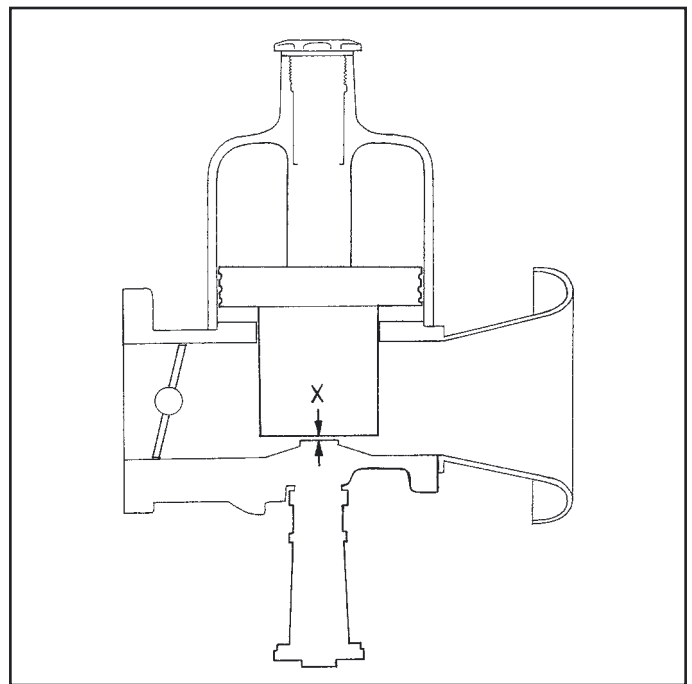
How an

SU carburettor

works



Butterfly 'B', piston 'P', suction chamber/vacuum chamber 'S', main jet 'M', needle 'N'.



Piston base is never in full contact with the bridge of the carburettor. There is always a minimum air gap of about 0.010-0.015in/0.25-0.35mm between the top of the bridge and the base surface of the piston 'X'. There is a plastic buffer fitted into the piston which is proud of the base surface, and this limits the shut off of the piston onto the bridge.

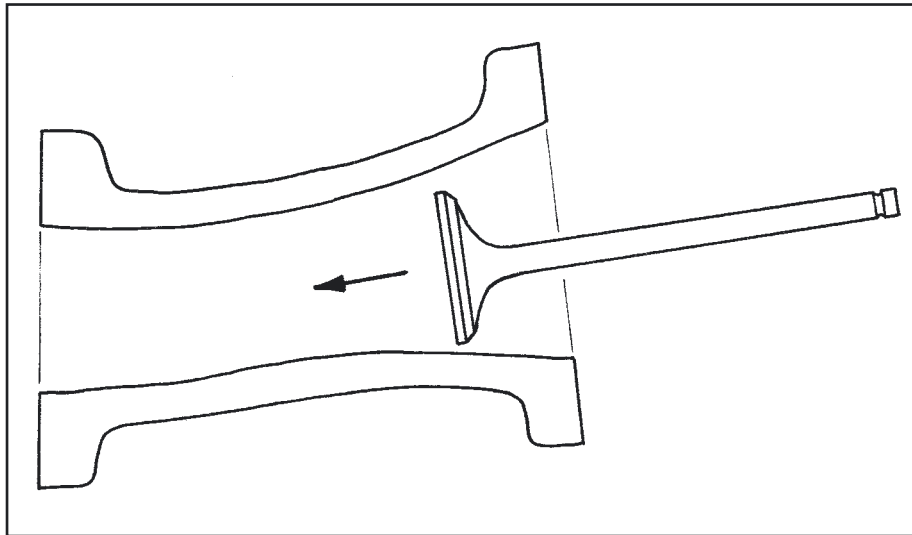
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larger gauge to check progress during the second stage of porting to finished size. The smaller gauge is used to get the bulk of the material out of the runner, while the larger gauge is used to carefully finish the runners to final size. The diameter of the finished runner (about 1.340in/34mm) will actually be a little larger than the gauge because, to pass the larger gauge through the runner, some clearance is necessary.

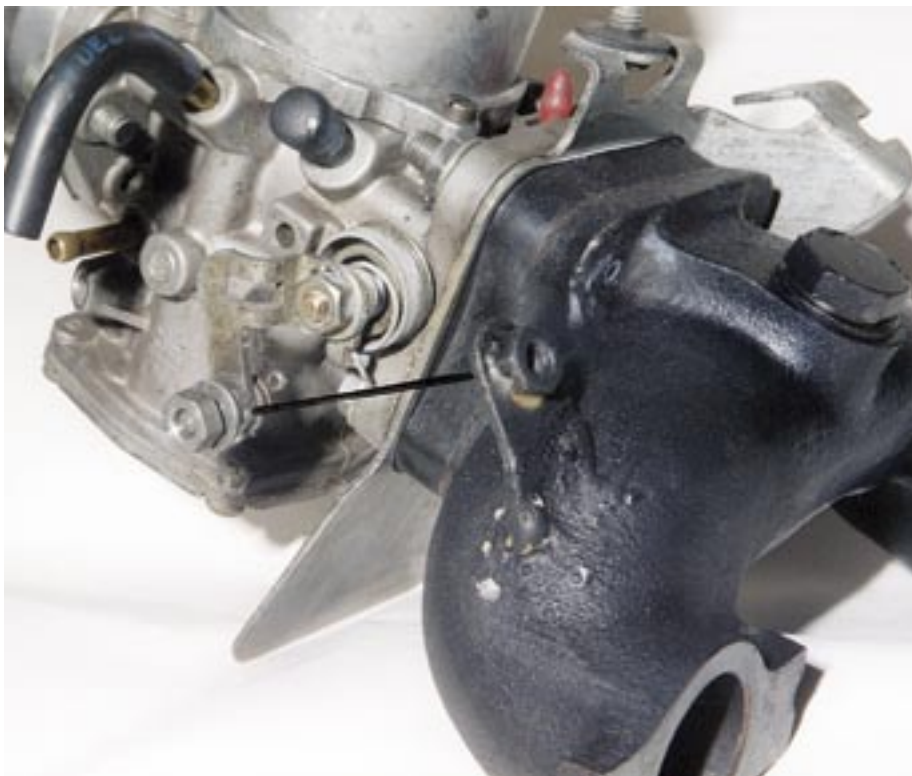
While the examples described so far have related to round port/runner engines, the same basic principles apply to square or rectangular types. It's a bit more difficult to check the sizes of square/rectangular runner inlet manifolds, some actually being impossible to check. The standard Rover V8 inlet manifold, for example, can't be checked throughout or resized. Any square/rectangular port cylinder head and inlet manifold can usually be measured using inside callipers or, preferably, a gauge made out of 16 gauge sheet steel with a stem brazed onto it. Forget methods like 'eyeballing' which are nothing more than guesswork, with which it is just too easy to make a mistake. Direct measurement is the only method to use, with the gauge method being superior to using inside callipers.

THROTTLE LINKAGES

Throttle linkages are often a problem with twin SU setups, but not so with a single (usually). If the inlet manifold is cast iron, for example, a bracket can be braised to the actual inlet manifold very easily, and be absolutely rigid. What you don't want with any linkage/bracketry is movement which reduces the throttle action. Having the throttle cable mounting bracket firmly attached to the inlet manifold means it's there for good. A simple bracket and linkage system is shown in the accompanying photo. The



Turned down valve head being used as a gauge to size the inlet manifold runners. The valve's head must pass right through the runner.



Simple throttle linkage has a bracket braised to the inlet manifold, a small hole in the bracket for the cable to pass through, and, in this case, a nut braised to the bracket to locate the metal-encased end of the outer sheath of the throttle cable. Everything can be positioned very accurately, and it will be a solid assembly, and very quick to set.



0.090in diameter needle on the left, 0.100in in the middle and 0.125in fixed needle on the right.

results given by each needle tested.

The problem here is that needles are not particularly cheap and there may also be a small delay in getting alternative needles. The consolation is that once the needle specification is optimised the engine tune will be 'dead right.'



Fixed type of needle on the left and spring-loaded type on the right.

Money can be spent on a needle, or needles, which in five minutes prove to be incorrect for the particular application, more needles then have to be procured and this process can be frustrating. Unfortunately, there is no alternative to a little of this experimentation, but time and money can be saved by making sure that each



Fixed type needle on the left fits into the piston just as it comes. Spring-loaded needle needs a spring and collar, as shown on the right, before it can be fitted into the piston.

subsequent size of needle bought is definitely a step in the right direction: in this way the choice of needles is quickly narrowed down. There is no point in haphazardly trying different needles in the hope that a particular size might



This calibrated rod is made of a 6 inch length of bamboo. A stick-on label has been wrapped around it, and the measuring point lines drawn on. The 1st measuring point is positioned above the top of the vacuum chamber, the same distance the top of the main jet is below the top of the bridge, plus the plastic stop height.

bowl volumes is to cut the engine at maximum power and then record exactly how much fuel is in each bowl – it must equal what's in there at idle. Most mechanics and engineers don't like doing this, of course, but it has to be proven beyond doubt, and this is one way of doing so. At maximum rpm and on wide open throttle, there will be more fuel being used than at any other time. If the fuel level reduces below what the engine has been set to operate with, the mixture goes lean. It's a proven fact that SUs give the best top end performance if the fuel level found at idle is maintained throughout the entire rpm range. In drastic cases, the needle is removed entirely from the fuel inlet assembly and the fuel allowed to go into the fuel bowl completely unrestricted all of the time. The hole



Engine not running: the piston is resting on the bridge and the main jet is wound down from the bridge. The 1st measuring point is, as a consequence, above the top of the vacuum chamber.

in the seat can even be drilled out if it proves to be necessary. The excess fuel is scavenged from the fuel bowl on a constant basis and returned to the fuel tank. This takes some specialist work to incorporate but it definitely works.

The pistons must lift at the same rate during acceleration if the air/fuel mixture amounts and ratios are to be maintained across the board. This is quite difficult to check, and the best most people can do is check the rise rate visually. A good time to check this is when the car is on a rolling road dyno with the air cleaners off. Check that the pistons are lifting at the same time. With side-by-side twin SUs, you can usually spot a slow lifting piston quite easily if you can see both pistons at the same time. Checking triple side-by-side SUs, however, is more difficult, which is one of the problems with multiple SUs – it's more difficult to check several things at once. People have devised all sorts of ingenious ways of checking piston



Engine idling: the reading now shows the 2nd measuring point. This is a low reading; most engines will give a reading of between the 2nd and 3rd measuring points.

rise rates in an effort to make sure that they're not missing out on acceleration because of this. The condition of the fit between the vacuum piston and the vacuum chamber is an important factor here; on a twin carburettor system, if one piston is worn, it won't rise as quickly as the other, and there won't be the same quality of seal. It's critical that the basic seal be the same for all vacuum chambers on multiple setups.

The springs must have identical pressure at the checking height. If there are two carburettors on the engine, one with a weaker piston spring, the pistons will 'ride' at different heights, and, to a small degree, cause the carburettors to effectively give the engine two different acceleration rates due to the different amounts of air and fuel being admitted to it. Spring strength will change over time and with use; and this point is often missed. It doesn't take much of a difference in spring strength to make a difference in engine performance!

As you can see there are a few

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economy decreases rapidly. A car used on the road with a carburettor altered in the manner listed here is always going to use about 10% more fuel than it otherwise would.

In many respects, and to save altering a standard piston spring, you could just fit the lightest piston spring SU makes, (the 'light blue', part number AUC 4587) in the appropriate dashpot assembly, and alter the needle to suit the action of this piston spring.

Not all piston springs are suitable for all dashpots, but, using the 1½in, 1¾in HS as examples, the HS dashpots will fit (fortunately) all HIF carburettors, so the ball bearing type dashpot and piston assemblies can be replaced, and a light spring obtained by substitution. This means that the standard 2½oz/in light blue piston spring can be fitted to all of these later carburettors, and 2½oz/in force obtained. All you have to do is find and fit the earlier dashpot and piston assembly, and order new springs. It's a good idea to use the earlier dashpot and piston assemblies whenever possible, so that you start off with 2½oz/in spring pressure, and cut and reshape the end of these springs to get down to the minimum 1oz/in. It makes the whole process of obtaining a 1oz/in spring pressure (if that's how low you want to go) simple. Many people think that the best place to put the earlier dashpot and piston assemblies is in the rubbish tin but it isn't.

Once they get the hang of altering the needles, and then realise just how much of a difference the reduction in spring pressure, the removal of the dashpot oil, or a customised needle/needles makes, most people just want to go into it all to the last detail to obtain the best possible rate of acceleration. Altering these springs can always be done later to get the absolute maximum possible out of the setup.



Standard SU carburettor spindle.



Modified SU carburettor spindle with the standard butterfly screws fitted and ready to be ground down.

Many competition engines idle at 1200-1500rpm and don't come 'on cam' until 2000-4000rpm, making the lower rev range largely irrelevant. However, engines fitted with long duration camshafts can be improved 'low down' by fitting very light piston springs and making needles that have needle measuring point sizes at the 1st, 2nd and 3rd points that are rich, but not so rich as to cause plug fouling. The piston spring should be light enough



Both sides of the spindle are reduced, not just one.



Both sides of the spindle are reduced, not just one.



Thinned down spindle after screws have been ground down and the spindle 'flash soldered' (see text).

not to interfere with rapid lifting of the piston during acceleration, while still offering reasonable resistance to the